Ministry of the Environment
of the Czech Republic

MINERAL COMMODITY SUMMARIES OF THE CZECH REPUBLIC 2016

STATISTICAL DATA TO 2015

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Czech Geological Survey

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EXPLANATORY NOTES

List of abbreviations, symbols and technical units

AOPK ČR	Nature Conservation Agency of the Czech Republic (Agentura ochrany přírody a krajiny České republiky)
a. s.	initials after a Czech company name indicate that it is a joint stock company (akciová společnost)
bbl	barrel of crude petroleum, 158.99 dm^3; 1 tonne of crude petroleum is approximately 7 bbl (6.76–7.75 bbl for crude petroleum extracted in the Czech Republic)
bn	billion, 10^9
BP	British Petroleum, British multinational oil and petrochemical company
BRICS	acronym for economic group of Brazil, Russia, India, China, South Africa
CFR	Cost and Freight (named port of destination)
CHKO	protected landscape area (Chráněná krajinná oblast)
CHLÚ	protected deposit area (Chráněné ložiskové území)
CHOPAV	Natural water accumulation protected area (chráněná oblast přirozené akumulace vod)
CIF	Cost, Insurance and Freight (named port of destination)
CIS	Commonwealth of Independent States, in Russian: Содружество Независимых Государств
CMMI	Council of Mining and Metallurgical Institutions
Coll.	Collection of laws (Sbírka zákonů České republiky) of the Czech Republic
CPPP	constant prices of previous period
CSO	Czech Statistical Office
CZK	Czech crown (česká koruna)
CZSO	Czech Statistical Office
CZ NACE	Czech adoption of the General Industrial Classification of Economic Activities within the European Communities (Nomenclature générale des Activités économiques dans les Communautés Européennes)
ČBÚ	Czech Mining Authority (Český báňský úřad)
ČGÚ	Czech Geological Office (Český geologický úřad)
ČNB	Czech National Bank (Česká národní banka)
ČNR	Czech National Council (Česká národní rada) – former parliament of the Czech (Socialist) Republic
ČR	Czech Republic (Česká republika)
ČSÚ	Czech Statistical Office (Český statistický úřad)
DERA	Deutsche Rohstoffagentur (German Mineral Resources Agency) is a part of Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)

DP	mining lease (dobývací prostor)
EIA	1) Environmental Impact Assessment 2) Energy Information Administration, section of the Department of Energy of the USA providing energy statistics, data, analysis
EU	European Union
EURATOM	Euratom Supply Agency (ESA), European agency for common supply policy on the principle of regular and equitable supply of nuclear fuels for European Community users
EUROSTAT	Statistical Office of the European Communities, organisational branch of the European Commission
FDI	foreign direct investment
FMPE	Federal Ministry of Fuels and Power (Federální ministersvo paliv a energetiky)
FNM	National property Fund (Fond národního majetku)
FOB	Free on Board (port) – seller pays for transportation of the goods to the port of shipment, plus loading costs
GDP	Gross domestic product
GVA	Gross value added (GVA) is a widely used indicator of the total economic performance of each branch. It is an indicator corresponding to the GDP in the whole national economy. It is calculated by subtraction of the intermediate consumption (consumption of the raw materials, energy, materials) from the total value of the production (in terms of accounting, this is the difference between the sales and other services of companies and their consumption of materials, energy and services, this is therefore the sum of their book values added)
IEA	International Energy Agency
IM	Industrial Minerals (journal)
IMF	International Monetary Fund
JORC	Joint Ore Reserves Committee
KKZ	Commission for Classification of Mineral Reserves (Komise pro klasifikaci zásob)
k. s.	initials after a Czech company name indicate that it is a limited partnership company (komanditní společnost)
kt	kilotonne, 1,000 t
Ma	Million of years
MB	Metal Bulletin (journal)
MCS	Mineral Commodity Summaries, mineral yearbook of the US Geological Survey
MH ČR	Ministry of Economy of the Czech Republic (Ministerstvo hospodářství České republiky)
MHPR	Ministry of Economic Policy and Development (Ministerstvo pro hospodářskou politiku a rozvoj)
mill	million, 10^6
MIT	Ministry of Industry and Trade
MoE	Ministry of the Environment
MŽP ČR	Ministry of the Environment of the Czech Republic (Ministerstvo životního prostředí České republiky)

N	not available or not reliable data
NP	natural park (Národní park)
NPF	National Privatization Fund
OBÚ	Regional Mining Authority (obvodní báňský úřad)
OPEC	Organization of Petroleum Exporting Countries
o.p.s.	initials after a Czech organization name indicate that it is a not profit organization (obecně prospěšná společnost)
pcs	pieces
PKÚ	Palivový kombinát Ústí, s.p.
POPD	plan of mine development work of reserved mineral deposits (plán otvírky, přípravy a dobývání výhradních ložisek)
PÚ	exploration area (průzkumné území)
ROPO	Recognised Overseas Professional Organizations
Sb.	Collection of Laws (abbreviated as Coll.) of the Czech Republic
SD	Severočeské doly, a.s.
SITC	Standard International Trade Classification
s. p.	initials after a Czech company name indicate that it is a state public enterprise (státní podnik)
spol. s r. o.	initials after a Czech company name indicate that it is a limited liability company (společnost s ručením omezeným), ditto initials s. r. o.
s. r. o.	initials after a Czech company name indicate that it is a limited liability company (společnost s ručením omezeným), ditto initials spol. s r.o.
SU	Sokolovská uhelná, právní nástupce, a.s.
t	metric tonne, 1,000 kg, 1,000,000 g
tce	tonne of coal equivalent, the energy unit representing energy 7 million kcal (29,3067 GJ) generated by burning one metric ton of coal; Czech steam coal 1 tce = 1.1–1.6 t, coke coal 1.0–1.3 t
ths	thousand, 10^3
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Commission for Europe
UNFC	United Nations Framework Classification
UNSTAT	United Nations Statistics Division (http://unstats.un.org/unsd/default.htm)
USGS	United States Geological Survey – Geological survey of the USA
v. o. s.	initials after a Czech company name indicate that it is an unlimited company (general partnership) (veřejná obchodní společnost)
VAT	Value Added Tax
WBD	Welt Bergbau Daten (World Mining Data), mineral yearbook of Austrian Federal Ministry for Science, Research and Economy
WNA	World Nuclear Association
ZCHÚ	specially protected area (zvláště chráněné území)

Exchange and inflation rates of currencies in which minerals are priced

Annual inflation rates (%) in the USA (US), the United Kingdom (UK), the Euro Area (EUR) and the Czech Republic (CZ)

	US	UK	EUR	CZ
1991	4.2	7.4	–	56.6
1992	3.0	4.3	–	11.1
1993	3.0	2.5	–	20.8
1994	2.6	2.1	–	10.0
1995	2.8	2.6	–	9.2
1996	2.9	2.4	–	8.8
1997	2.3	1.8	–	8.4
1998	1.5	1.6	–	10.6
1999	2.2	1.3	1.1	2.3
2000	3.4	0.9	2.1	3.8
2001	2.8	1.2	2.4	4.7
2002	1.6	1.3	2.3	1.8
2003	2.3	1.4	2.1	0.1
2004	2.7	1.3	2.1	2.8
2005	3.4	2.0	2.2	1.8
2006	3.2	2.3	2.2	2.5
2007	2.9	2.3	2.2	2.9
2008	3.8	3.6	3.3	6.3
2009	-0.3	2.2	0.3	1.0
2010	1.6	3.3	1.6	1.5
2011	3.1	4.5	2.7	1.9
2012	2.1	2.8	2.5	3.3
2013	1.5	2.6	1.3	1.4
2014	1.6	1.5	0.4	0.4
2015	0.1	0.1	0.0	0.3

Notes:
- *source – IMF. World Economic Outlook Database. October 2016*
- *inflation rates based on average annual changes of consumer price indices*

Average yearly exchange rates of CZK against EUR, USD and GBP

	EUR	USD	GBP
1991	–	29.5	52.0
1992	–	28.3	49.9
1993	–	29.2	43.8
1994	–	28.8	44.0
1995	–	26.5	41.9
1996	–	27.1	42.3
1997	–	31.7	51.9
1998	–	32.3	53.4
1999	36.9	34.6	56.0
2000	35.6	38.6	58.4
2001	34.1	38.0	54.8
2002	30.8	32.7	49.0
2003	31.8	28.2	46.0
2004	31.9	25.7	47.1
2005	29.8	23.9	43.6
2006	28.3	22.6	41.6
2007	27.8	20.3	40.6
2008	24.9	17.0	31.4
2009	26.4	19.1	29.7
2010	25.3	19.1	29.5
2011	24.6	17.7	28.3
2012	25.1	19.6	31.0
2013	26.0	19.6	30.6
2014	27.5	20.7	34.2
2015	27.3	24.6	37.6

Source: Czech National Bank

Mineral reserve and resource classification in the Czech Republic and its evolutional comparison with international classifications

Czech classification

After 1948 the reserve classification of the USSR was progressively adopted in Czechoslovakia, of which the Czech Republic formed part. A Commission for Classification of Mineral Reserves *(Komise pro klasifikaci zásob – KKZ)* was established in 1952, as a state agency to review the categorisation and estimation of reserves of all types of minerals, except radioactive ores.

Initially geological reserves (all reserves in their original state in the deposit without subtracting losses from mining, beneficiation and processing) were classified into subdivisions of groups and categories (slightly simplified).

Groups of geological reserves according to industrial utilisation:
nebilanční potentially economic – currently unminable due to a low grade, small deposit thickness, particularly complicated mining conditions, or due to the unfamiliarity with economic processing methods for the given mineral type, yet which may be considered as exploitable in the future

bilanční economic **–** minable, suitable for industrial utilisation and for the technical mining conditions for extraction

Categories of geological reserves according to the degree of deposit exploration:

A – explored in detail and delimited by mining works or boreholes, or by a combination of these. Geological setting, distribution of quality mineral types in the deposit and the technological properties of the mineral are known to such a degree that allow for the development of a method for beneficiation and processing of the mineral. Natural and industrial types of minerals are given. Reserves A include those parts of the deposit, where the geological setting, hydrogeological conditions and mining conditions are known to such a degree that a deposit development method can be developed**.**

B – explored and delimited by mining works or boreholes, or by a combination of these in a sparser network than in category A. It further includes reserves of deposits adjoining blocks of category A, verified by exploration works. The manner of geological setting, natural and industrial types of minerals are determined without knowing their detailed distribution in the deposit. The quality and technological characteristics of the minerals are given within a range allowing for a basic choice of a processing method. Hydrogeological conditions and general principles of deposit development are sufficiently clarified.

C_1 – determined by a sparse network of boreholes or mining works, or by a combination of these, as well as reserves which adjoin the reserves of categories A and B, if they are justified from a geological perspective. They also include the reserves of relatively complex deposits with a very irregular distribution of the mineral, even though these deposits were explored in detail. Included here are the deposit reserves partially mined-out with low recovery methods. The setting conditions, quality, industrial types and processing technology of the mineral are defined based on analyses or laboratory tests of samples, or based on analogy with explored deposits of a similar type. The hydrogeological conditions and the principles of deposit development are defined quite in general.

C_2 – are assumed based on geological and geophysical data, confirmed by sampling of the mineral deposit from outcrops, isolated boreholes or mining works. Also, reserves adjoining the reserves of A, B, C_1categories, where geological conditions for this exist.

It is further defined that project development and investment amounts for the construction of mining facilities are permitted on the basis of the economic mineral reserves in categories A+B+C_1, which are therefore reserves eligible for industrial utilisation. That is why, in practice, the economic reserves of categories A, B, C_1, or their total A+B+C_1 were designated by the term industrial reserves.

Further improvement of the classification introduced Order of the CSSR Government no.80 in 1988 [7].

In 1963, KKZ established the prognostic reserves *(prognózní zásoby)* category in an amendment of its Principles for the Classification of Solid Minerals (hereinafter Principles) *(Zásad pro klasifikaci zásob pevných nerostných surovin)*. They were defined as unexplored mineral reserves, assumed on the basis of the formation patterns and the distribution of mineral deposits, and investigations, dealing with the geological structure and the history of geological evolution of the evaluated locality. The parameters for the evaluation of prognostic reserves (strike, length, thickness, average grade and the like) are determined according to geological assumptions or they are derived. According to the Principles, prognostic reserves are not listed in the national Register of Reserves *(bilance zásob)*. They serve only as a basis for future planning of geological exploration.

In 1968, KKZ innovated the definition of prognostic reserves. In the amended Principles for reserve classification, it established the division of reserves into proved (by exploration or mining) and assumed, or prognostic. Prognostic geological reserves are unverified reserves, however they are assumed based on geological, geophysical and other scientific knowledge and material. They are predominantly the reserves of larger localities and formations, and, in isolated cases, the reserves of unexplored parts of large structures or deposits.

Due to the establishment of the prognostic reserve category, geological reserves *(geologické zásoby)* can, with regard to contents, be translated into English as total resources. However up to 1989, the term resources did not appear in Czech or Czechoslovak classifications. But up to now, reserves also represent mineral accumulations, which meet the reserves criteria due to being explored, but which do not meet them due to technical and economic reasons (potentially economic reserves *nebilanční zásoby*). They are therefore mineral resources.

In 1981, the Czech Geological Office issued Directive No. 3 [3], where the present prognostic reserves *(prognózní zásoby)* were divided into categories D_1, D_2, D_3. They are defined as follows:

D_1 – relate to verified mineral deposit reserves, with which they form one whole deposit. Determined in delimited areas and quantifiable based on positive detection of an existing mineral and its basic quality characteristics.

D_2 – territorially independent. They are determined in a delimited area based on positive detection of an existing mineral and its basic quality characteristic. Analogies are also used for their determination.

D_3 – determined on the basis of regional investigation. So far, mineral existence has not been proven in such a way, in order to be able to delimit the area of their occurrence and to quantify the prognosis.

In October 1989, the Czech Geological Office issued Decree No. 121/1989 Coll., which redefined the prognostic reserve categories, changed their designation, and for the first time in the Czech Republic established the term resources. The term prognostic resources has been used instead of the term prognostic reserves ever since. The categories P_1, P_2, P_3 were as follows:

P_1 – assumed due to the continuation of an already investigated deposit beyond the reserve outline of category C_2 or due to the discovery of new deposit parts (bodies). The basis for this category are the results of geological mapping, geophysical, geochemical and other work in the area of possibly occurring prognostic resources: geological extrapolation of data results from the investigation, or the verification of part of the deposit. In justified cases this category also includes areas with isolated technical works which do not fulfill the requirements in order to be included in the reserves category C_2. The quantity and quality of the prognostic resources of this category is estimated according to the given deposit type and its part with detected reserves.

P_2 – assumed in basins districts and geological regions, where deposits of the same formation and generation type were detected. It is based on a positive evaluation of deposit indications and anomalies observed during geological mapping and geophysical, geochemical and other work, whose prospect is, if necessary, confirmed by a borehole or surface excavation work. The prognostic resource estimate of assumed deposits and the concept of the shape and dimensions of the bodies, their composition and quality, are derived by analogy with known deposits of the same type.

P_3 – assumed solely on the basis of conclusions concerning the formation possibilities of the deposit types under consideration with regard to favourable stratigraphic, lithological, tectonic and paleogeographic conditions detected while evaluating the locality during geological mapping, and during analysis of geophysical and geochemical data. The quantity and quality of prognostic resources is estimated according to assumed parameters of the deposit development by analogy with more closely explored localities, where deposits of the same genetical type were detected or verified. The prognostic resources of minerals in category P_3 can only be displayed by a surface projection.

The amendment of Mining Act no. 541/1991 Coll. divided the classification of reserves (reserved deposits) according to exploration into the categories of prospected reserves (*vyhledané zásoby)* and explored reserves *(prozkoumané zásoby)*, and, according to exploitability conditions, into economic reserves *(zásoby bilanční)* and potentially economic reserves *(zásoby nebilanční)* .

Economic – reserves suitable for existing technical and economic conditions in exploiting a reserved deposit.

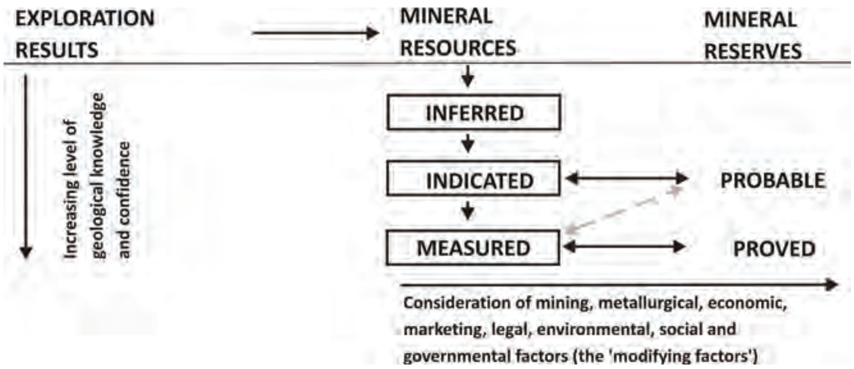
Potentially economic reserves – currently unexploitable due to being unsuitable for existing technical and economic conditions of exploitation, yet assumed to be exploitable in the future in consideration of expected technical and economic development.

Neither this amendment nor any other regulation defined the content of the terms **prospected** and **explored** reserves. In practice, these categories are identified with the categories of reserve exploration, as they were in effect before the amendement of Mining Act no. 541/1991 Coll., in the following manner: explored reserves = sum of reserve categories $A + B + C_1$ (also called industrial), prospected reserves = reserves of category C_2.

International classifications

International systems of classifying reserves and resources developed most rapidly in the last quarter of the twentieth century. In 2001, the Pan European Reserves and Resources Reporting Committee (PERC) published Code for Reporting of Mineral Exploration Results, Mineral Resources and Mineral Reserves [1]. This corresponds to the reporting standards of the Australian, Canadian, South African and other organisations grouped in the Combined Reserves International Reporting Standards Committee (now called Committee for Mineral Reserves International Reporting Standards) – CRIRSCO which is a subcommittee of CMMI (Council of Mining and Metallurgical Industries). It is summarized as follows:

Relations between mineral reserves and resources, their definitions
Chart of the relations [1]



The given definitions are in accordance with the definitions of the UNFC (United Nations Framework Classification) classification of the UN, published by UN-ECE in 1997 [4]. This classification divides (just as, for example, the classification of the USA [5]) its categories according to economic feasibility (quantity and quality of the mineral in situ) in one direction into 3 groups. For the division according to the level of geological knowledge it does not use one direction, one criterion (verification according to technical work carried out), as is common, but two directions, two criteria: 1) According to which of the 4 phases of exploration (from geological to mining) and 2) according to which study (from geological to mining) the given mineral accumulation was prospected or verified. Thus in the area between the axes E (economic), F (feasibility) and G (geological), a total of 36 categories can be established mechanically, out of which about 10 actually exist. The categories are marked with a three-digit code and a priori do not have designations (although recommended designations exist).

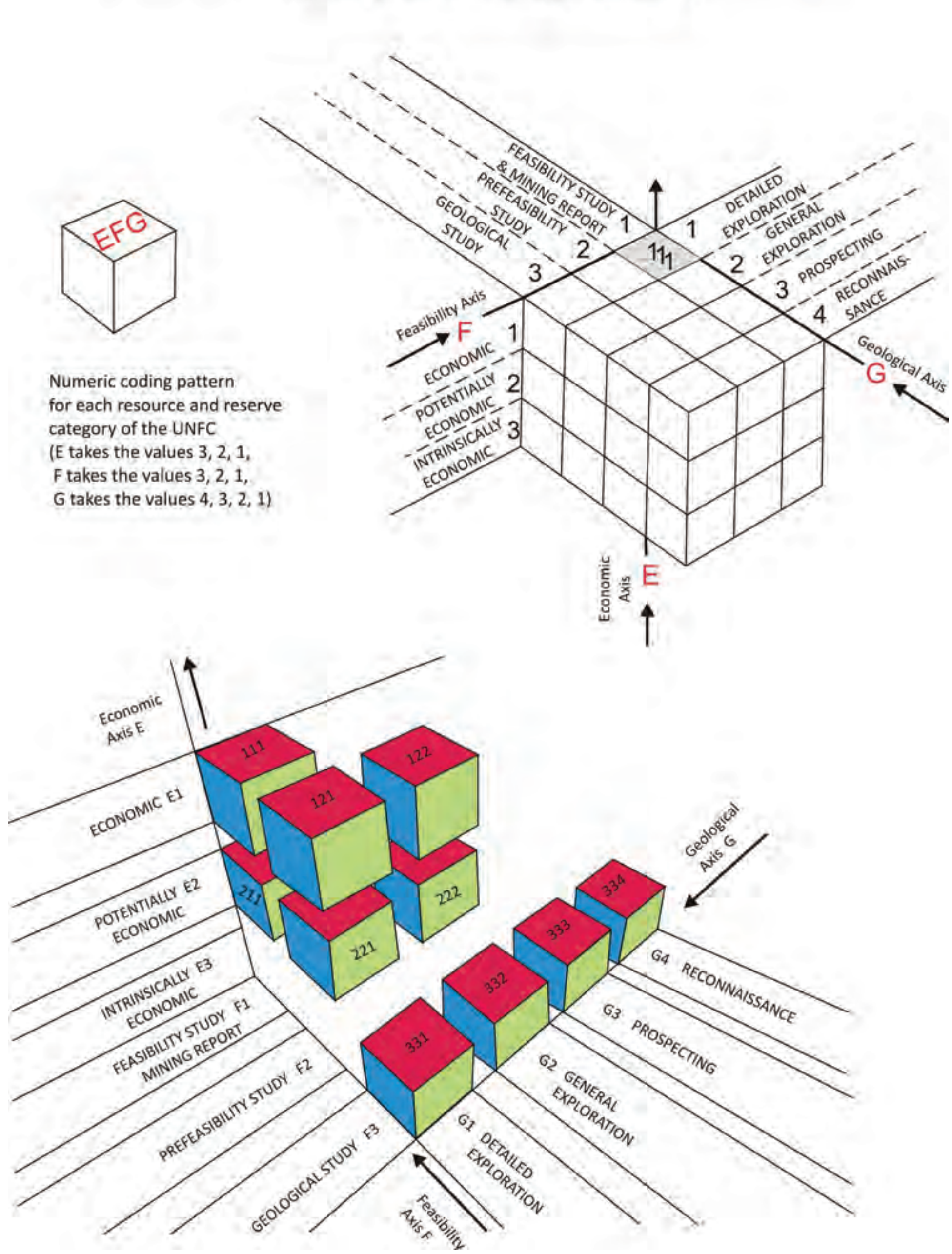
(Notice: In the course of discovery and verification of mineral deposits and their estimations of mineral resources and reserves two fundamental stages connect at each other: prospecting and exploration.

Prospecting is a set of geological activities aiming at discovery of a mineral accumulation (mineral accumulations) which could be a mineral deposit (mineral deposits) and to express in numbers its (their) mineral resources.

Exploration is to decide if a mineral accumulation (prospective mineral deposit) is a mineral deposit or not and if it is, to estimate its mineral reserves.)

An important aspect of the European and similar reporting codes is the concept of the "competent person". He/she is responsible for the calculation of reserves and its categories, is a member of an acknowledged professional society (which sees to the expertise and ethics of its members via sanctions), and has expert and moral qualities. His estimates are accepted

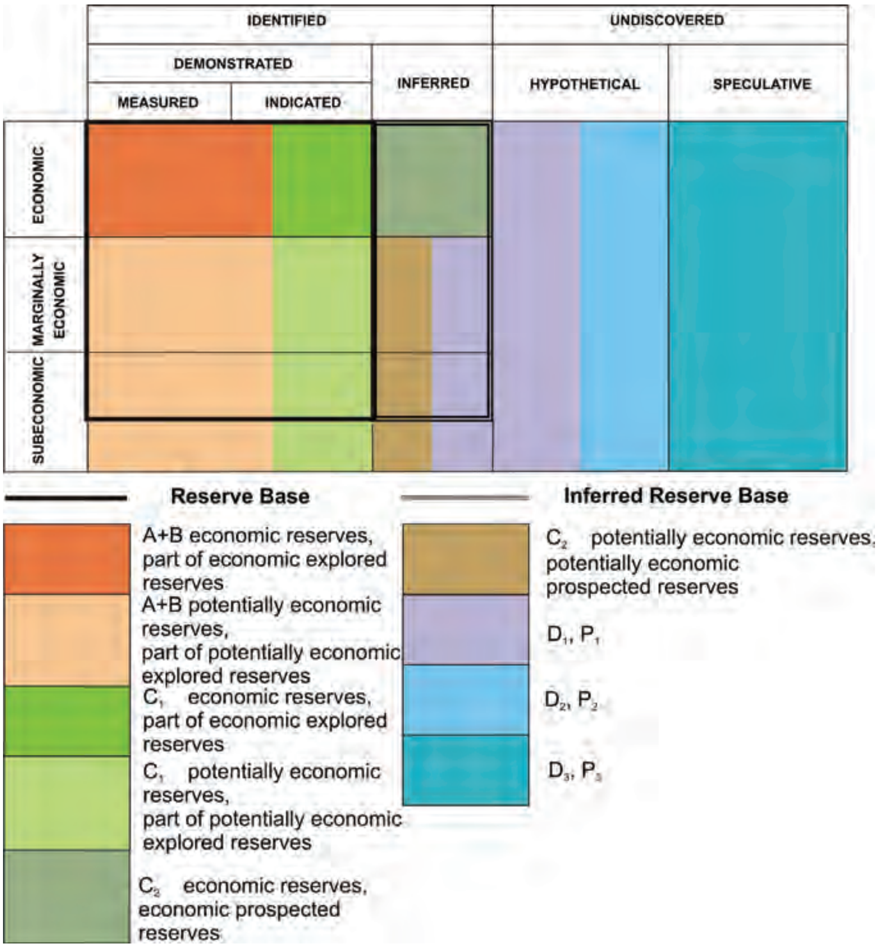
Two ways of presenting UNO spatial mineral resource - reserve classification system (United Nations Framework Classification)[4]



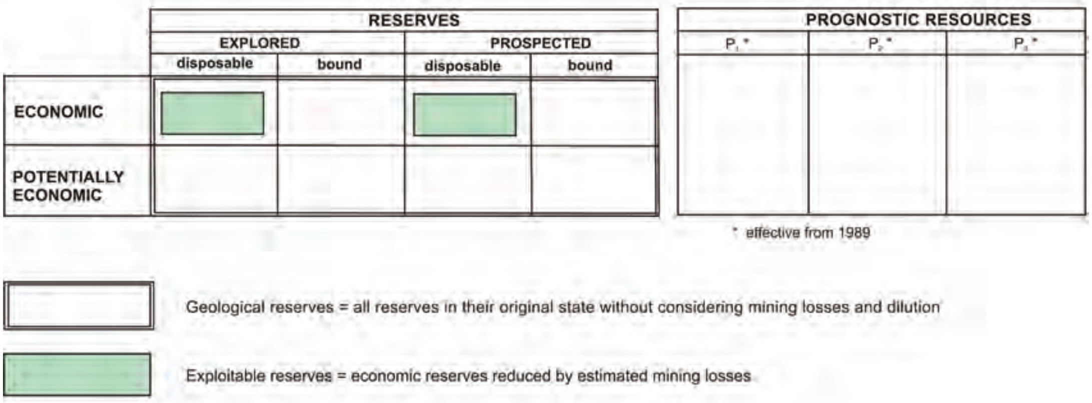
as reliable by banks and securities exchanges. Competent persons are members of Recognized Overseas Professional Organizations (ROPO). A list of organisations is compiled by the Australasian Joint Ore Reserves Committee (JORC).

Although some national and international classifications are relatively complicated, the mining industry frequently still makes do with only the categories of proved and probable reserves. If it is seeking funds from banks or share issues (initial public offering) on securities exchanges, it must respect the regulations for reporting its mineral reserves. The securities exchanges have reporting requirements which are particularly strict or even provided by law. In general they require adherence to the reporting codes of the international organizations such as those that cooperate in framing the European Code [1].

Comparison of the mineral resource classification valid in the USA from 1980 [5] with the reserve and resource classifications valid in the territory of the Czech Republic from 1956



HISTORY OF RESERVE AND RESOURCE CLASSIFICATION ON THE TERRITORY OF THE CZECH REPUBLIC



reserves of categories $A + B + C_1$ (before 1991) = explored reserves (since 1991)
reserves of category C_2 (before 1991) = prospected reserves (since 1991)
disposable reserves = reserves mining of which is not made impossible by protection of surface objects and mining workings
bound reserves = reserves in protection pillars of surface objects and mining workings
exploitable reserves = economic geological reserves reduced by amount of prospective mining losses connecting with selected mining technology or with natural conditions
categories A, B, C_1 = so-called industrial categories of reserves (before 1991)
reserve of categories $A + B + C_1$ = so-called industrial reserves (before 1991), also - in the limited interpretation - economic explored disposable reserves

Comparison of Czech and international systems of classification

The following scheme and table compare the reserve and resource classifications of the Czech Republic with the international classifications discussed above.

Is to be noted that reserves in the Czech classification still include potentially economic reserves, i.e. reserves which are currently not recoverable and which are, therefore, potentially economic resources. The term reserves as used, by contrast, in standard international classifications represents only the parts of explored resources which are available for immediate or developed extraction. All other registered parts are resources, not reserves, of a given mineral.

Comparison of UNFC with the reserve and resource classifications of the Council of Mining and Metallurgical Industries (CMMI) [4] and of the Czech Republic

Code of the UNFC category	Proposed designation of the UNFC category	CMMI category	Czech categories up to 1981	Czech categories in 1981–1989	Czech categories in 1989–1991	Czech categories after 1991
111	Proved Mineral Reserve	Proved Mineral Reserve	economic reserves – part of exploitable part* A+B	economic reserves – part of exploitable part* A+B	economic reserves – part of exploitable part* A+B	part of exploitable part* of explored economic reserves
121 + 122	Probable Mineral Reserve	Probable Mineral Reserve	economic reserves – part of exploitable part* of A + B + C_1	economic reserves – part of exploitable part* of A + B + C_1	economic reserves – part of exploitable part* of A + B + C_1	part of exploitable part* of explored economic reserves
123		Inferred Mineral Resource	economic reserves – C_2	economic reserves – C_2	economic reserves – C_2	prospected economic reserves
211	Feasibility Mineral Resource	Measured Mineral Resource	potentially economic reserves – A+B	potentially economic reserves – A+B	potentially economic reserves – A+B	part of explored potentially economic reserves
221 + 222	Prefeasibility Mineral Resource	Indicated Mineral Resource	potentially economic reserves – C_1	potentially economic reserves – C_1	potentially economic reserves – C_1	part of explored potentially economic reserves
223		Inferred Mineral Resource	potentially economic reserves – C_2	potentially economic reserves – C_2	potentially economic reserves – C_2	prospected potentially economic reserves
331	Measured Mineral Resource	Measured Mineral Resource	potentially economic reserves – A + B	potentially economic reserves – A + B	potentially economic reserves – A + B	part of explored potentially economic reserves
332	Indicated Mineral Resource	Indicated Mineral Resource	potentially economic reserves – C_1	potentially economic reserves – C_1	potentially economic reserves – C_1	part of explored potentially economic reserves
333	Inferred Mineral Resource	Inferred Mineral Resource	potentially economic reserves – C_2 + part of prognostic reserves	potentially economic reserves + part of D_1	potentially economic reserves + part of P_1	prospected potentially economic reserves + part of P_1
334	Reconnaissance Mineral Resource	not available	part of prognostic reserves	D_2 + D_3+ part of D_1	P_2 + P_3+ part of P_1	P_2 + P_3+ part of P_1

** geological reserves reduced by amount of prospective mining losses*

Conclusions

If they are to be of practical use national and international classifications have to respect the information base given by the reserve estimations of mining enterprises. It may be unsuitable to overly expand the classification requirements or expectations beyond the realistic means of this base. Combining a classification with a study (project), which classifies given resources or reserves, or with a prospecting and exploration phase, in which mineral resources and reserves were estimated, causes problems. For economic (acquiring financial means, taxes, market position) or political reasons, a prospector or a mining company developer may be led, for example, to move their exploration phase higher or lower in comparison with its actual position. In socialist (communist) Czechoslovakia with its completely nationalised industry, commerce and services, results of geological prospecting and exploration were judged not according to the mineral reserves prospected or verified by exploration, but according to the fulfillment of exploration work plans, whether planned investments in exploration were completely spent on "drilling and digging", or not. The wage of the employees of exploration and mining organisations depended on the fullfilment of plans. That is why at all levels**,** there was also an interest, that prospecting and exploration constantly continue. Consequently, prospecting strictly speaking and general exploration were the most frequent type of prospecting, and verified reserves were possibly never categorised under A. They were commonly only inserted into categories C_1 and C_2. That enabled their permanent verification. On the other hand, many mining organisations mined the reserves of category C_2 which however could have been ranked factually higher; they were over-explored.

References

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[2] *Schejbal, C. (2003): Problematika výpočtu a klasifikace zásob a zdrojů pevných nerostných surovin. – Sborník vědeckých prací Vysoké školy báňské – Technické univerzity Ostrava, ročník XLIX, řada hornicko-geologická, monografie 9, s. 139–161 (Transactions of the VŠB – Technical University Ostrava, vol. XLIX, Mining and Geological Series, Monograph 9, pp. 139–161).

[3] ** Směrnice č. 3/1981 Českého geologického úřadu pro hodnocení a evidenci geologických prognóz a prognózních zásob nerostných surovin. – Geologický průzkum, 23, 10: Zpravodaj ČGÚ, 5: 1–2.

[4] United Nations international framework classification for reserves/resources – solid fuels and mineral commodities. – United Nations Economic and Social Council, Economic Commission for Europe, Committee on Sustainable Energy, 1997. Geneva.

[5] U. S. Bureau of Mines and U. S. Geological Survey. Principles of a resource/reserve classification for minerals. – U. S. Geological Survey Circular 831, 1980.

[6] *** Lhotský, P. – Morávek, P. (2002): Ložiskový průzkum a hospodaření se zásobami výhradních ložisek (návrh k analýze třetí části horního zákona). – Uhlí, rudy, geologický průzkum, 5: 8–15.

[7] **** Nařízení vlády Československé socialistické republiky č.80/1988 Sb., o stanovení kondic, klasifikaci zásob výhradních ložisek a posuzování, schvalování a státní expertize jejich výpočtů.

Translations of Czech article (and legislation) titles:

* *Problems of evaluation and classification of reserves/resources of solid mineral raw materials*

** *Directive no. 3/1981 of the Czech Geological Office for evaluation and registration of geological prognoses and prognostic reserves of minerals*

*** *Mineral exploration and management of reserved deposit mineral reserves (proposal for analysis of the third part of the Mining Act)*

**** *Order of the Czechoslovak Socialistic Republic Government, on setting of standards, classification of reserves of reserved deposits and on assessing, approval and the State expertise of their estimates*

INTRODUCTION

This year, the yearbook *Mineral Commodity Summaries of the Czech Republic* is being published for the twenty-fourth times in its history. It was published and distributed on behalf of the Ministry of Economy until 1996, and on behalf of the Ministry of the Environment from 1997 till present.

After the dissolution of the state-funded organization Czech Geological Survey – Geofond on 31 December 2011, the semi-budgetary organization Czech Geological Survey was charged with compiling the publication *Mineral Commodity Summaries of the Czech Republic*. With isolated interruption in 2011, the Ministry of the Environment commissions the compilation and distribution of the publication, by increasing the budget of the Czech Geological Survey, under which continues to compile the yearbook. This enables the continuation of the unique research (and its publication) regarding the geological evolution of the area of the Czech Republic and the development of the Cech and global economies relate to minerals, economic situation of domestic mining companies and regarding the expenses of rectifying negative impacts of mining in the Czech Republic. The research of price development of aggregates namely in Central European countries can prosecute and be published too.

The yearbook is published and distributed predominantly in electronic format.

The publication continues to provide information for those interested in the research, exploration and mining of mineral deposits in the Czech Republic and in the environmental impact of mining in the Czech Republic. It of course continues to cover the most important minerals of the Czech Republic that are or have recently been of industrial importance, but also those minerals, whose reserves or (approved and unapproved) resources have not been mined in the Czech Republic in the past. The listed minerals also include minerals unmined in the present and past, without existing resources and reserves, which are items of Czech foreign trade that can be monitored via tariff items. The publication includes basic data on the status and changes in the mineral reserves of the Czech Republic taken from the Register of Mineral Deposit Reserves of the Czech Republic *(Bilance zásob výhradních ložisek nerostů České republiky)* (hereinafter "the Register"), which is published for a limited number of state administration agencies.

Additional information on domestic prices of minerals, imports and exports, major mining companies, and the location of mineral deposits is intended to assist in understanding the mineral potential of the Czech Republic and to stimulate investment in the minerals industry. This is also aided by the listed prognostic resources, both officially approved by the Commission for Projects and Final Reports of the Ministry of the Environment *(Komise pro projekty a závěrečné zprávy – KPZ)* in categories P_1, P_2, P_3 and unapproved by KPZ (mentioned only in expert reports).

The mineral reserves presented are geological reserves, also called *total reserves,* i.e. original reserves (in situ) within individual deposits, estimated according to the given classification and technical-economic conditions of their exploitability. The initial data come from mineral reserve estimates, which were approved or verified in the past by the Commission for Classification of Mineral Reserves and/or by the Commission for Exploration and Mining of Reserved Minerals of the former MHPR ČR and MH ČR, or by former commissions for management of mineral reserves of individual mining and processing industries. Uranium reserves and reserve estimates were approved by the Commission for Classification of Radioactive Mineral Reserves of the former Federal Ministry of Fuels and Energy. Currently, an approval of a reserve estimation lies within authority of the subject financing the estimation. If the subject is a private company, the company itself approves its reserve estimation. If the subject is the state, the KPZ approves the estimation. In accordance with section 14, article 3) of the Mining Act no. 44/1988 Coll. as amended also the private company submits its reserved mineral reserve estimation to the KPZ via the Ministry of the Environment of the Czech Republic, so that the KPZ may review if the estimation report contents comply with the provisions of the Mining Act.

There are reserved and non-reserved minerals and deposits as defined by the Mining Act no. 44/1988 Coll., as amended. Reserved minerals always form reserved deposits which are owned by the Czech Republic. Non-reserved deposits are owned by landowners. Non-reserved minerals (construction minerals) can form both reserved and non-reserved deposits. Until 1991, reserved deposits of sufficient mineral quantity and quality were proclaimed „suitable for the needs and development of the national economy" as defined by the Mining Act at that time. Since 1991, the newly recognised and explored deposits of non-reserved minerals form non-reserved deposits.

In 1993–2001, the Ministry of the Environment along with the Ministry of Industry and Trade undertook a fundamental economic revaluation of the mineral wealth of the Czech Republic**.** In 2003–2006, the task has continued to a smaller extent. Therefore compared to past years, many considerable changes have occurred in the number of deposits and registered reserves of many minerals (especially metallic ores).

The *Mineral Commodity Summaries of the Czech Republic* includes selected minerals according to whether they are or were mined in the territory of the Czech Republic. Currently mined minerals also include approved prognostic resources, if existing. Currently unmined minerals are divided into those that were mined in the past and those that have never been mined. In both cases, it is distinguished whether their resources and reserves are known or not and, generally, also whether they are metallic ores or industrial minerals. Separate chapters are dedicated to each mineral, or mineral grouping common in its deposit. Each chapter is structured identically. The separate chapters of *currently mined minerals* listed – mineral fuels, industrial and construction minerals, and metallic ores, which are of economic importance and of substantial reserves in the territory of the Czech Republic – consist of six parts.

Part 1 – Registered deposits and other resources of the Czech Republic – is based on the inventory of mineral deposits of the Czech Republic and, for the majority of minerals, includes a list of deposits and their location. The names of exploited deposits are given in bold. As for energy minerals and some industrial minerals, only regions and basins rather than single deposits are given. As for dimension stone and construction minerals, which are scattered in hundreds of deposits over the whole territory of the Czech Republic, their groupings are located in the subdivisions of reserved, non-reserved, exploited and unexploited deposits.

Part 2 – Basic statistical data of the Czech Republic as of December 31 – are extracted especially from the Register. There are 3 groups of minerals (ores, energy minerals, and reserved industrial and construction minerals) registered in the Czech Republic. Mine production of non-reserved deposits has been monitored since 1999. Approved prognostic resources are stated, too, if proved they exist.

NOTE:* The *Register* presents the *reserves* data in the categories on exploration (prospected, explored) and economic use (economic, potentially economic), as stipulated by relevant statutes starting with the Mining Act. *Reserves* include *potentially economic reserves*, i.e. reserves which are currently not recoverable and which are, therefore, *potentially economic resources.* Consequently, *total mineral reserves* are in reality *total mineral resources*. The term *reserves* as used, by contrast, in standard international classifications represents only the parts of explored resources which are available for immediate extraction. All other registered parts are resources, not reserves, of a given mineral.** The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter of this yearbook ***"Mineral reserve and resource classification in the Czech Republic and its evolutional comparison with international classifications".

Part 3 – Foreign trade – provides information on import and export, and on average import and export prices of important tariff items of the given raw material (and cites international numeric codes of the tariff items). The foreign trade data are the latest (continuously reviewed) data of the Czech Statistical Office (ČSÚ) – without analyses of their reliability.

Part 4 – Prices of domestic market – provides indicative prices on domestic production, import and export prices. Domestic prices do not include VAT.

Part 5 – Mining companies in the Czech Republic as of December 31, 2015 – provides a list of companies mining the given mineral in the territory of the Czech Republic. The companies are listed according to the production level. Their addresses are available at the Czech Geological Survey.

Part 6 – World production and world market prices – provides data on mining and production of commercial products for the last 5 years, and lists significant world producers, i.e. the top ten countries in world production. Data on resources and reserves of minerals is often used to be presented. Evolution of world prices is mentioned as current quoted or indicative prices in the last five years.

Numerous domestic and foreign data, used in compiling the present yearbook, came from journals, expert literature and the latest editions of various international statistical yearbooks.

MINERAL BASE OF THE CZECH REPUBLIC AND ITS DEVELOPMENT IN 2015

Petr Uldrych et al.
Ministry of the Environment of the Czech Republic

1. Legal framework for mineral resource use

1.1. Reserved and non-reserved minerals and their deposits

The minerals defined in Act No. 44/1988 Coll., on the Protection and Use of Mineral Resources (the Mining Act) as amended, are classified as being reserved and non-reserved. Natural accumulations of reserved minerals form reserved mineral deposits which constitute the mineral wealth of the country and are owned by the Czech Republic. Deposits of non-reserved minerals (especially sand and gravel, crushed stone and brick clay) are a constituent part of the land as stipulated in section 7 of the Mining Act. The possibility to declare significant non-reserved mineral deposits as reserved deposits, was cancelled by the amendment of the Mining Act in 1991. Decisions of administrative agencies in this matter, which had been issued before the amendment went into effect, remain valid based on transitional provisions (section 43 and 43a of the Mining Act). The deposits specified by these decisions are still reserved deposits, i.e. owned by the state, separated from the land itself.

1.2. Planning, approval and carrying out of mineral prospecting and exploration

1.2.1. Reserved minerals

Prospecting and exploration for reserved mineral deposits, by virtue of the ČNR Act No. 62/1988 Coll., on Geological Work (the Geological Act) as amended, may be conducted by an individual or organisation, providing that the work is managed and guaranteed by a qualified and certified person (certified responsible manager for the geological work). An organisation seeking to prospect for and explore these mineral deposits, to verify their reserves, and to process geological documents for their exploitation and protection, must make a request to the Ministry of the Environment to establish an exploration area. The proceedings, subject to administrative rules, are concluded by the establishment or non-establishment of an ‘exploration area’ (exploration permit). In the former case, the following must be determined: the survey area, the mineral to be prospected and explored for which the exploration area is being established, the conditions for the execution of the work, and the period of validity of the exploration area. The exploration area is not a territorial decision, but provides the entrepreneur or organisation (hereinafter “entrepreneur”) with the exclusive privilege to prospect for the mineral in a given exploration area. In the first year, the entrepreneur is obliged by law to pay a tax of CZK 2,000 per km^2 or km^2 piece of exploration area, which increases annually by CZK 1,000 per km^2 and its piece (to CZK 3,000 in the second year, to CZK 4,000 in the third year, etc.). These taxes represent an income for the municipalities, in whose cadastral areas the exploration area is established.

Within the scope of planning and conducting the prospecting for and exploration of reserved mineral deposits, the organisation must consider the conditions and interests protected by special regulations (section 22 of the Act on Geological Work). These primarily refer to the laws for the protection of landscape and nature, agricultural and forest land; to the Water and Mining Acts etc. The Ministry of the Environment can cancel the established exploration area, if the organisation repeatedly or severely violates the obligations set by the Geological Act.

1.2.2. Non-reserved minerals (and their mining)

The above-mentioned enactments apply to prospecting and exploration for non-reserved mineral deposits, only, if they were previously declared as reserved deposits according to the transitional provisions of the Mining Act. In other cases, an organisation can prospect and explore for non-reserved minerals only upon agreement with the landowner. The provision under section 22 of the Act on Geological Work is also valid in these cases. The mining of reserved deposits is considered a mining operation under section 2 of the Mining Act and the mining of non-reserved deposits, which constitutes a part of the land, an operation conducted according to the mining methods set by Act No. 61/1988 Coll., on Mining Operations, Explosives and the State Mining Administration, as amended.

1.3. Permit to mine a prospected and explored deposit

If, during prospecting and exploration, a reserved mineral is found to be of quality and quantity indicative of its accumulation (supported by a partial deposit reserve estimate given in the category of prospected reserves), the organisation must report it to the Ministry of the Environment, which issues a certificate for the reserved deposit owned by the state. At the same time, this certificate ensures the deposit against actions rendering its mining difficult or impossible by the establishment of a protected deposit area (CHLÚ) according to section 17 of the Mining Act.

The entrepreneur’s right to mine the reserved deposit is provided by the grant of a mining lease. The submittal of a proposal for the grant of a mining lease must be preceded by an approval from the Ministry of the Environment, which may depend on the fulfilment of limiting conditions accounting for the interests of the state mineral policy, and on covering expenses of geological work already funded by the state. The organisation, on whose behalf the exploration was carried out, has priority in receiving the approval for the grant of the mining lease. If it fails to assert its mining lease, precedence is then given to the organisation which participated financially in the exploration. Somewhat different rules apply to cases concerning crude oil and natural gas based on a transposed EU directive.

The mining lease is only granted to an entrepreneur possessing a Certificate of Mining Operations issued by an authorised Regional Mining Office. This grant procedure takes place in cooperation with relevant administrative agencies, mainly in agreement with environmental, land use planning and building authorities. The entrepreneur‘s proposal for the grant of a mining lease must be furnished with documentation as stipulated by law. The procedure deals with landowner relations and settlement of conflicts of interests, which are protected by special regulations. The environmental impact assessment (EIA) represents a part of the documentation, too. The grant of a mining lease represents a mining as well as land use authorisation.

The entrepreneur, who has been granted a mining lease, may start mining operations only after obtaining a mining permit from the authorised Regional Mining Office. The issue of this permit is subject to an administrative procedure assessing the plans of the opening, the preparation and the mining of the deposit, and the plans for rehabilitation and reclamation after termination of the mining. In justified cases, the Regional Mining Authority may combine the grant of a mining lease and of a mining permit into one administrative procedure.

1.4. Royalties on reserved minerals mined

The entrepreneur is obliged to pay royalties on the mining lease and the extracted reserved minerals. An annual lease payment of CZK 100–1,000 is assessed on every hectare opened within the mining lease area, which is marked off on the surface. The payment is graded with respect to the degree of environmental protection of the affected area, the type of activity conducted in the mining lease, and its environmental impact. The Regional Mining Authority fully transfers this payment to the municipalities, in whose territories the mining lease is located, according to the lease proportions in each municipal territory.

An annual royalties on minerals extracted in mining leases is given by the MPO Decrees No. 426/2001 Coll., and 63/2005 Coll., which amend the Decree No. 617/1992 Coll., detailing the payment of royalties on mining leases and extracted minerals.

Royalty rates by kind of extracted reserved mineral
(Annex no.1 to Decree no. 617/1992 Coll., as amended)

	Kind of extracted mineral	Rate %
1	Radioactive minerals	0.3
2	Crude oil in deposits, residual reserves of which are exploited to end by the help of secondary recovery methods	0.5
3	Crude oil and natural gas	5
4	Metallic ores	10
5	Graphite	1
6	Diatomite	2
7	Glass and foundry sand	6
8	Bentonite	2
9	Minerals used for stone-cutting manufacturing inclusive fissile shales	8
10	Technically usable mineral crystals and gemstones	10
11	Gypsum	5
12	Ceramic clays and claystones from underground mining	0.5
13	Ceramic clays and claystones from surface mining	4
14	Kaolin for production of porcelain	8
15	Kaolin for paper industry	6
16	Other kinds of kaolin	2
17	Feldspar pegmatites	1
18	Other feldspar raw materials	8
19	Quartz, quartzite, dolomite, marl, basalt, trachyte provided that these minerals are suitable for technochemical processing or melt treatment	4
20	High percentage limestone	10
21	Other limestones and corrective aditives for cement production	4
22	Coal from underground mining	0.5
23	Coal from surface mining	1.5
24	Other reserved minerals	5
25	Crushed stone	2
26	Sand and gravel	3
27	Brick clays and related minerals	1
28	Other non-reserved minerals	2“

The royalties on extracted minerals are calculated as

$$U = \frac{Nd}{Nc} \cdot T \cdot \frac{S}{100},$$

where by
Nd = costs of mineral extraction (ths CZK)
Nc = total costs of the enterprise for manufacture of products (ths CZK)
T = sales (ths CZK)
S = royalty rate (%)
U = royalties total (ths CZK)

The Regional Mining Authority transfers 25 % of the yielded royalties to the state budget of the Czech Republic to be purposefully used in remediation of environmental damage caused by the mining of reserved and non-reserved deposits, and the remaining 75 % to the budget of the relevant municipalities.

1.5. Reserves for mining damages and remediation during the mining of reserved minerals

During the course of mining, the entrepreneur is required to generate sufficient financial reserves for mining damages and for reclamation of areas affected by the deposit exploitation. Generating of the financial reserves is approved by the Regional Mining Authority during the mining permit procedure regarding the opening and extraction of the deposit. Drawing on the reserves is permitted by the Regional Mining Authority upon agreement with the Ministry of the Environment and upon notification by the relevant municipality. In the case of (partially) state-owned enterprises, the Regional Mining Authority decides in agreement with the Ministry of Industry and Trade.

2. Selected statistical data on exploration and mining on the territory of the Czech Republic

Statistical data/Year	2011	2012	2013	2014	2015
registered geological works – number	2 900	3 000	3 340	3 585	4 128
protected deposit areas – number	1 075	1 087	1 098	1 100	1 105
mining leases – total number	964	967	969	973	974
number of exploited reserved deposits	496	495	502	504	505
number of exploited non-reserved deposits	220	209	203	209	208
mine production of reserved deposits, mill t [a)]	124	114	107	109	114
mine production of non-reserved deposits, mill t [a)]	13	11	11	10	12
organizations managing reserved deposits	321	320	321	318	319
organizations mining reserved deposits	185	183	179	181	179
organizations mining non-reserved deposits	166	151	170	152	165

Note: [a)] conversions: natural gas 1 mill m^3 = 1 kt, dimension and crushed stones 1,000 m^3 = 2.7 kt, sand and gravel and brick clays and related minerals 1,000 m^3 = 1.8 kt

3. Significance of mining in the Czech economy

Ratio/Year	2011	2012	2013	2014	2015
Annual GDP * growth	2,0	–0,7	–0,5	2,7	4,6
Share of mining and quarrying in GDP, % of current prices	1,2	1,1	0,8	0,9	0,8
Share of mining and quarrying GVA in GVA of industrial production**, % of current prices	4,5	3,9	2,9	3,2	2,9

Source: Czech Statistical Office, [VSP] – Professor Vojtěch Spěváček's information
Note:
* *GDP determined by production approach, volume indices, stable period of previous year = 100*
** *Industrial production = mining and quarrying + manufacturing + electricity, gas, steam and air conditioning supply*

4. Trends of reserves of minerals (economic explored disposable reserves)

Totals in mill t (if not otherwise stated)

Statistical data/Year	2011	2012	2013	2014	2015
Metallic ores [a)]	26	26	26	27	27
Energy minerals [b)]	2 939	2 891	2 847	2 807	2 769
of which: uranium (U) (kt)	1	1	1	1	1
crude oil	20	20	21	21	21
natural gas [b)]	6	6	6	6	6
Industrial minerals	2 718	2 718	2 684	2 673	2 612
Construction minerals [c)]	5 200	5170	5 153	5 107	5 156

Note:
[a)] *till 2013 only Au ores (25 642 kt), in 2014-2015 Au ores (25 642 kt) and Li ores (860 kt)*
[b)] *natural gas – conversion into kt: 1 mill m^3 = 1 kt*
[c)] *at reserved mineral deposits including dimension stone, conversion into kt – dimension and crushed stones 1,000 m^3 = 2.7 kt, sand and gravel and brick clays and related minerals 1,000 m^3 = 1.8 kt*

5. Summary of exploration licences valid in 2015 and newly issued in 2015 (listed according to minerals) – prospecting and exploration works financed by companies

Minerals and underground placement sites	Number of valid EA (min. 1)	Number of valid EA (min. 2)	Number of new issues in 2015	Start of validity in 2015
Bituminous coal	1	0	0	0
Crude oil and natural gas	21	0	8	8
Sn-W and Li ores	5	3	1	1
Li ore	0	7	1	1
Cu ore	0	4	0	0
Graphite	2	0	0	0
Gemstones	7	0	5	1
Kaolin	7	0	3	3
Clays	1	0	0	0
Bentonite	7	4	3	3
Feldspar and feldspar substitutes	5	4	2	2
Silica raw materials	0	0	0	0
Corrective additives for cement production	0	0	0	0
Dimension stone	0	0	0	0
Crushed stone	0	0	0	0
Sand and gravel	7	0	4	4
Underground placement sites, underground reservoirs	21	0	7	7
Total	**84**	**22**	**34**	**30**

EA – exploration area
Mineral 1 (min. 1) – in case that the raw material is the major one
Mineral 2 (min. 2) – in case that the raw materials is a by-product

6. State-funded geological projects

6.1. Economic geology projects

The Central Geological Authority of the state administration fulfils the duty involving the state register of reserved deposits – state property (section 29 of the Mining Act). Accordingly, it issues the register as one of the main sources for

- land use planning
- the raw material policy
- the energy policy
- the environmental policy
- the structural policy
- the employment policy

The register lists the latest status of the deposits as documented in the reserves estimate. The reserves estimate is prepared with respect to the conditions of exploitability expressing

- the state of the market, prices, business economy,
- the mining and technical conditions of exploitation,
- the conflicts of interests arising from the deposit exploitation (primarily environmental protection and other conflicts)

It is altogether entirely unstable factors reflecting political, economic and social change (in the largest sense).

In the field of economic geology works on verification of Kojetice type feldspar for opening material preparation were finished. Works assessing new potential usage of K-feldspars from Třebíč region were realized. Technological properties and potential usage of feldspathic materials from a variety of localities in the Czech Republic were assessed. Risk factors associated with exploitation of hypothetical and unconventional hydrocarbon shale resources inclusive absorption of methane and carbon oxides in the area of Bohemian Massif southeastern slopes were appraised.

Expenditures for state-funded exploration work related to economic geology (rounded values)

1993	CZK 248.7 mill
1994	CZK 249.8 mill
1995	CZK 242.3 mill
1996	CZK 163.0 mill
1997	CZK 113.2 mill
1998	CZK 114.2 mill
1999	CZK 110.8 mill
2000	CZK 26.3 mill
2001	CZK 21.5 mill
2002	CZK 17.0 mill
2003	CZK 7.0 mill
2004	CZK 26.2 mill
2005	CZK 12.0 mill
2006	CZK 1.7 mill
2007	CZK 3.0 mill
2008	CZK 9.9 mill
2009	CZK 10.1 mill
2010	CZK 4.2 mill
2011	CZK 4.0 mill
2012	CZK 1.0 mill
2013	CZK 1.5 mill
2014	CZK 0.7 mill
2015	CZK 0.7 mill

6.2. Other geological projects

Mainly geological work of a non-economic geology character was funded by the state. Individual projects were publicly commissioned in order to implement the following partial programmes:

- geological informatics
- geological mapping
- geohazards of the environment
- hydrogeology
- engineering geology
- comprehensive geological studies

The following expenditures were spent on these geological projects since 2001:

2001	CZK 72.8 mill
2002	CZK 61.0 mill
2003	CZK 67.0 mill
2004	CZK 52.1 mill
2005	CZK 60.3 mill
2006	CZK 55.4 mill
2007	CZK 58.1 mill
2008	CZK 41.0 mill
2009	CZK 42.2 mill
2010	CZK 35.0 mill
2011	CZK 22.8 mill
2012	CZK 12.6 mill
2013	CZK 8.2 mill
2014	CZK 7.5 mill
2015	CZK 9.2 mill

7. Summary of selected legal regulations on mineral prospecting and exploration in force as of June 30, 2016

7.1. Acts

Act No. 44/1988 Coll., on Mineral Protection and Use (the Mining Act) – as amended by the Acts No. 541/1991 Coll., No. 10/1993 Coll., No. 168/1993 Coll., No. 132/2000 Coll., No. 258/2000 Coll., No. 366/2000 Coll., No. 315/2001 Coll., No. 61/2002 Coll., No. 320/2002 Coll., No. 150/2003 Coll., 3/2005 Coll., No. 386/2005 Coll., No. 186/2006 Coll., No. 313/2006 Coll., No. 296/2007 Coll., No. 157/2009 Coll., No. 227/2009, Coll., No. 281/2009 Coll., No. 85/2012 Coll. , No. 350/2012 Coll., No. 498/2012 Coll., 257/2013 Coll., No. 89/2016 Collb. a No. 264/2016 Coll.

Act No. 61/1988 Coll., on Mining Operations, Explosives and the State Mining Administration as amended by the Acts No. 425/1990 Coll., No. 542/1991 Coll., No. 169/1993 Coll., No. 128/1999 Coll., No. 71/2000 Coll., No. 124/2000 Coll., No. 315/2001 Coll., No. 206/2002 Coll., No. 320/2002 Coll., No. 226/2004 Coll., No. 3/2005 Coll., No. 386/2005 Coll., No.186/2006 Coll., No. 313/2006 Coll., No. 342/2006 Coll., No. 296/2007 Coll., No.376/2007 Coll., No.124/2008 Coll., No.274/2008 Coll., 223/2009 Coll., No. 227/2009 Coll., No. 281/2009 Coll., No. 155/2010 Coll., No 184/2011 Coll. , No. 18/2012 Coll., 64/2014 Coll., No. 250/2014 Coll., No. 206/2015 Sb., No. 204/2015 Sb., No. 320/2015 Coll., No. 91/2016 Coll. a No. 243/2016 Coll.

Act No. 62/1988 Coll., on Geological Work, as amended by the Acts No. 543/1991 Coll., No. 366/2000 Coll., No. 320/2002 Coll., No. 18/2004 Coll., No. 3/2005 Coll., No. 444/2005 Coll., No. 186/2006 Coll., No.124/2008 Coll., No. 223/2009 Coll., No. 227/2009 Coll., No. 281/2009 Coll., No. 85/2012 Coll., 64/2014 Coll.

Act No. 157/2009 Coll., on Mining Waste Treatment and Amendment of Some Acts, as ammended by the Act No. 168/2013 Coll.

7.2. Other legal regulations

7.2.1. Mineral deposits exploitation

Decree of the ČBÚ No. 104/1988 Coll., **on efficient use of reserved deposits, on permits and notification of mining operations and other activities employing mining methods,** as amended by the Decree No. 242/1993 Coll., No. 434/2000 Coll., and No. 299/2005 Coll.

Decree of the ČBÚ No. 415/1991 Coll., **on construction, the elaboration of documentation and the determination of safety pillars, rods and zones for the protection of underground and surface sites** in the wording of the Decree of the ČBÚ No. 340/1992 Coll., and No. 331/2002 Coll.

Decree of the ČBÚ No. 172/1992 Coll., **on mining leases** in the wording of the Decree No. 351/2000 Coll.

Decree of the ČBÚ No. 175/1992 Coll., **on the conditions of non-reserved mineral deposit exploitation** in the wording of the Decree No. 298/2005 Coll.

Decree of the MŽP ČR No. 363/1992 Coll., **on the survey and registry of old mine workings** in the wording of the Decree of the MŽP No. 368/2004 Coll.

Decree of the MŽP ČR No. 364/1992 Coll., **on protected deposit areas**

Decree of the ČBÚ No. 435/1992 Coll., **on mine surveying documentation during mining and during some operations employing mining methods** in the wording of the Decree of the ČBÚ No. 158/1997 Coll. and the Decree No. 298/2005 Coll. and the Decree No. 382/2012 Coll.

Decree of the MH ČR No. 617/1992 Coll., **detailing the payment of royalties on mining leases and extracted minerals**, in the wording of the Decree of the MPO No. 426/2001 Coll. and No. 63/2005 Coll.

Decree of the MHPR ČR No. 497/1992 Coll., **on the registration of reserves of reserved mineral deposits**

7.2.2. Geological work

Decree of the MŽP No. 282/2001 Coll., **on the registration of geological work**, in the wording of the Decree of the MŽP No. 368/2004 Coll.

Decree of the MŽP No. 368/2004 Coll., **on geological documentation**

Decree of the MŽP No. 369/2004 Coll., **on the planning, execution and evaluation of geological work, on announcing geohazards, and on the procedure for estimating reserves of reserved deposits** as amended by the Decree of the MŽP No.18/2009 Coll.

7.2.3. Regulations on licensing of mining operations and verification of qualification

Decree of the ČBÚ No. 298/2005 Coll., **on the requirements for professional qualification and competence in mining or operations employing mining methods, and on some legal regulation changes,** in the wording of the Decree No. 240/2006 Coll. and the Decree No. 378/2012 Coll.

Decree of the ČBÚ No. 15/1995 Coll., **on the licensing of mining operations and operations employing mining methods as well as on the development of sites and installations, which constitute these operations,** in the wording of the Decree No. 298/2005 Coll. and the Decree No. 380/2012 Coll.

Decree of the MŽP ČR No. 206/2001 Coll., **on the certificate of qualification for planning, executing and evaluating geological work**

ECONOMY AND MINERALS

Development of the Czech and global economies and the importance of minerals

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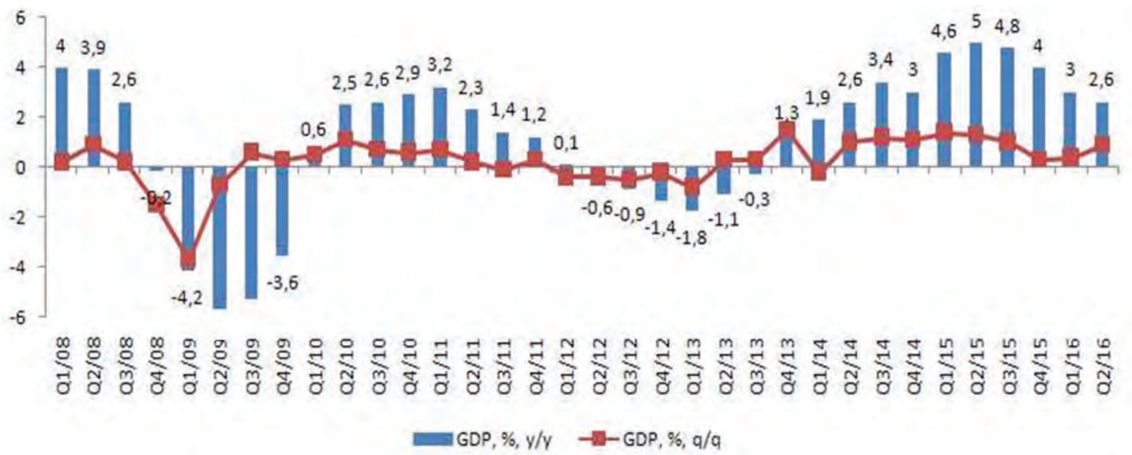
1. Macroeconomic development of the Czech economy

In 2014 and 2015, the Czech economy returned to a growth trajectory which was interrupted by the crisis year of 2009 and the subsequent slow recovery of the economy. The latest revised statistical data from the national accounts, however, indicate that the weak economic activity and the subsequent recession besetting the Czech economy in the years 2012 and 2013 were not as deep as the original data suggested. Quarterly and annual growth rates **of the gross domestic product (GDP) /1**/ are shown in Figure 1. On the **demand side of the economy /2/,** there were differences mainly in the **household consumption /3**/, the investment demand, or development of the **gross fixed capital formation /4/,** remained virtually unchanged.

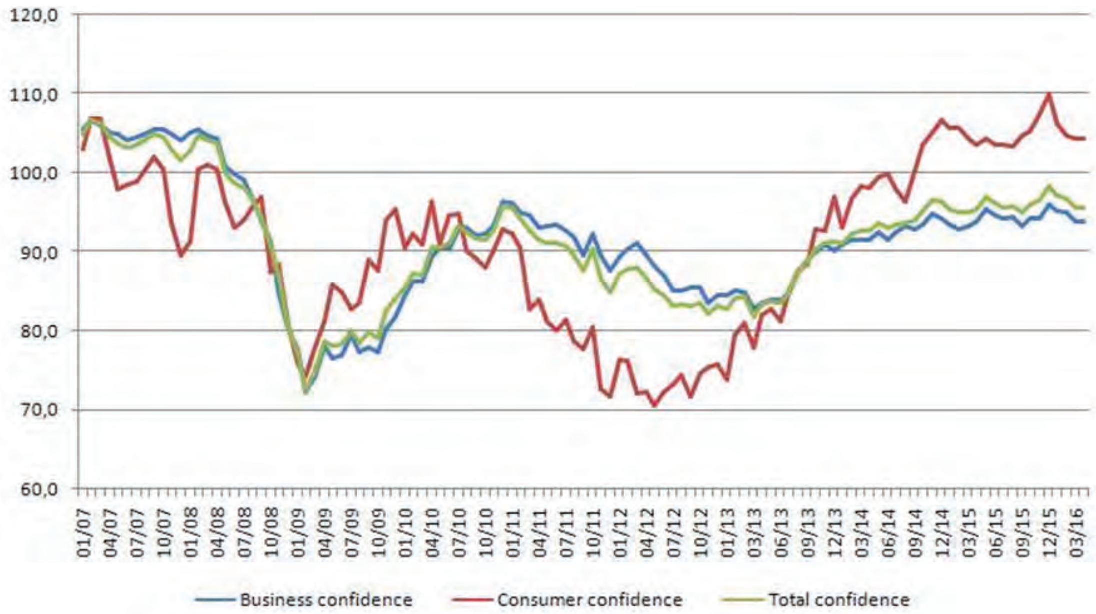


Source: CZSO, National accounts (September 2016).

Figure 1: Real GDP, annual and quarterly changes (in per cent)

In **2014,** a full-year GDP growth reached 2.7% (according to the current data). The reversion of the Czech economy was primarily stimulated by changes in domestic factors. Between 2012 and 2013, there was a negative sentiment in the Czech economy, both in households and in the corporate sector. The reversal in the perception of confidence **/22/** in the Czech economy occurred in the second and third quarters of 2013. As for the perception of households, their confidence in the domestic economy reached pre-crisis values already in 2014, entrepreneurs regained their confidence later and more slowly – see Figure 2.

In 2015, Czech economic growth accelerated significantly. This acceleration surprised all institutions engaged in forecasting the Czech economy – even at the beginning of 2015,



Source: CZSO, September 2016

Figure 2: Indicators of confidence (basic indices, 2005 = 100)

forecasts spoke about approx. 2.5% growth. The first estimate of GDP growth for the first quarter (3.9% yoy), which was published in May 2015, was unexpectedly positive. Starting with the publication of preliminary results for the first quarter, there were repeated upward corrections of GDP forecasts. Overall, GDP growth reached 4.6% in 2014. However, the growth was supported by an extraordinary combination of favourable transient factors with varying intensities and durations.

A strong pro-growth impulse was the fall in oil prices, which contributed to the growth by about one percentage point. This estimate can be considered the lower limit as it was not only oil but also other commodities like natural gas and other imported raw materials. The cause of the price slump was particularly a weak economic growth, and thus demand for commodities, of emerging economies. It was not only the frequently mentioned China, but also other major economies with high material intensities of production – e.g. Russia and Brazil which struggled with economic problems.

At the beginning of 2015, the average oil price was about USD 100 per barrel, yet there were also many much higher estimates. Even in October 2015, the average oil price was estimated at USD 61 per barrel. However, due to the sharp decline, the overall average price was only USD 52 per barrel. The drop in oil prices caused a strong positive supply shock to the economies that are dependent on imported oil and other commodities. The small, open, and raw material-dependent Czech economy was one of those which significantly benefited from the drop in oil prices – fuel prices decreased both for individual customers, who were able to increase their consumption of fuel and also other services and commodities, as well as for manufacturers. Low oil prices led to lower costs, higher profitability, and wider space for investment and wage growth. Developments in oil prices is shown in Figure 3.

Another factor was the fiscal stimulation and the subsequent increase in **public consumption /5/**. According to the Ministry of Finance (Macroeconomic Forecast, October 2015), this contributed by extra eight tenths of a percentage point and was associated with the drawing of EU funds. The central bank, on the other hand, emphasised the contribution of their monetary

Source: Thomson Reuters, September 2016

Figure 3: Oil price (USD per barrel)

policy in the form of artificially weakened koruna. The artificial weakening of koruna helped to boost profits of export companies. The improved economic situation of these companies then uplifted the long-cold investment climate. The improved economic situation of exporters had a beading effect on other sub-contractors and thus the economic growth obtained a broader base. However, the problem is that after leaving the exchange rate commitment the removal of this artificial stimulation may cause a shock for the unprepared exporters.

In 2016, when the investment stimuli (especially from EU funds) vanished, the Czech economy slowed down a bit. Data for the first half of the year, when GDP growth was 2.8%, indicate that the slowdown will not be dramatic. The strong result in 2015 set a high comparative base for 2016 and thus the development can be considered positive in light of the extraordinary performance achieved last year. Confidence indicators show the values observed before the crisis year of 2008. As expected, a slowdown occurred particularly in investment demand while household consumption kept its dynamics. In the first half of the year, growth was driven mainly by **foreign trade /6/** and especially by net exports. This will also apply for full-year result. In 2016, the total GDP growth should be just below 2.5%.

In 2017, a slight acceleration is expected while the growth rate would be slightly above 2.5%. The key component of the growth should still be the**Domestic demand /7/** should still be the key component of the growth. It is expected that household consumption will continue at a steady pace while the growth will be supported by the same factors as in 2016. As the

Table 1: Main macroeconomic indicators, forecast for 2016 and 2017

Institution	Ministry of Finance		Czech National Bank	
Indicator	**2016**	**2017**	**2016**	**2017**
GDP (real, y/y, %)	2.2	2.4	2.4	3.0
Consumption of households (real, y/y, %)	3.1	2.7	3.0	2.9
Government consumption (real, y/y, %)	2.2	1.6	2.2	2.4
Gross fixed capital investment (real, y/y, %)	–0.6	2.8	–0.3	4.2
GDP in eurozone (real, y/y, %)	1.5	1.2	N	N

Source: Ministry of Finance, July 2016, Czech National Bank, August 2016

unemployment rate /8/ is expected to decline to 5.3%, wage growth should be just above 4% again. The wage growth should be also influenced by the new minimum wage which was agreed by the tripartite. 2017 will be an election year so the consumption will be also supported by government spendings. In 2017, investments will no longer be burdened by the exceptionally strong base from 2015 and they should rise by at least 3% in comparison with 2016. A 2–3% GDP growth is close to the Czech economy's potential and means a fundamentally a sustainable trajectory which does not create undesirable economic imbalances and thus risks for the future development.

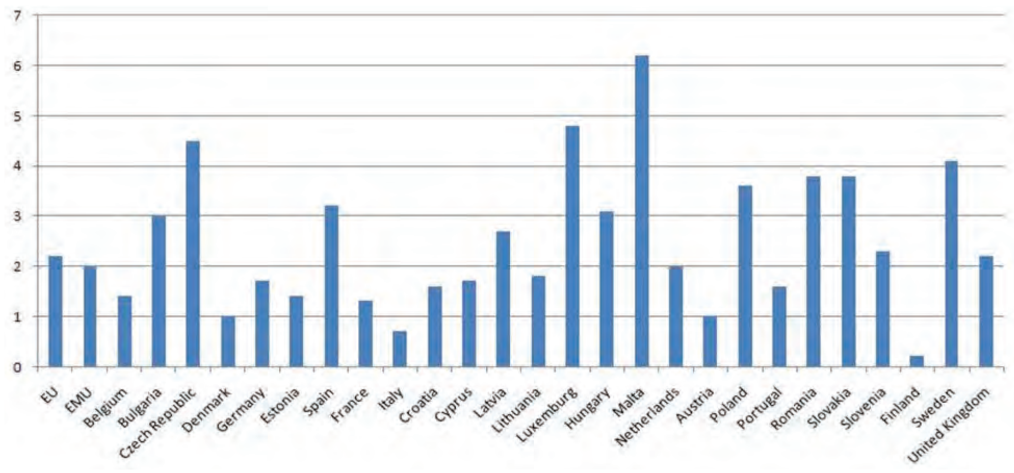
In its macroeconomic forecast of July 2016, the Ministry of Finance anticipated GDP growth of 2.2% in 2016 and 2.4% in 2017. The prognosis published by the Czech National Bank in August 2016 is slightly optimistic it expects the economy to grow by 2.4% in 2016 and by 3% in 2017. The differences are especially apparent in government spendings and investment demand, where the CNB expects higher results.

Forecasts for the Czech economy are affected by certain risks and uncertainties. On a global scale, there is an increasing political uncertainty and risk regarding the outlook for 2017, especially due to uncertainties in Western Europe. The result of the referendum on exit of the UK from the EU has virtually no effect on the economic outlook for this year, yet it may have a negative impact on the next year's prognosis. Negotiations on the particular form of "Brexit" may slow down foreign demand, both directly – through lower Czech exports to the UK – and indirectly – via deceleration of economic growth in eurozone. The future foreign demand is also threatened by conditions of banking sectors of some euro area countries. At present, the economic growth of eurozone is expected to reach around 1.5% in both years.

It can be expected that the oil price will rise gradually and will reach around USD 50 per barrel in 2017. The bi-directional sensitivity of oil prices to geopolitical developments represents a permanent factor of uncertainty. A further strengthening of the dollar against the euro is not expected. Due to global uncertainties, the US central bank (Fed) will not rush with tightening of their monetary policy, despite the fact that the current economic situation of the US would better correspond with higher interest rates. The ECB's monetary policy can respond to the risks associated with Brexit and condition of the banking sector by extending the quantitative easing. This is associated with the main uncertainty in the domestic economy, which is the timing and the method of leaving the exchange rate commitment. Currently, this step is expected to be taken in mid-2017.

In 2015, the growth of the Czech economy was one of the highest in the EU, faster GDP growths were reported only by Malta[1] and Luxembourg (see Figure 4). The restored economic growth in 2014 and 2015 also meant restoration of the economic convergence, which was achieved after seven years. The convergence is expressed by the economic level measured by GDP per capita in the **purchasing power parity /9/** (PPP) to the EU average. In the pre-crisis year of 2007, our GDP per capita in PPS reached 83% of the EU average. As a result of the crisis downturn and recession in 2012 and 2013, our position to the EU average was slightly deteriorating until 2013. The growth achieved in 2014 brought an increase to 84% and the continued growth in 2015 to 85% of the EU average. However, it should be noted that our position to the most advanced European economies has not been improving over time. In 2015, the Czech Republic reached 68% of economic level of Germany, which is the same

[1]Although Ireland reported a 26.3% growth, it has not been included in Fig. 4 due to methodological problems with measuring.



Source: CZSO, September 2016

Figure 4: Real GDP annual growth in EU and individual EU member states, 2015 (in per cent)

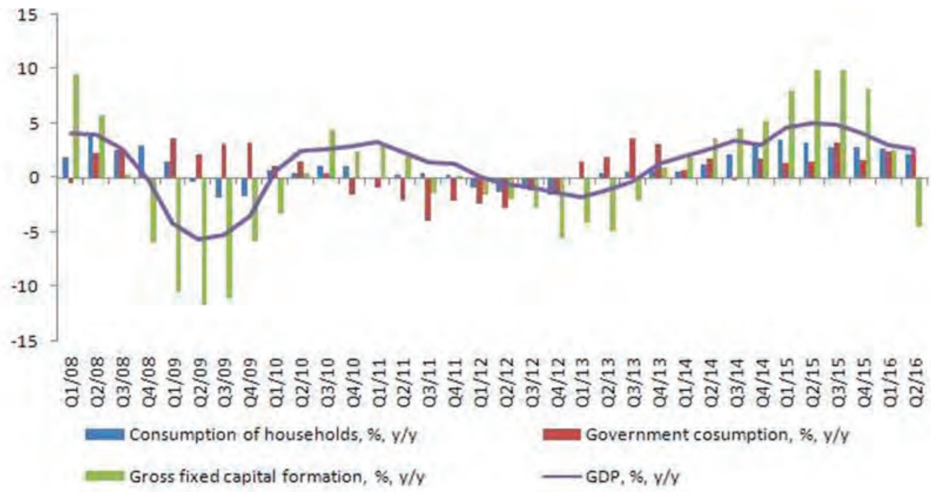
value as in 2007. Therefore, in the long-term, our position to the EU has been improving rather due to the EU's enlargements by countries with lower economic levels. In order to improve in relation to the most developed economies, such as neighbouring Germany and Austria, the Czech economy would have to increase production with higher added value. For now, this shift has been rather dull.

2. Changes on the demand side

Growth or decline of individual components of demand affect the development of the gross domestic product in the extent to which the individual demand components contribute to GDP. The main demand component is household consumption, which contributes by about a half to the domestic GDP. It is also relatively most stable component with the lowest oscillations and fluctuations in the business cycle. Household consumption depends mainly on the development of the labour market, i.e. employment (or unemployment), wage increases, **inflation (10),** and the overall condition of the economy. However, consumers' perception may differ from development of "hard" statistical data, but "consumer confidence" may be affected by a number of other factors, e.g. the domestic political situation and the intensity of geopolitical risks. Consumer confidence is most intensively associated with the expected development of unemployment and expected inflation.

Investment demand, in contrast, is primarily associated with outlooks of demands in the main trading partners. The Czech economy belongs to the most open European economies and thus foreign trade is crucial for it. Therefore, all investment projects are associated primarily with expectations of foreign demand. However, a solid demand for exports is not a sufficient condition for the growth of domestic consumer and investment demand. As the proportion of multinational companies in the structure of the economy is extremely high, especially in the engineering sector, a good condition of European countries and companies is vital not only for export, but also for investment decisions and wage developments.

The weak domestic demand in 2011 and 2012 was partly offset by a positive, growth-promoting effect foreign trade – see Figures 5 and 6, Table 2. As domestic demand revived



Source: CZSO, National accounts (September 2016).

Figure 5: Consumption of households, government consumption, investments, (real annual changes in %)

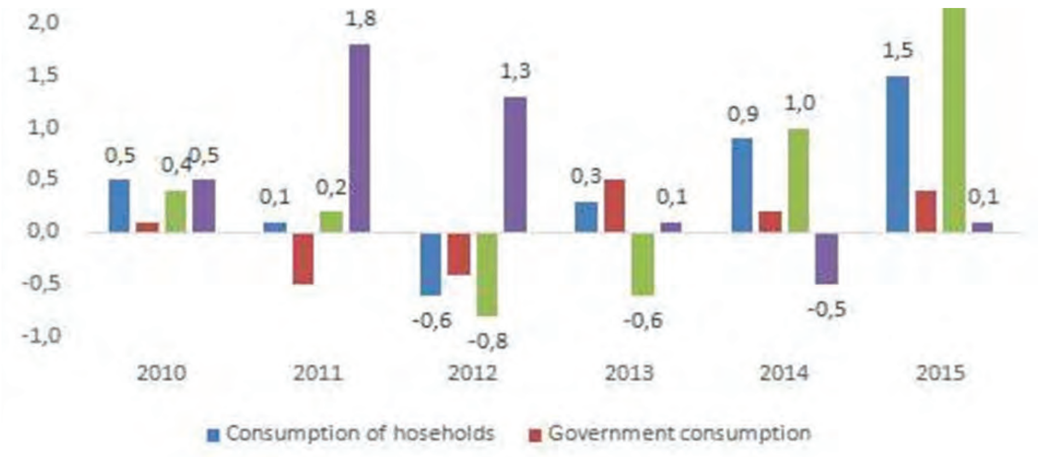
in 2014 and strengthened in 2015, the effect of net exports was marginal and it even got to red numbers in 2014. However, that does not mean that the foreign trade would develop negatively. Exports rose by 8.7% in 2014 and by 7.9% in 2015. Exports remain to be highly import-dependent, both regarding raw materials and semi-finished products. The stronger domestic demand also led to an increase of imports, which made net exports optically worse. In 2014, the faster growth of imports in comparison with exports reflected in a slight negative contribution of foreign trade to GDP growth. In 2015, the effect of net exports was neutral.

Table 2: Components of final demand (real annual changes in %)

	2009	2010	2011	2012	2013	2014	2015
GDP	–4.7	2.1	2.0	–0.7	–0.5	2.7	4.6
Final consumption	0.5	0.8	–0.5	–1.4	1.1	1.6	2.8
Private consumption	*–0.6*	*0.9*	*0.3*	*–1.2*	*0.5*	*1.8*	*3.1*
Public consumption	*3.0*	*0.4*	*–2.2*	*–2.0*	*2.5*	*1.1*	*2.0*
Gross capital formation	–17.8	4.1	1.9	–3.8	–5.1	8.5	10.2
Gross fixed capital formation	*–9.8*	*1.0*	*0.9*	*–2.9*	*–2.5*	*3.9*	*9.1*
Exports	**–9.5**	**14.4**	**9.2**	**4.5**	**0.2**	**8.7**	**7.9**
Imports	**–10.7**	**14.5**	**6.7**	**2.8**	**0.1**	**10.1**	**8.4**

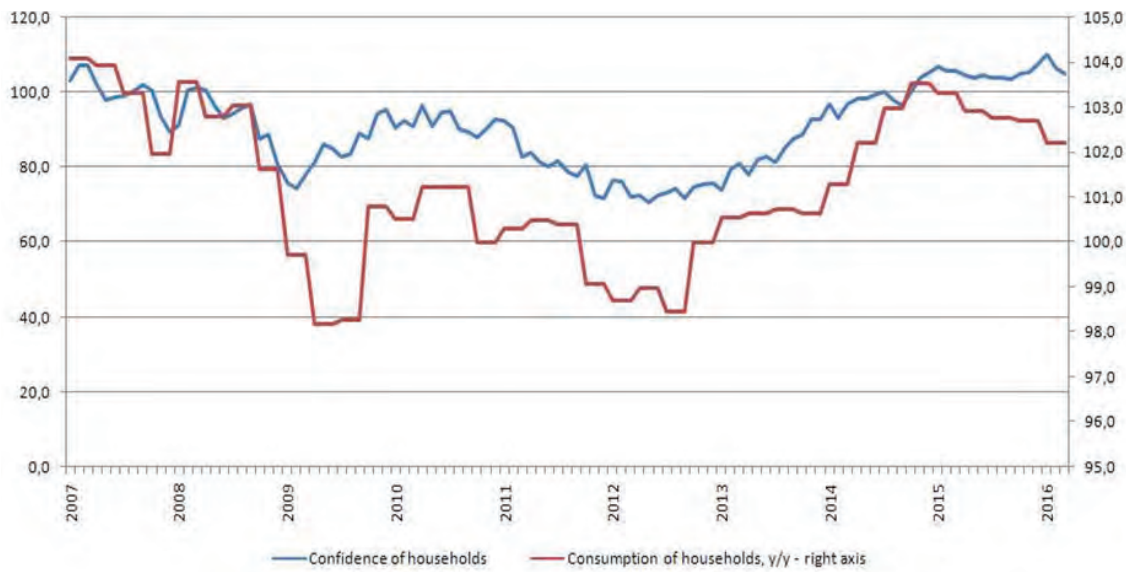
Source: CZSO, National accounts (September 2016).

It was the good export performance, which enabled the revival of investment, employment and wage growth, that created the background for strengthening of the domestic demand. At the beginning of 2016, the situation reversed again – a drop in investment demand reduced the demand for imports and thus the impact of net exports on growth rose again. We can say that domestic demand, and particularly the component of gross fixed capital formation, and imports are communicating vessels to a large extent.



Source: CZSO, National accounts (September 2016)

Figure 6: Contributions of individual components of final demand to GDP annual change (in percentage points)



Source: CZSO, National accounts (September 2016)

Figure 7: Consumer confidence (basic indices 2005 = 100) and consumer demand (y/y, in %)

Based on the newly revised CSO data, household consumption was shifted slightly upwards for 2011 and 2012. In 2011, household consumption increased slightly, although the original data showed a slight weakening. Also the decrease in consumption in 2012 was milder than the original statistical data implied. In the surveys carried out in the years 2011 – 2013 households accentuated not only they concerns about the rise in unemployment, but also concerns about price increases. It is likely that the weakening of household consumption was also driven by fiscal consolidation which was accompanied by two stages of increases of the value-added tax (VAT). In January 2012, the lower VAT rate was increased from 10 to 14% and in January 2013 both rates were raised by one percentage point, i.e. to 21% (basic rate) and 15% (reduced rate).

Source: CZSO, September 2016

Figure 8: Consumer confidence (basic indices 2005 = 100) and consumer price index (y/y, in %)

In 2012, consumer confidence of households fell even lower than in 2009 and remained at record low levels from autumn 2011 to autumn 2012. Figure 7 clearly shows that consumer confidence began to recover at the turn of 2012 and 2013, i. e. this was probably the period when households absorbed the price increases. For illustration, Figure 8 clearly shows that households' sentiment is negatively correlated with growth of consumer prices (CPI). According to the CSO, three quarters of CPI growth were represented by administrative adjustments. The low inflation in 2014 and 2015 was an important factor brought the growth of real wages closer to the growth of nominal wages. Thanks to this positive pension effect household consumption increased by 1.8% in 2014 and accelerated to 3.1% in 2015 which significantly supported our economy's performance in both years. In 2014, household consumption the dominant factor, in 2015, it contributed to the growth by 1.5 percentage points. Unlike government consumption and gross fixed capital formation, household consumption was not supported by other unexpectedly favourable factors (next to cheap fuels) in 2015.

Fiscal policy started to stimulate growth by increasing government investment, wages of government employees and retirement pensions and introducing the second reduced rate of value added tax. The favourable economic development and the growing confidence in the future development boosted government investments. The share of expenditures on general government consumption to GDP reached around 20% of GDP. In 2011 and 2012, public consumption had a negative effect due to austerity measures applied. Between 2013 and 2014, public consumption rose again and its influence was very significant in 2015 because it reflected funding through the European funds.

Investment demand, or precisely gross fixed capital formation, was the main reason for the protracted recession of 2012–2013. There were multiple causes of the slump in investments – there were expectations of domestic economic subjects and also the overall situation of the European economy (due to a high number of ownership-based interconnections with the EU countries). Government cost-saving measures, which led to a steep drop in public investment (primarily in infrastructure), had a negative impact as well. The recovery in business confidence took place later than the recovery in consumer confidence and also the recovery in

Table 3: Households: Income, consumption, savings rate

	Nominal wage. %. y/y	Real wage. %. y/y	Disposable real income of households. %. y/y	Household consumption. %. y/y	Gross savings rate of households (%)
2010	2.2	0.8	0.1	1.0	12.7
2011	2.5	0.6	–1.3	0.3	11.4
2012	2.5	–0.8	–1.2	–1.2	11.3
2013	–0.1	–1.5	–0.8	0.5	11.1
2014	2.9	2.5	2.9	1.8	12.1
2015	2.7	2.4	3.3	3.0	12.2

Source: Ministry of Finance. Macroeconomic prediction. July 2016.

investment occurred in 2014, when the growth in investment demand reached 3.9%. In 2015, the dynamics of investment significantly accelerated to 9.1% and investments were the main driver of GDP growth that year. However, such a high growth in gross fixed capital formation occurred only once as it was stimulated by an extremely positive combination of favourable factors – similarly to government consumption, the delayed use of the EU funds from the programming period 2008–2014 played a crucial role here.

3. Structural changes in the Czech economy

As for the **supply side of the economy /11/,** i.e. the shares of individual sectors and industries, the structure of the Czech economy has not undergone any significant changes in recent years. There are persisting differences in comparison with economic structures of other EU countries. These differences stem from a high share of industry and a low share of services in the Czech economy. The share of services hovers around 60%, which is still a low value when compared internationally (in the EU-27, the share of services reached 73.5% in 2015). The development in the industry sector is heavily influenced by foreign demand, while the development of services is primarily determined by the strength of domestic demand. Services produced within the domestic economy are mainly purchased by Czech households and domestic entrepreneurs. Exports of services are indeed an indispensable factor in the development of the Czech economy, yet they have been concentrated mainly in services related to tourism and transport so far because the EU's internal market with services has not been fully liberalised yet.

Therefore, developments in the industry sector are the key factor influencing the development of our economy. The share of industry in the **gross value added (GVA) /12/** represents almost thirds of the total GVA in the national economy. With a slight simplification (abstracting from taxes and subsidies), the share of gross value can be considered the sector's contribution to GDP. The main role plays the manufacturing industry, mining and quarrying have been contributing to the GVA by approximately 1% for several years (Table 4)

The role of minerals, measured by this sector´s share in the gross value added and employment within the entire national economy, remains very small and has a declining trend.

Table 4: Structure of gross value added (in %, current prices)

	Gross value added		
	2005	2010	2015
Agriculture and forestry	2.4	1.7	2.5
Industry	31.0	29.9	32.1
Manufacturing	*29.8*	*23.4*	*27.0*
Mining and quarrying	*1.2*	*1.3*	*0.9*
Electricity, gas and water supply	*4.3*	*5.2*	*4.2*
Construction	6.7	6.9	5.7
Services	59.9	61.5	59.7

Source: CZSO, National accounts (September 2016).

The share of mining and quarrying in the total GVA decreased from 1.2% in 2005 to 0.9% in 2015. From a macroeconomic perspective /12/, the low and diminishing importance of mining and quarrying stems from the Czech Republic´s mineral scarcity (with the exception of coal and construction minerals) and dependence on imports of important energy minerals and other raw materials (especially crude oil and natural gas). Other additional factors are the ongoing structural changes and the declining importance of the mineral-dependent industry.

According to the **tables of inter-industry relations** /**13**/, the decisive part of resources (domestic production and imports) provided by the mining and quarrying industry was used for intermediate products (nearly 70%) and the largest consumers were two industries – production of coke and refining of petroleum and the supply of electricity, natural gas and water. In the case of other minerals, there were three main consumers – production of other non-metallic mineral products, production of basic metals, and construction. Minerals used primarily for the production of construction materials such as stone, sand, limestone, or kaolin thus reflect the situation in construction output. That is why it is necessary to also assess the importance of domestic minerals based on the weight of the mineral-based manufacturing branches in the national economy. A significant factor are also environmental aspects as the mining industry mostly affects the environment adversely and this phenomenon is currently paid attention not only domestically, but also within the entire EU. All significant domestic investment projects are assessed in terms of environmental impacts within the EU (EIA).

While in 2014 the economic recovery was primarily driven by recovery of the manufacturing industry, in 2015 the growth was spread broadly to other sectors, especially services. Table 5 shows production growth rates of twenty major sectors.

After years, agriculture production rose revived in 2014 and 2015, however due to its small weight in the national economy, its impact on the overall economic growth its marginal. The construction sector accelerated to 6.5% in 2015, but this growth has been supported by similar factors as the extraordinary increase in investments (especially to infrastructure) – a significant role played the already mentioned use of European funds. Therefore, we expect a considerable decrease in construction output in 2016.

On the other hand, the significant recovery in the manufacturing sector is mainly due to the recovery in foreign demand, which occurred in 2014 and 2015. There is a wide range of services depending on performance of industry, in particular commercial and transport services. The strong domestic demand also promoted growth in the real estate sector. Here, a mortgage boom and an increased interest of households in purchasing real estates also played role in 2016. Also corporate investments are increasingly directed to the real estate sector. Performance in the sectors of information and communication services is determined by the

Table 5: Output by industries (real annual changes in %)

Sector	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL	**101.9**	**91.8**	**104.7**	**102.8**	**97.9**	**99.9**	**104**	**104.8**
Agriculture, forestry and fishing	104.6	103.1	94.1	111.1	99.3	100.6	104.4	103.9
Mining and quarrying	98.6	85.9	98.1	96.6	99.2	90.4	99.1	94.7
Manufacturing	101.9	85.4	111.3	106.9	98.6	99.3	107.6	105.7
Electricity, gas, steam and air conditioning supply	97.7	91.8	99.2	100.5	97	97.4	90.4	99.9
Water supply; sewerage, waste management and remediation activities	103.4	97	98.2	104.9	93.9	92	102.2	100.2
Construction	99.1	91.3	98.9	95.9	91.6	97.1	102.5	106.5
Wholesale and retail trade; repair of motor vehicles and motorcycles	101.6	97.1	108.9	104.6	97.4	102.3	106.4	107.3
Transportation and storage	100.4	91.1	102.3	97.4	98	99.6	102.4	104.5
Accommodation and food service activities	95.8	92.2	93.3	100.9	95.3	98.1	98.5	107.3
Information and communication	101.5	101.1	100.2	100.9	97.8	102.8	104.6	108.8
Financial and insurance activities	102	101.3	103.7	100.4	100.5	104.2	99.9	95.5
Real estate activities	110.1	98.1	105.5	102.2	101.3	100.3	101.3	105.4
Professional, scientific and technical activities	106.5	90.8	102.6	99.9	99.1	99.8	103.4	106.9
Administrative and support service activities	103.6	94.8	90.8	106.3	98.7	106.4	100.6	103.6
Public administration and defence; compulsory social security	102.7	101.2	100.2	95.8	96.5	101.3	100.3	99
Education	101.6	100.2	100.4	102.5	97.9	102.4	101.9	100.3
Human health and social work activities	101.4	101.6	99.3	98.5	99.9	101.4	102.3	104.9
Arts, entertainment and recreation	101.9	94.7	96	102.7	96.6	102.1	102	103.6
Other service activities	92.9	93.3	102.7	101.7	96.3	99.1	101.2	100.5
Activities of households as employers and producers for own use	120.6	127.9	93.2	96.2	108	108.5	105.4	109.0

Source: CZSO, National accounts (September 2016).

strong domestic demand and a rising global tendency towards universal digitisation. The strong consumer demand also supported performance of the services sectors of hospitality, accommodation, culture, and recreation in 2015. We expect the trends in these sectors to continue as the domestic consumer demand is forecast to be strong also in 2016 and 2017.

It is obvious that production in mining and quarrying continued with its long-term decline in the previous years. However, the developments in individual sectors were differentiated – see Table 6 showing a detailed structure of the GVA in the sectors of mining and quarrying. In the years 2014 and 2015, there was a significant recovery in ore mining and processing while the coal sector growth in 2014 was only a short-term fluctuation. Overall, the dynamics of these sectors is subject to strong fluctuations which are much stronger than the fluctuations in manufacturing sectors. The future development in the production and processing of bituminous and brown coal, which has the largest share of production in mining and quarrying (nearly 70 %), will depend both on demand, and especially on the long-term policy of the Czech energy sector. The current preference for renewable resources is one of the factors that reduce this sector's production.

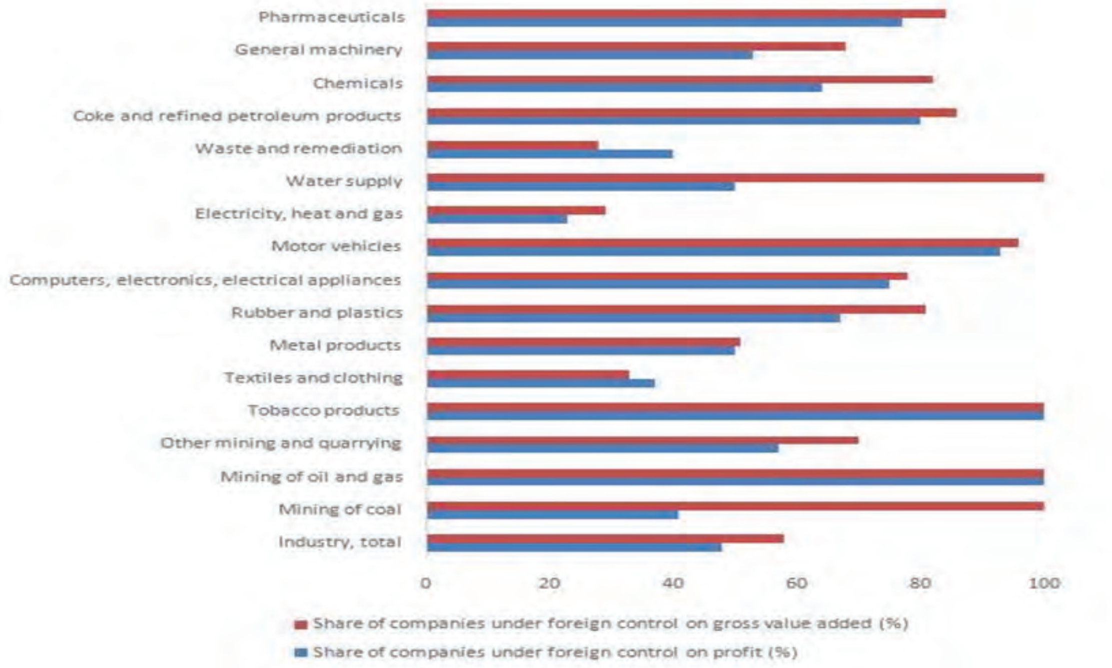
Table 6: Gross value added in mining and quarrying industries (real annual changes in %)

	2008	2009	2010	2011	2012	2013	2014	2015
Mining of coal and lignite	–13.8	–12.7	2.5	–6.3	–5.5	–28.3	40.9	–4.9
Extraction of crude petroleum and natural gas	–25.6	32.5	–43.8	1.9	61.8	9.7	28.8	–10.0
Mining of metal ores	76.0	5.5	–16.9	–44.8	59.2	–4.1	86.1	37.2
Other mining and quarrying	–5.6	–13.6	–12.5	–4.5	–8.2	–5.0	2.0	0.2
Mining support service activities	–23.6	10.9	–7.2	23.6	–13.4	–1.5	–18.5	–17.7

Source: CZSO, National accounts (September 2016).

The development of the domestic economy's structure was also affected by the inflow of foreign capital and the growing role of private enterprises controlled by foreign entities. Since 1998, the Czech economy has experienced one of the strongest inflows of **foreign direct investment (FDI) /14/** both in the Central and Eastern Europe, as well as in the global economy. By the end of 2014 (the latest accurate data of the CNB) foreign direct investments in the Czech economy amounted to CZK 2,774.6 billion (i.e. 64% of GDP). CZK 32.9 billion were invested in the mining and quarrying sector, which corresponds to the sector's share in the Czech economy. FDI inflows have gradually led to a high penetration of foreign-owned companies in the Czech economy (with its benefits, as well as costs). On average, foreign-owned companies create almost half of the gross value added in the domestic corporate sector.

Figure 9 shows shares of companies controlled by foreign entities in the value added in individual industrial sectors, as recorded in 2014 (latest data available). Their share is above-average in many key sectors – foreign-owned companies dominate in the extraction of oil and natural gas and a similar situation is in the sector of water distribution and treatment. In the coal-mining sector, their share in GVA reaches 41%, in manufacturing of coke and petroleum products it is 80%, and more than 50% in mining and quarrying of other raw materials.



Source: CZSO, National accounts (September 2016).

Figure 9: Shares of companies under foreign control on gross value added and profit by selected industries in 2014 (in %),

Figure 9 shows shares of foreign-owned companies in the net operating surplus (i.e. profit). Not only do the data clearly confirm that companies controlled by foreign entities dominate in many key sectors of the domestic industry, but they also show that foreign-owned companies have a higher share in profit than in the value added. For the industry as a whole, the share of foreign-owned companies in the GVA amounts to 48% and the share in profit to 58%. However, both proportions differ quite significantly in individual sectors. It generally holds that their share in profit is higher than in the GVA (except coal mining). In the key export sectors, the share of foreign-owned companies in the GVA oscillates between 53% (in general engineering) and 93% (production of motor vehicles). Profit shares are even higher – in general engineering they reach 68%, in manufacturing of electrical appliances, electronics, and computers 78%, and in production of motor vehicles 96%.

It should be noted that in foreign-owned companies the decision on whether profits will be reinvested in the company or repatriated as dividends to foreign owners or shareholders lies fully within the competence of foreign owners. The year 2008 brought a major turnaround here. While until 2008 about half of the profits of foreign-owned companies were reinvested, after 2008 the ratio between reinvestments and dividends decreased to approximately 25%. In the case of the Czech economy, the sudden change was a result of the crisis which hit the vast majority of the source countries of direct investments to the Czech Republic. This most likely disturbed the standard mechanisms of investor behaviour. Worldwide empirical experience from the pre-crisis decades implies that the ratio between repatriation and reinvestment of profits should stabilise slightly above fifty percent in favour of dividends – approximately 45% of generated profits is reinvested back to subsidiaries. This is also why the sudden change was so surprising. It was obvious that if the companies controlled by foreign entities would not strengthen reinvestments of profits, a significant recovery in investment demand was not

Source: CNB: Balance of Payments (September 2016)

Figure 10: Companies under foreign control: Profit splitting into reinvestments and dividends (CZK bill.)

likely. Preliminary data of CNB show that the years 2014 and 2015 were record-breaking in terms of profits generated by foreign-owned companies. According to the preliminary data, more than CZK 100 bil.were reinvested back to domestic companies, which also stimulated domestic investment demand.

By looking to the past, we can evaluate the strengths and weaknesses of the Czech economy in a broader perspective. The above-average share of industry – particularly manufacturing – in gross value added created in the economy seems rather convenient – see the example of the German economy (with no deeper analysis performed). Unlike our large and economically powerful neighbour, the Czech economy is unable to generate a sufficient demand. Therefore, the economy is crucially dependent on export performance. However, our export-oriented industrial sectors are heavily concentrated in pro-cyclical sectors which help the economy to achieve rapid growth in good times, but pull it into recession just as intensely in bad times. Before the crisis, it was also not so evident that the extremely high percentage of foreign-owned companies brings the economy, which is by definition dependent on demand of the main trading partners, another – rather "microeconomic" – form of dependency. Developments of subsidiaries in the Czech corporate sector will depend on conditions of foreign parent companies and decisions taken with respect to interests of entire holdings.

4. Global economic development

4.1 Main trends

In the second half of the first decade of the new millennium developments in the world economy deteriorated and the world entered into a very difficult period marked by the financial and economic crisis which broke out in 2008–2009 – after the collapse of the American investment bank *Lehman Brothers* – and which caused the deepest recession since the Great Depression from the 30s of the last century. 2010 and 2011 saw a slight "technical" recovery, yet a new recession occurred in 2012 and 2013 (see Table 7 below). With the passage of nearly a decade, we can therefore speak of a global economic crisis which caused long-term economic stagnation and substantial losses in production, consumption, investment, and foreign trade. It led to an increase in unemployment, deepening of income disparities, and deterioration of public finances. According to a number of indicators, the impacts of the crisis have not been overcome yet. The situation in the European region became critical and the local economies become a weak link in the global economy. The recovery which started in 2014 is indeed promising, but also fragile and highly uneven. New risks have emerged in connection with the ongoing slowdown in the dynamics of the Chinese economy in 2015 and growing economic imbalances in China. Consequences of this development for the world economy are difficult to predict. Then it was the crucial decision of the UK to leave the EU (the "Brexit") from June 2016. This step could have far-reaching consequences not only for trade, investment, and the competitive position of both countries. There are some positive signals in the form of stabilising financial sector, improving situation in the labour market, and recovery of domestic demand, yet they were repeatedly undermined by concerns about the financial health of Italian and German banks. The situation of government finances is still complicated – on the one hand, some EU countries successfully continue with reductions of deficit and debts accumulated during crisis, yet on the other hand, a number of countries (especially the economically weaker ones) basically face constant concerns about the health of their public finances. This applies despite a strong support through a non-standard monetary policy of the ECB and a number of other central banks which has been provided for several years. Economic policies therefore face difficult and mutually incompatible problems – continue with stabilisation of the financial system, stimulate the anaemic economic growth, stabilise public finances, and reduce macroeconomic imbalances.

The recession of **2008 and 2009** was preceded by the global financial crisis which was caused by many factors, such as abundance of liquidity, low interest rates, strong growth of credits and asset prices (primarily real estate), as well as granting of loans to insolvent clients. Adverse effects were also created by complicated, high-risk operations with sophisticated financial instruments and the lack of transparency and regulation of financial markets on the one hand and some regulatory measures implemented in financial institutions that contributed to the subsequent spreading and deepening of the crisis on the other hand. In the global, considerably liberalised financial system, the crisis spread from a relatively insignificant financial segment in the US and spilled over to Europe and other countries. Although there were indications of unsustainability of the current development (overheating of many economies, bubbles in financial markets, increasing macroeconomic imbalances), only some of the analysts were able to see the imminent danger and warn against it. However, these analysts were not paid sufficient attention. As the economic theory was lagging behind real developments, there was no adequate economic policy to tackle the collapsing financial markets. On the contrary, the traditional tools only made the situation worse, at best they merely delayed the collapse.

[2]After more than 3% average annual growth in 1998-2008, the world product stagnated **in 2009**. However, in 2009 developed countries suffered the deepest economic decline in the entire postwar period. The overall GDP decreased by 3.4% while the US fell by 2.8%, the EU-28 by 4.3%, and Japan by 5.5%. Though the duration of the recession itself was not the main problem (despite the fact it was different in each country – usually 4-5 quarters) –

[2] The real GDP growth is calculated through purchasing power parities which give more weight to emerging and developing countries. It is because market rates of these economies are undervalued against purchasing power parities. If market rates were used, the world product would fell by about 2% in 2009 (the difference between the two GDPs amounted to nearly USD 20,000 billion that year).

the main problem turned out to be a crisis-related structural change. The point is that the crisis created unfavourable conditions for future growth. The financial system was shocked, businesses and households could obtain loans which they needed to revive investment and consumption; the situation of public finances became critical as their deficits became unbearable and government debts rocketed. The combination of the global financial crisis and the depth of declines made the recession unprecedentedly deep, long, and difficult to tackle when compared with previous recessions. It was only thanks to the ongoing (albeit slow) GDP growth in emerging and developing countries (by about 3.0%) that the total world GDP fell only slightly. Drivers of this disparate group were Asian economies (GDP growth by 7.5%) while GDP of the former Soviet Union countries fell by 6.4% and Latin American countries decreased by 1.2%.

The recovery of the world economy which occurred in **2010 and 2011** (GDP growth of 5.4 and 4.2%) was associated with the recovery of stocks and continuing growth-oriented macroeconomic policies of developed countries (2010). Also the confidence in a long-term recovery, which stimulated growth in investment, consumption, and foreign trade, also played its part. During 2010, GDP grew by 2.0 % in the EU and by 2.5 % in the US. Emerging and developing countries recorded a significant increase in GDP by 7.4% in that year. In 2011, however, new risks for future development occurred: (1) instability in financial markets, (2) debt crisis in Greece, Portugal, and Ireland, which began to spread to larger European economies (Spain and Italy) with a looming danger for banks holding bonds of vulnerable countries, (3) ongoing macroeconomic imbalances, (4) difficult conditions of the labour market. Confidence declined and doubts rose among consumers and investors. This inevitably reflected in GDP growth rate which fell both in developed countries (from 3.1% in 2010 to 1.7% in 2011) and in emerging and developing countries (from 7.4% to 6.3%).

In the following years (2012 and 2013), there has been a decline in the pace of economic growth in developed, as well as emerging countries. The average values for the whole world economy (world GDP growth of 3.5% and 3.3% yoy), however, mask considerable differences between countries which even increased due to the crisis. The situation became serious in the EU where many countries experienced a new recession. For the whole EU, GDP dropped by 0.4% in 2012, in euro area countries (19) it was even by 0.9%. In 2013, the European Union de facto stagnated (+0.3%) while the slight GDP decline continued in euro area (-0.3%). This was caused by recessions in Greece, Cyprus, Italy, Portugal, Slovenia, and Spain. On the other hand, GDP growth in the US reached 2.2% in 2012 and slowed down to 1.5% in 2013. The fastest growth recorded emerging and developing countries (about 5% yoy), although their growth rates decreased in comparison to previous years.

In the last two-year period (2014 and 2015) the world economy maintained its overall economic growth rate above the value of 3% per year (see Table 7). However, this global number was a result of a slight acceleration in developed countries (GDP growth of 2%) and a slowdown in emerging economies (GDP growth of 4.3%). The economic recovery in developed countries was related to stabilisation of the financial sector, revival in domestic demand, and structural reforms. However, the global economic recovery is still weak and fragile and the risks related to future growth are rather increasing. The latest IMF forecast from April 2016, or the update from July 2016 (see IMF, 2016, 2016a)[3] foresees virtually

[3] IMF: *Too Slow for Too Long. World Economic Outlook*, IMF, Washington, D.C., April 2016. IMF: *Uncertainty in the Aftermath of the U.K. referendum*. World Economic Outlook update. IMF, Washington, D.C., July 2016 (a).

the same values for 2016 as were recorded in 2015 – both in developed and emerging economies. A slight acceleration should take place in 2017. Since the financial crisis affected growth rate estimations of the real and potential GDP, various explanations to this slowdown emerged (or to consequences for the economy). Other interrelated factors here include low inflation and interest rates. The **stagnation hypothesis** *(Secular stagnation,* see Summers, 2014) is a quite frequently mentioned concept here.[4] Its basic idea is that sluggish economies with high unemployment rates occur due to supply or demand-based factors (see Hansen, 1939[5]): slowdown of technological progress and the negative impact of demographic factors *(ageing)* on the trend (potential) product in the medium and long term affecting investment activity and demand in the short term.[6] A complementary theory explaining stagnation is the Debt super-cycle hypothesis created by Rogoff (2015)[7]. The hypothesis stresses the high risk environment (financial regulation limiting market supply, post-crisis aversion reducing demand) where, however, risk-averse institutional investors (pension funds, etc.), and the government increased their holdings of safe assets. The result is a restriction of financial levers *(deleveraging)* and decline in GDP growth in the US and EU.

In terms of development of the world's major economies, or economic units, the **US economy** has long been characterised by a good growth dynamics which outpaced growth in most European countries. However, this growth was largely based on domestic consumption and accompanied by low investments and savings. During the decade 2001–2010, the growth rate significantly declined and by the end of 2007 the US economy fell into the deepest and longest recession in the last 60 years.[8] In the second half of 2008 the serious problems in the financial sector intensified; the culmination came in September 2008.[9] This triggered significant financial instability with serious implications for the real economy not only in the US, but in the global markets. In 2009, GDP fell by 2.8%. In 2010 came a relatively strong recovery (GDP increased by 2.5%) driven by growth of stocks. However, the recovery was

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4 Summers, L.: U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound. *Business Economics*, r. 49, April 2014, č. 2, s. 65–73.

5 Hansen, A. H.: Economic Progress and Declining Population Growth. *American Economic Review,* r. 29, March 1939, č. 1, s. 1–15.

6 In this respect, Crafts (2015) points out that this alternative explanation is more likely with regard to the results of an empirical study mapping the likelihood of replacement of human work by artificial intelligence in the United States within the next two decades. Therefore, the solution is to increase flexibility of the labour market and promote education focused on skills that cannot be obtained by artificial intelligence; these include various non-automated or non-routine activities, see Crafts N.: The Threat of Secular Stagnation in Europe: an Historical Perspective. In: OeNB (ed.): Long-Term Perspectives for Economic Growth, 43rd Economics Conferences, OeNB, Vienna 2015, s. 128–145.

7 Rogoff, K.: Debt Supercycle, not secular stagnation (online). VOX CEPR portal, April 2015. URL: www.voxeu.org.

8 The US does not define the beginning of a recession by two consecutive quarterly declines in GDP, it uses a variety of other indicators. The authority to decide on the date when a recession began (and ended) is the National Committee of Economic Research (NBER).

9 While the crisis-stricken insurer AIG was saved at the cost of massive investments (loan from the New York branch of the central bank – NY FED – reaching USD 85 billion), funds managing housing loans (Fannie Mae and Freddie Mac) were placed in receivership of the newly established Federal Housing Finance Agency (*FHFA*), one bank was sold (*Merrill Lynch*) to the financial group *Bank of America* and one traditional bank could not be saved (probably also due to its own managers' attitude) and collapsed – Lehman Brothers. During the second half of September there were also other forced takeovers and changes in banks' statutes (i.e. nationalisations – *Goldman Sachs* and *Morgan Stanley*) both in the US and Europe (Belgium, Ireland, Iceland, Germany, Great Britain).

not sustained and economic activity declined again in 2011–2013. It took the US economy until 2014–2015 to reach a relatively decent growth of 2.4%.[10] The economic growth was positively affected by increase in household consumption (as real incomes of lower-income households rose for the first time after the crisis) and ongoing recovery in housing construction and other investments.

The **European Union**, which was hit by a debt crisis, has been a problematic region for several years and some countries of eurozone (primarily its southern part) got into a very serious economic situation. After the negative economic growths in 2012 and de facto stagnation in 2013, there was a slight recovery in 2014 when most countries achieved positive growths. The exceptions were Italy, Cyprus, Finland, and Croatia. A relatively high GDP growth rate was registered in Ireland, Malta, Poland, Hungary, Great Britain, Lithuania, and Romania. In 2015, the economic growth in the European Union strengthened further to 2.0%. It was driven by increasing household consumption, low prices of oil and some other commodities, effects of the ECB's loose monetary policy, and lower exchange rate of the euro. However, the overall economic growth remains weak and unemployment (especially of young people), government debt, and corporate debt remain high. Also the remaining problematic loans held by some financial groups pose a risk. Developments in the EU confirm the experience that recovery from a financial crisis which was accompanied by a recession is slow and uneven and a considerable further weakening of economic activity cannot be ruled out. The severe recession in 2008–2009, eurozone's debt crisis, and the unstable financial sector indicate a relatively long and modest recovery characterised by a below-potential growth, insufficient increase in employment, and persisting large disparities between countries. This is accompanied by serious risks of future developments arising from the development of the world economy, such as slowdowns in China and other emerging countries, the situation on global financial markets, migration crisis, the UK's decision to leave the EU, or the further-increasing overall uncertainty about the future, which negatively affect corporate investment activity.

The **Japanese economy** has been struggling with weak economic growth for a long time. The recession in 2011 was affected by a strong earthquake.[11] After a recovery in 2012 and 2013, there was a stagnation in 2014 associated with changes in excise taxes. The changes resulted from the need to solve the problems in government finances. There was a slight recovery in 2015 (GDP increased by 0.5%) supported by loosened monetary policy and

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[10] This growth rate corresponds to the long-term average of the US economy. Some authors, however, pointed to the problem of depletion of further growth potential (slower growth of potential product **/15/** leading to a reduced pace of the real product, see Helbling, T.: Perspectives on potential output after the Global Financial Crisis. In: OeNB (ed.): *Long-Term Perspectives for Economic Growth*, 43rd Economics Conferences, OeNB, Vienna 2015, s. 63–74 nebo OECD: *The Future of Productivity*. OECD, Paris, December 2015. In case of the US economy, calculations were made which showed the impact of slower economic growth in the next decades (see Gordon, R.J.: The Demise of U. S. Economic Growth: Restatement, Rebuttal, and Reflections. Northwestern University, January 2014 mimeo) due to reasons called "Headwinds": (1) continuous (negative) demographic changes, (2) equalizing level of the population's education, (3) increasing social inequalities, and (4) the need to tackle the accumulated problems of the past (debt). These are supplemented by other, not so much clearly acting factors like the impact of globalisation, slowdown in development and deployment of ICT, or effects related to energy and the environment. These findings are primarily focused on the world's largest economy, yet they are indirectly valid for almost all developed Western economies.

[11] It was followed by an ecological disaster related to the accident at Fukushima nuclear power plant in central Japan.

structural reforms, particularly in the labour market (as well as further postponement of tax reform). A faster growth is still hindered by the need for fiscal stabilisation due to extremely high government debt.

In recent years, the workhorses of the global economy were **emerging and developing countries** which produced 70% of the world´s GDP in 2014. In 2008–2013, their average annual growth reached 5.5 %, while developed countries grew only by 0.6 %. Thanks to their growth in 2009 (3.0%), the drop in global economic activity was not sharper that year. These countries also acted as locomotives of the global economy in subsequent years. However, the growth dynamics are declining even in these countries and there are considerable disparities between individual economies. The fastest growing region became the emerging Asia dominated by China. China became the world´s second largest economy after the US and its contribution to global growth was roughly 25 percent. However, Chinese economy, which is heavily oriented on investments and export, is affected by the cooldown of the global economy, its growth rates are declining and economic policy needs to be shifted towards stronger domestic consumption. The nearly 10% growth rate is a history now and the growth dynamics begins to oscillate around 7%. In 2014, GDP growth amounted to 7.4% and, according to preliminary data, it was 6.9% in 2015. India keeps growing at fast and slightly increasing pace. On the other hand, Latin American countries and the Commonwealth of Independent States of the former Soviet Union struggle with economic problems.

4.2 Development of main indicators

The growth rate decline in emerging economies was mainly due to a significant decrease of economic performance in large countries such as China, Russia, Brazil, and oil exporting countries (as prices of oil decreased significantly). However, economic performance varied considerably in individual countries and was affected by many factors, such as low oil prices, currency rate movements, lower potential growth due to previous decrease of investments, substantial indebtedness of governments, companies, and households, and implementation of economic policies. Overall, however, the higher performance of emerging economies (especially China, India, and oil-exporting countries) kept global economic growth at an acceptable level. In total (152 countries) these countries created almost 60% of the world’s GDP in 2015 (calculated at purchasing power parity); throughout the financial crisis that started in 2008 they contributed to global growth by more than 70%. Chinese economy, which grew primarily thanks to investments while private consumption growth was not significant, contributed greatly. One of the reasons was the a high savings rate which resulted in a significant surplus of the current account. Also India, Latin American countries, and Russia maintained a relatively high dynamics. However, favourable years were followed by a difficult period of declining economic growth, capital outflow, and deteriorated prospects for the future. However, developing countries represent very diverse and inhomogeneous group. Therefore, there are considerable differences between economic performances of individual countries and groups of countries. For example Brazil and Russia experienced recessions in 2015 (Brazil due political scandals and falling oil prices, Russia because of trade and financial sanctions) while India (also thanks to implementation a series of reforms allowing the central bank to cut interest rates and thus further stimulate growth) and Mexico (which benefited from continuing favourable developments in the US) achieved high growths. Deceleration of China’s economic growth is related to major changes in the Chinese economy (transition from industry to services, from investment to consumption, from exports to the domestic market,

Table 7: Real GDP growth and growth of world trade, 2008–2017 (in %)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
HDP – world	3.0	–0.1	5.4	4.2	3.5	3.3	3.4	3.1	3.1	3.4
US	–0.3	–2.8	2.5	1.6	2.2	1.5	2.4	2.4	2.2	2.5
Euro area(19)	0.5	–4.5	2.1	1.6	–0.9	–0.3	0.9	1.7	1.6	1.4
Japan	–1.0	–5.5	4.7	–0.5	1.7	1.4	0.0	0.5	0.3	0.1
Brazil	5.1	–0.1	7.5	3.9	1.9	3.0	0.1	–3.8	–3.5	0.5
Russia	5.2	–7.8	4.5	4.3	3.5	1.3	0.7	–3.7	–1.2	1.0
India	3.9	8.5	10.3	6.6	5.6	6.6	7.2	7.6	7.4	7.4
China	9.6	9.2	10.6	9.5	7.7	7.7	7.3	6.9	6.6	6.2
South Africa	3.2	–1.5	3.0	3.2	2.2	2.2	1.6	1.3	0.1	1.0
Advanced countries	0.2	–3.4	3.1	1.7	1.2	1.2	1.9	1.9	1.8	1.8
Emerging markets and developing economies	5.8	3.0	7.4	6.3	5.3	4.9	4.6	4.0	4.1	4.6
World trade	3.0	–10.5	12.4	7.1	2.8	3.4	3.7	2.6	2.7	3.9

Note: values for 2015 are preliminary and values for 2016 and 2017 are projections of IMF.
Source: IMF (2016), own adaptation.

and the need to reduce public investment due to rapidly growing indebtedness). Decline in oil prices affected oil-exporting countries (in the Middle East and Central and South America, e.g. Venezuela). But the international political situation worsened, especially due to the crisis in Ukraine and the Middle East.

Public finances deteriorated considerably due to the worst post-war recession and the development in **public finances** combined with a sharp increase in government deficit and debt became a risk factor for development of most developed countries. The financial crisis and recession led to a decrease in tax revenues on the one hand and to increased budget expenditures connected with growing unemployment, bank rehabilitation and fiscal stimulation of demand on the other hand. The deteriorated fiscal situation reflected in financial markets, in the private sector´s willingness to finance huge government deficits, and in the growing costs of this financing. Public deficits got above the threshold of long-term sustainability of fiscal stability and after the crisis of 2009, most countries (also influenced by recommendations of international organisations) quickly started to implement austerity measures which, however, partially or completely undermined the fragile growth.[12] On the

[12] The reason was that at that time there was still a lack of awareness about the real causes and problems associated with the economic, financial, and debt crisis and the continued confidence in the private sector and its active role in starting sustainable economic growth (which happened, but a few years later). Looking back, it is easy to criticize the former measures and their timing. Some international organisations are aware of this when presenting retrospective evaluations of their past recommendations (e.g. the report of the IMF's IEO Institute on procedures adopted in crisis-stricken EU countries: Ireland, Portugal, and Greece, see IEO: *The IMF and the Crises in Greece, Ireland, and Portugal: An Evaluation by the Independent Evaluation Office*. IEO, Washington, D.C., July 8, 2016).

Table 8: General government deficit in selected advanced countries (as a percentage of GDP)

	2008	2009	2010	2011	2012	2013	2014	2015
Big advanced countries	–5.1	–10.2	–8.8	–7.4	–6.4	–4.3	–3.8	–3.4
USA	–7.8	–13.5	–10.9	–9.6	–7.9	–4.4	–4.1	–3.7
Japan	–4.1	–10.4	–9.3	–9.8	–8.8	–8.5	–6.2	–5.2
Euro area (19)	–2.1	–6.2	–6.2	–4.2	–3.7	–3.0	–2.6	–2.0
Germany	–0.1	–3.0	–4.1	–0.9	0.1	0.1	0.3	0.6
United Kingdom	–5.0	–10.8	–9.6	–7.7	–7.7	–5.6	–5.6	–4.4

Source: IMF (World Economic Outlook [WEO], Spring 2016), p. 180.

other hand, they helped to reduce government deficits (which were reaching double digits – see Table 8)[13]

Another danger became the sharp rise in government debt, which has reached its highest level in developed countries since the end of World War II·[14] Government debt, which basically reflects accumulated government deficits, grew by nearly 33 percentage points in the US and by 23 percentage points in eurozone at the end of 2015 when compared to 2008 (see Table 9). There could be a dangerous tendency towards a further growth in government debts, although the relations have remained almost unchanged since 2013. Of the largest developed countries, Japan had the highest debt in 2015 (248.1 %), followed by the USA (105.8 %). As government debt grows so does the debt service (payments of interest and principal), which puts a considerable strain on public budgets. That is why some countries got into a situation where it is difficult and very costly for them to obtain resources for re-financing. However, non-standard measures adopted by many central banks (including the ECB) significantly reduced the volume of interest paid giving space to the necessary budget-stabilising steps·[15] The debt crisis mainly affected the southern part of the European Union. The most serious situation was in Greece (in 2014, government debt reached 177.1% of GDP), which was saved from bankruptcy by loans from the European Union, the ECB, and the IMF. However, the financial help is conditioned by reduction of government deficits, reforms promoting growth and competitiveness, and measures strengthening financial sector's stability.

Employment declined and **unemployment**, which represents a serious economic and social problem, grew as a result of the recession. The loss of jobs and household incomes

[13] Deficits were also affected by the "forced" support to financial institutions which drew out funds that could promote economic recovery

[14] Government debt often does not include "implicit" or "contingent" liabilities which reached enormous amounts in the countries that guarantee, for example, deposits with financial institutions. But these implicit liabilities affect the willingness to lend or buy (and at what yield) government securities on international markets.

[15] At the time of writing this text (third quarter of 2016) a number of government bonds and treasury bills were even issued with negative yields. This represents an entirely unprecedented situation because investors paid some indebted governments for the opportunity to buy their securities (e.g. in Germany, Switzerland, and also in the Czech Republic). OECD (2016) quantifies the expected savings in selected countries – they shall reach more than 1% of GDP over the period 2015–2017; see OECD: *OECD Science, Technology and IndustryScoreboard*. OECD, Paris, 2016.

Table 9: General government gross debt in selected advanced countries (as a percentage of GDP)

	2008	2009	2010	2011	2012	2013	2014	2015
USA	72.8	86.0	94.7	99.0	102.5	104.8	105.0	105.8
Japan	191.8	210.2	215.8	231.6	238.0	244.5	249.1	248.1
Euro area	68.5	78.2	84.0	86.6	91.3	93.4	94.5	93.2
Germany	66.8	74.2	81.0	78.4	79.7	77.4	74.9	71.0
United Kingdom	51.7	65.7	76.6	81.8	85.3	86.2	88.2	89.3

Source: IMF (WEO Spring 2016), p. 180.

during the recession led to lower household consumption and contributed to decline in GDP, the repayment of loans worsened and, thus, bank losses grew and the situation in the real estate market deteriorated.[16] Growing unemployment had a negative effect on public budgets (higher expenditures and lower tax revenues). Long-term unemployment increased which can have a negative impact on the potential growth rate. Unemployment more affects the traditionally "problematic" groups (young, disabled, people with health problems) which threatens the social cohesion of the country. Even though the situation in the labour market differs in various countries, growth of unemployment has been enormous in recent years and experience from past recessions shows that labour market recovers slowly and that unemployment rate remains high (see Table 10).

Table 10: Unemployment rate in selected countries (in per cent)

	2008	2009	2010	2011	2012	2013	2014	2015
USA	5.8	9.3	9.6	9.0	8.1	7.4	6.2	5.3
Japan	4.0	5.1	5.1	4.6	4.4	4.0	3.6	3.4
EU-28	6.5	8.8	9.7	9.6	10.4	10.8	10.2	9.4
Euro area (19)	7.6	9.6	10.2	10.2	11.4	12.0	11.6	10.9
Germany	7.4	7.6	7.0	5.8	5.4	5.2	5.0	4.6
Greece	7.8	9.6	12.8	17.9	24.5	27.5	26.6	25.0
Spain	11.3	17.9	19.9	21.4	24.8	26.1	24.5	22.1

Note: harmonized unemployment rates. EU-28 is simple average for all member states. Source: OECD (2016), Economic Outlook No. 99, Statistical Annex, table 21, own calculation.

Long-term unemployment rate was lower in the US than in Europe (except for a sharp rise during the recession in 2009). In mid-2016, unemployment rate in the EU-28 decreased to 8.6% (according to Eurostat, 2016) and in the US to only 4.9%. The highest unemployment rates in the EU had Greece (23.5%) and Spain (20.1%). The lowest unemployment rates were

[16] In 2009, many countries actually experienced a decrease in real private consumption, which is a phenomenon not seen since the crisis in the mid 70s.

reported by the Czech Republic and Malta (both 4.1%) and Germany (4.3%). The decrease in Germany's unemployment (from 7.8% in the third quarter of 2009 to 4.3% in the second quarter of 2016) was driven not only by the economic recovery, but also by the fact that most companies did not not dismiss their employees and tried to keep them part time. Great Britain reported a different dynamics where, despite the significant impact of the crisis, no dramatic increase in unemployment occurred (the highest unemployment rate – 8.4% – was recorded at the end of 2011). Since 2014, the Czech Republic has been belonging to countries with the lowest unemployment rate in the EU.

Development of **inflation** was affected by substantial fluctuations in demand. The sharp rise in commodity prices in 2007 and in the first half of 2008 was followed by a strong decline related to dampened demand in the second half of 2008 and during 2009, when inflation rates fell sharply in developed countries. A revival of economic activity and demand in 2010 and 2011 led to a new rise in inflation, primarily due to a sharp increase in energy and commodity prices. The development in 2012–2015 was characterised by idle capacities, stagnating demand, and moderate inflation expectations. As a result, inflation rate dropped to historically low levels in 2015. While in 2014 the average inflation rate (measured by the consumer price index) in developed countries reached only 1.4% and 0.3% in 2015. According to the International Monetary Fund's forecast, inflation rate should exceed 1% in 2016 (the expected value is 0.7%). Because many developed countries faced the risk of deflation, central banks started to lower interest rates. The EU recorded a mild deflation recorded in some crisis-stricken eurozone countries (Cyprus, Greece, Spain, in 2014–2015), but for example also in the Slovak Republic. In November 2013, the Czech central bank (Czech National Bank) even decided to use the exchange rate of the Czech koruna as an additional instrument for loosening monetary conditions.

A relatively mild growth was also recorded in emerging countries, most of which did not get into recession and maintained high growths. Consumer prices in the dynamic Asian region rose by 3.5% and 2.7% (2014–2015) and some countries even reported deflations, while in the middle of the first decade of the 21st century, prices were growing here in double-digit rates. China reported a moderate, 1.4% growth of consumer prices . In India, on the other hand, price increased by 5.9% in 2014 and 4.9% in 2015. High inflations rates pose a problem for the Commonwealth of Independent States. Between the years 2014 and 2015, inflation significantly accelerated here and reached 15.5%. The acceleration was primarily driven by extremely high inflation rates in Ukraine (48.7%), Belarus (18.1%), and also Russia (15.5%).

The globalization and intensification of business and capital flows between countries helped produce considerable **external imbalances**/**16**/ as reflected by high current account deficits in one group of countries and large surpluses in other countries. It was possible to cover the current account deficits of one group of countries with the savings of the second group of countries during the expansion of the global economy, which occurred as a result of considerable expansion in the financial sector, liberalized capital flows and sufficient disposable financial resources. Ironically, capital did not flow from developed to developing countries, as may be expected, but the largest recipient of foreign savings was the US economy.[17] The largest current account surpluses reported China, Japan, and countries exporting oil and other commodities (these countries, however, often fell to deficits due to decreasing prices of oil

[17] The reason was a lack of quality investment instruments for risk-averse investors (in term of investment losses) which led to the growth of attractiveness of the US assets, despite their low rates of return.

and other commodities, or the slowdown of China and other economies). That led to many problems in countries that do not save at least part of their revenues to special "bad times" funds. The problems occurred both in current accounts (deficits that have to be funded), as well as government which got into deficits (due to lower revenues, or slowdowns in GDP growths) and had to reduce a number of generously funded social programs. This opens space for extreme political groups and the related deepening of instability.[18] An accompanying problem may be side effects of "normalisation" policies adopted by a number of central banks. The side effects include increased movement of capital from less[19] to more developed countries, with affects current account balances, as well as exchange rate volatilities and other factors increasing the likelihood of a financial crisis. For now, capital flows are affected by declined growth rates (in fact, this has applied since 2010), or by low growth predictions. However, the latest IMF analyses indicate that compared to the similar situation from the 80s and 90s of last century, economies now have higher capital reserves and larger portfolios of assets, more countries use flexible exchange rates, inflation rates are low and under control, and national economies are much more interconnected with the world economy. Flexible exchange rates allow countries to cope better with external shocks and minor fluctuations in capital flows (this applies to countries with lower government debts), or the existence of capital controls and requirements for higher reserves in foreign currencies. Therefore, the IMF recommends maintaining a healthy government finances which do not require external (= foreign) financing. Another recommendation is to use reserves and flexible exchange rates to active policies and implement stabilization (macro-precautionary) measures limiting any significant exposure of domestic subjects (in a particular currency) against foreign subjects.

5. External balance and foreign trade[20]

5.1 Importance of trade for the Czech economy

While in the previous years (2009–2013) the Czech economy faced some major external and internal impacts which originated in the global financial (economic) crisis or, more precisely, the European debt crisis and consolidation of public finances, the end of 2013 and especially the years 2014 and 2015 brought a significant economic recovery. Even though the actual effects are difficult to quantify, the reason for the dynamic growth may be the artificially undervalued exchange rate of the koruna against the euro, which the central bank established in November 2013 (and the reserve created by the undervaluation was quickly drawn out).[21] Although the Czech economy was not directly affected by the financial crisis (due to the limited exposure of domestic financial institutions in international markets and especially in the US), adverse effects occurred in our major trading partners in the EU and in other parts of the world which affected the Czech Republic indirectly. The reason was that foreign demand

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[18] Extreme recent cases include Brazil or Venezuela.

[19] Generally, these can be developing, transition, or catching-up economies.

[20] Unless explicitly stated otherwise, this section is also based on the data published by the CSO in their ESA 2010 methodology, or the data from the sixth edition of the Balance of Payments Manual (IMF BPM6) published by the CNB during the third quarter of 2014 in relation to harmonisation of statistical monitoring of transactions falling within the balance of payments with the ESA 2010 methodology. Partial figures for previous periods may therefore differ from those published under the older methodology IMF BMP5 and included in previous editions of the Yearbook.

[21] Graphical representation of GDP development since 2008 resembles the letter "W".

and changes in foreign trade strongly influenced the development of the Czech economy, which may be characterized as a small open economy.[22]

The gradually increasing involvement of the Czech economy (mainly due to the inflow of foreign direct investment, FDI) in international production chains led to an increase in the share of imports and exports in GDP (and therefore also the "import intensity"). However, the educated and relatively cheap domestic labour allowed the contractors to play different roles in different forms of production cooperation – both with emphasis on price, as well as skills and experience in case of technically challenging productions (albeit the amount of properly qualified workers was limited at first).[23] The growth of the Czech economy is strongly influenced by behaviour of foreign capital because shares of foreign-owned companies (related to FDI) are already well above 50% in some sectors. In case of production companies, FDI are concentrated in automotive and electrical industries (see above). Here, a significant role played the system of investment incentives, which was adopted after 2000. An additional impulse was the accession of the CR to the EU in 2004, which translated to expansion and easier penetration of European markets (although the majority of barriers were eliminated already prior to the actual accession) and also a stimulus for non-European companies to branch out in the Czech Republic.[24] On the other hand, foreign owners were withdrawing their profits during the economic and debt crisis and thus impairing the balance of current account. The lower economic growth was also caused by decreased dynamics of investment (not only new projects, but also replacement investment).

5.2 Foreign trade – analysis of major trends

Production and trade cooperation also reflected in foreign trade data – exports grew rapidly, their structure, technical level, as well as prices changed, and terms of trade shifted significantly /**17**/. On the other hand, this strong pro-export orientation represents a problem which was reflected in an external demand shock accompanying the financial and debt crisis. The relatively long crisis, comparable to the crisis in the 1930s, and the need to resolve problems in many European economies also affected the main economic centre of the EU and eurozone – Germany, which is the main trading partner of the CR in the long term and whose share in Czech imports and exports amounts to about one-third. The renewed export growth in 2010–2012 was only slightly lower than growth of imports (in 2013, the dynamics was opposite) and annual growth rates generally decreased (see Figure 11). The years 2014 and 2015 brought the same momentum that could be seen in the pre-crisis period. The reason was a recovery in the

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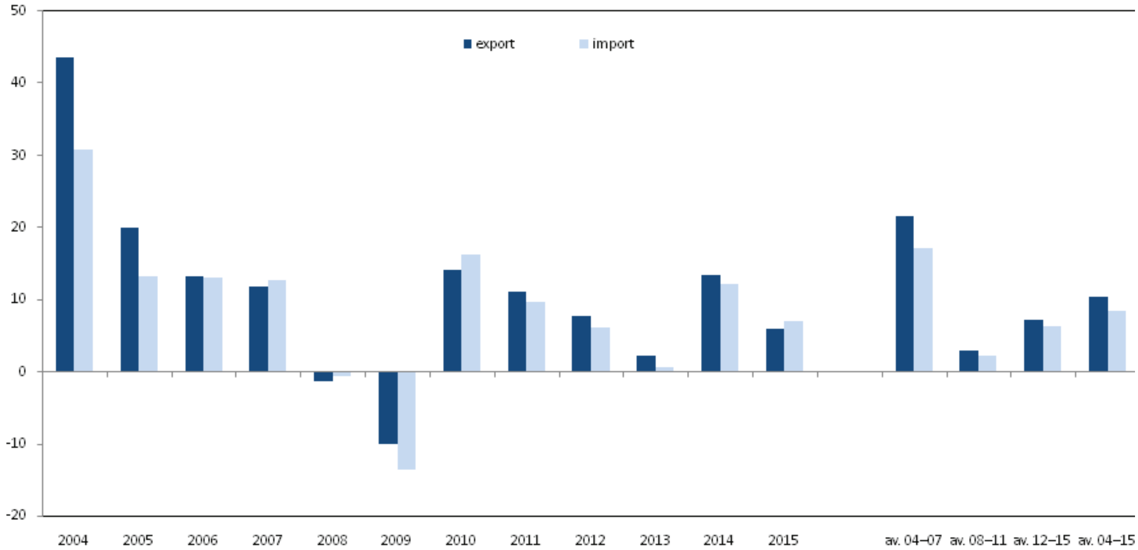
[22] Measured in current prices, the share of exports and imports of goods and services on GDP increased from around 114% at the time of our accession to the EU to 160% in 2015, which is one of the highest values in the EU. (This comparison is not entirely correct because it compares foreign and domestic prices while domestic prices in transition economies are generally undervalued. However, even when using the internationally comparable prices (parities), the openness of the Czech economy is relatively high.

[23] The latest assessment presented by the Ministry of Industry and Trade shows that on average 50% of imports were destined for manufacturing, about 29% for investment, and the rest for private consumption in 2013 (according to anticipated use), see MIT: *Analýza vývoje ekonomiky ČR za rok 2013/Survey of the Czech Economy in 2013.* MIT, Prague, May 2014, p. 83.

[24] The mentioned problem is connected with the FDI structure, which was not very favourable as the dominant forms of cooperation were based on cost advantage, or low value added. At the present time, it will be interesting to observe the behaviour of foreign investors, whose negotiated subsidies are slowly ending and the hourly labour costs are higher in comparison with CEE economies (except Croatia) which do not use the euro; see Eurostat: *Labourcosts in the EU*. News Release 56/2015, 30 March 2015.



Note: aggregation of quarterly values in current prices, seasonally and working day adjusted series, av. = average of growth rates over a period. Source: ČSÚ, Quarterly GDP time series (September 2016), own calculation.

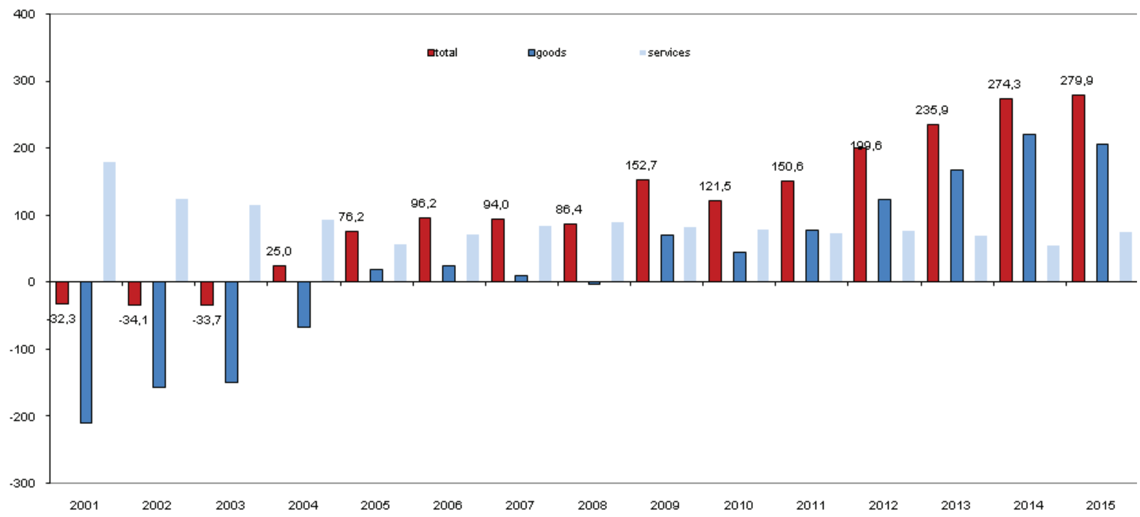
Figure 11: Growth rates of export and import, 2004–2015 (GDP definition and goods only, y-on-y changes, in %, current prices)

major European economies. However, impacts of the crisis are apparent in the average growth rates of imports and exports of goods (in current prices), which reached about 21% and 17% in pre-crisis years, and only 3% and about 2% after 2008 (7% and 6% after 2012).

When assessing the entire period after 2004, i.e. after the Czech Republic's accession to the EU, it was characterised by strong growth dynamics in 2004 and 2005 when growth rates of exports reached two-digit values and imports grew only a little bit slower, which was followed by about 10% growth rates of imports and exports. In crisis years, a radically different dynamics came. While the annual rate of decline in exports and imports was minimal in 2008, especially thanks to a very favourable first half of the year, 2009 saw a real drop in trade (with faster decline in imports, see Figure 11). However, the recovery that ensued in 2010 was slightly stronger on the import side – partially due to the statistical effect and it gradually slackened until 2013. The following year (2014) brought the same foreign trade dynamics as in 2006. However, 2015 saw only about half the pace again and faster growth in imports than exports, which reflected strong domestic demand.[25] When comparing long-term (twelve-year) growth rates of both variables (from 2004 to 2015), it is evident that the growth rate of Czech exports of goods (average growth of 10.3%) was outstripping the growth rate of imports (average 8.4%), i.e. by approx. 2 p.p., but the crisis critically affected growth rates (see 2008–2011 vs. 2011–2015).

When considering trade as a whole (goods and services), the fundamental importance of foreign trade for the CR may be exemplified by high shares of exports of goods and services in GDP. Moreover, the shares were gradually rising since 2004 and approached 67% of GDP

[25] Although a more detailed breakdown or econometric analysis was not conducted, it seems that the given data clearly illustrate the import intensity of the Czech economy and the reaction time delay, as declining sales led to a faster decline in imports (2009) and subsequently to the growth during the restoration of production (2010); other important factors were the effects of the koruna´s exchange rate and commodity prices.



Note: values (current prices) reflect the National accounts methodology. Source: ČSÚ, Quarterly GDP time series (September 2016), own calculation.

Figure 12: Balances of external trade, 2001–2015 (cur.prices, bil. CZK)

before the outbreak of the financial crisis in 2007 (67% of imports and 64% of exports in current prices). The crisis had an impact here as well, specifically in the form of an unusual year-on-year decline in 2008–2009, when the Czech Republic was fully hit. Total exports and imports fell by more than 4 p.p. and 6 p.p. (trade in goods experienced similar decline). However, the previous uptrend was restored in the following year (2010) and exports and imports of goods exceeded 83% and 77% in relation to GDP in 2015 respectively (the values for trade in goods were 11–12 p.p. lower).

Despite a temporary stagger during the first years of the crisis, which was exceptional on a global scale,[26] the impressive results of Czech foreign trade from recent years point to the growing competitive strength of domestic production which is gaining ground in challenging markets (faster growth in exports than imports). This is also supported by the fact that the foreign trade balance has improved considerably (the overall balance got into black numbers in 2004, see Figure 12) in spite of a slowdown in economic activity in the old EU countries, and primarily in Germany, during 2008–2009. This applies even when we exclude changes in prices of imported raw materials. From the macroeconomic perspective, it is also important that foreign trade has become an important factor of GDP growth on the demand side, specifically its positive contribution partially compensated decline in domestic demand and, thus, softened impacts on the overall economic performance in the past few years. (It was mainly the trade in goods, since the positive balance of services remained virtually unchanged, or has been gradually decreasing since 2008. The rebound from 2015 may mean a temporary change.)

In 2015, trade balance surplus surpassed the record level from the previous year again and thus represents a new record high in the history of the Czech Republic. The value was close to CZK 280bn. The year-on-year surplus, however, almost stagnated (only +CZK 5.6bn). The the

[26] The largest decline worldwide in the post-war era occurred in 2009 when trade fell by 10.3 % accompanied by a slight decline of GDP and a one-third decrease of FDI inflow (see UNCTAD: *World Investment Report 2013*. UN, Geneva & New York, 2013).

surplus is almost twice as high as the "crisis" year 2009, or the "post-crisis" year 2011. This result may be considered a proof of the competitive strength of Czech exports and ongoing attractiveness of "Czech" products even in turbulent and highly unfavourable economic environment and despite the impact of artificial intervention in the exchange rate (see below). The growth in the trade surplus in goods, which compensated the year-on-year decreasing trade surplus in services (since 2011, yet there was an increase in 2015), was reflected more strongly in the overall surplus. A significant contribution to this result had the exchange rate of the Czech koruna, which appreciated considerably (overshooting long-run equilibrium paths) in 2000–2002 and primarily from mid-2007 to mid-2008 and then returned temporarily to the values from 2006 and 2007 and then remained in a relatively narrow range since mid-2010 (at an average of 25.1 CZK/euro) until the exchange rate intervention of the CNB at the beginning of November 2013 (introduction of an exchange rate "floor" of 27 CZK/euro). This artificial barrier of exchange rate movements resulted a weakening to the level of 27.50. However, thanks to the improving economic situation in the Czech Republic, the gradually rose and in 2015 and 2016 tested the artificial "ceiling" and forced the CNB to intervene again. Recent statements of the CNB suggest that the exchange rate will remain higher until the expected easing of monetary policy in mid 2017. The easing will be probably followed by "adjusting", i.e. gradual appreciation of the koruna up to 25 korunas per euro (interventions, or rate changes) with respect to the situation in currency markets and operations of the world's main central banks (FED, ECB, Bank of England, and the Bank of Japan). This artificial intervention in the currency market did not immediately reflect in the behaviour of exporters vying for customers (due to existing contracts), but it created room to react to fluctuations in demand via price adjustments.[27,28]

From a long-term perspective, it is possible to consider not only the Czech Republic´s accession to the EU as one of the factors leading to favourable results of Czech foreign trade, but primarily the strong inflow of foreign direct investment to industries with a high share of exports (e.g. manufacturing of transport and telecommunication equipment, consumer electronics, and computer technology),[29] and the process of gradual diversification of trading

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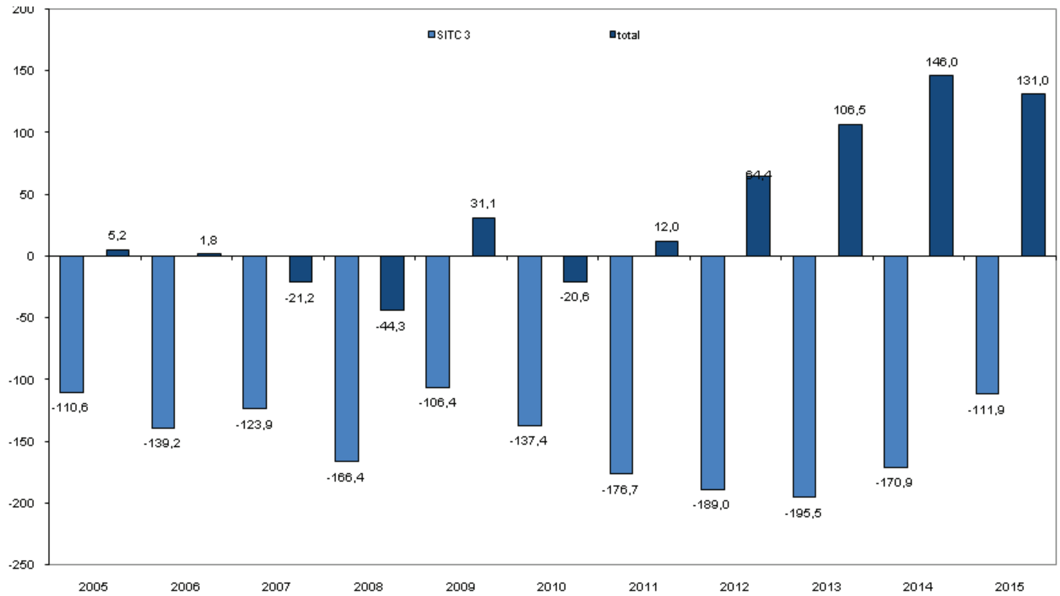
[27] However, it would require a thorough analysis of the intervention to see what the actual effects were (price, production, and foreign trade developments). The initial information from exporters indicated that the effects were rather losses from unsecured foreign-currency exposures, the need to purchase more expensive raw materials abroad, or the lack of space for price adjustments of products sold abroad. However, it seems that the "J-curve" effect took place in the long term, as exporters adapt (and change) to the new conditions regarding exchange rates. This "textbook" behaviour was, however, influenced by the fact that this is an artificial and temporary intervention in the exchange rate, partially increasing the already relatively high uncertainty and thus reducing potential positive effects (e.g. as a result of various considerations such as how long will the exchange rate be artificially "depressed", what will happen after the "ceiling" is removed, etc.). Other influencing factors were changes in the behaviour of monetary authorities in eurozone and China, or the expected changes in the US and the UK. Behaviour of market actors was affected by development of commodity prices on world markets.

[28] In this respect, it should be noted that in past years, Czech exports also profited partially from measures implemented to strengthen prosperity in some countries (the "scrappage scheme"). See MIT: *Analýza vývoje ekonomiky ČR a odvětví v působnosti MPO za rok 2009/Survey of the Czech Economy and MIT Sectors in 2009.* Prague, MIT, April 2010, p. 53.

[29] To a certain extent, we can also consider changes in structure of investments, such as FDI, which were directed at more technologically demanding industries that withstand demand shocks more easily than "run-of-the-mill" companies belonging to the manufacturing industry. This is also reflected in the structure of imports and exports reflecting the degree of processing – the latest data for 2012 show that products with a higher degree of processing represented about 85% of exports and 72% of imports, see MIT: *Analýza*



Note: according to SITC Rev. 4, Section 3 includes mineral fuels, lubricants and related products. Values for 2015 are revised as of September 2016. Values for export (FOB) and import (CIF) include estimates of the CZSO. Source: ČSÚ, Main external trade statistics indicators based on the national concept (the principle of change of ownership), September 2016, own calculation.

Figure 13: Balance of external trade (national concept, goods only), 2005–2015 (bil. CZK)

partners (and export markets), which allows for the weakening prosperity of the main trading partner of the CR (Germany) to be compensated for by exporting to other markets in the EU and the world.

Regarding the **commodity structure** of foreign trade (here we use the data gathered by the use of methodology for foreign trade), the largest deficit is traditionally creates by the group SITC 3 (mineral fuels, lubricants, and related materials – see Figure 13). However, the surpluses from SITC 7 (machinery and transport equipment) are still capable of compensating for the deficit easily and thus the overall trade surpluses exceeded 100 billion CZK in the last two years. Figure 13 shows the trend in the balance of Group 3 and all other groups since 2005 – solely for the trade in goods (based on the "national concept").[30] We can clearly see the impact of the crisis, fluctuation in commodity prices, as well as the gradual improvement in Czech exports However, especially the last mentioned phenomenon was not so evident as might seem from Figure 12. The clear improvement in the balance of SITC 3, which corresponds to the absolute amount recorded in 2005, also occurred due to a significant decline in energy prices during the second half of 2014, which persisted also in 2015.[31]

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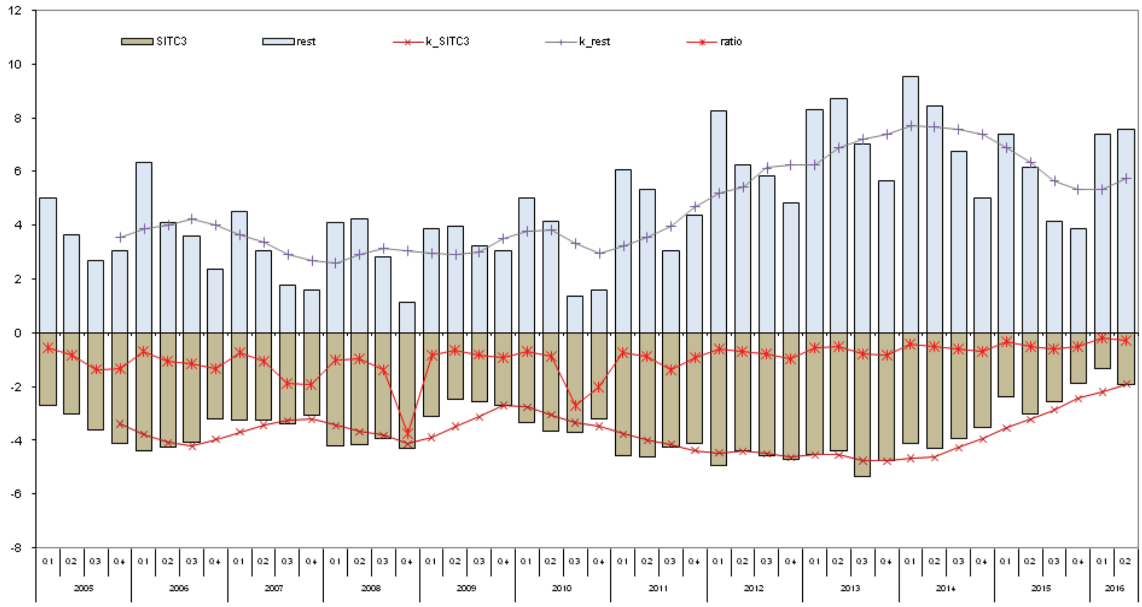
vývoje ekonomiky ČR za rok 2012/Survey of the Czech Economy in 2013. MIT, Prague, April 2013, p. 81.

[30] The national concept of foreign trade is based on transitions of ownership between residents and non-residents, not only on the movement of goods across borders (customs statistics), which is traditionally used in foreign trade statistics. The national concept is compatible with the methodologies of national accounts and balance of payments.

In this text we basically work with the data reflecting the national concept (which is more accurate), only in a few cases we use "cross-border" data in order to ensure comparability over longer periods.

[31] This surplus must also compensate for the deficit in the group of food and live animals (SITC 0), which has been oscillating around CZK 31bn since 2005 (in 2015 it was CZK 34.5bn), and especially a large



Note: according to SITC Rev. 4, Section 3 includes mineral fuels, lubricants and related products. SITC3 and rest are quarterly values related to quarterly GDP (not seasonally adjusted series). k_SITC3 is cumulative 12M balance of Section SITC3 (a simple non-centred four-quarter moving average), k_rest is cumulative 12M balance of all remaining sections (calculated in the same way), ratio is calculated as a fraction of total balance (without Section 3) and balance of Section 3. Quarterly values for 2016 are preliminary. Source: ČSÚ, Main external trade statistics indicators based on the national concept (the principle of change of ownership) (September 2016); ČSÚ, GDP quarterly time series (September 2016), own calculation.

Figure 14: External trade, 2005:Q1–2016:Q2 (national concept, goods only, in % of GDP)

In the national approach, the foreign trade surplus decreased by CZK 15bn yoy in 2015, but it still managed to exceed CZK 100bn for a third consecutive year. This result was influenced by the improving balance of SITC 3, but the total for the other groups recorded an absolute decline (driven by absolute decreases of most groups' balances, mainly machinery and transport equipment and manufactured goods, see below). Developments in individual commodity groups are very diverse. Despite the gradual subsiding of the crisis, the development was still influenced by crisis-related factors (uncertainty, increased volatility) and also by non-standard monetary policy measures (including the ECB's policy which was de facto not announced until January 2015) and the above-mentioned trend in the exchange rate of the Czech koruna. In recent years, the relatively stronger exchange rate of koruna partially supported decreases in commodity prices (for example crude oil, for more details see below), however, the artificial weakening of the exchange rate led to an increase in imported commodity prices at the end of 2013, which was more or less compensated by the price decrease recorded in 2014. In spite of that, in the case of mineral fuel and lubricant imports, the deficit reached the highest values since 2005 for the fourth year in a row (the absolute amount of about CZK 59bn, yet there was a significant yoy improvement by CZK 171bn) On the other hand, in case of chemical products, the deficit deepened again (for the fifth consecutive year, now from around CZK

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deficit in the group of chemical products (SITC 5), which has been exceeding CZK 80bn since 2011 (the average value is CZK 111.6bn, in 2015 the deficit exceeded CZK 153bn).

142bn to more than CZK 153bn) and reached the highest amount since 2005. Also in the case of group of food and live animals there was a slight yoy increase of deficit (from about CZK 31bn to CZK 34.5bn) and in Group 1 (beverages and tobacco), which recorded a new deficit of CZK 9bn (again, this is the worst result since 2005). The year-on-year deterioration in the overall surplus was caused by several factors which included (in addition to the above): (1) Significant decrease of excessive semi-products and materials (Group 6, decline of about CZK 14bn) and consumer goods (Group 8, about CZK 17bn) (2) and the first absolute decline in the surplus in Group 7 (machinery and transport equipment) since 2009 – although the surplus exceeded CZK 400bn for the second consecutive year, there was a decrease by about CZK 15bn yoy.[32]

Developments of two main groups within foreign trade are shown in Figure 6 (quarterly and cumulative quarterly (four) balances). While the group SITC 3 reported a relatively stable deficit value throughout the entire monitored period, while the deficit changed mostly due to imported raw material prices and exchange rate fluctuations (gradually growing to about 5% of GDP at the turn of the years 2013 and 2014, or decline to 2% of GDP at the end of 2015 – see the line showing the cumulative balance according to quarterly data), a gradual improvement in the Czech economy's export performance is apparent in the balance that includes other groups (quarterly values for 2014 got close to 8% of GDP), but the cumulative trend already indicates that the surplus has stabilised close to 6%.[33] A striking fact was the influence of energy mineral price changes, reflected in the rise in the balance deficit of Group 3 in 2005–2006, or since 2009 (from less than 3% to nearly 5% of GDP according to quarterly values from 2013 and 2014), which greatly influenced the total balance of foreign trade. However, there were two conflicting factors that were even changing over time – changing prices of raw materials and the fixing of the koruna in recent quarters (which modified the value of changes in the balance).

5.3 Structure of trade

In terms of territorial structure of foreign trade, only small changes occurred after the accession of the CR to the EU (major changes occurred already during the transformation of the economy in the 1990s). Even the course of the financial and debt crisis did not have a significant impact, which proves stable orientation of the Czech economy on longer-term trade relations and also indirectly the structure of imports and exports (see Table 11). A dominant more share of exports (than 80%) are destined for the EU-28 countries, or for eurozone countries (65–70% of exports). The share has virtually not changed for more than ten years (a decline of about 4 and 7 p.p. occurred between 2005 and 2015, respectively). Correspondingly, EU countries accounted for about two thirds and eurozone nearly 52% of Czech imports. Even in this case, the share of both main trading partners declined during the monitored period (by 3 and 7 p.p., respectively). This decrease was offset by an increase in non-EU countries, especially China and decreasing share of Russia due to sanctions imposed on it in 2015 and the decline in the value of imported raw materials.

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[32] It could be caused by the scandal in the Volkswagen group regarding misrepresentation of data on emissions from diesel engines (which are also used in cars made by Škoda).

[33] The balance of other groups is shown as an aggregate, which makes it impossible to see the development of individual components. A clearly dominant component has been SITC 7 so far (although there were also increases of surpluses in other groups, SITC 7 has contributed to the total surplus for the year 2015 by about 92% and its average contribution since 2005 was around 89 %) which allows us to apply this simplification.

Table 11: External trade in goods by group of countries, selected years (shares in %)

	Export						Import					
	2005	2007	2010	2013	2015	Average[1)]	2005	2007	2010	2013	2015	Average[1)]
EU-28	87.4	86.6	85.6	81.7	83.7	**84.9**	71.9	71.1	65.4	66.8	68.3	**68.1**
EA-19	70.9	68.2	68.1	64.0	65.0	**67.2**	59.4	57.1	51.5	51.8	52.3	**54.0**
Germany	*35.1*	*32.0*	*33.0*	*31.4*	*32.1*	***32.6***	*31.5*	*29.0*	*26.4*	*26.3*	*27.3*	***27.7***
Slovakia	*9.0*	*9.1*	*9.5*	*9.9*	*10.4*	***9.5***	*5.7*	*5.5*	*5.9*	*6.0*	*5.6*	***5.8***
Outside EU	12.5	13.4	14.3	18.2	16.2	**15.0**	28.0	28.8	34.3	32.7	31.0	**31.5**
Russia	*1.6*	*2.3*	*2.4*	*3.7*	*2.0*	***2.6***	*5.2*	*4.4*	*5.5*	*5.7*	*3.3*	***5.1***
China	*0.3*	*0.6*	*0.8*	*1.1*	*1.1*	***0.8***	*5.8*	*8.4*	*11.4*	*9.1*	*10.4*	***9.3***

Note: [1)] simple average of yearly values for the period 2005–2015. Because of rounding, the total value can be different from 100. Source: ČSÚ, External trade in goods by group of countries (national concept), September 2016, own adaptation.

The gradual decline in the share of EU countries in Czech exports may be considered a positive phenomenon because it indicates that export is gradually diversifying and that Czech exporters are capable of penetrating non-European (and often more demanding) markets.[34] As for the main trading partners, Germany and Slovakia maintain a privileged positions in terms of volumes of exports and imports for the entire period. Their average shares were 33% and 10%. China´s share remains substantially imbalanced because its average share of Czech exports is nearly 1%, but it accounts for 9% of Czech imports. This applies both to 2015, as well as to average values for the entire period 2005–2015. The latest available data show that exports to China and Russia grew, while imports from Russia stagnated and imports from China were slightly increasing. The trade sanctions imposed by the EU and Russian countermeasures have had a negative impact on our trade with Russia. With regard to China, our trade with it will depend on Chinese economy's ability to accommodate to the changing environment and changes in the sources of growth brought by increasing average standard of living (elimination of considerable regional and structural imbalances, which have developed in recent years).

With regard to **commodity structure**, there is an apparent shift towards commodities with higher added values (higher degree of processing). Czech exports were dominated by two SITC rev. 4 groups in recent years – manufactured goods classified by material (Group 6) and especially machinery and transport equipment (Group 7). The share of Group 7 in total exports slightly increased from 52.1% in 2004 to 52.7% in 2015 (see Table 12), while the group's share was rather decreasing in recent years due to a gradual diversification of exports. Shares of other groups did not change much during this period (for example Group 2 and

[34] This cannot be taken for granted because of the substantial number of small and medium-sized Czech enterprises for which the costs associated with penetrating non-European markets may represent very high budget items. To a certain extent, the renewed pro-export policies of Czech governments, including definition of our priority countries (12) and countries of interest (25), may have played their roles; see Exportní strategie ČR pro období 2012–2020/Strategy of the Czech Republic for 2012-2020. MIT, Prague, March 2012. URL: http://databaze-strategie.cz/cz/mpo/strategie/exportni-strategie-cr-2012-2020?typ=struktura.

Table 12: External trade – commodity structure, selected years (SITC, Rev. 4, shares in %)

	Export						Import					
SITC Rev.4 oddíl (kód)	**2005**	2007	**2010**	2013	**2015**	*Av.[1]*	**2005**	2007	**2010**	2013	**2015**	*Av.[1]*
0, 1 – Food, beverages, tobacco and live animals	**3.8**	3.8	**4.1**	4.9	**4.8**	*4.3*	**5.1**	5.1	**5.4**	**6.2**	**6.3**	*5.6*
2 – Crude materials	**2.8**	2.8	**3.3**	3.0	**2.6**	*2.9*	**2.5**	2.4	**2.8**	2.9	**2.4**	*2.7*
3 – Mineral fuels. lubricants	**3.0**	2.9	**4.0**	3.5	**3.6**	*3.6*	**8.9**	8.2	**9.8**	10.9	**7.3**	*9.7*
4 – Animal and vegetable oils	**0.1**	0.1	**0.2**	0.3	**0.3**	*0.2*	**0.2**	0.2	**0.2**	0.3	**0.3**	*0.2*
5 – Chemicals and related products	**6.3**	6.2	**7.0**	7.1	**6.6**	*6.7*	**10.7**	10.7	**11.1**	12.1	**11.8**	*11.3*
6 – Manufactured goods by material	**21.3**	21.3	**18.5**	19.4	**18.3**	*19.7*	**19.5**	21.1	**18.5**	19.0	**18.8**	*19.2*
7 – Machinery and transport equipment	**52.1**	52.2	**52.2**	50.0	**52.7**	*51.9*	**42.5**	41.9	**41.8**	37.9	**42.1**	*40.7*
8, 9 – Manufactured articles and not classified commodities	**10.7**	10.5	**10.7**	11.8	**11.1**	*10.8*	**10.6**	10.4	**10.4**	10.7	**10.9**	*10.6*

Note: [1] simple average of yearly value over the period 2005–2015. Values for 2015 reflect September 2016 revision.
Source: ČSÚ, External trade in goods by SITC (national concept), September 2016, own calculation.

Group 3 in 2005 and 2014). Group 6 was the sole exception. Shares of groups 2 and 3, which are closely related to the mining and quarrying industry, remained virtually unchanged – they increased from 5.8% in 2005 to 6.2% in 2015. Yet the trend was variable in time, as evidenced by simple average of both groups (6.5%) for the analysed period. In case of imports, the share of mineral fuels, lubricants and related materials (SITC 3) has been gradually increasing in recent years, reaching the current maximum of 11.6% of total imports in 2012. A decrease to 7.3% occurred in 2015. Share of chemicals and related products has been relatively stable (on average 11.3%). Fluctuation in shares of groups 3 and 6, were primarily caused by substantial changes in crude oil and natural gas prices and the long-term strengthening of the Czech koruna during 2004–2008, and also partially by the exchange rate change at the end of 2013 (this had an impact in 2014 and 2015, but was suppressed, or enhanced, by stagnating/declining commodity prices). Group 3 recorded a considerably higher share of imports than exports (9.7% vs. 3.6%), which also resulted in a very high and growing negative balance (see Figures 5 and 6). A problematic factor in the structure of Czech trade is a high proportion of cyclic (cars, electrical equipment) exported commodities and relatively high raw-material demands of production (illustrated by the high share of Group 3). Other structural changes include an increasing share of imported food commodities (groups 0 and 1 on both export and import sides) which reflects changes and increasing specialisation of Czech agriculture within the EU, or the persisting prevalence of exports over imports in the dominant Group 7 (by about 10 p.p.). (on average 51.9% vs. 40.7%).

A more detailed look at the trend in the trade with selected import and export Czech commodities since 2004 provides Table 12. The influence of the financial and debt crisis and

Table 13: External trade – export and import of selected commodities, 2004–2014

	Export						Import			
	Cement[1]	Kaolin[1]	Limestone[1]	Pass. cars[2]	Hops[3]	Beer[4]	Crude oil[1]	Iron ore[1]	Cereals[1]	Cotton[1]
2004	747	484	140	373 397	5 158	285	6 406	7 639	125	52
2005	559	271	124	522 364	4 895	314	7 730	6 807	102	45
2006	496	261	162	763 744	4 096	366	7 752	7 987	308	36
2007	646	249	98	853 956	3 428	372	7 147	6 592	345	32
2008	663	239	107	824 075	4 336	381	8 142	7 711	232	19
2009	676	380	100	860 247	4 145	346	7 452	4 810	160	10
2010	683	526	93	971 168	4 405	329	7 770	5 938	177	10
2011	862	542	176	1 059 296	4 100	323	6 969	7 366	197	7
2012	699	513	205	1 050 368	4 276	349	7 024	5 867	358	5
2013	620	516	176	1 023 329	3 573	374	6 631	6 273	330	5
2014	616	523	118	1 135 747	4 059	390	7 313	6 305	378	3
2015	581	561	93	1 210 343	3 811	443	7 239	6 376	396	4
Index[5]	**0.78**	**1.16**	**0.66**	**3.24**	**0.74**	**1.55**	**1.13**	**0.83**	**3.17**	**0.08**

Note: values for 2015 are preliminary. [1]Ths tons, [2]pcs, [3]tons, [4]mill l.; [5]Index 2004 = 100. Source: ČSÚ, Indicators of Social and Economic Development of the Czech Republic 1st quarter 2016 (June 2016), own calculation.

structural changes, which reflected both in imports and exports (e.g. in 2008 for passenger cars and, during the "crisis" year 2009, primarily in import items), is clearly seen in this example as well. Looking at the long-term trend of the six main export and the four main import commodities, the sharp rise in exports of passenger cars (by 224% – production has been exceeding 1 million units for several years) or beer (14% increase yoy, 55% in total) is, in case of exports, not as surprising as the relatively sharp decline and the subsequent increase in hops exports, which potentially indicates both the export of products with higher value added and changes in consumer preferences (return to traditional beer brewing methods), as well as effects of weather.[35] The differentiated development and structural shift of the Czech industry is also evidenced by the relatively stable export of selected primary commodities (export of kaolin rose by 6%, limestone by 28%), while the import of cotton, for example, almost stopped (more than 90% decrease) and the import of iron ore dropped (by 17%) due to restructuring processes. Also the gradual reduction of energy consumption has led to only a moderate increase in imports of crude oil (which is affected by re-exports and re-imports motivated by koruna's fluctuations). Similarly to exports, also raw material imports are subject to cyclical development and as there are excess capacities in Asia and a pressure on prices (lower investment construction, decline in production because of poor demand caused by weak global growth. On the other hand, effects of climate and other changes, and not just

[35] The Czech Republic is a traditional and important world producer of hop (according to the latest data up to 2014, it is fifth in the world after Germany, the United States, Ethiopia, and China; see FAOSTAT: *Food and Agricultural Commodities Production*. FAO, Rome, 2016, URL:http://faostat3.fao.org/browse/Q/*/E.

Table 14: Price indices of selected world commodities, 2004–2015

		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Oil Brent	USD/barrel	38.3	54.4	65.4	72.7	93.6	61.9	79.6	111.0	112.0	108.8	98.9	52.4
	CPPR = 100	*132.7*	*142.1*	*120.1*	*111.2*	*128.7*	*66.1*	*128.7*	*139.3*	*100.9*	*97.2*	*90.9*	*53.0*
Index in CZK	2005 = 100	75.5	100.0	113.4	113.3	122.3	90.4	116.7	150.6	168.2	163.3	157.5	98.8
	CPPP = 100	*121.0*	*132.5*	*113.2*	*99.9*	*108.3*	*73.7*	*129.1*	*129.1*	*111.7*	*97.2*	*96.4*	*62.7*
Wheat	USD/t	156.9	152.4	191.7	255.2	319.3	223.4	223.7	316.2	313.3	265.8	242.5	185.6
	CPPP = 100	*107.3*	*97.2*	*125.8*	*133.1*	*125.1*	*70.0*	*100.1*	*141.4*	*99.1*	*96.2*	*91.2*	*76.5*
Index in CZK	2005 = 100	110.4	100.0	118.5	141.7	149.2	116.5	116.9	153.2	167.9	167.1	161.8	146.7
	CPPP = 100	*97.8*	*90.6*	*118.5*	*119.6*	*105.3*	*78.1*	*100.4*	*131.0*	*109.6*	*96.2*	*96.8*	*90.7*
Natural Gas	USD/mil. BTU	3.8	5.9	8.2	8.1	13.4	8.9	8.2	10.6	12.0	11.2	10.5	7.3
	CPPP = 100	*107.7*	*157.5*	*138.8*	*99.1*	*164.1*	*66.3*	*92.9*	*128.9*	*113.1*	*93.4*	*93.5*	*69.8*
Index in CZK	2005 = 100	68.1	100.0	130.9	116.5	160.9	119.0	110.8	132.3	165.5	154.5	153.3	126.8
	CPPP = 100	*98.1*	*146.9*	*130.9*	*89.1*	*138.1*	*73.9*	*93.1*	*119.4*	*125.1*	*93.4*	*99.2*	*82.7*
Uranium	USD/pound	18.0	27.9	47.7	99.2	63.2	46.7	46.0	56.2	48.9	38.6	33.5	36.8
	CPPP = 100	*160.6*	*154.8*	*170.7*	*208.1*	*63.7*	*73.8*	*98.5*	*122.4*	*87.0*	*78.9*	*86.8*	*109.8*
Index in CZK	2005 = 100	69.3	100.0	160.9	300.8	161.2	132.8	131.1	148.7	143.1	112.8	103.9	135.1
	CPPP = 100	*146.3*	*144.3*	*160.9*	*186.9*	*53.6*	*82.4*	*98.7*	*113.4*	*96.2*	*78.9*	*92.1*	*130.1*
Copper	USD/t	2863.5	3676.5	6731.4	7131.6	6678.6	5165.3	7538.4	8823.5	7958.9	7331.5	6863.4	5510.5
	CPPP = 100	*160.9*	*128.4*	*183.1*	*105.9*	*93.6*	*77.3*	*145.9*	*117.0*	*90.2*	*92.1*	*93.6*	*80.3*
Index in CZK	2005 = 100	83.5	100.0	172.6	164.2	129.4	111.7	163.4	177.2	176.9	162.9	161.7	153.9
	CPPP = 100	*146.6*	*119.7*	*172.6*	*95.2*	*78.8*	*86.3*	*146.3*	*108.5*	*99.8*	*92.1*	*99.3*	*95.1*

Note: values are monthly averages of spot prices and annual averages of CZK/USD exchange rate. CPPP – constant prices of previous period = 100. BTU – British thermal unit. Source: ČNB. ARAD (September 2016); IMF Commodity database (September 2016), own calculation.

the impact of changes in agricultural production structure (crop vs. livestock), may have played a role in the case of agricultural commodities such as grains.

The trend in global prices of selected commodities and its impact on the Czech economy is illustrated in Table 14. The table summarizes price developments of crude oil, natural gas, and three other selected commodities – wheat, copper, and uranium – between 2004 and 2015. The price fluctuations in 2007–2009 and the sharp price rise in 2010–2011 which got the prices to pre-crisis levels (with a slight correction in 2012/2013–2015 and recovery in case of uranium) are clearly evident when comparing price indices with the year 2005. The impact on the trade balance and enterprises (i.e. also the indirect impact) can be estimated from development of the global price index in CZK, which not only reflects changes in crude oil prices, but also the trend in the CZK/USD exchange rate. Each year, the unfavourable trend in prices was thus compensated for by strengthening koruna (e.g. this is clearly visible for the period 2004–2005 when comparing yoy indices in USD and CZK). Price indices of wheat or copper were influenced by a sharp rise in production costs stimulated by growth in demand. The increasing demand reflects rising consumption in many economies worldwide or the fact that non-energy commodities and food became investment instruments (underlying instruments for various financial instruments – "derivatives" such as futures or options) for international investors operating in low-yield environments. The consequences of this are stronger price fluctuations in both directions, higher price volatility, and also a derivative growth of market liquidity (decreasing costs) and thus also better availability of funds for those needing to hedge against unexpected events.

As mentioned and illustrated above, development of trade balance is, to a certain extent, influenced by developments of **prices of commodities** which are imported into the Czech Republic (as the CR is relatively poor in raw materials). A new trend of sharp increases in global prices of industrial and food commodities (see Figure 7) started about in 2004. The situation resembles the beginning of the 1970s and the second oil shock.[36] A new aspect is that, with the exception of 2009, there was no sharp drop in prices across the spectrum of commodities until 2014, except for the price stabilisation at more or less "corrected" levels. No significant decrease could be expected due to higher demand in emerging (African, Asian, Near Eastern or Latin American) countries. The crucial fact for the Czech economy was that the negative impact on foreign trade was suppressed by shifts in the exchange rate (appreciation /**18**/ of the koruna against the dollar).[37] The continuously rising commodity prices began to fall in the second half of 2008, specifically in connection with the spread of the global financial crisis. However, even this decline was temporary due to strong demands of some economies (BRICS) and the growth trend gradually resumed in the second half of 2009. As a result, 2011 saw achievements of new highs (see Figure 15). However, dynamics

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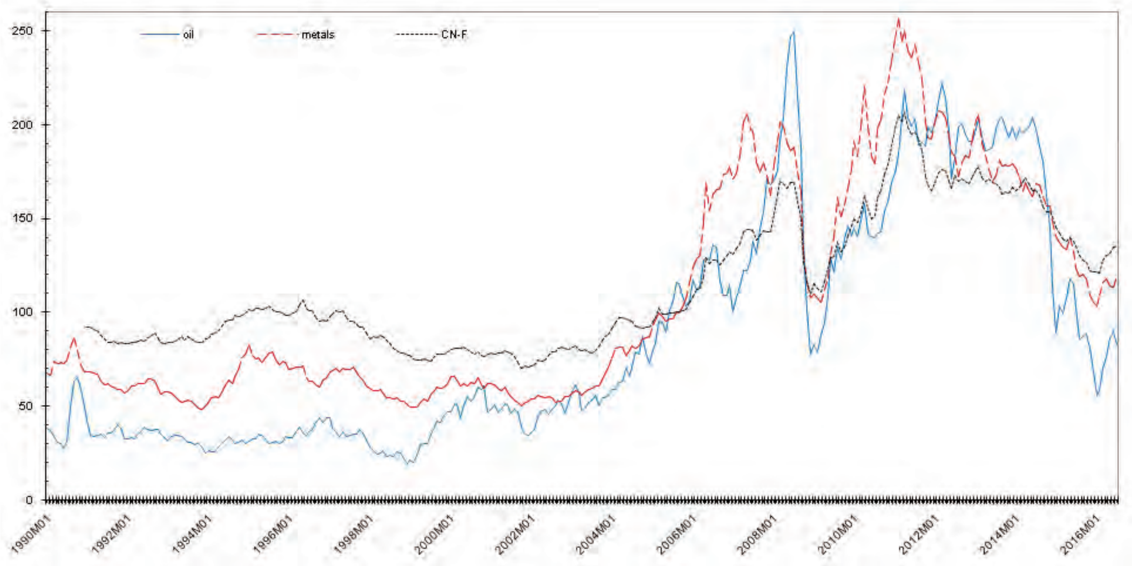
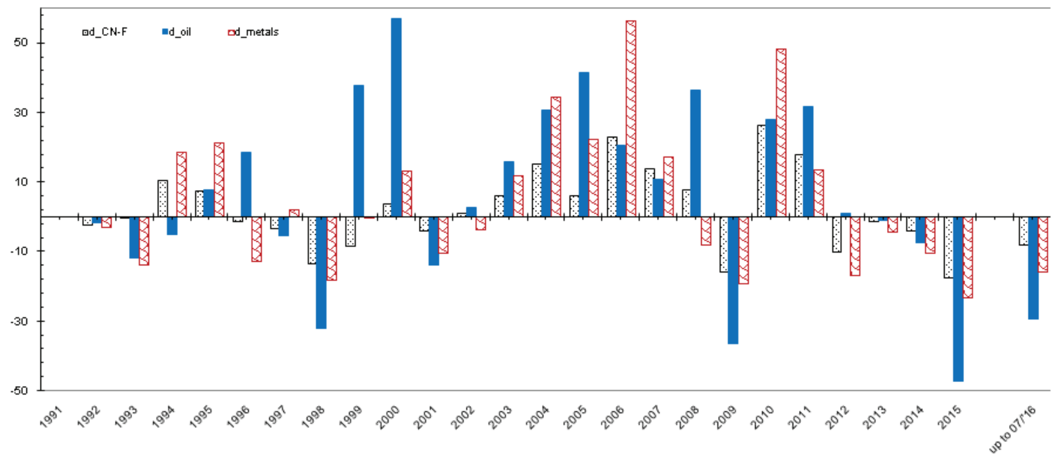
[36] When we take the highest price per barrel of Brent Crude (quoted on the New York Mercantile Exchange) during the second oil crisis in the amount of USD 39.50 from April 1980, then a barrel of crude oil would cost approximately USD 103.76, recalculated to the present value of money (based on the consumer price index, 1 USD from 1980 has now the value of USD 2.61). During the first oil crisis, the price did increase from about USD 3 to USD 12 per barrel (1974), however that amounts only to USD 52.29 at today´s prices. The record level from 1990, which was driven by the Persian Gulf War (USD 40.42 per barrel), amounts to only USD 66.44 per barrel after being recalculated at today´s prices. The current record value was reached in June 2008 – USD 139.89 per barrel (monthly price averages for June and July were USD 133.05 and USD 133.90 per barrel, respectively). However, after reaching the peak, the price got quite volatile: first, there was a decrease (by about 2/3 over the coming months), then growth again (to USD 100 per barrel in January 2011) and then the price stabilised around USD 100 until mid-2014 when a drop came. The price got to about half in January 2015 and then it stabilised in the range between USD 40–50 per barrel. Recent estimates indicate that the price could remain at this level even for a longer period, see Areyki, R, Obstfeld, M.: *The Price of Oil and the price of Carbon*. IMFdirect, December 2015. URL: https://blog-imfdirect.imf.org/2015/12/02/the-price-of-oil-and-the-price-of-carbon/ .

The price of crude oil became harder to predict in recent years and its behaviour can no longer be defined by tapping global reserves or by geopolitical impacts such as regional conflicts and also the existence of alternative ways of crude oil production (see below), the dynamics of several major customers, and mainly speculative trades of institutional investors.

[37] However, the persisting high energy intensity of the Czech economy, also reflected in increased raw material imports, is a problematic aspect. This is a result of the past (partly reflecting a higher proportion of the industry compared to the EU average and the development of individual traffic), which is also reflected, among other things, in raw material imports. A positive aspect is its gradual reduction since 2007.



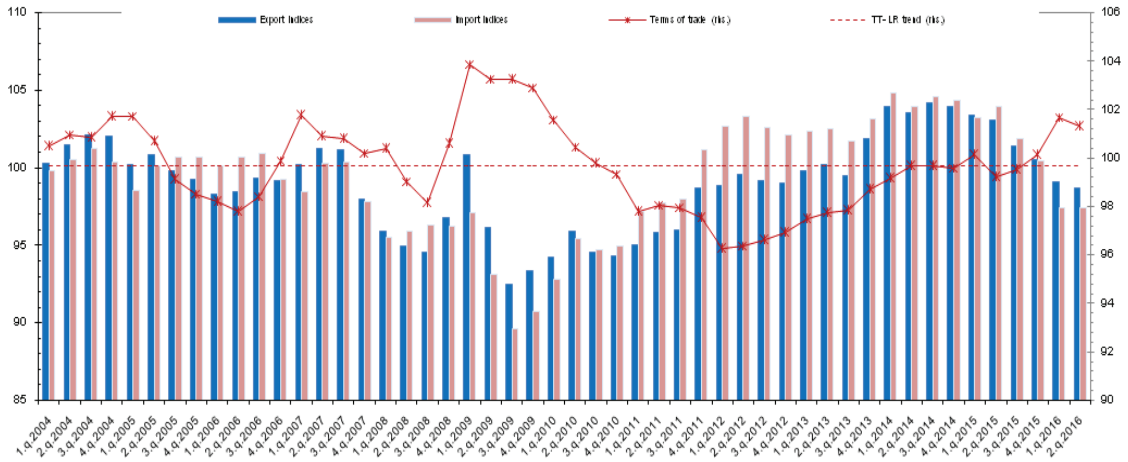


Note: Oil – Crude Oil (petroleum, price index, 2005 = 100) is a simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fateh. CN-F – Non-Fuel Price Index (2005 = 100) includes Food and Beverages and Industrial Inputs Price Indices, available since 1991; metals – Metals Price Index (2005 = 100), includes Copper, Aluminium, Iron Ore, Tin, Nickel, Zinc, Lead, and Uranium Price Indices. Y-on-y changes of indices (d_CN-F, d_oil, d_metals) are calculated from yearly averages of monthly values. Source: IMF. IMF commodity database (September 2016), own calculation.

Figure 15: IMF Primary Commodity Prices Indices and their y-on-ychanges. January 1990–July 2016

of the monitored prices changed – while oil prices stagnated until about mid-2014, other commodities (such as metals and food products) were gradually declining in 2012 and 2013 and then stabilised.[38] The second half of 2014 and the first half of 2015 brought a further

[38] There may be reasons for this, for example that the investment cycle has different length for individual commodities, partly because of the differing situations regarding the supply where closed oil drilling sites may be quickly re-activated, or through high investments of oil companies in searching for new deposits, regardless of the actual development of prices due to depletion of reserves and potential price increases. Then it is the use of alternative resources of fuel (ethanol) and new methods of obtaining oil – *shale oil production* – through new technologies (*Hydraulic fracturing (fracking)* and *horizontal drilling,* primarily in the US and Canada). The expansion of oil production in Europe is hindered by environmental protests concerned about environmental impacts due to high water intensity (e.g. in the UK and Poland). However,



Note: quarterly averages (2005 = 100). TT-LR trend – long-run trend of TT (unweighted average for the period). Axes are of different scale because of improved readability. Source: ČSÚ. Import and Export price indices (September 2016), own calculation.

Figure 16: Export and import indices and terms of trade for the Czech Republic, 2004:1.Q.–2016:2.Q. (2005 = 100)

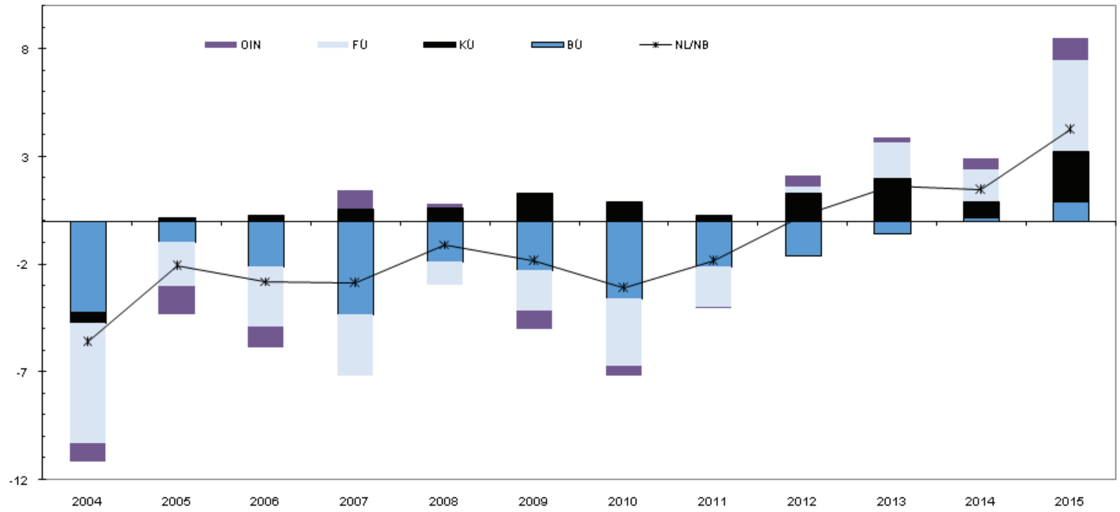
significant drop in prices (by about 50%, see bottom panel of Figure 15) and thus commodity prices now correspond to the levels of 2004 (oil), or 2006 (2009) for other commodities and metals showed in the figure.[39]

Of course, the trend in raw material prices reflects in development of terms of trade of the CR. The share of raw materials is higher in import than in export prices, and that is why increases in raw material prices have negative impacts on terms of trade and vice versa. In 2009, for example, the development of terms of trade was very positive (annual index 102.8) compared to 2008 (index 99.5), but terms of trade worsened already in the course of the year and a significant drop came in 2010 and 2011 (below the level from 2006). Since the first quarter of 2012, there has been a gradual return to neutral values (i.e. the index had the value of 100 during the last quarter of 2014) followed by a spike during the first half of 2015 and an improvement (index above 100.0) in the first half of 2016.[40] Figure 16 also shows the long-term slightly negative trend (the value is below 100) in terms of trade development over more than 10 years. The long-term average indicates a persistent negative trait of our highly open

the decline in prices from recent months significantly changed calculations for alternative methods of oil production, which led to limiting the alternative and more expensive production methods. On the other hand, Russia extracted the largest volume in its history in 2016 (almost 11 mil. Bbl/day), see OPEC: *Monthly Oil Market Report*. OPEC, Vienna, September 2016.

[39] The reason may be the fact that for many investors commodities are a very attractive investment instrument, which in many cases yields positive returns (inflation-adjusted) when other instruments generate very low or even negative returns, and it is therefore preferred to traditional investment instruments such as bonds or stocks. This may have been the reason for decreased price fluctuations of traditional commodities, which reflected global prosperity in the past.

[40] This is partly due to the statistical effect because the index base is the average value of 2005 which was extremely favourable. If the base year was 2000, or if we performed yoy comparisons, values of terms of trade would be favourable, i.e. above 100, already during 2013. CSO also publishes terms of trade that are partially adjusted by effect of exchange rate fluctuations – development of these TT has been even more favourable.



Note.: BÚ – current account, FÚ – financial account including foreign reserves, KÚ – capital account, OIN – net errors and omissions, NL/NB = total balance of PB (net lending / net borrowing item). Time series show net balances of individual balances. The period 2004–2007 is due to be revised in December 2016 reflecting new data available. Source: ČNB, ARAD database (September 2016); ČSÚ, Quarterly GDP time series (September 2016), own calculation.

Figure 17: Components of balance of payment, 2004–2015 (net values in % of GDP)

Czech economy – it is unable to generate sufficient "value added" in the form of price margins of exported goods and services which would then allow compensations of input-related price shocks.

5.4 External balance

The **external economic balance**, based on the current account balance which indicates flows of goods, services, and primary and secondary income between residents and non-residents, registered substantial changes in 2004-2015. Prior to our accession to the EU, there was a strong net capital inflow (exceeding 5 % GDP, see previous editions of the Yearbook)[41], which reflected in balances of the financial account and the current account (due to double entries and many import-intensive activities such as direct investment, see Figure 17). While net capital inflow did not change much during 2005–2010, it fell sharply to 1% of GDP in 2008 and 2009. On the other hand, in the years 2012 to 2013 there was a net capital outflow. This was mainly due to outflow of dividends from FDI and decreasing foreign investments. While 2014 brought a temporary interruption of trend of improving balances of PB, which started in 2010, (expressed by net lending/borrowing, i.e. funding resources), although the current account got into black numbers for the first time since 2004, preliminary figures for

[41] However, there are inconsistencies in the comparison caused by transition from the fifth to the sixth version of the IMF's Balance of Payments Manual within which sub-indicators' time series were changed. Before 2008, only approximate calculations were available, absolutely correct data are available only for the years after 2008. While the original manual (BMP5) used balances of payments and changes in central bank reserves accounted for overall changes in the year/quarter, new manual (BMP6) is aligned with national accounting and the emphasis is on assets and liabilities and investment position of economy **/19/.** For more information on the new Balance of Payments Manual see e.g. Spěváček, V., Žďárek, V. et al.: *Macroeconomic Analysis: Theory and Practice.* Grada, Prague 2016.

2015 indicate restoration of the previous trend of improving balances of PB. The cause was a significant surplus in the capital account resulting from drawing of EU funds and increasing surplus of the current account.[42]

From the perspective of current account structure, the balance of primary income replaced the balance of goods as the main source of the deficit in 2004–2015. This was mainly due to a net outflow of primary income in the form of salaries, repatriated and reinvested earnings, and interest amounting to as much as 6.6% of GDP in 2007 (see Table 15).[43] The primary income balance deficit was not even compensated for by the gradually increasing trade balance surplus in goods and services (reaching the average value of 4.2% of GDP in 2012–2015, but the balance of primary income was 5.8% of GDP). Balance of services has had declining surpluses (1.6% in the same four-year period) and it (together with trade balance) therefore cannot compensate for the relatively high income balance deficits. The individual trends resulted in a decline in the size of the current account deficit, which was consequently easily covered by a surplus in the financial account. According to the preliminary data, the current account reached a small surplus of 0.9% in 2015.[44] The share of capital account has been changing dynamically over time. It was because EU funds which contributed significantly to investments in the CR's infrastructure (drawing down funds within a seven-year programme, 2007–2013, or the obligation to return some funds drawn in the past).[45]The result was a significant surplus balance in 2015 (previously 2.3%) The financial account experienced an opposite development. Since the CR's accession to the EU, the financial account has not reached the record values of the previous years (deficits between 1–3% representing capital inflows in double entry records), except for 2005 (over 11% of GDP). The reasons were a downturn in privatization activity and factors influencing FDI inflows into Czech economy. Since 2012, the financial account repeatedly swung into a deficit associated with higher investments of Czech companies abroad and growing capital outflows. At the time of the CR's accession to the EU FDIs were rather sporadic and amounted to hundreds of millions

[42] The revision of BMP (see previous footnote) brought also changes in titles of PB balances: (1) the current balance of primary income was formerly called the balance of income, (2) the current balance of secondary income was the balance of current transfers. The amendments also included partial harmonisations of outputs: processing (in BPM5 included in balance of goods, now it is part of services balance), merchanting **/20/** (now part of the trade balance); for more information see *(rep. quot.).*

[43] The income balance also affects performance indicators, when traditional indicators such as GDP ("domestic perspective") lose their explanatory power and alternative indicators such as gross national income ("ownership perspective") have to be used. The implication for the Visegrád Group countries is briefly mentioned by, for example, Žďárský, V.: *Vliv globalizace na zvýšení odchylek mezi HDP a HNP ve vybraných zemích v posledních dvou dekádách/ The effect of globalisation on deviations between GDP and GNP in selected countries over the last two decades.* GEV, CNB, August 2013, pp. 12 to 20

[44] The theoretical literature generally indicates the danger of external imbalances by a current account deficit of more than 5% of GDP (one-sided interval because the deficits are seen as a problem in terms of their financing in the medium and long term). On the other hand, MIT (2015): *Analýza vývoje české ekonomiky za rok 2014/Survey of the Czech Economy in 2014.* MIT, Prague, 2015, defines imbalance as an interval limited from both sides, i.e. ± 5%, thus also excessive surpluses that may negatively influence the floating exchange rate development and lead to shocks in non-exporting industries. These shocks, however, were not frequent and occurred in a few economies during the postwar period. They were especially connected with mining of certain minerals (in Europe, they occurred, for example, in the Netherlands and Norway).

[45] While 2013 saw a record surplus of nearly CZK 82bn, in 2014 there was an annual decrease by about CZK 50bn. A concomitant effect was the decline in the current account surplus (due to decrease in secondary incomes and also due to lower revenues and higher expenditures within transactions with the EU). MIT stated that the net income from the EU budget represented about 60% of the surplus in 2013; See MIT: *Analýza vývoje ekonomiky ČR za rok 2013/Survey of the Czech Economy in 2013.* MIT, Prague, May 2014.

Table 15: Current account, 2004–2015 (in % of GDP)

	Current account	Goods and services balance	Out of which balance of services	Primary income balance	Secondary income balance
2004	**–4.2**	0.7	*2.9*	–5.1	0.2
2005	**–0.9**	2.7	*2.1*	–3.9	0.3
2006	**–2.1**	2.9	*2.2*	–4.7	–0.3
2007	**–4.3**	2.6	*2.3*	–6.6	–0.2
2008	**–1.9**	2.1	*2.2*	–3.7	–0.3
2009	**–2.3**	3.7	*2.1*	–5.5	–0.5
2010	**–3.6**	3.0	*2.0*	–6.3	–0.3
2011	**–2.1**	3.9	*2.0*	–5.5	–0.5
2012	**–1.6**	5.0	*1.9*	–5.9	–0.7
2013	**–0.5**	5.8	*1.7*	–6.1	–0.2
2014	**0.2**	6.4	*1.3*	–6.0	–0.2
2015	**0.9**	6.3	*1.6*	–5.3	0.0
Av. 2004–2007 1)	**–2.9**	**2.2**	***2.4***	**–5.1**	**0.0**
Av. 2008–2011 1)	**–2.5**	**3.2**	***2.1***	**–5.3**	**–0.4**
Av. 2012–2015 1)	**–0.3**	**5.9**	***1.7***	**–5.8**	**–0.3**
Av. 2004–2015 1)	**–1.9**	**3.7**	***1.4***	**–5.4**	**–0.2**

Note: 1) simple averages of yearly values over the given period. The period 2004–2007 is due to be revised in December 2016 reflecting new data available. Sources: ČNB, database ARAD (September 2016), ČSÚ, quarterly time series of GDP (September 2016), own calculation.

of CZK, yet during 2012–2015 they already amounted to nearly CZK 100bn each year (the average for the period 2004-2015 is CZK 65bn).

The current account surplus of 0.9% of GDP achieved in 2015 affected by the continued yoy increases in the trade surplus by 6.4% of GDP (similarly to the period 2010–2014), or stabilisation at nearly the same level in 2015 (6.3%), as well as stagnation of income deficit at about 5.6% of GDP (preliminary estimation). The balance of services also worsened slightly (1.3% of GDP) and the current transfers balance was slightly negative. As mentioned above, the net outflow of primary income to foreign countries in 2015 in the form of salaries, reinvested or repatriated earnings and interest represented 5.3 % of GDP (the previous maximum was 6.6% in 2007)[46], thus lowering the gross national income **/21/** of the Czech Republic compared to gross domestic product. The Czech Republic thus joined some other countries such as Ireland (abt. 15%), or the relatively extreme case of the Luxembourg, which are losing an important part of created value, i.e. the created value cannot be used for

[46] Analysts link these significant outflows to the repatriation of earnings by parent companies during the European debt crisis. A significant impact will also have the life cycle stage of individual investments and the end of tax incentives for some of the first investment projects.

consumption or investment. Hungary, on the other hand, is losing only a small part of the created value compared to the past. The same applies for example to Slovakia (see below). Reinvestment and repatriation of earnings is likely to continue to be the main source of the current account deficit also because of expected restrictions on reinvestment of earnings in existing companies and due to continued income flow to parent companies abroad.[47]

In the past four years, the current account deficit of the CR improved significantly and the annual average was 0.3% of GDP (for the entire period, however, it was 1.9%, see Table 15). From the perspective of developed countries of the EU-15, or eurozone countries, deficits were reported only the UK (4.6%), France (0.7), Finland (1.1), Greece (2.0), and Belgium, which was close to zero (–0.1), other countries had surplus current accounts. Taking into account that the Czech economy is still at a lower economic level and approaches income levels of developed countries and was not forced to implement strong fiscal measures to stabilize public finances, it is an acceptable imbalance. However, an important aspect is the current account structure, which may become a problem if the sharp rise in the income balance deficit and only a weak improvement in net exports continue. Of the thirteen new EU countries, the CR reported the seventh-highest current account surplus in 2015.[48]

With respect to the national economy, the current account deficit is the result of insufficient national savings in relation to investments. This gap has to be financed from foreign sources. While the entrepreneurial sector increased its ability to generate savings and improved its profitability, the rate of household savings is low compared to developed EU countries. The negative gap between savings and investments is created primarily by the government sector.

[47] The Czech Republic together with Russia, Kazakhstan and Kyrgyzstan were the only "European" and "Eurasian" countries ranked among countries with the highest FDI income in 2011 (double-digit values), see UNCTAD: *World Investment Report 2013*. UN, Geneva and New York, 2013. In 2014, for example, the Czech National Bank reported that the volume of dividends paid abroad to parent companies amounted to CZK 250bn.

[48] A number of new member countries reported significant current account surpluses, which a relatively radical change compared to the first decade of the new century. In 2015, deficits were reported by Lithuania, Latvia, Poland, Romania, and Slovakia (0.3–1.7% of GDP). On the other hand, countries with high current account deficits reported considerable improvements in their current accounts – deficit-plagued Bulgaria, Croatia, and Estonia (1.4, 5.0, and 2.1% of GDP), positive and relatively high values were reported by Hungary (4.2%) or bank crisis-stricken Slovenia (5.2 %, all in relation to GDP); the values were calculated from the data published by Eurostat: Balance ofPayments. Eurostat, Luxembourg, September 2016.

Glossary of selected economic terms

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/1/ Gross domestic product (GDP) is one of the basic and widely used macroeconomic indicators characterizing economic activity and growth. It can be defined either as the sum of the gross value added of various sectors and branches of the national economy (the value of goods and services produced after subtracting intermediate consumption, i.e. the value of goods and services consumed during their production) or as the value of domestic final demand (final consumption and gross capital formation) plus exports minus imports.

/2/ Demand side explores the basic components of demand in the use of GDP, which satisfy the basic needs of the population and society and which determine economic growth. They include final consumption, which is further divided into private and public consumption, gross capital formation (investments), and foreign trade.

/3/ Private consumption is given by household final consumption expenditures and determines the standard of living of the population. It contains household consumption of goods and services for final use, which is covered by the disposable income of the population. The general rule is the faster the GDP growth, the faster the rise in private consumption.

/4/ Gross fixed capital formation is a basic component of investment and includes acquisitions of fixed assets (esp. machinery, equipment, buildings and structures) during a certain period. Accumulation of fixed assets (its growth, structure and technical level) is regarded as a significant growth factor, which is important for economic growth as well as for growth in the standard of living. Total investments include gross fixed capital formation, changes in reserves, and net acquisition of valuables.

/5/ Public consumption is part of final consumption, which is covered by the disposable income of government institutions. It may be individual consumption (expenditures on health care, education, culture) or collective consumption (military, police and state administrative expenditures).

/6/ Foreign trade is an important growth factor, primarily in small open economies dependent on foreign demand, such as the Czech Republic. The balance of foreign trade (so-called net export, which is the difference between the value of exports and imports of goods and services) influences GDP growth and the macroeconomic balance of a country. An increase in net exports speeds up economic growth and improves macroeconomic balance. On the other hand, a declining surplus or growing deficit of foreign trade has the opposite effect.

/7/ Domestic demand is a sum of final consumption and gross capital formation.

/8/ Unemployment rate is the ratio of the unemployed to the total labour force. We distinguish between the general unemployment rate determined by surveys of the CSO and the proportion of unemployed persons calculated by the Ministry of Labour and Social Affairs – this is called the "Registered unemployment rate".

/9/ Purchasing power parity is a notional, artificially calculated currency exchange rate, which corresponds to its purchasing power. It is a rate at which we would obtain the same amount of goods and services at home as well as in the country with which we compare ourselves. It is used in the international comparisons of real magnitudes, such as GDP per capita, for which the market exchange rates are not useful. For comparison purposes, prices of so-called reference countries are usually used. A so-called purchasing power standard (PPS), derived from average prices of European Union countries, is used for countries of the EU.

/10/ Inflation is generally understood as a recurring growth of most prices in the economy. It is a weakening of the real value (i.e. purchasing power) of a given currency against the goods and services bought by consumers – if there is a consumer price inflation in an economy, then consumers need increasingly more local currency units to buy the same basket of goods. In practice, inflation of consumer prices is measured by consumer price index (CPI)

/11/ Supply side of the economy relates to the basic factors of economic activity (labour, capital, and total factor productivity) and to the main branches of activity (agriculture, industry, construction, services).

/12/ Gross value added (GVA) is a widely used indicator of the total economic performance of each branch. It is an indicator corresponding to the GDP in the entire national economy. It is calculated by subtracting so called intermediate consumption (value of raw materials, energy, materials consumption) from the total value of production.

/13/ Tables of inter-industry relations (input-output tables) are chessboard tables (in the form of matrices), which show flows of output of individual industries. Intermediate consumption (according to individual industries) and final use of the output of industries are given in the lines. Industry costs according to supplier industries are given in the columns.

/14/ Foreign Direct Investments (FDI) are performed in order to obtain a share of common stock and decision-making powers reaching at least 10% (or such a share that gives the foreign investor decision-making powers). The condition is the investor's long-term interest in the company and active participation in management.

/15/ Potential product – it is the maximum product (maximum value) which can achieved when all available production factors (labour, capital...) are used effectively at a given level of technology. The concept is based on the assumption of a perfect competition in all markets and absence of distortions in sub-markets (production inputs or final products). Given this definition, this is generally a theoretical construct only.

/16/ External economic balance is given by the relationship of the total income of a country from abroad (incomes from the export of goods and services, and inflow of primary incomes and transfers) and expenses to foreign countries (import of goods and services, outflow of primary incomes and transfers). It can be assessed from the current account balance.

/17/ Terms of trade express the movement of prices in foreign trade (the ratio of changes of export prices to import prices). They are calculated by dividing the export price index by the import price index. When prices of exports grow more quickly than those of imports, a country can import a higher physical volume of imports for the same physical volume of exports.

/18/ Appreciation means valuation (strengthening) of the currency exchange rate of one country against another depending on the demand and supply on the foreign exchange market.

/19/ Investment position is the difference between the total value of assets located abroad and owned by local residents and the total value of liabilities which the residents have abroad. It is always determined by the end of a certain period (quarter, year), i.e. it is a "status indicator".

/20/ Merchanting– the Balance of Payments Manual (IMF BMP6) defines it as a purchase of goods by a resident (in the country for which the balance of payments is prepared) from a non-resident and the subsequent sale to another non-resident; during this process, the goods are not physically located in the territory of the resident's country.

/21/ Gross national income is an indicator based on the gross domestic product, which takes into account inflow and outflow of primary income from abroad and abroad (income from labour, capital and ownership). It equals to the gross domestic product reduced by an efflux of the primary income abroad and increased by the primary income from abroad. Primary income balance towards foreign countries influences the so-called disposable income of a country, on which final consumption and savings depend. If the outflow of income is higher than the inflow, which is the case of the Czech Republic, the possibility of increasing the standard of living is reduced. This indicator is therefore more appropriate for characterizing the growth of a country's welfare than GDP.

/22/ Confidence Index
Composite confidence indicator (economic sentiment indicator)is aweighted average of seasonally adjusted **confidence indicators in industry, construction, trade, selected services, and consumer confidence.**

Composite business confidence indicator is a weighted average of seasonally adjusted confidence indicators in industry, construction, trade, and selected services.

Consumer confidence indicator is composed of four indicators calculated by GfK Prague (expected financial situation of consumers, expected total economic situation, expected total unemployment (with inverted sign) and savings expected in the next 12 months).

Business cycle surveys are based on opinions of entrepreneurs operating in specific areas of interest (e.g. industry, construction, trade, selected services). By the use of partial questions, they reveal prospects for the future (on manufacturing or business activity, demand, prices, loans, etc.). Consumer surveys indicate intentions of consumers, especially the propensity to make purchases or savings and plans for purchase of selected consumer durables. The common feature of these surveys is that the answers do not provide direct quantifications, but outline future in generic terms – e.g. better, same, worse. Evaluations of results are carried out via variant summaries of responses. A clear expression of tendencies is the business cycle balance, which is the difference between expected improvements and deteriorations expressed as a percentage. The higher the positive balance of answers, the more optimistic is considered the answer obtained.

CSO calculates separate indicators of confidence among business and consumers and also the composite confidence indicator (economic sentiment indicator) which summarizes business and consumer confidence in a certain way.

Foreign direct investment in mining in the Czech economy

Foreign direct investment (FDI) is an investment of money or money assessable assets and rights made by a company or individual in one country in business interests (e.g. agreement on profit distribution, excercise of effective influence on a company business, minimum stake 10% in a company equity, in a company voting rights) in another country in order to gain share in the business.

FDI = equity (investment of foreign investor into a company equity also equity of branches, daughter and associate companies)
+ reinvested profit (= retained profit of past periods + post-tax profit – dividends)
+ other capital (given and taken credits and debt securities among direct investors and their branches, daughters and associate companies)

(compiled on the basis of the texts:
Foreign Direct Investment – FDI.-(I)INVESTOPEDIA, www.investopedia.com/terms/fdi.asp
Bolotov I. (2015): Diskuse na téma přímé zahraniční investice a a) jejich obecné dopady na Českou ekonomiku b) jejich dopady na strukturu zapojení České republiky do mezinárodního obchodu. 2M0301 „Mezinárodní obchod“, cvičení č.9. – Katedra mezinárodního obchodu, Fakulta mezinárodních vztahů, VŠE, Praha.

Following tables are based on ČNB data, own calculations and texts:
Přímé zahraniční investice za rok 2011. – ČNB, 2013.
Přímé zahraniční investice za rok 2012. – ČNB, 2014.
Přímé zahraniční investice za rok 2013. – ČNB, 2015.
Přímé zahraniční investice za rok 2014. – ČNB, 2016.)

Foreign direct investment in the Czech Republic – state on the date December 31 of the given year (ths CZK)

		FDI total	In mining and processing of bituminous and brown coal	In extraction of crude oil and natural gas	In other mining	In supporting activity in mining total	Total in mining activities
2011	Equity	1 239 750 279	15 537 820	69 162	3 975 483	140 958	19 723 423
	Reinvested profit	919 935 548	23 262 174	6 590 752	4 595 154	600 385	35 048 465
	Other capital	244 465 594	5 724 725	–408 945	–132 103	–19 571	5 164 106
	Total	2 404 151 420	44 524 719	6 250 969	8 438 535	721 772	59 935 995
2012	Equity	1 304 237 872	16 185 657	1 118 914	2 592 788	53 829	19 951 188
	Reinvested profit	1 038 388 081	16 423 431	6 284 626	4 436 723	1 076 965	28 221 745
	Other capital	258 251 075	12 806 584	–451 474	–212 508	–22 680	12 119 922
	Total	2 600 877 029	45 415 672	6 952 066	6 817 003	1 108 114	60 292 855
2013	Equity	1 338 371 170	16 337 020	1 799 477	2 728 094	48 834	20 913 425
	Reinvested profit	1 120 866 569	–3 440 124	6 338 148	4 008 953	1 047 482	7 954 459
	Other capital	209 503 325	15 549 418	29 206	361 020	–12 533	15 927 111
	Total	2 668 741 063	28 446 314	8 166 831	7 098 067	1 083 783	44 794 995
2014	Equity	1 332 900 000	N	N	N	N	21 506 000
	Reinvested profit	1 189 900 000	N	N	N	N	8 319 000
	Other capital	251 800 000	N	N	N	N	9 305 000
	Total	2 774 600 000	N	N	N	N	52 374 000
2015	Equity	1 305 890 600	N	N	N	N	16 361 500
	Reinvested profit	1 294 441 100	N	N	N	N	7 194 000
	Other capital	204 355 600	N	N	N	N	1 604 400
	Total	2 804 687 300	N	N	N	N	38 403 900

Foreign direct investment in the Czech Republic – state on the date December 31 of the given year (share of their structure in allocation in economy in single years in %)

		FDI total	In mining and processing of bituminous and brown coal	In extraction of crude oil and natural gas	In other mining	In supporting activity in mining total	Total in mining activities
2011	Equity	52%	35%	1%	47%	20%	33%
	Reinvested profit	38%	52%	105%	54%	83%	58%
	Other capital	10%	13%	–107%	–102%	–103%	9%
	Total	100%	100%	100%	100%	100%	100%
2012	Equity	50%	36%	16%	38%	5%	33%
	Reinvested profit	40%	36%	90%	65%	97%	47%
	Other capital	10%	28%	–106%	–103%	–102%	20%
	Total	100%	100%	100%	100%	100%	100%
2013	Equity	50%	57%	22%	38%	5%	47%
	Reinvested profit	42%	–112%	78%	56%	97%	18%
	Other capital	8%	55%	0%	5%	–101%	36%
	Total	100%	100%	100%	100%	100%	100%
2014	Equity	48%	N	N	N	N	41%
	Reinvested profit	43%	N	N	N	N	16%
	Other capital	9%	N	N	N	N	18%
	Total	100%	N	N	N	N	100%
2015	Equity	47%	N	N	N	N	43%
	Reinvested profit	46%	N	N	N	N	19%
	Other capital	7%	N	N	N	N	4%
	Total	100%	N	N	N	N	100%

Foreign direct investment in the Czech Republic – state on the date December 31 of the given year (comparison of their allocation in economy based on investment structure in single years in %; all the items of investment groups in the reference year 2011 = 100%)

		FDI total	In mining and processing of bituminous and brown coal	In extraction of crude oil and natural gas	In other mining	In supporting activity in mining total	Total in mining activities
2011	Equity	100%	100%	100%	100%	100%	100%
	Reinvested profit	100%	100%	100%	100%	100%	100%
	Other capital	100%	100%	100%	100%	100%	100%
	Total	100%	100%	100%	100%	100%	100%
2012	Equity	105%	104%	1 618%	65%	38%	101%
	Reinvested profit	84%	106%	9 087%	112%	764%	143%
	Other capital	21%	82%	–753%	–105%	–116%	61%
	Total	210%	292%	10 052%	171%	786%	306%
2013	Equity	108%	105%	2 602%	69%	35%	106%
	Reinvested profit	90%	–22%	9 164%	101%	743%	40%
	Other capital	17%	100%	42%	9%	–109%	81%
	Total	215%	183%	11 808%	179%	769%	227%
2014	Equity	108%	N	N	N	N	109%
	Reinvested profit	96%	N	N	N	N	42%
	Other capital	20%	N	N	N	N	47%
	Total	224%	N	N	N	N	266%
2015	Equity	105%	N	N	N	N	83%
	Reinvested profit	104%	N	N	N	N	36%
	Other capital	16%	N	N	N	N	8%
	Total	226%	N	N	N	N	195%

Foreign direct investment in the Czech Republic – state on the date December 31 of the given year (comparison of their time evolution of allocation in economy based on investment structure in single years in %; all the items of investment group total foreign direct investment „FDI total“ in all the years = 100%)

		FDI total	In mining and processing of bituminous and brown coal	In extraction of crude oil and natural gas	In other mining	In supporting activity in mining total	Total in mining activities
2011	Equity	100%	1%	0%	0%	0%	2%
	Reinvested profit	100%	3%	1%	0%	0%	4%
	Other capital	100%	2%	–100%	–98%	–105%	2%
	Total	100%	2%	0%	0%	0%	2%
2012	Equity	100%	1%	0%	0%	0%	2%
	Reinvested profit	100%	2%	1%	0%	0%	3%
	Other capital	100%	5%	–100%	–98%	–105%	5%
	Total	100%	2%	0%	0%	0%	2%
2013	Equity	100%	1%	0%	0%	0%	2%
	Reinvested profit	100%	–100%	1%	0%	0%	1%
	Other capital	100%	7%	0%	0%	–100%	8%
	Total	100%	1%	0%	0%	0%	2%
2014	Equity	100%	N	N	N	N	2%
	Reinvested profit	100%	N	N	N	N	1%
	Other capital	100%	N	N	N	N	4%
	Total	100%	N	N	N	N	2%
2015	Equity	100%	N	N	N	N	1%
	Reinvested profit	100%	N	N	N	N	1%
	Other capital	100%	N	N	N	N	1%
	Total	100%	N	N	N	N	1%

Foreign direct investment of the Czech Republic origin abroad – state on the date December 31 of the given year (ths CZK)

		FDI total	In mining and processing of bituminous and brown coal	In extraction of crude oil and natural gas	In other mining	In supporting activity in mining total	Total in mining activities
2011	Equity	112 671 379	1	0	0	0	1
	Reinvested profit	133 395 750	–36 521	0	0	0	–36 521
	Other capital	17 427 230	0	0	0	0	0
	Total	263 494 359	–36 520	0	0	0	–36 520
2012	Equity	164 478 923	0	0	57 590	0	57 590
	Reinvested profit	152 277 998	0	0	52 179	0	52 179
	Other capital	14 189 204	0	0	0	0	0
	Total	330 946 125	0	0	109 769	0	109 769
2013	Equity	217 200 000	0	0	0	0	0
	Reinvested profit	169 900 000	0	0	0	0	0
	Other capital	29 000 000	0	0	0	0	0
	Total	411 600 000	0	0	0	0	0
2014	Equity	242 500 000	0	0	0	0	0
	Reinvested profit	167 900 000	0	0	0	0	0
	Other capital	6 000 000	0	0	0	0	0
	Total	416 400 000	0	0	0	0	0
2015	Equity	259 579 200	0	0	0	0	0
	Reinvested profit	196 391 100	N	N	N	N	–22 700
	Other capital	17 131 700	0	0	0	0	0
	Total	473 105 000	N	N	N	N	–22 700

Foreign direct investment of the Czech Republic origin abroad – state on the date December 31 of the given year (share of their structure in allocation in economy in single years in %)

		FDI total	In mining and processing of bituminous and brown coal	In extraction of crude oil and natural gas	In other mining	In supporting activity in mining total	Total in mining activities
2011	Equity	43%	0.003%	–	–	–	0.003%
	Reinvested profit	51%	100%	–	–	–	100%
	Other capital	7%	–	–	–	–	–
	Total	100%	100%	–	–	–	100%
2012	Equity	50%	–	–	52%	–	52%
	Reinvested profit	46%	–	–	48%	–	48%
	Other capital	4%	–	–	–	–	–
	Total	100%	–	–	100%	–	100%
2013	Equity	53%	–	–	–	–	–
	Reinvested profit	41%	–	–	–	–	–
	Other capital	7%	–	–	–	–	–
	Total	100%	–	–	–	–	–
2014	Equity	58%	–	–	–	–	–
	Reinvested profit	40%	–	–	–	–	–
	Other capital	1%	–	–	–	–	–
	Total	100%	–	–	–	–	–
2015	Equity	55%	–	–	–	–	–
	Reinvested profit	42%	N	N	N	N	100%
	Other capital	4%	–	–	–	–	–
	Total	100%	N	N	N	N	100%

Foreign direct investment of the Czech Republic origin abroad – state on the date December 31 of the given year (comparison of their allocation in economy based on investment structure in single years in %; all the items of investment groups in the reference year 2011 = 100%)

		FDI total	In mining and processing of bituminous and brown coal	In extraction of crude oil and natural gas	In other mining	In supporting activity in mining total	Total in mining activities
2011	Equity	100%	100%	–	–	–	100%
	Reinvested profit	100%	100%	–	–	–	100%
	Other capital	100%	–	–	–	–	–
	Total	100%	100%	–	–	–	100%
2012	Equity	146%	0%	–	–	–	5 759 000%
	Reinvested profit	135%	0%	–	–	–	5 217 900%
	Other capital	13%	0%	–	–	–	0%
	Total	294%	0%	–	–	–	10 976 900%
2013	Equity	193%	0%	–	–	–	0%
	Reinvested profit	151%	0%	–	–	–	0%
	Other capital	26%	0%	–	–	–	0%
	Total	365%	0%	–	–	–	0%
2014	Equity	215%	0%	–	–	–	0%
	Reinvested profit	149%	0%	–	–	–	0%
	Other capital	5%	0%	–	–	–	0%
	Total	370%	0%	–	–	–	0%
2015	Equity	230%	0%	–	–	–	0%
	Reinvested profit	174%	N	N	N	N	–2 270 000%
	Other capital	15%	0%	–	–	–	0%
	Total	420%	N	N	N	N	–2 270 000%

Foreign direct investment of the Czech Republic origin abroad – state on the date December 31 of the given year (comparison of their allocation in economy based on investment structure in single years in %; all the items of investment group total foreign direct investment „FDI total“ in all the years = 100%)

		FDI total	In mining and processing of bituminous and brown coal	In extraction of crude oil and natural gas	In other mining	In supporting activity in mining total	Total in mining activities
2011	Equity	100%	0%	0%	0%	0%	0%
	Reinvested profit	100%	–100%	0%	0%	0%	–100%
	Other capital	100%	0%	0%	0%	0%	0%
	Total	100%	–100%	0%	0%	0%	–100%
2012	Equity	100%	0%	0%	0%	0%	0%
	Reinvested profit	100%	0%	0%	0%	0%	0%
	Other capital	100%	0%	0%	0%	0%	0%
	Total	100%	0%	0%	0%	0%	0%
2013	Equity	100%	0%	0%	0%	0%	0%
	Reinvested profit	100%	0%	0%	0%	0%	0%
	Other capital	100%	0%	0%	0%	0%	0%
	Total	100%	0%	0%	0%	0%	0%
2014	Equity	100%	0%	0%	0%	0%	0%
	Reinvested profit	100%	0%	0%	0%	0%	0%
	Other capital	100%	0%	0%	0%	0%	0%
	Total	100%	0%	0%	0%	0%	0%
2015	Equity	100%	0%	0%	0%	0%	0%
	Reinvested profit	100%	N	N	N	N	–100%
	Other capital	100%	0%	0%	0%	0%	0%
	Total	100%	N	N	N	N	–100%

Mineral facts.
Mining in Europe need not be so hard

Chris Cann
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Miners and member states must get behind EU policy if it is to gather momentum

You don’t have to look far to find someone prepared to knock the European Union. This feels particularly true for *Mining Journal*, based in the UK, where an ‘In- Out’ referendum on EU membership in June has provoked an increase in anti-EU rhetoric. In mining circles, at times, it’s not much better. Europe, for all its mining history and known mineral wealth, has lacked meaningful mining development for decades. The EU, as the default governing body for greater Europe, or at least its 28 member states, is the easy scapegoat. The criticisms of European mining vary depending on where you are – Western Europe has permitting problems, Central Europe is overtly bureaucratic, Eastern Europe is antiquated and fullof activists. Not that these problems recognise state boundaries. The theme, with the exception of Scandinavia, is miners generally find life difficult in this part of the world. “There is an industry [*in Europe*] built-up around not permitting mines,” Euromax Resources chief executive Steve Sharpe said on a Mines and Money panel chaired by *Mining Journal* late last year. “It would be interesting to see how much that sector is actually worth in terms of revenues because it employs a lot of people.” Sharpe is most familiar with the Greek mining system from his time spent at European Goldfields (taken over by Eldorado Gold in 2012). He said Macedonia, where Euromax is developing its Ilovica gold-copper project and which is not an EU state, had provided a conspicuously different experience, so far. The problems further east are well-documented: the headlining problem child, Rosia Montana in Romania, is described in more detail in an Eastern and Central Europe feature in this edition of *Mining Journal* (see page 28–29). This part of the world is heavily populated by environmental activism driven by mining’s poor track record. An Eastern European bloc unsuccessfully petitioned the EU parliament for a blanket ban on cyanide in gold processing in 2010, though Slovakia went ahead and issued its own ban in 2014, joining EU members Germany, Czech Republic and Hungary in going cyanide-free. In Western Europe, Spain has been criticised for its complicated mining framework, which has claimed multiple mining scalps in the past decade, while England-focused Wolf Minerals chief executive Russell Clark has complained about the inflexibility of waste management legislation, having been forced to build a triple-lined tailings dam for thechemically innert tailings product from Wolf’s Drakelands tungsten mine. The Fraser Institute’s most recent rankings paint a similarly diverse picture of EU member states, ranking them from fourth (Ireland) of 109 jurisdictions through to 106th (Greece) on its key Investment Attractiveness index, which combines ratings for mining policy and mineral potential. Only 12 of 28 member states were covered, implying those not covered are generally even less suitable for mineral investment. The better rankings are generally reserved for countries in Northern and, to a lesser extent, Western Europe. The worst scores were recorded for Central and Eastern Europe. This was reflected across a range of separate indices (*see table, below* *left*) that considered mining policy, mineral potential and encouragement of exploration (*see the column 'Current practices mineral potential' in the table*). The obvious question is: for how many of these poor experiences and poor ratings can the EU be held responsible? That is: how much influence does the EU actually have on the mining industry?

Getting real

Though quick to deride the EU, few mining companies based in EU member states have a full understanding of how the organisation works. The EU is not authorised to govern the mining policies of its member states, but, in reality, it keeps a close eye on the key practices through two separate documents: the Waste Management directive and the Environmental Impact Assessment directive. These provide the EU "legislative competence" over the two key areas for which miners must gain approval before digging anything up, according to Control Risks analyst Stina Hartikainen. "In these areas, EU bodies can adopt regulation that member states are obliged to transpose into their national legislation, giving the EU some leeway to set minimum standards of environmental and safety rules for the extractive industries," she said. What this means is the standards set out are binding but individual member states are free to work them into their own systems in the manner they see fit. In the UK, for example, the EIA and Waste Management directives have essentially been adopted verbatim. A company operating to the standards set out by those directives can expect to be granted relevant permits, provided it is compliant with the mineral policy of the country. These are not mining specific directives, nor are they country specific. The concept is that within the binding frameworks set out by the directives, member states have a level of discretion when assessing individual

Fraser Institute EU 2016 rankings (out of 109 juristictions)

	Investment attractiveness	Policy perception	Mineral potential	Current practices mineral potential
Ireland	4	1	17	5
Finland	5	5	15	4
Sweden	13	3	35	2
Portugal	22	10	45	14
Greenland (Denmark)	26	25	35	21
Spain	48	35	64	43
Serbia*	53	27	78	47
Poland	57	33	78	24
Bulgaria	63	46	78	58
Romania	67	73	54	82
France	80	49	97	70
Greece	106	93	106	100

**Accession*

mining projects. The head of Fasken Martineau's mining practice in London, Al Gourley, told *Mining Journal* the full adoption of those directives into state law was a sensible move. "I've looked at probably 100 mining codes and environmental directives around the world and I would say the European directive is uncomplicated and it's certainly not off-market – it's pretty standard stuff," he said. "From an industry standpoint, I think miners would like to see a standard adopted across Europe." However, problems arise in two areas. First, most countries that adopt the directives in their entirety lack the mining experience and expertise to exercise discretion over individual mining project applications and so the directives are followed to the letter, resulting in the kind of inflexibility to which Wolf Minerals' Clark referred. Second, not all countries have the will or, more accurately, the administrative competence to apply the directives and so there is a situation in Europe where the same set of rules results in multiple operating environments. That is, though directives are legally binding, several countries are non-compliant for various reasons. Though companies have the right to legal action and some exercise that right, by that point everybody besides the lawyers has lost. "The directives ask countries to consolidate all the environmental processes into a onestop process," Gourley said. "To the extent member states don't do that, the blame lies with them, not with the EU. "The EU approach is quite rational and sensible, but you can have member states not applying directives quickly enough, not applying them in the right way, [*and*] not applying them atall." It is this problem with implementation of good frameworks that has led to an impression the frameworks themselves or the organisation responsible for them, the EU, are not up to scratch. This is not the case. "There are a lot of problems within the EU that really tie into the fact that the quality of member states varies dramatically," Gourley said. He said Northern Europe was the clear leading light for the continent and had been able to establish a world-class mining framework for the same reasons as Australia and Canada had been successful. "There are large swathes of undeveloped land and mining is seen as a positive way to develop and grow the country. "They almost uniformly have reasonable mining codes that have been adopted to the demands of the companies and the population, both of which want mineral development. These codes are stable and almost uniformly positive toward mining," Gourley said. This changes as you enter more densely populated areas such as in Western Europe and the challenges reach fever pitch as you move east and combine large and often dense populations with transitioning economies. "In Eastern Europe you have a whole series of countries transforming … from state-owned and controlled mines to privately controlled mines. Bulgaria,Serbia, Romania, Hungary and the coal sector in Poland have seen a shift from operating these mines themselves to the entry of private enterprise," Gourley said. "There are a lot of archaic mineral development systems [*and*], even if they modernise their mining codes, which a lot of them have done, they still need to modernise all the things that go with it like corporate law, taxation, and foreign investment law – you need a modernisation of the entire economic legal structure. "That's being done at varying rates and to varying degrees, Poland being well ahead of others. Albania would be a country lagging behind most where state mining is a thing of the present [*and*] where connections between business and government are seen in all respects." Adding to the muddle is a varied style of governance across the continent between centralised systems in places such as Northern Europe and in the UK, which find it relatively simple to implement EU directives, and states such as Spain, where the devolved power structure means implementation of EU directives is an individual challenge from region to region. Just as it is wrong to blame the EU for problems arising from the inability of member state's to implement directives, it is equally counter-productive to conclude that a failure to implement a supportive mining framework means a country is anti-mining. In most cases, nothing could be further from the truth, according to Mark Rachovides, a former European Goldfields executive who heads Euromines, the industry body for European miners. “Implementation problems can be because of political infrastructure or a lack of academic background,” he told *Mining Journal*. “These are barriers to implementing change quickly and efficiently. “Many governments in countries struggling to develop their mining industries are portrayed as being not willing. In many cases that would mean choosing not to receive funding and not receive the economic benefits that come with progress. “And when you look at someof these issues and see whethers the mining industry that has problems or industry in general, it’s industry in general. Too often people say this is a problem with mining or raw materials – it’s not. We see the same issues time and time again across sectors.”

Shooting for the stars

While some miners are aware of the directives immediately affecting mining practices and all are aware of the problems, few have any idea of the broader EU policy that acknowledges the implementation challenges and is assisting member states to overcome them. This policy can be traced back to 2008 and the launch of the Raw Materials Initiative (RMI), which was promoted as a framework to ensure “EU demands for industrial metals and other non-energy resources could be met, both by ensuring access to imports from outside the EU and through development of the existing resources in the EU”, Control Risks’ Hartikainen said. The second pillar of the RMI covering efforts to ensure domestic supply encourages information sharing between member states to improve national mining policy, regulation and environmental guidelines in countries lagging behind. The RMI was followed by a review of critical raw materials (CRM) for the EU, which resulted in the current list of 20 elements deemed strategic to Europe’s industrial future. Working in parallel with the RMI and CRM programmes is the European Innovation Partnerships (EIP) and, within that, the EIP on Raw Materials, which provides“high-level guidance to the European Commission, member states and private business on the challenges of raw materials supply”. These initiatives within programmes within larger initiatives within larger programmes are part of a greater overarching EU vision called Horizon 2020, which would see 20% of Europe’s GDP come from industry by 2020. In an effort to pull this off, the EU has set aside €315 billion (US$362 billion) for the reindustrialisation of Europe. Those who can be bothered wading through the sea of acronyms will discover a clear theme: to drive forward the industrialisation of Europe as an integrated, self-reliant manufacturing centre by pooling the vast experience and knowledge across the EU member states – to help Eastern Europe replicate the mining industries of Scandinavia. What this means for extractive industries is there is a pool of capital currently being deployed that is slowly pulling together geological databases across Europe, exploring opportunities to develop European markets for Europeanraw materials, and reviewing mining codes and frameworks. These projects are designed to get into grassroots Europe and engage across sectors and across borders. “It’s all about engagement,” Rachovides said. “We need topraise and demonstrate the success stories and then spend money to bring others up to the same level. You have to point out the countries that are strong in certain areas such as regulation, why they are strong, and then engage with countries that aren’t so good to identify the key areas in which they could improve and enjoy the same success.” He said only by co-ordinating thinking and resources across Europe would miners start to see significant improvement in the most problematic states. And that, he said, was the responsibility of not just the EU and the member states, but of the companies, too.

Head of steam

Unlike directives that are at least meant to be binding, the EU policy provides incentives and resources, but it is powerless toforce the issue into those areas where it is most needed. As put by Hartikainen: “While the RMI provides aframework for direct EU influence on mining policy, its non-binding character means that participation and adherence to recommendations varies considerably.”There has been discussion on introducing a binding EU mining code but that conversation has, so far, been a short one. The consensus has been environment and waste directives adequately police mining activity and a country’s natural resources are too emotive a subject to be governed from Brussels. This leaves EU mining policy open to criticism identical to that levelled by ‘Euro-sceptics’ at the broader concept of the EU: it is a lovely thought with some big ideas that have fancy names but, in practice, it just doesn’t work. The knockers would point to the current state of play in Eastern Europe, eight years after the RMI was launched, as supporting evidence. Rachovides, in contrast, believes the initiatives, the people and the money being pointed at Europe’s mining industry are starting to get some traction. “If you’re sitting in London watching a sky-scraper being built, the first part of construction looks like nothing is happening because of all the work to source the necessary materials, to iron out any wrinkles in design, and to put in all the foundations – only when that’s done do you start building,” he said. “That’s a simple metaphor and I think it works. “Yes there were issues that needed to be addressed urgently, but you’re not going to solve the problems of 550 million people with 40-something different languages overnight. There has to be a long period of learning before we can start addressing the questions. “You create the data and then you spend time understanding it. That takes time, but once you’ve done that you can build quickly. We’re beginning to gather momentum in actually delivering [*results*] now.” Rachovides pointed to successful forums run by Euromines in conjunction with trade unions, academics and NGOs across Europe as evidence of changing attitudes. Much as the EU must wear some criticism for its past political indifference toward mining, which played a large role in the decline of raw material extraction in Europe, it should be credited with a significant shift in policy that has the potential to reverse the situation. If miners and member states want this process to gather speed, they must fully engage themselves with it.

Economic situation of domestic mining companies

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Tab. 1: Mining in total

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		192	191	241	242	245
Number of employees		52 397	53 298	57 146	55 895	55 457
Sales	mill. CZK	144 583	141 021	153 688	147 489	159 770
Value added	mill. CZK	66 153	60 765	57 054	57 473	60 330
Sales per employee	ths. CZK/ employee	2 759	2 646	2 689	2 639	2 881
Labour produktivity based value added	CZK/ employee	1 262 534	1 140 089	998 385	1 028 222	1 087 870
Hourly labour produktivity	CZK/ working hour	743	672	595	609	645
Average salary	CZK/ employee	29 951	30 388	29 736	29 847	30 462
(Value added - salaries) per employee	CZK/ employee	1 232 582	1 109 702	968 649	998 374	1 057 551

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	28%	-1%	26%	0%	2%
Number of employees	6%	2%	7%	-2%	-1%
Sales	11%	-2%	9%	-4%	8%
Value added	-9%	-8%	-6%	1%	5%
Sales per employee	4%	-4%	2%	-2%	9%
Labour produktivity based value added	-14%	-10%	-12%	3%	6%
Hourly labour produktivity	-13%	-10%	-11%	2%	6%
Average salary	1%	1%	-2%	0%	2%
(Value added - salaries) per employee	-14%	-10%	-13%	3%	6%

Source: Data from CSO and MIT, own calculations

The aim of the analysis was to identify selected economic characteristics of enterprises extracting surveyed raw materials (see Tab. 1). However, it was necessary to deal with the following problems:

1. Some companies extract more raw materials. These companies are included in each raw material's statistics, which leads to duplicities in aggregate data.
2. It is impossible to distinguish pure mining from other company activities. All data are for the company as a whole, such as, for example, the manufacture of bricks and trade activity are combined.
3. Extraction of raw materials is also carried out by enterprises belonging to other economic sectors of the CZ-NACE classification (other than sections B – Mining and quarrying). These are companies belonging to CZ-NACE 23 – Manufacture of other non-metallic mineral products. They mostly operate in glass and ceramics industry or building materials industry and belong to NACE F Construction while mining is one of their side activities.
4. It is possible to collect many data (e.g. from annual reports) for large companies, but in the case of small ones data are not available. This affects the selection of indexes. There are small enterprises for which no data are available. These enterprises were not included in analyses.
5. Due to the confidentiality of individual data, information on some raw materials cannot be provided separately. In these cases, data are provided as aggregates of several raw materials.

These specifics can be illustrated on sales, for example (see Tab. 2). Total mining sales (selected companies extracting the surveyed raw materials) amounted to CZK 159,770 mill in 2015. According to the industrial classification CZ-NACE Section B (CSO data), sales of companies engaged solely in mining and quarrying amounted to CZK 83,350 mill in 2015. The difference is due to the above mentioned assignments of some enterprises to more raw materials and the inclusion of enterprises from other CZ-NACE groups.

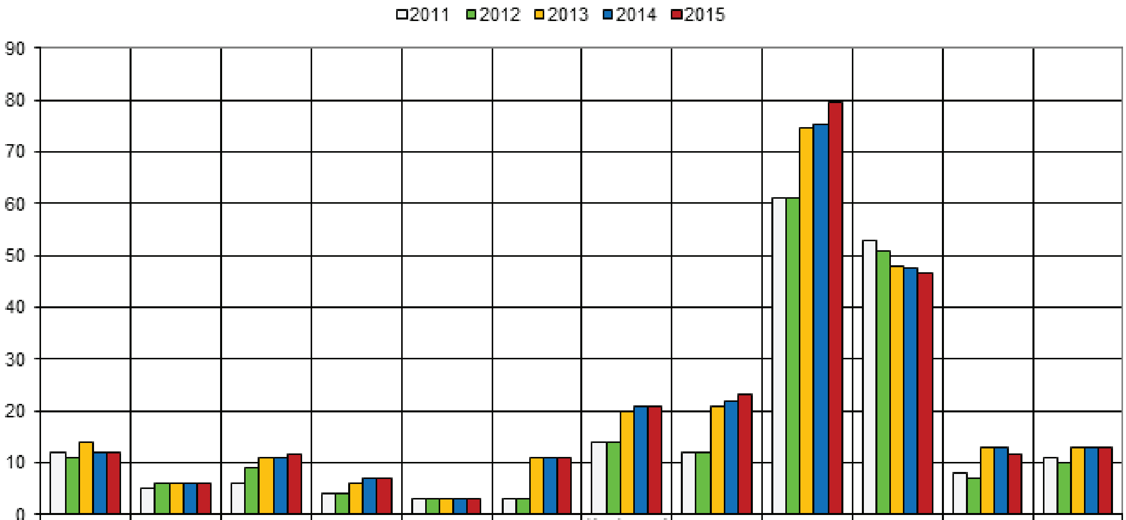
Mining is performed both by companies from CZ-NACE B Mining and quarrying (sales of CZK 123,849 mill) and companies from other CZ-NACE groups (sales of CZK 35,921 mill). Sales generated in CZ-NACE B are significantly higher than the value in the CSO's data. The point is that enterprises with sales of CZK 84,828 mill are included only once. When taking this into account, sales are similar. The small difference (86,256 – 84,828 = CZK 1,428 mill) is due to omission of small enterprises (for which the data could not be obtained). Because some companies extract several raw materials and thus are included more times (the relevant sales amount to CZK 39,021 mill). With respect to individual raw materials, shares of other sectors differ significantly – from zero share in coal to two thirds in brick clays.

Tab. 2: Sales in 2015 (mill CZK)

Mineral raw material	Total	CZ-NACE B	Other CZ-NACE
Bituminous coal	17 449	17 449	0
Brown coal and lignite	25 565	25 565	0
Kaolin	7 750	3 502	4 248
Clays and betonite	5 824	5 237	587
Feldspar	7 783	3 110	4 672
Glass sand	2 881	2 416	466
Foundry sand	7 084	3 782	3 303
Limestones and coretive sialic additives for cement production and dolomite	8 118	5 132	2 986
Dimension stone	2 959	2 959	0
Crushed stone	22 058	18 920	3 138
Sand and gravel	13 675	12 242	1 432
Brick clays and related minerals	6 771	2 187	4 584
Other minerals	31 853	21 348	10 505
Mining total	**159 770**	**123 849**	**35 921**
Firm classified one time into data processing		84 828	
CZ-NACE B		**86 256**	
Firm classified more times into data processing		39 021	

Source: own calculations according to Ministry of Industry and Trade and CSO

The selection of indicators in the tables is as follows:
- Number of companies
- Registered average number of employees
- Sales (sales of goods and sales of own goods and services)
- Book value added (VA) (= sales + change of stocks of own production + capitalization (production of a company for own consumption) – purchased goods – intermediate consumption (consumption of supplies and raw materials, energy and services))
- Sales per employee (labour productivity based on sales, i.e. sales per registered employee)
- Book value added per employee (labour productivity based on book value added, i.e. book value added per registered employee)
- Hourly labour productivity (book value added per working hour)



	Bituminous coal, Brown coal and lignite	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corrective silalic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals
2011	12	5	6	4	3	3	14	12	61	53	8	11
2012	11	6	9	4	3	3	14	12	61	51	7	10
2013	14	6	11	6	3	11	20	21	75	48	13	13
2014	12	6	11	7	3	11	21	22	75	48	13	13
2015	12	6	12	7	3	11	21	23	79	47	12	13

Source: Data from CSO and MIT, own calculations

Fig. 1. Number of companies

- Average salary
- (Book value added – salaries) per employee, i.e. book value added after deduction of salaries to cover other costs and formation of profits.

The period covers the years 2011–2015. Indicators for time series are supplied by chain indices and by average growth for a given period. Comparable indices for individual minerals are compared with values for Mining total that equals 100%.

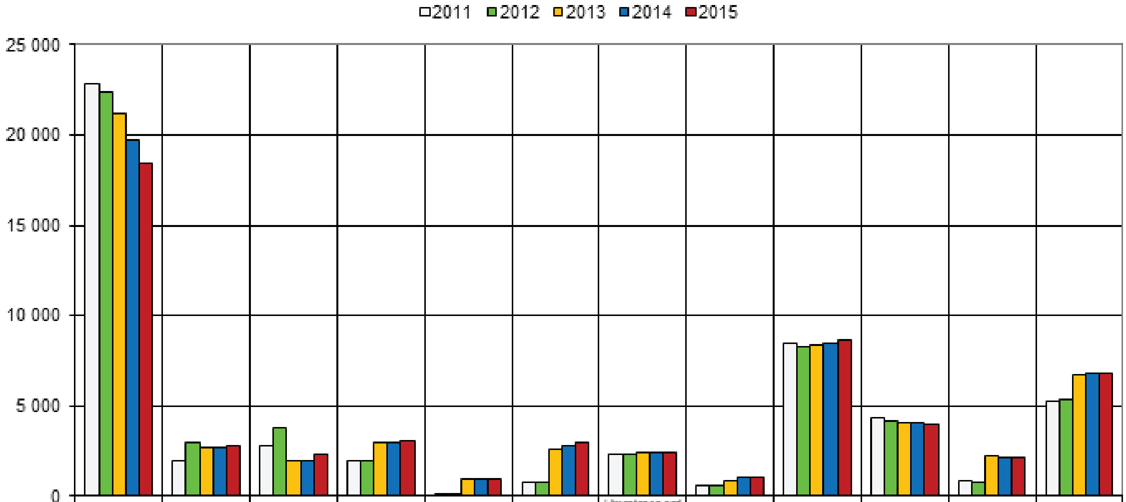
Even though the following figures and tables are self-explanatory, a brief commentary is included.

We can say that there was a significant change in the number of companies (see Tab. 1) in 2013 due to inclusion of new enterprises in the analysis. During 2011–2015, the number of analysed enterprises rose by 28%. The newly included enterprises deal mainly with building stone, dimension stone, foundry sand, and also other raw materials. Predictive capabilities of analyses have thereby improved.

As expected in our sample of minerals, crushed stone and sand and gravel account for the highest number of companies. 1). In reality this number will probably be significantly higher, because these mineral industries have many small companies, which we have not recorded. On the contrary, for bituminous and brown coal we recorded all companies because there are big companies only in these commodities. The smallest number of companies is recorded for glass sand.

The average number of employees of mining companies (see Tab. 1) rose by 6% in the period 2011–2015. The main cause was the inclusion of new enterprises in 2013.

Data for individual raw materials are shown in Fig. 2. Bituminous coal, brown coal, lignite and crushed stone account for the highest number of employees. The least number of employees was registered in dimension stone and glass sand industries. Developments of numbers of employees in various raw-material related sectors. In coal industry, however, the number of



	Bituminous coal, Brown coal and lignite	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corrective sialic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals
2011	22 873	1 983	2 806	1 996	147	778	2 366	575	8 430	4 343	827	5 284
2012	22 369	2 996	3 751	1 940	142	725	2 294	565	8 228	4 134	803	5 360
2013	21 223	2 715	1 967	2 971	953	2 640	2 405	900	8 323	4 087	2 215	6 746
2014	19 707	2 722	1 939	2 978	943	2 748	2 399	1 015	8 441	4 017	2 158	6 827
2015	18 421	2 763	2 292	3 069	952	2 946	2 426	1 047	8 614	3 968	2 115	6 846

Source: owncalculationsaccording to Ministry ofIndustry and Trade and CSO

Fig. 2. Number of employees

employees has been steadily decreasing. As a result of inclusion of new enterprises processing raw materials, 2013 saw a jump in employment, e.g. in processing of foundry sand, glass sand, or brick clays. Other sectors – e.g. with processing of kaolin and gravel – stagnated.

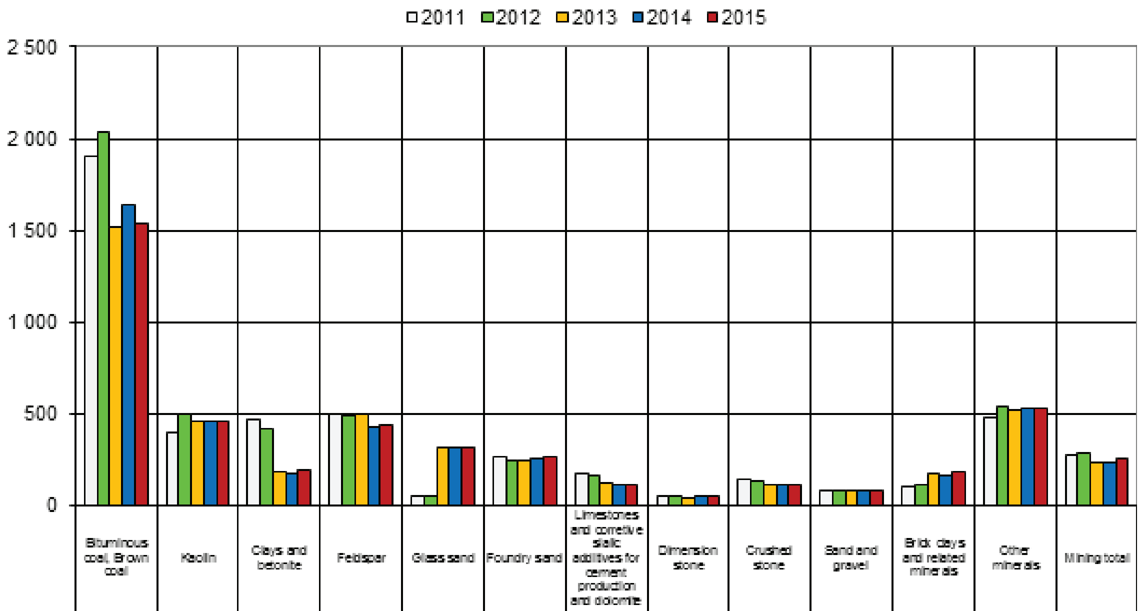
According to the CSO data, the average number of employees of enterprises falling under the CZ-NACE B was 34,985 in 2011 and 29,213 in 2015. I.e. there was a decrease by 16%. The Mining total aggregate, on the other hand, recorded an increase of 6%. It is due to multiple inclusions of enterprises engaged in extraction of energy raw materials and especially inclusion of enterprises from other groups of CZ-NACE.

In order to provide more detailed information on the number of employees, the authors added Figure 3 which shows the average number of employees per company in individual mining sectors. The largest enterprises operate in extraction of black and brown coal and lignite. Companies producing dimension stone, gravel and crushed stone belonged to the smallest ones.

Due to concentration and inclusion of new enterprises in 2013, the average size of enterprises producing glass sands and clays increased (but it dropped in producers of bentonite).

According to the CSO data for 2015, the average number of employees per company in the section CZ-NACE B was 79. The aggregate figure does not "cover" a large part of small and micro enterprises.

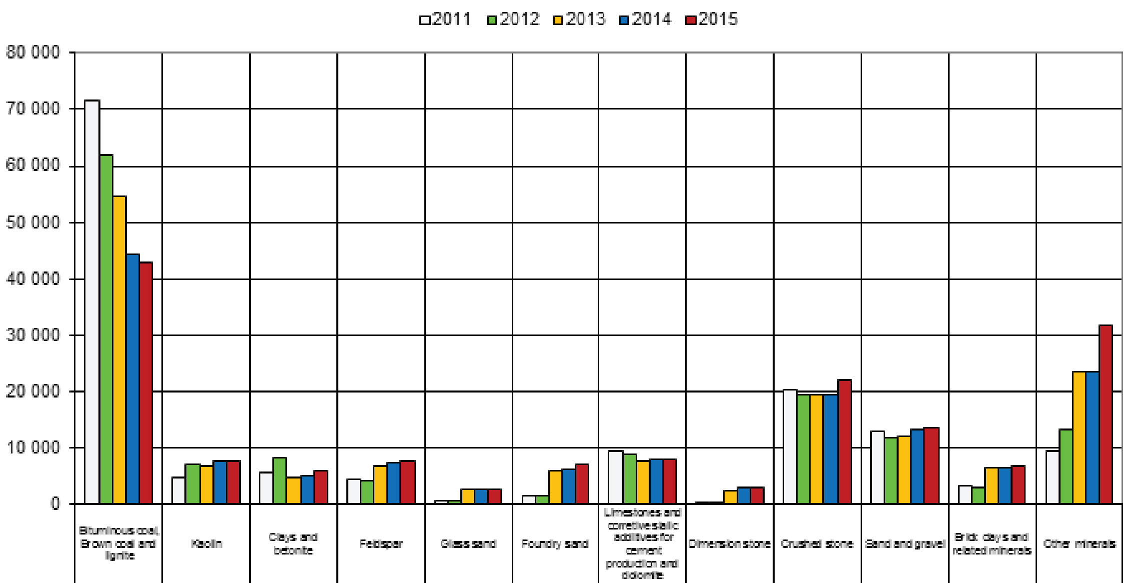
Sales define the overall performance of companies producing raw materials. If there are no sales, there are no money flows to cover expenses as well. Sales of mining companies (see Tab. 1) developed in a W shaped curve from 2011 to 2015. After a decline in 2012 there was a growth in 2013 (primarily due to inclusion of new enterprises), which was followed by a decline in 2014 and a renewed growth in 2015. In the period 2011 to 2015, the overall sales in mining increased by 11%, yet according to the CSO data on the section CZ-NACE 23, they dropped by 13%. However, in CZ-NACE 23, for example, they increased by 12% and in



	Bituminous coal, Brown coal	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corrective sialic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals	Mining total
2011	1 906	397	468	499	49	259	168	48	138	82	103	480	273
2012	2 034	499	417	485	47	242	164	47	136	81	115	536	279
2013	1 516	462	179	495	318	240	120	43	111	85	170	519	237
2014	1 642	454	176	425	314	250	114	46	112	85	166	525	231
2015	1 536	460	195	438	317	268	116	45	108	85	184	527	252

Source: Data from CSO and MIT, own calculations

Fig. 3. Average number of employees per firm



	Bituminous coal, Brown coal and lignite	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corrective sialic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals
2011	71 504	4 688	5 566	4 391	666	1 681	9 649	483	20 327	12 867	3 406	9 476
2012	61 946	7 034	8 240	4 275	660	1 638	8 936	517	19 542	11 937	3 097	13 199
2013	54 486	6 907	4 890	6 834	2 730	5 971	7 740	2 519	19 328	12 117	6 579	23 587
2014	44 296	7 592	5 147	7 536	2 793	6 357	7 875	2 903	19 541	13 220	6 660	23 568
2015	43 014	7 750	5 824	7 783	2 881	7 084	8 118	2 959	22 058	13 675	6 771	31 853

Source: Data from CSO and MIT, own calculations

Fig. 4. Sales (mill CZK)

agriculture – CZ-NACE A even by 31%. “Mining total” represents an aggregate of selected large and medium-sized enterprises engaged in mining and quarrying and large and medium-sized enterprises from other CZ-NACE.

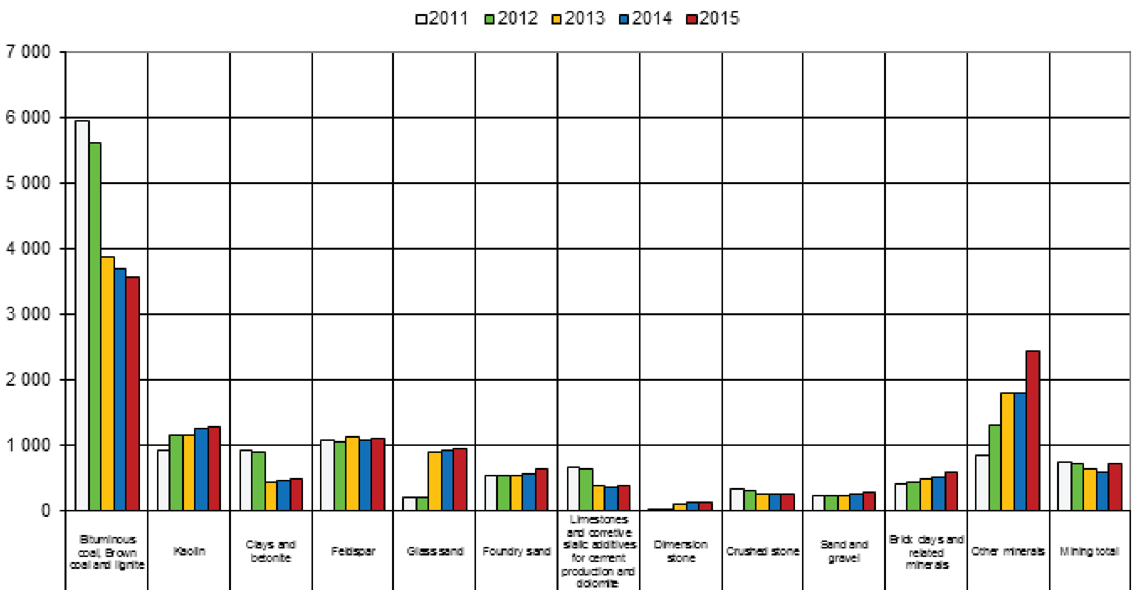
Fig. 4 shows revenues from individual raw materials. By far, the largest revenues were generated by coal, although due to the drop in coal prices and reduction in mining the revenues are decreasing. The second largest revenues were generated by other materials, in terms of individual raw materials, the second was building stone in 2015. The growth in sand and gravel and the Other minerals group was mainly due to the inclusion of new companies in the processing.

Similarly to the number of employees, average values per company are also provided for sales (Fig. 5). Clearly the largest companies in terms of sales are those involved in the production of coal. On the contrary, as may be expected, the smallest companies were those involved in the production of stone, gravel and sand.

In the period 2010 to 2015, coal recorded the biggest drop in average sales per company. The highest increases were recorded in the companies belonging to the Other minerals group.

There is a relationship between value added and GDP, or more precisely gross value added (GVA), which serves as a basis for calculating GDP. The advantage of value added compared to sales is that it does not change as a result of company break-ups and mergers. The value added generated by all mining companies (see Tab. 1) decreased by 9% during 2011–2015, unlike the growth of sales by 11%. From this perspective, indices of value added are more informative than those of sales.

Analysis of the value added by individual raw materials shows that the share of coal in the value added was by far the highest, despite its decrease in 2010–2015. The second material in terms of value added was building stone, followed by other raw materials and gravel.



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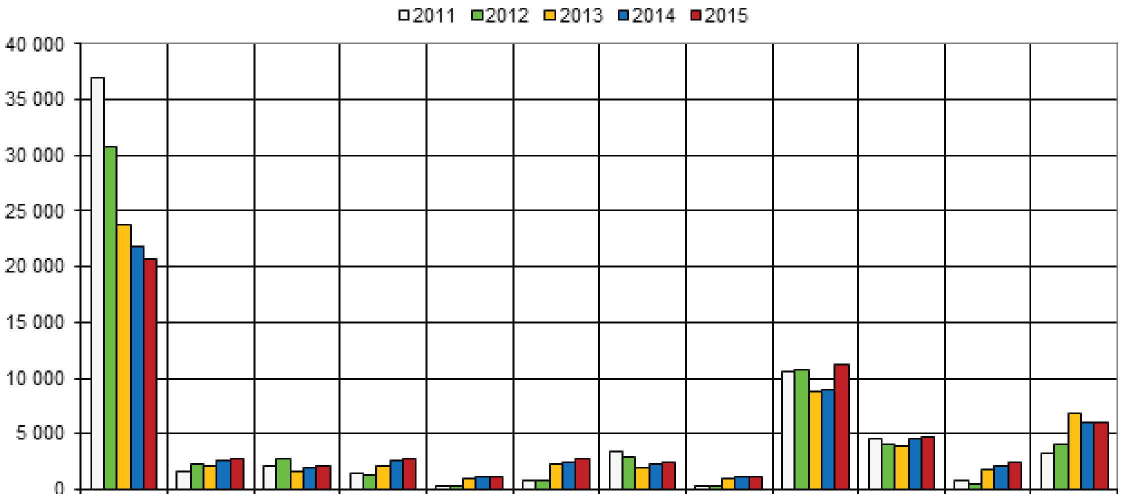
2011	5 959	938	926	1 098	219	580	682	40	333	243	426	861	753
2012	5 631	1 172	916	1 069	220	546	638	43	320	234	442	1 320	738
2013	3 892	1 161	446	1 139	910	543	387	120	259	232	506	1 814	638
2014	3 691	1 265	468	1 077	931	578	375	132	260	278	512	1 813	610
2015	3 584	1 292	495	1 112	960	644	387	128	278	294	589	2 450	737

Source: Data from CSO and MIT, own calculations

Fig. 5. Average sales per firm (mill CZK)



	Bituminous coal, Brown coal	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corretive sialic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals
2011	36 926	1 571	2 154	1 480	302	776	3 445	239	10 645	4 561	734	3 321
2012	30 816	2 270	2 827	1 358	316	733	2 984	263	10 692	3 980	527	3 996
2013	23 752	2 179	1 652	2 082	1 034	2 195	1 972	944	8 704	3 885	1 835	6 821
2014	21 780	2 599	1 857	2 626	1 116	2 475	2 273	1 090	8 864	4 525	2 175	6 090
2015	20 748	2 734	2 158	2 731	1 200	2 804	2 356	1 158	11 285	4 740	2 374	6 042

Source: Data from CSO and MIT, own calculations

Fig. 6. Book value added (mill CZK)

If we take into account the structure of the other minerals group, where production of crude oil, natural gas and uranium prevail, than it is possible to state that the share of energy mineral production is crucial for GDP (or GVA) formation in mining and quarrying.

The overall change of the value added in the total mining was –9% in the period 2011 to 2015. According to the CSO data,section mining and quarrying, it was -37%. But in other CZ-NACE, for example CZ-NACE 23, the value added increased by 22%. Again, Mining total is affected by sizes of enterprises and by other CZ-NACE.

The set of relative indicators must begin with the most important one – labour productivity. Labour productivity, calculated as value added by one employee, shows how much is left to the employee's wage, depreciation, financial and other costs, and profits for the enterprise owner. Table 1 shows that labour productivity dropped significantly in 2013. It rose again in subsequent years, yet it failed to reach the level of 2011.

As is evident in Figure 7, there are great differences between different minerals. Glass sand industry was excellent until 2012. In 2013, the highest labour productivity recorded production of coal, in 2014 it were gravels, and in 2015 building stone.

Labour productivity from value added is a relative indicator that allows for quality comparisons regardless of the absolute size of the value added. In 2011, the aggregate of companies "Mining total" had labour productivity reaching 95% of the value of CZ-NACE Section B. Labour productivity in Mining total was decreasing at a slower pace than in CZ-NACE B, in 2015 it surpassed the labour productivity in CZ-NACE B by 8%. The aggregate Mining total includes mining enterprises (CZ-NACE Section B), as well as companies from CZ-NACE C Manufacturing and CZ-NACE F Construction. Labour productivities in both these sections are significantly lower than in the section B. Their effect was more pronounced in 2011.

The higher labour productivity in section B compared to sections C and F is due to the fact that the companies in sections C and F buy materials, components, parts etc. In section B, virtually nothing is produced from purchased materials.

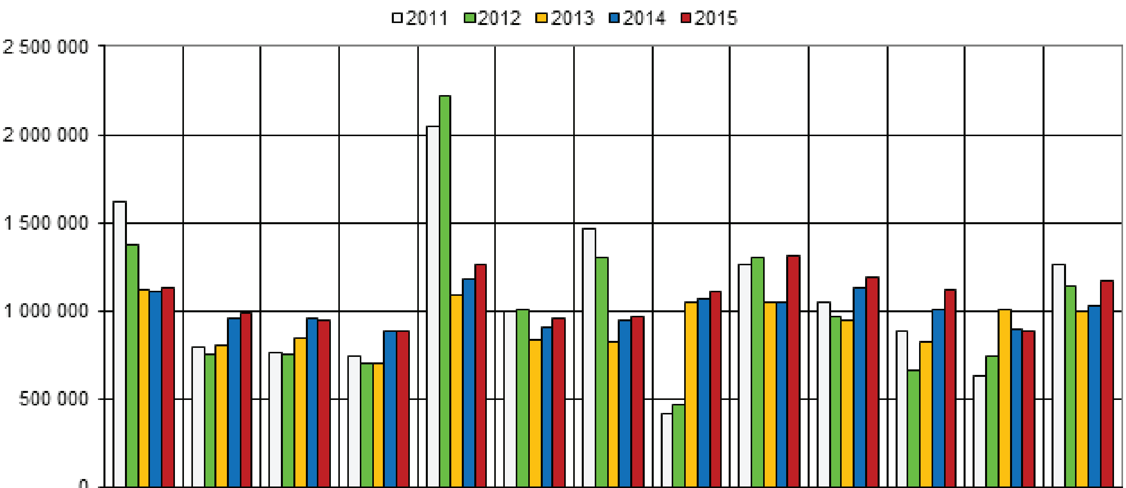
Hourly value added labour productivity (Fig. 8) has similar characteristics as productivity per employee (Fig. 7). On the other hand, it is a more precise expression of productivity, because it shows the book value added per working hour.

In comparison with the CSO data for in 2011, the hourly labour productivity in Mining total was by 25% higher than in the section CZ-NACE B. The productivities converged in 2015, when Mining total was higher by 6% only. Developments in the same mutual relations of hourly labour productivities were opposite.

Similarly to sales in absolute values, development of sales per employee during the period 2011 to 2015 resembled letter W (see Tab. 1). When comparing data of the CSO and the section CZ-NACE B, development of the aggregate Mining total was favourable as sales revenues per employee reached 98% of the values provided by the CSO in 2011 and 2012. In general, the greater the integration of mineral extraction with subsequent manufacturing, the higher the sales per employee in relation to value added labour productivity. This is obvious in the case of brick clays mostly mined by companies that use it to make bricks and roof tiles. However, the impact of other CZ-NACE sections on sales per employee was quite small.

Sales per employee (Fig. 9) show that the top performers in the period 2011 and 2012 were glass materials, limestone and cement, and dolomite and brick clays. A change came in 2013 when the highest sales were generated in the group of other raw materials. This group increased its lead significantly in 2015.

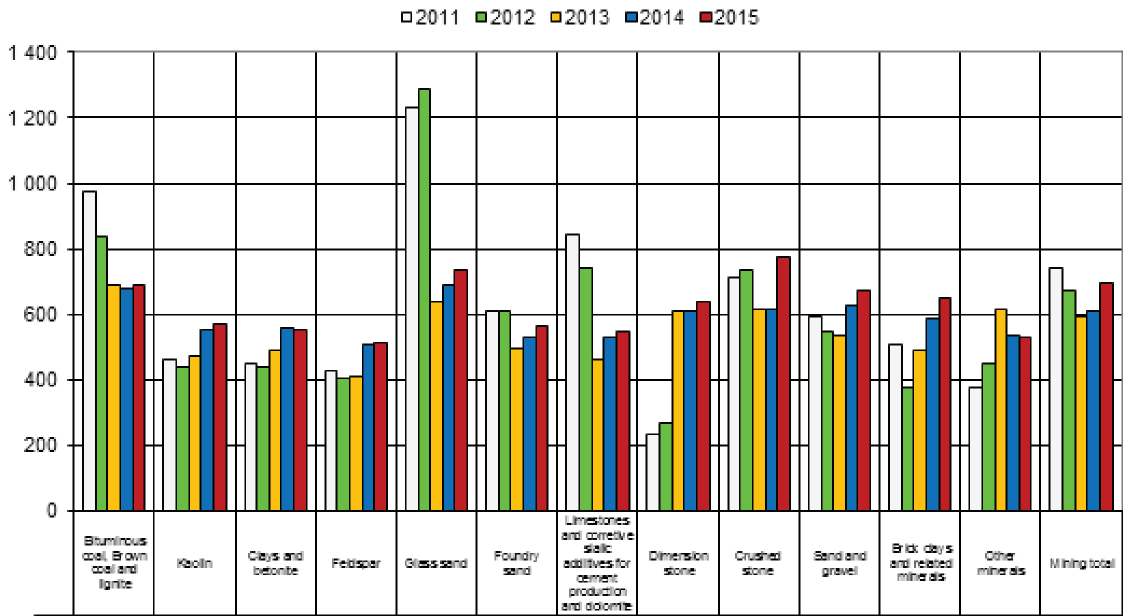
The average wage peaked in 2015 and the subsequent yearly changes were not significant (see Tab. 1) in comparison to labour productivity. Compared to CZ-NACE B Mining and



	Bituminous coal, Brown coal	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corrective silicic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals	Mining total
2011	1 614 381	792 480	767 755	741 752	2 050 514	996 579	1 462 613	415 169	1 262 679	1 050 103	887 985	628 366	1 262 534
2012	1 377 607	757 576	753 580	700 403	2 220 664	1 011 319	1 300 964	465 932	1 299 436	962 880	656 684	746 998	1 140 089
2013	1 119 146	802 816	839 617	700 566	1 084 252	831 377	820 009	1 048 139	1 045 686	950 618	828 739	1 011 101	998 385
2014	1 105 194	954 939	958 072	881 904	1 183 464	900 564	947 566	1 073 362	1 050 153	1 126 506	1 007 901	892 066	1 028 222
2015	1 126 364	989 720	941 891	889 927	1 260 241	961 804	971 358	1 106 196	1 310 021	1 194 416	1 122 326	882 607	1 170 808

Source: Data from CSO and MIT, own calculations

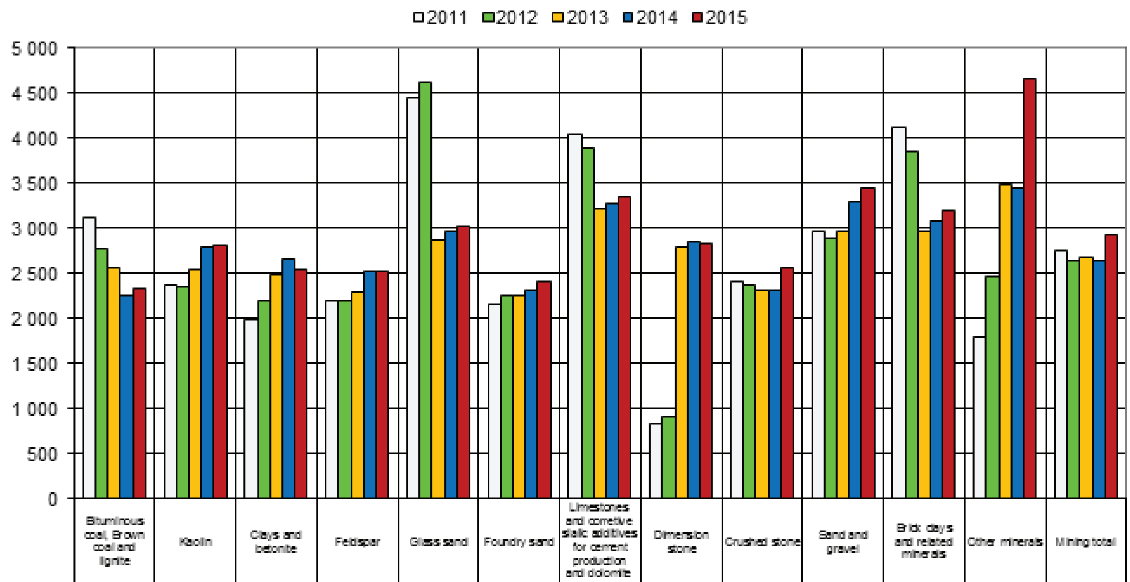
Fig. 7. Labour productivity based on book value added (CZK/employee)



	Bituminous coal, Brown coal and lignite	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corrective sialic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals	Mining total
2011	976	460	452	428	1 231	607	843	234	711	593	506	376	743
2012	837	437	440	402	1 290	610	740	266	736	548	376	448	672
2013	687	474	490	409	637	492	460	607	612	534	490	613	595
2014	677	555	557	508	691	528	529	610	614	629	588	537	609
2015	691	570	551	510	732	565	544	636	776	671	650	529	697

Source: Data from CSO and MIT, own calculations

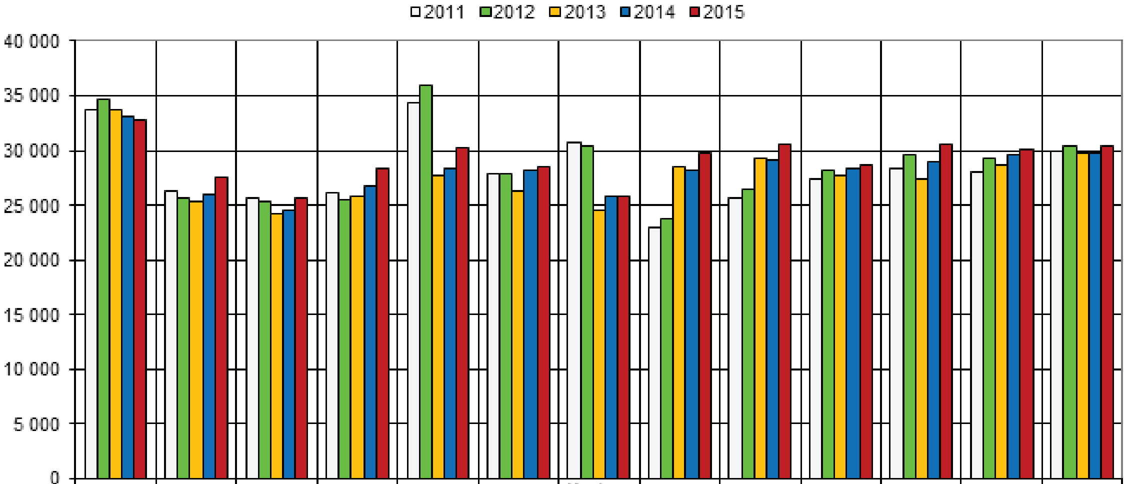
Fig. 8. Hourly labour productivity (CZK/working hour)



	Bituminous coal, Brown coal and lignite	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corrective sialic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals	Mining total
2011	3 126	2 364	1 980	2 201	4 460	2 160	4 054	841	2 411	2 963	4 119	1 793	2 759
2012	2 769	2 348	2 197	2 204	4 632	2 258	3 896	915	2 375	2 888	3 856	2 467	2 646
2013	2 567	2 544	2 486	2 300	2 863	2 262	3 218	2 798	2 322	2 965	2 971	3 496	2 689
2014	2 248	2 789	2 665	2 531	2 961	2 313	3 282	2 850	2 315	3 291	3 086	3 462	2 639
2015	2 336	2 806	2 542	2 536	3 027	2 406	3 347	2 827	2 561	3 446	3 201	4 653	2 922

Source: Data from CSO and MIT, own calculations

Fig. 9. Sales per employee (ths CZK/employee)



	Bituminous coal, Brown coal and lignite	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corrective sialic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals	Mining total
2011	33 807	26 348	25 737	26 120	34 294	27 927	30 729	22 988	25 662	27 468	28 271	28 036	29 951
2012	34 659	25 630	25 365	25 496	36 028	27 922	30 437	23 710	26 426	28 169	29 673	29 273	30 388
2013	33 684	25 344	24 307	25 865	27 692	26 265	24 477	28 476	29 232	27 717	27 431	28 664	29 736
2014	33 026	25 958	24 522	26 762	28 360	28 202	25 843	28 149	29 216	28 322	29 043	29 543	29 847
2015	32 836	27 557	25 641	28 318	30 301	28 536	25 827	29 752	30 549	28 667	30 577	30 167	30 462

Source: Data from CSO and MIT, own calculations

Fig. 10: Average salary (CZK/employee)

quarrying (CSO data), the average wage in the aggregate Mining total was slightly lower – by 4% in 2011 as well as in 2015. It is primarily due to our choice of companies. The section also includes very small enterprises and tradesmen businesses that have no employees. Average wages in other CZ-NACE are generally lower than in CZ-NACE B.

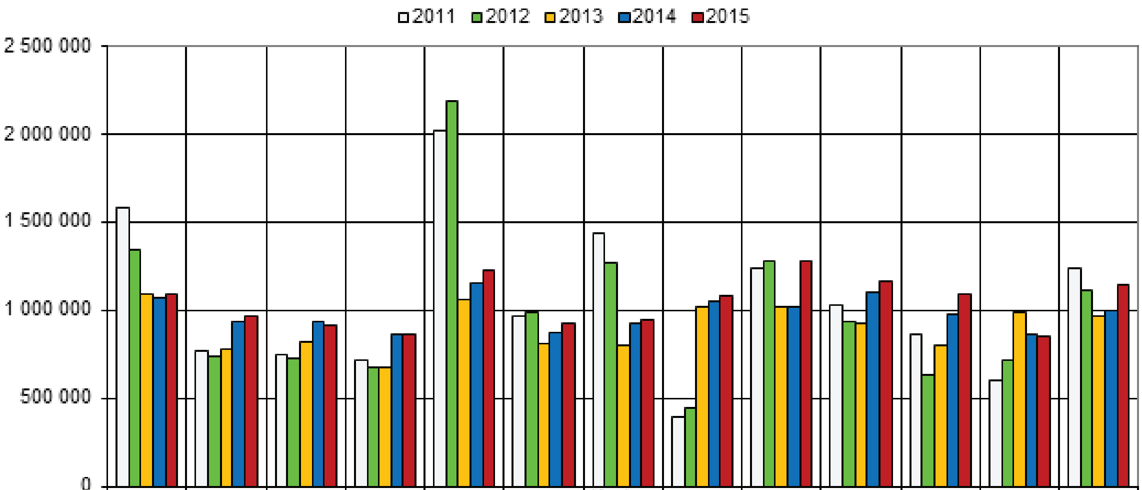
The average salary (Fig. 10) is more or less equal despite relatively big differences in labour productivity between individual minerals. The highest average wages are paid in production of bituminous, which is understandable because of underground mining. A slight surprise is glass sand, which ranked first in 2011–2012. The lowest average wages are paid in production of clays and bentonite, limestone, cement, and kaolin.

The difference in value added labour productivity and average wage (Fig. 11) is a critical indicator for evaluation of performance of enterprises (in our selection of indicators). The higher the value, the better, i.e. it leaves more money for covering other costs (depreciation, social taxes, financial costs etc.) and for profit creation. In view of the fact that average salaries are not too variable, the result is due to differences in the book value added labour productivity. For company owners, this is the most important index from this selection of indices. The more an employee produces, the more remains at an owner´s disposal to cover costs and for formation of profits. Table 1 clearly shows that the indicator value peaked in 2011. In 2015, the value was lower by 14%.

Glass sand was at the top of the list in 2011 and 2012. It was followed by coal, limestone and corrective additives for cement production, and dolomite. In 2013, coal became the top performer. In 2014, the first place was regained by glass sand, and the top performer in 2015 became building stone.

A review of individual minerals follows.

As there is only one company included in bituminous coal production, we cannot provide data solely for bituminous coal.



	Bituminous coal, Brown coal and lignite	Kaolin	Clays and betonite	Feldspar	Glass sand	Foundry sand	Limestones and corrective stalic additives for cement production and dolomite	Dimension stone	Crushed stone	Sand and gravel	Brick clays and related minerals	Other minerals	Mining total
2011	1 580 574	766 132	742 017	715 632	2 016 220	968 682	1 431 884	392 180	1 237 017	1 022 634	859 714	600 332	1 232 582
2012	1 342 948	731 947	728 214	674 906	2 184 636	983 397	1 270 527	442 222	1 273 010	934 711	627 010	717 724	1 109 702
2013	1 085 461	777 471	816 310	674 689	1 056 560	805 112	795 532	1 019 663	1 016 464	922 901	801 308	992 437	968 649
2014	1 072 169	928 981	933 560	856 142	1 155 104	872 362	921 712	1 045 202	1 020 937	1 098 183	978 858	862 514	998 374
2015	1 093 929	962 163	916 291	861 609	1 229 940	923 267	946 532	1 076 443	1 279 472	1 165 749	1 091 749	852 441	1 140 346

Source: Data from CSO and MIT, own calculations

Fig. 11: (Value added – salaries) per employee (CZK/employee)

Enterprises producing coal (Tab. 3) were relatively numerous in the Mining total aggregate and their number was quite stable in the period 2011-2015. However, a huge drop was registered in the number of employees –19%), sales (-40%), and value added (–44%) in the period 2011 to 2015. No other material underwent such a negative development. It was caused by reduction of coal mining due to drop in coal prices and reduction of production. This applies especially to coal. The annual report of OKD, a.s. clearly shows that the number of employees decreased by 22%, sales by 62%, and value added by 69% in the period 2011 to 2015. In 2016, OKD, a.s. got in insolvency proceedings and thus we can expect further decline in absolute indicators.

Development of relative indicators reflects the development of absolute indicators. In the period 2011–2015, there was a 30% decline in labour productivity from the above-average level of 2011 (compared to Mining total) – from 128% to 96% in 2015. Hourly labour productivity and sales per employee developed similarly. Only the average wage remained above the average of Mining total and fell only by 3%.

Kaolin-producing companies (Tab. 4) belong to sections and sectors outside mining. Kaolin is often produced by companies primarily focused on manufacturing products from it (e.g. porcelain). We cannot separate this production from mining activities at the company level and therefore data for raw materials are a combination of kaolin mining and related production.

In terms of numbers of organisations, this is the second smallest raw material (2.39% share in Mining total), in terms of sales it is a medium-sized raw material (7th place, 4.18% share in Mining total), regarding value added it is on the 6th place (3.68% share in Mining total), and regarding the number of employees it is on the 7th place (4.36% share in Mining total). Absolute indices for the period 2011 to 2015 are higher primarily due to inclusion of a new

Table 3: Bituminous coal, brown coal, and lignite

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		12	11	14	12	12
Number of employees		22 873	22 369	21 223	19 707	18 421
Sales	mill. CZK	71 504	61 946	54 486	44 296	43 014
Value added	mill. CZK	36 926	30 816	23 752	21 780	20 748
Sales per employee	ths. CZK/ employee	3 126	2 769	2 567	2 248	2 335
Mining total = 100%	*%*	*113%*	*105%*	*95%*	*85%*	*80%*
Labour produktivity based value added	CZK/ employee	1 614 381	1 377 607	1 119 146	1 105 194	1 126 364
Mining total = 100%	*%*	*128%*	*121%*	*112%*	*107%*	*96%*
Hourly labour produktivity	CZK/ working hour	976	837	687	677	691
Mining total = 100%	*%*	*131%*	*125%*	*116%*	*111%*	*99%*
Average salary	CZK/ employee	33 807	34 659	33 684	33 026	32 836
Mining total = 100%	*%*	*113%*	*114%*	*113%*	*111%*	*108%*
(Value added - salaries) per employee	CZK/ employee	1 580 574	1 342 948	1 085 461	1 072 169	1 093 529
Mining total = 100%	*%*	*128%*	*121%*	*112%*	*107%*	*96%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	0%	-8%	27%	-14%	0%
Number of employees	-19%	-2%	-5%	-7%	-7%
Sales	-40%	-13%	-12%	-19%	-3%
Value added	-44%	-17%	-23%	-8%	-5%
Sales per employee	-25%	-11%	-7%	-12%	4%
Labour produktivity based value added	-30%	-15%	-19%	-1%	2%
Hourly labour produktivity	-29%	-14%	-18%	-1%	2%
Average salary	-3%	3%	-3%	-2%	-1%
(Value added - salaries) per employee	-31%	-15%	-19%	-1%	2%

Source: Data from CSO and MIT, own calculations

Tab. 4: Kaolin

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		5	6	6	6	6
Number of employees		1 983	2 996	2 715	2 722	2 763
Sales	mill. CZK	4 688	7 034	6 907	7 592	7 750
Value added	mill. CZK	1 571	2 270	2 179	2 599	2 734
Sales per employee	ths. CZK/ employee	2 364	2 348	2 544	2 789	2 805
Mining total = 100%	*%*	*86%*	*89%*	*95%*	*106%*	*96%*
Labour produktivity based value added	CZK/ employee	792 480	757 576	802 815	954 939	989 720
Mining total = 100%	*%*	*63%*	*66%*	*80%*	*93%*	*85%*
Hourly labour produktivity	CZK/ working hour	460	437	474	555	570
Mining total = 100%	*%*	*62%*	*65%*	*80%*	*91%*	*82%*
Average salary	CZK/ employee	26 348	25 630	25 344	25 958	27 557
Mining total = 100%	*%*	*88%*	*84%*	*85%*	*87%*	*90%*
(Value added - salaries) per employee	CZK/ employee	766 132	731 947	777 471	928 981	962 163
Mining total = 100%	*%*	*62%*	*66%*	*80%*	*93%*	*84%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	20%	20%	0%	0%	0%
Number of employees	39%	51%	-9%	0%	1%
Sales	65%	50%	-2%	10%	2%
Value added	74%	44%	-4%	19%	5%
Sales per employee	19%	-1%	8%	10%	1%
Labour produktivity based value added	25%	-4%	6%	19%	4%
Hourly labour produktivity	24%	-5%	8%	17%	3%
Average salary	5%	-3%	-1%	2%	6%
(Value added - salaries) per employee	26%	-4%	6%	19%	4%

Source: Data from CSO and MIT, own calculations

enterprise in 2012. During the period 2012 to 2015, the growth was lower, but still high. Sales grew by 10% and value added by 20%. The number of employees decreased by 8%.

Relative indicators and labour productivity increased from 63% in 2011 to 85% in 2015, sales per employee rose from 86% to 96%, and the average wage level rose from 88% to 90%. In 2011 to 2015, all relative indicators developed very favourably – from 5% in the average wage to 25% in labour productivity.

Regarding clays and bentonite (Tab. 5) in the period 2011 to 2012, and especially in 2012, there were also enterprises belonging to CZ-NACE 23, i.e. the bricks and porcelain production. Due to organizational changes implemented in 2013 and in 2014 and thanks to a better availability of data in this sector, a prevailing number of companies belongs to the section Mining of raw materials, i.e. CZ-NACE Section B. For this reason, year 2013 saw a sharp decline in sales (there was no downstream production), but also a sharp increase in labour productivity (compared to mining, production always has higher labour productivity calculated from the value added). This change also meant a sharp decline in the number of employees.

In terms of number of organisations, this is rather a medium raw material (4.68% share in Mining total), it is less important in terms of the number of employees (3.61% share in Mining total), sales (3.14% share), and value added (2.91% share).

In terms of relative indicators, the values of 2015 (except for sales per employee in 2014) were below Mining total by ten or more percentage points. This is a typical condition of smaller, less important raw materials.

The situation in feldspar production (Tab. 6) was opposite to clay and bentonite. In 2013, the data included more companies from other sections than CZ-NACE B Mining. Again, this is the result of organisational changes in companies and data availability. As a result of this

Tab. 5: Clays and bentonite

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		6	9	11	11	12
Number of employees		2 805	3 751	1 967	1 939	2 292
Sales	mill. CZK	5 555	8 240	4 890	5 147	5 824
Value added	mill. CZK	2 154	2 827	1 652	1 857	2 158
Sales per employee	ths. CZK/ employee	1 980	2 197	2 486	2 655	2 542
Mining total = 100%	*%*	*72%*	*83%*	*92%*	*101%*	*87%*
Labour produktivity based value added	CZK/ employee	767 755	753 580	839 617	958 072	941 891
Mining total = 100%	*%*	*61%*	*66%*	*84%*	*93%*	*80%*
Hourly labour produktivity	CZK/ working hour	452	440	490	557	551
Mining total = 100%	*%*	*61%*	*65%*	*82%*	*91%*	*79%*
Average salary	CZK/ employee	25 737	25 365	24 307	24 522	25 641
Mining total = 100%	*%*	*86%*	*83%*	*82%*	*82%*	*84%*
(Value added - salaries) per employee	CZK/ employee	742 017	728 214	815 310	933 550	916 251
Mining total = 100%	*%*	*60%*	*66%*	*84%*	*94%*	*80%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	96%	50%	22%	0%	7%
Number of employees	-18%	34%	-48%	-1%	18%
Sales	5%	48%	-41%	5%	13%
Value added	0%	31%	-42%	12%	16%
Sales per employee	28%	11%	13%	7%	-4%
Labour produktivity based value added	23%	-2%	11%	14%	-2%
Hourly labour produktivity	22%	-3%	12%	14%	-1%
Average salary	0%	-1%	-4%	1%	5%
(Value added - salaries) per employee	23%	-2%	12%	15%	-2%

Source: Data from CSO and MIT, own calculations

Tab. 6: Feldspar

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		4	4	6	7	7
Number of employees		1 995	1 940	2 971	2 978	3 069
Sales	mill. CZK	4 391	4 275	6 834	7 536	7 783
Value added	mill. CZK	1 480	1 358	2 082	2 626	2 731
Sales per employee	ths. CZK/ employee	2 201	2 204	2 300	2 531	2 536
Mining total = 100%	*%*	*80%*	*83%*	*86%*	*96%*	*87%*
Labour produktivity based value added	CZK/ employee	741 752	700 403	700 555	881 904	889 927
Mining total = 100%	*%*	*59%*	*61%*	*70%*	*86%*	*76%*
Hourly labour produktivity	CZK/ working hour	426	402	409	508	510
Mining total = 100%	*%*	*57%*	*60%*	*69%*	*84%*	*73%*
Average salary	CZK/ employee	26 120	25 496	25 865	26 762	28 318
Mining total = 100%	*%*	*87%*	*84%*	*87%*	*90%*	*93%*
(Value added - salaries) per employee	CZK/ employee	715 632	674 906	674 689	855 142	861 609
Mining total = 100%	*%*	*58%*	*61%*	*70%*	*86%*	*76%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	75%	0%	50%	17%	0%
Number of employees	54%	-3%	53%	0%	3%
Sales	77%	-3%	60%	10%	3%
Value added	85%	-8%	53%	26%	4%
Sales per employee	15%	0%	4%	10%	0%
Labour produktivity based value added	20%	-6%	0%	26%	1%
Hourly labour produktivity	20%	-6%	2%	24%	0%
Average salary	8%	-2%	1%	3%	6%
(Value added - salaries) per employee	20%	-6%	0%	27%	1%

Source: Data from CSO and MIT, own calculations

combination of mining and production, the share of mining companies, i.e. the share of CZ-NACE Section B was only 40%. However, it should be borne in mind that the inclusion of new companies is by their principal activity. This means that even in these companies there is a "contamination" by activities not belonging to mining activities. Due to a change in 2013 there was a high annual growth in sales and number of employees.

In terms of number of companies, it is a less important mineral (2.92% of the number of companies), a medium-important mineral in terms of sales (5.05% of sales), and a medium-important mineral in terms of the value added (5.35%).

The level of relative indicators is below Mining total. There is a combination of two influences – a lower productivity in non-energy raw materials and a high proportion of "less" efficient production. An interesting development occurred in 2014 when all relative indicators grew significantly. 2015 saw a higher growth only in the average wage.

Glass sand (Tab. 7) saw radical change due to organisational changes in existing companies and their interconnection with other mining and downstream production activities. Now it seems that there were other companies in 2012, although according to their Company IDs they were the same entities.

In absolute terms, the number of employees, sales, and value added there was a multiple jump upward. On the other hand, this was by far the most efficient raw material in terms of relative indicators ((book value added – wages) per employee) and had the highest labour productivity in 2011 and 2012. After organisational changes, this was the second raw material in terms in labour productivity in 2013 and the first one in 2014 and 2015.

In comparison to other minerals, this was the raw material with the fewest number of companies (1.19% share in Mining total), the smallest sales (1.50% share), the lowest number of employees (1.55% share), and the second smallest value added (1.62% share).

Tab. 7: Glass sand

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		3	3	3	3	3
Number of employees		147	142	953	943	952
Sales	mill. CZK	656	660	2 730	2 793	2 881
Value added	mill. CZK	302	316	1 034	1 116	1 200
Sales per employee	ths. CZK/ employee	4 460	4 632	2 863	2 961	3 027
Mining total = 100%	*%*	*162%*	*175%*	*106%*	*112%*	*104%*
Labour produktivity based value added	CZK/ employee	2 050 514	2 220 664	1 084 252	1 183 454	1 260 241
Mining total = 100%	*%*	*162%*	*195%*	*109%*	*115%*	*108%*
Hourly labour produktivity	CZK/ working hour	1 231	1 290	637	691	732
Mining total = 100%	*%*	*166%*	*192%*	*107%*	*114%*	*105%*
Average salary	CZK/ employee	34 294	36 028	27 692	28 350	30 301
Mining total = 100%	*%*	*114%*	*119%*	*93%*	*95%*	*99%*
(Value added - salaries) per employee	CZK/ employee	2 016 220	2 184 636	1 056 560	1 155 104	1 229 940
Mining total = 100%	*%*	*164%*	*197%*	*109%*	*116%*	*108%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	0%	0%	0%	0%	0%
Number of employees	547%	-3%	570%	-1%	1%
Sales	339%	0%	314%	2%	3%
Value added	298%	5%	227%	8%	7%
Sales per employee	-32%	4%	-38%	3%	2%
Labour produktivity based value added	-39%	8%	-51%	9%	6%
Hourly labour produktivity	-41%	5%	-51%	9%	6%
Average salary	-12%	5%	-23%	2%	7%
(Value added - salaries) per employee	-39%	8%	-52%	9%	6%

Source: Data from CSO and MIT, own calculations

Tab. 8: Foundry sand

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		3	3	11	11	11
Number of employees		778	725	2 640	2 748	2 946
Sales	mill. CZK	1 681	1 638	5 971	6 357	7 084
Value added	mill. CZK	776	733	2 195	2 475	2 804
Sales per employee	ths. CZK/ employee	2 160	2 258	2 262	2 313	2 405
Mining total = 100%	*%*	*78%*	*85%*	*84%*	*88%*	*82%*
Labour produktivity based value added	CZK/ employee	996 579	1 011 319	831 377	900 554	951 804
Mining total = 100%	*%*	*79%*	*89%*	*83%*	*88%*	*81%*
Hourly labour produktivity	CZK/ working hour	607	610	492	528	565
Mining total = 100%	*%*	*82%*	*91%*	*83%*	*87%*	*81%*
Average salary	CZK/ employee	27 927	27 922	26 265	28 202	28 536
Mining total = 100%	*%*	*93%*	*92%*	*88%*	*94%*	*94%*
(Value added - salaries) per employee	CZK/ employee	968 652	983 397	805 112	872 352	923 267
Mining total = 100%	*%*	*79%*	*89%*	*83%*	*87%*	*81%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	267%	0%	267%	0%	0%
Number of employees	278%	-7%	264%	4%	7%
Sales	321%	-3%	265%	6%	11%
Value added	261%	-5%	199%	13%	13%
Sales per employee	11%	5%	0%	2%	4%
Labour produktivity based value added	-4%	1%	-18%	8%	6%
Hourly labour produktivity	-7%	0%	-19%	7%	7%
Average salary	2%	0%	-6%	7%	1%
(Value added - salaries) per employee	-5%	2%	-18%	8%	6%

Source: Data from CSO and MIT, own calculations

For glass sand (Tab. 7) we managed to obtain data for another 8 foundry sand-producing companies (Tab. 8). There was a jump in absolute indicators, such as sales, value added, and number of employees. In the relative indicators – productivities – the inclusion of new companies had much less impact. We can deduce that the newly included companies have similar mix of mining and the douwnstream production, which was about 50%/50% in 2015.

In 2015, foundry sand was a medium-important raw material regarding the number of organisations (4.37% share of Mining total) and the number of employees (4.64% share), in terms of sales (3.82% share in Mining total) and the value added (3.78% share) it was a rather less important raw material.

In terms of efficiency, foundry sand was a much less efficient raw material against, for example, glass sands, and also Mining total in 2015. In terms of labour productivity, it is a moderate raw material. Its share to this situation has a greater interconnection of foundry sand mining and construction production, which exhibits lower labour productivity than companies from the manufacturing industry.

Limestone and corrective additives for cement production and dolomite (Tab. 9) are materials that are highly integrated with manufacturing, specifically with CZ-NACE 23, 24 (chemical industry) and construction. Activities other than mining accounted for more than 50% of these minerals until 2012. In 2013, we obtained data for six new companies. The good thing is that they were mostly mining companies and therefore the share of mining companies increased to two thirds.

Compared with other minerals, these minerals have a medium importance in terms of number of organisations (8.35% share in Mining total) and sales (4.38% share). In terms of numbers of employees (3.82% share in Mining total) and value added (3.17% share) it is a medium-important mineral.

Table 9: Limestone and corrective additives for cement production and dolomite

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		14	14	20	21	21
Number of employees		2 356	2 294	2 405	2 399	2 426
Sales	mill. CZK	9 549	8 936	7 740	7 875	8 118
Value added	mill. CZK	3 445	2 984	1 972	2 273	2 356
Sales per employee	ths. CZK/ employee	4 054	3 896	3 218	3 282	3 347
Mining total = 100%	*%*	*147%*	*147%*	*120%*	*124%*	*115%*
Labour produktivity based value added	CZK/ employee	1 462 613	1 300 964	820 009	947 555	971 358
Mining total = 100%	*%*	*116%*	*114%*	*82%*	*92%*	*83%*
Hourly labour produktivity	CZK/ working hour	843	740	460	529	544
Mining total = 100%	*%*	*114%*	*110%*	*77%*	*87%*	*78%*
Average salary	CZK/ employee	30 729	30 437	24 477	25 843	25 827
Mining total = 100%	*%*	*103%*	*100%*	*82%*	*87%*	*85%*
(Value added - salaries) per employee	CZK/ employee	1 431 884	1 270 527	795 532	921 712	945 532
Mining total = 100%	*%*	*116%*	*114%*	*82%*	*92%*	*83%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	50%	0%	43%	5%	0%
Number of employees	3%	-3%	5%	0%	1%
Sales	-15%	-6%	-13%	2%	3%
Value added	-32%	-13%	-34%	15%	4%
Sales per employee	-17%	-4%	-17%	2%	2%
Labour produktivity based value added	-34%	-11%	-37%	16%	3%
Hourly labour produktivity	-36%	-12%	-38%	15%	3%
Average salary	-16%	-1%	-20%	6%	0%
(Value added - salaries) per employee	-34%	-11%	-37%	16%	3%

Source: Data from CSO and MIT, own calculations

In 2012 and 2013, sales and the value added were decreasing, they reached the current bottom in 2013. In the following years, they began to rise again, but they still could not reach the levels of 2011 in 2015. In absolute indices, the development in 2011 to 2015 was not too favourable, as sales fell by 15% and an added value even by 32%. These minerals are linked primarily to construction output. Construction was constantly declining in 2011 to 2013. The good news is that construction began to rise in 2014 and 2015. Development of sales copies the development in the construction industry.

The connection with the construction industry also reflected in productivities, which decreased between 2011 to 2015, yet they began to grow in 2014.

Dimension stone (Tab. 10) included nine new companies, specifically from the manufacturing and construction sectors. In 2014, the principal activity of these companies was mining and thus we can conclude that in 2015, all companies engaged in this mineral operated in the mining industry. However, the classification was made according to the principal activity, i.e. the related production has not disappeared from the companies, it is only marginal. There is one company that mines and processes stone and carries out construction work. Every year, this company is classified in different CZ-NACE.

In terms of added value, dimension stone is the smallest mineral (its share of Total mining is 1.56%). In terms of sales (1.60% share in Mining total) and the number of employees (1.65% share) it is the second smallest mineral.

The level of relative indicators improved significantly in 2013, due to the inclusion of new companies. It peaked in 2014 and then it declined slightly.

Indices for the period 2011 to 2015 are affected by inclusion of new enterprises. When we look at indices for the period 2013 to 2015, the material grew steadily – sales by 17% and value added by 23%.

Tab. 10: Dimension stone

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		12	12	21	22	23
Number of employees		575	565	900	1 015	1 047
Sales	mill. CZK	483	517	2 519	2 903	2 959
Value added	mill. CZK	239	263	944	1 090	1 158
Sales per employee	ths. CZK/ employee	841	915	2 798	2 860	2 827
Mining total = 100%	*%*	*30%*	*35%*	*104%*	*108%*	*97%*
Labour produktivity based value added	CZK/ employee	415 169	465 932	1 048 139	1 073 352	1 106 195
Mining total = 100%	*%*	*33%*	*41%*	*105%*	*104%*	*94%*
Hourly labour produktivity	CZK/ working hour	234	266	607	610	636
Mining total = 100%	*%*	*32%*	*40%*	*102%*	*100%*	*91%*
Average salary	CZK/ employee	22 988	23 710	28 476	28 149	29 752
Mining total = 100%	*%*	*77%*	*78%*	*96%*	*94%*	*98%*
(Value added - salaries) per employee	CZK/ employee	392 180	442 222	1 019 663	1 045 202	1 076 443
Mining total = 100%	*%*	*32%*	*40%*	*105%*	*105%*	*94%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	93%	0%	75%	5%	5%
Number of employees	82%	-2%	59%	13%	3%
Sales	513%	7%	387%	15%	2%
Value added	385%	10%	258%	15%	6%
Sales per employee	236%	9%	206%	2%	-1%
Labour produktivity based value added	166%	12%	125%	2%	3%
Hourly labour produktivity	171%	14%	128%	1%	4%
Average salary	29%	3%	20%	-1%	6%
(Value added - salaries) per employee	174%	13%	131%	3%	3%

Source: Data from CSO and MIT, own calculations

Tab. 11: Crushed stone

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		61	61	75	75	79
Number of employees		8 430	8 228	8 323	8 441	8 614
Sales	mill. CZK	20 327	19 542	19 328	19 541	22 058
Value added	mill. CZK	10 645	10 692	8 704	8 864	11 285
Sales per employee	ths. CZK/ employee	2 411	2 375	2 322	2 315	2 561
Mining total = 100%	*%*	*87%*	*90%*	*86%*	*88%*	*88%*
Labour produktivity based value added	CZK/ employee	1 262 679	1 299 436	1 045 686	1 050 153	1 310 021
Mining total = 100%	*%*	*100%*	*114%*	*105%*	*102%*	*112%*
Hourly labour produktivity	CZK/ working hour	711	735	612	614	776
Mining total = 100%	*%*	*96%*	*109%*	*103%*	*101%*	*111%*
Average salary	CZK/ employee	25 662	26 426	29 232	29 216	30 549
Mining total = 100%	*%*	*86%*	*87%*	*98%*	*98%*	*100%*
(Value added - salaries) per employee	CZK/ employee	1 237 017	1 273 010	1 016 454	1 020 937	1 279 472
Mining total = 100%	*%*	*100%*	*115%*	*105%*	*102%*	*112%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	30%	0%	23%	1%	6%
Number of employees	2%	-2%	1%	1%	2%
Sales	9%	-4%	-1%	1%	13%
Value added	6%	0%	-19%	2%	27%
Sales per employee	6%	-2%	-2%	0%	11%
Labour produktivity based value added	4%	3%	-20%	0%	25%
Hourly labour produktivity	9%	3%	-17%	0%	27%
Average salary	19%	3%	11%	0%	5%
(Value added - salaries) per employee	3%	3%	-20%	0%	25%

Source: Data from CSO and MIT, own calculations

Crushed stone (Tab. 11) is a material with the highest number of organisations engaged in its production (31.60% share in Minerals total) and with the second highest number of employees (13.58%) and value added (15.20%), it holds third place in sales (14.25%).

Again, absolute terms imply connection to construction production. In line with the development of construction industry, absolute indicators of sales and value added hit their bottoms in 2013 and then rose. The number of employees began to rise a year earlier. In 2015, they slightly exceeded the level of 2011 (sales + 9%, value added + 6%) and the number of employees also rose – by 2%.

In terms of labour productivity, the mineral usually exceeds the average value of Mining total. The average wage in 2015 reached the value of Mining total. Only the indicator of sales per employee is below Mining total.

Again, this is a mineral produced by a large number of small companies. Our analysis covers larger companies. We have no data on small and very small enterprises.

In 2015, sand and gravel (Tab. 12) accounted for the second highest number of companies (18.52% of the total number). In terms of sales (7.38% share), value added (6.38% share), and the number of employees (6.28% share), sand and gravel is the fourth most important mineral.

Absolute indicators developed differently – the number of employees steadily declined, sales got to their minimum in 2012 and then grew, and value added hit their bottom in 2013 and then rose. The change in sales between 2015 and 2011 was 2%, value added 4%, and the number of employees –9%.

As a result of this development of absolute indicators, there was a significant increase in labour productivity (by 14%). Especially the labour productivity from value added developed favourably and increased from below-average to above-average values relative to the total mining. Sales per employee remained constantly above the average of Mining total.

Tab. 12: Sand and gravel

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		53	51	48	48	47
Number of employees		4 343	4 134	4 087	4 017	3 968
Sales	mill. CZK	12 867	11 937	12 117	13 220	13 675
Value added	mill. CZK	4 561	3 980	3 885	4 525	4 740
Sales per employee	ths. CZK/ employee	2 963	2 888	2 965	3 291	3 446
Mining total = 100%	*%*	*107%*	*109%*	*110%*	*125%*	*118%*
Labour produktivity based value added	CZK/ employee	1 050 103	962 880	950 618	1 126 505	1 194 416
Mining total = 100%	*%*	*83%*	*84%*	*95%*	*110%*	*102%*
Hourly labour produktivity	CZK/ working hour	593	548	534	629	671
Mining total = 100%	*%*	*80%*	*81%*	*90%*	*103%*	*96%*
Average salary	CZK/ employee	27 468	28 169	27 717	28 322	28 667
Mining total = 100%	*%*	*92%*	*93%*	*93%*	*95%*	*94%*
(Value added - salaries) per employee	CZK/ employee	1 022 634	934 711	922 901	1 098 183	1 165 749
Mining total = 100%	*%*	*83%*	*84%*	*95%*	*110%*	*102%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	-12%	-4%	-6%	-1%	-2%
Number of employees	-9%	-5%	-1%	-2%	-1%
Sales	6%	-7%	2%	9%	3%
Value added	4%	-13%	-2%	16%	5%
Sales per employee	16%	-3%	3%	11%	5%
Labour produktivity based value added	14%	-8%	-1%	19%	6%
Hourly labour produktivity	13%	-8%	-2%	18%	7%
Average salary	4%	3%	-2%	2%	1%
(Value added - salaries) per employee	14%	-9%	-1%	19%	6%

Source: Data from CSO and MIT, own calculations

Again, sand and gravel is a mineral produced by a high number of small companies (for which we have no data).

Companies producing brick clays (Tab. 13) are rather manufacturing enterprises (brickworks) than only mining companies. Mining companies accounted for one-third of sales only in 2015. In 2013, new companies were added to this mineral production-related group which led to a jump in absolute indicators: number of employees +176%, sales +112%, and value added +248%. We have improved the coverage of miners, but we increased the "contamination" by downstream production.

It was rather a small to medium-important mineral in 2015, as it accounted for 3.65% of Mining total, 3.20% of value added, and 3.33% of the total number of employees. In terms of number of companies, brick clays and related minerals are a medium mineral with a 4.57% share.

In terms of relative indicators, there is an turning point in 2013 caused by inclusion of new companies. Their level oscillated below the level of Mining total, with the exception of sales per employee (the effect of interconnection with production). However, developments in the 2015/2013 period were generally favourable.

Because there were only few companies in the other mineral sectors, it is impossible to publish data on them. Therefore, they were aggregated into the Other minerals group (Tab. 14). It includes production of uranium, crude oil, natural gas, graphite, gemstones, diatomite, silica minerals and gypsum.

To comment on such a diverse group is problematic. It contains very efficient mineral industries (crude oil, natural gas), but also very problematic ones (uranium) due to near-zero or intermittent mining.

Tab. 13: Brick clays and related minerals

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		8	7	13	13	12
Number of employees		827	803	2 215	2 158	2 115
Sales	mill. CZK	3 406	3 097	6 579	6 660	6 771
Value added	mill. CZK	734	527	1 835	2 175	2 374
Sales per employee	ths. CZK/ employee	4 119	3 856	2 971	3 086	3 201
Mining total = 100%	*%*	*149%*	*146%*	*110%*	*117%*	*110%*
Labour produktivity based value added	CZK/ employee	887 985	656 684	828 739	1 007 901	1 122 326
Mining total = 100%	*%*	*70%*	*58%*	*83%*	*98%*	*96%*
Hourly labour produktivity	CZK/ working hour	506	376	490	588	650
Mining total = 100%	*%*	*68%*	*56%*	*82%*	*97%*	*93%*
Average salary	CZK/ employee	28 271	29 673	27 431	29 043	30 577
Mining total = 100%	*%*	*94%*	*98%*	*92%*	*97%*	*100%*
(Value added - salaries) per employee	CZK/ employee	859 714	627 010	801 308	978 858	1 091 749
Mining total = 100%	*%*	*70%*	*57%*	*83%*	*98%*	*96%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	44%	-13%	86%	0%	-12%
Number of employees	156%	-3%	176%	-3%	-2%
Sales	99%	-9%	112%	1%	2%
Value added	223%	-28%	248%	19%	9%
Sales per employee	-22%	-6%	-23%	4%	4%
Labour produktivity based value added	26%	-26%	26%	22%	11%
Hourly labour produktivity	29%	-26%	30%	20%	11%
Average salary	8%	5%	-8%	6%	5%
(Value added - salaries) per employee	27%	-27%	28%	22%	12%

Source: Data from CSO and MIT, own calculations

Tab. 14: Other minerals (uranium + crude oil + graphite + gemstones + silica minerals + gypsum)

Indicator	Unit	2011	2012	2013	2014	2015
Number of enterprises		11	10	13	13	13
Number of employees		5 284	5 350	6 746	6 827	6 846
Sales	mill. CZK	9 475	13 199	23 587	23 568	31 853
Value added	mill. CZK	3 321	3 996	6 821	6 090	6 042
Sales per employee	ths. CZK/ employee	1 793	2 467	3 496	3 452	4 653
Mining total = 100%	*%*	*65%*	*93%*	*130%*	*131%*	*159%*
Labour produktivity based value added	CZK/ employee	628 366	746 998	1 011 101	892 056	882 607
Mining total = 100%	*%*	*50%*	*66%*	*101%*	*87%*	*75%*
Hourly labour produktivity	CZK/ working hour	376	448	613	537	529
Mining total = 100%	*%*	*51%*	*67%*	*103%*	*88%*	*76%*
Average salary	CZK/ employee	28 035	29 273	28 664	29 543	30 167
Mining total = 100%	*%*	*94%*	*96%*	*96%*	*99%*	*99%*
(Value added - salaries) per employee	CZK/ employee	600 332	717 724	982 437	862 514	852 441
Mining total = 100%	*%*	*49%*	*65%*	*101%*	*86%*	*75%*

Indexes	15/11	12/11	13/12	14/13	15/14
Number of enterprises	18%	-9%	30%	0%	0%
Number of employees	30%	1%	26%	1%	0%
Sales	236%	39%	79%	0%	35%
Value added	82%	20%	71%	-11%	-1%
Sales per employee	160%	38%	42%	-1%	35%
Labour produktivity based value added	40%	19%	35%	-12%	-1%
Hourly labour produktivity	41%	19%	37%	-12%	-1%
Average salary	8%	4%	-2%	3%	2%
(Value added - salaries) per employee	42%	20%	37%	-12%	-1%

Source: Data from CSO and MIT, own calculations

Outline of domestic mine production

		2011	2012	2013	2014	2015
Energy minerals						
Uranium	t U	252	222	232	165	134
	Concentrate production, t U (1)	216	219	206	146	122
Bituminous coal	kt	10 967	10 796	8 610	8 341	7 640
Brown coal	kt (2)	46 848	43 710	40 585	38 348	38 351
Lignite	kt	0	0	0	0	0
Crude oil	kt	163	150	152	147	126
Natural gas	mil m^3	187	204	207	198	200
Industrial minerals						
Pyrope bearing rock	kt	17	12	16	18	17
Moldavite (tectite) bearing rock	ths m^3	65	41	41	45	67
	kt (1 m^3 = 1.8 kt)	117	74	74	81	120
Kaolin	Raw, kt (3)	3 606	3 318	3 108	3 281	3 454
	Beneficiated, kt	660	624	609	617	648
Clays	kt	499	485	465	518	569
Bentonite (4)	kt	160	221	226	301	369
Diatomite	kt	46	43	49	34	15
Feldspar	kt	407	445	411	422	433
Feldspar substitutes	kt	22	15	15	17	21
Silica minerals	kt	24	17	15	16	14
Glass sand	kt	976	849	862	734	812
Foundry sand	kt	395	491	412	603	535
Limestones and corrective additives for cement production	kt	11 244	9 858	9 605	10 342	10 859
Dolomite	kt	369	440	392	449	451
Gypsum	kt	11	14	11	11	11
Construction minerals						
Dimension stone	Mine production in reserved deposits, ths m^3 (5)	192	138	140	145	187
	Mine production in reserved deposits, kt (1 m^3 = 2.7 kt) (5)	518	374	378	392	505
	Mine production in non-reserved deposits, ths m^3 (6)	46	44	31	58	55
	Mine production in reserved deposits, kt (1 m^3 = 2.7 kt) (6)	130	130	84	157	149
Crushed stone	Mine production in reserved deposits, ths m^3 (5)	12 299	10 950	11 420	12 341	13 740
	Mine production in reserved deposits, kt (1 m^3 = 2.7 kt) (5)	33 207	29 565	30 384	33 321	37 98
	Mine production in non-reserved deposits, ths m^3 (6)	1 300	1 100	970	982	1 171
	Mine production in non-reserved deposits, kt (1 m^3 = 2.7 kt) (6)	3 510	2 970	2 620	2 651	3 162
Metallic ores (not mined)						

(1) corresponds to sales production (without beneficiation losses)

(2) ČSÚ (Czech Statistical Office) presents so-called sales mining production which is production of marketable brown coal and reaches on average about 95 % of given mine production

(3) raw kaolin, total production of all technological grades

(4) including mining of montmorillonite clays overburden of kaolins since 2004

(5) decrease of mineral reserves by mining production

(6) estimate

Domestic share in the world mine production

			2011	2012	2013	2014	2015
Energy minerals							
Uranium (U)		world: WNA	0.47%	0.38%	0.39%	0.29%	0.22%
Bituminous coal		world: EIA, BP	0.16%	0.16%	0.12%	0.12%	0.11%
Brown coal + Lignite		world: EIA, BP	5.14%	4.83%	4.83%	4.73%	4.75%
Crude oil		world: WBD, BP	0.004%	0.004%	0.004%	0.003%	0.003%
Natural gas		world: BP	0.006%	0.006%	0.005%	0.006%	0.006%
Industrial minerals							
Gemstones	Pyrope bearing rock	N	N	N	N	N	N
	Moldavite (tectite) bearing rock	N	N	N	N	N	N
Kaolin		world: MCS	10.64%	9.76%	8.40%	8.00%	9.65%
Clays			N	N	N	N	N
Bentonite		world: MCS	1.55%	2.21%	2.19%	2.47%	2.31%
Diatomite		world: MCS	2.19%	2.05%	2.28%	1.44%	0.66%
Feldspar		world: MCS	1.92%	2.34%	1.79%	1.96%	2.04%
Feldspar substitutes			N	N	N	N	N
Glass + Foundry sand		world: MCS	0.99%	0.96%	0.90%	0.81%	0.74%
Limestones		world: MCS *	0.26%	0.23%	0.20%	0.21%	0.23%
Dolomite			N	N	N	N	N
Gypsum		world: MCS	0.01%	0.01%	0.01%	0.004%	0.004%
Gypsum		world: MCS	0.003%	0.01%	0.01%	0.01%	0.004%
Construction minerals							
			N	N	N	N	N
Metallic ores (not mined)							

** calculation based on lime and cement production. 2 t of limestone = 1 t of lime or 2 t of cement*

ENVIRONMENT AND MINERALS

Mining and nature protection

1,492 reserved and 756 non-reserved mineral deposits were registered in the Czech Republic as of December 31, 2015. The number of exploited deposits was markedly lower – 505 reserved and 208 non-reserved. Only 39 reserved and 13 non-reserved deposits were mined in the specially nature protected areas, which represents 2.6 % and 1.7 % of the total number, respectively.

Act No 114/1992 Sb. on nature and landscape protection in its present wording regulates activities in specially protected areas (ZCHÚ) of the Czech Republic (national parks – NP (Národní park), protected landscape areas – CHKO (Chráněná krajinná oblast), national nature reserves, nature reserves, national nature monuments and nature monuments). According to this Act, all mineral mining (section 16) in national parks (with exception of crushed stone and sand mining for construction in the territory of the national park), in the first zone of protected landscape areas (section 26) and in national nature reserves (section 29) is prohibited. Although the mining of mineral resources is not prohibited by law in other areas (2nd to 4th zones of the CHKO, nature reserves, national nature monuments and nature monuments), it is very difficult to obtain authorization. Legal regulations which mention prohibition of the "permanent damage of the soil surface" are the main reason – and they practically exclude mineral mining. A further reason is the civil activity in the field of environmental protection.

Mineral deposits are mined, and were in the past mined, in the CHKO in majority of cases where the mining claims were already determined before these CHKO were established. Mining in the CHKO declined after 1989 till 2002, after it rather grows till 2008 and after declines and stagnates respectively namely of registered deposits, which follows from the data in the table "Mining of reserved and non-reserved mineral deposits in CHKO" below and also from the fact that reserved deposits were mined in 19 from 25 CHKO in 2007 and 2008 (see the table "Mining of reserved and non-reserved mineral deposits in individual CHKO") compared to 17 from 25 CHKO in 2006. Deposits were mined only in 16 CHKO in 2009 and 2010, in 14 CHKO in 2011 till 2014 and in 15 CHKO in 2015 when CHKO Kokořínsko was extended about 140 km^2 and now is colled Kokořínsko-Máchův kraj.

Specially protected areas (ZCHÚ) in the Czech Republic

Number/Year	2011	2012	2013	2014	2015
Total number	2 301	2 338	2 421	2 601	2 639
National parks (NP)	4	4	4	4	4
Protected landscape areas (CHKO)	25	25	25	25	25
Others	2 272	2 309	2 392	2 572	2 610

Source: AOPK ČR (2016)

Structure of ZCHÚ in 2015

Category of specially protected areas	Number	Area (km²)	Proportion on the territory of the Czech Republic 78 864 km² (%)
LARGE-EXTENT ZCHÚ:			
National parks (NP) – mining explicitly prohibited	4	1 195	1.51
Protected landscape areas (CHKO)	25	11 008	13.95
– (in them the 1st zones of CHKO where mining is explicitly prohibited)	25	891	1.12
ZCHÚ with mining explicitly prohibited by the Act No. 114/1992 Sb.	29*	2 066*	2.62*
SMALL-EXTENT ZCHÚ:			
National nature monuments (NPP)	120	58	0.07
National nature reserve (NPR)	115	287	0.36
Nature monuments (PP)	1 536	376	0.47
Nature reserves (PR)	839	423	0.53
NPP, NPR, PP, PR	2 610	1 144	1.45
– (from them NPP, NPR, PP, PR on the area of NP, CHKO)	765	543	0.68
LARGE-EXTENT AND SMALL-EXTENT ZCHÚ – total	2 639	13 347	16.92

* *data from 2013*
Source: AOPK ČR (2016)

Mining of reserved and non-reserved mineral deposits in CHKO, kt

Mineral	Reserved deposits					Non-reserved deposits				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Gemstones*	17	12	16	18	17	–	–	–	–	–
Crude oil	0	0	0	0	0	–	–	–	–	–
Natural gas**	0	2	0	1	1	–	–	–	–	–
Quartz sand	0	0	0	225	176	–	–	–	–	–
Feldspar	240	286	279	265	293	–	–	–	–	–
Limestone	3 033	3 501	3 278	3 344	3 169	–	–	–	–	–
Dimension stone**	55	54	41	32	35	3	3	2	1	1
Crushed stone**, ***	3 146	2 685	3 041	2 764	3 308	586	219	173	223	53
Sand and gravel**	1 206	1046	980	1 072	1 189	36	43	28	34	47
Brick clay**	0	0	0	0	0	0	0	0	0	0
Total	**7 697**	**7 586**	**7 636**	**7 721**	**8 188**	**625**	**265**	**203**	**258**	**101**
Index, 1990 = 100	48	47	48	48	51	–	–	–	–	–
Index, 2000 = 100	–	–	–	–	–	202	85	66	84	33

** pyrope bearing rocks, ** conversion to kt: natural gas (1,000,000 m³ = 1 kt), dimension and crushed stone (1,000 m³ = 2.7 kt), sand and gravel and brick clays (1,000 m³ = 1.8 kt), *** increase in mine production of non-reserved crushed stone deposits in 2011 is caused by increase in production of non-reserved part of Měrunice deposit at the expense of its reserved one*

Mining of reserved and non-reserved mineral deposits in individual CHKO, kt*

Name of CHKO	2011	2012	2013	2014	2015
Beskydy Mts.	117	63	30	38	10
Bílé Karpaty Mts.	186	220	170	208	181
Blaník	0	0	0	0	0
Blanský les	516	536	663	484	711
Broumov region	100	104	149	117	96
České středohoří Mts.	1 383	1 231	1 439	1 341	1 505
Český kras (Bohemian Karst)	3 016	3 360	3 375	3 473	3 328
Český les Mts.	0	0	0	0	0
Český ráj	0	0	0	0	0
Jeseníky Mts.	103	136	94	70	102
Jizerské hory Mts.	0	0	0	0	0
Kokořín region – Máchův kraj	0	0	0	225	176
Křivoklát region	381	250	234	226	254
Labské pískovce (Elbe sandstones)	0	0	0	0	0
Litovelské Pomoraví region	0	0	0	0	0
Lužické hory Mts.	0	5	8	5	7
Moravský kras (Moravian Karst)	201	289	31	0	0
Orlické hory Mts.	0	0	0	0	0
Pálava region	0	0	0	0	0
Poodří region	0	0	0	0	0
Slavkovský les region	148	154	160	140	155
Šumava Mts.	78	54	63	82	61
Třeboň region	1 298	1 196	1 130	1 263	1 327
Žďárské vrchy Mts.	130	130	131	131	112
Železné hory Mts.	132	123	162	176	170
Total mine production (rounded)	**7 789**	**7 851**	**7 839**	**7 979**	**8 195**

* *in 2014 the CHKO Kokořínsko was extended about 140 km², now is called Kokořínsko-Máchův kraj*

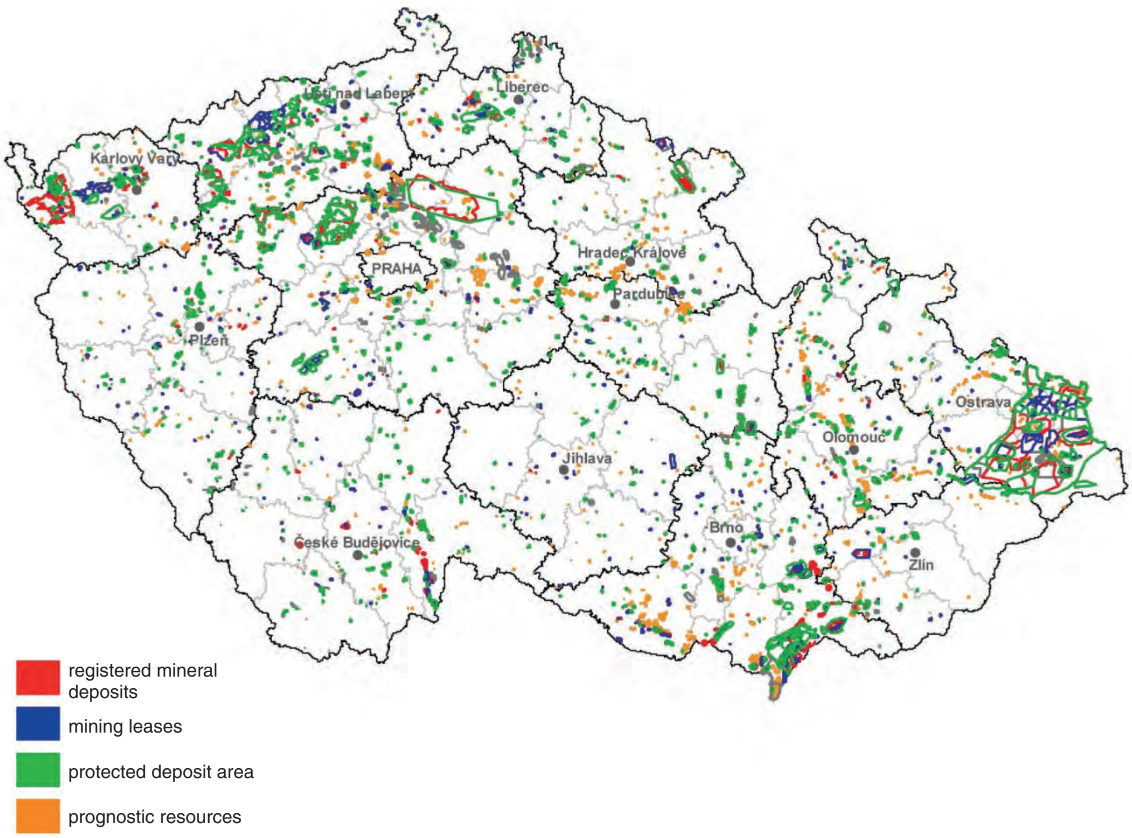
As far as the impact of mining on the area is concerned, the CHKO Český kras (Bohemian Karst – limestone mining) is especially unfavourably affected. The impact on some other CHKO, especially CHKO Třeboň region, Poodří, České středohoří Mts., Blanský les is still rather high (see Tab. “Impact of mining of reserved deposits in CHKO”). The mining activities in the area of Moravský kras (Moravian Karst) were terminated in 2014. From 2015 when CHKO Kokořínsko was extended about 140 km^2 (now is colled Kokořínsko-Máchův kraj) is reported quartz sand deposit Srní - Okřešice in this CHKO.

Impact of mining of reserved deposits in CHKO, t/km² in a year
(areas of CHKO as of December 31)

Name of CHKO	area km² in 2015	2011	2012	2013	2014	2015
Beskydy Mts.	1 160	101	54	26	33	9
Bílé Karpaty Mts.	715	260	308	238	291	253
Blaník	40	0	0	0	0	0
Blanský les	212	2 434	2528	3 122	2 283	3 354
Broumov region	410	244	254	363	285	234
České středohoří Mts.	1 070	1 293	1 150	1 345	1 253	1 407
Český kras (Bohemian Karst)	132	22 848	25 288	25 485	26 227	25 212
Český les Mts.	473	0	0	0	0	0
Český ráj	182	0	0	0	0	0
Jeseníky Mts.	740	139	184	127	95	138
Jizerské hory Mts.	350	0	0	0	0	0
Kokořín region – Máchův kraj*	410	0	0	0	0	176
Křivoklát region	630	605	390	365	359	403
Labské pískovce (Elbe sandstones)	245	0	0	0	0	0
Litovelské Pomoraví	96	0	0	0	0	0
Lužické hory Mts.	270	0	0	0	0	0
Moravský kras (Moravian Karst)	92	2 185	3 141	337	0	0
Orlické hory Mts.	200	0	0	0	0	0
Pálava region	70	0	0	0	0	0
Poodří region	82	0	0	0	0	0
Slavkovský les	640	231	241	250	219	242
Šumava Mts. (CHKO + NP)	1 684	46	32	37	49	95
Třeboň region	700	1 854	1 708	1 614	1 804	1 895
Žďárské vrchy Mts.	715	182	182	182	183	157
Železné hory Mts.	380	347	323	426	463	447
TOTAL (total mining/total area)	**11 698**	**666**	**656**	**661**	**663**	**699**

Note: an impact exceeding 10,000 t/km² in a year is regarded as critical

** in 2014 the CHKO Kokořín region was extended about 140 km², now is called Kokořín region – Mácha's country (Máchův kraj)*



Mining activities charge of the Czech Republic territory

It is possible to get a clearer picture of mining activities in the Czech Republic from following map.

As well as the Act No. 114/1992 Sb. on nature and landscape protection, Act No. 100/2001 Sb. on environmental impact assessment and the Decree of the MŽP No. 175/2006 Sb. (formerly No. 395/1992 Sb.), by which some provisions of the Act No. 114/1992 Sb. are applied, have a fundamental influence on permission for exploration and mining.

The Mining Act No. 44/1988 Sb. obliges the mining companies by its section 31 to reclaim the areas with mining impacts and to create financial means for this reclamation. These are considered as mining costs from the viewpoint of the profi tax. Table "Development of reclamations after mining" shows that the areas with mining impact decreased and those reclaimed increased in 2010–2015.

Methods of reclamation used in 2013 are shown in the table "Reclamation after mining of reserved minerals in 2015".

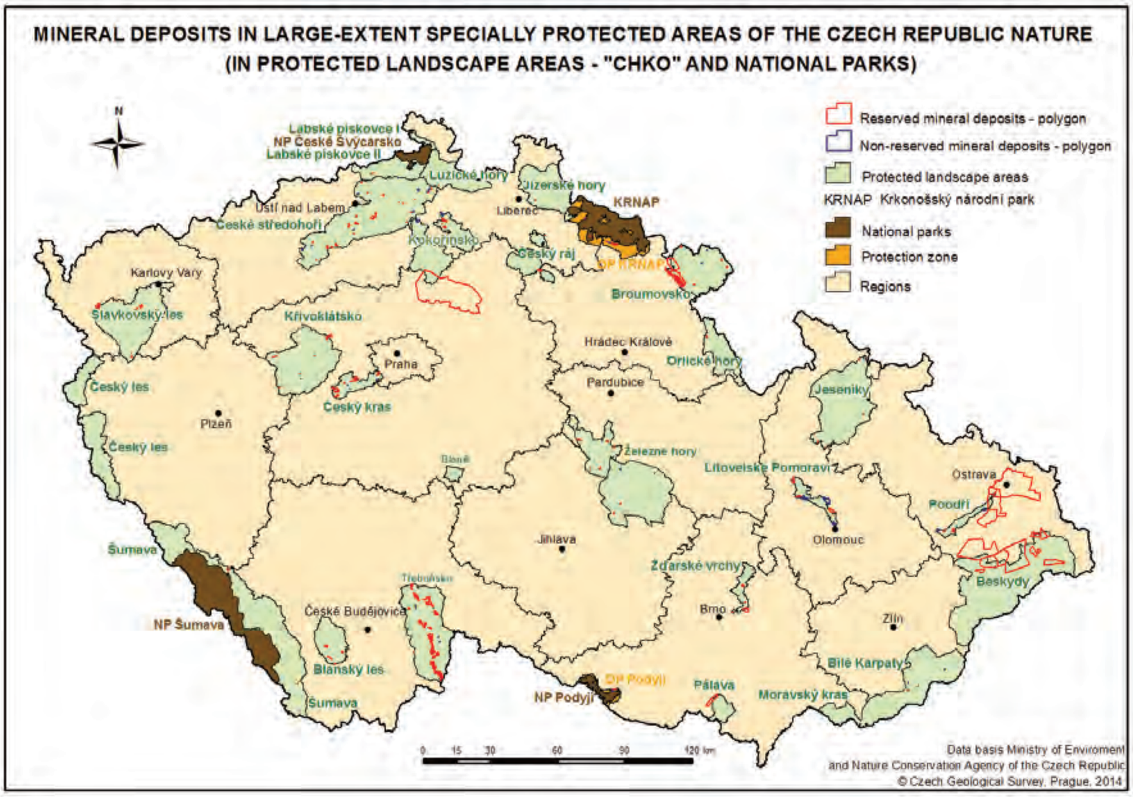
Development of reclamations after mining

km²		2011	2012	2013	2014	2015
Reserved deposits	Area with manifestation of mining, not yet reclaimed	538	521	529	481	536
	Reclamations in process	109	95	93	89	79
	Reclamations finished since the start of mining	209	222	230	235	258
	Reclamations finished in the given year	11	5	5	2	12
Non-reserved deposits	Area with manifestation of mining, not yet reclaimed	13	13	12	13	14
	Reclamations in process	3	3	3	3	4
	Reclamations finished since the start of mining	2	2	3	2	3
	Reclamations finished in the given year	0.2	0.1	0.2	0.05	0.32

Reclamation after mining of reserved minerals in 2015

Region	Reclamations in process								Reclamations finished							
	agricultural		forest		water		other		agricultural		forest		water		other	
	in DP	out DP	in DP	out DP	in DP	out DP	in DP	out DP	in DP	out DP	in DP	out DP	in DP	out DP	in DP	out DP
South Bohemia	17	0	42	3	14	0	8	0	149	39	88	30	288	22	39	17
South Moravia	169	3	52	1	2	0	25	9	500	36	180	22	8	0	23	8
Karlovy Vary	102	188	268	1048	1	6	24	17	330	1 083	1 260	1 824	564	26	137	33
Hradec Králové	31	0	21	5	2	0	12	0	61	6	133	4	60	0	21	4
Liberec	38	0	101	22	0	0	39	0	69	51	228	14	4	0	16	4
Moravia and Silesia	28	1	374	38	27	0	146	12	837	66	575	39	371	5	393	11
Olomouc	20	3	61	66	112	2	2	0	28	121	13	3	48	0	8	5
Pardubice	11	0	5	7	0	0	5	0	36	0	10	9	36	0	10	2
Plzeň	32	0	41	0	1	0	0	0	11	21	40	48	0	0	22	12
Prague	1	0	0	0	0	0	7	0	2	5	0	0	0	0	3	1
Central Bohemia	172	0	158	9	14	0	28	2	335	94	96	12	170	1	84	24
Ústí nad Labem	508	204	1 221	757	290	29	967	411	1 847	2 361	2 335	3 243	775	224	2 472	1 448
Vysočina	0	0	1	0	0	0	3	2	0	0	29	5	0	0	3	11
Zlín	32	0	1	0	3	0	5	0	90	54	40	0	130	6	100	4
Czech Republic intotal	**1 161**	**399**	**2 347**	**1 956**	**467**	**37**	**1 271**	**452**	**4 294**	**3 937**	**5 027**	**5 252**	**2 452**	**284**	**3 332**	**1 585**

[ranked according to regions and way of reclamation; DP = mining lease (in = within, out = outside), areas in hectares (1 km² = 100 ha)]



Mining infl the environment, changes the character of the landscape, and alters ecological conditions for fl and fauna. In some areas mining activities can last several human generations. This way the impact of mining persists and a more permanent new arrangement of natural conditions and relationships in its area is not quickly evident. The new arrangement can be equal to or even better than the original one, of course on a different level. Examples include artificial lakes formed e.g. in south Bohemia by sand and gravel mining, constructions and sport grounds in former quarries or specially protected nature areas proclaimed paradoxically in the territory of former quarries, and also 35 hectares of new vineyards planted as agricultural reclamation of a closed brown coal mine in the north of Bohemia in the Most wine region. They represent by their area almost 6.5 % of the total 550 hectares of productive vineyards of the Czech wine region.

In Bavaria, Germany, they studied the plant biodiversity in local quarries (S.Gilcher-U. Tränkle (2005): Steinbrüche und Gruben Bayerns und ihre Bedeutung für den Arten- und Biotopschutz.-Bayerischen Industrieverband Steine und Erden e.V.,München.). Of the 2 533 known plant species (of which 701 are endangered) in Bavaria in quarries whose combined area amounts to 0.006 % of Bavaria´s total area, they counted 1039 species (41 % of the total count), of which 87 species were endangered (12.4 % of all endangered plant species).

In Baden-Württemberg, Germany, (Schelkingen quarries – raw material for cement) an original research project was developed *(Brodkom E.-Benett P.-Jans D. (editors)(2001): Good environmental practice in the European extractive industry. A reference guide.-Environnement, hors-série no 1, p. 35. Société de l'industrie minérale.Paris.)*. "This consisted of using cut grass to encourage vegetation growth by spreading it over the floor of a closed-down quarry. In order to protect germination, the grass counteracts high soil temperatures. The moisture of the soil is retained much longer, and the air humidity under the grass is higher. ... Corresponding tests on the following substrates were carried out at the quarry: raw soil substrate (unchanged quarry site), mixed substrate (screen residue and excavated material), excavated material. ... With regard to effectiveness, it can be stated that 50 to 60 % of the species established on the areas from which the cut grass was taken were introduced and naturalised in an single mowing process. The costs incurred by such the process range between a minimum of 0.43–0.61 EUR/ m^2 (without site preparation) and a maximum of 1.36–1.87 EUR m^2 (including distribution of substrate and further measures). In contrast to that, the costs occuring for recultivation for agricultural or forestry purposes, amount to between 1.02–3.07 EUR/m^2."

In 2009, participants in the workshop Obnova území narušených těžbou nerostných surovin ("Restoration of Mining-Impacted Land") organized by the citizens association Calla- Association for Preservation of the Environment and by the Department of Botany of the Faculty of Science at the University of South Bohemia set down principles of eco-friendly restoration of mining-impacted land (J. Řehounek (2010): Přírodovědci formulovali zásady ekologické obnovy po těžbě./Naturalists formulate principles of post-mining ecological restoration.-Minerální suroviny/Surowce mineralne (magazine), 1: 32–33. Mining Union of the Czech Republic, Brno:

1. Prior to commencing mining, a qualified biological assessment not only of the mining area, but also of its surroundings is essential. It would be beneficial if the actual mining were to be managed, if possible, in such a way so as to preserve (possibly maintain and expand) as many (semi) natural habitats in the immediate vicinity of the mine site or dumping ground. A roughly 100-metre zone in an area that can be accessed by most of the species is key for the subsequent colonization of the mining-impacted land during spontaneous succession.
2. Environmental impact assessments, biological assessments and reclamation plans, which concern the restoration of mining-impacted land and dumping grounds, should be prepared by experts, who are not only familiar with the current state of knowledge in the field of ecological restoration, but also with realistic possibilities and limits of mining technology. These problems should henceforth be included in the examinations for persons authorized to prepare environmental impact assessments pursuant to Act No. 100/2001 Coll. (EIA), and for persons certified in preparing biological assessments pursuant to § 67 of Act No. 114/1992 Coll. and in preparing assessments evaluating impacts on bird areas and on Special Areas of Conservation (SAC) pursuant to § 45i of said Act. Ongoing training in ecological restoration should be mandatory for these persons.
3. A basic restoration plan (e.g. in the form of a remediation and reclamation summary) should already be known when a mining lease (in the case of reserved deposits) is granted, or when a planning permit that designates the area for mining (in the case of non-reserved deposits) is granted, and should take into account the potential possibilities of the area. Room must be left to make any possible changes according to current conditions during the mine planning phase (plan of mine development work /POPD/ including detailed rehabilitation and reclamation plans, mining permits, etc.) and during the actual mining and completion phases.
4. It is essential to conduct another continuous assessment of the locality (a scheduled monitoring programme) already during the course of mining and after its termination, which may discover the presence of rare and endangered species and communities, as well as important geological and geomorphological phenomena. The restoration plan will have to be modified with respect to this assessment, which should be provided by the mining company via or under supervision of a qualified person.

5. Prior to, during and after mining, it is necessary to monitor invasive species at the mine site and in its surroundings. If their presence may possibly jeopardize the intended restoration method, then they must be removed by sanitation methods.
6. The great majority of mining-impacted land can restore itself spontaneously – via spontaneous succession, which may in some cases also be guided (directed, blocked or reversed). As a rule, at least 20 % of a large mine site´s total area should be left to spontaneous succession in the most bilogically valuable areas. Smaller mining sites and dumping grounds can usually be integrated into the landscape without problem, thus ecological succession may be implemented in their entire area.
7. If endangered and specially protected species and communities are highly dependent on the mine site environment, then their population and biotypes will have to be managed appropriately. This should be covered by mandatory funds generated by the mining company for reclamation, after its completion by public funds designated for landscape programmes.
8. The most valuable mine sites and dumping grounds should be declared specially protected areas (most often classified specifically as a nature monument) and managed accordingly, or declared temporary protected areas if only temporary protection is needed. Less valuable mine sites and dumping grounds left to eco-friendly restoration should almost always at least be registered as important landscape elements. Special attention should be paid to mine sites that may be incorporated into the territorial system of ecological stability.
9. Restoration of a mine site or dumping ground should primarily increase the observable landscape diversity. It is necessary to break up straight lines and surfaces (peripheries, shore lines, etc.) with uneven areas, at the very latest after termination of (or preferably during the course of) mining. Shallow shore areas are necessary at flooded mine sites.
10. Unsuitable pieces of equipment and waste should removed after mining is terminated, if the aim is to integrate a mine site or dumping ground into the environment.
11. The nutrient-rich top soil sections must be permanently removed from those parts of the mine site that are designated for eco-friendly restoration in the least amount of time. This already needs to be taken into account during the reclamation planning phase. As overburden is returned, so are excess nutrients, which mostly support the evolution of a few less abundant, agressive species, including invasive ones. Once mining commences it is therefore necessary to verify, in collaboration with protection of agricultural land resources authorities (hereinafter OZPF), if the overburden is being carefully and completely removed from areas designated for eco-friendly restoration. Otherwise it is necessary to modify the implementation of the reclamation plan, again however in collaboration with OZPF and mining authorities.
12. From an environmental protection perspective, phased mining and restoration works best at larger mine sites, specifically when spread out over a longer period so that abandoned areas of the mining area are gradually left to restoration. This procedure helps create more varied and higher-quality communities with regard to age and extent in restored areas.
13. It is beneficial to place permanent study areas designated for scientific research, testing of eco-friendly interventions and monitoring in all types of mining areas. These areas should be respected by the mining companies.

Conclusion of the workshop: Eco-friendly restoration of mining-impacted land is certainly not the only option of how to deal with the integration of these areas into the landscape. Our laws should however allow for this restoration method, which is common in many countries, to become an equivalent alternative to the thus far predominant forest and agricultural reclamations.

In 2011, a fi report on project VaV SP/2d1/141/07 "Rekultivace a management nepřírodních biotopů v České republice" ("Reclamation and Management of Non-Natural Biotypes in the Czech Republic") was published for the entire duration of the project in 2007 – 2011 carried out by the Institute for Environmental Policy, Public Benefit Corporation, by the Institute of Geology of the Academy of Sciences of the Czech Republic, Public Research Institution, and by the Czech University of Life Sciences Prague. Its findings and recommendations state among other things:

Areas impacted by mining and by some other human activities such as quarries, sand pits, mining sites of kaolin and brick clays, waste piles/dumps and large waste depots, are by far not really devastated, dead "lunar landscapes". On the contrary, it is being demonstrated that, in terms of the protection of diverse biotypes, they are a very important refuge, where mushrooms and wild plants and animals are finding optimum living conditions, which they entirely lack in urbanized and industrial areas, and on land used intensively by agriculture. ...

It is absolutely vital that the relevant state administration authorities respond appropriately to the new scientific findings. In the next legislative session, they should in collaboration with experts prepare and put into practice appropriate changes to laws and executive regulations, which regulate mining and other related human activities, primarily remediation and reclamation. The following legal regulations must be amended:

- Act No. 44/1988 Coll., on mineral protection and use (the Mining Act) – subsequently amended
- Regulation of the ČBÚ No. 172/1992 Coll., on mining leases in the wording of the Regulation No. 351/2000 Coll.
- Regulation of the ČBÚ No. 104/1988 Coll., on efficient use of reserved deposits, on permits and notifi ation of mining operations and other activities employing mining methods – subsequently amended
- Act No. 61/1988 Coll., on mining operations, explosives and the state mining – subsequently amended
- Act No. 334/1992 Coll. on protection of agricultural land resources – subsequently amended
- Regulation of the MŽP ČR No. 13/1994 Coll., governing some details of agricultural land resources protection – subsequently amended
- Act No. 289/1995 Coll., on forests, modifying and amending certain acts (the Forest Act);
- Regulation of the Ministry of Agriculture of the Czech Republic No. 77/1996 Coll., on necessary elements of applications for dispossession or curtailment of rights, and on details of protection of lands devoted to forest function performance – subsequently amended
- Act No. 114/1992 Coll., on nature and landscape protection – subsequently amended

These unavoidable changes should eliminate evident discrepancies and deficiences in the legislation concerning the areas in question and harmonize legal regulations, so that ecological and economic highly effective nature-friendly methods of restoration based on natural or directed ecological succession may be used to a greater extent. ..."

Share of specially Protected Areas of the Czech Republic nature (zvláště chráněná území přírody České republiky (ZCHÚs)) established in localities with former mining (“after mining”) in all the ZCHÚs
(compiled after data of the Nature Conservation Agency of the Czech Republic – AOPK ČR in 2016)

Region	Number of ZCHÚs (without CHKOs)	Area of ZCHÚs (without CHKOs) (ha)	Number of ZCHÚs “after mining”	Area of ZCHÚs (without CHKOs) “after mining” (ha)	Share of ZCHÚ areas “after mining” in the all ZCHÚs area	Share of ZCHÚ number “after mining” in the all ZCHÚs number	Share of ZCHÚ areas “after mining” in the all ZCHÚs area in the Czech Republic	Share of ZCHÚ number “after mining” in the all ZCHÚs number in the Czech Republic
	data 2015	data 2015	* data 2013	* data 2013	* data 2013	* data 2013	* data 2013	* data 2013
Central Bohemia	278	14 133	41	817.99	6.79%	16.14%	0.80%	1.69%
Prague	93	2 328	36	714.04	30.46	39.56%	0.70%	1.48%
Karlovy Vary	76	4 576	6	33.03	0.81%	8.70%	0.03%	0.25%
Olomouc	166	7 600	20	195.88	2.67%	13.16%	0.20%	0.82%
South Moravia	344	10 794	23	343.00	3.98%	7.64%	0.34%	0.95%
Pardubice	108	5 434	5	116.84	2.22%	4.95%	0.12%	0.21%
Plzeň	196	11 003	17	148.09	1.35%	8.76%	0.15%	0.70%
Zlín	206	2 442	6	23.72	1.11%	3.39%	0.02%	0.25%
Moravia and Silesia	162	8 279	17	264.81	3.21%	10.49%	0.26%	0.70%
Liberec	126	5 709	6	244.38	4.38%	4.84%	0.24%	0.25%
Vysočina	197	5 887	4	29.25	0.51%	2.13%	0.30%	0.16%
Ústí nad Labem	173	8 862	12	327.79	5.11%	7.50%	0.32%	0.25%
Hradec Králové	140	8 314	6	17.10	0.24%	4.58%	0.02%	0.25%
South Bohemia	345	19 014	18	247.24	1.62%	5.50%	0.24%	0.75%
Czech Republic total	**2 610**	**114 375**	**217**	**3 523.16**	**3.48%**	**8.93%**	**3.48%**	**8.93%**

** data from 2013, onwards are not available*

Publication *Řehounek J., Řehounková K., Prach K. (editoři [eds]) (2010): Ekologická obnova území narušených těžbou nerostných surovin a průmyslovými deponiemi. – Calla, České Budějovice. [Ecological reclamation of regions disturbed by minerals mining and industrial stockpiles.]* keep to the conclusions of the workshop.

Eliminating negative consequences of mining in the Czech Republic – main methods and financial resources

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Introduction

The process of restructuring coal and ore mining, and of eliminating negative environmental consequences of mining in the landscape and erasing these consequences in affected areas of the Czech Republic, is executed in several ways and with various financial resources. It specifically involves:

1. Use of funds from a financial reserve generated by mining companies for remediation, reclamation, and mining damages
2. Use of funds from annual royalties paid by mining companies on mining leases and on extracted reserved minerals pursuant to the Mining Act
3. Phase-out programme of mining activities and erasing consequences of coal, ore and uranium mining funded by the national sources via the Ministry of Industry and Trade
4. Use of proceeds from privatisation of state assets in eliminating old ecological burdens caused by mining, existing prior to privatisation of mining companies
5. A programme which deals with ecological damage caused prior to privatisation of brown coal mining companies in the Ústí nad Labem Region and Karlovy Vary Region, with ecological revitalisation upon termination of mining operations in the Moravian-Silesian Region, with eliminating ecological burdens caused by the exploration for and extraction of crude oil and natural gas in designated areas of the South Moravian Region, and with reducing the impacts caused by the termination of coal mining in the Kladno Region based on Government resolutions in 2002. Funds are provided by proceeds from privatisation of national assets.

Sources of European Union – Operational Programme Environment (administered by the Ministry of Industry and Trade).

1. Use of funds from a financial reserve generated by mining companies for remediation, reclamation, and mining damages

Financial reserve for remediation and reclamation

The most important source for funding the elimination of the consequences of mining operations in the Czech Republic is the financial reserve for remediation and reclamation, generated by mining companies during the exploitation of reserved mineral deposits.

The amendment to Mining Act No. 541/1991 Coll., under Article 31 Section 6, imposes on the mining company to generate a financial reserve in order to meet the obligation established under Article 31 Section 5 of the Mining Act, thus guaranteeing the remediation and reclamation of all plots of land affected by mining (hereinafter referred to as “reserves”). The reserves are part of the company’s expenses. Pursuant to article 32 section 2 of the Mining Act, the determination of anticipated expenses for remediation and reclamation is part of the plan for opening, preparation and exploitation of reserved deposits (hereinafter referred to as "POPD"), and the POPD must also contain a proposal regarding the amount of, and the method for, generating the required financial reserve. However, the anticipated amount of financial costs for remediation and reclamation must for be already included the first time, pursuant to the provision under Article 2, Section 4, Par. k) Point 4 of Decree No. 172/1992 Coll., as amended, in the application for the grant of a mining lease. An interim provision of Act No. 541/1991 Coll. established that the required reserve amount should be provided in 10 years (i.e. by 20 December 2001) in the case of existing mines. In the subsequent amendment of the Mining Act by Act No. 168/1993 Coll., the time period for generating the reserve was changed to last for the duration of the economic life of the mine, quarry or their sections. However, that did not apply to companies with an announced or approved phase-out programme (ores, coal).

According to the provision under article 37a section 2 of the Mining Act, creation of reserves is subject to approval by Regional Mining Authorities (RMA). Upon the request of

Generated and drawn reserves for remediation and reclamation (in CZK thousand)

Year	Bituminous coal		Brown coal		Crude oil and natural gas		Ores		Industrial minerals		Radioactive minerals		Total	
	generated	drawn	generated	drawn	generated	drawn	generated	drawn	generated	drawn	generated	drawn	generated	drawn
1993	118,500	0	1,341,769	65,615	12,722	0	0	0	97,438	8,236	0	0	1,570,429	73,851
1994	123,750	18,600	573,242	259,929	6,836	0	0	0	255,155	30,335	0	0	958,983	308,864
1995	85,895	136,064	3,845,935	265,856	22,414	370	0	0	276,724	24,230	0	0	4,230,968	426,520
1996	143,500	97,993	1,436,957	831,817	25,811	113	0	0	270,432	31,829	0	0	1,876,700	961,752
1997	108,000	42,108	1,302,735	1,087,993	62,618	5,569	0	0	484,420	53,262	0	0	1,957,773	1,188,932
1998	51,594	48,033	1,226,036	994,133	22,112	9,541	0	0	466,649	59,913	0	0	1,766,391	1,111,620
1999	132,143	56,236	1,199,633	704,199	26,181	7,473	0	0	318,852	141,530	0	0	1,676,809	909,438
2000	42,747	52,029	1,119,474	683,179	23,487	600	0	0	307,433	140,225	0	0	1,493,141	876,033
2001	876,194	77,458	1,267,431	678,515	23,184	2,750	390	0	215,379	53,893	0	0	2,382,578	812,616
2002	887,250	129,600	1,007,561	653,557	100	250	0	0	157,721	50,604	0	0	2,052,632	834,011
2003	1,800	498	5,199,919	4,844,371	11,782	1,050	0	0	179,763	57,848	0	0	5,393,264	4,903,767
2004	65,002	54,162	1,031,828	720,168	4,770	0	0	0	160,102	73,177	0	0	1,261,702	847,507
2005	66,504	54,204	964,222	547,883	17,524	9,409	0	0	228,713	113,743	0	0	1,276,963	725,239
2006	74,178	113,691	845,008	663,055	17,893	3,300	0	0	144,665	92,489	0	0	1,081,744	872,535
2007	32,696	88,462	718,820	240,060	25,417	17,259	0	0	127,413	82,329	0	0	904,346	428,110
2008	17,660	66,941	626,649	330,397	24,828	16,372	0	0	233,615	99,610	0	0	1,008,637	513,320
2009	21,780	69,711	650,696	394,528	15,454	1,324	0	0	177,681	77,290	0	0	955,897	542,853
2010	22,800	147,848	298,205	133,171	16,302	461	0	0	96,207	94,517	0	0	433,515	375,997
2011	22,500	170,958	625,011	491,068	22,336	986	0	0	82,252	87,681	0	0	752,099	750,693
2012	22,500	141,432	632,601	364,264	9,871	1,693	0	0	96,263	91,721	0	0	761,235	599,110
2013	15,000	240,951	648,019	325,791	13,530	2,044	0	0	86,121	57,478	0	0	762,670	626,254
2014	15,000	204,020	612,459	470,297	11,566	1,341	0	0	84,084	40,704	0	0	723,109	716,362
2015	15,000	108,188	577,398	518,197	12,131	809	0	0	98,192	70,309	0	0	702,721	697,503

a company, these also permit the drawing on funds from the generated reserve upon agreement with the Ministry of the Environment and upon approval of the relevant municipality. In the case of public enterprises, the RMA makes a decision regarding the drawing on the reserve upon agreement with the Ministry of Industry and Trade.

The issues mentioned are further regulated by FMF (Federal Ministry of Finance) Measure No. ref. V/20 100/1992 Coll. (published in the Collection of Laws, part 106/1992), on the chart of accounts and on accounting procedures, which lays down the rules regarding the generating and use of financial reserves by companies with permitted mining operations. At the end of each accounting period, companies execute closings of books and carry out document inventories, which verify the balancing of books (Act No. 593/1992 Coll. and No. 563/1991 Coll.).

The last update of the legal regulation of reserves for remediation, reclamation as well as mining damage occurred after Act No. 223/2006 Coll. (amendment of the Reserves Act) and No. 313/2006 Coll. (amendment of the Mining Act) came into effect.

Generated and drawn reserves for mining damages (in CZK thousand)

Year	Bituminous coal		Brown coal		Crude oil and natural gas		Ores		Industrial minerals		Radioactive minerals		Total	
	generated	drawn	generated	drawn	generated	drawn	generated	drawn	generated	drawn	generated	drawn	generated	drawn
1993	400,721	4,093	150,548	42,957	0	0	0	0	28,462	0	0	0	579,731	47,050
1994	105,650	38,813	50,000	32,223	0	0	0	0	9,328	28,852	0	0	164,978	99,888
1995	204,785	86,001	209,207	37,748	0	0	0	0	10,673	9,394	0	0	424,665	133,143
1996	151,643	74,952	259,779	84,258	0	0	0	0	13,100	3,407	0	0	424,522	162,617
1997	77,900	142,512	318,981	127,715	0	0	0	0	5,733	683	0	0	402,614	270,910
1998	185,723	174,640	252,920	112,852	0	0	0	0	16,043	3,638	0	0	457,686	291,130
1999	111,588	174,640	212,722	40,448	0	0	0	0	10,803	6,844	0	0	335,113	221,932
2000	110,088	107,852	240,655	188,685	0	0	0	0	11,414	1,020	0	0	362,157	297,557
2001	145,750	188,073	105,513	217,306	192	0	100	0	35,877	6,628	0	0	287,432	412,007
2002	102,750	168,531	102,700	510,200	0	0	0	0	2,327	2,338	0	0	207,777	681,069
2003	0	0	816,197	999,271	90	0	0	0	12,576	2,263	0	0	828,863	1,001,534
2004	187,700	139,714	164,700	315,321	0	0	0	0	3,007	4,560	0	0	355,407	459,595
2005	191,700	143,974	97,433	279,955	0	0	0	0	6,597	4,273	0	0	295,730	428,202
2006	285,780	251,941	522,908	1,334	150	0	0	0	4,517	6,846	0	0	813,355	260,121
2007	260,850	190,982	193,147	932,392	30	0	0	0	4,298	3,831	0	0	458,325	1,127,205
2008	304,700	308,593	64,601	155,924	0	0	0	0	3,739	2,788	0	0	373,040	467,305
2009	317,625	282,928	30,200	25,800	0	0	0	0	3,447	1,216	0	0	351,272	309,944
2010	283,008	173,686	25,034	15,730	100	0	0	0	2,644	1,514	0	0	310,786	190,930
2011	468,508	196,012	25,663	25,248	100	0	0	0	2,695	2,595	0	0	496,966	223,855
2012	811,202	741,987	30,000	5,818	100	0	0	0	6,157	3,325	0	0	847,459	751,130
2013	145,000	131963	30,000	0	0	0	0	0	3,378	2,724	0	0	178,378	134,686
2014	75,000	183,517	57,391	60,201	50	0	0	0	15,495	3,330	0	0	145,833	245,339
2015	75,000	148,989	35,000	67,096	50	0	0	0	5,076	13,212	0	0	115,126	229,297

Financial reserve for mining damages

Pursuant to article 37a section 1 of the Mining Act, a mining company is obliged to generate a financial reserve to ensure settlement of mining damages. The reserve amount generated and charged to expenses must correspond to the needs for settling mining damages in the course of time depending on their creation, or prior to their creation.

Generating of reserves is subject to approval by the relevant Regional Mining Authority, which also approves the drawing on these reserves upon agreement with the Ministry of the Environment. Prior to making a decision on the drawing on these reserves, the Regional Mining Authority requests a statement from the relevant municipality. In the case of public enterprises, the RMA decides in agreement with the Ministry of Industry and Trade.

A company´s request to draw on the financial reserve for mining damages must be furnished with a list of mining damages, an expense estimate for their elimination and a time table of resource expenses for the elimination of mining damages.

2. Use of funds from annual royalties paid by mining companies on mining leases and on extracted reserved minerals pursuant to the Mining Act

Royalties on mining leases

Act No. 44/1988 Coll., on the protection and use of the mineral resources (the Mining Act), imposes an obligation on mining companies, under Sec. 32a) Par. 1, to pay to the account of the relevant Regional Mining Authority annual royalties on the mining lease. The amount of royalties on the mining lease is set at CZK 100 to CZK 1 000 per hectare, and graded with respect to the environmental protection level of the relevant area, the type of activity conducted in the mining lease and its environmental impact.

The ultimate recipient of the mining lease royalties are the municipalities in whose territory the mining lease is located. These resources are used, in large measure, as compensation for negative impacts of mining on the municipalities in question. As shown in the following table, approx. CZK 446.4 million was paid out to municipalities since the inception of royalties payments on mining leases in 1993 till 2015.

Royalties from mining lease areas paid out to municipalities pursuant to Article 32a) Sec. 1 of the Mining Act (in CZK thousand) CZK)

Royalties on extracted reserved minerals

The royalties on extracted minerals established under Article 32a) Section 2 of Act No. 541/1991 Coll. amount to 10% of the market price of the extracted minerals at the most and, under section 4, from the royalties yield, pursuant to section 2, the Regional Mining Authority transfers 50% to the state budget of the Czech Republic and 50% to the budget of the municipality in whose territory the mining lease is situated. If the mining lease is located in the territory of several municipalities, the Regional Mining Authority distributes the revenue according to the share in mining, similarly to the royalties on a mining lease.

Amendment No. 10/1993 Coll. of the Mining Act established that 50% of the royalties transferred to the state budget shall be used for the purpose of remediation of environmental damage caused by the mining of reserved deposits.

In 2000 a change occurred and Article 32a), Section 4 of Act No. 366/2000 Coll. established that, of the royalties pursuant to section 2, the Regional Mining Authority shall transfer only

Royalties from mining lease areas paid out to municipalities pursuant to article 32a) sect. 1 of the Mining Act (in CZK thousand)

Year	Number of municipalities	Total
1993	1,327	25,929
1994	1,194	22,752
1995	1,168	24,114
1996	1,225	24,032
1997	1,191	23,446
1998	1,269	22,885
1999	1,208	23,629
2000	1,178	23,780
2001	1,171	23,728
2002	1,168	22,899
2003	1,158	21,740
2004	1,161	21,511
2005	1,138	21,077
2006	1,127	16,178
2007	1,118	15,512
2008	1,305	15,127
2009	1,239	14,925
2010	938	14,032
2011	885	13,888
2012	939	13,809
2013	918	13,800
2014	918	13,800
2015	919	13,800
Total		**446,393**

25% to the state budget of the Czech Republic, from which these funds will be used for the purpose of remediating environmental damage caused by the mining of reserved as well as non-reserved deposits, and that the Regional Mining Authority shall transfer the remaining 75% to the municipality´s budget. Simultaneously, Government Resolution No. 906/2001 and, again, Government Resolution No. 69/2008 approved to divide the 25% of royalties transferred to the state budget into 12.5% for use by the Ministry of Industry and Trade in remediation of environmental damage caused by the mining of reserved as well as non-reserved deposits, and into 12.5% for use by the Ministry of the Environment in liquidation of old mine workings.

At the same time, Government Resolution No. 69/2008 approved the transfer of the yield from royalties on extracted minerals pursuant to Sec. 32a Par. 4 of Act No. 44/1988 Coll., on the protection and use of mineral resources (Mining Act), as amended, via Regional Mining Authorities directly to the income accounts of the budget of the Ministry of Industry and Trade and the Ministry of the Environment starting in 2008.

The following table clearly shows payments and use of funds during 1993–2014. In 23 years, mining companies paid a total of CZK 12.4 billion., of which municipalities received cca CZK 7.3 billion, and Regional Mining Authorities transferred to the state budget a total of CZK 4.0 billion for remediation of environmental damage caused by the mining of reserved as well as non-reserved minerals, which was subsequently released from the state budget and of which cca CZK 3.0 billion went to the Ministry of Industry and Trade and cca CZK 1.0 billion to the Ministry of the Environment.

Distribution of royalties on extracted reserved minerals pursuant to Sec. 32a) Par. 4 of the Mining Act (in CZK thousand)

Year	50 % SB (State budget)		50 % Municipalities	Total
1993	230,400		230,526	460,926
1994	245,762		245,276	491,038
1995	221,909		221,566	443,475
1996	229,703		229,703	459,406
1997	228,874		228,874	457,748
1998	220,885		220,886	441,771
1999	219,938		219,938	439,876
2000	227,778		227,859	455,637
total	**1,825,249**		**1,824,628**	**3,649,877**
Year	**12.5 % MIT**	**12.5 % MoE**	**75 % Municipalities**	**Total**
2001	153,166	12,500	302,221	467,887
2002	55,000	59,500	356,724	471,224
2003	61,713	61,800	371,827	495,340
2004	70,000	69,500	393,695	533,195
2005	76,398	76,700	449,135	602,233
2006	76,305	76,400	455,947	608,652
2007	82,716	82,300	494,737	659,753
2008	84,367	84,250	505,782	674,399
2009	80,720	80,720	484,556	645,996
2010	73,023	73,023	435,103	581,149
2011	80,714	80,714	484,284	645,712
2012	78,711	78,711	472,266	629,688
2013	74,554	74,554	447,323	596,430
2014	73,146	73,146	438,875	585,167
2015	64,699	64,699	388,193	517,591
Total 2001–2015	**1,185,232**	**1,048,517**	**6,480,668**	**8,177,629**
Total 1993–2015	**3,010,481**	**1,048,517**	**7,305,296**	**12,364,293**

3. Phase-out programme of mining activities and erasing consequences of coal, ore and uranium mining funded by the national sources

The restructuring of industry in the Czech Republic, specifically of metallurgy and engineering, initiated after 1989, had an immediate impact on the mining sector. Uneconomic ore, coal and uranium mining, and a lower raw material demand were the decisive reasons for the restructuring and subsequent privatisation of mining companies. Part of the restructuring of the mining industry was the announcement of a phase-out of mining activities in uneconomic underground mines and quarries.

The essential method of funding the restructuring of the mining sector is provided by subsidies from the state budget, in accordance with relevant Government resolutions, for the phase-out and to erase the consequences of mining operations.

In the initial phase, the phase-out in individual branches of mining occurred independently, mainly because mining companies reported to various departments.

The phase-out of uranium mining was already decided upon in 1989, as based on documents processed by the Federal Ministry of Fuel and Energy, which was approved by ČSSR (Czechoslovak Socialist Republic) Cabinet Resolution No. 94/1989 on the concept of lowering the unprofitability of uranium mining in the ČSSR in 1990, in the 9th and 10th five-year plans by phasing it out. This Cabinet resolution from 1990 was subsequently amended by the Government of the ČSFR (Czechoslovak Federal Republic) with new Government Resolution No. 894/1990 regarding the modification of the phase-out concept for uranium mining in the ČSFR.

In 1990, ore mining was integrated into the Federal Ministry of Metallurgy, Engineering and Electric Engineering which, for the purpose of dealing with ore mining and the announcement of a phase-out programme for the ore mining industry as of 1 July 1990, processed documents for Government proceedings and Government Resolution No. 440/1990 was adopted.

The phase-out of coal mining was announced at the end of 1992 based on Government Resolution No. 691/1992 concerning the programme for restructuring the coal industry, and documents for Government proceedings were processed by the Ministry of Industry and Trade.

Even though the phase-out of ore mining was not completed, a merger of Rudné doly Příbram state enterprise with DIAMO state enterprise occurred as of 1 January 2001, thereby ending the industry-by-industry monitoring of the phase-out, i.e. ore and uranium mining.

Another modification of the reporting method concerning the drawing on state budget funds occurred in 2003, when, in addition to the proposed state participation in the completion of the restructuring of coal mining, Government Resolution No. 395/2003 authorised the transfer of the Barbora locality from OKD, a. s. company to DIAMO state enterprise, and the localities of Ležáky, Kohinoor and of Kladenské doly to Palivový kombinát Ústí state enterprise.

Since the initiation of the phase-out of mining in 1992, a total of cca CZK 93,245.6 billion was released from the state budget for the phase-out of mining and to erase the consequences of mining. As shown in the table above, cca CZK 58,500.1 billion were spent on technical work related to the phase-out of mining and on erasing the consequences of mining operations, and cca CZK 34,745.5 billion on social health benefits for miners.

Use of national sources subsidies for the phase-out of mining and to erase consequences of mining and mandatory social health expenses (in CZK million)

Year	Mining in total			Coal mining			Ore mining			Uranium mining		
	TPO	MSHE	total	TPO	MSHE	total	TPO	MSHE	total	TPO	MSHE	total
1992	1,100.3	0	1,100.3	555.7	0	555.7	248.0	0	248.0	296.6	0	296.6
1993	2,555.1	1,436.3	3,991.4	1,816.1	949.7	2,765.8	43.2	189.0	232.2	695.8	297.6	993.4
1994	3,940.1	1,528.0	5,468.1	2,333.4	1,011.7	3,345.1	35.1	179.6	214.7	1,571.5	336.7	1,908.2
1995	3,861.1	1,678.1	5,539.2	1,956.8	1,329.9	3,286.7	198.8	36.4	235.2	1,759.3	346.4	2,105.7
1996	3,755.5	1,823.2	5,578.7	2,168.3	1,422.7	3,591.0	126.7	33.0	159.7	1,486.9	367.0	1,853.9
1997	2,305.9	1,811.1	4,117.0	1,364.6	1,362.8	2,727.4	100.1	34.9	135.0	836.6	413.4	1,250.0
1998	2,571.7	1,862.9	4,434.6	1,690.2	1,403.7	3,093.9	94.8	30.2	125.0	979.7	422.9	1,402.6
1999	2,073.5	1,955.8	4,029.3	1,206.1	1,475.9	2,682.0	79.2	37.6	116.8	787.9	442.2	1,230.1
2000	2,064.2	1,986.1	4,050.3	1,193.8	1,475.2	2,669.0	158.0	30.2	188.2	712.3	474.9	1,187.2
2001	2,296.2	1,955.6	4,251.8	1,118.4	1,451.0	2,569.4	part of the uranium mining			1,174.6	500.4	1,675.0
2002	1,729.9	1,913.8	3,643.7	574.9	1,359.2	1,934.1				1,154.8	553.3	1,708.1
2003	2,148.5	1,751.1	3,899.6	654.4	1,294.2	1,948.6				1,494.1	455.5	1,949.6
2004	2,576.1	1,713.2	4,289.3	With the merger of s. p. Rudné doly Příbram with s. p. DIAMO and the takeover of phased out areas of OKD, a. s., monitoring on an industry-by-industry basis was terminated.								
2005	2,110.3	1,669.1	3,779.4									
2006	2,069.8	1609.3	3,679.1									
2007	1,917.9	1,574.1	3,492.0									
2008	1,971.9	1,465.7	3,437.6									
2009	2,027.4	1,383.5	3,410.9									
2010	2,281.0	1,257.6	3,538.6									
2011	2,557.1	1,149.6	3,706.7									
2012	2,717.8	979.4	3,697.2									
2013	2,428.0	855.9	3,283.9									
2014	2,768.8	744.5	3,513.3									
2015	2,672.0	641.6	3,313.6									
Total	**58,500.1**	**34,745.5**	**93,245.6**	**16,632.7**	**14,536.0**	**31,168.7**	**1,083.9**	**570.9**	**1,654.8**	**12,950.1**	**4,610.3**	**17,560.4**

TPO – technical work related to phase-out and erasing consequences of mining operations
MSHE – mandatory social health expensesMSHE – mandatory social health expenses

4. Use of proceeds from privatisation of state assets in eliminating old ecological burdens originated prior to privatisation of mining companies

Based on a decision by the Czech Republic Government, the former National Property Fund of the Czech Republic (as of 1 January 2006 the Ministry of Finance, based on Act No. 178/2005 Coll. and Act No. 179/2005 Coll.) pledged, by virtue of "ecological contracts" entered into with particular individual assignees of assets from privatisation, to eliminate old ecological burdens created prior to privatisation by the use of its privatisation proceeds.

The procedures and process principles for implementing measures leading to remediation of old ecological burdens created prior to privatisation are established in accordance with Government Resolution No. 51 dated 10 January 2001.

The process adheres primarily to the following Acts and Resolutions of the Czech Republic Government:

a) Act No. 92/1991 Coll., on the terms and conditions regarding the transfer of state assets to other persons, as amended;
b) Act. No. 178/2005 Coll., on the National Property Fund of the Czech Republic liquidation and on on the responsibility of Ministry of Finance during privatisation Czech Republic assets (Act on the National Property Fund liquidation), as amended;
c) Act No. 179/2005 Coll., which amends some laws in connection with adopting the Act on the National Property Fund liquidation, as amended;
d) Government Resolution No. 51 from 10 January 2001, which contains the appendix entitled Principles for Settlement of Ecological Obligations Arising during Privatisation (hereinafter Principles), as amended;
e) Government Resolution No. 565/2006 on Principles during completion of privatisation pursuant Act No. 92/1991 Coll., on the terms and conditions regarding the transfer of state assets to other persons and Act No. 178/2005 Coll., on the National Property Fund of the Czech Republic liquidation and on on the responsibility of Ministry of Finance during privatisation Czech Republic assets, as amended;
f) Act No. 137/2006 Coll., on public contracts, as amended.

Overview of entities with which "ecological contracts" were entered into, including guaranteed financial sums and their actual amount drawn (in CZK) – as of 4/30/2016

Name of mining company	Amount of guarantee	Drawn from guarantee	Amount available for drawing
DIAMO, státní podnik	4,200,000,000	2,739,919,444.56	1,460,080,555.44
DIAMO, státní podnik	3,797,000,000	3,787,286,690.79	On 1. 12. 2014 environmental contract successfully executed
DIAMO, státní podnik	32,000,000,000	5,621,609,509	26,378,390,491
OKK Koksovny, a.s.	27,800,000,000	2,668,891,912.77	25,131,108,087.23
Sokolovská uhelná, právní nástupce, a.s.	214,000,000	144,903,443.71	69,096,556.29
Severočeské doly, a.s.	172,265,000	5,678,383.15	166,586,616.85

The processing of the programme is always provided by the Ministry of Finance. The Ministry of the Environment provides guaranteed expertise in the process, it issues binding opinions to the individual procedural steps of implementation in accordance with the “NPF and MoE Directive No. 3/2004 On preparation and implementation of contracts addressing environmental obligations in the privatization”. Mutual collaboration of both authorities in the implementation process is regulated by the “Rules for Mutual Collaboration of the Ministry of the Environment and the Ministry of Finance in the Awarding of ‘Ecological Contracts’ to Eliminate Old Ecological Damage”.

Elimination of old ecological damage created prior to privatisation proceeds for the most part according to priorities established by the MoE (Ministry of the Environment).

5. A programme dealing with ecological damage caused prior to privatisation of brown coal mining companies in the Ústí nad Labem Region and the Karlovy Vary Region, with ecological revitalisation upon termination of mining in the Moravian-Silesian Region, with eliminating ecological burdens caused by the exploration for and extraction of crude oil and natural gas in designated areas of the South Moravian Region, and with reducing impacts caused by the termination of coal mining in the Kladno Region based on Government resolutions in 2002 and 2008. Funds are provided by proceeds from privatisation of national assets.

After the privatisation of mining companies, the financial settlement of related ecological damage was not resolved in an appropriate manner, within the scope of privatisation projects. However, within the scope of privatisation, companies took over not only mining localities but also extensive areas from the state, which were designated for revitalisation and for which a required financial reserve was not generated in the past.

Mining companies are only obliged to generate a financial reserve for remediation and reclamation of areas affected by mining since 1994, and that on the basis of Amendment (No. 168/1993 Coll.) of the Mining Act.

In 2002, the Czech Republic Government being aware of this fact began to intervene financially in the ecological and partially economic revitalisation of regions with active or terminated mining operations. The aim was to remedy the environmental damage caused by mining operations prior to implemented legal regulation.

For this purpose it earmarked CZK 15 billion from the proceeds from sale of assets designated for privatisation and from the profits of public enterprises to deal with ecological damage created prior to privatisation of brown coal mining companies in the Ústí nad Labem Region and Karlovy Vary Region, CZK 20 billion to deal with ecological damage caused by mineral mining, primarily underground mining of bituminous coal in the Moravia and Silesia Region, CZK 1 billion to eliminate ecological burdens caused by the exploration for and extraction of crude oil and natural gas in the South Moravian Region, and CZK 1.177 billion to deal with reducing the impacts caused by the termination of coal mining in the Kladno Region.

The funds from the proceeds from privatisation are released in accordance with Government decisions to cover the expenses of eliminating environmental damage caused by present operations of mining companies, to cover the expenses of and support investment and non-investment activities connected with the remediation of environmental damage caused by mineral mining and to revitalise affected areas, and for financial support of development projects in areas designated for industrial use approved by the Government.

Dealing with ecological damage created prior to privatisation of brown coal mining companies in the Ústí nad Labem Region and the Karlovy Vary Region

For more than 150 years, the character of the landscape was affected significantly by intensive opencast and underground mining of brown coal in the Krušné Hory Mts. piedmont area of Northwest Bohemia. Underground mining primarily affected the territory with the deepest seams (up to 450m below the surface) in the central, Most-Bílina area of the basin as well as the Teplice area of the North Bohemian Basin. Opencast mining occurred primarily in areas of coal seam outcrops southwest of Chomutov, west and east of the City of Most, north of the City of Bílina, northwest of the City of Teplice, southwest and north of the City of Ústí nad Labem.

In 2002, the then National Property Fund of the Czech Republic was bound by resolutions of the Czech Republic Government to eliminate ecological damage caused by the activities of coal mining companies in the Ústí nad Labem Region and the Karlovy Vary Region, and to revitalise affected areas. The process was initiated that same year.

In accordance with a relevant resolution of the Czech Republic Government, the process dealing with ecological damage created prior to privatisation of brown coal mining companies in the Ústí nad Labem Region and the Karlovy Vary Region includes both of the Krušné hory Mts. Basin situated in the territory of the Districts of Sokolov, Chomutov, Most, Teplice and of Ústí nad Labem, i.e. the Sokolov Basin and the North Bohemian Basin, or the mining leases of Sokolovská uhelná, a.s., Severočeské doly, a.s., Mostecká uhelná společnost, a.s. (currently mining companies Severní energetická, a.s. and Vršanská uhelná, a.s.), Kohinoor, a.s., and Palivový kombinát Ústí, s. p.

The programme mentioned specifies a group of projects aimed primarily at creating and renewing:

– forest stands,
– agricultural land,
– bodies of water,
– landscape vegetation,
– biocorridors and biocentres,
– areas for recreation,
– areas designated for ecology and natural science,
– building sites.

As of 31 December 2015, the funds actually spent on **209** finished projects amounted to **CZK 9.126 billion**, and **CZK 2.636 billion** on **33** projects under implementation. The remaining amount required to secure additional money for the projects in progress amounts to **CZK 0.520 billion**.

List of companies included in the programme plan:

Sokolovská uhelná, právní nástupce, a.s. (SU)
Severočeské doly, a.s. (SD)
Mostecká uhelná společnost, a.s. (MUS) currently mining companies Severní energetická, a. s. a Vršanská uhelná, a. s.
Palivový kombinát Ústí, s.p. (PKÚ) with the registered office in Hrbovice

List of regions (projects of cities and municipalities) included in the programme plan:
Karlovy Vary Region – KK
Ústí nad Labem Region – ÚK

Finished and ongoing projects (in CZK)

Coal Companies	Finished projects		Ongoing projects		
	Number of projects	Project costs	Number of projects	Project prices	Amount drawn as of 12/31/2015
SU	16	1,741,272,441	10	1,457,306,295	1,358,687,895
SD	27	2,047,032,779	2	64,490,479	7,233,002
MUS	42	541,844,871	18	1,444,403,777	1,223,449,048
PKÚ	43	2,962,851,300	1	52,831,213	47,324,835
Total 1	**128**	**7,293,001,391**	**31**	**3,019,031,764**	**2,636,694,780**

Municipalities	Finished projects		Ongoing projects		
	Number of projects	Project costs	Number of projects	Project prices	Amount drawn as of 31 Dec 2015
KK	38	1,073,966,344	1	136,707,292	0
ÚK	43	759,148,480	1	1,654,184	0
Total 2	**81**	**1,833,114,824**	**2**	**138,361,476**	**0**

Total 1-2	**209**	**9,126,116,215**	**33**	**3,157,393,240**	**2,636,694,780**

Revitalisation of the Moravian-Silesian and South Moravian Region

Currently, the revitalisation of the Moravian-Silesian Region is aimed primarily at eliminating the consequences of ecological burden caused by bituminous coal mining and, in the South Bohemian Region, at eliminating ecological burdens caused by the exploration for and extraction of crude oil and natural gas.

As of 31 December 2015, the funds actually spent on **121** finished projects amounted to **CZK 4.661 billion**, and **CZK 5.272 billion** on **53** projects under implementation.

Categories of priority projects, approved by the Government, which deal with eliminating environmental damage caused by mineral mining in the Moravian-Silesian and South Moravian Region

1. Reclamation work
2. Reducing thermal activity
3. Comprehensive site development
4. Comprehensive reduction of uncontrolled methane emissions
5. Eliminating old ecological burdens in OKD, a. s.
6. Land development upon termination of mining
7. Eliminating ecological burdens caused by the exploration for and extraction of crude oil and natural gas

Finished projects (in CZK) – as of 12/31/2015

Project title	Project costs
1. Reclamation work	
7/02 Reclamation of the Rudná area, Construction No. 5, (along the street Polanecká)	5,213,707
7/03 Reclamation of reservoirs and lands below the Stachanov reservoirs	40,634,358
7/03 Reclamation of reservoirs and lands below the Stachanov reservoirs – additional construction works	8,824,451
7/04 Reclamation of the Žofie waste dump	1,950,601
7/05 Drainage of waterlogged land near Ščučí	7,345,430
7/06 Drainage of lands south of Kuboň Pond – site A and B	2,377,507
7/10 Remediation of the Václav waste dump – external review AR	36,000
7/10 Remediation of the Václav waste dump	18,816,781
7/10 Remediation of Salma	7,105,772
7/14 Reclamation of the Oskar waste dump	6,091,629
7/15 Development along the Orlovská Stream	6,275,508
7/16 Development along the Sušanky Stream	6,796,317
7/16 Development along the Sušanky Stream – phase II.	2,026,032
7/16 Development along the Sušanky Stream – updated estimate of project documentation	17,850
7/17 Remediation of the Urx slide area	6,934,739
Final assessment of the “Reclamation of reservoirs and lands below the Stachanov reservoirs” project – additional construction work	42,000
7/20 Drainage of waterlogged land near Paskov	6,974,421
Total 1	**127,463,104**
2. Reducing thermal activity	
8/01 Survey and monitoring of thermal activity in the Heřmanice waste dump	4,962,696
8/02 Survey and monitoring of thermal activity in the Hedvika waste dump	6,506,627
8/04 Survey and monitoring of thermal activity in the Heřmanice waste dump – site II	4,224,505
8/05 Survey and monitoring of thermal activity in the Ema waste dump	1,487,696
8/10 Comprehensive remediation of the contaminated area in the Trojice locality – phase I: updated risk assessments of the contaminated area Trojice – stage I: review of risk analyses of the contaminated area	2,337,570
Examiner´s report: Comprehensive remediation of the contaminated area in the Trojice locality Trojice – stage I: review of risk analyses of the contaminated area	46,800
8/08 Long term monitoring of thermal activity in the Hedvika waste dump	3,270,345
Total 2	**22,836,239**
3. Comprehensive site development	
9/01 Height measurement in areas with phased out mining operations managed by DIAMO (ODRA) – execution	5,626,650
9/02 Monitoring (incl. measurements) and evaluation of the territory of Slezskoostravský and Bartovický zlom	533,520
Height measurement in areas with phased out mining operations	1,094,800
Examiner´s report: Height measurement in areas with phased out mining operations	44,140
Extinguishing of local fire on the Ludvík waste dump in the cadastral area of Radvanice – project	513,600
Total 3	**7,812,710**

4. Comprehensive reduction of uncontrolled methane emissions	
Comprehensive analysis of the methane problem in connection with old mine workings – study	7,602,000
Examiner´ s report on the conceptual solution of the methane problem	35,000
Measures for removal of accidental methane emissions in Orlová	62,873,211
Reducing verified methane emissions in the City of Orlová – Project Orlová 2 – additional construction work	6,933,219
35/1 Security provision of liquidated shaft Jan Maria and remediation of mine area	32,103,924
35/2 Elimination of uncontrolled natural gas emissions from deep exploration boreholes in the area of Trojanovice – survey	19,980,000
35/A Preparing individual methodical procedures of basic activities	1,856,400
Survey of mine gas emissions in areas with phased out coal mining and related health and environmental risks	2,344,300
Reducing verified methane emissions in the City of Orlová – Project Orlová 2	34,503,154
Expert assessment 35/AKT updated project no. 35 – Comprehensive analyses of the methane problem in connection with old mine workings	178,500
35/L1 “Economics of filling underground spaces”	2,261,000
35/L2 Geophysical and borehole survey	1,707,650
35/L3 “Scientific-research support for important safety improvements regarding uncontrolled mine gas emissions from old workings, as a result of dealing with residual coal gas capacity and gas bearing capacity of phased out and abandoned mine sections”	2,261,000
Reducing verified methane emissions in the City of Orlová from 1 February to 31 May 2010 – provision of essential safety measures	2,397,600
Reducing verified methane emissions in the City of Orlová from 1 June to 30 September 2010 – provision of essential safety measures	2,397,600
Reduction of verified methane emissions in Orlová from 1 October 2010 to 31 January 2011 – provision of essential safety measures	2,397,600
Reducing verified methane emissions in the City of Orlová from 1 February 2011 to 31 May 2011 – provision of essential safety measures	2,397,600
Reducing verified methane emissions in the City of Orlová from 1 June 2011 to 30 September 2011 – provision of essential safety measures	2,397,600
Methane emissions in locations of plugged shallow boreholes in the cadastral area of Trojanovice – project	780,000
35/5 Elimination of uncontrolled natural gas emissions from deep exploration boreholes in the area of Trojanovice – boreholes NP 546 and NP 805	48,295,233
35/6 Elimination of uncontrolled natural gas emissions from deep exploration boreholes in the area of Václavovice, Soběšovice, – Dolní Domaslavice, Fryčovice – Příbor východ – exploration	46,607,352
35/D3 monitoring and maintenance of SDD throughout project implementation, control metascreening	21,645,499
35/B OKR area categorisation map	2,264,500
35/D3 Monitoring and maintenance of SDD with continuous data transfers (4 SDD) – project	2,192,121
35/J Reconstruction of the existing Electronic Monitoring System – project	37,815,164
Re-liquidation of SDD Michálkovická jáma	9,389,164
35/7 Liquidation of the oil and natural gas deep exploratory borehole Lm 1 Dolní Lomná	15,471,008
Total 4	**371,087,399**
5. Eliminating old ecological burdens in OKD, a. s.	
Processing the “Remediation and reclamation of the Kašpárkovice lands” project	809,200
Processing the “Remediation of the Solca tailing ponds” project	1,224,510
Processing the “Development of lands including Karvinský Creek in the area of Špluchov – phase 3” project	1,860,565
Remediation and reclamation of the Křemenec area	113,929,281

Expert assessment of the legitimacy of OKD, a.s. request for approval of Method Changes No. 3 – Křemenec	39,668
Reclamation of waste dump D – reclamation of waste dump D1 and D2	57,387,914
Dolina I land decontamination and reclamation	21,295,875
Louky land reclamation – structure no. 8	60,525,001
Land development within the scope of revitalising the František locality	379,154,077
František locality – additional construction work	63,260,118
Remediation of Solec hill, structure 2 – additional construction work	4,389,633
Remediation of Darkov area, stage I, site C2	386,637,496
Remediation of the former surface mine Paskov	14,020,975
Total 5	**1,104,542,357**
6. Land development upon termination of mining	
Demolition KOBLOV	6,914,610
Demolition HRUŠOV	6,845,432
Project documentation regarding land development within the scope of eliminating environmental damage upon termination of mining – executed in areas no. 1 and 3 of project no. 45	1,543,500
45/01 František premises, phase 1	13,917,808
45/02 František premises, phase 2 – demolition	1,229,793
Ostravice Dam – Hrabová km 12.05, st. no. 237	63,580,471
Remediation of the damaged Ostravice dam body – additional construction work	12,184,996
45/07 Přívoz premises, demolition	10,835,872
45/08 Pokrok premises, demolition	25,498,110
Slide area stabilisation and drainage modification in the area of Bučinský les in the cadastral area of Radvanice and Bartovice – project	1,591,030
Slide area stabilisation and drainage modification in the area of Bučinský les in the cadastral area of Radvanice and Bartovice – supplemental engineering-geological survey	235,620
45/09 Farma VKK 1 Rychvald premises	19,276,732
VKK Rychvald premises – additional construction work	3,321,357
45/11 Comprehensive development of the water channel and canal network on the premises of the Petr Bezruč mine – project documentation	1,920,000
45/12 Land development upon termination of mining by DIAMO, s. p., o. z. ODRA – Hlubina premises	7,057,921
45/14 Land development upon termination of mining by DIAMO, s. p., o. z. ODRA – Barbora premises, phase 2	2,268,698
Huminisation of the town centre of Orlová Lutyně – study	2,257,430
Construction of the recreation area “Stříbrné jezero” – project	3,468,000
Reclamation of lands of the former František – Horní Suchá mine – additional construction work	17,729,490
Preparation of a biological assessment according to Act No. 114/1992 Coll., as amended, as part of the land development upon termination of sand and gravel mining – Hlučín	237,600
Realization of Mír Gardens in Svinov – project documentation	201,600
45/15 Petr Bezruč mine premises, phase 2	3,519,308
Reclamation of former mining land in the cadastral area of Malá Štáhle for leisure and tourism purposes – project documentation	2,208,000
Documentation according to article 6, Act No. 100/2001, on environmental impact assessment, noise and dispersion study to the project Huminisation of the town centre of Orlová	228,000
Huminisation of the town centre of Orlová – Lutyně – project documentation	3,600,000
Reclamation of the waterbody in the historic Božena Němcová Park, affected by mining, for leisure activities of residents of the City of Karviná – project documentation	2,352,000.

Revitalization of former mining land in the area o the cemetery in Ostrava – Nová Ves	3,591,601
Reclamation of the former sand quarry and forest land in the cadastral area of Sedlnice for leisure activities – project documentation	2,338,350
Revitalisation of former mining land in the cadastral area of Horní Benešov – project documentation	2,358,440
Remediation, reclamation, and revitalization of former gravel-sand-mining areas near Hlučín – project documentation	31,669,450
Reclamation of the centre of the city district Svinov near Bílovecká primary school – project	158,400
Revitalisation of former mining land in the cadastral area of Bruntál – locality „Za mlékárnou“ – EIA documentation	496,100
Remediation and reconstruction of the sewerage system due to residual effects of coal mining in Petřvald	353,808,426
Reconstruction of the bridge in Albrechtice – project	1,438,830
Land development upon termination of mining – multifunctional premises of the former Dukla Mine	250,685,969
Revitalization and rehabilitation of areas affected by mining activities in Horní město – village centre revitalization after termination of mining – securing of old stopes	22,741,061
Revitalization and rehabilitation of areas affected by mining activities in Horní město – village centre revitalization after termination of mining – securing of old stopes	1,977,021
Preparation of project documentation and engineering services for the Remediation, reclamation and revitalization of areas near Hlučín upon termination of sand and gravel mining – additional services	3,567,212
Remediation and reconstruction of the sewerage system due to residual damage caused by coal mining in Petřvald DSP	13,661,058
Remediation of environmental damage caused by undermining – liquidation of slit tanks – project documentation	1,415,700
Repair of the road along the water conduit to Žermanice dam	2,699,264
Remediation of Slezská Ostrava Castle in connection with damage control of former mining activity and land preparation for leisure activities – DSP	5,838,272
45/20 Potable water conveyance to and from the Alexander premises – project documentation	337,700
Remediation of Mír gardens in Svinov	2,416,799
Revitalization of former mining land in the cadastral area of Bruntál – Locality “Uhlířský vrch” – Stage I – project documentation	145,200
Ostravice river, check dam in river kilometrage 0.0-3.0 construction no. 5659 – project	2,328,040
Total 6	**931,357,327**
Total 1 – 6	**2,565,099,136**
7. Eliminating ecological burdens caused by the exploration for and extraction of crude oil and natural gas	
Remediation of old environmental burdens – insufficiently liquidated probes after the extraction of oil and gas – Remediation of the emergency-state probe HR 43	238,144,159
Remediation of old environmental burdens – insufficiently liquidated probes after the extraction of oil and gas – Remediation of the emergency-state probe HR 44 – additional construction work	6,580,424
Remediation of old environmental burdens – insufficiently liquidated probes after the extraction of oil and gas in sector I in the Morava Quaternary Protected Area of Natural Accumulation of Water (PANAW)	750,927,090
Remediation of old environmental burdens – insufficiently liquidated probes after the extraction of oil and gas in sector II in the Morava Quaternary PANAW	639,187,165
Remediation of old environmental burdens – insufficiently liquidated probes after the extraction of oil and gas in sector III in the Morava Quaternary PANAW	461,068,789
Total 7	**2,095,907,627**
Total 1 – 7	**4,661,006,763**

Ongoing projects (in CZK)

Project title	Project price	Project costs thus far
1. Reclamation work		
7/09 Reclamation of NP 1 lands	117,400,280	38,443,430
7/18 Capacity increase of Sčučí floodway – project documentation	2,371,600	1,365,300
7/21 Anti-erosion measures Salma	877,212	752,742
7/23 Remediation of Lipina premises, land A	5,963,654	4,838,931
Total 1	**126,612,746**	**45,400,403**
2. Reducing thermal activity	**0**	**0**
3. Comprehensive site development	**0**	**0**
4. Comprehensive reduction of uncontrolled methane emissions		
Controlled methane drainage from underground areas in the City of Orlová (Project Orlová 3)	111,299,603	58,089,013
35/2 Elimination of uncontrolled natural gas emissions from deep exploration boreholes in the area of Trojanovice	105,914,779	0
35/4 – Humanisation of sealed or liquidated old mine works and degassing boreholes in the urban area of Ostrava	193,140,597	192,675,399
Updated project no. 35 – Comprehensive analyses of the methane problem in connection with old mine workings in the Moravian-Silesian Region	1,279,790,558	789,247,021
Total 4	**1,690,145,537**	**1,040,011,433**
5. Eliminating old ecological burdens in OKD, a. s.		
Decontamination and reclamation of sludge tanks – phase III., IV. and V.	261,721,195	242,695,681
Decontamination and reclamation of the Lazy mine sludge tanks, phase I. and II.	33,773,258	28,676,632
Reclamation of the Lazy waste dump	101,268,628	90,300,170
Rehabilitation of the Zdeněk Nejedlý Park – phase I., remediation of land south of the Karvinský Stream	47,697,096	41,384,661
Reclamation at the former OKD Dopravy, site A – construction work	4,713,506	4,041,581
Reclamation of Solecký Hill, structure no. II	22,569,081	9,720,922
Regulation of the Stonávka River, km 0.00-2.90 phase A	177,037,484	172,337,652
Regulation of the Stonávka River, km 0.00-2.90 phase A – additional construction work	31,789,848	21,833,568
Reclamation of the D1 waste dump – slope adjustment	11,443,632	10,480,277
Forensic verification of correctness of the state/OKD ratio (proportion) in financing of submitted sub-projects	30,252	0
Total 5	**692,043,980**	**621,471,144**
6. Land development upon termination of mining		
Reclamation of lands of the former František – Horní Suchá mine	95,200,679	93,765,102
Land stabilisation and drainage modification in the area of the Šporovnice locality in the cadastral area of Radvanice – project	1,779,600	1,779,600
Revitalization of municipality Doubrava centrum – square – project	120,000	110,000
Reviclamation of the area of Volný Pond and forest lands in the cadastral area of Radvanice for leisure activities	4,912,661	4,399,019
Development of former mining land – Reconstruction of road no.III/472 (Doubrava-Dědina) damaged by mining activities – project documentation	2,403,790	1,636,690
Reclamation of former mining land in the cadastral area of Horní Benešov – Cycle Routes – project	2,157,330	809,600
45/19 Comprehensive development of the water channel and canal network on the premises Koblov – project documentation	2,110,700	1,508,350

45/20 Potable water conveyance to and from the Alexander premises – project documentation	368,200	337,700
Reclamation of former mining land in the cadastral area of Horní Benešov – Road Restoration – project	1,136,406	535,260
Revitalization of former mining land in the cadastral area of Bruntál – locality “Za mlékárnou” – project documentation	2,416,975	943,500
Revitalization of former mining land in the cadastral area of Bruntál – locality “Laguny” – project documentation	2,349,700	1,078,000
Revitalization (remediation) of Slezská Ostrava Castle in connection with damage control of former mining activity and land preparation for leisure activities	34,626,442	28,469,824
Revitalization of territory negative influenced by construction of water reservoirs for mines and iron works – Revitalization Žermanice dam territory – right bank protection – phase I and II	70,996,213	55,731,788
Revitalization (remediation) of the Ostravice river in connection with damage control of former mining activity	174,795,342	170,121,072
Lučina, revitalization of waterway after mining activity, river kilometrage 0.000-3.262, construction no. 5657 – project documentation	2,323,200	882,450
Ostravice river, check dam in river kilometrage 0.0-3.0 construction no. 5659 – project	2,328,040	2,328,040
Remediation of mine damages at Bohumínská Stružka, Rychvaldy weir – Czech Railways track, kms 4.595-10.530, construction no. 5660 – project documentation	2,318,360	0
Damage control of former mining activity and subsidence of ground – flood control Žabník in Ostrava – Koblová	58,657,519	58,537,837
Revitalization and resocialization of lands affected by mining activity in Horní Město – Revitalization of former mining land in Skály u Rýmařova, the cadastral area of Skály u Rýmařova – project	1,172,490	507,270
Revitalization and resocialization of lands affected by mining activity in Horní Město – Preparation of industrial zone – project documentation	1,076,900	477,300
Revitalization and resocialization of lands affected by mining activity in Horní Město – Preparation of industrial zone – Cycle track Rešov – Rešovské vodopády (Rešov waterfalls) – project documentation	965,580	741,480
Revitalization and resocialization of lands affected by mining activity in Horní Město – Cycle track Dobřečov – Ferdinandov – project documentation	851,840	653,790
Reclamation of former mining land in the cadastral area of Horní Benešov – Technical infrastructure in the Šibeník locality	11,961,423	11,961,423
Reclamation of former mining land and rehabilitation of damages in the cadastral area of the Hranečník terminal	153,365,761	61,976,302
45/23 Liquidation of mine work “Nová jáma, ZH-jih” – implementation	9,808,875	6,960,419
45/24 Liquidation of the main mine workings “Obránců míru” and “Úklonné jámy” – realisation	43,415,284	33,940,026
45/25 Liquidation of the main mine working “Nová jáma Josef” – realisation	61,707,447	54,286,315
Remediation of the pond Volný in Radvanice	5,626,625	4,170,481
Revitalization of territory negative influenced by construction of water reservoirs for mine and iron works – Revitalisation Žermanice dam territory – right bank protection – phase I and II – DSD	6,838,156	5,520,747
Reclamation of unpaved areas	5,868,653	0
Reconstruction of a sports complex in Karviná – Ráj – removal of negative impacts of mining activities	61,290,423	13,208,563
Revitalisation of territory affected by construction of water reservoirs for mine and iron works – Revitalisation of the Těrlice dam territory – cycle track, phase I – project documentation	1,452,000	0
Liquidation of the main mine work No. 735 – descending gallery Zálužné 2 and sealing of the main mine work No. 733 – Jáma Zálužné in the cadastral area of Nové Těchanovice – project documentation	332,750	296,450
Total 6	**824,407,323**	**615,346,358**

7. Eliminating ecological burdens caused by the exploration for and extraction of crude oil and natural gas		
Remediation of old environmental burdens – insufficiently liquidated probes after the extraction of oil and gas in sector IV in the Morava Quaternary PANAW	812,284,527	495,272,125
Remediation of old environmental burdens – insufficiently liquidated probes after the extraction of oil and gas in sector V in the Morava Quaternary PANAW	714,553,603	333,477,180
Remediation of old environmental burdens – insufficiently liquidated probes after the extraction of oil and gas in sector VI in the Morava Quaternary PANAW	3,204,512,981	2,120,568,316
Total 7	**4,731,351,111**	**2,949,317,621**
Total 1 – 7	**8,064,560,697**	**5,271,546,959**

Reducing impacts caused by the termination of coal mining in the Kladno Region

In the middle of 2002, the Czech Republic Government decided to phase out underground mining of bituminous coal in the Kladno Region due to the economic ineffectiveness of mining. This hasty closure of mines in this region brought about, similarly as in the preceding coal districts, the need to deal with eliminating environmental damage caused by past mining operations in a special way.

In consideration of the situation which developed in the Kladno Region, the Czech Republic Government noted the need to reduce the impacts caused by the termination of coal mining in the Kladno Region, by issuing Resolution **No. 552** on 4 June 2003, dealing with the reduction of impacts caused by the termination of coal mining in the Kladno Region. It agreed with the idea of gradually releasing, according to the means of the National Property Fund of the Czech Republic, an amount of up to **CZK 1.177 billion** from FNM resources starting in 2004 in order to deal with ecological impacts caused by coal mining in the past and with land reclamation. Considering the shortage of funds in order to carry out the "Reclamation of the Tuchlovice Mine Waste Dump" contract, the Czech Republic Government modified the above-mentioned resolution with Resolution **No. 1467** on 20 December 2006, and **agreed** with the idea of gradually releasing, according to the means of the MF, funds in the amount of up to **CZK 1.427 billion** starting in 2004 from a special account managed by the MF pursuant to article 4 of Act No. 178/2005 Coll., on the termination of the National Property Fund, in order to deal with ecological burdens caused in the past and with land reclamation. From that time the sum was increased to **CZK 1.727 billion** pursuant Government Resolution **No. 688** dated 9 June 2008.

The following projects are considered essential:

- eliminating the dangerous conditions at the V Němcích Schöeller mine waste dump,
- reclamation of the Tuchlovice mine waste dump.

As of 31 December 2015, the funds actually spent on 7 finished projects amounted to **CZK 1.713 billion**.

Finished projects (in CZK)

Project title	Project costs
V Němcích Schoeller mine waste dump – eliminating dangerous conditions	234,429,193
Eliminating the dangerous conditions at the V Němcích Schoeller mine waste dump – stage 2, western section	106,862,466
Eliminating the dangerous conditions at the V Němcích Schoeller mine waste dump – additional construction work	46,608,677
Reclamation of Tuchlovice dump – Supplement no. 1 of the Project Erosion-control measures	20,274,715
Reclamation of the Tuchlovice mine waste dump	1,024,249,827
Reclamation of the Schoeller mine waste dump in Libušín	271,192,891
Reclamation of the Schoeller mine waste dump in Libušín – additional construction work	9,625,428
Total	**1,712,987,466**

6. Sources of European Union – Operational Programme Environment (administered by the Ministry of the Environment)

The European Union funds used via Operational Programme Environment have been the important source of funding of mining activity damages and old environmental burden avoidance since 2008. In the period 2008–2015, this source financed 11 completed projects by the amount of about CZK 1,468,539 thous. and 4 ongoing projects by the amount of about CK 2,110,917 thous.

Project title	Project realization term	Share of EU subsidy (issued RoPD) 85% (CZK)	Total project costs (incl. VAT) – as per attached invoices (CZK)	Project status as of 31. 12. 2015
Remediation of environmental damage DIAMO s.p. Stráž pod Rálskem				
Risk analysis of the territory administered by DIAMO s.p. – o.z SUL Příbram, former mining – coal preparation plant in Březové Hory – Příbram	2009	2,509,246	3,705,571	Project finished, documents of ZVA delivered to the SEF
Risk analysis of dumps affected by internal burning managed by DIAMO s.p., o.z. Odra		11,547,099	16,673,582	Project finished, documents of ZVA delivered to the SEF
Remediation and reclamation of old environmental burden of DIAMO s.p. at Mydlovary premises – chemical treatment plant and tailing pond K IV/D	2008 – 2011	467,951,745	704,758,892	Project finished, documents of ZVA delivered to the SEF

Territory risk analysis for lands managed by DIAMO s.o. – o.z. SUL Příbram, former mining – coal preparation plant Kaňk – Kutná Hora	2009	3,382,997	5,188,890	Project finished, documents of ZVA delivered to the SEF
Risk analysis of the territory administered by DIAMO s.p., o.z TÚU Stráž pod Ralskem affected by underground mining of uranium	2008 – 2010	14,337,972	20,240,150	Project finished, documents of ZVA delivered to the SEF
Risk analysis of uranium ore and aggregates loading area Milín	2011	1,340,778	4,176,782	Project finished, documents of ZVA delivered to the SEF
Complex risk analysis of DIAMO s.p. at Mydlovary premise and tailing ponds, inclusive wider vicinity	2011 – 2012	11,039,922	17,005,730	Project finished, documents of ZVA delivered to the SEF
Risk analysis of Bytíz facility after underground mining of uranium	2012 – 2013	3,262,494	6,557,336	Project finished, documents of ZVA delivered to the SEF
Completion of exploration of soil and groundwater contamination in the area administered by DIAMO s.p. – o.z. SUL Příbram, former mining – coal preparation plant Kaňk – Kutná Hora and the surrounding area	2012 – 2014	4,009,456	5,690,932	Project finished, documents of ZVA delivered to the SEF
Land remediation of former mining and benefication plant Příbram, Březové Hory – Phase 1	2012 – 2015	95,861,128	127,206,320	Ongoing project
Liquidation of the protected area Stráž pod Rálskem	2014 – 2015	348,246,422	547,977,681	Ongoing project
Liquidation of surface facilities after the underground mining of uranium – DIAMO s.p, o.z. TÚU Stráž pod Ralskem	2014 – 2015	271,629,119	602,611,824	Ongoing project
Redevelopment of areas endangered by the hazardous waste landfill in Pozďátky	2010 – 2012	407,447,166	579,497,456	Project finished, documents of ZVA delivered to the SEF
Remediation of environmental damage in Palivový kombinát Ústí s. p.				
Risk analysis of endangering the withdrawal area by insufficiently liquidated drilled wells after oil and natural gas mining in the Morava Quaternary PANAW	2009 – 2011	73,293,161	105,243,581	Project finished, documents of ZVA delivered to the SEF
“Elimination of old ecological burdens after the extraction of oil in the withdrawal area Moravská Nová Ves – the Morava Quaternary PANAW”	2010 – 2015	643,126,980.08	833,121,332	Ongoing project

Note:

– the “Share of EU subsidy (issued RoPD) 85%” includes the subsidies from EU funds (85%) provided by the end of 2015”

– the “Total project costs” column includes both eligible and ineligible costs incl. VAT for the period 2010 – 2015.

– PANAW = Protected Area of Natural Accumulation of Water

– ZVA, SEF = Final evaluation, State Environmental Fund

GEOLOGY AND MINERALS

Geological evolution of the area of the Czech Republic

Arnošt Dudek

The Czech Republic is located in the very centre of Europe at the limit between the Hercynian Meso-Europe and the Neo-Europe (Fig. 1). There is hardly any country with such a variegated geological structure in such a small area and with such a complex geological evolution. Practically all known rocks and the majority of geological formations and known types of ores and industrial minerals occur on the state territory. Even though most ore deposits are interesting mainly from a scientific and mineral collectors' point of view, a number were of European importance during the Middle Ages and the beginning of modern time. The interesting and complex history of this area attracted attention of researchers already in early times and it strongly influenced the evolution of the mining and geological sciences. It was on this territory where one of the oldest mining laws, the Jihlava Mining Law (1260), and slightly later the mining law of the King Wenceslas II "Ius regale montanorum" (1300), which became basis of many mining laws in other states of the world especially in South America, came into being. The origin of the world-known works of Georgius Agricola, especially his book "Bermannus sive de re metallica dialogus" (1530), is also linked to the territory of the Bohemian Massif.

Three main structural complexes form the geological structure of Czech territory. The oldest one, consolidated already during the Precambrian orogenies, is **Brunia (Brunovistulicum)**, taking basically the area of Moravia. This segment of the Earth's crust probably represents an extremity of the East European platform, even though some researchers consider it as a part of the African plate. The influence of the younger – Paleozoic and Alpine – orogenies was only minor and it served as a foreland of the nappe structures which were thrust over it. The **Hercynian-consolidated Bohemian Massif**, overlapping to the area of the neighbouring Austria, Germany and Poland in the south, west and north, forms the major part of the state territory. Bohemian Massif belongs to the Paleo-Europe. The Hercynian orogeny in the end of the Carboniferous put the finishing touches on it, even though it also contains older building elements. It already behaved as a consolidated block after the Hercynian orogeny, only sometimes flooded by epi-continental sea and affected only by fault tectonics. As a crustal block rising from young sedimentary formations, it broke up only during the younger mountain-building processes, morphologically only in the end of the Neogene and in the Quaternary. Geological continuation of the Hercynides towards the west is indicated by other crustal blocks which were created later – Schwarzwald, Vosges Mountains, the French Massif Central and Iberian Meseta, in the northern branch then the Armorican Massif and massifs in southern England and Ireland. The eastern margin of the Bohemian Massif was thrust over the Cadomian unit of the Brunovistulicum during the Hercynian orogeny. The boundary between the hercynian Mesoeurope and alpine Neoeurope crosses the eastern part of the Czech Republic. The Alpides are represented there by the **West Carpathians**. They are

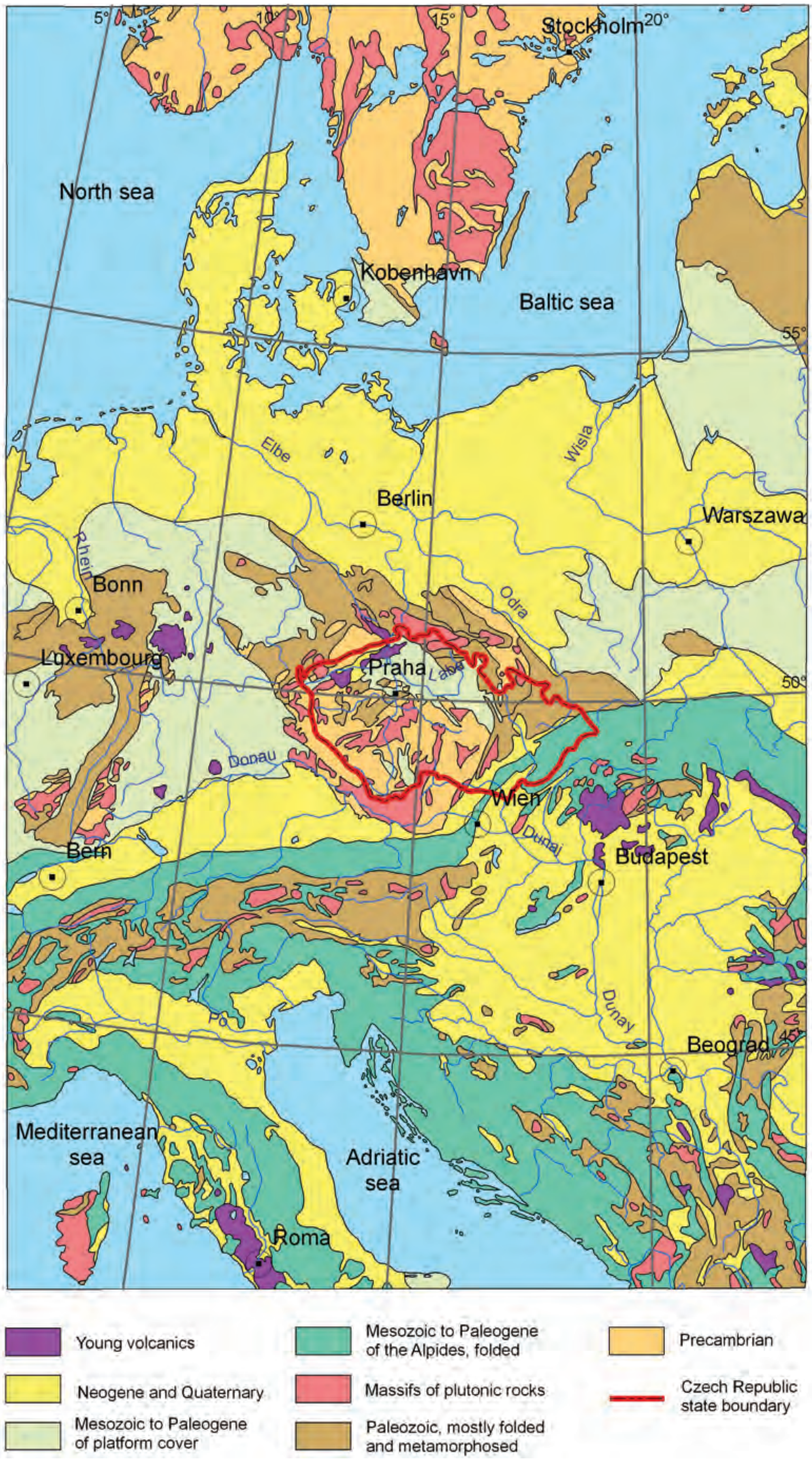

Fig. 1: Geological position of the Czech Republic in Europe

built by an inner unit – Central West Carpathians, Outer Flysh Carpathians and the Carpathian Foredeep. The ***Central West Carpathians*** are formed by pre-Mesozoic volcanosedimentary complexes, mostly metamorphosed and penetrated by late-Hercynian granitoid plutons, and their sedimentary cover (Trias to Lower Cretaceous). At the beginning of Upper Cretaceous the Central Carpathians were intensively folded and in places also metamorphosed. A tectonic zone of first order – the ***Klippen Belt,*** built mostly by Mesozoic sedimentary rocks separates the Central Carpathians from the external Flysh Carpathians. The ***Outer Flysh Carpathians*** are formed (besides rare uppermost Jurassic sediments and local Cretaceous volcanics) predominantly by sedimentary complexes of Cretaceous and Paleogene age. These complexes were as horizontal nappes thrust over the Brunovistulian basement and its sedimentary cover over a distance of tens of kilometres partly even over the Neogene Carpathian Foredeep.

As in the study of the history of mankind, there is little information on the oldest periods of the evolution of the Earth we live on, and our findings are accompanied by a large number of uncertainties. This of course applies also for the Czech territory, even though it belongs to the areas where systematic geological research was in progress since the beginning of the 19th century.

Complexes of the **Brunia (Brunovistulicum)** crop out on the surface only in the western Moravia, but they reach far to the east below the overthrust nappes of the Outer Flysh Carpathians. They are formed by metamorphic rocks – mainly monotonous biotite paragneisses – which were altered during the Proterozoic orogenies, and intruded by huge massifs of abyssal magmatic rocks of about 550 Ma age at the boundary between the Proterozoic and Paleozoic. The Brno and Dyje Massifs represent the exposures of these rocks. Granitoid plutons covering large areas as well as smaller basic massifs of gabbros and norites compacted this unit and prevented its later reworking by younger mountain-building processes, which formed the Bohemian Massif. Western parts of the Brunovistulicum are built by variegated volcano-sedimentary complexes (involving limestones, graphitic rocks, quartzites, amphibolites and orthogneisses). These parts were strongly affected by the Hercynian tectonometamorphic processes. They crop out from beneath of the overthrust Hercynian complexes of the Moldanubicum and Lugicum in tectonic windows of the Dyje and Svratka Domes of the **Moravicum** and Desná Dome of the **Silesicum**. Their appurtenance to the Brunia (Brunovistulicum) has not been commonly accepted yet and these units are by some authors ranked to the Lower Paleozoic and to the Hercynian Bohemian Massif. Platform sediments – the Cambrian conglomerates and sandstones in limited areas, marine Silurian shales sporadically and extensive and important sediments of the Devonian, Mississippian (Lower Carboniferous) and continental sediments of the coal-bearing Pennsylvanian (Upper Carboniferous) – are deposited on the Cadomian basement. The younger platform cover is represented by sediments of the Jurassic, Cretaceous, Paleogene and the Neogene of the Carpathian Foredeep. This consolidated basement was overthrust by nappes of the Outer Flysh Carpathians from the east (Fig. 2).

The lower level (basement) of the **Bohemian Massif** – the epi-Variscan platform – is built by metamorphic rocks intruded by numerous and very large granitoids massifs, and by only weakly metamorphosed or unmetamorphosed but Hercynian-folded Lower Paleozoic. Regionally it is divided (Fig. 3) into the core, formed by the highly metamorphosed **Moldanubicum** and mostly only weakly metamorphosed **Bohemicum (Teplá-Barrandian domain)**. This core is rimmed by the **Saxothuringicum** (Krušné hory Mts.) on the NW, **Lugicum** (Krkonoše Mts., Orlické hory Mts., Králický Sněžník) on the north and **Moravo-Silesicum** (Jeseníky Mts., eastern part of the Českomoravská vrchovina Highlands) on the east (see Fig. 3). These marginal complexes are metamorphosed mostly less intensively than the central Moldanubicum.

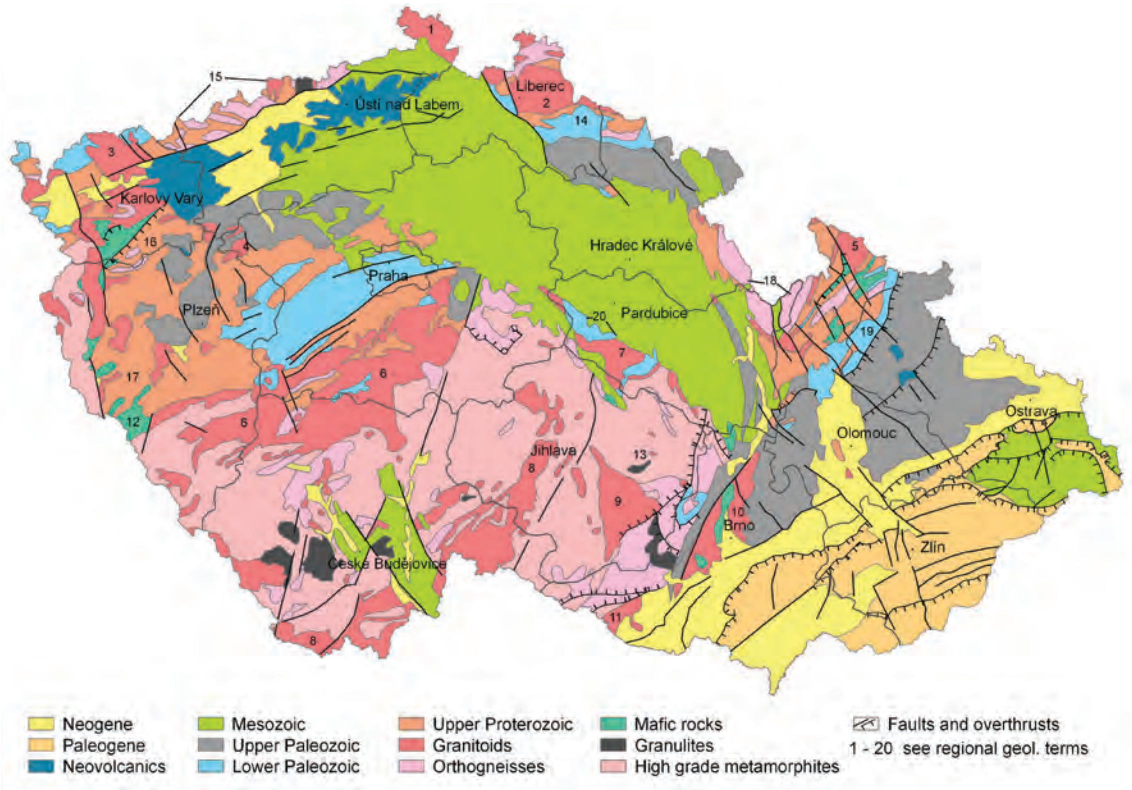

Fig. 2: Geology of the Czech Republic

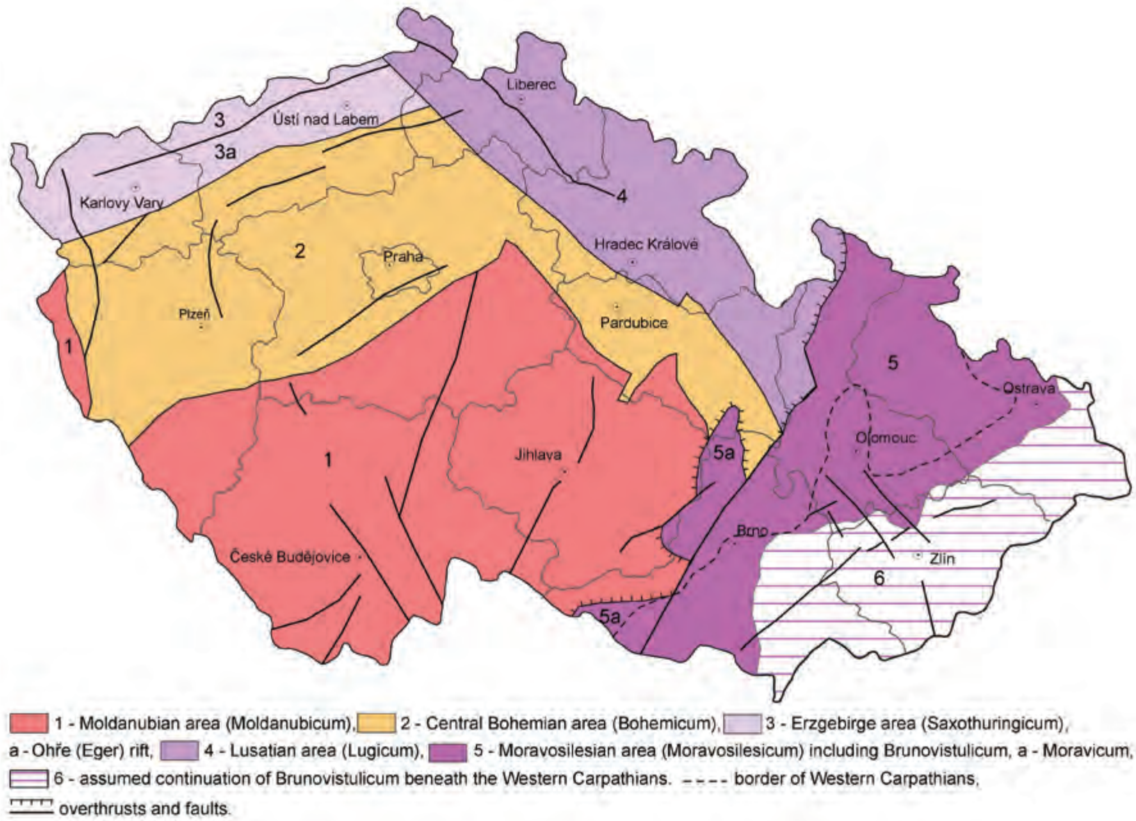

Fig. 3: Regional basement division of the Bohemian Massif on the territory of the Czech Republic

The ***Moldanubicum*** is formed by rocks metamorphosed mainly in the amphibolite facies – sillimanite and cordierite gneisses and migmatites with intercalations of orthogneisses, marbles, quartzites, graphitic rocks and amphibolites. Bodies of high-temperature and high-pressure metamorphic rocks – granulites and garnet peridotites with eclogites – are numerous, too. Their occurrences mark the course of old tectonic zones, along which these rocks were exhumed from depth. They are exposed mainly in southern Bohemia (Blanský les, Prachatice, Křišťanov and Lišov granulite massifs) and western Moravia (Bory and Náměšť granulite massifs). The age of the protolith of Moldanubian complexes is probably Upper Proterozoic; their metamorphism under the amphibolite, granulite and eclogite facies conditions is linked to the Hercynian orogeny. Pre-Paleozoic, Cadomian metamorphism of regional extent, mostly overprinted by the Hercynian processes, is nevertheless documented. Minor bodies of old orthogneisses exhumed along deep-reaching faults in the southern Bohemia, the radiometric age of which is even 2.1 Ga, represent a single exception. They document the existence of the Lower Proterozoic in the deeper crustal structure of the Bohemian Massif. Some Moldanubian rocks, especially gneisses, granulites and amphibolites, represent common resources of building stone.

The metamorphic rock complexes of the central Bohemian ***Bohemicum (Teplá-Barrandian domain)*** as well as the marginal complexes of the Saxothuringicum, Lugicum and Moravo-Silesicum developed by regional metamorphism of mainly Upper Proterozoic protoliths (1,000–545 Ma). During this period, the area of today's Bohemian Massif was covered by a deep sea, in which sandy and clayey rocks were deposited. Surrounding continents, probably rather distant in the mainland formed by very old rocks, represented the source area of the deposited material. Some clastic minerals from metamorphic rocks of the southern Bohemia (up to 2.7 Ga old, in the neighbouring Bavaria even 3.8 Ga) were at least in part derived from the Archaic of the African shield. They were of course deposited much later. The sedimentation was accompanied by submarine volcanism of tholeiitic basalts, which formed linear structures tens of kilometres long, maybe in some cases standing out above the sea level (*island arcs*) as well as much less extensive acid volcanism. The volcanic activity was accompanied by deposition of black shales with abundant pyrite and of siliceous sediments – lydites. Finely banded structures resembling organogenic stromatolites, which would belong to the oldest organic remnants on the Czech territory, were found rarely in the latter. A set of these sediments and volcanic rocks was intensively folded and mostly also metamorphosed in the end of the Proterozoic. Very weakly metamorphosed Proterozoic rocks are nowadays exposed only in central Bohemia between Prague and Plzeň (in the so-called *Barrandian*). The intensity of their alteration increases towards the marginal mountains. A continuous succession of thin metamorphic zones of Barrovian type up to gneisses with kyanite and sillimanite developed especially towards the W and SW. Proterozoic rocks are altered into gneisses and amphibolites also in the Krušné hory Mts., Krkonoše Mts., Orlické hory Mts. and Hrubý Jeseník Mts. These complexes were intruded by numerous massifs of granites (especially Stod, Čistá-Jesenice and Lužice massifs) and gabbros (Kdyně and Poběžovice massifs) in the end of the tectonometamorphic processes especially in the western and northern Bohemia. The Pre-Paleozoic ***Cadomian orogeny*** represents one of the most important magmatogennic and tectonometamorphic processes in the evolution of the Bohemian Massif.

The Earth's crust in Czech territory was not completely solid after the Cadomian orogeny and it gradually broke into a number of smaller blocks, which moved away from each other and were partly flooded by sea again during the ***Lower Paleozoic*** [Cambrian, Ordovician, Silurian, Devonian to Mississippian (Lower Carboniferous)]. Unaltered sediments were preserved especially in central Bohemia, in the area between Prague and Plzeň (Pilsen), named Barrandian, to a lesser extent also in other parts of the Bohemian Massif. In its marginal parts (excluding Brunovistulicum), Paleozoic complexes experienced strong metamorphism and therefore their identification and dating is commonly very difficult. In the Barrandian, sedimentation started already in the ***Lower Cambrian***, represented by a formation of conglomerates and sandstones up to several hundred to thousand meters thick. Sporadic occurrences of shales of fresh-water or brackish origin, in which the oldest fossils of arthropods in Bohemia were found, are known here. Sea penetrated to central Bohemia in the Middle Cambrian and deposited sandstones and especially shales, which are world-known for their occurrences of trilobite fauna. The evolution of the Cambrian was terminated by extensive rhyolites and andesite terrestrial volcanism.

The ***Ordovician*** started by the sea again transgressing in central Bohemia and by the formation of the so-called ***Prague Basin***, the evolution of which continued until the Middle Devonian. The Ordovician rocks are represented mainly by clastic sediments, mostly various types of shales with thick quartzite intercalations), the deposition of which was accompanied by intensive basaltic volcanism. Deposits of sedimentary iron ores (e.g. Nučice, Ejpovice etc.) which were of a high importance in the 19th and beginning of the 20th century originated in relation to the volcanic activity. The Bohemian Massif was located close to the southern polar circle in the Ordovician and sedimentation of rocks as well as volcanic activity proceeded in the sub-polar climate. This crustal segment moved rather rapidly to the north, into warmer waters of the tropic of Capricorn in the end of the Ordovician.

The change of the climate and by this also conditions of development of organisms and sedimentation during the ***Silurian*** resulted in formation of fine-grained black shales with abundant graptolite fauna, accompanied also by intensive volcanic activity and intrusions of numerous diabase sills. Mass development of organisms with carbonate shells occurred in its upper parts with regard to the increasing temperature and massive limestone formations were formed.

Continuous carbonate sedimentation in the Prague Basin lasted until the ***Devonian***, whereas in the surrounding parts of Europe as well as more distant areas the rock deposition was interrupted by the ***Caledonian orogeny***. Gradual unaffected evolution of both the sediments and organisms and their long-lasting detailed study by several generations of Czech paleontologists was a prerequisite for the determination of the first, globally valid ***stratotype*** between two systems (Silurian and Devonian) in Klonk u Suchomast SW of Prague. The limestone sedimentation in the Prague Basin terminated in the Middle Devonian and sandstones with terrestrial flora ended the Devonian sedimentation in this area.

Sedimentation of the Devonian rocks continued in the Upper Devonian only in the area of the Krkonoše Mts. (on Ještěd Mt.) and especially in Moravia in the Jeseníky Mts. and in the Moravian Karst. Evolution of the Devonian in Moravia differed from that on the Bohemian territory. Transgressive complex of the siliciclastic and volcanic rocks with stratiform deposits of Fe, Cu, Au, Zn and Pb overlie the old Brunovistulian basement in its western, more mobile part. This clastic sedimentation continues also in the Mississippian (Lower Carboniferous). The Devonian rocks on the more stable Brunovistulian basement in the south and east begin by clastic rocks, which in places reach over 1,000 m in thickness. Limestones appear only in the Upper Devonian and their evolution continues until the Mississippian (Lower Carboniferous). There is therefore no manifestation that the sedimentation was interrupted by the Hercynian orogeny in Moravia. Sedimentation spaces just moved to the east to Ostrava region and to today's Carpathian basement. Limestones of the Upper Devonian form important deposits especially in central Moravia (e.g. Mokrá, Líšeň, Hranice etc.).

A change in the character of the sedimentation in the end of the Devonian is an expression of the ***Hercynian orogeny***, which affected (about 340–310 Ma ago) the majority of the Czech lands with a high intensity and expressed itself by the development of the nappe structure and a very strong metamorphism of large areas. Even the crystalline complexes formed during the Cadomian orogeny were metamorphosed again. Vast massifs of granitoid magmatic rocks of several thousand km^2 extent, not yet completely uncovered by denudation, formed practically simultaneously. Their intrusions were accompanied also by extensive surface volcanic activity and the development of very numerous deposits of variable genetic types (e.g. Krušné Hory Mts. massifs and Sn, W, Li, Ag, U, Co, Ni mineralization in the Saxothuringicum or Central Bohemian and Moldanubian Plutons in the Moldanubicum and Au, Sb, Ag, Pb, Zn, U mineralization). Granitoid massifs represent an important resource of building and dimension stone as well as feldspar raw materials. Weathered crusts of granitoids (e.g. Krušné hory Mts. massifs, Dyje Massif) are an important source of kaolin, too.

There are two different types of the ***Carboniferous*** and its rocks in the Bohemian Massif as a result of the Hercynian orogeny. The Mississippian (Lower Carboniferous) is represented in Bohemia only by restricted relics of marine sediments found by drillings under the Bohemian Cretaceous Basin E of Hradec Králové, and by weakly metamorphosed slates in the Ještěd Ridge SW of Liberec. The sedimentation of the continental type begins in the intra-mountain basins only in the Pennsylvanian (Upper Carboniferous, Westphalian) and continues in the Permian. Basins with partly individual evolution extend in the Plzeň (Pilsen) surroundings towards the North and Northeast as far as the Broumov area in the NE tip of the Bohemian part of the Czech Republic (Fig. 4), where their stratigraphic extent is the largest and the sedimentation finishes as late as the Lower Triasic. They are to a large extent overlain by sediments of the Bohemian Cretaceous Basin. River and lake deposits – conglomerates, arkoses and shales with layers of tuffs, tuffites and lavas – are in many places accompanied also by formation of coal seams, which were and still are of a high economic importance. Some seams show an elevated U content making them even potential deposits. The Carboniferous arkoses in the Plzeň (Pilsen) and Podbořany regions gave rise to important deposits of kaolin. Carboniferous mainly refractory clay and claystone are important, too. The Bohemian Massif reached the equator on its way to the north and coal formation reflects the dominating tropical climate.

In Moravosilesian area, which was just weakly influenced by the Hercynian orogeny thanks to the solid Brunovistulian basement, the Devonian sedimentation was continuous until the Mississippian (Lower Carboniferous), when the formation of limestones terminated. It was followed by flyshoid sedimentation of conglomerates, greywackes and shales in multiple alternation of individual layers (Culm development). The greywackes represent a resource of a high-quality building stone. The depositional environment gradually changed from marine to fresh-water during the latest Mississippian and the Pennsylvanian (Upper Carboniferous) and important deposits of bituminous coal (paralic basins of the Ostrava, and limnic basins of the Karviná region) formed in the coastal marshes. The Czech part of the Upper Silesian Basin represents the most important bituminous coal mining district in the Czech Republic. The Carboniferous system in the Czech Republic was, and remains, not only an important energy base of the state but also a world-known classical area of Carboniferous flora and fauna.

The Hercynian mountains were rapidly lowered by erosion and denudation in the ***Permian***, and thick formations of red-brown conglomerates, sandstones, arkoses and shales formed.

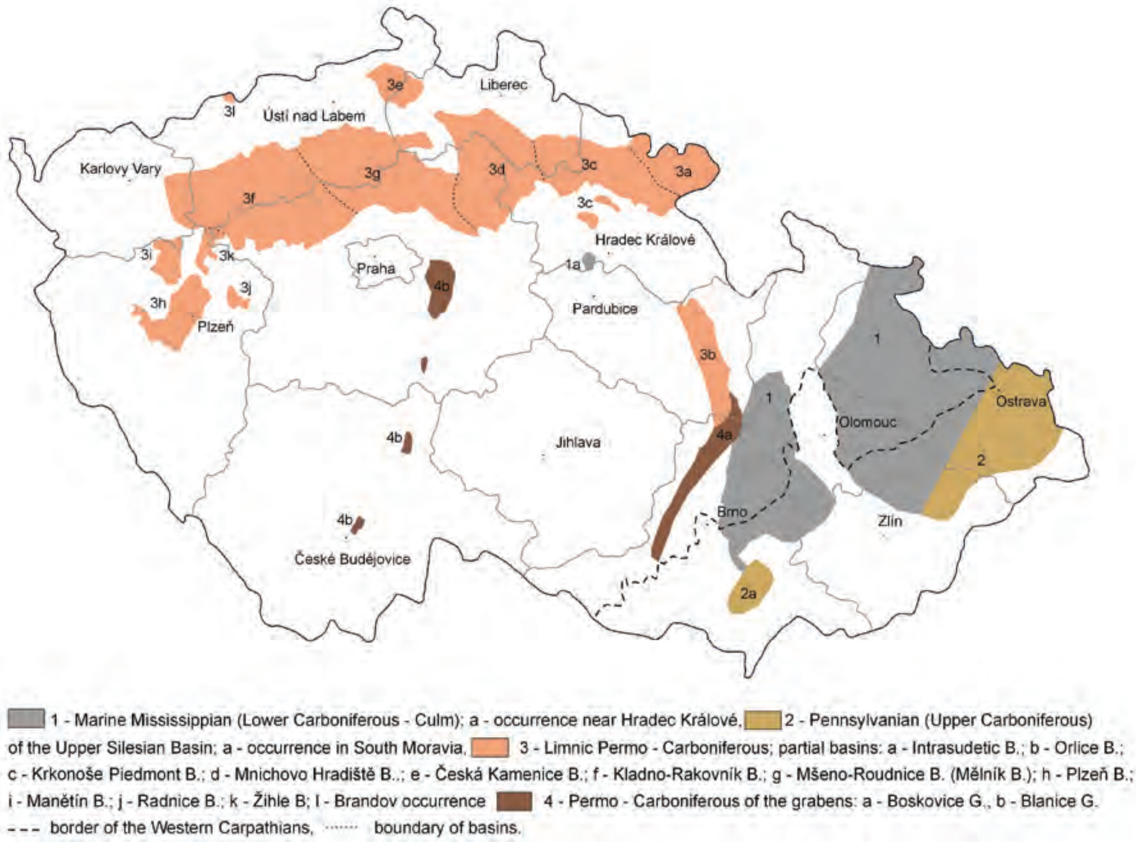

Fig. 4: Carboniferous and Permian in the Bohemian Massif and in the basement of the Western Carpathians on the territory of the Czech Republic

Sedimentation was accompanied also by basaltoid, andesitoid up to rhyolitic volcanism of the intra-plate type and sedimentation of clastic rocks with elevated Cu content. A substantial change of climate, caused by the shift of the lithospheric plate with the Bohemian Massif further north, into the belt between the equator and tropic of Cancer, resulted in the formation of deserts, which covered most of Europe. These sediments are today preserved in the Bohemian Massif only in relics. They reach the highest thickness – up to 3 km – in tectonic troughs of roughly N-S direction, so-called grabens (Boskovice and Blanice grabens). Coal seams (today already mined out) of Upper Stephanian age occur locally on the basis of the Permian in these grabens, and higher horizons contain restricted lake and river calcareous sediments. These are commonly overfilled by relics of Stegocephalians and especially of the Permian insects, which made the Boskovice Graben famous.

The Bohemian Massif was slowly uplifted as a compact block after the Hercynian consolidation and it remained mainly land almost until the end of Mesozoic. White lake sandstones of the ***Triassic*** are represented only to minor extent in NE Bohemia in the Krkonoše Mts. Piedmont and Intra-Sudetic Basins. Sea penetrated from the Carpathian area to northern Germany by a narrow channel across northern Bohemia (roughly between Brno and Dresden) in the ***uppermost Jurassic***. This channel linked the deep Tethys on the SE with the shallow shelf sea to the north from the Bohemian Massif. Limestones (Oxfordian–Kimmeridgian) are exposed only in small islands along the Lužice Fault. In the consolidated Bohemian Massif was the ***Alpine orogeny*** represented mainly by origin of faults or rejuvenation of older fault

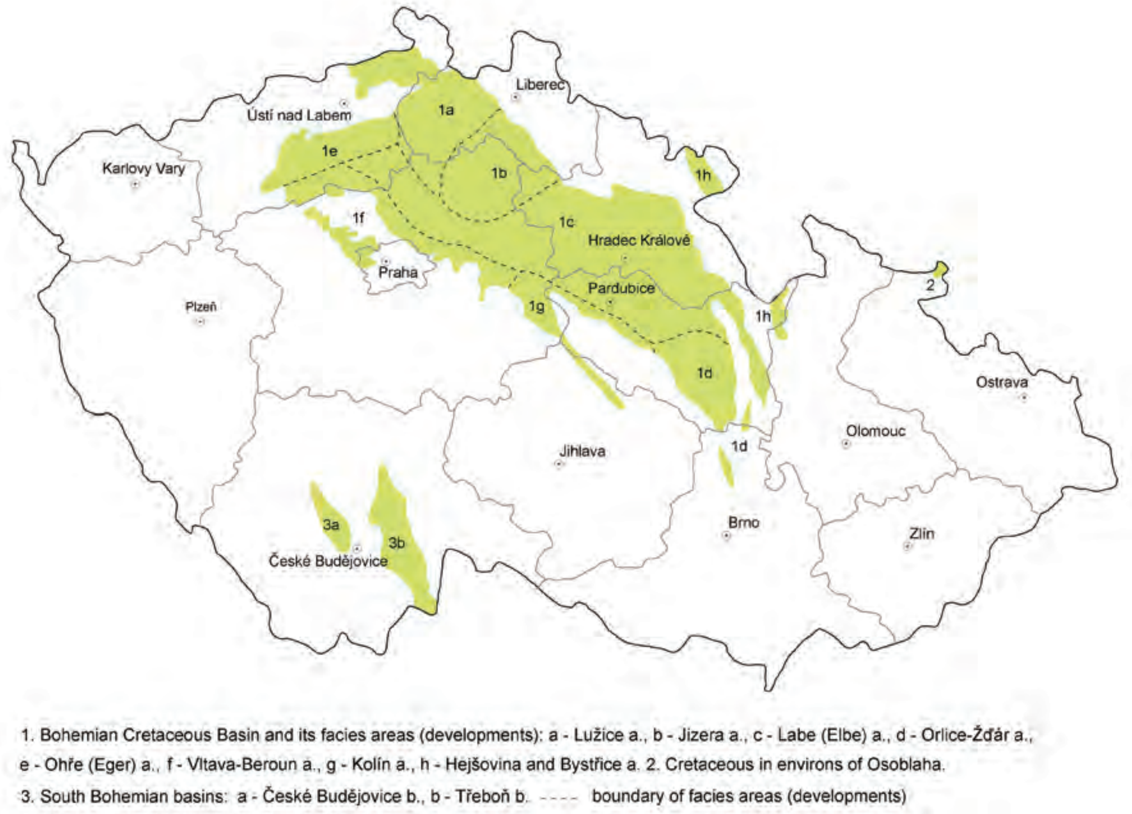

Fig. 5: Upper Cretaceous in the Bohemian Massif on the territory of the Czech Republic

systems. ***Transgression of the Upper Cretaceous sea***, which flooded all the northern and partly also the central part of the Bohemian Massif, was of much higher importance. Several hundreds meters thick strata of the Upper Cretaceous claystones, marlites, sandy marlites and sandstones (the Bohemian Cretaceous Basin – Fig. 5) developed there. The Bohemian Cretaceous Basin is divided into facies areas (developments) shown in Fig. 5 based on character of sedimentation in particular parts of the Basin. Rock complexes of the Basin represent the most important underground water reservoir in the Czech Republic and also an important raw material resource (ceramic and refractory clay, glass, foundry and mortar sand, cement raw materials, building and sculpture stone but also uranium). A small occurrence of Upper Cretaceous sediments near Osoblaha is an extremity of the Polish Opole Cretaceous Basin. Smaller, but fresh-water Upper Cretaceous basins formed also in southern Bohemia. It is the České Budějovice Basin localized more westward and the Třeboň Basin localized more eastward.

The evolution in Moravia was different. The Triassic is not represented at all, whereas in the ***Jurassic*** the sea penetrated from the Mediterranean area far to the NW and flooded the eastern margin of the Bohemian Massif. Jurassic sediments are nowadays to a large extent covered by rocks of the Neogene or the Outer Flysh Carpathian nappes. Tectonic blocks of the Jurassic limestones, exhumed from depth in front of the Carpathian nappes and forming isolated klippen by Štramberk and in the Pavlovské vrchy Hills, represent an important land-forming element and also an important resource of very pure carbonate raw material.

The character of the sedimentation in the Outer Carpathians markedly changed in the ***Cretaceous***. Sediments formed in deeper sea from submarine slides and turbidite currents,

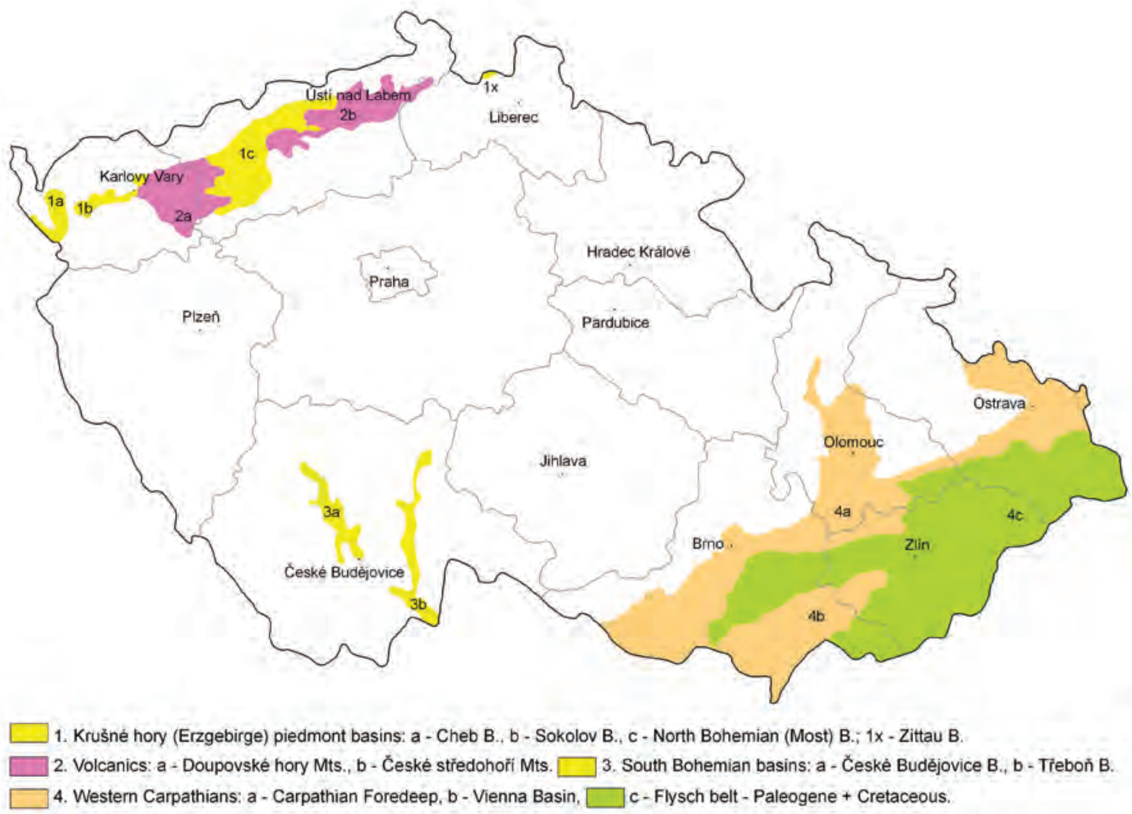

Fig. 6: Tertiary in the Bohemian Massif and Western Carpathians on the territory of the Czech Republic

transporting clastic material far from the land. They are characterized by multiple alternations of sandy and clayey layers of a low thickness (dm to m) and infrequently also sandstone benches, which are collectively called **flysh**. The sediments reach even many thousand meters in thickness. The flysh sedimentation continued in this area also in the Paleogene (Fig. 6).

The Bohemian Massif remained land which was only occasionally flooded in the east by shallow epicontinental sea from the Carpathian area. Nevertheless, several depressions with intensive freshwater sedimentation were formed as a result of strong tectonic movements in the Alpine and Carpathian space in the end of the ***Paleogene and in the Neogene***. This is the area of the South Bohemian basins (the České Budějovice Basin and the Třeboň Basin) with lignite, clay and diatomite deposits and also a marked tectonic trough of the SSW-NNE direction (Ohře Rift) in north-western Bohemia, where the Krušné Hory Piedmont basins (Cheb, Sokolov, North Bohemian and Zittau) formed – see Fig. 6. Sandstones and especially clays and claystones with thick (exceptionally and locally up to 60 m) brown coal seams sedimented in these basins. Brown coal deposits in the North Bohemian and Sokolov basins represent the most important brown coal deposits in the Czech Republic. Important deposits of Neogene clays then occur in the Cheb Basin. Formation of basins was accompanied by very intensive **volcanic activity** and a large accumulation of lavas and pyroclastics (the Doupovské hory Mts. Volcanic Complex, České středohoří). The rocks are mainly various types of olivine basalts and alkaline basaltic rocks, to lesser extent also more acid phonolites. Volcanic conduits and necks give today's landscape a beautiful character. The main volcanic activity took place 35–17 Ma ago, a younger phase 8 Ma ago and the last minor volcanoes are just several thousand years old (Komorní and Železná hůrka). The area represents a classical example of alkaline volcanism and it played an important role in the evolution of geosciences. The rocks are important not only as a building stone but also as a raw material for manufacture of molten basalt products. Deposits of the Bohemian garnets at the southern margin of České středohoří are related to the volcanic activity, too (pyropes were carried up by volcanic necks from the ultrabasic rocks in the crystalline basement). Weathering and decomposition of tuffs of the Doupovské hory and České středohoří Mts. resulted in the formation of important bentonite deposits.

The flysh complexes of the Carpathian area were folded and thrust in the form of nappes (verified by exploration) over a distance of several tens of kilometres towards the west and southwest over the Bohemian Massif in the end of the ***Paleogene***. The Carpathian Foredeep, partly still covered by the arriving nappes, formed in front of the thrust nappes in the ***Neogene*** (Miocene). The sediments of the Vienna Basin (of up to 5 km in thickness) were subsequently hardly folded. These are represented mainly by marine clay, marl and sand, just partially diagenetically consolidated, which contain smaller deposits of oil and gas. The depositional setting of the younger formations became progressively fresh-water. The youngest ones contain deposits of lignite.

Important tectonic processes expressing themselves by marked vertical movements of individual crustal segments operated in the Bohemian Massif in the end of the Tertiary and beginning of the Quaternary. In this way, the marginal mountains – Šumava Mts., Český les Mts., Krušné hory Mts., Krkonoše Mts., Orlické hory Mts. as well as Hrubý Jeseník Mts. – were uplifted by up to 1,000 m and the Bohemian basin was formed. This is sometimes considered as being formed by the impact of a large meteorite, but this is a nonsense resulting from the

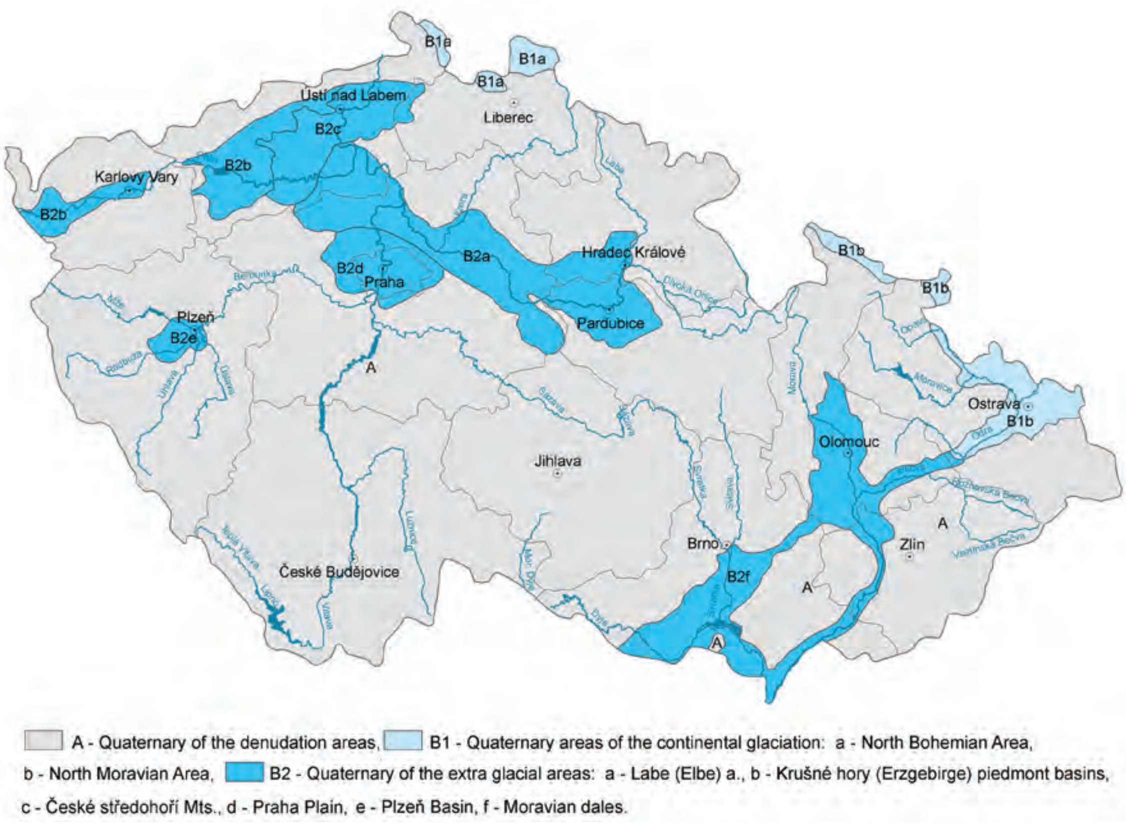

Fig. 7: Quaternary division on the territory of the Czech Republic

interpretation of satellite images without knowledge of the real structure of the massif. The Bohemian Massif was influenced by several phases of continental and mountain **glaciations** during the ***Quaternary***. A periglacial climate dominated here, which resulted in the formation of massive stony debris and block-seas, terrace system of the rivers (Fig. 7) as well as really extensive loesses. Terrace sediments of rivers especially form important deposits of sand and gravel and feldspar raw materials, and loesses of brick clays. The continental ice sheet reached as far as the northern margin of the massif and left sediments of frontal moraines in the Ostrava region, on the northern piedmont of the Hrubý Jeseník Mts. and in the Šluknov and Frýdlant extremities. Mountain glaciers modified morphology of the marginal mountains, especially the Krkonoše Mts., to a lesser extent also the Jeseníky Mts. and Šumava Mts., where even minor glacier lakes formed.

Figures in this chapter were adapted by the author from:

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Regional geological units and minerals associated with them

(that minerals are indicated whose deposits belong to the units; digits of figures and units are related to the previous chapter "Geological evolution of the area of the Czech Republic")

Arnošt Dudek

Bíteš orthogneiss – mostly muscovite orthogneiss of the Cadomian age, characteristic of the Moravicum of the Dyje and Svratka domes between Krems in Austria and Svojanov in the Czech Republic (opal, kaolin, crushed stone) – Fig. 3 – unit 5a

Blanice Graben – fault system of the NNE-SSW direction in central and southern Bohemia, marked also by downthrown islands of the uppermost Carboniferous and Permian with hard coal and anthracite seams. It continues as Rodel line in Austria (Au-Ag-ores) – Fig. 4 – unit 4b

Bohemian Cretaceous Basin – sediments of the Upper Cretaceous (Cenomanian to Santonian), overlying mainly crystalline complexes and Upper Paleozoic rocks in the northern part of the Bohemian Massif. Based on the lithological character, it has been regionally classified into facial developments as follows:

- *Lužice* (U-Zr-ores, glass and foundry sand) – Fig. 5 – unit 1a
- *Jizera* (glass and foundry sand, dimension stone) – Fig. 5 – unit 1b
- *Orlice-Žďár* (foundry sand) and its *east Bohemian* (clays) and *Moravian parts* (clay) Fig. 5 – unit 1d
- *Ohře (Eger)* – the Most, Teplice (quartzite, corrective additives for cement production) and Louny part (clay) Fig. 5 – unit 1e
- *Vltava-Beroun* including Prague surroundings (clay, dimension stone) Fig. 5 – unit 1f

Boskovice Graben – tectonic trench of the NNE-SSW direction in western Moravia filled with sediments of the uppermost Carboniferous and Permian (hard coal) Fig. 4 – unit 4a

Bory granulite massif – a small granulite body in the Moldanubicum N of Velké Meziříčí in western Moravia (feldspar, crushed stone) – Fig. 4 – unit 4a

Brno Massif – a large massif in western Moravia built by a variable series of both acid and basic plutonic rocks of the Cadomian age (feldspar, crushed stone) – Fig. 2 – unit 10

Carpathian Flysh – a part of the Outer Carpathians in eastern Moravia built by clayey and sandy Cretaceous and Paleogene sediments, with a marked nappe structure of the pre-Miocene age. It composes the Chřiby Mts. and the Ždánice Forest and mountain ranges on the border with Slovakia – the Beskydy, Javorníky and Bílé Karpaty Mts. (natural gas) – Fig. 6 – unit 4c

Carpathian Foredeep – the external part of the Carpathian mountain chain in eastern Moravia, which was formed in front of the Outer Carpathian nappes and overlies the south-eastern slope of the Bohemian Massif. It is filled with the Miocene sediments of the Egerian to Badenian (oil, natural gas, clay, bentonite, gypsum in the Opava Basin) – Fig. 6 – unit 4a

Central Bohemian Pluton – an extensive Hercynian granitoids pluton on the border between Bohemicum and Moldanubicum, more basic than the massifs of the Krušné hory Mts. and in Českomoravská vrchovina Highlands (granodiorites, tonalite, diorite). Important deposits in the exocontact (U, Au, Ag-Pb-Zn-ores, feldspar, quartz, dimension and building stone) – Fig. 2 – unit 6

Cheb Basin – the westernmost of the Tertiary basins, at the crossing of the Ohře rift and the Tachov Graben. Sedimentation continued from Eocene until Pliocene (brown coal, kaolin, clay, diatomite, glass and foundry sand – numerous conflicts of interest) – Fig. 6 – unit 1a

České Budějovice Basin – a smaller, western basin of South Bohemian basins, filled with fresh-water sediments of the Upper Cretaceous and to a minor extent Neogene and Quaternary. Episodic ingressions of the sea from the Alpine foredeep (lignite, tectites, diatomite, sand and gravel) – Fig. 6 – unit 3a

České středohoří Mts. – a classical area of the Tertiary alkaline volcanic rocks (olivine basalts to phonolites) exposed in the Ohře (Eger) rift between Chomutov and Nový Bor, with the main volcanic centre in Roztoky nad Labem (pyrope, diatomite, feldspar substitutes, crushed stone) – Fig. 6 – unit 2b

Čistá-Jesenice Massif – a minor granitoid massif in western Bohemia composed of both Cadomian and Hercynian bodies. It is covered from a large part by Carboniferous and Permian sediments (feldspar, dimension and building stone) – Fig. 2 – unit 4

Domažlice Crystalline Complex – south-western part of the upper Proterozoic of the Bohemicum in the Šumava piedmont, metamorphosed during both Cadomian and Hercynian orogeny, with minor massifs of granitoids and gabbroic rocks and abundant pegmatites (feldspar) – Fig. 2 – unit 17

Doupovské Hory Mts. – a volcanic complex of the Tertiary age at the crossing of the Ohře rift with the Jáchymov fault, between Karlovy Vary and Kadaň. Alkaline volcanic rocks are represented mainly by olivine basalt, "leucitic" tephrite and abundant tuffs. Phonolites are missing (bentonite, crushed stone) – Fig. 6 – unit 2a

Dyje Massif – a massif of the Cadomian granitoids in the Dyje Dome of the Moravicum in SW Moravia, extending from the northern vicinity of Znojmo almost to Danube. It was affected by a strong tropical weathering in the Jurassic and Neogene and from a large part covered by sediments of the Carpathian foredeep (kaolin, feldspar, building stone) – Fig. 2 – unit 11

Hroznětín Basin – the northern extremity of the Sokolov Basin N of Karlovy Vary (bentonite) – Fig. 6 – unit 1b

Intra-Sudetic Basin – southern extremity of the Lower Silesian Basin in the NE tip of Bohemia, with sedimentary fill from the Mississippian (Lower Carboniferous) to Upper Cretaceous about 3,000 meters in thicknes, and Pennsylvanian and Permian volcanites. (hard coal) – Fig. 4 – unit 3a

Islet zone of the Central Bohemian Pluton – a number of both large and minor blocks of the contact metamorphosed Proterozoic and Lower Paleozoic rocks from the mantle of the pluton, downthrown into granitoids (Au, building stone, barite, limestone) – Fig. 2 – unit 6

Jílové Belt – a belt of the Upper Proterozoic volcanic (basalt, andesite, boninite and rhyolites), subvolcanic and acid plutonic rocks extending over 120 km in NNE-SSW direction south of Prague, from a major part enclosed in granitoids of the Central Bohemian Pluton (Au-ores, building stone) – Fig. 2 – unit 6

Kdyně Massif – a complex of metabasic, gabbroic and dioritic rocks in the Domažlice Crystalline Complex on the border of Šumava and Bohemian Forest (dimension and building stone) – Fig. 2 – unit 12

Kladno-Rakovník Basin – one of the basins of the Central Bohemian limnic Carboniferous, partly covered by Cretaceous sediments (hard coal, kaolin, claystone) – Fig. 2 – unit 12

Krkonoše-Jizera Crystalline Complex – western part of the Lužice area built by metamorphic rocks of the Proterozoic and Lower Paleozoic age (limestone, dolomite) and intruded by plutons of the Cadomian (Lužice) and Hercynian (Krkonoše-Jizera) age (feldspar, dimension and building stone). Fe-bearing skarns, Sn and W-ores, fluorite and barite occur in the exocontact of the plutons – Fig. 2 – unit 14

Krkonoše-Jizera Massif – Hercynian granitoid massif building the border range with Poland (excellent dimension stone, feldspar) – Fig. 2 – unit 2

Krkonoše Mts. piedmont basin – one of the Sudetic (Lugian) Upper Paleozoic basins partially covered with Cretaceous sediments. Formations encompass Westphalian C, Stephanian, whole Permian and extend up to the lowermost Triasic (Cu-ores, Au paleoplacers, bituminous coal, pyrope) – Fig. 4 – unit 3c

Krušné hory Mts. Piedmont basins – a group of limnic Tertiary basins associated with the Ohře Rift SE of the Krušné hory Mts. From WSW to ESE, these are: Cheb, Sokolov and North Bohemian basins. – Fig. 6 – unit 1

Krušné hory Mts. Pluton – a large Hercynian granitoid pluton underlying metamorphic rocks of the Krušné Hory and Smrčiny Mts., exposed by erosion only in numerous partial massifs (Sn-W-ores, Li-Rb-Cs ores, kaolin, feldspar, quartz, building stone) – Fig. 2 – unit 3

Krušné hory Mts. Crystalline Complex – a part of the Saxothuringicum built by metamorphic complexes mostly of the Proterozoic, subordinately also of the Lower Paleozoic age (U, Ag, Bi, Co, As-ores, Cu-ores, Sn-skarns, fluorite, barite, kaolin) and intruded by Hercynian granitoids. – Fig. 3 – unit 3 (Fig. 2 – unit 15)

Lužice Massif – an extensive Cadomian granitoids massif predominantly on the German territory, extending into the Jizera Mts. (quartz, dimension and building stone) – Fig. 2 – unit 1

Moldanubian Pluton – the largest Hercynian granitoids complex in the Bohemian Massif in Českomoravská vrchovina Highlands, Šumava and Waldviertel (dimension and building stone; Au-W and U-ores and Ag-Pb-Zn-ores in the exocontact) – Fig. 2 – unit 8

Moldanubicum – basement of the southern part of the Bohemian Massif built by high-grade metamorphic complexes of Proterozoic and probably also Lower Paleozoic age. The cadomian tectonometamorphic processes were followed by hercynian high temperature and low pressure metamorphism and the whole complex was penetrated by numerous late-Hercynian granitoid plutons. – Fig. 3 – unit 1

Moravian-Silesian Devonian – weakly metamorphosed volcano-sedimentary unites in the Jeseníky Mts. – *Vrbno Strata, Šternberk-Benešov Belt* (Fe-ores, Cu-ores, Pb-Zn-ores, barite, quartzite, dolomite) – Fig. 2 – unit 19

Moravian-Silesian Carboniferous – marine flyshoid Mississippian (Lower Carboniferous) of the Nízký Jeseník Mts. and Drahany Highlands (slate, quartz) and productive paralic Mississippian to limnic Pennsylvanian (Upper Carboniferous) of the Ostrava region (Upper Silesian Basin – hard coal, natural gas) – Fig. 4 – unit 1, 2

Mšeno-Roudnice Basin – one of the Central Bohemian Carboniferous to Permian basins, completely overlain by the Bohemian Cretaceous Basin (hard coal) – Fig. 4 – unit 3g

Nasavrky Massif – a minor however very complex Hercynian granitoid body exposed in the Železné hory Mts. (pyrite, dimension and building stone; fluorite and barite in the exocontact) – Fig. 2 – unit 7

North Bohemian Basin – the largest Tertiary basin of the Ohře Rift between the Doupov Mts. and České středohoří Mts. (brown coal, clay, bentonite, diatomite, quartzite) – Fig. 6 – unit 1c

Ohře rift **–** a prominent fault structure in the south-eastern piedmont of the Krušné hory Mts. delimited by the Krušné hory and Litoměřice faults and their directional continuations. Tertiary alkaline volcanites, coal-bearing basins and mineral as well as thermal waters are associated with the rift – Fig. 3 – unit 3a

Orlické hory Mts.-Kłodzko Crystalline Complex **–** metamorphic complexes of probably Proterozoic age in the eastern part of the Lužice area in the Orlické hory and Rychleby Mts. and in Kłodzko – Fig. 2 – unit 18

Outer klippen zone of the Western Carpathians **–** extensive fragments of Jurassic and Cretaceous sediments brought up from depth in front of the flysh nappes – Štramberk, Pavlovské vrchy (limestone) – Fig. 2 and 6 – unit 4c

Plzeň Basin **–** an independent basin at the SW margin of the West Bohemian Carboniferous (hard coal, kaolin, clay) **–** Fig. 4 **–** unit 3a

Quaternary alluvia – alluvia and terraces of majority of larger water courses (feldspar, sand and gravel, in south Bohemia and SW Moravia also tectites) **–** Fig. 7 **–** units B2a, B2b, B2f

Quaternary placers – in piedmont of the Šumava and Jeseníky Mts. (Au), Krušné Hory Mts. (Sn), southern piedmont of the České středohoří Mts. (pyrope)

Sokolov Basin – the smallest Tertiary basin of the Ohře Rift WSW of the Doupovské hory Mts. with important deposits of energy minerals (brown coal, U, clay, bentonite) – Fig. 6 – unit 1b

South Bohemian Basins – freshwater sedimentation space of the Upper Cretaceous and Tertiary age, where the Rudolfov horst separates the smaller České Budějovice Basin in the west from the larger Třeboň Basin in the east – Fig. 6 – unit 3

Svratka Dome of the Moravicum – the northern of the domes built by metamorphic rocks of the Moravicum W of Brno (graphite, feldspar, limestone, building stone) – Fig. 3 – unit 5a

Syrovice-Ivaň terrace **–** a higher located Quaternary terrace between the Jihlava and Svratka rivers S of Brno (feldspar) – Fig. 7 – unit B2f

Teplá Crystalline Complex – the NW part of the Proterozoic of the Central Bohemian area (Bohemicum) with a rapid succession of metamorphic zones from SE to NW into the Slavkov Forest (feldspar) – Fig. 2 – unit 16

Tertiary relics of the Plzeň region **–** relics of the formerly more extensive Tertiary sediments on the site of a river paleostream discharging into the North Bohemian Basin (clay, bentonite) – not shown on scale of the maps

Třebíč Massif **–** an extensive massif of the Hercynian melanocratic granitoids and syenitoids (durbachites) in the Českomoravská vrchovina Highlands (amethyst, morion, feldspar, dimension stone) – Fig. 2 – unit 9

Třeboň Basin **–** a larger, eastern basin of South Bohemian basins with continental Cretaceous and Tertiary sediments (kaolin, clay, bentonite, diatomite) **–** Fig. 6 **–** unit 3b

Upper Silesian Basin – a Carboniferous basin formed by sediments of Upper Mississippian and Pennsylvanian situated predominantly in Poland and extending to the Czech Republic only by its SW part. It is formed by volcanoclastic sediments with numerous hard coal seams. On the Czech territory, it is further subdivided into i) western, more mobile paralic Ostrava part, ii) eastern, platform limnic Karviná part and iii) southern Beskydy part (hard coal, natural gas) **–** Fig. 4 **–** unit 2

Variegated Group of the Moldanubicum **–** metamorphic complexes of paragneisses and migmatites with numerous intercalations of amphibolites, marbles, quartzites, graphitic rocks and skarns (Fe-skarns, graphite, feldspar, limestone, dolomite, fluorite, building stone) – part of the Modanubian unit 1, in Fig. 3

Vienna Basin – an extensive Tertiary Neogene basin with marine sedimentary fill gradually becoming freshwater of more than 5,000 m in thickness (lignite, oil, natural gas) – Fig. 6 – unit 4b

Železné hory Mts. area – part of Bohemicum built by weakly metamorphosed volcanosedimentary series of the Upper Proterozoic and sediments of the Lower Paleozoic (Mn-Fe-carbonates, pyrite, fluorite, barite, limestone) and the Hercynian granitoid Nasavrky Massif – Fig. 2 – unit 20

Zittau Basin – a Tertiary basin in the continuation of the Ohře Rift, extending only by a negligible south-eastern extremity into the Czech territory (brown coal, lignite, clay) – Fig. 6 – unit 1d

Žulová Massif – a minor Hercynian granitoid massif in the northern tip of the Moravian-Silesian area (kaolin, quartz, dimension and building stone) – Fig. 2 – unit 5

Geodynamics of the origin of the Bohemian Massif covering the territory of the Czech Republic

Karel Schulmann, Vojtěch Janoušek, Ondrej Lexa

The Bohemian Massif represents one of the largest exposure of the European Variscan belt located at its eastern extremity (Figure 1). The Variscan architecture of the Bohemian Massif can be defined by four major tectonic units: 1) The Saxothuringian Neoproterozoic continental basement with its Palaeozoic cover, 2) The Teplá-Barrandian (Bohemicum) Neoproterozoic basement and its Early Palaeozoic cover of the Prague Basin (the Bohemia Terrane of South Armorica), 3) The Moldanubian high- to medium-grade metamorphic unit intruded by numerous Carboniferous granitic plutons, altogether forming the high-grade core of the orogen, 4) The easterly Brunia Neo-Proterozoic basement with Early to Late Palaeozoic cover.

The Gondwana faunas of Lower Palaeozoic (Cambrian and Ordovician) sediments of the Saxothuringian and Teplá-Barrandian domains and numerous isotopic and U-Pb zircon data imply affinity to northern Gondwana margin. Schulmann et al. (2009) suggested that the Variscan structure of the Bohemian Massif resulted from Andean type convergence and formed as a typical upper plate orogen located above a long lasting Devonian-Carboniferous subduction system. These authors shown that all the current criteria defining an Andean type of convergent margin are present and surprisingly well preserved. In particular it is: 1) the development of blueschist facies metamorphism along the Saxothuringian margin, 2) calc-alkaline to potassium rich (shoshonitic) arc type magmatism in distance 150 – 200 km from the suture zone (Žák et al., 2005), 3) back-arc basin developed on continental upper plate crust later replaced by thick continental root (Schulmann et al., 2005), 4) deep granulite facies metamorphism associated with supposed underplating of the crust by mafic magmas at the bottom of the root and 5) continental lithosphere underthrust underneath the thickened root system. Based on these criteria, the architecture of the eastern Variscan belt is interpreted as the result of a large-scale and long-lasting subduction process associated with crustal tectonics, metamorphism, magmatic and sedimentary additions that developed over the width of at least 500 km, in present coordinates, and time scale of ~80 Ma.

Present day architecture of the Bohemian Massif and location of Palaeozoic sutures

Saxothuringian is represented by Neoproterozoic par-autochthon represented by migmatites and paragneisses dated at ~580–550 Ma. These rocks are intruded by Cambro-Ordovician calc-alkaline porphyritic granodiorites converted to augen orthogneiss during the Variscan orogeny. The basement is unconformably covered by Cambrian and Ordovician sequences overlain by Late Ordovician to Famennian pelagic sediments and Famennian to Visean flysh. The par-autochthon is thrust by allochthonous units containing deep water equivalents of the Ordovician to Devonian rocks of the para-autochthon and proximal flysh sediments.

The allochthonous are represented by pile of thrust sheets marked by decreasing pressure and metamorphic age from the top to the bottom (Franke, 2000; Konopásek and Schulmann, 2005).

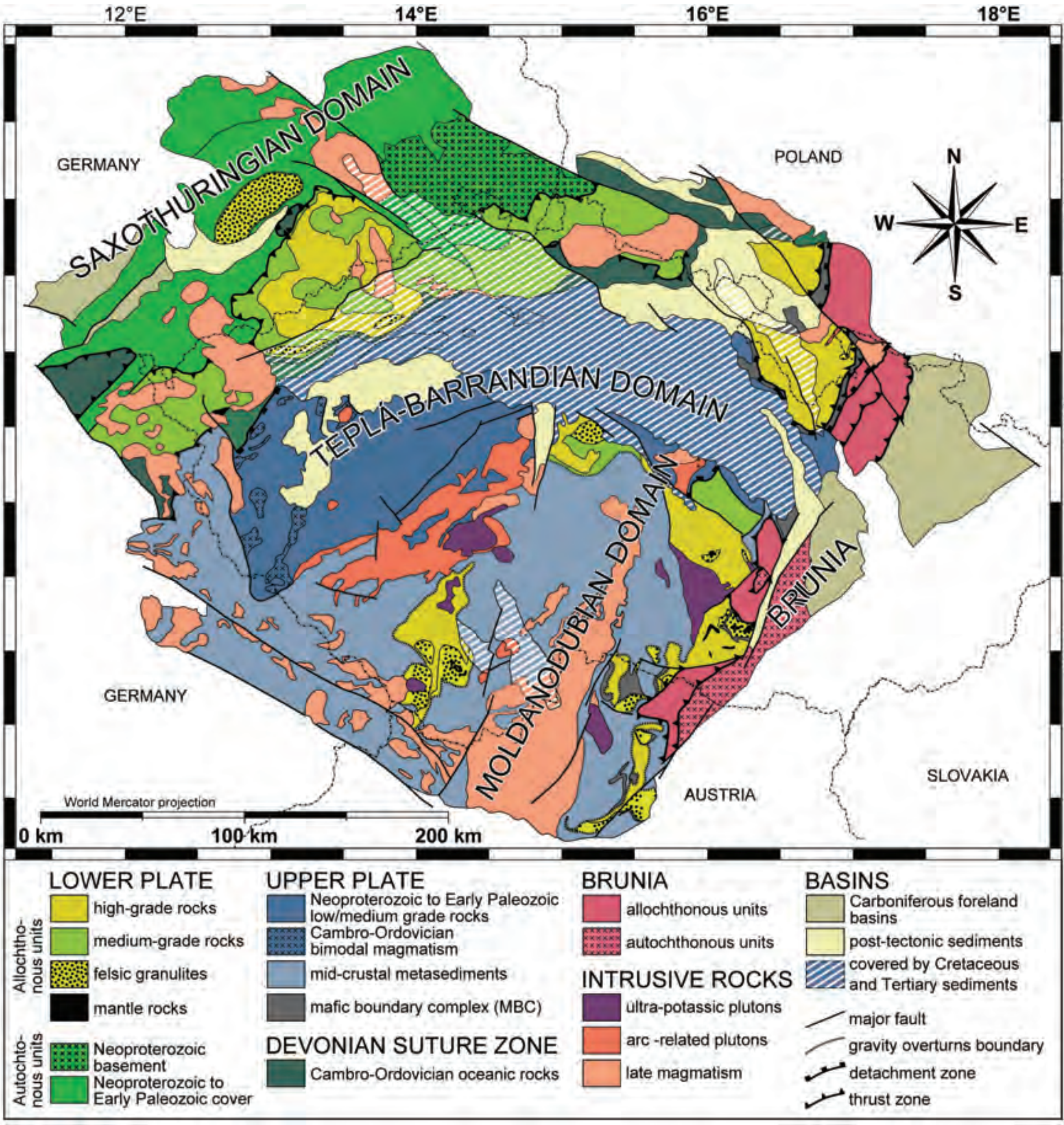


Figure 1. Plate tectonic map of the Bohemian Massif

In the highest structural position occur thrust sheets with metabasites of Ordovician protolith age eclogitized during Devonian (~395 Ma). Structurally deeper occur sheets associated with middle pressure assemblages and Late Devonian zircon and Hbl cooling ages (~365 Ma). This rock pile represents Late Ordovician to Devonian passive margin imbricated during Devonian convergence. In the Sudetic part (Figure 1, Figure 2a-c) of the Bohemian Massif, the Ordovician rift sequences are characterized by the presence of deep marine sediments and MORB type volcanics followed by Silurian and Devonian sedimentary sequences. The Ordovician oceanic rocks are metamorphosed at blueschist-facies conditions probably at Late Devonian.

Metamorphic zones and facies: Ky – kyanite zone, St – staurolite zone, amphibolite facie, Grt – granulite facie, Bt – blueschist facie

The oceanic subduction stage was followed by Carboniferous continental subduction of the Saxothuringian continental rocks underneath easterly Teplá-Barrandian block which was responsible for the eclogitization of continental crust at ~350–340 Ma (Schmädicke et al.,

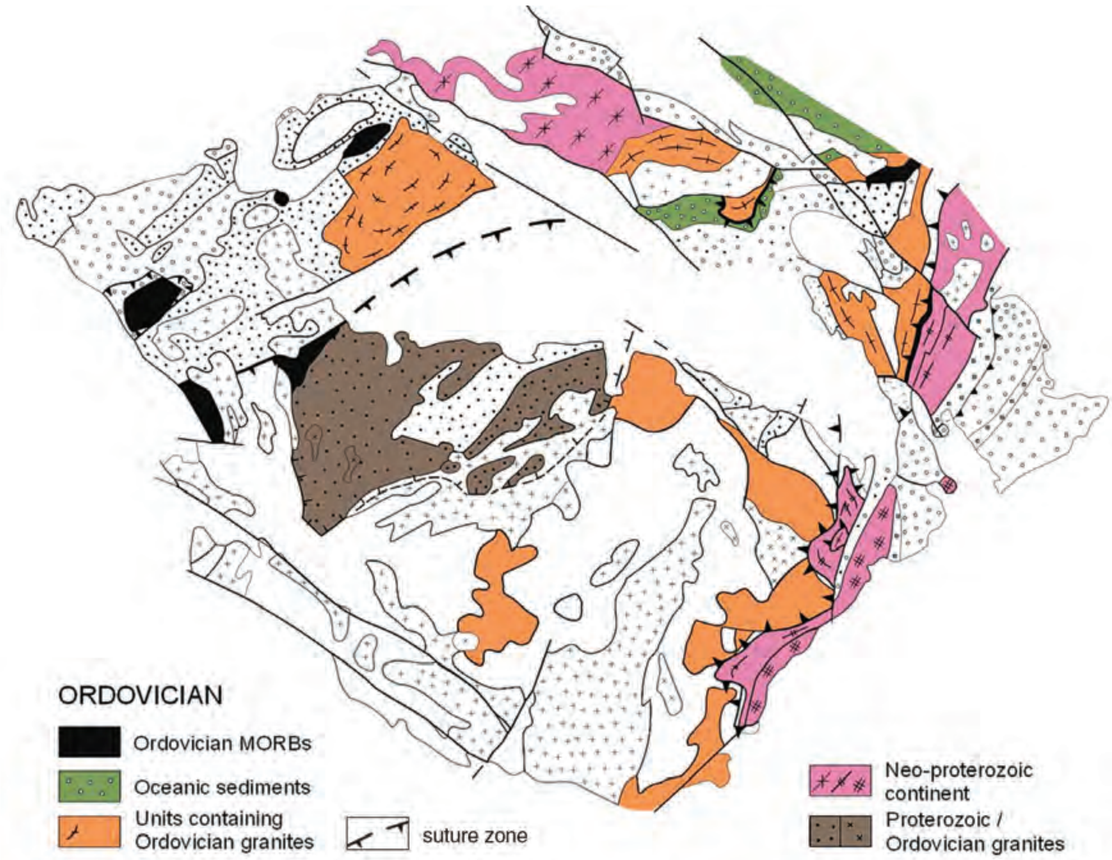


Figure 2a. Architectural evolution of the Bohemian Massif – Ordovician stage

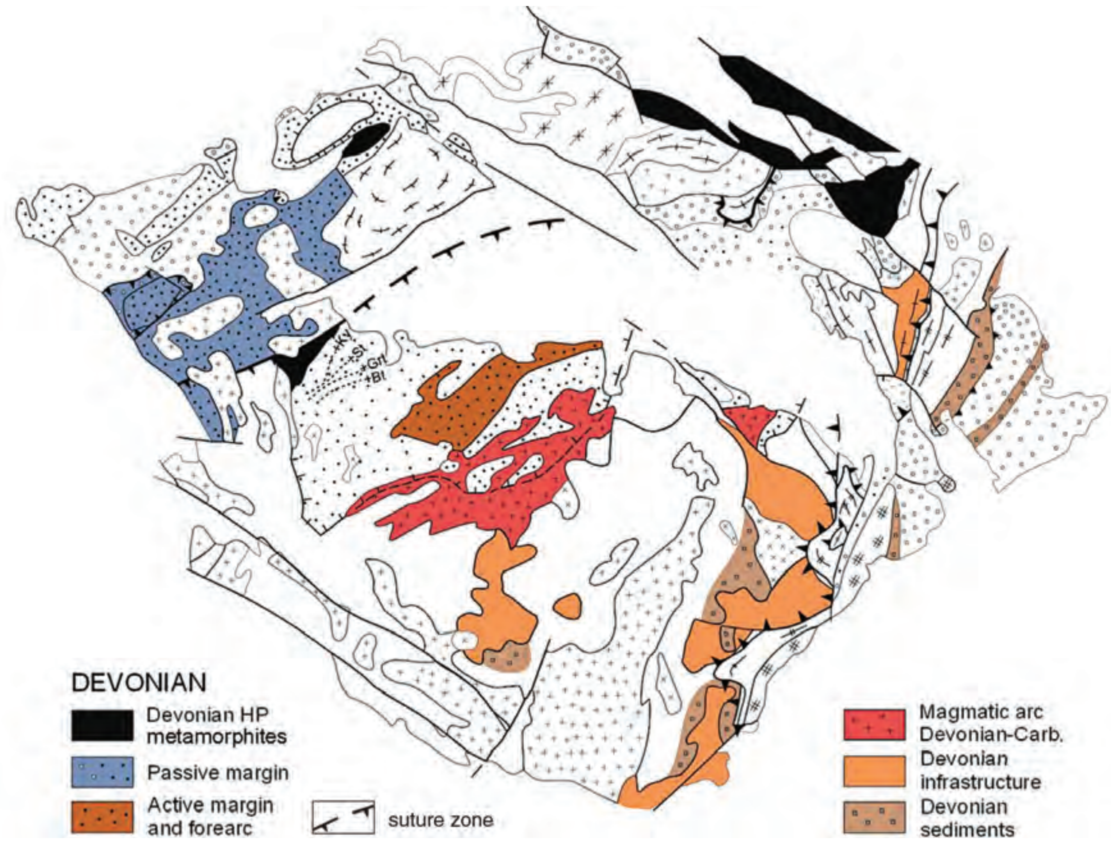
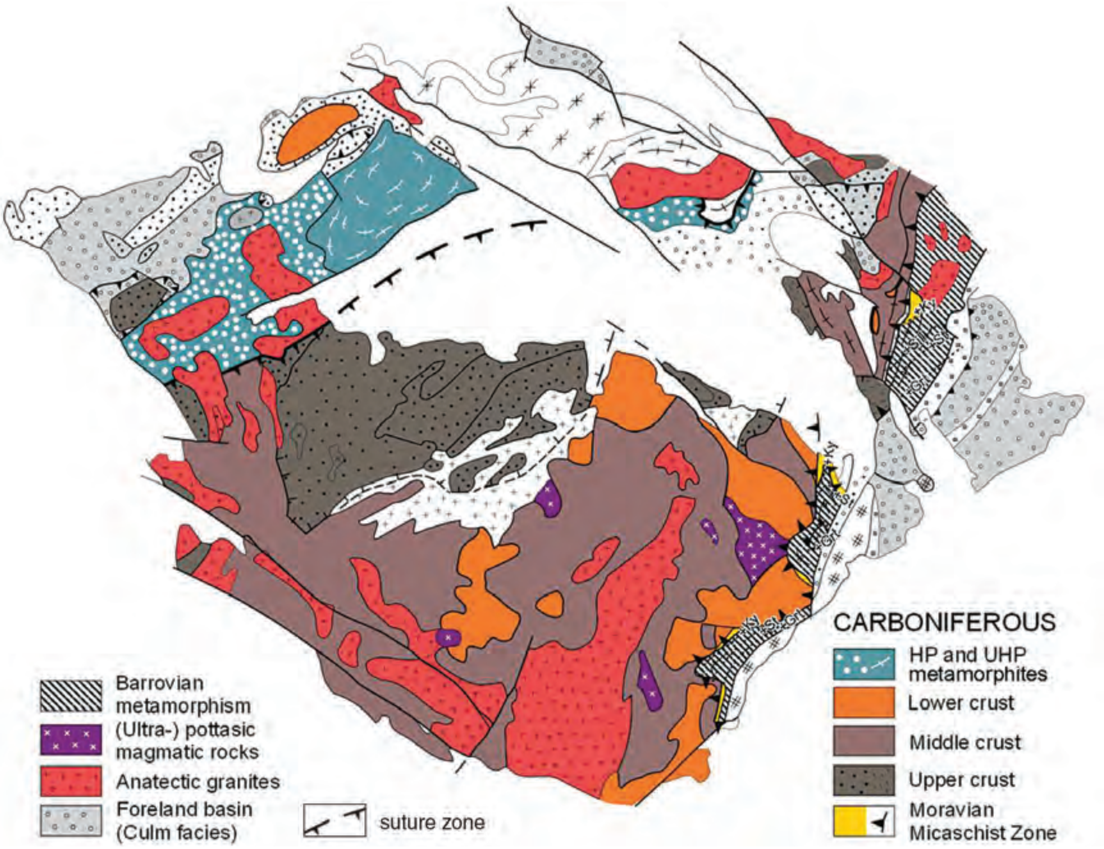


Figure 2b. Architectural evolution of the Bohemian Massif – Devonian stage



Metamorphic zones and facies: Ky – kyanite zone, St – staurolite zone, amphibolite facies, Grt – granulite facies, Bt – blueschist facies

Figure 2c. Architectural evolution of the Bohemian Massif – Carboniferous stage

1995). This event is responsible for the global reworking of the Saxothuringian at high pressure conditions, thrusting of subducted continental crust and exhumation of deep rocks.

The Saxothuringian – Teplá-Barrandian boundary is characterized by presence of units with high proportions of ultramafic and mafic high pressure rocks (Figure 1). Represented by serpentinites at the bottom and thick body of amphibolites, eclogites and metagabbros (Medaris et al., 1995). The protolith of gabbros and eclogites was dated as Cambrian and Ordovician while the Devonian metamorphic and cooling ages range between 410 and 370 Ma. The metamorphic evolution started with eclogite-facies metamorphism and terminated by granulite and amphibolite-facies retrogression. These rocks are interpreted as the oceanic fragment at suture position.

Teplá-Barrandian (the Bohemicum) consists of Neoproterozoic basement with the lower arc-related volcano-sedimentary sequence, followed by siliceous black shales and a flyshoid sequence (shales, greywackes and conglomerates. The Neoproterozoic basement is unconformably overlain by a thick sequence (1500–2000 m) of Lower Cambrian conglomerates, graywackes, and sandstones and Upper Cambrian volcanics. The Lower Palaeozoic Prague Basin is characterized by Early Ordovician (Tremadocian) transgression followed by mid-Ordovician rift related volcanics. Sedimentation of Silurian graptolite shales was associated with important volcanic activity accompanied by basaltic and ultramafic intrusions. The sedimentation continued from Upper Silurian to Devonian by carbonate dominated sequence and terminated at mid-Devonian with Givetian calc turbidites.

The whole sedimentary package is folded by steep folds presumably of Late Devonian age as indicated by Culm facies sediments unconformably deposited on folded Early Paleozoic strata. The deformation affected also the underlying Neoproterozoic basement, with the intensity and age increasing progressively to the west (Zulauf, 2001). In the same direction rises also the metamorphic degree, reaching amphibolite-facies conditions close to the Teplá-Barrandian/Saxothuringian boundary. In this area is developed a typical Barrovian metamorphic zonation ranging from biotite zone in the east up to kyanite zone in the west dated at middle Devonian by $^{40}Ar/^{39}Ar$ method (Dallmeyer and Urban, 1988).

The Teplá-Barrandian and Moldanubian domain boundary is masked by the Central Bohemian Plutonic Complex. Its activity started with intrusions of calc-alkaline Devonian (~370 Ma) tonalites to granodiorites transformed into orthogneisses. The first unmetamorphosed plutonic rocks were Late Devonian (~354 Ma) calc-alkaline tonalites, granodiorites, trondhjemites, quartz diorites and gabbros. The source of the basic magmas was a slightly depleted mantle above a subduction zone. Further south/southeast occur Early Carboniferous (~349–346 Ma) high-K calc-alkaline plutonic bodies (mainly granodiorites with minor quartz monzonite and monzogabbro bodies). The intermediate rock types resulted from mixing of slightly enriched mantle-derived and crustal magmas. Finally, further east occur syn-deformational bodies or post-tectonic elliptical intrusions of magnesio-potassic rocks of mid-Carboniferous (~343–337 Ma) ages. The plutonic bodies contain numerous xenoliths, screens of the Barrandian-like Palaeozoic and Neo-Proterozoic rocks.The Central Bohemian Plutonic Complex is interpreted as a relatively shallow section (< 10 km) through the Devonian-Carboniferous magmatic arc, which widened and expanded to the east with time.

The Moldanubian is subdivided into two tectonic units: The Drosendorf Unit composed of the "Monotonous Group" represented by Proterozoic metasediments, with numerous Late Proterozoic to Early Palaeozoic orthogneisses, quartzites and amphibolites and the "Varied Group" composed of plagioclase-bearing paragneiss quartzites and marbles intercalated with amphibolites and leptynites (Tollmann et al., 1982). The protoliths of varied metasediments are supposed to be at least partly Early Palaeozoic in age. Structurally highest is the "Gföhl Unit" composed of orthogneiss with Ordovician protolith ages, amphibolitized eclogites, granulites, garnet- and spinel-bearing peridotites surrounded by felsic migmatites.

Two NW-SE trending belts of high-pressure rocks (granulites, eclogites and peridotites) are distinguished: the western belt located close to the Barrandian–Moldanubian boundary, and the eastern belt rimming the eastern margin of the Bohemian Massif (Medaris et al., 1995). These two belts alternate with NW-SE trending wide belts represented by the Varied and Monotonous groups.

The amphibolite-facies metamorphism developed on the regional scale in the Drosenforf Unit and reflects maximal pressures of 10 kbar at temperatures of 650–700 °C. However, higher grade (eclogitic) boudins have been identified, generally at the boundary between both groups. Metamorphism of the Gföhl unit is characterized by early eclogite facies followed with granulite-facies and amphibolite-facies retrogression (O'Brien and Rötzler, 2003). The age of early high-pressure metamorphism was probably Late Devonian and the granulite-facies overprint is of Viséan age as shown by a number of zircon ages.

The deformation history in the Moldanubian Zone reveals early vertical NNE-SSW trending fabrics, associated with crystallization of high-pressure mineral assemblages. These steep foliations are reworked by flat deformation fabrics that are associated with medium- to low-pressure and high-temperature mineral assemblages. The sub horizontal foliations bear intense

NE-SW trending mineral lineation that is commonly associated with generalized ductile flow towards NE. The early sub-vertical fabrics is dated at 350 to 340 Ma, while the ages for the sub-horizontal vary around 335 Ma. In the SW part of the Moldanubian domain, younger set of steep NW-SE metamorphic fabrics reworks the flat foliation, having been associated with low-pressure metamorphic conditions at around 325–315 Ma (Schulmann et al., 2005).

The Moldanubian metamorphic units are commonly intruded by numerous Variscan plutons including magnesio-potassic syenites to melagranites (durbachites), and S-type granitoids. The magnesio-potassic syenites to melagranites are spatially, structurally and temporally associated with high-pressure granulites (Janoušek and Holub, 2007). These rocks have isotopic signatures indicating a metasomatized lithospheric mantle source, presumably contaminated by subducted mature crustal material.

The Moldanubian – Brunia continental transition zone was defined as a zone of medium grade metamorphism called the Moravo-Silesian Zone (Suess, 1926). This zone of intense deformation resulted from thrusting of the Moldanubian over Brunia continent to the east. The contact between these units is marked by a particular unit, the Moravian "micaschist zone", which is composed of kyanite-bearing micaschists. This first order tectonic boundary contains boudins of eclogites, high-pressure granulites and peridotites embedded in the metapelites of both Moravian and Moldanubian parentage order tectonic boundary.

The underlying Moravo-Silesian Zone is characterized by two nappes composed of orthogneiss at the bottom and metapelite sequence at the top. This nappe sequence is overlying Neoproterozoic basement which is often imbricated with Pragian to Givetian cover. The orthogneisses of the Moravian Zone are derived from the underlying Brunia continent. This zone of intense deformation, 50 km wide and 300 km long, is marked by a tectonically inverted metamorphic sequence ranging from chlorite to kyanite-sillimanite zones. The metamorphism is interpreted as a result of continental underthrusting associated with intense top to the NNE oriented shearing. The subsequent deformation is connected with recumbent folding and imbrication of Neoproterozoic gneisses with Devonian cover. The age of this later phase is constrained at 340 – 325 Ma $^{40}Ar/^{39}Ar$ ages (Fritz et al., 1996).

The Brunia continent originally called the Brunovistulicum by Dudek (1980) consists of Neoproterozoic migmatites and schists dated at ~680 Ma and intruded by 550 Ma old granites. This basement is unconformably overlain by Cambrian and Ordovician strata followed by Lower Devonian quartzites and conglomerates and Givetian carbonate platform sedimentation. Since Early to Late Carboniferous (~350–300 Ma), foreland sedimentary environment developed resulting in deposition of 7.5 km thick Variscan flysch (Culm facies). Low-grade source rocks gradually pass to high-grade metamorphic source material marked by pyrope-rich mineral fraction and granulite pebbles dated at 340–330 Ma (Hartley and Otava, 2001, Kotková et al., 2007). Since 310 Ma deformation started of the flysch basin characterized by metamorphism and intense deformation in the west. The deformation terminated by folding of molasse sediments at ~ 300 Ma.

Geodynamic evolution of the Bohemian Massif

The succession of tectonic events (Figure 3) can be interpreted in terms of south-eastward (in the present-day coordinates) oceanic subduction of large Saxohuringian ocean underneath an active continental margin, obduction of the passive margin units, formation of a fore-arc region, growth of a magmatic arc and development of a large-scale back-arc system on the continental

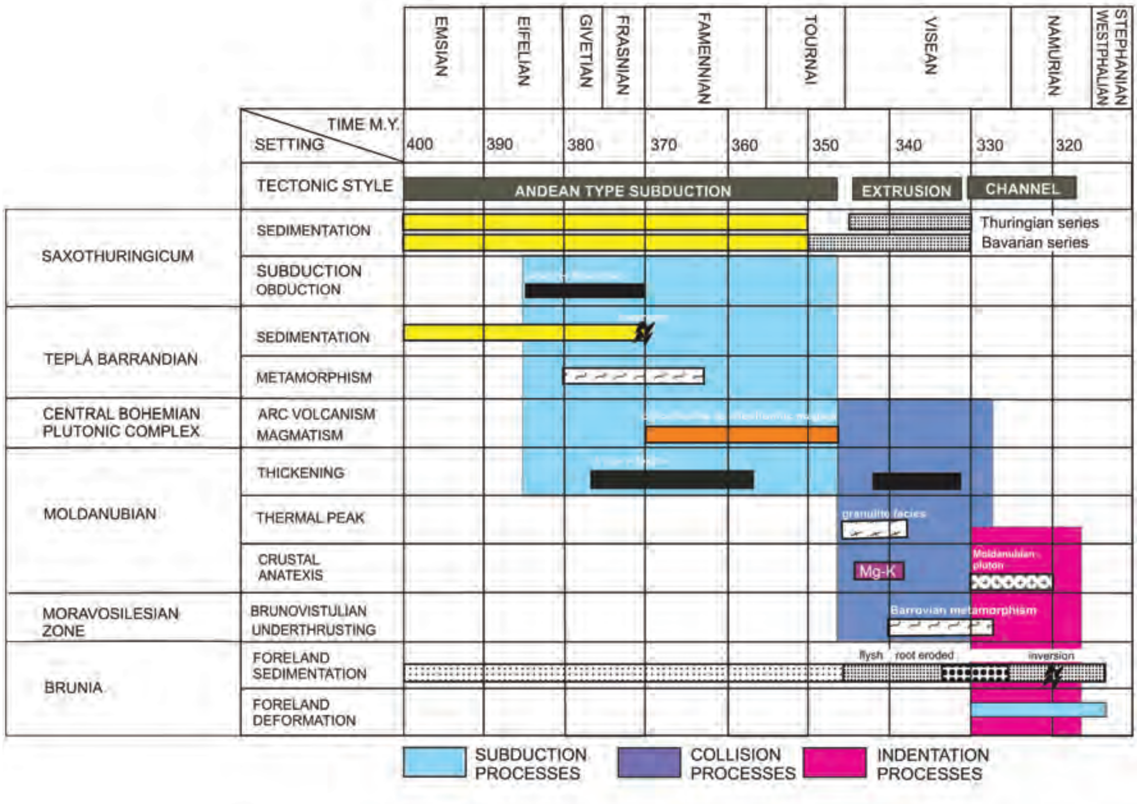


Figure 3. Chronological chart of tectonic events forming Bohemian Massif

lithosphere. The early Saxothuringian oceanic subduction event was followed by a continental underthrusting of Saxothuringian continent leading to gradual flattening of the subduction zone marked by eastward migration of arc depocenters and subsequent crustal thickening. The latter event was responsible for the development of a thick continental root at the expense of the upper plate composed of the Teplá-Barrandian and Moldanubian units. The final evolution is marked by the continental indentation of easterly Brunia continent, exhumation of the Moldanubian lower crust, collapse of the Teplá-Barrandian and Moldanubian thrusting over Brunia platform.

Early Devonian oceanic subduction underneath the continental margin (Figure 4) is marked by relics of Ordovician to Lower Devonian passive margin metamorphosed under blueschist–eclogite facies conditions indicating a Mid-Devonian oceanic subduction. These units are obducted above a continuously underthrust continental Saxothuringian plate. The Barrovian metamorphic zonation and related deformation in the overriding Teplá-Barrandian continental margin are interpreted as ductile part of the Barrandian crust extruded during early stage of upper plate Late Devonian shortening. The steep folding of central part of anchimetamorphic Barrandian Neoproterozoic sequences is interpreted as a same deformation event but occurring in more shallow crustal levels. The subduction of a Saxothuringian oceanic crust underneath the Tepla-Barrandian crust is responsible for the origin of a magmatic arc represented by Devonian calc-alkaline orthogneisses and tonalities of the Central Bohemian Magmatic Complex and by isolated granodiorite stocks intruding Neoproterozoic sediments. At this stage the Barrandian basin operated as fore-arc domain as it is indicated by Devonian zircons in the sediments of the same age in the Prague basin. It is difficult to evaluate the original depositional origin of Moldanubian metasediments, metabasites and other high grade rocks due to severe and polyphase reworking.

Amphibolites derived from Siluro-Devonian tholeiitic basalts associated with carbonates, widespread in Lower Austria and south Bohemia, are interpreted as volcanic products of a large-scale back-arc system. In addition, the felsic metavolcanics and amphibolite layers in the Varied Group are regarded as continuity of back-arc bimodal volcanism till Givetian. The back-arc hypothesis corroborates with impressive amount of marbles with high Sr isotopic ratios that indicate shallow marine environment during Palaeozoic. A back-arc environment is further supported by bimodal volcanic activity in narrow Devonian basins developed on the north-eastern margin of the Brunia continent suggesting only minor thinning of continental crust at the easternmost termination of the back-arc system. In this concept the rest of Brunia represents a stable continental domain not affected by the back-arc spreading.

The Barrandian became a for-arc region, while the future Moldanubian continued to evolve as a crustal back-arc system. The position of high-pressure rocks, existence of the Mariánské Lázně Complex at suture position and location of calc-alkaline magmatic rocks confirm a polarity of the oceanic subduction underneath the easterly fore-arc and magmatic arc system during Late Devonian. The distance of the arc from the trench area represented by the suture indicates that the dip of subduction zone was probably moderate (30–40 degrees). The migration of magmatic centres to the east associated with temporal evolution of magma geochemistry from calc-alkaline to more potassic/shoshonitic affinities (from 370 to 336 Ma) are compatible with flattening of the subduction zone during Early Carboniferous.

The Carboniferous crustal thickening is recognized in all units except the Teplá-Barrandian. The Saxothuringian domain is characterized by the arrival of the continental crust and its subduction underneath the easterly Teplá-Barrandian–Moldanubian. The main thrust boundary migrated further west, so that the continent was thrust underneath the fossil Devonian suture and former fore-arc region. At the same time the deformation regime changed in the far field back-arc region, which recorded progressive thickening of the whole previously thinned and thermally softened domain. Recent structural studies have shown that the earliest preserved fabrics have been sub-horizontal, which may indicate that the lower crustal material was flowing horizontally from the area of subduction channel towards region of easterly back stop.

Indeed, the influx of lower crustal material transported by east dipping Saxothuringian continental subduction zone underneath the fore arc (Teplá-Barrandian) and subsequently towards the former back-arc domain is regarded to be at the origin of the future "Gföhl Unit". This hypothesis is in line with the whole-rock geochemical and Sr-Nd isotopic composition as well as the zircon inheritance patterns in the Moldanubian HP-HT granulites. Importantly, the crustal material involved in the subduction and extruded over the sub-arc and sub-back arc mantle lithosphere may have developed voluminous high-pressure granulites known from many regions of the Bohemian Massif. Alternatively, the back-arc domain with inherited high thermal budget from Devonian stretching may have been thickened and the partially molten lower crust may have been transported downwards and transformed to high-pressure granulites.

The onset of thickening of the root is not recorded in the Teplá domain, which behaved as a supra-structural domain at this time, but it is shown by deformation in the Barrandian domain. Here, the steep fabric is well dated by adjacent syntectonic calc-alkaline plutons at about 355–345 Ma. In contrast to the west, the eastern sector records onset of loading of the Brunia platform at Tournaisian manifested by sedimentation of coarse basal clastics and destruction of the Givetian carbonate platform.

Late Visean exhumation of orogenic lower crust of the upper plate during Early Carboniferous is exemplified by the two NE–SW trending belts of granulites, eclogites and peridotites

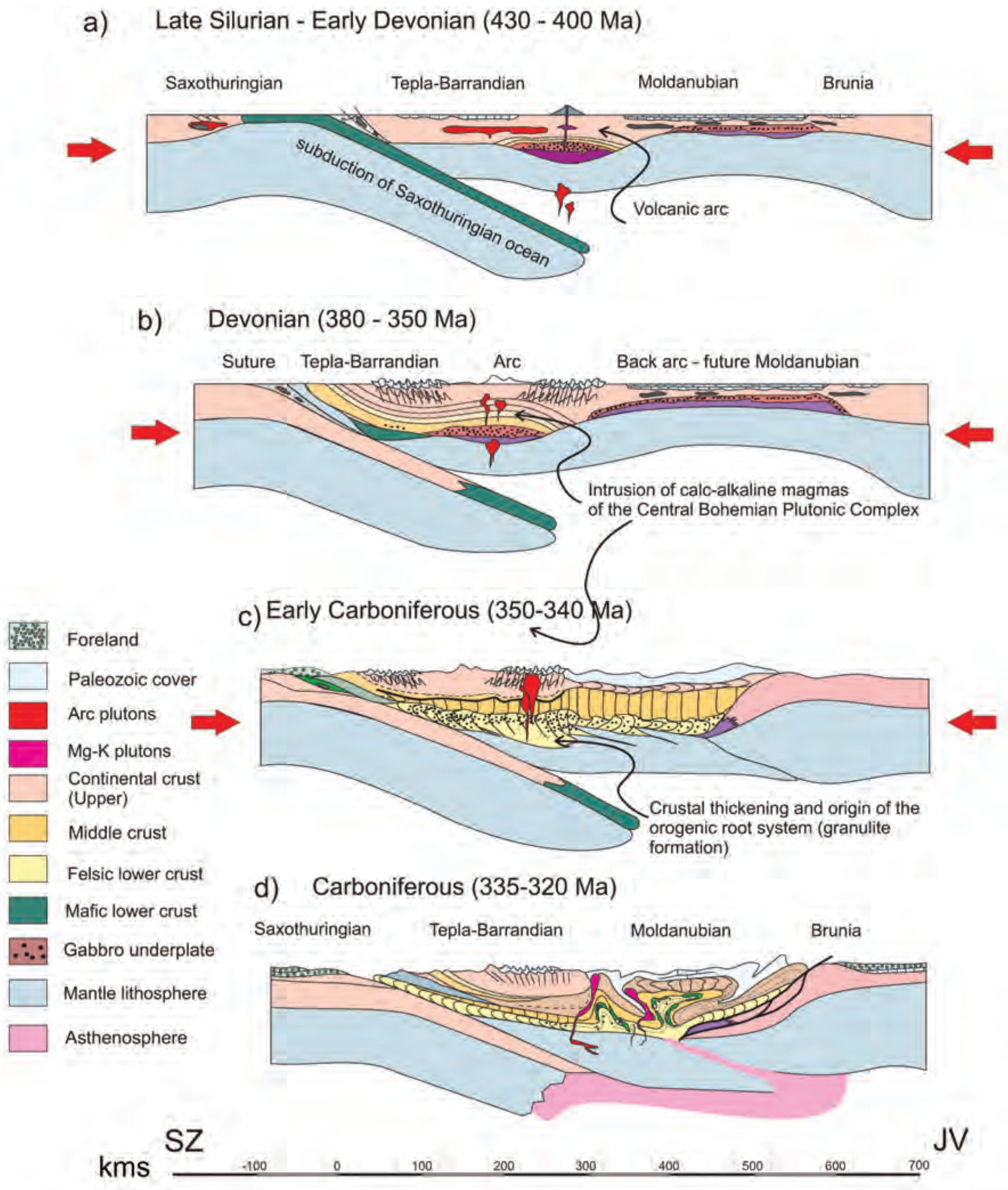


Figure 4. Geodynamics of the Bohemian Massif

intimately associated with the magnesio-potassic plutons. The first belt, recognized west of the magmatic arc, was exhumed along huge west dipping detachment zone, which was also responsible for collapse of the upper part of the magmatic arc system and downthrow of the whole Barrandian section. Such a huge vertical material transfer could have been responsible for vertical exchange of lower crustal and upper crustal material in a range of 50 km with final throw of 15 km. The cooling ages from the lower crustal domain show that the granulites passed the 300 °C isotherm during Carboniferous, suggesting that the lower crustal bulge reached very shallow position in the upper plate.

The second lower crustal belt rims the eastern margin of the Bohemian Massif, i.e. the boundary with the Brunia continent. Here the fabric of granulites is also vertical and is interpreted in terms of massive vertical exchanges with orogenic middle crust. The zone of lower crustal bulge is interpreted as enormous anticline extrusion surrounded by middle crust coevally transported downwards in form of huge crustal scale synforms. The model of vertical extrusion is based on the concept of buckling of lower and mid-crustal interface followed by growth of crustal scale antiforms. This process is thought to be triggered by rheological and thermal instabilities in the arc region, while to the east it is forced by rigid back-stop, preserved only locally.

However, the most important feature of the eastern Variscan front is the development of horizontal fabrics in the Moldanubian root zone, parallel to the Brunia continental margin. The intense deformation of the Brunia leading to the formation of Moravo-Silesian imbricated nappe system, the origin of crustal mélange forming the Moravian micaschist zone and mixed high-pressure rocks and migmatites in the overlying Moldanubian nappe have been recently interpreted in terms of indentation of the Brunia continent into the hot and thick continental root. This lower crustal indentation and flow of hot lower crustal rocks in supracrustal levels are consistent with the model of continental channel flow driven by arrival of crustal plunger, a model which is advocated for two decades for the deformation of the Eastern Cordillera in the Andes. Finally, the load of Brunia platform related to deep indentation process, leads to the development and easterly propagation of the foreland basin associated with progressive involvement of the early clastic basin infill into the channel flow process. In our model (Schulmann et al., 2008) as the hot Moldanubian rocks advances over the Brunia platform, the imbricate footwall nappe system of the Moravian zone is generated and thrust over the foreland basin rocks.

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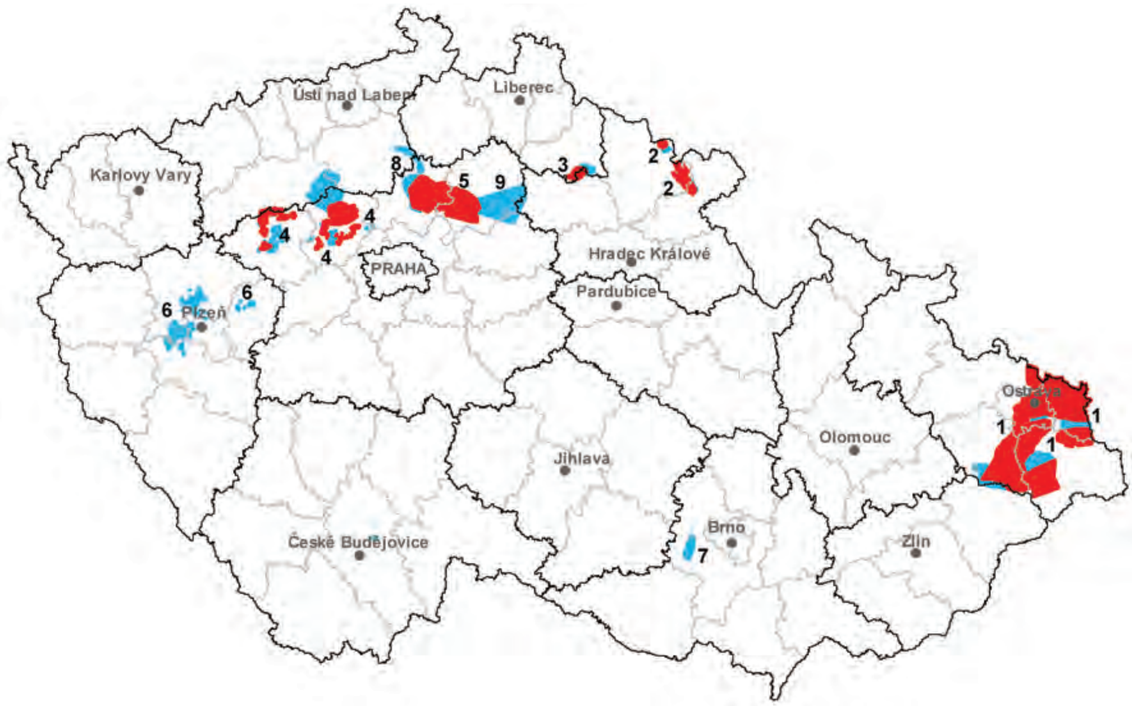
MINERALS CURRENTLY MINED IN THE CZECH REPUBLIC

ENERGY MINERALS

Bituminous coal

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits | exhausted deposits and other resources

Coal basins:

(Names of basins with mined deposits are indicated in ***bold type****)*

1 **Czech part of the Upper-Silesian Basin**
2 Czech part of the Intra-Sudetic Basin
3 Krkonoše Mts. Piedmont Basin
4 Central Bohemian Basins (namely Kladno-Rakovník Basin)
5 Mšeno Part of Mšeno-Roudnice Basin
6 Plzeň Basin and Radnice Basin
7 Boskovice Graben
8 Roudnice Part of Mšeno-Roudnice Basin
9 Mnichovo Hradiště Basin

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2010	2011	2012	2013	2014
Deposits – total number	62	62	62	62	62
exploited	8	8	8	8	8
Total mineral *reserves, kt	16 339 004	16 324 263	16 315 667	16 304 609	16 304 846
economic explored reserves	1 518 929	1 496 792	1 487 287	1 475 446	1 475 464
economic prospected reserves	5 998 902	5 995 983	5 993 801	5 993 812	5 746 510
potentially economic reserves	8 821 173	8 831 488	8 834 579	8 835 351	8 839 345
exploitable (recoverable) reserves	180 729	168 538	66 301	56 569	41 844
Mine production, kt	10 967	10 796	8 610	8 341	7 640

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year	2011	2012	2013	2014	2015
P1, kt	590 300	590 300	590 300	590 300	590 300
P2	–	–	–	–	–
P3	–	–	–	–	–

3. Foreign trade

2701 – Bituminous coal, briquettes and similar solid fuels made of bituminous coal

		2011	2012	2013	2014	2015
Import	kt	2 408	1 978	2 153	3 138	2 886
Export	kt	6 257	5 370	4 845	4 315	3 565

2701 – Bituminous coal, briquettes and similar solid fuels made of bituminous coal

		2011	2012	2013	2014	2015
Average import prices	CZK/t	3 521	3 147	2 472	2 161	2 058
Average export prices	CZK/t	3 349	3 012	2 377	2 303	2 255

2704 – Coke and semi-coke from bituminous coal, brown coal or peat, agglomerated retort coal

		2011	2012	2013	2014	2015
Import	kt	552	472	438	787	413
Export	kt	511	431	450	518	523

2704 – Coke and semi-coke from bituminous coal, brown coal or peat, agglomerated retort coal

		2011	2012	2013	2014	2015
Average import prices	CZK/t	6 491	5 232	4 696	4 343	4 345
Average export prices	CZK/t	9 574	8 385	7 366	6 719	6 376

4. Prices of domestic market

Average sale prices of bituminous coal EXW (EUR/tonne) recalculated to CZK/tonne with using of Czech National Bank CZK/EUR exchange rate annual averages

Coal type/Year		2011	2012	2013	2014	2015
coking coal	EUR/tonne	177	125	98	85	90
steam coal	EUR/tonne	67	74	56	54	50
exchange rate	CZK/EUR	24.6	25.1	26.0	27.5	27.3
coking coal	CZK/tonne	4 453	3 112	2 548	2 228	2 457
steam coal	CZK/tonne	1 722	1 857	1 456	1 540	1 365

Sources:
For 2011 – 2013 – New World Resources Annual Report and Accounts 2013. New World Resources Plc, p.45.
For 2014 – New World Resources Annual Report and Accounts 2014. New World Resources Plc, p.43.
For 2015 – New World Resources Annual Report and Accounts 2014. New World Resources Plc, p.34.

OKD, a.s. bituminous coal sales

Coal type/Year			2011	2012	2013	2014	2015
coking coal	sales	tonnes	4 964 500	5 167 830	4 290 210	4 225 372	3 760 717
	revenue	ths CZK	22 390 420	16 574 935	11 147 387	10 806 786	9 573 614
	average price	CZK/ tonne	4 510	3 207	2 598	2 558	2 546
steam coal	sales	tonnes	5 849 660	4 726 870	5 079 459	3 834 365	3 674 358
	revenue	ths CZK	9 577 580	8 738 661	7 371 043	7 141 678	6 894 975
	average price	CZK/ tonne	1 637	1 849	1 451	1 863	1 877

Sources:
For 2011– OKD výroční zpráva 2012, OKD, a.s., pp. 17–18.
For 2012– 2013 – OKD výroční zpráva 2013, OKD, a.s., p. 12.
For 2014– OKD výroční zpráva 2014, OKD, a.s., pp. 11, 74.
For 2015– OKD výroční zpráva 2015, OKD, a.s.,pp. 7, 13, 54.
Note: výroční zpráva – annual report

5. Mining companies in the Czech Republic as of December 31, 2015

OKD, a.s., Ostrava

6. World production and world market prices

World mine production

During 2010 and 2015, world production of bituminous coal developed as follows:

	2011	2012	2013	2014	2015
Steam coal (WBD), mil. t	5,269.1	5,894.1	6,006.9	6,006.1	5,996.5
Coking coal (WBD), mil. t	914.8	1,015.7	1,024.0	1,086.1	1,109.4

Total world production of bituminous coal reached 7,105.9 mil. t in 2014 of which the coking coal, which is regarded a strategic raw material in the EU, accounted for 15.6%.

Main producers according to WBD

2014			2014		
Steam coal			Coking coal		
country	mil. tonnes	%	country	mil. tonnes	%
China	3,040	50.7	China	610	55.0
USA	757	12.6	Australia	181	16.3
India	555	9.3	Russia	76	6.9
Indonesia	468	7.8	USA	75	6.8
RSA	251	4.2	India	57	5.1
Australia	245	4.1	Canada	31	2.8
Russia	212	3.5	Kazakhstan	15	1.4
Kazakhstan	94	1.6	Ukraine	13	1.2
Colombia	83	1.4	Poland	12	1.1
Poland	60	1.0	Mongolia	10	0.9
world	**5,997**	**100.0**	**world**	**1,109**	**100.0**

Main producers according Coal Information, IAE

2015^e			2015^e		
Steam coal			Coking coal		
country	mil. tonnes	%	country	mil. tonnes	%
China	2,916	50.2	China	611	56.1
USA	691	11.9	Australia	191	17.5
India	594	10.2	Russia	78	7.2
Indonesia	467	8.0	USA	57	5.2
Australia	252	4.3	India	55	5.0
South Africa	249	4.3	Canada	26	2.4
Russia	198	3.4	Kazakhstan	16	1.5
Colombia	86	1.5	Poland	13	1.2
Kazakhstan	85	1.5	Mongolia	8	0.7
Poland	60	1.0	Ukraine	6	0.6
world	**5,811**	**100.0**	**world**	**1,090**	**100.0**

e – preliminary values

EURACOAL (Market Report 1/2016) reported, that 7,200 mil. t of bituminous coal was produced globally in 2014 of which about 6,200 mil. t accounted for steam coal and the rest, almost 1,000 mil. t, coking coal. In 2015, world production decreased for the first time since the 90s. It dropped to about 7,000 mil. t., of which about 6,100 miles. t was steam coal and about 900 mil. t. coking coal.

According to the BP Statistical Review of World Energy 2015, at the end of 2014, the world's extractable reserves of anthracite and bituminous (principally coking) coal amounted to 403,199 mil. t. and sub-bituminous (steam) coal and lignite to 488,332 mil. t. Almost three quarters of these reserves are located in five countries (sorted by the size of reserves) USA, Russia, China, Australia, and India.

According Coal Facts 2014, 1,028 mil. t of steam coal and 301 mil. t of coking coal were traded in international markets in 2013. The largest steam coal exporters were Indonesia (423 mil. t), Australia (182 mil. t), and Russia (118 mil. t). They were followed by Colombia (73 mil. t), South Africa (72 mil. t), and the US (47 mil. t). The largest exporter of coking coal was Australia (154 mil. t), followed by the US (60 mil. t), Canada (33 mil. t), Russia (22 mil. t), and Mongolia (15 mil. t). The largest importers of bituminous coal were China (327 mil. t, of which there were 77 million tons o coking coal), followed by Japan (196 mil. t in total, 54 mil. t of coking coal), India (180 mil. t, of which 38 mil. t of coking coal), and South Korea in fourth place (126 mil. t in total, 31 mil. t of coking coal). Interestingly, the importers have become former major producers, such as Ukraine, Germany, and the United Kingdom.

EURACOAL (Market Report 2016) published data on the extent of maritime trade in bituminous coal in 2014 and 2015:

Steam coal (mil. t)

Exporter	2014	2015
Indonesia	348	325
Australia	201	200
Russia	110	128
Colombia	75	79
South Africa	77	73
USA	29	37
Other	28	16
Total	**878**	**858**

Coking coal (mil. t)

Exporter	2014	2015
Australia	185	185
Canada	31	28
USA	53	28
Russia	33	22
World in total	**303**	**264**

World market prices

World prices of coal, both contractual and momentary (spot) ones, are traditionally determined primarily by the prices of American and Australian coal. The last peak of coal prices in Northwest Europe occurred in the summer of 2008, then the prices significantly weakened in the context of the emerging global economic crisis. The gradual rise in prices occurred again in 2010 and in mid-2011 they have been oscillating around a relatively high values of 120–130 USD/t. The absolute long-term peak was reached in January 2011, when the price rose to USD 139.05/t. However, during the second half of that year the price dropped to around 100 USD/t. The cause was an unusually mild onset of winter. Since then coal stocks have been increasing - especially the steam coal. According to EURACOAL, steam coal prices were volatile in 2013 and 21014 with a declining trend. For example, in 2013, 1 tce of steam coal CIF ports of Northwestern Europe peaked in March, when it rose to USD 105.11 or EUR 81.08, and bottomed in July at USD 85.26 or EUR 65,18. In the case of euro prices there was a notable decline by almost EUR 10 to 71.50 EUR/tce in April. Year 2013 closed by the December average price of 97.07 USD/tce or 70.83 EUR/tce. Year 2014 started by the January average price of 95.48 USD/tce or 70.16 EUR/tce. In both cases these were the highest prices of the year because they were followed by a decrease to USD 84.02/tce or EUR 67.92/tce in March. In 2014, the December average price was 84.62 USD/tce or 68.63 EUR/tce. There was a further decline in steam coal price in 2015 and the year ended with USD 45/tce.

EURACOAL (Market Report 2016) brought overview of monthly prices of steam coal in USD/tce and EUR/tce CIF NW Europe converted to 7,000 kcal/kg:

		01	02	03	04	05	06	07	08	09	10	11	12
2014	USD	95.48	93.45	85.59	90.45	88.07	85.40	84.02	88.85	88.87	84.83	84.27	84.62
2014	EUR	70.16	68.41	61.92	65.49	64.13	62.83	62.06	66.73	68.88	66.94	67.57	68.63
2015	USD	77.90	68.76	73.28	69.72	70.39	66.86	69.41	67.25	64.40	60.55	63.12	58.00
2015	EUR	67.03	60.58	67.89	64.23	63.13	59.63	63.12	60.37	57.39	57.90	58.79	53.32

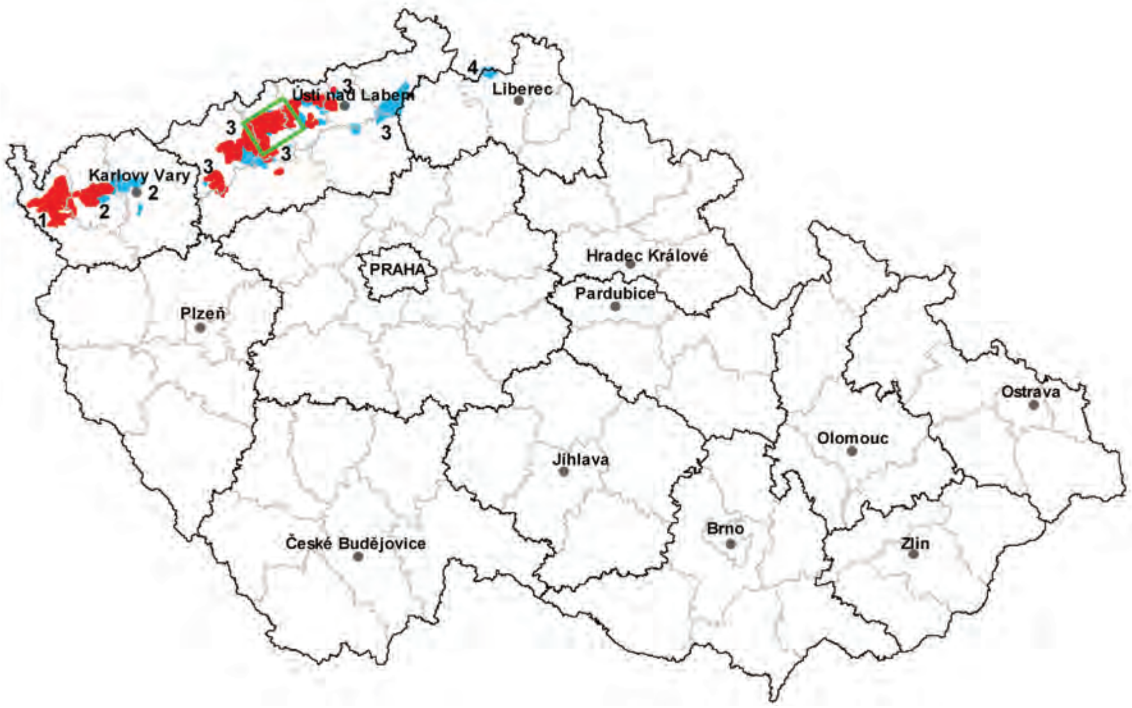
Coking coal done better. In 2011, spot prices of US coking coal averaged to about 280 USD/t FOB. This relatively high price was also affected by difficulties in Australian coal supplies due to the floods in Queensland. During 2012, there was a further fall in prices and in the second half of the year bituminous coal price oscillated around 90 USD/t. Although contractual transactions prevail on a quarterly basis, the importance of momentary trades. It is also linked to the weakening US dollar which made purchases of US coal more attractive in Europe. Coking coal is purchased in relatively small parts, which negatively affects price stability of momentary trades. In Q3 2013, the “spot” price got to the level of USD 152/t. In the same quarter, contract prices reached the level of 145 USD/t. NWR in Ostrava sold coking coal for around 100 EUR/t in the second quarter of 2013 and for about 92 EUR/t in the third quarter. In early 2014, NWR was selling coking coal for EUR 91/t and steam coal for only EUR 60/t. In the last quarter of 2015, coking coal prices fell below USD 100/tce.

BP Statistical Review of World Energy (BP) and the World Bank-The Pink Sheet (WB) report average prices of some types of coal (USD/t):

Year	2011	2012	2013	2014	2015
Market price in NW Europe (BP)	121.52	92.50	81.69	75.38	54.64
Spot prices of the US Central Appalachian coal	87.38	72.06	71.39	69.00	63.69
The price of Japanese imports coking coal CIF (BP)	229.12	191.46	140.45	114.41	93.85
Price of Japanese imports of steam coal CIF (BP)	136.21	133.61	111.16	97.65	79.47
Asian market price (BP)	125.74	105.50	90.90	77.89	63.52
Australian steam coal, 6300kcal CIF Neawcastle (WB)	121.45	96.36	84.56	70.13	57.51
Colombian coal (WB)	111.50	83.99	71.88	65.73	52.51
South African coal (WB)	116.30	92.92	80.24	72.34	57.04

Brown coal

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits

exhausted deposits and other resources

area of ecological territorial limits for mining (Government Resolution no. 444/1991)

Coal basin

*(Names of basins with mined deposits are indicated in **bold type**)*

1 Cheb Basin	3 **North–Bohemian Basin**
2 **Sokolov Basin**	4 Czech part of the Zittau (Žitava) Basin

Territorial ecological mining limits

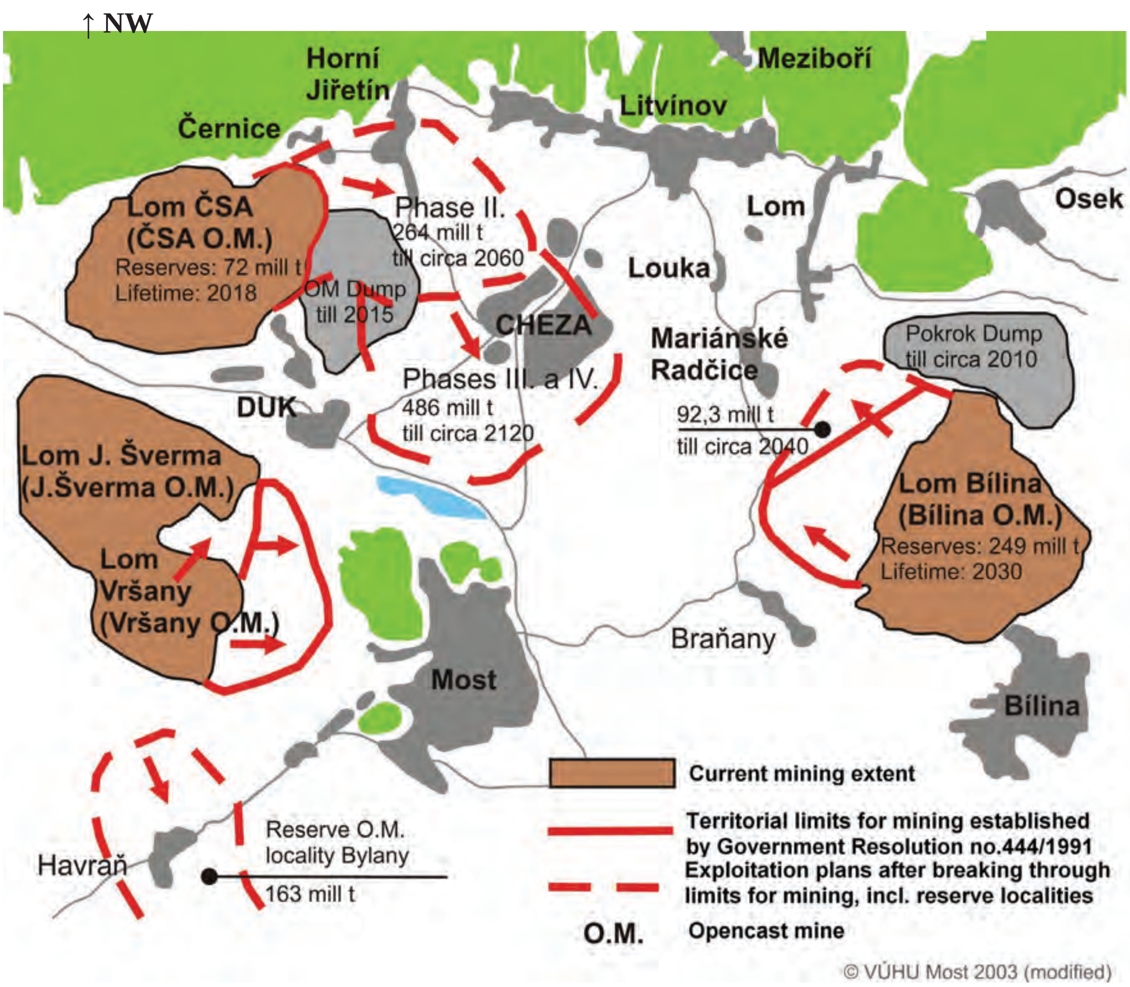
Josef Godány

The relatively large reserves of brown coal in Northern Bohemia (North Bohemian coal basin) are blocked by “Regional environmental limits” for brown coal mining in Northern Bohemia (today this relates only to the North Bohemian coal basin). The limits were set by Czech Government Resolutions Nos. 166, 443, and 490 of 1991 (for the Sokolov coal basin) and Resolution No. 444 of the same year (for the North Bohemian coal basin). The Government

Resolutions define mining areas which should remain unexcavated. The main reason for setting the limits was environmental and landscape protection of Northern Bohemia. However, territorial limits for the Sokolov coal basin were removed relatively soon – by Government Decree No. 511 of 1993.

With diminishing reserves of brown coal in mined areas there is an escalating pressure to reconsider or amend the original decision of 1991, i.e. the preserved Government Resolution No. 444/1991. There was a minor change to the territorial environmental limits in the foreground of the large opencast mine Bílina (deposit in Bílina) by Government Resolution No. 1176/2008 and the subsequent Government Resolution No. 827/2015 which repealed Government Resolution No. 1176/2008 and significantly moved the environmental limit boundary – to the distance of 500 m from the urban area of MariánskéRadčice. This shifted the anticipated end of mining in the mine from 2038 to 2055. The mining company has been ordered to primarily use the mined coal to meet the needs of the heating industry. Government Resolution No. 444/1991 still applies to the remaining deposit area, including the large opencast mine ČSA (deposit in Ervěnice– ČSA mine). The question of breaking the territorial environmental limits in the ČSA opencast mine will remain conditionally open until 2020 (if the current territorial environmental limits are preserved, the mining is expected to end in 2024). The coal reserves behind the territorial environmental limits in the ČSA opencast mine are of the highest quality (the calorific value of coal from this deposit area is at least 17 MJ/kg).

Overall, the environmental territorial limits block about 954 million tonnes of coal reserves. The truth is that brown coal and nuclear power are still the only relevant sources for our energy



sector. Brown coal is also the most important raw material for the Czech heating industry. The main product of the brown coal industry is a dusty brown coal for power stations and heating plants. In the long term, approximately 93% of brown coal produced is consumed by these facilities. Graded coal production for households accounts for the remaining 7%.

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	53	53	53	52	52
exploited	10	11	11	10	9
Total mineral* reserves, kt	8 948 767	8 936 157	8 859 890	8 826 333	8 775 056
economic explored reserves	2 361 825	2 347 268	2 308 649	2 273 951	2 239 329
economic prospected reserves	2 063 444	2 063 444	2 062 445	2 062 445	2 062 445
potentially economic reserves	4 523 498	4 525 445	4 488 796	4 489 937	4 473 282
exploitable (recoverable) reserves	871 142	862 202	825 322	796 277	749 075
Mine production, kt	46 848	43 710	40 585	38 348	38 351

*Notes: * See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

3. Foreign trade

2702 – Brown coal, also agglomerated, except jet

		2011	2012	2013	2014	2015
Import	kt	236	486	447	1 470	1 102
Export	kt	1 188	1 335	1 250	932	928

2702 – Brown coal, also agglomerated, except jet

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 017	1 203	1 263	606	653
Average export prices	CZK/t	1 426	1 543	1 643	1 714	1 686

Note: Jet is a compact black variety of brown coal used in (mourning) jewelry

4. Prices of domestic market

Domestic brown coal prices*

Product specification	2011	2012	2013	2014	2015
graded; cube coal II; 17.6 MJ/kg; Severočeské doly	1 900–2 150	1 930–2 170	2 135–2 150	2 165–2 170	2 185–2 190
graded; nut coal I; 17.6 MJ/kg; Severočeské doly	1 730–1 950	1 960–1 730	1 800–1 850	1 910–1 920	1 950–1 970
graded; nut coal II; 17.6 MJ/kg; Severočeské doly	1 470–1 790	1 810–1 490	1 700–1 800	1 870–1 900	1 985 –2 020
coarse coal dust I, II; Severočeské doly; 16.9 MJ/kg	812–1 169	1 095–1 250	N	N	N
industrial mixture; 10.5–15.6 MJ/kg; Severočeské doly	538–962	570–1 010	N	N	N

** Prices given without taxes on solid fuels.*

Sokolovská uhelná Company has not been producing graded coal since 2009. Mostecká uhelná Company has been selling the coal in auctions, price lists will no longer be issued.

Price quotations*) (for home consumption) of Graded Brown Coal Most (THU**)) quoted on the Energy Exchange of the Czech Moravian Commodity Exchange Kladno (CZK/tonne)

Coal type***)	Calorific value Qir (MJ/kg)	2011		2012	2013	2014	2015
		1.1.–31.3.	1.4–31.12.	1.1.–1.2.			
cube	19.90	1 737	1 775	1 786	–	–	–
nut 1	20.00	1 667	1 695	1 700	–	–	–
nut 2	19.80	929	1 173	1 310	–	–	–

Source: Czech Moravian Commodity Exchange Kladno
Explanations:
**) Prices are quoted in CZK without VAT, solid fuels tax or any other indirect tax and do not include transport costs*
***) THU = tříděné hnědé uhlí*
****) Regular grain size (mm): cube = 40–100, nut 1 = 20–40, nut 2 = 10–20*

Czech Moravian Commodity Exchange Kladno closed down its market with graded brown coal on 31 December 2012 that was organized by independent branch Energy Exchange since 2009. Purpose of the trading in the marketplace was to meet demand for graded brown coal above frame of wholesale – coal depots long-term contracts. Operation of the market was programmed for a term of years 2009 – 2012 and its closure had controlled character.

Domestic steam coal for hoseholds CZK/tonne according to IEA

Product specification	Price components	2011	2012	2013	2014	2015
brown coal; nut coal no 1; net calorific value 3 500–4 000 kcal/kg = 14.6–16.7 MJ/kg	ex-tax basis	2 680	2 645	2 656	2 640	2 617
	excise tax	133	133	133	133	133
	VAT	563	556	586	583	578
	total tax	696	689	719	716	711
	selling price	3 376	3 334	3 375	3 356	3 328

Source: Energy prices and taxes 2016. Quarterly statistics. 2nd quarter 2016. OECD/IEA

5. Mining companies in the Czech Republic as of December 31, 2015

Severočeské doly, a.s., Chomutov
Vršanská uhelná a.s., Most
Sokolovská uhelná, právní nástupce, a.s., Sokolov
Severní energetická a.s., Most

6. World production and world market prices

World mine production

The trend in world production of brown coal for the last five years was as follows:

	2010	2011	2012	2013	2014
Brown coal and lignite (WBD), mill tonnes	854.2	896.0	898.4	861.3	821.1

According to WBD, the main miner in 2014 was Germany with a 21.7% share of world production, followed by the US (8.8%) and Russia (8.4%). Other large producers were Poland (7.8%), Turkey (7.5%), Australia (7.4%), Greece (6.2%), and India (5.9%). The Czech Republic was on the ninth place (4.7%) before Serbia (3.8 %). China, which is one of the leading miners of brown coal, is not included in the list.

According to the World Energy Resources Survey 2013, the world‘s extractable reserves of

According to Key coal trends 2016, main producers were

country	2015^e mil. tonnes	2015^e %
Germany	178	22.1
Russia	73	9.1
Australia	65	8.1
USA	64	7.9
Poland	63	7.8
Turkey	50	6.2
Greece	46	5.7
India	43	5.3
Czech Rep.	38	4.7
Serbia	38	4.7
world	**807**	**100.0**

[e] *– preliminary values*

brown coal reached 488,332 mil. t in late 2013.

Market and prices

Brown coal is subject to world trade to a limited extent only. According to Coal Facts, the traded amount of coal reached 3.7 mil. t in 2011. High volume of international trade was recorded in 2012 (6.9 mil. t). In 2013, there was a decline again (to 4.8 mil. t).

Compared to the trade with bituminous coal, brown coal does not pay off when being transported over long distances. Therefore, trade mainly takes place between neighbouring countries on the basis of contract prices that are not available in the published statistics.

Crude oil

1. Registered deposits and other resources of the Czech Republic

reserved registered deposits   exhausted deposits and other resources

Principal areas of deposits presence:

*(names of areas with exploited deposits are indicated in **bold type**)*

1 **Vienna Basin**	2 **West–Carpathian Foredeep**

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	33	34	39	37	38
exploited	27	27	30	29	28
Total mineral *reserves, kt	30 891	30 781	28 811	27 094	28953
economic explored reserves	20 326	20 108	21 236	21 100	21402
economic prospected reserves	3 983	4 092	1 758	1 747	1735
potentially economic reserves	6 582	6 581	5 817	5 816	5816
exploitable (recoverable) reserves	1 664	1 628	1 534	1 449	1379
Mine production, kt	163	150	152	148	126

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

3. Foreign trade

2709 – Petroleum oils and oils obtained from bituminous minerals, crude

		2011	2012	2013	2014	2015
Import	kt	6 969	7 024	6 631	7 313	7 239
Export	kt	19	21	25	27	28

2709 – Petroleum oils and oils obtained from bituminous minerals, crude

		2011	2012	2013	2014	2015
Average import prices	CZK/t	14 126	16 374	15 966	16 018	10 500
Average export prices	CZK/t	13 733	15 411	14 988	14 119	9 088

271011 – Petrol (Gasoline)

		2011	2012	2013	2014	2015
Import	kt	607	462	561	451	522
Export	kt	315	298	332	459	593

271011 – Petrol (Gasoline)

		2011	2012	2013	2014	2015
Average import prices	CZK/t	18 136	N	N	N	N
Average export prices	CZK/t	17 757	N	N	N	N

Source:
2011 - CZSO
2012 - Oil information 2012. International Energy Agency Statistics. OECD/IEA, 2012.
2013-2015 - Oil information 2016. International Energy Agency Statistics. OECD/IEA, 2016

Czech Republic crude oil import by country and import costs

		2011	2012	2013	2014	2015
Kazakhstan	kt	597	518	620	817	702
Russian Federation	kt	4 102	4 545	4 213	4 164	4 025
Poland	kt	1	–	–	–	–
Italy	kt	–	11	–	–	–
Hungary	kt					22
Other non-OECD Europe/Eurasia (Azerbaijan)	kt	2 038	1 859	1 659	2 317	2 383
Iran	kt	168	–	–	–	–
Algeria	kt	19	141	60	36	–
Total	kt	6 925	7 074	6 552	7 371	7 132
Import costs, average unit value, CIF	USD/bbl	110.42	112.33	110.26	102.13	54.91
	USD/tonne*	813.80	827.87	812.62	752.70	404.69

*Note: *1 tonne = 7.37 bbl (in average)*
Sources: Oil information 2012. International Energy Agency Statistics. OECD/IEA, 2012.
Oil information 2013. International Energy Agency Statistics. OECD/IEA, 2013.
Oil information 2014. International Energy Agency Statistics. OECD/IEA, 2014.
Oil information 2015. International Energy Agency Statistics. OECD/IEA, 2015.

4. Prices of domestic market

Prices of domestic producers are not open to public.

5. Mining companies in the Czech Republic as of December 31, 2015

MND a.s., Hodonín
LAMA GAS & OIL s.r.o., Hodonín

6. World production and world market prices

World mine production

World crude oil production reached these amounts in recent years:

	2011	2012	2013	2014	2015
World crude oil production (WBD), mil. t	3,946.9	4,055.3	4,065.4	4,156.9	N
World crude oil production (BP), mil. t	4,010.6	4,117.4	4,130.2	4,220.6	4,361.9

Note: BP – BP Statistical Review of World Energy. June 2015.

Main producers according to BP

2015[e]		
country	mil. tonnes	%
Saudi Arabia	569	13.0
USA	567	13.0
Russia	541	12.4
Canada	216	5.0
China	215	4.9
Iraq	197	4.5
Iran	183	4.2
United Emirates	176	4.0
Kuwait	149	3.4
Venezuela	135	3.1
world	**4,362**	**100.0**

[e] *– preliminary values*

In 2015, Saudi Arabia lost their leading position (which it held with a big lead for many years) and shared the first place with the US. Compared to past years, the biggest change in the position recorded Canada which moved from the 18th place (held in 2011) to the 5th place in 2013 and 2014. Already in 2014, Mexico was replaced by Venezuela on the 10th place.

According to World Energy Council (2013), recoverable world crude oil reserves were 179,682 mil. t in 2011 and the estimated amount of total reserves was 223,454 mil. t. At the current level of production, such a reserve would last for 56 years. BP reported that proved world reserves amounted to 2,384bn t. at the end of 2015. Shares of the ten countries with the largest reserves were:

Venezuela	17.7 %	Russia	6.0 %
Saudi Arabia	15.7 %	United Emirates	5.8 %
Iran	9.3 %	USA	3.2 %
Iraq	8.4 %	Libya	2.8 %
Kuwait	6.0 %	Nigeria 6	2.2%

Thus, the four leading countries held more than 50% of world reserves of oil and all ten countries together held more than 77%.

Crude oil and products made from it belong to the most internationally-traded commodities. 56,738 thousand barrels of crude oil is traded on international markets every day. According to BP, 1,876.4 mil. t of crude oil and 911.5 mil. t of crude oil products were the subject of world exports and imports in 2014.

World market prices

In last years – beginning with 2009 – world prices rose from nearly USD 60/bbl to more than USD 80/bbl in 2010 and then to a relatively high level of USD 95-110/bbl in 2011–2013 as a result of the "Arab Spring", the Russian aggression against Ukraine, and the Islamic State offensive in Northern Iraq. A more detailed view of these price changes is provided by the price quotes for Brent crude, which serve as benchmarks for the fuel prices in Europe. In 2010, these prices fluctuated from less than 75 USD/bbl to around 85 USD/bbl. In the first half of 2011, the prices rose relatively sharply to more than USD 120/bbl and declined to less than 105 USD/bbl in the second half of the year. At the end of the winter of 2011/2012 prices jumped to nearly 125 USD/bbl and a decline to 100 USD/bbl may be observed in mid-2012. According to EURACOAL data, the price increased to 109.28 USD/bbl in early 203 and the highest monthly average of 112.75 USD/bbl was reached in February. The lowest was price was in May – 100.65 USD/bbl. 2013 was closed by the December price which rose slightly to 104.97 USD/bbl. The year 2014 started the January price of USD 95.48/tce and EUR 70.16/tce. In March came a weakening to USD 84.02/tce or EUR 67.92/tce. In 2014, the December average price was 84.62 USD/tce or 68.63 EUR/tce.

According to EURACOAL (the Market Report 2015), the highest average monthly price of crude oil for 2014 was reported in June and it was USD 107.89/bbl. From September 2014 we can observe an unusually steep drop in prices – as shown in the following table (source: EURACOAL):

2014	September	October	November	December
Crude oil, USD/bbl	95.98	85.06	75.57	59.46

In 2014, the price of Brent Crude declined below 100 USD/bbl for the first time since 2010. In January 2015, Brent crude oscillated around USD 50/bbl and starting by February there was a slight increase above USD 60/bbl. In May, the price reached USD 65/bbl for a short time. Starting by August, the price was moving below USD 50/bbl and at the end of December, Brent crude was quoted at just USD 37.28/bbl.

According to analysts, th price decline from the end of 2014 was caused by a number of factors such as declining demand, weakening dollar, and even geopolitical reasons. Some of the OPEC members changed their tactics (in particular Saudi Arabia) and did not respond to the decline in world oil prices in the usual way, i.e. by lowering production rates. Saudi Arabia, which has the lowest production costs among the crude oil producers, is ok with the situation as it causes economic problems to its competitors.

According to estimates by Deutsche Bank, the minimum profitable price of crude oil is USD 100/bbl for Russia and Oman, USD 126 for Nigeria, USD 136 for Bahrain, and USD

Price development of OPEC's oil basket during years of significant price drops (2014 and 2015, values provided in USD/bbl) was mapped by EURACOAL (Market Report 2016):

Month/ Year	01	02	03	04	05	06	07	08	09	10	11	12
2014	104.71	105.38	104.15	104.27	105.44	107.89	105.61	100.75	95.98	85.06	75.57	59.46
2015	44.38	54.06	52.46	57.30	62.16	60.21	54.19	45.46	44.83	45.02	40.50	33.64

162 for Venezuela. The prices are probably determined by the total production costs until the moment of monetisation of the commodity. The mere mining costs are far lower and depend on the nature of the reservoir. According to data from the US television network CNBC, mining costs in Canada range between 50 and 100 USD/bbl, in Texas it is 40–80 USD and the cost of extracting shale oil is around 50 USD. The lowest costs are in Alaska – around 40 USD per barrel. According to the same source, the mining costs in Saudi Arabia are lower than 10 USD/bbl. CNBC also presented the mining costs at Russian oil deposits – these are supposed to range between USD 40 and 60/bbl.

The average price quotations of crude oil purchases according to the IEA and BP (USD/bbl)

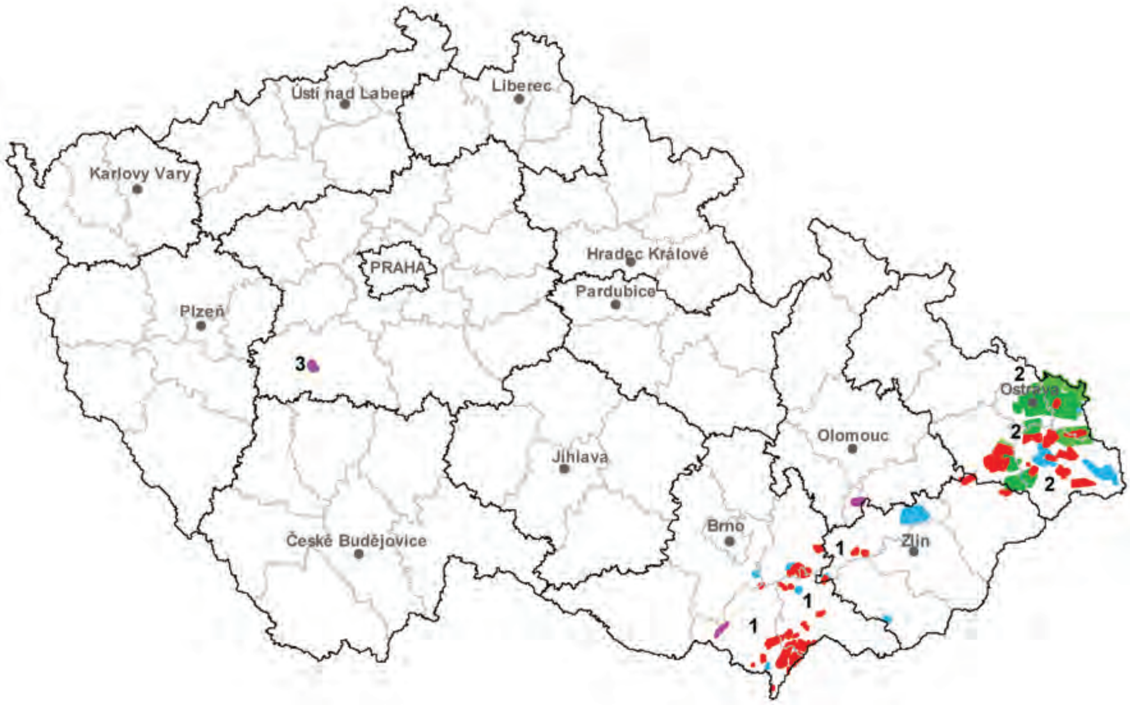
Commodity/Year	Units	Conversion factor	2011	2012	2013	2014	2015
Brent Crude, CIF Rotterdam	USD/bbl	1 t = 7.560 bbl	111.26	111.67	108.66	98.95	52.39
	USD/t		841.13	844.23	821.47	748.06	396.07
Dubai Crude, CIF Rotterdam	USD/bbl	1 t = 7.596 bbl	106.18	109.08	105.47	97.07	51.20
	USD/t		806.54	828.57	801.15	737.34	388.92
West Texas Intermediate (WTI), CIF Rotterdam	USD/bbl	1 t = 7.400 bbl	95.04	94.13	97.99	93.28	48.71
	USD/t		703.30	696.56	725.13	690.27	360.45
Nigerian Forcados Crude, CIF Rotterdam	USD/bbl	1 t = 7.500 bbl	113.65	114.21	111.95	101.35	54.41
	USD/t		852.38	856.58	839.63	760.13	408.08
OPEC Basket, CIF Rotterdam	USD/bbl	1 t = 7.090 bbl	107.46	109.45	105.00	96.29	49.52
	USD/t		761.93	776.00	744.45	682.70	351.10

Note: bbl = abbreviation of term barrel

In 2014, the price of Brent Crude declined below 100 USD/bbl for the first time since 2010.

Natural gas

1. Registered deposits and other resources of the Czech Republic



- reserved registered deposits of natural gas
- exhausted deposits and other resources of natural gas
- reserved registered deposits of natural gas adsorbed on coal seams
- other resources of natural gas adsorbed on coal seams
- underground gas reservoirs

Principal areas of deposits and underground gas reservoirs:

*(Names of regions with mined deposits are indicated in **bold type**)*

1 **South-Moravian region**	2 **North-Moravian region**	3 underground gas reservoir Háje

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	83	90	96	93	95
exploited	48	46	40	40	46
Total mineral *reserves, mill m^3	30 172	30 506	31 085	27 949	30 948
economic explored reserves	7 374	7 243	7 646	7 491	7 494
economic prospected reserves	2 335	2 791	2 981	2 956	2 998
potentially economic reserves	20 463	20 472	20 458	20 458	20 456
exploitable (recoverable) reserves	4 660	4 886	5 512	5 064	5 057
Mine production, mill m^3	187	204	207	198	200

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	mill m^3	16 767	16 767	16 767	16 767	16 767
P_2		–	–	–	–	–
P_3		–	–	–	–	–

3. Foreign trade

271121 – Natural gas

		2011	2012	2013	2014	2015
Import	ths m^3	N	N	N	N	N
Export	ths m^3	N	N	N	N	N

271121 – Natural gas

		2011	2012	2013	2014	2015
Average import prices	CZK/ths m^3	N	N	N	N	N
Average export prices	CZK/ths m^3	N	N	N	N	N

Czech Republic natural gas import by country and import costs

		2011	2012	2013	2014	2015
Norway	million m^3	280	3	4	699	99
Russian Federation	million m^3	9 041	7 468	8 475	6 550	7 375
Total	million m^3	9 321	7 471	8 479	7 249	7 474
Average pipeline import prices	USD/million Btu	11.14	13.22	12.10	8.97	6.97
	USD/MWh	38.02	45.12	41.30	30.61	23.79
	USD/m^3	0.41	0.49	0.45	0.33	0.26

Sources: Natural gas information 2013. International Energy Agency Statistics. OECD/IEA, 2013.
Natural gas information 2014. International Energy Agency Statistics. OECD/IEA, 2014.
Natural gas information 2015. International Energy Agency Statistics. OECD/IEA, 2015.
Natural gas information 2016. International Energy Agency Statistics. OECD/IEA, 2016.
Notes: 1) Own conversion of prices from USD/million Btu to USD/m^3 by equations 1 ft^3 (cubic foot) of natural gas = 1 050 Btu (British thermal unit); 1m^3 = 35.31ft^3; 1m^3 = 37 075,5 Btu
2) 3 412 969 Btu = 1 MWh

4. Prices of domestic market

Prices of domestic producers are open to public incompletely.

Unigeo a.s. shows data in its Annual Reports for 2011–2015 which allow to deduct approximate average prices of natural gas supply to local gas distribution system.

	2011	2012	2013	2014	2015
Unigeo a.s. price – CZK/m^3	< 6,6	< 9	< 9	< 12	< 8

Trading on the Energy Exchange of the Czech Moravian Commodity Exchange Kladno (CMKBK) with the SSDP (composite natural gas supply services of gas products (commodity)) – price quotation*) averages weighted by realized quantity

		2011	2012	2013	2014	2015
To 630 MWh/delivery point (630 MWh = 59 684 m^3)	CZK/MWh **)	696	705	715	660	442
	CZK/ths m^3 ***)	7 347	7 441	7 547	6 960	4 660
Over 630 MWh/delivery point (630 MWh = 59 684 m^3)	CZK/MWh **)	677	690	703	681	561
	CZK/ths m^3 ***)	7 146	7 146	7 420	7 180	5 910

Source: Czech Moravian Commodity Exchange Kladno
Explanations:
SSDP (sdružené služby dodávky zemního plynu) = composite natural gas supply services of gas products (commodity) = natural gas physically delivered into the customers offtake point on the territory of the Czech Republic with obligation of the customer to take delivery of the gas from the distribution network (gas grid) and responsibility of the holder of the natural gas trading licence (supplier) for any deviations in line with relevant legal regulations according to the Energy Act and the relevant implementing and related regulations in force including distribution of natural gas and the system services.

*) *Prices are quoted in CZK without VAT, gas tax or any other indirect tax or similar payment and do not include distribution of natural gas and related services*
**) *Original format of quoted prices*
***) *Recalculated quoted prices with using of calorific value 1 MWh = 94.74 m³ of natural gas*

5. Mining companies in the Czech Republic as of December 31, 2015

MND a.s., Hodonín
Green Gas DPB, a.s., Paskov
LAMA GAS & OIL s.r.o., Hodonín
UNIMASTER spol. s r.o., Praha
Unigeo a.s., Ostrava – Hrabová

6. World production and world market prices

World mine production

The volumes of world natural gas production in recent years were as follows

	2011	2012	2013	2014	2015
World natural gas production (WBD), mil. m^3	3,411.7	3,481.3	3,507.6	3,570.1	N
World natural gas production (BP), mil. m^3	3,233.0	3,310.8	3,347.6	3,460.6	3,538.6

Note: BP – BP Statistical Review of World Energy 2016.

Main producers according to BP

2015		
country	**USD/m³**	**%**
USA	767	21.7
Russia	573	16.2
Iran	193	5.5
Qatar	181	5.1
Canada	174	4.9
China	138	3.9
Norway	117	3.3
Saudi Arabia	106	3.0
Nigeria	83	2.3
Indonesia	75	2.1
world	**3,539**	**100.0**

[e] *– preliminary values*

The first two producers – the US and Russia – provided more than 38% of the entire world production, the first five one half of world production (53.2%), and all ten producers together accounted for even more than three quarters (75.9%) of world production in 2015.

BP estimated that proved world natural gas reserves were 187,100 bil. m³ in 2015. The first five countries have more than 63% of world reserves on their territories. These are Iran (18.2%), Russia (17.3 %), Qatar (13.1%), Turkmenistan (9.3%), and USA (5.6 %).

Natural gas prices in various countries according to the Statistical Review of Energy 2016 (USD/mil. Btu converted to USD/m³ and USD/MWh)

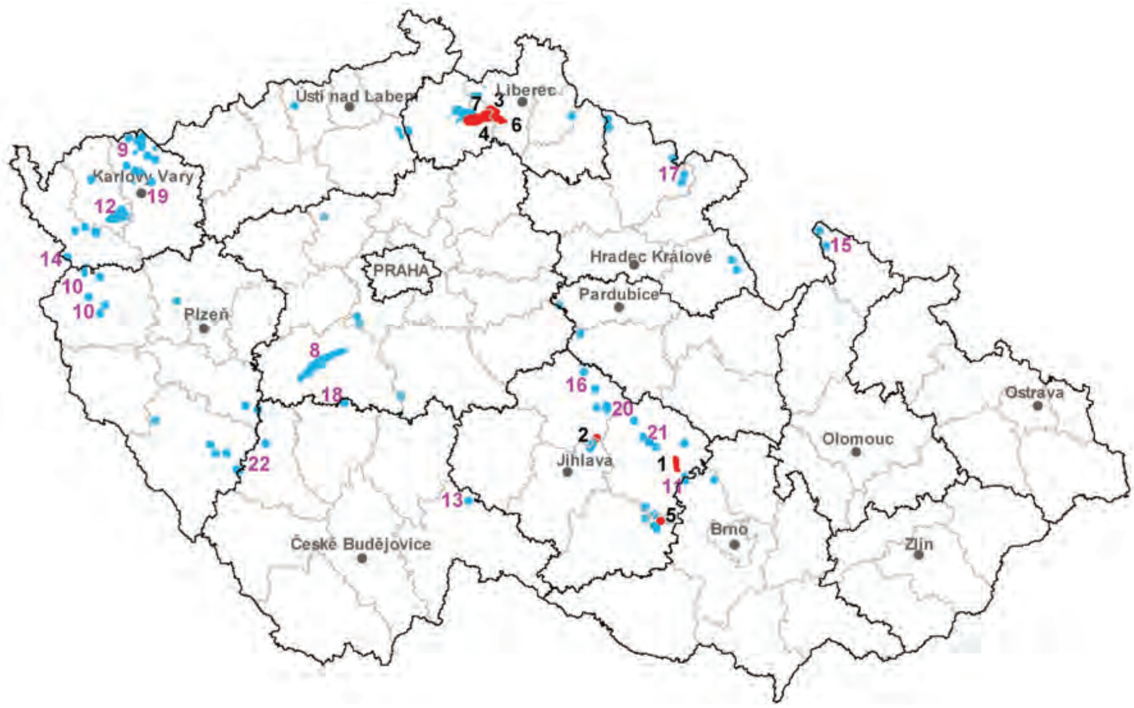
Country/year		2011	2012	2013	2014	2015
Germany, average import price	USD/mil. Btu	10.48	11.03	10.73	9.11	6.61
	USD/MWh	35.77	37.65	36.59	31.09	22.56
	USD/m³	0.39	0.41	0.4	0.33	0.25
United Kingdom, Heren NBP Index	USD/mil. Btu	9.04	9.46	10.63	8.22	6.53
	USD/MWh	30.85	32.29	36.28	28.05	22.29
	USD/m³	0.34	0.35	0.39	0.30	0.25
USA, Henry Hub, spot price	USD/mil. Btu	4.01	2.76	3.71	4.35	2.60
	USD/MWh	13.69	9.42	12.66	14.85	8.87
	USD/m³	0.15	0.1	0.14	0.16	0.10
Canada (Alberta)	USD/mil. Btu	3.47	2.27	2.93	3.87	2.01
	USD/MWh	11.84	7.75	10.00	13.21	6.86
	USD/m³	0.13	0.08	0.11	0.14	0.07

Note:
1) The price conversion from USD/mil. Btu to USD/m³ was performed by the use of the following ratios: 1 ft³ (cubic foot) of natural gas = 1,050 Btu (British thermal unit); 1 m³ = 35.31 ft³; 1 m³ = 37,075.5 Btu
2) 3,412,969 Btu = 1 MWh

In early 2015, the listed price of natural gas on the US stock exchange NYMEX was USD 2.89/mil. Btu, in October the price oscillated around USD 2.50/mil. Btu, in December it fell under USD 2 and it ended the year at the level of USD 2.21/mil. Btu.

Uranium

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits   exhausted deposits and other resources

Reserved registered deposits

*(Names of mined deposits are indicated in **bold type**)*

1 **Rožná**	3 Břevniště pod Ralskem	5 Jasenice-Pucov	7 Stráž pod Ralskem*
2 Brzkov	4 Hamr pod Ralskem	6 Osečná-Kotel	

** uranium is recovered only as a byproduct from the treatment of groundwater and technological solutions during mine liquidation and reclamation work upon termination of in-situ leaching (ISL), otherwise in situ recovery (ISR), of uranium ores*

Exhausted deposits and other resources

8 Příbram	13 Okrouhlá Radouň	18 Předbořice
9 Jáchymov	14 Dyleň	19 Hájek + Ruprechtov
10 Zadní Chodov + Vítkov 2	15 Javorník	20 Chotěboř
11 Olší	16 Licoměřice-Březinka	21 Slavkovice
12 Horní Slavkov	17 Radvanice + Rybníček + Svatoňovice	22 Mečichov-Nahošín

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	7	7	7	7	7
exploited	1	1	1	1	1
Total mineral * reserves, t U	135 276	135 214	135 144	135 071	135 071
economic explored reserves	1 406	1 323	1 327	1 321	1 330
economic prospected reserves	19 402	19 458	19 427	19 463	19 448
potentially economic reserves	114 468	114 433	114 391	114 287	114 259
exploitable (recoverable) reserves	338	312	284	314	308
Mine production, t U	252	222	232	165	134
Production of concentrate, t U **	216	219	206	146	122

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*
*** sales production (without ore milling losses)*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	t U	19 025	19 025	19 025	19 025	19 025
P_2,	t U	2 181	2 181	2 181	2 181	2 181
P_3		–	–	–	–	–

Other* prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	t U	202 827	202 827	–	–	–
P_2,	t U	16 522	16 522	–	–	–
P_3		–	–	–	–	–

** Prognostic resources of uranium-bearing sandstones type in the Bohemian Cretaceous Basin, unexploitable at the present time*

3. Foreign trade

28441030 – Natural uranium – wrought

		2011	2012	2013	2014	2015
Import	t U	N	0,001	N	N	N
Export	t U	176	242	264	193	118

28441030 – Natural uranium – wrought

		2011	2012	2013	2014	2015
Average import prices	CZK/kg U	N	96 000	N	N	N
Average export prices	CZK/kg U	3 032	3 228	2 878	3 082	10 183

4. Prices of domestic market

Extracted uranium is exported.

5. Mining companies in the Czech Republic as of December 31, 2015

DIAMO, s. p., Stráž pod Ralskem

6. World production and world market prices

World mine production

In recent years, the volume of world production of uranium expressed in terms of the U_3O_8 content of ores was as follows:

	2011	2012	2013	2014	2015
Uranium production, U_3O_8 (according to WBD)	63,252	70,100	70,806	67,944	N
Uranium production, t U (according to WNA*)	53,493	58,489	59,331	56,041	60,496

Note:

*1) * Uranium mining production. World Nuclear Association. July 2016.*

2) 1 t U = 1.179 t U_3O_8

According to Uranium Investing News.com (INN), the primary production of U reached the following values in recent years:

Year	2013	2014	2015
tonnes U	59 331	56 041	60 514

Main producers according to WNA

2015		
U_3O_8		
country	**tonnes**	**%**
Kazakhstan	23,800	39.3
Canada	13,325	22.0
Australia	5,654	9.3
Niger	4,116	6.8
Russia	3,055	5.0
Namibia	2,993	4.9
Uzbekistan	2,385	3.9
China	1,616	2.7
USA	1,256	2.1
Ukraine	1,200	2.0
world	**60,496**	**100.0**

[e] – *preliminary values*

The production was therefore quite concentrated as the first three countries produce 72% of all primary uranium and the first five almost 84%.

According to the World Nuclear Association (2013), the world´s known recoverable resources of uranium amounted to 5902,9 kt. The leading producers´ shares of these resources were as follows:

Australia	29%	Namibia	6%
Kazakhstan	12%	South Africa	6%
Russia	9%	Brazil	5%
Canada	8%	USA	4%
Niger	7%	China	4%

According to the "Red Book 2014", the breakdown of global uranium resources (one thousand tons U) by categories (Identified, Reasonably Assured - RAR, Inferred) and by price was as follows in 2013:

Resource category	2013
Identified (total)	
<USD 260/kg U	7 635.2
<USD 130/kg U	5 902.9
<USD 80/kg U	1 956.7
<USD 40/kg U	682.9
RAR (reasonably assured resources)	
<USD 260/kg U	4 587.2
<USD 130/kg U	3 698.9
<USD 80/kg U	1 211.6
<USD 40/kg U	507.4
Inferred resources	
<USD 260/kg U	3 048.0
<USD 130/kg U	2 204.0
<USD 80/kg U	745.1
<USD 40/kg U	175.5

Note:
1) Identified resources = RAR + Inferred resources
2) Resources in the price category <40 USD/kg U are probably higher than the reported values because some counties either do not have detailed calculation, or the data are confidential.
3) "Red Book 2014" - Uranium 2014:Resources, production and demand. OECD Nuclear Energy Agencyand the International Atomic Energy Agency. OECD Nuclear Energy Agency 2014.

In recent years, there has been a change in the overall ratio of primary uranium extraction methods, mainly as a result of a sharp and continuous rise in production in Kazakhstan, and also due to a slight decline in production in Australia and Canada. Underground mining accounted for 32% of primary uranium production in 2010, but for roughly only 30% (about 16 100 t) already in 2011. By contrast, uranium production from in-situ leaching increased significantly. Its share of production of around 30% in 2009 grew to roughly 40% in 2010, and in-situ leaching (ISL) accounted for around 51% of primary uranium production in 2014. One of the reasons for the high proportion of ISL is a lower metal content of Kazakhstan deposits, while the Canadian deposits (McArtur River, Rabbit Lake, Cigar Lake) are characterised by high metal contents with up to 18% U_3O_8. The share of open pit uranium mining declined from 25% in 2005 to nearly 19% in 2012. In 2014, the mined uranium´s share reached 42% and the share of uranium recovered as a by-product from the processing of other ores, usually Au and Cu, basically depends on the production of two deposits - Olympic Dam (Australia) and Vaal River (South Africa) and reached about 7% in 2014. The rest of uranium was obtained by other methods, e.g. by leaching heaps, during decontaminations (mostly during cleaning the contaminated mine water), etc.

Since 2011, the state-owned Kazakh companyKazAtomProm has been the largest mining company as a result of a sharp rise in Kazakhstan´s production. The French company AREVA and Canada´s CAMECO share second and third place. AREVA has a major stake in two deposits mined in Niger, in two in Kazakhstan and in Canada. CAMECO operates deposits in Canada, and has a 70% stake in the world´s richest deposit McArthur River (the remainder is held by AREVA). Together, these three companies produce roughly 50% of the world´s uranium. They are followed distantly by the Australian company BHP Billiton, which operates the Olympic Dam deposit.

According to WNA, almost 67% of the world production came from these 15 largest deposits (some rows have more than a single mine, these mines are operated and reported jointly) in 2015:

Deposit	**Country**	**Method of obtaining:** Opencast mine – OM Underground mine – UM In situ leaching – ISL	**Tonnes of U**
McArthur River	Canada	UM	7,354
Cigar Lake	Canada	UM	4,345
Tortkuduk + Myunkum	Kazakhstan	ISL	4,109
Olympic Dam	Australia	UM	3,161
SOMAIR	Niger	OM	2,509
Inkai	Kazakhstan	ISL	2,234
Budenovskoe 2	Kazakhstan	ISL	2,061
South Inkai	Kazakhstan	ISL	2,055
Priangursky	Russia	UM	1,977
Langer Heinrich	Namibia	OM	1,937
Central Mynkuduk	Kazakhstan	ISL	1,847
Ranger	Australia	OM	1,700
Budenovskoe 1, 3+4	Kazakhstan	ISL	1,642
Rabbit Lake	Canada	UM	1,621
COMINAK	Niger	UM	1,607

After reaching a historic peak in 2007, prices fell relatively sharply and approached the 100 USD/kg threshold in the first quarter of 2009. They remained practically unchanged in the following one and a half years, fluctuating between 110 and 120 USD/kg. However, they began to rise in the last quarter of 2010 and peaked between 180 and 190 USD/kg in January and February 2011. They declined slightly during the next three months and stabilized between 130 and 140 USD/kg since the second half of 2011. This period of price stability continued until July 2012; since then, prices declined and hovered around 113 USD/kg at the end of 2012. The trend in prices continued with another decline in 2013 and the price stabilized at around 80-85 EUR/kg U. According to the WNA, "spot" prices fluctuated between 34 and 45 USD/lb U_3O_8 at the end of 2014.

ESA average annual prices of natural uranium (EUR/kg U) according to EU Nuclear Observatory

	2011	2012	2013	2014	2015
Long-term price	83.45	90.03	85.19	78.31	94.30
Spot price	107.43	97.80	78.24	74.65	88.73

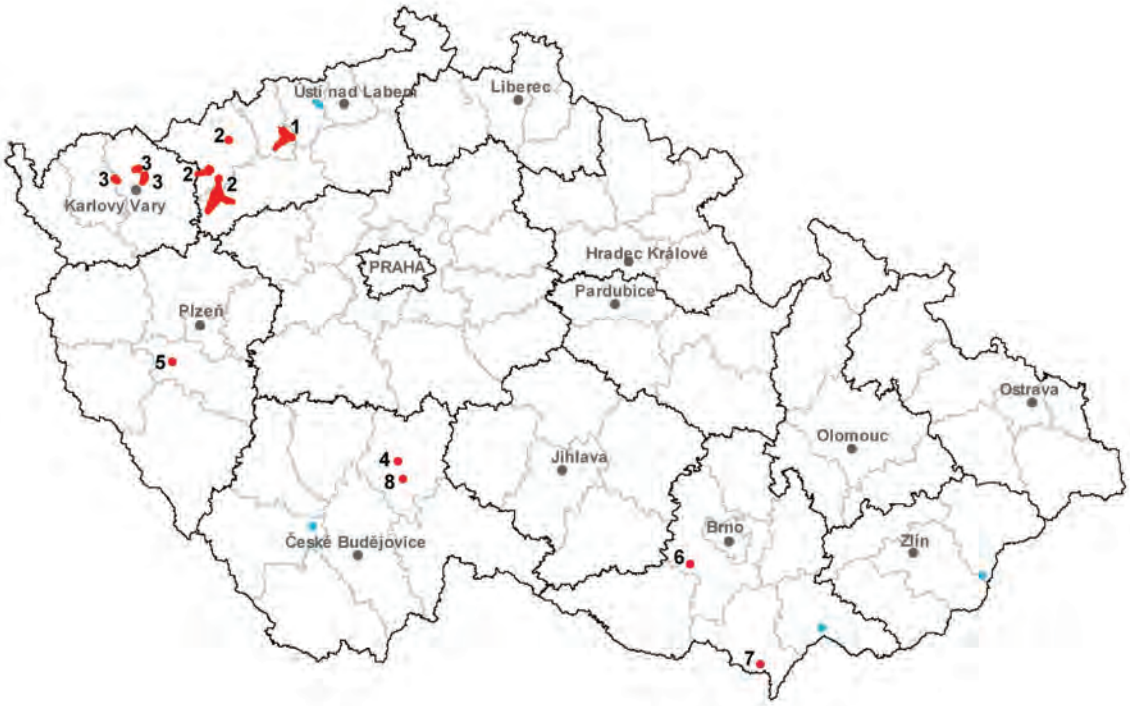
Note: ESA - Euratom Supply Agency, the European Agency for the common supply policy based on the principle of fair and equitable supplies of nuclear fuels to European users

As shown in the table above, 2015 saw the highest uranium prices in the last five years.

INDUSTRIAL MINERALS

Bentonite

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits   exhausted deposits and other resources

Principal areas of deposits and deposits outside them

*(Names of areas and the mined deposit outside are indicated in **bold type**)*

1 **České středohoří Mts.**
2 **Doupovské hory Mts.**
3 **Sokolov Basin**
4 **Maršov u Tábora**
5 Dněšice – Plzeňsko jih
6 Ivančice – Réna
7 Poštorná
8 Rybova Lhota

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	33	35	35	37	36
exploited	6	6	6	8	7
Total mineral *reserves, kt	292 159	302 946	294 885	306 992	306 793
economic explored reserves	73 849	73 832	73 703	73 515	73 316
economic prospected reserves	116 400	126 365	128 326	128 326	128 326
potentially economic reserves	101 910	102 749	105 151	105 151	105 151
exploitable (recoverable) reserves	29 599	29 438	30 493	30 843	30 656
Mine production, kt**	160	221	226	301	369

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*
*** Including montmorillonite clays from kaolin deposits overburden*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	23 792	23 792	23 792	27 017	27 017
P_2,	kt	36 874	36 874	36 874	36 874	36 361
P_3		–	–	–	–	–

3. Foreign trade

250810 – Bentonite

		2011	2012	2013	2014	2015
Import	kt	40	39	45	63	65
Export	kt	144	151	163	168	169

250810 – Bentonite

		2011	2012	2013	2014	2015
Average import prices	CZK/t	5 485	2 815	2 752	2 090	2 238
Average export prices	CZK/t	3 134	2 675	2 846	2 958	2 996

250820 – Decolourizing earths and fuller's earth

		2011	2012	2013	2014	2015
Import	kt	0	0	0	0	0
Export	kt	0	0	0	0	0

250820 – Decolourizing earths and fuller's earth

		2011	2012	2013	2014	2015
Average import prices	CZK/t	–	–	–	–	–
Average export prices	CZK/t	–	–	–	–	–

4. Prices of domestic market

Bentonite prices are not quoted.

5. Mining companies in the Czech Republic as of December 31, 2015

KERAMOST, a.s., Most
Sedlecký kaolin a.s., Božičany
KSB s.r.o., Božičany

6. World production and world market prices

World mine production

	2011	2012	2013	2014	2015^{e}
World mine production (according to MCS), kt	10,300	9,950	12,000	16,100	16,000
World mine production (according to WBD), kt	15,778.9	17,024.5	16,364.1	17,783.8	N

^{e} *– preliminary values*

In the Raw Material Yearbook 2015 we pointed out a discrepancy between the data of MCS and WBD, namely the missing data of China MCS statistics. This shortcoming was removed in MCS 2016 and the data for 2014 from both sources are comparable now:

Main producers according to MCS					Main producers according to WBD		
country	2014		2015^e		country	2014	
	kt	%	kt	%		kt	%
USA	4,800	29.8	4,320	27.0	USA	4,800	27.0
China	3,500	21.7	3,500	21.9	China	3,600	20.2
Greece	1,080	6.7	1,300	8.1	India	1,380	7.8
India	1,010	6.3	1,800	11.3	Turkey	1,088	6.1
Turkey	650	4.0	700	4.4	Greece	1,011	5.7
Mexico	500	3.1	600	3.8	Mexico	830	4.7
Brazil	440	2.7	440	2.8	Russia	680	3.8
Iran	430	2.7	430	2.7	Japan	500	2.8
Germany	360	2.2	360	2.3	Iran	420	2.4
Czech Rep.	230	1.4	310	1.9	Bulgaria	411	2.3
world	**16,100**	**100.0**	**16,000**	**100.0**	**world**	**17,784**	**100.0**

e – preliminary values

According BWD, Germany is 11th with a share of 2.2% and the Czech Republic is 12th with a share of 1.7%.

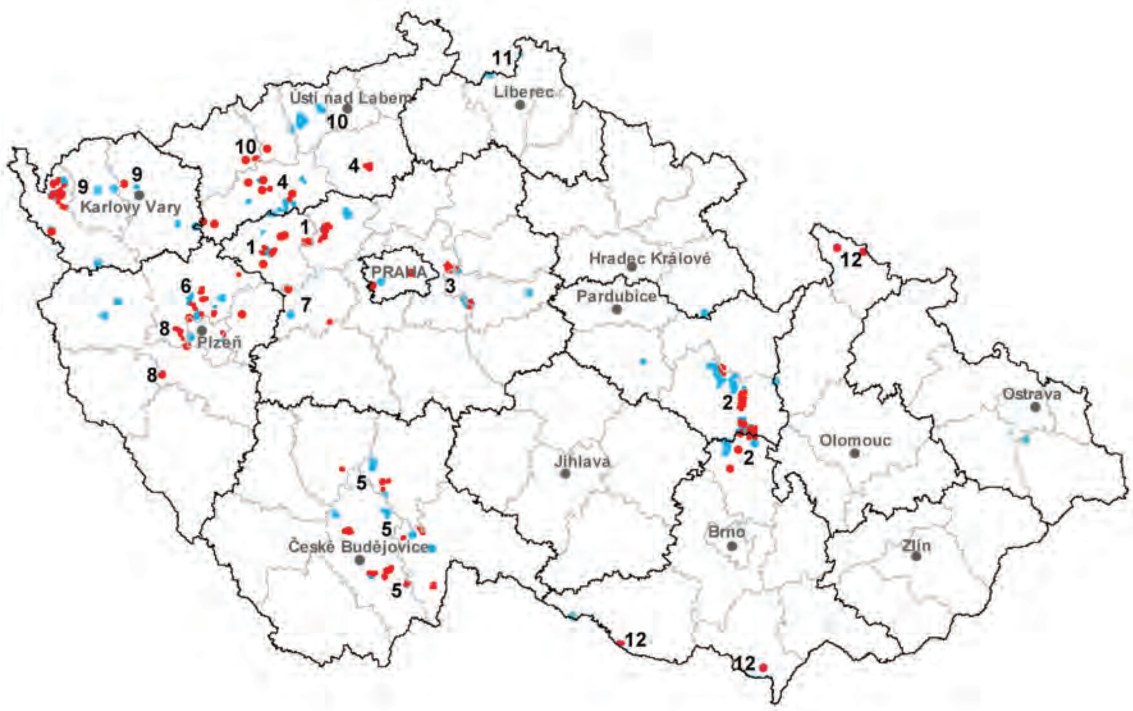
Prices of traded commodities (according to IM)

Commodity/Year		2011	2012	2013	2014	2015
Bentonite, cat litter, grade1–5 mm, bulk, FOB main European port	EUR/t	42–60	42–60	42–60	42–60	42–60
Bentonite, Indian, cat litter grade, crushed, dried, loose in bulk, FOB Kandla	USD/t	34–38	34–38	34–38	34–38	32–35
Bentonite, API grade, bagged, rail-car, ex-works Wyoming	USD/st	70–120	90–130	90–130	90–130	95–135
Bentonite, foundry grade, bagged, railcars, ex-works Wyoming	USD/st	90–115	90–124	97–124	97–124	97–124
Bentonite, IOP grade, crude, bulk, ex-works Wyoming	USD/st	55–60	66–72	66–72	66–72	60–72
OCMA/Foundry grades, crude & dried, bulk, FOB Milos	EUR/t	50–75	50–80	60–80	60–80	60–80
Bentonite, dried material in bulk, FOB Greece	EUR/t	N	50–75	65–75	65–75	65–75
Bentonite, cat litter grade, ex-works Wyoming	USD/st	N	50–60	50–60	50–65	47–65

The price range includes the lowest and highest monthly price quotes for a given year
Note: st – short ton; 1 st = 0,9072 t

Clays

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits   exhausted deposits and other resources

Major deposit areas:

(Names of areas with exploited deposits are in ***bold****)*

1 **Kladno-Rakovník Carboniferous**
2 **Moravian and East Bohemian Cretaceous**
3 **Cretaceous around Prague**
4 **Louny Cretaceous**
5 **South Bohemian Basins**
6 **Plzeň Basin**
7 **Tertiary relicts of Central Bohemia**
8 **Tertiary relicts of West Bohemia**
9 **Cheb Basin and Sokolov Basin**
10 **North Bohemian Basin**
11 Zittau Basin
12 Tertiary and Quaternary in Moravia

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	108	108	108	108	108
exploited	17	18	18	18	17
Total mineral *reserves, kt	925 554	920 624	923868	922 396	921 734
economic explored reserves	180 393	175 184	176 926	176 291	175 766
economic prospected reserves	401 667	399 478	399 072	398 263	398 216
potentially economic reserves	343 494	345 962	347 870	347 842	347 752
exploitable (recoverable) reserves	51 742	43 680	42 839	42 102	43 485
Mine production, kt	498	485	465	518	569

** See* ***NOTE*** *in the chapter* ***Introduction*** *above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter* ***Mineral reserve and resource classification in the Czech Republic*** *of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	330 710	331 988	331 988	331 988	331 988
P_2,	kt	38 196	38 196	38 196	38 196	38 196
P_3		–	–	–	–	–

3. Foreign trade

2508 – Other clays (not including expanded clays of heading 6806), andalusite, kyanite and sillimanite, whether or not calcined; mullite; chamotte or dinas earth

		2011	2012	2013	2014	2015
Import	t	78 294	74 210	84 299	95 314	99 527
Export	t	239 909	286 309	295 808	324 716	307 902

2508 – Other clays (not including expanded clays of heading 6806), andalusite, kyanite and sillimanite, whether or not calcined; mullite; chamotte or dinas earth

		2011	2012	2013	2014	2015
Average import prices	CZK/t	4 807	3 816	3 981	3 454	3 565
Average export prices	CZK/t	3 146	2 451	2 797	2 693	2 731

250830 – Refractory (fire) clay

		2011	2012	2013	2014	2015
Import	t	13 243	7 350	11 350	9 182	9 285
Export	t	22 540	22 068	10 869	21 211	17 547

250830 – Refractory (fire) clay

		2011	2012	2013	2014	2015
Average import prices	CZK/t	3 264	3 160	3 353	3 457	3 568
Average export prices	CZK/t	1 197	1 272	2 042	3 457	1 358

250840 – Other clays

		2011	2012	2013	2014	2015
Import	t	12 667	15 503	14 004	14 721	9 240
Export	t	51 453	73 481	62 632	71 729	82 239

250840 – Other clays

		2011	2012	2013	2014	2015
Average import prices	CZK/t	15 503	14 004	14 721	9 240	11 059
Average export prices	CZK/t	73 481	62 632	71 729	82 239	71 547

250870 – Chamotte or dinas earth

		2011	2012	2013	2014	2015
Import	t	1 559	2 457	2 551	4 132	4 034
Export	t	848	843	1 472	974	954

250870 – Chamotte or dinas earth

		2011	2012	2013	2014	2015
Average import prices	CZK/t	5 842	6 260	5 970	6 384	7 165
Average export prices	CZK/t	3 959	4 243	4 681	4 840	4 842

4. Prices of domestic market

Various qualities of clay have different market prices. Prices are made public in the limited extent only (some producers do not publish them at all). They fluctuate generally between CZK 70 – 4 400 per tonne.

5. Mining companies in the Czech Republic as of December 31, 2015

Whiteware clays
KERACLAY, a.s., Brník
LB MINERALS, s.r.o., Horní Bříza

Refractory clays for grog
KERACLAY, a.s., Brník
České lupkové závody, a.s., Nové Strašecí
P-D Refractories CZ a.s, Velké Opatovice
RAKO - LUPKY s.r.o., Lubná u Rakovníka

Other refractory clays (ball clays)
LB MINERALS, s.r.o., Horní Bříza

Non-refractory ceramic clays
LB MINERALS, s.r.o., Horní Bříza
Sedlecký kaolin a.s., Božíčany

6. World production and world market prices

World mine production

There are no recognised figures of world production and world trade with clays (referred to as other refractory clays in our terminology) because of difficulties in classifying these clays on a uniform basis and the questionability of their direct comparability based on quality and use. However, the world‘s leading producer and exporter of high-quality other refractory clays is the United Kingdom (Source: Ball clay. Mineral Planning Factsheet.-British Geological Survey-National Environment Research Council 2011).

Mine production of clays in the United Kingdom

		2011	2012	2013	2014	2015
Clays and slate	kt	6,154	5,497	6,464	6,806	N
Other refractory clays	kt	930	748	740	733	N

Source: United Kingdom minerals yearbook 2015.- British Geological Survey, Keyworth, Nottingham, 2016.

World fuller's earth production (MCS):

MCS statistics contains worldwide values of fuller's earth production:

	2011	2012	2013	2014	2015^e
World production, kt	3,210	2,980	3,000	3,260	3,240

^{e} *– preliminary values*

World production of fuller's earth (MCS):

	2014			2015^e	
country	**kt**	**%**	**country**	**kt**	**%**
USA	1,990	61.0	USA	1,970	60.8
Spain	647	19.8	Spain	645	19.9
Senegal	235	7.2	Senegal	235	7.3
Mexico	110	3.4	Mexico	110	3.4
India	6	0.2	India	6	0.2
world	3,260	100.0	world	3,240	100.0

^{e} *- preliminary values*

In statistics, the group of clays also includes raw materials consisting of minerals and rocks serving for non-clay refractory material production: kyanite, sillimanite, shales, siliceous sandstone (quartzite) – dinas.

World clay resources are extremely extensive.

World market prices

Clay prices are generally not provided. In the reporting period of 2011–2015, Industrial Minerals quoted indicative prices of minerals belonging to the sillimanite group:

commodity/year	2011	2012	2013	2014	2015
Andalusite, 55%-59% Al_2O_3, FOB European port, EUR/t	335–400	345–425	350–425	350–425	355–425
Andalusite, 57% -58% Al_2O_3, 2,000 t. batches, bulk, FOB Transvaal, EUR / t	225–265	230–280	235–280	235–280	235–290
Kyanite, 54% -60% Al2O3, 18-22 st batches, raw, ex-works USA, USD/st	211–320	224–320	224–320	224–320	225–320
Kyanite, 54% -60% Al2O3, 18-22 st batches, calcined, ex-works USA, USD/st	351–439	373–439	373–439	373–439	375–440
Mulcoa *products, 47% Al_2O_3, bagged, FOB USA USD/t	198	198	198	198	195–200

Note:
st – short ton; 1 st = 0,9072 t
** - Mulcoa is a registered trademark of calcined aluminosilicate produced in Georgia, USA. It is a clay with a high mullite content produced by calcining of clays with a low content of alkali to obtain stable quality and chemical composition.*
Mulcoa product business numbers are 45, 60, 70. The products are used to produce high quality solid clay and refractory products.
German DERA Preismonitor (Dez. 2015) provides the annual average price of fused white clay: 25kg bags, CIF Europe – EUR 823.33/t.

Diatomite

1. Registered deposits and other resources of the Czech Republic

reserved registered deposits   exhausted deposits and other resources

Exploited deposit: 1 Borovany-Ledenice

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	1	1	1	1	1
exploited	1	1	1	1	1
Total mineral *reserves, kt	4 318	2 573	2 520	2 482	2463
economic explored reserves	3 990	1 859	1 808	1 772	1755
economic prospected reserves	328	0	0	0	0
potentially economic reserves	0	714	712	710	708
exploitable (recoverable) reserves	4 303	1 673	1 624	1 590	1575
Mine production, kt	46	43	49	34	15

** See NOTE in the chapter* ***Introduction*** *above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter* ***Mineral reserve and resource classification in the Czech Republic*** *of this yearbook*

3. Foreign trade

2512 – Siliceous fossil meal*, siliceous earth

		2011	2012	2013	2014	2015
Import	t	3 268	3 830	3 703	6 927	8 929
Export	t	5 182	6 773	7 031	8 438	12 401

2512 – Siliceous fossil meal*, siliceous earth

		2011	2012	2013	2014	2015
Average import prices	CZK/t	8 143	8 687	9 034	6 868	6 302
Average export prices	CZK/t	5 684	6 101	6 548	6 111	5 416

*Note: * diatomite*

6901 – Bricks, blocks, tiles and other ceramic goods of siliceous fossil meals

		2011	2012	2013	2014	2015
Import	t	2 452	15 014	12 425	13 715	24 918
Export	t	50	68	72	31	73

6901 – Bricks, blocks, tiles and other ceramic goods of siliceous fossil meals

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 913	1 248	1 294	1 473	1 253
Average export prices	CZK/t	62 086	46 473	23 292	24 847	3 740

4. Prices of domestic market

Diatomite was sold domestically for CZK 9 800–16 500 per tonne.

5. Mining companies in the Czech Republic as of December 31, 2015

LB MINERALS, s.r.o., Horní Bříza

6. World production and world market prices

World mine production

World production of diatomite in the past five years was as follows:

	2011	2012	2013	2014	2015^e
World mine production (according to MCS), kt	2,100	2,120	2,270	2,360	2,290
World mine production (according to WBD), kt	1,973.4	2,100.0	2,222.5	2,232.7	N

^{e} *– preliminary values*

Main producers according to MCS

	2015^e	
country	**kt**	**%**
USA	925	40.4
China	420	18.3
Peru	125	5.5
Japan	100	4.4
Denmark (adjusted)	95	4.1
Mexico	80	3.5
France	75	3.3
Russia	70	3.1
Argentina	55	2.4
Czech Republic	50	2.2
world	**2,290**	**100.0**

^{e} *– preliminary values*

The statistics describes the extent of world resources as large. According to MCS, the USA has 250 000 kt of resources and China 110 000 kt.

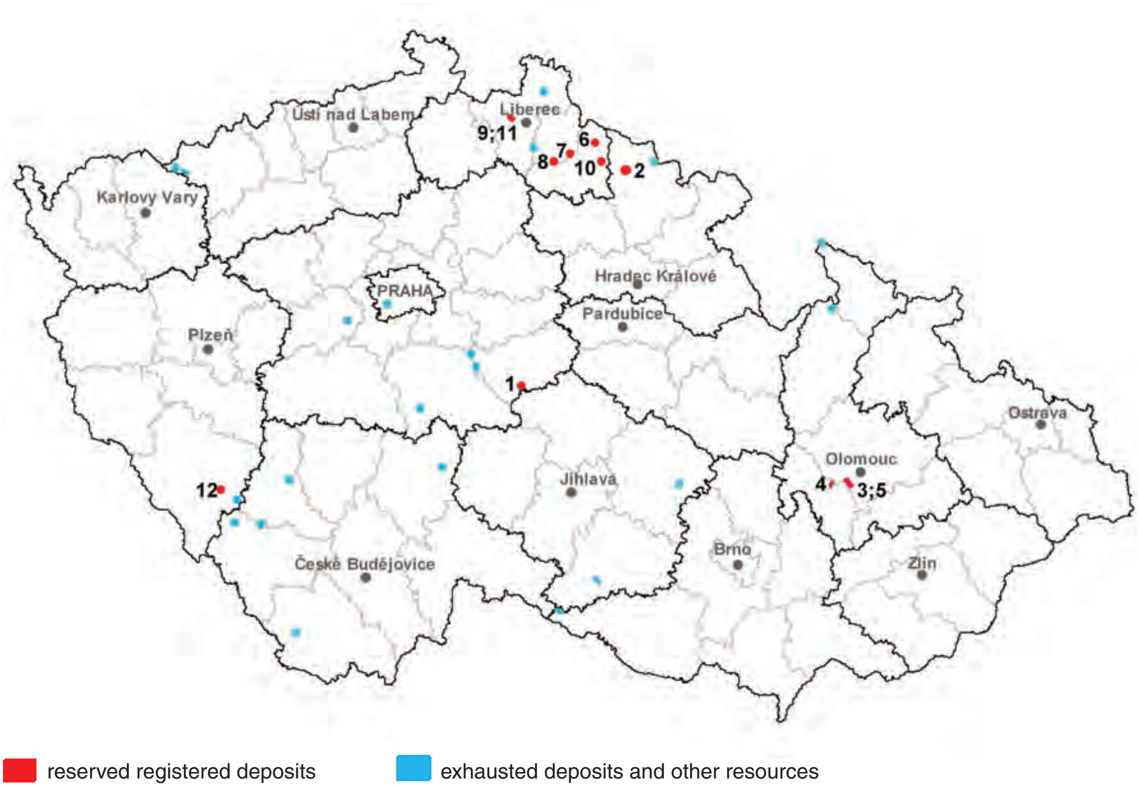
Prices of traded commodities (USD/t) according to IM

Commodity/Yeark	2011	2012	2013	2014	2015
US, calcined filter-aid grade, FOB plant	575–640	555–640	575–640	575–670	605–670
US, flux-calcined filter-aid grade, FOB plant	580–825	580–825	580–825	580–865	610–880

The price range includes the lowest and highest monthly price quotes for a given year.

Dolomite

1. Registered deposits and other resources of the Czech Republic



Principal areas of deposits presence:

(Names of exploited deposits are in ***bold type****)*

1 **Bohdaneč**	5 Hněvotín	9 Kryštofovo Údolí
2 **Lánov**	6 Horní Rokytnice	10 Křížlice
3 Bystročice	7 Jesenný-Skalka	11 Machnín-Karlov pod Ještědem
4 Čelechovice na Hané	8 Koberovy	12 Podmokly

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	12	12	12	12	12
exploited	2	2	2	2	2
Total mineral *reserves, kt	512 627	527 219	526 826	526 376	525 936
economic explored reserves	77 608	85 709	85 316	84 866	84 426
economic prospected reserves	340 843	348 288	348 288	348 288	348 288
potentially economic reserves	94 176	93 222	93 222	93 222	93 222
exploitable (recoverable) reserves	10 229	12 615	12 212	11 770	11 320
Mine production, kt	369	440	392	449	451

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	23 946	23 946	23 946	23 946	23 946
P_2		–	–	–	–	–
P_3		–	–	–	–	–

3. Foreign trade

2518 – Dolomite calcined, roughly trimmed or cut; agglomerated

		2011	2012	2013	2014	2015
Import	t	455 654	399 696	433 785	408 916	444 044
Export	t	7 209	30	77	39	86

2518 – Dolomite calcined, roughly trimmed or cut; agglomerated

		2011	2012	2013	2014	2015
Average import prices	CZK/t	182	202	299	254	260
Average export prices	CZK/t	2 626	5 134	2 599	16 098	8 220

4. Prices of domestic market

Average domestic prices of traded commodities

Product specification	2011	2012	2013	2014	2015
Dolomite aggregates, CZK/t	210–695	190–364	200–371	205–380	185–357
Ground calcitic dolomite, bulk, CZK/t	622–694	622–694	634–695	634–695	634–695
Ground calcitic dolomite, bagged, CZK/t	1 615	1 615	1 615	1 620	1 625

5. Mining companies in the Czech Republic as of December 31, 2015

Krkonošské vápenky Kunčice, a.s.
UNIKOM, a.s., Kutná Hora

6. World production and world market prices

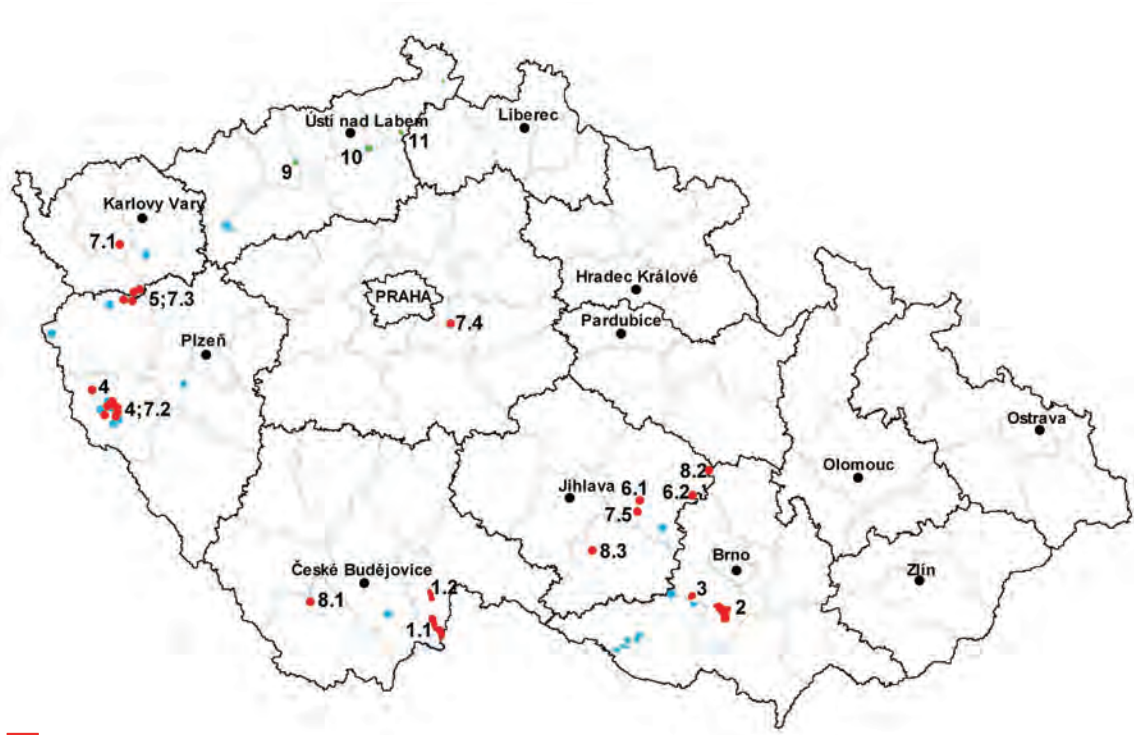
World mine production

World dolomite production is not listed in the statistics. Its world reserves, as a source of magnesia, are estimated at billions of tonnes. Even though dolomite is considered to be a main potential source of magnesium in the lithosphere, it is currently not used for the production of magnesium. Otherwise, calcined dolomite with a minimum magnesium content of 8% is suitable for this purpose.

World dolomite prices are not included in international overviews.

Feldspar

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits
exhausted deposits and other resources
feldspar mineral substitutes (reserved registered exploited deposit and and other resources)

Feldspar minerals:

*(Names of exploited deposits are in **bold type**)*

1 Sediments of the Lužnice River region:
1.1 **Halámky**
1.2 Dvory nad Lužnicí – Tušť
1.1 Krabonoš
1.2 Majdalena
1.1 Tušť – Halámky

2 Sediments of the Jihlava River (the Syrovice-Ivaň Terrace):
2 **Bratčice**
2 **Hrušovany u Brna**
2 **Hrušovany u Brna – Protlas**
2 **Ledce – Hrušovany u Brna**
2 Medlov
2 Medlov – Smolín
2 Smolín – Žabčice

3 Sediments of the Jihlava River (the Ivančice region):
3 Ivančice – Němčice

4 Pegmatites (the Poběžovice-Domažlice region):
4 **Luženičky**
4 Ždánov
4 Bozdíš
4 Luženičky – NE
4 Meclov 2
4 Meclov – Airport
4 Meclov – West
4 Mutěnín
4 Ohnišťovice – Za Kulichem

5 Pegmatites (the Teplá region):
5 Beroun – Tepelsko
5 Křepkovice – Nezdice
5 Zhořec 1
5 Zhořec 2 – Hanov zone

6 Pegmatites (the western Moravia region):
6.1 Bory – Olší
6.2 Smrček

7 Granitoids:
7.1 **Krásno – Vysoký kámen**
7.2 **Mračnice**
7.3 Hanov u Lestkova
7.4 Štíhlice
7.5 Velké Meziříčí – Lavičky

8 Others:
8.1 Chvalšiny
8.2 Malé (Velké) Tresné
8.3 Markvartice u Třebíče

Feldspar mineral substitutes (nepheline phonolites):

9 **Želenice**	10 Tašov-Rovný	11 Valkeřice-Zaječí vrch

2. Basic statistical data of the Czech Republic as of December 31

Feldspar
Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	35	37	37	36	36
exploited	9	9	9	9	9
Total mineral *reserves, kt	68 276	70 191	70 184	69 729	69 271
economic explored reserves	27 392	26 574	25 889	25 456	25 048
economic prospected reserves	27 079	29 621	30 815	30 793	31 052
potentially economic reserves	13 805	13 996	13 480	13 480	13 171
exploitable (recoverable) reserves	24 940	24 444	24 299	23 887	28 041
Mine production, kt	407	445	411	412	433

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	48 530	48 530	48 530	48 530	48 530
P_2		–	–	–	–	–
P_3		–	–	–	–	–

Feldspar substitutes (nepheline phonolites)
Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	3	3	3	3	3
exploited	1	1	1	1	1
Total mineral *reserves, kt	199 905	199 891	199 876	199 859	199 838
economic explored reserves	0	0	0	0	0
economic prospected reserves	199 905	199 891	199 876	199 859	199 838
potentially economic reserves	0	0	0	0	0
exploitable (recoverable) reserves	24 335	24 321	24 306	24 289	24 269
Mine production, kt	22	15	15	17	21

** See __NOTE__ in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1		–	–	–	–	–
P_2,	kt	52 900	30 300	30 300	30 300	30 300
P_3		–	–	–	–	–

3. Foreign trade

252910 – Feldspar

		2011	2012	2013	2014	2015
Import	t	6 551	4 800	5 946	5 575	5 325
Export	t	166 859	171 188	173 282	164 127	177 722

252910 – Feldspar

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 865	3 213	1 962	3 633	3 596
Average export prices	CZK/t	947	1 032	1 045	1 262	1 260

252930 – Leucite, nepheline and nepheline syenite

		2011	2012	2013	2014	2015
Import	t	2 252	1 325	2 338	3 250	3 192
Export	t	2	0	3	1	1

252930 – Leucite, nepheline and nepheline syenite

		2011	2012	2013	2014	2015
Average import prices	CZK/t	6 798	6 636	6 802	7 089	6 794
Average export prices	CZK/t	10 000	–	12 830	13 844	11 024

4. Prices of domestic market

Feldspars are sold domestically for CZK 97–4 800 per tonne depending on their chemism and usage.

5. Mining companies in the Czech Republic as of December 31, 2015

Feldspar
LB MINERALS, s.r.o., Horní Bříza
KMK GRANIT, a.s., Krásno
České štěrkopísky spol. s r.o., Praha
Družstvo DRUMAPO, Němčičky
Moravia Tech, a.s., Brno

Feldspar substitutes
KERAMOST, a.s., Most

6. World production and world market prices

World mine production

The data on world feldspar production and on the production of countries from various sources differ considerably:

Year	2011	2012	2013	2014	2015^e
World mine production of feldspar (according to MCS), kt	21,200	22,700	21,200	20,000	21,200
World mine production of feldspar (according to WBD), kt	27,169.2	29,968.9	35,217.8	29,111.7	N

^{e} *– preliminary values*

According to WBD (2016), in 2014, the top producer was Turkey with a share of 27.4% and the second was Germany with 20.1%. They were followed by Italy (7.5 %) and China (7.2 %). Of the 48 producers, the CR ranks thirteenth with 1.5% share. German statistics speak of domestic production of feldspar amounting to 350 kt, which would correspond to 1.2% share.

Main producers according to MCS

2015[e]		
country	**kt**	**%**
Turkey	5,000	23.6
Italy	4,700	22.2
China	2,500	11.8
India	1,500	7.1
Thailand	1,500	7.1
Spain	600	2.8
Iran	600	2.8
USA	510	2.4
Czech Rep.	430	2.0
Poland	400	1.9
world	**21,200**	**100.0**

[e] *– preliminary values*

Total world resources of feldspar are not published. The largest reserves have Brazil (320,000 kt) and Turkey (240,000 kt).

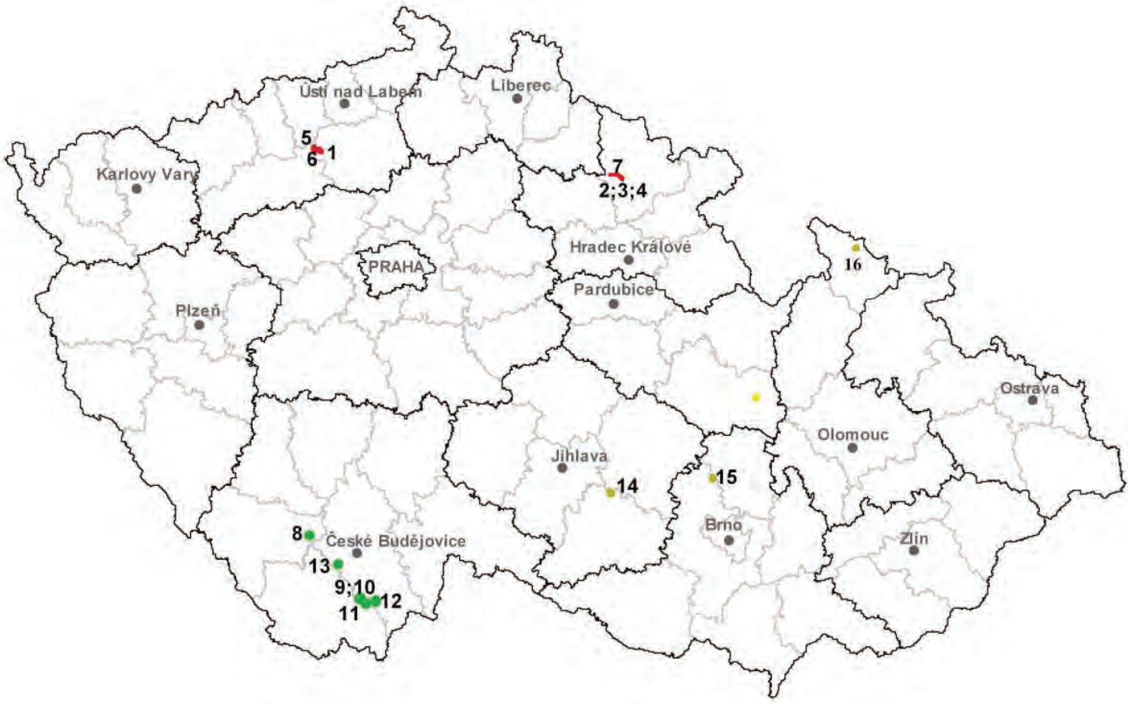
Prices of traded commodities (USD/t) (according to IM)

Commodity/Year		2011	2012	2013	2014	2015
Turkish, Na feldspar, crude, max. 10 mm size bulk, FOB Gulluk	USD/t	22–23	22–23	22–23	22–23	22–23
Turkish, Na feldspar, glass grade, max. 500 microns, bagged, FOB Gulluk	USD/t	70	70	70	70	70
Ceramic grade South African, bagged, FOB Durban	USD/t	N	168	168	168–176	168–176
Ceramic grade, 170–200 mesh, (Na), bagged, ex–works USA	USD/st	N	150–180	150–180	150–180	150–180
Na feldspar, floated –150 microns, bagged, FOB Gulluk, Turkey	USD/t	N	53–55	53–55	53–55	53–55
Na feldspar, floated –500 microns, bulk, FOB Gulluk, Turkey	USD/t	N	38–40	38–40	38–40	38–40

The price range includes the lowest and highest monthly price quotes for a given year.

Gemstones

1. Registered deposits and other resources of the Czech Republic



- reserved registered deposits of pyrope-bearing rock
- exhausted deposits and other resources of pyrope-bearing rock
- reserved registered deposits of moldavite-bearing rock
- exhausted deposits and other resources of moldavite-bearing rock
- reserved registered deposits of other gemstones
- exhausted deposits and other resources of other gemstones

Pyrope-bearing rock:	Moldavite-bearing rock:	Other gemstones:
1 **Podsedice-Dřemčice**	8 **Hrbov u Lhenic**	14 Bochovice *
2 Dolní Olešnice	9 **Chlum nad Malší-východ**	15 Rašov **
3 Horní Olešnice 1	10 **Ločenice-Chlum**	16 Velká Kraš***
4 Horní Olešnice 2	11 Besednice	
5 Linhorka-Staré	12 Slavče-sever	
6 Třebívlice	13 Vrábče-Nová Hospoda	
7 Vestřev		

** amethyst, ** opal, ***gem varieties of quartz*

*(Names of mined deposits are indicated in **bold type**)*

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number [a)]	14	14	15	13	16
exploited [b)]	3	3	3	3	3
Total mineral *reserves, kt [a)]	19 471	19 459	19 443	19 425	19408
economic explored reserves	3 288	3 276	3 260	3 242	3225
economic prospected reserves	13 002	13 002	13 002	13 002	13002
potentially economic reserves	3 181	3 181	3 181	3 181	3181
exploitable (recoverable) reserves	1 176	1 164	1 148	1 066	3960
Total mineral *reserves, m^3 [c)]	729 718	692 072	686 591	641 561	574348
economic explored reserves	169 362	154 596	141 638	130 310	114511
economic prospected reserves	557 257	534 377	541 854	508 152	456738
potentially economic reserves	3 099	3 099	3 099	3 099	3099
exploitable (recoverable) reserves	667 589	642 270	636 789	591 759	524546
Total mineral *reserves, kt ($1\ m^3 = 1.8\ t$) [c)]	1 313	1 246	1 236	1155	1 034
economic explored reserves	305	278	255	235	206
economic prospected reserves	1 003	962	975	915	822
potentially economic reserves	6	6	6	3	6
exploitable (recoverable) reserves	1 202	1 156	1146	1 065	944
Mine production, kt [a)]	17	12	16	18	17
Mine production, ths m^3 [c)]	65	41	41	45	67
Mine production, kt [c)] ($1\ m^3 = 1.8\ t$)	117	74	74	81	120

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] *pyrope-bearing rock*

[b)] *one deposit of pyrope and two deposits of moldavite*

[c)] *moldavite-bearing rock*

Approved prognostic resources P_1, P_2, P_3

Year			2011	2012	2013	2014	2015
P_1,			–	–	–	–	–
P_2,	a)	t	100	100	100	100	100
P_2,	b)	kt	749	749	749	749	749
P_2,	c)	ths m^3	66 000	66 000	66 000	66 000	66 000
P_2,	c)	kt	119	119	118	118	118
P_3			–	–	–	–	–

Notes:
[a] *jasper*
[b] *pyrope-bearing rock*
[c] *moldavite-bearing rock*

3. Foreign trade

7102 – Diamonds, whether or not worked, but not mounted or set

		2011	2012	2013	2014	2015
Import	kg	89	928	636	480	243
Export	kg	36	742	444	380	167

7102 – Diamonds, whether or not worked, but not mounted or set

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	5 542 112	835 775	543 657	952 238	825 524
Average export prices	CZK/kg	6 988 611	468 977	339 054	868 734	645 772

7103 – Precious (other than diamond) and semi-precious stones, whether or not worked or graded but not strung, mounted or set

		2011	2012	2013	2014	2015
Import	kg	375 415	231 965	249 855	216 981	311 215
Export	kg	1 254	4 140	1 135	6 591	65 986

7103 – Precious (other than diamond) and semi-precious stones, whether or not worked or graded but not strung, mounted or set

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	123	226	282	1 300	244
Average export prices	CZK/kg	8 557	3 132	9 980	3 570	813

251320 – Emery, natural corundum, natural garnet and other natural abrasives

		2011	2012	2013	2014	2015
Import	t	1 393	2 419	3 103	3 478	4 779
Export	t	68	121	339	184	149

251320 – Emery, natural corundum, natural garnet and other natural abrasives

		2011	2012	2013	2014	2015
Average import prices	CZK/t	6 467	6 230	6 638	6 809	6 495
Average export prices	CZK/t	32 576	11 592	54 923	86 332	88 991

4. Prices of domestic market

The international gemstone trade is currently so globalized that no substantial price differences exist anywhere in the world including the Czech Republic. The only difference is that rather lower-quality gemstones are imported due to lower purchasing power as well as to less experienced jewellers and customers; high-quality gemstones in the Czech market are rare.

Company Granát, cooperative of art manufacturing in Turnov, purchased Czech garnets (pyropes) under following conditions in 2011–2014:

Purchase prices of raw Czech garnets by size classes:

Class	Screen size (mm)	Minimum thickness (mm)	Price CZK/g
IV.	2.6 – 2.9 mm	2.6 mm	6
III.	3.0 – 3.9 mm	2.6 mm	18
II.	4.0 – 4.9 mm	3.0 mm	44
I.	5.0 – 5.9 mm	3.5 mm	negotiated price from CZK 100/g
E0 and bigger	From 6.0 mm and more	4.5 mm	negotiated price from CZK 150/g

Internet wholesale E-vltaviny offered moldavites in the following size–shape-number-price relations (each moldavite was packaged separately in a plastic box with its description):

Mine locality	Weight (g)	Number of pieces	Price (CZK)
Besednice *	1.27–3.6	1	1 422–1 884
mostly Chlum nad Malší	0.1–0.5	10	599
	0.1–0.5	25	1 325
	0.1–0.5	50	2 450
	0.1–0.5	100	4 550
	0.5–1	10	990
	0.5–1	25	2 375
	0.5–1	50	4 450
	0.5–1	100	7 999
	1–5	–	220–520
	5–10	–	620–1 100
	10–15	1	1 255–1 500
	15–20	1	2 251–2 955
	20–45	1	4 770–6 545
Dolní Chrášťany	52.9	1	26 900

*Note: * moldavites from this locality are visually regarded as the best*

5. Mining companies in the Czech Republic as of December 31, 2015

Pyrope-bearing rock
Granát, družstvo umělecké výroby, Turnov

Moldavite-bearing rock
MAWE CK s.r.o., Český Krumlov
Monday Morning s.r.o., Praha

6. World production and world market prices

World mine production

Statistical data on gem-quality garnet production are not available. MCS overviews provide the following data on global production of industrial garnets in recent years:

	2011	2012	2013	2014	2015e
World production, t	660,000	670,000	1,660,000	1,660,000	1,660,000

e – preliminary values

According to preliminary data of MCS, the largest mining companies, as well as exporters, in 2015 were India (48.2%), China (31.3%), and Australia (15.7%). The three largest producers produce more than 95% of the estimated world production of natural garnets. Garnet deposits are found in many other countries such as the US (2% of the world production), Russia, Turkey, Pakistan, Mongolia, Chile, Czech Republic, South Africa, Spain, Ukraine, and Thailand. Many of these countries use the mined garnets also for manufacturing of jewelry.

World statistics include principally diamond mining, both gem-grade and industrial ones.

World gem-grade diamond production was as follows:

	2011	2012	2013	2014	2015[e]
World mine production (according to WBD), ths ct (ct = carat; 1 ct = 0.2 g)	70,812.9	71,664.9	76,072.9	75,815.7	N
World mine production (according to MCS), mil USD	69,900	91,700	70,600	71,200	71,300

[e] – preliminary values

Main producers according to MCS

2014		
Gem-quality diamonds		
country	**thousand carats**	**%**
Russia	21,500	30.2
Botswana	17,300	24.3
Canada	12,000	16.9
Angola	7,100	10.0
RSA	5,950	8.4
Kongo (Kinshasa)	3,130	4.4
Namibia	1,920	2.7
Sierra Leone	496	0.7
Zimbabwe	477	0.7
Lesotho	346	0.5
world	**71,200**	**100.0**

Main producers according to MCS

2015[e]		
Gem-quality diamonds		
country	**thousand carats**	**%**
Russia	21,500	30.2
Botswana	17,300	24.3
Canada	12,000	16.8
Angola	7,100	10.0
RSA	6,000	8.4
Kongo (Kinshasa)	3,150	4.4
Namibia	1,920	2.7
Sierra Leone	500	0.7
Zimbabwe	500	0.7
Lesotho	350	0.5
world	**71,300**	**100.0**

e – preliminary values

Main producers according to MCS

2014		
Industrial diamonds		
country	**thousand carats**	**%**
Russia	17,000	32.0
Kongo (Kinshasa)	13,000	24.5
Australia	9,000	16.9
Botswana	7,000	13.2
Zimbabwe	4,000	7.5
RSA	1,000	1.9
world	**53,100**	**100.0**

Main producers according to MCS

2015[e]		
Industrial diamonds		
country	**thousand carats**	**%**
Russia	16,000	29.6
Kongo (Kinshasa)	13,000	24.1
Australia	10,000	18.5
Botswana	7,000	13.0
Zimbabwe	4,000	7.4
RSA	1,000	1.9
world	**54,000**	**100.0**

e – preliminary values

World production of industrial diamonds was as follows:

	2011	2012	2013	2014	2015[e]
World production (according to WBD), ths kt	52,128.8	56,613.0	56,113.4	50,610.5	N
World production (according to MCS), ths kt	77,000	75,000	60,000	53,000	54,000

Shares of producers in the world industrial diamond mining in 2015 (MCS):

Russia	29.6 %	Botswana	13.0 %
DR Congo (Kinshasa)	24.1 %	Zimbabwe	7.4 %
Australia	18.5 %	RSA	1.9 %

According MCS, diamondiferous rocks are in more than 35 countries. Most of them have from less than 1 carat/ton to about 6 c/t. The largest reserves of gem-quality diamonds are in South Africa, Australia, Canada, and Russia.

World market prices

Gemstone prices depend on the type, size, and quality of the stones while the price ranges are considerable.

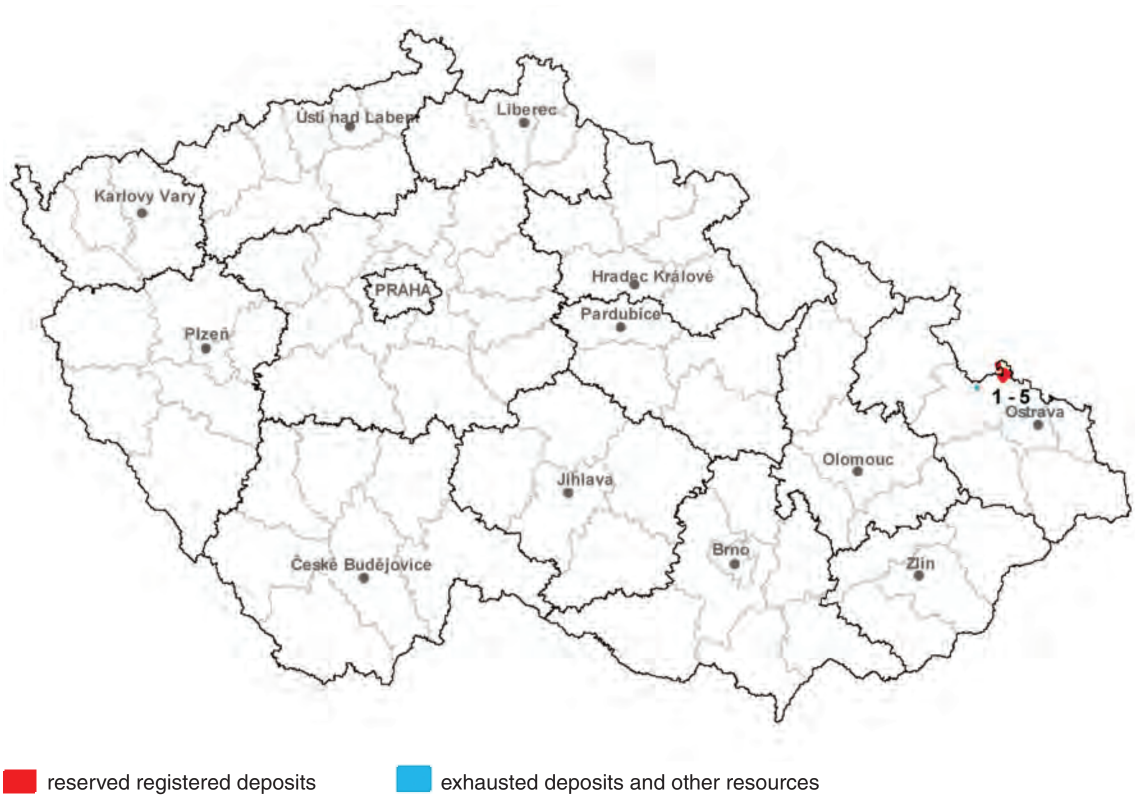
Approximate price of diamonds: lobal average price in USD per carat (plus five-year forecast). Does not include synthetic diamonds

Year	Average price USD/carat
2004	64
2005	66
2006	68
2007	71
2008	78
2009	69
2010	89
2011	115
2012	99
2013	108
2014	103
2015 (forecast by Paul Zimnisky)	103
2016 (forecast by Paul Zimnisky)	107
2017 (forecast by Paul Zimnisky)	114
2018 (forecast by Paul Zimnisky)	117
2019 (forecast by Paul Zimnisky)	120
2020 (forecast by Paul Zimnisky)	120

Source: Zimnisky P.(2015): Global diamond output to rise in 2015.-Mining Journal special publication-PDAC 2015, str.17–18.

Gypsum

1. Registered deposits and other resources of the Czech Republic



1 **Kobeřice ve Slezsku-jih**	3 Rohov-Strahovice	5 Třebom
2 Kobeřice ve Slezsku-sever	4 Sudice	

*(Names of mined deposits are indicated in **bold type**)*

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	5	5	5	5	5
exploited	1	1	1	1	1
Total mineral *reserves, kt	504 256	504 240	504 227	504 205	504 205
economic explored reserves	119 129	119 113	119 100	119 088	119 088
economic prospected reserves	302 990	302 990	302 990	302 990	302 990
potentially economic reserves	82 137	82 137	82 137	82137	82137
exploitable (recoverable) reserves	2 288	2 272	2 259	2 247	2 247
Mine production, kt	11	14	11	11	11

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

3. Foreign trade

252010 – Gypsum, anhydrite

		2011	2012	2013	2014	2015
Import	t	57 965	49 245	42 413	48 453	48 106
Export	t	103 363	63 758	70 706	88 861	118 047

252010 – Gypsum, anhydrite

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 094	2 299	2 396	2 419	2 070
Average export prices	CZK/t	87	157	174	185	225

4. Prices of domestic market

Average prices of traded commodities on the domestic market

	2011	2012	2013	2014	2015
mined gypsum, CZK/t	N	N	N	N	N
grey gypsum binder, bagged in 30 kgs, pallets, CZK/t	3 460	3 460	3 574	3 672	3 672
white gypsum binder, bagged in 30 kgs, paliets, CZK/t	5 851	5 851	6 044	6 210	6 210

5. Mining companies in the Czech Republic as of December 31, 2015

GYPSTREND s.r.o., Kobeřice

6. World production and world market prices

World mine production

Data on world production of primary gypsum in recent years:

	2011	2012	2013	2014	2015^{e}
World mine production of gypsum (according to MCS), kt	149,000	152,000	245,000	244,000	258,000
World mine production of gypsum (according to WBD), kt	154,372.2	163,014.1	165,328	162,589.2	N

^{e} – *preliminary values*

Main producers according to WBD

2014		
country	**kt**	**%**
China	40,000	24.6
Iran	19,550	12.0
Thailand	13,422	8.3
USA	11,000	6.8
Turkey	9,051	5.6
Mexico	8,500	5.2
Spain	7,200	4.4
Russia	5,100	3.1
France	5,000	3.1
Australia	3,600	2.2
world	**162,589**	**100.0**

Main producers according to MCS

2015^{e}		
country	**kt**	**%**
China	132,000	51.2
Iran	22,000	8.5
Thailand	12,500	4.8
USA	11,500	4.5
Turkey	10,000	3.9
Spain	6,400	2.5
Mexico	5,300	2.1
Japan	5,000	1.9
Russia	4,500	1.7
Italy	4,100	1.6
world	**258,000**	**100.0**

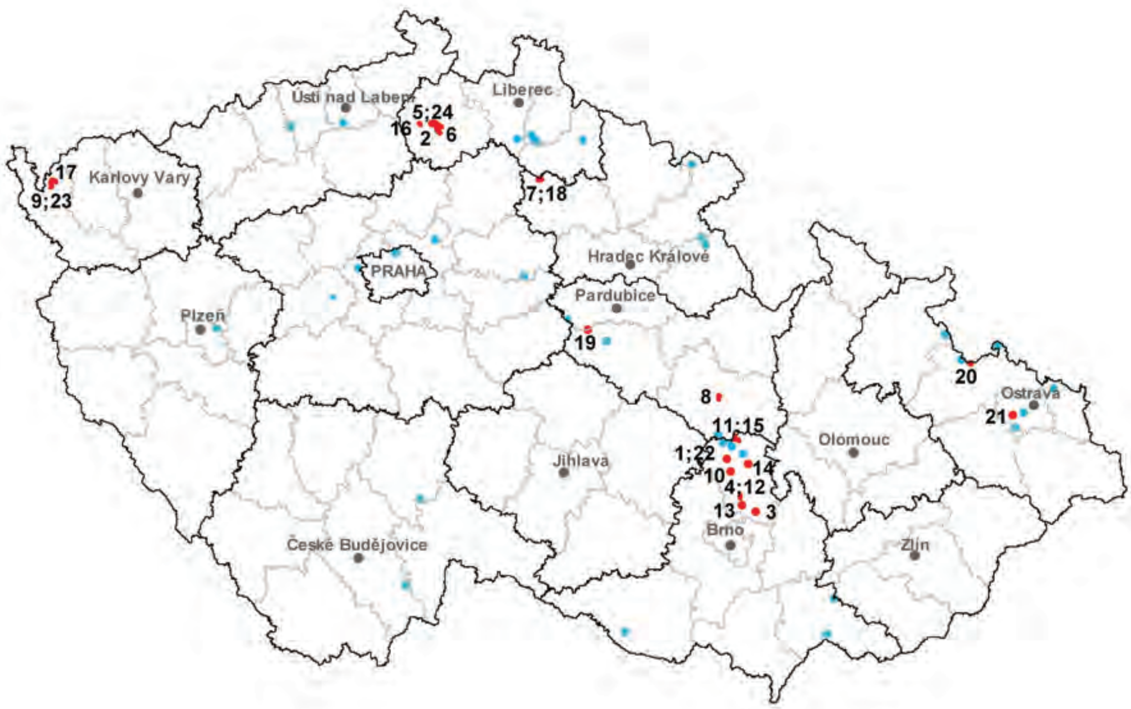
^{e} – *preliminary values*

Total world resources of gypsum are not known. The USA reports 700 million tonnes of reserves, 450 million tonnes are estimated for Canada, and 230 million tonnes for Brazil.

There are no global indicative prices of gypsum.

Industrial sands

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits — exhausted deposits and other resources

1 **Nýrov****
2 Provodín*
3 **Rudice-Seč****
4 **Spešov-Dolní Lhota****
5 **Srní-Okřešice***
6 **Srní 2-Veselí***
7 **Střeleč***
8 **Svitavy-Vendolí****
9 **Velký Luh***
10 **Voděrady****
11 Babolky**
12 Blansko 1-Jezírka**
13 **Blansko 2-Mošna****
14 Boskovice-Chrudichromy**
15 Deštná-Dolní Smržov**
16 Holany**
17 Lomnička u Plesné**
18 Mladějov v Čechách*
19 Načešice**
20 Palhanec-Vávrovice**
21 Polanka nad Odrou**
22 Rudka-Kunštát**
23 Velký Luh 1**
24 Zahrádky-Srní**

** deposits of glass and foundry sands*
*** deposits of foundry sands*

(Names of exploited deposits are in **bold type***)*

2. Basic statistical data of the Czech Republic as of December 31

Glass sand
Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	6	6	6	6	6
exploited	5	5	4	4	4
Total mineral *reserves, kt	254 942	254 007	254 872	254 063	253 186
economic explored reserves	86 844	86 004	84 755	83 971	83 170
economic prospected reserves	23 523	23 523	25 077	25 077	25 077
potentially economic reserves	144 575	144 480	145 040	145 015	144 939
exploitable (recoverable) reserves	79 873	79 183	78 429	77 789	76 914
Mine production, kt	976	849	862	734	812

* *See* ***NOTE*** *in the chapter* ***Introduction*** *above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter* ***Mineral reserve and resource classification in the Czech Republic*** *of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	0	0	0	0	0
P_2,	kt	14 927	14 927	14 927	14 927	14 927
P_3		–	–	–	–	–

Foundry sand
Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	23	23	23	25	25
exploited	11	9	8	7	8
Total mineral *reserves, kt	409 618	409 079	408 726	408 071	407 488
economic explored reserves	128 903	128 442	127 937	127 394	126 901
economic prospected reserves	133 460	133 448	133 377	133 370	133 360
potentially economic reserves	147 255	147 189	147 412	147 307	147 227
exploitable (recoverable) reserves	78 642	78 535	78 250	77 778	77 303
Mine production, kt	395	491	412	603	535

* *See* ***NOTE*** *in the chapter* ***Introduction*** *above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter* ***Mineral reserve and resource classification in the Czech Republic*** *of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	15 157	15 157	15 157	15 157	15 157
P_2,	kt	14 723	14 723	14 723	14 723	14 723
P_3		–	–	–	–	–

3. Foreign trade

250510 – Silica sands and quartz sands

		2011	2012	2013	2014	2015
Import	t	294 936	235 830	267 037	263 025	254 669
Export	t	472 249	388 964	388 054	370 169	395 217

250510 – Silica sands and quartz sands

		2011	2012	2013	2014	2015
Average import prices	CZK/t	535	553	292	691	790
Average export prices	CZK/t	475	548	561	497	592

7001 – Cullet and other waste and scrap of glass; glass in the mass

		2011	2012	2013	2014	2015
Import	t	143 580	122 705	133 440	168 023	188 212
Export	t	20 348	13 568	8 864	11 469	17 120

7001 – Cullet and other waste and scrap of glass; glass in the mass

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 138	1 992	1 933	1 949	1 882
Average export prices	CZK/t	1 067	1 496	1 976	1 189	870

4. Prices of domestic market

Prices of industrial sands are not open to public.

5. Mining companies in the Czech Republic as of December 31, 2015

Glass sand
Sklopísek Střeleč, a.s., Mladějov
Provodínské písky a.s., Provodín
LB MINERALS, s.r.o., Horní Bříza

Foundry sand
Provodínské písky a.s., Provodín
Sklopísek Střeleč, a.s., Mladějov
LB MINERALS, s.r.o., Horní
SEDOS doprava a.s., Drnovice
Kalcit s.r.o., Brno
PEDOP s.r.o., Lipovec
SETRA, s.r.o., Brno

6. World production and world market prices

World mine production

The published statistics on the production of industrial sand do not distinguish between glass and foundry sands. Their total production has developed as follows in recent years:

	2011	2012	2013	2014	2015^{e}
Industrial sand and gravel (according to MCS), kt	138,000	139,000	141,000	196,000	181,000

^{e} – *preliminary values*

Main producers according to MCS

country	2015^{e}	
	kt	%
USA	94,900	52.4
Italy	13,900	7.7
France	8,750	4.8
Turkey	8,000	4.4
Germany	7,500	4.1
Australia	5,500	3.0
Great Britain	4,000	2.2
Moldova	3,800	2.1
India	3,400	1.9
Spain	3,400	1.9
world	**181,000**	**100.0**

^{e} – *preliminary values*

Glass and foundry sand mineral resources are huge and they can be found all over the world.

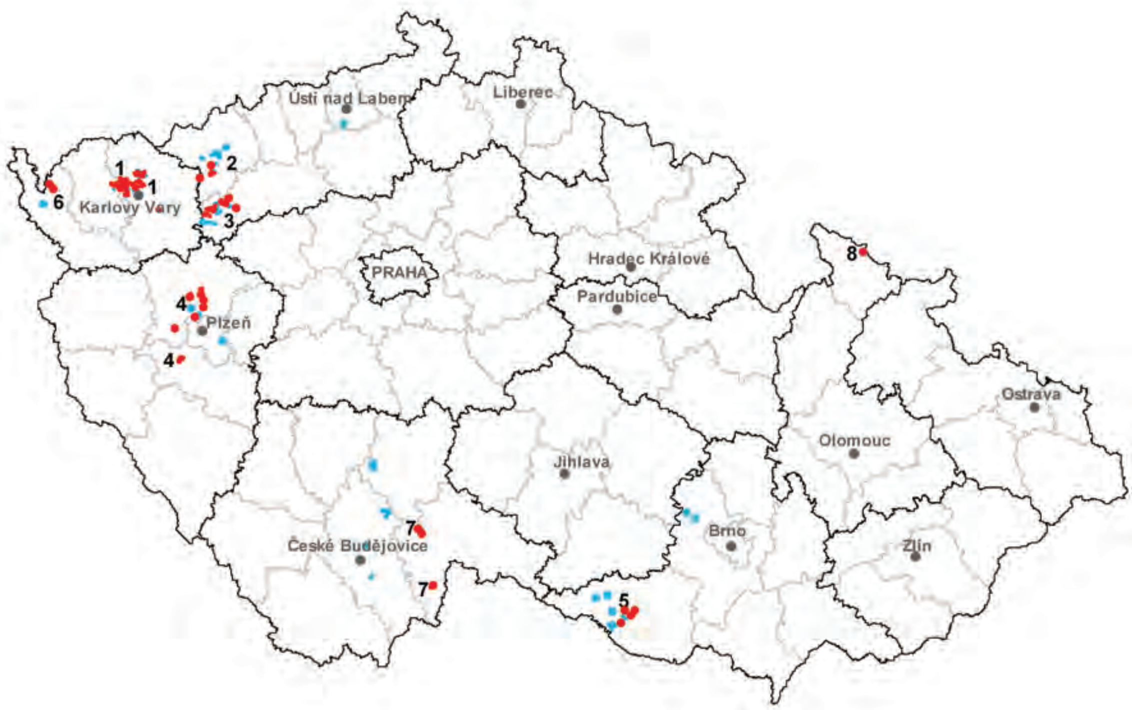
Prices of traded commodities – silica sand (according to IM)

Commodity/Year		2011	2012	2013	2014	2015
SiO_2 sand, minus 20 micron, bagged, > 92 brightness, FOB Durban	USD/t	295	295	295	295	300–375
Glass sand, container, ex–works USA	GBP/t	20–26	20–26	20–26	20–26	27–30

The price range includes the lowest and highest monthly price quotes for a given year.

Kaolin

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits

exhausted deposits and other resources

Major deposit areas:

*(Names of areas with exploited deposits are in **bold**)*

1 **Karlovy Vary Region**
2 **Kadaň Region**
3 **Podbořany Region**
4 **Plzeň Region**
5 Znojmo Region
6 Cheb Basin
7 Třeboň Basin
8 Vidnava

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	70	70	70	71	71
exploited	14	15	15	15	15
Total mineral *reserves, kt	1 204 751	1 194 922	1 191 129	1 189 075	1 180 891
economic explored reserves	234 061	228 510	225 092	231 203	225 756
economic prospected reserves	507 488	506 058	506 010	499 854	499 669
potentially economic reserves	463 202	460 354	460 027	458 018	455 466
exploitable (recoverable) reserves	102 257	101 277	98 199	104 177	98 842
Mine production, kt [a)]	3 606	3 318	3 108	3 281	3 454
Beneficiated (water-washed) kaolin production, kt	660	624	609	617	648

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] Raw kaolin, total production of all technological grades;

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	29 708	29 708	25 115	25 115	25 115
P_2,	kt	4 998	4 998	–	–	–
P_3		–	–	–	–	–

The data of kaolin for production of porcelain and fine ceramics and kaolin used as fillers in paper industry have been stated separately due to great varieties of end use and prices of the individual kaolin types.

Number of deposits; reserves; mine production

Kaolin for production of porcelain and fine ceramics	2011	2012	2013	2014	2015
Deposits – total number	30	30	30	30	30
exploited	7	7	7	7	7
Total mineral *reserves, kt	252 791	252 445	252 089	250 856	251 667
economic explored reserves	49 833	49 556	49 242	49 009	48 700
economic prospected reserves	111 713	111 713	111 713	110 713	111 713
potentially economic reserves	91 245	91 176	91 134	91 134	91 254
exploitable (recoverable) reserves	17 612	17 391	17 122	16 851	16 545
Mine production, kt [a)]	368	302	308	279	290

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] Exploited deposits: Božičany-Osmosa-jih, Jimlíkov, Krásný Dvůr-Podbořany, Mírová, Podlesí 2, Podlesí-Čapí hnízdo, Ruprechtov

Number of deposits; reserves; mine production

Kaolin for paper industry	2011	2012	2013	2014	2015
Deposits – total number	26	25	25	25	25
exploited	6	7	7	7	7
Total mineral *reserves, kt	301 326	295 572	294 576	292 385	290 775
economic explored reserves	55 350	53 186	52 228	54 589	53 046
economic prospected reserves	185 290	183 929	183 929	179190	179 190
potentially economic reserves	60 686	58 457	58 419	58 606	58 539
exploitable (recoverable) reserves	34 261	33 393	31 319	34 638	33 283
Mine production, kt [a)]	973	877	851	1 021	1 167

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] Exploited deposits: Horní Bříza-Trnová, Chlumčany-Dnešice, Kaznějov-jih, Lomnička-Kaznějov, Otovice-Katzenholz, Rokle

3. Foreign trade

2507 – Kaolin and other kaolinic clays, whether or not calcined

		2011	2012	2013	2014	2015
Import	t	19 356	17 054	15 848	16 758	18 641
Export	t	527 933	507 704	504 180	504 709	539 738

2507 – Kaolin and other kaolinic clays, whether or not calcined

		2011	2012	2013	2014	2015
Average import prices	CZK/t	3 563	3 992	4 567	4 640	4 951
Average export prices	CZK/t	2 629	2 834	2 925	2 955	2 921

25070020 – Kaolin

		2011	2012	2013	2014	2015
Import	t	12 288	12 872	11 777	12 165	13 259
Export	t	537 203	506 774	503 580	504 509	539 649

25070020 – Kaolin

		2011	2012	2013	2014	2015
Average import prices	CZK/t	4 221	4 366	4 958	5 161	5 751
Average export prices	CZK/t	2 627	2 830	2 923	2 954	2 920

25070080 – Kaolinic clay (other than kaolin)

		2011	2012	2013	2014	2015
Import	t	7 068	4 181	4 071	4 593	5 202
Export	t	731	929	600	201	89

25070080 – Kaolinic clay (other than kaolin)

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 418	2 839	3 434	3 259	2 911
Average export prices	CZK/t	4 510	5 342	4 607	5 558	7 247

4. Prices of domestic market

Average prices of traded kaolin on the domestic market

Product specification	2011	2012	2013	2014	2015
Ceramic grade kaolin, CZK/t	1 100–3 500	2 000–3 000	2 200–3 000	2 200–3 000	2 200–3 000
Paper grade kaolin, CZK/t	N	2 100–3 400	2 100–3 500	2 100–3 500	2 100–3 500
Beneficiated kaolin from Podbořany, KD, CZK/t	1 300–3 040	N	N	N	N
Kaolin for manufacture of fine porcelain and glazes, CZK/t	2 300–3 200	2 600–4 600	3 000–4 800	3 000–4 800	3 000–4 800
Activated kaolin from Podbořany, KDA, CZK/t	N	N	N	N	N

5. Mining companies in the Czech Republic as of December 31, 2015

Kaolin for manufacture of porcelain and fine ceramics
Kaolin Hlubany, a.s.
Sedlecký kaolin a.s., Božičany
KSB s.r.o., Božičany

Kaolin for ceramics manufacturing
LB MINERALS, s.r.o., Horní Bříza
Sedlecký kaolin a.s., Božičany
KSB s.r.o., Božičany

Kaolin for paper industry
LB MINERALS, s.r.o., Horní Bříza
KERAMOST, a.s., Most
Sedlecký kaolin a.s., Božičany

Titanium-bearing kaolin
Sedlecký kaolin a.s., Božičany
KSB s.r.o., Božíčany

Feldspar-bearing kaolin
In 2015 there were no companies mining feldspar-bearing kaolin on the territory of the Czech Republic

6. World production and world market prices

World mine production

World kaolin production in recent years was as follows:

	2011	2012	2013	2014	2015[e]
World mine production (according to MCS), kt	33,900	36,200	40,300	33,500e	34,000
World mine production (according to WBD), kt	35,438.7	35,471.0	36,428.1	35,945.4	N

[e] – preliminary values

Main producers according to WBD			Main producers according to MCS					
2014			2014			2015[e]		
country	kt	%	country	kt	%	country	kt	%
USA	6,310	17.6	USA	6,310	18.8	USA	6,160	18.1
Germany	4,275	11.9	India	4,480	13.4	India	4,480	13.2
India	3,861	10.7	Germany	4,300	12.8	Germany	4,300	12.6
China	3,300	9.2	China	3,300	9.9	China	3,300	9.7
Czech Rep.	3,281	9.1	Czech Rep.	3,100	9.3	Czech Rep.	3,300	9.7
Turkey	2,032	5.7	Brazil	1,710	5.1	Brazil	1,700	5.0
Brazil	1,706	4.7	Iran	1,500	4.5	Iran	1,500	4.4
South Korea	1,541	4.3	Turkey	1,200	3.6	Ukraine	1,400	4.1
Ukraine	1,426	4.0	Great Britain	1,100	3.3	Turkey	1,300	3.8
Great Britain	1,090	3.0	Ukraine	1,000	3.0	Great Britain	1,100	3.2
world	**35,945**	**100.0**	**world**	**33,500**	**100.0**	**world**	**34,000**	**100.0**

[e] – preliminary values

As for the order of producers according to the two sources, the major inconsistencies commented on in previous yearbooks were removed in 2014. The biggest differences occurred in the data on production of kaolin in Iran. According to MCS statistics, Iran was on the 7th place both in 2014 and 2015. In WBD statistics Iran is eleventh with the share of 2.3%.

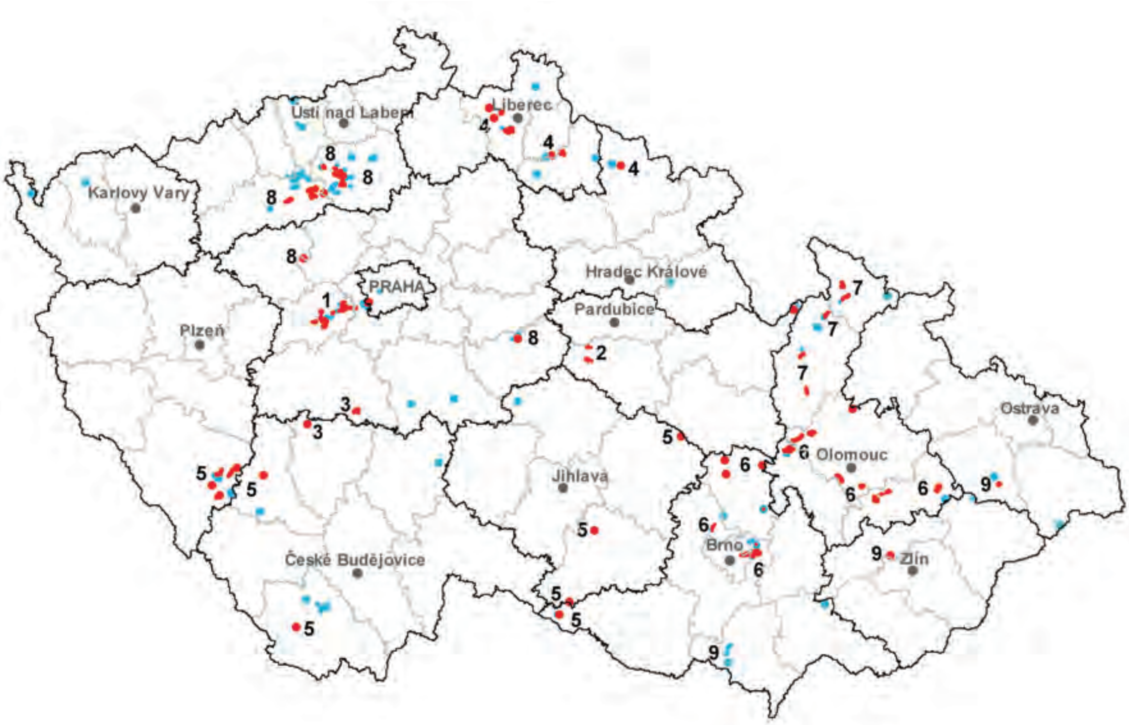
Prices of traded commodities (according to IM)

Commodity/Year		2011	2012	2013	2014	2015
№ 1 paper coating grade, Ex-Georgia plant	USD/st	150–195	150–209	167.44–217.36	130–217.36	137–190
№ 2 paper coating grade, Ex-Georgia plant	USD/st	100–155	100–166.70	111.8–173.3	111.8–185	118–185

Note: st – short ton; 1 st = 0,9072 t
The price range includes the lowest and highest monthly price quotes for a given year.

Limestones and corrective additives for cement production

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits   exhausted deposits and other resources

Major deposit areas:

(Names of areas with exploited deposits are in ***bold****)*

1 **Devonian of the Barrandian**
2 **Paleozoic of the Železné hory Mts.**
3 **Central Bohemian Islet Zone**
4 **Krkonoše Mts.-Jizerské hory Mts. Crystalline Complex**
5 **South-Bohemian and Moravian Moldanubicum**
6 **Moravian Devonian**
7 **Silesicum (Branná Group), Orlické hory Mts.-Kladsko Crystalline Complex and Zábřeh Group**
8 **Bohemian Cretaceous Basin**
9 **Outer Klippen Belt of the Western Carpathians**

2. Basic statistical data of the Czech Republic as of December 31

Limestones – total number
Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	85	85	85	85	85
exploited	21	22	22	22	22
Total mineral *reserves, kt	4 252 835	4 242 250	4 232 061	4 053 524	4 757 736
economic explored reserves	1 730 722	1 720 472	1 710 231	1 694 225	1 983 957
economic prospected reserves	1 777 351	1 777 016	1 776 915	1 600 932	1 894 356
potentially economic reserves	744 762	744 762	744 752	758 367	879 423
exploitable (recoverable) reserves	1 353 361	1 342 133	1 335 540	1 326 321	1 514 091
Mine production, kt	10 859	9 549	9 269	10 041	10 568

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Limestones – total number
Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	114 292	114 292	82 489	82 489	82 489
P_2,	kt	427 057	427 057	350 957	350 957	350 957
P_3		–	–	–	–	–

Owing to the importance and considerable differences in technological use and prices, high--percentage limestones, corrective additives for cement production and other limestones are monitored separately.

High-percentage limestones containing 96 % or more of $CaCO_3$
Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	27	27	27	27	27
exploited	10	10	10	10	10
Total mineral *reserves, kt	1 361 548	1 356 816	1 351 882	1 346 635	1 336 827
economic explored reserves	629 347	624 615	619 681	614 434	635 755
economic prospected reserves	546 096	546 096	546 096	546 096	515 010
potentially economic reserves	186 105	186 105	186 105	186 105	186 062
exploitable (recoverable) reserves	733 125	727 700	726 258	722 519	737 738
Mine production, kt	4 684	4 188	4 491	4 526	4 395

** See* ***NOTE*** *in the chapter* ***Introduction*** *above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter* ***Mineral reserve and resource classification in the Czech Republic*** *of this yearbook*

High-percentage limestones containing 96 % or more of $CaCO_3$
Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	5 400	5 400	5 400	5 400	5 400
P_2,	kt	26 345	26 345	26 345	26 345	26 345
P_3		–	–	–	–	–

Other limestones
Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	48	48	48	48	48
exploited	16	17	17	17	16
Total mineral *reserves, kt	2 268 240	2 263 378	2 259 004	2 257 213	2 231 936
economic explored reserves	955 286	950 759	946 496	936 892	914 988
economic prospected reserves	795 712	795 377	795 276	789 474	789 412
potentially economic reserves	517 242	517 242	517 232	530 847	527 536
exploitable (recoverable) reserves	560 804	555 957	551 654	547 021	543 886
Mine production, kt	5 205	4 399	3 932	4 667	5 041

** See* ***NOTE*** *in the chapter* ***Introduction*** *above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter* ***Mineral reserve and resource classification in the Czech Republic*** *of this yearbook*

Other limestones
Approved prognostic resources P_1, P_2, P_3

Year	2011	2012	2013	2014	2015
P_1, kt	103 070	103 070	71 267	71 267	71 267
P_2, kt	50 000	50 000	–	–	–
P_3	–	–	–	–	–

Corrective additives for cement production
Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	15	15	14	14	14
exploited	3	3	4	4	2
Total mineral *reserves, kt	621 236	618 267	617 930	617 622	583 223
economic explored reserves	340 041	337 072	336 735	336 427	302 028
economic prospected reserves	156 785	156 785	156 785	154 785	156 785
potentially economic reserves	124 410	124 410	124 410	124 410	124 410
exploitable (recoverable) reserves	186 538	183 745	183 408	183 101	176 527
Mine production, kt	385	310	336	302	291

** See __NOTE__ in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Corrective additives for cement production
Approved prognostic resources P_1, P_2, P_3

Year	2011	2012	2013	2014	2015
P_1, kt	86 880	86 880	84 493	84 493	84 493
P_2	–	–	–	–	–
P_3	–	–	–	–	–

In many limestone deposits, high-percentage limestones and other limestones are extracted together. Five out of fourteen corrective additives for cement production deposits make part of other limestones deposits.

3. Foreign trade

2521 – Limestone flux; limestone and other calcareous stone, of kind used for the manufacture of lime or cement

		2011	2012	2013	2014	2015
Import	t	458 373	438 037	527 774	569 427	507 648
Export	t	155 118	187 780	147 783	86 094	60 136

2521 – Limestone flux; limestone and other calcareous stone, of kind used for the manufacture of lime or cement

		2011	2012	2013	2014	2015
Average import prices	CZK/t	168	192	185	174	163
Average export prices	CZK/t	467	472	510	646	681

2522 – Quicklime, slaked lime and hydraulic lime

		2011	2012	2013	2014	2015
Import	t	105 850	92 785	98 967	118 373	83 119
Export	t	178 411	133 902	167 085	198 204	168 993

2522 – Quicklime, slaked lime and hydraulic lime

		2011	2012	2013	2014	2015
Average import prices	CZK/t	1 611	1 719	1 824	1 791	2 015
Average export prices	CZK/t	1 926	2 117	2 247	2 267	2 237

2523 – Portland cement, aluminous cement, slag cement, supersulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers

		2011	2012	2013	2014	2015
Import	t	843 279	760 857	757 746	720 643	624 051
Export	t	845 366	676 059	596 748	602 499	570 295

2523 – Portland cement, aluminous cement, slag cement, supersulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers

		2011	2012	2013	2014	2015
Average import prices	CZK/t	1 672	1 653	1 576	1 568	1 669
Average export prices	CZK/t	1 470	1 398	1 416	1 499	1 861

4. Prices of domestic market

Average prices of traded commodities on the domestic market

Product specification	2011	2012	2013	2014	2015
Cement CEM I, 42,5 R, on pallets, CZK/t	2 640	2 640	2 640	2 640	2 640
Cement CEM I, 42,5 R, on pallets, covered with foil, CZK/t	2 700	2 700	2 700	2 700	2 700
Cement CEM III A, 32,5 R, on pallets, CZK/t	2 300	2 300	2 300	2 300	2 300
Cement CEM III A, 32,5 R, on pallets, covered with foil, CZK/t	2 360	2 360	2 360	2 360	2 360
Dolomitic hydrated lime, bulk, CZK/t	3 540	3 790	3 790	3 790	3 790
Quicklime, ground, bulk, CZK/t	1 722	1 773	1 773	1 773	1 773
Limestone, ground, bulk, CZK/t	592–643	592–643	570–650	570–650	570–650
Limestone, crushed, CZK/t	185–1 408	157–1 408	157–1 408	157–1 408	157–1 408

5. Mining companies in the Czech Republic as of December 31, 2015

High-percentage limestones

Velkolom Čertovy schody a.s., Tmaň
Holcim (Česko) a.s., člen koncernu, Prachovice
Vápenka Vitošov s.r.o., Leština
LOMY MOŘINA spol.s r.o., Mořina
Českomoravský cement, a.s., Mokrá - Horákov
Omya CZ s.r.o.
Vápenka Vitoul s.r.o., Mladeč
Agir spol. s r.o., Petrovice

Other limestones

Českomoravský cement, a.s., Mokrá - Horákov
Cement Hranice, a.s.
Holcim (Česko) a.s., člen koncernu, Prachovice
Velkolom Čertovy schody a.s., Tmaň
HASIT Šumav. vápenice a omítkárny,s.r.o., Velké Hydčice
Omya CZ s.r.o.
LOMY MOŘINA spol.s r.o., Mořina

Krkonošské vápenky Kunčice, a.s.
Kalcit s.r.o., Brno
LB Cemix, s.r.o., Borovany

Clayey limestones
Lafarge Cement, a.s., Čížkovice

Carbonates for agricultural use
PRACTIC 99, s.r.o., Brno

Corrective additives for cement production
Českomoravský cement, a.s., Mokrá - Horákov
Cement Hranice, a.s.

6. World production and world market prices

World mine production

World limestone production is estimated at billions of tonnes. Its amount may be inferred from data on lime and cement manufacture. According to MCS data, world production of these two commodities in recent years was as follows:

	2011	2012	2013	2014	2015[e]
World cement production, mil. t	3,600	3,800	4,080	4,180	4,100
World lime production, mil. t	330	348	353	350	350

[e] – *preliminary values*

The same table as the previous one, but including limestone; calculations are based on the relationship: 2 tonnes of limestone = 1 tonne of lime or 2 tonnes of cement (limestone production for construction purposes is not taken into account)

Commodity/Year	2011	2012	2013	2014	2015[e]
World limestone production derived from the global cement production, mil. t	3,600	3,800	4,080[e]	4,180	4100
World limestone production derived from the global lime production, mil. t	660	696	706	700	700
World limestone production derived from the global lime production and cement production, mil. t	4,260	4,496	4,786	4,880	4,800

[e] – *preliminary values*

Main producers according to MCS

2015[e]			2015[e]		
Cement			Lime		
country	kt	%	country	kt	%
China	2,350,000	57.3	China	230,000	65.7
India	270,000	6.6	USA	19,000	5.4
USA	83,400	2.0	India	16,000	4.6
Turkey	77,000	1.9	Russia	11,000	3.1
Brazil	72,000	1.8	Brazil	8,300	2.4
Indonesia	65,000	1.6	Japan	7,800	2.2
Iran	65,000	1.6	Germany	6,900	2.0
South Korea	63,000	1.5	South Korea	5,000	1.4
Japan	55,000	1.3	Turkey	4,300	1.2
Egypt	55,000	1.3	France	3,800	1.1
world	**4,100,000**	**100.0**	**world**	**350,000**	**100.0**

[e] *– předběžné údaje*

Total world resources of limestone are huge, but they are not recorded statistically.

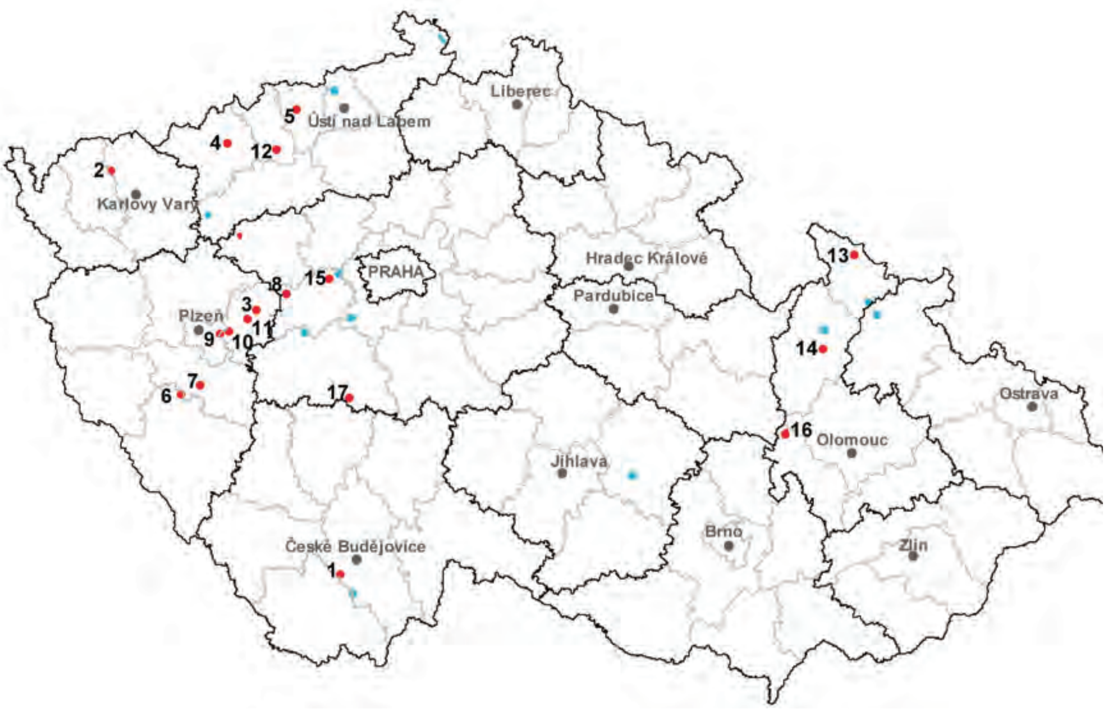
Prices of traded commodities – calcium carbonate (according to IM)

Commodity/Year		2011	2012	2013	2014	2015
$CaCO_3$, (GCC), fine grade, coated, ex-works UK	GBP/t	80–103	80–103	80–103	80–110	90–110
$CaCO_3$, (PCC), coated, ex-works UK	GBP/t	370–550	370–550	370–550	370–575	388–575
$CaCO_3$, (PCC), uncoated, ex-works	GBP/t	340–550	340–550	340–550	357–575	357–575

The price range includes the lowest and highest monthly price quotes for a given year.

Silica minerals

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits — exhausted deposits and other resources

Quartz – quartzites:

1 **Vrábče-Boršov**	6 Kaliště	11 Sklená Huť
2 Černava-Tatrovice	7 Kbelnice	12 Stránce
3 Drahoňův Újezd-Bechlov	8 Kublov-Dlouhá Skála	13 Velká Kraš
4 Chomutov-Horní Ves	9 Kyšice-Pohodnice	14 Vikýřovice
5 Jeníkov-Lahošť	10 Litohlavy-Smrkový vrch	15 Železná

Quartz for special glass:

16 Dětkovice	17 Krašovice

(Names of exploited deposits are in ***bold type****)*

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	17	15	15	15	15
exploited	1	1	1	1	1
Total mineral *reserves, kt	26 166	26 149	25 749	25 732	25 651
economic explored reserves	907	907	763	763	763
economic prospected reserves	20 507	20 490	20 297	20 280	20 266
potentially economic reserves	4 752	4 752	4 689	4 689	4 622
exploitable (recoverable) reserves	515	498	528	511	497
Mine production, kt	24	17	15	16	14

** See NOTE in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	4 533	4 533	4 533	4 533	4 533
P_2		–	–	–	–	–
P_3		–	–	–	–	–

3. Foreign trade

2506 – Quartz (other than natural sands); quartzite, whether or not roughly trimmed or merely cut

		2011	2012	2013	2014	2015
Import	t	13 352	9 077	8 232	10 809	17 722
Export	t	13	15	15	11	39

2506 – Quartz (other than natural sands); quartzite, whether or not roughly trimmed or merely cut

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 817	3 048	3 101	2 921	2 479
Average export prices	CZK/t	37 788	58 579	68 861	126 898	47 564

720221 – Ferrosilicon

		2011	2012	2013	2014	2015
Import	t	28 555	26 441	26 029	26 872	27 463
Export	t	6 051	7 344	6 915	5 473	8 607

720221 – Ferrosilicon

		2011	2012	2013	2014	2015
Average import prices	CZK/t	32 528	28 638	27 869	30 208	30 345
Average export prices	CZK/t	30 637	26 082	25 631	25 634	26 719

4. Prices of domestic market

Prices of silica minerals are not open to public.

5. Mining companies in the Czech Republic as of December 31, 2015

Budějovické štěrkopísky, spol. s r.o., Vrábče

6. World production and world market prices

World mine production

World production of silicon in recent years:

	2011	2012	2013	2014	2015^e
Silicon production (according to MCS), kt	7,370	7,770	7,880	8,110	8,100

^{e} – *preliminary values*

Main producers of Si according to MCS

country	2015^e	
	kt	%
China	5,500	67.9
Russia	680	8.4
USA	410	5.1
Norway	330	4.1
Brazil	150	1.9
India	86	1.1
RSA	84	1.0
Spain	81	1.0
Bhutan	72	0.9
Ukraine	70	0.9
world	**8,100**	**100.0**

^{e} – *preliminary values*

Regarding the production of ferrosilicon, China was followed by Russia, Norway, USA, Brazil, and Ukraine.

World silicon deposits are huge thanks to the available reserves of quartzite and quartz gravels.

Prices of traded commodities –

– **silicon** (EUR/t), free market, in warehouse, annual average of 2015 according to DERA Preismonitor (2016) 2,319.04.

– **silicon carbide** (EUR/tonne) according to Industrial Minerals

Commodity/Year	2011	2012	2013	2014	2015
FEPA*) 8-220, black, Grade 1, CIF UK	1,900–2,100	1,900–2,100	1,900–2,100	1,900–2,100	1,900–2,100
FEPA 8-220, black, Grade 2, CIF UK	1,500–1,650	1,500–1,650	1,500–1,650	1,500–1,650	1,500–1,650
Refractory grade, min. 98% SiC, CIF UK	1,500–1,800	1,500–1,800	1,500–1,800	1,500–1,800	1,500 – 1,800
Refractory grade, min. 95% SiC, CIF UK	1,350–1,450	1,350–1,450	1,350–1,450	1,350–1,450	1,350–1,450

Note:

*) *Federation of European Producers of Abrasives (FEPA) grain standards*

The price range includes the lowest and highest monthly price quotes for a given year

– **ferrosilicon** (EUR/t) according to Metal Bulletin

Commodity/Year	2011	2012	2013	2014	2015
Piece basis, 75% Si (proportionally by Si content)	1,080–1,550	1,080–1,260	1,060–1,180	1,134.38*)	1,148.96*)

*) *yearly average according to D-R*

The price range includes the lowest and highest daily price quotes for a given year.

According to DERA Preismonitor, the average price of one ferrosilicon piece (according to MB), 75% Si, was 1,196.83 EUR/t in the years 2010-2014, while the average market price of Si alone was 2,144.99 EUR/t in the same period.

CONSTRUCTION MINERALS

Aggregates

Aggregates market analysis of selected countries in Central Europe

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1. INTRODUCTION & MARKET DESCRIPTION

1.1. GRAVEL & SAND, CRUSHED STONE: GENERAL MARKET DYNAMICS

The sand, gravel and crushed stone industry together with the construction industry can be considered the most resource-intensive sector throughout Europe in terms of the volume of material used. According to Eurostat, they are representing about 40 % of the Direct Material Inputs (DMI) into the European economy (European Environment Agency, 2008).

Construction sand and gravel, which is one of the most accessible natural resources and a major basic raw material, is used mostly by the construction industry. The construction sand and gravel industry is a major contributor to and an indicator of the economic well-being of the Nation, by producing a high volume of basic products with a low unit value. Transportation is a major factor in the delivered price of construction sand and gravel. The cost of moving construction sand and gravel from the plant to the market often exceeds the sales price of the product at the plant. Because of the high cost of transportation, construction sand and gravel continues to be marketed locally. Economies of scale, which might be realized if fewer, larger operations served larger marketing areas, would probably not offset the increased transportation costs. Future demand for construction sand and gravel will continue to be dependent mostly on the growth of construction activity.

Crushed stone is a high-volume, low-value commodity. The industry is highly competitive and is characterized by lot of operations serving local or regional markets. Production costs are determined mainly by the cost of labour, equipment, energy, and water, in addition to the costs of compliance with environmental and safety regulations. These costs vary depending on geographic location, the nature of the deposit, and the number and type of products produced. The demand for crushed stone is determined mostly by the level of construction activity, and, therefore, the demand for construction materials. Demand for aggregates is closely related to the level of new house building, maintenance, renovation, and civil engineering projects. Other uses of sand, gravel and crushed stone include cement and lime manufacture, agriculture, metallurgical flux, and fillers and extenders.[1]

The aggregate sector mainly consists of small and medium-sized enterprises (SMEs) operating over 20 000 extraction sites that supply local and regional markets.[2]

1.2. MARKET RESEARCH: APPLIED METHODOLOGY

In this report a market analysis has been performed for selected Central European Union countries for the Sand and Gravel, as well as the Crushed stone industry. Price data has been collected for the mentioned minerals for various European Union countries from 2010–2015. The analysis part involves comparing the change in prices for these minerals in the following years and further a comparison has also been made with the United States of America's (USA) Market. For the analysis list of countries which have been considered is as follows: - Austria, Czech Republic, Poland, Slovakia, Germany, UK, France and Hungary.[3]

The data for price of aggregate minerals in the various markets has been collected from various sources which have been mentioned in the reference section. At the same time there has been the issue of missing data, wherein the prices were unavailable in some cases the following methodology was applied:

1. Pricing Index for United Kingdom (UK) and France with base as 2010 data[4]
2. Linear interpolation/regression of the data, when data is missing for a few years.
3. Based on Consumption data[5], estimating price (Using basic demand- price theory*)

In the third methodology, consumption data was calculated empirically (Production + Import - Export) of the primary aggregates (Sand & Gravel and Crushed Stone).

After collecting and observing the data for price of gravel and sand, crushed stone, average price was calculated for the European countries and compared with the price in USA from 2010–2015. Important changes and observed trends in the price are provided as a part of analysis. For better understanding of the analysis, the countries are analyzed after segregating them into developed and developing economies.

2. MARKET ANALYSIS

2.1. EU: MARKET RESEARCH, ANALYSIS AND COMPARISON WITH OTHER NATIONS

2.1.1. SAND AND GRAVEL

Prices quoted are (net) ex-works sand and gravel prices per ton. The Hungarian, British, Czech and Polish prices are converted into Euro (Slovakia adopted the Euro in 2009). The exchange rates resulted from the year average of the Central European Bank in 2015.[6]

1 Euro	27.28 Czech Koruna
1 Euro	4.18 Polish Zloty
1 Euro	0.73 British Pound
1 Euro	310.00 Hungarian Forint

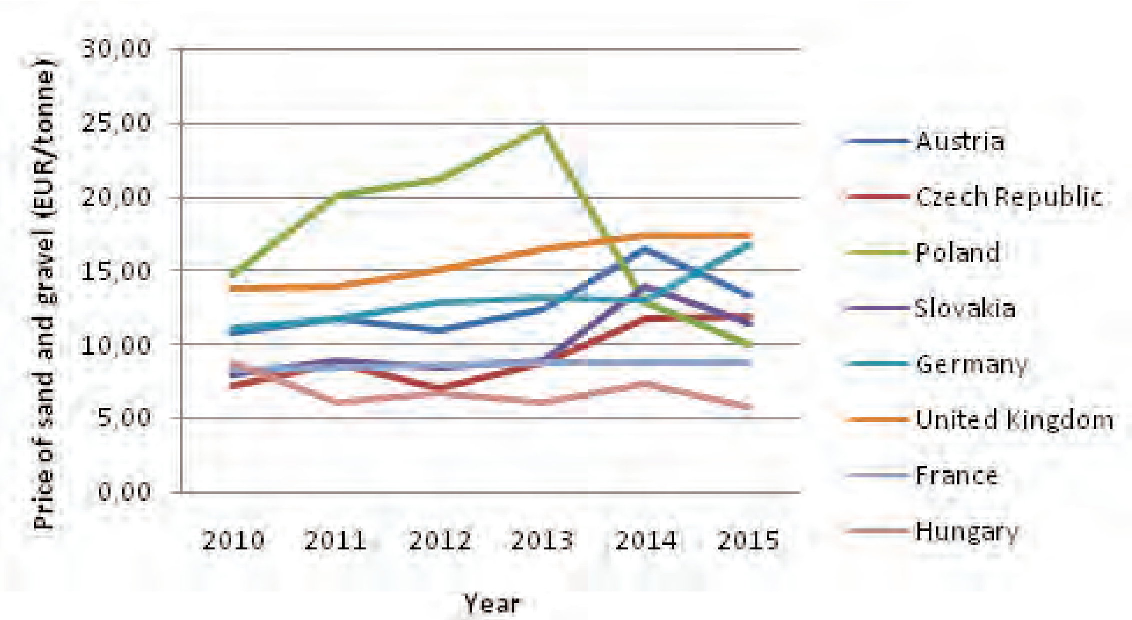
* A theory relating to the relationship between consumer demand for goods and services and their prices. Demand theory forms the basis for the demand curve, which relates consumer desire to the amount of goods available. As more of a good or service is available, demand drops and therefore so does the equilibrium price. However, if demand is high and the quantity of supply is scarce in that case the prices may rise. (Source: Investopedia)

Table 1: Price of sand and gravel in various EU nations in EUR/tonne from 2010–2015

Country name	2010	2011	2012	2013	2014	2015
Austria[12]	10.77	11.70	11.00	12.30	16.50	13.25
Czech Republic[14]	7.09	8.66	6.96	8.71	11.70	11.86
Poland[15]	14.75	20.00	21.20	24.60	12.90	10.00
Slovakia[16]	7.90	8.90	8.30	8.80	13.90	11.39
Germany[17]	11.10	11.71	12.78	13.10	13.00	16.76
United Kingdom[18]	13.80	13.90	15.05	16.40	17.30	17.30
France[19]	8.20	8.30	8.50	8.65	8.70	8.74
Hungary[21]	8.70	6.10	6.70	6.10	7.30	5.75
Average	10.29	11.16	11.31	12.33	12.66	11.88

(blue)	Based on Price Indices with base as 2010 data
(yellow)	Interpolated

(Source: Market evaluation conducted by MinPol)



(Source: Market evaluation conducted by MinPol)

Figure 1: Sand and gravel price trend in selected EU nations from 2010–2015

Sand and gravel price development between 2014 and 2015 in percentage in terms of developed economies and developing respectively emerging economies is as follows.

Developed economies:

COUNTRY	% CHANGE
Austria	–19.70%
Germany	28.92%
France	0.47%
United Kingdom	–0.25%

COUNTRY	% CHANGE
Czech Republic	1.36%
Poland	–22.48%
Slovakia	–18.06%
Hungary	–21.23%

It must be noted that the price/ton in U.K since 2009 has been estimated using price indices (with base as 2005), thus the value provided is a close approximation to the actual prices prevailing in the U.K market. Similar methodology has been applied for France with base as prices prevailing in 2009.

OVERALL MARKET TREND

Sand and gravel´s prices in Central-Eastern European countries have decreased approximately 20% with exception of Czech Republic which remain more less the same. Situation of developed countries is much heterogeneous. Austria,unlike rising Germany, after soared up in 2014 returns to level of previous years.

The constructionsector demonstrates growth in mayor part of Europe. The big impact to residential construction has the massive influx of migrants and this tendency is expected to continue in the nearest future. At the same time this phenomenon would influence the economic situation and stability in European trade such as consequences connected with the exit of Great Britain from European Union.

COUNTRY-WISE MARKET TREND

For Germany there has been a nominal increase of about 17% in 5 years. Lack of investments in the construction sector was the outcome of the 2009 recession. However, despite the debt crisis Germany is showing positive signs of solid economic growth as the GDP has been showing a noticeable increase ever since 2009 and the construction sector is expected to show a decent growth of 1.6% in 2014.[13] In 2015 despite the positive GDP[14] development construction sector has shown slight slowdown. Major players[15] on Sand and Gravel market show lower production numbers and increase in price. As a result of refugee crisis over 2% new dwelling[16] needed to be build beside 2014.

For Poland, the price has consistently showed an increasing trend up to 2013. The price in 2009 was hovering around 9 euro/ton which has skyrocketed to 24.6 Euros/ton in 2013, an increase by over 150%.[17] The accession of Poland in EU led to the start of modernisation and development of many sectors of the economy. A large proportion of the funds received were spent on infrastructure, mainly roads, with the aim of synchronising them with the European transport system[18]. Aggregate producers were located in the Southern Poland and the road construction plan was being executed in the Northern part. This led to an additional increase in the prices of Sand & Gravel.[1920] But in 2014 the price has almost been halved of what it was in the previous year possible due to the extended winter of 2013.In 2015, production of natural sands and gravel amounted to 167.93 million tonnes, increasing by 21.4 million tonnes (that is 14.6%) in relation to the previous year 2014.[21]

After steep increase of price since 2012 to 2014 significant change of trend can be visible[22]. Lower GDP 0.9%[23] and drop in export were main price creation factors in 2015. Price of aggregates decreased nearly about 20%. For year 2016[24] are more optimistic prediction mainly connected with new infrastructure program and new dwelling investment[25].

We observe a sudden increase in prices by a marginal amount in Czech Republic. Czech construction output continued to fall in 2013, the fifth consecutive year of decline but in the year 2014 prices have picked up. The reason for the drop in 2013 was mainly due to decreasing demand for construction brought on by the economic situation. In 2014 the Czech construction industry has stabilised and it is expected to see the first signs of recovery in 2015.[26]Accelerated drawdown of money from EU funds is reflected very strongly in investment in buildings and structures in 2015.[27]Construction output in 2015 increased by 5,5 %, due to growth in the segment of civil engineering by 16.4 %. Year-on-year improvement 2014-2015 in this sector was of 20.8%, while the ground construction stagnated.[28]

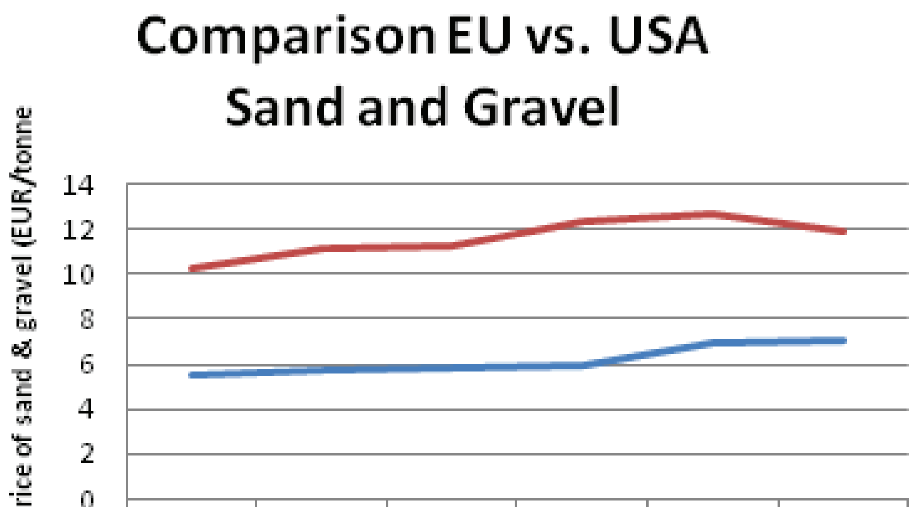
From the last crisis in 2008 Hungarian economics was slowly recuperating at the beginning of this decade, GDP even decreased annually – 1.7 % in 2012. Despite the year 2014 was most successful for Hungary, annual growth of GDP was 3.7 % and at the end of the 2015 the country register little slowdown, annual change was 2.9 %. This fluctuation is reflected well in prices of sand and gravel. At the same time is related to sand and gravel production. There was a growth 38%[29] between years 2013 and 2014. It was the highest volume from 2010. This significant change had effect on prices in 2015 which felt down to lowest value in this period.

Prices of construction materials in United Kingdom did not varied significantly or they remain stable. The production of construction materials even increased in 2014. Annual growth of GDP is slowing down from 2.9 % to 2.3 % in 2015.

EUROPE and USA: MARKET TREND COMPARISON

Price trend for **United States and average price in Europe** can be seen in Figure 2. The development of prices in the USA indicatescontinuous increasing prices, however, with price differences of about 4-6 €. European sand and gravel prices indicate a considerable higher price level and stronger increasing in terms of percentage. In 2015 for U.S was 7euro/tonne[30] and EU average was around 11.9 euro/tonne[31].

The European nations shows small fluctuation compared to the USA. This can be attributed to the price change in developing economies (Czech Republic, Slovakia, Austria and UK), which have been higher than their developed counterparts in Europe and the USA. It is rather than expected result since in developing nations the demand for construction materials has an increasing trend, due to the expanding economy. Thus the average price of a set of developed and developing nations (European Union) is giving a higher value than a developed nation (United States).



	2010	2011	2012	2013	2014	2015
USA average	5,5	5,7	5,8	5,9	6,9	7,0
Europen average	10,3	11,2	11,3	12,3	12,7	11,9

(Source: Market evaluation conducted by MinPol, USGS)

Figure 2: Sand and gravel price trend comparison between USA and EU, 2010–2015

Exchange rate – year average (Central European Bank, 2015)

1 EUR	**1.1095** U.S. Dollar

EUROPE and INDIA: MARKET TREND COMPARISON

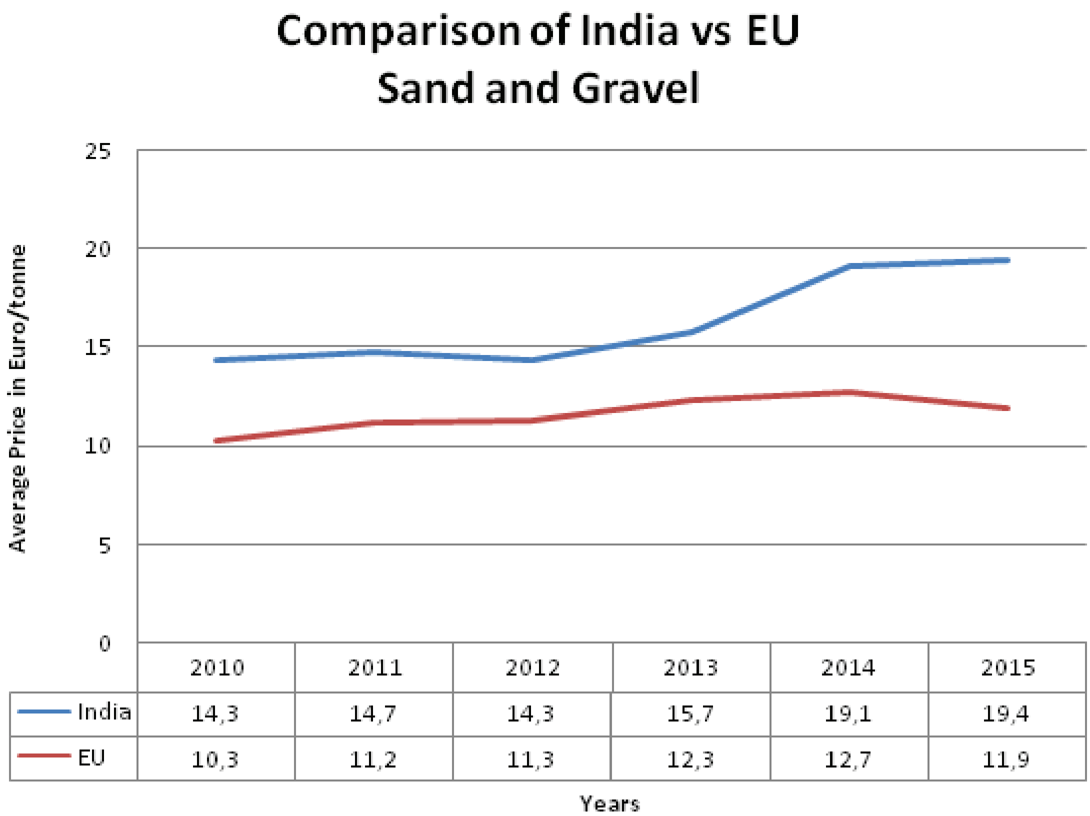
For Indian market, due to varied difference in prices in various states of the country average export price is taken for the comparison and the price of sandstone is considered as a proxy for the sand and gravel market.

The important observation in comparison is the difference between the rate of price change. India being a developing nation, the demand for construction material is high and it is reflected in the price rise.It can be clearly seen that fluctuations are high in case of India which is a developing economy and more sensitive to changing factors, it has increased sharply from 14€ to 19€ in just 2 years.

Again it is an expected trend since EU is an average representation of developing and developed economies but India is solely a developing economy with very high demand in the infrastructure sector.

Exchange rate – year average (Central European Bank, 2015)

1 EUR	**72.9** INR



(Source: Market evaluation conducted by MinPol, USGS)

Figure 3: Sand and gravel price trend comparison between India and EU, 2010–2015[32]

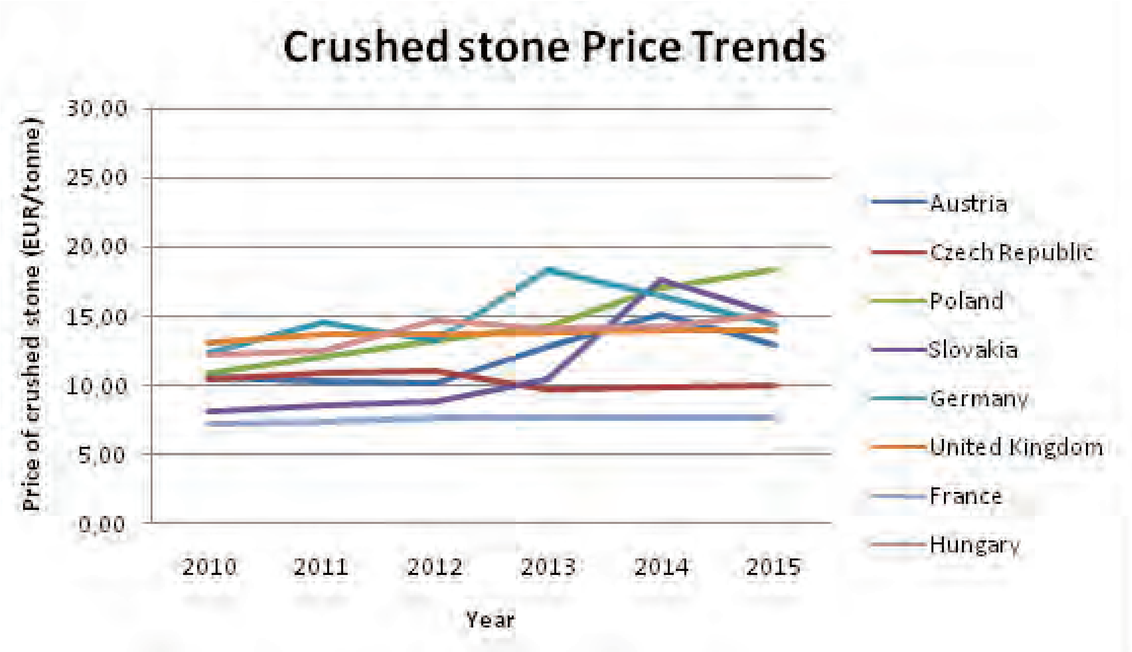
Table 2: Price od crushed stone in various EU nations in EUR/tonne from 2010–2015

Country name	2010	2011	2012	2013	2014	2015
Austria	10.52	10.36	10.20	12.80	15.10	12.93
Czech Republic	10.48	10.88	11.00	9.65	9.80	9.99
Poland	10.93	12.10	13.20	14.32	17.10	18.36
Slovakia	8.10	8.60	8.80	10.40	17.70	15.09
Germany	12.30	14.50	13.30	18.40	16.50	14.34
United Kingdom	13.10	13.70	13.60	13.75	13.90	14.00
France	7.20	7.40	7.60	7.60	7.70	7.68
Hungary	12.20	12.50	14.70	14.05	14.30	15.11
AVERAGE	10.60	11.26	11.55	13.21	14.01	12.60

(blue)	Based on Price Indices with base as 2010 data
(yellow)	Interpolated
(green)	Approx, based on production stats

(Source: Market evaluation conducted by MinPol)

2.1.2. CRUSHED STONES



(Source: Market evaluation conducted by MinPol)

Figure 4: Crushed stone price trend in selected EU nations, 2010–2015

Prices quoted are (net) ex-works crushed stone prices per ton. The Hungarian, British, Czech and Polish prices are converted into Euro. The exchange rates resulted from the year average of the Central Europian Bank, in 2015.

Czech	1 EUR	**27.28**	CZK
Poland	1 EUR	**4.18**	PLN
UK	1 EUR	**0.73**	GBP
Hungary	1 EUR	**310.00**	HUF

Crushed stone price development between 2014 and 2015 in percentage in terms of developed economies and developing respectively emerging economies is as follows

Developed economies:

COUNTRY	% CHANGE
Austria	–14.37%
Germany	–13.09%
France	–0.26%
United Kingdom	0.72%

COUNTRY	% CHANGE
Czech Republic	1.93%
Poland	7.37%
Slovakia	–14.74%
Hungary	5.66%

OVERALL MARKET TREND

Comparing developed and developing countries they have opposite tendency. While Austria and Germany experienced visible fall in prices in last year Hungary and Poland continued with slight growth. France and UK market remain stable as well as Czech Republic. Slovakia has copied trend of its western neighbour.

Civil engineering continued to grow in 2015, with a total growth of 3.3% estimated. In 2015 all Central-Eastern European countries experienced significant growth as they tried to absorb all available EU funds from the previous programming period.

COUNTRY-WISE MARKET TREND

There has been a decrease in price of Crushed Stone in Czech Republic from 10.48 euro/ton in 2010 to 9.99 euro/ton in 2015. This can be related to the decrease in construction activity also reflecting in the decreased GDP/capita of the nation.[33]The Czech construction market continued to decline at single-digit pace and certain growth in output is only likely to return post 2014. Cancelled civil engineering construction, particularly in the road infrastructure sector, combined with weaker development in the non-residential segment caused for low demand; a consequence of which is the low price of crushed stone.[34] The price has slightly increased since 2013 showing a recovering trend for Czech Republic. GDP growth in the Czech republic for the year 2015 is influenced by the drawdown of money from european funds, and helped by domestic demand. The Czech economy in 2015 prospered most in the last 8 years.[35]

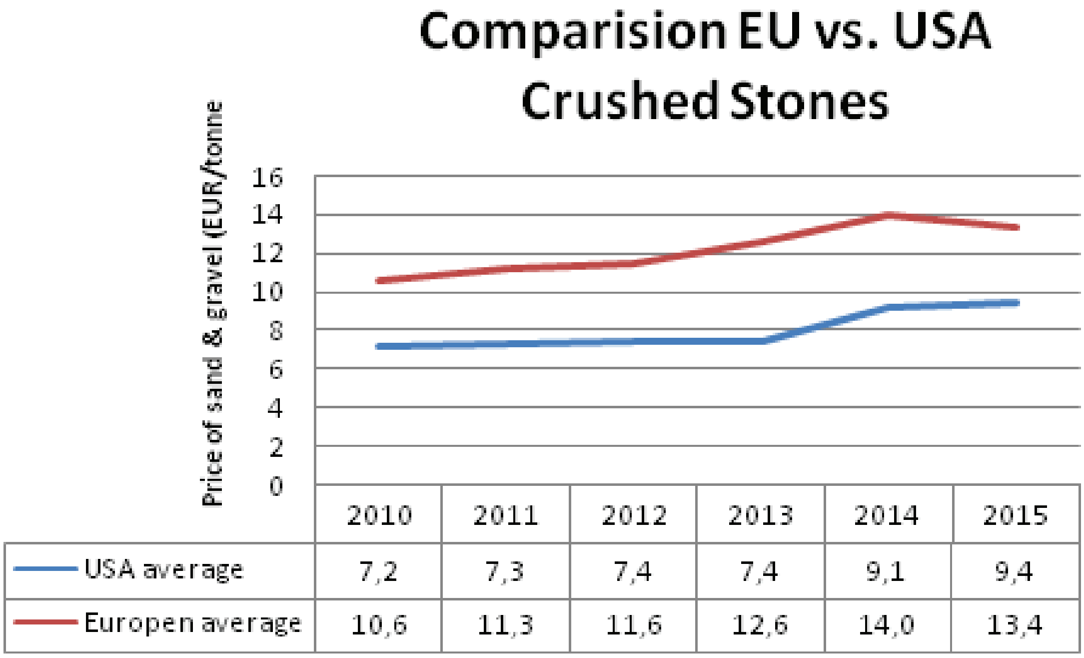
While in 2014 the Slovakian economics produced annual growth of GDP 2.5 % and year before only 1.4 % in 2015 was 3.6%[36]. This improvement had impact on construction development, which is given mainly by construction of new highway sections (there were + 33.8 % more tenders[37]), but there is also growth in new housing. Despite this tendency, prices of construction material have decreased 22 % in case of sands and gravels and 17 % crushed stone. It could be caused by production expansion. Other reason could be problems in metallurgical sector, because of low prices of china´s lead. The limestone is used in production of lead, which is one of the most important industries in the east of the country.

In 2015 prices of crushed stone in Hungary slightly increased, which could be reaction to small decrease in production from 15 to 14 millions of tones[38]. Construction sector have experienced rise in last year, thanks to increasing number of tenders in the civil engineering sector and non- residential building[39].

In 2015 Austrian prices reacted to continuously lower aggregate export since year 2014. After promising years construction sector has slowed to 1%. Low GDP 0.9%[40] in year 2015 will rise to 1.5% in 2016.

Private residential construction was also the growth driver in the United Kingdom. Construction activity in the United Kingdom has declined from the previous year after an increasing trend in 2013. But it is still higher than the prices in 2010, thus for a five year horizon the price can be considered to have appreciated.

Crushed stone sector slows throughout all developed countries in EU. Decrease in prices continues since 2014. In Germany can be expected that prices will be influenced by government program for recovery Highway and rail road network[41]. Program has 14 billion Euro funds from Federal government and 14 billion Euro from private sector for highways and 28 billion Euro for rail road network for years 2015–018.



(Source: Market evaluation conducted by MinPol, USGS)

Figure 5: Crushed stone price trend comparison between USA and EU, 2010–2015

Exchange rate – year average (Central European Bank, 2015)

1 EUR	**1.1095** U.S. Dollar

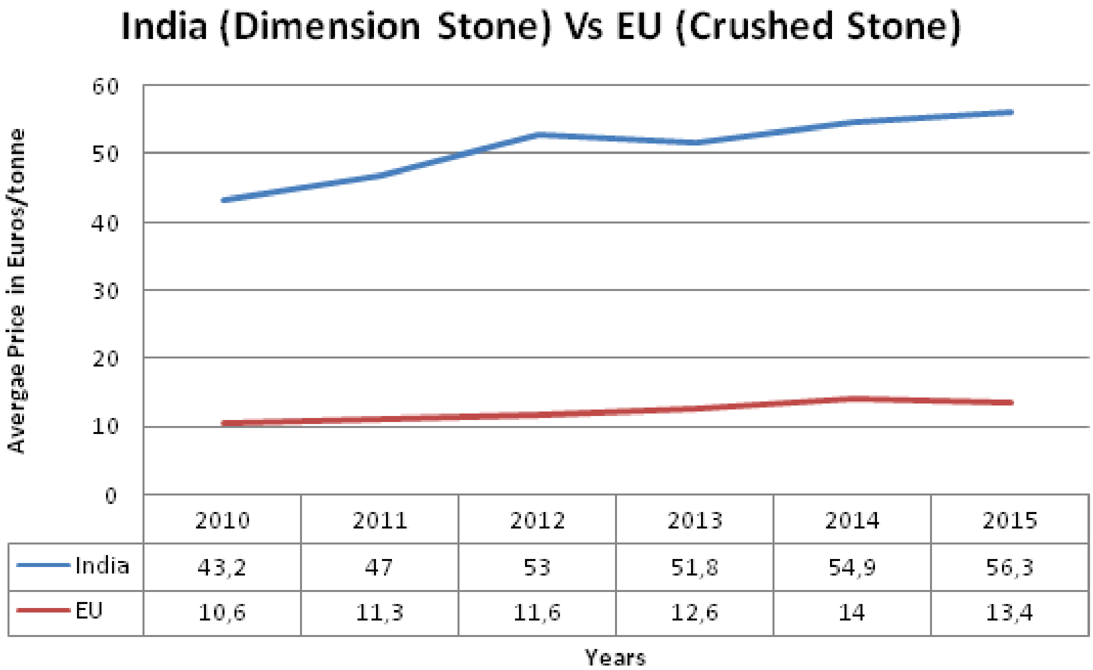
France's construction industry is undergoing a period of weakness.The economy is experiencing downfall due to economic troubles in the Eurozone, and this resulted in a flat trend in construction prices which continued in 2015 as well.[42]

Polish production of crushed stones in 2015 amounted to 64,18 million tonnes and slightly increased in comparison with 2014 – by 95 thousand tonnes (0,15%). [43]The situation in the sector of building construction is improving, while the civil engineering sector has been stagnant.[44]

EUROPE and INDIA: MARKET TREND COMPARISON

For Indian market, due to varied difference in prices in various states of the country average export price is taken for the comparison and the price of building and monumental stone (represented as dimension stone in Figure 6) is considered as a proxy for the crushed stone market. The high price range in the Indian market could be attributed to addition of the monument stone in calculating the average price. Data released by the Indian Bureau of Mines is combined for building and monument stones

The important observation in comparison is the difference between the rates of price change. India being a developing nation, the demand for building stone is quite high and is correctly reflected in the price rise. Again it is an expected trend since EU is an average representation of developing and developed economies but India is solely a developing economy with very high demand in the infrastructure sector.



Data Source for Indian Market – India Mineral Yearbook 2010–2015 , Indian Bureau Of Mines

Figure 6: Crushed stone price trend comparison between India and EU, 2010–2015[47]

Figure 6 shows a comparison between Indian dimension stone market and EU crushed stone market. Although it may not be a direct comparison but the constraints on availability of data makes it the best possible option for comparing the construction market trends of these two unions. Reason for the huge price difference gap is mainly because dimension stones are used for high end construction and are costlier than normal crushed stones.

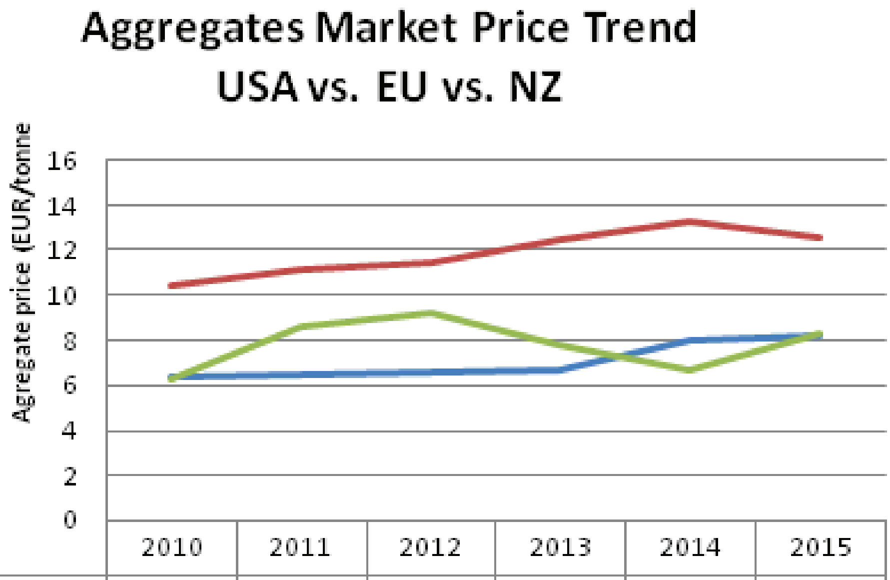
Exchange rate – year average (Central European Bank, 2015)

1 EUR	**72.9** INR

EUROPE and NEW ZEALAND: AGGREGATE MARKET TREND COMPARISON

New Zealand has strong open economy with focus on export. Its share is 30% in Country's GDP for 2016.[47, 48] Similar to India, in New Zealand has regional price difference between regions. In North Island mainly east and north regions are rich in sand. South Island is rich in sand in north-west regions. Crushed stone is most often made from greywacke.[49] Greywacke is regional name for grey sandstones or mudstones which spans from Carboniferous to Early Cretaceous in age.[50]

Data provided by New Zealand Petroleum and Minerals is not primarily divided in sand & gravel and crushed stones. Thus while comparing with EU and USA we have considered Market trend for USA and EU as combined average for sand & gravel and crushed



	2010	2011	2012	2013	2014	2015
USA average	6,35	6,5	6,6	6,65	8	8,2
Europen average	10,4	11,2	11,4	12,5	13,3	12,7
New Zealand	6,23	8,63	9,253	7,83	6,667	8,28

Data Source for Indian Market – India Mineral Yearbook 2010–2015 , Indian Bureau Of Mines

Figure 7: Aggregate Market Price development comparison for Europe, New Zealand and USA

stones and represented it in Figure 7 under "Aggregate Market Price Trend". For EU the average price calculation has been done by considering selected nations in the union which majorly represent the construction sector in the region.

Christchurch on South Island was heavily hit by earthquake in 2011.[51] Need for aggregate has helped the sector to recover after steep decrease in production in year 2009 which was result of 2008 economic crisis.

As is visible from the figure below, need for aggregates has levelled up price nearly about 50% in year 2012 than it was before year 2010. Current trend is decreasing due to changes in Chinese market which is New Zealand's one of the most significant export partner. Uncertainty in dairy sector has influenced investments in building sector. These factors are cause of aggregate price increase in 2015.[52] Also, construction activities in area affected by earthquake have started to slow down. Aggregate mining has decreased by 17% in 2015 compare to year 2014.

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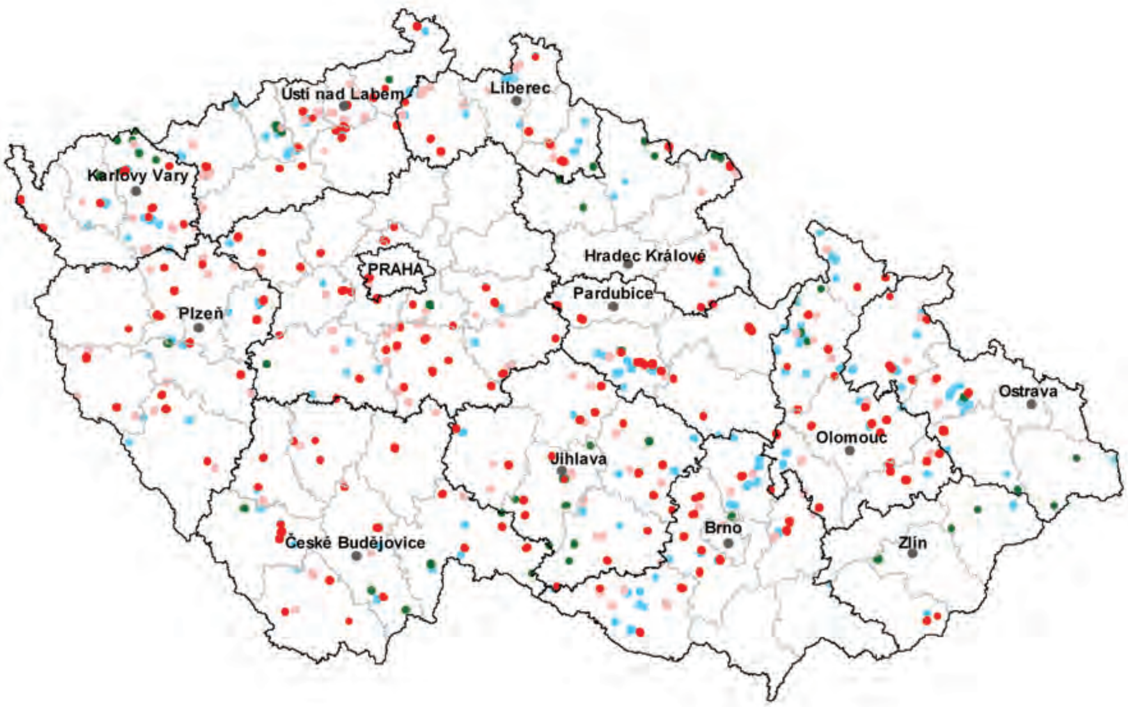
Crushed stone

1. Registered deposits and other resources of the Czech Republic



- reserved deposits – exploited (166)
- reserved deposits – unexploited (154)
- non-reserved deposits – exploited (44)
- non-reserved deposits – unexploited (177)

Because of the large number of crushed stone deposits in the Czech Republic, they are not listed.

2. Basic statistical data of the Czech Republic as of December 31

Reserved deposits: Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	320	319	319	319	320
exploited	165	170	169	172	166
Total mineral *reserves, ths m^3	2 392 105	2 391 958	2 383 849	2 373 413	2 416 382
economic explored reserves	1 157 255	1 155 910	1 089 703	1 142 842	1 165 330
economic prospected reserves	1 090 044	1 091 875	1 149 727	1 086 152	1 107 722
potentially economic reserves	144 806	144 173	144 419	144 419	143 330
exploitable reserves	717 064	715 299	704 187	649 252	665 434
Mine production in reserved deposits, ths m^3	12 299	10 950	11 420	12 341	13 740

** See* ***NOTE*** *in the chapter* ***Introduction*** *above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter* ***Mineral reserve and resource classification in the Czech Republic*** *of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	ths m^3	78 950	78 950	61 357	61 357	61 357
P_2,	ths m^3	399 314	399 314	408 807	408 807	408 807
P_3		–	–	–	–	–

Non-reserved deposits: Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	214	219	219	218	221
exploited	47	47	40	39	44
Total mineral *reserves, ths m^3	1 019 574	1 029 457	1 022 363	1 022 822	1 028 758
economic explored reserves	43 075	46 617	42 452	42 182	39 582
economic prospected reserves	892 905	899 291	896 645	897 496	906 032
potentially economic reserves	83 594	83 549	83 266	83 144	83 144
exploitable reserves	46 300	43 500	45 084	45 084	52 897
Mine production in non-reserved deposits, ths m^3 [a)]	1 300	1 100	969	982	1 171

** See* ***NOTE*** *in the chapter* ***Introduction*** *above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter* ***Mineral reserve and resource classification in the Czech Republic*** *of this yearbook*

[a)] *estimate*

3. Foreign trade

251710 – Pebbles, gravel, broken or crushed stone

		2011	2012	2013	2014	2015
Import	t	221 539	223 321	290 563	525 436	546 089
Export	t	465 375	384 132	432 645	573 767	465 801

251710 – Pebbles, gravel, broken or crushed stone

		2011	2012	2013	2014	2015
Average import prices	CZK/t	345	333	297	241	227
Average export prices	CZK/t	213	234	168	180	217

4. Prices of domestic market

Domestic prices of crushed stone – nationwide

Product specification	2011	2012	2013	2014	2015
crushed stone, spilite, fraction 4–8mm, CZK/t	269	292	274	273	283
crushed stone, amphibolite, fraction 4–8 mm, CZK/t	340	334	345	351	351
crushed stone, granite, fraction 4–8 mm, CZK/t	323	309	332	325	324
crushed stone, gneiss, fraction 4–8 mm, CZK/t	319	321	317	328	336
crushed stone, porphyry, fraction 4–8 mm, CZK/t	316	307	290	281	298
crushed stone, granodiorite, fraction 4–8 mm, CZK/t	298	311	319	311	314
crushed stone, greywacke, fraction 4–8 mm, CZK/t	315	309	315	307	326
crushed stone, basalt, fraction 4–8 mm, CZK/t	293	298	299	318	310
crushed stone, hornfels, fraction 4–8 mm, CZK/t	248	255	239	264	264
crushed stone, limestones, fraction 4–8 mm, CZK/t	258	261	259	300	285
crushed stone, spilite, fraction 8–16 mm, CZK/t	262	268	269	267	266
crushed stone, amphibolite, fraction 8–16 mm, CZK/t	275	273	270	272	269
crushed stone, granite, fraction 8–16 mm, CZK/t	241	242	248	250	256
crushed stone, gneiss, fraction 8–16 mm, CZK /t	255	255	252	259	260
crushed stone, porphyry, fraction 8-16 mm, CZK/t	248	245	–	268	292
crushed stone, granodiorites, fraction 8–16 mm, CZK /t	256	254	263	252	261
crushed stone, greywacke, fraction 8–16 mm, CZK /t	268	267	263	257	265
crushed stone, basalt, fraction 8–16 mm, CZK /t	267	271	269	278	282
crushed stone, hornfels, fraction 8–16 mm, CZK /t	238	216	224	251	234
crushed stone, limestones, fraction 8–16 mm, CZK /t	230	230	232	237	252

Domestic prices of crushed stone in 2015 – subdivided by rocks and regions which the rocks are mined in

2015		Average prices of (listed) fractions (CZK/t)							In region	In all regions
Rock-mineral	Size fraction (mm) / Region/average of fraction price	0-4	0-32	0-63	4-8	8-16	32-63	LK unsorted		
opoka-sandstone	Central Bohemia	FN	140	140	FN	FN	FN	FN	140	
	Zlín	FN	140	150	FN	FN	FN	FN	145	
	Average of fraction price	FN	140	145	FN	FN	FN	FN		143
serpentine	Central Bohemia	140	159	165	291	241	204	200	200	
	Average of fraction price	140	159	165	291	241	204	200		200
limestone	Central Bohemia	180	100	170	260	233	FN	300	207	
	Prague	165	185	185	255	255	230	400	239	
	Olomouc	159	195	190	340	270	200	220	225	
	South Bohemia	139	206	206	255	FN	208	198	202	
	Moravia and Silesia	190	213	180	315	250	205	203	222	
	Average of fraction price	167	180	186	285	252	211	264		221
basaltic rocks	Karlovy Vary	163	140	143	290	240	204	147	190	
	Hradec Králové	190	175	160	250	210	235	85	186	
	Central Bohemia	230	210	210	330	290	250	180	243	
	Plzeň	190	189	191	309	189	220	179	210	
	Prague	165	157	162	260	245	235	370	228	
	Liberec	180	212	221	363	321	233	231	252	
	Ústí nad Labem	239	212	200	292	276	216	204	234	
	Average of fraction price	194	185	184	299	253	228	199		220
greywacke	South Bohemia	200	105	120	315	255	195	FN	198	
	South Moravia	185	130	143	315	268	208	FN	208	
	Olomouc	180	176	170	343	271	212	164	217	
	Moravia and Silesia	202	196	192	331	264	216	191	227	
	Average of fraction price	192	152	156	326	265	208	178		221
skarn	Central Bohemia	150	150	170	320	230	220	220	209	
	Average of fraction price	150	150	170	320	230	220	220		209
gneiss	Plzeň	149	178	172	279	241	187	118	189	
	South Moravia	70	143	163	303	235	195	190	186	
	Vysočina	152	168	188	295	267	214	188	210	
	Pardubice	171	155	168	327	257	213	197	213	
	Central Bohemia	88	170	190	380	298	237	252	231	
	Olomouc	168	194	189	405	245	204	180	226	
	Hradec Králové	205	180	175	360	280	245	195	234	
	Average of fraction price	143	170	178	336	260	214	189		213
hornfels	Pardubice	118	155	158	275	220	195	163	183	
	Central Bohemia	133	163	164	253	248	213	277	207	
	Average of fraction price	126	159	161	264	234	204	220		195
amphibolite	Plzeň	249	182	182	314	220	201	168	217	
	South Moravia	120	190	205	340	255	210	190	216	
	Olomouc	215	193	196	344	286	217	193	235	
	Central Bohemia	152	235	195	370	283	228	210	239	
	Hradec Králové	215	185	190	370	295	250	195	243	
	Vysočina	205	160	165	365	275	235	195	229	
	Average of fraction price	193	191	189	351	269	224	192		230
granitic rocks	South Moravia	92	167	176	302	238	201	189	195	
	Karlovy Vary	163	140	143	290	240	204	147	190	
	Pardubický	155	164	170	342	253	204	164	207	
	Central Bohemia	105	166	185	273	257	191	198	196	
	South Bohemia	190	203	196	347	289	208	179	230	
	Vysočina	152	191	188	345	309	220	209	231	
	Ústí nad Labem	130	FN	185	FN	FN	FN	330	215	
	Average of fraction price	141	172	178	317	264	205	202		211
granulite	South Bohemia	183	214	212	349	277	233	187	236	
	Average of fraction price	183	214	212	349	277	233	187		236

Explanations:
LK: Quarry stone
basaltic rocks: melaphyrer+spilite+basalt+phonolite
granitic rocks: diorite+granite+syenite+diorite+porphyry
limestone: limestone+dolomite+marble
gneiss: orthogneiss+paragneiss

Domestic prices of crushed stone in 2015 – subdivided by regions and rocks mined in them

2015		Average prices of (listed) fractions (CZK/t)							In region
Region	Size fraction (mm) / Rock-mineral/price	0-4	0-32	0-63	4-8	8-16	32-63	LK unsorted	
Plzeň	gneiss	149	178	172	279	241	187	118	
	granitic rocks	210	198	213	303	270	215	200	
	amphibolite	249	182	182	314	220	201	168	
	basaltic rocks	190	189	191	309	189	220	179	
	meta-greywacke	225	205	185	300	285	235	200	
	Average of fraction prices in the region	**205**	**190**	**189**	**301**	**241**	**212**	**173**	**216**
South Moravia	greywacke	185	130	143	315	268	208	FN	
	gneiss	70	143	163	303	235	195	190	
	granitic rocks	92	167	176	302	238	201	189	
	amphibolite	120	190	205	340	255	210	190	
	Average of fraction prices in the region	**117**	**158**	**172**	**315**	**249**	**204**	**190**	**200**
Karlovy Vary	granitic rocks	163	140	143	290	240	204	147	
	basaltic rocks	256	200	210	315	272	234	180	
	trachyt	FN	106	159	FN	FN	179	FN	
	Average of fraction prices in the region	**210**	**149**	**171**	**303**	**256**	**206**	**164**	**208**
Moravia and Silesia	limestone	190	213	180	315	250	205	203	
	greywacke	202	196	192	331	264	216	191	
	basaltic rocks	173	FN	FN	282	286	FN	203	
	region	**188**	**205**	**186**	**309**	**267**	**211**	**199**	**223**
Pardubice	gneiss	171	155	168	327	257	213	197	
	granitic rocks	155	164	170	342	253	204	164	
	basaltic rocks	180	235	235	425	335	245	235	
	hornfels	118	155	158	275	220	195	163	
	region	**156**	**177**	**183**	**342**	**266**	**214**	**190**	**218**
Olomouc	limestone	159	195	190	340	270	200	220	
	greywacke	180	176	170	343	271	212	164	
	gneiss	168	194	189	405	245	204	180	
	amphibolite	215	193	196	344	286	217	193	
	Average of fraction prices in the region	**181**	**190**	**186**	**358**	**268**	**208**	**189**	**226**
Central Bohemia	limestone	180	100	170	260	233	FN	300	
	gneiss	88	170	190	380	298	237	252	
	granitic rocks	105	166	185	273	257	191	198	
	amphibolite	152	235	195	370	283	228	210	
	hornfels	133	163	164	253	248	213	277	
	basaltic rocks	230	210	210	330	290	250	180	
	opoka-sandstone	FN	140	140	FN	FN	FN	FN	
	serpentine	140	159	165	291	241	204	200	
	skarn	150	150	170	320	230	220	220	
	Average of fraction prices in the region	**147**	**166**	**177**	**310**	**260**	**220**	**230**	**216**
Prague	basaltic rocks	165	157	162	260	245	235	370	
	limestone	165	185	185	255	255	230	400	
	Average of fraction prices in the region	**165**	**171**	**174**	**258**	**250**	**233**	**385**	**234**
South Bohemia	limestone	139	206	206	255	FN	208	198	
	greywacke	200	105	120	315	255	195	FN	
	granitic rocks	190	203	196	347	289	208	179	
	granulite	183	214	212	349	277	233	187	
	region	**178**	**182**	**184**	**317**	**274**	**211**	**188**	**219**
Ústí nad Labem	granitic rocks	130	FN	185	FN	FN	FN	330	
	basaltic rocks	239	212	200	292	276	216	204	
	Average of fraction prices in the region	**185**	**212**	**193**	**292**	**276**	**216**	**267**	**234**
Liberec	basaltic rocks	180	212	221	363	321	233	231	
	Average of fraction prices in the region	**180**	**212**	**221**	**363**	**321**	**233**	**231**	**252**
Vysočina	gneiss	152	168	188	295	267	214	188	
	granitic rocks	152	191	188	345	309	220	209	
	amphibolite	205	160	165	365	275	235	195	
	Average of fraction prices in the region	**170**	**173**	**180**	**335**	**284**	**223**	**197**	**223**
Hradec Králové	limestone	357	FN	225	FN	FN	FN	FN	
	gneiss	205	180	175	360	280	245	195	
	granitic rocks	160	199	199	295	335	229	205	
	amphibolite	215	185	190	370	295	250	195	
	basaltic rocks	190	175	160	250	210	235	85	
	Average of fraction prices in the region	**225**	**185**	**190**	**319**	**280**	**240**	**170**	**230**
Zlín	opoka-sandstone	FN	140	150	FN	FN	FN	FN	
	Average of fraction prices in the region	**FN**	**140**	**150**	**FN**	**FN**	**FN**	**FN**	**145**

Explanations:
FN: frction is not produced
LK: Quarry stone
limestone: limestone+dolomite+marble
basaltic rocks: melaphyre+spilite+basalt+phonolite
granitic rocks: granodiorite+granite+syenite+diorite+porphyry
gneiss: orthogneiss+paragneiss

Average domestic prices of crushed stone in 2015 – by regional units

2015	Average prices of (listed) fractions (CZK/t)																		In regions
REGION	0-4 mm	0-8 mm	0-16 mm	0-32 mm	0-63 mm	0-125 mm	4-8 mm	8-16 mm	8-32 mm	11-22 mm	16-22 mm	16-32 mm	32-63 mm	63-125 mm	unsorted material	pit material	overburden	for backfills	
Hradec Králové	225	143	FN	183	190	160	319	280	FN	258	FN	200	240	221	170	323	FN	FN	**224**
Plzeň	203	181	160	192	193	175	307	268	FN	260	269	259	214	204	171	289	59	176	**211**
Central Bohemia	138	138	178	170	176	150	291	253	FN	249	252	239	212	191	238	361	64	75	**199**
Liberec	180	187	FN	212	221	FN	263	321	FN	303	324	309	233	208	231	298	70	165	**235**
Pardubice	155	109	FN	167	173	151	340	258	200	247	221	214	209	182	173	278	FN	FN	**205**
Ústí nad Labem	239	179	184	212	200	194	292	276	219	265	283	239	216	213	215	275	68	70	**213**
South Moravia	107	70	58	159	171	148	308	244	FN	233	260	213	202	195	189	220	60	50	**170**
Karlovy Vary	215	106	75	169	179	170	304	254	189	223	286	231	213	199	164	347	78	100	**195**
South Bohemia	187	148	149	202	198	190	339	282	234	273	260	253	214	201	182	233	73	178	**211**
Olomouc	178	150	FN	183	178	145	347	270	220	255	269	234	210	200	180	396	72	213	**218**
Zlín	165	FN	165	171	174	162	268	250	FN	235	235	248	233	205	385	FN	FN	FN	**223**
Moravia and Silezia	204	183	255	194	193	165	333	166	218	274	278	240	217	192	190	230	100	200	**213**
Vysočina	159	118	FN	180	185	178	333	267	185	257	FN	243	220	196	190	400	80	FN	**213**
Prague	165	FN	165	171	174	162	268	250	FN	235	235	248	233	205	385	FN	FN	FN	**223**
Czech Republic total	**180**	**143**	**154**	**183**	**186**	**165**	**308**	**260**	**209**	**255**	**264**	**241**	**219**	**201**	**219**	**304**	**72**	**136**	**211**

Explanation: FN – fraction is not produced

5. Mining companies in the Czech Republic as of December 31, 2015

Crushed stone – registered deposits

Českomoravský štěrk,a.s.,Mokrá
EUROVIA Kamenolomy, a.s., Liberec
KAMENOLOMY ČRs.r.o.,Ostrava- Svinov
KÁMEN Zbraslav,spol.sr.o.
COLASCZ,a.s., Praha
M-SILNICEa.s., Pardubice
Kámen a píseks.r.o., ČeskýKrumlov
BASALT CZs.r.o, Všechlapy
CEMEX Sand,k.s., Napajedla
BÖGL a KRÝSL,k.s., Praha
GRANITA s.r.o., Skuteč
Skanska a.s., Praha
ZAPA beton a.s., Praha
Berger Bohemia a.s., Plzeň
SHB s.r.o., Bernartice
Kámen Brno s.r.o.
LOMY MOŘINA spol.sr.o., Mořina
Rosa s.r.o., Drásov
Basalt s.r.o., Zabrušany
RENO Šumava a.s., Vlachovo Březí
BES s.r.o., Benešov
DOBET s.r.o., Ostrožská Nová Ves
Lom Klecany, s.r.o., Praha 9
ŽulaRácov, s.r.o., Batelov
Ludvík Novák, Komňa
C4SC78 s.r.o., Praha
Silnice Čáslav-Holding, a.s.
Stavební recyklace s.r.o., Sokolov
Středomoravská kapitálová, a.s., Olomouc
ŽPSV a.s., Uherský Ostroh
KARETA s.r.o., Bruntál Zemědělské družstvo Šonov u Broumova
Madest s.r.o., Bruntál
LOM DEŠTNO a.s., Sedlčany
PETRA – lom Číměř, s.r.o.
PEDOP s.r.o., Lipovec
Froněk s.r.o., Rakovník
FORTEX – AGS, a.s., Šumperk
EKOZIS spol. s r.o., Zábřeh
Kozákov-družstvo, Záhoří
František Matlák, Mochov
Pavel Dragoun, Cheb
HUTIRA-OMICE, s.r.o., Omice
ČNES dopravní stavby a.s., Kladno
Weiss s.r.o., Děčín
JHF Heřmanovice spol. s r.o.
EKOSTAVBY Louny s.r.o.
Thorssen s.r.o., Kamenolom Mladecko
LB spol. s r.o., NováRole
NATRIX, a.s., Bojkovice
Kamenolom KUBO s.r.o., MaléŽernoseky
Daosz, s.r.o., Jesenec

Crushed stone – non-registered deposits

Sokolovská uhelná, právní nástupce, a.s., Sokolov
Kámen a písek s.r.o., Český Krumlov
SILNICE MORAVA s.r.o., Krnov
Českomoravský štěrk, a.s., Mokrá

ZETKA Strážník a.s., Studenec
COLASCZ, a.s., Praha
Basalt s.r.o., Zabrušany
LOM Babí,a.s., Trutnov
KÁMEN Zbraslav, spol. s r.o.
EUROVIA Kamenolomy,a.s., Liberec
Kamenolom Žlutava, s.r.o.
DOBET s.r.o., Ostrožská Nová Ves
Stavoka Kosice a.s.
KAMENOLOMY ČR s.r.o., Ostrava–Svinov
Kalcit s.r.o., Brno
TS služby s.r.o., Ostrožská Nová Ves
SENECO s.r.o., Polná
RENO Šumava a.s., Vlachovo Březí
Vojenské lesy a statky ČR, s.p., Praha 6
Lesy České republiky, s.p., Hradec Králové
Lesostavby Frýdek-Místek, a.s.
Obec Hošťálková
Kozákov-družstvo, Záhoří
EKOZIS spol. s r.o., Zábřeh
Petr Vaněk-Lomstav, HorníMaršov
Kamena, výrobní družstvo, Brno
Lesní družstvo obcí, Přibyslav
Berger Bohemia a.s., Plzeň
LB spol. s r.o., Nová Role
Pískovec Bělov s.r.o.
Středomoravská kapitálová, a.s., Olomouc

6. World production and world market prices

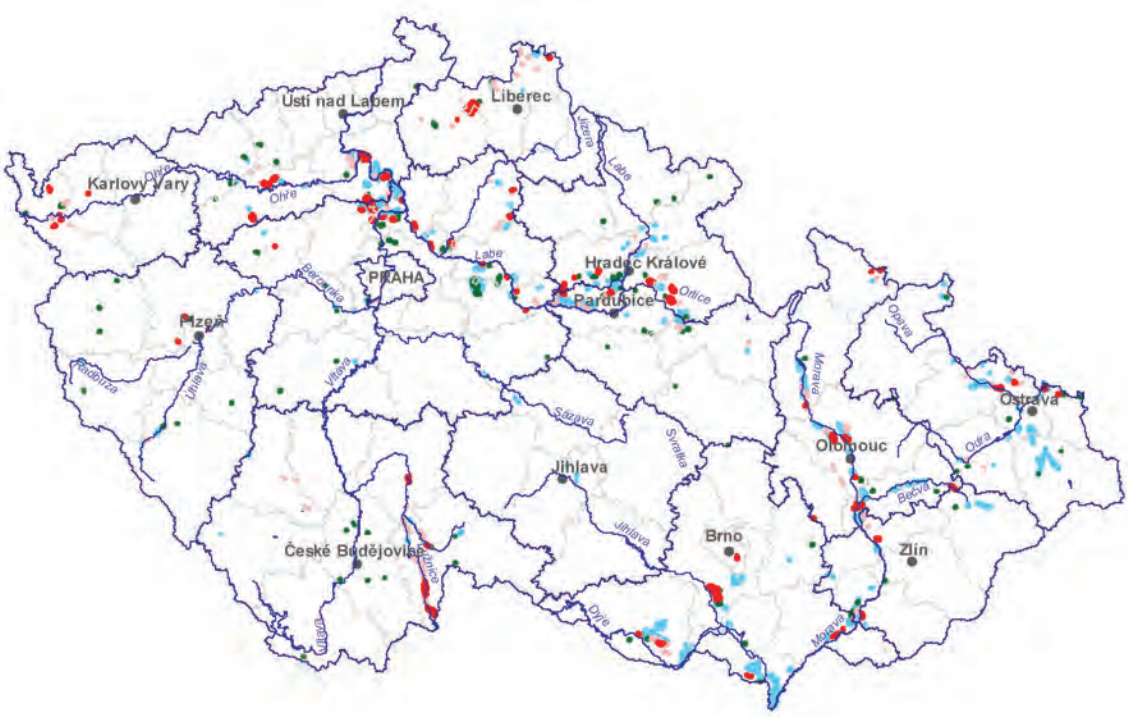
Mine production of the crushed stone is frequently reported together with sand and gravel under the term aggregates.

Crushed stone prices are not formed on the international market. Neither indicative regional prices are quoted.

Aggregates market and prices in the European Union, especially in the Central European countries, are described in *„**Aggregates market analysis of selected countries in Central Europe**“* subchapter of this yearbook.

Sand and gravel

1. Registered deposits and other resources of the Czech Republic



- reserved deposits – exploited (69)
- reserved deposits – unexploited (135)
- non-reserved deposits – exploited (94)
- non-reserved deposits – unexploited (257)

Because of their large number, deposits of sand and gravel are not listed.

2. Basic statistical data of the Czech Republic as of December 31

Reserved deposits: Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	206	207	207	205	204
exploited	72	74	80	77	69
Total mineral *reserves, ths m^3	2 126 991	2 120 076	2 138 208	2 107 455	2 099 731
economic explored reserves	1 126 123	1 114 756	1 102 371	1 084 172	1 077 433
economic prospected reserves	780 987	785 479	813 918	794 870	793 371
potentially economic reserves	219 881	219 841	221 919	228 413	228 927
exploitable reserves	362 676	379 201	381 649	381 288	406 787
Mine production in reserved deposits, ths m^3	6 902	6 136	5 346	5 753	6 063

** See NOTE in the chapter Introduction above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter Mineral reserve and resource classification in the Czech Republic of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	ths m^3	146 177	146 177	149 027	149 027	149 027
P_2,	ths m^3	1 007 985	1 007 985	946 239	946 239	946 239
P_3		–	–	–	–	–

Non-reserved deposits: Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	338	339	342	347	351
exploited	95	90	84	83	94
Total mineral *reserves, ths m^3	2 078 255	2 079 420	2 107 576	2 108 029	2 102 560
economic explored reserves	107 945	107 478	106 863	106 102	104 879
economic prospected reserves	1 731 910	1 733 544	1 760 824	1 761 945	1 761 879
potentially economic reserves	238 400	238 398	239 889	239 982	235 802
exploitable reserves	54 600	52 100	50 695	50 694	53 524
Mine production in non-reserved deposits, ths m^3 [a)]	5 000	4 300	4 297	4 063	4 796

** See NOTE in the chapter Introduction above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter Mineral reserve and resource classification in the Czech Republic of this yearbook*

[a)] estimate

3. Foreign trade

250590 – Other sand (natural sand of all kinds, also coloured, except sand containing metals and except silica sand and quartz sand)

		2011	2012	2013	2014	2015
Import	kt	19 977	29 827	88 389	169 762	180 592
Export	kt	4 928	362	2 979	1 968	2 423

250590 – Other sand (natural sand of all kinds, also coloured, except sand containing metals and except silica sand and quartz sand)

		2011	2012	2013	2014	2015
Average import prices	CZK/t	1 826	1 336	486	287	337
Average export prices	CZK/t	683	8 330	767	1 689	1 805

4. Prices of domestic market

Domestic prices of sand and gravel in 2014 – by regional units

2015	Average prices of (listed) fractions (CZK/t)																		In regions
REGION	0-4 mm	0-8 mm	0-16 mm	0-32 mm	0-63 mm	0-125 mm	4-8 mm	8-16 mm	8-32 mm	11-22 mm	16-22 mm	16-32 mm	32-63 mm	63-125 mm	unsorted material	pit material	overburden	for backfills	
Hradec Králové	225	143	FN	183	190	160	319	280	FN	258	FN	200	240	221	170	323	FN	FN	224
Plzeň	203	181	160	192	193	175	307	268	FN	260	269	259	214	204	171	289	59	176	211
Central Bohemia	138	138	178	170	176	150	291	253	FN	249	252	239	212	191	238	361	64	75	199
Liberec	180	187	FN	212	221	FN	263	321	FN	303	324	309	233	208	231	298	70	165	235
Pardubice	155	109	FN	167	173	151	340	258	200	247	221	214	209	182	173	278	FN	FN	205
Ústí nad Labem	239	179	184	212	200	194	292	276	219	265	283	239	216	213	215	275	68	70	213
South Moravia	107	70	58	159	171	148	308	244	FN	233	260	213	202	195	189	220	60	50	170
Karlovy Vary	215	106	75	169	179	170	304	254	189	223	286	231	213	199	164	347	78	100	195
South Bohemia	187	148	149	202	198	190	339	282	234	273	260	253	214	201	182	233	73	178	211
Olomouc	178	150	FN	183	178	145	347	270	220	255	269	234	210	200	180	396	72	213	218
Zlín	165	FN	165	171	174	162	268	250	FN	235	235	248	233	205	385	FN	FN	FN	223
Moravia and Silezia	204	183	255	194	193	165	333	166	218	274	278	240	217	192	190	230	100	200	213
Vysočina	159	118	FN	180	185	178	333	267	185	257	FN	243	220	196	190	400	80	FN	213
Prague	165	FN	165	171	174	162	268	250	FN	235	235	248	233	205	385	FN	FN	FN	223
Czech Republic total	**180**	**143**	**154**	**183**	**186**	**165**	**308**	**260**	**209**	**255**	**264**	**241**	**219**	**201**	**219**	**304**	**72**	**136**	**211**

Explanation: FN – fraction is not produced

5. Mining companies in the Czech Republic as of December 31, 2015

Sand and gravel – registered deposits

Českomoravský štěrk, a.s., Mokrá
EUROVIA Kamenolomy, a.s., Liberec
KAMENOLOMY ČR s.r.o., Ostrava-Svinov
KÁMEN Zbraslav, a.s.
COLAS CZ, a.s., Praha
M-SILNICE a.s., Pardubice
Kámen a písek s.r.o., ČeskýKrumlov
BASALT CZ s.r.o, Všechlapy
CEMEX Sand, k.s., Napajedla
BÖGL a KRÝSL, k.s., Praha
GRANITA s.r.o., Skuteč
Skanska a.s., Praha
ZAPA beton a.s., Praha 4
Berger Bohemia a.s., Plzeň
SHB s.r.o., Bernartice
Kámen Brno s.r.o.
LOMY MOŘINA spol. s r.o., Mořina

Rosa s.r.o., Drásov
Basalt s.r.o., Zabrušany
RENO Šumava a.s., Vlachovo Březí
BES s.r.o., Benešov
DOBET s.r.o., Ostrožská Nová Ves
Lom Klecany, s.r.o., Praha 9
Žula Rácov, s.r.o., Batelov
Ludvík Novák, Komňa
C4SC78 s.r.o., Praha
Silnice Čáslav-Holding, a.s.
Stavební recyklace s.r.o., Sokolov
Středomoravská kapitálová, a.s., Olomouc
ŽPSV a.s., Uherský Ostroh
KARETA s.r.o., Bruntál
Zemědělské družstvo Šonov u Broumova
Madest s.r.o., Pavlice
LOM DEŠTNO a.s., Sedlčany
PETRA-lom Číměř, s.r.o.
PEDOP s.r.o., Lipovec
Froněk s.r.o., Rakovník
FORTEX-AGS, a.s., Šumperk
EKOZIS spol. s r.o., Zábřeh
Kozákov-družstvo, Záhoří
František Matlák, Mochov
Pavel Dragoun, Cheb
HUTIRA-OMICE, s.r.o., Omice
ČNES dopravní stavby a.s., Kladno
Weiss s.r.o., Děčín
JHF Heřmanovices pol. s r.o.
EKOSTAVBY Louny s.r.o.
Thorssen s.r.o., Kamenolom Mladecko
LB spol. s r.o., Nová Role
NATRIX,a.s., Bojkovice
Kamenolom KUBO s.r.o., MaléŽernoseky
Daosz, s.r.o., Jesenec
Českomoravský cement, a.s., Mokrá-Horákov
ERB invest s.r.o., Praha
KAMENOLOM BRNIŠTĚ a.s.
Omnigon, s.r.o., Praha
SETRA s.r.o., Brno

Sand and gravel – non-registered deposits

Českomoravský štěrk, a.s., Mokrá
Holcim (Česko) a.s., člen koncernu, Prachovice
LB MINERALS, s.r.o., Horní Bříza
KÁMEN Zbraslav, a.s.
CEMEX Sand, k.s., Napajedla
České štěrkopísky spol. s r.o., Praha
TVARBET Moravia a.s., Hodonín
ZAPA beton a.s., Praha 4
KAMENOLOMY ČR s.r.o., Ostrava – Svinov
Družstvo DRUMAPO, Němčičky
EUROVIA Kamenolomy, a.s., Liberec
Štěrkovny Olomouc a.s.
Písek - Beton a.s., Veltruby-Hradištko
realma-pískovna dolany s.r.o., Zlín
Městské lesy Hradec Králové a.s.
Písky - J.Elsnic s.r.o., Postoloprty
TEKAZ s.r.o., Cheb
Kinský dal Borgo, a.s., Chlumec nad Cidlinou
Budějovické štěrkopísky spol. s r.o., Vrábče
MIROS MAJETKOVÁ a.s., Pardubice
DOBET s.r.o., Ostrožská Nová Ves
Jana Lobová, Pardubice
Pískovna Sojovice, s.r.o.
Obec Kostomlátky
Lubomír Kruncl, Travčice
Václav Maurer, Lužec nad Vltavou
Pískovna Černovice, s.r.o., Brno
Těžba štěrkopísku s.r.o., Brodek
NZPK s.r.o., Podbořany
Oldřich Psotka, Mikulovice u Jeseníka
KM Beta Moravia s.r.o., Hodonín
Kaolin Hlubany, a.s.
Zemědělské obchodní družstvo Zálabí, Ovčáry
Ladislav Šeda, Turnov
Zechmeister, spol. s r.o., Praha
ZOD Brniště a.s.
UNIM s.r.o., Všestudy u Veltrus
František Dvořák, Dolní Dunajovice
Berger Bohemia a.s., Plzeň
BÖGL a KRÝSL, k.s., Praha
BS Cost, s.r.o., Praha
Česká geologická služba
František Jampílek, Lázně Toušeň
FRISCHBETON s.r.o., Praha

KARETA s.r.o., Bruntál
Město Mělník
NOBI PLUS s.r.o., Praha 5
Plzeňské štěrkopísky s.r.o., Plzeň
S - MOST s.r.o. , Hradec Králové
Sokolovská uhelná, právní nástupce, a.s., Sokolov
ŠARAVEC A RUČ, spol. s r.o., Pardubice
TELETÍNSKÁ ŽULA, s.r.o., Praha
V.M.S. spol. s r.o., Louny

6. World production and world market prices

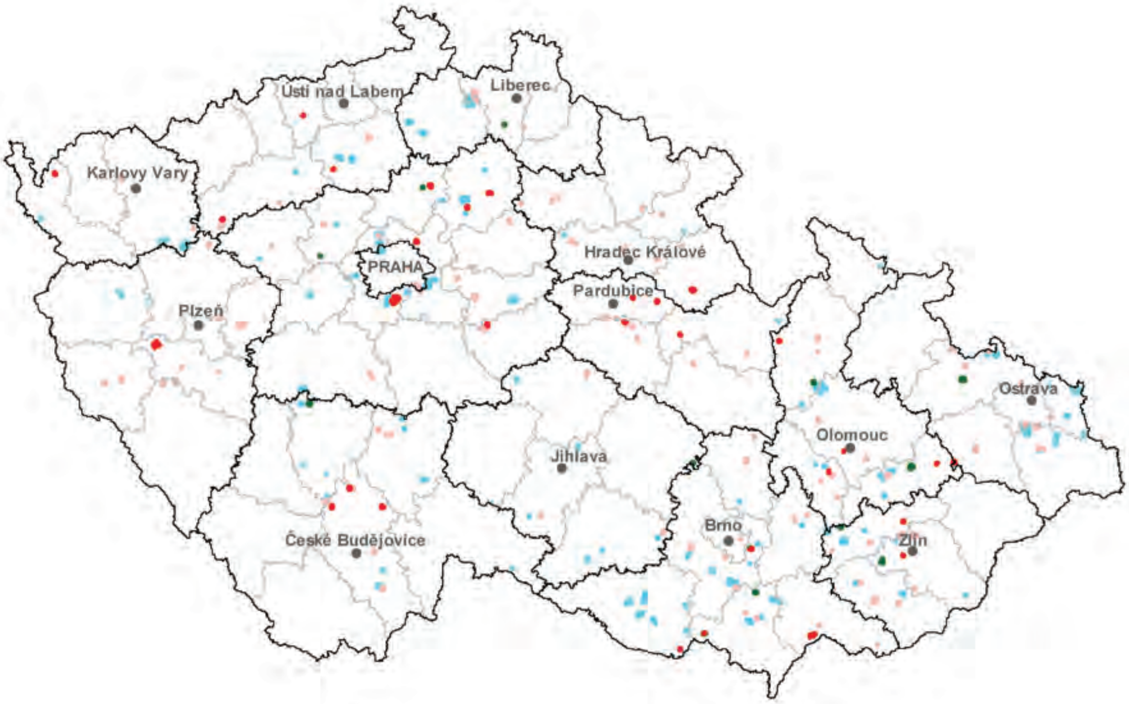
Sand and gravel extraction is often statistically recorded together with crushed stone extraction under the common term “aggregates”.

Sand and gravel prices are not created in the international market. Indicative and regional prices are also not quoted.

The aggregates market and prices in the European Union, especially in Central Europe, are described in sub-chapter ***“Aggregates market analysis of selected countries in Central Europe“*** of this yearbook.

Brick clays and related minerals

1. Registered deposits and other resources of the Czech Republic



- reserved deposits – exploited (14)
- reserved deposits – unexploited (117)
- non-reserved deposits – exploited (6)
- non-reserved deposits – unexploited (118)

There are large numbers of brick mineral deposits registered in the Czech Republic and thus they are not listed in this overview. Their distribution over the Czech territory is rather uneven and consequently in some regions there is a shortage of these minerals (e.g. Českomoravská vrchovina Highlands covering most of the area of Vysočina Region with capital Jihlava).

2. Basic statistical data of the Czech Republic as of December 31

Reserved deposits: Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	131	131	131	131	131
exploited	18	16	14	18	14
Total mineral *reserves, ths m^3	542 022	540 964	538 997	535 415	535 810
economic explored reserves	206 577	203 549	201 808	202 120	200 670
economic prospected reserves	232 827	232 746	232 522	232 197	232 227
potentially economic reserves	102 618	104 669	104 667	101 098	102 913
exploitable reserves	64 217	61 798	64 385	58 893	58 835
Mine production in reserved deposits, ths m^3	932	852	743	677	736

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	ths m^3	27 122	27 122	25 691	25 691	25 691
P_2,	ths m^3	245 494	245 494	245 459	245 459	245 459
P_3		–	–	–	–	–

Non-reserved deposits: Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	122	123	123	123	124
exploited	3	5	4	6	6
Total mineral *reserves, ths m^3	686 513	687 338	688 639	688 478	689 863
economic explored reserves	63 622	63 622	63 622	63 622	63 633
economic prospected reserves	516 038	516 863	518 164	518 003	519 377
potentially economic reserves	106 853	106 853	106 853	106 853	106 853
exploitable reserves	707	1 617	2 834	1 747	6 702
Mine production in non-reserved deposits, ths m^3 [a)]	147	176	140	161	165

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] *estimate*

3. Foreign trade

690410 – Building bricks

		2011	2012	2013	2014	2015
Import	ths pcs	169 797	119 487	99 140	88 323	73 282
Export	ths pcs	111 071	133 817	155 862	124 951	152 907

690410 – Building bricks

		2011	2012	2013	2014	2015
Average import prices	CZK/piece	1.5	1.7	1.8	1.7	1.7
Average export prices	CZK/piece	1.9	1.9	2.0	2.2	2.2

690510 – Roof tiles

		2011	2012	2013	2014	2015
Import	ths pcs	30 606	28 592	24 032	25 231	25 303
Export	ths pcs	43 708	43 379	44 258	38 963	36 110

690510 – Roof tiles

		2011	2012	2013	2014	2015
Average import prices	CZK/piece	4.6	5.3	5.6	5.4	5.1
Average export prices	CZK/piece	4.8	4.7	5.0	5.3	5.2

4. Prices of domestic market

Domestic prices of brick clay and brick products

Product specification	2011	2012	2013	2014	2015
Brick clay; CZK/t	90–180	95–180	60–120	60–120	60–95
Full brick; CZK/piece	6–7	6–7	6–7	6–7	4–12
Honeycomb brick; CZK/piece	11–14	11–14	11–15	11–15	11–15
Facing bricks; CZK/piece	8–51	17–34	17–30	17–30	17–30
Brick blocks Porotherm; CZK/piece	21–85	22–105	22–90	22–90	24–110
Clay (ground clay bricks for tennis courts); CZK/t	900–2 400	1 450–2 400	1 450–2 140	1 450–2 140	1 450–2 140
Roof tiles; CZK/t	20–44	20–46	21–46	21–46	21–46
Ventilating, boundary tile; CZK/t	81–123	86–205	86–205	86–205	86–205
Classical shingle tile; CZK/t	12–57	12–60	12–60	12–60	12–60

5. Mining companies in the Czech Republic as of December 31, 2015

Brick clays and related minerals – reserved deposits
HELUZ cihlářský průmysl v.o.s., Dolní Bukovsko
TONDACH Česká republika s.r.o., Hranice
Wienerberger Cihlářský průmysl, a.s., Č.Budějovice
Cihelna Kinský s.r.o., Kostelec n.Orl.
Cihelna Hodonín, s.r.o.
Zlínské cihelny s.r.o., Zlín
Cihelna Vysoké Mýto s.r.o.
LB MINERALS, s.r.o., Horní Bříza
Cihelna Polom, s.r.o.

Brick clays and related minerals – non–reserved deposits
Wienerberger cihelna Jezernice, spol. s r.o.
Wienerberger Cihlářský průmysl, a.s., Č.Budějovice
Ing.Jiří Hercl, cihelna Bratronice, Kyšice

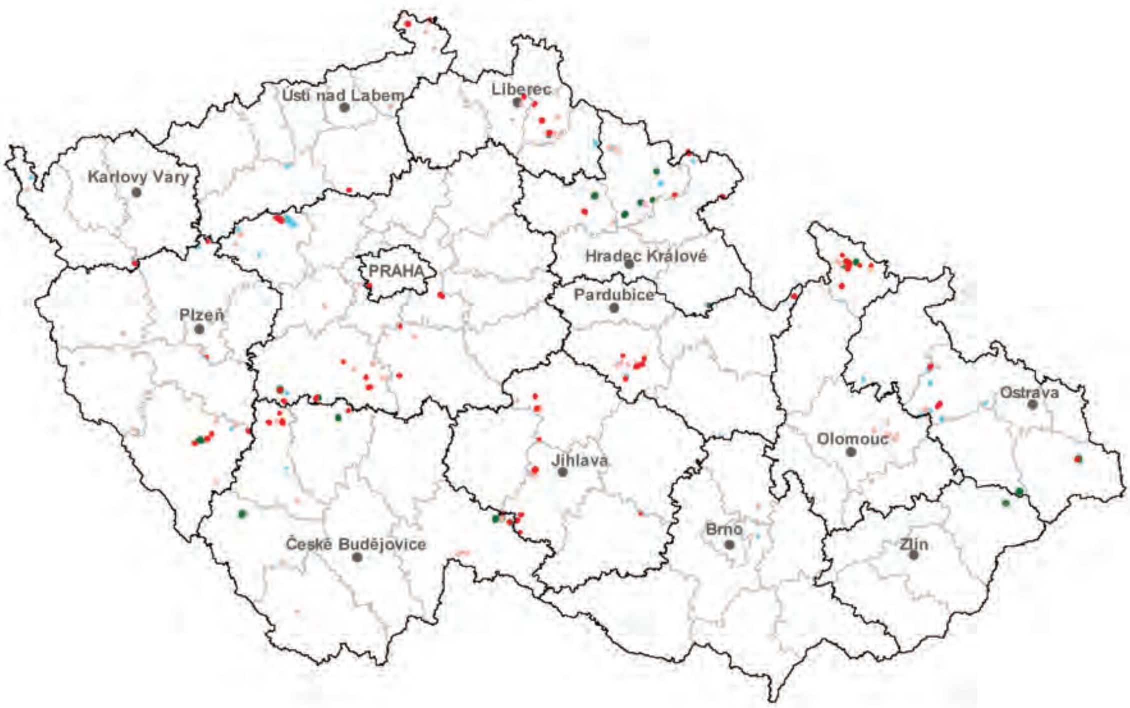
6. World production and world market prices

Global mining of brick clays is not statistically recorded and many states do not monitor it at all.

Brick clays are not subject to global trade.

Dimension stone

1. Registered deposits and other resources of the Czech Republic



- reserved deposits – exploited (54)
- reserved deposits – unexploited (105)
- non-reserved deposits – exploited (17)
- non-reserved deposits – unexploited (52)

There are many registered dimension stone deposits in the Czech Republic and therefore they are not listed.

2. Basic statistical data of the Czech Republic as of December 31

Reserved deposits: Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	159	159	159	159	159
exploited	61	55	52	53	54
Total mineral *reserves, ths m^3	182 753	182 573	181 396	182 369	181 702
economic explored reserves	79 287	77 575	77 414	77 565	77 584
economic prospected reserves	65 421	65 408	64 393	65 248	65 233
potentially economic reserves	38 045	39 590	39 589	39 556	38 885
exploitable reserves	79 099	79 153	79 985	89 801	90 148
Mine production in reserved deposits, ths m^3	192	138	140	145	187

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	ths m^3	5 043	5 043	5 043	5 043	5 043
P_2,	ths m^3	12 701	12 701	12 701	12 701	12 701
P_3		–	–	–	–	–

Non-reserved deposits: Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	70	69	69	69	69
exploited	18	17	15	17	17
Total mineral *reserves, ths m^3	33 437	33 391	33 362	33 249	33 237
economic explored reserves	2 264	2 257	2 257	2 232	2 204
economic prospected reserves	28 217	28 177	28 146	28 101	28 077
potentially economic reserves	2 956	2 956	2 956	2 916	2 956
exploitable reserves	2 120	1 810	1 582	1 582	9 329
Mine production in non-reserved deposits, ths m^3 [a)]	46	44	31	58	55

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] estimate

3. Foreign trade

2514 – Slate, also rougly worked or cut

		2011	2012	2013	2014	2015
Import	t	12 135	39 445	28 344	31 190	19 364
Export	t	12 488	3 694	4 201	5 094	4 124

2514 – Slate, also rougly worked or cut

		2011	2012	2013	2014	2015
Average import prices	CZK/t	1 209	693	1 200	1 095	1 308
Average export prices	CZK/t	1 260	1 260	1 369	1 319	1 036

2515 – Marble, travertine, ecaussine and other calcareous stone

		2011	2012	2013	2014	2015
Import	t	858	733	745	612	802
Export	t	86	35	47	10	2

2515 – Marble, travertine, ecaussine and other calcareous stone

		2011	2012	2013	2014	2015
Average import prices	CZK/t	18 690	12 636	17 239	15 438	12 146
Average export prices	CZK/t	170 367	180 489	34 714	2 500	3400

2516 – Granite, porphyry, basalt, sandstone and other stone

		2011	2012	2013	2014	2015
Import	t	10 365	10 139	8 755	5 978	8 886
Export	t	15 932	6 652	7 468	8 126	5 847

2516 – Granite, porphyry, basalt, sandstone and other stone

		2011	2012	2013	2014	2015
Average import prices	CZK/t	4 628	5 444	8 920	7 188	5 639
Average export prices	CZK/t	3 739	2 664	2 242	2 025	2 186

6801 – Setts, curbstones and flagstones of natural stone (except slate)

		2011	2012	2013	2014	2015
Import	t	4 517	8 731	12 705	15 202	16 480
Export	t	73 077	65 130	68 891	67 596	55 117

6801 – Setts, curbstones and flagstones of natural stone (except slate)

		2011	2012	2013	2014	2015
Average import prices	CZK/t	133 337	235 779	138 089	2 416	1 983
Average export prices	CZK/t	1 782	1 966	2 069	2 312	2 080

6802 – Worked monumental and crushed stone (except slate) and stonework

		2011	2012	2013	2014	2015
Import	t	33 219	34 322	27 220	22 653	23 849
Export	t	41 044	42 917	56 574	48 191	36 761

6802 – Worked monumental and crushed stone (except slate) and stonework

		2011	2012	2013	2014	2015
Average import prices	CZK/t	31 508	58 752	31 222	21 887	17 095
Average export prices	CZK/t	21 795	39 239	15 703	9 323	5 535

6803 – Worked slate and articles of slate or of agglomerated slate

		2011	2012	2013	2014	2015
Import	t	3 335	3 350	3 194	3 353	2 909
Export	t	182	132	80	59	77

6803 – Worked slate and articles of slate or of agglomerated slate

		2011	2012	2013	2014	2015
Average import prices	CZK/t	10 576	8 004	12 015	12 113	13 469
Average export prices	CZK/t	29 607	21 671	29 717	27 108	19 982

4. Prices of domestic market

Product specification			Unit	2011	2012	2013	2014	2015
greyish blue Hlinec granite	cobblestones		CZK/t	2 100–3 250	2 100–3 250	2 100–3 250	2 100–3 550	2 100–2 550
	margin stones		CZK/bm	320–400	320–400	320–400	320–400	320–400
	cleaved prisms		CZK/m^2	2 100	2 100	2 100	2 100	2 100
	curbstones		CZK/bm	1 000–1 200	1 000–1 200	1 000–1 200	1 000–1 200	1 000–1 200
	slabs	polished, thickness 2–8 cm	Kč/m^2	1 800–3 800	1 800–3 800	1 800–3 800	2050–4 530	1 800–3 800
		emery grounded, thickness 2–8 cm	Kč/m^2	1 600–3 600	1 600–3 600	1 600–3 600	1 780–4 100	1 600–3 600
		sand blasted finish, thickness 2–8 cm	Kč/m^2	1 400–3 100	1 400–3 100	1 400–3 100	1 565–3 600	1 400–1 200
		formatted suitable as pavement, thickness 3 cm	Kč/m^2	1 560–2 260	1 560–2 260	1 560–2 260	1 560–2 260	1 560–2 260
light Silesian granite	cobblestones		CZK/t	1 750–3 000	N	N	1 650–2 600	1 900–3 000
	margin stones		CZK/bm	290–320	N	N	320	300–330
	cleaved prisms		CZK/m^2	1 100–1 800	N	N	1500	1 650
Mrákotín type granite – pavement slabs		sand blasted finish, thickness 2–8 cm	CZK/m^2	1 450–2 250	1 450–2 250	N	1 220–2 501	1 450–2 250
		emery grounded, thickness 2–8 cm	CZK/m^2	1 580–2 480	1 580–2 480	N	1 630–2 738	1 580–2 480
		polished, thickness 2–8 cm	CZK/m^2	1 900–2 700	1 900–2 700	N	1 640–2 786	1 900–2 700
granite blocks			Kč/m^3	≥ 5 500	≥ 5 500	≥ 5 500	< 1.5 m^3 = 7 000 > 1.5 m^3 = 9 000	< 1.5 m^3 = 7 000 > 1.5 m^3 = 9 000
sandstone – cut slabs	thickness 5 cm		CZK/m^2	1 000–1 930	1 000–1 930	1 000–1 930	1 000–1 930	1 000–1 930
	thickness 10 cm		CZK/m^2	2 770–3 410	2 770–3 410	2 770–3 410	2 770–3 410	2 770–3 410
	thickness 15 cm		CZK/m^2	4 190–5 180	4 190–5 180	4 190–5 180	4 190–5 180	4 190–5 180
marble – pavement	cut	Supíkovice marble	CZK/m^2	N	300–1 080	N	N	280–1 100
		Lipová marble	CZK/m^2	N	300–1 180	N	N	280–1 190
	smoothed	Supíkovice marble	CZK/m^2	N	400–1 220	N	N	360–1 240
		Lipová marble	CZK/m^2	N	400–1 340	N	N	360–1 350
	polished	Supíkovice marble	CZK/m^2	N	440–1 500	N	N	390–1 280
		Lipová marble	CZK/m^2	N	440–1 630	N	N	390–1 390

Notice: bm (běžný metr) – running metre

5. Mining companies in the Czech Republic as of December 31, 2015

Dimension stone – reserved deposits
Průmysl kamene a.s., Příbram
MEDIGRAN s.r.o., Plzeň
Granit Lipnice s.r.o., Dolní Město
HERLIN s.r.o., Příbram
KAVEX - GRANITHOLDING a. s., Plzeň
Slezský kámen, a.s., Jeseník

Ligranit a.s., Liberec RALUX s.r.o., Uhelná
COMING PLUS, a.s., Praha
GRANITES, s.r.o., Žulová
SLEZSKÁ ŽULAspol. s r.o., Brno
JIHOKÁMEN, výrobní družstvo, Písek
Granit Zedníček s.r.o., Kamenná
KÁMEN OSTROMĚŘ s.r.o.
Josef Máca,Třešť
Kamenoprůmyslové závody s.r.o., Šluknov
Lom Matula Hlinsko, a.s.
GRANIO s.r.o., Chomutov
REDITFORFEIT, a.s., Praha
Kámen Hudčice s.r.o.
Krákorka a.s., Červený Kostelec
LOM DEŠTNO a.s., Sedlčany
Lom Žernovka, s.r.o., Mukařov
M. & H. Granit s.r.o., Plzeň
Mšenské pískovce s.r.o., Mšené – lázně
REVLAN s.r.o., Horní Benešov
Plzeňská žula, Plzeň
Česká žula s.r.o., Strakonice
Malkov Granit Baumann s.r.o.,
Drahenický Málkov Obec Studená
SATES ČECHY, s.r.o.,Telč
BÖGLa KRÝSL, k.s., Praha
Těžba nerostů a.s., Plzeň
ŘEBOCKÝ LOM CZ, s.r.o.
BioGinGo s.r.o., Kostelec nad Orlicí

Dimension stone – non-reserved deposits
RENO Šumava a.s.,Vlachovo Březí
HERLIN s.r.o., Příbram
KOKAM s.r.o., Kocbeře
Jiří Sršeň -TEKAM, Záměl
Obec Studená
Žula, spol. s r.o., Praha
Lom Horní Dvorce, s.r.o., Strmilov
KAVEX - GRANITHOLDING a. s., Plzeň
Josef Máca,Třešť
Alfonz Dovičovič, Hořice
PROFISTAVLitomyšl, a.s.
SPONGILITPP, spol. s r.o., Praha
KAJA-TRADING spol.s r.o., Praha
Lesostavby Frýdek-Místek, a.s.
Ing. Danuše Plandorová, Hážovice
Krákorka a.s., Červený Kostelec

6. World production and world market prices

Global mining of decorative stone is not statistically recorded and many states do not monitor it at all. The most important producer of dimension stone in Europe is Italy, in the world it is the US, Brazil, and China.

Dimension stone is subject to global trade while prices are determine by corporate price lists. Dimension stone prices depend on the quality and colour of the rock and the degree of processing. They can be estimated by price levels in the US market (*Source: Minerals Yearbook 2014.Stone, Dimension, pp.72.1-72.13.-U.S. Geological Survey, U.S. Department of Interior, Washington, DC, May 2016.*):

Decorative stone export from the US in 2014, classification by type

	Amount, t	Value, ths USD	Average price, USD/t
Granite	598,000	117,000	196
Limestone	1,040,000	180,000	173
Marble	45,700	17,400	381
Sandstone	416,000	53,400	128
Slate	43,300	17,000	393
Other types of stone	406,000	85,100	210

Dimension stone export from the US in 2014, classification by types

	Amount, ths t	Value, ths USD	Average value, USD/t	Main destination, by value
Worked marble, travertine, alabaster (more than just cut with a flat surface)	104	10,600	102	Canada, 53%
Marble, travertine, crude or roughly cut	6	6,880	1,147	Italy, 88%
Marble, travertine, cut by sawing or otherwise (blocks or slabs)	2	2,530	1,265	Canada, 22%
Granite, crude or roughly cut	66	24,300	368	China, 62%
Granite cut by sawing or otherwise (blocks or slabs)	22	7,520	342	Canada, 59%
Worked slate and slate products	N	4,170	N	Canada, 63%
Roughly cut or simply cut slate (blocks or slabs)	N	541	N	Canada, 28%
Other calcareous, memorial, or building stone; alabaster (other than marble and travertine. Crude, roughly cut or simply cut into blocks or slabs)	26	10,000	385	Canada, 97%
Other calcareous, memorial, or building stone (other than calcareous stone and alabaster, granite, sandstone, slate, dolomite, quartzite, and soapstone. Crude, roughly cut or simply cut into blocks or slabs)	13	3,770	290	Canada, 94%

Dimension stone import in the US in 2014, classification by types

		Amount	Value, ths USD	Average value, USD/t or USD/ft^2 (USD/m^2)	Main source, according to the value
Marble and alabaster (cut with a flat surface)	tonnes	21,500	27,600	1,284	Italy, 36%
Roofing slate	mil. ft^2	10	10,100	1.01 (10.87)	Spain, 37%
Roughly cut or simply cut slate (rectangular blocks or slabs)	mil. ft^2	8,000	3,610	0.0004 (0.005)	China, 53%
Slate, worked slate, slate products and other products (other than roofing products, including agglomerated slate)	mil. ft^2	N	57200	N	China, 53%
Travertine, memorial, or building stone and products thereof simply cut with a flat surface, other than tiles and granules	mil. ft^2	22,000	11,200	0.0005 (0.005)	Mexico, 28%
Travertine, worked memorial or building stone (surfaced or polished but not further worked)	mil. ft^2	29,400	18,200	0.0006 (0.007)	Turkey, 44%

Note: ft^2 – square foot; 1 ft^2 = 0.092903 m^2

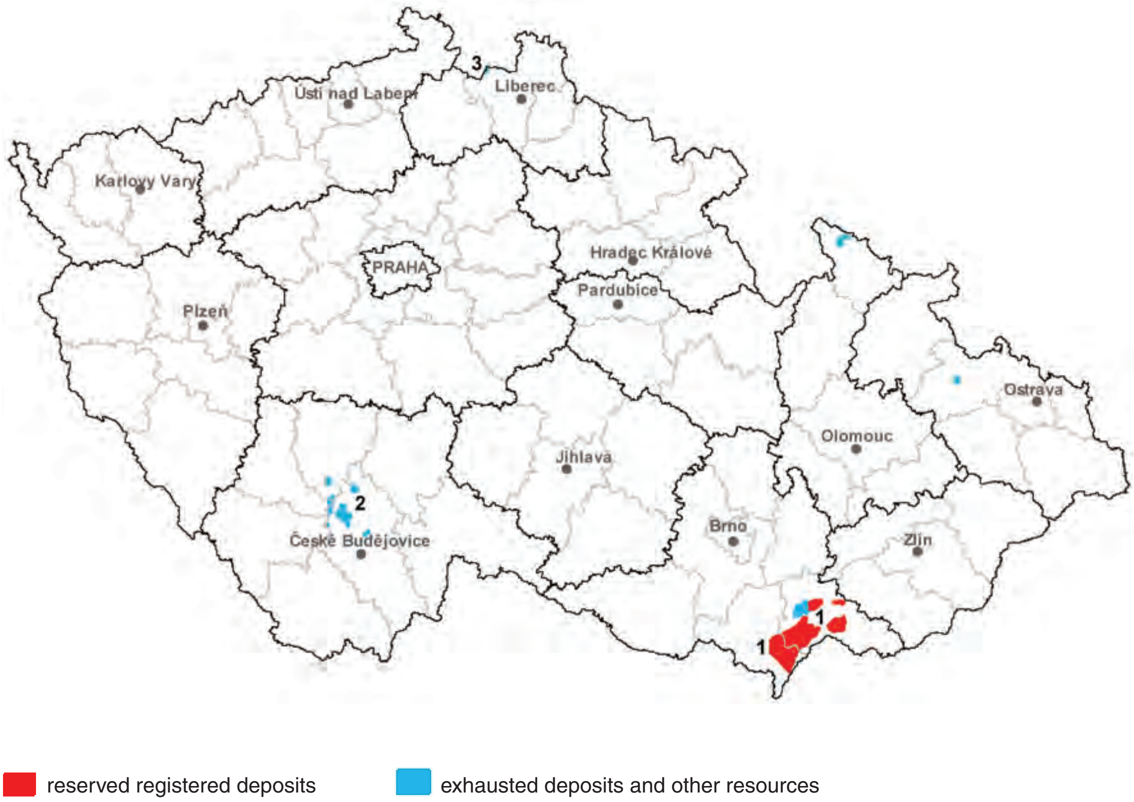
MINERALS CURRENTLY UNMINED IN THE CZECH REPUBLIC

MINERALS MINED IN THE PAST WITH RESOURCES AND RESERVES

ENERGY MINERALS

Lignite

1. Registered deposits and other resources of the Czech Republic



Principal areas of deposits presence:

1 Vienna Basin	2 České Budějovice Basin	3 Czech part of the Zittau (Žitava) Basin

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	5	5	5	5	5
exploited	0	0	0	0	0
Total mineral reserves*, kt	997 229	997 229	997 229	997 229	997 229
economic explored reserves	619 652	619 652	619 652	619 652	619 652
economic prospected reserves	229 932	229 932	229 932	229 932	229 932
potentially economic reserves	147 645	147 645	147 645	147 645	147 645
exploitable (recoverable)	1 903	1 903	1 903	1 903	1 903
Mine production, kt	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Lignite mining ended in 2009.

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	232 867	169 262	177 351	177 351	177 351
P_2	kt	–	37 531	37 531	37 531	37 531
P_3		–	–	–	–	–

3. Foreign trade

No separate tariff item exists for lignite.

4. World production and world market prices

World mine production

Worldwide, lignite production is included in brown coal (lignite) production.

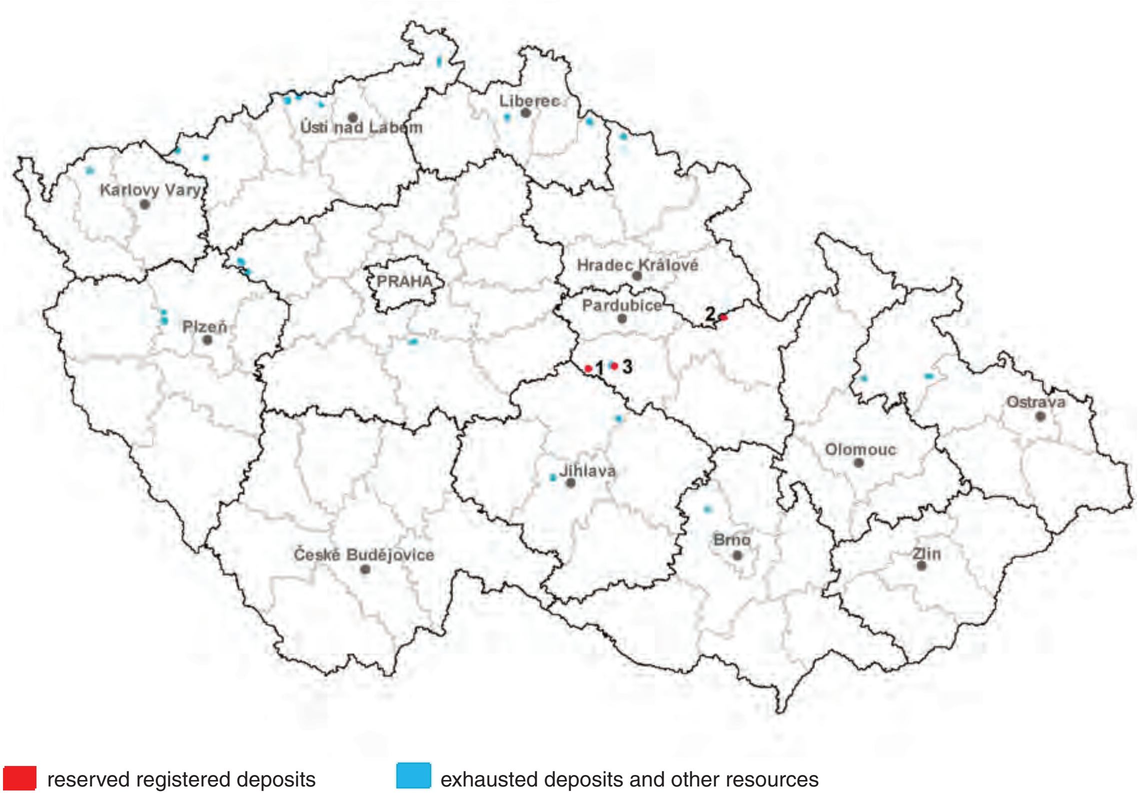
Prices of traded commodities

There are no international market for lignite commodities as lignite is generally not traded outside a producing country.

INDUSTRIAL MINERALS

Barite

1. Registered deposits and other resources of the Czech Republic



Registered deposits and other resources are not mined

1 Běstvina	2 Bohousová	3 Křižanovice

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number [a)]	3	3	3	3	3
exploited	0	0	0	0	0
Total mineral *reserves, kt	569	569	569	569	569
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	569	569	569	569	569
Mine production, kt	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] Deposits with registered barite reserves

3. Foreign trade

251110 – Natural barium sulphate (barite)

		2011	2012	2013	2014	2015
Import	t	7 461	7 083	6 964	7 915	10 630
Export	t	283	318	464	178	241

251110 – Natural barium sulphate (barite)

		2011	2012	2013	2014	2015
Average import prices	CZK/t	7 490	8 172	8 969	9 064	8 147
Average export prices	CZK/t	11 804	11 918	15 382	14 010	15 141

251120 – Natural barium carbonate (witherite)

		2011	2012	2013	2014	2015
Import	t	108	0.001	0	0	8
Export	t	0	0	0	0	0

251120 – Natural barium carbonate (witherite)

		2011	2012	2013	2014	2015
Average import prices	CZK/t	9 583	15 000	–	–	10 000
Average export prices	CZK/t	–	–	–	–	–

4. World production and world market prices

World mine production

World baryte production was as follows in recent years:

	2011	2012	2013	2014	2015[e]
World mine production of barite (according to MCS), kt	8,370	9,200	9,230	8,250	7,460
World mine production of barite (according to WBD), kt	9,652.2	10167.4	9,865.1	9,491.7	N

[e] *– preliminary values*

Main producers according to MCS

country	2015[e]	
	kt	%
China	3,000	40.2
India	900	12.1
Morocco	900	12.1
USA	700	9.4
Iran	300	4.0
Kazakhstan	300	4.0
Mexico	220	2.9
Turkey	200	2.7
Thailand	130	1.7
Pakistan	120	1.6
world	**7,460**	**100.0**

[e] *– preliminary values*

The MCS estimated total world resources in all categories at 2 000 million tonnes, but identified resources at only 740 million tonnes.

Prices of traded commodities (according to IM)

Barite is traded in three different quality grades: as a weighting agent in drilling muds and as white paint-grade and chemical-grade barite.

Commodity/Year			2011	2012	2013	2014	2015
Drilling grade, underground lump OCMA/API, bulk, s.g. 4.20							
FOB Chennai		USD/t	72–146	140–145	145–155	138–155	120–138
FOB Morocco		USD/t	84–113	108–152	105–130	105–130	115–140
FOB China		USD/t	72–127	127–148	120–140	115–140	115–140
C&F North Sea (Moroccan)		USD/t	100–113	124–160	145–160	145–160	145–172
API, CIF Gulf Coast	Chinese	USD/t	100–150	140–162	147–154	147–164	145–160
	Indian		107–170	157–171	157–171	157–171	158–171
Drilling–grade, ground							
OCMA, bulk, del. Aberdeen		GBP/t	95–105	95–105	95–105	95–105	95–130
OCMA, bulk, del. Gt Yamouth		GBP/t	110–120	110–120	110–120	110–125	112–150
OCMA/API, bulk (15t): FOB J.Turkey		USD/t	125–135	130–155	150–155	150–168	152–168
SG 4.22, bagged, FOB Morocco		USD/t	135–147	135–147	110–170	110–170	110–172
Paint grade, white 96–98% $BaSO_4$:							
350 mesh, 1–5 lots, del. UK		GBP/t	195–220	195–220	195–220	195–220	195–220
Chinese, lump CIF Gulf Coast		USD/t	235–290	235–275	235–275	235–275	235–290
325–350 mesh, 1–5 lots, ex–works USA		USD/st	315–400	315–400	315–400	315–400	315–400
Chemical grade							
Chinese, CIF Gulf Coast		USD/t	135–145	135–180	161–180	161–180	161–180

The price range includes the lowest and highest monthly price quotes for a given year.

Fluorspar

1. Registered deposits and other resources of the Czech Republic

reserved registered deposits   exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Běstvina	2 Jílové u Děčína	3 Kovářská	4 Moldava

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number [a)]	4	4	4	4	4
exploited	0	0	0	0	0
Total mineral *reserves, kt	2 033	2 033	2 033	2 033	2 033
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	2 033	2 033	2 033	2 033	2 033
Mine production, kt	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] *Deposits with registered fluorspar reserves*

3. Foreign trade

252921 – Fluorspar, containing 97 wt % or less of calcium fluoride

		2011	2012	2013	2014	2015
Import	t	4 851	5 796	6 199	4 858	4 841
Export	t	3 025	1 686	1 729	1 562	895

252921 – Fluorspar, containing 97 wt % or less of calcium fluoride

		2011	2012	2013	2014	2015
Average import prices	CZK/t	6 455	6 325	6 713	6 548	7 976
Average export prices	CZK/t	7 807	8 176	9 160	10 355	10 254

252922 – Fluorspar, containing more than 97 wt % of calcium fluoride

		2011	2012	2013	2014	2015
Import	t	10 871	9 624	11 031	9 053	12 356
Export	t	7 539	7 948	8 993	8 133	8 082

252922 – Fluorspar, containing more than 97 wt % of calcium fluoride

		2011	2012	2013	2014	2015
Average import prices	CZK/t	6 620	9 880	8 515	7 214	6 729
Average export prices	CZK/t	9 955	12 640	12 273	11 422	10 627

4. World production and world market prices

World mine production

World fluorspar production in recent years was as follows:

	2011	2012	2013	2014	2015[e]
World mine production of fluorspar (according to MCS), kt	7,520	7,070	6,770	6,390	6,250
World mine production of fluorspar (according to WBD), kt	6,738.4	6,012.2	6,705.3	6,887.1	N

[e] – *preliminary values*

Main producers according to MCS

country	2015[e]	
	kt	%
China	3,800	60.8
Mexico	1,100	17.6
Mongolia	375	6.0
RSA	200	3.2
Kazakhstan	110	1.8
Spain	96	1.5
Iran	90	1.4
Morocco	75	1.2
Great Britain	70	1.1
Kenya	63	1.0
world	**6,250**	**100.0**

[e] – *preliminary values*

Leading producers also include the USA, which, however, does not publish statistical data on fluorspar.

Identified world resources are estimated at 500 million tonnes of calcium fluoride in fluorspar ores. World resources of phosphate rock contain approximately another 4.7 billion tonnes of calcium fluoride.

Prices of traded fluorspar commodities (USD/t) according to IM

Two grades of fluorspar are listed in market quotations: filtercake for the production of hydrofluoric acid and metallurgical fluorspar.

Filtercake, bulk, for production of hydrofluoric acid

Commodity/Year	2011	2012	2013	2014	2015
Mexican, <5ppm As FOB Tampico	320–550	540–550	540–550	400–550	280–420
Mexican, FOB Tampico	290–450	400–450	350	310–350	260–330
Chinese, wet filtercake, CIF Rotterdam	340–650	500–650	310–330	350–420	290–360
Chinese,wetfiltercake, FOB China	500–600	400–415	290–320	300–330	240–310
South African, dry basis, FOB Durban	330–350	380–450	380–450	310–450	250–330
Chinese, dry basis, CIF US Gulf Port	370–650	480–650	480–530	340–530	270–370

Metallurgical fluorspar

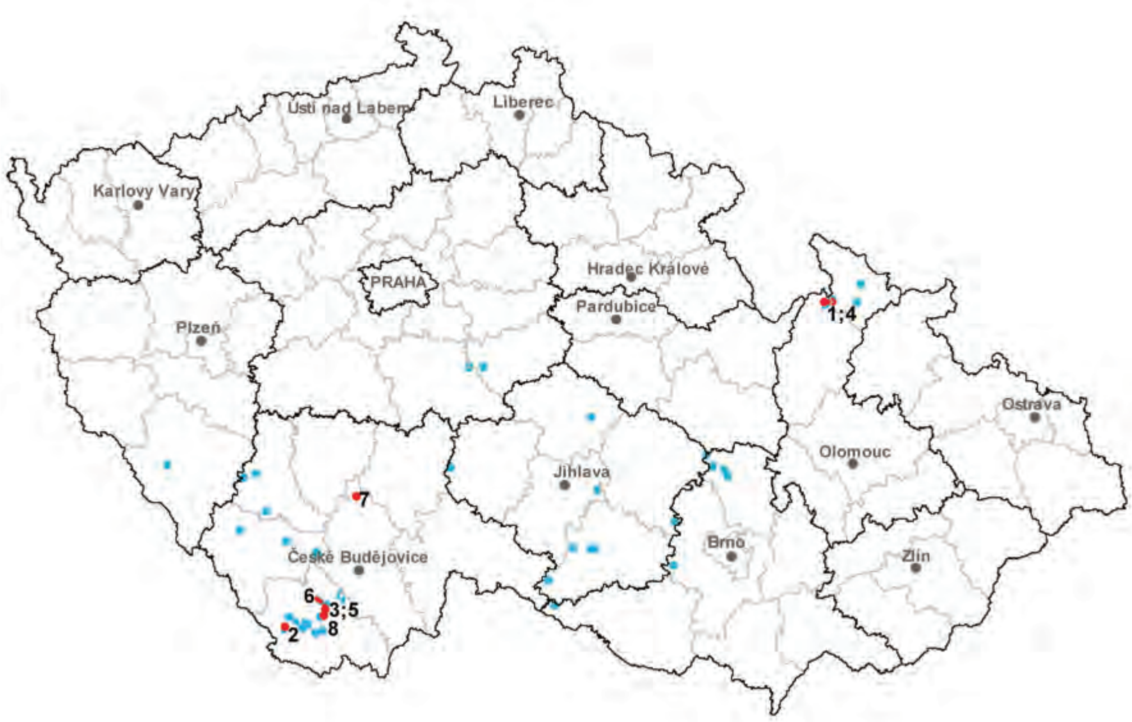
Commodity/Year	2011	2012	2013	2014	2015
Chinese, min. 85% CaF_2, CIF Rotterdam	280–310	310	N	290–310	290–310
Mexican, FOB Tampico	170–270	230–270	230–270	230–270	230–290
Chinese, min.80% CaF_2, wet bulk, FOB China	230–331	305–331	200–220	200–220	200–220
Chinese, min. 85% CaF_2 CIF Rotterdam	310–359	310–375	290–310	230–250	230–250
Chinese, min. 85% CaF_2, bulk FOB China	359–381	359–385*	250–275*	250–275*	230–260

** min. 90% CaF_2*

The price range includes the lowest and highest monthly price quotes for a given year.

Graphite

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits — exhausted deposits and other resources

Registered deposits and other resources are not mined

Amorphous graphite:	Crystalline graphite:	Mixed (from amorphous to crystalline) graphite:
1 Velké Vrbno-Konstantin	5 Český Krumlov-Městský vrch	8 Spolí
2 Bližná-Černá v Pošumaví	6 Lazec-Křenov	
3 Český Krumlov-Rybářská ulice	7 Koloděje nad Lužnicí-Hosty	
4 Velké Vrbno-Luční hora 2		

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	8	8	8	8	8
exploited	1	1	1	0	0
Total mineral *reserves, kt [a)]	14 159	14 159	14 159	14 159	14 159
economic explored reserves	1 321	1 321	1 321	1 106	1 106
economic prospected reserves	4 041	4 041	4 041	2 606	2 606
potentially economic reserves	8 797	8 797	8 797	10 447	10 447
Mine production, kt [a)]	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] Reserves and mine production are given for crude graphite (graphite "ore"); average graphite contents in the raw material range between 15 and 20% (crystalline grade) and 25–35% (amorphous grade), respectively

Approved prognostic resources P_1, P_2, P_3

Year		2011	2012	2013	2014	2015
P_1,	kt	3 878	3 878	3 997	3 997	3 997
P_2,	kt	5 279	5 279	5 279	5 279	5 279
P_3,	kt	1 505	1 505	1 505	1 505	1 505

3. Foreign trade

2504 – Natural graphite

		2011	2012	2013	2014	2015
Import	t	5 174	4 762	5 644	4 964	4 967
Export	t	3 418	3 109	2 675	2 982	2 670

2504 – Natural graphite

		2011	2012	2013	2014	2015
Average import prices	CZK/t	22 607	24 309	21 416	22 589	24 014
Average export prices	CZK/t	31 646	37 539	39 286	41 562	40 778

3801 – Artificial graphite; colloidal or semi-colloidal graphite; preparations based on graphite

		2011	2012	2013	2014	2015
Import	t	4 399	2 892	2 436	2 381	2 506
Export	t	1 178	1 428	1 483	1 806	1 487

3801 – Artificial graphite; colloidal or semi-colloidal graphite; preparations based on graphite

		2011	2012	2013	2014	2015
Average import prices	CZK/t	36 029	50 098	55 150	52 845	59 617
Average export prices	CZK/t	34 035	31 711	33 033	41 172	55 767

6903 – Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods)

		2011	2012	2013	2014	2015
Import	t	6 742	5 418	1 053	9 817	19 665
Export	t	12 471	13 924	20 069	21 655	29 609

6903 – Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods)

		2011	2012	2013	2014	2015
Average import prices	CZK/t	86 647	97 498	105 057	65 994	34 254
Average export prices	CZK/t	121 179	120 152	94 799	105 720	75 720

4. World production and world market prices

World mine production

World graphite production has again been rising gradually after reaching its latest lowest level in 2009:

	2011	2012	2013	2014	2015[e]
World mine production of graphite (according to MCS), kt	1,150	1,170	1,110	1,190	1,190
World mine production of graphite (according to WBD), kt	1,173.4	1,194.9	1,125.6	1,095.2	N

[e] – *preliminary values*

Main producers according to MCS

country	2015[e]	
	kt	%
China	780	65.5
India	170	14.3
Brazil	80	6.7
Turkey	32	2.7
Canada	30	2.5
North Korea	30	2.5
Mexico	22	1.8
Russia	15	1.3
Norway	8	0.7
Zimbabwe	7	0.6
world	**1,190**	**100.0**

[e] – *preliminary values*

China, Canada, and Madagascar were the leading producers of flake (crystalline) graphite.

Estimated World Resources of graphite exceed 800 mil. t. The EU includes graphite among strategic raw materials. According to Industrial Minerals (February 2009), the largest reserves of graphite are in following countries (in mil. t):

Crystalline graphite		**Amorphous graphite**	
China	400	India	180
Ukraine	100	China	100
Madagascar	100	Mexico	100
Sri Lanka	80	Sri Lanka	100
Brazil	15	Austria	100
		South Korea	100

Prices of traded commodities (USD/t) according to IM

Commodity/ Year	2011	2012	2013	2014	2015
Crystalline graphite, large flake, 94–97% C, +80 mesh, CIF main European port	1,450–3,000	1,400–1,800	1,250–1,300	1,350–1,400	1,050–1,500
Crystalline graphite, medium flake, 94–97% C, –80 mesh, CIF main European port	1,350–2,500	1,050–1,400	1,050–1,150	850–1,200	900–1,300
Crystalline graphite, fine, 94–97% C, +100 mesh, CIF main European port	1,250–2,400	1,200–1,600	850–950	850–1,050	900–1,050
Crystalline graphite, large flake, 90% C,+80 mesh, CIF UK port	1,100–2,500	1,200–1,600	1,100–1,150	1,100–1,200	750–1,200
Crystalline graphite, medium flake, 90% C, +100–80 mesh, CIF main European port	1,050–2,000	950–1,200	900–1,000	900–1,000	700–1,050
Crystalline graphite, fine, 90% C, –100 mesh, CIF main European port	950–1,800	850–1,050	750–850	750–850	600–800
Crystalline graphite, medium flake, 85–87% C, +100–80 mesh, CIF main European port	1,000–1,900	900–1,150	700–800	700–800	550–800
Amorphous graphite, powder, 80–85% C, Chinese CIF Europe	400–800	600–800	500–550	430–550	400–480

The price range includes the lowest and highest monthly price quotes for a given year.

METALLIC ORES

Copper

1. Registered deposits and other resources of the Czech Republic

reserved registered deposits   exhausted deposits and other resources

Registered deposits and other resources are not mined

Reserved registered deposits:

1	Křižanovice	3	Zlaté Hory-Hornické Skály
2	Kutná Hora	4	Zlaté Hory-východ

Exhausted deposits and other resources:

5	in Krušné hory Mts. (Erzgebirge Mts.) and Tisová	7	in Krkonoše Mts. Piedmont Basin and Intrasudetic Basin
6	Tři Sekery and surroundings	8	Staré Ransko

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number [a)]	4	4	4	4	4
exploited	0	0	0	0	0
Total mineral *reserves, kt Cu	49	49	49	49	49
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	49	49	49	49	49
Mine production, kt Cu	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*
[a)] deposits with registered Cu content

3. Foreign trade

2603 – Copper ores and concentrates

		2011	2012	2013	2014	2015
Import	t	1	17	93	94	90
Export	t	N	7	4	0	0

2603 – Copper ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	1000	25 376	113 821	75 873	74 276
Average export prices	CZK/t	N	20 152	22 864	–	–

7402 – Unrefined copper

		2011	2012	2013	2014	2015
Import	t	86	55	112	287	23
Export	t	1	0	387	602	0.4

7402 – Unrefined copper

		2011	2012	2013	2014	2015
Average import prices	CZK/t	139 912	193 243	170 904	154 926	297 556
Average export prices	CZK/t	150 000	–	149 727	145 518	2 015 766

7403 – Refined copper and copper alloys

		2011	2012	2013	2014	2015
Import	t	9 637	21 767	35 174	16 450	6 772
Export	t	13 516	30 799	53 182	26 627	4 930

7403 – Refined copper and copper alloys

		2011	2012	2013	2014	2015
Average import prices	CZK/t	148 012	159 431	152 028	144 197	135 665
Average export prices	CZK/t	150 126	159 721	67 016	146 282	144 246

7404 – Copper waste and scrap

		2011	2012	2013	2014	2015
Import	t	19 712	19 367	14 164	9 449	5 706
Export	t	86 508	74 740	67 016	68 421	56 130

7404 – Copper waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/t	133 409	121 300	122 015	118 523	132 672
Average export prices	CZK/t	113 254	109 178	101 140	99 208	93 359

740311 – Copper cathodes and sections of cathodes unwrought

		2011	2012	2013	2014	2015
Import	t	5 059	19 659	32 531	14 778	3 147
Export	t	10 371	29 517	51 532	25 037	3 103

740311 – Copper cathodes and sections of cathodes unwrought

		2011	2012	2013	2014	2015
Average import prices	CZK/t	150 728	161 005	154 116	146 775	144 012
Average export prices	CZK/t	154 903	160 492	169 359	146 176	141 710

740321 – Copper-zinc base alloys, unwrought

		2011	2012	2013	2014	2015
Import	t	3 021	1 531	2 244	2 442	3 109
Export	t	2 642	1 046	1 154	1 301	1 573

740321 – Copper-zinc base alloys, unwrought

		2011	2012	2013	2014	2015
Average import prices	CZK/t	126 077	130 485	108 820	114 660	104 265
Average export prices	CZK/t	125 463	138 261	141 589	152 722	145 909

740322 – Copper-tin base alloys, unwrought

		2011	2012	2013	2014	2015
Import	t	245	192	53	57	45
Export	t	71	132	99	71	132

740322 – Copper-tin base alloys, unwrought

		2011	2012	2013	2014	2015
Average import prices	CZK/t	192 082	128 019	281 980	452 125	499 546
Average export prices	CZK/t	254 293	159 724	157 222	173 864	176 063

4. World production and world market prices

World mine production

World production of primary copper has been rising in recent years:

	2011	2012	2013	2014	2015[e]
World mine production of copper (according to MCS), kt	16,100	16,900	17,900	18,500	18,700
World mine production of copper (according to WBD), kt	16,185.9	16,821.2	18,290.4	18,435.3	N

[e] – *preliminary values*

Metal Bulletin (12 March 2012) published an overview of the world´s copper production capacities (kt)

Capacity/Year	2011	2012	2013	2014
Hydrometallurgy (SX-BW)	4,655	4,751	4,837	5,227
Concentrates	15,649	16,123	16,978	18,378
Total mine production	**20,304**	**20,874**	**21,815**	**23,605**
Total metallurgical production	18,528	19,113	19,823	20,353
Electrolytic production	19,155	20,116	20,981	21,551
Total refinery production	**24,569**	**25,586**	**26,537**	**27,497**

Main producers according to MCS

country	2015[e]	
	kt	%
Chile	5,700	30.5
China	1,750	9.4
Peru	1,380	7.4
USA	1,250	6.7
Kongo (Kinshasa)	990	5.3
Australia	960	5.1
Russia	740	4.0
Canada	695	3.7
Zambia	600	3.2
Mexico	550	2.9
world	**18,700**	**100.0**

[e] – *preliminary values*

World reserves are estimated at 720 mil. t of metal in ore. Identified sources are estimated at 2.1 bn t of ore. The most significant resources are porphyry ores, whose identified resources were estimated at 1.8bn t and undiscovered resources at 3.5bn t by the USGS. Estimations of undiscovered resources speak of 3.5bn t. Deep-sea nodules and submarine massive sulphide ores represent other large unconventional resources.

Prices of traded commodities

According to the German Deutschland–Rohstoffsituation yearbooks for 2011–2014 (D-R), DERA Preismonitor 2015, and Metal Bulletin (MB), world copper prices (USD/t) developed as follows:

Commodity/ Year	2011	2012	2013	2014	2015
Electrolytic Cu, grade A, min. 99.9 %, LME, in warehouse, cash (according to D-R and DERA)	8,820.53	7,949.44	7,332.19	6,859.20	5,501.12
Electrolytic Cu, grade A, min. 99.9935%, contractual price (according to WB)	8,828.19	7,962.35	7,332.10	6,863.40	5,510.46
Copper, grade A, LME cash (according to MB)	6,784.50–10,147.75	7,251.25–8,656.50	6,637.25–8,242.25	6,305.50–7,439.25	4,515.25–6,446.50
Copper, grade A, 3-month contract, LME (according to MB)	6,812.00–10,124.00	7,270.00–8,647.00	6,676.00–8,286.00	6,253.50–7,421.50	4,499.50–6,442.50

The price range according to MB includes the lowest and highest monthly price quotes for a given year.

During 2015, LME registered a fall in copper prices from USD 6,309/t at the beginning of the year to USD 4,702/t at the end of the year. The lowest level was recorded in early December, when the price got to US 4,589/t. The highest spot price of copper was achieved at the end of May, when the quotation read USD 6,400/t.

Germanium

1. Registered deposits and other resources of the Czech Republic

reserved registered deposits

The registered deposit is not exploited

1 Lomnice u Sokolova

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	1	1	1	1	1
exploited	0	0	0	0	0
Total * reserves, t Ge	479	479	476	473	473
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	479	479	476	473	473
Mine production, t Ge	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic and its evolutional comparison with international classifications** of this yearbook*

3. Foreign trade

81129295 – Unwrought germanium, germanium powders; excluding waste and scrap

		2011	2012	2013	2014	2015
Import	kg	6	4	40	26	< 1
Export	kg	N	< 1	1	0	1

81129295 – Unwrought germanium, germanium powders; excluding waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	8 000	50 750	16 825	45 769	> 29 000
Average export prices	CZK/kg	N	> 3 000	57 000	–	75 000

4. World production and world market prices

World mine production

World germanium production was as follows in recent years:

	2011	2012	2013	2014	2015[e]
World germanium production (according to MCS), t	188	150	155	165	165
World germanium production (according to WBD), t	108	111	117	124	N

[e] – preliminary values

The cited sources do not give any insight into their data, which differ considerably. It may be the difference between the metal and the oxide.

According to WBD (2016), the largest producer of germanium in 2014 was China with 76.6% of global production. The second was Finland (13.7%), then Russia (4.8%), USA (2.4%), Japan (1.6%), and Ukraine (0.8%).

According to MCS (2016), China maintained its position of the world´s largest producer and consumer of germanium in 2015. Its share reached 72.7% of world production, while the refineries were used at about half their capacity (which reportedly reaches 200 t/y). MCS further mentions only Russia with a three-percent share of global production.

Main producers according to MCS

country	2015[e]	
	kt	%
China	120,000	72.7
Russia	5,000	3.0
USA	N	N
world	**165,000**	**100.0**

[e] – preliminary values

The most important recoverable resources of germanium are associated with zinc and Pb-Zn-Cu sulphide ores. However, on a global scale, only 3% of germanium contained in processed zinc concentrates are recovered. Another resource are coal deposits, with germanium being recovered from ash and flue dust during combustion. According to the Critical Metals Handbook (ed. G. Gunn, Wiley, 2014), China produces around 30 tonnes of germanium annually from these resources.

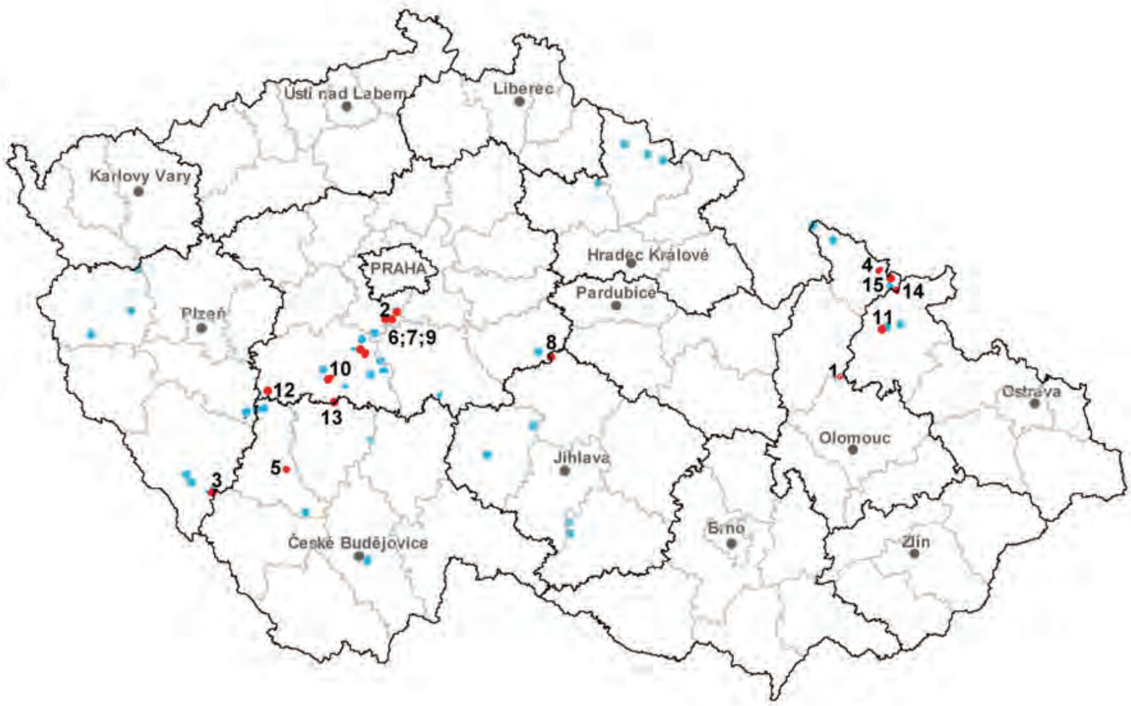
In 2012, the prices of germanium dioxide rose from 925 USD/kg in March to 1,375 USD/kg in September. Oxide prices did not change much in 2013. The prices of germanium metal increased in 2013 from 1 640 USD/kg to 1 875 USD/kg at the end of the year.

Average annual prices of germanium dioxide in USD/kg
according to the German yearbooks Deutschland-Rohstoffsituation (2011–2014) and DERA (2015)

	2011	2012	2013	2014	2015
GeO_2, min. 99.99 %, MB free market, in warehouse, Rotterdam	1,219.61	1,214.32	1,313.54	1,312.50	1,203.76

Gold

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits   exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Břevenec	6 Mokrsko	11 Suchá Rudná-střed
2 Jílové u Prahy	7 Mokrsko-východ	12 Vacíkov
3 Kašperské Hory	8 Podmoky	13 Voltýřov
4 Mikulovice u Jeseníka	9 Prostřední Lhota-Čelina	14 Zlaté Hory-východ
5 Modlešovice	10 Smolotely-Horní Líšnice	15 Zlaté Hory-Zlatý potok

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	15	15	15	15	15
exploited	0	0	0	0	0
Total mineral *reserves, kg Au	238 900	238 900	238 900	238 900	238 900
economic explored reserves	48 740	48 740	48 740	48 740	48 740
economic prospected reserves	28 644	28 644	28 644	28 644	28 644
potentially economic reserves	161 516	161 516	161 516	161 516	161 516
Mine production, kg Au	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

Approved prognostic resources P_1, P_2, P_3

Au metal in ores

Year		2011	2012	2013	2014	2015
P_1,	kg	60 221	60 221	60 221	60 221	60 221
P_2,	kg	65 846	65 846	65 846	65 846	52 246
P_3,		–	–	–	–	–

Au ore

Year		2011	2012	2013	2014	2015
P_1,	kt	16 700	16 700	16 700	16 700	16 700
P_2,	kt	20 341	20 341	23 191	23 191	23 191
P_3,	kt	2 850	2 850	–	–	–

3. Foreign trade

7108 – Gold in unwrought or semi-manufactured form, gold powder

		2011	2012	2013	2014	2015
Import	kg	20 354	5 420	6 892	6 129	5 888
Export	kg	9 848	54 533	91 636	8 405	13 760

7108 – Gold in unwrought or semi-manufactured form, gold powder

		2011	2012	2013	2014	2015
Average import prices	CZK/g	175.1	796.3	839.0	788.4	878.3
Average export prices	CZK/g	226.9	54.3	48.9	453.7	280.6

4. World production and world market prices

World mine production

Trend in the world´s primary gold production

	2011	2012	2013	2014	2015[e]
Mine production of gold, t (according to MCS)	2,660	2,60	2,770	2,990	3,000
Mine production of gold, t (according to WBD)	2,643.4	2,728.2	2,899.2	3,008.4	N

[e] *– preliminary values*

Main producers according to MCS

country	2015[e]	
	t	%
China	490	16.3
Australia	300	10.0
Russia	242	8.1
USA	200	6.7
Canada	150	5.0
Peru	150	5.0
RSA	140	4.7
Mexico	120	4.0
Uzbekistan	103	3.4
Ghana	85	2.8
world	**3,000**	**100.0**

[e] *– preliminary values*

According to WBD (2016), the ranking of countries was almost identical in 2014, with the exception of RSA (6th) and Peru (7th).

The USGS estimates the amount of world reserves of gold ore at 56,000 t, of which more than 16% is in Australia, more than 14% in Russia, and more than 10% in South Africa. On the other hand, China‘s reserves are estimated to account for 3.4% of world reserves only.

Reserves of the USA and Ghana amount to 5.4%. The estimated gold ore reserves in the USA are 33,000t, identified reserves 15,000t, and undiscovered reserves 18,000t. It is believed that about one quarter of undiscovered resources of Au lies in porphyry copper deposits.

Prices of traded commodities

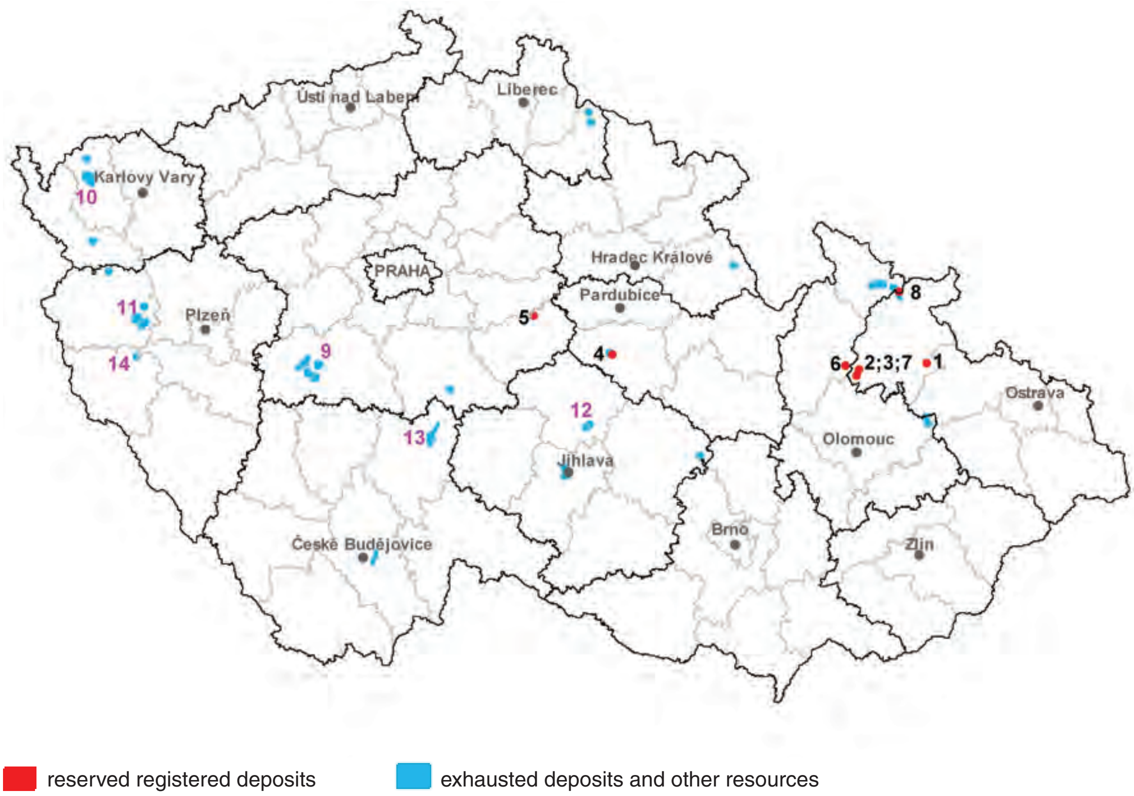
Average annual gold prices in USD/tr oz (1 tr oz (troy ounce) = 31,1035g) according to the German Deutschland-Rohstoffsituation yearbooks for 2011–2014 and DERA (2015) and the World Bank's "Pink Sheet" (WB)

Commodity/ Year	2011	2012	2013	2014	2015
Gold 99.9%, LME, in warehouse (according to D-R, DERA)	1,569.52	1,668.54	1,410.80	1,266.344	1,160.59
Au 99.5% (UK), LME average daily quotation (WB)	1,569.21	1,669.52	1,411.46	1265.43	1,160.66

According to MB, downtrend in gold prices on the LME continued in 2015. Prices fell from USD 1,184.25/tr oz (on January 1) to USD 1,062.50 tr/oz (on December 31). The highest price was reached in late March (USD 1,198.40/tr oz), the lowest in early December (USD 1,053.20/ tr oz).

Lead

1. Registered deposits and other resources of the Czech Republic



Registered deposits and other resources are not mined

Reserved registered deposits:

1 Horní Benešov
2 Horní Město
3 Horní Město-Šibenice
4 Křižanovice
5 Kutná Hora
6 Oskava
7 Ruda u Rýmařova-sever
8 Zlaté Hory-východ

Exhausted deposits and other resources:

9 Březové Hory + Příbram-Bohutín
10 Oloví
11 Stříbro
12 Havlíčkův Brod (Dlouhá Ves + Bartoušov + Stříbrné Hory)
13 Ratibořské Hory + Stará Vožice
14 Černovice

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number [a)]	8	8	8	8	8
exploited	0	0	0	0	0
Total mineral *reserves, kt Pb	152	152	152	152	152
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	152	152	152	152	152
Mine production, kt Pb	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] Deposits with registered Pb content

Approved prognostic resources P_1, P_2, P_3
Polymetallic (Pb – Zn ± Cu) ores

Year		2011	2012	2013	2014	2015
P_1,	kt	786	786	786	786	786
P_2,	kt	5 340	5 340	5 340	5 340	5 340
P_3,		–	–	–	–	–

3. Foreign trade

2607 – Lead ores and concentrates

		2011	2012	2013	2014	2015
Import	t	0.3	0.08	192	119	139
Export	t	0	0	0	0	0.5

2607 – Lead ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	354 331	626 506	48 036	47 036	26 490
Average export prices	CZK/t	–	–	–	–	22 000

7801 – Unwrought lead

		2011	2012	2013	2014	2015
Import	t	35 972	60 257	104 857	127 977	122 156
Export	t	21 104	23 623	28 444	35 363	53 585

7801 – Unwrought lead

		2011	2012	2013	2014	2015
Average import prices	CZK/t	45 540	43 874	46 201	47 100	47 659
Average export prices	CZK/t	45 240	43 823	48 595	49 989	50 715

7802 – Lead waste and scrap

		2011	2012	2013	2014	2015
Import	t	2 770	2 585	4 179	4 915	2 666
Export	t	1 115	1 185	1 139	1 476	973

7802 – Lead waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/t	37 005	34 836	33 297	35 884	35 299
Average export prices	CZK/t	33 899	39 428	30 826	28 213	31 982

4. World production and world market prices

World mine production

According to MCS and WBD, global lead production was as follows in recent years:

	2011	2012	2013	2014	2015^e
World mine production of lead (according to MCS), kt	4,700	5,170	5,400	4,870	4,710
World mine production of lead (according to WBD), kt	4,727.9	5,106.0	5,313.9	5,432.0	N

^{e} – *preliminary values*

Main producers according to MCS

country	2015[e]	
	kt	%
China	2,300	48.8
Australia	633	13.4
USA	385	8.2
Peru	300	6.4
Mexico	240	5.1
India	130	2.8
Russia	90	1.9
Bolivia	82	1.7
Sweden	76	1.6
Turkey	65	1.4
world	**4,710**	**100.0**

[e] – *preliminary values*

The USGS estimated world reserves at 89 mil. t. Identified resources are listed at around 2 bil. t. Significant lead reserves have been demonstrated in association with polymetallic ore deposits in Australia, China, Ireland, Mexico, Peru, Portugal, Russia, and in the USA (Alaska).

Prices of traded commodities

World lead prices (USD/t) according to the German Deutschland-Rohstoffsituation yearbooks for 2011–2014 (D-R), DERA 2015, World Bank (WB), and Metal Bulletin (MB)

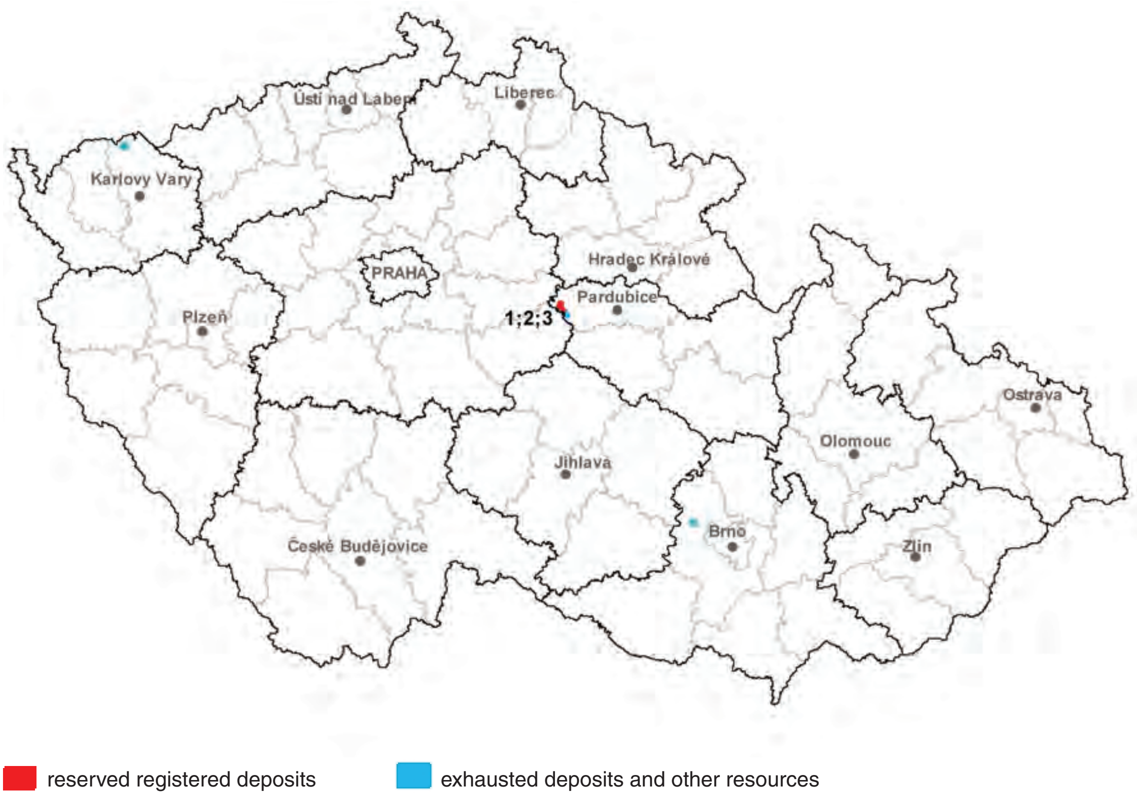
Commodity/ Year	2011	2012	2013	2014	2015
99.97% Pb, LME (according to D-R and DERA)	2,401.21	2,067.29	2 141,83	2,096.78	1,786.08
Refined 99.97 %, contractual price (according to WB)	2,400.81	2,064.64	2,139.39	2,095.46	1,787.82
Lead, LME cash (according to MB)	1,791.25–2,938.75	1,743.50–2,339.75	1,948.50–2,447.50	1,813.75–2,268.50	1,554.50–2139.50
Lead, LME 3-month contract (according to MB)	1,832.00–2,853.00	1,760.00–2,342.00	1,961.00–2,455.00	1,823.00–2,286.50	1,561.00–2,140.00

The price range according to MB includes the lowest and highest monthly price quotes for a given year.

During 2015, LME registered a relatively small decrease of spot prices – from USD 1,845/t to USD 1,802/t. In April and May, prices even oscillated around USD 2,000/t.

Manganese

1. Registered deposits and other resources of the Czech Republic



Registered deposits and other resources are not mined

1 Chvaletice	2 Chvaletice – tailing ponds No 1 & No 2	3 Řečany – tailing pond No 3

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	3	3	3	3	3
exploited	0	0	0	0	0
Total mineral *reserves, kt ores	138 801	138 801	138 801	138 801	138 801
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	138 801	138 801	138 801	138 801	138 801
Mine production, kt Mn	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

3. Foreign trade

2602 – Manganese ores and concentrates

		2011	2012	2013	2014	2015
Import	t	28 725	287	14 189	18 671	25 003
Export	t	50	383	65	32	42

2602 – Manganese ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	7 920	14 641	6 511	7 020	4 245
Average export prices	CZK/t	14 069	9 737	14 397	15 239	15 263

720211; 720219 – Ferro-manganese

		2011	2012	2013	2014	2015
Import	t	25 281	24 857	22 846	26 496	23 005
Export	t	1 758	1 776	2 107	1 780	1 158

720211; 720219 – Ferro-manganese

		2011	2012	2013	2014	2015
Average import prices	CZK/t	26 715	24 142	23 556	23 116	23 256
Average export prices	CZK/t	23 982	23 740	18 580	21 130	21 411

720230 – Ferrosilicomanganese

		2011	2012	2013	2014	2015
Import	t	45 062	46 992	45 736	45 046	41 302
Export	t	1 754	3 711	4 676	2 187	1 135

720230 – Ferrosilicomanganese

		2011	2012	2013	2014	2015
Average import prices	CZK/t	24 534	23 685	22 301	22 523	21 409
Average export prices	CZK/t	23 403	23 940	21 798	21 834	23 154

8111 – Manganese and articles thereof, including waste and scrap

		2011	2012	2013	2014	2015
Import	t	949	524	678	734	718
Export	t	24	12	34	76	47

8111 – Manganese and articles thereof, including waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/t	62 548	61 079	56 726	60 363	58 004
Average export prices	CZK/t	65 337	79 650	39 478	67 176	62 338

2820 – Manganese oxides

		2011	2012	2013	2014	2015
Import	t	1 093	1 183	963	803	782
Export	t	55	142	24	23	14

2820 – Manganese oxides

		2011	2012	2013	2014	2015
Average import prices	CZK/t	17 390	22 175	20 106	26 340	25 876
Average export prices	CZK/t	21 072	8 958	19 667	36 072	103 044

4. World production and world market prices

World production

The world´s primary production of manganese in mined ores was as follows in recent years:

	2011	2012	2013	2014	2015[e]
World mine production of manganese (according to MCS), kt	16,000	15,800	17,000	17,800	18,000
World mine production of manganese (according to WBD), kt	17,752.7	16,948.2	18,925.5	19,324.0	N

[e] – *preliminary values*

Hlavní producenti dle MCS

country	2015[e]	
	kt	%
RSA	6,200	34.4
China	3,000	16.7
Australia	2,900	16.1
Gabon	1,800	10.0
Brazil	1,000	5.6
India	950	5.3
Malaya	400	2.2
Ukraine	390	2.2
Ghana	390	2.2
Kazakhstan	390	2.2
world	**18,000**	**100.0**

[e] – *preliminary values*

Land-based reserves of manganese in ore are estimated at about 620 million tonnes. South Africa accounts for around 75% of resources. The USA as well as Russia do not have any suitable manganese deposits and rely on imports. Manganese nodules on the sea floor represent practically limitless resources.

Prices of traded commodities

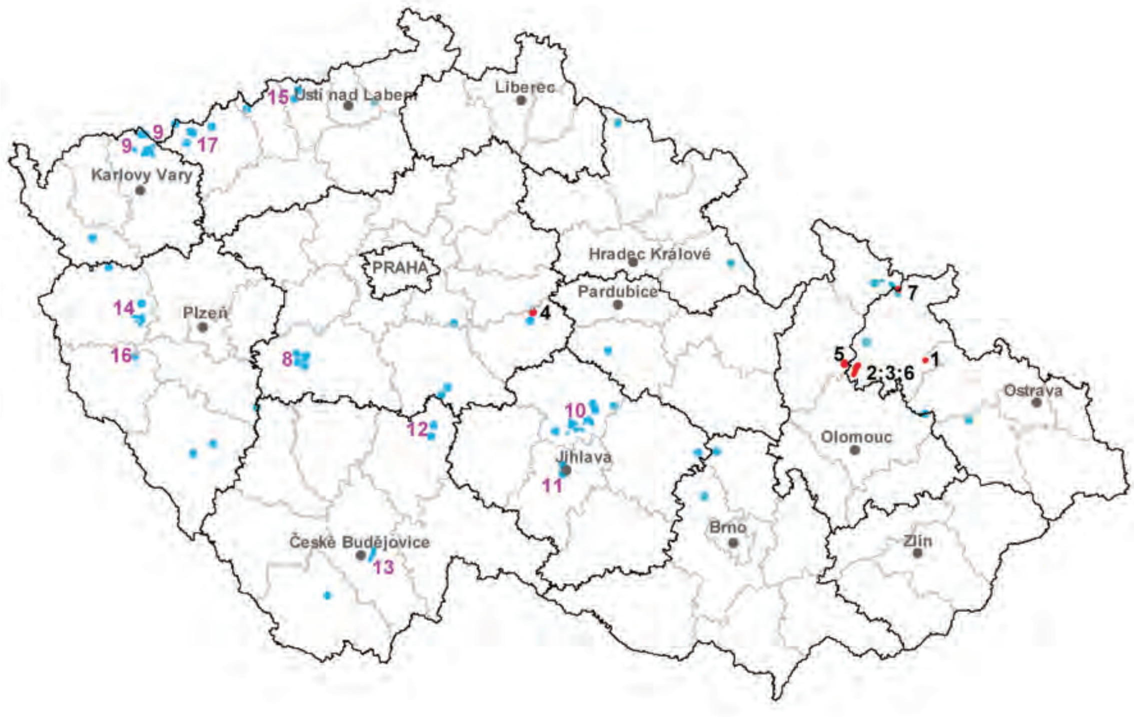
According to Deutschland-Rohstoffsituation 2011–2016 and DERA Preismonitor 2016 yearbooks, the average world prices of manganese commodities developed as follows in recent years:

Commodity/ Year		2011	2012	2013	2014	2015
Manganese, MB free market, in warehouse	USD/t	3,316.46	2,786.67	2,319.71	2,225.42	1,818.75
Ferro-Manganese , basis 78% Mn, standard 7.5% C, del. Consumers´ works	EUR/t	970.83	909.38	769.88	746.25	725.21

In early 2015, LME quotation price of manganese (flake) was USD 2090–2160/t, until the end of the year, prices fell to USD 1600–1650/t. The lowest price (USD 1450–1525/t) was recorded in November.

Silver

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits   exhausted deposits and other resources

Registered deposits and other resources are not mined

Reserved registered deposits:

1 Horní Benešov
2 Horní Město
3 Horní Město-Šibenice
4 Kutná Hora
5 Oskava
6 Ruda u Rýmařova-sever
7 Zlaté Hory-východ

Exhausted deposits and other resources:

8 Příbram surroundings
9 Jáchymov surroundings
10 Havlíčkův Brod surroundings
11 Jihlava surroundings
12 Ratibořské hory + Stará Vožice
13 Rudolfov
14 Stříbro
15 Hrob + Mikulov
16 Nalžovské hory
17 Vejprty + Hora sv. Kateřiny

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number [a)]	7	7	7	7	7
exploited	0	0	0	0	0
Total mineral *reserves, t Ag	532	532	532	532	532
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	532	532	532	532	532
Mine production, t Ag	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*
[a)] Deposits with registered Ag content

Approved prognostic resources P_1, P_2, P_3
Ag metal in ores

Year		2011	2012	2013	2014	2015
P_1,	t	33	33	33	33	33
P_2,	t	4	4	4	4	4
P_3,		–	–	–	–	–

3. Foreign trade

261610 – Silver ores and concentrates

		2011	2012	2013	2014	2015
Import	kg	0	2	0	0	2
Export	kg	3	2	0	3 644	2 660

261610 – Silver ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	–	4 500	–	–	16 000
Average export prices	CZK/kg	11 667	11 000	37 000	7 740	13 462

7106 – Silver, unwrought or in semi-manufactured or powder form

		2011	2012	2013	2014	2015
Import	kg	1 499 355	147 233	868 439	151 155	99 458
Export	kg	166 561	245 619	433 158	215 046	233 978

7106 – Silver, unwrought or in semi-manufactured or powder form

		2011	2012	2013	2014	2015
Average import prices	CZK/g	0.8	9.2	1.7	8.4	7.1
Average export prices	CZK/g	12.3	15.4	5.7	13.0	3.1

4. World production and world market prices

World mine production

According to statistics, world production of primary silver was as follows in recent years:

	2011	2012	2013	2014	2015
World mine production of silver (according to MCS), kt	23,300	25,500	26,000	26,800	27,300
World mine production of silver (according to WBD), kt	23,816.4	25,078.3	25,936.5	27,017.6	N

^{e} – *preliminary values*

Main producers according to MCS

country	2015^e	
	t	%
Mexico	5,400	19.8
China	4,100	15.0
Peru	3,800	13.9
Australia	1,700	6.2
Chile	1,600	5.9
Russia	1,500	5.5
Bolivia	1,300	4.8
Poland	1,300	4.8
USA	1,100	4.0
Canada	500	1.8
world	**27,300**	**100.0**

^{e} – *preliminary values*

According to WBD (2016), the 10th largest producer was Kazakhstan with 3.6%, while Canada (the 10th according to MCS) was 13th.

The USGS estimated world reserves at 570 kt of silver in ore. Polymetallic ores accounted for nearly two-thirds of that amount, and silver and gold-silver ores for the rest. It is believed that the proportion of silver in the Cu and Pb-Zn ores will remain dominant in the future.

Prices of traded commodities

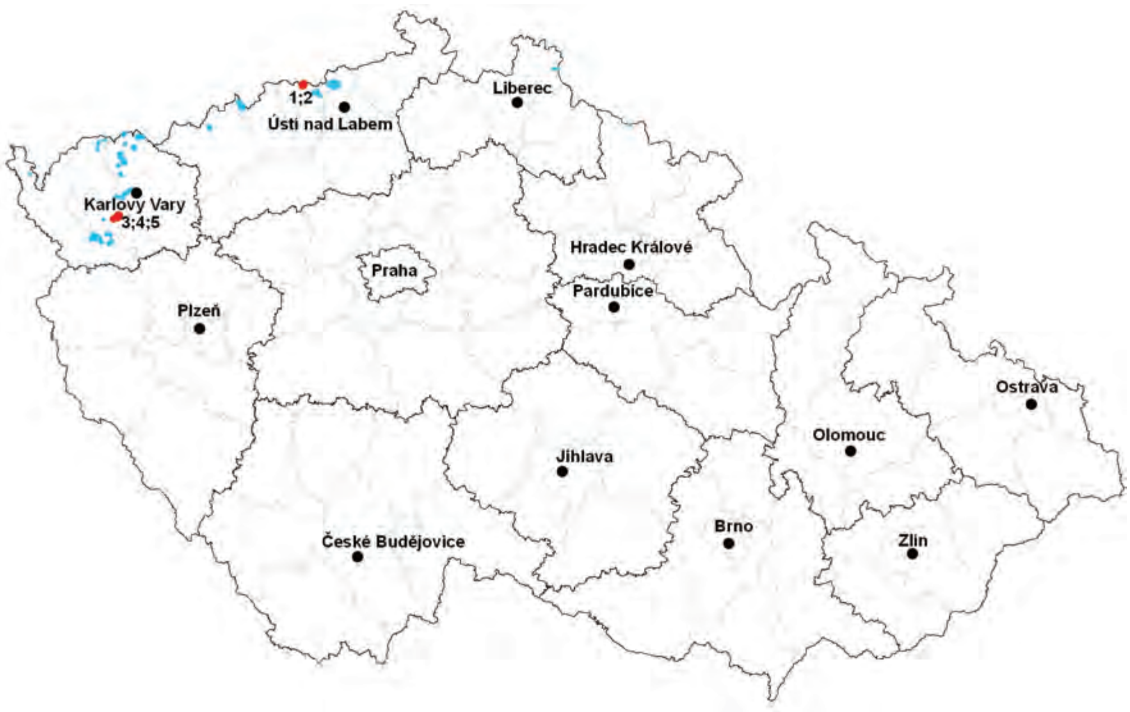
According to the German Deutschland-Rohstoffsituation yearbooks for 2011–2014 and DERA 2015 and the World Bank (WB), the world silver price in USD/ozt (1 ozt (troy ounce) = 31.1035 g) developed as follows in recent years:

Commodity/ Year	2011	2012	2013	2014	2015
Silver 99.5 %, LME, in warehouse, cash (according to D-R, DERA)	35.11	31.15	23.83	19.08	15.70
Refined. 99.9 %, Handy&Harman, New York (according to WB)	35.22	31.14	23.85	19.07	15.72

Since the beginning of 2015, silver prices quoted on the LME fell from USD 15.71/tr oz to USD 14.65/tr oz and by the end of the year they fell to just USD 13.82/tr oz.

Tin

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits   exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Cínovec-jih	3 Krásno	5 Krásno-Koník
2 Cínovec-východ	4 Krásno-Horní Slavkov	

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number [a)]	3	3	4	5	5
exploited	0	0	0	0	0
Total mineral *reserves, t Sn	163 809	163 809	164 299	187 224	187 224
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	6 887	6 887
potentially economic reserves	163 809	163 809	163 809	180 337	180 337
Mine production, t Sn	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] Sn-W ore deposits

Approved prognostic resources P_1, P_2, P_3
Sn – W ores

Year		2011	2012	2013	2014	2015
P_1,	kt	2 195	2 195	2 195	2 195	2 195
P_2,		–	–	–	–	–
P_3,		–	–	–	–	–

3. Foreign trade

2609 – Tin ores and concretates

		2011	2012	2013	2014	2015
Import	t	0	0.002	0	27	0.4
Export	t	< 0.001	0	0.002	0	0

2609 – Tin ores and concretates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	–	500 000	–	28 261	464 674
Average export prices	CZK/t	> 1 000	–	< 1 000	–	–

8001 – Unwrought tin

		2011	2012	2013	2014	2015
Import	t	643	631	1 402	1 041	959
Export	t	17	868	1 991	976	1 991

8001 – Unwrought tin

		2011	2012	2013	2014	2015
Average import prices	CZK/t	406 084	403 480	199 248	354 466	304 590
Average export prices	CZK/t	478 186	454 910	465 249	479 859	465 207

8002 – Tin waste and scrap

		2011	2012	2013	2014	2015
Import	t	5	0.4	1	0.1	92
Export	t	168	193	138	81	96

8002 – Tin waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/t	176 397	124 638	485 614	445 255	53 645
Average export prices	CZK/t	105 777	52 719	182 400	265 226	215 115

4. World production and world market prices

World mine production

World production of primary tin was as follows in recent years:

	2011	2012	2013	2014	2015[e]
World mine production of tin (according to MCS), kt	244	240	294	286	294
World mine production of tin (according to WBD), kt	327.3	311.8	333.8	48.1	N

[e] – *preliminary values*

According to MCS (2016), China was the largest producer and Indonesia the largest exporter in 2015. The top ten producers´ shares of production (not including the unpublished data for the USA) were as follows:

Main producers according to MCS

country	2015^{e}	
	kt	%
China	100,000	34.0
Indonesia	50,000	17.0
Myanmar	30,000	10.2
Peru	22,500	7.7
Bolivia	20,000	6.8
Brazil	17,000	5.8
Australia	6,400	2.2
Kongo (Kinshasa)	5,400	1.8
Vietnam	5,400	1.8
Malaya	3,800	1.3
world	**294,000**	**100.0**

^{e} – *preliminary values*

World reserves (not including the US and several other countries) are estimated at 4 800 kt. The US has quite large resources in Alaska.

Prices of traded commodities

According to Deutschland-Rohstoffsituation 2011–2014 and DERA 2015 (DERA) yearbooks and the World Bank (WB) and Metal Bulletin (MB), the world´s tin prices in USD/t developed as follows:

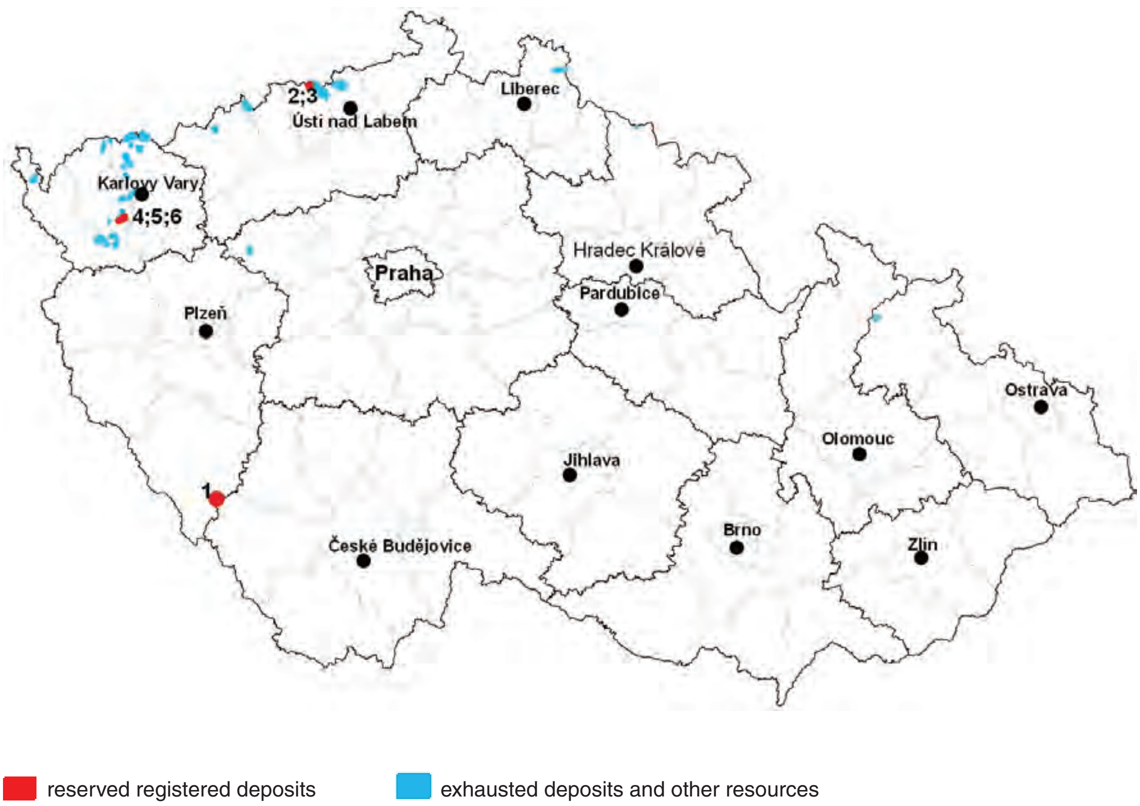
Commodity/ Year	2011	2012	2013	2014	2015
Tin, min. 99.85%, LME, in warehouse, cash (according to DERA)	25,687.41	21,104.01	22,308.91	21,908.47	16,066.52
High grade min.99,85%, LME contractual (WB)	N	N	22,228	21,899	16,057
LME cash (according to MB)	18,607.50–33,252.50	17,637.50–25,625.00	19,262.50–25,175.00	18,525.00–23,902.50	13,892.50–19,737.50
LME 3-month contract (according to MB)	18,700.00–33,210.00	17,675.00–25,700.00	19,300.00–25,750.00	18,487.50–23,765.00	13,837.50–13737.50

The price range according to MB includes the lowest and highest monthly price quotes for a given year.

According MB, the quotation price of LME tin was USD 19,750/t in early 2015. After a continuous downtrend, the end of the year saw the price of USD 14,600/t. Even in May the price held above USD 16,000/t, but starting in June it fell below USD 15,000/t.

Tungsten

1. Registered deposits and other resources of the Czech Republic



Registered deposits and other resources are not mined

1 Kašperské Hory
2 Cínovec-jih
3 Cínovec-východ
4 Krásno
5 Krásno-Horní Slavkov
6 Krásno-Koník

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number [a)]	4	4	4	4	4
exploited	0	0	0	0	0
Total mineral *reserves, t W	70 253	70 253	70 253	71 039	71 039
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	70 253	70 253	70 253	71 039	71 039
Mine production, t W	0	0	0	0	0

** See NOTE in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] Sn-W and W ore deposits

Approved prognostic resources P_1, P_2, P_3
W metal in ores

Year		2011	2012	2013	2014	2015
P_1,	t	3 252	3 252	3 252	3 252	3 252
P_2,	t	10 703	10 703	10 703	10 703	10 703
P_3,		–	–	–	–	–

3. Foreign trade

2611 – Tungsten ores and concentrates

		2011	2012	2013	2014	2015
Import	kg	292 634	799 902	100 090	6 045	55
Export	kg	0	0	20 000	45 372	1 230

2611 – Tungsten ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	13.8	11.8	12.3	188.6	1 091
Average export prices	CZK/t	–	–	244.5	41	198

8101 – Tungsten and its products, including waste and scrap

		2011	2012	2013	2014	2015
Import	kg	369 271	949 569	506 720	458 244	372 327
Export	kg	612 381	990 796	1 111 635	1 124 129	939 775

8101 – Tungsten and its products, including waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	977.1	713.6	803.6	934.2	999.1
Average export prices	CZK/kg	961.0	876.3	791.2	975.0	882.1

720280 – Ferro-tungsten and ferrosilicotungsten

		2011	2012	2013	2014	2015
Import	kg	84 496	35 867	14 701	66 760	77 536
Export	kg	22 201	5 214	6 592	60 199	35 008

720280 – Ferro-tungsten and ferrosilicotungsten

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	522.8	596.0	697.7	932.8	503.3
Average export prices	CZK/kg	516.9	836.4	796.9	966.7	593.9

810196 – Tungsten wires

		2011	2012	2013	2014	2015
Import	kg	101 938	67 557	70 056	114 112	99 842
Export	kg	32 881	7 203	10 080	12 751	29 804

810196 – Tungsten wires

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	1 766	3 133	2 431	1 878	2 280
Average export prices	CZK/kg	1 388	6 403	3 992	5 021	4 601

4. World production and world market prices

World mine production

World production of primary tungsten

	2011	2012	2013	2014	2015[e]
Mine production, kt (according to MCS)	73.1	75.7	81.4	86.8	87.0
Mine production, kt (according to WBD)	82.8	81.2	85.6	82.9	N

[e] – *preliminary values*

MCS data on world production of primary tungsten in 2016 does not include the USA. Production and exports were dominated by China. Due to anti-export measures implemented by the Chinese government, there is a long-term shortage of tungsten on the market, which leads to exploration and mining in other parts of the world, especially in the EU countries where tungsten is included among strategic raw materials. According to MCS (2016), the main producers of tungsten had the following shares in world production in 2015:

Hlavní producenti dle MCS

country	2015[e]	
	kt	%
China	71,000	81.6
Vietnam	5,000	5.7
Russia	2,500	2.9
Canada	1,700	2.0
Bolivia	1,200	1.4
Rwanda	1,000	1.1
Austria	870	1.0
Spain	730	0.8
Portugal	630	0.7
Great Britain	600	0.7
world	**87,000**	**100.0**

e – preliminary values

WBD (2016) lists Mongolia on the 8th place with a share of 0.9% in 2014. Spain was 11th with a share of 0.7%. A notable phenomenon is the growth of production in Vietnam during the last few years. Also the share of EU countries has been growing and reached 3.2% in 2015.

According to MCS, world tungsten reserves are estimated at 3,500 kt, of which 58% are in China, 9% in Canada, 8% in Russia, and 3% in the USA.

Prices of traded commodities

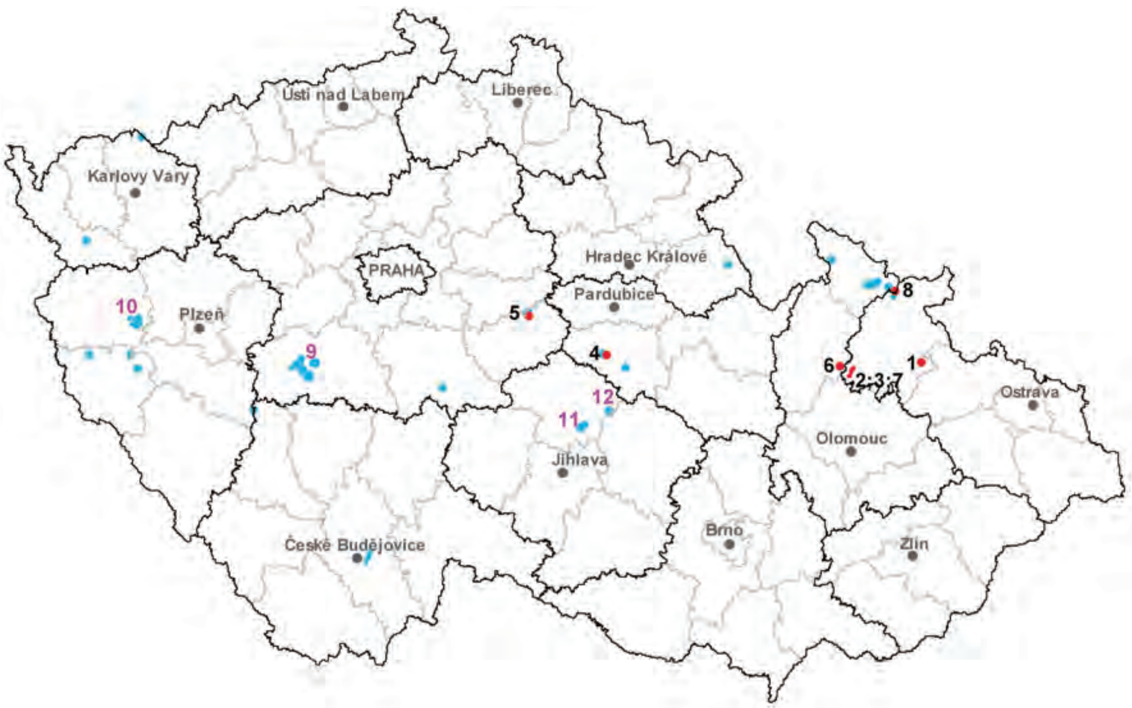
Commodity/Year		2011	2012	2013	2014	2015
Wolframite concentrate, min. 65% WO_3, CIF main European port	USD/mtu WO_3	150	315.21	319.94	N	N
Concentrate 65% WO_3, in warehouse China	CNY(RMB)/t	111.000–157.000	104.000–137.000	120.000–145.000	85.000–130.000	51.000–87.000
	USD/mtu WO_3*	274.55–388.33	253.57–334.02	300.19–362.73	212.29–324.68	124.94–213.13
Average exchange rate	CNY(RMB)/USD*	6.22	6.31	6.15	6.16	6.28
Ferro-Tungsten, basis min. 75% W, in warehouse Rotterdam	USD/kg W	48.69	48.67	45.37	34.83	28.58
APT, European free market	USD/mtu WO_3	430	381	372	380–283	169–314

Note:
mtu – metric ton unit; 1 mtu = 1% = 10 kg WO_3 in 1 t of concentrate
** Own calculation using © 2016 X-Rates data*
Yearly average prices or annual price ranges
RMB - Renminbi (= People's Currency) – officially CNY – Chinese yuan

Source: Deutschland-Rohstoffsituation 2010–2013, DERA Preismonitor 2014, Metal Bulletin

Zinc

1. Registered deposits and other resources of the Czech Republic



reserved registered deposits   exhausted deposits and other resources

Registered deposits and other resources are not mined

Reserved registered deposits:

1 Horní Benešov
2 Horní Město
3 Horní Město-Šibenice
4 Křižanovice
5 Kutná Hora
6 Oskava
7 Ruda u Rýmařova-sever
8 Zlaté Hory-východ

Exhausted deposits and other resources:

9 Březové Hory + Příbram + Bohutín
10 Stříbro
11 Havlíčkův Brod (Dlouhá Ves + Bartoušov + Stříbrné Hory)
12 Staré Ransko

2. Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number [a)]	9	8	8	8	8
exploited	0	0	0	0	0
Total mineral *reserves, kt Zn	477	472	472	472	472
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	477	472	472	472	472
Mine production, t Zn	0	0	0	0	0

** See **NOTE** in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic** of this yearbook*

[a)] Deposits with registered Zn content

3. Foreign trade

2608 – Zinc ores and concentrates

		2011	2012	2013	2014	2015
Import	t	37	1	4	8	8
Export	t	0.9	0.3	3	1.4	1

2608 – Zinc ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	39 835	414 201	148 826	114 274	135 250
Average export prices	CZK/t	52 980	79 245	53 387	50 534	88 000

7901 – Unwrought zinc

		2011	2012	2013	2014	2015
Import	t	27 916	28 685	32 843	83 035	75 150
Export	t	5 145	7 413	13 723	70 719	51 000

7901 – Unwrought zinc

		2011	2012	2013	2014	2015
Average import prices	CZK/t	41 586	42 239	42 815	50 384	56 607
Average export prices	CZK/t	30 973	36 502	41 311	51 524	58 563

7902 – Zinc waste and scrap

		2011	2012	2013	2014	2015
Import	t	909	643	187	161	280
Export	t	4 189	4 498	3 375	3 277	2 579

7902 – Zinc waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/t	30 651	26 745	21 422	25 504	11 221
Average export prices	CZK/t	25 683	26 445	25 233	32 969	35 662

4. World production and world market prices

World mine production

World production of primary zinc was as follows in recent years:

	2011	2012	2013	2014	2015^e
Mine production of zinc, kt (according to MCS)	12,800	13,500	13,400	13,300	13,400
Mine production of zinc, kt (according to WBD)	12,509.4	13,435.2	13,602.4	13,763.9	N

^{e} – *preliminary values*

Main producers according to MCS

country	2015[e]	
	kt	%
China	4,900	36.6
Australia	1,580	11.8
Peru	1,370	10.2
India	860	6.4
USA	850	6.3
Mexico	660	4.9
Bolivia	430	3.2
Kazakhstan	340	2.5
Canada	300	2.2
Ireland	230	1.7
world	**13,400**	**100.0**

[e] – *preliminary values*

MCS estimated world reserves at 200 mil. t, of which almost one third were located in Australia, around 19% in China, and about 12% in Peru. Identified resources are estimated at 1.9 bn t.

Prices of traded commodities

According to Deutschland-Rohstoffsituation yearbooks for 2011–2014 (D-R), DERA (2015), World Bank (WB), and Metal Bulletin (MB), world zinc prices in USD/t developed as follows:

Commodity/Year	2011	2012	2013	2014	2015
Special high grade, min. 99.995% cash, LME, in warehouse (according to D-R)	2,192.90	1,947.73	1,910.04	2,161.67	1,932.14
High quality min. 99.95 %, LME contractual price (according to WB)	2,193.90	1,950.41	1,910.26	2,160.97	1,931.58
Zinc, LME cash (according to MB)	1,749.00–2,545.25	1,759.25–2,178.25	1,783.75–2,187.25	1,941.75–2,419.75	1,461.25–2,402.50
Zinc, LME 3-month contract (according to MB)	1,770.00–2,574.00	1,756.50–2,065.55	1,820.50–2,214.00	1,947.75–2,409.50	1,482.75–2,376.50

The price range according to MB includes the lowest and highest monthly price quotes for a given year.

According to MB, LME spot prices of zinc decreased from USD 2,183.50/t to USD 1,600/t during 2015. The highest price was quoted in late April – USD 2,355.50/t. Until July, prices even oscillated around USD 2,000/t.

MINERALS MINED IN THE PAST WITHOUT RESOURCES AND RESERVES

Antimony

Foreign trade

261710 – Antimony ores and concentrates

		2011	2012	2013	2014	2015
Import	kg	69 061	92 009	48 174	25 030	18 303
Export	kg	1	0	0	0	0

261710 – Antimony ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	192	190	119	109	158
Average export prices	CZK/kg	6 000	–	–	–	–

8110 – Antimony and articles thereof, including waste and scrap

		2011	2012	2013	2014	2015
Import	t	64	31	42	103	21
Export	t	0.02	0.5	0	2	47

8110 – Antimony and articles thereof, including waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/t	263 697	283 040	216 831	207 080	192 290
Average export prices	CZK/t	238 095	339 623	–	274 331	62 422

World production and world market prices

World mine production

Trend in the world´s primary antimony production in 2011–2015

	2011	2012	2013	2014	2015^{e}
Mine production of antimony, kt (according to MCS)	178	174	163	158	150
Mine production of antimony, kt (according to WBD)	157.5	174.8	163.2	162.3	N

^{e} *– preliminary values*

Main producers according to MCS

country	2015^{e}	
	kt	%
China	115,000	76.7
Russia	9,000	6.0
Australia	5,500	3.7
Bolivia	5,000	3.3
Tajikistan	4,700	3.1
world	**150,000**	**100.0**

^{e} *– preliminary values*

MCS does not provide any data on the US production of antimony ore.

According to WBD (2016), the top ten of producers also included Myanmar (2%), Kyrgyzstan (1.5%), Morocco (0.9%), and Vietnam (0.7%) in 2014.

According to MCS, world reserves are estimated at 1,800 kt, of which nearly 48% are in China, around 17.5% in Russia, and 7% in Bolivia. MCS does not provide any data on the US reserves of antimony ore.

Prices of traded commodities (USD/t) according to IM

Commodity/ Year	2011	2012	2013	2014	2015
Antimony trioxide, typically 99.5%, 5 tonne lots, CIF Antwerp/ Rotterdam	12,000–14,600	8,750–12,850	9,000–1,000	7,900–9,200	4,800 – 7800
Antimony trioxide, typically 99.5%, 20 tonne lots, FOB China	12,000–14,500	9,500–12,800	9,000–10,100	7,700–9,200–	4,700–7850
Antimony trioxide, min. 99.65%, ingot, CIF Rotterdam	N	10,000–13,700	9,950–12,500	9,100–9,500	4,800–9000
Antimony trioxide, min. 99.65%, ingot, FOB China	N	11,200–17,000	9,550–10,800	9,100–9,500	4,750–9100

The price range includes the lowest and highest monthly price quotes for a given year.

According to D-R Yearbook 2014, Regulus Sb cost min. 99,65 %, max. 50 ppm, 100 ppm Bi USD 9,441.07/t on the open market in 2014, in 2015 it was USD 7,286.72/t (DERA 2015). According to MB, Regulus price declined from USD 8,500–8,800/t to USD 5,050–5,350/t during 2015. In early December, the price dropped to its current low in the range of USD 4,900–5,200/t. The highest prices of carbon Sb were recorded in June, yet the peak was followed by a fall to the minimum values above.

Arsenic

Foreign trade

280480 – Arsenic

		2011	2012	2013	2014	2015
Import	kg	19	27	6 032	8 636	13 560
Export	kg	0	0	0	0	0

280480 – Arsenic

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	9 000	9 148	102	90	129
Average export prices	CZK/kg	–	–	–	–	–

World production and world market prices

World mine production

World production of primary arsenic was as follows in recent years:

	2011	2012	2013	2014	2015[e]
World production of arsenic, kt (according to MCS)	45.8	46.7	45.0	36.4	36.0
World production of arsenic, kt (according to WBD)	49.0	52.0	50.7	48.6	N

[e] – *preliminary values*

Main producers according to MCS

country	2015[e]	
	kt	%
China	25,000	69.4
Morocco	8,500	23.6
Russia	1,500	4.2
Belgium	1,000	2.8
Bolivia	50	0.1
Japan	45	0.1
world	**36,000**	**100.0**

[e] – *preliminary values*

According to WBD (2016), the following countries accounted for the world´s primary production of arsenic in 2014:

China	51.5 %	Belgium	2.1 %
Chile	20.6 %	Iran	0.2 %
Morocco	14.1 %	Bolivia	0.1 %
Namibia	8.2 %	Japan	0.1 %
Russia	3.1%		

Shares of Belgium and Japan are probably given by metallurgical processing of imported ores.

MCS estimated global resources of arsenic contained in copper and lead ores at 11 mil. t. Reserves can reportedly cover at least twenty times the current production.

Prices of traded commodities

Metal Bulletin quoted the following prices:

Commodity/ Year	2011	2012	2013	2014	2015
Arsenic, USD/lb	0.60–0.80	0.70–0.80	0.70–0.80	0.70–0.80	0.70–1.00

Note: lb – pound; 1 lb = 0,4536 kg

Cobalt

Foreign trade

2605 – Cobalt ores and concentrates

		2011	2012	2013	2014	2015
Import	kg	577	275	410	350	700
Export	kg	0	0	0	0	0

2605 – Cobalt ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	1 596	1 596	1 515	1 726	1 479
Average export prices	CZK/kg	–	–	–	–	–

8105 – Cobalt mattes and other intermediate products of cobalt metallurgy; cobalt and articles thereof, including waste and scrap

		2011	2012	2013	2014	2015
Import	t	61	67	73	81	77
Export	t	17	14	24	30	26

8105 – Cobalt mattes and other intermediate products of cobalt metallurgy; cobalt and articles thereof, including waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/t	1 048 529	999 417	838 136	1 086 607	1 707 716
Average export prices	CZK/t	567 322	478 810	648 369	494 400	638 764

World production and world market prices

World mine production

Statistical data on world cobalt production:

	2011	2012	2013	2014	2015[e]
Mine production of cobalt (according to MCS), t	109,000	103,000	110,000	123,000	124,000
Mine production of cobalt (according to WBD), t	145,883	135 ,235	132,520	130,222	N

[e] – *preliminary values*

Main producers according to MCS

country	2015[e]	
	t	%
Kongo (Kinshasa)	63,000	50.8
China	7,200	5.8
Canada	6,300	5.1
Russia	6,300	5.1
Australia	6,000	4.8
Zambia	5,500	4.4
Philippines	4,600	3.7
Cuba	4,200	3.4
Madagascar	3,600	2.9
New Caledonia	3,300	2.7
world	**124,000**	**100.0**

[e] – *preliminary values*

According to MCS, world reserves of primary cobalt amount to 7,200 kt, of which more than 50% are in the DR Congo. Identified world terrestrial cobalt resources are estimated at 25 mil. t. It is estimated that in manganese nodules and crusts at the bottom of the world‘s oceans there are more than 120 mil. t. of identified cobalt sources.

Prices of traded commodities

Annual prices according to Deutschland-Rohstoffsituation yearbooks, DERA and MB

Commodity/ Year	2011	2012	2013	2014	2015
99.8% Co free market, in warehouse, Rotterdam (USD/kg)(D-R, DERA)	38.60	30.75	29.01	31.81	29.11
96.3% Co, LME, in warehouse, cash (USD/kg)(D-R, DERA)	N	N	27,021.91	30,704.30	28,441.68

According to MB, price of cobalt decreased from USD 14.0–14.85/lb to USD 9.20–11.40/lb during 2015. According to E&M Journal, price of cobalt dropped from USD 31,680/t at the beginning of the year to UD 24,900/t at the end of the year. MB published cash price of cobalt on the LME in 2015 as a price range of monthly averages. The values were from USD 22,750–33,425/t. Cobalt sold on the LME in the form of 3-month contracts ranged between USD 22,750 and 32,500/t.

Iron

Foreign trade

2601 – Iron ores and concentrates

		2011	2012	2013	2014	2015
Import	t	7 365 406	5 866 844	6 268 059	6 303 298	7 365 406
Export	t	984	1 098	1 797	12 210	25 387

2601 – Iron ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 657	2 686	2 567	2 490	2 657
Average export prices	CZK/t	16 266	17 640	18 232	5 024	2 992

7201 – Crude iron

		2011	2012	2013	2014	2015
Import	t	76 817	68 380	65 307	71 395	63 499
Export	t	45 652	82 770	82 515	43 398	17 435

7201 – Crude iron

		2011	2012	2013	2014	2015
Average import prices	CZK/t	10 222	9 551	9 462	9 816	9 363
Average export prices	CZK/t	10 285	8 585	8 190	8 663	8 181

7204 – Ferrous waste and scrap, remelted scrap ingots or iron or steel

		2011	2012	2013	2014	2015
Import	t	474 843	477 439	554 034	571 427	497 268
Export	t	2 056 045	2 052 360	1 911 717	2 064 792	1 764 945

7204 – Ferrous waste and scrap, remelted scrap ingots or iron or steel

		2011	2012	2013	2014	2015
Average import prices	CZK/t	7 483	7 845	7 193	6 956	6 618
Average export prices	CZK/t	7 840	7 472	6 807	7 188	6 075

World production and world market prices

World mine production

World production of iron ore in recent years according to published statistics:

	2011	2012	2013	2014	2015^e
World mine production of iron ore (according to MCS), mill t	2,940	2,930	3,110	3,420	3,320
World mine production of iron ore (according to WBD), mill t	1,361.3	1,393.1	1,526.5	1,554.5	N

^{e} *– preliminary values*

Hlavní producenti dle MCS

country	2015^e	
	millions of tonnes	%
China	1,380	41.6
Australia	824	24.8
Brazil	428	12.9
India	129	3.9
Russia	112	3.4
RSA	80	2.4
Ukraine	68	2.0
USA	43	1.3
Canada	39	1.2
Sweden	37	1.1
world	**3,320**	**100.0**

^{e} *– preliminary values*

MCS point out that the data for China are based on the production of crude ore, rather than usable ore, as reported for other countries. There is a considerable discrepancy between the numbers of both statistics due to different methods of calculating the iron content of mined ores. This is confirmed by the fact that there is a correspondence in the discrepancy, which in terms of global production in 2014 amounts to 120 % and is nearly identical with the difference of 124 % in terms of the total production for the top ten countries. A corresponding difference amounting to 123.5 % also exists in the case of reserves, which the MCS list under separate columns for crude ore and iron content, amounting to 190 000 mil. t of crude ore with a total iron content of 81 000 mil t, i.e. approx. 45% Fe. According to MCS, world resources are estimated at more than 230 billion tonnes of iron contained in more than 800 billion tonnes of crude ore, which therefore represents an iron content of only 29%.

Different figures for the years 2010–2014 published Eng.Min.J. (Nov. 2015, p. 34-39) in the Overview of iron ore market in 2015, where the Chinese production is converted to ore with 62% content of Fe. The values of world production listed here lie between MCS and WBD numbers:

Year	2011	2012	2013	2014	2015
1. Australia	432.78	477.33	520.03	608.90	723.70
2. Brazil	372.00	397.00	380.09	391.10	399.40
3. China *)	358.50	345.07	336.07	266.09	193.21
4. India	209.00	191.80	152.60	136.10	129.80
5. Russia	102.90	103.40	107.00	106.00	113.20
6. Ukraine	79.85	83.40	82.14	87.86	85.71
7. South Africa	55.00	52.90	59.00	60.60	66.92
8. USA	49.90	54.70	54.00	52.00	54.30
9. Iran	33.00	35.50	38.59	48.18	48.45
10. Canada **)	37.50	37.10	39.40	41.84	44.20
11. Sweden	25.29	26.11	26.54	27.29	28.14
12. Sierra Leone	-	1.30	6.73	16.49	21.42
13. Kazakhstan	21.67	21.74	20.90	21.41	21.30
14. Mexico	14.00	12.81	14.92	18.84	17.25
15. Chile	10.50	12.00	12.06	11.75	13.03
All others	80.04	103.19	102.46	116.02	89.69
World production in total	**1,881.92**	**1,955.35**	**1,952.52**	**2,010.45**	**2,049.73**
Top 3 (%)	62	62	63	63	64
Top 5 (%)	78	77	77	75	76

**) recalculated to 62% Fe*
***) loading on ships*

The authors expect that world production of iron ore will rise above the levels from 2014 to 2,067 mis. t in 2015 and 2,087 mil. t in 2016.

Prices of traded commodities

Average annual prices of iron ore according to Deutschland-Rohstoffsituation yearbooks

Commodity/Year		2011	2012	2013	2014	2015
MB iron ore index (62%), CFR China main port	USD/t	167.75	128.50	135.58	97.10	55.72
Iron ore, any origin, spot price, MBA (according to the World Bank) *)	USD/ dmt	135.55–187.18	99.47–147.64	114.82–154.64	96.94**)	40.50–60.50

Note:
**) The price range includes the lowest and the highest monthly price quotes for the given year.*
***) average annual price*
dmt – dry metric ton = one tonne of dry ore

World market for iron ore is significantly affected by three main producers (who account for about 38%): Vale from Brazil and Rio Tinto and BHP Billiton from Australia. These three companies increased their productions of iron ore by a total of 115 mil. t during 2014. The resulting excess supply was one of the causes of the price decline. Another cause was closing of iron ore mines in China. It is estimated that since the beginning of 2014, production capacity in Chinese iron ore deposits decreased by 100 thous. t and by a total of 200 thous. t during the first months of 2012.

Prices peaked in 2012 and since then they have a downward trend which has accelerated since the autumn of 2014. The price has more or less stabilised in the middle of 2015 – at the level of USD 50–60 per tonne of standard milled 62% ore shipped to China. In December 2015, one tonne of dry ore CFR China cost USD 40.70.

According to DERA, pellets containing 65% of Fe CFR Qingdao cost USD 104.64/t in 2014 and USD 79.33/t in 2015.

According to MCS, the average monthly price of 62% Fe ore CFR Tianjin port decreased to USD 56.43/t in September 2015. E&M Journal documents price developments of dry iron ore CFR China in 2015. The price moved from USD 71.75 at the beginning of the year through USD 53.00 (March 27) and 69.50 (June 26) to USD 40.60 at the end of the year (December 28)

In view of the fact that the leading importers of iron ore are China, Japan and South Korea and the main suppliers Australia (the companies BHP Billiton, RTZ, FMG) and Brazil (Vale DR), vast amounts of iron ore, pellets and concentrates are transported by sea. In 2010, sea transportation of iron ore exceeded 1bn t for the first time. In 2014 it surpassed the amount of 1.1bn t.

Mercury

Foreign trade

280540 – Mercury

		2011	2012	2013	2014	2015
Import	kg	4 385	2 513	3 259	19 601	6 418
Export	kg	1 946	141	128	128	116

280540 – Mercury

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	356	227	581	91	700
Average export prices	CZK/kg	770	830	1 102	1 031	1 440

World production and world market prices

World mine production

World mine production of mercury (t)

	2011	2012	2013	2014	2015^e
World mine production of mercury (according to MCS)	2,010	1,810	1,880	2,350	2,340
World mine production of mercury (according to WBD)	2,035	1,886	2,184	2,833	N

^{e} – *preliminary values*

Main producers according to MCS

country	2015^e	
	kt	%
China	1,600	68.4
Mexico	500	21.4
Kyrgyzstan	70	3.0
Russia	50	2.1
Peru	40	1.7
world	**2,340**	**100.0**

^{e} – *preliminary values*

World resources of primary mercury were estimated at 600 kt. Majority of the world‘s known reserves lies in a unique Spanish deposit named Almaden which is, however, out of operation.

Prices of traded commodities

Annual prices according to Deutschland-Rohstoffsituation yearbooks (2011–2014) and DERA (2015)

Commodity/ Year		2011	2012	2013	2014	2015
Mercury, min. 99.99%, MB free market, in warehouse	USD/ flask	1,656.71	2,701.27	3,438.89	2,719.85	2,383.85

A flask of mercury is the equivalent of 34 kg.

According to MB, there was a substantial decline in the price of mercury from USD 2,250–2,850/flask at the beginning of the year to just USD 1,250–1,650/flask.

Sulphur

Foreign trade

2503 – Sulphur of all kinds, other than sublimed, precipitated and colloidal

		2011	2012	2013	2014	2015
Import	t	14 947	70 157	54 002	63 382	17 860
Export	t	979	1 852	9 195	7 083	8 066

2503 – Sulphur of all kinds, other than sublimed, precipitated and colloidal

		2011	2012	2013	2014	2015
Average import prices	CZK/t	11 068	5 259	5 020	4 061	7 316
Average export prices	CZK/t	4 886	4 078	1 494	2 710	2 335

2802 – Sulphur, sublimed or precipitated; colloidal sulphur

		2011	2012	2013	2014	2015
Import	t	93 461	39 459	27 870	28 056	45 377
Export	t	316	253	142	172	169

2802 – Sulphur, sublimed or precipitated; colloidal sulphur

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 684	3 384	2 845	2 848	2 472
Average export prices	CZK/t	19 335	35 541	64 607	53 094	45 570

2807 – Sulphuric acid

		2011	2012	2013	2014	2015
Import	t	32 532	25 484	70 270	58 764	171 698
Export	t	46 378	45 131	29 465	55 006	51 326

2807 – Sulphuric acid

		2011	2012	2013	2014	2015
Average import prices	CZK/t	1 424	2 139	1 844	1 895	2 529
Average export prices	CZK/t	1 901	1 713	1 756	1 494	1 952

World production and world market prices

World mine production

World production of sulphur, primarily from the processing of liquid and gaseous hydrocarbons, has over the years had an upward trend. The trend was as follows in recent years:

	2011	2012	2013	2014	2015^e
World sulphur production (according to MCS), kt	70,500	68,100	70,400	70,000	70,100
World sulphur production (according to WBD), kt	64,375.7	65,359.6	67,652.1	70,773.0	N

^{e} *– preliminary values*

Main producers according to MCS

country	2015^e	
	kt	%
China	11,000	15.7
USA	9,300	13.3
Russia	7,300	10.4
Canada	6,000	8.6
Germany	3,800	5.4
Japan	3,300	4.7
Saudi Arabia	3,300	4.7
India	2,800	4.0
Kazakhstan	2,700	3.9
Iran	2,100	3.0
world	**70,100**	**100.0**

^{e} *– preliminary values*

Reserves of sulphur in crude oil, natural gas and sulphide ores are huge. Thanks to processing of crude oil and sulphides in industrial countries with limited mineral resources, production of sulphur is not much dependent on sulphur reserves (e.g. Germany). According to MCS, resources of elemental sulphur in evaporite and volcanic deposits and sulphur in the deposits of natural gas, crude oil, tar sands and sulphides amount to around 5 billion tonnes. The sulphur in gypsum and anhydrite is practically limitless. The MCS estimated that about 600 billion tonnes of sulphur is contained in coal and oil shale.

Prices of US sulphur USD/lt according to INTER-CHEM

Commodity/ Year	2009	2010	2011	2012
Alberta M. T. FOB	10–20	N	45	60–70
US West coast FOB	3–15	30–85	180–192	162.50–185
Houston del	5–15	75–145	170–205	145–157
Nola FOB	1–19	79–134	174–209	145–169
Florida, contract del	5–30	90–160	185–220	160–180
Tampa, spot FOB	20–80	N	230	165

Note: 1 lt (long ton) = 1.016 t

Prices of sulphur according to Industrial Minerals (IM) and MCS 2016 in USD/t

		2011	2012	2013	2014	2015
Canadian, solid, current price, FOB Vancouver	IM	N	N	N	170–200	140–155
Middle East, FOB	IM	N	N	N	160–195	119–195
USA, FOB mine or factory	MCS	159.88	123.54	68.71	80.07	100.00

*Note: * June to December*
IM prices represent the lowest and the highest monthly average of the respective year.
MCS prices are average prices

MINERALS UNMINED IN THE PAST WITH RESOURCES AND RESERVES

Lithium, rubidium and cesium

Registered deposits and other resources of the Czech Republic

The registered deposit are not exploited

1 Cínovec-jih*	3 Cínovec-východ	5 Krásno-Koník
2 Cínovec odkaliště	4 Horní Slavkov-odkaliště	

Note:
** Deposit of also potentially economic reserves of Sn-W ores and contents of Ta and Nb in experimental concentrates*

Basic statistical data of the Czech Republic as of December 31

Number of deposits; reserves; mine production

Year	2011	2012	2013	2014	2015
Deposits – total number	1	1	1	5	5
Exploited	0	0	0	0	0
Total *reserves, t Li	112 775	112 775	112 775	159 993	159 993
economic explored reserves	0	0	0	2 331	2 331
economic prospected reserves	0	0	0	15 685	15 685
potentially economic reserves	112 775	112 775	112 775	141 977	141 977
Mine production, t Li	0	0	0	0	0

** See __NOTE__ in the chapter **Introduction** above on a terminological difference between Czech official application of the term reserves and standard international application of the term. The relationship of domestic and foreign classifications of mineral reserves and resources is described in the separate chapter **Mineral reserve and resource classification in the Czech Republic and its evolutional comparison with international classifications** of this yearbook*

In the Czech Republic, it is possible to consider the entire Krušné hory Mts. as a lithium province. Around 300 million tonnes of ore with elevated lithium contents were identified in Cínovec and its surroundings alone. As for the potentially economic deposit of tin-tungsten ores of Cínovec-jih, 159,993 tonnes of lithium in 53.4 million tonnes of ore with an average lithium content of 0.117% are recorded in the *Balance of Reserves of Reserved Mineral Deposits of the Czech Republic*. In addition, byproduct amounts of 56 kt of rubidium and 1.8 kt of cesium were also evaluated in this deposit. Beside the *Balance of Reserves of Reserved Mineral Deposits of the Czech Republic* Li reserves are estimated also at former deposits Cínovec-sever-lomová těžba (79 kt), Cínovec-starý závod (3.8 kt), Vernéřov u Aše (15.2 kt) and Krásno-Koník (2 kt).

Brine reserves with anomalous bromine and lithium contents were calculated at 453.6 million m^3 in the mining lease of the Slaný deposit of bituminous coal. These groundwater reserves contain 123 kt of bromine, 15 kt of lithium and more than 18 million tonnes of NaCl.

Foreign trade

280519 – Lithium, potassium, rubidium, cesium

		2011	2012	2013	2014	2015
Import	kg	179 756	247 115	65 388	18 041	23 014
Export	kg	119	1 098	1	3	<1

280519 – Lithium, potassium, rubidium, cesium

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	113	58	168	903	626
Average export prices	CZK/kg	311	47	2000	42 000	> 30 000

28369100 – Lithium carbonates

		2011	2012	2013	2014	2015
Import	kg	71 775	88 801	75 096	87 693	88 728
Export	kg	1 738	2 284	2 095	502	0

28369100 – Lithium carbonates

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	112	132	129	124	139
Average export prices	CZK/kg	455	427	621	717	–

World production and world market prices

World production

World lithium production had an upward trend in recent years:

	2011	2012	2013	2014	2015[e]
World mine production of lithium (according to MCS), t	34,100	35,000	34,000	31,700	32,500
World mine production of Li_2O (according to WBD), t	64,363	73,446	64,763	68,768	N

[e] – *preliminary value*

Main producers according to MCS

country	2015[e]	
	t	%
Australia	13,400	41.2
Chile	11,700	36.0
Argentina	3,800	11.7
China	2,200	6.8
Zimbabwe	900	2.8
Portugal	300	0.9
Brazil	160	0.5
world	**32,500**	**100.0**

[e] – *preliminary values*

According to WBD (2016), the USA ranked fifth in 2014 with a 4.6% share of production. Data on world production of rubidium and cesium were not found.

According to MCS, Chile has 53.6% and China almost 23% of world lithium reserves, which totalled 14 mil t. Argentina (14.3%) is next, followed by Australia (10.7%). According to MCS, identified world resources of Li amount to 40 mil. t, of which 9 mil. t are in Bolivia, 7.5 mil. t in Chile, 6.7 mil. t in the USA, and 6.5 mil. t in Argentina. China's resources reportedly amount to 5.1 mil. t and Australia's 1.7 mil. t. Canada, DR Congo, Russia, and Serbia reportedly have 1 million tonnes of resources each.

The most important world source of Cs are lithium pegmatites with lepidolite and pollucite located in the Bernic Lake deposit in Canada. It is estimated that there are 120 kt of Cs oxide containing 23.3% Cs_2O. The underground mining is difficult and in 2010, for example, the mining had to be interrupted. According to MCS, Zimbabwe and Namibia produce minor quantities of cesium as a by-product of lithium ore processing.

According to MCS, world reserves and resources of rubidium are unknown. World reserves of cesium oxide are estimated at 210 kt, of which more than 57% are in Canada, almost 29% in Zimbabwe, and more than 14% in Namibia.

Prices of traded commodities containing lithium according to IM

Commodity/Year		2011	2012	2013	2014	2015
Petalite, 4.2% Li_2O, FOB Durban	USD/t	165–260	165–220	165–260	165–265	170–265
Spodumene concentrate, > 7.25 Li_2O, FOB West Virginia	USD/st	400–770	720–770	N	680–775	700–775
Spodumene, glass trade, 5% Li_2O, FBO West Virginia FOB West Virginia	USD/st	460–530	460–510	460–510	400–510	400–450
Spodumene concentrate.7.5% Li_2O, CIF Europe	USD/t	N	750–800	750–800	740–800	740–790
Spodumene conc. > 7.5% Li_2O, bulk, CIF Asia	USD/t	N	720–770	720–770*	720–775*	725–775
Spodumene conc. > 5% Li_2O, bulk, CIF Asia	USD/t	N	300–400	460–510*	300–400	310–410
Lithium carbonate, del. continental, USA large contracts	USD/lb	2.3–2.4	2.5–3	3–3.5	2.7–3.5	2.7–3.2
Lithium hydroxide, 56.5–57.5% LiOH, large contracts, packed in drums or bags, CIF Europe or USA	USD/kg	N	6.5–7.5	5.5–7	5.5–8.5	7.5–9.0
Lithium hydroxide, Chinese (56.5–57.5% LiOH), packed in drums or bags, large contracts, CIF Europe	USD/kg	N	6–6.6	7–8	7–8	7.2–9.0

*Notices: *CIF USA in USD/st*
st – short ton; 1 st = 0.9072 t
The price range includes the lowest and the highest monthly price quotes for the given year

According to German DERA Preismonitor (Dez. 2015), the average price of lithium carbonate was USD 6,375.03/t and petalite concentrate 4.2% Li_2O, FOB Durban cost on average USD 217.50/t in 2015.

Molybdenum

Registered deposits and other resources in the Czech Republic; basic statistical data of the Czech Republic as of December 31

In the Czech Republic, 80 million tonnes of prognostic resources (unapproved) of molybdenum ores with an average molybdenum content of 0.176 %, i.e. 14 037 tonnes of molybdenum, were estimated in the Hůrky locality in the Čistá-Jeseník Massif (L. Kopecký 1983).

Foreign trade

81029400 – Unwrought molybdenum, including bars, rods obtained by simple sintering

		2011	2012	2013	2014	2015
Import	kg	18 393	4 649	3 359	20	1 462
Export	kg	14 409	213	936	232	5 792

81029400 – Unwrought molybdenum, including bars, rods obtained by simple sintering

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	677	626	334	1 100	630
Average export prices	CZK/kg	695	643	602	707	599

World production and world market prices

World mine production

According to statistics, world production of primary molybdenum developed as follows during 2011–2015:

	2011	2012	2013	2014	2015[e]
World mine production of molybdenum (according to MCS), kt	264	259	258	281	267
World mine production of molybdenum (according to WBD), kt	264.6	272.7	279.5	298.5	N

[e] – *preliminary value*

Hlavní producenti dle MCS

country	2015^e	
	kt	%
China	101,000	37.8
USA	56,300	21.1
Chile	49,000	18.4
Peru	18,100	6.8
Mexico	13,000	4.9
Canada	9,300	3.5
Armenia	7,300	2.7
Iran	4,000	1.5
Mongolia	2,000	0.7
Turkey	1,400	0.5
world	**267,000**	**100.0**

^{e} – *preliminary values*

WMD‘s statistics for 2014 lists Russia as the eighth largest producer with a share of 1.5%. The list of the top 15 miners does not contain Turkey.

According to MCS, the top three producers accounted for more than 77% of the world´s molybdenum production. These three countries also have around 80% of estimated world reserves, which the MCS quantified to 11 mil. t. Identified resources reportedly amount to 20 mil. t, of which more than one-fourth is in the USA.

Prices of traded commodities

According to Deutschland-Rohstoffsituation yearbooks (2011–2014), DERA (2015), and Metal Bulletin (MB), world prices of molybdenum commodities (USD/kg Mo) developed as follows in recent years:

Commodity/Year	2011	2012	2013	2014	2015
Ferromolybdenum, 65-70% Mo base, free European market (USD/kg) (according to D-R, DERA)	38.32	31.41	25.87	23.14	17.09
Molybdic oxide, drummed, Europe, free market, in warehouse (USD/kg)	34.32	28.16	22.80	19.81	14.65
Molybdenum, LME cash (according to MB), (USD/t)	N	N	19,500–26,000	19,600–32,500	9,000–21,000

The price range according to MB includes the lowest and highest monthly price quotes for a given year.

According to Metal Bulletin, the LME cash price of Mo ranged between 19,500 and 26,000 USD/t in 2013 and between 19,600 to 32,500 USD/t in 2014. According to DERA, The average price of concentrate (57–63% Mo) with delivery to consumer was USD 14,636.50/t in 2015. E&N Journal reported that the price was USD 21,000/t at the beginning of 2015 and it fell to USD 12,000/t by the end of the year.

Rare earths

Registered deposits and other resources in the Czech Republic; basic statistical data of the Czech Republic as of December 31

In the Czech Republic, there are descriptions of estimated resources (unapproved) of rare earth oxides from various mineralisations and geological formations. For example, the cerium content in uranium ores of uranium-bearing sandstone of the Stráž block in the Bohemian Cretaceous Basin was evaluated at 4,750 tonnes of cerium. Anomalous rare earth oxide contents are also assumed to occur in the Hůrky locality in the Čistá-Jeseník Massif (along with resources of Mo, Ta, Nb, Zr, and Hf), in alkaline volcanic rocks in the České Středohoří, in volcanic rocks of the Šternberk-Horní Benešov belt in the Nízký Jeseník Mts., in graphitic phyllites of the Železné Hory Mts. Proterozoic, in argillitised tuffs of the Upper Silesian Basin etc.

Foreign trade

28461000 – Cerium compounds

		2011	2012	2013	2014	2015
Import	kg	90 300	285 361	84 091	70 275	67 866
Export	kg	2 818	2 993	2 517	3 696	3 205

28461000 – Cerium compounds

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	1 073	410	915	698	663
Average export prices	CZK/kg	1 364	1 260	1 249	1 059	579

28053010 – Rare earth metals, scandium and yttrium, intermixed or interalloyed

		2011	2012	2013	2014	2015
Import	kg	4 270	2 037	150	60	975
Export	kg	1 720	1 890	20	2 471	1 720

28053010 – Rare earth metals, scandium and yttrium, intermixed or interalloyed

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	1 962	1 365	1 427	333	305
Average export prices	CZK/kg	1 982	1 484	2 050	106	1 982

28053090 – Rare earth metals, scandium and yttrium, not intermixed or interalloyed

		2011	2012	2013	2014	2015
Import	kg	30 429	139	375	714	40
Export	kg	3	3	2	0	0

28053090 – Rare earth metals, scandium and yttrium, not intermixed or interalloyed

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	638	5 871	3 667	1 804	16 900
Average export prices	CZK/kg	2 000	1 333	7 000	–	–

World production and world market prices

World mine production

Statistical data on world production of rare earths for the past five years

	2011	2012	2013	2014	2015^e
World mine production, t (according to MCS)	111,000	110,000	110,000	123,000	124,000
World production of concentrates, t (according to WBD)	101,393	103,008	100,809	106,908	N

^{e} – *preliminary values*

Main producers of rare earths according to WBD

country	2014	
	t	%
China	95,000	88.9
Australia	4,785	4.5
USA	4,769	4.5
Russia	2,134	2.0
Malaya	220	0.2
world	**106,908**	**100.0**

Main producers of rare earths according to MCS

country	2015^e	
	t	%
China	105,000	84.7
Brazil	10,000	8.1
USA	4,100	3.3
Russia	2,500	2.0
Thailand	2,000	1.6
Malaya	200	0.2
world	**124,000**	**100.0**

^{e} – *preliminary values*

MCS estimated world reserves of rare earth oxides at 140 mil. t, of which 55 mil. t are in China and 22 mil. t in Brazil.

The MCS listed the data on the production of yttrium separately. Its production was as follows in recent years:

	2011	2012	2013	2014	2015[e]
World production of Y_2O_3, t	8,900	8,900	7,100	7,100	7,000

[e] *– preliminary values*

According to estimates, 8,000 to 10,000 t of carbon Y were produced worldwide in 2015.

According to MCS, global reserves of carbon Y exceed 50,000 t and are located in Australia, Brazil, China, India, and the USA.

Prices of traded commodities

According to yearbooks Deutschland-Rohstoffsituation for 2011–2014 and DERA 2015, world prices (USD/kg) of commodities with rare earths developed as follows in recent years:

Commodity/Year	2011	2012	2013	2014	2015
Cerium oxide, 99%, bulk, FOB China	98.44	24.97	7.90	4.90	2.39

Average prices of other rare earths according to DERA Preismonitor (Dez. 2015) in (USD/kg):

Dysprosium (metal), 99% min, FOB China	360.65	Praseodymium (oxide), min. 99%, FOB Europe	66.77
Dysprosium (oxide), min. 99 %, FOB China	270.73	Praseodymium (oxide), min. 99%, FOB China	67.40
Erbium (oxide), min. 99 %, FOB China	42.92	Samarium (metal), min. 99 %, FOB China	17.41
Europium (oxide), min. 99 %, FOB China	269.31	Samarium (oxide), min. 99 %, FOB China	2.50
Lanthanum (oxide) min. 99 %, FOB China	2.68	Scandium (oxide), min. 99.5 %, FOB China	1,1352.79
Lanthanum (sulfur), min. 99.999% FOB China	5.83	Terbium (metal), min. 99 %, FOB China	718.81
Neodymium (metal), min. 99 %, FOB China	63.30	Terbium (oxide), min. 99.9 %, FOB China	546.61
Neodymium (oxide), min. 99 %, FOB China	47.33	Yttrium (metal), min. 99 %, FOB China	44.38
Praseodymium (metal), min. 99 %, FOB China	101.73	Yttrium (oxide), min. 99.999 %, FOB China	6.81

According to Industrial Minerals, the prices of rare earth oxides (USD/kg) were as follows:

Commodity/Year		2011	2012	2013	2014	2015
Rare earth oxides, min.99%, large purchases, FOB China	Ce	52–90	16–21	4–6	4–6	1.8–5
	Dy	N	890–1000	310–350	310–400	215–400
	Eu	3650–4300	2020–2300	700–900	700–950	120–750
	La	50–95	15–21	4–6	4–6	1.9–5.2
	Nd	240–320	95–105	40–60	40–70	39–68
	Pr	85–235	95–105	75–90	75–120	43–120
	Sm	N	60–80	5–7	5–7	1.9–6

The price range includes the lowest and highest monthly price quotes for a given year.

Selenium, tellurium

Registered deposits and other resources in the Czech Republic; basic statistical data of the Czech Republic as of December 31

In the Czech Republic unapproved prognostic resources of Se, in the Zn-Pb-Cu deposit Zlaté Hory-západ, were evaluated tentatively at more than 13 tonnes (K. Stuchlíková – I. Frolíková 1988).

Foreign trade

280490 – Selenium

		2011	2012	2013	2014	2015
Import	kg	5 513	4 769	6 007	56 118	6 440
Export	kg	352	1	510	< 1	1

280490 – Selenium

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	2 468	2 376	1 568	141	798
Average export prices	CZK/kg	2 463	11 000	1 682	> 17 000	28 000

28045090 – Tellurium

		2011	2012	2013	2014	2015
Import	kg	26	14	2	< 1	9
Export	kg	–	–	1	–	–

28045090 – Tellurium

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	16 462	19 143	18 500	> 11 000	35 889
Average export prices	CZK/kg	–	–	48 000	–	–

World production and world market prices

World mine production

Statistical data on the production of selenium and tellurium are very fragmentary.

	2011	2012	2013	2014	2015
World production of selenium according to WBD, t	3,290	3,416	3,708	4,082	N
World production of tellurium according to WBD, t	129	132	183	164	N

In view of the fact that selenium and tellurium are by-products of the processing of copper ores, information on production and resources are based on the status of copper ore deposits. According to MCS, the largest producer of selenium in 2012 to 2015 was Japan (from Cu refineries), followed by Germany and Belgium. Others were Russia, Canada, Finland, Chile, and Peru.

Main producers of selenium according to WBD

country	2014	
	t	%
China	1,300	31.8
Japan	782	19.2
Germany	700	17.1
Belgium	200	4.9
Russia	170	4.2
Canada	154	3.8
Kazakhstan	130	3.2
Mexico	120	2.9
Sweden	100	2.4
Finland	94	2.3
world	**4,082**	**100.0**

Main producers of selenium according to MCS

country	2015[e]	
	t	%
Japan	790	35.3
Germany	700	31.3
Belgium	200	8.9
Canada	160	7.1
Russia	150	6.7
Finland	100	4.5
Poland	90	4.0
Chile	50	2.2
Peru	50	2.2
world	**2,240**	**100.0**

[e] – *preliminary values*

Main producers of tellurium according to WBD

country	2014	
	t	%
USA	50	30.5
Russia	33	20.1
Japan	32	19.5
Sweden	31	18.9
Peru	9	5.5
Canada	9	5.5
world	**164**	**100.0**

Main producers of tellurium according to MCS

country	2015^e	
	t	%
USA	N	–
Canada	10	–
Japan	35	–
Peru	N	–
Russia	35	–
Sweden	40	–
Other countries	N	–
world	**N**	**–**

[e] – *preliminary values*

MCS estimated world reserves of selenium at 120 kt, of which about 20% are in China, about 20% in Chile, and roughly 17% in Russia. The MCS estimated world reserves of tellurium at 24 kt. Peru and the USA account for the biggest share, roughly 15%.

Prices of global commodities

According to Deutschland-Rohstoffsituation yearbooks for 2011–2014 and DERA (2015), the average world prices of selenium (USD/kg) were as follows:

Commodity/Year	2011	2012	2013	2014	2015
Selenium, min. 99.5%, free market	136.24	114.33	72.95	53.40	33.50
Tellurium, min. 99.99%, Europe	N	N	127.42	129.17	88.64

According to MB, price of selenium fell from USD 22–26/lb at the beginning of the year to mere USD 6.80–8.80/lb at the end of 2015. In early August, the price of Se decreased below USD 10–13/lb.

Average prices of tellurium (USD/kg) in the USA (MCS 2016) were as follows:

Commodity/Year	2011	2012	2013	2014	2015
Tellurium, min. 99.95%	349	150	112	119	89

Tantalum, niobium

Registered deposits and other resources in the Czech Republic; basic statistical data of the Czech Republic as of December 31

In the Czech Republic, prognostic resources (unapproved) were evaluated at 3,238 tonnes in uranium deposits and uranium-bearing sandstone of the Stráž block in the Bohemian Cretaceous Basin (along with TR, Zr and Hf), and another 568 tonnes in the Hůrky locality in the Čistá-Jeseník Massif (along with Mo, TR, Zr and Hf), where 57 tonnes of prognostic tantalum resources were also calculated. Recoverable contents of tantalum and niobium are also known to occur in tungsten and tin concentrates, which were recovered experimentally during the exploration of the tin-tungsten ore deposit of Cínovec-jih (along with Li, Rb and Cs).

Foreign trade

26159010 – Tantalum and niobium ores and concentrates

		2011	2012	2013	2014	2015
Import	kg	100	20 122	2 604	2 371	4 953
Export	kg	0	19 878	75	1 200	19 878

26159010 – Tantalum and niobium ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	120	425	91	206	625
Average export prices	CZK/kg	–	421	67	205	421

810320 – Unwrought tantalum

		2011	2012	2013	2014	2015
Import	kg	173 469	145 786	184 971	212 871	133 153
Export	kg	79 048	60 940	81 263	92 820	72 446

810320 – Unwrought tantalum

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	11 710	10 935	9 530	8 067	11 196
Average export prices	CZK/kg	5 972	8 830	9 528	8 672	10 292

World production and world market prices

World mine production

World production of tantalum and niobium in 2010–2015:

	2011	2012	2013	2014	2015^e
World production of tantalum (according to MCS), t	767	670	1,170	1,200	1,200
World production of niobium (according to MCS), t	63,400	87,969	59,400	55,900	56,000

	2011	2012	2013	2014	2015
World production of tantalum (according to WBD), t	874	1,193	1,316	1,504	N
World production of niobium (according to WBD), t	70,028	87,906	79,771	87,006	N

^{e} – *preliminary values*

Main producers of tantalum according to WBD

country	2014	
	t	%
Brazil	80,000	91.9
Russia	581	0.7
DR Congo	376	0.4
Rwanda	345	0.4
Nigeria	30	0.0
Ethiopia	25	0.0
Burundi	25	0.0
China	15	0.0
Mozambique	9	0.0
world	**87,006**	**100.0**

Main producers of tantalum according to MCS

country	2015^e	
	t	%
Brazil	50,000	89.3
Canada	5,000	8.9
world	**56,000**	**100.0**

^{e} – *preliminary values*

Main producers of niobium according to MCS

country	2015^{e}	
	t	%
Brazil	50,000	89.5
Canada	5,480	9.8
Other countries	420	0.8
world	**55,900**	**100.0**

^{e} *– preliminary values*

Main producers of niobium according to WBD

country	2014	
	t	%
Rwanda	530	35.2
DR Congo	399	26.5
Brazil	190	12.6
Ethiopia	90	6.0
Nigeria	75	5.0
China	60	4.0
Mozambique	50	3.3
Russia	40	2.7
Burundi	37	2.5
Malaysia	26	1.7
world	**1 504**	**100.0**

World tantalum reserves are estimated at cca 100 ths tonnes and niobium reserves at cca 4 300 ths tonnes.

Prices of traded commodities

	2011	2012	2013	2014	2015
Ta conc. 30 % Ta_2O_5, CIF China, USD/lb (according to D-R)	N	N	107.38	84.94	156.48*
Ta pentoxide, min.99,5 %, FOB China, USD/kg (according to D-R)	N	N	334.37	252.73	224.46
Nb conc. min.50 % Nb_2O_5, min. 5% Ta_2O_5, CIF China, USD/kg (according D-R)	N	N	36.46	27.35	22.00
Nb pentoxide, 99,5 %, FOB China USD/kg (according to D-R)	N	N	52.37	45.33,	30.39
Feroniobium, imports to the US, USD/t (according to MCS)	41,825	43,658	44,000	N	N

*Note: * USD/kg Ta_2O_5 (according to DERA 2015)*

Zirconium, hafnium

Registered deposits and other resources in the Czech Republic; basic statistical data of the Czech Republic as of December 31

In the Czech Republic, prognostic resources of zirconium and hafnium in uranium deposits of uranium-bearing sandstone of the Stráž block in the Bohemian Cretaceous Basin (along with TR, Ta, Nb) were estimated at 71,800 tonnes of zirconium and 2,520 tonnes of hafnium. Another 122,370 tonnes of zirconium and 2,446 tonnes of hafnium are assumed to occur in fenites in the Hůrky locality in the Čistá-Jeseník Massif (along with Mo, TR, Ta, Nb). All the resources are unapproved.

Foreign trade

26151000 – Zirconium ores and concentrates

		2011	2012	2013	2014	2015
Import	kg	959 229	596 481	698 598	766 976	561 500
Export	kg	5 000	7 360	7 213	700	11 000

26151000 – Zirconium ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	47	69	55	51	41
Average export prices	CZK/kg	63	78	53	90	88

81129210 – Unwrought hafnium, hafnium waste and scrap, hafnium powders

		2011	2012	2013	2014	2015
Import	kg	4	0	0	0	142
Export	kg	0	0	0	14	140

81129210 – Unwrought hafnium, hafnium waste and scrap, hafnium powders

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	14 000	–	–	–	9 049
Average export prices	CZK/kg	–	–	–	27 000	7 479

World production and world market prices

World mine production

Statistical data on zirconium production

	2011	2012	2013	2014	2015^e
World production, kt (according to MCS)	1,620	1,460	1,510	1,420	1,410
World production, kt (according to WBD)	1,758.0	1,500.2	1,071.8	1,602.3	N

^e – *preliminary values*

Main producers according to MCS

country	2015^e	
	t	%
Australia	500	35.5
RSA	380	27.0
China	140	9.9
Indonesia	110	7.8
USA	60	4.3
Mozambique	50	3.5
India	40	2.8
world	**1,410**	**100.0**

^e – *preliminary values*

USGS estimates world reserves of Zr O2 at 78 mil. t, of which nearly two-thirds are in Australia. Quantitative estimates of world resources of both elements are not available.

Prices of traded commodities

Average annual prices of zircon in USD/t (according to the Deutschland-Rohstoffsituation yearbook for 2011–2014) and DERA (2015):

Commodity/Year	2011	2012	2013	2014	2015
Zircon, standard, bulk shipments, FOB Australia	1,720.83	2,393.75	1,375.00	1,087.92	977.52

The following prices (USD/t) were provided by Industrial Minerals:

Commodity/Year	2011	2012	2013	2014	2015
Zircon, bulk shipments, standard, FOB Australia	900–2,600	2,000–2,150	1,250–1,550	1,080–1,250	990–1,050
Zircon, bulk shipments, premium, FOB Australia	1,100–2,640	2,100–2,300	1,350–1,550	1,050–1,350	1,030–1,150
Zircon, bulk shipments, standard, FOB USA	850–2,750	2,550–2,750	2,550–2,750	950–1,150	910–1,150
Zircon, bulk shipments, premium, FOB USA	950–3,000	2,600–3,000	2,600–3,000	1,050–1,450	950–1,450
Zircon, ceramic grade, bulk shipments, FOB South Africa	1,100–2,650	2,300–2,650	2,300–2,650	1,000–1,170	1,000–1,150
Micronised zircon, 99.5% < 4 µ, average particle size < 0,95 µ, C&F Asia	2,750–2,800	2,750–2,800	2,750–2,800	1,500–1,750	1,000–1,750
Fused zirconia, monoclinic, refractory/abrasive, contract price, CIF main European port	6,500–7,800	6,500–7,800	6,500–7,800	6,000–7,800	6,000–7,000
Fused zirconia, monoclinic, ceramic pigment grade, contract price, CIF main European port	N	3,800–4,800	3,800–4,800	3,500–4,800	3,600–4,700
Fused zirconia, monoclinic, structural ceramic/electronic grade, contract price, CIF main European port	N	4,600–6,000	4,600–6,000	4,600–6,000	4,500–5,900
Fused zirconia, monoclinic, technical ceramic grade, contract price, CIF main European port	N	15,900–21,000	15,900–21,000	14,000–15,000–21,000	14,000–18,000
Fused zirconia, stabilised, refractory grade, contract price, CIF main European port	N	6,500–7,800	6,500–7,800	6,000–7,800	6,000–7,200
Fused zirconia, stabilised, technical ceramic grade, contract price, CIF main European port	N	5,000–10,000	5,000–10,000	4,500–10,000	4,500–9,500
Zircon opacifier, micronised, 100% < 6 µ, average 1–2 µ, bagged, CFR Asia	N	2,845–3,400	2,845–3,400	1,500–3,400	1,450–2,100
Zircon opacifier, micronised, 100% < 6 µ, average 1–2 µ, bagged, ex-works Europe	N	2,770–3,400	2,770–3,400	1,500–3,400	1,450–2,100
Baddeleyite, ceramic grade (98% $ZrO_2 + HfO_2$), contract price, CIF main European port	N	3,000–3,300	3,000–3,300	2,500–3,100	2,500–3,000
Baddeleyite, refractory/abrasive grade, contract price, CIF main European port	N	2,500–3,100	2,500–3,100	3,000–3,300	2,500–7,100
Baddeleyite, ceramic pigment grade, contract price, CIF main European port	N	3,200–3,500	3,200–3,500	3,200–3,500	3,000–3,500

Note: µ – micrometer, µm (micron); 1 µm = 1/1,000,000 m
The price range includes the lowest and highest monthly price quotes for a given year.

MINERALS UNMINED IN THE PAST WITHOUT RESOURCES AND RESERVES

INDUSTRIAL MINERALS

Andalusite, kyanite, sillimanite, mullite

Foreign trade

250850 – Andalusite, kyanite and sillimanite

		2011	2012	2013	2014	2015
Import	t	4 089	4 451	7 986	4 919	4 147
Export	t	10	16	3	7	33

250850 – Andalusite, kyanite and sillimanite

		2011	2012	2013	2014	2015
Average import prices	CZK/t	10 441	10 681	9 925	11 168	11 546
Average export prices	CZK/t	29 110	10 816	31 343	34 017	30 554

250860 – Mullite

		2011	2012	2013	2014	2015
Import	t	829	612	1 152	713	2 212
Export	t	27	140	0,5	0,3	10

250860 – Mullite

		2011	2012	2013	2014	2015
Average import prices	CZK/t	23 726	19 688	23 773	26 467	13 085
Average export prices	CZK/t	12 532	25 015	57 778	136 000	24 322

Asbestos

Foreign trade

2524 – Asbestos

		2011	2012	2013	2014	2015
Import	t	0,002	1	10	10	0,05
Export	t	0	0	0	0	0

2524 – Asbestos

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 000 000	567 901	1 056 502	922 696	1 780 000
Average export prices	CZK/t	–	–	–	–	–

Magnesite

Foreign trade

251910 – Natural magnesium carbonate (magnesite)

		2011	2012	2013	2014	2015
Import	t	4 579	5 271	3 386	2 845	3 176
Export	t	4	0.03	0.06	41	0.001

251910 – Natural magnesium carbonate (magnesite)

		2011	2012	2013	2014	2015
Average import prices	CZK/t	7 534	5 938	3 798	2 185	2 072
Average export prices	CZK/t	68 242	192 300	607 140	34 780	1 000 000

251990 – Magnesia*, fused, dead-burned, other magnesium oxides

		2011	2012	2013	2014	2015
Import	t	41 010	43 228	46 434	58 397	60 681
Export	t	7 095	5 999	4 691	3 662	3 267

*Note: * – MgO*

251990 – Magnesia*, fused, dead-burned, other magnesium oxides

		2011	2012	2013	2014	2015
Average import prices	CZK/t	8 324	12 495	8 712	7 832	7 969
Average export prices	CZK/t	9 546	10 237	10 808	10 506	11 217

*Note: * – MgO*

Perlite

Foreign trade

25301010 – Perlite

		2011	2012	2013	2014	2015
Import	t	N	N	N	N	N
Export	t	N	N	N	N	N

25301010 – Perlite

		2011	2012	2013	2014	2015
Average import prices	CZK/t	–	–	–	–	–
Average export prices	CZK/t	–	–	–	–	–

Rock salt

Foreign trade

2501 – Salt (inclusive table and denaturated salt), and pure sodium chloride; also in water solution

		2011	2012	2013	2014	2015
Import	t	865 939	564 710	1 046 602	367 075	565 894
Export	t	41 682	25 840	79 401	24 915	37 282

2501 – Salt (inclusive table and denaturated salt), and pure sodium chloride; also in water solution

		2011	2012	2013	2014	2015
Average import prices	CZK/t	1 440	1 562	1 386	2 015	1 856
Average export prices	CZK/t	3 155	4 315	2 902	5 521	4 998

Talc

Foreign trade

2526 – Natural steatite; talc

		2011	2012	2013	2014	2015
Import	t	12 755	8 826	9 751	14 767	17 390
Export	t	297	213	269	376	437

2526 – Natural steatite; talc

		2011	2012	2013	2014	2015
Average import prices	CZK/t	5 851	7 588	8 040	7 831	8 738
Average export prices	CZK/t	13 108	17 676	17 400	14 661	14 685

Other raw materials used in industrial fertilizers production

Foreign trade

3102 – Nitrogenous fertilizers

		2011	2012	2013	2014	2015
Import	t	556 146	656 947	651 474	764 539	881 875
Export	t	579 923	582 235	597 604	485 196	499 933

3102 – Nitrogenous fertilizers

		2011	2012	2013	2014	2015
Average import prices	CZK/t	556 146	656 947	651 474	764 539	881 875
Average export prices	CZK/t	579 923	582 235	597 604	485 196	499 933

2510 – Natural phosphates

		2011	2012	2013	2014	2015
Import	t	15 021	13 082	1	35	37
Export	t	0	0.1	0.1	1.2	1

2510 – Natural phosphates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	4 802	7 296	369 393	12 985	53 862
Average export prices	CZK/t	0	55 944	9 615	18 723	2 000

2809 – Phosphoric oxides and acids

		2011	2012	2013	2014	2015
Import	t	3 115	3 289	6 172	4 557	6 261
Export	t	46 290	51 171	51 482	55 215	56 692

2809 – Phosphoric oxides and acids

		2011	2012	2013	2014	2015
Average import prices	CZK/t	20 051	19 508	10 769	11 299	9 921
Average export prices	CZK/t	14 054	16 453	16 771	17 698	19 077

3103 – Phosphatic fertilizers

		2011	2012	2013	2014	2015
Import	t	17 269	19 207	23 087	16 377	27 652
Export	t	1 098	926	275	304	805

3103 – Phosphatic fertilizers

		2011	2012	2013	2014	2015
Average import prices	CZK/t	6 419	8 254	9 142	8 031	8 343
Average export prices	CZK/t	8 948	14 171	16 528	20 048	13 033

3104 – Potassic fertilizers

		2011	2012	2013	2014	2015
Import	t	87 235	90 669	79 046	75 755	94 918
Export	t	4 234	4 707	3 861	3 321	5 277

3104 – Potassic fertilizers

		2011	2012	2013	2014	2015
Average import prices	CZK/t	7 949	8 843	9 592	9 273	8 737
Average export prices	CZK/t	19 122	19 350	21 035	27 249	23 220

3105 – Fertilizers containing several elements

		2011	2012	2013	2014	2015
Import	t	100 466	119 271	134 909	146 855	164 005
Export	t	18 032	15 556	17 269	7 103	9 970

3105 – Fertilizers containing several elements

		2011	2012	2013	2014	2015
Average import prices	CZK/t	8 714	10 623	11 833	11 119	9 761
Average export prices	CZK/t	8 214	11 133	11 591	23 580	17 902

METALLIC ORES

Aluminium

Foreign trade

2606 – Aluminium ores and concentrates

		2011	2012	2013	2014	2015
Import	t	32 555	27 514	24 789	56 798	43 336
Export	t	97	1.5	5	8	55

2606 – Aluminium ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	2 973	3 172	4 008	2 901	3 302
Average export prices	CZK/t	6 420	616 758	37 960	75 752	1 645

281820 – Aluminium oxide (other than synthetic corundum)

		2011	2012	2013	2014	2015
Import	t	8 045	7 735	9 138	10 230	9 691
Export	t	3 672	4 069	5 389	6 723	7 142

281820 – Aluminium oxide (other than synthetic corundum)

		2011	2012	2013	2014	2015
Average import prices	CZK/t	22 542	23 206	21 676	25 467	23 863
Average export prices	CZK/t	8 499	10 199	7 863	7 508	6 424

281830 – Aluminium hydroxide

		2011	2012	2013	2014	2015
Import	t	10 062	8 893	9 605	9 485	10 076
Export	t	27	29	26	39	121

281830 – Aluminium hydroxide

		2011	2012	2013	2014	2015
Average import prices	CZK/t	7 013	9 631	9 758	10 368	9 338
Average export prices	CZK/t	21 611	18 527	15 749	16 501	6 424

7601 – Raw (unwrought) aluminium

		2011	2012	2013	2014	2015
Import	t	242 861	218 551	239 519	267 522	289 587
Export	t	53 610	60 943	65 031	74 559	89 387

7601 – Raw (unwrought) aluminium

		2011	2012	2013	2014	2015
Average import prices	CZK/t	49 495	46 775	45 066	48 591	55 102
Average export prices	CZK/t	48 020	44 291	44 968	48 851	53 126

7602 – Aluminium waste and scrap

		2011	2012	2013	2014	2015
Import	t	87 218	103 580	81 577	74 356	81 142
Export	t	89 711	86 004	56 084	69 546	79 101

7602 – Aluminium waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/t	32 354	30 937	30 214	31 704	32 273
Average export prices	CZK/t	32 593	29 862	27 569	28 730	30 090

Beryllium

Foreign trade

811212 – Unwrought beryllium, beryllium powders

		2011	2012	2013	2014	2015
Import	kg	0	0	3	0	< 1
Export	kg	0	0	0	0	0

811212 – Unwrought beryllium, beryllium powders

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	N	N	49 000	N	> 3 000
Average export prices	CZK/kg	–	–	–	–	–

Bismuth

Foreign trade

81060010 – Unwrought bismuth, including waste and scrap, powders

		2011	2012	2013	2014	2015
Import	kg	278 101	108 014	83 334	109 489	100 125
Export	kg	2 295	4 172	2 885	4 117	9 262

81060010 – Unwrought bismuth, including waste and scrap, powders

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	225	429	364	493	369
Average export prices	CZK/kg	392	310	324	417	251

81060090 – Wrought bismuth, articles of bismuth, excluding unwrought bismuth, waste, scrap and powders

		2011	2012	2013	2014	2015
Import	kg	1 708	2 695	19 319	1 987	3 843
Export	kg	1 188	1 201	6 414	1 586	1 944

81060090 – Wrought bismuth, articles of bismuth, excluding unwrought bismuth, waste, scrap and powders

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	2 405	1 556	545	2 688	2 093
Average export prices	CZK/kg	2 183	2 107	750	2 610	2 537

Cadmium

Foreign trade

810720 – Unwrought cadmium, cadmium powders

		2011	2012	2013	2014	2015
Import	kg	697	162	58	541	203
Export	kg	1	0	0	1	0

810720 – Unwrought cadmium, cadmium powders

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	264	1 130	1 069	155	788
Average export prices	CZK/kg	1 000	–	–	1 000	–

Chromium

Foreign trade

2610 – Chromium ores and concentrates

		2011	2012	2013	2014	2015
Import	t	8 039	8 142	6 899	6 974	6 772
Export	t	1 166	1 061	839	548	268

2610 – Chromium ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	11 201	10 206	9 750	9 142	8 967
Average export prices	CZK/t	7 426	7 089	7 229	5 771	4 956

811881 – Unwrought chromium

		2011	2012	2013	2014	2015
Import	kg	0	0	0	0	0
Export	kg	0	0	0	0	0

811881 – Unwrought chromium

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	–	–	–	–	–
Average export prices	CZK/kg	–	–	–	–	–

Gallium

Foreign trade

81129289 – Unwrought gallium, gallium powders

		2011	2012	2013	2014	2015
Import	kg	11	5	3	0	0
Export	kg	0	0	0	0	0

81129289 – Unwrought gallium, gallium powders

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	27 091	38 400	17 667	> 9 000	57 000
Average export prices	CZK/kg	–	–	–	–	–

Indium

Foreign trade

81129281 – Unwrought indium, indium powders

		2011	2012	2013	2014	2015
Import	kg	98	14	13	7	21
Export	kg	96	85	0	0	1

81129281 – Unwrought indium, indium powders

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	12 857	5 786	14 077	20 714	14 524
Average export prices	CZK/kg	12 354	7 659	–	–	4 000

Magnesium

Foreign trade

810411 – Unwrought magnesium, containing at least 99.8 % by weight of magnesium

		2011	2012	2013	2014	2015
Import	t	1 499	1 246	2 057	2 688	1 833
Export	t	0	0.3	17	0.7	579

810411 – Unwrought magnesium, containing at least 99.8 % by weight of magnesium

		2011	2012	2013	2014	2015
Average import prices	CZK/t	57 827	64 640	59 250	57 468	61 478
Average export prices	CZK/t	–	84 000	96 039	85 106	58 136

810419 – Unwrought magnesium, containing less than 99.8 % by weight of magnesium

		2011	2012	2013	2014	2015
Import	t	648	680	719	795	756
Export	t	7 699	7 147	8 118	9 121	9 330

810419 – Unwrought magnesium, containing less than 99.8 % by weight of magnesium

		2011	2012	2013	2014	2015
Average import prices	CZK/t	85 627	85 527	93 410	91 251	82 312
Average export prices	CZK/t	48 092	52 691	60 199	60 454	67 475

Nickel

Foreign trade

2604 – Nickel ores and concentrates

		2011	2012	2013	2014	2015
Import	t	14	6	129	860	9
Export	t	268	20	151	696	19

2604 – Nickel ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	376 438	461 745	310 710	348 993	368 014
Average export prices	CZK/t	3 407	352 077	314 198	359 106	4 698

7502 – Unwrought nickel

		2011	2012	2013	2014	2015
Import	t	3 748	3 761	2 367	4 493	4 553
Export	t	269	1 686	1 667	1 152	1 176

7502 – Unwrought nickel

		2011	2012	2013	2014	2015
Average import prices	CZK/t	430 349	369 393	317 657	274 925	328 529
Average export prices	CZK/t	478 353	352 971	284 858	326 017	356 518

Thallium

Foreign trade

811251 – Unwrought thallium

		2011	2012	2013	2014	2015
Import	kg	1	0	0	0	0
Export	kg	0	0	4	0	0

811251 – Unwrought thallium

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	17 000	–	–	–	–
Average export prices	CZK/kg	–	–	2 750	–	–

Thorium

Foreign trade

28443061 – Thorium bars, rods, angles, shapes, sections, wire, sheets, strips

		2011	2012	2013	2014	2015
Import	kg	0	< 1	<1	< 1	0
Export	kg	0	< 1	0	< 1	0

28443061 – Thorium bars, rods, angles, shapes, sections, wire, sheets, strips

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	–	> 1 280	> 82 000	> 29 000	–
Average export prices	CZK/kg	–	> 354 000	–	> 93 000	–

28443069 – Thorium other, not crude, waste, scrap, bars, rods, shapes, wire, sheets

		2011	2012	2013	2014	2015
Import	kg	< 1	N	< 1	< 1	0
Export	kg	0	0	0	0	0

28443069 – Thorium other, not crude, waste, scrap, bars, rods, shapes, wire, sheets

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	> 2 000	N	> 2 000	> 2 000	–
Average export prices	CZK/kg	–	–	–	–	–

28443099 – Thorium salts

		2011	2012	2013	2014	2015
Import	kg	0	1	1	172	0
Export	kg	0	0	0	0	0

28443099 – Thorium salts

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	–	5 000	3 000	669	–
Average export prices	CZK/kg	–	–	–	–	–

Titanium

Foreign trade

2614 – Titanium ores and concentrates

		2011	2012	2013	2014	2015
Import	t	146 778	98 071	100 317	107 926	113 764
Export	t	504	684	758	813	867

2614 – Titanium ores and concentrates

		2011	2012	2013	2014	2015
Average import prices	CZK/t	3 876	7 960	6 467	5 577	5 486
Average export prices	CZK/t	23 365	55 442	48 398	26 567	23 186

8108 – Titanium and products of it, including waste and scrap

		2011	2012	2013	2014	2015
Import	t	1 340	1 702	1 888	1 959	1 985
Export	t	268	390	369	726	932

8108 – Titanium and products of it, including waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/t	645 203	513 940	466 266	540 385	562 506
Average export prices	CZK/t	132 612	139 387	255 279	329 037	543 456

Vanadium

Foreign trade

81129291 – Unwrought vanadium, vanadium powders, excluding waste and scrap

		2011	2012	2013	2014	2015
Import	kg	0	1	1 928	1	40
Export	kg	0	0	0	1	7

81129291 – Unwrought vanadium, vanadium powders, excluding waste and scrap

		2011	2012	2013	2014	2015
Average import prices	CZK/kg	–	4 000	285	27 000	3 775
Average export prices	CZK/kg	–	–	–	20 000	13 143

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