MINERAL COMMODITY SUMMARIES OF THE CZECH REPUBLIC

(Data deadline: June 15, 2005)

MINISTRY OF THE ENVIRONMENT

CZECH GEOLOGICAL SURVEY– GEOFOND

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LIST OF ABBREVIATIONS, SYMBOLS AND TECHNICAL UNITS

API	American Petroleum Institute
ATPC	Association of Tin Producing Countries
bbl	barrel of crude petroleum, 158.99 dm^3
Btu	British thermal unit, 252 cal, 1,055.06 J
ČBÚ	Czech Mining Office
CFR	Cost and Freight (named port of destination)
ČGÚ	Czech Geological Survey
CHKO	Protected landscape area
CHLÚ	Protected deposit area
CIF	Cost, Insurance and Freight (named port of destination)
ČNR	Czech National Council
ČR	Czech Republic
CSK	Czechoslovak Koruna
ČSÚ	Czech Statistical Office
CZK	Czech Koruna
DEM	German Mark
DRI	Direct Reduction of Iron
e	estimate
ECU	European Currency Unit
EFTA	European Free Trade Association
EU	European Union
EXW	Ex Works (named place)
FAS	Free Alongside Ship (named port of shipment)
FOB	Free on Board (named port of shipment)
FOL	Free on Lorry (named place)
FOT	Free on Truck (named place)
GBP	British Pound
GBp	British pence
GDP	Gross Domestic Product
IEA	International Energy Agency
IPE	International Petroleum Exchange (London, UK)
kt	kilotonne, 1,000 t
lb	pound, 0.4536 kg
LME	London Metal Exchange
mesh	to designate screen size as the number of openings per linear inch (including screen wire diameter)
MH ČR	Ministry of Economy of the Czech Republic
MHPR ČR	Ministry of Economic Policy and Development of the Czech Republic
MJ	megajoule, 10^6 J
mill	million, 10^6
mlld	milliard, 10^9
MPO ČR	Ministry of Industry and Trade of the Czech Republic
mtu	metric ton unit, 10 kg
MŽP ČR	Ministry of the Environment of the Czech Republic
N	not available or not reliable data
NYMEX	New York Mercantile Exchange

OECD	Organization for Economic Cooperation and Development
OPEC	Organization of Petroleum Exporting Countries
PCE	Pyrometric cone equivalent
ppm	parts per million, 0.0001 %
PÚ	exploration area
Sb.	Collection of Laws (abbreviated as Coll.) of the Czech Republic
t	metric tonne, 1,000 kg, 1,000,000 g
st	short ton, 907.2 kg
ths	thousand, 10^3
troy oz	Troy ounce (t oz), 31.103 g
T/C	Treatment Charge, the amount per tonne charged by a smelter for converting ore to metal
UNCTAD	United Nations Conference on Trade and Development
USBM	United States Bureau of Mines
USD	United States Dollar
USc	United States cent
VAT	value added tax

INTRODUCTION

The yearbook "Mineral Commodity Summaries of the Czech Republic", published for the thirteenth time, is intended to inform professional and particularly businessmen communities and to assist by this in mineral business expansion in line with relevant legislation and interests of mining organizations.

The publication has been elaborated for the most important minerals of the Czech Republic, which have been recently of an industrial importance. It includes basic data on the state and changes in reserves of raw materials in the Czech Republic extracted from the "Register of Reserves of Mineral Deposits" (hereinafter "The Register"), which is published for only a limited number of state administration bodies.

Additional information on prices of minerals, their technological parameters and use, imports and exports, major mining companies and locations of mineral deposits is intended to assist in understanding the mineral potential of the Czech Republic and to stimulate investment activities when considering mining of minerals.

The publication is being updated by relevant statistical data as demanded by progress in the national information system and international cooperation and taking into account readers' comments.

Hereinto presented (mineral) reserves are geological otherwise "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 basic data come from mineral reserves estimations, 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 Ministry of Economy of the Czech Republic and Ministry of Economic Policy and Development of the Czech Republic or by former commissions for management of mineral reserves of individual mining and processing industries. Nowadays these are reserves approved by the Commission for Projects and Final Reports of the Ministry of the Environment of the Czech Republic or by bodies ordering geological works.

There are reserved and non-reserved minerals and deposits defined by the Mining Act no. 44/1988 Coll., as amended. Reserved minerals always form reserved deposits. The reserved deposits are owned by the Czech Republic. Non-reserved deposits are owned by ground owners. Non-reserved minerals (some industrial and all construction minerals) can form both reserved and non-reserved deposits. Until 1991, the reserved ones were those of sufficient raw material quantity and quality which were proclaimed „suitable for national economy needs and development" in then valid Mining Act wording. After 1991, the newly recognized and explored deposits of non-reserved minerals form non-reserved deposits.

Geological reserves on reserved deposits of reserved and non-reserved minerals – as of December 31, 2004 – achieved 49 billion tonnes with prevalence of energy minerals and construction minerals . The Ministry of the Environment together with the Ministry of Industry and Trade did a project for fundamental economic revaluation of the mineral wealth of the Czech Republic in 1993–2001. The task continued to a smaller extent into 2003. For this reason, many changes have occurred in volume of reserves or number of deposits of many minerals (especially metallic ores) in comparison with past years.

The yearbook "Mineral Commodity Summaries of the Czech Republic" includes selected minerals, i.e. metallic ores, mineral fuels, industrial minerals and construction minerals, which are of economic importance and substantial reserves (in case of ores in the past) on the territory of the Czech Republic. Each mineral is presented in a separate chapter consisting of eleven parts.

Part 1. **Characteristics and use** – provides a basic description of the mineral raw material, its abundance in nature, major minerals and general use.
Part 2. **Mineral resources of the Czech Republic –** describes major regions of occurrence, characteristics of deposits, ore types, mining and potential use of the given mineral.
Part 3. **Registered deposits and other resources of the Czech Republic** – is based upon The Register of mineral deposits of the Czech Republic and for the majority of minerals it includes a list of deposits and their location. 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, hundreds of these deposits are scattered over the whole territory of the Czech Republic. Consequently, neither their list nor locations are given in this paragraph; however, their groupings are localized in subdivision to registered, non-registered, worked and unworked deposits.
Part 4. **Basic statistical data of the Czech Republic as of December 31** are extracted from The Register. There are 3 groups of minerals (ores, energy minerals and reserved industrial and construction minerals (building materials)) registered in the Czech Republic. Mining production in non-reserved deposits has been monitored since 1999.
Part 5. **Foreign trade** – provides information on import and export of important customs tariff items of the raw material. Data on foreign trade are the latest (continuously reviewed) data of the ČSÚ.
Part 6. **Prices** – gives indicative prices on domestic production, import and export prices. Domestic prices do not include VAT.
Part 7. **Mining companies in the Czech Republic as of December 2004.** This part gives a list of companies, which are mining the given mineral on the territory of the Czech Republic. The companies are arranged according to the level of production. Their addresses are at disposal in the Czech Geological Survey – Geofond.
Part 8. **World production** gives data on mining and production of commercial products for the last 5 years. There are also quoted significant world producers, i.e. 5 - 10 top producers in the world production.
Part 9. **World market prices** – gives a summary of world prices and their evolution in the last five years as well as prices based upon quotations or prices negotiated in contracts.
Part 10. **Recycling** – gives a brief description of possible recycling methods known in the world.
Part 11. **Substitutes** – this paragraph provides an appraisal of materials, which can substitute for the given mineral (worldwide).

Numerous domestic data and foreign materials were used when compiling the present yearbook, especially data from journals and last editions of various international statistical yearbooks (for example Welt Bergbau Daten 2004, Mineral Commodity Summaries 2004, World Mineral Statistics 1998-2002, World Oil and Gas Review 2004, Coal Information 2004, World Metals & Mineral Review 2005).

MINERAL PROSPECTING, EXPLORATION AND MINING PRODUCTION IN THE CZECH REPUBLIC

Tomáš Sobota, Ministry of the Environment

Minerals, defined in Act No. 44/1988 Sb. on mineral protection and exploitation amended by later regulations, are divided into reserved and non-reserved. Natural accumulation of reserved minerals forms reserved mineral deposits. These 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 in the sense of the § 7 of the Mining Act. Former option to declare significant non-reserved mineral deposits as reserved ones was cancellled by the amendment of the Mining Act from the year 1991. Decisions of the state administration bodies in this matter, which had been issued before the amendment into force, remain valid based on the transient enactment (§ 43a par. 1 of the Mining Act). Deposits specified by these decisions are deposits reserved, i.e. owned by the state, detached from the land.

The prospecting of reserved minerals deposits and their exploration are regulated by the Czech National Council Act No. 62/1988 Sb. on geological works, amended by later regulations. Prospecting and exploration can be carried out by an individual or organization, supposing that the works are managed and guarantied by a person who has the certificate of qualification (responsible manager of geological works). The organization, which is going to carry out survey and exploration of deposits of these minerals, verification of reserves and processing of geological documents for their exploitation and protection, has to ask for establishment of the exploration area at the Ministry of the Environment. The proceedings according to the administrative rules is concluded by an establishment or non-establishment of the „exploration area“, which in the positive case includes a determination of the mineral for prospecting and exploration of which the area is established, the conditions of geological operations and the time of licence validity for the exploration area. It is not possible to prolong the extension of the licence validity in contrast to the past. The exploration area is not a territorial determination, but it creates for the entrepreneur the exclusively privilege of prospecting of the mineral on the exploration area. The entrepreneur is obliged to pay a tax from the exploration area CZK 2,000 per any opened square kilometre of the exploration area in the first year. This tax increases CZK 1,000 per any next year. These taxes represent an income of municipalities, which cadastral area the exploration area is established on.

Within the frame of working plans and operation works for reserved mineral deposits prospecting and exploration, the organization must consider conditions and respect interests, which are protected according to special regulations (§ 22 of the act on geological works). In the first place there are laws for landscape and nature protection, agriculture and forestland protection laws, water and mining laws and the like. If the organization repeatedly breaks the obligations given by the Geological Act, the Ministry of the Environment can cancel the established exploration area.

The above-mentioned regulations can be applied to prospecting and exploration of non-reserved mineral deposits only in the case that they were earlier declared reserved deposits in sense of the transient enactments of the Mining Act. An organization can carry out a new prospecting and exploration of non-reserved minerals only after agreement with the landowner. Mining of the non-reserved deposits which represent a part of the land is an activity carried out in the mining way according to the Act No 61/1988 Sb. on mining activity, explosives and on the state mining administration, amended by later regulations.

When the reserved mineral is found during prospecting and exploration in quality and volume indicative of its accumulation (it means a supporting of reserve estimation in category of prospected reserves), the organization reports it to the Ministry of the Environment, which issues the certificate of reserved deposit owned by the state. It also ensures the protection of the reserved deposit against aggravation of its mining or making the mining impossible by determination of its protected deposit area (CHLÚ) (§17 of the Mining Act).
The entrepreneur's right to mine the reserved deposit originates in the mining claim allocation. An application for the determination of a claim has to be agreed in advance by the Ministry of the Environment. The Ministry can condition its approval by fulfilling limiting conditions, which take into consideration state mineral policy interests, and by covering the expenses on geological works taken from the state budget. The priority over others for precedent approval for the determination of mining claims enjoys the entrepreneur who operated the exploration or who participated financially in it.
The mining claim is allocated only to the entrepreneur who is in possession of a "Certificate on mining operations" issued by the authorised Regional Mining Office. The local authorised Regional Mining Office determines the mining claim in cooperation with other state administration bodies, mainly in agreement with environmental and territorial planning authorities and with the Building Office. The entrepreneur must support the application for the determination of a claim by documentation given in the law. During the administrative procedure relations to owner of the piece of land and a settlement of conflicts of interests protected by special regulations are solved. Also analyse of mining influence of the environment (EIA) is a component of the basis. Besides mining authorization the decision on mining claim determination represents also a decision about area exploitation.
The entrepreneur who obtained the determined mining claim can start mining operations only after the mining activities licence is issued by the authorised Regional Mining Office. Before the mining activities licence is issued, an administrative procedure takes place where plans of opening, preparation and mining of the deposit and plans of rescues and recultivation after finishing the exploitation of the deposit are assessed. In some cases Regional Mining Office can combine the determined mining claim and the permission of mining activities into one administrative procedure.
The entrepreneur is obliged to pay taxes from the claims and extracted reserved minerals. Yearly tax from the claim is CZK 10,000 for every even opened square kilometre of the mining claim in the area demarcated on the surface. In case of the small claims (up to 0.02 square km), the yearly tax amounts to CZK 2,000. Every Regional Mining Office fully transfers this tax to the municipalities in territories of which the claim is found. The ratio corresponds to claim proportions on the territory of every municipality. Yearly tax for minerals exploited in mining claims (royalty) is given by the Ministry of Economy and Trade Decrees No. 426/2001 Sb. and 63/2005 Sb, amending the Decree No. 617/1992 Sb., on details of mining claim and extracted reserved minerals tax payment. The rate depends on type of extracted mineral and ranges between 0.5 to 10 % of its trade price. The Regional Mining Office transfers 25 % of the profit from extracted mineral tax to the state budget and 75 % to the budget of the interested municipalities.
During mining activities the entrepreneur is obliged to make a financial reserve for mine damages and for rescues and recultivation on injured area after finishing the exploitation of the deposit. The amount of this reserve is defined by the Regional Mining Office during the procedure of permission of mining activities, opening and exploitation of the deposit. The Regional Mining Office together with the Ministry of the Environment permits the withdrawal of financial reserves.

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

Statistical data/Year	2000	2001	2002	2003	2004
registered geological works	355	941	2 069	2 680	2 850
protected deposit areas	912	902	965	1 018	1 052
mining claims – total number	1 132	1 133	1 010	1 008	1 004
– area in square km	1 780	1 722	1 567	1 545	1 493
number of exploited deposits a)	554	531	525	540	513
mining production, mill t b)	132	131	125	133	134
organizations managing the deposits	362	340	362	387	314
organizations mining the deposits a)	232	222	236	231	227

Note:

a) data for reserved deposits only; furthermore 167 organizations exploited 220 non-reserved deposits in 2004

b) radioactive minerals not included; conversion to tonnes: natural gas – 1,000 m^3 = 1 t, dimension and crushed stones – 1,000 m^3 = 2,700 t, sand and gravel and brick clays – 1,000 m^3 = 1,800 t

Mining production of minerals in the Czech economy:

Ratio/Year	2000	2001	2002	2003	2004
Share of mining in GDP, %	1.5	1.4	1.4	1.2	1.4
Share of mining in industrial production, %	3.0	3.0	2.8	2.8	2.6

Trends of mineral industrial reserves (economic explored disposable reserves)

Total numbers according to groups, kt

Group/Year	2000	2001	2002	2003	2004
Metallic ores a)	3	3	3	3	0
Energy minerals b)	3 511 297	3 500 121	3 145 537	3 076 082	3 015 453
Industrial minerals	2 828 350	2 770 544	2 781 570	2 734 580	2 725 649
Construction minerals c)	5 347 098	5 579 387	5 398 011	5 395 278	5 316 214

Note:

a) metals in ores total, in 2000– 2003 only metal Sn and Au, in 2004 only Au 48 t

b) natural gas – conversion into kt: 1 mill m^3 = 1 kt

c) 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

Summary of exploration licences valid in 2004 and exploration licences issued during 2004:

Exploration areas in 2004

Prospecting and exploration works paid by companies

Mineral	Valid EA (min. 1)	Valid EA (min. 2)	New issues in 2004	Start of validity in 2004
Silver	0	0	0	0
Gold +	0	0	0	0
Hard coal	1	0	1	1
Crude oil	15	9	10	9
Natural gas	23	16	12	11
Gemstones	2	1	1	0
Heavy minerals	0	0	0	0
Kaolin	7	0	2	2
Clays	2	0	1	1
Bentonite	1	1	0	0
Feldspar and feldspar substitutes	3	1	4	3
Silica raw materials	3	0	2	1
Glass, and foundry sand	1	0	0	0
Abrasives	0	0	0	0
Staurolite	0	0	0	0
Limestones	0	0	0	0
Gypsum	0	0	0	0
Dimension stone	0	0	0	0
Crushed stone	1	1	0	0
Sand and gravel	2	2	3	3
Brick clays and related minerals	1	0	0	0
Total number	**62**	**31**	**36**	**31**

[+] In some cases, minerals suitable for industrial production of metals are given as accompanying minerals.
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 an accompanying one

Prospecting and exploration works paid from the state budget

Mineral	Valid EA (min. 1)	Valid EA (min. 2)	New issues in 2004	Start of validity in 2004
Crude oil	0	0	0	0
Natural gas	0	0	0	0
Kaolin	0	0	0	0
Clays	0	0	0	0
Bentonite	0	0	0	0
Feldspar and feldspar substitutes	0	0	0	0
Glass, foundry sand	0	0	0	0
Total number	**0**	**0**	**0**	**0**

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 an accompanying one

Geological Studies for Prospecting, Exploration and Protection of Reserved Deposits Financed from the State Budget and Realized by the Ministry of the Environment in 2004.

Josef Janda, Ministry of the Environment

The tasks of economic geology can be divided into following groups:

A.1. The Programme of the Czech Republic Raw Material Base Development

Until 1989, the state raw-material policy was supported by the structure of gigantic "production-economic units – PEU" (former General Managements covering the majority or even all the state enterprises in wide range of minerals). Hundreds of companies originating after the extinction of PEU (PEU were ensuring not only the raw-material conception but also the adequate advance of prospecting before production) and after further disintegration due to the privatisation. This process lasted from 1991 to 1994. Therefore a number of the new companies got in a complicated situation.

- They didn´t have any adequate raw-material base for their existence.
- They didn´t have any data for medium and long-term conceptions, any necessary data for decisions on strategic partners, investment, credits, modernization and development of the enterprise.
- They didn´t have enough finance for necessary geological works.

These events occurred in the situation of the proclaimed support of private enterprise, especially of small and medium companies. It has to be taken into the consideration, that the existence of tens and hundreds small private companies, production, services and consequently employment and prosperity in individual regions depended on function of mining companies. That's why the former Ministry of Economy declared "The Programme of the Czech Republic Raw Material Base Development". It was destined for mining companies (not for geological prospecting companies). Fundamental conditions were as follows:

- Elaboration of an entrepreneurial plan that proves
  - risk of the plan
  - benefits from possibly discovered deposit

This approach was a novelty in 1992, because by then the deposit prospecting had not been given by the necessity of a particular commodity, but it had been initiated by a need to discover and protect the total raw-material potential of the state. Volume of geological works decreased significantly after the principle had been introduced into the life;

- in case the deposit is discovered and it has parameters specified in the entrepreneurial plan, the financial funds spent on the prospecting will be returned to the state. Also this approach represented a fundamental change. The deposit prospecting had been always financed by the state as non-returnable regardless of its results till this time;
- the programme concerned industrial minerals and non-traditional raw materials. Ores of metals and coal were excluded from the programme. However, the absorbed natural gas associated with carboniferous coal was recognized as a non-traditional raw material. It promised a possibility of improvement of energy base of the country by means of ecological fuel.

These tasks started before the year 1995, mainly within the period 1992 – 1994, therefore before the geology administration was transferred from the Ministry of Economy to the Ministry of the Environment. This type of works was not carried on in 2004 anymore.

The results of the programme have been used on the level of public bodies

- for the preparation of raw-material and energy politics of the state
- for perspective deposit protection (article 7 of the Czech Republic Constitution and paragraphs 15 – 19 of the Mining Act)
- for ascertainment of necessary data for urban plan studies (the Ministry of Environment duty based on paragraph 13 of the Geological Act (no. 62/1988 Coll., as amended))

A.2. Exploration of new reserved deposits aimed at their protection for exploitation in future

In 2004, there were started for example geological works for prospecting and exploration of kaolin locality Nevřeň.

A.3. Evaluation of reserved deposits of raw materials in state reserve

The central geological state administration body (MŽP ČR) fulfils duty of the state register of reserved deposits – the state property (§ 29 of the Mining Act). For this purpose, it issues The Register as one of the main bases for

- territorial planning
- raw material policy
- policy of the environment
- structural policy
- policy of employment

In the register, deposits in the state documented by the most recent reserve estimation are given. The estimation of reserves is carried out according to the conditions of exploitability expressing

- state of the market, prices, economy of the business
- mining and technical conditions of the exploitation
- conflicts of interests with the deposit exploitation (first of all protection of the environment and other conflicts)

All these factors are changeable, reflecting political, economic and social changes (in the largest sense).
Revaluation of deposits not allocated for entrepreneurial exploitation continued.

A.4. Works aimed at obliteration of consequences of raw material exploration

Some of the technical works carried on during geological exploration in the past deteriorated and started to endanger the environment. Therefore they had to be liquidated. Works on the oil and gas exploration in Horní Žukov, Týnec and Uhřice and works on graphite exploration in Český Krumlov were liquidated for this reason in 2004.

A.5. Heaps, dumpings and tailings after mineral mining

A partial programme is being prepared, aiming to perform a revaluation of heaps, dumpings and tailings after mineral mining from two fundamental standpoints:

a) which of the existing heaps, dumpings and tailings will represent an accumulation of mineral potentially exploitable in future
b) biotope state in heaps, dumpings and tailings and which of them represent a risk factor from standpoints of environment creation and protection.

Results of works in this area are used also at evaluation of impact of former mining operations in individual localities.

Costs of exploration works on mineral deposits studies financed from the state budget

(rounded values)

1993	CZK 248 716 000
1994	CZK 249 841 000
1995	CZK 242 294 000
1996	CZK 163 030 000
1997	CZK 113 231 000
1998	CZK 114 213 000
1999	CZK 110 761 000
2000	CZK 26 264 000
2001	CZK 21 500 000
2002	CZK 17 000 000
2003	CZK 7 000 000
2004	CZK 26 236 000

B. "Non-deposit" geological works

Mainly geological works with a "non-deposit" character were financed from the state budget. Particular public orders were placed for an implementation of the following partial programmes:

- clearance of consequences of the last geological (non-deposit) works financed by the state (some till this time unliquidated mining products, boreholes)
- geological informatics
- geological mapping
- risk geofactors of environment
- hydrogeology
- engineering geology
- complex geological studies

About CZK 52,123,000 in total were spent on these geological works in 2004.

Selected legal regulations on mineral prospecting and exploration in force as of June 15, 2005

Acts

Act No. 44/1988 Sb. **on mineral protection and use (Mining Act)** – the complete wording with jurisdiction for the Czech Republic with amendments and supplements instituted through Czech National Council Act No. 541/1991 Sb., Czech National Council Act No. 10/1993 Sb., 132/2000 Sb., 286/2000 Sb., 366/2000 Sb., 315/2001 Sb., 61/2002 Sb., 320/2002 Sb. and 150/2003 Sb and 3/2005 Sb.
Act No. 61/1988 Sb. **on mining operations, explosives and state mining administration** in the wording of the ČNR Act No. 425/1990 Sb., the ČNR Act No. 542/1991 Sb., 128/1999 Sb., 71/2000 Sb., 124/2000 Sb., 315/2001 Sb. and 206/2002 Sb. and 320/2002 Sb. and 320/2002 Sb., 226/2004 Sb., 227/2004 Sb. and 3/2005 Sb.

Act No. 62/1988 Sb. **on geological works** and the Czech Geological Office amended in Act No. 543/1991 Sb. , No 366/2000 Sb., 320/2002 Sb. and 226/2003 Sb. , 18/2004Sb. and 3/2005 Sb.

Other law regulations

Mineral deposits exploitation

Decree of the ČBÚ No. 306/2002 Sb. that determines **districts of operation of the District Mining Offices.**
Decree of the ČBÚ No. 104/1988 Sb. on efficient use of reserved deposits, on permits and notification of mining operations and other operations that use mining methods amended in Decree No. 242/1993 Sb. and 434/2000 Sb.
Decree of the ČBÚ No 415/1991 Sb. on **construction, elaboration of documentation and determination of safety pillars, rods and zones of protection of underground and surface objects** in wording of the Decree of the ČBÚ No. 340/1992 Sb. and 331/2002 Sb.
Decree of the ČBÚ No. 172/1992 Sb. on **mining claims** in wording of the Decree No. 351/2000 Sb.
Decree of the ČBÚ No. 175/1992 Sb. on **conditions of non-reserved mineral deposit exploitation**
Decree of the MŽP ČR No. 363/1992 Sb. on **survey of old workings and old workings register management** in wording of the Decree of the MŽP No. 368/2004 Sb.
Decree of the MŽP ČR No. 364/1992 Sb. on **protected deposit areas**
Decree of the ČBÚ No. 435/1992 Sb., **on mine surveying documentation during mining and some other operations that use mining methods** in the wording of the Decree of the ČBÚ No 158/1997 Sb.
Decree of the MH ČR No. 617/1992 Sb. on **details of tax payment from mining claims and extracted reserved minerals**, in wording of the Decree of the MPO No. 426/2001 Sb.
Decree of the MHPR ČR No. 497/1992 Sb., on **registration of reserves in reserved mineral deposits**

Geological works

Decree of the MŽP No. 282/2001 Sb. **on evidence of geological works**, in wording of the Decree of the MŽP No 368/2004 Sb.

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

Decree of the MŽP No. 369/2004 Sb. **on projection, carrying out and evaluation of geological works, on announcing of risk geofactors and on procedure at reserve estimation of reserved deposits**

Regulations on licensing of mining operations and on verification of qualification

Decree of the ČBÚ No. 340/1992 Sb. on **qualification requirements, and on verification the specialists of mining operations and other operations that use mining methods and on changes of some regulations issued by the ČBÚ to secure the health safety and protection during the work and to secure safety of processes during mining operations and other operations that use mining methods**, in the wording of the regulations No. 239/1998 Sb. and 74/2001 Sb.
Decree of the ČBÚ No. 15/1995 Sb. on **licence of mining operations and other operations that use mining methods as well as of project development of objects and installations, which are a constituent part of these operations**
Decree of the MŽP ČR No. 206/2001 Sb. on **certificate of qualification to project, carry out and evaluate geological works**

METALLIC ORES

– GEOLOGICAL RESERVES AND MINE PRODUCTION

Geological reserves of metallic ores as of December 31, 2004 represent mostly potentially economic resources. More significant volume of economic reserves was presented only for gold bearing ores. ∟

Ore mining has got a very old tradition on the territory of the Czech Republic. The oldest archaeological evidence on gold panning date originates in the 9th century B.C. In the Middle Age, Bohemia became the centre of European gold, silver and tin mining. Long mining activity nearly exhausted their resources. All but exceptions (e.g. deposit of Au-W ores Kašperské Hory), poor ores only outlasted on the territory of the Czech Republic. Mining met with its last large boom in the cold war period after 1948, when the ore deposits were exploited even at considerable economic loss to ensure the independence of the communist state from the mineral imports from the western countries. After 1989, a large exploitation damping came and a closure of mining in the polymetallic deposit with gold Zlaté Hory terminated ore mining on the territory of the Czech Republic in 1994. State subventions for damping programs directed at social costs, technical liquidations, sanative activities (maintenance) and reclaiming exceeded CZK 2.5 milliard in 1990–2004.

All deposits of Fe ores, Ni ores and Sb ores, majority of Ge ores deposits, a large number of base metal (Pb, Zn, Cu) and Sn-W ores deposits were revaluated and gradually eliminated from The Register in the course of the revaluation carried out since 1993. Gradual elimination of small deposits of scheelite W ores has been foreseen, too.

IRON ORE

1. Characteristics and use

The highest concentrations of iron ores are associated with the Precambrian sedimentary formations, which represent the largest world source of hematite and magnetite ores. Deposits of magnetite also originate either by segregation of magnetite in mafic magmatic bodies or through contact metasomatic processes. Iron ores mostly occur in the form of oxides, carbonates and silicates. In general, two types of iron oxides are mined worldwide – hematite Fe_2O_3 and magnetite Fe_3O_4 containing up to 72 % Fe. Over 90 % of mining production has been obtained by surface mining. World reserves are estimated at 800,000 mill tonnes of ores.

Iron ores are used for the production of pig iron either in the form of crude lump ore or in the form of fines or sintered or pelletized concentrates. Modern technologies of iron manufacturing such as DRI process, Corex, etc. enable the use of fines and concentrates without sintering or pelletization.

A very small amount of iron is used for other than metallurgical purposes, such as heavy media, and the manufacture of cement, ferrites, feed, colouring agents, etc.

2. Mineral resources of the Czech Republic

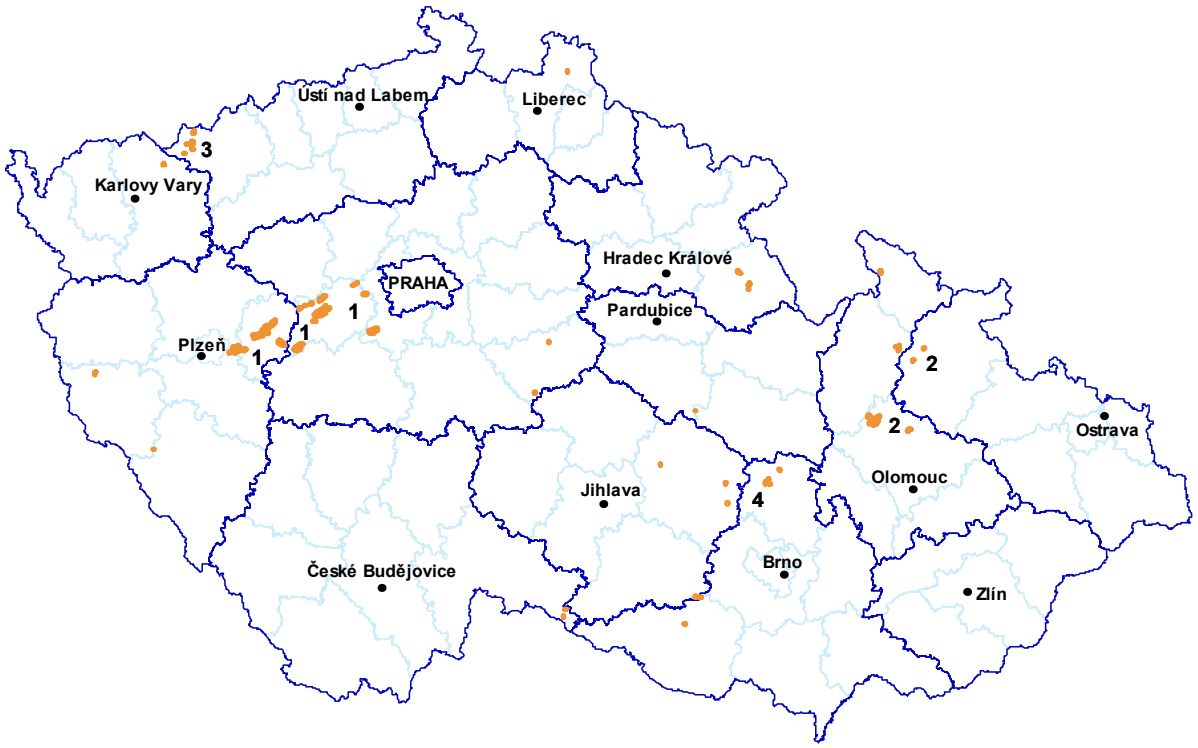
There are no economically exploitable iron ore deposits in the Czech Republic. Ores occurring on the territory of the republic are poor, altogether having Fe contents below 40 % and in the majority of cases workable by underground mining. Deposits of much richer ores with Fe contents around 50 % and more are exploited mainly by open pit mining in the world at present. The availability of much higher-quality and relatively cheaper iron ores from import led to gradual cessation of iron ore mining on the territory of the Czech Republic. At the same time, reserves of these ores were gradually eliminated from The Register as completely non-economic.

- Sedimentary iron ores occur in the Barrandian. These are Palaeozoic ores of marine origin in sediments of the Ordovician age. The deposits have mostly a form of rather extensive lenses. The ores consist mainly of hematite, siderite and Fe-silicates (leptochlorites). The content of iron is on average 25 to 30 %. Oolitic texture and high SiO_2 content characterize these ores. These ores were intensively mined on many sites (e.g. Nučice, Ejpovice, Mníšek pod Brdy, Zdice etc.) mainly in the 19th and the first half of the 20th century. The mining was definitely terminated in the beginning of the 1960s and the remaining reserves of all the sedimentary deposits of Fe in the Czech Republic were cancelled in 1997 – 1999.
- Volcano-sedimentary deposits of the Lahn-Dill type occur in the Moravian–Silesian Devonian. The ores containing mainly hematite, magnetite and to a lesser extent Fe-silicates form smaller lense-shaped bodies, which are often intensively folded. Magnetite ores had average Fe contents around 35 to 40 % Fe; ores with predominance of hematite slightly lower (about 30 %). The ores were mined on many places (Medlov, Benkov, Králová, Horní Město etc.). Mining activity reached its climax in the 19th century and it was definitely terminated in the mid-sixties of the 20th century. All remaining reserves of deposits of the Lahn-Dill type were cancelled in 1997 – 1999.
- Small magnetite lenses are typical of skarns of the Moldanubicum (Vlastějovice, Županovice, Malešov, Budeč etc.) and Saxothuringicum (Měděnec, Přísečnice, Kovářská) of the Bohemian Massif, Krkonoše Mts.-Jizerské hory Mts. crystalline unit etc. Fe contents of the ores were mainly about 33 to 38 %. The mining activity was terminated largely already in the sixties, at Přísečnice and Měděnec deposits in 1992. The remaining reserves of these deposits were to a large extent cancelled before the 1990s.
- Other genetic types of Fe mineralization were of only a marginal importance. This concerned for instance banded ores of Sydvaranger type (Sobotín et al.), hydrothermal ores (Krušné

hory Mts. et al.), stratabound (Hraničná et al.), sedimentary (except the Ordovician ones), residual, metasomatic ores etc.

Iron ore deposits were mined in the past (peak in the 19th and beginning of the 20th century) on a large scale and the ore was dressed at high cost and used mostly for pig iron production. This applies particularly for low-grade and siliceous sedimentary ores of the Barrandian, which were thermally treated through the Krupp-Renn process. Magnetite was mostly – and in 1970s to 1990s almost exclusively - used for other than metallurgic purposes, such as for production of cement (heavy concrete), as a heavy medium of jigs in coal processing plants, etc.

3. Registered deposits and other resources in the Czech Republic



exhausted deposits and other resources

Principal areas of deposits presence:

1 Barrandian

2 Silesicum – Moravo-Silesian Devonian

3 Krušné hory Mts. (Erzgebirge Mts.) crystalline complex

4 Moldanubicum

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	5	5	2	1	0
exploited	0	0	0	0	0
Total mineral reserves, kt ores	22 237	22 237	21 000	14 770	0
economic explored reserves	0	0	0	0	0

economic prospected reserves	11 520	11 520	11 520	11 520	0
potentially economic reserves	10 717	10 717	9 480	3 250	0
Mine production, kt Fe	0	0	0	0	0

5. Foreign trade

2601 – Iron ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, kt	6 933	6 891	6 812	8 222	7 560
Export, kt	0	0	0	0	0

7201 – Pig iron

Raw material	2000	2001	2002	2003	2004
Import, kt	66	92	91	72	87
Export, kt	33	25	29	50	53

7204 – Ferrous waste and scrap

Raw material	2000	2001	2002	2003	2004
Import, kt	183	347	372	506	528
Export, kt	988	1 000	1 058	1 179	1 632

6. Prices

7.56 million tonnes of Fe ores were imported at average price of CZK 1,745 per tonne in 2004. The import prices almost doubled in comparison with 2003 due to significant increase of the world prices of iron ores. Iron ores were imported mainly from Ukraine (60.9 %) and from Russia (33.1 %). In addition, 87 kt of crude iron were imported (67.7 % from Russia, 15.5 % from Slovakia) at average price CZK 9,535 per tonne and 53 kt of crude iron were exported (28.6 % to Poland, 23.5 % to Germany, 20.8 % to Slovakia) at average price of CZK 7,513 per tonne. The Czech export increased again in the last two years after the significant decrease in the years 1999-2002. It is nevertheless still relatively low compared to the 1994 – 1998 period, when it reached 160 to 230 kt. 528 kt of ferrous waste and scrap were imported (51.9 % from Poland, 44 % from Slovakia) for CZK 5,602 per tonne; 1,632 kt were exported at average price of CZK 5,845 per tonne to Germany (58.7 %), Austria (21.5 %) and Poland (12.2 %).

7. Mining companies in the Czech Republic as of December 31, 2004

In 2004, the same way as before, no mining companies were operating in the Czech Republic to extract iron ores.

8. World production

World production of iron ores has been still increasing since the 1930s with an average annual production of approx. 100 million tonnes. The world mine production exceeded the 1 mlld limit in the mid-1990s. It more or less stagnated during the next ten years. A significant change in the volume of the mine production did not occur until the recent years and it is related to an

important increase of crude iron and steel consumption in populated, rapidly developing countries of the third world (China, India, Brazil et al.).

World mine production of iron ores

Year	2000	2001	2002	2003	2004 e
Mine production, mill t (according to MCS)	1 060	1 060	1 080	1 160	1 250
Mine production, mill t (according to WMS)	1 085	1 049	1 118	1 238	N

Main mine producers´ share in the world mining output (2003, according to MCS):

China	22.5 %
Brazil	18.3 %
Australia	16.1 %
India	9.1 %
Russia	7.9 %
Ukraine	5.3 %
USA	4.0 %

Brazil and Australia reached also high share in the world export of iron ores.

World production of crude iron

Rok	2000	2001	2002	2003	2004 e
Production, mill t (according to MCS)	571	581	604	647	703
Production, mill t (according to WMMR)	562	626	653	705	N

Main producers of crude iron (2003, according to MCS):

China	31.2 %
EU	13.8 %
Japan	12.7 %
Russia	7.5 %
USA	6.3 %
Ukraine	4.6 %
Brazil	4.6 %
South Korea	4,6 %

World production of steel

Year	2000	2001	2002	2003	2004 e
Production, mill t (according to MCS)	845	851	904	962	1 030
Production, mill t (according to WMMR)	847	850	903	967	N

Main producers of crude steel (2003, according to MCS):

China	22.9 %
EU	15.9 %

Japan	11.5 %
USA	9.7 %
Russia	6.5 %
South Korea	4.8 %
Ukraine	3.8 %

9. World market prices

Prices of the European market are quoted in FOB for calendar year in USc/mtu. Prices FOB are being established with regard to shipping costs of the major importers in order to maintain similar prices of ores having a similar grade in CFR North Sea ports. This is why the FOB prices of ores of similar grade of suppliers from various regions differ from each other.
Steep increase of the iron ore world prices occurred in 2004 as a result of an elevated demand from the side of China, which, though the biggest world producer, has become an important iron ore importer recently, too. Companhia Vale do Rio Dolce (CVDR) company, the biggest world producer of iron ores, announced in February 2005, that it concluded an agreement on raw material supply for Japan (Nippon Steel Corporation), Taiwan and Australia at prices by 71.5 % higher than those of the year 2004. Prices reached 79.58 USc/mtu (Carajás Lump) and even 115.51 USc/mtu (Blast Furnace Pellets) in the first half of the year 2005.

Quoted prices of staple traded iron ores according to their grade in USc/mtu FOB are as follows:

A Brazilian fine ore CJF (Carajás Fines)
B Brazilian lump ore CJL (Carajás Lump)
C Australian fine ore (Mt. Newman Fines)
D Mauretanian fine ore (TZF Fines)
E Brazilian pellets BFP (Blast Furnace Pellets)

Commodity/Year	2000	2001	2002	2003	2004
A	28.79	30.03	29.42	28.84	37.90
B	33.94	35.04	34.31	37.36	44.46
C	36.50	38.15	37.39	30.83	33.99
D	29.94	31.40	30.78	30.30	37.75
E	49.24	50.10	47.36	52.00	61.88

Costs for imports of iron ores from Western Australia and Brazil to Europe depend on cargo volume. In case of 200,000 tonnes cargo they fluctuate between 3.7 and 6.5 USD per tonne, on case of cargo from 60,000 to 65,000 tonnes costs increase by USD 1.5 – 3 per tonne.

10. Recycling

Metal recycling is widely used. Iron scrap (steel scrap and cast iron scrap) is widely used in production of crude steel but very little in production of pig iron. The share of iron scrap in production of crude steel was 40 % worldwide in the last twenty years (according to UNCTAD) and the same share of iron scrap has been reached in the Czech Republic. The reason for the high recycling ratio is in particular the reduction of fuels and energy consumption by as much as 80 % versus energy consumption when using pig iron as a charge in steel-making furnaces. Production of steel requires mostly chemically pure and high-grade iron scrap, i.e. scrap availability of which continues to decrease with increasing portion of continuous steel casting. Processing scrap

and particularly the increasing proportion of consumer's iron scrap does not meet specific requirements of the steel industry. Electric furnaces have the major share in consumption of iron scrap, allowing as much as 100 % charge of iron scrap.

11. Possible substitutes

Iron ore in pig iron production can be substituted by iron scrap up to 7 % of the charge. Steel products can be substituted to a certain extent by products of other metals, alloys, glass, ceramics and composite materials.

MANGANESE

1. Characteristics and use

Manganese is one of the most abundant elements in the Earth´s crust and it forms easily various compounds in the nature due to its chemical character. There are two principal types of manganese deposits – marine chemical sediments and deposits of oxidation zone enriched in manganese. The former type represents the majority of known reserves of manganese. Resources occurring in the Earth's crust are equal to 3,630 mill tonnes, of which reserves of high grade ore having over 44 % Mn represent 500 to 600 mill tonnes. Prognosed resources confined to deep-sea nodules having an average content of 25 % Mn represent about 358 million tonnes of metal. Among 300 known manganese minerals only 12 are principal constituents of economic deposits. The following are the most important: pyrolusite, psilomelane, manganite, braunite and hausmannite. Manganese world reserves are estimated at 805 mill tonnes. Manganese contents in traded ores range between 35 and 54 %.

More than 90 % of manganese is used for production of manganese ferro-alloys for the iron industry both in production of pig iron and particularly in the steel industry as a desulphurizing and deoxidizing agent and as an important alloying metal. The average world consumption of manganese is 10 kgs in 1 tonne of crude steel, in up-to-date steelworks the minimum is 6 kgs. Manganese is also used in alloys with non-ferrous metals (Al, Cu, Ti, Ag, Au, Bi). Another applications are in the manufacture of dry batteries, colouring agents, soft ferrites, fertilizers, feed for animals, fuel additives, welding electrodes, water treatment, etc. Manganese raw materials are classified into metallurgical, chemical and for batteries production based on the use and demands on quality of ores or concentrates.

2. Mineral resources of the Czech Republic

The Czech Republic has no Mn ore reserves other than Chvaletice deposit with poor ores, exploitation of which is problematic. Mn contents in currently mined ores in the world are about 30-50 % in primary, mainly metamorphic ores and significantly over 10% in sedimentary ores.

- The most significant accumulations of Mn ores are known from the Železné hory Mts. area, where they are confined to volcano-sedimentary deposits of the Proterozoic. The mineralization is associated with a horizon of graphitic-pyritic slates, which have been metamorphosed together with neighbouring rocks. The ore horizon extending from Chvaletice to Sovolusky is composed of a mixture of Mn and Fe carbonates (mainly Fe-rhodochrosite), quartz, graphite and Fe-sulphides. Silicates of Mn originated during the regional metamorphic processes. The ore contains up to 13 % Mn.
- Major mining operations were executed at Chvaletice deposit. First only Fe ores of the gossan type (since the 17th century) and since World War I also experimentally Mn ores were mined on the outcrops. Pyrite was mined since the 1950s until the termination of mining operation in 1975 as a raw material for the chemical industry. Mn ores were extracted along with pyrite but due to incomplete technology were not processed and were deposited in tailing ponds at the former mineral processing plant. Average Mn content in the tailing pond No 3 is 9-11 % and in the tailing ponds No 2 and 3 between 5 and 8 %. Desulphurization of combustion products could represent a potential use of these ores.
- Other occurrences of Mn ores in the Czech Republic (e.g. Horní Blatná, Arnoštov, Maršov near Veverská Bítýška et al.) were not of any economic importance.

3. Registered deposits and other resources in the Czech Republic

reserved registered deposits exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Chvaletice 2 Chvaletice-odkaliště 1,2 (Chvaletice-tailing ponds No 1 and 2) 3 Řečany-odkaliště 3 (Řečany-tailing pond No 3)

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
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

5. Foreign trade

2602 – Manganese ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, t	10 436	7 314	11 507	11 966	11 291
Export, t	31	0	163	33	558

720211; 720219 – Ferro-manganese

Raw material	2000	2001	2002	2003	2004
Import, t	17 569	20 717	21 055	24 154	25 670
Export, t	658	810	233	533	2 007

720230 – Ferrosilicomanganese

Raw material	2000	2001	2002	2003	2004
Import, t	22 291	25 660	26 130	55 989	55 809
Export, t	68	926	331	50	2 040

8111 – Manganese and articles thereof, including waste and scrap

Raw material	2000	2001	2002	2003	2004
Import, t	244	206	376	386	592
Export, t	26	0	0	4	10

2820 – Manganese oxides

Raw material	2000	2001	2002	2003	2004
Import, t	1 255	1 310	1 660	1 386	787
Export, t	31	65	223	238	318

6. Prices

In 2004, average import prices of manganese ores and concentrates were CZK 5,386 per tonne. 11.3 kt of the ores were imported, out of which 55.7 % came from Georgia, 23.4 % from Ukraine and 16.1 % from the Netherlands.

Ferroalloys represented the most important item of the foreign trade. 25.7 kt of ferromanganese were imported at average price of CZK 28,746 per tonne from Slovakia (32.6 %), Ukraine (32.4 %) and Norway (18.7 %). Almost 56 kt of ferrosilicomanganese were imported from Slovakia (47.1 %), Ukraine (19.3 %) and Romania (14.1 %). The average price was CZK 25,895 per tonne. 0.8 kt of manganese oxides were imported at average price of CZK 18,235 per tonne from India (51.4 %), Belgium (26.0 %) and Brazil (19.7 %). 592 t of manganese, manganese products and manganese waste and scrap were imported at average price of CZK 41,557 per tonne from Germany (68 %), China (6.7 %) and South Africa (6.7 %). Export of all these items was not significant in 2004.

7. Mining companies in the Czech Republic as of December 31, 2004

In 2004, no mining companies were operating in the Czech Republic to extract manganese ores.

8. World production

Production of manganese ores is actually copying the production of iron ores, because their consumption is connected with the production of pig iron and steel. The individual yearbooks differ significantly as the estimates of the world production concerns: whereas mine production of about 7 to 8 mill tonnes was given in Mineral Commodity Summaries (MCS), the mine production was considerably higher in individual years according to the Welt Bergbau Daten (WBD).

Year	2000	2001	2002	2003	2004 e
Mine production, kt Mn (MCS)	7 280	7 600	8 100	8 200	11 000
Mine production, kt Mn (WBD)	10 077	11 026	12 200	13 187	N

Main mine producers´ share in the world mining output (2003; according to MCS):

South Africa	19.5 %
Australia	14.6 %
Brazil	12.1 %
Ukraine	10.7 %
Gabon	10.6 %
China	9.8 %
India	7.6 %

Operating technologies of manganese nodules offshore mining were by the end of the 2004 at disposal in France, Japan, Germany, the USA (consortia), Russia, South Korea, India and China. Czech Republic as a member of the international Interoceanmetal (IOM), established in 1987 with the main aim to utilize mineral resources from the seabed, has one fifth share in about 75,000 km^2 IOM claim of the ocean bottom in the north-eastern part of the tectonic zone Clarion–Clipperton in the sub-tropic part of the northern Pacifik, where nodules with promising contents of Mn, Cu, Co, Ni but also Zn, Pb, Mo et al. occur.

9. World market prices

Basically three types of manganese ore are traded on the world market – metallurgical ore (38 to 55 % Mn), raw material with a content of 48–50 % Mn as a standard for production of manganese ferro-alloys, and chemical and battery grade ores with 70 to 85 % Mn. Only metallurgical ore of grade 48– 50 % Mn with maximum 0.1 % P is quoted on a long-term basis on the world market. The price is quoted on a USD/mtu basis CFR Europe. The price in the eighties fluctuated on average around USD 1.5 per mtu until 1988. Then price increased and reached its peak in 1990 and 1991 (USD 4 per mtu). Since this period the prices have been decreasing again. The major cause was decline in market demand owing to a world economic recession and continuous reduction of Mn content in pig iron. The average prices of the given manganese ore grade at year-end (commodity A):

Commodity/Year	2000	2001	2002	2003	2004
A	1,99	1,99	1,99	1,99	1,97

10. Recycling

Recycling of manganese is of only minor importance because of easy availability and relatively low price of primary manganese raw materials. Only scrap from iron and non-ferrous metals production and particularly steel slag rich in Mn in form of MnO and MnS are recycled to a certain extent. Manganese from used electric dry batteries is also recycled to a lesser extent.

11. Possible substitutes

No substitute for manganese in principal areas of use exists. In steel manufacture, other deoxidizing additives – silicon, aluminium, complex alloys and rare earth elements – can substitute it to a certain extent, conditioned by economic parameters.

COPPER

1. Characteristics and use

Copper deposits can be divided into five main groups (according to their origin) – porphyry copper deposits with Mo, stratabound, sulphide in greenschists, magmatic with Ni (Pt) and hydrothermal (vein) deposits. About one half of known mined Cu deposits belong to porphyry type. Among 300 known Cu minerals only a few sulphides are of economic importance: chalcopyrite, covellite, Cu-pyrite, chalcosine, bornite and enargite. Economic world reserves of Cu in ore are estimated at 0.3 milliard tonnes, reserves of Cu in deep-sea nodules are estimated at 0.7 milliard tonnes. About one half of the mined Cu deposits belong to the porphyry type.
Much copper is used in electrotechnics (50 %), in the engineering (20 %) and building industries. Majority of copper is used in alloys, particularly in brass and bronze.

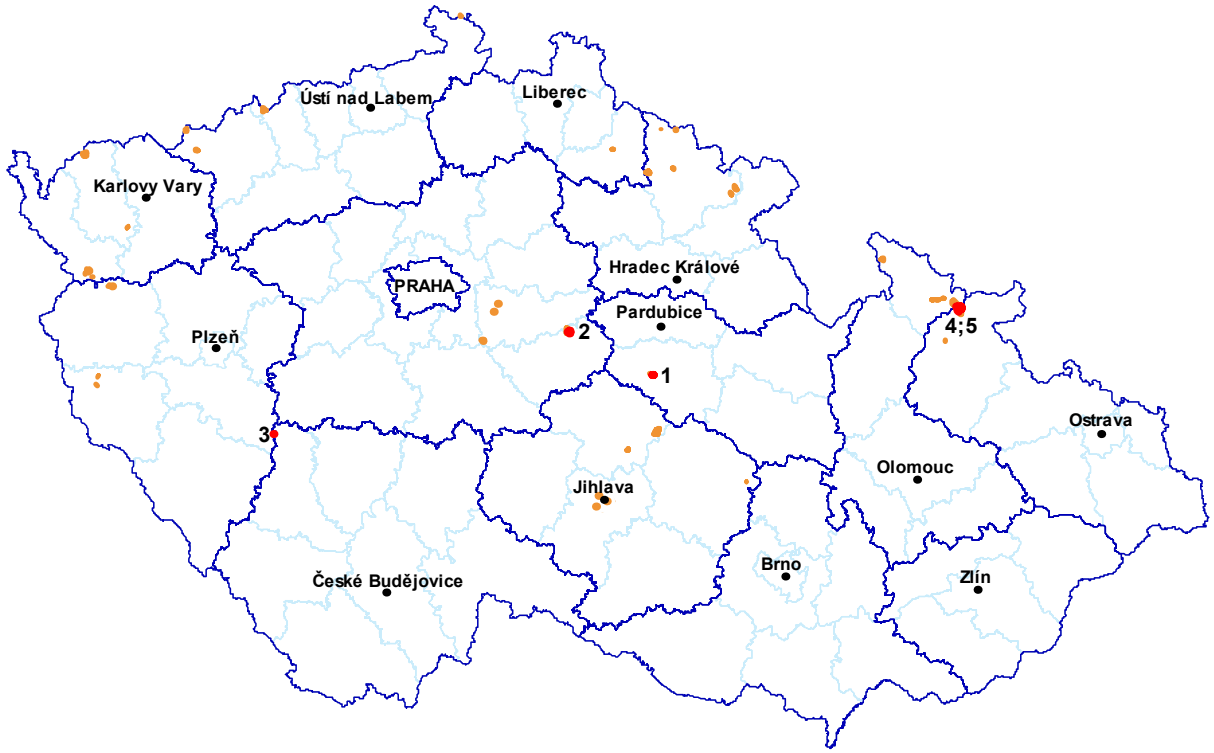
2. Mineral resources of the Czech Republic

There are no economically exploitable Cu ore deposits in the Czech Republic. Cu ores of various genetic types occur here and were exploited in the past.

- Major mining activities were focused on volcano-sedimentary sulphide deposits of the Zlaté Hory mining district. The mineralization is associated with the spilite-keratophyre volcanism and is localized in volcanosedimentary complex of the Vrbno Formation of the Devonian. Individual types of local ores – Cu monometallic, complex Cu-Pb-Zn with Au and Pb-Zn - occur separately in space and show a certain zonation. About 50 % of the economic reserves have been confined to complex ores, 25 % to monometallic, and 25 % to Pb-Zn ores. Monometallic ores consist of chalcopyrite with varying admixture of pyrite or pyrrhotite. Their grade ranges between 0.4 % and 0.7 % Cu. These ores were mined at deposits Zlaté Hory-jih and Zlaté Hory–Hornické skály. Mining of these ores at the Zlaté Hory deposit was terminated in 1990. 5,808 kt of ore containing 34,741 t of copper were mined in 1965-1990 period.
- Stratabound monometallic Cu ores (chalcopyrite) confined to a low-grade metamorphic volcaniclastic complex were discovered and their reserves evaluated and explored in the deposit of Tisová near Kraslice. Mining of local ores, having about 1 % Cu, was terminated in 1973. A mineral exploration project was then executed in the ore district in the eighties, but mining was not resumed and the deposit was temporarily flooded.
- Less important Cu mineralizations and/or Cu-Zn-Pb ores of stratabound type pyrite formation are known at numerous localities of the Bohemian Massif (e.g. Staré Ransko, Křižanovice, Svržno).
- Hydrothermal (vein) Cu deposits (Rybnice, Rožany, Tři Sekery) and sedimentary Cu ores (Krkonoše Mts. piedmont) were of a historical importance only. A very poor abandoned deposit Horní Vernéřovice–Jívka was exploited here in 1958-1965.

Mining of Cu ores in the Czech Republic was terminated in 1990 and the deposits have been gradually eliminated from The Register.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Křižanovice
2 Kutná Hora
3 Újezd u Kasejovic
4 Zlaté Hory-Hornické Skály
5 Zlaté Hory-východ

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number a)	9	9	7	5	5
exploited	0	0	0	0	0
Total mineral reserves, kt Cu	115	115	111	51	51
economic explored reserves	0	0	0	0	0
economic prospected reserves	2	2	0	0	0
potentially economic reserves	113	113	111	51	51
Mine production, kt Cu	0	0	0	0	0

Note:
a) deposits with registered Cu content

5. Foreign trade

2603 – Copper ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, t	0	0	0	2	0
Export, t	43	69	92	45	21

7402 – Unrefined copper

Raw material	2000	2001	2002	2003	2004
Import, t	1	14	4	9	1 130
Export, t	0	0	1	0	2

7403 – Refined copper and copper alloys

Raw material	2000	2001	2002	2003	2004
Import, t	14 223	18 345	12 006	6 209	4 631
Export, t	5 605	1 909	1 727	977	7 827

7404 – Copper waste and scrap

Raw material	2000	2001	2002	2003	2004
Import, t	3 133	2 759	1 656	2 080	5 621
Export, t	37 390	39 503	38 212	36 874	53 013

6. Prices

In 2004, almost 4.6 kt of refined copper and copper alloys were imported from Poland (42.0 %), Germany (30.1 %) and Austria (19.1 %) at average price of CZK 75,235 per tonne. 7.8 kt were exported mainly to Germany (71.9 %), Austria (6.3 %) and Luxembourg (6.2 %) at average price of CZK 69,647 per tonne. Copper import decreased by full three quarters compared to the year 2001. Copper waste and scrap represented an important item of foreign trade in the last year, too. Almost 5.6 kt were imported on price of CZK 44,949 per tonne from Slovakia (34.7 %), Poland (31.0 %) and Germany (22.1 %). Export of copper waste and scrap was nine times higher than the import – 53 kt were exported mainly to Germany (51.5 %), Poland (13.3 %) and Slovakia (8.8 %). Import of Cu-ores was negligible; 21 t were exported (100 % to Slovakia). Foreign trade in unrefined copper was insignificant with an exception of a deviation in 2004.

7. Mining companies in the Czech Republic as of December 31, 2004

In 2004, no companies were operating in the Czech Republic to extract Cu ores.

8. World production

Production of Cu ores continues to rise and it conforms to the increasing world consumption (industrial countries show an increase in copper consumption by 3 % per year on average in the last decade). World production represents about 13.0 to 14.5 mill tonnes per year at present. Mine production of Chile has been increasing in the last years (from 2.2 mill tonnes in 1994 to 4.9 mill tonnes in 2003). Mine production of Peru and since 1997 also Argentine has been increasing with similar dynamics. On the contrary, mining production of the USA has been

decreasing. Mine production of the European largest producer Poland has been stable around 450-500 kt per year.
World production data are adopted from Mineral Commodity Summaries (MCS), the International Copper Study Group (ICSG) database and the yearbook Estadísticas del Cobre y otros Minerales published by a renowned institute Comisión Chilena del Cobre (COCHILCO).

Year	2000	2001	2002	2003	2004 e
Mine production, kt Cu (MCS)	13 200	13 700	13 600	13 600	14 500
Mine production, kt Cu (ICSG)	13 211	13 626	13 581	13 674	14 513
Mine production, kt Cu (COCHILCO)	13 233	13 729	13 560	13 605	N

Main mine producers´ share in the world mining output (2004; according to COCHILCO):

Chile	36.0 %
USA	8.3 %
Indonesia	7.4 %
Australia	6.4 %
Peru	6.2 %
Russia	4.9 %
China	4.3 %
Canada	4.1 %
Kazakhstan	3.6 %
Poland	3.4 %

9. World market prices

Copper ores are not quoted on the world market; sales are based upon negotiated prices only. Prices of Cu metal (Grade A Electrolytic Copper) are commonly quoted at LME. The highest annual average was recorded in 1989 – GBP 1,734.14 per tonne (Cash). The following temporary decrease in prices was caused by a surplus production, particularly due to supplies from the East European countries and by the decrease in consumption resulting from the global economic recession. The prices hit twelve-year minima in the first part of the year 1999. This trend has not changed until the second half of the year 2003, by the end of which the prices reached the limit of USD 2,300 per tonne. Prices of all non-ferrous metals on the world marked significantly hardened during the year 2004. Copper prices increased up to 3,300 USD/t in this period, the evident cause being a high demand from the side of rapidly growing economies of Asia.
The average annual metal price (commodity A) at LME in USD per tonne (Cash) was as follows:

Commodity/Year	2000	2001	2002	2003	2004
A	1 814	1 577	1 557	1 779	2 868

10. Recycling

Copper belongs to metals, which are recycled on a large scale. The proportion of recycled copper reached about 20 % of total world metal production in the 2004. Copper is recovered mainly through pyrometallurgical processes, to lesser extent through hydrometallurgy.

11. Possible substitutes

Aluminium replaces copper in electrotechnics, in the manufacture of car radiators and refrigerators. Titanium and steel despite their worse conductivity substitute for copper in the production of heat exchangers. Steel substitutes for copper in the manufacture of ammunition, too. Optical fibres in telecommunication and plastics in water distribution (lines) and the building industry are other substitutes.

LEAD

1. Characteristics and use

Lead deposits are of five main genetic types – sedimentary, volcanosedimentary, metasomatic, contact metamorphic and hydrothermal (veins). Major part of the world production comes from the first type. The principal ore mineral is galena, usually accompanied by sphalerite, pyrite and chalcopyrite. Exploited ores are mostly of polymetallic character with various contents of minor metals – Cd, Ge, Ga, In, Tl, Ag and Au. The ore is designated as lead ore providing the Pb : Zn ratio is higher than 4. Proved economic reserves of Pb metal in the world are estimated at 69 mill tonnes. They occur mainly in Australia, the USA, China and Canada. Lead is used mainly in manufacture of accumulators and batteries (70 %) and lead pigments and chemicals (13 %). Lead is also used in rolled and extruded products, in shielded cables, in alloys, in ammunition. Its use as additive in gasoline is on decline. High toxicity of lead leads to a reduction of its consumption in some industries; e.g. consumption index in gasoline production 1990/1985 was equal to 0.64.

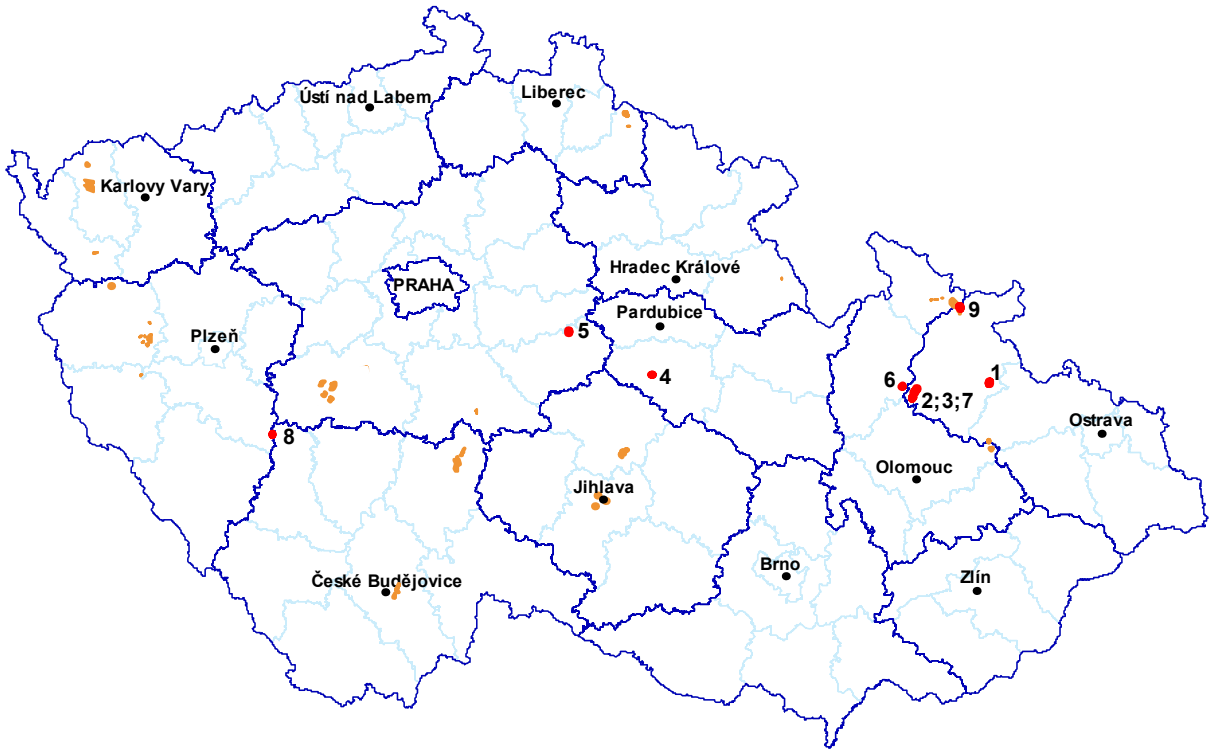
2. Mineral resources of the Czech Republic

Mining of vein-type hydrothermal base metal deposits brought fame and glory to the medieval ore mining in Bohemia. These deposits due to the silver contents in these ores, which were later in 16th century used for extraction of lead and then even for zinc. After World War II, new exploration projects turned the attention to volcanosedimentary deposits of the sulphide formation.

- Hydrothermal vein base metal mineralization is abundant in the Bohemian Massif. Besides medieval ore districts of Jihlava, Havlíčkův Brod, Oloví, Stříbro and the Blanice Furrow and others, the mining districts of Příbram, Stříbro and Kutná Hora maintained their significance till the 20th century. The major Pb mineral is galena (more or less Ag-bearing), which can be as abundant as sphalerite in the majority of Pb-Zn deposit. Only the Kutná Hora ore district shows considerably lesser contents of galena relative to sphalerite in the majority of veins.
- A distinct type of hydrothermal vein mineralization occurred at Harrachov, where galena is accompanied by barite and fluorite.
- Stratabound base metal ores of volcanosedimentary origin related to Devonian volcanism were explored in the fifties through to eighties in northern Moravia. Extensive mining was focused on the deposits of Horní Město, Horní Benešov, Zlaté Hory-východ and Zlaté hory-západ. Contents of lead varying up to 0.5 % are bound in galena, accompanied in ore bands by sphalerite. Mining of any other base metal deposits of similar origin has not started because of reduction of ore mining.

Mining of base metal deposits in the Czech Republic was terminated at the beginning of 1994. A complex Pb-Zn concentrate represented a final product of mining. This concentrate was exported, as there was no domestic capacity for its smelting. Reserves of base metal ores have been gradually eliminated from The Register.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Horní Benešov
2 Horní Město
3 Horní Město-Šibenice
4 Křižanovice
5 Kutná Hora
6 Oskava
7 Ruda u Rýmařova-sever
8 Újezd u Kasejovic
9 Zlaté Hory-východ

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number a)	11	11	9	8	8
exploited	0	0	0	0	0
Total mineral reserves, kt Pb	194	194	173	152	152
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	194	194	173	152	152
Mining production, kt Pb	0	0	0	0	0

Note: a) deposits with registered Pb content

5. Foreign trade

2607– Lead ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, t	0	0	0	506	0
Export, t	211	0	0	0	0

7801– Unwrought lead

Raw material	2000	2001	2002	2003	2004
Import, t	52 886	58 777	56 941	55 699	73 472
Export, t	9 200	6 786	5 724	7 112	7 207

7802 – Lead waste and scrap

Raw material	2000	2001	2002	2003	2004
Import, t	656	1 554	184	908	1 348
Export, t	4 152	3 750	3 346	2 926	3 059

6. Prices

55.7 kt of crude lead were imported from Germany (68.2 %), from Sweden (14.9 %) and from Poland (6.7 %) in 2004. The average price was CZK 21,355 per tonne. 7.2 kt of crude lead were exported to Germany (60.6 %), Poland (28.2 %) and Hungary (5.6 %) at average price of CZK 25,726 per tonne. 1.35 kt of lead waste and scrap were imported from Hungary (43.5 %), Poland (29.0 %) and Germany (16.7 %) at average price of CZK 18,540 per tonne in 2004. Significantly higher export of lead waste and scrap (3.1 kt) went practically exclusively to Germany. The average price was CZK 12,365 per tonne.

7. Mining companies in the Czech Republic as of December 31, 2004

In 2004, no companies exploiting ores with Pb content were operating in the Czech Republic.

8. World production

The world production exceeded the level of 3 mill tonnes of metal content in 1968. The largest production so far was recorded in 1977 – 3,657 kt.

Since the second part of 1990s, the world mine production has been oscillating around 3,000 kt. Data according to Mineral Commodity Summaries (MCS), International Lead and Zinc Study Group (ILZSG) database and yearbook Welt-Bergbau-Daten (WBD):

Year	2000	2001	2002	2003	2004 e
Mine production, kt Pb (MCS)	3 100	3 100	2 910	2 950	3 150
Mine production, kt Pb (ILZSG)	NA	2 998	2 829	3 097	3 066
Mine production, kt Pb (WBD)	2 997	3 064	2 913	2 978	N

Main producers´ share in the world mining output (2003; according to MCS):

Australia	23.5 %
China	22.4 %
USA	15.6 %
Peru	10.4 %
Canada	5.1 %
Mexiko	4.7 %
Sweden	1.7 %

Metal production

Year	2000	2001	2002	2003	2004 e
Metal production, kt Pb (according to ILZSG)	N	6 579	6 662	6 723	6 777

9. World market prices

On the world market, the price of lead concentrate of grade 70-80 % Pb is quoted in USD/t, CIF Europe (commodity A) and on T/C basis. The price of concentrate exceeded a limit of USD 100 per tonne at the end of 1987 and since then it was gradually increasing by almost 100%. Metal price at LME (commodity B, refined metal having minimum 99.97 % Pb) reached its peak in 1979 – GBP 556 per tonne (Cash). The price of lead has been decreasing in the last years; mostly it was oscillating under the level of USD 500 per tonne in 2000 and 2002. This trend changed in the second half of the year 2003, during which the prices increased up to the limit of USD 700 per tonne. Prices of all non-ferrous metals on the world market significantly hardened during the year 2004. Lead prices increased up to the extraordinary level of 1,040 USD/t in this period. It was again a high demand from the side of rapidly growing economies of Asia which caused this increase.

The price was quoted by June 1993 in GBP/t and in the following period in USD/t.

An average price of commodity A at year-end and an average annual price of commodity B per tonne:

Commodity/Year	2000	2001	2002	2003	2004
A	187	110	110	110	110
B	454	476	452	515	888

10. Recycling

The share of recycled lead in world production of Pb metal has been continuously increasing. This trend leads to a decrease in demand for lead concentrates and it also affects their price. Due to the high lead consumption in the accumulator and battery production, batteries represent the most recycled material. Less recycled is scrap from consumer's and manufacture industries. Recycled lead has supplied 59 % of the metal world production according to the UNCTAD data. Mainly Japan, Germany, France, Great Britain, the USA and Canada took part in the recycling. It is at the same time estimated, that about 85 % of products made of or containing lead were recycled in 2004. According to the Battery Council International, 97 % of lead accumulators are recycled at present.

11. Possible substitutes

Lead used for piping in the building industry and for electric cables is being replaced by plastics. Aluminium, tin, iron and plastics gradually replace lead in packing and preserving of products. Tetraethyl lead used as anti-knock additive in gasoline is replaced by aromatic hydrocarbons. Other agents are also efficiently replacing lead in the manufacture of pigments. The volume of lead substitutes continues to increase and will include even the manufacture of accumulators and batteries. Lead in solders is being efficiently replaced by tin.

1. Characteristics and use

The major economic mineral of zinc is sphalerite, which is usually accompanied by galena, pyrite and chalcopyrite in base metal deposits. The ore is marked as zinc ore providing the Zn : Pb ratio is higher than 4. Sphalerite usually contains cadmium, whose concentrations vary from traces up to 2 %, then germanium, gallium, indium and thallium. Zinc ores occur mostly in base metal deposits of various origins, the same way as lead ores. Economic demonstrated reserves of Zn in the world are estimated at 144 mill tonnes. Potential source of zinc may be also zinc-bearing coal, in which the content of zinc is estimated at an order of millions of tonnes.
Much zinc is used in zinc plating (47 %), in alloys (particularly brass – 19 %), in castings (14 %), in rolled materials for the building industry and manufacture of batteries (7 %), etc. As for the volume, zinc represents the 3rd most used non-ferrous metal after aluminium and copper.

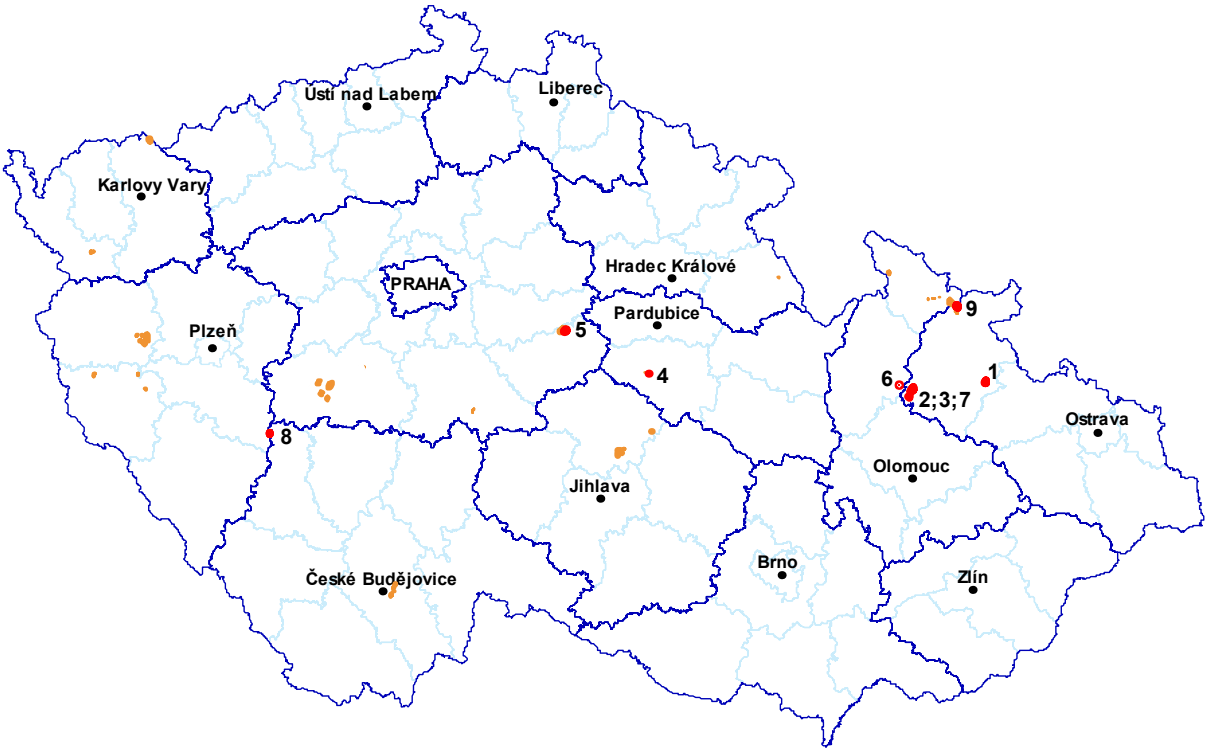
2. Mineral resources of the Czech Republic

Zinc ores almost exclusively occur as a part of base metal ores Pb-Zn±Ag (±Cu) of hydrothermal or volcanosedimentary origin.

- Large volume of zinc ores represented mostly by sphalerite was extracted from the vein-type base metal deposits of the Březové Hory, Bohutín and Vrančice ore districts in the vicinity of Příbram (until 1962). The grade of these ores ranges between 1.0 and 2.9 %. Other base metal deposits were explored and partly mined in the period after World War II: in the northern part of the Kutná Hora district (Rejské pásmo, Turkaňské pásmo and Staročeské pásmo zones), in the Havlíčkův Brod district (Stříbrné Hory, Dlouhá Ves, Bartoušov) and in western Bohemia (Stříbro, Kšice).
- The most important base metal deposits of volcanosedimentary origin occur in the Jeseníky Mountains. Disseminated sulphide ores grading 1.1 – 1.8 % Zn were mined in the deposits of Horní Město (1967 - 1970) and Horní Benešov (1963 - 1992). 6,561 kt of ore containing 39,210 t of lead and 90,711 t of zinc were mined from both deposits in 1963 – 1992. Mining of the Au-Zn ores at Zlaté Hory–východ deposit in the Zlaté Hory ore district was terminated in 1994. 771.6 kt of base metal ores containing 9,111 t Zn, 395 t Pb and 1559 kg Au was mined at Zlaté Hory–východ and Zlaté Hory-západ deposits in 1988 - 1994.
- The deposit of Staré Ransko-Obrázek is probably of polygenetic origin. Sphalerite-barite ore, having up to 1.8 % Zn, was mined here until 1990. The Křižanovice deposit of Pb-Zn-Cu ores with barite belongs to deposits of unclear genesis, too. The ore contained about 4–6 % Zn. The deposit was discovered during an exploration project in the eighties.

The production of Zn ores in the Czech Republic was terminated at the beginning of 1994, in line with the policy of a gradual reduction of ore mining adopted by the Government. A composite Pb-Zn concentrate was the final product of the base metal ores mining. The concentrate was exported because there was no smelter in the Czech Republic. Base metal reserves have been gradually eliminated from the The Register.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Horní Benešov
2 Horní Město
3 Horní Město-Šibenice
4 Křižanovice
5 Kutná Hora
6 Oskava
7 Ruda u Rýmařova-sever
8 Újezd u Kasejovic
9 Zlaté Hory-východ

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number a)	12	12	10	9	9
exploited	0	0	0	0	0
Total mineral reserves, kt Zn	740	740	652	477	477
economic explored reserves	0	0	0	0	0
economic prospected reserves	5	5	0	0	0
potentially economic reserves	735	735	652	477	477
Mine production, kt Zn	0	0	0	0	0

Note:
a) deposits with registered Zn content

5. Foreign trade

2608 – Zinc ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, t	1	0	2	0	0
Export, t	0	0	0	0	21

7901– Unwrought zinc

Raw material	2000	2001	2002	2003	2004
Import, t	27 724	27 142	27 102	28 748	34 181
Export, t	2 865	1 571	1 251	1 670	5 570

7902 – Zinc waste and scrap

Raw material	2000	2001	2002	2003	2004
Import, t	16	28	16	25	220
Export, t	2 750	2 266	2 328	2 247	2 976

6. Prices

34 kt of crude zinc were imported from Poland (50.1 %), Germany (5.1 %) and Belgium (8.6 %) in 2004. The average price was CZK 30,231 per tonne. 5.6 kt of crude zinc were exported – 65.5 % back to Poland, 25.8 % to Slovakia and 7.6 % to Germany at average price of CZK 27,378 per tonne. 3.0 kt of zinc waste and scrap were exported to Germany (35.5 %), Austria (21.0 %) and Belgium (18 %) at average price of CZK 16,033 per ton. Only 220 t were imported (65.4 % from Slovakia, 28.2 % from Germany) at average price of CZK 18,226 per tonne. Foreign trade in Zn-ores has been insignificant.

7. Mining companies in the Czech Republic as of December 31, 2004

In 2004, no companies were operating in the Czech Republic to extract Zn ores.

8. World production

Production of zinc ores exceeded 7 mill tonnes in metal content in 1985. Increase in production terminated in 1992 and in the next years mine production was decreasing. High increase in stock and increase of recycled metal proportion in the total production, covering increase of demand, were the cause of the above mentioned decline. The production has been increasing again since 1994. It was higher than 8 mill t in 1999; the 9 mill tonne limit was according to the international statistics exceeded in the 2002-2003 period. While the Canadian production has been decreasing, mine production of Peru has been increasing in the recent years. The most significant increase in mining production was monitored in China (1,000 kt in 1995; 1,476 kt in 1999; 1,700 kt in 2001; 2,200 kt in 2003). Data come from Mineral Commodity Summaries (MCS), International Lead and Zinc Study Group (ILZSG) database and the yearbook Welt-Bergbau-Daten (WBD).

Year	2000	2001	2002	2003	2004 e
Mine production, kt Zn (MCS)	8 730	8 850	8 360	9 010	9 100
Mine production, kt Zn (ILZSG)	NA	8 934	8 900	9 576	9 632
Mine production, kt Zn (WBD)	8 220	8 765	9 332	9 330	N

Main producers´ share in the world mining output (2003; according to MCS):

China	18.3 %
Australia	16.4 %
Peru	13.9 %
Canada	11.1 %
USA	8.2 %
Mexico	5.1 %
Kazakhstan	4.4 %

Metal production

Year	2000	2001	2002	2003	2004 e
Metal production, kt Zn (according to ILZSG)	NA	9 221	9 721	9 885	10 189

9. World market prices

Since 1992 two grades of zinc concentrate have been quoted on the world market – sulphide concentrate grade 49-55 % Zn (commodity A) and sulphide concentrate grade 56-61 % Zn (commodity B) in USD/t of dry substance, in transport parity CIF main European ports and on the T/C basis. The price of pure metal grading 99.995 % Zn (commodity C) is quoted at LME in USD/t. The price of sulphide concentrates (different in quality than above mentioned) and pure metal reached its peak in 1989. Later on, a significant fall in prices occurred owing to a continuous increase in stock. Price of the zinc concentrates decreased below the limit of USD 150 per tonne in the years 2002 – 2003. The same way, the pure metal prices were very low in the years 2001 and 2002 – about half compared to the year 1997. The world prices of the pure zinc started to increase again only in the second half of the year 2003. Prices of all non-ferrous metals on the world market significantly hardened during the year 2004. Zinc prices oscillated between 940 and 1,220 USD/t in 2004. The increase of prices was caused by an increasing demand from the side of rapidly developing (mainly Asian) economies.

The trend in average prices of the commodities (A and B – year-end, C – annual) was as follows:

Commodity/Year	2000	2001	2002	2003	2004
A	189	189	169	146	146
B	190	190	170	146	146
C	1 128	886	778	828	1 047

10. Recycling

Zinc scrap – metal scrap, galvanized plates, alloys, flue dust, oxides and chemicals containing zinc – is being reworked by both the pyrometallurgical and hydrometallurgical processes. An increase of share in recycled metal consumption has reached 35 % of the whole consumption in the world according to the UNCTAD data.

11. Possible substitutes

Aluminium, plastics and magnesium replace zinc in foundry work. Coatings of aluminium alloys, pigments, plastics and cadmium replace galvanic zinc plating. Zinc plates are completely replaced by other materials like stainless steel, aluminium, plastics etc. Aluminium alloys

substitute for brass. Other materials in the manufacture of chemicals, electronic devices and pigments also efficiently replace zinc.

1. Characteristics and use

Tin was concentrated at the end of the magma differentiation and its deposits are related to granitic rocks and their effusive equivalents. The only economic mineral of tin is cassiterite, which contains as much as 78 % Sn. The majority of tin comes from placer deposits, whereas hydrothermal (vein) tin is mined rather exceptionally. More than 50 % of placer deposits occur in SE Asia. River (alluvial) placers, where heavy minerals were naturally sorted by water flowing over the riverbed, are most important and the richest ones among the secondary deposits. World economic reserves are estimated at 8 mill tonnes of metal.

The majority of tin is used in solders (35 %), tin plates (25 %) and production of chemicals (15 %), then in alloys (bronze) etc.

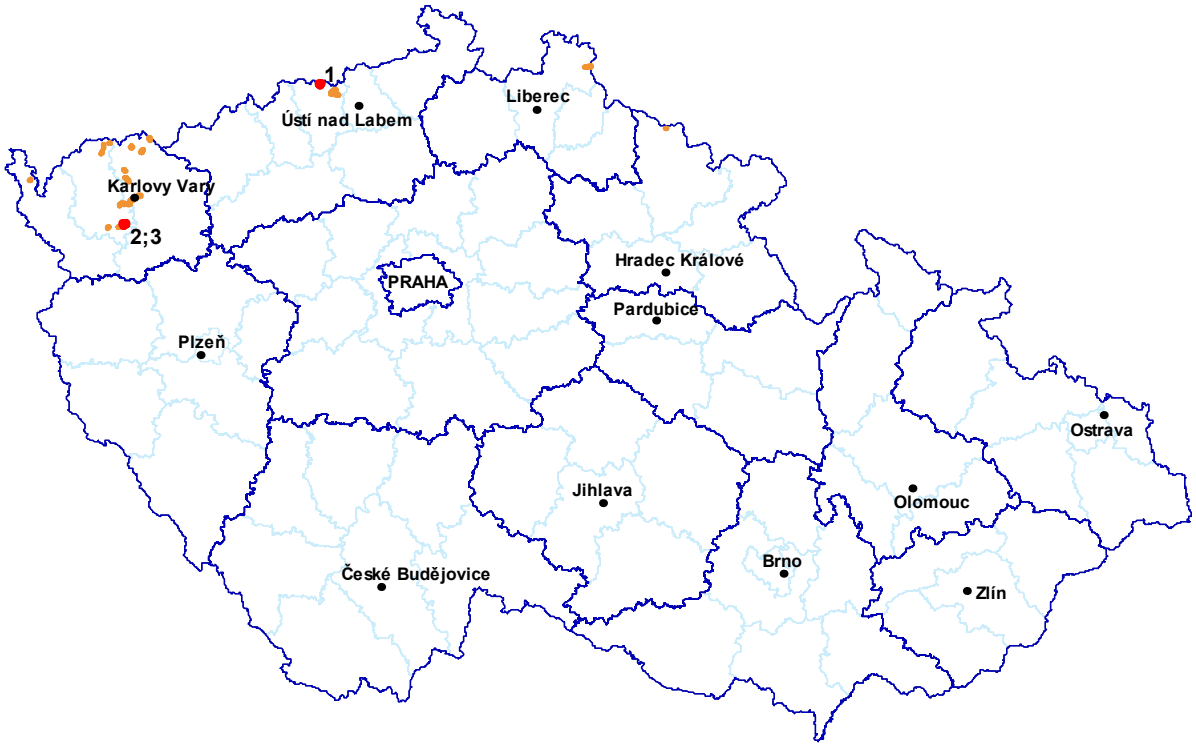
2. Mineral resources of the Czech Republic

Tin deposits of the Czech Republic are almost exclusively concentrated in the Krušné hory Mts., Slavkovský les and their piedmont, where they were mined since the beginning of the medieval times.

- The most important type of tin mineralization is represented by greisen deposits of Sn-W-(Li). These deposits occur in both the eastern part (Cínovec, Krupka) and the western part (Rolava, Přebuz) of the Krušné hory Mts as well as in the Slavkovský les area (Krásno-Horní Slavkov). The origin of these deposits is connected with greisenization and silicification of the Late Variscan domes of granites high in lithium and topaz. The major Sn mineral is cassiterite, which is disseminated in the greisen bodies and usually accompanied by wolframite and zinwaldite. The Krupka and Cínovec ore districts are also rich in hydrothermal quartz veins with cassiterite, wolframite, prospectively Bi and Mo minerals. Sn-W ores with 0.2 – 0.5 % Sn were mined in greisen and vein-type deposits.
- An interesting type of Sn mineralization occurs at Zlatý Kopec near Boží Dar, where tin minerals are constituents of a complex skarn, consisting of major magnetite accompanied by minor cassiterite, sphalerite and chalcopyrite. The complex ore contains 0.95 % Sn.
- Basically, the only deposit of primary Sn ores outside the Krušné hory Mts. region is a stratabound mineralization of cassiterite and sulphides at Nové Město pod Smrkem. An exploration project was carried out after World War II, which proved an average content of 0.23 % Sn in the ore.
- Sn mineralization consisting of stannite was found in deeper levels at the Staročeské pásmo zone of the historical Kutná Hora mining district. Due to the complex character of the ore and mainly its uneconomic accumulation, the Sn mineralization (occurrence) is of scientific importance only, particularly from the viewpoint of metallogeny and specific mineral assemblage.

The tin mining focused first at secondary (placer) deposits and gradually passed to the primary ones. Placer deposits near the primary ores of the Krušné hory Mts. region and their piedmont are in principle exhausted. Only small primary and secondary accumulations of cassiterite and wolframite in the Slavkovský les area and its piedmont have been preserved. Majority of the reserves of the primary deposits has been mined out, too, the remaining ones do not have any economic significance at present. Sn ores mining in the Czech Republic was terminated in 1991 by closing down the Krásno deposit. Mining at Cínovec deposit was terminated one year earlier. Larger resources of poor ores remained just at Krásno and Cínovec deposits. These could represent even a possible source of trace and rare elements (e.g. Li, Rb, Cs, Nb, Ta, Sc etc.) in future.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Cínovec-jih 2 Krásno 3 Krásno-Horní Slavkov

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number a)	7	7	6	6	3
exploited	0	0	0	0	0
Total mineral reserves, kt Sn	174 500	174 500	174 000	174 000	163 809
economic explored reserves	3 014	3 014	3 014	3 014	0
economic prospected reserves	7 314	7 314	6 884	6 884	0
potentially economic reserves	164 172	164 172	164 102	164 102	163 809
Mine production, t Sn	0	0	0	0	0

Note:
a) Sn-W ore deposits

5. Foreign trade

2609 – Tin ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, t	0	0	0	0	0
Export, t	0	0	0	0	0

8001– Unwrought tin

Raw material	2000	2001	2002	2003	2004
Import, t	556	592	531	635	550
Export, t	20	34	20	66	191

8002 – Tin waste and scrap

Raw material	2000	2001	2002	2003	2004
Import, t	0	0	14	37	63
Export, t	16	17	15	25	129

6. Prices

550 tonnes of crude tin were imported from China (44.6 %), Germany (28.1 %) and Thailand (14.5 %) in 2004. The average price was CZK 188,295 per tonne. 191 tonnes were exported to Germany (80.0 %), the Netherlands (10.5 %) and Poland (7.7 %) at average price of CZK 193.134 per tonne. 63 t of tin waste and scrap were imported from Slovakia at average price of CZK 115,387 per tonne. 129 tonnes were exported to the Netherlands (37.8 %), Belgium (36.6%) and Germany (14.6 %) at price of CZK 157,805 per tonne. Both volume of trade and prices of tin waste and scrap increased significantly compared to previous years. 70 kg only of tin ores and concentrates were imported in 2004.

7. Mining companies in the Czech Republic as of December 31, 2004

There were no mining companies operating on the territory of the Czech Republic to extract ores with Sn content in 2004.

8. World production

The world production of tin concentrates was a long time about 200 kt of Sn metal per year. This level has been significantly overstepped each year since 2000. According to statistical data, the production reached its peak in 2002 – almost 250 kt. In contrast to decreasing mine production of Brazil, Indonesia and Portugal, production in China and Peru has been increasing. Yearbook MCS nevertheless substantially corrected its data on the Chinese and Peruvian mine production in 2003. Data according to Mineral Commodity Summaries (MCS) and the World Mineral Statistics (WMS):

Year	2000	2001	2002	2003	2004 e
Mine production, kt Sn (MCS)	238	222	249	207	250
Mine production, kt Sn (WMS)	249	244	248	253	N

Main producers´ share in the world mining output (2003; according to MCS):

Indonesia	33.8 %
China	24.2 %
Peru	18.4 %
Bolivia	7.2 %
Brazil	6.9 %
Australia	3.1 %
Vietnam	2.2 %

In the past, tin concentrate production and its export quotas were to a large extent affected by ATPC, the members of which are Indonesia, Bolivia, Malaysia, Australia, Thailand, Nigeria, Zaire, China and Brazil. ATPC originated one year after the tin world market crisis in autumn 1985. China intervenes in the price evolution significantly recently, influencing the amount of the commodity on world market by means of export licences.

Year	2000	2001	2002	2003	2004
smelting production, kt Sn (according to WMS)	253	273	250	267	N

9. World market prices

Three grades of tin concentrate are quoted on the world market: 40-60 % Sn (commodity A), 60-70 % Sn (commodity B), and 70-75 % Sn (commodity C) in USD/t CIF Europe on the T/C basis – and pure metal grading 99.85 % Sn (A Grade) quoted at LME in USD/t Cash (commodity D). Prices of all non-ferrous metals on the world marked significantly hardened during the year 2004. Tin prices oscillated between 6,200 and 10,200 USD/t, reaching roughly fifteen years´ maxima. The cause of this was again a high demand from the side of rapidly growing Asian economies.

Prices of tin concentrates at year-end and an average annual price of pure metal were as follows:

Commodity/Year	2000	2001	2002	2003	2004
A	525	525	525	-	-
B	375	375	375	-	-
C	345	345	345	-	-
D	5 428	4 476	4 056	4 890	8 495

10. Recycling

The last decades have seen a significant increase in the amount of recycled tin. The secondary production of the metal gained by recycling reached about 40,000 tonnes in 2004. Rate of recycling of tinplate scrap oscillates in developed countries between 50 and 70 %.

11. Possible substitutes

Aluminium, glass, stainless steel, paper and plastic foils are the major substitutes for tin in the food industry. Multicomponent epoxy resins are more and more used instead of solders. Tin alloys are replaced by Cu and Al alloys or by plastics. Pb and Na compounds replace some Sn chemicals.

TUNGSTEN

1. Characteristics and use

Higher concentrations of tungsten are nearly always associated to granites. Primary tungsten ores are confined to pegmatite and greisen deposits genetically associated with acid granitoid intrusions and to scheelite skarn deposits. Tungsten ores often occur together with Sn, Mo, Cu, Au and Bi ores. Among the known tungsten minerals, only wolframite (having as much as 76.5 % WO_3) and scheelite (up to 80.5 % WO_3) are of economic importance. Wolframite contains besides Fe and Mn also some minor or trace concentrations of Nb and Ta. Tungsten placers occur in close vicinity of primary ores. World economic reserves of tungsten ores are estimated at 40 mill tonnes, 40 % of which occur in China.

Tungsten ores and concentrates are processed to obtain intermediate products – ammonium paratungstate (APT), tungstic acid, sodium tungstate, metal powder and powder tungsten carbide. Much tungsten is consumed in steel alloying used in heavy engineering, particularly in the armament industry. Much tungsten is also used in the manufacture of cutting tools and tools for oil and gas exploitation and for mining of solid minerals (drilling bits made of tungsten carbide). About 80 % W is consumed in the aforementioned fields. Some tungsten is used in electrotechnics and electronics.

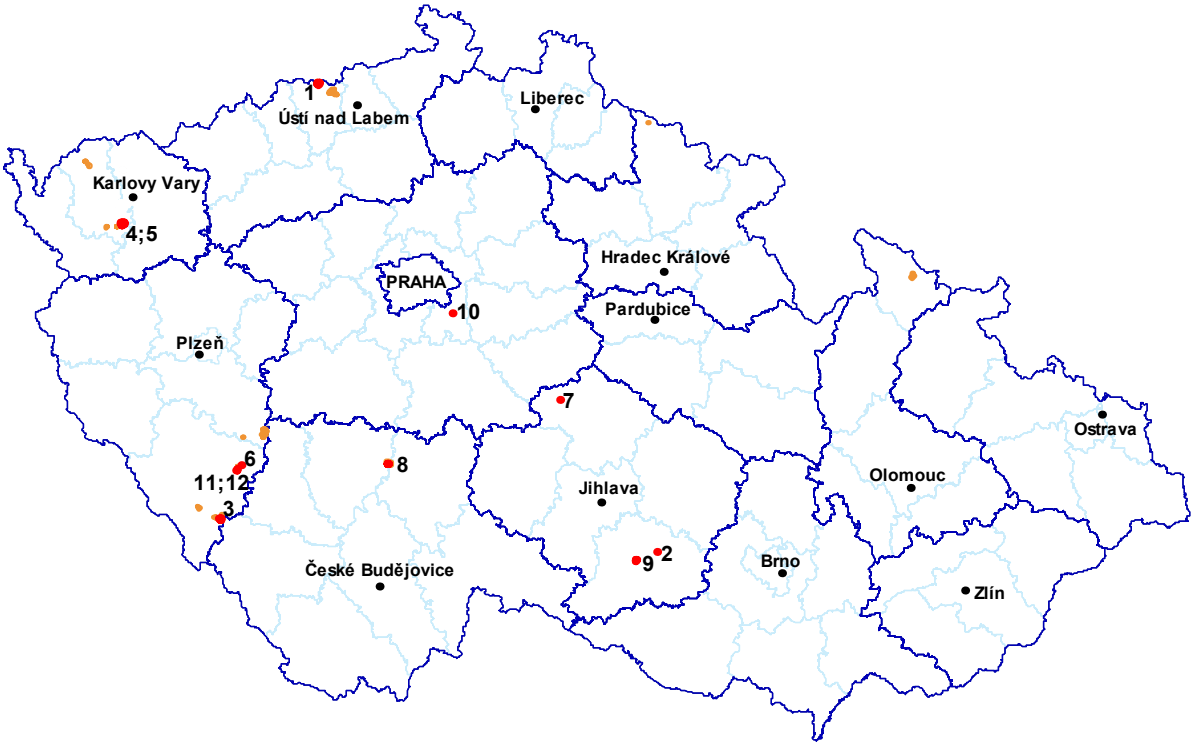
2. Mineral resources of the Czech Republic

Wolframite concentrate was obtained as a by-product during the mining and processing of vein and greisen Sn-W ores of the Cínovec (where also an important Li mineralization – zinwaldite - occurred) and Krásno mining districts of the Czech Republic. Besides that, numerous occurrences of scheelite and wolframite mineralization were found and verified in various places of the Bohemian Massif, particularly during the last few years. Tungsten ores mining was terminated along with the Sn ores in 1990 at Cínovec deposit and a year later at deposit Krásno. Some small occurrences in the Moldanubicum were mined out during the exploration in the end of 1980s and beginning of 1990s (Malý Bor-Vrbík, Nekvasovy-Chlumy).

- Quartz veins and greisens mainly rich in Sn (Krásno, Cínovec), less frequently rich in W (Krupka 4) occur in the Krušné hory Mts region. Greisen ores have usually contents ranging between 0.02 and 0.07 % W. Only ores of the Krupka 4 deposit showed up to 0.1 – 0.2 % W. A tungsten mineralization is known from quartz veins and stockworks at Rotava and disseminated scheelite in calc-silicate rocks (erlans) of Vykmanov near Perštejn.
- Typical contact metasomatic scheelite mineralization occurs in the exocontact of the Krkonoše Mts.–Jizerské hory Mts. and Žulová plutons. However, known localities of Obří důl and Vápenná are of no economic importance.
- Number of mainly small new localities of the W-ores was found in the Moldanubicum. They are represented by both quartz veins with wolframite eventually scheelite which mostly occur along the exocontacts of the Variscan granitoids and disseminated or vein scheelite in calc-silicate rocks (erlans). Some bodies represent bigger strataboud deposits of scheelite-bearing crystalline schist or skarn type. So far the most important stratabound deposit of Au-W ores is located at Kašperské Hory. Disseminated and banded scheelite occurs there in silicified layers underlying gold-bearing quartz veins. An average W content of the ore is 1.32 %.
- Introduction of more sophisticated exploration methods allowed discovering numerous localities of W ores in the Czech Republic, mostly of enigmatic origin. In contrast to former ideas about the common occurrence of Sn-W ores, it was proved that wolframite or scheelite ores occur mostly as separate mineralizations, and only a minor part belongs to combined Sn-W assemblages.

After the Sn-W ores mining termination in 1991, the remaining reserves have been revaluated and gradually eliminated from the The Register.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Cínovec-jih	5 Krásno-Horní Slavkov	9 Slavice
2 Hostákov	6 Malý Bor-k.462	10 Tehov
3 Kašperské Hory	7 Nezdín	11 Týnec-Hliněný Újezd-východ
4 Krásno	8 Sepekov	12 Týnec-Hliněný Újezd-západ

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number a)	14	14	13	13	12
exploited	0	0	0	0	0
Total mineral reserves, kt W	73 661	73 661	73 611	73 611	72 740
economic explored reserves	0	0	0	0	0
economic prospected reserves	44 224	44 224	2 623	2 623	1 752
potentially economic reserves	29 437	29 437	70 988	70 988	70 988
Mine production, t W	0	0	0	0	0

Note:

a) Sn-W and W ore deposits

5. Foreign trade

2611 – Tungsten ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, t	25	0	0	1	0
Export, t	61	0	0	0	0

8101– Tungsten and its products, including waste and scrap

Raw material	2000	2001	2002	2003	2004
Import, t	184	136	65	73	116
Export, t	372	412	252	108	133

720280 – Ferro-tungsten and ferrosilicotungsten

Raw material	2000	2001	2002	2003	2004
Import, t	39	60	55	52	51
Export, t	2	2	0	2	8

6. Prices

116 t of tungsten were imported from Germany (35.9 %), the USA (31.4%) and China (13.2 %) in 2004. The average price was CZK 1,907 per kg. 133 t were exported – 55.3 % to Germany, 16.6% to Great Britain and 6.1 % to South Korea – at average price of CZK 1,627 per kg. 51 t of ferro-tungsten and ferrosilicotungsten were imported from China (87.9 %), Russia (5.9 %) and Germany (5.8 %) at average price of CZK 204 per kg, about 8 t were re-exported to Spain (94.1%) and Slovakia (5.9 %). Foreign trade in tungsten ores and concentrates was insignificant in 2004.

7. Mining companies in the Czech Republic as of December 31, 2004

In 2004, there were no mining companies on territory of the Czech Republic to extract ores with W content.

8. World production

World production of tungsten metal in ores and concentrates exceeded 40 kt in 1970 and reached its peak – 52 kt - at the end of 1980s. The subsequent drop in prices was related to restriction of demand on the world market resulting from the economic recession and from structural changes in major consumer branches. The world production has been again slowly increasing since 2000. China, which has the highest mining growth potential, too, represents the dominant world producer. The data on the world mine production in individual yearbooks partly differ from each other: According to Mineral Commodity Summaries (MCS), the world production is higher and it has increased significantly in the last four years.

Year	2000	2001	2002	2003	2004 e
Mine production, t W (MCS)	37 400	44 200	59 100	62 100	60 000
Mine production, t W (WMS)	30 400	35 100	42 900	46 000	N

Main producers´ share in the world mining output (2003; according to MCS):

China	83.7 %
Russia	6.3 %
Canada	4.4 %
Austria	2.3 %
Portugal	1.1 %
Korea,D.P.R. of	1.0 %
Bolivia	0.7 %

9. World market prices

Among all W raw materials traded on the world market (ores, concentrates, oxides, hydroxides, tungstenites, FeW, tungsten carbide and raw W), the ores and concentrates represented the major share of the trade. The price of wolframite – standard, grading min. 65 % WO_3 – on the world market was quoted in USD/mtu WO_3, CIF Europe (commodity A). Quotation of scheelite was abandoned in 1992 due to small extent of trade. Quoted price now includes both types of ore. The price peak was reached in 1977 – USD 180 per mtu WO_3. The subsequent drop in price was caused by global economic recession and particularly by a surplus of cheep Chinese wolframite, import of which was restricted in some countries, which imposed high antidumping import taxes. Wolframite prices increased again from 42 - 50 USD/mtu up to 62-64 USD/mtu in the beginning and end of the year 2004, respectively. Of other W raw materials, ammonium paratungstate (APT) powder (commodity B) – quoted on the European free market in USD/mtu W – has been achieving more and more significant position. The average prices of both commodities at year-end were as follows:

Commodity/Year	2000	2001	2002	2003	2004
A	53	45	39	45	55
B	84	71	50	64	N

10. Recycling

Recycling of W (especially alloys containing tungsten) is carried out only in Japan, the USA and Western Europe. According to incomplete data, recycling roughly accounts for 30 % of the total metal production.

11. Possible substitutes

The metal remains irreplaceable in the steel-making industry as an alloying additive, in the manufacture of armament, cutting and drilling tools and electrotechnics. Some attempts were made during the period of the tungsten price rise to replace W by molybdenum or even by depleted uranium showing large surplus worldwide. Replacement of W by ceramic materials is reasonable in some fields and replacement of W by Mo in automobile industry is more than equivalent. Sintered tungsten carbide used in the manufacture of cutting and drilling tools can be partly replaced by carbides of other metals or by nitrides and oxides and/or new composite materials, particularly in less exposed fields and where the price of tungsten and tungsten carbide plays a decisive role.

SILVER

1. Characteristics and use

Silver is an element of chalcophile character, which during the magmatic differentiation tends to concentrate in minerals of late stages or hydrothermal fluids. About 2/3 of the silver world reserves occur in base metal (Cu and Pb-Zn) deposits of various origin. Remaining 1/3 of Ag occurs in hydrothermal vein deposits, where it is the major economic element. The major silver-bearing mineral is Ag-bearing galena, the other ones are mainly sulphides and sulphosalts of Ag, such as e.g. argentite, hessite, proustite, kerargyrite, polybasite, pyrargyrite, stromeyerite, sylvanite and tetrahedrite (freibergite). Silver fineness is expressed in thousandths of total alloy; sterling silver, its commonest alloy, contains of 92.5 % silver (fineness of 925/1,000). World economic reserves of silver metal are estimated at 300 kt. Majority of silver is used in photography (29 %), in jewelry and table plate ware (30 %), in electrotechnics and electronics (15– 17 %), in mints (3 %), in alloys for brazing (5 %), in batteries, mirrors and special reflecting surface coatings (to absorb solar energy) and in catalysts (for production of formaldehyde from methanol and conversion of ethylene to ethylenoxide). Silver is also used in medicine and in nuclear power generation to produce control rods for water reactors (an alloy consisting of 80 % Ag, 15 % In and 5 % Cd).

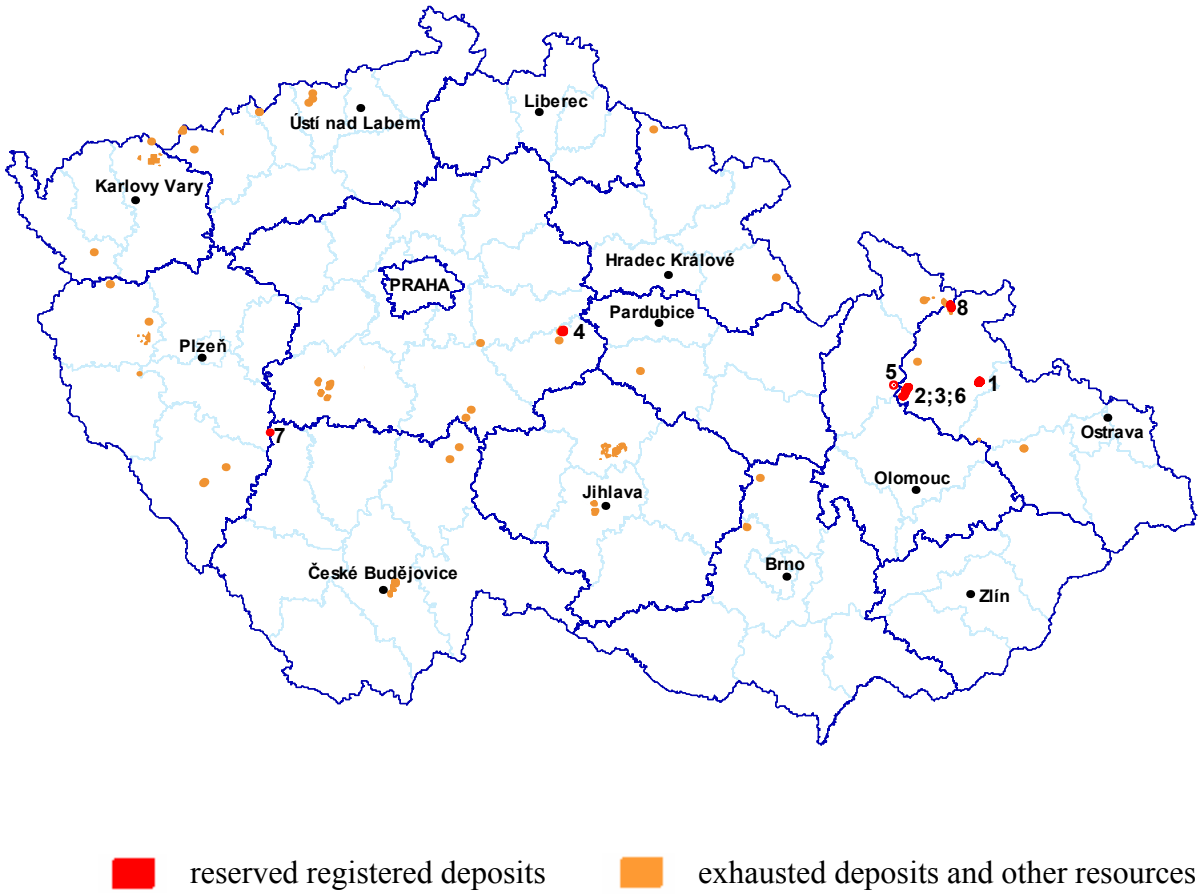
2. Mineral resources of the Czech Republic

Mining for silver played a decisive role in medieval ore mining in Bohemia and in prosperity of old mining towns.

- The major portion of silver resources in the Czech Republic occurs in base metal sulphide deposits, where it forms an isomorphous admixture particularly in galena. Some Ag was extracted as a byproduct when mining high-grade base metal ores (58–70 ppm Ag) and U-Ag ores (high grade Ag ores with native silver and Ag minerals exhibiting around 480 ppm Ag) of the Příbram uranium-base metal deposit, until the mining operations were reduced and ceased completely in the early nineties. Base metal ores of the Horní Benešov and Horní Město deposits contained obtainable amount of Ag, too. The 50 % lead concentrate showed average Ag content of 846 g/t, the 49 % zinc concentrate contained 86.6 g/t Ag on average in 1963 – 1992. Deposit Zlaté Hory-východ was the one containing silver in base metal ores in the Zlaté Hory district. The Pb-Zn concentrate produced from the ores of this deposit in 1988 – 1992 displayed average Ag content of 0.19 g/t.
- Numerous recently abandoned deposits of Pb-Zn-Ag and deposits of so-called five element assemblage in medieval mining districts of Kutná Hora, Jihlava, Příbram, Jáchymov, Stříbro, Rudolfov, Havlíčkův Brod, Stará Vožice etc. were an important source of European silver in the past. The deposits represent classic types of base metal and other metallic deposits.

Also silver reserves have been gradually eliminated from the The Register in connection with the revaluation of base metal ores.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Horní Benešov
2 Horní Město
3 Horní Město-Šibenice
4 Kutná Hora
5 Oskava
6 Ruda u Rýmařova-sever
7 Újezd u Kasejovic
8 Zlaté Hory-východ

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number a)	12	12	10	9	8
exploited	0	0	0	0	0
Total mineral reserves, t Ag	586	586	564	533	533
economic explored reserves	0	0	0	0	0
economic prospected reserves	1	1	0	0	0
potentially economic reserves	585	585	564	533	533
Mine production, kg Ag	0	0	0	0	0

Note:
a) deposits with registered Ag content

5. Foreign trade

261610 – Silver ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, kg	46	53	21	115	38
Export, kg	0	0	13	2	5

7106 – Silver, unwrought or in semi-manufactured or powder form

Raw material	2000	2001	2002	2003	2004
Import, kg	147 991	146 810	173 805	238 752	257 623
Export, kg	121 707	129 855	140 600	171 398	285 526

6. Prices

Almost 260 t of crude silver at average price of CZK 3,992/kg were imported in 2004. 286 t for CZK 3,933/t on average were exported for the same period. Data on the spectrum of import and export countries are not at disposal. In 2004, only 38 kg of silver ores were imported from France. Re-export of 5 kg was directed back to France.

7. Mining companies in the Czech Republic as of December 31, 2004

In 2004, there were no mining companies operating on the territory of the Czech Republic to extract ores with Ag content.

8. World production

The world production exceeded 10 kt per year in 1976. Since then it was increasing and reached its peak in 1989 – 15.8 kt.

Mine production was gradually decreasing and reached the quantity of 13.8 kt in 1994. Since 1996, the world production of silver has been increasing again. The last maximum production was reached in 2002. The high mine production was one of the causes of low silver prices. Mine production of silver increased the most in China and Peru during the last five years. Mine production of Mexico, Australia, Chile, Canada and Kazakhstan has not shown big variations. In contrast, mine production of the USA and Poland decreased. Data on silver production according to Mineral Commodity Summaries (MCS), World Mineral Statistics (WMS) and the yearbook Estadísticas del Cobre y otros Minerales published by Comisión Chilena del Cobre (COCHILCO):

Year	2000	2001	2002	2003	2004 e
Mine production, t Ag (MCS)	17 700	18 700	20 000	18 800	19 500
Mine production, t Ag (COCHILCO)	17 744	18 524	18 676	18 201	N
Mine production, t Ag (WMS)	18 179	18 984	18 847	18 825	N

Main producers´ share in the world mining output (2003; according to COCHILCO):

Peru	15.2 %
Mexico	14.0 %
China	11.0 %

Australia	10.3 %
Chile	7.2%
Canada	7.2 %
the USA	6.8 %
Poland	6.8 %
Kazakhstan	4.5 %
Bolivia	2.5 %

According to Silver Institute company, only 28 % of silver came from the mine production and processing of silver ores in 2003. Majority of silver was a by-product of dressing of lead-zinc (31 %), copper (25 %) and gold-bearing (14 %) ores. Extracted silver covered about 60 % of consumption. Jewellery represents an important consumer of silver.
Following companies belonged to ten most important silver world producers in 2003: Industrias Peñoles (Mexico), KGHM Polska Miedź (Poland), BHP Minerals (Australia), Kazakhmys (Kazakhstan), Grupo Mexico (Mexico), Rio Tinto (Great Britain), Barrick Gold (Canada), Coeur d'Alene Mines (USA), Polymetal (Russia) and Xstrata (Australia).

9. World market prices

Only price of pure metal 99.9 % Ag is quoted on the world market. It is quoted in GBp or USc/troy oz. The highest price since 1880 (London Brokers' Official Yearly Average Prices) was recorded in 1980 – GBp 905.2 per troy oz. An average annual price trend in USc per troy oz (commodity A) is given in a summary as follows:

Commodity/Year	2000	2001	2002	2003	2004
A	495	437	459	487	665

Fluctuations in silver world prices reflect among others political situation and speculations on the market similarly to other precious metals. Marked increase of silver prices during the last two years was related to increase of demand from side of rapidly developing populated Asian states. Silver price oscillated between 550 and 830 USc/t oz in 2004.

10. Recycling

Recycling of silver, which is technologically a very simple operation, dramatically dropped in the early nineties to about one half of Ag recycled during the same period of the eighties. The drop in recycling was attributed to low prices of silver, its lower content in secondary raw materials and restrictive measures in government stockpile policy. Share of the recycled silver in the offer of the world market was estimated at 20 % in 2004.

11. Possible substitutes

Silver is efficiently replaced in numerous fields. Photo materials are produced with lower content of silver or without silver at all. Photography continues to be largely replaced by xerography and electronic displays. Aluminium and rhodium substitute for silver in the manufacture of special mirrors and other reflecting surface coatings, tantalum and special steels are now used in surgical tools and artificial joints. Silver is being also replaced in batteries and ceramic materials replace dental alloys. Sterling silver was, except memorial mints and several exceptions (e.g. Mexico put again in circulation silver coins in 1992), replaced by common metals, particularly by Cu alloys.

GOLD

1. Characteristics and use

Primary gold deposits can be divided into three large groups according to their origin: volcano-hydrothermal, plutonic-hydrothermal and metamorphic. Secondary deposits – recent and fossil placers – resulted from physical weathering processes. Gold occurs in the form of native metal, in a natural alloy with silver (electrum) or other metals or in some cases in the form of tellurides. It occurs in sulphides of antimony, arsenic, copper, iron and silver. During their processing and smelting, gold is recovered as a byproduct. The grade or fineness of gold is given in carats or in 1,000 units (fine gold 24 carats = 1,000, 10 carats = 10/24 = 41.7 % = 417/1,000). Total economic world reserves are estimated at about 100 kt of Au, 15 % to 20 % of which occur as a minor constituent in ores of other metals (first of all Cu and Ag). Much gold is used in jewellery (84 %), then in electrotechnics (6 %), in medals and coins (5 %), in dentistry (2 %), in special alloys for the aircraft (particularly armament) industry, in reflectors of infrared radiation, etc.

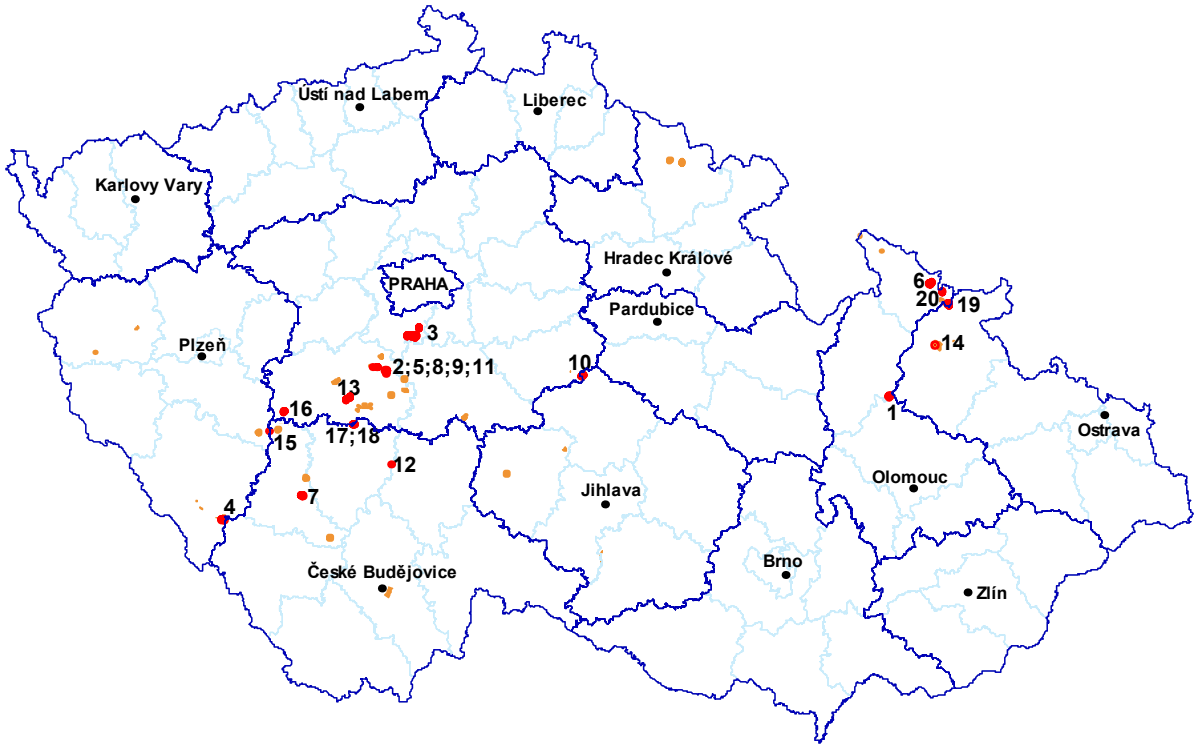
2. Mineral resources of the Czech Republic

The tradition of mining for primary and secondary gold in the Bohemian Massif dates back almost three millennia. Bohemia used to be one of the most important producers of gold in Europe in the Middle Ages.

- The major part of gold mineralization is associated with regionally metamorphosed volcanosedimentary complexes locally penetrated by Variscan granitoids. Such a complex in the central Bohemian region is represented by the Jílové zone of the Proterozoic age, with abundant gold-quartz mineralization (deposits of Jílové, Mokrsko, Čelina and some others). Gold mineralization in the Jeseníky Mountains area is confined to stratabound base metal deposits related to Devonian volcanism (Zlaté Hory-západ). Gold ores mining was terminated in 1994 by closure of the Zlaté Hory-–západ deposit. 1,524 kg Au was mined at this deposit in 1990 – 1994. Mokrsko deposit represents an explored deposit containing substantial Au reserves – 108 t Au in ores exploitable by open pit mining with average content of economic disposable reserves of 1.9 g/t Au.
- Some hydrothermal quartz veins with gold as well as stratabound gold mineralization with scheelite (Kašperské Hory) and quartz veins and stockworks with Ag (Roudný) occur in the crystalline complex of the Moldanubicum. Deposit Kašperské Hory, where the exploration was not completed, contains 189 t of Au in potentially economic reserves of average content of 3.44 g/t.
- Placer gold deposits are spatially and genetically linked to the primary gold deposits. Carboniferous to Permian paleoplacers occur in western Bohemia (Křivce) as well as in the Krkonoše Mts. piedmont and in the Intra–Sudetic Basins. The largest areas of Quaternary placers are located in the foothills of the Šumava Mountains and in northern Moravia and Silesia. Still recognizable remnants of placer gold panning indicate extensive mining for gold, which goes back to Celtic times.

No gold mining is currently taking place in the Czech Republic, following the termination of mining operations at the Krásná Hora Au-Sb deposit in 1992 and at the Zlaté Hory-západ base metal deposit in 1994. Unsolved conflicts of interests with nature protection and from the world aspect an unusual prohibition of the cyanide process in mining in the Czech Republic block the use of the explored Au reserves at Mokrsko and Kašperské Hory deposits.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Registered deposits and other resources are not mined

1	Břevenec	8	Mokrsko	15	Újezd u Kasejovic
2	Dražetice-šachtice č.IV	9	Mokrsko-východ	16	Vacíkov
3	Jílové u Prahy	10	Podmoky	17	Voltýřov
4	Kašperské Hory	11	Prostřední Lhota-Čelina	18	Voltýřov-rozsyp
5	Libčice	12	Sepekov	19	Zlaté Hory-východ
6	Mikulovice u Jeseníka	13	Smolotely-Horní Líšnice	20	Zlaté Hory-Zlatý potok
7	Modlešovice	14	Suchá Rudná-střed		

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	26	26	26	23	20
exploited	0	0	0	0	0
Total mineral reserves, kg Au	248 989	248 989	248 989	242 624	240 677
economic explored reserves	48 740	48 740	48 740	48 740	48 740
economic prospected reserves	86 600	86 600	36 948	36 467	35 777
potentially economic reserves	113 649	113 649	163 301	157 417	156 160
Mine production, kg Au	0	0	0	0	0

5. Foreign trade

7108 – Gold in unwrought or semi-manufactured form, gold powder

Raw material	2000	2001	2002	2003	2004
Import, kg	1 845	1 402	1 288	1 599	1 472
Export, kg	3 573	4 086	5 567	5 182	1 735

6. Prices

1.5 t of crude gold were imported at average price of CZK 110,463 per kilogram in 2004. 1.7 t of crude gold at average price of CZK 394,650 per kilogram was exported in the same period. Data on spectrum of the import and export countries are not at disposal. No ores containing gold were imported in 2003.

7. Mining companies in the Czech Republic as of December 31, 2004

In 2004, there were no mining companies operating on the territory of the Czech Republic to extract ores with Au content.

8. World production

World production of gold, following a slight decrease in the early seventies, continued to rise steadily and reached its peak so far in 2001-2003 (about 2,500 to 2,600 t in metal content). Based on the information from Peter Hambro Mining Company, average world expense on Au production from deposits reach 224 USD/t oz, whereas average expenses on production from deposits in Russia represent only 166 USD/t oz (MBM, Febr. 2004, p.12). Data on bulk production of Au from mined ores slightly differ depending on the source (according to Mineral Commodity Summaries-MCS, World Mineral Statistics-WMS and the Welt Bergbau Daten-WBD):

Year	2000	2001	2002	2003	2004 e
Mine production, t Au (MCS)	2 550	2 570	2 550	2 590	2 470
Mine production, t Au (WMS)	2 560	2 530	2 520	2 520	N
Mineproduction, t Au (WBD)	2 576	2 577	2 512	2 469	N

Main producers´ share in the world mining output (2003; according to MCS):

South Africa	14.4 %
Australia	10.9 %
the USA	10.7 %
Čhina	7.8 %
Peru	6.6 %
Russia	6.6 %
Canada	5.4 %
Indonesia	5.4 %

The first three countries produce more than one third of the world production. More than 60 % of world reserves are concentrated on their territories.

According to The Gold Institute, following mines belonged to those with the highest gold mining production in the last years: Grasberg (Indonesia), Yanacocha (Peru), Muruntau (Uzbekistan), Betze Post (USA), Driefontein (South Afrika), Twin Creeks (USA), Carlin (USA), Kloof (South Africa), Cortez (USA), Great Noligwa (South Africa), Porgera (Papua New Guinea), Randfontein (South Africa), Pierina (Peru), Meikle (USA), KCGM (Australia), Kumtor (Kyrgizstan), Obuasi (Ghana), Round Mountain (USA), Sadiola (Mali) and Lihir (Papua New Guinea).
Newmont Mining (mining production in 2003: 7.38 mill. t oz), AngloGold Ashanti (5.63 mill. t oz), Barrick Gold (5.51 mill. t oz), Gold Fields (4.20 mill. t oz), Placer Dome (3.86 mill. t oz) and Harmony Gold Mining (3.33 mill. t oz). represent six most important gold mining companies.

9. World market prices

As for prices, gold represents a special metal. Its price is affected by many factors, among which speculative trade and global political climate are the most important. Consequently, the major world stock exchanges quote gold prices twice a day (morning and afternoon fixing) in USD/ troy oz. The price development is observed in actual and real prices using deflator of USD. The highest average price during the last 25 years was reached in 1980 – USD 614.63 per troy oz (actual price). This highest price was due to the global political situation, which reflected the revolution in Iran, the Soviet invasion of Afghanistan, the petroleum shock, high inflation and the onset of the Iraqi– Iranian war. The average annual prices fluctuated down to USD 400 per troy oz in London in the last 5 years (average p.m. fixing) and fell under USD 300 per troy oz in the end of 1997. Prices of gold hit twenty-years´ minimum in 1999. That's why a number of the National Banks began to sell parts of gold reserves, which resulted in further price decrease. No significant price changes followed in 2000. Agreement among the most important national banks about co-ordination and limitation of gold sale of their reserves caused only a short-term price increase. Gold prices remained on a very low level major part of the year. The low prices were characteristic also for 2001, when the metal prices were oscillating between 255 and 295 USD/troy oz. This trend changed during 2002, when the price of gold started to increase from about 280 USD/troy oz up to 350 USD/troy oz in the end of the year. World price oscillated between 320 and 400 USD/troy oz for major part of the year 2003 and it reached its highest level since February 1996, i.e. 411.70 USD/troy oz (1 troy oz = 31.1035 g), in December 2003. In 2004, in line with the increasing trend of other raw materials, a marked increase of gold prices occurred. The prices oscillated between 375 and 455 USD/troy oz, which represented the highest maxima since 1988.

A Average annual gold prices in USD/troy oz, London quotations

Commodity/Year	2000	2001	2002	2003	2004
A	279	271	310	364	409

10. Recycling

Gold is widely recycled from jewellery and other industries. Recycling may reach as much as 25 % worldwide, even though the data on recycling are rather difficult to obtain.

11. Possible substitutes

The consumption of gold and its alloys in jewellery and electrotechnics is decreasing due to the introduction of parts made of common but gilded metals. Gold can be replaced by palladium, platinum and silver. Gold for monetary storage can be replaced by rhodium, which is the most valuable metal. In classic jewellery, however, gold and its alloys are indispensable.

ENERGY MINERALS – GEOLOGICAL RESERVES AND MINE PRODUCTION

Significant geological reserves of energy minerals on the territory of the Czech Republic can be found only in uranium ores, hard coal and brown coal. Geological reserves of these raw materials have reached a share in first percent of the world resources.

Coal production started to thrive on the Czech territory in the 19th century in the beginning of the industrial revolution. After the World War II, uranium ore mining developed. Production of energy minerals as a whole reached its peak in the second half of the eighties and after that a recession came connected with the decline of U-ore and all kinds of coal mining. State subventions for damping programs directed at social costs, technical liquidations, sanative activities and reclaiming reached roughly CZK 34 billion in coal industry and about CZK 27 billion in uranium industry in 1990–2004. Subventions for coal industry damping will continue also in the following years. Out of mineral fuels, the quickest decline affected the uranium ore mining. All requirements of the Czech Republic, as U ore and coal concerns are secured by the domestic production (hard coal is also exported) but the dependence upon oil and gas import reaches nearly hundred per-cent. The world prices of crude oil and natural gas increased significantly in 2000. The Czech Republic then purchased both strategic raw materials for CZK 82.3 billion (in 1999 it was only 41 billion). This amount represented 90 % of all finances used for purchase of primary mineral row materials. High sums were paid for purchase of crude oil and natural gas in 2001 (more than CZK 86 billion), 2002 (67 billion), 2003 (72 billion), and 2004 (74 billion), too.

Mining of energy minerals

Raw material	Unit	2000	2001	2002	2003	2004
Uranium ore	t U	498	490	477	458	435
Hard coal	kt	17 028	14 808	14 097	13 382	14 648
Brown coal	kt	50 610	51 036	48 834	49 920	47 840
Lignite	kt	453	507	501	470	450
Crude oil	kt	168	178	253	310	299
Natural gas	mill m^3	118	101	91	131	175

Lifetime of industrial reserves

(economic explored disposable reserves) and so-called minable reserves after the decrease of reserves by production incl. losses of registered deposits per year 2004 (A) and the average annual decrement of reserves in period 2000– 2004 (B) was as follows:

Raw materiál	Lifetime - A (years)		Lifetime - B (years)	
reserves	industrial	mineable	industrial	mineable
Uranium ore	14	2	14	1
Hard coal	69	15	68	15
Brown coal a)	32	22	30	21
Lignite	133	2	194	3
Crude oil	43	7	53	9
Natural gas	13	142	18	201

a) including reserves blocked by territorial limits

URANIUM

1. Characteristics and use

The uranium ores of various genetic types represent the only raw material for fuel production in the nuclear power plants. The most frequent genetic types of uranium deposits are hydrothermal (mostly vein), sedimentary, infiltration, metamorphogenic and albitite ones. Uranium is present in several tens of minerals (exclusively oxidic compounds), of which economicly most important are oxides (uraninite - pitchblende), phosphates (torbernite, autunite), silicates (coffinite) and organic compounds (anthraxolite). The most important uranium deposits are situated in Canada, the USA, Zaire, South Africa and Australia. World reserves are estimated at 3.1 mill tonnes of uranium metal (according to the World Nuclear Association).

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Ores grading about 0.1 % U_3O_8 are the minimum metal content of ore, which are mined. The mined grades depend on the deposit type, volume of reserves and the method of mining. Processed products of U-ore are chemical concentrates containing 70 – 90 weight percent of uranium oxides.

Uranium compounds were used originally in dyes for ceramics and glass production. Nowadays uranium is used for production of fuel elements for nuclear reactors, in preparation of radioisotopes for medicine, in crack detection etc. A lot of extracted uranium is stored as nuclear weapon charges.

2. Mineral resources of the Czech Republic

Exploitable uranium accumulations have been found both in the crystalline basement and in the cover formations of the Bohemian Massif. Two major periods of the formation of uranium deposits can be distinguished – Late Variscan and Alpine. The deposits can be classified in 6 morphogenetic types:

- graphitised crashed zones in crystalline rocks with veinlet-disseminated type of mineralization and main minerals uraninite, coffinite and brannerite (e.g. Rožná, Olší, Zadní Chodov, Dyleň, Okrouhlá Radouň).
- veins and vein systems – hydrothermal deposits with predominant carbonate-uraninite mineralization, spatially and genetically associated with Variscan granitoid massifs - deposits of the Jáchymov, Horní Slavkov and Příbram districts, small deposits in the Železné hory Mts. area (Licoměřice-Březinka, Bernardov), in the Krkonoše Mts. (e.g. Bedřichov) and the Rychlebské hory Mts. (Zálesí u Javorníka) et al.
- metasomatic mineralization associated with chloritized tectonic zones in Variscan granitoids predominantly with uraninite-coffinite-brannerite mineralization (Vítkov 2, Lhota u Tachova, Nahošín),
- stratabound mineralization confined to the Late Palaeozoic sediments, formed by uranium-bearing coal seams and surrounding rocks of the Upper Carboniferous and Lower Permian in the Intra-Sudetic Basin (e.g. Radvanice, Bečkov) and Kladno-Rakovník Basin,
- predominantly stratabound mineralization in the Cretaceous sediments – ore bodies formed mainly by uraninite and U-blacks, locally with zircon, confined to the Cenomanian sediments of the Laussicum development of the Bohemian Cretaceous Basin in Stráž pod Ralskem surroundings, where both classical underground mining (e.g. Hamr, Křižany, Břevniště) and ore leaching from boreholes (Stráž) took place
- stratabound mineralization in Tertiary basins – small deposits of high-grade ore in sediments rich in organic matter in the broader vicinity of Karlovy Vary (e.g. Hájek, Hroznětín, Odeř, Ruprechtov).

Deposits of economic importance, which were intensively used especially in the past, are concentrated into five regions. Their list with type of mineralization and the most important

deposits is given below. The regions are ordered according to their importance, given by the amount of the obtained uranium. The share of the individual region on bulk mining production in per cent is given in parentheses.

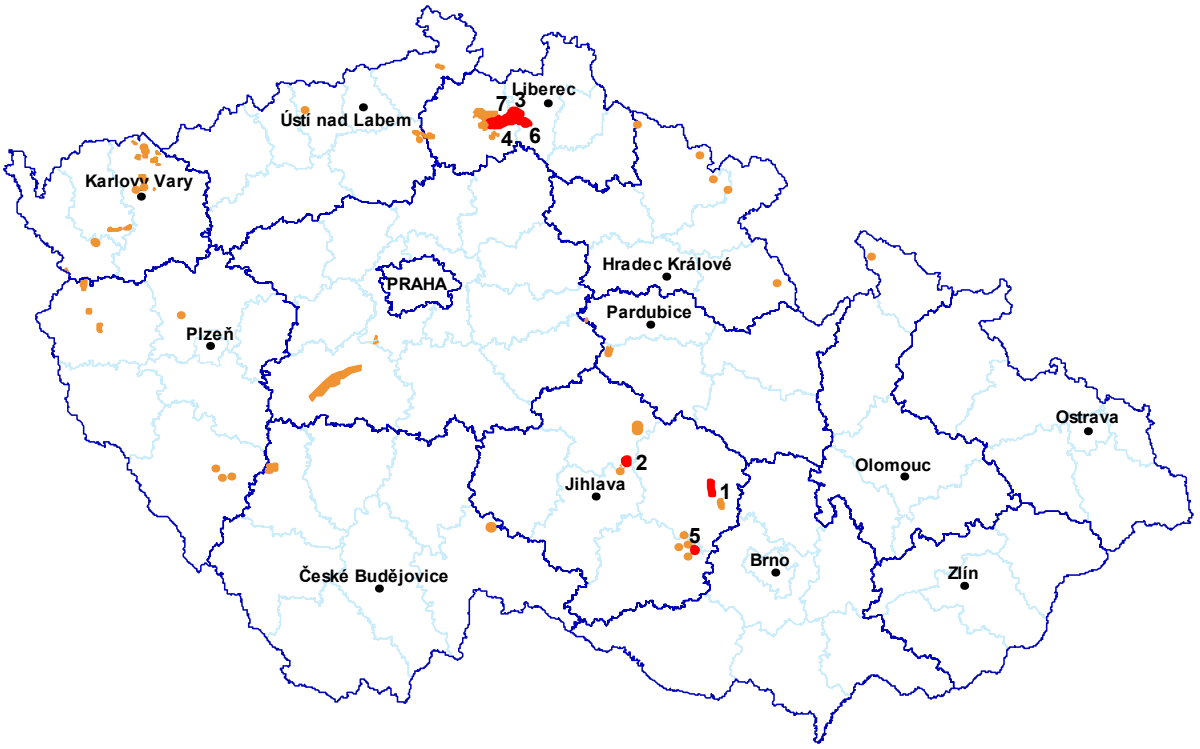
- central Bohemian region – metasomatic and hydrothermal vein mineralization - Příbram (about 42 %).
- north Bohemian region – mineralization in the Cretaceous sediments - Hamr, Stráž pod Ralskem (about 22 %)
- Moravian region – mineralized fracture zones and hydrothermal veins - Rožná, Olší (about 17 %)
- West Bohemian region – mineralised fracture zones and metasomatic mineralization - Vítkov 2, Zadní Chodov (about 10 %)
- Krušné hory Mts. region – mineralization in Tertiary sediments and hydrothermal vein deposits - Jáchymov, Horní Slavkov, Hájek (about 9 %).

Only two of the registered uranium ore deposits were mined in 2004 – deposit of the zone type Rožná and Stráž pod Ralskem in the Bohemian Cretaceous Basin – the latter within the frame of liquidation works. At Rožná, underground mining took place (average grading 0.308 % U in explored reserves), whereas the Stráž deposit (average grading 0.031 % U in explored reserves) has been exploited by means of in situ leaching (liquidation of operation since April 1, 1996). All extracted ore was chemically processed to provide chemical concentrate (yellow cake). The only customer to buy U-concentrates was České energetické závody, a. s.

Tailing pond in Stráž pod Ralskem, where waste from leaching of the deposit containing 0.030 – 0.063 % of rare earths accumulated for 30 years, is a potential source not only of rare earths (lanthanum – gadolinium) but also scandium, yttrium, niobium, zirconium and hafnium. With an exception of Zr, reserves of these metals have not been evaluated yet.

Contemporary uranium consumption in nuclear power stations Dukovany and Temelín reaches 690 t per year. The surplus of production was deposited as state material reserves in the previous years.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Names of mined deposits are indicated in **bold type**

1 Rožná	2 Brzkov	3 Břevniště pod Ralskem
4 Hamr pod Ralskem	5 Jasenice-Pucov	6 Osečná-Kotel
	7 Stráž pod Ralskem*	

* mining intra-liquidation of in situ leaching operation

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	7	7	7	7	7
exploited	1	1	1	1	1
Total mineral reserves, t U	137 205	136 943	136 785	136 409	136 044
economic explored reserves	20 389	20 226	1 945	1 710	1 622
economic prospected reserves	20 858	20 626	19 448	19 448	19 418
potentially economic reserves	95 958	96 091	115 392	115 251	115 004
Mine production, t U	498	490	477	458	435

5. Foreign trade
Neither import nor export volumes of uranium ores and concentrates have been published.

6. Prices
Neither import nor export prices of uranium have been published.

7. Mining companies in the Czech Republic as of December 31, 2004
DIAMO, s.p. Stráž pod Ralskem

8. World production
Large increase in world production of uranium ores began in the fifties due to nuclear arms race and later due to large development on nuclear energy facilities, especially after the first "oil shock" in 1973. A record production 45,6 kt of uranium was reached in 1990. Mine production has increased in Canada, Russia and Kazakhstan, on the contrary the USA have been decreasing domestic mine production during the recent years. In Europe, uranium is mined in Ukraine, in the Czech Republic, in Germany, in Spain, in France and in Portugal. Share of the Czech Republic in the world mining production was about 1.3 % in 2003. World mine production in past five years was as follows (according to The Uranium Institute/World Nuclear Association, World Mineral Statistics and Welt-Bergbau Daten):

Year	2000	2001	2002	2003	2004
Mine production, t U (UI/WNA)	35 186	36 366	36 063	35 613	40 219
Mine production, t U (WMS)	34 800	36 200	37 200	36 300	N
Mine production, t U_3O_8 (WBD)	38 727	44 227	44 811	41 429	N

Main producers´ share in the world mining output (2003; according to WBD):

Canada	24.9 %	Kazakhstan	7.7 %
Australia	23.0 %	Uzbekistan	5.3 %
Russia	8.9 %	South Africa	2.5 %
Niger	8.2 %	the USA	2.4 %
Namibia	8.0 %	Ukraine	2.4 %

In 2004, 88 % of uranium were obtained by U-ores mining (27 % by surface mining, 40 % by underground mining and 21 % by in situ leaching) and 12 % was obtained as a by-product of the Au, V and Cu-ores mining. The important uranium mining companies-founders fused in the nineties. Only 8 biggest world mining companies (with the output volume more than 1,000 tonnes per year) covered 82 % of the world production in 2004. These were the following companies: Cameco, Cogema, ERA, KazAtomProm, WMC, Rossing, Priargunsky and Navoi (according to the World Nuclear Association).

9. World market prices

There are two categories of uranium prices: prices for spot sales and future delivery prices (negotiated). Prices of spot sales were still higher than those of future delivery contracts in the seventies. Recently, however, the ratio is reversed and majority of sales is materialized in spot prices. Until 1992, only two companies – Nuexco and Nukem – were releasing the spot prices. So far the highest price was reached in 1978 – USD 95 per kg U_3O_8 (Nuexco). Since then there was a drop in prices, and starting 1989 the average prices of spot sales persisted around USD 22 per kg U_3O_8. The fall in prices resulted in a closure of a number of mines. Low prices in general resulted from political and economic changes on the world scene. Until 1995, offer prevailed over demand, which was caused by nuclear disarmament (high supplies from Russia to the world market at price of 15.4 – 15.9 USD/kg U_3O_8), by lowering of consumers stockpiles, etc. The prices increased substantially only in 1996. Since then, however, high offer of uranium caused a continuing decrease of the price till 2000. The price was about 22 USD/kg U_3O_8 in the years 2001 and 2002, and it increased significantly up to 32 USD/kg U_3O_8 in the end of the year 2003. Price of the uranium concentrate markedly increased in relation to a steep increase of prices of other fuels (oil, gas, hard coal) in 2004. These raw materials can to a certain extent replace each other at the electric energy production; therefore their prices are interrelated on a long term. Continued marked increase of prices of the uranium concentrate can be expected in 2005. Nevertheless, countries with energetic sector standing on a strong role of the core (France, Japan, South Korea) will still show huge financial savings compared to production of the same amount of electric energy from other sources (e.g. gas).

The average prices of uranium concentrate in USD per kg U_3O_8 fluctuated as follows (up to 1995 at year-end):

A Nuexco

Commodity/Year	2000	2001	2002	2003	2004
A	15.7	20.9	22.5	31.7	46.3
B	15.5	19.1	21.7	25.4	40.3

A – end of the year, B – annual average

Prices for spot sales and future deliveries are traditionally different for US and European markets (market of the Euroatom member countries), particularly after 1989 when US market prices dropped down to 50 % of those of the European market. Prices for the future deliveries on the European market are treble the prices for spot sales.

10. Recycling

Theoretically, the burned-up fuel elements of nuclear reactors, which still contain 80 % of uranium, can be reprocessed. However, due to hygienic and economic reasons, burned-up fuel elements are not recycled but stored.

11. Possible substitutes

Problems related to nuclear power generation versus energy generation from fossil fuels are widely discussed worldwide. Replacement of U^{235} by Th^{232} or U^{238} cannot be materialized because of the Treaty for non-proliferation of nuclear weapons. When using so-called reactors with fast neutrons (i.e. in case of Th and U^{238}), the fission products could be misused for the production of nuclear weapons.

HARD COAL

1. Characteristics and use

Hard coal is a phytokaustobiolite exhibiting a higher degree of coalification, i.e. more than 75.4 % carbon, less than 50 % volatile matter and calorific value on an ash-free but moist basis exceeding 24 MJ/kg. The internationally recognized boundary between lignite and hard coal is the value of vitrinite reflectance (R = 0.5 %), which in the case of hard coal is higher than 0.5 %.
Coking coal by definition is a hard coal, which allows producing coke for blast-furnace production of pig iron and/or for heating. Other coal is classified as steam coal and it is used predominantly for electric energy production (40 % of electric energy in the world is generated by coal burning).
Total world resources of the hard coal are estimated at more than 500 milliard tonnes.

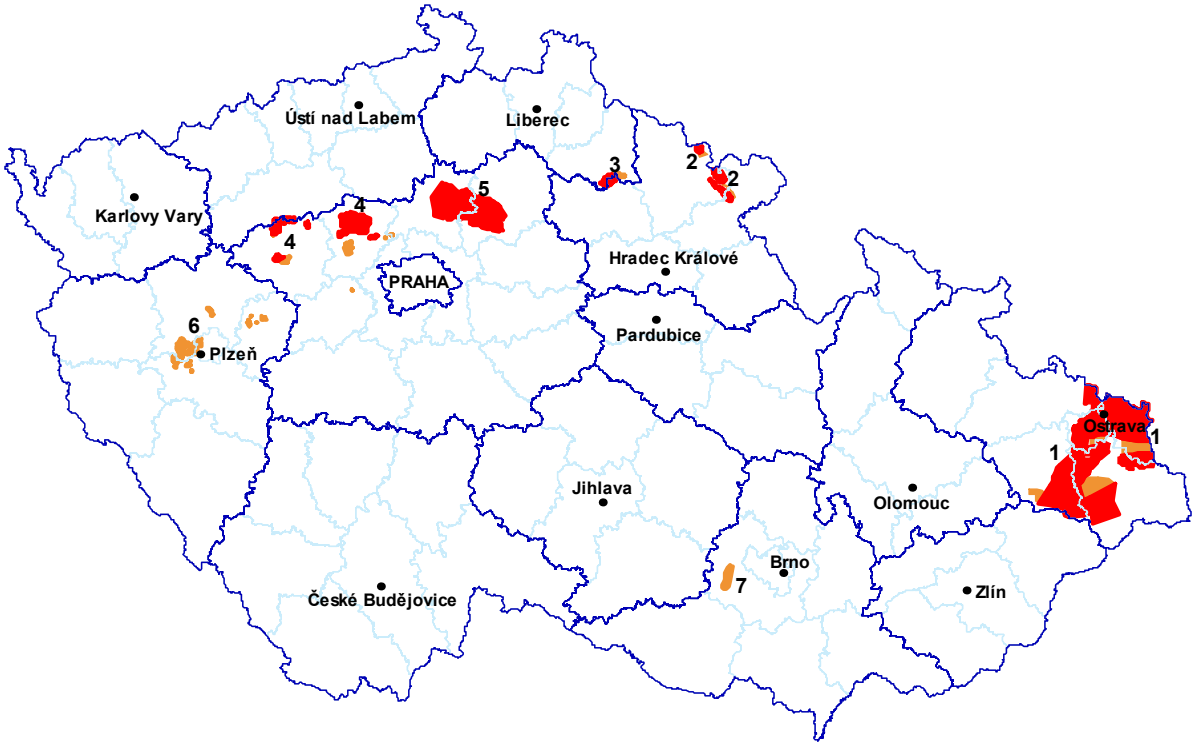
2. Mineral resources of the Czech Republic

Both the coking coal and the steam coal deposits occur on the territory of the Czech Republic. Czech part of the Upper Silesian Basin with an area of about 1,600 km^2 (about 30 % of coal resources is in the Czech Republic and 70 % in Poland), is of a decisive importance. This part called the Ostrava-Karviná coalfield containing an important portion of coking coal, represents the only area with hard coal mining in the Czech Republic at present.

- The Bludovice fault divides the Czech part of the Upper Silesian basin into two sections: the northern Ostrava-Karviná and the southern Beskydy Mts. Piedmont sub-basins. A major fault (the Orlová structure) separates the western (Ostrava) and eastern (Karviná) part of the Ostrava-Karviná coalfield. The former is filled with older sediments and havily affected by tectonics, of paralic character of sediments and coal seams. The latter, less complex, exhibits limnic character of the sediments as well as of coal. The western part consists of several tens of high-grade coking coal seams of relatively low thickness (about 0.7 m on average), whereas the eastern part is characterised by abundant seams of medium thickness (about 1.8 m on average) containing mixed coking coal and high volatile steam coal. 4 mines with 9 deposits (mining claims Darkov, Dolní Suchá, Doubrava, Karviná-Doly I and II, Lazy, Louky, Stonava) in the Karviná part of the basin supply roughly 90 % of the basin production. A long-term intensive mining activity resulted in that the mining in the Ostrava part of the basin reached higher and higher depth (even above 1,000 m), which together with complex and unfavorable mining and geological conditions increased the mining costs. Consequently, some of the Ostrava mines became unprofitable and they were gradually closed and liquidated. The majority of mines in the eastern part have enough reserves with a less complex geological structure, which makes their extraction less expensive. However, this coal is of a lower grade due to coking properties.
- Two deposits of predominantly coking coal are still extracted by a single mine in the northern part of the Beskydy piedmont part of the basin (mining claim Staříč). Relatively large reserves of coal were verified south of the original Upper Silesian Basin, particularly near Frenštát pod Radhoštěm, where Carboniferous sediments are buried under Miocene sediments and the Beskydy nappes. Here, the coal would be extracted from the depths of 800 to 1,300 m under difficult geological and mining conditions. Besides, a part of the deposit extends into the Protected Landscape Area (CHKO) Beskydy Mts. and this is why its exploitation is not considered in the meantime.

- Kladno–Rakovník Basin in central Bohemia, west of Prague, part of the Central Bohemian Basins, represented the second most important area with hard coal reserves until the mining in the three last mining claims (Kačice, Srby, Tuchlovice) was definitely terminated. The major part of the coal reserves (steam coal) were already mined out and the remaining ones lost their economic importance. Another deposit with a small share of coking coal of a rather high quality was discovered and explored in the 1950s and 1960s near Slaný. It is the north-eastern extension of the Kladno Basin and has about 223 mill tonnes of coal. In addition to a high depth of 1,000 to 1,300 m, the hydrogeological situation is complicated, too. The mining activity was terminated in the beginning of the 1990s after two shafts were put down.
- The so-called Mšeno (Mělník) Basin, having more than 1.1 mlld tonnes of reserves of steam coal, has been explored northeast of Prague. However, economic aspects and conflicts of interest – the overlying Cretaceous sandstones represent a source of potable water for central Bohemia - obstruct exploitation of this deposit. The neighbouring Roudnice Basin and the eastern neighbouring Mnichovo Hradiště Basin appear to be completely without perspective at present.
- A deposit of low-quality steam hard coal of a low perspective has been evaluated in the Krkonoše Mts. Piedmont Basin.
- The underground mining of mainly steam coal in the Intra-Sudetic (Lower Silesian) Basin was definitely terminated in the beginning of the 1990s. A surface mining of a very restricted extent has been taking place since 1998 on a waste damp of the Žacléř deposit.
- The hard coal mining in the Plzeň (Pilsen) region (Plzeň and Radnice Basins) was definitely terminanted in the first half of the 1990s, too. The remaining reserves were eliminated from The Register in 2002.
- Steam coal mining in the Boskovice Furrow (Rosice-Oslavany District) west of Brno was definitely terminated already in 1991.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Coal basins:

1 Hornoslezká pánev (Upper-Silesian Basin)
2 Vnitrosudetská pánev (Intra-Sudetic Basin)
3 Podkrkonošská pánev (Krkonoše Mts. Piedmont Basin)
4 Středočeské pánve (Central Bohemian Basins)
5 Mělnická pánev (Mělník Basin)
6 Plzeňská a Radnická pánev (Plzeň Basin and Radnice Basin)
7 Boskovická brázda (Boskovice Furrow)

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	67	66	63	62	62
exploited	15	15	12	11	11
Total mineral reserves, kt	16 353 961	16 315 084	16 128 871	16 110 431	16 093 442
economic explored reserves	2 072 075	2 094 274	1 751 320	1 688 785	1 670 133
economic prospected reserves	7 219 168	7 155 491	5 947 714	5 891 179	5 891 506
potentially economic reserves	7 062 718	7 065 319	8 429 837	8 530 467	8 531 803
Mine production, kt	17 028	14 808	14 097	13 382	14 648

Notes:

- *ČSÚ presents so-called sales production, which represents production of marketable hard coal and reaches on average about 80 % of the given mining production*
- *From the presented economic reserves, 271,120 kt are classified asminable in 2004*
- *There was no real decrease in the mining production between 2000 and 2001, as the production stated for 2000 was the bulk (broken coal) output*

5. Foreign trade

2701 – Hard coal, briquettes and similar solid fuels made of hard coal

Raw material	2000	2001	2002	2003	2004
Import, kt	1 095	1 203	1 217	1 281	1 695
Export, kt	5 886	5 713	5 690	5 669	5 707

2704 – Coke and semi-coke from hard coal, lignite or peat, agglomerated retort coal

Raw material	2000	2001	2002	2003	2004
Import, kt	602	527	523	701	725
Export, kt	948	868	946	944	966

6. Prices

Hard coal prices are agreed and the OKD a.s. mining company considers them as a part of the firm secret. It can be however assumed that the prices considerably increased in 2004. 1,695 kt of hard coal was imported in the Czech Republic in 2004 - 96.1 % from Poland, 3.1 % from Russia, 0.6 % from Ukraine. The average price was CZK 1,868 per tonne. World prices of hard coal increased, too, in relation to the increase of world price of oil and gas. The average import price of Polish coal increased by about 60 % between the years. 5,707 kt of hard coal were exported (38.0 % to Austria, 35.3% to Slovakia, 10.9 % to Poland, 10.3 % to Germany and 5.3 % to Hungary) at average price of CZK 2,036 per tonne. The export price of hard coal increased by 33 % between the years. 725 kt of coke and semi-coke were imported in 2004 at average price of CZK 5,749 per tonne (91.1 % from Poland, 4.3 % from Slovakia and 2.6 % from Ukraine). 966 kt of coke and semi-coke were exported at average price of CZK 5,518 per tonne (46.1 % to Germany, 33.5 % to Austria, 4.8 % to Poland and 4.3 % to Slovakia). Import and export prices of coke and semi-coke increased between 2003 and 2004, too, 2.2 times and 1.6 times, respectively.

7. Mining companies in the Czech Republic as of December 31, 2004

OKD, a.s. – vnitřní organizační složka Důl ČSA, o.z. Karviná
OKD, a.s. – vnitřní organizační složka Důl Darkov, o.z. Karviná
OKD, a.s. – vnitřní organizační složka Důl Lazy, o.z. Orlová
ČMD, a.s., člen koncernu Karbon Invest
OKD, a.s. – vnitřní organizační složka Důl Paskov, o.z. Staříč
GEMEC – UNION, a.s., Jívka

8. World production

World production of hard coal exceeded 3,000 mill tonnes in 1985. Despite the prognoses of the UNO European Economic Commission, the world mine production exceeded the limit of 4,000

mill tonnes already in 2003 (not after 2010). A long-term decrease of the mine production in Europe is being replaced by mine production in Asia and South America. The Asian continent has a share of 55 % in the world mine production. Increase of mine production in China, India, but also in Indonesia, Columbia and Kazakhstan is especially dynamic. The production of steam coal exceeds presently the production of coking coal and the production ratio of both types of coal is expected to be 2:1 in favour of steam coal in near future. The world mine production has been developing as follows in the last five years (according to the Welt-Bergbau-Daten and Coal Age):

Year	2000	2001	2002	2003	2004 e
Mine production, mill t (IEA/OECD)	3 629	3 794	3 910	4 038	N
Mine production, mill t (WMS)	3 494	3 791	4 025	4 293	N
Mine production, mill t (WBD)	3 575	3 791	3 997	4 008	N

Main mine producers´ share in the world mining output (2003; according to WBD):

China	36.9 %	Russia	4.4 %
the USA	22.5 %	Poland	2.4 %
India	8.2 %	Kazakhstan	2.0 %
Australia	7.1 %	Canada	1.6 %
South Africa	5.6 %	Korea, D.P.R.of	1.5 %

9. World market prices

Prices for spot sales and future delivery prices are quoted on the coal world market. Prices of both major technological types of coal (coking and steam coal) are further divided according to the calorific value and the contents of volatile constituents, sulphur and ash.

Decisive prices are those of the Australian and US coal since this coal represents 55 % of the world sales. Prices are quoted in USD/t FOB, FAS or CIF. Prices of overseas coal on the European market (CIF) during the last decade were fluctuating between USD 34 and 46 per tonne of steam coal and between USD 48 to 60 per tonne of coking coal. Price variations were due to fluctuation in supplies and demands and also due to oscillations in sea transport costs. Low prices of overseas coal lead to a gradual reduction of coal mining in Europe, where mining cost is considerably higher.

The average annual prices of hard coal in USD per tonne CIF EU (according to the International Energy Statistics):

A	Coking hard coal, American
B	Coking hard coal, Australian
C	Coking hard coal, South African
D	Coking hard coal, Polish
E	Steam hard coal, American
F	Steam hard coal, Australian
G	Steam hard coal, South African
H	Steam hard coal, Chinese
I	Steam hard coal, Russian
J	Steam hard coal, Polish

K Steam hard coal, Columbian

Commodity/Year	2000	2001	2002	2003	2004
A	52.91	58.54	61.48	64.18	N
B	45.45	51.24	55.52	58.03	N
C	39.09	42.10	38.69	39.20	N
D	50.43	51.58	50.15	62.24	N
E	41.07	46.52	43.48	47.37	N
F	39.04	44.13	43.28	46.83	N
G	33.83	42.32	36.65	39.10	N
H	31.45	40.90	44.30	51.38	N
I	33.59	42.16	36.79	42.22	N
J	35.30	44.41	40.75	43.26	N
K	34.22	42.32	36.99	41.65	N

According to preliminary and partial data, some hard coal quotes increased by full 100% in 2004. This was unequivocally caused by a break in raw material consumption in the third world countries. Number of these countries delivered large volumes of hard coal to developed countries until recently and their own domestic consumption was negligible. Domestic consumption of these countries (often) increases dramatically and raw materials are therefore in still larger volumes consumed already in the mother country.

10. Recycling

Coal is not recycled.

11. Possible substitutes

Coking coal can be replaced by steam coal due to introduction of new technologies in production of pig iron e.g. (Corex). Other energy minerals can replace coal in energy generation.

BROWN COAL

1. Characteristics and use

Brown coal is a phytokaustobiolite showing lower degree of coalification, i.e. having less than 73.5 % carbon, more than 50 % volatile matter and calorific value on an ash-free but moist basis lower than 24 MJ/kg. Internationally recognized boundary between brown coal and hard coal is the reflectance value of vitrinite (R = 0.5 %), which in case of brown coal is lower than 0.5 %. The coal terminology is not unified in the international practice. English term lignite sometimes designates both coal of Czech (Central European) brown coal grade and Czech lignite grade whereas the latter is registered separately in the Czech Republic. There are also terms bituminous coal (for rather hard coal grade) and subbituminous coal (for rather brown coal grade).

Total world deposit reserves of the brown coal (incl. lignite) have been estimated at more than 500 milliard tonnes.

Brown coal is used mainly in energy industry and to a smaller extent in chemical industry.

2. Mineral resources of the Czech Republic

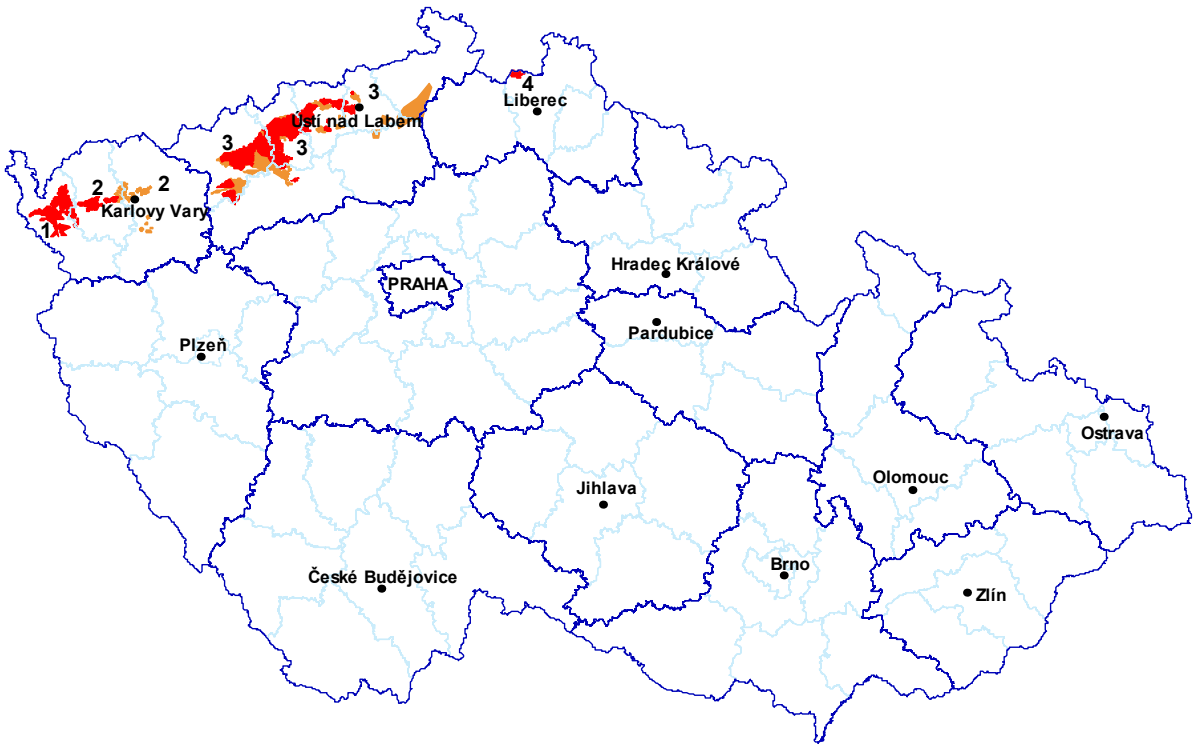
The majority of brown coal in the Czech Republic is still used for energy generation. The major Bohemian brown coal basins originated and are located in the graben along the Krušné hory Mts, which follows the Hercynian direction and the NW boundary of the Czech Republic. The total area of the coal-bearing sedimentation is 1,900 km^2 large. Underlying sediments are of the Oligocene to Early Miocene age. The brown coal seams are mostly of the Middle Miocene age, whereas overlying sediments, of 400 m thickness or even more, are of the Late Miocene age. The sedimentation in the Cheb Basin was terminated as late as in the Pliocene. The following independent basins are recognized in the whole area of the Krušné hory Mts. Basin (from NE to SW): North Bohemian, Sokolov and Cheb Basins. The largest North Bohemian Basin is then divided into three parts. The share of the North Bohemian Basin on the total mining production of the brown coal in the Czech Republic is about 75%, the remaning 25% comes from the Sokolov Basin. The coal is exploited with one exception only by open-pit mining operations.

- In the Chomutov part of the North Bohemian Basin, the coal seam is divided into 3 benches. These become connected or are close to each other towards the north-western part of the basin, which allows their common open-pit mining. The raw material represents less caloric steam coal with a low degree of coalification. Its major use is burning in power plants. The problem with the elevated sulphur content in this coal was solved by desulphurization of power plants exhaust gases. The ash content in general increases from NW to SE, where it can reach up to 50%. The coal in this part of the basin is extracted by one large open-pit mine (Tušimice-Libouš).
- Brown coal in the Most part of the North Bohemian Basin shows higher degree of coalification and a lower content of ash. The coal is used in energy generation; sorted types for small customers are produced, too. Locally, however, it is very rich in sulphur and arsenic. The depth of open-pit mines continues to increase, being currently at about 150 m in some parts. The extraction takes place in four large open-pit mines (Bílina, Ervěnice, Holešice, Vršany) and one underground mine (Dolní Jiřetín u Mostu) at present.
- Mining production of the Teplice part of the North Bohemian Basin was terminated in 1997 by closure of the Chabařovice open-pit mine. The remaining reserves of high-quality almost sulphur- and ash-free brown coal located under the Chabařovice municipality cannot be mined out because of the conflicts of interests and complex hydrogeological conditions.

Similar conflicts will probably block extraction of the other reserves of the high-quality coal also in other parts of the basin.

- The Sokolov Basin west of Karlovy Vary has two groups of strata with brown coal seams – Antonín and Josef. The major reserves are confined to the thickest and the uppermost seam called Antonín, which is separated into 2 to 3 seams in its western part. The steam coal is of a lower to medium coalification, relatively poor in sulphur and rich in water compared to the coal of the North Bohemian Basin. Only the eastern part of the basin has been mined since 2001. The seam is extracted by two large (Alberov-Jiří, Nové Sedlo-Družba) and one smaller open-pit mines (Královské Poříčí-Marie) and the coal is used mainly in energy generation (sorted brown coal, burning in power plants, gas and briquette production) but also in some carbochemical products. Coal of the lower Josef seam with higher degree of coalification but at the same time higher ash, sulphur and other impurities (Ge, As, Be) contents, is not used anymore.
- The Cheb Basin has more than 1.7 billion tonnes of reserves of brown coal of a low coalification. The coal is characterised by a high content of water, ash, sulphur and other impurities. It might be suitable for chemical processing due to its locally high content of liptodetrite and therefore also mineral tar. The mining operations in this basin are though excluded as major part of the reserves is blocked by protection of the mineral water sources of the Františkovy Lázně Spa.
- The Zittau (Žitava) Basin extends into the Czech Republic by a minor part from Poland and Germany. The upper seam was already mined out by surface mining. Remaining two lower seams are difficult to be mined underground because of both technical and economical problems associated with overlying quicksand.

3. Registered deposits and other resources in the Czech Republic




reserved registered deposits


exhausted deposits and other resources

Coal basins:

1 Chebská pánev (Cheb Basin)

2 Sokolovská pánev (Sokolov Basin)

3 Severočeská pánev (North-Bohemian Basin)

4 Žitavská pánev (Zittau Basin)

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004 b)
Deposits – total number	60	59	57	58	57
exploited	10	10	9	9	9
Total mineral reserves, kt	9 652 302	9 587 995	9 521 538	9 501 242	9 873 178
economic explored reserves	3 293 064	3 242 113	3 159 993	2 989 071	3 088 277
economic prospected reserves	1 945 161	1 943 193	1 942 857	1 942 506	2 334 200
potentially economic reserves	4 414 077	4 402 689	4 418 688	4 569 665	4 450 701
Mine production, kt a)	50 610	51 036	48 834	49 920	47 840

Note:

a) ČSÚ presents so-called sales mining production, which presents production of marketable brown coal and reaches on average about 95.0% of given mining production

b) 1,091,284 *kt of economic reserves are classified as minable*

5. Foreign trade

2702 – Lignite, also agglomerated, except gagate

Raw material	2000	2001	2002	2003	2004
Import, kt	1	0	0	0	4
Export, kt	2 888	3 145	1 950	1 274	1 233

6. Prices

Brown coal prices depend on calorific value and granularity. Prices of brown coal oscillated between CZK 800 and 1,450 per tonne on domestic market in 2004. Prices of small lumps were CZK 670 – 1,065 per tonne. Brown coal rough powder prices fluctuated between CZK 570 and 820 per tonne, multi powder prices were about CZK 1,400 per tonne. Prices of brown coal mixtures used in industry fluctuated between CZK 400 and 700 per tonne. Prices of brown coal briquettes of E 235 quality fluctuate from CZK 1,200 per tonne (fragments) up to CZK 3,100 per tonne (prisms in packages). Almost 1.2 mill t of brown coal were exported to Slovakia (60.3 %), Hungary (22.1 %) and Germany (12.8 %) at average price of CZK 984 per tonne. A more important amount of brown coal was also imported in the Czech Republic after several years. The import volume was 4.3 kt and the raw material came from Poland (66.5 %) and Germany (32.4 %) at price of CZK 1,981 per tonne.

7. Mining companies in the Czech Republic as of December 31, 2004

Severočeské doly a.s., Chomutov
Mostecká uhelná společnost, a.s., Most
Sokolovská uhelná a.s., Sokolov
Důl Kohinoor a.s., Mariánské Radčice

8. World production

World production (including lignite) exceeded 1,000 mill tonnes in 1980. It reached its peak probably in 1989 – 1,273 mill t, and then a decline came. The world production stagnated on the level of about 850 mill t per year in the second part of 1990s. Mine production in Germany (the most important world producer) is slowly increasing again in the last years. Mine production in Greece has been slowly increasing, too. Mine production in Russia and Poland has been rather stable during the recent years. Mine production in Turkey increased by 17 % in 1998. However, data on the total world production showed differences up to 30 % in the last five years.

Years	2000	2001	2002	2003	2004 e
Mine production, mill t (WMS)	776	740	793	730	N
Mine production, mill t (WBD)	857	882	900	877	N
Mine production, mill t (IEA/OECD)	889	897	877	N	N

Main producers´ share in the world mining output (2003; according to WBD):

Germany	20.4 %	Poland	7.0 %
Russia	8.7 %	China	5.9 %
Greece	7.9 %	Czech Republic	5.8 %
Australia	7.8 %	Turkey	5.0 %
the USA	7.8 %	Yugoslavia	4.8 %

9. World market prices

Brown coal sales represent only negligible volume of the total world trade and are usually materialized only between neighbouring countries based upon individual contracts and negotiated prices considering the grade and transport costs. Data on these prices are not available.

10. Recycling

Brown coal is not recycled.

11. Possible substitutes

Possible substitutes differ according to the type of brown coal and its use. In energy generation, other fuels, particularly nuclear fuel, can replace it. This substitution, however, is connected with large investment, environmental and other problems.

LIGNITE

1. Characteristics and use

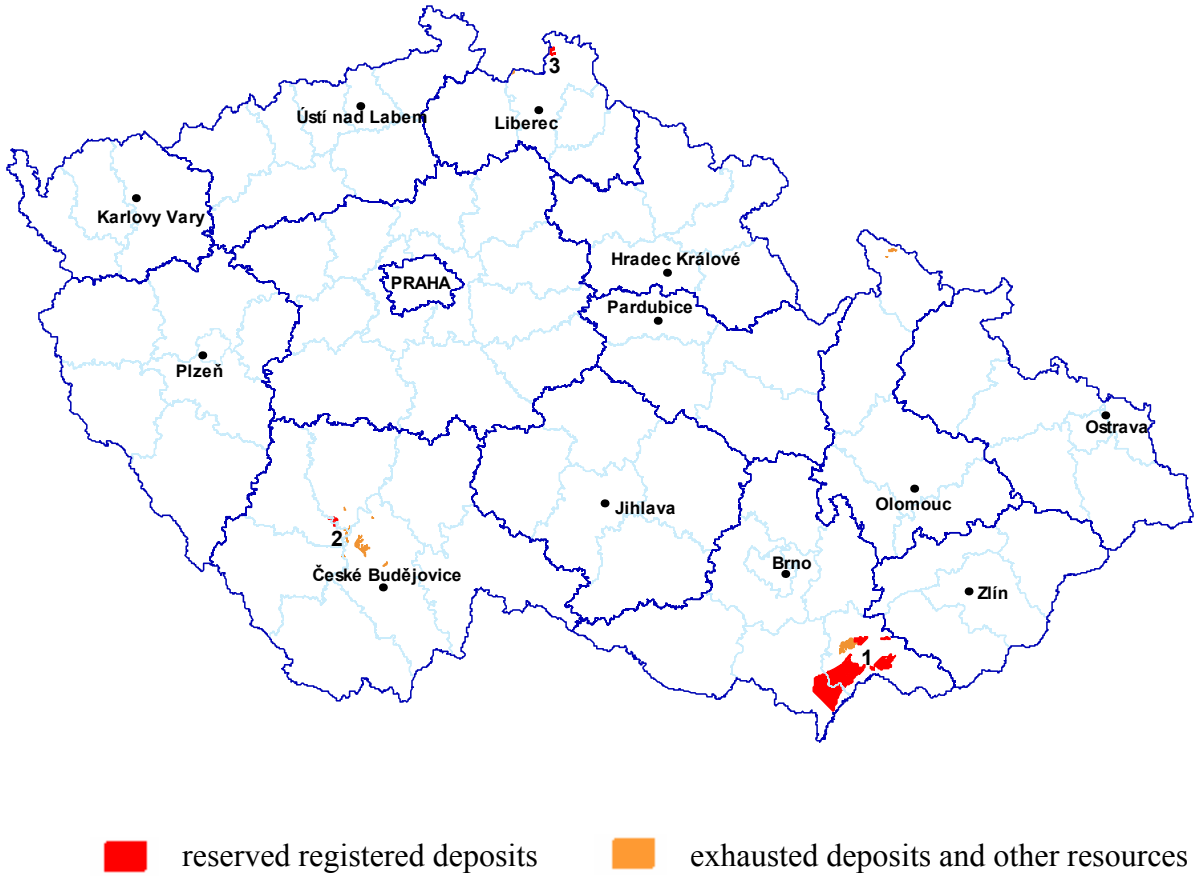
Lignite is a variety of brown coal, which exhibits the lowest degree of coalification, is of xylitic character with preserved tree trunks and with large or small fragments of wood. From the geochemical and petrological viewpoints, it is a brown coal hemitype. Its calorific value on an ash-free but moist basis is lower than 17 MJ/kg.

However, no strong boundary between brown coal grade and lignite grade of coal has been internationally established and term lignite can designate both Czech brown coal grade and lignite grade of coal which are marketed separately in the Czech Republic. Lignite is used in energy generation and for heating. It represents the lowest quality mineral fuel consumption of which gradually decreases.

2. Mineral resources of the Czech Republic

- Largest deposits of lignite occur along the northern margin of the Vienna Basin, which extends from Austria into southern Moravia. There are two lignite seams in the youngest sediments of the Pannonian and Pliocene age. Reserves of the northern Kyjov seam are already exhausted (the last mine Šardice was closed in the end of 1992). Those of the southern Dubňany seam have been mined by only one underground mine Hodonín-Mikulčice since 1994, when the mining at Dubňany deposit was terminated. The last mine should be closed in 2004, nevertheless negotiations on prolongation of the contract with ČEZ, a.s. and by that also continuation of the mining are in progress. Practically all production is burned in the Hodonín power station owned by ČEZ, a.s. Economic reserves are registered at six other deposits, but their exploitation is not anticipated. South Moravian lignite is of a xylodetrital character with numerous tree trunks. It is rich in water (45– 49 %), average content of S is 1.5– 2.2 % and its calorific value is 8–10 MJ/kg.
- Other deposits of low-quality lignite occur in narrow lobe-shaped extremities of the České Budějovice Basin. Major part of the reserves has been mined out and the remaining ones are not of any economic importance.
- Smaller isolated occurrences of lignite (Pleistocene xylite) in the Zittau (Žitava) Basin were to a large extent mined out, too, and the remaining reserves are not of any economic importance.

3. Registered deposits and other resources in the Czech Republic



Principal areas of deposits presence:

1 Vídeňská pánev (Vienna Basin)

2 Českobudějovická pánev (České Budějovice Basin)

3 Žitavská pánev (Zittau Basin)

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	13	13	13	11	11
exploited	1	1	1	1	1
Total mineral reserves, kt	1 029 320	1 028 765	1 028 672	1 011 865	1 010 123
economic explored reserves	216 514	215 959	215 866	214 270	212 982
economic prospected reserves	622 577	622 577	622 577	619 978	622 534
potentially economic reserves	190 229	190 229	190 229	177 617	174 607
Mine production, kt	453	507	501	470	450

Note: 3,065 kt of given economic reserves are classified as minable in 2004

5. Foreign trade
No separate customs tariff item exists for lignite.

6. Prices
Prices of South Moravian lignite for energy production (predominant part of the mining production) have been oscillating around CZK 500 per tonne during the last years. Sorted lignite was offerred in the category small lump at CZK 570 per tonne, in the category cube at CZK 580 per tonne in 2004.

7. Mining companies in the Czech Republic as of December 31, 2004
Lignit Hodonín s.r.o.

8. World production
World production of lignite is included in the brown coal (lignite) production.

9. World market prices
Lignite is generally not traded on the world market.

10. Recycling
Lignite is not recycled.

11. Possible substitutes
Other energy minerals can replace lignite exclusively used as a fuel.

CRUDE OIL

1. Characteristics and use

Oil (petroleum) is a natural mixture of gaseous, liquid and solid chemical compounds, predominantly hydrocarbons. Its specific gravity fluctuates between 0.75 and 1 t/m^3, the average content of carbon is between 80 and 87.5 %, hydrogen between 10 – 15 % and its calorific value ranges between 38 and 42 MJ/kg. Hydrocarbons are derived from an organic matter originating from subaqueous biochemical decomposition of biomass under specific conditions. The crude oil originates at temperatures between 60 and 140°C in pelitic oil-bearing sediments at depths between 1,300 and 5,000 m. From these sediments it subsequently migrates and accumulates in permeable, porous reservoir or fractured collector rocks. The extracted oil is called crude oil and it has highly variable properties such as colour, viscosity, molecular and specific gravity.

Principally 4 types of crude oil can be distinguished, based upon its chemical composition – paraffin-base petroleum, asphalt-base petroleum, naphtene petroleum, and mixed bases (aromatic) petroleum.

Total deposit reserves of crude oil in the world are estimated at 137,000 mill tonnes about 75 % of which have been found in OPEC member countries.

Crude oil is processed mainly by distillation (rafination) so that its individual fractions are separated: dissolved gas, gasoline, petrol, kerosene, oil, and lubricating oil, asphalt. Higher carbohydrates (long carbohydrate chains) are processed (shortened) by cracking.

All-round oil industrial use is evident and new applications are still under way. Nevertheless, energy generation, petrochemical and chemical industries are the principal oil consumers.

2. Oil resources of the Czech Republic

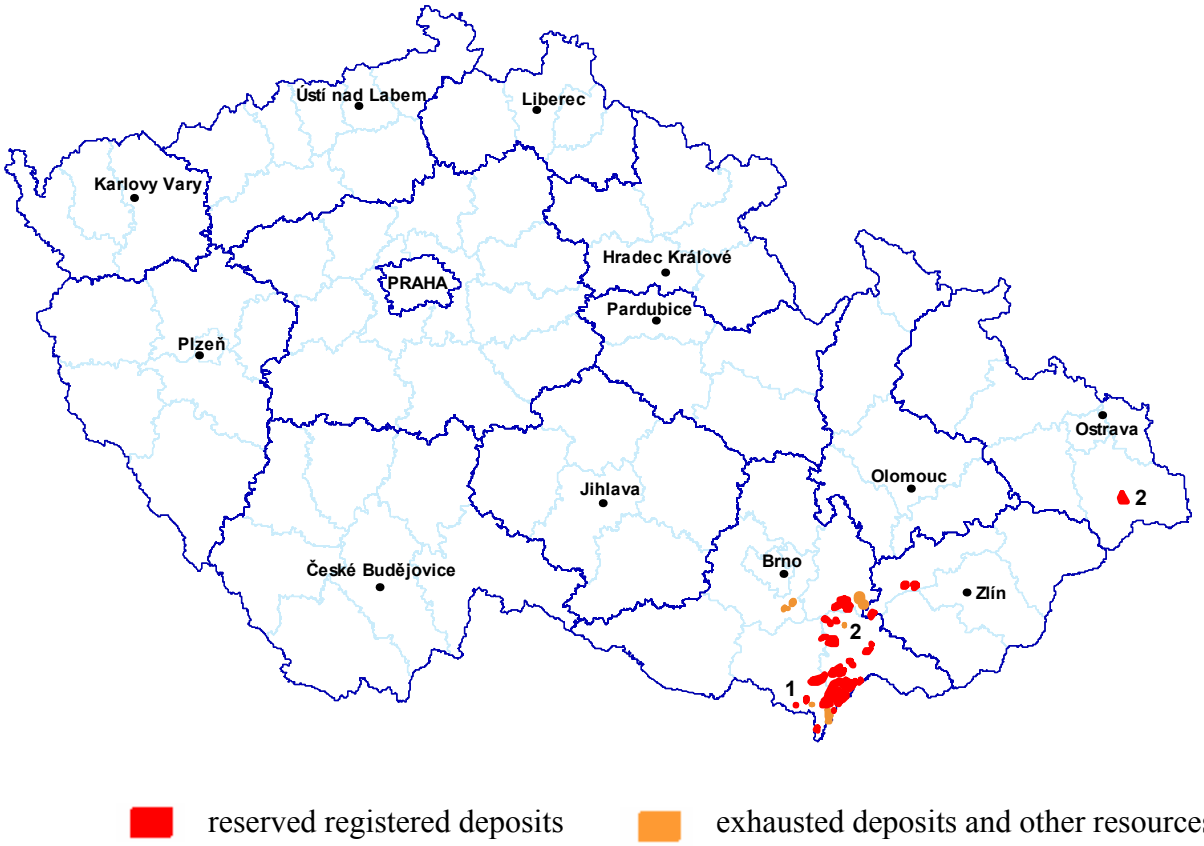
In contrast to coal, the Czech Republic does not dispose by sufficient resources of oil neither gas. Reserves and deposits of oil are concentrated mainly in southern Moravia and they are associated with geological units of the Western Carpathians. Even though the domestic mining production of crude oil has been increasing in recent years, it covers only roughly 5 % of domestic consumption.

- The deposits of the Vienna Basin (Moravian part) are distributed over a great number of individual oil-bearing structures and producing horizons situated at the depth going down to 2,800 m. Sandstones of the Middle and the Upper Badenian represent the most productive oil-bearing rocks. The largest deposit of this area (Hrušky), major part of which has already been extracted, serves as underground gas storage.
- Another region with oil deposits lies in the Moravian part of the Carpathian foredeep and on the south - eastern slope of the Bohemian Massif. The most important accumulations occur particularly in the collectors in the Miocene, Jurassic and jointed and weathered portions of the crystalline rocks. Dambořice-Uhřice 2 deposit represents the largest and most important deposit; importance of Žarošice, Uhřice-jih, Ždánice deposits and others has been increasing.

Oil and gas deposits are mutually genetically related. Oil deposits of the Vienna Basin are concentrated especially in its central part, whereas gas deposits predominate in its marginal parts.

Light, sulphur-free paraffin to paraffin-naphtene oil prevails in the Czech Republic. Three grades of oil with specific gravity from 856 to 930 kg/m^3 at 20°C, which corresponds to 20– 33° API, with sulphur content of 0.08– 0.32 wt %, were extracted in 2003.

3. Registered deposits and other resources in the Czech Republic



Principal areas of deposits presence:

1 Vídeňská pánev (Vienna Basin)

2 karpatská předhlubeň (West-Carpathian Foredeep)

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	22	28	28	28	28
exploited	15	16	17	18	19
Total mineral reserves, kt	37 463	41 617	32 371	32 443	32 790
economic explored reserves	11 055	11 734	12 785	12 484	12 824
economic prospected reserves	13 496	17 091	8 183	8 557	8 567
potentially economic reserves	12 912	12 793	11 403	11 402	11 399
Mine production, kt	168	178	253	310	299

Note: 2,238 kt of economic reserves are classified as minable in 2004

5. Foreign trade

2709 – Petroleum oils and oils obtained from bituminous minerals, crude

Raw material	2000	2001	2002	2003	2004
Import, kt	5 819	6 005	6 082	6 344	6 531
Export, kt	111	119	142	133	64

6. Prices

6,532 kt of crude oil were imported in 2004 at average price of CZK 6,511 per tonne. 66.90 % were imported from Russia, 15.0 % from Azerbaidjan, 4.8 % from Syria, 3.6 % from Libya, 3.3 % from Kazakhstan and 2.9 % from Algeria. 64 kt of crude oil were exported at average price of CZK 6,795 per tonne (79.2 % to Austria, 18.7 % to Slovakia and 2.0 % to Poland) in 2004.

In comparison with the year 1999, when crude oil was imported at average price of CZK 3,680 per tonne, the import prices were two times higher in 2000 (CZK 7,486 per tonne). That was caused by a vehement increase of crude oil prices on the world market and by a significant weakening of the CZK against USD. Also in 2001, the import price of crude oil was still relatively high (CZK 6,808 per tonne) with regard to the situation on the world markets, irrespective of a repeated strengthening of the CZK against USD. This unfavourable trend did not improve until 2002, when the average import price of CZK 5,501 per tonne was reached thanks to the lower oil prices on the world market and the long-term increase of the CZK rate to USD. Average import price increased again up to CZK 5,733 per tonne in 2003 due to the evolution on the world market and this trend continued in 2004, too. The average import price reached CZK 6,511/t (255 USD/t). Strengthening of the CZK against USD protects domestic economy against even more serious impacts.

7. Mining companies in the Czech Republic as of December 31, 2004

Moravské naftové doly a.s., Hodonín
UNIMASTER s.r.o., Ostrava-Hrabová
Česká naftařská spol. s.r.o., Rohatec

8. World production

World crude oil production fluctuated between 3 – 3.6 milliards tonnes in the last years. In 1990s the crude oil production in Russia significantly decreased. The production volume was greatly influenced by cartel OPEC, whose members agreed on a production limit of 1.7 mill bbl a day in 1999 to confront the low prices of that time (1 barrel = 158.987 litre, 1 tonne of crude oil corresponds approximately to 7 barrels). The fall in mine production of OPEC together with other four non-OPEC members represented 2.1 mill bbl a day. The cartel influenced significantly the world market also in 2000, when a deficiency of the raw material resulted in vehement crude oil prices increase. Mining production of Saudi Arabia, Russia, Algeria and Brazil has been increasing, while that of Iraq, Great Britain and Indonesia has been decreasing during recent years.

Total production was as follows (WOGR – World Oil and Gas Review, WMS – World Mineral Statistics, WBD – Welt Berbau Daten):

Year	2000	2001	2002	2003	2004 e
Mine production, thousand bbl/day (WOGR)	74 945	75 036	74 805	77 499	N
Mine production, mill t (WMS)	3 488	3 467	3 441	3 596	N
Mine production, mill t (WBD)	3 596	3 523	3 512	3 632	N

Main producers´ share in the world mining output (2003; according to WBD):

Saudi Arabia	13.7 %	China	4.7 %
Russia	11.0 %	Norway	4.2 %
the USA	9.6 %	Venezuela	3.8 %
Mexico	5.2 %	Canada	3.7 %
Iran	5.0 %	Nigeria	3.0 %

9. World crude oil market price

Crude oil represents a commodity, which is extremely sensitive to the global political climate and development. It held true until recently that it was in 1990 when it was sold for the highest price. In this year, the crude oil price exceeded USD 40/bbl in consequence of the Gulf War. In 1991 – 1995, the crude oil price was USD 15 – 20/bbl. The price increased by about USD 24/bbl in 1996. However, the prices were decreasing since the end of 1996 in consequence of uncontrollable growth of production. The crude oil price hit twelve-year minimum (USD 10/bbl) in December 1998. Therefore the OPEC members signed an agreement on the significant reduction in production in spring 1999, which was joined by some important producers – non-OPEC members (Mexico, Oman, Russia, Norway). Surprisingly disciplinary respecting of the production limits by the member states led to the considerable growth of prices. During 1999 the prices increased about three times and they oscillated between USD 24 (Dubai) – USD 27 (Brent) per barrel at the end of the year. The OPEC influenced significantly the crude oil world prices also in 2000, when the prices were increasing even if the OPEC production increased several times and even if at year-end the total mine production of this cartel was higher than during of the price crisis at the beginning of 1999. The OPEC succeeded to drain a considerable part of crude oil stockpiles in particular countries by which it provoked impression of the raw material deficiency. At the beginning of September 2000, price of Brent was around USD 37 and of Dubai USD 31 – 32 per barrel. Also in 2001, the OPEC succeeded in ruling the world prices according to its ideas – price of Dubai was between USD 16 and 27 per barrel, of Brent USD 17 – 29 per barrel. In 2002 the oil prices on the world market were 18 – 30 USD per barrel (Brent) and 17 – 28 USD per barrel (Dubai), respectively. The year 2003 has seen a further increase of the world oil prices. Its major cause was a conflict in the Middle East, due to which the uncertainty concerning supply of the world market by this strategic raw material increased. Oil prices oscillated between 23 and 34 USD per barrel (Brent) and 22 and 31 USD per barrel (Dubai), respectively, as a result of the international situation.

World price of oil experienced a dramatic evolution in 2004. The uncertainty of deliveries from the Persian Gulf area all the time tossed with violence was joined by a more important factor – vehemently increasing oil consumption in rapidly growing economies of the third world (China, India, Indonesia, Brazil etc.). Indonesia, until recently an important world producer of oil, represents a specimen: it considers leaving the OPEC cartel as it has become a pure oil importer

during the last 2-3 years. In consequence of these factors, the oil price Brent increased systematically for whole ten months from value of USD 29 per barrel (January 2004) up to USD 52 per barrel (October 2004). The price evolution of oil Dubai followed a similar scenario in 2004, just the interval of the prices was narrower (USD 27 to 41 per barrel). With regard to the fact that the cause of the growth trend will not cease to exist, we can expect further and further until recently hardly credible price maxima.
The major world commodity exchanges (IPE, NYMEX) quote prices of direct sales (Spot) and prices of long-term contracts in USD per barrel, FOB. Daily quotations regularly include prices of the North Sea Brent, the American West Texas Intermediate (WTI) and the OPEC basket of crude oils (7 types of oils – Saharan Blend of Algeria, Minas of Indonesia, Bonny Light of Nigeria, Arab Light of Saudi Arabia, Dubai Fateh of Dubai, Tia Juana of Venezuela and Isthmus of Mexico). Different crude oil prices reflect its grade, which is expressed in degrees of API (Brent 38°, WTI 34.5°, Arab Light 34°, Dubai Fateh 32°, Russia Export blend 32°).

The average price quotations of direct sales in the last 5 years in USD per barrel, CIF Rotterdam were as follows:

A Brent crude oil
B OPEC basket crude oil

Commodity/Year	2000	2001	2002	2003	2004
A	28.79	24.87	25.01	28.28	37.80
B	26.39	22.78	23.67	26.75	33.43

10. Oil recycling

Crude oil is not recycled.

11. Oil substitutes

Oil may be successfully substituted to certain extent by other types of fuels in energy generation. As for gasoline or other oil derivatives, these can be substituted to a certain degree by fuels based on plants.

NATURAL GAS

1. Characteristics and use

Natural gas is a mixture of gaseous hydrocarbons, principally methane (CH_4), with other gases (nitrogene, carbon dioxide, hydrogene sulphide, hydrogene, inert gases). There is also some admixture of crude oil, water and sand when exploiting natural gas. Three principal grades of natural gas are recognized in the Czech Republic: dry gas (containing 98 – 99 % of methane), wet gas (85 – 95 % of methane plus admixture of other hydrocarbons) and gas containing higher portion of inert components (50 – 65 % of methane, more than 10 % of nitrogen – N_2 and more than 20 % of carbon dioxide – CO_2).

Natural gas world economic reserves were estimated at more than 140 trillions of m^3. The greatest part of economic reserves is situated in the territories of Russia – 32.2 % and Iran – 14.9 %.

Gas of Carboniferous age emitted out of coal seams may be classified as natural gas, too. The Carboniferous gas contains 90 – 95 % of methane. Its volume varies from 0 to 25 litres per tonne of coal. It depends on a degree of carbonification and on the depth of occurrence.

2. Natural gas resources of the Czech Republic

Similarly to crude oil, the Czech Republic does not dispose by sufficient resources of natural gas either. Deposits and reserves are accumulated in southern and northern Moravia. They are associated with geological units of the Western Carpathians, where they usually occur together with crude oil. In northern Moravia they are associated with coal seems of the Upper Silesian Basin, too. Gas mining production in the Czech Republic has been rather stable on a long term and it covers roughly 1-2 % of domestic consumption.

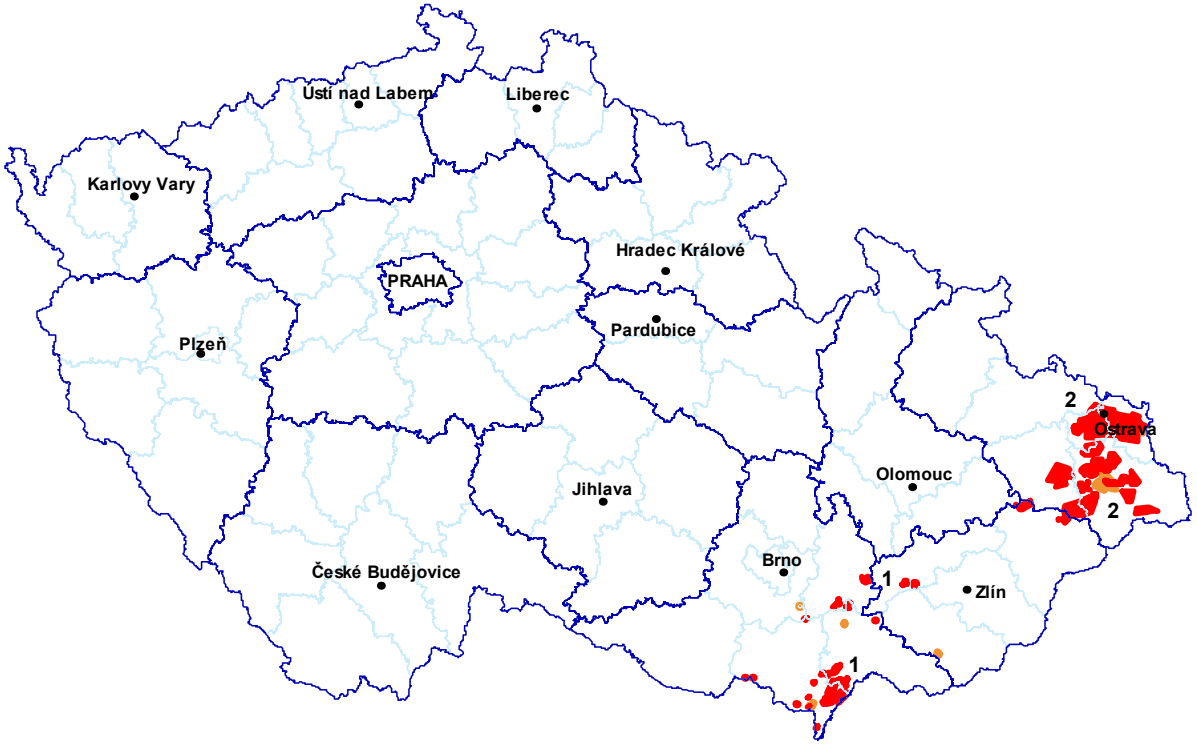
- Natural gas deposits are genetically associated with formation of oil. The deposits are mostly located in south Moravian part of the Vienna Basin. Northern part of the basin contains rather oil deposits. Exploited natural gas contains 87.2 – 98.8 % of CH_4, its calorific value is 35.6 – 37.7 MJ/m^3 (dry natural gas at 0°C), specific gravity is 0.72 – 0.85 kg/m^3 (at 0°C) and content H_2S is under l mg/m^3.
- The Carpathian foredeep and south – eastern slopes of the Bohemian Massif are considered as a promising area for the occurrence of natural gas. Dolní Dunajovice and Horní Žukov (gas deposits converted into underground storages) and Lubná-Kostelany (today almost mined out) belong to the largest deposits. The most important accumulations are confined mainly to collectors in the Miocene, Jurassic and jointed and weathered portions of the crystalline rocks. The deepest exploited deposit is Karlín, where natural gas (and gas condensate) was mined from depth of more than 3,900 m. The composition of local gas deposits varies considerably. The Dolní Dunajovice deposit is characterized by high content of methane (98 %), whereas the deposit Kostelany– západ contains only 70 % methane and is rich in helium and argon, which can be extracted on industrial scale.
- In northern Moravia, specifically between Příbor and Český Těšín, the gas deposits are mostly associated with the weathered and tectonically affected Carboniferous paleorelief, or with the directly overlying clastic rocks of the Miocene. This concerns principally the gas deposits of Žukov, Bruzovice and Příbor.The origin of gas in these deposits developed in the apical parts of the Carboniferous morphological elevations has not been explained yet – either the gas is formed during the coalification of coal deposits, or it is related to crude oil formation. Part of the Příbor gas deposit is used as underground gas storage.
- Natural gas of obviously Carboniferous origin and age is extracted during so-called degasification of coal seams of the Czech part of the Upper Silesian coal basin. Mine gases are diluted by air and the resulting concentration of such gases reaches about 50 – 55 % CH_4.

The natural gas quality varies considerably depending on the method of extraction and technical limitations related to degasification. Natural gas from the mines Dukla, Lazy and Doubrava goes by 22 km long pipeline to the steel works Nová Huť in Ostrava. The Carboniferous gas contains from 94 to 95 % of CH_4.

- Numerous occurrences of natural carbohydrates both on the surface and in boreholes were found in the area of the Carpathian flysh nappes. Extraction of several deposits (e.g. Hluk) of restricted extent took place in the past.

Deposits of natural gas and crude oil are in majority of cases genetically related. Crude oil deposits are concentrated in the central part of the Vienna Basin, whereas gas deposits predominate in its marginal parts. The mined gas contains 87.2 to 98.8 vol. % CH_4, its caloricity reaches 35.6 to 37.7 MJ/m^3 (dry gas at 0^oC), specific gravity 0.72 to 0.85 kg/m^3 (at 0^oC) and H_2S content is below 1 mg/m^3. Natural gas deposits in the Carpathian foredeep and south–eastern slopes of the Bohemian Massif have very variable composition. It contains 98% of methane at Dolní Dunajovice deposit; on the contrary at Kostelany deposit there is just 70 % of methane with He and Ar concentrations of industrial use.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Principal areas of deposits presence:

1 South-Moravian region 2 North-Moravian region

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	62	70	73	82	83
exploited	31	30	36	35	35
Total mineral reserves, mill m^3	15 392	16 154	16 250	41 699	41 731
economic explored reserves	3 898	4 004	4 066	3 996	4 097
economic prospected reserves	9 372	10 015	10 158	35 675	35 606
potentially economic reserves	2 123	2 135	2 026	2 028	2 028
Mine production, mill m^3	118	101	91	131	175

Note: 24,933 mill m^3 of economic reserves are classified as minable in 2004

5. Foreign trade

271121 – Natural gas

Raw material	2000	2001	2002	2003	2004
Import, mill m^3	9 550	9 782	10 065	9 786	9 169
Export, mill m^3	0	0	0	29	63

6. Prices

6,346 mill m^3 of natural gas in gaseous state were imported in 2004 (79.1 % from Russia and 20.8 % from Norway). The average price was CZK 5,017 per thousand m^3. Like in case of crude oil, the import prices were two times higher in 2000 (CZK 2,063 for thousand m^3 in 1999; CZK 4,059 on thousand m^3 in 2000). That was caused by a vehement increase of crude oil prices on the world market and by a significant decrease of the CZK rate to USD. Import prices of natural gas – in contrast with oil – continued to increase also in 2001 (CZK 4,615 per thousand m^3) and 2002 (CZK 4,880 per thousand m^3), despite the repeated strengthening of the CZK against USD. This increase continued also in the year 2003 – the increase of the average import price between the years represented almost 9 %, up to 5,312 per thousand m^3. A slight decrease of the average import price in 2004 was due to strengthening of the CZK against USD. 63 mill m^3 at CZK 6,195 per thousand m^3were exported, out of which 99.8 % went to Austria.

7. Mining companies in the Czech Republic as of December 31, 2004

Moravské naftové doly a.s., Hodonín
OKD, Důlní průzkum a bezpečnost, a.s., Paskov
UNIGEO a.s., Ostrava - Hrabová
Česká naftařská spol. s.r.o., Rohatec

Besides natural gas production there was another major activity of Moravské naftové doly – construction of underground storage. Storage in Dolní Bojanovice started to operate in October 1999. Its present capacity is 570 mill m^3. Underground storage in Uhřice with capacity of 180 mill m^3 started operation in April 2001.
Company Transgas, a.s., owns six underground storages (Dolní Dunajovice, Tvrdonice, Štramberk, Lobodice, Háje u Příbrami and Třanovice) on the territory of the Czech Republic with capacity of about 2.04 milliard m^3 in 2001. Transgas has used also a rented capacity in Slovakia (0.5 milliard m^3) and in Germany (0.5 milliard m^3).

8. World production

World natural gas production persisted in the range of about 2,400 up to 2,600 milliard m^3 a year during the last five years and it was not affected by the decrease in production in Russia, the major world producer of natural gas because it was compensated by increased production in other countries, particularly in Canada, the Middle East countries, and elsewhere. World production was as follows (according to the Welt-Bergbau-Daten – WBD, World Mineral Statistics – WMS, World Oil and Gas Review - WOGR):

Year	2000	2001	2002	2003	2004 e
Mine production, mlld. m^3 (WBD)	2 433	2 444	2 535	2 558	N
Mine production, mlld. m^3 (WMS)	2 504	2 562	2 592	2 666	N
Mine production, mlld. m^3 (WOGR)	2 547	2 596	2 624	N	N

Main producers´ share in the world mining output (2003; according to WBD):

Russia	23.1 %	Norway	3.0 %
the USA	21.5 %	the Netherlands	2.9 %
Canada	7.1 %	Indonesia	2.8 %
Great Britain	4.3 %	Iran	2.5 %
Algeria	3.2 %	Uzbekistan	2.3 %

Russian natural gas production has been reported under the standard pressure of 0.1 MPa and temperature of 20°C. To compare it with western standards it is necessary to multiply the values by a factor of 0.9315.

The gas of Carboniferous origin emitted during extraction of coal seams reached about 25 milliard m^3 per year. It represented 4 – 6 % of all methane emissions from both natural and man-made sources of methane in the world. About 1.6 milliard m^3 of gas, i.e. approximately 6 % of the given 25 milliard m^3, were used for industrial purposes. The remainder went to the atmosphere. According to 1996 data, 10 countries used the Carboniferous gas – China, Russia, Czech Rep., Germany, Poland, Great Britain, the USA, Australia, France and Ukraine.

9. World market prices

General increase in natural gas consumption was accompanied by decrease in costs of transport paid by consumers for imported gas (approximately 75 % of gas is transported through pipelines and about 25 % in tankers in liquefied state). Natural gas prices are negotiated and are quoted in USD per mill Btu. Natural gas price for customer in Europe that had been still fluctuating between USD 3.6 and 4 per mill Btu in 1985 fluctuated around USD 2.25 per mill Btu in 1996. Prices fell down to USD 1.7 – 2.0 per mill Btu in 1998. Natural gas prices fluctuated between 1.8 and 2.9 per mill Btu in 1999. Natural gas prices increased significantly in connection with increase of crude oil prices during 2000. In autumn 2000, natural gas prices were for the first time in history higher than USD 5 per mill Btu. In 2001, the prices were oscillating between USD 1.9 and 3.4 mill Btu, in 2002 in a relatively broad range of 2.0 – 5.3 USD/mill Btu. The record-breaking prices were reached in 2003, when natural gas was traded shortly in the end of February for 9.5 USD/mill Btu. The prices fluctuated mainly between 4.5 and 7.2 USD/mill Btu for the rest of the year, with the annual average of 5.5 USD/mill Btu. The very record-breaking prices of the natural gas in 2003 copied the record-breaking prices of the crude oil. Natural gas price remained rather high in 2004 in relation to the still record crude oil prices. The price oscillated between 4.5 and 9.0 USD/mill Btu and the annual average was 6.17 USD/mill Btu. Increase of the world natural gas prices is due to the fact that this energy mineral represents an alternative to the other sources of fuel.

(Note: 1 mill Btu = 252,000 kcal = 1,055,060 kJ = 293.0 kWh = 27.9 m^3 approximately (combustion heat of natural gas given at 10.5 kWh/m^3))

10. Recycling

Natural gas is not recycled.

11. Natural gas substitutes

Natural gas can be successfully substituted to a certain extent by other types of fuel in energy industry. However, natural gas itself represents economicly and ecologically effective substitute for all other mineral fuels.

INDUSTRIAL MINERALS – GEOLOGICAL RESERVES AND MINE PRODUCTION

In addition to energy minerals, industrial minerals represent the most important group of minerals on the territory of the Czech Republic. In this group the largest reserves are of limestones, kaolin, clays, bentonite and natural (glass and foundry) sand. Other industrial minerals represent smaller nevertheless important raw material potential of the national economy. Kaolin, quartz sand, limestone, clays, feldspar and dimension stone are also important export commodities in mineral sector.

Mining of industrial minerals – reserved deposits

Raw material	Unit	2000	2001	2002	2003	2004
Graphite	kt	23	17	16	9	5
Pyrope-bearing rock	kt	62	47	52	53	42
Kaolin	kt	5 573	5 543	3 650	4 155	3 862
Clays	kt	601	585	564	554	649
Bentonite	kt	280	224	174	199	201
Feldspar	kt	337	373	401	421	488
Feldspar substitute (phonolite)	kt	24	25	29	27	26
Silica raw material	kt	0	0	0	0	0
Glass and foundry sand	kt	1 814	1 745	1 527	1 616	1 659
Fusible basalt	kt	14	14	38	13	12
Diatomite	kt	34	83	28	41	33
Limestones (total)	kt	11 376	10 523	9 872	10 236	10 568
high percentage limestones	kt	4 784	5 071	5 017	4 573	4 629
other limestones	kt	5 138	4 186	3 632	4 444	4 666
Dolomites	kt	430	364	314	416	345
Corrective sialic additives for cement production	kt	267	222	163	201	232
Gypsum	kt	82	24	108	104	71
Dimension stone*	ths m^3	270	255	235	244	273

*** In addition, about 65 ths m^3 of dimension stone were exploited in non-reserved deposits in 2004.**

Lifetime of industrial reserves

(economic explored disposable reserves) based on the decrease of reserves by mining production incl. losses in registered deposits per year 2004 (A) and on the average annual decrement of reserves in period 2000 – 2004 (B) is as follows:

Raw material	Lifetime – A (years)	Lifetime – B (years)
Graphite	260	69
Pyrope-bearing rock	52	42
Kaolin	39	35
Clays	155	169
Bentonite	239	211
Feldspar	47	55
Glass and foundry sand	60	65
Fusible basalt	632	566
Diatomite	94	75
Limestones (total)	137	138
high percentage limestones	114	112
other limestones	169	176
Dolomites	232	214
Corrective sialic additive for cement production	1320	1475
Gypsum	1471	1343
Dimension stone	261	278

FLUORSPAR

1. Characteristics and use

Most fluorspar deposits are veins of hydrothermal origin. Fluorspar deposits which originated by infiltration, metasomatism and sedimentation are much less abundant. Other minerals like quartz, barite, calcite, etc. accompany fluorspar usually. World economic reserves are estimated at 400 mill t.

Three basic grades of fluorspar can be distinguished according to their quality and specification:

a) metallurgical grade (min. 85 % CaF_2, max. 15 % SiO_2);
b) acid grade (min. 97 % CaF_2, up to 1.5 % SiO_2, 0.1– 0.3 % S);
c) ceramic grade (80– 96 % of CaF_2, up to 3 % SiO_2).

More than half of the mined fluorspar is used in chemical industry for production of fluorine (F), hydrofluoric acid (HF), NaF and synthetic cryolite. Fluorine is contained in teflon and refrigerants (freons). Metallurgical industry of alumina also consumes relatively large volumes of fluorspar (1/3 of the total fluorspar production). Other applications are for example in cement production, in glass industry (glass with 10 to 30 % CaF_2 is milky, opaque and opalescent) in enamels, etc. Complex chemicals with fluorine and bromine are used in fire extinguishers and anaesthetics.

2. Mineral resources of the Czech Republic

All Czech fluorspar deposits are of hydrothermal origin, i.e. vein, stockwork and rarely even impregnation or metasomatic types. They are mostly located in marginal parts of the Bohemian Massif, associated with major fault zones of the Krušné hory Mts. (NE– SW) and the Labe– Lužice (NW– SE) lineaments direction. The most important deposits are located in the Krušné Hory Mts. (e.g. Moldava, Kovářská), less important ones in the Lužice area of the Bohemian Cretaceous Basin (Jílové u Děčína), Železné hory Mts. (Běstvina). Smaller deposits and occurrences are also in other parts of the Bohemian Massif (e.g. Krkonoše Mts. – Harrachov, Ještěd Mts. piedmont – Křižany et al.)

- Fluorite accumulations are the most often associated with a considerable proportion of barite (for instance registered deposits Běstvina, Kovářská, and mined out deposits Krásná Lípa, Hradiště u Vernéřova, Harrachov, Křižany u Liberce et al.).
- Smaller part of fluorite accumulations contains almost no barite (e.g. registered deposit Jílové u Děčína and mined out deposits Blahuňov u Chomutova, Kožlí u Ledče et al.) or there are just subordinate barite contents (e.g. registered deposit Moldava, mined-out deposit Vrchoslav et al.).

Industrial mining of fluorite in the Czech Republic started in the beginning of the 1950s (apart from a minor mining in Kožlí u Ledče nad Sázavou during both of the world wars) and continued until the first quarter of 1994, when extraction of Jílové, Běstvina and Moldava deposits was terminated. Renewal of mining is not foreseen, as there is sufficient amount of raw material of higher quality and lower price especially from China. Remaining reserves in Czech deposits are not of any economic use at present.

3. Registered deposits and other resources in 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

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number a)	5	5	4	4	4
exploited	0	0	0	0	0
Total mineral reserves, kt	2 193	2 193	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	2 193	2 193	2 033	2 033	2 033
Mine production, kt	0	0	0	0	0

Note:
a) deposits with registered fluorspar reserves

5. Foreign trade

252921 – Fluorspar, containing 97 wt % or less of calcium fluoride

Raw material	2000	2001	2002	2003	2004
Import, t	12 893	4 603	6 954	7 206	8 342
Export, t	7 359	2 204	1 727	16 613	3 620

252922 – Fluorspar, containing by more than 97 wt % of calcium fluoride

Raw material	2000	2001	2002	2003	2004
Import, t	19 010	23 182	11 228	9 422	19 516
Export, t	6 299	7 238	6 405	6 858	6 454

6. Prices

19,516 t of acid-grade fluorspar were imported from China (88.4 %), Germany (6.1 %) and Mexico (5.1%) at average price of CZK 4,661 per tonne in 2004. 8,342 t of metallurgical and ceramic-grade fluorspar were imported from Germany (66.8 %) and Mexico (30.8 %) at average price of CZK 3,958 per tonne. 6,454 t of acid-grade fluorspar were exported to Germany (39.3 %), Slovakia (17.2 %) and Israel (11.5 %) at average price of CZK 7,416 per tonne. 3,620 t of metallurgical and ceramic-grade fluorspar were exported to Bulgaria (28.2 %), Hungary (20.4 %) and Germany (16.1 %) at average price of CZK 4,469 per tonne. This re-export was unusual as both the amount and export price concerns.

7. Mining companies in the Czech Republic as of December 31, 2004

No mining companies were operating on the territory of the Czech Republic to extract fluorspar in 2004.

8. World production

The world production was increasing until 1989 when 5,925 kt of fluorspar were extracted. Since then, there was a sharp fall in the production due to reduction of fluorspar consumption in steel and aluminium production and in chemical industry (reduction of freon production). World mine production increased insignificantly from the minimum of 4,031 kt in 1993 on 4,670 kt in 1998. World production increased slowly from 4.4 to 5.0 mill tonnes during the last five years. In addition to China and Mexico, mine production has increased also in Russia and Iran. Data according to Mineral Commodity Summaries (MCS) and the Welt-Bergbau-Daten (WBD):

Year	2000	2001	2002	2003	2004 e
Mine production, kt (MCS)	4 520	4 530	4 550	4 750	4 930
Mine production, kt (WBD)	4 413	4 499	4 426	5 062	N

Main producers´ share in the world mining output (2003; according to MCS):

China	55.8 %
Mexico	15.4 %
South Africa	4.9 %
Mongolia	4.0 %
Russia	3.6 %

Spain	2.7 %
France	2.2 %
Kenya	2.1 %
Namibia	1.7 %

9. World market prices

Fluorspar prices were recently affected not only by fall in demand but also by supplies of cheap Chinese fluorspar on the world market. Prices of majority of quoted types significantly increased in 2004. Fluorspar prices valid for various fluorspar grades and place of origin are monthly quoted in the Industrial Minerals magazine in GBP/t or in USD/t and at different transport rates. The average prices of traded commodities at year-end were as follows:

A Metallurgical, min. 85 % CaF_2, GBP/t, ex-UK mine
B Acidspar, South African, dry bulk, USD/t, FOB Durban
C Acidspar, Chinese, wet filtercake, USD/t, CIF Rotterdam
D Metallurgical, Mexican, USD/t, FOB Tampico
E Acidspar, Mexican, filtercake, USD/t, FOB Tampico
F Acidspar, Chinese, dry, USD/t, CIF US Gulf Port

Commodity/Year	2000	2001	2002	2003	2004
A	112.50	115.00	115.00	115.00	-
B	115.00	115.00	115.00	115.00	137.00
C	132.50	138.50	134.00	131.50	-
D	95.00	105.00	-	-	-
E	120.00	115.00	115.00	115.00	173.00
F	132.50	138.50	131.50	167.50	200.00

10. Recycling

In chemical industry where fluorspar consumption prevails, fluorspar recycling is virtually impossible because of its dissociation during acid leaching. However, maximum effort is evident to recycle or reduce the consumption of saturated fluorohydrocarbons (freons) due to their negative environmental impacts. Not too much fluorspar is recycled in metallurgy when producing aluminium.

11. Possible substitutes

Fluorspar is virtually a unique source of fluorine for chemical industry and thus irreplaceable. However, an extensive replacement of fluorohydrocarbon derivatives is under way when using new agents and methods in cosmetics and refrigerants (fluorine and its compounds are replaced by carbon dioxide, nitrogen, air, mechanical sprays, etc.). Fluorohydrocarbons are replaced by hydrocarbons in production of foamed plastics. Fluorspar can be to a certain extent substituted by cryolite (incl. synthetic) in metallurgy when producing aluminium. Fluorspar can also be substituted by dolomite, limestone and/or olivine in ferrous metallurgy.

BARITE

1. Characteristics and use

Barium, which is the major constituent of barite, occurs in igneous rocks. It is released during their weathering and transferred into sediments and residual rocks. Barite deposits, in general, can be divided in fissure veins, metasomatic, residual and volcanosedimentary (stratabound) deposits. World barite reserves are estimated at 303 mill t.

Barite is widely used because of its specific properties such as whiteness, high density, chemical resistance, absorption of X-rays and gamma radiation, etc. Barite is used in glassmaking to produce special glass, in ceramic glazes, porcelain enamels, paints, plastics, fireworks (signal flares, detonators, etc.), for radiation shielding, in insecticides, etc. The major use of barite, however, is as high-weight mud for petroleum and natural gas exploration drilling.

2. Mineral resources of the Czech Republic

Barite deposits of the Czech Republic are of hydrothermal origin, mainly of the vein or stockwork type, to a lesser extent of the metasomatic or stratabound types. These deposits are randomly distributed over the Bohemian Massif, which is caused by a great number of barite-bearing formations of various age and origin. The most important deposits were located in the Krušné hory Mts. (e.g. Kovářská, Mackov), Železné hory Mts. (e.g. Běstvina), Krkonoše Mts. (e.g. Harrachov); smaller deposits and occurrences are known from the Jeseníky Mts. (e.g. Horní Benešov), from the Proterozoic of the western (e.g. Pernarec) and central (e.g. Krhanice) Bohemia, Orlické hory Mts. (e.g. Bohousová), Čistá-Jesenice Massif (e.g. Otěvěky) etc.

- Hydrothermal veins, locally with base metals, are tens to hundreds metres, exceptionally even 1 km, long, and having thickness between a few decimetres to several meters. The vein filling consisting of barite is in the form of lenses or columns. These veins are mostly confined to regional faults or faults of lower order trending mostly NW– SE and NWN–SES. Younger polymetallic (base metal) and the latest quartz mineralization, which downgrades the vein fillers in deeper parts, are common, too (e.g. the Mackov and Bohousová deposits). Mined out deposit of Pernárec (1924 – 1960), further the deposits and occurrences Mackov, Bohousová etc., where barite is sole or predominating raw material. Fluorite is present in substantial amount along with barite at deposits Běstvina, Moldava, Kovářská, Harrachov etc. A barite mineralization is known from the Květnice deposit near Tišnov in the Moravicum, where barite was mined in 1905 – 1908 and during World War II.
- Stratabound barite deposits originated from submarine hydrothermal solutions ascending along the faults at sea floor. These deposits are in the Bohemian Massif represented by layers and lenses in the Proterozoic sediments of the islet zone (Krhanice nad Sázavou), Železné hory Mts. (Křižanovice) and in the Devonian of the Jeseníky Mountains (Horní Město-Skály, Horní Benešov, where barite was mined as a by-product in 1902 – 1914 and 1955 - 1960).

Barite was exploited in Czech Republic until the year 1990 from Běstvina deposit, and until the year 1991 from Harrachov deposit. Renewal of the mining is not foreseen in the nearest future. The deposits lost their industrial importance; their reserves are gradually revaluated and in majority of the cases excluded from the The Register. Also in this case, the same way as in that of fluorite, there is a sufficient amount of higher-quality and less expensive raw material, first of all from China.

3. Registered deposits and other resources in the Czech Republic

reserved registered deposits exhausted deposits and other resources

Registered deposits and other resources are not mined

1 Běstvina 2 Bohousová 3 Křižanovice

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number a)	6	6	3	3	3
exploited	0	0	0	0	0
Total mineral reserves, kt	1 309	1 309	569	569	569
economic explored reserves	0	0	0	0	0
economic prospected reserves	0	0	0	0	0
potentially economic reserves	1 309	1 309	569	569	569
Mine production, kt	0	0	0	0	0

Note:

a) deposits with registered barite reserves

5. Foreign trade

251110 – Natural barium sulphate (barite)

Raw material	2000	2001	2002	2003	2004
Import, t	8 730	10 077	10 396	8 090	7 383
Export, t	204	258	755	452	303

251120 – Natural barium carbonate (witherite)

Raw material	2000	2001	2002	2003	2004
Import, t	500	517	358	358	1 399
Export, t	362	277	231	443	156

6. Prices

7.4 kt of barite were imported from Germany (47.2 %), Great Britain (16.1 %) and Slovakia (16.0 %) at average price of CZK 6,402 per tonne in 2003. 303 t were exported at average price of CZK 10,569 per tonne – 74.3 % back to Slovakia, 23.5 % to Serbia and Monte Negro. 1.4 t of witherite was imported (100 % from China) at CZK 7,073 per tonne; re-export was directed from major part to Slovakia.

7. Mining companies in the Czech Republic as of December 31, 2004

No mining companies were operating on the territory of the Czech Republic to extract barite in 2004.

8. World production

The world barite production was gradually increasing till 1990 (8,209 kt). Then the barite production decreased mostly due to global economic recession, which affected not only major barite consuming sectors (both crude oil and natural gas exploration), but also chemical industry. Then the barite production was increasing till 1997 (6,930 kt). Since 1999, the world production is increasing again. The increase of the world production is caused particularly by the increase of the Chinese mine production. Data by various international yearbooks are relatively variable. Data on the world mining production according to Mineral Commodity Summaries (MCS) and Welt Bergbau Daten (WBD):

Year	2000	2001	2002	2003	2004 e
Mine production, kt (MCS)	6 200	6 700	6 000	6 700	6 900
Mine production, kt (WBD)	6 377	7 170	7 572	7 726	N

Main producers´ share in the world mining output (2003; according to MCS):

China	52.2 %
India	10.4 %
USA	7.0 %
Morocco	5.3 %
Mexico	3.8 %
Iran	2.2 %
Thailand	1.9 %

Germany	1.8 %
Turkey	1.6 %

9. World market prices

Barite prices are under pressure of oversupply, particularly of cheap Chinese and Indian barite. Chinese barite acquired the leading position on the world market already in the seventies, being used not only in drilling mud but also in other sectors of various industries. Similar way as in the case of fluorite, world prices of barite of Asian provenance significantly increased in 2004, too. Prices of barite of various grade and origin are quoted monthly in the Industrial Minerals magazine in GBP/t or USD/t. The average prices of traded commodities at year-end were as follows:

A API, Chinese lump, USD/t, CIF Gulf Coast
B API, Indian lump, USD/t, CIF Gulf Coast
C API, Moroccan lump, USD/t, CIF Gulf Coast
D Micro-ground white < 20 microns, paint grade, min. 99 %, GBP/t UK
E Ground white, paint grade, 96 – 98 $BaSO_4$, 99 % - 350 mesh, GBP/t EXW UK
F Ground, bagged, USD/t, FOB Morocco

Commodity/Year	2000	2001	2002	2003	2004
A	44.50	46.50	44.00	44.50	63.50
B	49.50	49.50	49.00	48.00	70.00
C	40.00	40.00	51.00	51.00	63.50
D	145.00	145.00	145.00	145.00	145.00
E	207.50	207.50	-	-	-
F	80.00	80.00	-	-	-

10. Recycling

Barite is actually continuously recycled when used in drilling mud. In other applications (chemicals, paints, enamels, glass, rubber etc.) it is not recycled.

11. Possible substitutes

Magnetite, hematite (incl. synthetic), ilmenite, celestite and other heavy minerals can be alternatively used instead of barite in drilling mud. However, it is just a marginal alternative. Barite can be replaced by other fillers (e.g. by limestone, dolomite, soot) in production of rubber, in glassmaking partly by strontium salts, in lithopone by other whites (e.g. zinc white) etc. However, all these substitutes were found not as good as barite.

GRAPHITE

1. Characteristics and use

Graphite represents one of the forms of carbon (C) occurring in the nature. Graphite is an important technical mineral exhibiting perfect basal cleavage, very good electric and heat conductivity, high refractoriness and resistance to acids.

All rocks, which contain considerable amount of graphite that can be recovered, are considered as a graphite raw material. Graphite is graded primarily on the size of flakes – "crystalline" flake graphite with flakes exceeding 0.1 mm and "amorphous" graphite with flakes smaller than 0.1 mm, which appears like a massive material. The latter looks like a dull solid matter. A discrimination of crystalline graphite into large, medium and small flake is a business division without any general rules. It differs in accordance to particular producers.

Graphite deposits can be divided into early magmatic, contact metasomatic, metamorphogenic (metamorphic and metamorphosed) and residual deposits. World reserves of graphite are estimated at 21 mill tonnes. Use of graphite is based upon its physical and chemical properties. It is used in foundry industry, electrotechnics, electrochemistry, chemical, rocket, armament and nuclear industries, in manufacture of refractory materials, lubricants, protective coatings, pencils, threads, production of synthetic diamonds et al.

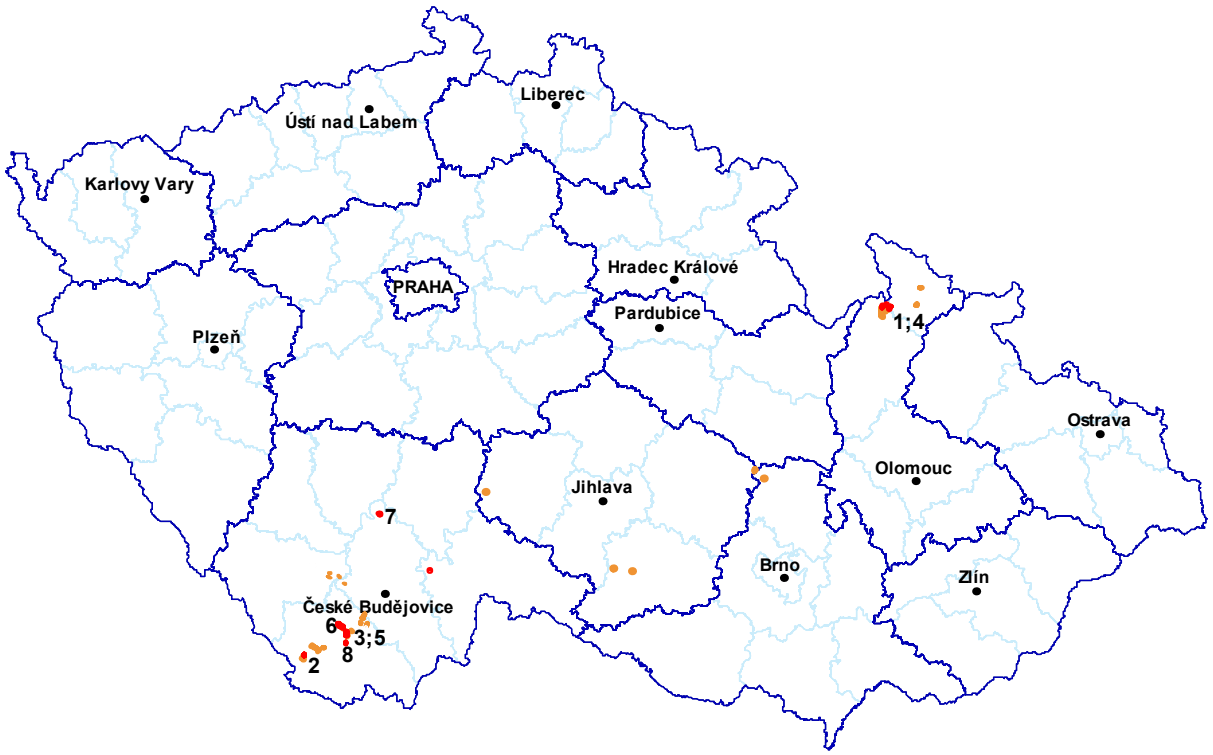
2. Mineral resources of the Czech Republic

All graphite deposits in the Czech Republic belong to the metamorphogenic type. They originated during regional metamorphism of clayey sandy sediments high in organic matter, which is also indicated by higher concentrations of S, P, V and abundant limestones. The deposits occur in the Bohemian Massif in the Moldanubicum, Moravicum and Silesicum.

- The most important deposits occur in the Modanubicum, particularly in the so-called Varied Group of Český Krumlov (mined deposits: Český Krumlov–Městský vrch, Lazec, where the mining was terminated in the middle of the year 2003; further deposits: Bližná, Spolí, Český Krumlov–Rybářská ulice). Other less important deposits occur in the Votice–Sušice Varied Group (a single, until 1967 mined deposit at Koloděje nad Lužnicí–Hosty) and in the Chýnov mica schists (Černovice – mined-out former deposit). South Bohemian graphitic rocks have a character of graphite-rich gneisses, quartzites and carbonates. Smaller occurrences, which are of no economic importance at present, are known also from the Moravian Moldanubicum (e.g. Lesná, Lubnice, Louka, Římov et al.).
- Deposits in the Moravian–Silesian region occur in an area affected by lower grade metamorphism. Graphite shows lower degree of crystallization and contains much more sulphur, which is confined to pyrite and pyrrhotite. The whole region is characterized by higher contents of combustibles and lower sulphur content in graphitic layers in limestones than those in graphitic schists and phyllites. The deposit Tresné, already mined out, was considered the largest graphite deposit of the Moravicum. It is located in the Olešnice group of the Svratka dome. The major deposit in the Silesicum is Velké Vrbno–Konstantin, which makes a part of a graphitic zone at the western margin of the Velké Vrbno dome. This deposit has been the last mined one in the Czech Republic since the second half of the year 2003. Other 8 small deposits in Branná and Velké Vrbno surroundings are registered.

The same way as in the case of fluorite and barite, the mining of graphite deposits in the Czech Republic is not economically profitable and it is on decline, as there is a sufficient amount of a cheaper raw material especially from China.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Names of mined deposits are indicated in **bold type**

Amorphous graphite:

1 Velké Vrbno - Konstantin
2 Bližná-Černá v Pošumaví
3 Český Krumlov-Rybářská ul.
4 Velké Vrbno (8 small deposits)

Crystalline graphite:

5 Český Krumlov-Městský vrch
6 Lazec-Křenov
7 Koloděje nad Lužnicí-Hosty

Mixed (from amorphous to crystalline) graphite:

8 Spolí

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	15	15	15	15	15
exploited a)	3	3	3	1	1
Total mineral reserves, kt b)	14 412	14 389	14 366	14 355	14 350
economic explored reserves	1 401	1 378	1 355	1 344	1 339
economic prospected reserves	4 154	4 154	4 154	4 154	4 154
potentially economic reserves	8 857	8 857	8 857	8 857	8 857
Mine production, kt b)	23	17	16	9	5

Note:

b) mining at Český Krumlov–Městský vrch and Lazec–Křenov was terminated in the course of the year 2003

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.

5. Foreign trade

2504 Natural graphite

Raw material	2000	2001	2002	2003	2004
Import, t	975	1 518	1 476	2 765	3 660
Export, t	2 712	2 620	3 487	4 058	3 924

3801 – Synthetic graphite and graphite products; colloidal, semicolloidal graphite

Raw material	2000	2001	2002	2003	2004
Import, t	1 711	2 122	1 659	1 397	2 682
Export, t	236	521	616	703	829

6903 – Refractory ceramics products

Raw material	2000	2001	2002	2003	2004
Import, t	3 510	4 311	3 816	4 985	5 693
Export, t	3 382	5 120	8 428	10 158	12 129

6. Prices

3,660 t of graphite were imported from Germany (50.8 %), China (29.9 %) and Great Britain (10.2 %) in 2004. The average import price was CZK 19,612 per tonne. The increase of the import represents a logic consequence of the termination of mining at south Bohemian deposits in May 2003. This trend will continue in the next years, too. 3,924 t of graphite were exported to Germany (55.5 %), Italy (18.3 %) and Poland (14.1 %) at average price of CZK 21,899 per tonne. 2.7 kt of synthetic graphite and graphite products was imported from Germany (26.8 %), Poland (19.8 %) and Slovakia (14.4 %) at average price of CZK 45,877 per tonne. 0.8 kt of synthetic graphite and graphite products was exported – 35.1% to Poland, 34.0 % to Slovakia, 12.7 % to Croatia – at average price of CZK 14,927 per tonne. 5.7 kt of products made of

refractory graphite ceramics was imported from Germany (57.6 %), Great Britain (14.7 %) and Canada (11.2 %) at average price of CZK 138,202 per tonne. Roughly twice as high export was directed mainly to Germany (50.1%), Austria (10.3 %) and Italy (6.2 %) at price of CZK 144,787 per tonne. Products made of the Czech refractory graphite ceramics were exported to more than 60 countries in and outside Europe in 2004.
Prices of domestic flotation concentrates of natural graphite oscillated between CZK 11 and 15 thousand per tonne depending on the content of combustion matters and sulphur and also on contents of moisture. Flotated crystalline flake graphite is sold for CZK 20,000 per tonne, flotated crystalline graphite with synthetic flake for CZK 15,000 per tonne. Graphite product (petroleum coke powder) was offered for roughly CZK 10,000 per tonne in 2004. A wide spectrum of final graphite products, including chemically treated, micro-ground, expandable, pressed graphite and graphite lubricants, is offered by company Maziva Týn nad Vltavou, s.r.o. Prices of chemically treated graphite (purity above 99.5 % C) oscillate between CZK 54,000 and CZK 100,000 per tonne (according to the granular composition). Prices of further processed micro-ground graphites start from CZK 62,000 per tonne.

7. Mining companies in the Czech Republic as of December 31, 2004

Grafitové doly Staré Město, s.r.o.

8. World production

World production of graphite remained consistently around 1 mill t/year till 1992 and then has decreased. Data in various international yearbooks are variable. Mine production in the Czech Republic reached 810 kt in 2002, i. e. around 2 % of the world production, but only about 2 % in 2003 based on preliminary data. Data according to Mineral Commodity Summaries (MCS) and the Welt-Bergbau-Daten (WBD):

Year	2000	2001	2002	2003	2004 e
Mine production, kt (MCS)	571	826	810	742	756
Mine production, kt (WBD)	605	593	572	483	N

Main producers´ share in the world mining output (2003; according to MCS):

China	60.6 %
India	14.8 %
Brazil	8.2 %
Canada	3.4 %
North Korea	3.4 %
Mexico	2.0 %
Turkey	2.0 %

9. World market prices

Prices of graphite were at the end of eighties influenced by its surplus on the world market. Prices of graphite of majority of grades dropped in 1993 down to 50 % of those in 1990. Prices were affected particularly by supplies of cheap Chinese graphite and by introduction of Russia graphite on the world market. World prices of graphite stagnate since the second half of the 1990s. Prices of natural graphite are published monthly in the Industrial Minerals magazine and

quoted in USD/t CIF UK ports. The average prices of traded grades of graphite at year-end were as follows:

A Crystalline large flake, 94 – 97 % C, + 80 mesh
B Crystalline medium flake, 94 – 97 % C, + 100 – 80 mesh
C Crystalline small flake, 94 – 97 % C, + 100 mesh
D Crystalline large flake, 90 % C, + 80 mesh
E Crystalline medium flake, 90 %, + 100 – 80 mesh
F Cystalline small flake, 90 % C, – 100 mesh
G Amorphous powder, 80/85 % C,

Commodity/Year	2000	2001	2002	2003	2004
A	660	660	660	660	660
B	-	-	600	600	600
C	-	-	525	525	525
D	515	515	515	515	515
E	390	390	390	390	390
F	385	385	375	375	375
G	228	228	-	-	-

In 1993 – 2001, the magazine Industrial Minerals has quoted also synthetic graphite with 99.93 % content of C, later with 99, 95 % content of C. Its price was USD 2.23 per kg at year-end 1993; it was continuously increasing and reached USD 2.55 per kg FOB Swiss border at year-end 1996. In the following years, the price oscillated between USD 2.23 – 2.55 per kg FOB Swiss border. Synthetic graphite was traded for USD 1.94 per kg at year-end 2000 and for USD 2.07 per kg at year-end 2001.

10. Recycling

Recycling of graphite in major fields of its use is virtually impossible (refractory materials, break lining, foundry industry, lubricants). Recycling of graphite electrodes is rather an exception of a limited importance.

11. Possible substitutes

Natural graphite is replaced by the synthetic one in the foundry industry (artificial soot and/or oil coke mixed with olivine or staurolite), by lithium, mica, talc and molybdenite in lubricants, by calcined petroleum coke, anthracite coal, used carbon electrodes and magnesite in steel production. All alternative materials, however, have only limited use.

GEMSTONES

1. Characteristics and use

The designation "gemstone" refers to such minerals or rocks, which are valued for their beauty, durability, colour, transparency, high lustre, brilliance, attractiveness, rarity, etc. and which are employed after finishing mostly for decorative purposes. The price of gemstones depends on their quality; size, rarity and it can be affected strongly by last fashion. Gemstones and gem materials occur in a large variety of rocks and mineral deposits. Among gemstones are elements, oxides, silicates, alumosilicates, borosilicates and other compounds.

Some gemstones are (or were) used in various sectors of industry, mostly as abrasives and in instruments requiring precision elements – knife-edges for balances, jewel bearings in timing devices, parts of theodolites, etc.

Recently, there has been relatively large production of synthetic crystals, particularly those of ruby, corundum, spinel, emerald and diamond. The latter are rather dark and they are being used as abrasives. Manufactured crystals, in general, include applications in electronics, infrared optics, bearings, lasers, etc.

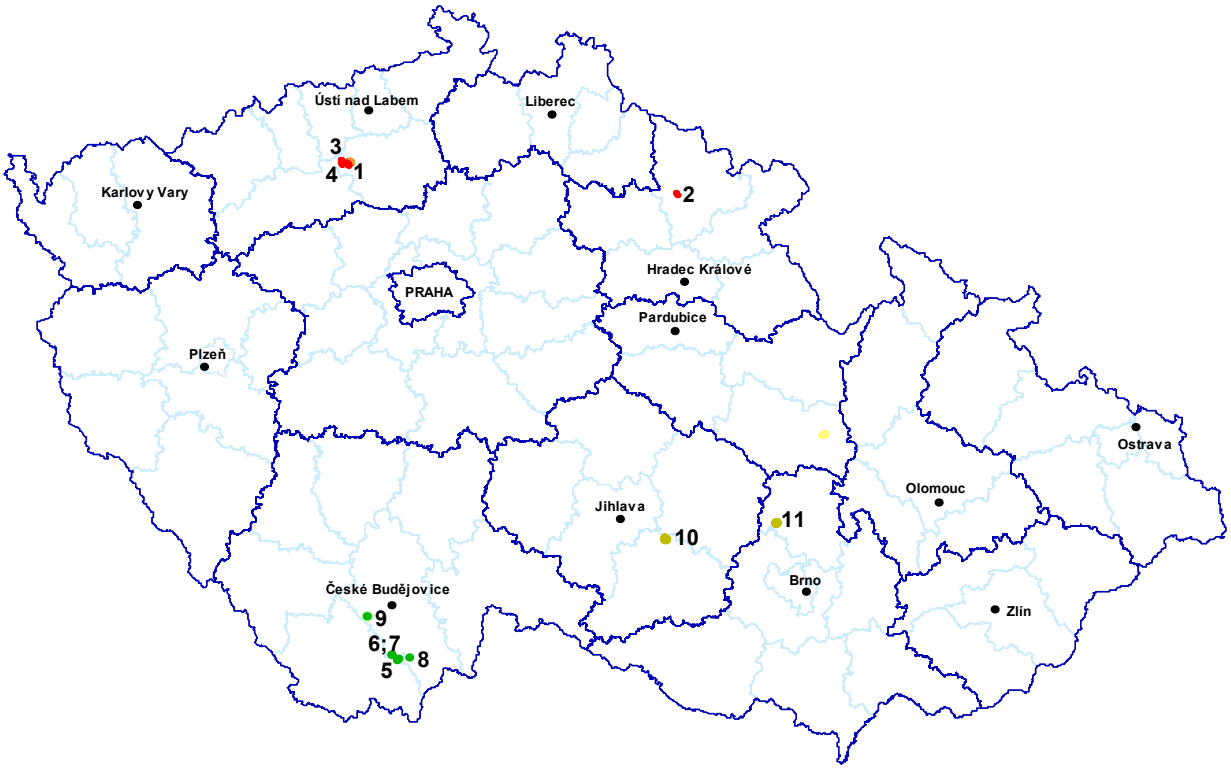
2. Mineral resources of the Czech Republic

Complex and varying geology of the Czech Republic is suitable for the occurrence of a large selection of gemstones, which were known and mined since time immemorial. At present, the most significant gemstones in the Czech Republic are represented by the so-called Bohemian garnet (pyrope).

- Pyrope, the most famous Czech gemstone, is relatively complex Mg-rich Al silicate of varying chemistry, always containing low concentrations of Fe and Cr. Primary source of pyrope are ultramafic rocks, but there are mined only pyrope-bearing placers on the southern slopes of the České středohoří (the deposit Podsedice) and in the Krkonoše Mts. Piedmont Basin (the deposit Vestřev). Stones of large size are used as gemstones, smaller grain sizes as abrasives.
- Moldavites seem to represent an example of the influence of the fashion trends on the popularity of certain gemstones. The moldavites are tectites whose origin is still enigmatic. They occur loosely in Tertiary and Quaternary alluvial sand in southern Bohemia, in a belt, which extends from Vodňany across České Budějovice to the Kaplice region. Green-brownish moldavites occur in south-western Moravia, along the Jihlava River, in a belt extending from Telč across Třebíč as far as Moravský Krumlov. Moldavites, particularly those from southern Bohemia, are due to their attractiveness used in jewellery (mostly in their natural form). Industrial accumulations of moldavites were verified at Besednice, Ločenice and Vrábče in southern Bohemia.
- Increasing interest and demand for gemstones initiated a survey aimed at search for some other gemstones (varieties of SiO_2) in the Czech Republic. Amethyst was found to occur in relatively large volumes in quartz veins penetrating a porphyry syenite of the Třebíč massif, particularly at the Bochovice and Hostákov localities. Druses with crystals of amethyst and morion occur in these veins. The crystals exhibit zonal structure, which is particularly well developed at Bochovice, where the vein quartz envelops so-called barrier amethyst. An opal deposit has been discovered in a fault zone NE of Rašov. A lenticular body of opal, about 60 m of length along the strike, occurs in a tectonic breccia developed in the hydrothermally altered Bíteš gneiss.

From the text above it is obvious that industrial mining for gemstones is of a small extent and a low economic importance.

3. Registered deposits and other resources in 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

Names of mined deposits are indicated in **bold type**

Pyrope-bearing rock:

1 Podsedice – Dřemice **2 Vestřev** 3 Linhorka – Staré
4 Třebívlice

Moldavite-bearing rock:

5 Besednice **6 Ločenice** 7 Chlum nad Malší – východ
8 Slavče – sever 9 Vrábče – Nová Hospoda

Other gemstones:

10 Bochovice 11 Rašov

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number a)	10	11	10	11	11
exploited b)	3	3	4	4	4
Total mineral reserves, kt a)	22 776	19 317	19 265	19 231	19 198
economic explored reserves	3 408	2 197	3 510	3 492	3 469
economic prospected reserves	12 888	12 879	12 866	12 850	12 840
potentially economic reserves	6 480	4 241	2 889	2 889	2 889
Mine production, kt a)	62	47	52	53	42

Note:

a) pyrope-bearing rock

b) two deposits of pyrope, two deposits of moldavite in 2002 - 2004

5. Foreign trade

7103 – Precious (other than diamond) and semi-precious stone, also finished, sized but unstrung, unassembled, unmounted

Raw material	2000	2001	2002	2003	2004
Import, kg	19 168	50 823	67 669	47 232	51 880
Export, kg	1 102	4 339	8 468	6 765	2 965

251320 – Emery, natural corundum, garnet and other natural abrasives

Raw material	2000	2001	2002	2003	2004
Import, t	539	961	1 357	1 375	3 089
Export, t	59	99	100	141	1 063

6. Prices

51,880 kgs of precious or semiprecious stones were imported from South Africa (58.6 %), Brazil (37.7 %) and Tanzania (2.0 %) in 2004; the average price was about CZK 262 per kg. During the same period, 2,965 kgs of precious or semiprecious stones were exported to Poland (35.0 %), Germany (23.5 %) and Hong-Kong (11.3 %). The average export price was CZK 3,363 per kg. In these numbers diamonds are not included. 3,089 tonnes of emery, natural corundum, garnet and other natural abrasives were imported from Australia (82.3 %) and India (17.1 %) in 2004; the average price was CZK 4,453 per tonne. 1.1 kt were exported mainly to Poland (33.5 %), Lithuania (20.6 %) and Hungary (16.7 %). The average export price was CZK 5,362 per tonne.

7. Mining companies in the Czech Republic as of December 31, 2004

Granát - družstvo umělecké výroby, Turnov

FONSUS první těžební a.s., Praha

8. World production

World production of industrial diamonds reached about 70 mill carats in 2003. The main producer was Zaire – 26.4 %, followed by Russia – 25.9 %, Australia – 21.0 %, Botswana – 12.9

% and South Africa – 9.3 %. These countries covered more than 95 % of the world production.
World production of gem-quality diamonds was estimated at about 79 mill carats in 2003. In this case there was Botswana – 26.7 % - in the first place, followed by Russia – 22.9 %, Canada – 14.2 %, Australia – 12.4 %, Angola – 7.1 %, Zaire – 5.9 % and South Africa – 5.5 %. These seven countries covered roughly 95 % of the world production.
World capacity of garnet production (mostly for industrial use) was about 277 kt in 2003. The largest mining capacity was in Australia – 45.8 %, other producers were India – 22.7 %, the USA – 10.5 % and China – 9.7 %.

9. World market prices

Market prices of gemstones depend on their type, size and quality. Garnet (almandine) used as abrasive is quoted in the Industrial Minerals magazine monthly as 8– 250 mesh class, FOB mine Idaho, USA (Commodity A). The average prices in USD/t with minimum 20 t of taken material in the end of the year were as follows:

Commodity/Year	2000	2001	2002	2003	2004
A	210	210	210	210	210

10. Recycling

Gemstones in jewellery are not currently recycled. Recycling is basically possible in some sectors of their industrial applications (garnet as an abrasive can be recovered, cleaned, resized, and reused several times).

11. Possible substitutes

Generally, individual gemstones in jewellery can be combined and replaced. Pyrope can be replaced by almandine, amethyst and similarly looking minerals. Many minerals and products can alternate garnet used as abrasive: especially natural or synthetic corundum, silicon carbide, silica sand, perlite, pumice, etc.

KAOLIN

1. Characteristics and use

Kaolin is mostly residual (primary), less often sedimentary (secondary) white or whitish rock, containing substantial amount of the kaolinite group clay minerals. It always contains quartz and it may contain other clay minerals, micas, feldspars, and other minerals, depending on the nature of the parent rock.

Kaolin originated mostly through weathering or hydrothermal alteration of various rocks, rich in feldspar, as granitoids, arkoses, gneisses, etc. These so-called residual (primary) kaolins can be transported, thus forming sedimentary (secondary) kaolins. The deposits are concentrated in areas of feldspar rocks presence in which the kaolinization had occurred. World economic reserves of kaolin are estimated at about 12,000 mill tonnes.

Kaolin is used for various purposes and the required grade depends on the use. Most often it is used as a raw material in the ceramic industry – in production of porcelain and other clay ware, then as a filler in the production of paper, rubber, plastics and pigments, in production of refractory materials, and in cosmetics, pharmaceutical and food industries. Kaolin is also used in production of synthetic zeolites. Production of kaolin is often classified among production of clays and vice versa.

2. Mineral resources of the Czech Republic

Technological suitability of kaolin is assessed according to properties of the beneficiated (water-washed) kaolin. In the Czech Republic, kaolins are classified according to their use:

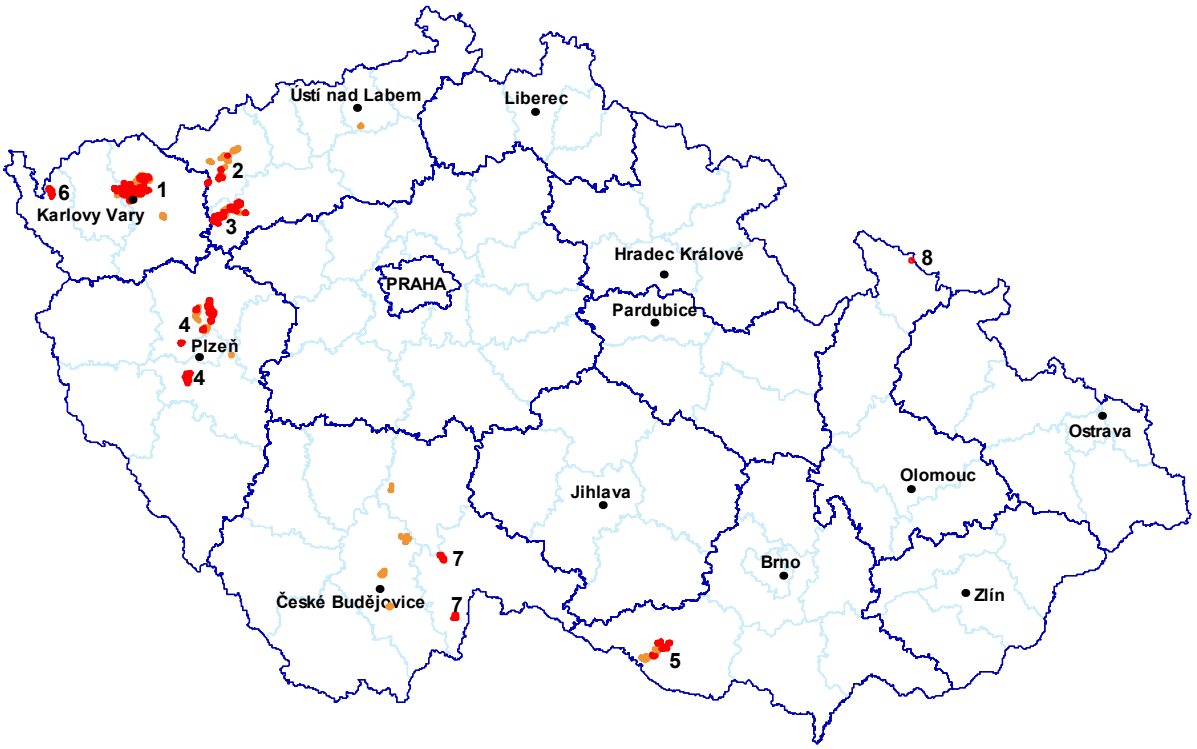
- Kaolin for production of porcelain and fine ceramics (KJ) – the highest quality kaolin with high requirements on purity, rheological properties, strength after drying, pure white-fired colour (content of Fe_2O_3 + TiO_2 without high-intensity electromagnetic separation up to 1.2 %), refractoriness min. 33 PCE (1,730° C).
- Kaolin for other ceramics manufacturing (KK) has no specifically defined parameters and is used in many ceramic recipes. Specially appreciated are white-fired colours, low content of colorant oxides, etc.
- Kaolin used in paper industry (KP) is used both for fillers and coatings. Required properties are high whiteness and low content of abrasive particles. It is also used as fillers in production of rubber (requires minimum content of the so-called "rubber poisons" – Mn max. 0.002 %, Cu max. 0.001 % and Fe max. 0.15 %), in plastics, glass fibres etc.
- Titanium-bearing kaolin (KT) contains over 0.5% TiO_2 and this type of kaolin occurs only in the Karlovy Vary region, where it formed from granites with high contents of Ti-minerals. Tests proved in some cases a possibility to reduce TiO_2 content by high intensity electromagnetic separation, after which most of these kaolins can be used as KJ, KP or KK grades.
- Feldspar-bearing kaolin (KZ) contains higher amount of non-kaolinized feldspars and has been used mostly in ceramics for production of sanitary and technical ceramics.

All kaolin deposits in the Czech Republic originated by kaolinitic weathering of feldspar rocks. Decrease of kaolinization with increasing depth and transition into non-weathered parent rock are characteristic of these deposits. The major regions with kaolin deposits are as follows:

- The Karlovy Vary region – parent rocks are represented by autometamorphosed and younger granites of the Karlovy Vary massif. This is the most important source of the top quality kaolins for the production of porcelain (KJ) or their eventual substitutes (KT). There are also deposits of the KK, less of the KP grades. Božičany, Jimlíkov and Mírová, where the KJ, KT and KK are mined together, represent the most important deposits. KP is mined at the Otovice-Katzenholz deposit.
- The Kadaň region – kaolins of this area originated from granulite gneiss of the Krušné hory Mts. crystalline complex. This kaolin is of the KK and KP grades. Kralupy u Chomutova-Merkur (KP) deposit was mined out in 2003, other deposits were mined out already earlier (e.g. Kadaň, Prahly). Relatively large reserves of KP and KK are registered at the Rokle deposit, where kaolin has been extracted since 2003 and overlying bentonite has been mined since 1980s.
- The Podbořany region – parent rock is subarkose of the Líně formation belonging to the Central Bohemian Permo-Carboniferous. All grades of kaolin given above occur here. Some of the kaolins classified as KJ are though of a lower quality (rather KK even KZ grade) and their use as an additive into the Karlovy Vary kaolins in production of porcelain is rather restricted due to their rheological properties. Large Krásný Dvůr-Podbořany deposit of the KJ kaolin grade represents the most important deposit.
- The Plzeň region – parent rock is represented by Carboniferous arkoses of the Plzeň Basin. Kaolins of this area are of the KP grade (the largest reserves of the best quality kaolin), less of the KK grade, and only negligible part of the reserves is of the KZ and KJ grades. Horní Bříza, Kaznějov and Lomnička-Kaznějov deposits north of Plzeň and Chlumčany-Dnešice south of Plzeň represent the most important large mined deposits of KP.
- The Znojmo region – these kaolins originated mostly from granitoids of the Dyje massif, to a lesser extent from the Bíteš orthogneiss of the Dyje dome of the Moravicum. These kaolins are of the KZ grade and less of the KP grade. A small deposit of KP Únanov-sever will be mined out shortly.
- The Cheb Basin – these kaolins originated through kaolinization of granites of the Smrčiny massif. A single deposit in this area - Plesná-Velký Luh (KK, KP) - has not been mined yet.
- The Třeboň Basin – less important deposits, local kaolins originated from granites and biotite paragneisses of the Moldanubicum. Only ceramic kaolins (KK) are evaluated here. The raw material is not mined and its exploitation is not foreseen due to its low quality.
- Vidnava – kaolins formed from granites of the Žulová Massif. The raw material of a single, until now not mined deposit Vidnava has been alternatively evaluated as KP and KK. In The Register it is however listed under refractory clays for grog production to ensure its best use.
- Other smaller kaolin occurrences have been either mined out (Lažánky) or not explored yet (Žlutice, Toužim, Javorník areas).

The kaolin deposits of the Czech Republic are important also on a world scale, the most important areas being Plzeň, Karlovy Vary and Podbořany ones. All Czech kaolin deposits are extracted by open-pit mining operations at present.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Principal areas of deposits presence:

1 Karlovy Vary region
2 Kadaň region
3 Podbořany region
4 Plzeň region
5 Znojmo region
6 Cheb Basin
7 Třeboň Basin
8 Vidnava

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	65	65	65	65	65
exploited	11	12	13	15	15
Total mineral reserves, kt	1 152 423	1 141 012	1 127 292	1 121 045	1 120 859
economic explored reserves	257 451	224 358	233 868	221 695	215 777
economic prospected reserves	493 525	517 984	495 636	488 404	494 164
potentially economic reserves	401 447	398 670	397 788	410 946	410 918
Mine production, kt a)	5 573	5 543	3 650	4 155	3 862

Note:

a) raw kaolin, total production of all technological grades;
beneficiated kaolin (refined – water-washed) represents about 20 – 25 % of given mining production

The data of kaolin for production of porcelain and fine ceramics (KJ) and kaolin used as fillers in paper industry (KP) have been stated separately due to great varieties of technological use and prices of the individual kaolin types.

Kaolin for production of porcelain and fine ceramics (KJ)	2000	2001	2002	2003	2004
Deposits – total number	27	28	29	29	29
exploited a)	5	5	6	7	7
Total mineral reserves, kt	243 811	256 168	257 441	258 622	257 119
economic explored reserves	54 163	53 737	58 114	56 541	56 008
economic prospected reserves	103 652	115 969	110 155	108 362	107 762
potentially economic reserves	85 996	86 462	89 172	93 719	93 349
Mine production, kt	443	417	424	402	448

a) exploited deposits of KJ: Božičany–Osmosa–jih, Bystřice–Hájek, Jimlíkov, Krásný Dvůr, Mírová, Nepomyšl–Velká, Podlesí 2

Kaolin for paper industry (KP)	2000	2001	2002	2003	2004
Deposits – total number	22	23	22	22	22
exploited a)	6	7	7	8	8
Total mineral reserves, kt	407 178	375 312	380 352	376 722	365 127
economic explored reserves	117 132	88 128	88 918	82 513	77 365
economic prospected reserves	189 616	194 516	190 399	186 149	185 975
potentially economic reserves	100 430	92 668	101 035	108 060	101 787
Mine production, kt	5 085	4 702	2 768	3 401	3 181

a) Exploited deposits of KP: Horní Bříza, Chlumčany–Dnešice, Kaznějov–jih, Kralupy u Chomutova–Merkur, Lomnička–Kaznějov, Otovice–Katzenholz, Rokle, Únanov–sever 3

5. Foreign trade

2507 – Kaolin and other kaolinitic clays, also calcined

Raw material	2000	2001	2002	2003	2004
Import, t	17 649	19 491	12 791	15 466	13 994
Export, t a)	442 934	455 041	444 820	441 500	483 636

a) export of kaolin of the highest quality Sedlec Ia was limited by Ministry of Industry and Trade

As kaolin is a very important Czech export commodity, foreign trade numbers are given in detail below:

25070020 – Kaolin

Raw material	2000	2001	2002	2003	2004
Import, t	7 618	9 058	3 904	5 626	6 834
Export, t a)	441 510	452 968	440 128	438 441	482 167

a) export of kaolin of the highest quality Sedlec Ia was limited by Ministry of Industry and Trade

25070080 – Kaolinic clay (other than kaolin)

Raw material	2000	2001	2002	2003	2004
Import, t	10 031	10 433	8 887	9 840	7 158
Export, t	1 424	2 074	4 692	3 059	1 469

6. Prices

The average prices of ceramic grade on domestic market oscillated depending on quality between CZK 2,000 – 3,500 per tonne. The average export prices were CZK 3,600 – 3,900 per tonne. Paper filling kaolin has been sold at CZK 1,400 – 3,500 per tonne and average export price has been CZK 3,000 per tonne. Crude kaolin for building ceramics is sold for CZK 200 – 300. Beneficiated (water-washed) kaolin from Podbořany is sold on domestic marked at CZK 1,500 per tonne, kaolin for fine ceramics and glazes production roughly at CZK 2,000 per tonne and activated kaolin at CZK 2,400 per tonne.

Roughly 14 kt of kaolin and other kaolinitic clays (item 2507 of the customs tariff) were imported in 2004 (53.9 % from Great Britain, 23.4 % from Ukraine and 15.4 % from Germany). The average import price was CZK 4,153 per tonne (British kaolin – CZK 3,851 per tonne, Ukrainian kaolin – CZK 1,921 per tonne, German kaolin – CZK 5,649 per tonne). 483.6 kt of kaolin and other kaolinitic clays were exported to Germany (31.5 %), Slovakia (15.5 %), Belgium (10.4 %), Austria (9.2 %), the Netherlands (8.3 %), Italy (6.4 %), Poland (5.8 %), Romania (3.0 %), Hungary (2.1 %) and the United Arabian Emirates (1.6 %) at average price of CZK 2,357 per tonne. Czech kaolins were exported to 32 countries in and outside Europe in 2004.

7. Mining companies in the Czech Republic as of December 31, 2004

LASSELSBERGER, a.s. Plzeň
Sedlecký kaolín a.s., Božičany
Kaolin Hlubany a.s., Podbořany
KERAMOST, a.s., Most
KSB s.r.o., Božičany

8. World production

Data on the world production of kaolin vary considerably; the statistics quote alternately dry or wet weight, raw or refined kaolin, exact figures on mined and produced volumes of saleable product or their estimates. Very various numbers are quoted also in different year's volumes of the same publications. In spite of these misleading facts we can estimate that the world production since 1984 ranged above 20 mill tonnes per year, and in 1990 according to the Welt-Bergbau-Daten (WBD), it obviously reached its top (27.7 mill t). After the fall to 21 mill t in 1993, the world production of kaolin has been slowly increasing again. Numbers in the World Mineral Statistics (WMS) are somewhat higher, those in the Mineral Commodity Summaries (MCS) are even markedly higher. In general, an increase of kaolin mine production in rapidly developing countries of the third world (China, Brazil, South Korea) and stagnation or decrease of mine production in developed countries (Germany, Great Britain, the USA) can be observed.

Year	2000	2001	2002	2003	2004 e
Mine production, kt (MCS)	NA	44 100	43 200	41 000	41 000
Mine production, kt (WMS)	22 600	22 200	22 000	22 700	N
Mine production, kt (WBD)	26 731	26 930	25 904	26 472	N

Main producers´ share in the world mining output (2003; according to the Welt Bergbau Daten):

the USA	30.3 %	Russia	4.9 %
Germany	13.6 %	Czech Republic	3.5 %
China	8.7 %	South Korea	2.7 %
Brazil	8.3 %	Spain	2.2 %
Great Britain	7.9 %	India	2.1 %

Note:
Data on production share of the Czech Republic are variable in various yearbooks. Welt-Bergbau-Daten gives about 3.5 % for 2003, whereas World Mineral Statistics 5.0 % (for year 2000). The renowned publication The Industrial Minerals HandyBook has given even 8 % as a share on the world production for 1997.

9. World market prices

Prices of kaolin on the world market – in spite of the lasting surplus of the supply – kept at the generally steady level. The Industrial Minerals magazine quotes each month prices of British and US kaolin. However, the prices of the British kaolin Cornwall have not been quoted since 2002. The average prices of traded commodities at year-end were as follows:

A Kaolin refined, filler, GBP/t, FOT Cornwall, Great Britain
B Kaolin refined, coating, GBP/t, FOT Cornwall, Great Britain
C Kaolin refined, ceramic grade, GBP/t, FOT Cornwall, Great Britain
D Kaolin refined, porcelain grade, GBP/t, FOT Cornwall, Great Britain
E Kaolin refined, filler, USD/st, Ex Georgia plant, USA
F Kaolin refined, coating, USD/st, Ex Georgia plant, USA
G Kaolin refined, calcined, bulk, USD/st, Ex Georgia plant, USA
H Kaolin refined, ceramic grade, bulk, GBP/t, EXW France
I Kaolin refined, ceramic grade, bulk, GBP/t, FOB Rotterdam

Commodity/Year	2000	2001	2002	2003	2004
A	52.50	52.50	-	-	-
B	76.50	76.50	-	-	-
C	62.50	62.50	-	-	-
D	105.00	105.00	-	-	-
E	-	-	90.00	90.00	90.00
F	-	-	135.00	135.00	135.00
G	365.00	365.00	348.00	348.00	348.00
H	-	-	70.00	70.00	70.00
I	-	-	80.00	80.00	80.00

10. Recycling

In ceramic production, a part of bodies is recycled. Increasing recycling of paper little influences the kaolin consumption; when recycled mineral fillers and coating pigments are separated and slurry is discarded. The recycled paper – used mainly for newsprint and wrapping – uses little if any kaolin.

11. Possible substitutes

Depending on the use, the situation is as follows:

- In production of porcelain, kaolin is irreplaceable.
- In ceramic recipes, kaolin can be in some cases partially substituted by clays, talc, wollastonite or mullite (also synthetic mullite), but mostly these substitutions are financially pretentious.
- In production of paper (which consumes almost a half of the total production of kaolin), the possibilities for substitution are the highest – kaolin as a filler can be replaced by extra finely pulverized limestone, dolomite (also synthetic – precipitated), mica (muscovite), talc, wollastonite, etc.
- In other cases, where kaolin is used as filler (insulation materials, pigments, glass fibres), the situation is analogous.
- In production of refractory materials and applications in the building industry, other materials with adequate properties can successfully substitute kaolin.

CLAYS

1. Characteristics and use

Clays are sedimentary or residual unconsolidated rocks consisting of more than 50 % of clay fraction (particle size less than 0.002 mm), containing as the major constituent clay minerals, particularly those of the kaolinite group, then hydromicas (illite) and montmorillonite (see bentonite). Depending on the composition of clay minerals, clays are divided into monomineral (e.g. kaolinite, illite, etc.) and polymineral clays (composed of more clay minerals). Clays can contain various admixtures, e.g. quartz, micas, carbonates, organic matter, oxides and hydroxides of Fe, etc. Their colour depends on admixtures and can be white, grey, yellow, brown, violet, etc. They can be also secondarily consolidated (claystones) or recrystallized unmetamorphosed (shales or clay shales).

From the point of view of deposits and further technological processing, this category includes a wide selection of rocks rich in clay minerals. Abroad, bentonite, brick-clays and even kaolins are often included in this category. Clays can be found virtually in all sedimentary formations all over the world.

They are mostly used in production of ceramics, as refractory and sealing materials, fillers, in paper industry and for filtration of oils, etc.

2. Mineral resources of the Czech Republic

According to technological properties and use, the clays in the Czech Republic are classified as follows:

- Whiteware clays (JP) – they are used as a raw material for production of ceramics with white- or light-burning colour, sintering at temperatures over 1,200° C. The clay minerals are represented mostly by kaolinite, the content of clastic particles is low.
- Refractory clays for grog (JZ) – after firing, these clays are suitable as an opening material for production of fireclay products. The material is required to contain maximum Al_2O_3 and minimum Fe_2O_3, other required parameters are very high refractoriness and the lowest possible absorption capacity after firing. The major clay mineral is again kaolinite (and/or dickite).
- Other refractory clays (JO) – used as binding (plastic) clays in production of mainly refractory products. Besides high binding properties they should contain as low as possible amount of Fe_2O_3 and clasts.
- Non-refractory ceramic clays (JN) – the raw material of wide spectrum of technological properties and uses (production of floor and wall tiles, additives, etc.).
- Aluminous underlying clays (JA) – kaolinite clays underlying the coal seams near Most in the North Bohemian Basin, containing about 40 % Al_2O_3, locally 3 – 7 % TiO_2 and usually a large amount of siderite. These clays were considered as a possible source of Al in the past. They are of no importance today due to the energy-demanding processing. They are moreover overlain by waste dumps of coal mines.

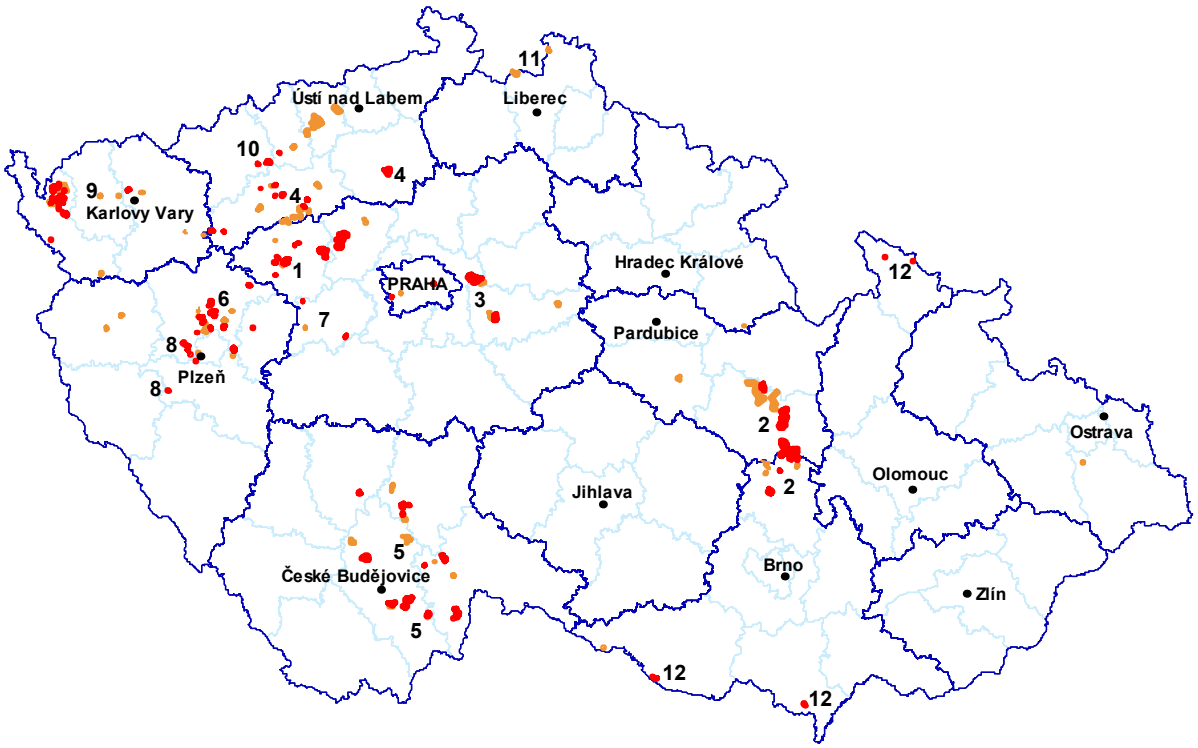
Clay deposits in the Czech Republic are concentrated in the following major areas:

- The Kladno-Rakovník Permo-Carboniferous – the deposits contain mostly high-grade refractory claystones (shales or schistose clays) (JZ), which are used in production of refractory opening materials. Less common are deposits of red-burning tile clays and grey non-refractory claystones (JN). Rynholec-Hořkovec 2 and Rakovník represent the most important deposits.

- Moravian and east Bohemian Cretaceous sediments – this is the area of the largest clay reserves (JZ grade), with the same use as the ones from the previous area (but of a slightly lower quality). A single deposit Březinka is mined at present.
- Cretaceous sediments in the Prague surroundings – these clays are suitable as a highly refractory (non-plastics) opening material (JZ) and refractory binding clays (JO), as well as whiteware clays (JP). The most important are deposits of JZ Vyšehořovice and Brník.
- The Louny Cretaceous – these clays are suitable as whiteware clays (JP) and other refractory clays (JO), but particularly as ceramic clays (JN). A medium-sized Líšťany deposit (JN) is the only deposit mined at present.
- South Bohemian Basins – medium or high-grade refractory clays, suitable for use namely as binding clays (JO), whiteware clays (JP) and non-refractory clays (JN). Borovany-Ledenice (JO, diatomite is mined here, too) and Zahájí-Blana represent the main deposits.
- The Plzeň Basin and Tertiary relics of Central and Western Bohemia – mostly medium grade refractory clays, classified as binding clays (JO) and ceramic clays for production of floor and wall tiles, as well as for stoneware (JN). The large Kyšice-Ejpovice deposit (JO) is the most important deposit here.
- The Cheb and Sokolov Basins – more significant is the Cheb Basin containing important binding clays (JO), whiteware clays (JP), refractory and sintering clays (JO, JN), etc. Nová Ves u Křižovatky 2 represents the significant exploited deposit of JO.
- North Bohemian and the Žitava (Zittau) Basins – apart from high aluminous underlying clays (JA), there are also overlaying ceramic (mostly sintering and tile) clays (JN). Only a medium-sized deposit of JN Tvršice in the North Bohemian Basin is mined.
- Tertiary and Quaternary sediments in Moravia – mostly ceramic (sintering and tile) clays (JN). The mining in this region was terminated in 1997 (Poštorná, Šatov).

The most important areas with clay deposits in the Czech Republic are nowadays Cheb Basin, south Bohemian Basins, Cretaceous in the Prague surroundings, Permo-Carboniferous of Rakovník region and less and less Cretaceous of Moravia and eastern Bohemia. Clays and claystones in the Czech Republic are extracted by open-pit mining and locally even underground operations (Rakovník, Lubná, Březinka).

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Principal areas of deposits presence:

1 Kladno-Rakovník Permo-Carboniferous
2 Moravian and East-Bohemian Cretaceous
3 Cretaceous in the Prague surroundings
4 Louny Cretaceous
5 South-Bohemian Basins
6 Plzeň Basin
7 Tertiary relics of Central Bohemia
8 Tertiary relics of Western Bohemia
9 Cheb Basin and Sokolov Basin
10 North-Bohemian Basin
11 Zittau Basin
12 Tertiary and Quaternary in Moravia

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	116	115	116	112	111
exploited	22	23	26	26	25
Total mineral reserves, kt	1 057 361	1 057 102	1 049 496	960 604	959 285
economic explored reserves	231 689	230 202	231 500	194 480	193 861
economic prospected reserves	528 712	528 348	511 233	416 399	416 348
potentially economic reserves	296 960	298 552	306 763	349 729	349 076
Mine production, kt	601	585	564	554	649

5. Foreign trade

2508 – Other clays (except expanded clays), andalusite, kyanite, sillimanite, also baked , mullite, fire-clay or dinas earths

Raw material	2000	2001	2002	2003	2004
Import, t	38 457	41 728	36 853	41 954	58 368
Export, t	174 212	185 711	157 918	145 597	230 124

As the item 2508 includes various raw materials (often with a different way of application), also numbers on foreign trade on chosen sub-items are given below:

250820 – Decolourizing earths and Fuller's earth

Raw material	2000	2001	2002	2003	2004
Import, t	637	595	547	702	564
Export, t	0	0	53	32	27

250830 – Refractory (fire) clay

Raw material	2000	2001	2002	2003	2004
Import, t	8 837	11 908	8 140	9 388	11 841
Export, t	46 784	46 415	46 785	46 678	41 722

250840 – Others clays

Raw material	2000	2001	2002	2003	2004
Import, t	6 093	5 351	5 317	6 494	16 880
Export, t	57 957	45 008	37 285	35 827	44 383

250850 – Andalusite, kyanite a sillimanite

Raw material	2000	2001	2002	2003	2004
Import, t	3 672	3 341	2 373	3 480	3 333
Export, t	0	144	23	0	0

250860 – Mullite

Raw material	2000	2001	2002	2003	2004
Import, t	377	444	300	340	446
Export, t	22	1	12	5	72

250870 – Fire-clay or dinas earths

Raw material	2000	2001	2002	2003	2004
Import, t	5 954	4 679	7 553	9 755	5 887
Export, t	36 595	47 321	41 758	45 597	81 891

6. Prices

Different quality of clay and schistose clay in the market gives variable prices. For example, crude refractory clay is delivered at CZK 450 – 780 per tonne, average price is roughly CZK 600 per tonne, dried refractory clay reaches CZK 860 – 1,840 per tonne, and average prices are about CZK 1,200 per tonne. Prices of kaolinic clay with high plasticity and refractoriness of about 1,700 ^{o}C were sold for CZK 450 – 1,050 in crude state and for CZK 2,500 – 5,000 dried. 11.8 kt of refractory clay were imported from Poland (82.5 %), Ukraine (10.4 %) and Germany (6.5 %) in 2004. The average import price was CZK 1,261 per tonne. At the same time, 41.7 kt of refractory clay were exported to Germany (33.0 %), Austria (27.7 %) and Slovakia (19.4 %). The average price was CZK 1,766 per tonne.

Prices of crude sintering clay oscillate between CZK 170 – 665 per tonne, average price is CZK 400 per tonne. Dry sintering clay is sold at CZK 1,000 per tonne. Prices of crude bleaching clay oscillate between CZK 350 and CZK 1,630 per tonne, average price is about CZK 1,300 per tonne if it is crude, prices of dry bleaching clay reach CZK 1,375 – 2,950 per tonne, and average price is about CZK 2,160 per tonne. The average prices of other crude clays are CZK 230 per tonne; prices of dry ones are about CZK 1,300 per tonne. In 2004, 16.9 kt of other clays were imported (78.4 % from Germany, 17.6 % from Great Britain) at average price of CZK 2,847 per tonne. 44.4 kt of other clays were exported to Germany (66.8 %), Austria (19.9 %) and Poland (4.9 %). The average export price was CZK 834 per tonne.

5.9 kt of fire-clay and dinas earths were imported (65.0 % from Ukraine, 28.1 % from Germany, 5.1 % from the Netherlands) at average price of CZK 3,183 per tonne. 82 kt at CZK 3,009 per tonne were exported. 47.3 % of this amount went to Germany, 17.9 % to Hungary and 12.2 % to Italy. The increase by 80 % in between the years was caused by about twice as high export to Germany and Hungary in 2004.

Prices of crude schistose clay on domestic market oscillate between CZK 400 – 551 per tonne. Calcined schistose clay is sold at CZK 2,600 – 4,000 per tonne.

446 tonnes of mullite were imported – 41.6 % from Hungary, 36.7 % from the Netherlands and 20.6 % from Germany – at average price of CZK 27,825 per tonne in 2004. 3,333 t of andalusite, sillimanite and kyanite were imported from South Africa (87.5 %), France (6.4 %) and the USA (4.0 %) at average price of CZK 8,073 per tonne. 564 t of decolourising earths and Fuller's earth were imported mainly from Slovakia (91.9 %) and from Germany (8.0 %) at price of CZK 15,015 per tonne. Export of all these three items was negligible in 2004.

7. Mining organizations in the Czech Republic as of December 31, 2004

KEMAT s.r.o., Skalná
LASSELSBERGER, a.s. Plzeň
KERAMOST a.s., Most
České lupkové závody a.s., Nové Strašecí
P-D Refractories CZ a.s., Velké Opatovice
RAKO - Lupky s.r.o., Lubná u Rakovníka
Kaolin Hlubany a.s., Podbořany

8. World production

Overall data on the world production of clays are not available. There are some partial statistics on certain grades of clays; according to these, the production of clays has been slowly but steadily growing. World production of the so-called Fuller´s earth has been oscillating between 4 and 5 mill t during the recent years (according to the Mineral Commodity Summaries).

9. World market prices

The average prices of most of the clays were steadily growing. Prices of some of the clays were quoted each month in the Industrial Minerals magazine. Only quotations of the refractory clay world prices have been published since 2002. The overview of average prices of sales at yearend for the following commodities:

A Fuller's earth, soda ash-treated, del GB, foundry grade, bagged, GBP/t
B Calcined refractory, 40– 70 % Al_2O_3, GBP/t, CIF GB
C Ball clay, air dried, shredded, bulk, GBP/t, FOB GB
D Ball clay, pulverized, air fluid, bagged, GBP/t, FOB GB
E Westerwald clay, dried & ground, bulk, DEM/t, FOB Germany
F Refractory clay, 45 % Al_2O_3, USD/t FOB China
G Calcined kaolinic clay, 47 % Al_2O_3, USD/t FOB EU

Commodity/Year	2000	2001	2002	2003	2004
A	106.50	115.00	-	-	-
B	112.00	112.00	-	-	-
C	45.00	45.00	-	-	-
D	105.00	105.00	-	-	-
E	162.50	162.50	-	-	-
F	67.50	67.50	67.50	67.50	67.50
G	112.00	112.00	120.00	120.00	140.00

10. Recycling

The material is not recycled.

11. Possible substitutes

Majority of the clays are used in various fields of ceramics production. According to the use, the following substitutes are possible:

- Whiteware clays used in ceramic recipes – here the clays are irreplaceable. On the contrary, the selection of used clays is still wider, depending on local resources and new recipes.
- Clays for opening materials – especially in production of fire-clay and similar materials, the clays can be successfully substituted by a number of refractory materials – andalusite, mullite (recently even synthetic mullite), etc. – depending on the use and local availability.
- The same applies for clays used in production of other refractory products; there are numbers of possible substitutes, which depend on the purpose and use of these products, economic limits, and local resources.
- Clays for non-refractory ceramic products (earthenware pipes, tanks for acids, floor and wall tiles, jars, etc.) – besides natural mineral substitutes (such as halloysite for floor tiles, mineral pigments instead of colour-burning clays, cast basalt), another possible substitutes can be glass (tiles), artificial stoneware (floor tiles, paving bricks, slabs), metals, plastics, etc. However, in the ceramic production itself, the clays are irreplaceable.
- Titanium-bearing and aluminous clays are a potential source of titanium and aluminium and as such represent a substitute for traditional metallic ores of these elements.

BENTONITE

1. Characteristics and use

Bentonite is a soft, very fine-grained heterogeneous rock of various colours, composed mostly of clay mineral montmorillonite, which originated mostly by submarine or atmospheric weathering of basic (to a smaller extent also of acid) volcanic rocks (mainly tuffs). Montmorillonite gives to bentonite its typical properties – high sorption capacity, characterized by a high value of cation exchange (the ability to receive certain cations from solutions, and replace them with its own molecules – Mg, and in some cases also Ca and alkalies); internal swelling after contact with water (some bentonites do not swell, but have a high absorptive capacity as bleaching clays, especially when they are activated); high plasticity and binding ability. Bentonite also contains other clay minerals (kaolinite, illite, beidellite), Fe compounds, quartz, feldspars, volcanic glass, etc., which represent impurities and if possible they are removed during the mineral processing. World economic reserves of bentonite are estimated at more than 1,400 mill t. Bentonite has many uses, which depend upon its mineralogical composition and technological properties. It is mostly used in foundry industry, for pelletizing of iron ores (4– 10 kg per one tonne of pellets), as an adsorbent (decolourization, catalysis, refining, filtration, drying, waste water treatment, pesticide carrier), in drilling mud, as a filler (dyes, varnishes, pharmaceutical and cosmetic products), a suspension (lubricating oils), in the building industry (sealing material), in agriculture, etc. In recent years, the bentonite is still more used as a pet waste adsorbent (cat litter) and a granulated food binder.

2. Mineral resources of the Czech Republic

All bentonite deposits in the Czech Republic were formed by clay weathering of volcanic rocks. Bentonite deposits and reserves in the Czech Republic are almost exclusively concentrated in the area of the Doupovské hory Mts. and the České středohoří Mountains. Large portion of bentonite raw material from these deposits is of the highest grade, suitable especially for the foundry industry (bonding agent for moulding sand) – both activated (Ca^{2+} and Mg^{2+} ions replaced by Na^{+} ions) and non-activated bentonites are used for this purpose.

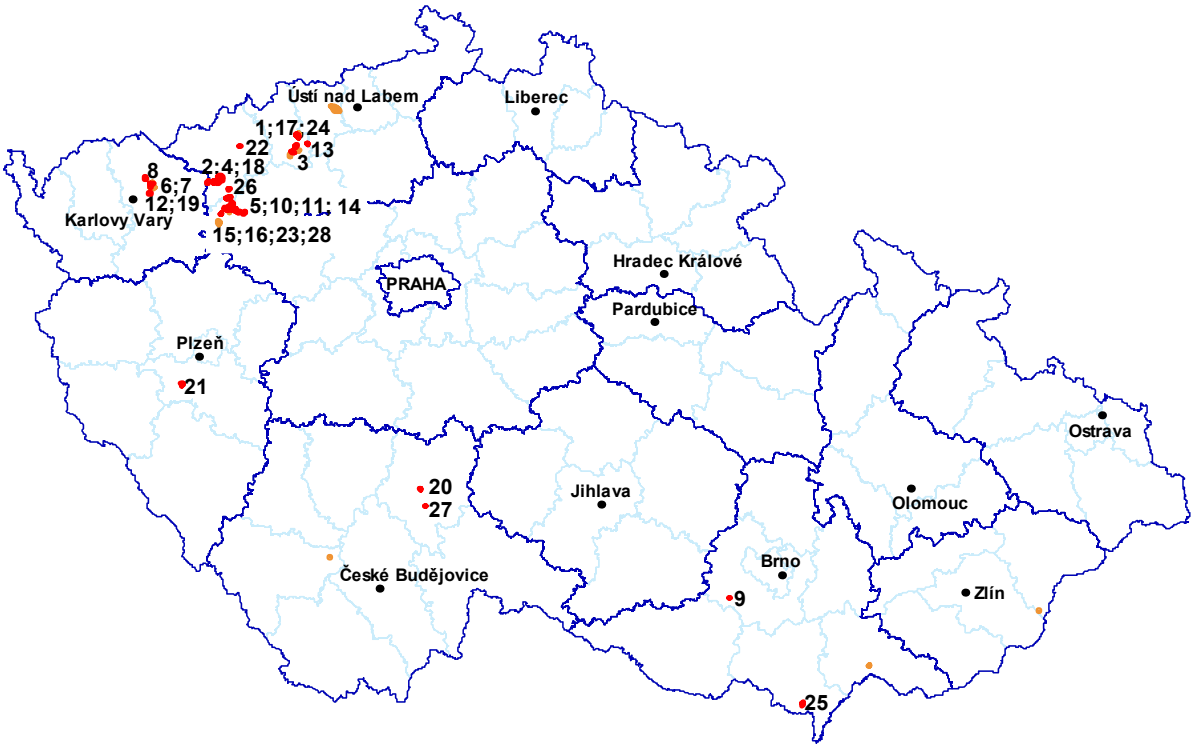
Mining, mineral processing and use of bentonite in the Czech Republic started only in the late 1950s, particularly due to its use in the foundry industry. The mining culminated first at the beginning and end of the 1980s (207 kt in 1987). Decrease of demand from foundry industry in the first half of the 1990s resulted in decrease of the mining production (54 kt in 1995). The mining production substantially increased again in 1996 – 2000 especially due to the higher demand for a non-traditionally used bentonite (pet waste adsorbent, e.g. cat litter, use in animal food, insulation materials etc.).

- The eastern margin of the Doupovské hory Mts. at the contact with the North Bohemian Basin represents the most important area with bentonite deposits. Major part of the reserves and the largest bentonite deposits are concentrated in Kadaň and Podbořany surroundings. Rokle is the most important deposit mined at present.
- Bentonite deposits of the western margin of the Doupovské hory Mts. at the contact with the Hroznětín Basin are concentrated mainly in Hroznětín surroundings. Mining and processing activity at Hroznětín-Velký Rybník deposit was terminated in 1993 for economic reasons. Rather large reserves were evaluated at several deposits in the end of the 1990s. Majority of these deposits (except Všeborovice deposit) have however unfavourable stripping conditions, they are less explored and in some cases also the raw material is of a lower quality than that of the Podbořany, Kadaň and Most regions deposits.
- Deposits of the Most region at the contact of the south – eastern margin of the North Bohemian Basin and the České středohoří Mts. represent the second most significant bentonite area of the Czech Republic at present. Braňany-Černý vrch deposit, where

mining is about to be terminated, and Stránce and Střimice belong to the most important ones.

- Tertiary basins of the Plzeň region (Dnešice) and south Bohemian basins (Maršov, Rybova Lhota) represent the less important bentonite areas. Local raw material – mostly montmorillonite clays – is mostly of a lower quality and suitable mainly for agriculture or as a sealing material. Bentonites occur also in the Sokolov Basin.
- Montmorillonite clays predominate in the Miocene sediments of the Carpathian Neogene in southern Moravia. The raw material is with some exceptions (Ivančice–Réna) of a lower quality, suitable mainly for agriculture or as a sealing material. Two small deposits have been evaluated here (Ivančice–Réna, Poštorná).

3. Registered deposits and other resources in the Czech Republic



reserved registered deposit exhausted deposits and other resources

Names of mined deposits are indicated in **bold type**

Foundry bentonite:

1 **Braňany-Černý vrch**
2 **Rokle**
3 **Stránce**
4 Blov-Krásný Dvoreček
5 Blšany 2
6 Hájek 1
7 Hájek 2
8 Hroznětín-Velký Rybník
9 Ivančice-Réna
10 Krásný Dvůr-Podbořany
11 Krásný Dvůr-Vys.Třebušice 1
12 Lesov
13 Liběšice
14 Nepomyšl
15 Nepomyšl-Velká
16 Podbořany-Letov
17 Střimice 1
18 Vlkaň
19 Všeborovice

Other bentonite:

20 Maršov u Tábora	23 Krásný Dvůr-Vys.Třebušice	26 Račetice
21 Dnešice-Plzeňsko-jih	24 Obrnice-Vtelno	27 Rybova Lhota
22 Chomutov-Horní Ves	25 Poštorná	28 Veliká Ves-Nové Třebčice

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	27	27	27	28	28
exploited	3	3	3	4	4
Total mineral reserves, kt	312 656	312 424	318 491	317 390	315 256
economic explored reserves	51 669	51 624	54 268	54 201	54 035
economic prospected reserves	173 621	173 621	169 969	168 982	168 104
potentially economic reserves	87 366	87 179	94 254	94 207	93 117
Mine production, kt	280	224	174	199	201

5. Foreign trade

250810 - Bentonite

Raw material	2000	2001	2002	2003	2004
Import, t	12 887	15 410	12 623	11 795	19 417
Export, t	32 853	46 822	32 002	17 458	62 028

6. Prices

Technical bentonite, which can be used as sealing and backfilling material or as an additive in fertilizers, has been sold on domestic market for prices from CZK 3,000 per tonne. 19,417 t of bentonite were imported – 70.7 % from Slovakia and 18.4 % from Germany – at average price of CZK 3,158 per tonne in 2004. High-quality bentonite from Slovakia is imported for the most demanding usage. 62,028 t of bentonite were exported to Germany (71.0 %), Austria (13.3 %) and Poland (6.0 %). The average export price was CZK 9,414 per tonne. The increase of export in 2004 was caused by roughly fourfold increase of export to Germany compared to 2003.

7. Mining companies in the Czech Republic as of December 31, 2004

KERAMOST a.s., Most
LITH s.r.o., Malé Chvojno

8. World production

Annual world production of bentonite is about 12 mill tonnes. World production oscillated between 10 and 12 mill tonnes in the last 5 years. Data of the individual statistical reviews though differ considerably. The amount of mine production of the biggest producers (the USA, Greece, and Germany) does not show large fluctuations. Mine production in Great Britain and Italy decreased and that of Mexico increased markedly during the last five years.

Year	2000	2001	2002	2003	2004 e
Mine production, kt (MCS)	NA	10 500	10 000	10 200	10 500
Mine production, kt (WMS)	11 400	11 800	11 400	12 000	N
Mine production, kt (WBD)	9 996	10 489	9 859	10 192	N

Main producers´ share in the world mining output (2003; according to WBD):

the USA	39.0 %	Mexico	4.4 %
Greece	11.4 %	Japan	4.0 %
Russia	8.8 %	Italy	2.8 %
Turkey	8.2 %	Spain	2.2 %
Germany	4.7 %	Czech Republic	2.0 %

9. World market prices

Bentonite prices showed just short-time fluctuations in the last few years. The higher increase of price of some bentonite sorts (commodity C, D) didn´t come until 2000. The prices of all the mentioned quotations continued to increase in 2001 and stagnated in 2002 – 2004. According to quotation of the Industrial Minerals magazine, the average prices at year-end were as follows:

A Wyoming, foundry grade, 85 % <200 mesh, bagged, 20-tonne lots, GBP/t, del GB
B Wyoming, crude, bulk, rail hopper cars, USD/st, FOB ex-works
C Wyoming, foundry grade, bagged, rail hopper cars, USD/st, FOB ex-works
D Wyoming, API, bagged, rail cars, USD/st, FOB ex-works
E Indian bentonite, cat litter grade, crashed, dried, bulk, USD/t FOB Kandla
F Indian bentonite, foundry grade, crashed, dried, bulk, USD/t FOB Kandla
G Cat litter grade, 1 – 5 mm, bulk, Euro/t, FOB main European port

Commodity/Year	2000	2001	2002	2003	2004
A	135.00	165.00	-	-	-
B	42.50	44.50	44.50	44.50	44.50
C	59.00	64.00	63.00	63.00	63.00
D	43.00	49.00	48.00	48.00	48.00
E	-	-	36.00	36.00	36.00
F	-	-	42.50	42.50	42.50
G	-	-	50.00	43.50	40.00

10. Recycling

Bentonite can be recycled on a very limited scale only.

11. Possible substitutes

In moulding sand, bentonite can be replaced by bonding agents containing graphite, synthetic polymers, or other clay minerals. Drilling mud can use similar substitutes; fillers can use chalk, dolomite, limestone, etc., in ecological applications bentonite can be replaced by zeolites. In production of iron ore pellets, burnt lime, polymers and other binders replace bentonite.

DIATOMITE

1. Characteristics and use

Diatomite is a sedimentary rock, consisting mainly of the microscopic cells of fresh-water or marine diatoms. This rock shows various degree of consolidation – it is either loose (diatomaceous earth) or consolidated (diatomaceous shale or chert). Loose rock has a character of very fine-grained sediment. Shells are partly dissolved during diagenesis and the sediment is impregnated by released opal, which leads to consolidation and schistosity development. Polishable and absorbing shales, sometimes even opal cherts are distinguished depending on the degree of porosity. Chemically, diatomite is dominated by SiO_2, the content of which should be the highest possible. From the technological point of view, important parameters are porosity, resistance against acids, refractoriness, thermal and electric conductivity, density, moisture, chemical composition et al. Clastic, clayey and organic particles (sponges) and higher Al_2O_3, Fe_2O_3 and CaO contents are contaminants. Deposits originate in water basins with low content of $CaCO_3$ and suspended alumosilicate material. The most favourable conditions are in cool water near volcanic areas. The world economic reserves are estimated at 800 mill t, about 250 mill t of which occurs in the USA.

The raw material is used for filtration purposes (the highest grades), in production of fillers (rubber, paper, cosmetics), as abrasives, as carrier for catalysts, and in building industry for manufacturing of thermal and sound insulating materials.

2. Mineral resources of the Czech Republic

Diatomite accumulations in the Czech Republic are confined to areas with Tertiary and Quaternary lake sediments, first of all to the Tertiary sediments of the south Bohemian basins and volcanic rocks of the České středohoří Mts. Smaller occurrences are known from other areas of the Bohemian Massif and in the Neogene of the Carpathian foredeep and flysh.

- The biggest accumulations of diatomite in Bohemia are situated in the south Bohemian basins. Spongy diatomites and diatomaceous clays (low-grade building diatomites) occur together with lignite. The only registered and also mined deposit in the Czech Republic - Borovany-Ledenice – is located in the Třeboň Basin. Tertiary sediments were deposited in tectonically confined space on the Moldanubian basement. Deposit layer of diatomites, diatomite clays and spongy diatomites occur in the upper part of the Mydlovary formation. Diatomites are in subhorizontal position, of whitish grey to ochre colour, unconsolidated. Average thickness of the raw material is about 8.5 m (15 m at maximum). High-grade diatomite is used after processing for filtration purposes or as filler in food, chemical, pharmaceutical industries, etc. The highest-grade (extra pure) diatomite is used in wine, spirits, beer, edible oil or fat filtration. Diatomite of lower grade is suitable mostly only for building and insulation materials production. It is partly used for a cat litter production at present.
- Many diatomite outcrops, which were occasionally mined already in the first half of the 19th century as a raw material for abrasives and polishing materials production, are known in the České středohoří Mts. The most significant deposit Kučlín was mined out in 1966. These occurrences are of no importance at present.
- Lens-shaped occurrences of diatomites in the Carpathian flysh south of Brno (Pouzdřany) were prospected, with a negative result.
- Quaternary diatomites are known from the Most (together with lake mud rich in organic matter) and Františkovy Lázně surroundings (deposit Hájek – earlier mined together with peat, nowadays a natural preserved area Soos).

3. Registered deposits and other resources in the Czech Republic

reserved registered deposits exhausted deposits and other resources

Mined deposit:

1 Borovany - Ledenice

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	1	1	1	1	1
exploited	1	1	1	1	1
Total mineral reserves, kt	4 800	4 699	4 661	4 607	4 562
economic explored reserves	4 472	4 371	4 333	4 279	4 234
economic prospected reserves	328	328	328	328	328
potentially economic reserves	0	0	0	0	0
Mining production, kt	34	83	28	41	33

5. Foreign trade

2512 – Siliceous fossil meal, siliceous earth

Raw material	2000	2001	2002	2003	2004
Import, t	1 895	1 695	1 647	1 562	1 966
Export, t	5 976	5 493	5 288	5 081	4 734

6901 – Bricks, blocks, and other ceramic goods of siliceous fossil meals

Raw material	2000	2001	2002	2003	2004
Import, t	1 009	3 259	2 983	1 900	1 575
Export, t	336	161	811	820	215

6. Prices

Diatomite for filtration purposes of variable parameters (filtration velocity, pouring mass, pH) is sold for CZK 13 – 15 thousand per tonne on domestic market. Diatomite absorbent, used as pet litter, or to remove bad smells were accessible for prices about CZK 40 per kg.
1,966 tonnes of diatomite (39.0 % from the USA, 34.3 % from France, 15.8 % from Denmark) were imported at average price of CZK 12,443 per tonne in 2003. About twice as high export amounted at 4,734 t (38.2 % to Austria, 29.3 % to Germany and 8.9 % to Poland). Average price was CZK 8,661 per tonne. 1.6 kt of ceramic building elements made of siliceous fossil meals was imported (36.8 % from Germany, 30.1 % from Poland and 12.7 % from Italy) at average price of CZK 10,532 per tonne in 2004. 0.2 kt was exported (74.1 % to Slovakia, 18.4 % to Slovenia, 7.1 % to Austria) for CZK 2,934 per tonne in the same period.

7. Mining companies in the Czech Republic as of December 31, 2004

LASSELSBERGER, a.s. Plzeň

8. World production

World production of diatomite oscillated between about 1 and 2 mill t per year. Data of the individual statistical reviews differ considerably; yearbook Welt Bergbau Daten (WBD) gives traditionally lower values, mining production in China is however not included in the totals. According to the Mineral Commodity Summaries (MCS), the world production during the last 5 years oscillated between 1.7 and 2.0 mill t per year with a slightly decreasing tendency; according to the World Mineral Statistics (WMS), it actually stagnated around 1.65 mill t per year.

Year	2000	2001	2002	2003	2004 e
Mine production, kt (MCS)	1 890	1 700	1 730	1 950	1 960
Mine production, kt (WBD)	1 088	1 071	996	1 020	N
Mine production, kt (WMS)	1 650	1 640	1 640	1 660	N

Main producers´ share in the world mining output (2003; according to MCS):

the USA	31.8 %
China	19.5 %
Denmark	11.9 %
Japan	9.2 %
France	3.8 %

Mexico	3.1 %
Spain	1.8 %
Peru	1.8 %
Czech Republic	1.5 %

9. World market prices

Exclusively prices of the American diatomite are published on the world market. Prices on the American market ex-works oscillated between USD 255 and 270 per ton. Diatomite is quoted in the renowned magazine Industrial Minerals monthly as CIF, Great Britain. Prices of both diatomite sorts have been very stable. Average prices at year-end reached:

A diatomite calcined, filtration, GBP/t CIF Great Britain

B diatomite calcined, burned, filtration, GBP/t CIF Great Britain

Commodity/Year	2000	2001	2002	2003	2004
A	390.00	390.00	390.00	390.00	390.00
B	400.00	400.00	400.00	400.00	400.00

10. Recycling

Diatomite can be recycled only on a very restricted scale.

11. Possible substitutes

Diatomite, which has a number of applications due to its unique properties, can be replaced by a number of materials. In filtration – the dominant area of use – it can be replaced by expanded perlite or quartz sand, respectively by various types of membranes. However, diatomite parameters are usually not reached. As filler, diatomite can be replaced by talc, ground quartz sand, crushed mica, some clay types, perlite, vermiculite or ground limestone. As a heat insulating material, it can be replaced also by various types of clay and bricks, mineral wool, expanded perlite or vermiculite. As friction material, it can be replaced by asbestos, barite, bauxite, alumina, clays, graphite, gypsum, mice, pumice, pyrophyllite, silica, slate, vermiculite and zircon.

FELDSPAR

1. Characteristics and use

Feldspar raw materials are rocks with the prevalent portion of some mineral of the feldspar group or feldspar mixture in such a form, quantity and quality, which allow their industrial processing. Feldspars are a group of monoclinic (orthoclase, sanidine) and triclinic (microcline, plagioclases) potassium and sodium-calcium alumosilicates, and together with quartz they represent the most common rock-forming minerals, which create 60% of the Earth's crust. For industrial use are suitable potassium feldspars (orthoclase, microcline) and acid plagioclases (Na > Ca; albite, oligoclase, andesine). Basic plagioclases (Ca > Na; labradorite, bytownite, anorthite) are of a marginal importance. Suitable feldspar resources are dike rocks (pegmatites, aplites), igneous rocks (granites) and sediments (feldspar-bearing sand and sand and gravel), eventually also residues of incompletely kaolinized rocks and metamorphic rocks. The major impurity represents higher content of iron in the feldspar structure (unremoveable) or in the form of admixtures (removeable).

Because of their low melting point, feldspars are used as a melting agent in ceramic mixtures, glass batches, glazes, enamels and recently also as casting powders. Almost 90 % of feldspars are consumed by the glass and ceramic industry. A small amount is used as filler, especially in colours and plastic materials.

Rocks containing alkalies in other mineral than feldspar (mostly nepheline – anhydrous sodium-potassium alumosilicate) can be used as substitutes for feldspar raw materials. Particularly nepheline syenites, to a lesser extent nepheline phonolites are used for this purpose in the world.

2. Mineral resources of the Czech Republic

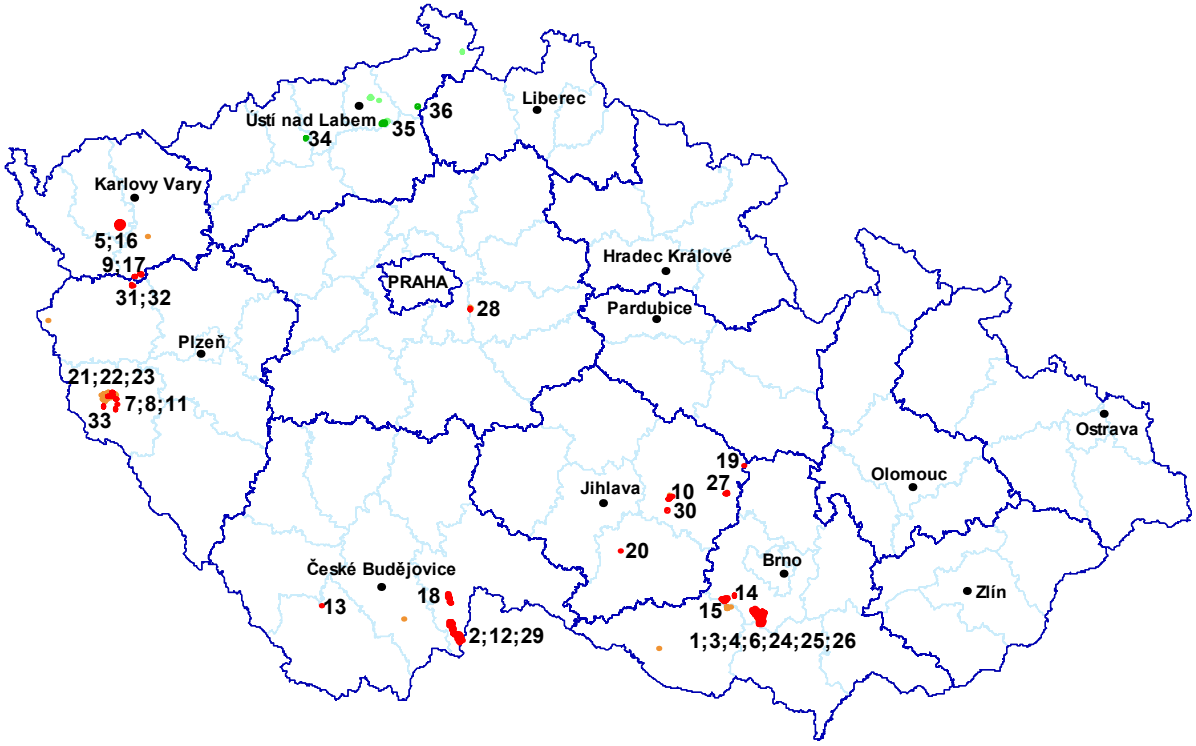
Deposits of feldspar raw materials in the Czech Republic are first of all associated with primary sources, formed mainly by leucocratic granitoids and pegmatite bodies. Nevertheless, the importance of secondary sources, represented by feldspar sand and gravel, has been increasing.

- Fluvial Quaternary feldspar placer deposits represent at present the most important feldspar resource. They were formed by deposition of disintegrated granitic rocks with a high content of mainly potassium feldspar phenocrysts. The decisive deposits are concentrated into two regions.
  1) the upper course of the Lužnice River with the crucial exploited deposit Halámky, mined from water. Other deposits of the region - Tušť, Dvory nad Lužnicí and Majdalena - are not mined yet. A large part of reserves of these deposits is blocked by conflicts of interests with nature protection, especially with the Protected Landscape Area (CHKO) Třeboňsko.
  2) the area south of Brno with sediments of the Jihlava River – the so-called Syrovice-Ivaň terrace with deposits Bratčice, Hrušovany, Ledce, etc. Quality of feldspar is slightly lower, as it has higher Fe contents. A major part of the local raw material is used only as a construction sand and gravel at present. Only a portion – size fraction 4 - 8 mm - has been stored in depots for later use as feldspar raw material since 2000. Similar deposits of feldspar accumulations of the Jihlava River are located in the Ivančice area southwest of Brno.

  Feldspar sand and gravel with a predominance of potassium feldspar over plagioclase represents the raw material of fluvial deposits. It is suitable for production of utility china, sanitary ceramics, glass and to a limited extent also glazes.

- Fine to medium-grained leucocratic granitoids (granites and granite aplites, quartz diorites) represent another important feldspar raw material. Feldspar deposits are developed for instance in the Krušné hory Mts. pluton (with the fundamental deposit Krásno mined by open pit: albite-bearing aplitic granite), Mračnice granitoid massif (Mračnice: quartz diorite – trondhjemite), Třebíč massif (Velké Meziříčí–Lavičky: aplitic granite). Prospecting was carried out also in other massifs such as the Brno massif (Moravský Krumlov), Dyje massif (Přímětice), Chvaletice massif, Babylon, Blatná and other individual massifs of the Central Bohemian Pluton (all granites and granodiorites). Raw material consists mainly of sodium-potassium feldspars and it is used for sanitary ceramics, coloured glass, china and abrasive disc production.
- Coarse-grained to porphyric leucocratic granitoids could represent an important resource of the feldspar raw material in future. Such rocks occur in the Říčany massif (Štíhlice), in the Čistá-Jesenice Massif, the Krkonoše-Jizera (Izera-Karkonosze) Pluton (Liberec granite) etc. Raw material consists mainly of sodium-potassium feldspars, which mostly require high-intensity magnetic separation to decrease the Fe content.
- Deposits of feldspar raw materials forming lenses in metamorphosed rocks have recently been the subjects of new prospecting. Deposit of orthoclasite to microclinite Markvartice by Třebíč is located in the western branch of the Varied Group of the Moldanubicum in Moravia. The albitite deposit Malé Tresné is situated at the north-western margin of the Svratka dome at the contact of the Micaschist Zone and Olešnice Unit. A small deposit of anorthosite to gabbro Chvalšiny occurs within amphibolites of the Český Krumlov Varied Group of the Moldanubicum in Šumava.
- Pegmatite deposits known from several regions represented the only source of the raw material used mainly for ceramic production in the past. Pegmatites of medium to lower quality occur in south - west Bohemia in the Poběžovice- Domažlice region (e.g. Luženičky, Meclov, Otov). These pegmatites contain equal proportions of sodium and potassium feldspars and an admixture of dark minerals. In this region there are also deposits of high-quality sodium and sodium-calcium feldspars, used for glazes and pellucid glass (Ždánov). K-feldspars are dominant in pegmatites in the other regions. Abundant occurrences of relatively high-quality feldspar with low contents of impurities (Beroun, Křepkovice, Zhořec) are in the Teplá region in western Bohemia. The Písek region with its pegmatites appears to be promising but has not been well explored yet. Some smaller deposits of feldspar are known from the Humpolec, Tábor and Rozvadov (Česká Ves) areas, from western Moravia (Smrček) etc. Feldpars from pegmatites do not represent too perspective feldspar resource anymore at present due to irregular shape of deposit bodies, small and to a large extent mined-out reserves and also conflicts of interests. Large amount of the highest-quality raw material of the pegmatite deposits (mainly from the Poběžovice-Domažlice and Písek regions) has been to a large extent exhausted by mining in the past – this involves especially the more easily accessible subsurface parts. This holds true also for the area of the Bory granulite massif with a small deposit Bory-Olší, linked to a classical but mined-out deposit Dolní Bory.
- Kaolinized feldspar raw materials with unaltered or imperfectly altered feldspars can represent another promising resource of the feldspar raw material. This concerns most of all arkoses of the Plzeň and Podbořany regions and gneisses and granitoids of the Znojmo region (see Kaolin – KZ).
- Tertiary volcanic rocks – nepheline phonolites from České středohoří (Želenice deposit) – are used as feldspar substitutes in the Czech Republic. They can be used in the glass and ceramic industry only as a melting agent in coloured materials, due to high contents of colouring oxides. A high content of alkalis (10-10.5 % Na_2O and 3.5-5 % K_2O) results in a lower melting temperature and a shorter burning time.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits of feldspar minerals
exhausted deposits and other resources of feldspar minerals
reserved registered deposits of feldspar mineral substitutes
exhausted deposits and other resources of feldspar mineral substitutes

Names of mined deposits are indicated in **bold type**

Feldspar minerals:

1 Bratčice
2 Halámky
3 Hrušovany u Brna
4 Hrušovany u Brna-Protlas
5 Krásno-žula
6 Ledce-Hrušovany u Brna
7 Luženičky
8 Mračnice
9 Beroun-Tepelsko
10 Bory-Olší
11 Bozdíš
12 Dvory nad Lužnicí-Tušť
13 Chvalšiny
14 Ivančice-Letovisko
15 Ivančice-Němčice
16 Krásno-Vysoký Kámen
17 Křepkovice
18 Majdalena
19 Malé Tresné
20 Markvartice u Třebíče
21 Meclov 2
22 Meclov-Letiště
23 Meclov-západ
24 Medlov
25 Medlov-Smolín
26 Smolín-Žabčice
27 Smrček
28 Štíhlice
29 Tušť-Halámky
30 Velké Meziříčí-Lavičky
31 Zhořec 1
32 Zhořec 2-Hanovské p.
33 Ždánov

Feldspar mineral substitutes:

34 **Želenice**
35 Tašov-Rovný
36 Valkeřice–Zaječí vrch

4. Basic statistical data of the Czech Republic as of December 31

Feldspar

Year	2000	2001	2002	2003	2004
Deposits – total number	28	28	33	33	33
exploited	5	5	6	8	8
Total mineral reserves, kt	77 846	77 447	84 048	83 372	68 093
economic explored reserves	35 738	35 400	35 957	35 367	25 432
economic prospected reserves	35 755	35 694	40 747	40 670	35 516
potentially economic reserves	6 353	6 353	7 344	7 335	7 145
Mine production, kt	337	373	401	421	488

Feldspar substitutes

Year	2000	2001	2002	2003	2004
Deposits – total number	3	3	3	3	3
exploited	1	1	1	1	1
Total mineral reserves, kt	200 192	200 167	200 137	200 110	200 084
economic explored reserves	0	0	0	0	0
economic prospected reserves	200 192	200 167	200 137	200 110	200 084
potentially economic reserves	0	0	0	0	0
Mine production, kt	24	25	29	27	26

5. Foreign trade

252910 – Feldspar

Raw material	2000	2001	2002	2003	2004
Import, t	7 658	7 226	7 976	7 388	8 722
Export, t	85 931	131 696	122 206	133 862	143 917

252930 – Leucite, nepheline and nepheline syenite

Raw material	2000	2001	2002	2003	2004
Import, t	697	727	699	736	890
Export, t	0	0	0	0	0

6. Prices

Potassium feldspar, which can be used for flat and utility glass and package glassware production, is sold on domestic market for CZK 950 – 1,150; feldspar for special utility glass, lights and TV-screens production for CZK 1,050 – 1,250. Potassium feldspar, which can be used for ceramics, china, glazes and electroporcelain production, was offered for 1,350 – 1,700 CZK in 2003. Sodium-potassium feldspar used as fluxing agent and opening material in ceramic materials is offered on domestic market for CZK 500 per tonne. The raw material is delivered

crashed to size 0 – 5 mm. Feldspars from Krásno were offered at CZK 560 per tonne on domestic market.
8.7 kt of feldspar were imported from Germany (71.3 %), Austria (13.4 %) and Turkey (6.8 %). The average feldspar import prices were CZK 2,717 per tonne in 2004. Cheap Turkish feldspar started to appear more systematically on domestic market since 2002, the traded amounts are though still negligible. 143.9 kt of feldspar were exported to Poland (76.2 %), Hungary (10.9 %) and Slovakia (6.2 %). Export price was CZK 1,026 per tonne. It is characteristic of the Czech raw material that it is traded almost exclusively on markets of the neighbouring East European countries; decisive is especially export to Poland. 736 t of leucite, nepheline and nepheline syenite (item 252930 of the customs tariff) were imported from Spain (61.9 %), the Netherlands (18.9 %) and Norway (16.2 %) at average price of CZK 8,894 per tonne in 2004.

7. Mining companies in the Czech Republic as of December 31, 2004

LASSELSBERGER, a.s., Plzeň
KMK Granit s.r.o., Sokolov
Brněnské papírny s.p., Předklášteří
Družstvo DRUMAPO, Němčičky
AGRO Brno-Tuřany a.s.
KERAMOST a.s., Most (feldspar substitutes)

8. World production

Annual world production (including nepheline syenite and aplite) is about 9 – 11 mill tonnes. The production continues to rise owing to an increase of use in metallurgy and other industrial branches. Mine production rapidly increased in Turkey, Thailand and the Czech Republic and slightly increased in France and Spain during the last five years. Feldspar production stagnated in Germany and the USA, on the contrary in Italy it noticeably decreased. Numbers according to Mineral Commodity Summaries (MCS) and the Welt-Bergbau-Daten (WBD):

Year	2000	2001	2002	2003	2004
Mine production, kt (MCS)	9 280	9 500	9 800	10 800	11 000
Mine production, kt (WBD)	8 687	9 070	8 957	9 664	N

Main producers´ share in the world mining output (2003; according to MCS):

Italy	23.1 %	Germany	4.2 %
Turkey	16.7 %	Spain	4.2 %
the USA	7.4 %	South Korea	3.7 %
Thailand	7.2 %	Czech Republic	3.2 %
France	6.0 %	Egypt	3.2 %

According to the international reviews, the Czech Republic occupies the 9th position in the world with a share of 3.2 % (yearbook Mineral Commodity Summaries) or the 8th position with a share of 4.4 % (Welt Bergbau Daten). At world mine production of feldspars of 11 mill tonnes in 2004 it however occupies in fact the 6th – the 7th position.
The largest producers of the nepheline syenite were Canada, Norway and Russia. Nepheline phonolite was mined in France, Germany and in the Czech Republic.

9. World market prices

The average contractual prices of sales quoted in the Industrial Minerals magazine were constant during the period 1990– 1992. Feldspar prices were increasing in 1993 and in 1995 in

consequence of the recovery of demand. Feldspar prices were stagnating in the last three years. The average feldspar prices at year-end were as follows:

A Feldspar, ceramic grade, powder, 300 mesh, bagged, GBP/t, ex-store GB
B Feldspar, glass grade, sand, 28 mesh, GBP/t, ex-store GB
C Feldspar, ceramic grade, bagged, USD/t, FOB Durban, South Africa
D Feldspar, micronised, bagged, USD/t, FOB Durban, South Africa
E Feldspar, ceramic grade, sand, USD/t plant, Italy
F Sodium feldspar, crude, max. 10 mm, bulk, USD/t FOB Gulluk, Turkey
G Sodium feldspar, ground, max. 63 microns, bagged, USD/t FOB Gulluk, Turkey
H Sodium feldspar, glass grade, max. 500 microns, bagged, USD/t FOB Gulluk, Turkey
I Potassium feldspar, ceramic grade, bulk, USD/t FOB India
J Nepheline syenite, Norwegian; glass grade, 0.5 mm, bulk, FOL UK port
K Nepheline syenite, Norwegian; ceramic grade, 45 microns, bulk, FOL UK port

Commodity/Year	2000	2001	2002	2003	2004
A	182.50	182.50	-	-	-
B	99.00	99.00	-	-	-
C	150.00	150.00	140.00	140.00	138.50
D	205.00	205.00	205.00	205.00	205.00
E	23.50	23.50	-	-	-
F	-	-	13.50	13.50	13.50
G	-	-	77.50	77.50	77.50
H	-	-	55.00	55.00	55.00
I	-	-	26.00	26.00	26.00
J	97.00	97.00	97.00	97.00	97.00
K	145.00	145.00	146.00	146.00	146.00

10. Recycling

At glass recycling the consumption of virgin raw materials, thus also of feldspar, is reduced. The recycling rate is about 33% in the USA and as high as 90% in some European countries like Switzerland.

11. Possible substitutes

Feldspar substitutes are materials having alkali metals bound in other minerals than feldspars, like nepheline syenites- or - in the case of the Czech Republic - nepheline phonolites. These raw materials replace feldspars used as a melting agent. In other applications (fine abrasives, filler in rubber, plastics and paints), feldspars can be replaced by bauxite, corundum, diatomite, garnet, magnetite, nepheline syenite, olivine, perlite, pumice, silica sand, staurolite, ilmenite, barite, kaolin, mica, wollastonite, calcined alumina, clays, talc, spodumene, pyrophyllite or their mixtures.

SILICA MINERALS

1. Characteristics and use

Silica minerals are represented by various rocks high in SiO_2 (usually min. 96 %). These are various quartzites (sedimentary or metamorphosed rocks, consisting mostly of quartz and originated through silicification of sandstones or by cementing of silica sand by siliceous cement), silicified sandstones, siliceous rocks, quartz sands and pebbles, and vein and pegmatite quartz. The grade is established by various standards. The observed parameters are the content of SiO_2 and refractoriness. High Al_2O_3, Fe_2O_3 and possibly other oxides represent impurities.
Silica raw materials are used in production of ferroalloys for the metallurgical industry, silicon metal (in metallurgy, in semiconductors), refractory building materials (silica - bricks, mortars, ramming masses), porcelain and ceramics. Vein quartz, rock crystal and quartz pebbles are used in production of pure silica glass, UV glass and optical glass (fibre).

2. Mineral resources of the Czech Republic

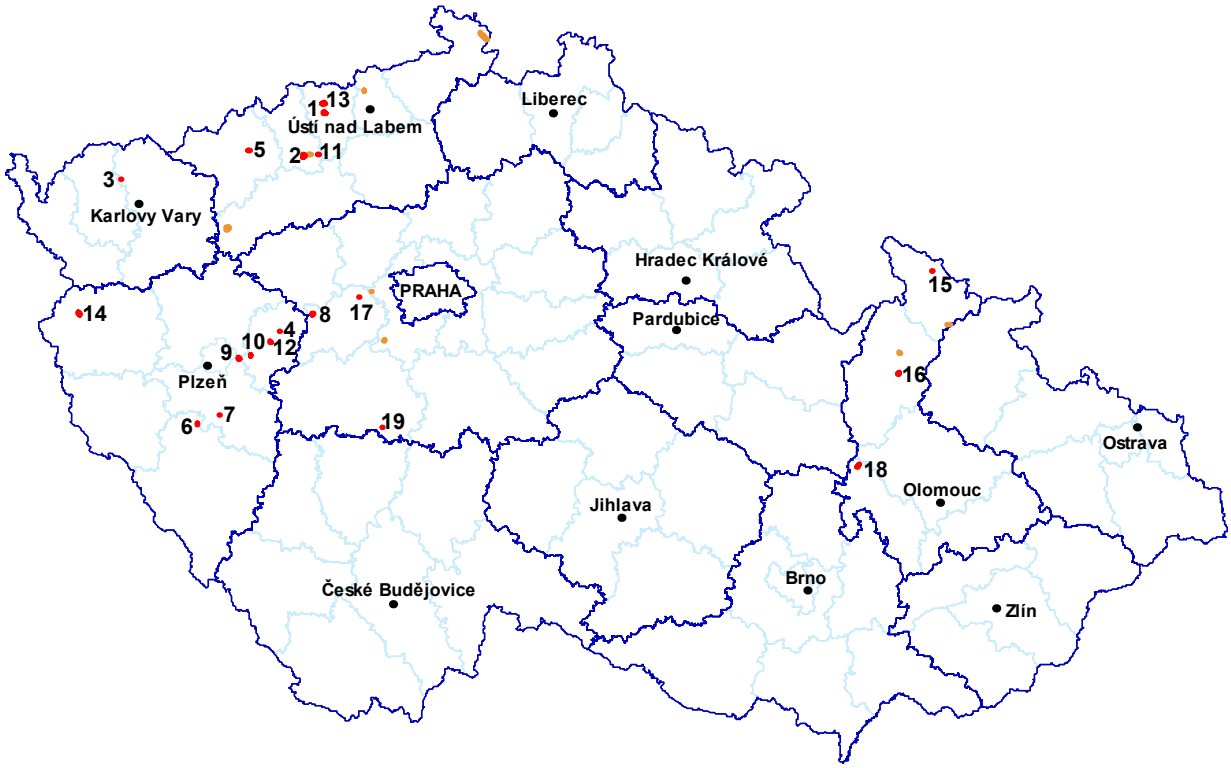
In the Czech Republic, silica raw materials are classified into two groups**:** silica raw materials, and silica raw materials for production of special glass. Silica mineral deposits are formed especially by the occurrences of the Tertiary "amorphous" quartz, Cretaceous "crystalline" quartz and Ordovician quartz, to lesser extent by the occurrences of vein quartz and lydites of the Upper Proterozoic. These raw materials are practically not mined in the Czech Republic anymore and they are mostly replaced by quartz sand (completely replaced in ceramic and glass industry), of which there is a sufficient amount at the market and which are moreover less variable and cheaper.

- Vein quartz deposits can be found almost all over the territory of the Czech Republic. The raw material is suitable for ferrosilicon and silicon production and for ceramics and glass. Vein quartz accumulations are not perspective at present due to their low and variable quality and they are gradually eliminated from The Register. Deposits and occurrences can be divided into the following genetic groups:
  1) Deposits of a very pure quartz in pegmatites (Dolní Bory) – of no significance at present
  2) Quartz dikes (silicified fault zones) in Tachov region (Tachov-Světecká hora), in northern (Rumburk) and southern (Římov–Velešín) Bohemia and in the Jeseníky Mts. (Bílý Potok – Vrbno, Žárová)
  3) Quartz veins related to granitoid massifs (the Žulová massif – Velká Kraš, the Karlovy Vary massif – Černava-Tatrovice, the Lužice massif – Rumburk et al.)
- Deposits of "amorphous" quartzite (quartz grains are cemented by a very fine quartz matrix) originated through silicification of Tertiary and Upper Cretaceous sediments in the Most— region (Lužice u Mostu-Dobrčice, Stránce, Skršín) and Chomutov region (Chomutov-Horní Ves). In the Podbořany (Skytaly, Vroutek) and Žlutice regions this quartzite occurs only as relic boulders. Quartzite is a traditional material for production of dinas and the raw material of the highest purity is suitable even for silicon metal production. Quartzites in the Podbořany region were used also for ceramic manufacture.
- Neoid silicification of Cretaceous sandstones gave origin to important deposits of "crystalline" quartzites (isometric grains of quartz) in the Teplice (mined deposit of Jeníkov–Lahošť, Střelná) and Most (Bečov) regions. Quartzites are suitable mostly for metallurgy and partly also for production of dinas and silicon metal.
- The Ordovician quartzites of the Barrandian zone (Kublov, Mníšek pod Brdy, Drahoňův Újezd-Bechlov, Sklenná Huť, Železná) were the most important of the Palaeozoic quartzites. They are usually classified as of a lower grade for production of ferrosilicon and to a lesser extent dinas. Other larger accumulations of quartzites occur in the Devonian

rocks of the Silesicum (Vikýřovice) et al. These quartzites are of a low grade and they are suitable after processing for production of dinas of a lower quality.

- Deposits of the Upper Proterozoic silicites (lydites) might be promising for future industrial use because of their reserves and quality. This concerns especially the Rokycany (Litohlavy, Kyšice-Pohodnice) and Přeštice (Kaliště, Kbelnice) regions. Tests showed that the material might be suitable for production of siliceous alloys, and to a lesser extent perhaps for production of dinas.
- Quartz pebbles from sand and gravel mined in alluvial deposits of the Labe and Dyje rivers and in the Cheb region used to be considered as a potential source of silica, too.
- Only milky white vein quartz (after mineral processing) is suitable for production of special glass. It is associated with the Central Bohemian pluton in the Příbram region (Krašovice in the metamorphosed islet zone) and with hydrothermal veins, which were metamorphosed together with the country rocks (phyllites) in the Prostějov region (Dětkovice).

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits exhausted deposits and other resources

Names of mined deposits are indicated in **bold type**

Quartz - quartzites:

1 Jeníkov-Lahošť	**2 Stránce**	3 Černava-Tatrovice
4 Drahoňův Újezd-Bechlov	5 Chomutov-Horní Ves	6 Kaliště
7 Kbelnice	8 Kublov-Dlouhá Skála	9 Kyšice-Pohodnice
10 Litohlavy-Smrkový vrch	11 Lužice u Mostu-Dobrčice	12 Sklená Huť
13 Střelná	14 Tachov-Světecká hora	15 Velká Kraš
16 Vikýřovice	17 Železná	

Quartz for special glass:

18 Dětkovice	19 Krašovice

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	21	21	20	20	19
exploited	2	2	2	2	2
Total mineral reserves, kt	36 607	36 607	35 361	35 361	31 379
economic explored reserves	5 479	5 479	5 479	5 479	4 607
economic prospected reserves	27 309	27 309	26 063	26 063	26 063
potentially economic reserves	3 819	3 819	3 819	3 819	709
Mine production, kt	0	0	0	0	0

5. Foreign trade

2506 – Quartz (except natural sand), crude quartzite, also dressed

Raw material	2000	2001	2002	2003	2004
Import, t	27 841	22 346	12 704	14 686	18 282
Export, t	68	50	65	259	384

720221 – Ferrosilicium

Raw material	2000	2001	2002	2003	2004
Import, t	19 093	18 388	17 956	24 652	28 514
Export, t	1 194	459	3 127	5 810	7 118

6. Prices

18.3 kt of quartz and quartzite were imported to the Czech Republic (48.5 % from Slovenia, 27.3 % from Poland, 20.8 % from Germany) at average price of CZK 2,685 per tonne in 2004. 0.4 kt of quartz and quartzite was exported (91.8 % to Slovakia, 5.8 % to Germany). 28.5 kt of ferrosilicium was imported from Poland (37.9 %), Slovakia (19.5 %) and Ukraine (11.6 %) at average price of CZK 20,090 per tonne. 7.1 kt of this amount was re-exported (57.8 % to Poland, 25.6 % to Slovakia, 15.3 % to Germany) at CZK 18,764 per tonne on average. Lump quartz has been sold at CZK 45 – 177 per tonne on domestic market.

7. Mining companies in the Czech Republic as of December 31, 2004

KERAMOST a.s., Most

8. World production

Among many known silica raw materials (except sand), special attention is paid to materials for production of synthetic quartz crystals for use in electronics and optics, and then to mining for natural quartz crystals for direct use in industrial applications. Mining for natural crystals is limited (Brazil, China, Namibia, Madagascar and the USA) and that is why number of countries have built plants for production of synthetic crystals – the largest factories are in the USA and Japan, smaller ones are in Belgium, Brazil, Bulgaria, France, Germany, South Africa and Great Britain. Among the largest exporters of raw material for production of synthetic crystals were Brazil and Namibia. Production in the USA reached its peak 778 t in 1992; in 1993 the production decreased to 500 t. The production in the USA became stabilized in the following years: 1995 – 435 t, 1996 – 435 t, 1997 – 450 t. During the last years, the production was not published in the international reviews.

9. World market prices

Silica materials (except for glass and foundry sand) are not quoted. Prices of raw material for production of synthetic quartz crystals dropped in the USA from USD 1.43 per kg in 1988 to USD 0.85 per kg in 1990. The price stagnated on a level of USD 1.20 per kg. Quotations of ferrosilicium have been published by the magazine Industrial Minerals since 2002. The average prices of trades at the year-end were as follows:

A ferrosilicium, 99 % SiC, grade 1, GBP/t CIF Great Britain
B ferrosilicium, min. 98 % SiC, refractory grade, USD/t CIF Great Britain
C ferrosilicium, min. 95 % SiC, refractory grade, USD/t CIF Great Britain

Commodity/Year	2000	2001	2002	2003	2004
A	-	-	825.00	825.00	825.00
B	-	-	745.00	745.00	745.00
C	-	-	540.00	540.00	540.00

10. Recycling

Silica material is not recycled.

11. Possible substitutes

Quartz had been, as a strategic mineral, irreplaceable until the fifties. At present it is being more and more replaced, both in electronics and optics, by synthetic crystals. Synthetic quartz competes with natural quartz also in production of clear silica glass. More accessible glass sand represents the major source of quartz for ceramics and pellucid quartz glass production at present. Other types of lining can replace dinas.

GLASS SAND

1. Characteristics and use

Glass sand is granular, light or even white-coloured rock (quartz sand or sandstone), which is used, after processing, as a raw material for production of glass. Required parameters (grain size, mineral and chemical composition) vary according to the type of glass. Sand of required grade does not usually occur in the nature; therefore the sand has to be processed by crushing, washing (to remove floating particles) and grading (to reach the required grain size). To obtain high grade glass sand, it is necessary to apply more sophisticated methods of mineral processing (electromagnetic separation, flotation, etc.); it is of utmost importance to reduce the content of colorant oxides (Fe_2O_3, TiO_2, Al_2O_3) in order to meet rigid specifications with respect to purity of silica and its maximum content. Sand for glass melting is used for making of glass batches for production of flat glass, package glassware and some technical glasses (max. content of Fe_2O_3 0.0023 – 0.0040 %), and utility glass (up to 0.0021 % Fe_2O_3); glass sand of higher grade is used for production of non-transparent silica glass (max. 0.0020 % Fe_2O_3) and the top quality sand (max. 0.0012 % and 0.0015 % Fe_2O_3) are used for production of crystal glass, semi-optical glass and some special technical glasses.

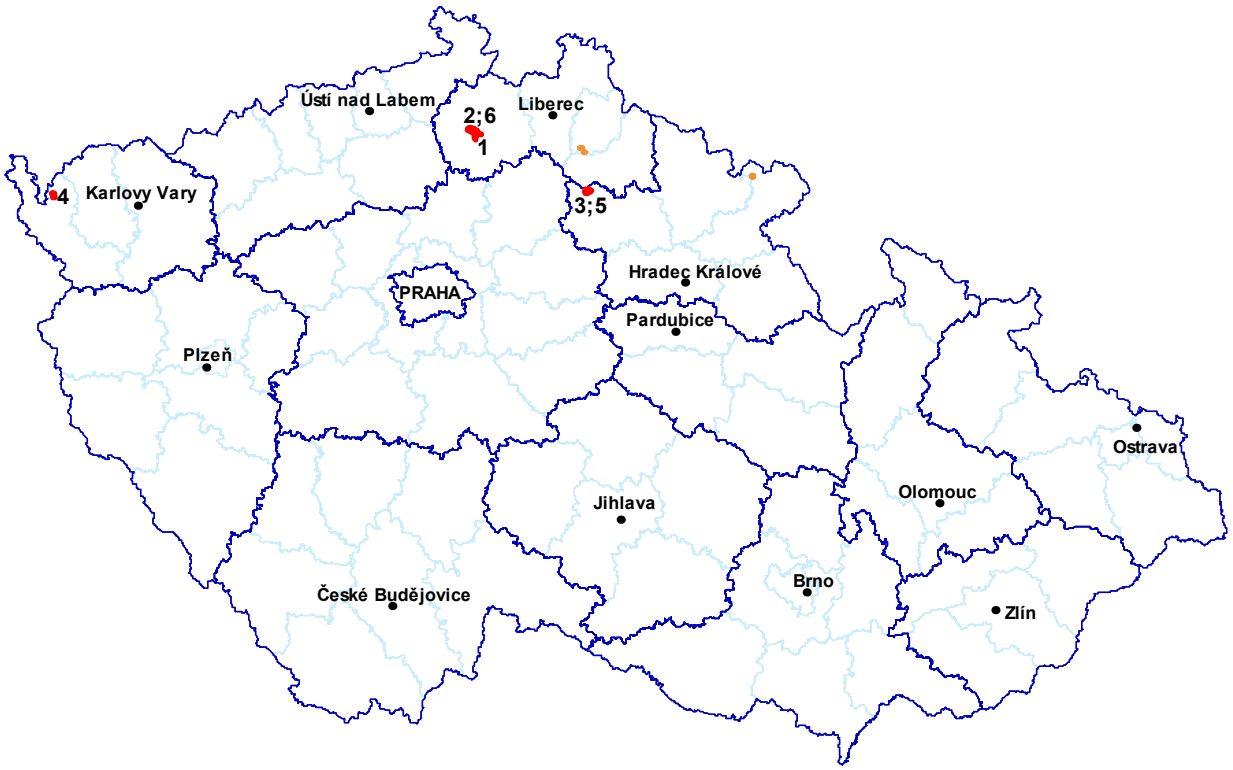
Natural quartz sand is after washing, separation and drying often coloured by inorganic pigments and used for plasters, as gunite sand and for other decorative purposes.

2. Mineral resources of the Czech Republic

The largest and most important deposits of glass sand in the Czech Republic are located in the Bohemian Cretaceous Basin, smaller ones occur in the Cheb Basin. Some potentially interesting areas of the Bohemian Cretaceous Basin are of no perspective especially due to nature protection reasons – this concerns for instance Lužické hory Mts, Český ráj (The Bohemian Paradise), Adršpašsko-teplické skály (Adršpach-Teplice Rocks) etc.

- Střeleč deposit in the Jizera facies development area of the Bohemian Cretaceous Basin represents the most important deposit of the Czech Republic. The mined raw material consists of weakly consolidated quartz sandstone of the Coniac age and its quality reaches the world parameters. A reserve deposit Mladějov v Čechách has been evaluated in its southern foreland.
- Southern surroundings of Česká Lípa in the Lužice facies development area of the Bohemian Cretaceous Basin represent the second most significant deposit area. The raw material consists of weakly consolidated quartz sandstone of the Middle Turonian age. Srní 2-Veselí and Provodín deposits which are exploited at present will be soon mined out and they will be replaced by Srní-Okřešice deposit in the near future.
- Non-traditional deposit of Velký Luh consists of the Pliocene sand and gravel of the Cheb Basin (redeposited material from kaolinic weathered Smrčiny granite). The raw material is used in technical, ceramic and filtering sand for water-plants, most of the potentially economic raw material as building sand. No glass sand is produced here, as it would require a complex processing (abrasion, electromagnetic separation, grinding).

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits
exhausted deposits and other resources

* deposits of glass and foundry sands

Names of mined deposits are indicated in **bold type**

1	**Provodín***	3	**Střeleč***	5	Mladějov v Čechách*
2	**Srní 2-Veselí***	4	**Velký Luh***	6	Srní-Okřešice*

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	6	6	6	6	6
exploited	4	4	4	4	4
Total mineral reserves, kt	278 945	277 051	275 162	270 935	268 876
economic explored reserves	91 190	90 105	89 206	97 282	96 595
economic prospected reserves	66 945	22 601	22 601	15 375	15 305
potentially economic reserves	120 810	164 345	163 355	158 278	156 976
Mining production, kt	985	974	851	904	828

5. Foreign trade

250510 – Silica sand and quartz sand

Raw material	2000	2001	2002	2003	2004
Import, t	121 549	158 888	99 409	189 130	240 391
Export, t	599 843	710 836	461 442	490 218	589 811

7001 – Cullet & other waste and scrap of glass; massive glass in pieces

Raw material	2000	2001	2002	2003	2004
Import, t	48 838	49 041	37 100	65 942	77 588
Export, t	14 512	6 313	16 051	18 110	11 970

6. Prices

Mineral prices are specified both by technological point of view and quality. Domestic prices of wet glass sand oscillate between CZK 300 and 1,000 per tonne. Prices of dry glass sand (not bagged) are about CZK 750 – 1,500 per tonne, of the bagged ones at CZK 1,100 – 1,850. Prices of very finely milled sand oscillate between 2,950 and 4,600 depending on the quality. Prices of filtration sand are as follows: wet CZK 375 – 550 per tonne, dry CZK 740– 910 per tonne. About 240 kt of silica sand (item 250510 of the customs tariff) were imported to the Czech Republic at average price of CZK 530 per tonne in 2004. Silica sand was imported from Slovakia (51.7 %), Austria (22.3 %) and Poland (18.2 %). About 590 kt of silica sand were exported to Austria (44.3 %), Slovakia (21.8 %), Germany (17.1 %), Croatia (11.3 %) and Slovenia (4.1 %) at average price of CZK 478 per tonne. Czech quartz sand has been exported to 40 countries all over the world during the last 5 years. Almost 78 kt of cullet and waste and scrap of glass were in addition imported for further processing in 2004. The material came from Germany (73.1 %), Austria (14.0 %) and Hungary (4.4 %) at CZK 1,740 per tonne in average. Only 12 kt of cullet and waste and scrap of glass was exported - 73.5 % to Germany and 21.2 % to Poland – at average price of CZK 2,674 per tonne. It is positive that this material is not exported in large amounts - unlike many other secondary raw materials - but its recycling proceeds in the Czech Republic, i.e. there are significant savings of electric energy.

7. Mining companies in the Czech Republic as of December 31, 2004

Sklopísek Střeleč, a.s., Mladějov
Provodínské písky, a.s., Provodín
KEMAT s.r.o., Skalná

8. World production

World statistics provide only data on production of sand for industrial use (glass production, foundry industry, abrasives etc.). These numbers are regrettably distorted by the fact that they are available predominantly only for industrially more developed countries. The production had been rising until 1988 (119 mill t). Since then the production was decreasing due to general economic recession. The volume of production returned back to the level of about 120 mill t in 1995. World production slowly increased between 1996 and 2002. The change did not arrive until 2003 when world production increased again to about 110 mill tonnes. Numbers on world mine production according to Mineral Commodity Summaries (MCS):

Year	2000	2001	2002	2003	2004
Mine production, mill t (MCS)	97	95	95	110	111

Main producers´ share in the world mining output (2003; according to MCS):

the USA	25.0 %
Germany	7.7 %
Austria	6.2 %
France	5.9 %
Spain	5.9 %
Japan	4.3 %
Great Britain	4.1 %
Australia	4.1 %

9. World market prices

Quartz sand for industrial use was traded on European market at average price GBP 11.00 per tonne at the first half of the 1990s. The price increased to GBP 13.50 per tonne in 1995. The prices increased again to GBP 15.00 per tonne in 2000 and to GBP 16.00 per tonne in 2001. The price stagnates since 2001. Prices of sand quoted by the Industrial Minerals magazine in GBP/t EXW GB at year-end were as follows:

A Glass sand, flint, container

Commodity/Year	2000	2001	2002	2003	2004
A	15.00	16.00	16.00	16.00	16.00

10. Recycling

Glass sand, for obvious reasons, cannot be recycled; however, it is possible to use sorted glass waste in a glass batch, which is being done.

11. Possible substitutes

In glass production, the sand is in fact only a source of SiO_2, therefore it can be replaced by sorted vein quartz, waste glass, synthetic SiO_2, etc.

FOUNDRY SAND

1. Characteristics and use

Foundry sand is granular, light-coloured rock, being used directly or after mineral dressing for production of foundry moulds and cores. The main required properties include sufficient resistance to high temperatures and strength (depends on quality and quantity of the binding component), and suitable grain size (the average grain size and its regularity). Because of its variability, natural foundry sand is more and more often being replaced by synthetic sand, i.e. quartz sand mixed with appropriate amount of binding agents (mostly bentonite).

Natural quartz sand is after washing, separation and drying often coloured by inorganic pigments and used for plasters, as gunite sand and for other decorative purposes.

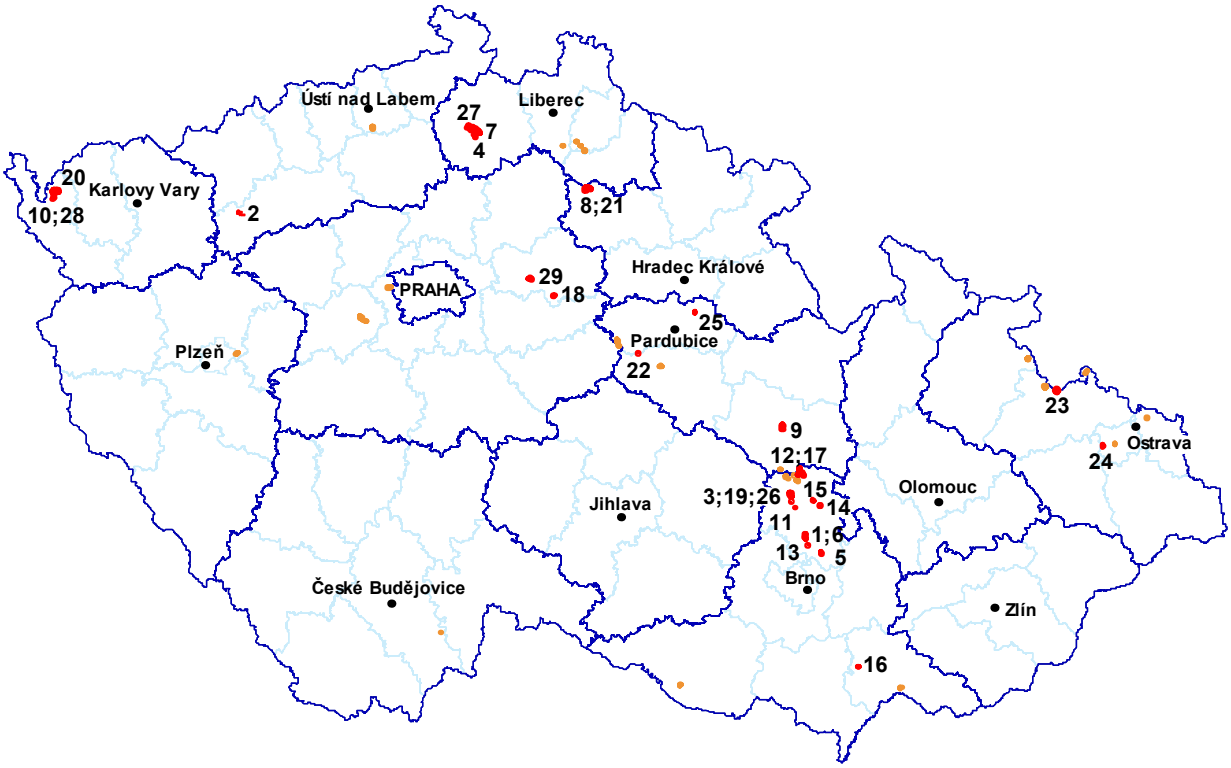
2. Mineral resources of the Czech Republic

Foundry sand deposits always accompany glass sand (material of lower grade), but they can occur also separately. Deposits in the Provodín and Střeleč surroundings are of a highest importance, the same way as in case of glass sand.

- Orlice-Žďár facies area of the Bohemian Cretaceous Basin represents the third most important area. The raw material consists of weakly consolidated Cenomanian quartz or glauconitic (so-called natural sand) sandstones. The mining operations are concentrated in Blansko, Voděrady and Svitavy surroundings.
- There is no interest in glacial sand of the northern Moravia (Palhanec-Vávrovice, Polanka nad Odrou), aeolian sand in the Labe River area (Zvěřínek, Kluk) and southern Moravia (Bzenec, Strážnice, Břeclav), fluvial terrace sand of the central (Tetín, Srbsko, mined-out Kobylisy-Dolní Chabry), southern (Lžín) and western Bohemia (Kyšice) and other at present. The reason is a low quality, demanding processing of the raw material and sufficient amount of a higher-quality raw material from other sources. The same holds for sand of the Carpathian Neogene basins (Nový Šaldorf) etc.
- Pliocene sand of the Cheb Basin (Velký Luh) is of a local importance.
- In addition, sand representing a waste product of kaolin refining (e.g. Krásný Dvůr) is used in foundry industry, too.

Glass and foundry sand deposits in the Czech Republic are extracted by open pits. Lower-quality raw material is used in the building industry.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposits
exhausted deposits and other resources

Names of mined deposits are indicated in **bold type**

1 Blansko 1-Jezírka	**11 Voděrady**	21 Mladějov v Čechách*
2 Krásný Dvůr –Podbořany**	12 Babolky	22 Načešice
3 Nýrov	13 Blansko 2-Mošna	23 Palhanec-Vávrovice
4 Provodín*	14 Boskovice	24 Polanka nad Odrou
5 Rudice-Seč	15 Boskovice-Chrudichrom	25 Rokytno-Bohumileč
6 Spešov-Dolní Lhota	16 Čejč-Hovorany	26 Rudka-Kunštát
7 Srní 2-Veselí*	17 Deštná-Dolní Smržov	**27 Srní-Okřešice***
8 Střeleč*	18 Kluk-Mostkový Les	28 Velký Luh 1
9 Svitavy-Vendolí	19 Kunštát-Zbraslavec	29 Zvěřínek-Polabí
10 Velký Luh*	20 Lomnička u Plesné	

* deposits of glass and foundry sands
** byproduct of crude kaolin beneficiation

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	31	30	29	29	29
exploited	11	10	11	11	12
Total mineral reserves, kt	450 670	448 747	447 499	444 218	442 305
economic explored reserves	165 580	158 198	157 821	158 574	142 134
economic prospected reserves	101 218	100 052	100 015	96 230	85 786
potentially economic reserves	183 872	190 497	189 663	189 414	214 385
Mine production, kt	829	771	676	712	831

5. Foreign trade

250510 – Silica sand and quartz sand

Raw material	2000	2001	2002	2003	2004
Import, t	121 549	158 888	99 409	189 130	240 391
Export, t	599 843	710 836	461 422	490 218	589 811

6. Prices

Prices of foundry sand are lower than prices of glass sand. Wet sand was sold at CZK 205 – 290 per tonne, dry (not bagged) at CZK 730 – 790 per tonne, in bags for CZK 1,050 to 1,550 per tonne. About 240 kt of silica sand (item 2505 10 of the customs tariff) were imported from Slovakia (51.7 %), Austria (22.3 %) and Poland (18.2 %) at average price of CZK 530 per tonne in 2004. About 590 kt of silica sand were exported to Austria (44.3 %), Slovakia (21.8 %), Germany (17.1 %), Croatia (11.3 %) and Slovenia (4.1 %) at average price of CZK 478 per tonne. Czech quartz sand has been exported to 40 countries all over the world during the last five years.

7. Mining companies in the Czech Republic as of December 31, 2004

Provodínské písky a.s., Provodín
Sklopísek Střeleč a.s., Mladějov
Moravské keramické závody a.s., Rájec–Jestřebí
Jaroslav Sedláček – SEDOS, Drnovice
KEMAT s.r.o., Skalná
P-D Refractories CZ a.s., Velké Opatovice
SETRA s.r.o., Brno

8. World production

World statistics provide data on production of sand for industrial use (glass production, foundry industry, abrasives etc.). These numbers are regrettably distorted, because they are available predominantly for developed countries. The production had been rising until 1988 (119 mill t). Since then the production was decreasing due to general economic recession. The volume of production returned back to the level of about 120 mill t in 1995. World mine production slowly increased between 1996 and 2002. The change did not arrive until 2003, when the production increased again to about 110 mill tonnes. Numbers of world production volume according to Mineral Commodity Summaries (MCS):

Year	2000	2001	2002	2003	2004
Mine production, mill t (MCS)	97	95	95	110	111

Main producers´ share in the world mining output (2003; according to MCS):

the USA	25.0 %
Germany	7.7 %
Austria	6.2 %
France	5.9 %
Spain	5.9 %
Japan	4.3 %
Great Britain	4.1 %
Australia	4.1 %

9. World market prices

The average price of foundry sand for industrial use on the European market was steady (around 10 GBP/t) in the first half of the 1990s. It slowly increased in the period 1995 – 2001. World prices stagnate since 2002. Prices of foundry sand quoted by the Industrial Minerals magazine at year-end were as follows:

A Foundry sand, dry, bulk, GBP/t EXW Great Britain
B Foundry sand, dry, bulk, USD/t EXW USA

Commodity/Year	2000	2001	2002	2003	2004
A	14.50	15.00	16.00	16.00	16.00
B	-	-	19.50	19.50	19.50

10. Recycling

Foundry sand used in moulding is mixed with bentonites, water glass, etc; having been exposed to high temperatures, their properties change to such extent, which makes their full recycling impossible. A research with an objective to increase a share of recycled sand in new mixtures is carried out in many countries, also in the Czech Republic.

11. Possible substitutes

Foundry sand for moulding mixtures, especially in precision casting and few other uses, can be replaced by crushed olivine, staurolite or chromite with graphite binder.

LIMESTONES AND CORRECTIVE SIALIC ADDITIVES FOR CEMENT PRODUCTION

1. Characteristics and use

Limestones as a mineral are sedimentary (limestones) and metamorphic rocks (crystalline limestone or marble) containing $CaCO_3$ (calcite or aragonite). Limestones originated through chemical, biogenic and mechanical processes or their combination. Primary and secondary admixtures in limestones are dolomite, silicates, phosphates, etc. Limestones of different origin show variations in physical characteristics, texture, hardness, colour, weight, and porosity, ranging from loosely consolidated marls through chalk to compact limestones–. Their colour depends on sort of admixture (pyrite and organic substance - black, pure – light to white). Marble (crystalline limestone) is a metamorphic rock formed of limestone under increased temperature and pressure. Limestones occur in practically all the sedimentary geological formations and their metamorphosed equivalents worldwide.

Limestones are used for production of building materials (lime, cement, mortar mixtures, granulated gravel, dimension and crushed stone, etc.), in the metallurgical, chemical and food industries, recently also for desulphurization of industrial flue gas (e.g. in thermal power stations), in agriculture, glass and ceramic industries, etc.

This group of raw materials also includes corrective sialic additives for cement production (CK), e.g. shales, clays, loess, loams, sand, etc., which correct the content of SiO_2, Al_2O_3 and Fe_2O_3 in the basic raw material for burning of clinker. These corrective materials mostly occur directly in deposits of portland limestones or separately in their close neighbourhood.

2. Mineral resources of the Czech Republic

According to use, the limestones in the Czech Republic are classified into the following grades:

- Limestones with very high percentage of $CaCO_3$ (VV), containing at least 96 % of carbonate component (with max. 2 % $MgCO_3$). These limestones are used mostly in chemical, glass, ceramics, rubber, food and metallurgical industries, for desulphurization, and for production of the top quality lime (quick lime);
- Other limestones (VO) – with carbonate content at least 80% – they are used mostly for production of cement, further for production of lime, desulphurization, etc. Also dolomites and dolomitic limestones were included in this group in the Czech Republic until 1997.
- Clayey limestones (VJ) – with $CaCO_3$ content over 70 % and higher content of SiO_2 and Al_2O_3. These limestones are used for production of cement, all kinds of lime, and for desulphurization;
- Carbonates for use in agriculture (VZ) – with the content of carbonates at least 70 – 75%. They are used for agricultural land and forest soils conditioning;

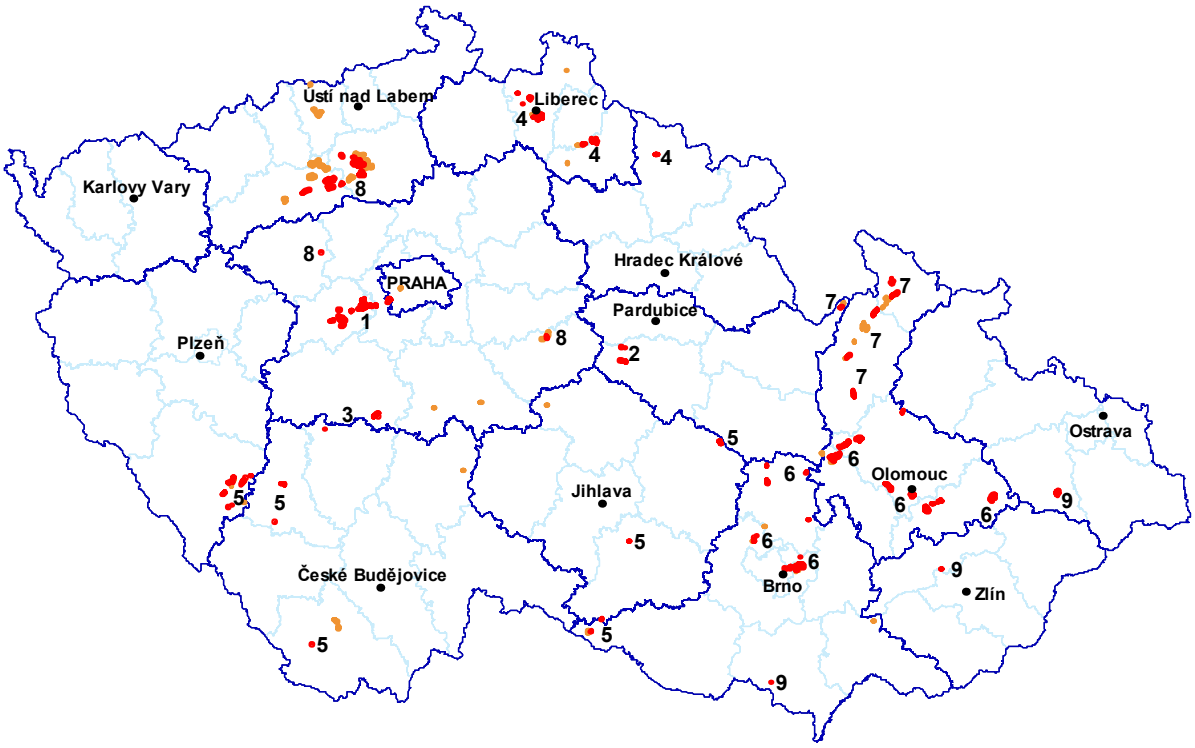
Limestone deposits in the Czech Republic are concentrated in the following main areas:

- The Devonian of the Barrandian area – the most important and largest mining district. Almost all types of limestones occur there, particularly those of VV and VO grades, but also VZ and CK grades. Limestone deposits are hosted by sediments of mostly Lower Devonian age, and consist usually of several lithological types. The Upper Koněprusy limestones are of the highest grade (average content of $CaCO_3$ is about 98%). A considerable part of reserves and hypothetical resources is however blocked by conflicts of interests with the nature protection in Protected Landscape Area Český kras. The most important deposits are Koněprusy (VV), Kozolupy-Čeřinka (VV+VO), Kosoř-Hvížďalka (VO), Loděnice (VO), Radotín-Špička (VO), Tetín (VV+VO) and Trněný Újezd-Holý vrch (VO).

- The Palaeozoic of Chrudim region (of the Železné hory Mts.) – relatively small surface area with important deposits. They are composed of the Podolí crystalline limestones (VV grade, 95 % $CaCO_3$) and less pure darker marbles of VO grade (90 % $CaCO_3$). Mined deposit Prachovice (VV+VO) represents the only and decisive deposit.
- Central Bohemian metamorphosed "islands" – small isolated areas with rather pure metamorphosed limestones (mostly VV a VO grades). Skoupý deposit (VV) is the most important one.
- Crystalline complex of the Krkonoše–Jizerské hory Mts. – medium and small-size deposits, mostly in the form of lenses within phyllitic and mica schistous rocks. Limestones are crystalline, often with variable contents of $MgCO_3$ (dolomitic limestones to calcareous dolomites) and SiO_2 (mostly VO and VZ grades). Apart from dolomite deposit Lánov, the almost exhausted Černý důl deposit (VO) is the only exploited deposit.
- Moldanubicum – small-size deposits of crystalline limestones, forming bands or lenses in metamorphic rocks. Dolomitic limestones or dolomites usually accompany the limestones here. The majority of local limestones are of VZ and VO grades. The highest number of deposits and amount of reserves is concentrated in the Šumava part of the Moldanubicum, with an important exploited deposit Velké Hydčice-Hejná (VO).
- The Moravian Devonian – represents the most important and very big region with limestone deposits of various sizes in Moravia. The Vilémovice limestones (VV grade, 96–97% $CaCO_3$) represent the major raw material in almost all deposits. Further types represented are the Křtiny, Hády and Lažánky limestones (VO). They are mostly registered as corrective sialic additives for cement production. The largest and most important deposits are concentrated in particular areas of the Moravian Karst with a large mined deposit Mokrá u Brna (VV+VO+CK) and of the Hranice Devonian with a large mined deposit Hranice-Černotín (VO+CK). Other mostly not mined deposits occur in the Konice-Mladeč Devonian, Čelechovice-Přerov Devonian and in the Devonian of the Boskovice Furrow.
- The Silesicum (the Branná group), the Zábřeh group and the Orlické hory Mts.–Kłodzko crystalline complex – smaller deposits of crystalline limestones forming bands in metamorphic rocks. Limestones are often of high grade (VV grade, up to 98% $CaCO_3$, less of VO grade) and in the northern part of the area there are limestones suitable for dimension stones (KA). Horní and Dolní Lipová (VV+VO) in the Silesicum and Vitošov (VV), located at the border of the Desná Dome and Zábřeh crystalline complex, represent the most important mined deposits.
- The Bohemian Cretaceous Basin (the Ohře and Kolín regions) – large and medium-size deposits. Deposits contain clayey limestones and marls with content of $CaCO_3$ ranging between 80 and 60 % (the most important deposits of clayey limestones – VJ). Exploited deposit Úpohlavy-Chotěšov (VJ) is of a fundamental importance.
- Outer Klippen Belt of the Western Carpathians – limestones form tectonically isolated blocks in surrounding rocks (so-called "klippen"). The limestones - Štramberk limestones in the NE and Ernstrunn limestones in the SW - are of a very high grade, with an average content of $CaCO_3$ 95.0–98.0 %, and $MgCO_3$ about 1.0 % (VV). Štramberk (VV+VO) is the most important mined deposit.

Other regions with carbonate rocks occurrences, such as Krušné hory Mts. crystalline complex, the Culm of the Nízký Jeseník Mts., Moravicum, the Tertiary of the southern and central Moravia etc. are mostly of just local importance. Deposits of limestones, sialic additives for cement production and dolomites are extracted by open-pit mines.

3. Registered deposits and other resources in the Czech Republic



reserved registered deposit exhausted deposits and other resources

Principal areas of deposits presence:

1 Devonian of the Barrandian area

2 Palaeozoic 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.-Kłodzko Crystalline Complex and Zábřeh Group

8 Bohemian Cretaceous Basin

9 Outer Klippen Belt of the Western Carpathians

4. Basic statistical data of the Czech Republic as of December 31

Limestones – total number

Year	2000	2001	2002	2003	2004
Deposits – total number	101	101	100	99	95
exploited	24	24	24	24	25
Total mineral reserves, kt	4 889 640	4 833 902	4 776 754	4 525 784	4 447 004
economic explored reserves	1 885 936	1 836 512	1 826 345	1 815 869	1 845 807
economic prospected reserves	2 309 619	2 319 250	2 291 983	2 039 737	1 931 626
potentially economic reserves	694 085	678 140	658 426	670 178	669 571
Mine production, kt	11 376	10 523	9 871	10 236	10 568

Owing to the importance and considerable differences in technological use and prices, high-percentage limestones (VV), corrective sialic additives for cement production (CK) and other limestones (VO) are monitored separately.

High-percentage limestones

Year	2000	2001	2002	2003	2004
Deposits – total number	30	30	31	30	30
exploited	12	12	12	12	12
Total mineral reserves, kt	1 757 026	1 682 079	1 676 784	1 431 653	1 426 550
economic explored reserves	766 290	699 967	694 808	690 135	685 191
economic prospected reserves	814 018	824 514	824 378	572 168	572 009
potentially economic reserves	176 718	157 598	157 598	169 350	169 350
Mine production, kt	4 784	5 071	5 017	4 573	4 629

Other limestones

Year	2000	2001	2002	2003	2004
Deposits – total number	48	48	49	50	50
exploited	13	14	14	14	15
Total mineral reserves, kt	2 425 163	2 445 714	2 441 609	2 437 066	2 362 640
economic explored reserves	996 141	1 015 912	1 012 138	1 007 595	993 551
economic prospected reserves	982 230	981 437	981 106	981 106	919 718
potentially economic reserves	446 792	448 365	448 365	448 365	449 371
Mine production, kt	5 138	4 186	3 632	4 444	4 666

Corrective sialic additives for cement production

Year	2000	2001	2002	2003	2004
Deposits – total number	15	16	16	16	16
exploited	3	4	5	5	5
Total mineral reserves, kt	745 653	779 038	778 849	778 630	778 372
economic explored reserves	335 112	343 388	343 199	342 980	342 722
economic prospected reserves	226 390	224 300	224 300	224 300	224 300
potentially economic reserves	184 151	211 350	211 350	211 350	211 350
Mine production, kt	267	222	163	201	232

In many limestone deposits, VV and VO are extracted together. Seven deposits out of sixteen CK deposits make part of VO deposits.

5. Foreign trade

2521 – Limestone flux, limestone and other calcareous stone, for lime or cement manufacturing.

Raw material	2000	2001	2002	2003	2004
Import, t	303 940	314 744	478 187	524 152	398 643
Export, t	305 304	269 542	211 956	103 111	133 184

2522 – Quicklime, slaked and hydraulic lime

Raw material	2000	2001	2002	2003	2004
Import, t	54 430	72 870	100 252	104 552	104 737
Export, t	192 384	224 575	184 348	198 479	170 020

2523 – Portland, aluminous, slag, supersulphate and similar hydraulic cements also coloured or in the form of clinkers

Raw material	2000	2001	2002	2003	2004
Import, t	673 542	730 892	838 750	1 148 584	1 301 242
Export, t	1 493 773	866 051	465 854	562 474	674 149

6. Prices

Price relations are influenced by quality requirements. Prices of high percentage limestones used especially in metallurgy and in chemical and sugar industries are the highest. The average prices of lump high-percentage limestone oscillated between CZK 150 – 250 per tonne during the last years. Prices of bulk cement oscillated depending on the quality between CZK 1,700–2,550 per tonne, cement on pallets between CZK 2,250 and 2,650 per tonne. Prices of ground lime were CZK 780–2,280 per tonne, lump lime CZK 1,400–1,750 per tonne. Lime hydrate was sold at CZK 1,630–2,415 per tonne. Prices of bulk crushed limestone depending on $CaCO_3$ content were CZK 250–850 per tonne, its average price was CZK 370 per tonne. Prices of ground limestones were higher: CZK 580–2,800 per tonne for microground limestone.

Almost 400 kt of limestone for cement and lime production were imported almost exclusively from Slovakia at average price of CZK 243 per tonne in 2004. 133 kt were exported to Poland

(72.5 %), Germany (16.2 %) and Hungary (9.2 %) at average price of CZK 507 per tonne. About 105 kt of lime were imported from Slovakia (84.3 %) and Germany (13.1 %) at CZK 1,375 per tonne in 2004. 170 kt of lime were exported to Germany (71.5 %), Slovakia (14.1 %) and Austria (14.0 %) at average price of CZK 1,585 per tonne. In the same period, 1,300 kt of cement were imported from Slovakia (49.7 %), Germany (32.6 %) and Poland (14.6 %) at average price of CZK 1,489 per tonne. 674 kt of cement were exported to Germany (63.9 %), Slovakia (25.6 %) and Serbia and Monte Negro (3.9 %), and the average price was CZK 1,161 per tonne. The amount of cement import was about double in 2004 compared to 2000. The long-term trend of the multiple Czech export surplus over import of cement reversed in 2002, since then the situation is completely opposite and unfavourable for the Czech foreign trade balance.

7. Mining companies in the Czech Republic as of December 31, 2004

Limestones:
Českomoravský cement a.s., Beroun
Velkolom Čertovy schody a.s., Tmaň
Lafarge Cement, a.s., Čížkovice
Lomy Mořina, s.r.o., Mořina
Holcim (Česko), a.s., člen koncernu, Prachovice
Vápenka Vitošov s.r.o., Leština
Cement Hranice, a.s.
Kotouč Štramberk, s.r.o.
OMYA a.s, Vápenná
HASIT Šumavské vápenice a omítkárny, a.s., Velké Hydčice
Lom Skalka, s.r.o., Ochoz u Brna
Krkonošské vápenky Kunčice, a.s.
LM Cemix, s.r.o., Čebín
Vápenka Vitoul s.r.o., Mladeč
Kamenolom a vápenka Malá dohoda, s.r.o., Holštejn
AGIR s.r.o., Petrovice
Agrostav Znojmo, a.s.
Kalcit, s.r.o., Žďár

Corrective sialic additives for cement production:
Českomoravský cement a.s., Beroun
Cement Hranice, a.s.
Holcim (Česko), a.s., člen koncernu, Prachovice

8. World production

Overall data on production of limestones in the world are missing. Accessible are data on mining production in some of the neighbouring countries – the average annual mining production in Slovakia (high-percentage limestones and other limestones) oscillated between 6.5 and 7.5 mill t in the last years. The annual mine production in Poland (including limestones used as crushed stone) has been roughly between 33 and 42 mill t. The major producing areas can be indirectly traced based on production of cement and lime, which consumes most of the mined limestone. In the last five years, the largest world producers were then China, India, the USA, Japan, Rep. of Korea, Brazil, Germany, Turkey and Russia, which together produced more than 65 % of the world production of cement. China, the USA, Russia, Japan, Germany, Mexico and Brazil have produced about two thirds of the world lime production.

World production of cement

Year	2000	2001	2002	2003	2004 e
Production, mill t (MCS)	1 600	1 700	1 800	1 950	2 000

World production of lime

Year	2000	2001	2002	2003	2004 e
Production, mill t (MCS)	116	118	116	120	121

9. World market prices

Prices of limestones are not quoted. Prices of lime on the US market in 1999 – 2003 oscillated between USD 57 – 62 per tonne, prices of lime hydrate were between USD 80 and 92 per tonne. Prices of calcium carbonate of various grades have been published by the Industrial Minerals magazine.

A calcium carbonate ground (GCC), coated fine grade, GBP/t EXW Great Britain
B calcium carbonate precipitated (PCC), coated fine grade, GBP/t EXW Great Britain
C calcium carbonate precipitated (PCC), fine (0.4 – 1.0 microns), USD/st FOB USA
D calcium carbonate precipitated (PCC), very fine (0.02-0.36 microns), USD/st FOB USA

Commodity/Year	2000	2001	2002	2003	2004
A	90.00	90.00	91.50	91.50	91.50
B	352.50	352.50	358.50	358.50	358.50
C	-	-	260.00	260.00	260.00
D	-	-	562.50	562.50	562.50

10. Recycling

The material is not recycled. Recycled are just some products of glass industry, construction materials, etc.

11. Possible substitutes

Limestones of all grades have various uses. Limestones can be replaced in many applications. Limestones, dolomites and various burnt lime are often mutually replaceable (e.g. in agriculture). Also in the desulphurization, various mixtures of carbonates can replace limestones. Limestone and products made of limestone (lime, hydrated lime) used for acid neutralization can be replaced by MgO minerals, natural and synthetic zeolites and anaerobic bacteria; biological technologies are successfully used in acid rain effects suppression and acid mine water neutralization. Yet the limestones are irreplaceable in many of their uses – for instance in production of cement and lime, or in the metallurgical industry (melting agent for production of pig iron).

DOLOMITE

1. Characteristics and use

In the Czech Republic, carbonates containing at least 27.5% of $MgCO_3$ and their $MgCO_3$ + $CaCO_3$ content is higher than 80%, are classified as dolomites.

Pure dolomite is important material for glass, ceramic and chemical industries. Dolomitic rocks are used in production of dolomitic lime, hydrates, magnesium cements, and magnesia refractories for metallurgy, in desulphurization of power station waste gases. They are also used as dimension stone and in production of fertilizers and fillers, and often also for crushed stone production and other building purposes.

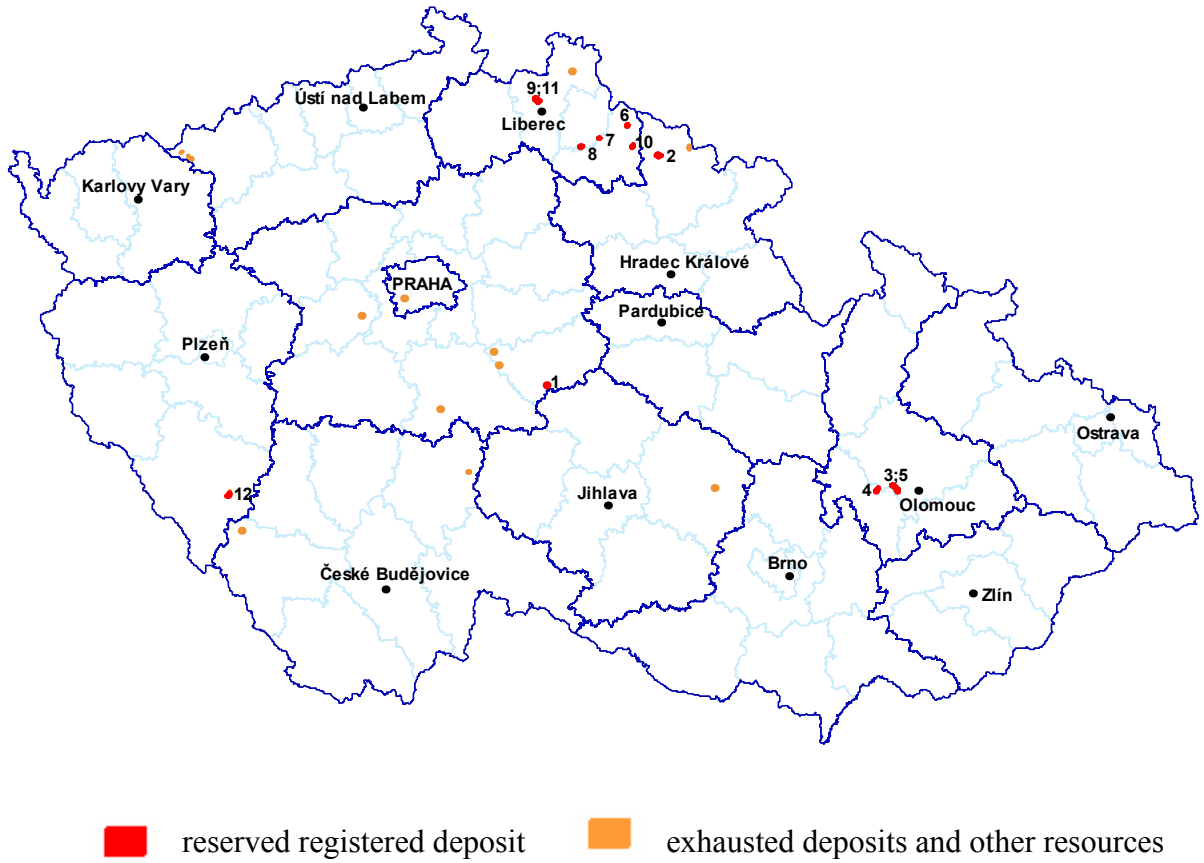
2. Mineral resources of the Czech Republic

Dolomite and calcitic dolomite deposits and occurrences are located in the following main regions of the Czech Republic:

- Crystalline complex of the Krkonoše Mts.–Jizerské hory Mts. – crystalline calcareous dolomite and dolomite deposits in the form of lenses in host rocks. This region is the most important in the Czech Republic, because it has the highest number of deposits and the largest volume of reserves. The largest deposit of dolomites in the Czech Republic Horní Lánov contains raw material with 32% of CaO and nearly 19% of MgO on average.
- Šumava Mts. and Bohemian Moldanubicum – it contains several smaller pure dolomite deposits (mined deposit Bohdaneč, abandoned deposit Jaroškov) and calcitic dolomite deposits (Podmokly, Krty).
- Crystalline complex of the Krušné hory Mts. – several small deposits near Kovářská and Přísečnice (for instance mined-out deposit of pure dolomite Vykmanov).
- Moravian branch of the Moldanubicum with small but often high-quality dolomite occurrences (mined-out deposit Dolní Rožínka) and little explored prognostic resources (Lukov u M.Budějovic, Číchov et al.).
- Devonian of the Barandian – a typical dolomite deposit (Velká Chuchle) already mined out.
- The Orlické hory Mts–Kłodzko crystalline complex and Silesicum (Velké Vrbno group) – several smaller (Bílá voda).
- Moravian (Čelechovice–Přerov) Devonian near Olomouc – with two larger deposits of Lažánky calcitic dolomites (Hněvotín, Bystročice), associated here with Vilémovice limestones (VO). The average content of Mg in both deposits is 17 %. Another medium-sized deposit of Lažánky calcareous dolomites occurs near Čelechovice. The reserves are blocked by spa protection zone.

Krkonoše Mts.–Jizerské hory Mts. crystalline complex and Moravian Devonian are the most important regions where dolomites partly occur at some deposits (Lánov, Hněvotín), but these are mainly calcitic dolomites. Deposits of the Šumava branch of the Moldanubicum are usually smaller or they are formed by impure calcitic dolomites. In other regions, dolomites form only smaller lenses and they are often not enough explored (especially in the western Moravia).

3. Registered deposits and other resources in the Czech Republic



reserved registered deposit exhausted deposits and other resources

Names of mined deposits are indicated 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	8 Koberovy	12 Podmokly

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	12	12	12	12	12
exploited	2	2	2	2	2
Total mineral reserves, kt	511 206	510 842	510 528	511 469	515 382
economic explored reserves	81 159	80 824	80 510	80 601	80 255
economic prospected reserves	335 807	335 807	335 807	336 584	340 843
potentially economic reserves	94 240	94 211	94 211	94 284	94 284
Mine production, kt	430	364	314	416	345

5. Foreign trade

2518 – Dolomite calcined, roughly worked or cut; agglomerated

Raw material	2000	2001	2002	2003	2004
Import, t	1 202 601	1 045 042	662 887	578 828	441 823
Export, t	10 046	7 553	14 557	14 245	14 403

6. Prices

Prices of lump dolomite are CZK 75 per tonne; prices of dolomite aggregates reach depending on granularity CZK 170 - 300 per tonne. Ground lime dolomites are sold in bulk at CZK 470 - 590 per tonne, on pallets at CZK 1,500 per tonne. White dolomite is sold crashed at CZK 950 (0-2 mm) to 1,330 (2-5, 5-8, 8-16 mm) per tonne. 422 kt of dolomite were imported almost exclusively from Slovakia at average price of CZK 181 per tonne in 2004. In addition, 15.5 kt of dolomite were imported from Germany at CZK 445 per tonne. 14.4 kt only were exported (99.8 % to Poland); according to the high export price of CZK 2,205 per tonne, the raw material was probably white dolomite of a very high quality.

7. Mining companies in the Czech Republic as of December 31, 2004

Krkonošské vápenky Kunčice, a.s.
UNIKOM a.s., Kutná Hora

8. World production

Dolomite production and consumption are not statistically followed in the world market. Annual market production in Slovakia has been oscillating roughly between 1.7 and 2.0 mill t during the last five years. The Polish annual mine production of dolomite has been between 5 and 6 mill tonnes.

9. World market prices

World market prices are not given in the international statistical surveys.

10. Recycling

Dolomite is not recycled.

11. Possible substitutes

Dolomite as source of Mg is substituted by magnesite, by Mg obtained from the seawater and salt brines and by brucite.

GYPSUM

1. Characteristics and use

Gypsum is a sedimentary rock, consisting mostly or completely of monoclinic mineral gypsum ($CaSO_4.2H_2O$), which is usually colourless or white. The rock often contains impurities (clay minerals, quartz, iron oxides, limestone, dolomite, anhydrite, etc.). The majority of gypsum deposits was formed as evaporites from marine or lake waters in arid areas. Deposits of different origin (weathering and decomposition of sulphides, hydration of anhydrite, metasomatic processes, etc.) are of no economic importance. Anhydrous $CaSO_4$ is often classified into the gypsum group. It is usually transformed into gypsum by wet grinding. Present world reserves of gypsum are estimated at 2,600 mill tonnes.

Gypsum is used mostly for production of building materials (calcined gypsum, cement, plasters, prefabricated elements) and small amount for other purposes (in agriculture, glass and paper manufacturing, in pharmacy, also as a filler, etc.).

2. Mineral resources of the Czech Republic

Gypsum deposits in the Czech Republic are confined to the Miocene (Badenian-Wieliczkien) sediments of the Opava Basin (marginal part of the Carpathian foredeep). Larger part of the productive Badenian is on the Polish side of the basin. The average content of gypsum in the rock is 70– 80 %. The impurities are mostly clay and to a smaller extent sand. Close-to-surface deposit parts are often karstified. The mining for gypsum (in the past there were also underground mines) in the Opava region has been going on continuously since the second half of the 19th century. At present, there is only one open-pit mine at Kobeřice–jih deposit.

3. Registered deposits and other resources in the Czech Republic

 reserved registered deposits  exhausted deposits and other resources

Names of mined deposits are indicated in **bold type**

1 Kobeřice ve Slezsku-jih
2 Kobeřice ve Slezsku-sever
3 Rohov-Strahovice
4 Sudice
5 Třebom

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	5	5	5	5	5
exploited	1	1	1	1	1
Total mineral reserves, kt	504 833	504 809	504 701	504 597	504 527
economic explored reserves	119 706	119 682	119 574	119 470	119 400
economic prospected reserves	302 990	302 990	302 990	302 990	302 990
potentially economic reserves	82 137	82 137	82 137	82 137	82 137
Mining production, kt	82	24	108	104	71

5. Foreign trade

252010 – Gypsum, anhydrite

Raw material	2000	2001	2002	2003	2004
Import, t	8 628	9 523	14 790	20 266	28 864
Export, t	68 115	39 412	87 247	92 133	90 377

6. Prices

The average price of extracted domestic gypsum fluctuated around CZK 300 per tonne depending on the off taken quantity in 2004. Prices of gypsum binder oscillate according to quantity and colour. Price of grey gypsum binder in packages of 30 kg on pallets without foil was about CZK 2,060 per tonne and price of white one was about CZK 3,500 per tonne in 2003. Almost 29 kt of gypsum and anhydrite were imported from Germany (97.7 %) and Poland (1.7 %) at average price of CZK 1,415 per tonne. 90.4 kt of gypsum and anhydrite were exported exclusively to Slovakia at average price of CZK 296 per tonne. It seems that the situation slowly stabilizes after the radical drop of both domestic mining production and volume of the foreign trade in the years 2000 – 2001 caused by big surplus of by-product gypsum, resulting from desulphurization of flue gases from coal-burning power plants, on the Central European markets..

7. Mining companies in the Czech Republic as of December 31, 2004

GYPSTREND, s.r.o., Kobeřice

8. World production

World production of gypsum (including anhydrite) has been for a long time in the range of 80–100 million tonnes. The highest mining production was in the statistically closed year 2000 (101.2 mill tonnes), according to the yearbook Welt-Bergbau-Daten. The production is closely related to building activities, the reduction of which caused also a temporary reduction of mining for gypsum after 1989. There appeared a big competitor of natural gypsum, so-called “synthetic gypsum”, in some countries in the last years. It originates like a product of desulphurizing of

thermal power stations. Mine production numbers of USGS yearbooks Mineral Commodity Summaries (MCS) are higher than those of the Welt-Bergbau-Daten (WBD).

Year	2000	2001	2002	2003	2004 e
Mine production, kt (MCS)	106 000	104 000	101 000	104 000	106 000
Mine production, kt (WBD)	100 062	90 817	96 710	94 743	N

Main producers´ share in the world mining output (2003; according to MCS):

the USA	16.1 %
Iran	11.1 %
Canada	8.7 %
Spain	7.2 %
China	6.6 %
Mexico	6.5 %
Thailand	6.3 %
Japan	5.5 %

9. World market prices

Prices of natural gypsum have been steady in the last years. Even in times of more extensive building activities, the prices were stable, which was also caused by a supply of waste gypsum (desulphurization by-product of flue gas in thermal power stations, chemical industry), production of which highly exceeded the demand. Gypsum prices were quoted by the Industrial Minerals magazine until 2001. The average prices of crude gypsum (commodity A) in GBP/t EXW UK at year-end were as follows:

Commodity/Year	2000	2001	2002	2003	2004
A	9.00	9.00	-	-	-

10. Recycling

Waste gypsum wallboards from construction sites are recycled in a limited volume.

11. Possible substitutes

Natural gypsum is replaceable to some extent by waste gypsum for example from production of phosphoric acid, titanium dioxide and flue gas desulphurization (FGD). The latter one is the only more widely used waste gypsum (wallboards, cement production).

DIMENSION STONE

1. Characteristics and use

Rock, which has been specially cut or shaped for use in buildings, curbing or other construction or special use, is termed "dimension stone" or "decorative stone". Architectural specifications for dimension stone concern primarily aesthetic qualities such as design, surface appearance, etc. Important requirements include mineralogical composition, strength, weather resistance, colourfastness, porosity, texture, structure, etc. Dimension stone includes all kinds of solid rocks of magmatic, sedimentary or metamorphic origin which can be quarried in the form of blocks and which are suitable for cutting to specific dimensions. Weathered surface, altered or crushed zones or intercalation of unsuitable rocks represent undesirable imperfections.

2. Mineral resources in the Czech Republic

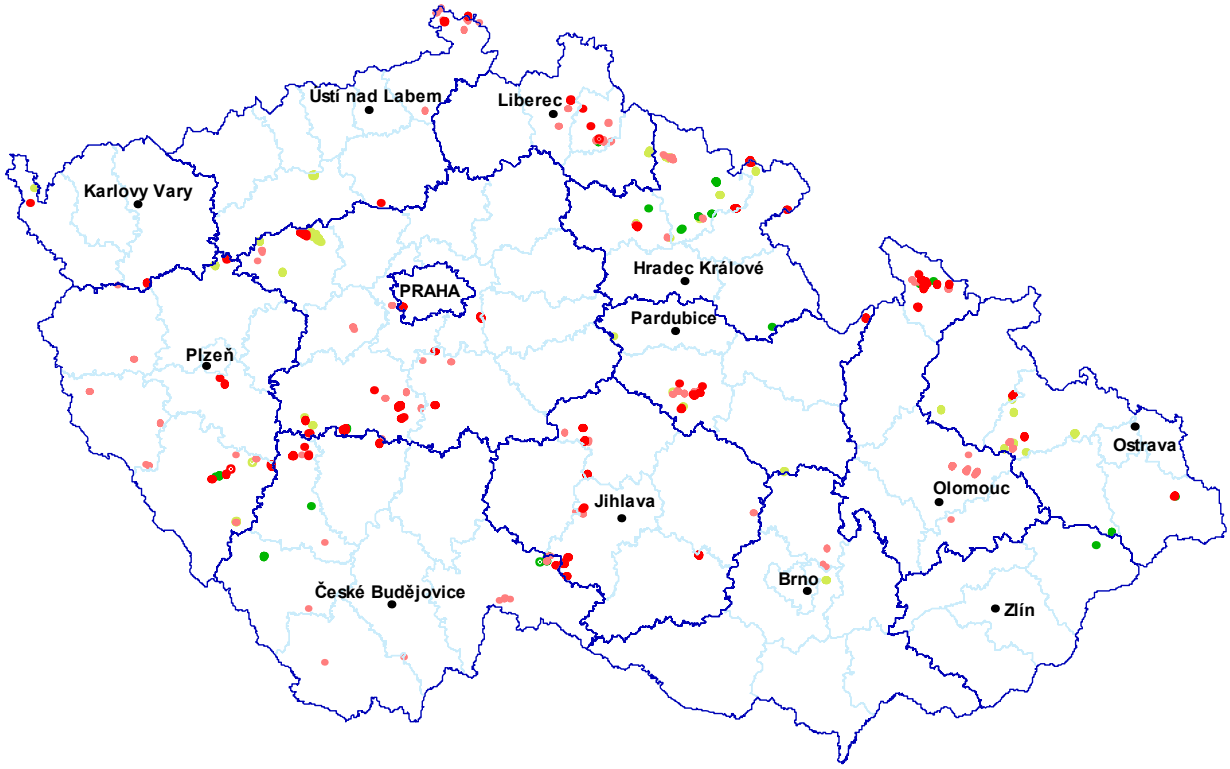
Mostly deep-seated igneous rocks (predominantly granitoids), forming about 70 % of exploited reserved deposits, are used as dimension stone in the Czech Republic at present. Their share of the total geological reserves is higher than 50 %. These rocks make 65 % at reserved and about 60 % at non-reserved deposits of the total mining production of dimension stone. Higher than 20 % share of the mining production at reserved deposits have shales and slates and about 8 % sandstones. In the case of non-reserved deposits, more than 30 % of the mining production is represented by sandstone. The share of marbles is low – around 1 %.

- Dimension stone used in buildings, curbing and other applications (paving cubes, curb stones, guard stones, stairs etc.) mostly involves igneous rocks, much less other rocks (basalt columns, dike rocks). Deposits, similarly to those of crushed and broken stone, are bounded to the Central Bohemian pluton and Moldanubian pluton, the Nasavrky massif, eventually other plutonic bodies of the Bohemian Massif (Štěnovice massif, Žulová pluton, etc.).
- Mostly marbles and plutonic rocks are exploited for architectural and sculpture dimension stone production. Light granites and granodiorites, which occur in the Central Bohemian and Central Moldanubian plutons, the Štěnovice, the Krkonoše Mts.–Jizerské hory Mts., the Jeseníky Mts. and Nasavrky massifs in Bohemia, and in Třebíč and Žulová massifs in Moravia, are mostly in use. Less important are dark igneous rocks – diabase, diorite and gabbro, which also occur in the Central Bohemian Pluton, further in the Kdyně and Lužice massifs. Aforesaid rocks are used for wall lining (also polished), paving, for building of monuments and in sculpture, etc.
- Neovolcanic rocks are not very suitable, apart from some trachytes of the České středohoří Mts. and Doupovské hory Mts., which are used in sculpture and as a polished lining.
- Among sedimentary rocks in Bohemia, the most important are Cenomanian sandstones from the area east of Prague and from Hořice and Broumov regions. Less important are Triassic and red Permian sandstones from the Krkonoše Mts. Piedmont Basin. In Moravia, there are the Cretaceous Těšín sandstones or red Permian sandstones of the Tišnov region. Sandstones are used for production of cut and polished wall linings. Very suitable are also Devonian limestones of the Barrandian area and of the Moravian karst (wall lining, terrazzo, etc.). Pleistocene travertines, used for interior wall lining, terazzo and conglomerates, were quarried in the Přerov region. Slates of the Moravian–Silesian Palaeozoic are used as lining, covering and paving material, and as expanded materials. Greywackes of the Culm were often used, too.
- Crystalline limestones and dolomites – marbles – are the most widely used metamorphic rocks (polished wall linings, paving materials, terrazzo, conglomerates, sculptures). Large deposits are in the Šumava region and Czech part of the Moldanubicum, in the Krkonoše Mts.–Jizerské hory Mts. crystalline complex and Orlické hory Mts.–Kłodzko crystalline

complex, the Svratka anticline, in the Silesicum, and in the Branná group (Silesia). Proterozoic phyllites (slates) of the western Bohemia (the Střela valley) and the Železný Brod crystalline complex are used for roofing and wall lining (the waste as a filler). Serpentinites of Moravia and Western Bohemia are used, too.

3. Registered deposits in the Czech Republic

There is a large amount of registered dimension stone deposits in the Czech Republic and therefore they are not listed.



mined reserved deposits (72)
unmined reserved deposits (92)
mined non-reserved deposits (26)
unmined non-reserved deposits (36)

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	167	169	171	165	164
exploited	75	72	74	75	72
Total mineral reserves, ths m^3	204 001	199 716	197 576	198 263	197 503
economic explored reserves	85 436	85 371	84 237	84 656	84 537
economic prospected reserves	86 099	71 150	68 771	69 081	68 440
potentially economic reserves	32 466	43 195	44 568	44 527	44 527
Mining production in reserved deposits, ths m^3 a)	270	255	235	244	273
Mining production in non-reserved deposits, ths m^3 b)	50	45	50	60	65

Note:

a) decrease of mineral reserves by mining production

b) estimate

5. Foreign trade

2514 – Slate, also roughly worked or cut

Raw material	2000	2001	2002	2003	2004
Import, t	849	815	757	1 528	836
Export, t	186	345	8 520	26 414	50 131

2515 – Marble, travertine, ecaussine and other calcareous stone

Raw material	2000	2001	2002	2003	2004
Import, t	749	1 253	1 063	1 038	1 185
Export, t	535	316	90	60	34

2516 – Granite, porphyry, basalt, sandstone and other stone

Raw material	2000	2001	2002	2003	2004
Import, t	8 884	8 673	10 305	12 693	7 267
Export, t	16 302	18 217	15 126	11 486	10 049

6801 – Setts, curbstones and flagstones of natural stone (except slate)

Raw material	2000	2001	2002	2003	2004
Import, t	1 093	2 291	2 622	5 344	3 919
Export, t	207 781	204 060	170 739	166 184	125 690

6802 – Worked monumental and crushed stone (except slate) and stonework

Raw material	2000	2001	2002	2003	2004
Import, t	14 110	14 410	20 491	22 408	22 704
Export, t	59 480	53 832	49 134	48 520	41 768

6803 – Worked slate and articles of slate or of agglomerated slate

Raw material	2000	2001	2002	2003	2004
Import, t	1 198	1 167	1 249	1 235	1 735
Export, t	299	250	209	328	95

6. Prices

Price relations of dimension stone products depend on mineral quality and on level of processing. For example: prices of granite blocks oscillate between CZK 5,500 – 17,900 per m^3 depending on block volume; prices of granite paving cubes oscillate between CZK 1,750 and CZK 3,200 per tonne (average price is CZK 2,460 per tonne); prices of granite curbs reach CZK

900 – 3,000 per running meter (average price is CZK 1,670 per running m). Crude sandstonnee blocks are sold at CZK 4,300 – 15,000 per m^3 (average price is CZK 10,000 per m^3).
Prices of polished panel boards made of granite, syenite or other igneous rocks oscillate between CZK 1,220 – 7,700 per m^2 depending on thickness of the board. Panel boards with blasted finish made of the same material reach up to CZK 1,150 – 6,650 per m^2. Ground finish sandstone boards are sold at CZK 1,520 – 3,300 per m^2 depending on their thickness and rock colour; the price of cut sandstone boards (30 cm thick) reach up to CZK 4,900 per m^2. In contrast, sandstone prisms are sold at CZK 950 per tonne.
Domestic marble (of Supíkovice and Lipová) is sold at CZK 1,210 – 2,210 per m^2 as polished panel or pavement boards. Prices of imported marble (for instance Carrara) reach up to CZK 1,800 – 2,600 per m^2. Polished granite parapets are sold at CZK 447– 790 per running meter; marble parapets at CZK 390 – 760 per running meter. Price of polished bench top boards made of granite and other igneous rocks is CZK 3,500 – 5,000 per m^2. Marble bench top boards are sold at CZK 2,700 – 6,700 per m^2.
Prices of slate products are different. For instance, roofing is sold depending on shape-piece size at CZK 560 – 1,100 per m^2. Price of slate revetment is about CZK 300 per m^2; slate pavement is sold at about CZK 350 per m^2.
836 t of slate (item 2514 of the customs tariff) were imported from Germany (60.4 %), Spain (19.0 %) and China (9.3 %) at average price of CZK 5,339 per tonne. 1,187 t of marble and travertine (item 2515 of the customs tariff) were imported from Italy (30.2 %), Greece (21.0 %) and Spain (12.8 %) in 2004. The average price was CZK 17,407 per tonne. 7.3 kt of granite, basalt and sandstone (item 2516 of the customs tariff) were imported from Italy (19.0 %), South Africa (17.8 %)¨and India (16.8%) The average price was CZK 6,884 per tonne.
3,919 t of rough dimension stone products (setts, curbstones and flagstones – item 6801 of the customs tariff) were imported from Italy (71.9 %), Germany (15.0 %) and Slovakia (5.6 %) at average price of CZK 4,178 per tonne; 22.9 kt of worked stone (item 6802 of the customs tariff) were imported from Italy (47.3 %), China (21.8 %) and Belgium (10.2 %) at average price of CZK 19,741 per tonne. 1,735 t of worked slate (item 6803) were imported from Spain (67.3 %), Italy (9.4 %) and India (8.9 %) at average price of CZK 14,612 per tonne.
50.1 kt of slate were exported to Poland (40.0 %), Ukraine (25.3 %) and Russia (22.3 %) at average price of CZK 1,362 per tonne. 34 tonnes of marble and travertine were exported to the Netherlands (65.4 %), France (19.6 %) and Slovakia (13.7 %) at average price of CZK 11,091 per tonne. 10.0 kt of granite, basalt and sandstone were exported to Germany (82.8 %) at average price of CZK 2,728 per tonne. 126 kt of rough dimension stone products (setts, curbstones and flagstones) were exported to Germany (89.4 %) and Austria (9.9 %) at CZK 2,074 per tonne. Export of cut stone reached 41.8 kt – 62.7 % went to Poland, 12.9 % to Slovakia and 6.0 % to Lithuania.. The average export price was CZK 3,901 per tonne. 95 t of worked slate were exported, too (49.1 % to Slovakia,44.2 % to Poland) at average price of CZK 16,895 per tonne.

7. Mining companies in the Czech Republic (reserved deposits) of December 31, 2004

REVLAN s.r.o., Horní Benešov
Průmysl kamene a.s., Příbram
HERLIN s.r.o., Příbram
Slezský kámen a.s., Jeseník
Bohumil Vejvoda, obchodní činnost VEDA CS, Krakovany v Čechách
Granit Lipnice s.r.o., Dolní Město
MEGALOM s.r.o. Praha
MEDIGRAN s.r.o., Plzeň

Lom Něčín a.s.
Česká žula s.r.o., Strakonice
RALUX s.r.o., Uhelná
DCK – Družstvo cementářů a kameníků Holoubkov Bohemia, a.s.
Kámen Hudčice s.r.o.
GRANIO s.r.o., Chomutov
Jindřich Zedníček, Kamenná
Ligranit s.r.o., Liberec
COMPLETINVEST s.r.o., Vítkov-Lhotka
Kámen Ostroměř s.r.o.
Obec Studená
SLEZSKÁ ŽULA s.r.o., Javorník
Agroplast a.s., Liberec
Granit – Zach s.r.o., Prosetín
Těžba nerostů a.s., Praha
REKO GRANIT s.r.o., Přerov
COMING PLUS a.s., Praha 4
Krákorka a.s., Červený Kostelec
Anna Mrázová, Mukařov
Špaček - kamenolomy s.r.o., Štěnovice
Lom Matula Hlinsko a.s.
JIHOKÁMEN, výrobní družstvo, Písek
M.& H. Granit s.r.o., Plzeň
Max Boegl & Josef Krýsl k.s., Sušice
Kamenoprůmyslové závody s.r.o., Šluknov
Pražský kamenoservis s.r.o., Praha 10
Lucie Salavcová Babická, Vrchotovy Janovice
Mramor s.r.o., Dobřichovice
Ladislav Peller – Těžba a úprava surovin, Praha 4
CZECH – TRADING s.r.o., Rychnov nad Kněžnou
Mšenské pískovce s.r.o., Mšené-lázně
LIVIA, spol. s r.o., Praha
K – Granit s.r.o., Jeseník

The most important mining organizations in non-reserved deposits of 31.12.2004

RENO Šumava s.r.o., Prachatice
VKD stavby s.r.o., Plzeň
KOKAM s.r.o., Kocbeře
HERLIN s.r.o., Příbram
Lom Horní Dvorce s.r.o., Strmilov
HERKU – kamenolomy s.r.o., Sušice
GEKOL a.s., Kolín
Josef Máca – Kamenosochařství, Lovětín
UNIEXPORT Plzeň s.r.o.
K – Granit s.r.o., Jeseník
Profistav s.r.o., Litomyšl
Lesostavby Frýdek-Místek, a.s.
Jiří Sršeň – TEKAM, Záměl
KOKAM H+H, spol. s.r.o., Kocbeře

Alfonz Dovičovič, Hořice
REVLAN s.r.o., Horní Benešov
Ing. Danuše Plandorová, Hážovice
Kamenolom Javorka s.r.o., Lázně Bělohrad
Krákorka a.s., Červený Kostelec
Kamenolom Dubenec s.r.o., Všestary

8. World production

Production of dimension stone hasn't been monitored in a long term. According to the USGS Mineral Yearbook, world production was estimated at 76 mill t in 2002. Main producers were China, Italy, India, Iran and Spain. These countries produced more than 73% of the world production. Annual production of the USA has been about 1.34 mill tonne in the recent years. Granites represent about 35 %, carbonates 28 %, sandstones 13 %, marbles 5 %, slate 1 % and other types 18 % of the total amount. Annual production of the architectural and sculpture dimension stone in Poland has been oscillating between 600 and 1,100 ths m^3. Mining production in Slovakia reaches only about 20 ths m^3 per year (the only mined deposit Spišské Podhradie – travertine).

9. World market prices

Prices of dimension stone in international market depend on mineral quality and degree of working. They usually have not been given in international price lists.

10. Recycling

The material is recycled to a limited extent (setts, worked slate, worked building stone etc.).

11. Possible substitutes

Individual types of dimension stone are mutually replaceable. Synthetic materials, ceramics, metals, glass, etc can replace all types. However, an opposite tendency has been evident recently – a growing interest in natural materials.

CONSTRUCTION MINERALS– GEOLOGICAL RESERVES AND MINE PRODUCTION

There are very high geological reserves of construction minerals – crushed stone, sand and gravel and brick clays and related minerals (brick minerals) – in the Czech Republic. The volume of mining production of construction minerals decreased significantly – to about one half – in the beginning of the 1990s. Very stable volumes of mining production were typical of dimension stone and sand and gravel in the following years. The change did not arrive until 2003, when the demand for construction minerals increased in relation to reparation of damages after the destructive flood which affected a substantial part of the Czech Republic in August 2002. The increased mining production pertained also in 2004, when the flood-related demand was replaced by a higher consumption at restoration of the uncared-for infrastructure and line constructions.

Mining of construction minerals in reserved deposits (decrease of mineral reserves volume by mining)

Raw material	Unit	2000	2001	2002	2003	2004
Crushed stone	ths m^3	9 451	9 695	9 654	11 210	11 966
Sand and gravel	ths m^3	7 740	8 281	8 264	9 105	8 859
Brick minerals	ths m^3	1 653	1 729	1 525	1 626	1 554

Lifetime of industrial reserves

(economic explored disposable reserves) based on the decrease of reserves by mining incl. losses in registered deposits per year 2004 (A) and on the average annual decrement of reserves in period 2000– 2004 (B) was follows:

Raw material	Lifetime A (years)	Lifetime B (years)
Crushed stone	89	103
Sand and gravel	106	111
Brick minerals	142	137

Construction minerals production data presented by the Czech Geological Survey - Geofond were to a certain extent distorted till 1998. The reason was classification of deposits as reserved and non-reserved. During exploitation of non-reserved deposits, producers are not obliged to submit statistical statement Geo (MŽP) V3-01 and therefore their production could not be recorded. That's why the actual production of construction minerals before 1998 was higher than numbers presented by the Czech Geological Survey – Geofond (Česká geologická služba – Geofond).

Since 1999, the non-reserved deposit production has been observed in the form of Hor (MPO) 1-01 statements. These data precise the idea of total building material production (crushed stone included) in the Czech Republic. As the return of the form was about 90% it can be supposed that the real mining production in non-reserved deposits is by about 10% higher.

Mine production of construction minerals in non-reserved deposits is as follows:

Raw material	Unit	2000	2001	2002	2003	2004
Crushed stone	ths m^3	660	750	900	960	960
Sand and gravel	ths m^3	4 900	3 800	4 200	4 400	4 800
Brick minerals	ths m^3	190	150	120	180	330

CRUSHED STONE

1. Characteristics and use

Crushed stone involve all kinds of solid magmatic, sedimentary or metamorphic rocks, which have suitable technological properties to be used in construction works. They must have certain physical and mechanical properties based on their origin, mineralogical and petrographic composition, structure, texture, secondary alterations, etc. The rocks are used in the form of quarried stone or mostly in the form of crushed and broken aggregates. Impurities are represented by fractured, crushed, weathered or altered zones, inclusions of technologically unsuitable rocks, higher content of sulphur, amorphous SiO_2, etc. The world reserves are virtually inexhaustible.

2. Mineral resources in the Czech Republic

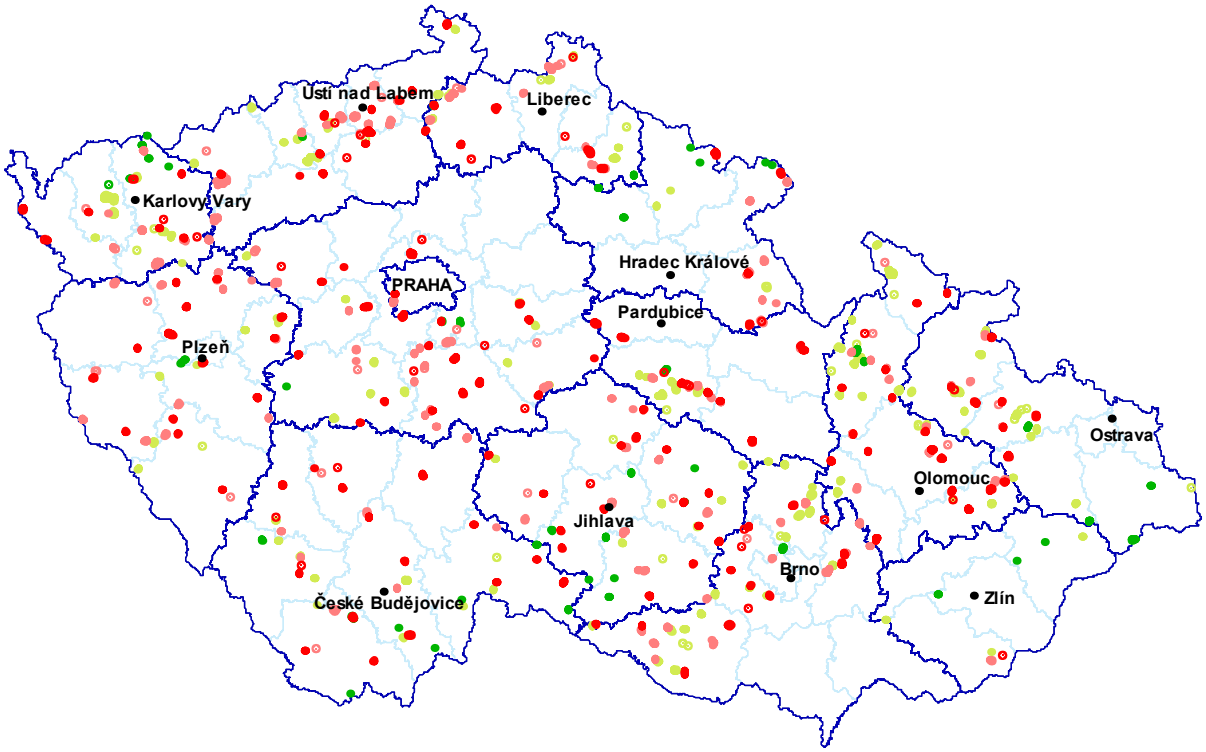
Commercially usable deposits of crushed stone can be found throughout the Bohemian Massif but much less frequently in its basin regions. Western Carpathians are rather poor in crushed stone.

- Volcanic rocks represent the major source of stone for production of crushed aggregates in the Czech Republic. Deposits of paleovolcanic rocks (pre-Tertiary volcanites) occur only in the Barrandian area (suitable are also consolidated pyroclastics), in the Krkonoše Mts. Piedmont Basin and in the Intra-Sudetic depression. They locally enclose also layers or bodies of pyroclastic or altered rocks. Important are especially deposits of mafic rocks – spilites, diabases, etc. Among neovolcanic rocks (post-Cretaceous volcanites), mafic (especially basaltic) varieties appear to be the most important, too. They are most abundant in the České středohoří and Doupovské hory Mountains, less abundant in the neovolcanic area of the Bohemian Cretaceous Basin, eastern Sudetes and in the Železný Brod region. Share of basic volcanic rocks in the total mining production of crushed stone in the Czech Republic is higher than 30 %.
- Igneous rocks (particularly granites and quartz-diorites) represent an important source of crushed stone. Various types of igneous rocks (including accompanying swarms of dike rocks) are quarried at many localities in the Central Bohemian Pluton, Central Moldanubian Pluton, the Železné hory Mts. Pluton (the Nasavrky Massif), the Brno Massif and in other plutonic bodies. Single deposits of dike rocks are of small importance. Share of deep-seated igneous rocks in the total mining production of crushed stone in the Czech Republic is about 18 %.
- Among the sedimentary rock deposits there prevail the ones of consolidated clastic sediments (siltstones, greywackes, etc.). Culmian greywackes of the Nízký Jeseník Mountains and the Drahanská vrchovina plateau are the most important source of crushed stone. Similar rocks also occur in the Proterozoic of the Barradian area, Moravian Devonian and the flysh belt of the Western Carpathians. Sedimentary rocks (mainly greywackes) make about 23 % of the crushed stone production in the Czech Republic.
- Carbonates (the Lower Palaeozoic of the Barrandian area, the Moravian–Silesian Devonian) and siliceous rocks (lydites or cherts in the Upper Proterozoic of the Plzeň region) represent deposits of chemical and organogenous origin.
- Regionally metamorphosed rock deposits, represented by crystalline schists or gneisses, which occur exclusively in crystalline complexes of the Bohemian Massif in Moldanubicum, Moravicum, Silesicum, crystalline areas of the Slavkovský les, West Sudetes etc. are of a high importance, too. Besides technologically very suitable rocks (orthogneisses, granulites, amphibolites, serpentinites, crystalline limestones, etc.) there occur also some less suitable rocks (mica-schists, paragneisses, quartzites).

- Less important are deposits of contact metamorphosed rocks (hornfelses, schists) occurring along the contact of the Central Bohemian and the Nasavrky Plutons with Late Proterozoic and Palaeozoic sediments. Metamorphosed (both regionally and contact) rocks share by more than 25 % in the total mining production of crushed stone.

3. Registered deposits in the Czech Republic

Because a large number of crushed stone deposits in the Czech Republic, they are not listed.



mined reserved deposits (168)
unmined reserved deposits (156)
mined non-reserved deposits (52)
unmined non-reserved deposits (150)

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2003
Deposits – total number	340	338	336	329	324
exploited	181	172	169	169	168
Total mineral reserves, ths m3	2 372 692	2 398 049	2 321 444	2 338 034	2 281 082
economic explored reserves	1 182 536	1 193 175	1 156 151	1 158 022	1 142 528
economic prospected reserves	1 032 825	1 055 859	1 016 280	1 028 320	983 239
potentially economic reserves	157 331	149 015	149 013	151 692	155 315

Mining production in reserved deposits, ths m3 a)	9 451	9 695	9 654	11 210	11 966
Mining production in non-reserved deposits, ths m3; b)	660	750	900	960	960

Note:

a) decrease of mineral reserves by mining production

b) estimate

5. Foreign trade

251710 – Pebbles, gravel, broken or crushed stone

Commodity	2000	2001	2002	2003	2004
Import, kt	256	259	126	144	379
Export, kt	814	773	290	324	210

6. Prices

Prices of crushed aggregates oscillate depending on the mineral quality and granularity between CZK 35 and 280 per tonne. The average price is about CZK 160 per tonne. Current price of quarried stone is CZK 50 – 480 per tonne, on average about CZK 160; price of regulation quarried stone is CZK 390 – 450 per tonne. Facing stone is sold at CZK 420 – 990 per tonne; average price is CZK 650 per tonne. Average prices of setts oscillated between CZK 2,100 and 3,800 per tonne, paving mosaic is offered at CZK 2,100 – 3,800 per tonne on the domestic market.

380 kt of pebbles, broken or crushed stone were imported from Slovakia (84.9%), Germany (6.8 %) and Poland (4.9 %) at average price of CZK 299 per tonne in 2004. 210 kt were exported to Austria (90.9 %) and to Germany (7.5 %) at CZK 266 per tonne.

7. Mining companies in the Czech Republic (reserved deposits) of December 31, 2004

TARMAC CZ a.s., Liberec
Českomoravské štěrkovny a.s., Mokrá
KAMENOLOMY ČR s.r.o., Ostrava – Svinov
Hájek s.r.o., Opava
Kámen a písek s.r.o., Český Krumlov
Lomy s.r.o., Brno
COLAS CZ a.s., Praha
KÁMEN Zbraslav, spol. s.r.o.
M – SILNICE a.s., Pardubice
Hanson ČR a.s., Veselí nad Lužnicí
Granita s.r.o., Skuteč
Max Boegl & Josef Krýsl k.s., Sušice
STONE s.r.o., kamenolom Všechlapy
Hanson Kamenivo, s.r.o., Veselí nad Lužnicí
TARMAC SEVEROKÁMEN a.s., Liberec
Berger Bohemia a.s., Plzeň
Štěrkovny s.r.o., Dolní Benešov
SHB s.r.o., Bernartice
Basalt s.r.o., Měrunice
Stavby silnic a železnic a.s., Praha 1
DOBET s.r.o., Ostrožská Nová Ves

Kamenolom Císařský a.s., Šluknov
Kamenolomy ČR Herous s.r.o., Lhota Rapotina
Lom Klecany, s.r.o., Praha 9
PIKASO s.r.o., Praha 4
Žula Rácov s.r.o., Batelov
Kámen Brno, s.r.o.
Agroplast a.s., Liberec
RENO Šumava s.r.o., Prachatice
Karlovarské silnice a.s., Karlovy Vary
VIA – VODA s.r.o., Hrubá Voda
ROSA s.r.o., Drásov
Železniční průmyslová stavební výroba Uherský Ostroh, a.s.
BES s.r.o., Benešov
Lesostavby Šumperk, a.s.
LOMY MOŘINA spol. s.r.o., Mořina
Silnice Čáslav – Holding, a.s.
ATS – Silnice s.r.o., Libá
PETRA – lom Číměř, s.r.o.
Sokolovská uhelná, a.s., Sokolov
EKOZIS, spol. s.r.o., Zábřeh
ZD Šonov u Broumova
BERON, spol. s.r.o., Čerčany
Vít Karásek – VPAS, Ústí nad Labem
HUTIRA – OMICE, s.r.o., Omice
Froněk s.r.o., Rakovník
František Matlák, Mochov
Kozákov – družstvo, Záhoří
Jaromír Slaný, Polnička
SOL-EX s.r.o., Valšov
Weiss s.r.o., Děčín
GO Point a.s., Liberec
Agrostav Znojmo, a.s.
Libinská AGRO a.s., Libina
Jan Hamáček – Stavby Prunéřov
PEDOP s.r.o., Lipovec
LOMING s.r.o., Tomice
Thorssen s.r.o., Kamenolom Mladecko
Formanservis s.r.o., Nebřenice
HORNA – Doprava a mechanizace, s.r.o., Sokolov
Josef Žirovnický, Vlašim
NATRIX a.s., Rohatec
JAMEL s.r.o., Velké Přítočno
JHF Heřmanovice spol. s.r.o.
Kamenolom KUBO s.r.o., Malé Žernoseky
CEFEUS s.r.o., Praha 2
Kamenolom Zderaz s.r.o., Proseč
Pavel Dragoun, Cheb
KATORGA s.r.o., Praha
EKOSTAVBY Louny s.r.o.

The most impotrant mining organization in non-reserved deposits of 31.12.2004

Sokolovská uhelná, a.s., Sokolov
KÁMEN Zbraslav, spol. s.r.o.
ZUD, a.s., Zbůch
ZETKA Strážník a.s., Studenec
COLAS CZ a.s., Praha
FORMANSERVIS s.r.o., Nebřenice
Granita, s.r.o., Skuteč
Rosis, s.r.o., Opava
KAMENOLOMY ČR s.r.o., Ostrava-Svinov
Stavoka Kosice, a.s.
Kamenolom Žlutava s.r.o.
SENECO, s.r.o., Polná
RENO Šumava s.r.o., Prachatice
BAK a.s., Trutnov
LB, s.r.o., Mezirolí
TS služby, s.r.o., Nové Město na Moravě
Valašské lesotechnické meliorace, a.s.
Jihočeské lesy České Budějovice, a.s.
EKOZIS spol. s.r.o., Zábřeh
Mendelova zemědělská a lesnická universita Brno
Vojenské lesy a statky ČR, s.p., Praha 6
KATORGA s.r.o., Praha
Lesostavby Frýdek Místek, a.s.
Lesy České republiky, s.p., Hradec Králové
Obec Hošťálková
Petr Vaněk – Lomstav, Horní Maršov
Milan Hrdý – Zemní a dopravní stavby, Dobrná
Kamena, výrobní družstvo Brno
Lesy obcí Trhové Sviny a Besednice s.r.o.

8. World production

World production of the crushed stone has not been monitored. Mine production of the crushed stone has not been individually followed in the international statistical reviews or it is stated together with sand and gravel under the term “aggregates”. According to the FOREGS report (Forum of the European Geological Surveys Directors, EuroGeoSurveys Mineral Resources Policy Sector - Aggregates in Europe), the annual production of the “aggregates” was about 550-600 mill t in Germany, roughly 300-400 mill t in France, 250-400 mill t in Spain, 200-250 mill t in Great Britain, 60-90 mill t in Sweden and 60-75 mill t in Finland in the years 1995-1999. The Polish production of the “aggregates“ has been about 90 mill tonnes (20 mill t crushed stone, 65 mill t sand and gravel) according to the Polish sources. “Aggregate“ production in Austria is 50 – 60 mill tonnes, in Belgium about 50 mill tonnes, in Denmark 50 – 60 t, in the Netherlands about 30 mill t (only sand and gravel), in Ireland about 110 mill t, in Portugal 70 – 90 mill t and in Hungary about 45 mill t (according to the same source). Production of the crushed stone in Slovakia has been oscillating between 8 and 12 mill t per year. Data from other countries are either not accessible or they do not appear reliable.

9. World market prices

Crushed stone is not traded on the international market. Trade exchange takes place only between neighbouring countries. For this reason, quotes for this raw material are not published.

10. Recycling

Because of low price of the raw material, recycling has been of minimum importance. Construction waste can be recycled following crushing up, sorting and/or screening and washing. The "Association for recycling of building materials development" is active in the Czech Republic, which associates persons and organizations dealing with problems in waste building materials processing. Apart from other activities, the association regularly organizes expert seminars and popularizes usage of recycled building materials.

11. Possible substitutes

Crushed stone can be replaced, depending on their use and grade, by gravel sand, synthetic aggregates, slags and various waste materials.

SAND AND GRAVEL

1. Characteristics and use

Sand and gravel belong to the principal construction minerals worldwide. Sand and gravel represent loose sediments originated by transport and deposition of more or less reworked rock fragments of certain size (gravel e.g. 2 to 128 mm, sand e.g. 0.063 to 2 mm), which are products of the weathering of rocks. They consist mostly of pebbles and boulders of resistant rocks and minerals (quartz, feldspar, quartzite, granite, etc.), to a smaller extent of less resistant rocks and minerals (mostly of crystalline or metamorphic and sedimentary rocks). Sand and gravel also contain silty and clayey fractions. Major impurities are humus, clay intercalations, higher content of floatable particles and sulphur, high content of unsuitable (as shape concerns) or weathered grains. Gravel and sand deposits are common all over the world and they are not registered.

The ultimate use of sand and gravel is determined by gravel size, their shape, rock type and composition. Sand and gravel are used mostly in the building industry in concrete mixtures, as drainage and filtration layers, road base, fill, etc. Sand is used in the building industry in mortar and concrete mixtures, as a filler material in production of bricks, in plasters, as a filling of abandoned stopes in mines, etc.

2. Mineral resources of the Czech Republic

Most of the deposits in the Czech Republic are of Quaternary age mainly of fluvial origin, less often of fluvio-lacustrine, fluvioglacial, glacio-lacustrine and eolian origin. Industrially exploitable deposits occur particularly in large river basins.

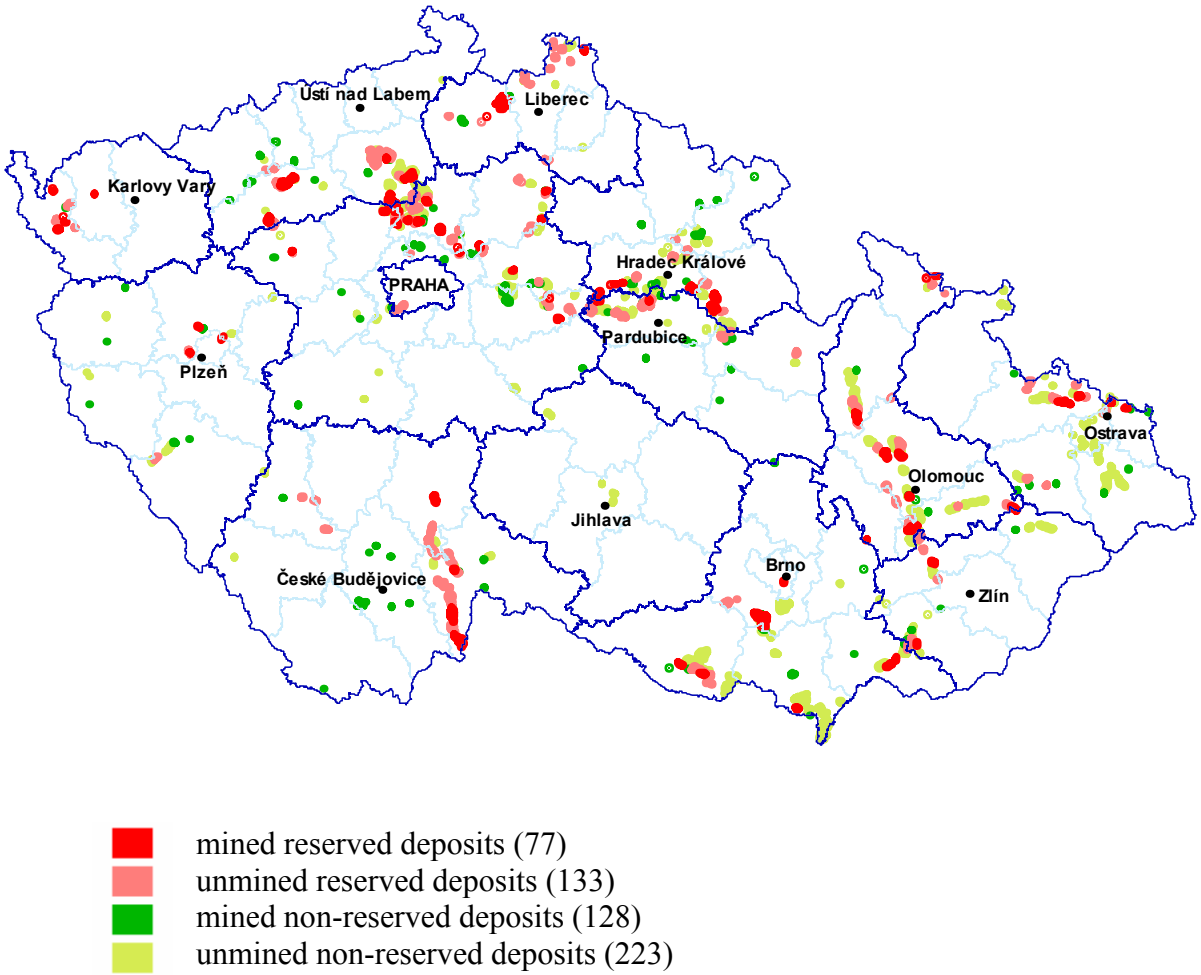
- The Labe River basin – deposits along the right bank of the middle course (important deposits for central and eastern Bohemia) and lower course are characterised by well rounded pebbles and boulders, varying ratio of gravel and sand and suitability for concrete mixtures. Other important deposits are in basins of the rivers Orlice and Ohře, along the lower course of the rivers Cidlina and Jizera, and along the middle course of the Ploučnice River. The material requires processing when used for concrete.
- The Vltava River basin – important deposits are at lower course but there are common conflicts of interests. Important deposits are along the Berounka River, too. Major deposits in the southern Bohemia occur along the Lužnice River. The right bank of the Nežárka River shows good prospects for extraction of sand and gravel.
- The Morava River basin – along the upper and middle course of the Morava River there are deposits of gravel and sand with prevailing coarse fraction, which are after processing suitable for concrete mixtures. Deposits in the Hornomoravský úval (Upper Moravian depression) contain abundant fine fractions. Reserves are parts of the flood plains; the material is suitable for road construction and for mortar mixtures. Important deposits of sand and gravel in southern Moravia occur along the middle and lower course of the Dyje River and its tributaries, particularly the Dyje–Svratka depression and area around Brno (Svitava, Svratka).
- The Odra River basin – important deposits of sand and gravel are at the middle course of the Opava River and near confluence of rivers Opava and Odra. The material is suitable for reinforcing of road shoulders and stabilization.

Less important are deposits of glacial origin in northern Bohemia (the Frýdlant region) and in the Ostrava and Opava regions. Aeolian sand of the Labe River basin and those located in southern Moravia are used mostly in mortar mixtures. Proluvial sediments of northern Bohemia, the Ostrava region, the Olomouc region, etc. are only of local importance. Variable facies of Tertiary sand in the Cheb region, in north Bohemian basins, in the Plzeň region (mortar sands), and particularly in Moravia (e.g. the Prostějov and Opava regions) is exploited more often.

Weathered sandstones of the Bohemian and Moravian Cretaceous sediments and sand from washing of kaolin are used in construction works.

3. Registered deposits in the Czech Republic

Because of their large number, deposits of sand and gravel are not listed.



mined reserved deposits (77)
unmined reserved deposits (133)
mined non-reserved deposits (128)
unmined non-reserved deposits (223)

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	214	213	214	211	210
exploited	80	81	81	80	77
Total mineral reserves, ths m3	2 285 417	2 272 433	2 224 061	2 202 415	2 201 697
economic explored reserves	1 209 477	1 219 803	1 183 041	1 187 283	1 178 495
economic prospected reserves	820 161	807 736	784 321	780 157	792 129
potentially economic reserves	255 779	244 894	256 699	234 975	231 073
Mining production in reserved deposits, ths m3 a)	7 740	8 281	8 264	9 105	8 859
Mining production in non-reserved deposits, ths m3; b)	4 900	3 800	4 200	4 400	4 800

Note:

a) decrease of mineral reserves by mining production
b) estimate

5. Foreign trade

250590 – Other sand (natural sand of all kinds, also coloured, except sand containing metals and except silica sand and quartz sand)

Raw material	2000	2001	2002	2003	2004
Import, kt	130	139	95	44	42
Export, kt	11	9	7	6	1

251710 – Pebbles, gravel, broken or crushed stone

Raw material	2000	2001	2002	2003	2004
Import, kt	171	173	126	144	379
Export, kt	543	515	290	324	210

6. Prices

Prices of extracted aggregate oscillate depending on granularity between CZK 35 and CZK 400 per tonne; average price is about CZK 140 per tonne. Prices of pit sand reached up to CZK 50 - 300 per tonne, prices of washed sand oscillated between CZK 100 - 400 per tonne.
42 kt of sand were imported from Poland (89.3 %) and Germany (6.9 %) at average price of CZK 474 per tonne in 2004. Less than 1 kt was exported to Austria (62.0 %), Slovakia (27.7 %) and Poland (2.5 %) at CZK 8,361 per tonne. The high export price was strongly influenced by the small volume of trade. 380 kt of aggregate were imported from Slovakia (84.9 %), Germany (6.8 %) and Poland (4.9 %). The average import price was CZK 299 per tonne. 210 kt of aggregate were exported to Austria (90.9 %) and to Germany (7.5 %) at average price of CZK 266 per tonne.

7. Mining companies in the Czech Republic (reserved deposits) of December 31, 2004

Českomoravské štěrkovny a.s., Mokrá
TARMAC CZ a.s., Liberec
LASSELSBERGER, a.s., Plzeň
Hanson ČR a.s., Veselí nad Lužnicí
KÁMEN Zbraslav, spol. s.r.o.
Holcim (Česko) a.s. člen koncernu, Prachovice
Družstvo DRUMAPO, Němčičky
GZ - SAND s.r.o., Napajedla
František Jampílek, Lázně Toušeň
Brněnské papírny s.p., Předklášteří
PIKASO s.r.o., Praha 4
ALAS Morava s.r.o., Mohelnice
Hanácký agrospolek s.r.o., Olomouc
Václav Maurer, Lužec nad Vltavou
ILBAU s.r.o, Praha
TEKAZ s.r.o., Cheb
DOBET s.r.o., Ostrožská Nová Ves
Štěrkovny s.r.o., Dolní Benešov

TVARBET Moravia a.s., Hodonín
Zemědělská společnost Kratonohy, a.s.
RASTRA AG-CZ a.s., Pardubice
Pískovna Černovice s.r.o., Brno
Pískovna Sojovice, s.r.o.
Ing. František Lob, Pardubice
Těžba štěrkopísku s.r.o., Brodek
Městské lesy Hradec Králové, a.s.
Písky – J. Elsnic s.r.o., Postoloprty
TAPAS Borek s.r.o., Stará Boleslav
Agropodnik Humburky, a.s.
BUILDING SP s.r.o., Sadská
KEMAT s.r.o., Skalná
KM Beta Moravia s.r.o., Hodonín
Zemědělské obchodní družstvo Zálabí, Ovčáry
KAMENOLOMY ČR s.r.o., Ostrava – Svinov
NZPK s.r.o., Podbořany
Oldřich Psotka, Mikulovice u Jeseníka
MPC s.r.o., pískovna Račiněves
Kaolin Hlubany, a.s.
Josef Šeda – TAUM, Turnov
Zemědělské obchodní družstvo Brniště
UNIM s.r.o., Všestudy u Veltrus
František Dvořák, Dolní Dunajovice
1. Stavební a.s., Litoměřice
CHESIL s.r.o., Nebanice

The most important mining companies in the Czech Republic (non-reserved deposits) of December 31, 2004

Pískovny Hrádek, a.s., Hrádek nad Nisou
GZ – Sand s.r.o., Napajedla
ZEPIKO, s.r.o., Brno
Vltavské štěrkopísky s.r.o., Chlumín
Lubomír Kruncl, Travčice
Stavby silnic a železnic a.s., Praha 1
AGKV s.r.o., Chbany
Písek Žabčice, s.r.o.
DMP a.s., Pardubice
AGRO Brno – Tuřany, a.s.
Písek – Beton a.s., Veltruby – Hradištko
Rovina Písek a.s., Písek u Chlumce nad Cidlinou
František Jampílek, Lázně Toušeň
Budějovické štěrkopísky spol. s.r.o., Vrábče
Obec Konětopy
Plzeňské štěrkopísky s.r.o., Plzeň
AG Skořenice, a.s.
Max Boegl & Josef Krýsl k.s., Sušice
Josef Šeda – TAUM, Turnov
Pískovny Morava spol. s.r.o., Brno
Sušárna a.s., Kratonohy

ACHP s.r.o., Hradec Králové
SABIA s.r.o., Bohušovice nad Ohří
Hradecký písek a.s., Brno
Agrodružstvo Klas, Staré Ždánice
Luděk Měchura, Kyjov
Ladislav Peller – Těžba a úprava surovin, Praha 4
STAVOKA Kosice a.s.
Štěrkopísky Milhostov s.r.o., Sokolov
META Servis s.r.o., Černošice
STAVOKA Hradec Králové, a.s.
Ing. Václav Luka, Český Brod
Ing. Milan Tichý – Inženýrské stavby VOKA, Zahrádky
Vratislav Matoušek, Tursko
ZEPOS a.s., Radovesice
TAPAS Borek s.r.o., Stará Boleslav
Pískovna Klíčany HBH s.r.o.
Vlastimil Beran, Daleké Dušníky
Severočeské štěrkovny a pískovny s.r.o., Žatec
Kobra Údlice, s.r.o.
Obec Polešovice
Obecní lesy Bludov s.r.o.
Obec Police
ISSO – Inženýrské stavby Sokolov, s.r.o.
Lenka Kratochvílová, Choceň
AGROSPOL Hrádek, spol. s.r.o.
LIKOD s.r.o., Boršice u Buchlovic
Technické služby města Strakonice s.r.o.
BEST a.s., Rybnice
Obec Ledenice
Mgr. Milan Roček, Turnov
Profistav s.r.o., Litomyšl
Štěrkovna Zaječí s.r.o., Velké Pavlovice
Rynoltická pískovna s.r.o.
Dopravní a zemědělské služby s.r.o., N. Bystřice
Václav Merhulík, prodej a těžba písku, Lety
UNIGEO a.s., Ostrava – Hrabová
GKR TRANSPORT s.r.o., Roudnice nad Labem
Jaroslav Rubáček, Jaroměř
KOPA-HADRBOLEC s.r.o., Dřísy
Obec Senomaty
Ilona Seidlová, Jetřichov
MORAS a.s., Moravany
Jiří Bartoš, Dolní Újezd
Obec Rabštejnská Lhota
Lesy České republiky, s.p., Hradec Králové
Ing. František Klika, Kladno
HUMECO a.s., Most
Zemědělské družstvo Kokory
Správa a údržba silnic Jihočeského kraje, České Budějovice
Písky – Skviřín, s.r.o. Tachov

Služby Frýdlant nad Ostravicí s.r.o.
Pražské vodovody a kanalizace a.s.
JSK Rozhraní, s.r.o.
Ing. Josef Novák – NOBI, Praha 5
Vladislav Durczok – pískovna Petrovice
Radomír Kopecký, Suchdol nad Odrou
ZD v Pňovicích
VIKING Holoubkov s.r.o., Plzeň
Ekopísky s.r.o., Postoloprty
Josef Mikulík, Příbor
HYDROSPOL spol. s.r.o., Staré Město u Bruntálu
Obec Libá
Václav Staněk, pískovna Pihovice
ZD Hraničář se sídlem v Loděnici
Václav Mašek, Hýskov
Lesostavby Frýdek Místek a.s.
Obec Nová Ves u Českých Budějovic
Jiří Řezáček, Postřekov
Technické služby města Úpice

8. World production

The world production of sand and gravel is not statistically monitored. The annual production of the USA was fluctuating between 700 –1,200 mill t in the last ten years, reaching about 1,130 mill t in 2003. The production of all the EU states reached 1,115 mill t in 1995. The highest mine production in EU on a long term states Germany (about 400 mill t per year), followed by France (about 200 mill t per year), Great Britain and Spain (both about 100 mill t) and Poland (about 65 mill t).. The sand and gravel production in Slovakia oscillates roughly between 2 and 3 mill t per year.

9. World market prices

The average prices of sand and gravel on the world market are not published. In the USA, prices of sand and gravel were oscillating between USD 4.81 and 5.28 per tonne in 2000-2004.

10. Recycling

Similar to all construction minerals, recycling is problematic and is important for concrete only.

11. Possible substitutes

Crushed aggregate, artificial aggregate, slags, etc can replace coarser fractions of sand and gravel. Finer fractions, i.e. sand, cannot be replaced because of reduced strength of the final products. Substitution of sand and gravel on large scale is questionable also from the economic point of view.

BRICK CLAYS AND RELATED MINERALS

1. Characteristics and use

Minerals for production of bricks are all varieties of minerals applicable to a brick manufacturing separately or in a mixture. For this purpose following types of rocks are used: loess, loams, clays and claystones, marls, weathered shales, etc. The brick manufacturing material itself (under common term "brick clay") contains two main components – plastic and non-plastic (opening material) in correct proportions either directly in the material, or alternatively their optimum ratio can be reached by their mixing. The prevailing component in the mixture forms the base whereas the complementary component, which is correcting the properties of the base, serves as a plasticizing agent or a non-plastic component. Harmful substances in brick minerals are mostly carbonates, gypsum, siderite, organic matter, larger fragments of rocks, etc.

Deposits of brick minerals are common all over the world and usually they are not registered.

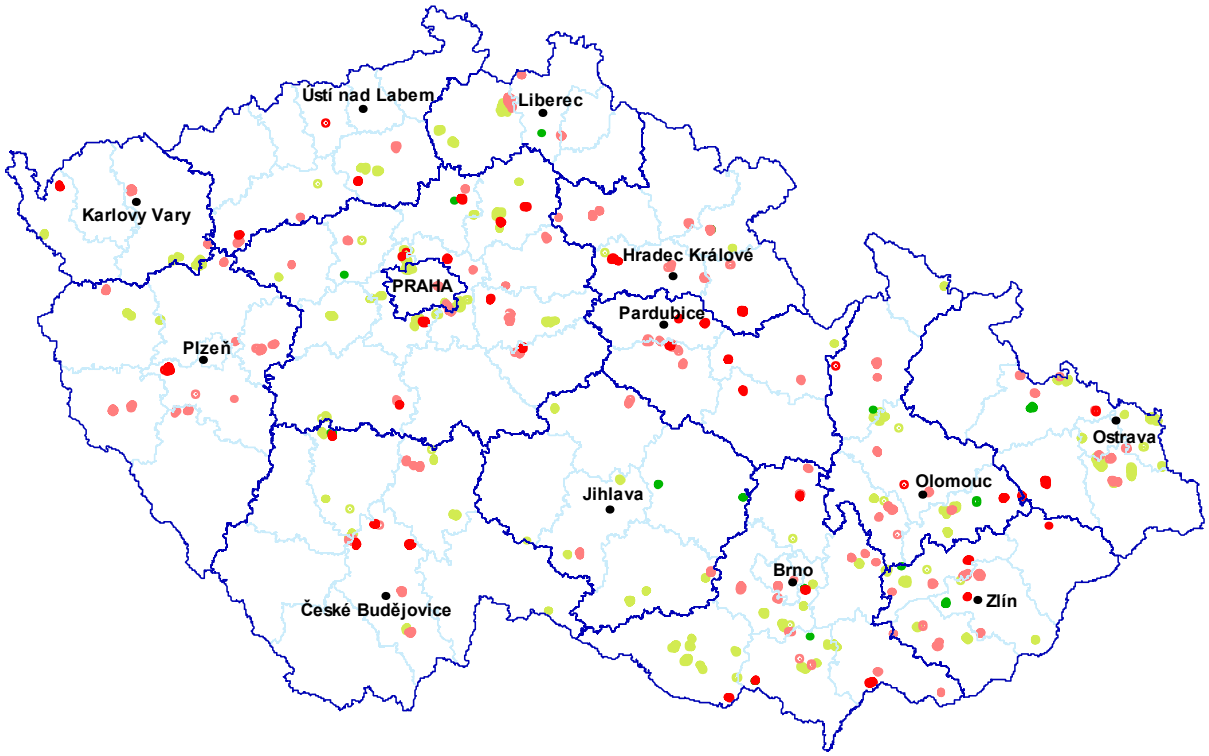
2. Mineral resources of the Czech Republic

Quaternary loams of various origins prevail among brick minerals in the Czech Republic. The source of corrective minerals represent mostly pre-Quaternary sediments.

- Deposits of Quaternary brick minerals (loess and loess loam, loam, sand, sandy-clayey residues) are common all over the country and they are mined extensively. The most important of them are formed by sediments of aeolian, deluvio-aeolian or glacial origin (northern Bohemia and Silesia). Impurities in aeolian sediments are represented by buried soil horizons, clastics and calcareous nodules, in deluvial sediments detritus of hard rocks. Aeolian materials are suitable (usually in a mixture) for production of exacting thin-walled elements. Deluvial materials can be used as corrective components for more plastic soils, or directly for production of thick-walled brick elements.
- Neogene pelites are a common pre-Quaternary brick mineral in the Bohemian limnic basins and in the Vienna Basin. They are characterized by sandy admixture and locally also by higher content of montmorillonite or clastics, in the Vienna Basin and the Carpathian foredeep also by higher content of soluble salts. They have been exploited for a very long period of time. They are suitable also for production of exacting thin-walled bearing and shaped elements.
- Paleogene claystones (also calcareous) are exploited in eastern and south-eastern Moravia. They represent weathered parts of flysh layers of outer nappes of the Western Carpathians. Efflorescence-forming salts and layers of sandstones are their major harmful substances.. They are used for production of solid or perforated bricks.
- Upper Cretaceous clays and claystones (often calcareous) are used as the base in brick manufacturing material in areas of the Bohemian Cretaceous Basin and in South Bohemian Basins. Marl, marlstone and sand are used as corrective materials. The material is suitable for production of the most exacting perforated bricks and ceiling elements. In southern Bohemia, because of contamination by limonitized sandstone, it can be used only for production of unexacting building elements.
- Permo-Carboniferous pelites and aleuropelites are used for brick production in Permo-Carboniferous basins and grabens of Bohemia and Moravia. These deposits are characterized by the occurrence of sandstones and by complex structure. The minerals can be used also for production of roof tiles and thin-walled elements.
- The Late Proterozoic and Early Palaeozoic weakly weathered slates and their residues are used around Prague, in the Plzeň and Rokycany regions, etc. Harmful substances are clastics and pyrite. They are not suitable for production of exacting bricks.

3. Registered deposits in the Czech Republic

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).



mined reserved deposits (40)
unmined reserved deposits (103)
mined non-reserved deposits (16)
unmined non-reserved deposits (111)

4. Basic statistical data of the Czech Republic as of December 31

Year	2000	2001	2002	2003	2004
Deposits – total number	161	156	156	144	143
exploited	58	50	44	41	40
Total mineral reserves, ths m3	623 814	617 813	588 523	584 108	567 069
economic explored reserves	285 100	278 985	253 675	248 444	238 408
economic prospected reserves	261 913	260 528	249 679	246 312	241 152
potentially economic reserves	76 801	78 300	85 169	89 352	87 509
Mining production in reserved deposits, ths m3 a)	1 653	1 729	1 525	1 626	1 554
Mining production in non-reserved deposits, ths m3; b)	190	150	120	180	330

Note:
a) decrease of mineral reserves by mining production
b) estimate

5. Foreign trade

690410 – Building bricks

Raw material	2000	2001	2002	2003	2004
Import, t	39 248	43 199	42 154	95 712	213 786
Export, t	285 362	117 469	102 775	89 643	22 783

690510 – Roof tiles, ceramic

Raw material	2000	2001	2002	2003	2004
Import, t	6 148	6 690	6 546	7 291	12 087
Export, t	109 746	109 712	83 618	112 245	102 697

6. Prices

Price of brick clays on domestic market has been about CZK 500/t. Clay (for clay courts) is offered at CZK 1,050 – 1,800 per tonne. Prices of full bricks oscillate between CZK 5.00 and 10.50 a piece depending on their quality (especially resistance against frost) and producer. The average price is CZK 5.20/piece. Lightened full bricks were sold at about CZK 5.00 a piece. Honeycomb bricks were sold at CZK 6.00 – 12.00 a piece, on average for CZK 10.00 a piece. The average price of drain tiles was CZK 5.40 – 11.50/piece according to diameter; the average price of ceiling drain tiles was CZK 14.70 – 18.80/piece. Roof tiles are sold at CZK 13.00 – 27.50 a piece. Brick blocks "Porotherm" are offered at CZK 50.00 a piece.

About 214 kt of classical bricks were imported to the Czech Republic from Germany (50.7 %), Austria (29.4 %) and Poland (12.7 %) at average price of CZK 1,447 per tonne in 2004. Export of the Czech tiles on the contrary steeply decreased again to as little as 23 kt. Bricks were exported especially to Slovakia (82.1 %) and to Germany (13.8 %) at average price of CZK 1,360 per tonne. The ratio between import and export of bricks changed dramatically during the last five years – while import increased about five times, Czech export decreased to as little as one tenths.

12.1 kt of roof tiles were imported from Germany (92.7 %) and Austria (4.7 %).at the price of CZK 4,656 per tonne. About 103 kt of roof tiles were exported to Germany (37.1 %), Slovakia (30.9 %) and Poland (19.7 %) at the price of CZK 4,717 per tonne in 2003. In contrast with bricks, volume balance of the foreign trade in roof tiles is substantially more favourable. Brick minerals are not stated in the Czech foreign trade statistics.

7. Mining companies in the Czech Republic (reserved deposits) of December 31, 2004

WIENERBERGER Cihlářský průmysl a.s., České Budějovice
TONDACH Česká republika s.r.o., Hranice
HELUZ cihlářský průmysl, v.o.s., Dolní Bukovsko
FLACHS a.s., Hodonín
Cihelna Kinský s.r.o., Kostelec nad Orlicí
České cihelny s.r.o., Stod
Cihelna Hodonín s.r.o.
Cihelna Malenovice s.r.o.
Logistic CZ a.s., Plzeň
Cihelna Žopy s.r.o., Holešov
CIDEM Hranice a.s.

Karel Hrabčuk – HRAKA, Ústí nad Orlicí
PARALAX a.s., Praha 8
Bratři Řehounkové – cihelna Časy s.r.o.
5. Cihlářská a.s., Praha
Cihelna Polom, s.r.o.
Cihelna Sedlčany a.s.
KEMAT s.r.o., Skalná

The most important mining organization in non-reserved deposits of 31.12.2003
WIENERBERGER Cihlářský průmysl, a.s., České Budějovice
WIENERBERGER cihelna Jezernice, spol. s.r.o.
IMOS Zlín s.r.o.
GEOPOS spol. s.r.o., Dřínov
STAMP s.r.o, Náchod
ŠAMO, spol. s.r.o., Liberec
THERKOM s.r.o., Krnov
Vlastimil Bělák, cihelna Bořinov
Bohumil Křesťan, Bohdalov
Ladislav Konečný, cihelna Šitbořice
Ing. Jiří Hercl, cihelna Bratronice, Kyšice
PARALAX a.s., Praha 8

8. World production

Production of brick clays is not monitored on the global scale. The annual mine production in Slovakia oscillates roughly between 300 and 600 ths m^3, in Poland it has been between 2.5 and 3.5 mill m^3 during the last five years.

9. World market prices

Brick clays and related minerals represent no subject of the world trade.

10. Recycling

Brick clays and related minerals cannot be recycled, but the final products – bricks, tiles and blocks – can be reused. It is possible to recycle construction detritus and mixed construction waste (for instance recycled material "Remexit").

11. Possible substitutes

In production of conventional brick elements, brick minerals are irreplaceable. Other types of bricks can be produced from other materials (compare calcareous-acid bricks, agloporite, gas silicates, etc.), of course. In such a case, various natural and artificial materials (quartz, lime, powder aluminium, artificial aggregates, cinder and flue ashes of thermal power plants, tailings, etc.) can be used as substitutes.

BASIC DATA ON SELECTED RAW MATERIALS NOT PRODUCED IN THE CZECH REPUBLIC

Many types of raw materials were not included in this yearbook, as they have not been produced in the Czech Republic. As a part of them represents an important item of the Czech foreign trade of mineral raw materials, at least basic data on these commodities are newly given here.

Aluminium

Bauxite deposits form industrial exploitable Al-resources. Bauxite is an impure mixture of Al-minerals – gibbsite ($Al_2O_3.3H_2O$), boehmite ($Al_2O_3.H_2O$) and diaspore ($Al_2O_3.H_2O$). From a genetic standpoint bauxite is divided in type "terra rossa" alias genuine bauxite, connected to carboniferous rocks weathering (for example Jamaica, Haiti, Dominican Republic, Hungary), and lateritic bauxite, created by lateritic weathering of various rocks with Al-contents (Guyana, Surinam, Brazil, India, Ghana, Australia). Al-clays were registered in the North Bohemian (brown coal) Basin (deposit Ležáky) in the Czech Republic until recently.

World production of primary Al fluctuates near 20 mill t per year; it was higher than 27 mill t in 2003. The most important world producers are China (20 %), Russia (13 %), Canada (10%), the USA (10%), Australia (7%), Brazil (5 %) and Norway (5 %)..

Foreign trade

2606 – Aluminium ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, t	12 013	15 212	15 391	13 871	20 919
Export, t	79	368	390	546	502

281820 – Aluminium oxide (other than synthetic corundum)

Raw material	2000	2001	2002	2003	2004
Import, t	17 095	24 767	22 117	23 142	26 828
Export, t	69	212	85	93	126

281830 – Aluminium hydroxide

Raw material	2000	2001	2002	2003	2004
Import, t	10 935	9 960	11 981	12 767	17 169
Export, t	20	33	68	205	140

7601 – Raw (unwrought) aluminium

Raw material	2000	2001	2002	2003	2004
Import, t	106 456	120 570	142 957	149 570	165 928
Export, t	47 454	38 362	34 634	43 044	48 646

7602 – Aluminium waste and scrap

Raw material	2000	2001	2002	2003	2004
Import, t	34 678	26 012	24 006	24 336	28 542
Export, t	26 241	30 435	33 716	33 134	43 080

Titanium

Primary Ti-ores deposits are created by bodies of magmatogenous origin in anorthosite and gabbro (Canada, Russia) and also in alkaline rocks, where are enriched by weathering (Brazil, South Africa, India). But the most important deposit type for industry represents placers, especially placers of a beach type (Australia, India). In Ti-production, there dominates the Australian beach sand, which represents about one fourth of world production of ilmenite (1,8 mill t) and rutile (220 kt) concentrates and practically the total world mining production of leucoxene (35 kt). World production of ilmenite represented about 4.9 mill t in 2003. After Australia with 24 % share in ilmenite mining production, South Africa (22 %), Canada (1 %), China (8 %) and Norway (7 %) belong to the largest ilmenite producers. World production of rutile is substantially lower, amounting to 0.4 mill t in 2003. Australia (43 %) and South Africa (38 %) followed by Ukraine (15 %) and India (5 %) belong to the biggest rutile producers.

Foreign trade

2614 – Titanium ores and concentrates

Raw material	2000	2001	2002	2003	2004
Import, t	75 502	78 510	60 976	74 709	75 101
Export, t	14	24	106	177	873

8108 – Titanium and products of it, including waste and scrap

Raw material	2000	2001	2002	2003	2004
Import, t	189	111	372	620	800
Export, t	32	58	82	239	191

Rock salt

Rock salt (halite) is a sedimentary rock composed mostly or completely of sodium chloride (NaCl). It usually originates by chemical sedimentation (evaporation) from true solutions. There are two genetic types of halite deposits in solid state – fossil bedded deposits, salt domes and deposits of salt in brine including recent deposits, originated by the sea water vaporisation ("solar salt"). New hypotheses of evaporate sedimentation presume sedimentation both on coastal supratidal mud flats, or sabkhas and in deep sea basins that did not dry up and were not salt pans at all. Rock salt is used mainly in chemical industry for production of chlorine, soda and some inorganic salts (60 %), in the food industry as preservative (23 %), for roads sprinkling in winter (8 %), in rubber, paints, ceramics and agriculture. Salt is produced in more than 120 countries in the world; world mining production of rock salt reached about 210 mill t in 2003. Leaders in salt production are the USA (21 %), China (15 %), Germany (7 %), India (7 %) and Canada (6 %).

Foreign trade

2501 – Salt (inclusive table and denaturated salt), and pure sodium chloride; also in water solution

Raw material	2000	2001	2002	2003	2004
Import, t	649 768	602 690	622 480	681 134	889 137
Export, t	13 252	7 126	7 764	10 490	12 985

Asbestos

Term asbestos is used for technically utilizable solid mineral fibres of variable mineral composition. The asbestos of the highest quality is formed by ductile chrysotile fibres, less commonly by amosite and crocidolite. Brittle fibres are usually composed of anthophyllite. Less important is amphibole asbestos formed by tremolite or actinolite.

Asbestos deposits originate by hydrothermal processes connected with metamorphism of ultramafic rocks, dolomitic limestones or ferruginous sedimentary formations.

The asbestos quality is given by length of fibres and their ductility. The most expensive is so-called textile asbestos, the raw material of the lowest quality is used in production of asbestos-concrete products. The extent of asbestos use (e.g. in brake lining in car industry) has been restricted for health and ecological reasons during the last years. Chrysotile asbestos covers about 90 % of the world production, two thirds of the remaining 10 % are represented by crocidolite and one third by amosite. World mining production of asbestos was estimated at 2,150 kt in 2003, 880 kt of which covered Russia, 350 kt Kazakhstan, about 260 kt was produced by China, 200 kt by Brazil and 130 kt by Zimbabwe.

Foreign trade

2524 – Asbestos

Commodity	2000	2001	2002	2003	2004
Import, t	1 402	2 322	785	1 464	2 891
Export, t	0	0	0	0	248

Magnesite

Magnesite ($MgCO_3$) is the most important mineral of magnesium. It occurs in crystalline and massive (crypto-crystalline) form. Crystalline magnesite grain size is more than 10 mm. Massive magnesite is characterised by grain size of 0.004 to 0.01 mm and conchoidal fracture resemblant porcelain. Magnesite deposits are related to rocks rich in magnesium – dolomites and serpentinites. Crystalline magnesite originates by hydrothermal Mg influx into carbonate rocks; massive magnesite originates by CO_2 addition to serpentine or is of sedimentary origin. Magnesite usually contains admixtures of CaO, Fe_2O_3, MnO, Al_2O_3, SiO_2 and other, which affect the quality of raw material. The mineral is marked as magnesite providing MgO content more than 40% and CaO content max. 4%. Both magnesite types are used for caustic clinker production for refractory materials, insulations and special cements. Magnesite is also used in chemical industry and in paper and synthetic silk production. Magnesite world mining production is fluctuating between 12 and 14 mill t in the last years. The major producer of magnesite is China (30 %), followed by Turkey (25 %), Russia (10 %), Slovakia (8 %) and Austria (6 %).

Foreign trade

251910 – Natural magnesium carbonate (magnesite)

Raw material	2000	2001	2002	2003	2004
Import, t	1 522	4 362	3 516	5 528	5 137
Export, t	1	4	7	1 569	1 033

251990 – Magnesia, fused, dead-burned, other magnesium oxides

Raw material	2000	2001	2002	2003	2004
Import, t	34 156	33 374	32 090	34 407	41 659
Export, t	100	698	44	355	2 675

Talc

Talc is a soft scaled magnesium silicate $Mg_3Si_4O_{10}(OH)_2$ of melting-point from 1,200 to 1,500^{0}C. All admixtures containing Fe^{3+}, pyrite and Mn oxides represent undesirable impurities. Talc is characterised by chemical (acid and alkaline lye) resistance, low electric and heat conductivity, high sorption ability, perfect basal cleavability and pure white colour (some high grade varieties). Talc originates by SiO_2 addition to rocks rich in magnesium (dolomites, dolomitic limestone, magnesites and ultrabasic rocks) during the hydrothermal processes and regional metamorphism. Well-workable massive crypto-crystalline talc variety with high electric resistance is called steatite. Also rock mixtures of talc and magnesite, often with high chlorite admixture, called soapstone, are of the similar properties like talc. Volume of talc world mining production has been oscillating between 9 and 10 mill t per year since 1997. The major producer of talc is China (40 %), followed by South Korea (11 %), the USA (10 %), Japan (7 %) and India (6 %).

Foreign trade

2526 – Natural steatite; talc

Raw material	2000	2001	2002	2003	2004
Import, t	8 659	9 080	9 299	10 278	9 407
Export, t	59	149	191	133	172

Perlite

Perlite is a natural volcanic glass formed largely of SiO_2 (65-78 %), mainly of rhyolite and sometimes andesite composition. It originates by lava disintegration in contact with water. Heating up to temperatures of about 1,000^{o}C results in abrupt expansion and formation of glass foam, during which the volume increases four to twenty times so that the density reaches values of 0.08 to 0.2 t/m^3. Expanded perlite is used in building industry for its both heat and sound insulation properties, for production of light weight concrete and in adsorption mixtures used for removing of oil patches on the water surface. Adsorption properties of perlite are used also in production of feeding mixtures and litter. World mining production of

perlite for year 2003 was estimated at 1,600 kt. The largest producers are the USA (500 kt) and Greece (360 kt), followed by Japan (250 kt), Turkey (150 kt) and Hungary (150 kt). Slovakia with its deposit Lehôtka pod Brehy represents an important producer, too.

Foreign trade

25301010 – Perlite

Commodity	2000	2001	2002	2003	2004
Import, t	6 958	6 429	6 315	5 388	4 621
Export, t	14	53	95	42	61

Sulphur

Sulphur resources are represented by natural sulphur deposits and sulphides (or sulphates) deposits. Sulphur deposits are of volcanic, biogenic, oxidative or thermogenetic origin. Sulphur is mainly extracted as a by-product during crude oil, natural and industrial gas processing. Sulphur world production reached about 62 mill t in 2003; more than 3 mill t represent natural sulphur production, 49 mill t come from smelting works and crude oil (and natural gas) refineries; the rest comes from sulphide ores or sulphates. World sulphur leaders are the USA and Canada (both 15 %), followed by China (10 %) and Japan (5 %). An important producer of natural sulphur is also Germany (22.4 mill t in 2003) and Poland (1.2 mill t).

Foreign trade

2503 – Sulphur of all kinds, other than sublimed, precipitated and colloidal

Raw material	2000	2001	2002	2003	2004
Import, t	68 252	56 621	51 922	52 784	34 483
Export, t	4 294	2 397	7 414	10 087	9 704

2802 – Sulphur, sublimed or precipitated; colloidal sulphur

Raw material	2000	2001	2002	2003	2004
Import, t	46 615	45 665	39 772	49 164	70 158
Export, t	5 875	3 069	118	134	1 581

2807 – Sulphuric acid

Raw material	2000	2001	2002	2003	2004
Import, t	48 553	75 090	60 566	57 788	52 488
Export, t	42 269	40 149	50 416	52 860	47 490

Others raw materials used in industrial fertilizers production

Raw materials used in industrial fertilizers production are divided in nitrogenous, phosphatic, potassic and combined. Also microelements needful for sustenance of organisms (Ca, Mg, B, Cu, Fe, Mn, Mo and Zn) are included into this group. World consumption of industrial fertilizers reached about 76.5 mill t N, 34 mill t P_2O_5 and 22.8 mill t K_2O in 1997.

Natural nitrates are known as the Chile saltpetre, they form a long narrow deposits zone (100 km) in desert Atacama in Chile. Production capacity of the Chile saltpetre reaches 1 mill t, whereas world production capacity of synthetic NH_3 is fluctuating about 150 mill t. The most used fertilizers with N contents are $(NH_4)_2 HPO_4$ and $Ca(NH_2)_2$.

There are two genetic types of natural phosphorus resources – endogenous type and exogenous type. Exogenous deposits in sea sediments (about 80 % of the world production) and endogenous apatite deposits in alkaline igneous rocks (almost the total remaining production) are of the most important resources for industrial fertilizers production. World production of P_2O_5 contained in phosphorus-bearing rocks oscillates between 130 and 150 mill t (137 mill tonnes in 2003). The most important producers of sedimentary phosphorites are the USA (25 %), China (18 %) and Morocco (17 % including the Western Sahara area). The major world apatite supplier is Russia.

Resources of potassic raw materials are represented almost exclusively by evaporate deposits occurred together with rock salt. There are two chemical types of evaporate deposits: deposits rich on Mg-sulphates (main minerals are carnallite, polyhalite and epsomite) and deposits poor on Mg (main minerals are sylvite and carnallite). World K_2O production reached about 24.7 mill t in 1999. Leader of producers is Canada (32 %), followed by Russia (17 %), Belarus (15 %) and Germany (13 %).

Foreign trade

3102 – Nitrogenous fertilizers

Commodity	2000	2001	2002	2003	2004
Import, t	464 686	554 763	463 680	431 489	518 263
Export, t	593 985	470 906	403 762	547 624	598 044

2510 – Natural phosphates

Commodity	2000	2001	2002	2003	2004
Import, t	45 473	48 539	27 955	24 299	24 282
Export, t	166	530	592	683	33

2809 – Phosphoric oxides and acids

Commodity	2000	2001	2002	2003	2004
Import, t	20 961	30 473	23 918	21 879	15 214
Export, t	683	543	5 190	33 631	30 520

3103 – Phosphatic fertilizers

Commodity	2000	2001	2002	2003	2004
Import, t	21 345	27 394	16 490	14 736	14 642
Export, t	406	863	1 228	642	1 150

3104 – Potassic fertilizers

Commodity	2000	2001	2002	2003	2004
Import, t	98 553	92 242	83 492	78 801	111 422
Export, t	585	253	541	808	2 196

3105 – Fertilizers containing more elements

Commodity	2000	2001	2002	2003	2004
Import, t	88 705	93 885	100 822	99 490	117 581
Export, t	142 819	72 724	47 923	36 089	29 058

MINERALS IN THE CZECH FOREIGN TRADE

Minerals and mineral products represent an important group in the Czech foreign trade. However, foreign trade balance of minerals and mineral products has been permanently passive owing to large import volume of mineral fuels (crude oil and natural gas), iron ores and materials for mineral fertilizers production. The foreign trade with statistically important (in current prices) minerals and products is demonstrated by the specification of 38 items of the Customs tariff in nomenclatures HS-4 and HS-6:

Definition of selected customs tariff items

Raw material	**Code** [1)]	**Specification of item according to the customs tariff**
Fe-ores and concentrates	2601	Iron ores and concentrates incl. roasted iron pyrites
Mn-ores and concentrates	2602	Manganese ores and concentrates including Mn-Fe ores and concentrates with 20 wt% Mn or more (calculated on dry substance)
Ni-ores and concentrates	2604	Nickel ores and concentrates
Cu-ores and concentrates	2603	Copper ores and concentrates
Pb-ores and concentrates	2607	Lead ores and concentrates
Zn-ores and concentrates	2608	Zinc ores and concentrates
Sn-ores and concentrates	2609	Tin ores and concentrates
W-ores and concentrates	2611	Tungsten ores and concentrates
Ag-ores and concentrates	261610	Silver ores and concentrates
Au-ores and concentrates	7108 261690	Gold in unwrought or semimanufactured form, gold powder Other precious metal ores and concentrates
U-ores and concentrates	261210	Uranium ores and concentrates
Crude oil	2709	Petroleum oils and oils obtained from bituminous minerals, crude
Natural gas	271121	Natural gas
Hard coal	2701	Hard coal, briquets and similar solid fuels made of hard coal
Brown coal	2702	Lignite, also agglomerated, except gagate
Fluorspar	252921 252922	Fluorspar, containing 97 wt % or less of calcium fluoride Fluorspar, containing more than 97 wt % of calcium fluoride
Barite	251010	Natural barium sulphate (barite)
Graphite	2504	Natural graphite
Kaolin	2507	Kaolin and other kaolinitic clays, also calcined
Clays	2508	Other clays (except expanded clays No. 6806), andalusite, kyanite, sillimanite, also baked, mullite, chamotte or dinas earths
Bentonite	250810	Bentonite
Feldspar Feldspar substitute	252910 252930	Feldspar Leucite, nepheline and nepheline syenite
Silica minerals	2506	Quartz (except natural sand), crude quartzite, also

		dressed
Glass and foundry sand	250510	Silica sand and quartz sand
Limestones	2521	Limestone flux, limestone and other calcareous stone for lime or cement manufacturing
Dolomite	2518	Dolomite, dolomite calcined, roughly worked or cut, agglomerated
Gypsum	252010	Gypsum, anhydrite
Dimension stone	2514 2515 2516 6801 6802 6803	Slate, also roughly worked or cut by saw or other way only into blocks or rectangular slabs Marble, travertine, ecaussine and other calcareous monumental or crushed stone, density 2.5 or higher, and alabaster, also roughly worked or cut by saw or other way cut only into blocks or rectangular slabs Granite, porphyry, basalt, sandstone and other monumental or crushed stone, also roughly trimmed or cut into blocks or rectangular slabs Setts, curbstones and flagstones of natural stone (except slate) Worked monumental and crushed stone (except slate and slate products, except products No. 6801; little stones for mosaics or tasselated pavements or similar objects, also on beds; artificially coloured granules, chippings and dust of natural stone (including slate) Worked slate and articles of slate or of agglomerated slate
Crushed stone	251710*	Pebbles, gravel, broken or crushed stone in general used for concreting and gravelling of roads, railroads etc., flint and hard head also heat-treated
Sand and gravel	250590 251710*	Other sand (natural sand of all kinds, also coloured, except sand containing metals and except silica sand and quartz sand) Pebbles, gravel, broken or crushed stone in general used for concreting and gravelling of roads, railroads etc., flint and hard head also heat-treated

[1)] *Code of the customs tariff*
** item included in one commodity only*

Definition of other important customs tariff items

Raw material	Code [1)]	Specification of item according to the customs tariff
Al – ores and concentrates	2606	Aluminium ores and concentrates
Ti – ores and concentrates	2614	Titanium ores and concentrates
Nb, Ta, V and Zr-ores and concentrates	2515	Niobium, tantalum, vanadium or zirconium ores and concentrates
Coke	2704	Coke and semi-coke of coal, lignite or peat; agglomerated; retort carbon
Salt	2501	Salt (inclusive table and denatured salt), pure sodium chloride; also in water solution
Sulphur	2503 2802	Sulphur of all kinds, other than sublimed, precipitated and colloidal Sulphur, sublimed or precipitated colloidal sulphur
Sulphuric acid oleum	2807	Sulphuric acid
Natural phosphates	2510	Natural calcium phosphates, aluminium calcium phosphates, etc., unground
Phosphoric substances	2809	Diphosphorus pentaoxide, phosphoric acid and polyphosphoric acids
Nitrogenous fertilizers	3102	Mineral or chemical fertilizers, nitrogenous
Phosphatic fertilizers	3103	Mineral or chemical fertilizers, phosphatic
Potassic fertilizers	3104	Mineral or chemical fertilizers, potassic
Fertilizers of more elements	3105	Mineral or chemical fertilizers of 2 – 3 of elements
Magnesite	251910	Natural magnesium carbonate (magnesite)
	251990	Magnesia, fused, dead-burned, magnesium oxides
Talc	2526	Natural steatite, also roughly worked or cut etc., talc
Quicklime	2522	Quicklime, slaked and hydraulic, other than calcium oxide and calcium hydroxide of 2825
Cement	2523	Portland, aluminous cement, slag, supersulfate and other hydraulic cement

[1)] *Code of the customs tariff*

Main export and import countries of statistically significant minerals and mineral products in % share of FOB current prices:

	Country / year	2000	2001	2002	2003	2004
Export	Germany	34.9	33.9	32.8	34.5	28.5
	Austria	19.7	22.9	24.4	24.9	26.5
	Slovakia	23.2	25.0	24.8	23.4	24.3
	Hungary	8.7	5.5	5.6	5.4	7.7
	Poland	7.9	7.3	6.0	5.1	4.7
	others	5.6	5.4	6.4	6.7	8.3
Import	Russia	67.8	62.4	57.7	57.3	54.2
	Poland	3.4	3.5	4.0	4.4	9.2
	Norway	9.7	11.4	12.1	11.1	8.0
	Ukraine	5.3	5.3	6.2	6.0	7.6
	Azerbaidjan	0.2	4.1	6.6	7.2	6.7
	Slovakia	1.7	0.8	3.2	3.0	2.6
	Germany	1.5	1.0	1.9	2.0	2.3
	Syria	0.0	0.4	3.8	4.2	1.8
	Libya	0.0	3.7	1.0	1.5	1.6
	Kazakhstan	4.6	3.3	0.1	0.5	1.6
	Algeria	4.2	1.9	0.6	0.0	1.3
	Others	1.6	2.2	2.8	2.8	3.1

Note:
A significant deflection in the import structure according to the countries in current prices occurred in the period of 1999– 2000. The reasons were the radical price increase of crude oil and contemporaneous weakening of CZK against USD. (The most important items of mineral raw materials (crude oil, natural gas) are purchased for USD.) A big share of countries, from which Czech Republic imports crude oil and natural gas, manifested itself also in years 2001 to 2004 with regard to still high world prices of both commodities, and regardless of a repeated strengthening of CZK against USD.

Czech foreign trade with raw materials is characterized by a high dependence on import of strategic natural fuels, especially oil and gas. A fact that predominant part of raw material import comes from countries outside the EU represents another characteristic feature. Volume of raw materials from the EU 15 oscillates between only 2 and 4 % in current prices of the import on a long term. This proportion increased when the new member countries are taken into account (thanks to Poland and Slovakia), amounting to 15.7 % in 2004. Despite this, about 85 % of raw materials is imported from the territories outside the EU.
The situation on side of the Czech raw material export is completely different. Predominant part of the Czech export is directed traditionally to western and central European markets. Export to three most important customer countries (Germany, Austria and Slovakia) exceeds 80 % of the value of total Czech export of raw materials and intermediate products made of on a long term.

Share of EU 15 resp. EU 25 countries on the Czech foreign trade with raw materials (% of FOB current prices)

Group of countries/year	2000	2001	2002	2003	2004
Import from EU 15 (%)	2.4	1.8	3.3	3.6	3.7
Import from EU 25 (%)	-	-	-	11.2	15.7
Export to EU 15 (%)	57.1	59.0	58.6	62.4	58.4
Export to EU 25 (%)	-	-	-	96.9	96.1

Important commodities of the Czech export of mineral substances in 2004 were as follows: hard coal – 40.5%, coke – 15.0%, brown coal – 5.5% and kaolin – 4.8%. Main import commodities were at the same time: crude oil – 40.0 %, natural gas – 30.0 %, and iron ore – 12.6 % (% of raw material import, resp. export in current prices). Detailed data are given in the following tables.

Export and import of raw materials registered in Raw Material Politics * (in mill CZK)

Raw material		Customs tariff code	2000	2001	2002	2003	2004**
Ores and concentrates total	import		6 759	6 895	7 197	8 195	13 418
	export		7	2	5	1	6
Fe – ores and concentrates	import	2601	6 701	6 833	7 129	8 125	13 351
	export		0	1	0	0	0
Mn – ores and concentrates	import	2602	56	56	66	63	64
	export		0	0	1	0	3
Ni – ores and concentrates	import	2604	1	4	1	2	3
	export		0	0	3	0	3
Cu – ores and concentrates	import	2603	0	0	0	1	0
	export		0	0	0	0	0
Pb – ores and concentrates	import	2607	0	0	0	2	0
	export		1	0	0	0	0
Zn – ores and concentrates	import	2608	0	0	0	0	0
	export		0	0	0	0	0
Sn – ores and concentrates	import	2609	0	0	0	0	0
	export		0	0	0	0	0
W – ores and concentrates	import	2611	0	0	0	0	0
	export		6	0	0	0	0
Ag – ores and concentrates	import	261610	1	2	1	2	N
	export		0	0	0	0	N
Au – ores and concentrates	import	261690	0	0	0	0	0
	export		0	0	0	0	0
Fuels total	import		83 596	87 868	68 952	73 865	77 546
	export		11 798	13 137	10 780	10 742	13 656
Uranium – ores	import	261210	N	N	N	N	N

and concentrates	export		N	N	N	N	N
Crude oil	import	2709	43 562	40 882	33 455	36 361	42 527
	export		577	546	565	675	437
Natural gas	import	271121	38 769	45 139	33 991	35 972	31 838
	export		2	2	1	172	389
Hard coal	import	2701	1 265	1 846	1 506	1 531	3 172
	export		9 383	10 624	8 896	8 706	11 617
Brown coal	import	2702	0	0	0	1	9
	export		1 836	1 966	1 317	1 189	1 213

Industrial and construction minerals - total	import		1 096	1 135	1 191	1 163	1 512
	export		2 930	2 890	2 504	2 609	2 931
Fluorspar	import	252921 252922	146	128	81	64	127
	export		89	68	53	61	64
Barite	import	251110	42	48	51	42	47
	export		1	1	5	4	4
Graphite	import	2504	31	35	30	42	72
	export		55	50	56	68	87
Kaolin	import	2507	77	87	58	52	58
	export		1 118	1 066	942	1 026	1 140
Clays	import	2508	137	144	123	148	193
	export		293	394	358	382	557
Bentonite	import	250810	41	48	46	47	64
	export		89	149	160	164	199
Feldspars	import	252910	25	23	24	22	24
	export		120	153	123	135	142
Glass and foundry sand	import	250510	62	74	65	95	131
	export		206	200	199	208	262
Limestones	import	2521	47	62	122	90	97
	export		139	113	85	52	67
Gypsum	import	252010	14	14	20	20	42
	export		25	13	24	25	27
Dimension stone	import	2514-6 6801-3	458	455	542	530	568
	export		792	740	604	580	521
Crushed stone	import	251710	24	28	40	36	134
	export		87	83	49	64	56
Sand and gravel	import	250590 251710	57	65	74	58	153
	export		92	92	55	67	60
Raw materials total	**import**		**91 451**	**95 898**	**77 340**	**83 223**	**92 476**
	export		**14 735**	**16 029**	**13 288**	**13 351**	**16 593**

Notes:

* *In 1999 by Decree no. 1311 of December 13 the Czech government approved the paper* ***„Surovinová politika v oblasti nerostných surovin a jejich zdrojů“*** *(Raw material politics in sphere of minerals and their resources) which defines main principles and strategies in the sphere of minerals and their resources*

*** data for 2004 are preliminary according to the Czech Statistical Office information*

Export and import of other chosen raw materials in mill CZK

Raw material		Customs tariff code	2000	2001	2002	2003	2004*
Al – ores and concentrates	import	2606	50	67	57	39	60
	export		0	2	2	3	14
Alumina oxide	import	281820	243	311	270	256	302
	export		9	17	9	5	4
Alumina hydroxide	import	281830	72	82	100	105	98
	export		1	1	3	10	4
Ti – ores and concentrates	import	2614	274	285	185	176	189
	export		0	1	2	4	13
Nb, Ta, V and Zr – ores and concentrates	import	2615	55	68	53	37	29
	export		1	0	0	1	1
Coke	import	2704	1 595	1 522	1 263	1 844	4 332
	export		2 482	2 910	2 873	3 221	5 329
Rock salt	import	2501	773	716	760	775	2 544
	export		42	29	28	36	41
Asbestos	import	2524	12	18	5	7	13
	export		0	0	0	0	0
Magnesite	import	251910	8	22	15	22	26
	export		0	0	0	10	8
Talc	import	2526	69	75	73	80	74
	export		4	3	2	2	2
Perlite	import	25301010	10	13	15	15	13
	export		0	1	2	1	1
Sulphur	import	2503	284	243	146	205	230
	export	2802	22	19	19	23	23
Sulphuric acid	import	2807	29	45	34	33	39
	export		44	44	44	58	60
Natural phosphates	import	2510	127	126	72	49	51
	export		3	15	22	27	1
Phosphorus substances	import	2809	195	246	190	146	105
	export		9	8	58	321	421
Nitrogenous fertilizers	import	3102	1 465	2 008	1 445	1 387	1 815
	export		1 586	1 514	1 123	1 617	1 712
Phosphatic fertilizers	import	3103	71	93	52	45	50
	export		1	1	4	4	6
Potassic fertilizers	import	3104	396	389	329	324	475
	export		5	7	14	16	31
Fertilizers of more elements	import	3105	587	641	633	597	771
	export		663	391	254	202	183

Quicklime	import	2522	66	89	126	130	144
	export		285	339	263	303	270
Cement	import	2523	1 175	1 331	1 522	1 948	1 940
	export		2 014	1 270	573	586	782
Total	**import**		**7 556**	**8 390**	**7 345**	**8 218**	**13 300**
	export		**7 171**	**6 571**	**5 293**	**6 450**	**8 906**

*Note: * data for 2004 are according to the Czech Statistical Office preliminary*

MINE PRODUCTION IN NATURE PROTECTED AREAS

Act No 114/1992 Sb. on nature and landscape protection regulates activities in specially protected areas 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 mining 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 and in national nature reserves is prohibited. Although the mineral resources mining is not prohibited by law in other areas (protected landscape area zones), it is very difficult to obtain authorization. Civil activities in the field of environmental protection is often the main reason.

Specially protected areas in the Czech Republic

Amount/Year	2000	2001	2002	2003	2004
Total number	2 032	2 070	2 075	2 170	2 202
national parks (NP)	3	4	4	4	4
protected landscape areas (CHKO)	24	24	24	24	24
others	2 005	2 042	2 047	2 142	2 174

The area of specially protected large-scale areas (NP and CHKO) has been 11,614 square kilometres, of which the area of prohibited mining of minerals has amounted to 19.8%. The area of NP and CHKO has amounted to 14.7% of the territory of the Czech Republic (78,864 km^2). Reserved mineral deposits were mined also in the territory of 19 CHKO in the last years, but nearly all the mining claims were defined before establishment of the protected areas. Mine production in CHKO's was on decline after 1989. This fact is illustrated in following tables. Mining was realized in 17 CHKO only in 2004. As to impact of mining in protected landscape areas the continuing unfavourable situation pertains only in CHKO Český kras (limestone mining).

Mining of reserved mineral deposits in CHKO, kt

Mineral	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Gemstones	21	36	44	39	44	49	38	39	38	31
Graphite	13	15	21	25	20	17	13	15	6	0
Hard coal	454	424	512	386	322	386	280	25	0	0
Natural gas	2	1	1	1	0	1	1	0	0	0
Clays	105	137	140	0	70	75	72	0	0	0
Glass, foundry sand	8	6	5	2	0	0	0	0	0	0
Feldspar	125	152	163	174	197	231	256	247	269	296
Limestone	2 327	2 730	3 440	3 772	3 462	3 637	3 585	3 364	3 381	3 427
Dimension stone	21	21	28	52	50	102	28	27	36	27
Crushed stone	2 943	3 202	3 435	3 125	1 975	3 169	2 601	2 381	2 816	2 614
Sand and gravel	2 329	2 459	2 470	1 983	2 016	1 532	1 343	1 512	1 472	1 589
Brick minerals	20	16	67	56	27	0	0	70	63	27
Total	8 368	9 199	10 326	9 615	8 183	9 199	8 217	7 683	8 082	8 011
Index, 1990 = 100	52	57	64	59	51	57	51	48	50	50

Notes:

- *conversion to kt: natural gas (1,000,000 m^3 = 1 kt), dimension and crushed stone (1,000m^3 = 2.7 kt) sand and gravel and brick clays (1,000 m^3 = 1.8 kt)*
- *since 2002, mine production in deposits located within 1km zone outside the protected landscape area (CHKO) is not included, i.e. the data represent the real mine production in the territory of the CHKO itself*

Mining of reserved mineral deposits in individual CHKO, kt

CHKO/Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Beskydy Mts.	5	8	16	30	24	5	19	23	17	15
Bílé Karpaty Mts.	30	41	49	64	43	35	41	49	41	22
Blanský les region	489	577	644	493	608	606	510	593	605	583
Broumov region	75	86	99	98	104	152	72	108	121	117
České středohoří Mts.	1 583	1 755	1 909	1 666	1 296	1 314	1 375	1 111	1 285	1 243
Český kras (Bohemian Karst)	2 345	2 715	3 223	3 549	3 634	3 577	3 260	3 194	3 362	3 269
Jeseníky Mts.	193	109	210	179	159	261	116	97	119	135
Jizerské hory Mts.	4	2	1	5	4	3	2	2	1	0
Kokořín region	0	0	0	0	0	0	0	0	0	0
Křivoklát region	779	706	918	848	748	824	660	263	311	267
Litovelské Pomoraví region	0	32	389	572	344	102	104	0	0	0
Moravský kras (Moravian Karst)	167	254	311	303	184	186	185	207	185	222
Pálava region	46	64	60	54	36	56	71	66	64	71
Poodří region	0	16	22	18	27	0	0	70	63	27
Slavkovský les region	28	35	42	42	88	108	164	138	170	165
Šumava Mts.	50	30	25	36	76	35	38	19	38	30
Třeboň region	2 426	2 576	2 591	2 115	1 781	1 655	1 435	1 621	1 571	1 720
Žďárské vrchy Hills	56	42	56	59	46	151	46	41	51	48
Železné hory Mts.	70	103	90	98	96	134	119	81	78	76
Total mining production (rounded)	8 346	9 151	10 655	10 229	9 298	9 204	8 217	7 683	8 082	8 011

Impact of mining in CHKO, t/km^2/year

CHKO/Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Beskydy Mts.	3	6	13	25	21	4	16	20	15	13
Bílé Karpaty Mts.	42	57	71	89	60	49	57	69	57	31
Blanský les region	2 306	2 721	3 037	2 325	2 825	2 858	2 402	2 797	2 854	2 750
Broumovsko region	182	209	241	239	254	371	176	263	295	285
České středohoří Mts.	1 489	1 650	1 795	1 567	1 219	1 236	1 285	1 045	1 209	1 169
Český kras (Bohemian Karst)	**18 320**	**21 210**	**25 179**	**27 726**	**28 387**	**27 945**	**24 697**	**24 953**	**26 266**	**25 539**
Český ráj (Bohemian Paradise) region	0	0	0	0	0	0	0	0	0	0
Jeseníky Mts.	259	146	282	240	214	351	157	131	161	182
Jizerské hory Mts.	10	5	3	13	11	8	6	5	3	0
Kokořín region	0	0	0	0	0	0	0	0	0	0
Křivoklát region	1 240	1 124	1 461	1 350	1 191	1 312	1 048	419	495	425
Litovelské Pomoraví region	0	333	4 052	5 958	3 583	1 063	1 083	0	0	0

Moravský kras (Moravian Karst)	1 777	2 702	3 309	3 223	1 957	1 979	2 011	2 202	1 968	2 362
Orlické hory Mts.	0	0	0	0	0	0	0	0	0	0
Pálava region	554	770	723	650	434	675	1 014	795	771	855
Poodří region	0	195	268	219	329	0	0	854	768	329
Slavkovský les region	43	54	65	65	138	177	256	226	279	270
Šumava Mts.	72	43	36	52	80	37	40	19	38	30
Třeboň region	3 465	3 680	3 701	3 021	2 544	2 364	2 050	2 316	2 244	2 457
Žďárské vrchy Hills	78	59	78	83	65	213	64	58	72	68
Železné hory Mts.	246	362	316	345	338	472	313	285	275	268

Note: an impact exceeding 10,000 t/km^2/year is concerned critical

IMPORTANCE OF MINERALS IN THE CZECH NATIONAL ECONOMY

In the last 15 years, structural changes in the Czech economy, especially in industry, have influenced both the role and the importance of sectors of extraction and processing of minerals and materials of mineral origin. Index of mineral production share of the GDP reflects the changes, as it has decreased from 3.7% in 1993 to 1.2% in 2003. Share of mineral extraction in the industrial production decreased from 6.9% in 1993 to 2.8 % in 2003.
Market economy caused a restriction or even termination of mining of non-economic deposits, where mining continued with the help of state subventions in the past. All mining was stopped in the deposits of metallic ores, barite and fluorspar. The mining of coal has been limited significantly in many regions. The mining of uranium ores (registered in mineral fuels) was strongly reduced.

Minerals and materials of mineral origin represent the basis for production of many industries: electricity industry, metallurgical, engineering, chemical, brick and tile industries, ceramics, stoneware manufacturing, glass industry, etc. While there are domestic resources for most of given branches at disposal, the Czech Republic depends on imports of important energetic and chemical raw materials, i.e. crude oil, natural gas, ores, metals, sulphur, salts and phosphates. Significant increase of the crude oil and natural gas world prices in 1999 and 2000 represented a large load for the Czech economy. In 2000 and 2001, the same volume of these raw materials was purchased for two times higher price than in 1999. The situation slightly improved thanks to partial decrease of the world prices of crude oil and contemporaneous strengthening of the CZK against USD. World prices of crude oil were again very high due to the war conflict in the Middle East in 2003, which resulted in the record increase of natural gas prices. Oil prices exceeded recently unimaginable value of 50 USD per barrel in 2004. The impact on the Czech foreign trade saldo is really alarming. CZK which strengthens against USD protects the domestic economy from even more serious consequences. Hard coal, brown coal, kaolin and glass sand continued to be major export commodities among raw materials also in 2002. Further listed can be also export of coke, cement, industrial fertilizers, and ceramic and glass products.
Mining industry influences (in many cases negatively) the environment. That is why production restrictions in many deposits can have a positive effect on landscape and nature and on other factors with environmental impacts. Very important is decrease of mineral production in protected landscape areas. Mining in these areas has reached the half level in 2004 compared to 1990. However, there still exist protected landscape areas where restrictions have not been materialized. In this category belong: Český kras (Bohemian Karst), Třeboň region, České středohoří Mts., Blanský les region and Křivoklát region. The protected landscape area of Český kras (Bohemian Karst) has the index of landscape affliction by mining more than ten times higher than the other protected areas. Mineral production was completely terminated in Český ráj (Bomemian Paradise) region, Kokořín region, Orlické hory Mts. and Litovelské Pomoraví region; mining production decreased considerably in protected landscape area of Křivoklát region and in the Železné hory Mts.
As a next evolution concerns, we have to note a limited lifetime of our most important resources of mineral fuels represented by deposits of brown and hard coal. A short lifetime of brown coal reserves following from area restriction is especially alarming. These limits have arisen during the effort to recover the atmosphere and to stabilize the territory of the North Bohemia. In metallic ores mining, only gold deposits come into question. Their exploitation,

however, depends on solution of conflicts of interests with nature protectors. As to industrial minerals, the Czech Republic is rich in minerals for ceramic and glass industries and in building raw materials.

Stabilization of the volume of mining production of a number of raw materials-a trend which started about in 2000 – continued in 2004. We can expect that a high interest in the Czech kaolin, feldspar, glass sand, bentonite and refractory clay – i.e. raw materials which find its place in domestic and foreign market – will pertain in future. Termination of graphite mining in southern Bohemia strengthened already dominant position of China in European trade with this commodity. Over-production of waste gypsum will continue to limit the use and mining of the natural gypsum. Construction raw materials seem to have found a new level of equilibrium between offer and demand after the increase of their mining production caused primarily especially by construction works at reparation of damages after the flood of summer 2002. In view of the fact that the "flood" demand was replaced by a higher intensity of restoration of the uncared-for infrastructure and line constructions, it is not probable that mining production of building raw materials would jump down to the level before the flood. Another increase or at least keeping of the present domestic mining production amount can be expected in case of oil and gas, in the situation of almost full dependence of the Czech Republic on their import. Logic and authorized effort to minimize impacts of raw material extraction in the nature preserved areas will continue. It will be though partly limited by the geological structure of the Czech Republic and therefore by irregular distribution of reserves. There will be therefore no possibility to ensure the mineral base for a number of branches without a careful use of some strategic deposits behind the limits of the nature protected areas. It has to be noted that the important proportion of the mining claims were defined before CHKO were declared.
Evolution of hard and brown coal mining can have several scenarios; fulfilling the energy concept of the state, solving the problem of ecological limits in the northern Bohemia and last but not least also the strategy of the ČEZ a.s. company (principal Czech electricity producer and distributor) will play a fundamental role. More extensive exploitation of domestic mineral reserves can be expected with regard to the irreversible price jump which occurred on the world market with natural fuels and consequently also other raw materials. Despite this, it remains in question in the conditions of the Czech Republic, if brown coal burning is the best way of use of a valuable petrochemical raw material. An inspiration can represent the energy policy of France; this country as one of a few European states keeps out of the pressure of enormous world prices of fuels thanks to a fundamental role of the nuclear energy. Since all indicates that the price increase of raw materials is a long-term trend, which is caused by a steep increase of consumption in rapidly developing populated (especially Asian) countries. It can be expected that this trend will continue to amplify in future.