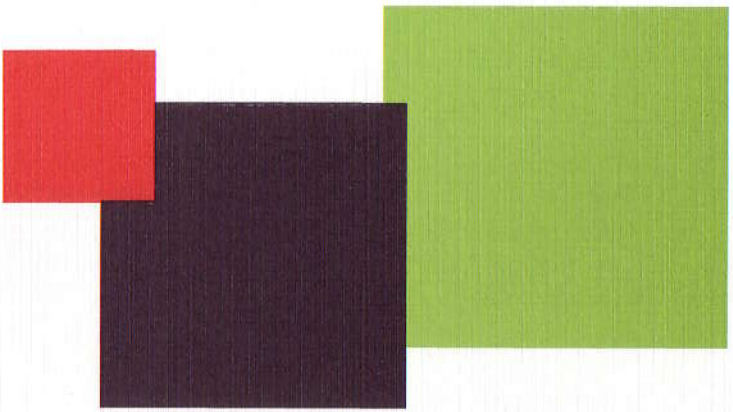
MINISTRY OF THE ENVIRONMENT

MINERAL COMMODITY SUMMARIES OF THE CZECH REPUBLIC



GEOFOND OF THE CZECH REPUBLIC
JUNE 2001

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2001 Yearbook

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STATE TO DECEMBER 31, 2000

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JUNE 2001

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LIST OF ABBREVIATIONS, SYMBOLS AND TECHNICAL UNITS

API	American Petroleum Institute
ATPC	Association of Tin Producing Countries
Btu	British thermal unit
ČBÚ	Czech Mining Office
CFR	Cost and Freight (named port of destination)
ČGÚ	Czech Geological Office
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	Czechoslovakian 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)
FOT	Free on Truck (named place)
GATT	General Agreement on Tariffs and Trade
GBP	British Pound
GBp	British pence
GDP	Gross Domestic Product
IPE	International Petroleum Exchange (London, UK)
kt	kiloton, 1000 t
lb	pound, 0.4536 kg
LME	London Metal Exchange
mesh	to designate screen size as the number of openings per linear inch
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
MPO ČR	Ministry of Industry and Trade of the Czech Republic
mtu	metric ton unit, 10 kg
MŽP ČR	Ministry of 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
VAT	value-added tax
Sb.	Act Digest of the Czech Republic

st	short ton, 907.2 kg
Troy oz	Troy ounce, 31.103 g
T/C	Treatment Charge, the amount per ton 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
ZO	Foreign Trade

INTRODUCTION

The yearbook "Mineral Commodity Summaries of the Czech Republic", published for the ninth time, is intended to provide information for professionals and particularly for businessmen in order to assist them in developing small and medium-sized enterprises in mineral exploration and mining in line with relevant legislation and interests of mining organizations.
The publication also includes basic data extracted from the "Register of Reserves of Mineral Deposits", which is elaborated 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.
The term mineral reserves refers to geological and/or total reserves, i.e. original reserves within individual deposits, calculated according to the assessed classification and conditions of their utilization. The basic data come from calculations of mineral reserves, which were approved or verified in the past by the Commission for Classification of Mineral Resources and/or by the Board of Minerals, Exploration and Mining of the former Ministry of Economy of the Czech Republic or by former commissions for control and utilization of mineral reserves of individual mining and processing industries. Nowadays these are reserves approved by the Comission for Projects and Final Reports of the MŽP ČR or by bodies ordering geological works.
Geological reserves on reserved deposits of reserved and non-reserved minerals - as of December 31, 2000 - exceeded 48,000 mill. tons with prevalence of mineral fuels and building materials. The Ministry of the Environment together with the Ministry of Industry and Trade have recently announced a project of recalculation of reserves of regale minerals, which will lead to a fundamental economic revaluation of the mineral wealth of the Czech Republic. That´s why many changes have occurred in volume of reserves or number of deposits of many minerals (especially ores) in comparison with recent years.

The year-book "Mineral Commodity Summaries of the Czech Republic" includes all minerals, i.e. metallic ores, mineral fuels, industrial minerals and building materials, which are of economic importance and substantial reserves in the territory of the Czech Republic. Each mineral is presented in a separate chapter consisting of eleven parts.
Part 1. **Characteristics and uses** - 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 their occurrence, characteristics of their deposits, types, exploitation and potential use.
Part 3. **Registered deposits 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 written by extra bold. As for mineral fuels and some industrial minerals, only regions and basins rather than single deposits are given. As for dimension stone and building materials, hundreds of these deposits are scattered over the whole territory of the Czech Republic. Consequently, neither their list nor location are given in this paragraph.

Part 4. **Basic statistical data of the Czech Republic as of December 31,** are extracted from the "Reserves register" and from the ČSÚ statistical data on mineral imports and exports.There are 3 groups of minerals (ores, mineral fuels and reserved industrial minerals) balanced in the Czech Republic. Statistical data has not covered up data of the Register of Reserves of Non-reserved Mineral Deposits yet. Mining production in non-reserved deposits has been monitored since 1999.
Part 5. **Foreign trade** – provides informations about 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 prices of orientation on domestic production, import and export prices. Domestic prices do not include VAT.
Part 7. **Mining companies in the Czech Republic.** 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 Geofond of the ČR.
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. top producers in the world market.
Part 9. **World prices** - gives a summary of 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 statistical yearbooks (for example Welt Bergbau Daten 2000, Mineral Commodity Summaries 2001, World Mineral Statistics 1995 - 1999).

MINERAL PROSPECTING, EXPLORATION AND MINING PRODUCTION IN THE CZECH REPUBLIC

Dr. Petr Šponar

Minerals defined in Act No. 44/1988 Sb. on mineral protection and exploitation amended by the Czech National Council Act No. 541/1991 Sb. (The Mining Law) 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 gravel, stone, sand, brick clay) are constituent part of the land (§ 7 of the Mining Act) and the Mining Act is not applicable to them. Amendment of the Mining Act dated 1991 cancelled the possibility to declare some deposits of non-reserved minerals as reserved and consequently as a part of mineral wealth. Decisions of the state administration bodies in this matter, which had been issued before the amendment ame 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 and the Czech Geological Office (The Geological Act), amended in Act No. 543/199l Sb. Prospecting and exploration can be carried out by a natural or legal person (organization), supposing that the works are managed and guarantied by a person who has the certificate of qualification (responsible manager). 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 approval to realize these works at the Ministry of the Environment. Before the licence is granted, it is necessary to ask for the standpoint of a municipality in cadaster of which the prospecting and exploration are going to be carried out. The administrative procedure is subject to administrative regulations. It results in the decision to issue a permit of works. The permit includes delimitation of the „exploration area“, determination of the mineral prospecting and exploration of which are approved, the conditions of geological operations and the time of licence validity. It is possible to prolong the extension of the licence validity when the organization applies for it. The permit is not a territorial determination, but with regard to the risk and financial costs it creates for the enterpreneur the reservation of rights to operate. The enterpreneur is obliged to pay a tax from the exploration area CZK 2,000 per any opened square kilometer 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.

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 Geological Act). In the first place there are laws for landscape and nature protection, agriculture and forest land 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 withdraw the licence from them.

The above mentioned regulations can be applied to prospecting and exploration of non-reserved mineral deposits (building stone, sand and gravel, brick clay) only in the case that they were earlier declared reserved deposits according to the transient enactment (§ 43). An organization can carry out a new prospecting and exploration of non-reserved minerals only after agreement with the land owner.

When the reserved mineral is found during prospecting and exploration in quality and volume indicative of its accumulation, the organization will ask the Ministry of the Environment to

issue the reserved deposit certificate. This certificate declares the reserved deposit mineral wealth owned by the state. It also ensures the protection of reserved deposit against aggravation of its mining or making the mining impossible by determination of the protected deposit area (CHLÚ) (§17 of the Mining Law).

The enterpreneur'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 Environment of the Czech Republic. The Ministry can condition its approval by fulfiling limiting conditions which take into consideration state mineral policy interests. The priority over others for precedent approval for the determination of a mining claims enjoys the enterpreneur who operated the exploration or who participated financially in it.

The mining claim is allocated only to the enterpreneur who is in possesion 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 enterpreneur must support the application for the determination of a claim by documentation given in the law. During the administrative procedure clashes of interests and also the impact on the environment (EIA) are solved. The decision on mining claim determination is the decision about an area exploitation.

The enterpreneur 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 the plans of opening, preparation and mining of the deposit are assessed together with advanced funding height proposal (demanded by law) for covering the mining effects after finishing the exploitation of the deposit.

The enterpreneur 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 kilometer of the mining claim in the area demarcated on the surface. In case of the smal 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 in the territory of every municipality. Yearly tax (royalty) is given by the Ministry of Economy 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.

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

Statistical data/Year	1996	1997	1998	1999	2000
registered tasks of geological exploration	464	370	347	330	355
protected deposit areas	902	969	1 046	925	912
mining claims – total number	1 066	1 066	1 053	1 054	1 132
- area in square km	1 704	1 649	1 642	1 682	1 780
number of exploited deposits a)	632	594	588	572	554
mining production, mill. t b)	150	152	136	127	132
organizations managing the deposits	364	378	377	380	362
organizations mining the deposits a)	262	287	260	256	332

Note:

a) Data for reserved deposits only; further 187 organizations exploited 186 non-reserved deposits in 2000

b) radioactive minerals not included; conversion to tons: natural gas - $1000m^3$ = 1 t, dimension and building stones - $1000m^3$ = 2700 t, sand and gravel and brick clays - $1000m^3$ = 1800 t

Summary of exploration licences valid in 2000 and exploration licences issued during 2000:

Exploration areas in 2000

Prospecting and exploration works paid by companies

Mineral code	Mineral	Valid EA (min. 1)	Valid EA (min. 2)	New issues in 2000	Start of validity in 2000
AG	Silver	0	0	0	0
ZR	Gold +	2	0	0	0
UC	Hard coal	0	12	0	0
RP	Crude oil	39	5	12	12
ZP	Natural gas	31	39	15	15
PD	Gemstones	4	0	4	4
KN	Kaolin	16	0	11	11
JL	Clays	8	5	7	7
BT	Bentonite	0	8	7	7
ZS	Feldspar and f. substitutes	3	0	2	2
NZ					
PI	Gl., foundry sand	0	2	1	1
AB	Abrasives	0	0	0	0
SU	Staurolite	0	0	0	0
VA	Limestones	1	0	0	0
SA	Gypsum	0	0	0	0
KA	Dimension stone	2	0	1	1
SP	Sand and gravel	1	0	0	0
CS	Brick clays	0	1	0	0
Total number		107	71	60	60

[+] Within several EA issues of licences were held up
Min. 1 - primary mineral
Min. 2 - secondary mineral

Exploration areas in 2000

Prospecting and exploration works paid from the state budget

Mineral code	Mineral	Valid EA (min. 1)	Valid EA (min. 2)	New issues in 2000	Start of validity in 2000
RP	Crude oil	0	0	0	0
ZP	Natural gas	0	0	0	0
KN	Kaolin	5	0	0	0
JL	Clays	0	0	0	0
BT	Bentonite	0	0	0	0
ZI, NZ	Feldspar and f. substitutes	1	0	0	0
PI	Gl., f. sand	0	0	0	0
Total number		6	0	1	0

Min. 1 - primary mineral
Min. 2 - secondary mineral

Geological Studies for Prospecting, Exploration and Protection of Reserved Deposits Financed from the State Budget and Realized by The Ministry of the Environment in 2000

Dr. Petr Šponar, Ministry of the Enviroment

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

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

Untill 1989, the raw-material politics was supponted 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 (they were ensuring not only the raw-material conception but also the adequate prospecting before production) and after further disintegration due to the privatisation. This process lasted from 1991 to 1994. Therefore a lot 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 decision 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 companie. 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 Ministry of Industry declared "The Programme of Development of Raw-material Base of the Czech Republic". It was destined for mining companies (not for geological prospecting companies). Fundamental conditions were as follows:

- Elaboration of an enterprising plan that proves
  a) risk of the plan
c) deposit profit, is a condition of carrying out of the works
d) This approach was a novelty in 1992, because by then the deposit prospecting had not been given by the necessity of a concrete commodity, but it had been iniciated 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 enterprising plan, the financial funds of the prospecting will be returnable**.** Also this approach represented a fundamental change. The deposit prospecting had been always financed by the state as non-returnable till this time.
- The programme concerns industrial minerals and non-traditional raw-materials. Ores 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.

Realized tasks in 2000 were as follows:

Task	Raw-material
Tichá SP3	Absorbed natural gas
Lukavice – Výsonín	Kaolin
Teplá – Beroun	Feldspar
Sedlec – Čankovská	Kaolin
CBM 6-10 – Příbor	Absorbed natural gas
Frenštát p. Radhoštěm TR – 2	Absorbed natural gas
Ostravice 1	Absorbed natural gas
Čeladná 1	Absorbed natural gas

To the programme belonged also the finishing of natural gas prospecting in the northern Moravia in the protected landscape area of Beskydy. The aim was ecologic energy sources for regional use. The previous achievements meant the gas instalment in distant villages which would depended on the delivery of solid fuel. (Tasks Komorní Lhotka 1 and Řeka 1.) All the tasks had been befor year 1995 (1992 – 1994 mostly) – i. e. before the transfer of geology section from the Ministry of Industry in the Minisry of the Environment.
Programme results will be used on a level of state organizations

- for the preparation of raw-material and energy politics of the state
- for perspective deposit protection
- for ascerteinment of necessary data for urbanplan studies

The most extensive prospecting programme (in hard coal-absorbed natural gas) will be evaluated in a complex report in 2001. It will critically evaluate the achieved results and also future perspectives of use of this potential ecological energy source.

A.2. Prospecting of New Reserved Deposits and Their Protection for Use in Future

Feldspar prospection continued in the part of the „Syrovice-Iváň" terrace, where no geological works were carred out yet and where is a chance to find new deposits of ceramic feldspar associated with sand and gravel. The potentional deposit of Czech ceramic industry could be destructed in consequence of sand and gravel mining production for the building industry. The aim is to verify the ceramic feldspar deposit and to ensure its protection against an inconvenient mining in term of building material.

A.3. Elaboration of Geological Studies on Old Non-evaluated Prospecting Works

Uranium prospecting was financed by the Department of Uranium of the former Federal Ministry of Fuel and Energy till 1990, because uranium was representing a strategy raw material. A considerable extent of geological prospecting was performed, which was financed by the state but it was not evaluated in any final report. In some cases also the primary documentation was missing. That's why the new tasks were set not aiming at uranium deposit prospecting but at elaboration of a documentation of older studies in form of final report. No new field studies with measurement and sampling are carried out. The results can be used in future in all geological branches.

Realized tasks in 1999 were as follows:

- Kuřimská Nová Ves – Jestřabí
- Vaneč - Ocmanice

A.4. Rebilance of Deposits Not Allocated for Enterprise

Central geological department of state administration follows up the registered reserved deposit reserves – property of the state (§ 29 of the Mining Act). Another task is publishing of Reserve bilance as a fundamental base for

- territorial planning
- raw-material politics
- environmental politics
- structural industrial politics
- politics of employment.

Deposits are registered in the state as documented by the **last reserve calculation.**

The calculation of reserves is carried out **according to conditions of their use**, which express

- conditions of market, prices and enterprise economy
- mining and technical conditions of use
- conflicts of interests (environmental and others).

These all are quite changeable factors that respond to political, economic and social changes, resulting also in changes of the legal regulations. Unfortunately, in the state bilance are given unchanged even deposits and their reserves from 50‘s and 60’s, the majority being from before 1990. It means that these of deposits were evaluated under differently and today invalid conditions. In the bilance **are therefore added the real reserves with the unreal ones**. Existence of unreal deposits in the state bilance is moreover a **legal reason for their protection and for blocade of even large areas against another use**. It is necessary to re-evaluate all the non-allocated deposits according to the contemporaneous legal, social, economic, mining, technical and ecological conditions of the state bilance.

That’s why exists the programme of „Rebilances“, which is realized by GEOFOND of the Czech Republic in the co-operation of companies selected in competition. Results of the programme are reflected in the state evidence and in the reserves bilance of reserved deposits and deposit protection every year.

A.5. The potential of mineral raw materials in nature protected areas and limits of its using

Rebilance of the potential of mineral raw materials in nature protected areas was started on the basis of a Czech government decree. The aim is an analysis of its extent and importance and an investigation of using limits in the future. Particular areas are being worked on the basis of a competition. Total numbers of all protected areas in the Czech Republic will be at disposal in 2003.

Costs of exploration works on deposits financed from the state budget

1993	CZK 248 716 006
1994	CZK 249 841 345
1995	CZK 242 293 906
1996	CZK 163 029 555
1997	CZK 113 230 640
1998	CZK 114 212 711
1999	CZK 110 761 308
2000	CZK 26 264 000

Mining production of minerals in the Czech economics

Ratio/Year	1996	1997	1998	1999	2000
Share of mining in GDP, %	2,0	2,2	2,1	1,5	1,5
Share of mining in industrial production, %	6,7	4,0	3,3	3,3	N

Trends of mineral industrial reserves (economic proved free reserves)
total numbers according to groups, kt

Group/Year	1996	1997	1998	1999	2000
Ores a)	28 731	32	32	3	3
Mineral fuels b)	4 237 488	3 962 830	3 738 617	3 483 057	3 511 297
Industrial minerals	2 885 542	3 081 258	3 033 301	3 066 382	2 685 404
Building materials c)	5 796 308	5 781 186	5 757 833	5 481 022	5 347 098

Note:

a) only metals Pb, Z, Sn were stated in 1997-1998, only metal Sn and Au in 1999 and 2000

b) during 1996-2000 conversion into kt - natural gas 1 mill. m^3 = 1 kt

c) including dimension stone, conversion into kt - dimension and building stones 1000 m^3 = 2.7 kt, sand and gravel and brick clays 1000 m^3 = 1.8 kt

Selected legal regulations on mineral prospecting and exploration in force as of December 31, 2000

Legal standards on mining

Act No. 44/1988 Sb. on mineral protection and use (Mining Law) - 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.; Act No. 168/1993 Sb. and Act No. 366/2000 Sb.

Act No. 61/1988 Sb. on mining operations, explosives and state mining administration in the wording of the CNR Act No. 425/1990 Sb., the CNR Act No. 542/1991 Sb. And the Act No. 169/1993 Sb.

Act No. 62/1988 Sb. on geological works and the Czech Geological Office amended in Act No. 543/1991 Sb. and Act No 366/2000 Sb. The complete wording in Act No. 166/2001 Sb.

Decree of the ČBÚ No. 56/1982 Sb. which determines districts of operation of the District Mining Offices in the wording of the ČBÚ decree No. 120/1993 Sb.

Regulations on exploitation of deposits

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.

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 CBU Decree No. 340/1992 Sb.

Decree of the ČBÚ No. 172/1992 Sb. on mining claims

Decree of the ČBÚ No. 175/1992 Sb. on conditions of non-reserved mineral deposit usage

Decree of the MŽP ČR No. 363/1992 Sb. on survey of old workings and old workings register management

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 Decre 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.

Geological and related regulations

Decree of the ČGÚ No. 85/1988 Sb. on reserved deposit survey and prospecting procedure with respect to a protection and rational use of mineral wealth and on information about mineral deposit occurrence, its rewards and cost payments in wording of the Act of the ČNR No. 541/1991 Sb.

Decree of the ČGÚ No. 8/1989 Sb. on geological work registration, on passing over and accessibility of geological work results, and on survey of old workings and old workings register management in the wording of the Decree No. 363/1992 Sb.

Decree of the ČGÚ No. 121/1989 Sb. on projects, carrying out and evaluation of geological works, and on granting the certificate on qualification to carry them out in the wording of the CNR Act No. 543/1991 Sb.

Decree of the MHPR ČR No. 497/1992 Sb. on evidence of reserves of reserved mineral deposits

Regulations on licencing 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

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

Geological reserves of metallic ores as of December 31, 2000 represent mostly potentially economic resources. More significant volume of economic reserves was presented only for goldbearing ores. Ore mining has got a very old tradition in the territory of the Czech Republic. The oldest archaeological evidence on gold panning date originates in the 9th century B.C. In the Middle Ages, Bohemia became the centre of European gold and silver mining. Long mining activity caused of the fact that the territory of the Czech Republic became rich in poor ores only. 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 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 in the territory of the Czech Republic in 1994. State subventions for damping programs directed at social costs, technical liquidations, sanative activities (maintenance) and reclaimings reached more than CZK 2 milliard in 1990-2000.

Mining production - metal content

Metal	Unit	1996	1997	1998	1999	2000
Iron	t	0	0	0	0	0
Copper	t	0	0	0	0	0
Lead	t	0	0	0	0	0
Zinc	t	0	0	0	0	0
Silver	kg	0	0	0	0	0
Gold	kg	0	0	0	0	0

IRON ORE

1. Characteristics and use

The highest concentrations of iron are associated with the occurrence of Precambrian sedimentary formations - 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, silicates and carbonates. 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.

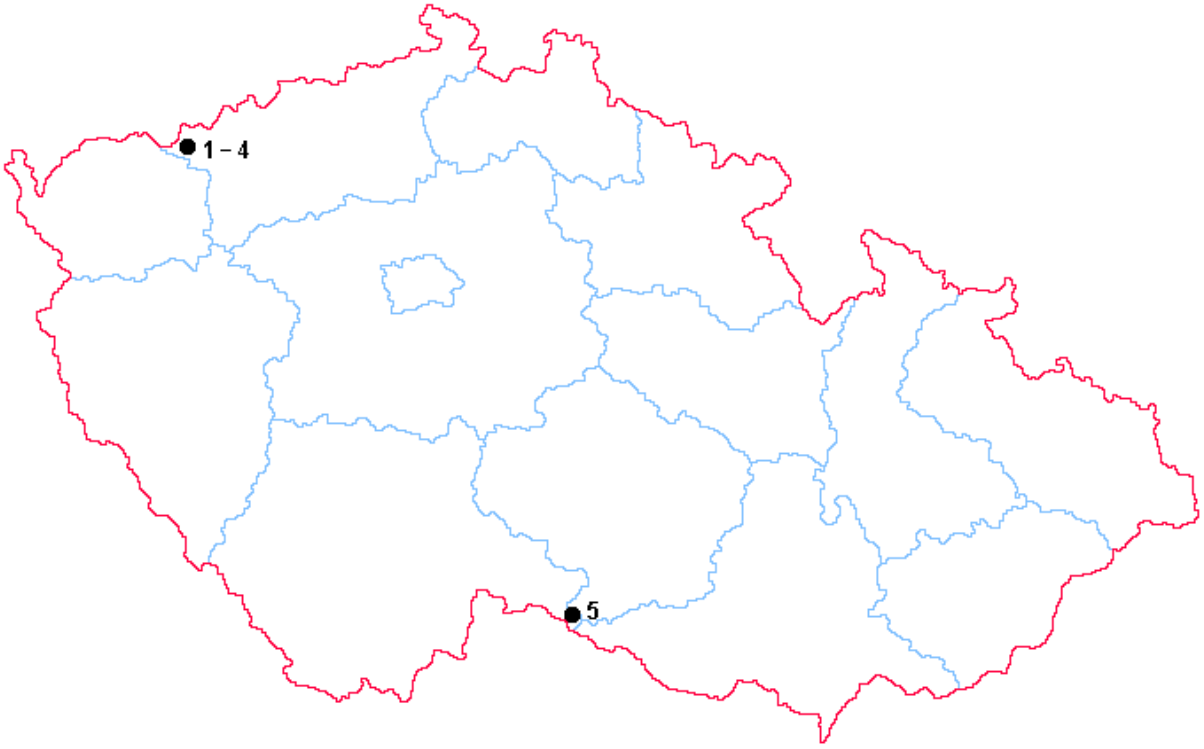
2. Mineral resources of the Czech Republic

- Sedimentary deposits of iron ores occur in the Barrandian. These ores are of marine origin and of Ordovician age. The ore forms mostly lenses. Early Ordovician ores contain mostly hematite (hematite-siderite ores). The content of iron is on average 25 to 30 %. Oolitic texture and high SiO_2 content characterize these ores. The reserves of the all sedimentary deposits of Fe were canceled in 1997 – 1999.
- Deposits of the Lahn-Dill type related to the submarine volcanic activities occur in the Moravian-Silesian Devonian. Most abundant is hematite, less abundant is magnetite and Fe-silicates. Magnetite of the Medlov deposit, which was still mined in the sixties, similarly to the sedimentary deposits of the Barrandian, contained on average 38 % Fe and about 30 % SiO_2 . All the reserves of deposits of the Lahn-Dill type were canceled in 1997 – 1999.
- Pyrometasomatic deposits of magnetite are characteristic of skarns of the Moldanubicum crystalline unit and the Krušné hory Mts. unit. The content of Fe in ore of Měděnec and Přísečnice, which were mined as late as in 1992, was on average 33 %.

Deposits of the above mentioned three genetic types were mined in the past 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 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.

The availability of higher-grade and relatively cheaper imported iron ores led to the gradual closing of iron mines in the territory of the Czech Republic.

3. Registered deposits and their location in the Czech Republic



Magnetite:
1 Kovářská
2 Kovářská-Orpus
3 Měděnec – north
4 Přísečnice
5 Županovice

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

Year	1996	1997	1998	1999	2000
Deposits – total number	27	9	8	5	5
Exploited	0	0	0	0	0
Total mineral resources, kt	488 566	32 284	32 284	22 237	22 237
economic proved reserves	519	0	0	0	0
economic probable reserves	12 232	11 520	11 520	11 520	11 520
Potentially economic resources	475 815	20 764	20 764	10 717	10 717
Mining production, kt	0	0	0	0	0

5. Foreign trade

2601 – Iron ores and concentrates

Raw material	1996	1997	1998	1999	2000
Import, kt	7 931	7 383	7 395	5 357	6 933
Export, kt	2	3	1	2	0

7201 – Pig iron

Raw material	1996	1997	1998	1999	2000
Import, kt	31	31	42	62	66
Export, kt	168	230	161	42	33

7204 – Ferrous waste and scrap

Raw material	1996	1997	1998	1999	2000
Import, kt	83	40	114	135	183
Export, kt	915	978	873	852	987

6. Prices

6.933 million tons of Fe-ores were imported on average price CZK 967 per ton in 2000 from Ukraine (79.6%) and from Russia (18.7%) mainly. Also 66 t of crude iron were imported on average price CZK 4495 per ton from Slovakia (35.4%), from Poland (25.7%) and from Russia (17.9%). 33 kt of crude iron were exported on average price CZK 5429 per ton to Slovakia (29.6%), to Austria (25.3%) and to Germany (19.6%). The Czech export of crude iron decreased significantly in 1999 and 2000. 183 kt of ferrous waste and scrap were imported on average price CZK 2977 per ton from Slovakia (52.3%) and from Poland (46.5%), 987 kt were exported on average price CZK 3152 per ton to Germany (63.7%) and to Austria (31.5%).

7. Mining companies in the Czech Republic as of December 31, 2000

In 2000, 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 1930' with an average annual production of approx. 100 million tons, reaching its last peak probably in 1995. The important iron ore - producing countries are as follows - according to UNCTAD (1996) and Mineral Commodity Summaries (1997-2000):

Year	1996	1997	1998	1999	2000 e
Mining production, mill. t	1049	1040	1020	994	1010

Main producers (1999):

China	21.0 %	(crude ores - average 35 % Fe content)
Brazil	19.1 %	
Australia	15.6 %	
Russia	8.1 %	
India	6.8 %	
USA	5.8 %	
Ukraine	5.0 %	

Brazil and Australia reached also high share in the world export of iron ores (60% in 1995).

9. World market prices

Prices of the European market are quoted in FOB for calendar year in USD/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.

Quoted prices of staple traded iron ores according to their grade in USD/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	1996	1997	1998	1999	2000
A	30,00	30,15	31,00	26,96	28,85
B	35,25	35,25	35,25	32,28	35,20
C	37,79	37,19	38,84	32,68	34,64
D	37,79	37,19	38,84	32,68	35,97
E	52,40	52,10	53,56	46,46	47,40

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

10. Recycling

Metal recycling is widely used. Iron scrap (steel scrap and cast iron scrap) are 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

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. Reserves occurring in the Earth's crust are equal to 3,630 mill. tons, of which reserves of high grade ore having over 44 % Mn represent 500 to 600 mill. tons. Inferred reserves confined to deep-sea nodules having an average content of 25 % Mn represent about 358 million tons 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. tons.

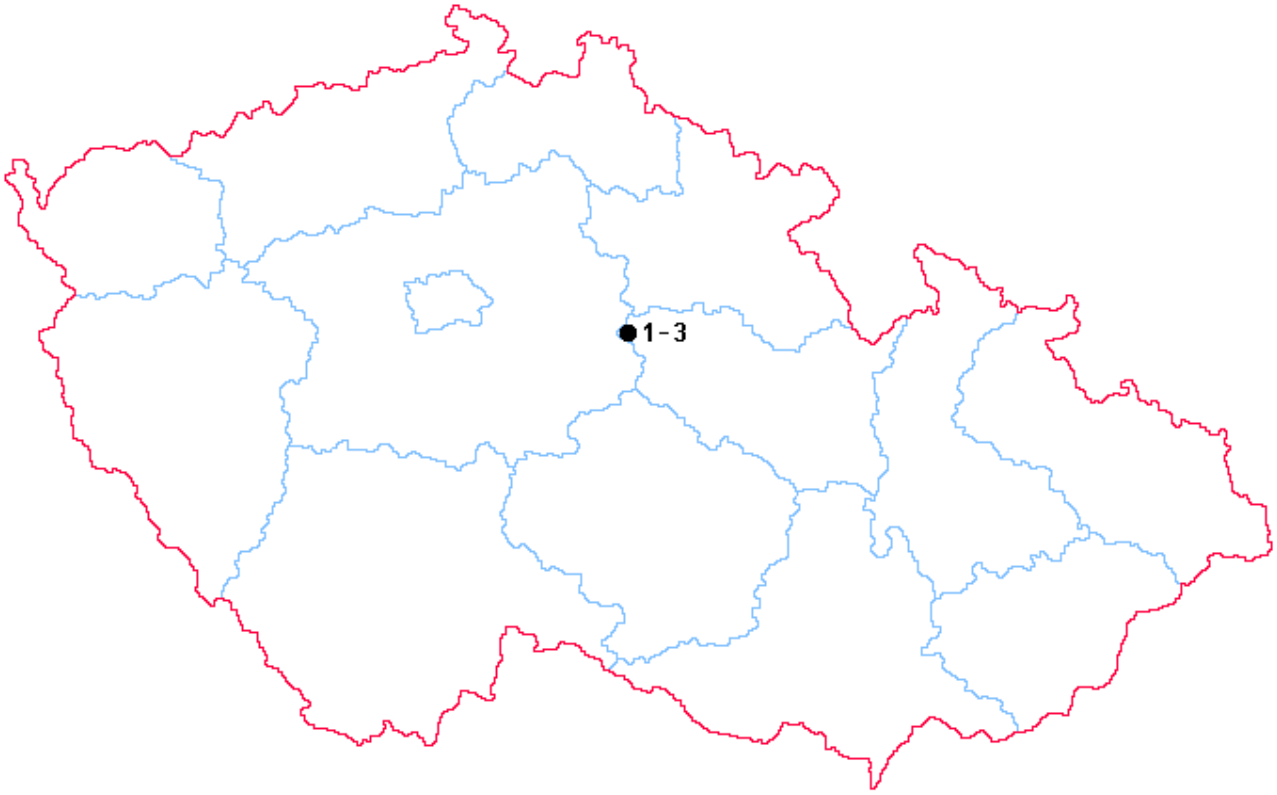
More than 90 % of manganese is used on production of manganese ferro-alloys for the iron industry both in production of pig iron and particularly in the steel industry as a desulphurizing and deoxidizing agent and as an important alloying metal. Average world consumption of manganese is 10 kgs in 1 ton of crude steel, in up-to-date steel foundries 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.

2. Mineral resources of the Czech Republic

Mn ores are known from the Železné hory Mountains area, where they are confined to volcano-sedimentery deposits of the Proterozoic. The mineralization is associated a horizon of graphitic-pyritic slates which are 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. Fe-Mn ores of the gossan type were mined in the past on the outcrops. Pyrite was mined in the fifties and sixties 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 of the ore is 9,8%).

3. Registered deposits and their location in the Czech Republic



1 Chvaletice
2 Chvaletice - tailing ponds 1 and 2
3 Řečany - tailing pond 3

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

Year	1996	1997	1998	1999	2000
Deposits – total number	3	3	3	3	3
exploited	0	0	0	0	0
Total mineral resources, kt	138 801	138 801	138 801	138 801	138 801
economic proved reserves	0	0	0	0	0
economic probable reserves	0	0	0	0	0
potentially economic resources	138 801	138 801	138 801	138 801	138 801
Mining production, kt	0	0	0	0	0

5. Foreign trade

2602 – Manganese ores and concentrates

Raw material	1996	1997	1998	1999	2000
Import, t	18 515	18 231	3 507	3 505	10 436
Export, t	1	50	25	297	31

720211; 720219 – Ferro-manganese

Raw material	1996	1997	1998	1999	2000
Import, t	28 424	32 463	25 430	19 517	17 569
Export, t	90	3 120	2 266	2 446	658

720230 – Ferrosilicomanganese

Raw material	1996	1997	1998	1999	2000
Import, t	18 753	18 818	22 924	16 777	22 291
Export, t	0	0	0	50	68

8111 – Manganese and articles thereof, including waste and scrap

Raw material	1996	1997	1998	1999	2000
Import, t	185	198	207	155	244
Export, t	6	54	20	157	26

2820 – Manganese oxide

Raw material	1996	1997	1998	1999	2000
Import, t	628	955	1 082	1 469	1 255
Export, t	3	39	49	8	31

6. Prices

In 2000 average import prices of manganese ores and concentrates were CZK 5391 per ton. 10.4 kt of Mn ores were imported from Ukraine (63.0%), from Netherlands (24.6%) and from Greece (6.8%).

Ferroalloys represented the most important item of the foreign trade. 17.6 kt of ferromanganese were imported on average price of CZK 17 021 per ton from Slovakia (49.4%), from Norway (34.5%) and from France (12.0%). 22.3 kt of ferrosilicomanganese were imported from Slovakia (53.2%), from Ukraine (31.1%) and from Norway (12.3%). The average price was CZK 18 048 per ton. Also 1.25 kt of manganese oxide were imported on average price of CZK 37 237 per ton from China (57.5%), from Belgium (23.4%) and from India (8.4%). 244 t of manganese, manganese products and manganese waste and scrap were imported on average price of CZK 49 645 per ton from China (53.5%), from Germany (17.6%) and from France (9.9%). Export of all these items was not significant in 2000.

7. Mining companies in the Czech Republic as of December 31, 2000

In 1999 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. So far the highest peak of production of manganese ores with regard to metal content was reached in 1990 - 11096 kt.

Data of 1996 – 2000 according to Mineral Commodity Summaries (MCS). However, estimations of the world production are variable in various yearbooks. For example, according to the Welt-Bergbau-Daten (WBD), the mining production was significantly higher in 1997 and 1998 – 8416 kt and 8457 kt.

Year	1996	1997	1998	1999	2000 e
Mining production, kt Mn (MCS)	7 730	7 680	7 040	6 990	7 450
Mining production, kt Mn (WBD)	7 711	8 416	8 457	N	N

Main producers (1999):

South Africa	19.2 %
China	15.7 %
Gabon	13.8 %
Australia	13.2 %
Ukraine	9.7 %
Brazil	9.2 %
India	8.2 %

Operating technologies of manganese nodules offshore mining were at disposal in France, Japan, Germany, USA and India at the end of 1995.

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. Average prices of the given manganese ore grade at year-end (commodity A):

Commodity/Year	1996	1997	1998	1999	2000
A	1,93	1,85	1,10	1,86	1,99

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, it can be substituted to a certain extent - conditioned by economic parameters - by other deoxidizing additives - silicon, aluminium, complex alloys and rare earth elements.

COPPER

1. Characteristics and use

Copper deposits can be divided into five 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 belongs 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 310 million tons, reserves of Cu in deep sea nodules are estimated at 0.7 billion tons.

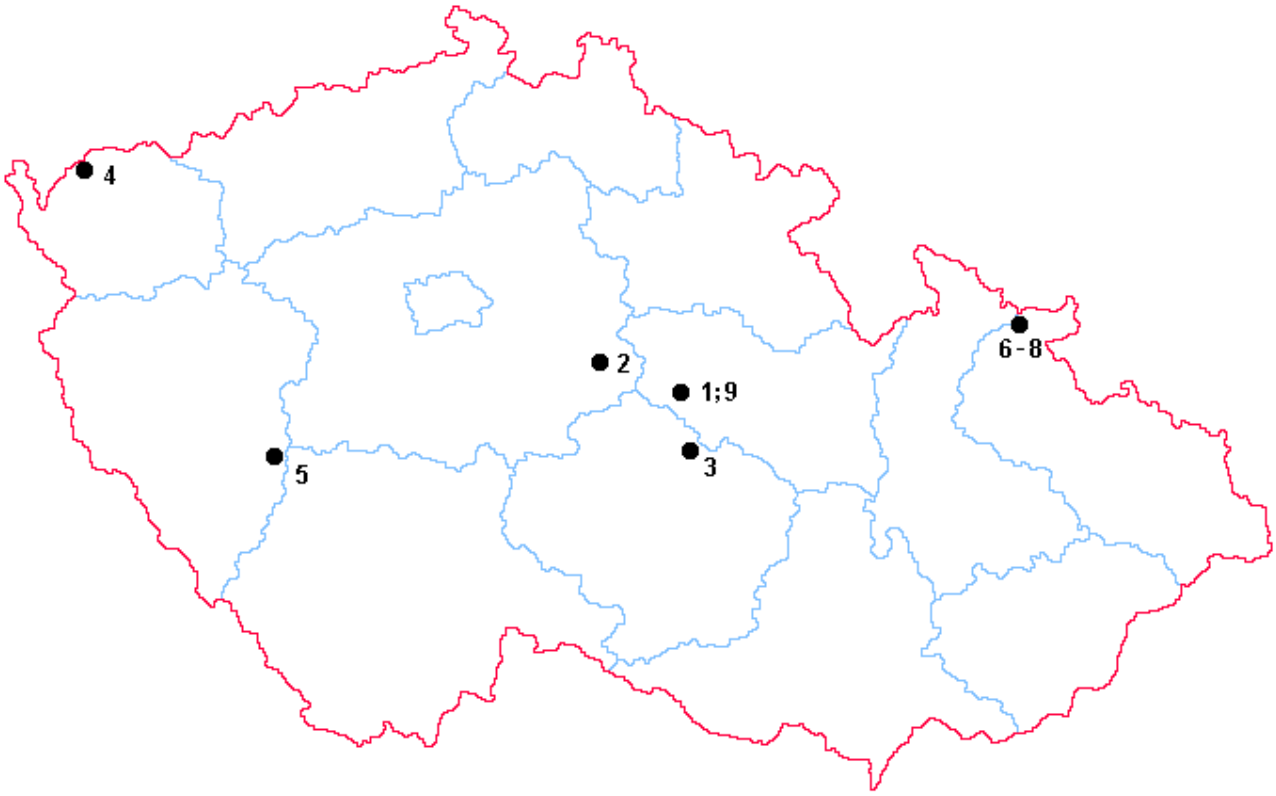
Much copper is used in electrotechnics (50 %), in the engineering (20 %) and building industries. Majority of copper is used in alloys, particularly in brass and bronze.

2. Mineral resources of the Czech Republic

Copper deposits of various origin occur in the Czech Republic and were mined in the past.

- Major mining activities were focused on volcano-sedimentary sulphide deposits of the Zlaté Hory mining district. The mineralization is associated with to the initial spilite-keratophyre volcanism and is confined to volcano-sedimentary complex of the Vrbno Formation of the Devonian. Individualtypes of local ores - Cu monometallic, complex Cu-Pb-Zn with Au and Pb-Zn occur separately and show a certain zonation. Out of the total proved reserves about 50 % 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 0.6 % Cu. Mining of these ores at the Zlaté Hory deposit was terminated in 1990.
- Stratabound monometallic Cu ores (chalcopyrite) confined to a low-grade metamorphic volcaniclastic complex were discovered and their reserves evaluated and proved 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 and pyrite formation are known at numerous localities of the Bohemian Massif (e.g. Staré Ransko, Křižanovice, Svržno).
- Hydrothermal (vein) Cu deposits of the Czech Republic are of historical importance only. Mining of Cu ores in the Czech Republic was gradually terminated. The last small volume of Cu was extracted from complex ores with gold of the Zlaté Hory deposit in 1993.

3. Registered deposits and their location in the Czech Republic



9 deposits with prevailing potentially economic resources have been registered recently. The most important of them are shown on the map.

1 Křižanovice
2 Kutná Hora
3 Staré Ransko
4 Tisová u Kraslic
5 Újezd u Kasejovic
6 Zlaté Hory-east
7 Zlaté Hory-west
8 Tlaté Hory-Hornické Skály
9 Liboměřice

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

Year	1996	1997	1998	1999	2000
Deposits – total number a)	20	15	15	12	9
exploited	0	0	0	0	0
Total mineral resources, kt Cu	245	185	181	178	115
economic proved reserves	2	0	0	0	0
economic probable reserves	41	5	5	2	2
potentially economic resources	202	180	176	176	113
Mining production, t Cu	0	0	0	0	0

Note:
a) deposits with balanced Cu content

5. Foreign trade

2603 – Copper ores and concentrates

Raw material	1996	1997	1998	1999	2000
Import, t	0	0	0	22	0
Export, t	163	69	128	129	43

7402 – Unrefined copper

Raw material	1996	1997	1998	1999	2000
Import, t	9	8	0	1	0
Export, t	0	0	0	0	0

7403 – Refined copper and copper alloys

Raw material	1996	1997	1998	1999	2000
Import, t	19 693	12 168	14 318	14 470	14 223
Export, t	4 645	4 586	3 187	2 030	5 605

7404 – Copper waste and scrap

Raw material	1996	1997	1998	1999	2000
Import, t	2 070	2 711	2 836	1 854	3 133
Export, t	26 639	26 574	28 042	32 306	37 390

6. Prices

In 2000, 14 kt of refined copper and copper alloys were imported from Poland (43.0 %), from Austria (29.8 %) and from Germany (24.9 %) on average price of CZK 72 078 per ton. 5.6 kt were exported to Germany (63.6 %), to Slovakia (25.8 %) and to Austria (8.3 %) on price of CZK 69 115 per ton. Also copper waste and scrap represented an important raw material for foreign trade in the last year – 3 kt were imported on price of CZK 34 091 per ton from Poland (49.6 %), from Slovakia (25.8 %) and from Germany (17.3 %). Export of copper waste and scrap was twelve times hiher than the import – 37.4 kt were exported to Germany (79.6 %) and to Austria (11.3 %). No Cu-ore was imported in 2000, but 43 t were exported on price of CZK 6083 per ton to Netherlands. Foreign trade in unrefined copper was insignificant.

7. Mining companies in the Czech Republic as of December 31, 2000

In 2000 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 an increasing world consumption (industrial countries show an increase in copper consumption by on average 3% per year in the last decade). Data on the world production according to Mineral Commodity Summaries (MCS) and the yearbook Estadísticas del Cobre y otros Minerales published by a renowned institute Comisión Chilena del Cobre (COCHILCO).

Year	1996	1997	1998	1999	2000 e
Mining production, kt Cu (MCS)	11 000	11 400	12 200	12 600	12 900
Mining production, kt Cu (COCHILCO)	11 103	11 494	12 286	12 364	N

Main producers (1999; according to MCS):

Chile	34.8 %
USA	12.7 %
Indonesia	5.9 %
Australia	5.8 %
Canada	4.9 %
Peru	4.3 %
Russia	4.2 %

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 ton (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. Average annual metal price (commodity A) at LME in USD per ton (Cash) was as follows:

Commodity/Year	1996	1997	1998	1999	2000
A	2 304	2 256	1 596	1 571	1 816

10. Recycling

Copper belongs to metals which are recycled on a large scale. The proportion of recycled copper reached about 18 % of total world metal production in 1994. 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 substitute for copper in the manufacture of heat exchangers despite their worse conductivity. Steel substitutes for copper in the manufacture of ammunition, too. Other substitutes are represented by optical fibres in telecommunication and plastics in water distribution (lines) and the building industry.

LEAD

1. Characteristics and use

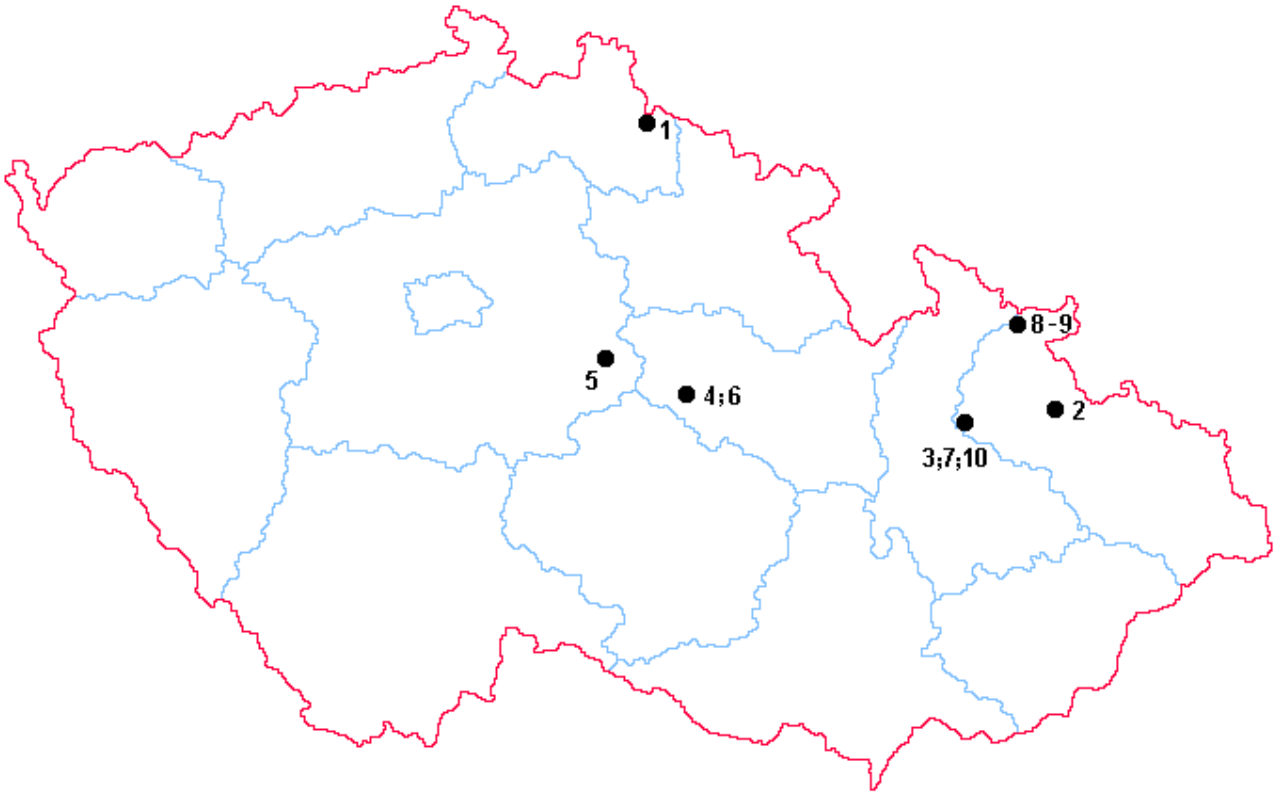
Lead deposits are of five genetic types - sedimentary, volcano-sedimentary, metasomatic, contact metamorphic and hydrothermal (veins). Major part of the world production comes from the first type. The principal ore mineral is galena, usually accompanied by sphalerite, pyrite and chalcopyrite. Exploited ores are mostly of polymetallic character with various contents of minor metals - Cd, Ge, Ga, In, Tl, Ag and Au. The ore is marked 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.tons, occurring in Australia, 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 volcano-sedimentary deposits of the sulphide formation.

- Hydrothermal base metal mineralization is abundant in the Bohemian Massif. Besides medieval ore districts of Jihlava, Havlíčkův Brod, 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 occurs at Harrachov, where galena is accompanied by barite and fluorite.
- Stratabound base metal ores of volcano-sedimentary 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 and some deposits of the Zlaté Hory ore district. Contents of lead varying up to 0.5 % are confined to 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.

3. Registered deposits and their location in the Czech Republic



Reserves of Pb in ore are registered in 11 deposits. The most important of them are shown on the map.

1 Harrachov
2 Horní Benešov
3 Horní Město
4 Křižanovice
5 Kutná Hora
6 Liboměřice
7 Oskava
8 Zlaté Hory-east
9 Zlaté Hory-west
10 Ruda near Rýmařov-north

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

Year	1996	1997	1998	1999	2000
Deposits – total number a)	27	18	17	15	11
exploited	0	0	0	0	0
Total mineral resources, kt Pb	270	208	195	169	194
economic proved reserves	17	13	13	0	0
economic probable reserves	62	53	43	16	0
potentially economic resources	191	142	139	153	194
Mining production, kt	0	0	0	0	0

Note:
a) deposits with balanced Pb content

5. Foreign trade

2607– Lead ores and concentrates

Raw material	1996	1997	1998	1999	2000
Import, t	1	0	0	0	0
Export, t	0	50	263	0	211

7801– Unwrought lead

Raw material	1996	1997	1998	1999	2000
Import, t	14 408	19 660	30 050	34 306	52 881
Export, t	10 651	4 857	2 783	6 704	9 200

7802 – Lead waste and scrap

Raw material	1996	1997	1998	1999	2000
Import, t	1 241	692	1	0	656
Export, t	124	1 585	3 039	3 313	4 152

6. Prices

52.9 kt of crude lead were imported from Germany (71.7 %) and from Poland (19.6 %) in 2000. Average price was CZK 19 372 per ton. 9.2 kt of crude lead were exported to Ukraine (25.1 %), to Germany (22.8 %) and to Poland (20.8%) on average price CZK 20 343 per ton. In 2000 Pb-ore was not imported, but 211 t of Pb-ore were exported to Germany on price of CZK 2635 per ton.

656 t of lead waste and scrap were imported from Hungary (88.1 %) and from Slovakia (11.9 %) on average price of CZK 3999 per ton. Export of lead waste and scrap was six times higher than the import - 4152 t were exported to Germany (80.9 %) and to Austria (11.3 %). Average price was CZK 7652 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

In 2000 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.tons of metal content in 1968. The largest production so far was recorded in 1977 - 3,657 kt.

In the second part of 90´s, the world mining production was oscillating around 3000 kt. Data according to Mineral Commodity Summaries (MCS) and the Welt-Bergbau-Daten (WBD):

Year	1996	1997	1998	1999	2000 e
Mining production, kt Pb (MCS)	2 920	3 010	3 100	3 020	2 980
Mining production, kt Pb (WBD)	2 899	2 887	3 123	N	N

Main producers (1999; according to MCS):

Australia	22.5 %
USA	17.2 %
China	16.6 %
Peru	9.0 %
Canada	5.3 %

Mexico	4.0 %
Sweden	3.8 %

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 ton at the end of 1987 and since then it increased by almost 100%. Metal price at LME (commodity B, refined metal having minimum 99.97 % Pb) reached its peak in 1979 - GBP 556 per ton (Cash). The price of lead is decreasing in the last years. 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 ton:

Commodity/Year	1996	1997	1998	1999	2000
A	168	170	195	187	187
B	775	626	516	503	454

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 major 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 USA, Germany, France, Great Britain, Japan and Canada took part in the recycling.

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. Lead in the manufacture of pigments is also being efficiently replaced by other agents. 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.

ZINC

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 origin, the same way as lead ores. Economic demonstrated reserves of Zn in the world are estimated at 144 mill.tons. Potential source of zinc may be also zinc-bearing coal, in which the content of zinc is estimated at an order of millions of tons.

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.

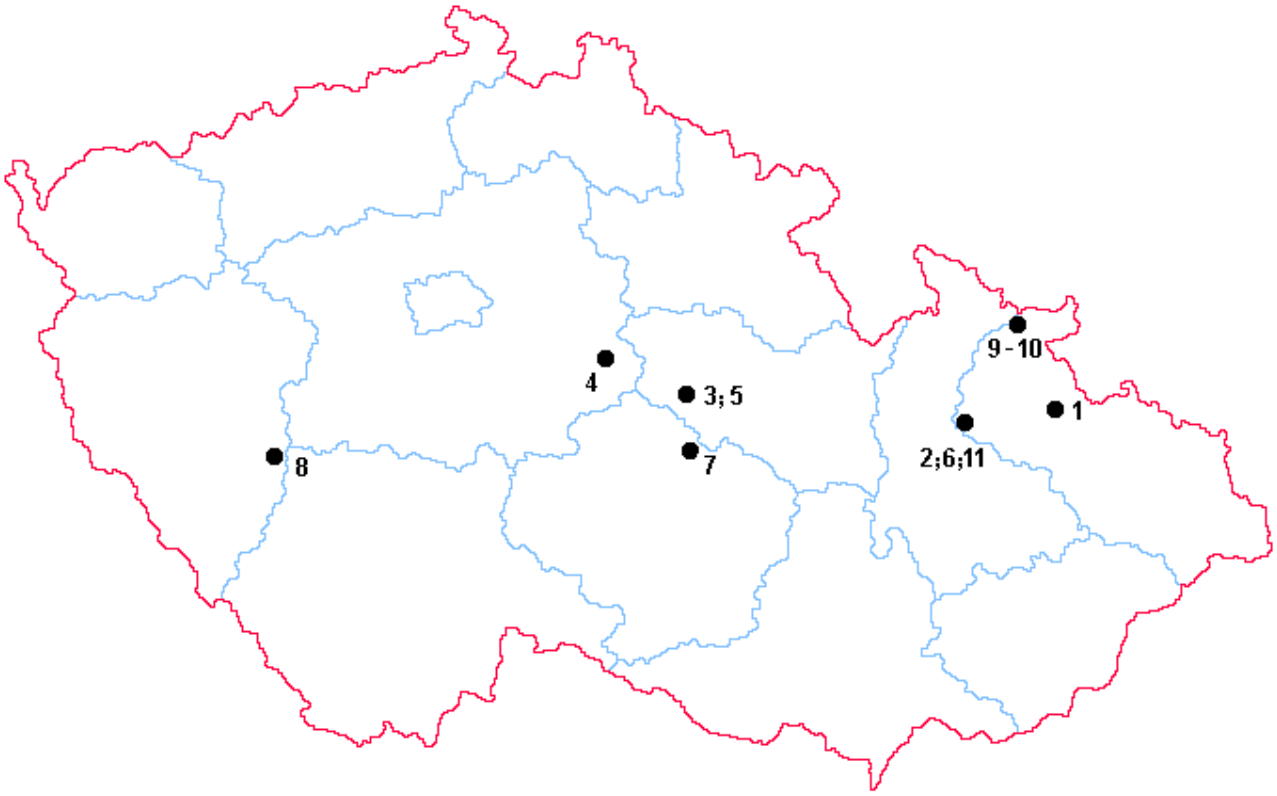
2. Mineral resources of the Czech Republic

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

- Large volume of zinc ores represented mostly by sphalerite was extracted from the base metal deposits of the Březové Hory, Bohutín and Vrančice ore districts in the vicinity of Příbram. Zinc ores were also verified in other historical as well as in newly explored vein-type deposits. The grade of these ores ranges between 1.0 and 2.9 %.
- The most important base metal deposits of volcaniclastic origin occur in the Jeseníky Mountains. Disseminated sulphide ores grading 0.7-2.6 % Zn were mined in the deposits of Horní Město (till 1970) and Horní Benešov (till 1992). Mining operations in the Zlaté Hory ore district were terminated in 1993.
- The deposit of Staré Ransko - Obrázek is of enigmatic origin. A sphalerite-barite ore, having up to 1.8 % Zn, was mined here until 1990. The Křižanovice deposit of Pb-Zn-Cu ores with barite is classified as volcaniclastic mineralization. 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 in line with the policy of gradual reduction of ore mining adopted by the Government. A composite Pb-Zn concentrate was the final product of mining the base metal ores. The concentrate was exported because there was no smelter in the Czech Republic.

3. Registered deposits and their location in the Czech Republic



Reserves of Zn in ores are registered in 12 deposits. The most important of them are shown on the map.

1	Horní Benešov	6	Oskava
2	Horní Město	7	Staré Ransko-Obrázek
3	Křižanovice	8	Újezd u Kasejovic
4	Kutná Hora	9	Zlaté Hory-east
5	Liboměřice	10	Zlaté Hory-west

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

Year	1996	1997	1998	1999	2000
Deposits – total number a)	30	22	18	16	12
exploited	0	0	0	0	0
Total mineral resources, kt Zn	1 036	882	802	695	740
economic proved reserves	75	41	41	0	0
economic probable reserves	234	220	146	48	5
potentially economic resources	727	621	615	647	735
Mining production, t Zn	0	0	0	0	0

Note:
a) deposits with balanced Zn content

5. Foreign trade

2608 – Zinc ores and concentrates

Raw material	1996	1997	1998	1999	2000
Import, t	1	0	1	7	1
Export, t	0	0	0	0	0

7901– Unwrought zinc

Raw material	1996	1997	1998	1999	2000
Import, t	17 528	20 101	22 394	21 238	27 724
Export, t	283	3 008	757	1 861	2 865

7902 – Zinc waste and scrap

Raw material	1996	1997	1998	1999	2000
Import, t	0	6	4	22	16
Export, t	3 734	4 794	2 509	2 607	2 750

6. Prices

27.7 kt of crude zinc were imported from Poland (58.1 %), from Germany (11.6 %) and from Kazakhstan (4.6 %) in 2000. The average price was CZK 46 261 per ton.2,9 kt of crude zinc were exported to Netherlands (29.3 %), to Germany (28.6 %) and to Hungary (18.9 %) on average price CZK 47 135 per ton.

2.75 kt of zinc waste and scrap were exported to Germany (82.9 %) and to Austria (10.3 %) on average price of CZK 16 316 per ton. Only 16 t were imported from Germany (55.0 %) and from Slovakia (27.5 %) on average price of CZK 9186 per ton. Foreign trade in Zn-ores was insignificant in 2000.

7. Mining companies in the Czech Republic as of December 31, 2000

In 2000 no companies were operating in the Czech Republic to extract Zn ores.

8. World production

Production of zinc ores exceeded 7 mill. tons in metal content in 1985. Increase in production terminated in 1992 and in the next years mining 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.

While the Canadian production is decreasing, mining production of Australia, USA and Peru is increasing in the last years. The most significant increas in mining production was monitored in China (1000 kt in 1995; 1476 kt in 1999). Data according to Mineral Commodity Summaries (MCS) and the Welt-Bergbau-Daten (WBD).

Year	1996	1997	1998	1999	2000 e
Mining production, kt Zn (MCS)	7 440	7 460	7 550	8 040	8 000
Mining production, kt Zn (WBD)	6 865	6 963	7 553	N	N

Main producers (1999; according to MCS):

China	17.0 %
Australia	14.4 %

Canada	12.6 %
Peru	11.2 %
USA	10.5 %

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 an expressive fall in prices occurred owing to a continuous increase in stock. A trend in average prices of the commodities (A and B – year-end, C - annual) was as follows:

Commodity/Year	1996	1997	1998	1999	2000
A	189	171	187	168	189
B	190	172	188	170	190
C	1 026	1 332	991	1 076	1 132

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

Zinc in foundries is replaced by aluminium, plastics and magnesium. Galvanic zinc plating is replaced by coatings of aluminium alloys, pigments, plastics and cadmium. Zinc plates are completely replaced by other materials like stainless steel, aluminium, plastics etc. Aluminium alloys substitute for brass. Zinc is also efficiently replaced by other materials in the manufacture of chemicals, electronic devices and pigments.

TIN

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 river bed, are most important and the richest ones among the secondary deposits. World economic reserves are estimated at 8 mill.tons of metal.

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

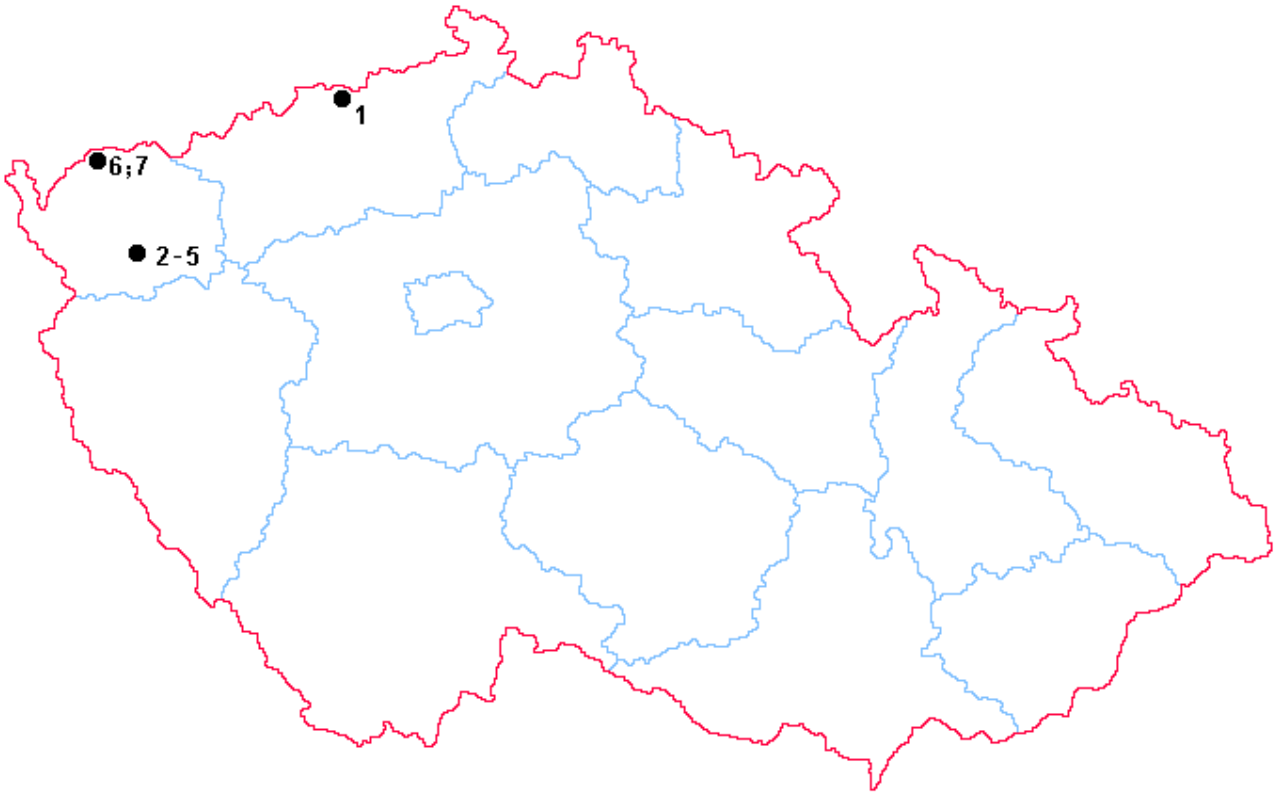
2. Mineral resources of the Czech Republic

Tin deposits of the Czech Republic are almost exclusively concentrated in the Krušné hory Mountains region, where they were mined since 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 ore district is also rich in hydrothermal quartz veins with cassiterite, wolframite and/or Bi and Mo minerals. Sn-W ores with 0.2 - 0.5 % Sn were mined in greisen type deposits.
- An interesting type of Sn mineralization occurs at Zlatý Kopec near Boží Dar, where tin minerals are confined to 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 Old Bohemian zone of the Kutná Hora mining district. Due to the complex character of the ore, the Sn mineralization is of rather scientific importance, particularly from the viewpoint of metallogeny and specific mineral assemblage.

Placer deposits near the primary ores of the Krušné hory region are in principleexhausted. Only some Sn-W placers in the Slavkovský les area have been preserved and appear to be still economic and mineable.

3. Registered deposits and their location in the Czech Republic



1 Cínovec-south
2 Horní Slavkov-the Hány elevation
3 Krásno
4 Krásno-Horní Slavkov
5 Krásno-Koník
6 Přebuz
7 Rolava-east

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

Year	1996	1997	1998	1999	2000
Deposits – total number a)	14	11	11	7	7
exploited	0	0	0	0	0
Total mineral resources, t Sn	234 913	208 076	208 076	174 500	174 500
economic proved reserves	3 757	3 014	3 014	3 014	3 014
economic probable reserves	37 266	12 425	12 425	7 314	7 314
potentially economic resources	193 890	192 637	192 637	164 172	164 172
Mining production, t Sn	0	0	0	0	0

Note:
a) Sn-W ore deposits

5. Foreign trade

2609 – Tin ores and concentrates

Raw material	1996	1997	1998	1999	2000
Import, t	1	0	0	0	0
Export, t	0	0	0	0	0

8001– Unwrought tin

Raw material	1996	1997	1998	1999	2000
Import, t	615	587	436	483	556
Export, t	175	219	15	110	20

8002 – Tin waste and scrap

Raw material	1996	1997	1998	1999	2000
Import, t	0	0	0	1	0
Export, t	42	5	15	12	16

6. Prices

556 tons of crude tin were imported from China (72.5 %) and from Germany (7.3 %) in 2000. Average price was CZK 212 768 per ton. 20 tons were exported to Slovakia (67.2 %) and to Germany (32.7 %) on average price of CZK 117 402 per ton. Also 16 t of tin waste and scrap were exported to Germany (84.7 %) and to Austria (15.3 %) on price of CZK 86 921 per ton. Tin ores were imported in a negligible quantity in 2000.

7. Mining companies in the Czech Republic as of December 31, 2000

There were no mining companies operating on the territory of the Czech Republic to extract ores with Sn content in 2000.

8. World production

The world production of tin concentrates has been permanently around 200 kt of Sn metal per year. According to statistical data, the production reached its peak in 1981 - 238.9 kt.

In contrast to decreasing mining production of Brazil, Indonesia and Portugal, production in China and Peru is still higher. Data according to Mineral Commodity Summaries (MCS) and the World Mineral Statistics (WMS).

Year	1996	1997	1998	1999	2000 e
Mining production, kt Sn (MCS)	196	211	206	198	200
Mining production, kt Sn (WMS)	221	219	206	217	N

Main producers (1999; according to MCS):

China	31.3 %
Indonesia	24.2 %
Peru	15.2 %
Brazil	6.6 %
Bolivia	5.6 %
Australia	5.1 %

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 influences the prices of tin greatly recently, because the government provides a few of export licences.

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

Commodity/Year	1996	1997	1998	1999	2000
A	525	525	525	525	525
B	375	375	375	375	375
C	345	345	345	345	345
D	6 171	5 661	5 503	5 398	5 441

10. Recycling

Only a small quantity of tin is recycled, tin removal from white plates is to a large extant a financially demanding process. According to the UNCTAD data, only 10 % of the tin world consumption is represented by the recycled metal.

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. Some chemicals are replaced by Pb and Na compounds.

TUNGSTEN

1. Characteristics and use

High concentrations of tungsten are always associated to granites. Primary tungsten ores are confined to pegmatite and greisen deposits geneticallyrelated to acid granitoid intrusions and on scheelite skarn deposits. Tungsten ores often occur together with Sn, Mo, Cu and Bi ores. Among the known tungsten minerals, only wolframite (having as much as 75 % WO_3) and scheelite (up to 80 % 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. tons, 40 % of which occur in China.

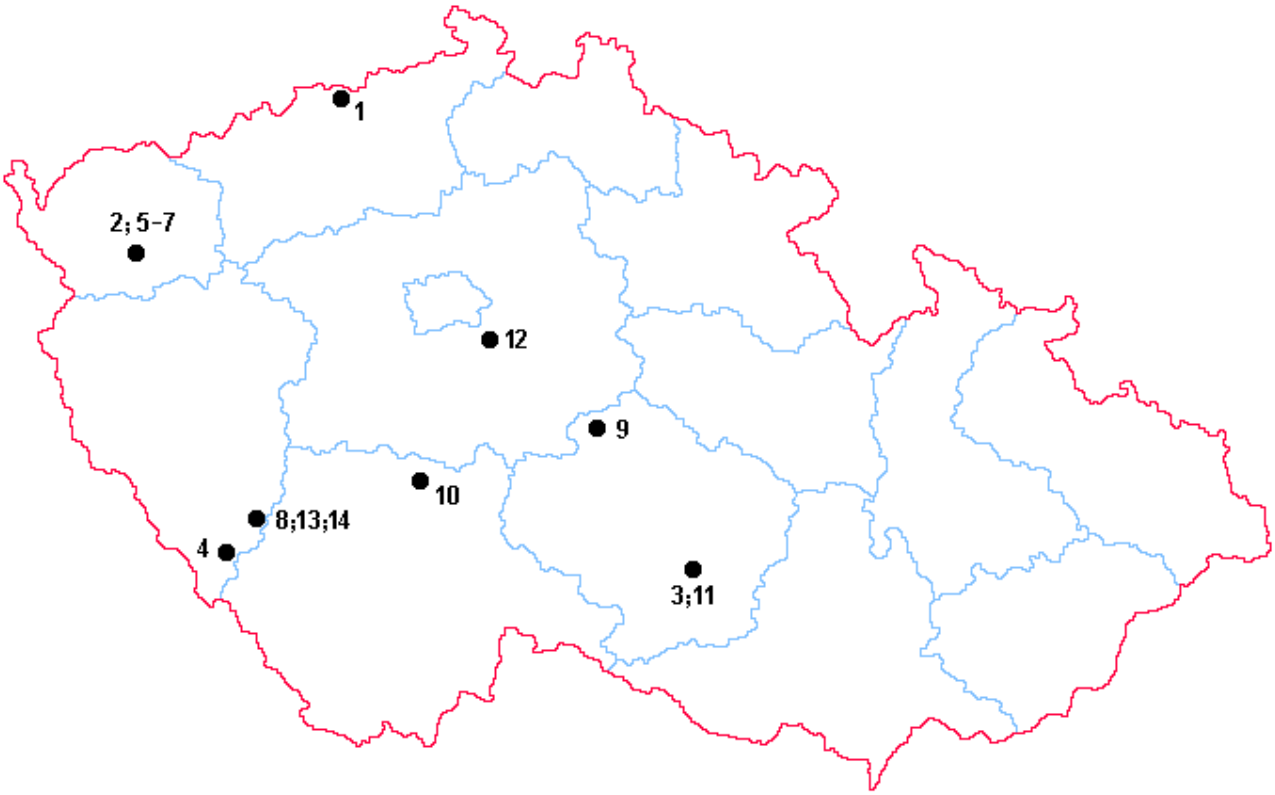
Tungsten ores and concentrates are processed to obtain intermediate products - ammonium paratungstate (APT), tungstic acid, sodium tungstate, metal powder and powder tungsten carbide. Much tungsten is consumed in alloyed steels used in heavy engineering, particularly in the armament industry. Much tungsten is also used in the manufacture of cutting tools and tools for oil and gas exploitation and mining of solid minerals (drilling bits made of tungsten carbide). About 80 % W is consumed in the afore mentioned 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 greisen Sn-W ores of the Cínovec 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.

- Greisens rich in Sn (Krásno, Cínovec) as well as 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 stringers at Rotava and disseminated scheelite in calc-silicate rocks of Vykmanov near Perštejn.
- Typical contact metasomatic scheelite mineralization occurs in the exocontact of the Krkonoše-Jizerské hory Mts. and Žulová plutons. However, known localities of Obří důl and Vápenná are of no economic importance.
- Numerous localities of W-ores were found in the Moldanubicum of the Bohemian Massif. They are represented by quartz veins with wolframite and/or scheelite which mostly occur along the exocontacts of the Variscan granitoids and disseminated or vein scheelite confined to calc-silicate rocks. Some localities represent rather large strataboud deposits of scheelite-bearing crystalline schists and/or skarn types. 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 to discover 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.

3. Registered deposits and their location in the Czech Republic



1 Cínovec-Souh
2 Horní Slavkov-the Hány elevation
3 Hostákov
4 Kašperské Hory
5 Krásno
6 Krásno-Horní Slavkov
7 Krásno-Koník
8 Malý Bor-k.462
9 Nezdín
10 Sepekov
11 Slavice
12 Tehov
13 Týnec-Hliněný Újezd-East
14 Týnec-Hliněný Újezd-West

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

Year	1996	1997	1998	1999	2000
Deposits – total number a)	19	18	18	14	14
exploited	0	0	0	0	0
Total mineral resources, t W	95 120	93 948	93 948	73 661	73 661
economic proved reserves	127	0	0	0	0
economic probable reserves	52 488	53 373	53 373	44 224	44 224
potentially economic resources	42 505	40 575	40 575	29 437	29 437
Mining 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	1996	1997	1998	1999	2000
Import, t	11	18	52	61	25
Export, t	128	137	105	128	61

8101– Tungusten and articles thereof, including waste and scrap

Raw material	1996	1997	1998	1999	2000
Import, t	167	125	89	52	184
Export, t	109	116	174	133	372

720280 – Ferro-tungusten and ferrosilicotungusten

Raw material	1996	1997	1998	1999	2000
Import, t	26	141	71	23	39
Export, t	961	745	63	0	2

6. Prices

184 t of tungsten were imported from Poland (47.4%), from France (21.0 %) and from Germany (9.7 %) in the Czech Republic in 2000. Average price was CZK 442 370 per ton.372 t were exported to Poland (38.1 %), to Germany (22.6 %) and to Austra (15.2 %) on average price of CZK 456 946 per ton. Also 25 t of tungsten ores were imported from Netherlands (100%) on price of CZK 10 435 per ton. There were exported 61 t of tungsten ores to Ukraine (99.9%), average price was CZK 94 516 per ton. 39 t of ferro-tungusten and ferrosilicotungusten were imported from China (73.6 %) and Russia (25.1 %) on average price of CZK 125 524 per ton. Only 2 t were exported to Slovakia (90.4 %) on average price of CZK 177 233 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

In 2000 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 the peak in 1989 - 52 kt. The subsequent drop in prices occured connected with a limitation in demand on the world market resulted from the economic recession and from structural changes in major consumer branches.

The data on the world mining production are in particular yearbooks different: According to Mineral Commodity Summaries (MCS), the world production of tungsten has not been changed a lot and it has been oscillating between 31 and 33 kt in the last years. According to World Mineral Statistics (WMS), the world production of tungsten has been slowly decreasing.

Year	1996	1997	1998	1999	2000 e
Mining production, t W (MCS)	32 000	33 400	32 200	31 000	31 500
Mining production, t W (WMS)	36 300	34 500	30 900	26 500	N

Main producers (1999; according to MCS):

China	77.4 %
Russia	11.3 %
Austria	5.2 %
Korea, D.P.R. of	2.3 %
Portugal	1.5 %
Bolivia	1.1 %

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 scope 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 is assumed to have been 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. 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	1996	1997	1998	1999	2000
A	48	47	37	43	53
B	67	58	52	49	84

10. Recycling

Recycling of W is carried out only in the USA, Japan and Western Europe. According to incomplete data, recycling accounts for 20-30 % 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

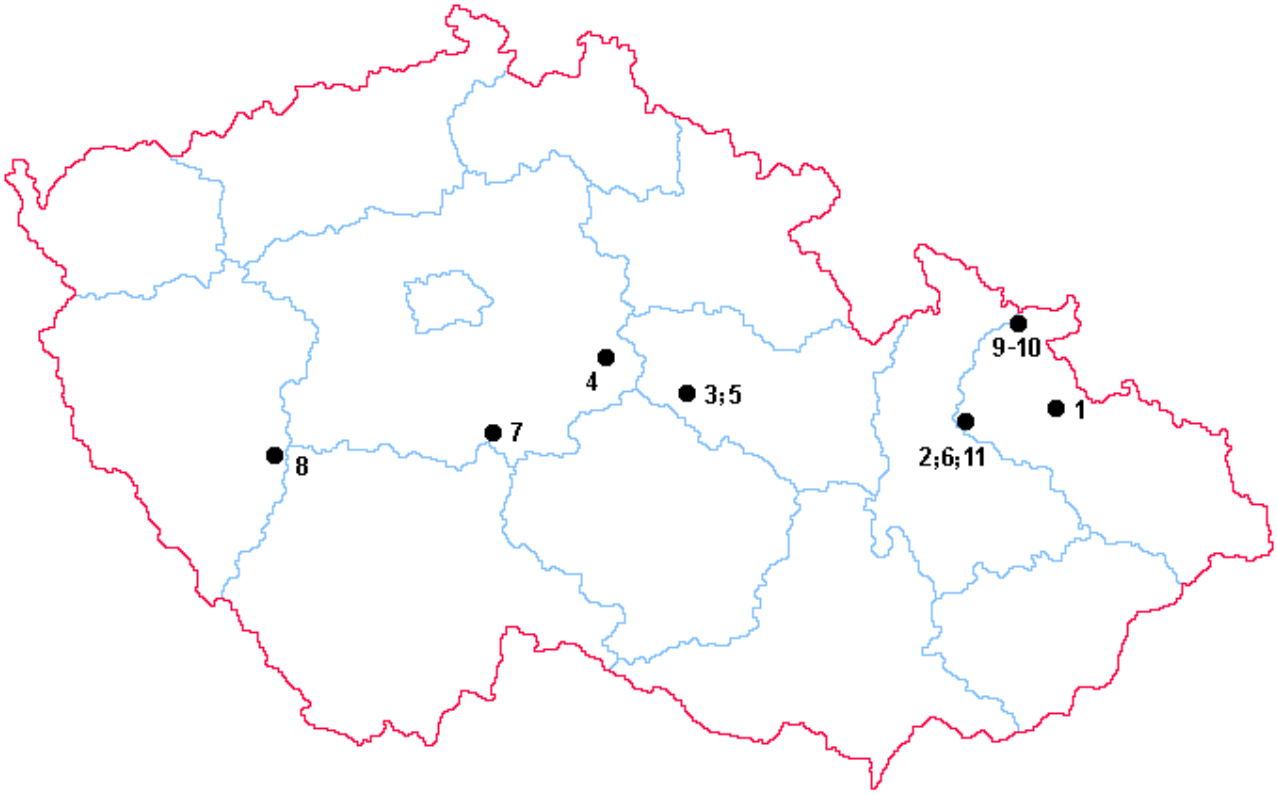
Silver is an element of chalcophile character, which during the magmatic differentiation tends to concentrate in minerals of late stages or hydrothermal fluids. About 2/3 of the silver world reserves occur in Cu and Pb-Zn deposits of various origin. Remaining 1/3 of Ag occurs in hydrothermal vein deposits, where it is the major economic element. The major silver-bearing minerals are argentite, hessite, Ag-galena, kerargyrite, polybasite, pyrargyrite, stromeyerite, sylvanite and tetrahedrite (freibergite). Silver fineness is expressed in thousandths of total metal; sterling silver, its commonest alloy, contains of 95.5% silver (fineness of 925/1000). 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 reserves in the Czech Republic occurs in base metal sulphide deposits, where it forms an isomorphous admixture particularly in galena. Minimum Ag grade was found to occur in all base metal deposits, e.g. 8-20 ppm Ag in base metal ores of the Horní Benešov deposit, 15 ppm Ag at Zlaté Hory - east, 15-22 ppm Ag at Horní Město, 30-50 ppm at Kutná Hora, etc. Some Ag was extracted as a by-product 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.
- 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 and Stříbro were an important source of European silver in the past. The deposits represent classic types of base metal and other metallic deposits.

3. Registered deposits and their location in the Czech Republic



Reserves of silver are registered in 12 deposits of polymetallic ores. The most importand deposits are shown on the map.

1 Horní Benešov
2 Horní Město
3 Křižanovice
4 Kutná Hora
5 Liboměřice
6 Oskava
7 Roudný – Aleška
8 Újezd u Kasejovic
9 Zlaté Hory-east
10 Zlaté Hory-west
11 Ruda near Rýmařov-north

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

Year	1996	1997	1998	1999	2000
Deposits – total number a)	32	22	22	16	12
exploited	0	0	0	0	0
Total mineral resources, t Ag	1 035	772	590	539	586
economic proved reserves	8	0	0	0	0
economic probable reserves	344	308	175	45	1
potentially economic resources	683	464	415	494	585
Mining production, kg Ag	0	0	0	0	0

Note:
a) deposits with balanced Ag content

5. Foreign trade

261610 – Silver ores and concentrates

Raw material	1996	1997	1998	1999	2000
Import, kg	0	0	21	36	46
Export, kg	0	0	2	0	0

7106 – Silver, unwrought/in semi-manufactured/pdr form

Raw material	1996	1997	1998	1999	2000
Import, kg	27 879	69 979	90 423	102 789	147 991
Export, kg	33 269	86 186	84 400	105 084	121 707

6. Prices

148 t of crude silver were imported from Germany (79.6 %), from Italy (8.7%) and from Austria (3.7 %) in 2000. Average price was CZK 6173 per ton. There were exported 122 t of crude silver to Germany (56.0 %) and to Slovakia (43.0 %) on average price of CZK 7735 per ton. In 2000, only 46 kg of ores containing silver were imported from France.

7. Mining companies in the Czech Republic as of December 31, 2000

In 2000 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 10,000 t per year in 1976. Since then it was increasing and reached its peak in 1989 - 15,835 t.

Mining production was gradually decreasing and reached the quantity of 13 800 in 1994. Since 1996, the world production of silver has been increasing again. The last maximum production was reached in 1999. Nowadays the high mining production causes the low silver prices. Data on silver production according to Mineral Commodity Summaries (MCS) and World Mineral Statistics (WMS):

Year	1996	1997	1998	1999	2000 e
Mining production, t Ag (MCS)	15 200	16 400	16 400	17 700	17 900
Mining production, t Ag (WMS)	15 108	16 070	16 621	16 990	N

Main producers (1999; according to MCS):

Mexico	13.2 %
Peru	12.5 %
USA	11.0 %
Australia	9.7 %
Canada	7.1 %

Only about 17% of silver was obtained by mining and processing of silver ores. Majority of silver was a byproduct of dressing of copper (27%), lead-zinc (41%) and gold-bearing (15%) ores. Extracted silver covered about 60% of consumption. Jewelry represents an importend consumer of silver.

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	1996	1997	1998	1999	2000
A	515	489	508	522	496

Fluctuations in silver world prices reflect among others political situation and speculations on the market similary to other precious metals.

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 is attributed to low prices of silver, its lower content in secondary raw materials and restrictive measures in stockpile policy.

11. Possible substitutes

Silver is efficiently replaced in numerous fields. Photomaterials 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 dental alloys are replaced by ceramic materials. Sterling silver was, except memorial mints and several exceptions (i.e. 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 two large groups according to their origin: volcano-sedimentary and volcano-plutonic. 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 and/or 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 by-product. The grade or fineness of gold is given in carats or in 1000 units (fine gold 24 carats = 1000, 10 carats = 10/24 = 41.7 % = 417/1000). Total economic world reserves are estimated at 46 kt of Au, 15 to 20 % of which occur as a minor constituent in other ore deposits. Much gold is used in jewelry (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.

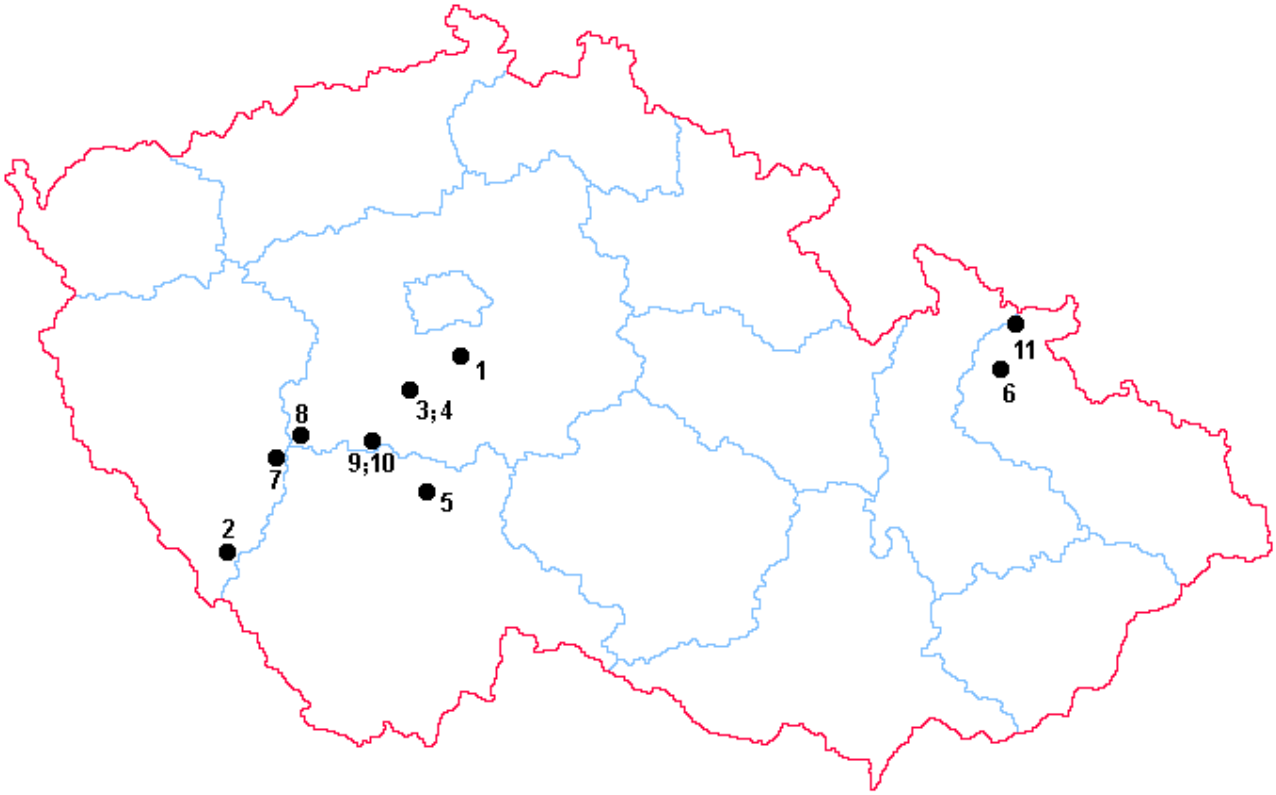
2. Mineral resources of the Czech Republic

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 confined to regionally metamorphosed volcaniclastic 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-west).
- Some hydrothermal quartz veins with gold as well as stratabound gold mineralization with scheelite (Kašperské Hory) and quartz veins and stringers with Ag (Roudný) occur in the crystalline complex of the Moldanubicum.
- 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 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-west base metal deposit in 1993.

3. Registered deposits and their location in the Czech Republic



26 deposits of gold are registered in balance of reserves. Just in eight localities the accumulation is of higher importance. The important localities are shown on the map.

1 Jílové u Prahy
2 Kašperské Hory
3 Mokrsko
4 Mokrsko-east
5 Sepekov
6 Suchá Rudná-central part
7 Újezd u Kasejovic
8 Vacíkov
9 Voltýřov
10 Voltýřov-placer
11 Zlaté Hory-west

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

Year	1996	1997	1998	1999	2000
Deposits – total number	27	27	27	26	26
exploited	0	0	0	0	0
Total mineral resources, kg Au	249 660	249 660	249 660	248 989	248 989
economic proved reserves	48 740	48 740	48 740	48 740	48 740
economic probable reserves	86 600	86 600	86 600	86 600	86 600
potentially economic resources	114 320	114 320	114 320	113 649	113 649
Mining production, kg Au	0	0	0	0	0

5. Foreign trade

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

Raw material	1996	1997	1998	1999	2000
Import, kg	4 728	3 934	2 645	2 244	1 845
Export, kg	5 021	3 453	2 970	3 484	3 573

6. Prices

1.85 t of crude gold were imported from Germany (78.9 %) and from Austria (13.3 %) in 2000. Average price was CZK 184 595 per kgs. 3.57 t of crude gold were exported in this period to Germany (57.7%), to Switzerland (25.8 %) and to Slovakia (8.2 %). Average price was CZK 262 849 per kgs. No ores containing gold were imported in 2000.

7. Mining companies in the Czech Republic as of December 31, 2000

In 2000 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 1999 with a production of 2540 tons of metal. The major producing countries were as follows (according to Mineral Commodity Summaries - MCS, World Mineral Statistics – WMS and the Welt Bergbau Daten - WBD):

Year	1996	1997	1998	1999	2000 e
Mining production, t Au (MCS)	2 250	2 410	2 460	2 540	2 445
Mining production, t Au (WMS)	2 270	2 420	2 450	2 490	N
Mining production, t Au (WBD)	2 246	2 433	2 316	N	N

Main producers (1999; according to MCS):

South Africa	17.7 %
USA	13.4 %
Australia	11.9 %
China	6.7 %
Canada	6.2 %
Indonesia	5.1 %
Peru	5.0 %
Russia	4.1 %

The first three countries produce more than 40% of all world production. In their territories more than 65% of world reserves is concentrated.

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-year 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 were 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 were oscillating on a very low level in the major part of the year.

Commodity/Year	1996	1997	1998	1999	2000
A	387,70	331,00	291,00	279,00	279,00

10. Recycling

Gold is widely recycled from jewelry and other industries. Recycling may reach as much as 50 % worldwide, even though the data on recycling are rather difficult to obtain.

11. Possible substitutes

The consumption of gold and its alloys in jewelry 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 jewelry, however, gold and its alloys are indispensable.

MINERAL FUELS - GEOLOGICAL RESERVES AND MINING PRODUCTION

Significant geological reserves of mineral fuels in 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 percents of the world reserves.

Coal production originated in the Czech countries in the 19th century in the beginning of the industrial revolution. After the 2nd World War uranium ore mining developed. Production of mineral fuels 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 reclaimings reached CZK 25.4 milliards in coal industry and CZK 19.7 milliards in uranium industry in 1990-2000. High subventions for coal industry damping will continue also in 2001, when the total granted amount will be CZK 4,020 mill. However half of this sum is reserved for social compensations. 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 and brown coal are 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 purchased both strategic raw materials for CZK 82.3 milliards (in 1999 it was only 41 milliards). This amount represented 90 % of all finances used for purchase of primar mineral row materials.

Mining of mineral fuels

Raw material	Unit	1996	1997	1998	1999	2000
Uranium ore	t U	589	624	611	605	498
Hard coal	kt	21 784	20 847	19 521	17 227	17 028
Brown coal	kt	59 539	57 395	51 283	44 858	50 610
High volat. lignite	kt	902	747	652	512	453
Crude oil	kt	155	159	172	176	168
Natural gas	mill. m3	146	118	137	143	118

Lifetime of industrial reserves (economic proved mineable reserves) after the decrease of reserves by production incl. losses of registered deposits per year 2000 (A) and the average annual decrement of reserves in period 1996-2000 (B) was as follows:

Raw material	Lifetime – A (years)	Lifetime - B (years)
Uranium ore	41	35
Hard coal	91	81
Brown coal a)	35	34
High volat. lignite	383	266
Crude oil	66	67
Natural gas	14	12

a) including reserves blocked by area limits

URANIUM

1. Characteristics and use

The most frequent genetic types of uranium deposts are hydrothermal (mostly vein), sedimentary, infiltration, metamorphogenic and albitite ones. Uranium is present in several tens of minerals (exclusively oxidic compounds), of which economically most important are oxides (uraninite - pitchblende), phosphates (torbernite, autunite), silicates (coffinite) and organic compounds (anthraxolite). The most important uranium deposits are situated in Canada, USA, Zaire, South Africa and Australia. World reserves are estimated at 2.1 mill.tons of uranium metal.

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

Uranium compounds were used originally in dyes for ceramics and glass production. Nowadays uranium is used in fuel elements for nuclear reactors production, 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

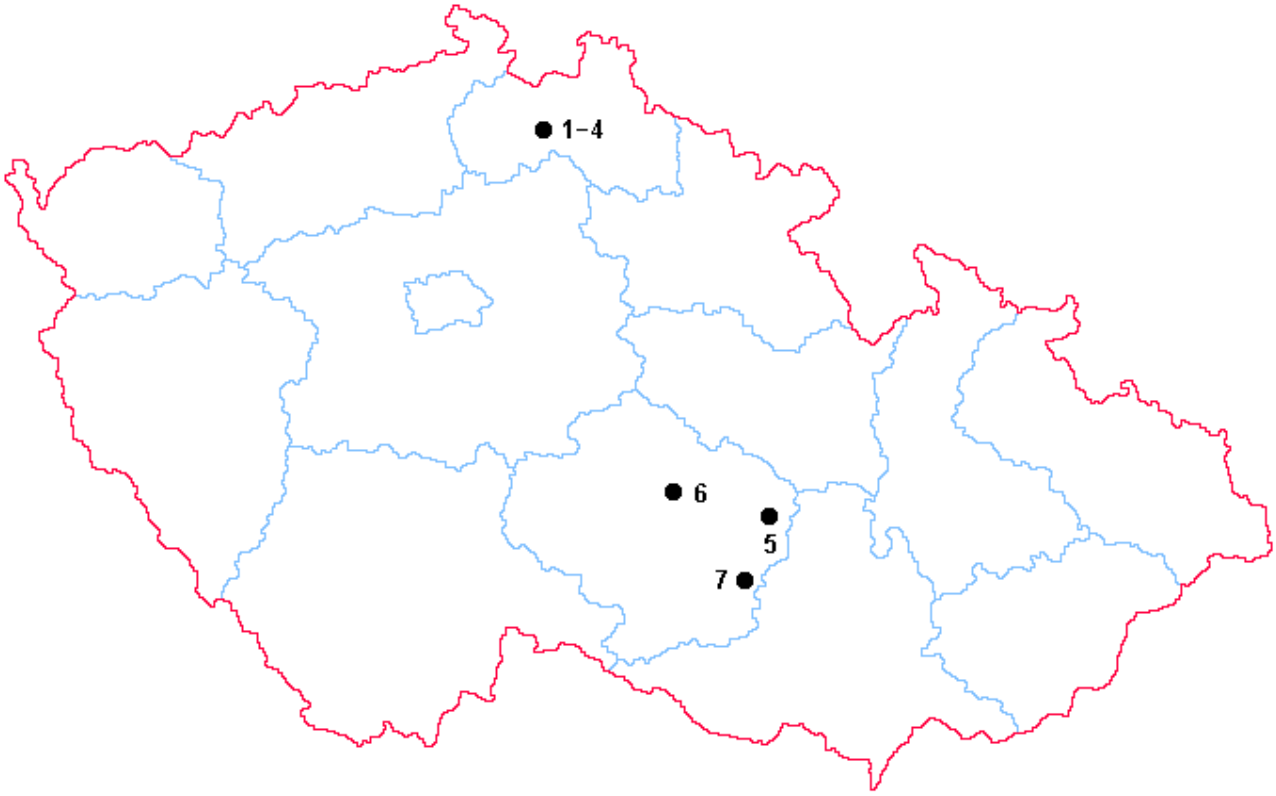
Two major periods of the formation of uranium deposits can be distinguished in the Bohemian Massif - Late Variscan and Alpine. The deposits can be classified in 6 morphogenetic types:

- crushed zones with graphite and disseminated uranium ores in crystalline rocks of the Bohemian Massif (Rožná, Zadní Chodov),
- veins and vein systems - hydrothermal deposits related to Variscan granitoids (Jáchymov, Slavkov, Příbram),
- metasomatic mineralization in chloritized granitoids of the Borek massif (Vítkov II, Lhota) and Central Bohemian pluton (Nahošín),
- stratabound mineralization confined to the Late Paleozoic sediments- in coal seams of the Intra-Sudetic and Kladno-Rakovník basins,
- uranium mineralization in Cretaceous sediments - ore bodies confined to Cenomanian sediments of the Laussicum development of the Bohemian Cretaceous basin,
- stratabound mineralization in Tertiary basins - small deposits of high-grade ore in sediments richin organic matter in the broader vicinity of Karlovy Vary.
- Deposits of economic grade and/or historical important deposits are concentrated in the following regions, including brief characteristics of the mineralization:
- north Bohemian region - mineralization in Cretaceous sediments,
- Moravian region - mineralized fracture zones and hydrothermal veins,
- Krušné hory Mts. region - mineralization in Tertiary sediments and exhausted hydrothermal vein deposits (Jáchymov, Slavkov),
- west Bohemian region - metasomatic mineralization,
- central Bohemian - metasomatic and already exhausted hydrothermal veins (Příbram).

Of the registered deposits only Hamr and Stráž in the Bohemian Cretaceous basin and mineralized fracture zone at Rožná were mined in 2000. Underground mining takes place at Rožná (in average grading 0.308 % U in proven reserves), whereas the

Stráž deposit (in average grading 0.031 % U in proven 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 were Czech Power Plants.
Tailing pond in Stráž pod Ralskem, where waste leach of deposit with 0.030-0.063% of rare earths was accumulated for 30 years, is a potential source not only of rare earths (lanthanum - gadolinium) but also scandium, yttrium and niobium. Reserves have not been evaluated yet. Contemporary uranium consumption (in nuclear power station Dukovany) reaches 330 t per year. A surplus of production was deposited as state material reserves. Annual consumption should increase into 690 t after starting two blocks of the nuclear power station Temelín.

3. Registered deposits and their location in the Czech Republic



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

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

Year	1996	1997	1998	1999	2000
Deposits – total number	16	13	13	13	7
exploited	1	1	1	1	1
Total mineral resources, t U	141 069	139 396	139 528	139 141	137 205
economic proved reserves	22 615	21 527	21 229	20 926	20 389
economic probable reserves	34 800	21 946	21 685	21 720	20 858
potentially economic resources	83 654	95 923	96 614	96 495	95 958
Mining production, t U	589	624	611	605	498

5. Forign trades
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, 2000
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 45,646 tons of uranium was reached in 1990. Major uranium producing countries were as follows (according to the Welt-Bergbau Daten - WBD and Engineering and Mining Journal - EMJ):

Year	1996	1997	1998	1999 e	2000 e
Mining production, t U	40 142	35 551	37 963	38 200	38 000

Main producers (1998; WBD):

Canada	31.0 %
Australia	15.2 %
Niger	11.6 %
Namibia	8.6 %
Russia	6.2 %
Uzbekistan	6.0 %
USA	5.8 %
South Africa	3.0 %
Gabon	2.3 %

In 1997, 91 % of uranium were obtained by U-ores mining (39 % by surface mining, 39 % by underground mining and 13 % by in situ leaching) and 9 % was obtained as a by-product of the Au- V- and Cu- ores mining (according to The Uranium Institute).

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 revealing the spot prices. So far the highest price was reached in 1978 - USD 95 per kg U_8O (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. The prices increased substantially only in 1996. However, high offer of uranium causes a continuing decrease of the price at present.

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	1996	1997	1998	1999	2000
A	27,2	23,7	19,9	18,7	15,7

Prices for spot sales and future deliveries are 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 European market are treble the prices for spot sales.

General low level in prices has been due to global political relaxation and economic changes. Until 1995 there was a surplus of uranium due to nuclear disarmament (large supplies from Russia for USD 15.4 - 15.9 per kg U_3O_8), reduction of consumers stockpiles and declining nuclear energy generation, etc.

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 vs. 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 73.4 % carbon, less than 50 % volatile matter and dry (ash free) caloric value 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 to produce coke for blast-furnace production of pig iron and/or for heating. Other coal is marked as steam coal (40 % of electric energy is generated by burning of coal).

Total world deposit reserves of the hard coal are estimated at more than 500,000 mill. tons.

2. Mineral resources of the Czech Republic

Both the coking coal and the steam coal deposits occur on territory of the Czech Republic.

- Coking coal occurs mostly in the Upper Silesian basin. About 15% of reserves are in the Czech Republic and about 85% in the territory of Poland.

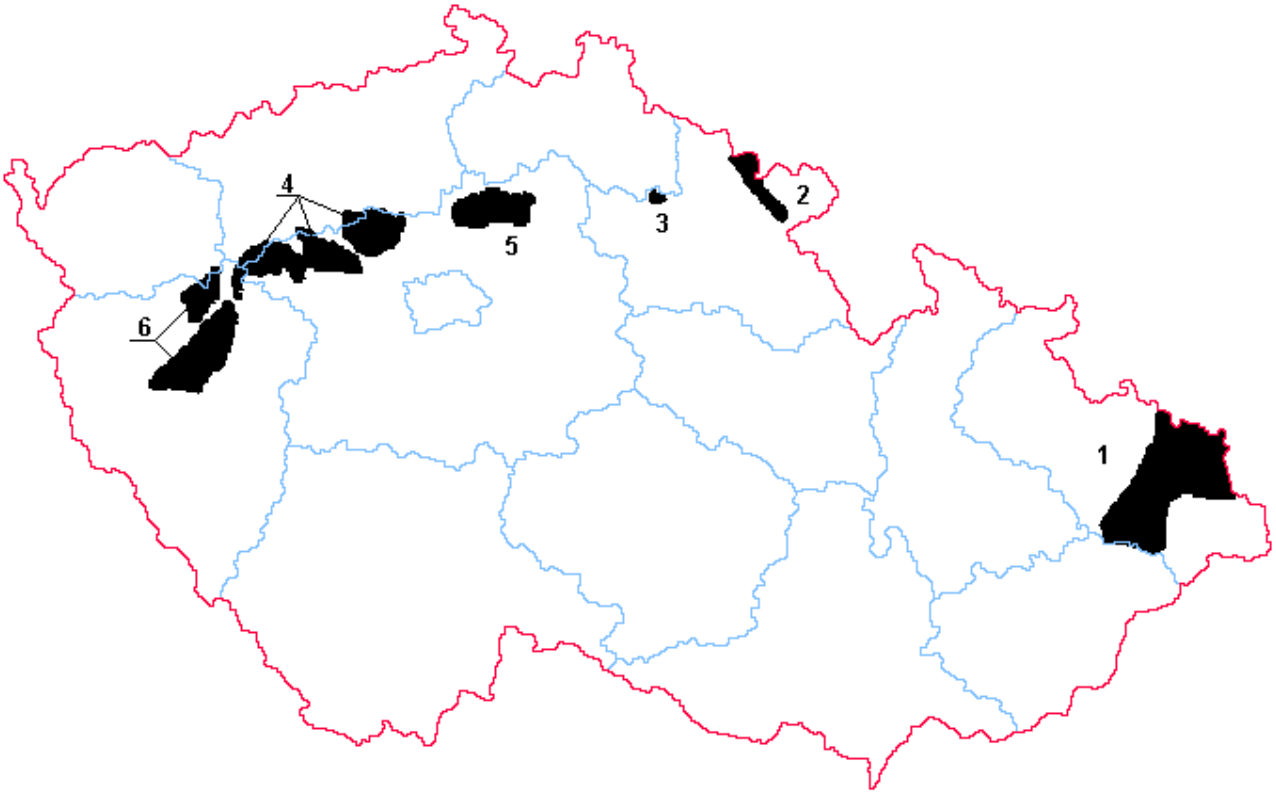
The major fault, called the Orlová fault, divides the Moravian part of the Upper Silesian basin into the western section (the Ostrava part), which is older and of paralic character of sediments and coal seams, and the eastern section (the Karviná part), which exhibits limnic character of the sediments as well as of coal. The western part consists of several tens of thin coal seams off high grade coking coal, whereas the eastern part is characterised by abundant thick seams containing mixed coking coal and high volatile steam coal.

Mining in the Ostrava part of the basin reached the depth of about 1,000 m, which together with complex and unfavorable mining and geological conditions makes economic mining extremely difficult. Consequently, the Ostrava mines were gradually abandoned. The majority of mines in the eastern part have enough reserves which can be extracted with much lower costs. However, this coal is of lower grade, as far as coking properties are concerned.

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. As the deposit is situated on the border of protected landscape area, there can arise conflicts of interests with Beskydy protection in the case of its mining.

- Another area with reserves of hard coal occurs in central Bohemia, west of Prague. The majority of coal reserves of the Kladno-Rakovník basin (steam coal) were already mined out and remaining three mines, still in operation, have limited volume of mineable reserves. Another deposit of coking coal was discovered and explored in the fifties and sixties near Slaný. It extends NE from the Kladno basin and has about 223 mill. tons of coal, which occurs at depths of 1,000 to 1,300 m. Also the hydrological situation could complicate the mining production. The deposit was opened by two main shafts which were later closed.
- NE of Prague, there has been explored the so-called Mšeno (Mělník) basin, having 1,268 mill.tons of reserves of steam coal. However, conflicts of interest prevent to exploit this deposit (overlying Cretaceous sandstones represent a source of potable water for central Bohemia).
- Since 1998 the production of hard coal is renewed in the Trutnov region.
- Some other deposits of hard coal in the Plzeň (Pilsen) region and near Brno became subeconomic.

3. Registered deposits and their location in the Czech Republic



1 the Upper Silesian basin
2 the Intrasudeten basin
3 the Krkonoše piedmont basin
4 the Central Bohemian basin
5 the Mělník basin
6 the Plzeň and Radnice basin

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

Year	1996	1997	1998	1999	2000
Deposits – total number	72	68	67	69	67
exploited	17	20	18	17	15
Total mineral resources, kt	13 942 239	13 954 950	13 941 612	16 305 887	16 353 961
economic proved reserves	2 612 865	2 417 365	2 355 800	2 114 334	2 072 075
economic probable reserves	6 401 303	6 147 991	6 045 714	7 231 075	7 219 168
potentially economic resources	4 928 071	5 389 594	5 540 098	6 960 478	7 062 718
Mining production, kt	21 784	20 847	19 521	17 227	17 028

Note:
ČSÚ presents so-called sale production, which presents production of marketable hard coal and reaches in average about 80.0% of above mentioned mining production
681 210 kt of reserves are presented as mineable, i.e. 4,2% of all resources and 7.7% of economic reserves.

5. Foreign trade

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

Raw material	1996	1997	1998	1999	2000
Import, kt	3 211	2 274	1 578	1 029	1 095
Export, kt	6 741	6 648	6 726	6 127	5 886

2704 – Coke and semi-coke of coal, lignite/peat, w/n agglomerated retort carbon

Raw material	1996	1997	1998	1999	2000
Import, kt	142	361	245	304	602
Export, kt	1 334	1 038	975	1 049	948

6. Prices

Prices of sized coal fluctuated between CZK 1400-1830 per ton in 2000. Prices of coking coal were CZK 1146 – 2021 per ton. Prices of coke fluctuated between CZK 1800 – 3515 per ton according to the quality. In 2000 there were imported 1095 kt of hard coal (99% from Poland) in Czech Republic. Average price was CZK 1156 per ton. 5886 kt of hard coal were exported (31.3% to Slovakia, 26.8 % to Austria, 17.6% to Germany, 13.4% to Hungary and 10.9% to Poland) on average price of CZK 1594 per ton.
602 kt of coke and semi-coke of coal were imported in 2000 on average price of CZK 2647 per ton (91.3% from Poland, 8.2% from Slovakia). 948 kt of coke and semi-coke of coal were exported on average price of CZK 2618 per ton (42.0% to Austria, 37.0% to Germany and 8.0% to Slovakia).

7. Mining companies in the Czech Republic as of December 31, 2000

OKD, a.s. - Důl Darkov, o.z., Karviná
OKD, a.s. - Důl Lazy, o.z., Orlová - Lazy
OKD, a.s. - Důl ČSA, o.z., z. ČSA, Karviná
ČMD, a.s. - Důl ČSM, o.z., Stonava
OKD, a.s. - Důl Paskov, o.z., Paskov

ČMD, a.s. - Kladno
OKD, a.s. – Důl Odra, o.z., Ostrava
GEMEC – UNION, a.s., Jívka

8. World production

World production of hard coal exceeded 3,000 mill. tons in 1985. According to the 1995 prognosis of the UNO European Economic Commission, the world production should not exceed 4000 mill. t per year by 2010. An expected decrease of production in Europe should be exceeded significantly by production in Asia and Latin America. 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 favor of steam coal in near future. The world mining production has been developing as follows in the last five years (according to the Welt-Bergbau-Daten and Coal Age):

Year	1996	1997	1998	1999 e	2000 e
Mining production, mill.t (WBD)	3 866	3 875	3 825	3 850	3 900

Main producers (1998; according to WBD):

China	33.6 %
USA	24.4 %
India	7.7 %
Australia	7.4 %
South Africa	5.9 %

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 30 and 37 per ton of steam coal and between USD 43 and 47 per ton 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.

Average annual prices of US coal in USD per ton FAS (according to Coal Age):

A Coking coal

B Steam coal

Commodity/Year	1996	1997	1998	1999	2000
A	43,55	45,89	45,45	47,01	50,83
B	34,33	32,81	30,47	31,69	35,49

According to prognoses, hard coal prices should increase by 2005, prices of coking coal should increase by 34% and steam coal by 40% against the price level reached in 1996. This increase in prices should be evoked by higher consumption especially in Europe and Asia.

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). Coal can be replaced by other mineral fuels in energy generation.

BROWN COAL

1. Characteristics and use

Brown coal is a phytokaustobiolite showing lower degree of coalification, i.e. having lower than 73.5 % carbon, more than 50 % volatile matter and dry (ash free) caloric value less 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 boundary between brown coal and high volatile lignite is usually not recognized because, in practical terms, brown coal generally includes high volatile lignite. However, in the Czech Republic both types are treated separately.
Total world deposit reserves of the brown coal (incl. high volatile lignite) were estimated at more than 500,000 mill. tons.
Brown coal is used mainly in energetics and to a smaller extent in chemical industry.

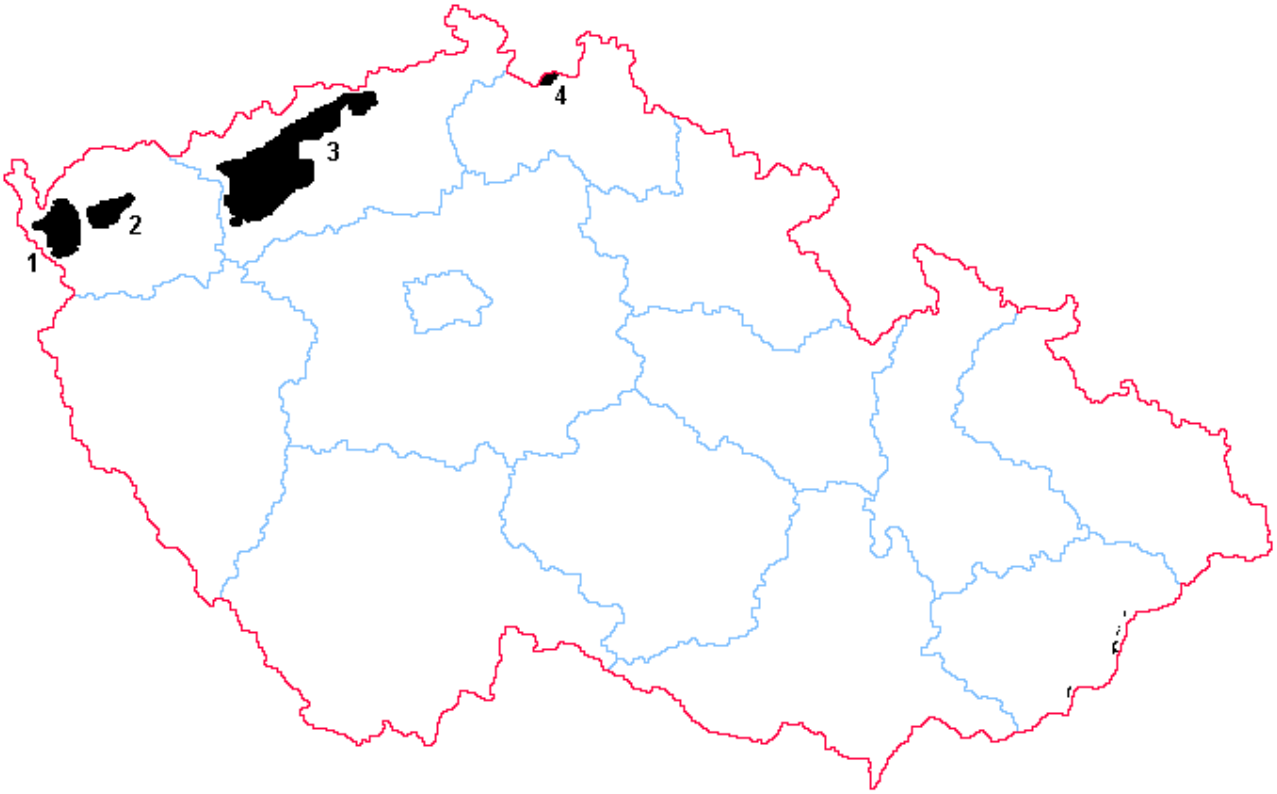
2. Mineral resources of the Czech Republic

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 furrow 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, which are as much as 400 m thick and even more, are of the Late Miocene age. The sedimentation in the Cheb basin was terminated as late as in the Pliocene. The following single basins are recognized in the whole area of the Krušné hory Mts. furrow (from NE to SW): North Bohemian, Sokolov and Cheb basins. The largest North Bohemian basin is then divided into three partial basins. It used to be and still is the major source of brown coal, which is now exploited by huge open pit mining operations.

- In one part of the North Bohemian basin, in the so-called Chomutov basin, there are several coal seams which, in the major part of the basin, are close to each other to allow open pit mining for all of them. Lignite shows a low degree of coalification and high content of ash (up to 50 %). Burning of this brown coal in large power plants inflicts environmental problems because it is rich in sulphur and arsenic. Due to low caloric value, a part of reserves exceeds the earlier used norm specifying the amount of sulphur in grams related to a unit of net caloric value.
- Brown coal in the Most partial basin of the North Bohemian basin shows higher degree of coalification and a lower content of ash. Locally, however, it is very rich in sulphur and arsenic. The depth of open pit mines continues to increase, being currently about 150 m.
- Mining production of the Teplice partial basin of the North Bohemian basin was stopped in 1997. Remaining reserves of almost sulphur-free brown coal located under the Chabařovice township are likely to be abandoned because of the conflicts of interests. Similar conflicts may occur even in other parts of the basin.
- The Sokolov basin west of Karlovy Vary has two brown coal seams. The major reserves are confined to the thickest and the uppermost seam called Antonín. The brown coal is of xylitic character, it is rich in water and relatively poor in sulphur. The seam is extracted by open pit mining and is used in energy generation (sorted brown coal, burning in power plants, lighting gas production).

- The Cheb basin has about one billion of reserves of stratigraphically youngest lignite characterised by high content of water (about 50 to 55 %), rich in liptodetrite, and consequently rich in mineral tar. It is a brown coal suitable for chemical processing. Mining operations in this basin were not allowed because they are likely to affect sources of mineral water for nearby Františkovy Lázně spa.
- The Žitava basin extends into the Czech Republic from Poland and Germany. The upper seam was already mined out. Remaining two lower seams are difficult to be mined underground because of overlying quicksand and technical problems.

3. Registered deposits and their location in the Czech Republic



1 the Cheb basin
2 the Sokolov basin
3 North Bohemian basin
4 the Žitava basin

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

Year	1996	1997	1998	1999	2000
Deposits – total number	71	66	62	61	60
exploited	16	14	13	13	10
Total mineral resources, kt	10 376 959	9 893 368	9 741 936	9 637 410	9 652 302
economic proved reserves	3 417 784	3 456 447	3 648 979	3 413 773	3 293 064
economic probable reserves	1 956 191	1 910 604	2 078 570	1 956 487	1 945 161
potentially economic resources	5 002 984	4 526 317	4 014 387	4 267 150	4 414 077
Mining production, kt	59 539	57 395	51 283	44 858	50 610

Note:
ČSÚ presents so-called sale production, which presents production of marketable brown coal and reaches in average about 95.0% of above mentioned mining production
1 521 139 kt of reserves are presented as mineable, i.e. 15.8% of all reserves and 29.0% of economic reserves.

5. Foreign trade

2702 – Lignite, whether or not agglomerated

Raw material	1996	1997	1998	1999	2000
Import, kt	5	3	2	13	1
Export, kt	6 173	5 031	3 930	3 397	2 888

6. Prices

Brown coal prices depend on caloricity value and granularity. Prices of brown coal oscillated around CZK 920 per ton in the domestic market. Prices of "double nuts" (sort of brown coal) were CZK 635–930 per ton. Brown coal rough powder prices fluctuated between CZK 490 and 700 per ton. Prices of brown coal mixtures used in industry fluctuated between CZK 350 and 610 per ton. Prices of brown coal briquettes of E230 quality fluctuate from CZK 1148 per ton (fragments) up to CZK 2888 per ton (packages). 2.9 mill. t of brown coal were exported to Germany (67.1%), to Slovakia (25.6%) and to Hungary (6.3%) on average price of CZK 636 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

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

8. World production

World production (including high volatile lignite) exceeded 1,000 mill. tons 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 90´s. Mining production in Germany (the most important world producer) is slowly increasing in the last years. Mining production in Russia and Poland is almost stable. Mining production in Turkey increased World production data showed differences up to 30 % in the last five years.

Years	1996	1997	1998	1999 e	2000 e
Mining production, mill. t	850	850	857	860	865

Main producers (1998; according to WBD):

Germany	19.4 %	Australia	7.0 %
Russia	9.0 %	China	5.8%
Turkey	7.8 %	USA	5.8%
Poland	7.3 %	Czech Republic	5.7%
Greece	7.1%	Yugoslavia	5.1%

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 prices on world market 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, it can be replaced by other fuels, particularly by nuclear fuel. This substitution, however, is connected with large investment, environmental and other problems.

LIGNITE

1. Characteristics and use

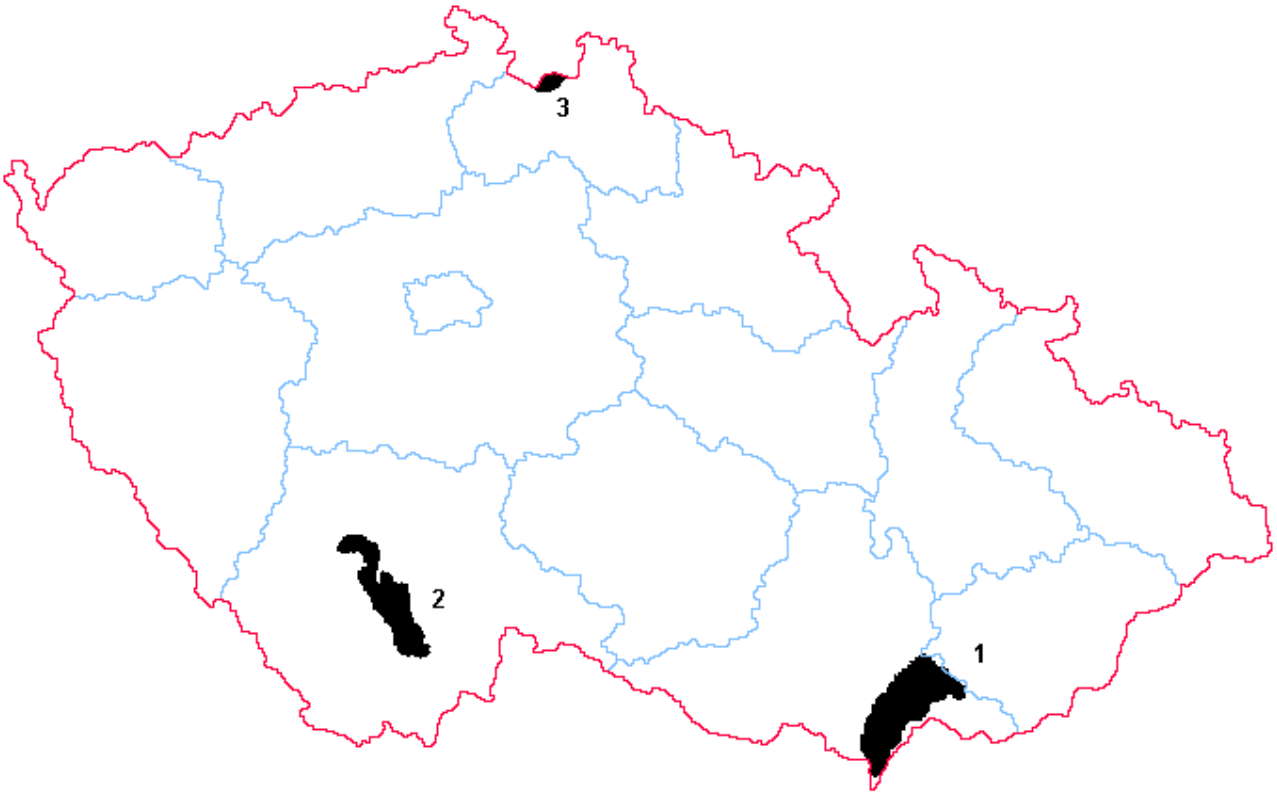
High volatile lignite is a variety of brown coal which exhibits the lowest degree of coalification, is of xylitic character with preserved tree trunks and with large or small fragments of wood. From the geochemical and petrological viewpoints, it is a brown coal hemitype. Its dry (ash-free) caloric value is less than 17 MJ/kg.

No boundary between brown coal and high volatile lignite has been established and high volatile lignite is generally included in regular brown coal. In the Czech Republic, however, it is treated separately. High volatile lignite is used in energy generation and for heating. It represents the lowest quality mineral fuel whose consumption of which gradually decreases.

2. Mineral resources of the Czech Republic

- Largest deposits of high volatile lignite occur along the northern margin of the Vienna basin, which extends from Austria into southern Moravia. There are two lignite seams in the youngestsediments of the Pannonian and Pliocene age. Reserves of the northern Kyjov seam are already exhausted, whereas those of the southern Dubňany seam are currently mined by one shaft. Economic reserves are registered at another deposits, but their exploitation is not anticipated. South Moravian high volatile lignite is of xylodetrital character with numerous tree trunks. It is rich in water (45-49 %), average content of S is 1.5-2.2 % and its caloric value is 8-10 MJ. The lignite is burnt in the Hodonín power plant.
- There are four deposits of high volatile lignite of low quality in southern Bohemia which are still registered.
- Isolated occurrences of high volatile lignite (Pliocene xylite) are in the vicinity of Liberec in northern Bohemia.

3. Registered deposits and their location in the Czech Republic



1 the Vienna basin 2 South Bohemian basin 3 the Žitava basin

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

Year	1996	1997	1998	1999	2000
Deposits – total number	20	13	13	13	13
exploited	1	1	1	1	1
Total mineral resources, kt	1 017 621	1 023 455	1 025 720	1 011 860	1 029 320
economic proved reserves	145 940	124 920	142 117	149 796	216 514
economic probable reserves	590 960	564 590	606 825	622 577	622 577
potentially economic resources	280 721	333 945	276 778	239 487	190 229
Mining production, kt	902	747	652	512	453

4345 kt of reserves are presented as mineable, i.e. 0.4% of all reserves and 0.5% of economic reserves.

5. Foreign trade

No separate customs tariff item exists for lignite.

6. Prices

Prices of South Moravian high volatile lignite fluctuate between CZK 450 and 490 per ton (according to granularity).

7. Mining companies in the Czech Republic as of December 31, 2000
Lignit Hodonín s.r.o., Důl Mír Mikulčice

8. World production
World production of high volatile lignite is included in the brown coal production.

9. World market prices
High volatile lignite is generally not traded on the foreign market.

10. Recycling
High volatile lignite is not recycled.

11. Possible substitutes
High volatile lignite exclusively used as a fuel can be replaced by other mineral fuels.

CRUDE OIL

1. Characteristics and use

Oil (petroleum)is a natural mixture of gaseous and dissolved solid hydrocarbons and their derivatives. 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 caloric value ranges between 38 and 42 MJ/kg. Principal source of hydrocarbons is represented by an organic material originating from subaqual anaerobic decay of plants and/or animals 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. 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. tons about 75 % of which have been found in OPEC member countries.

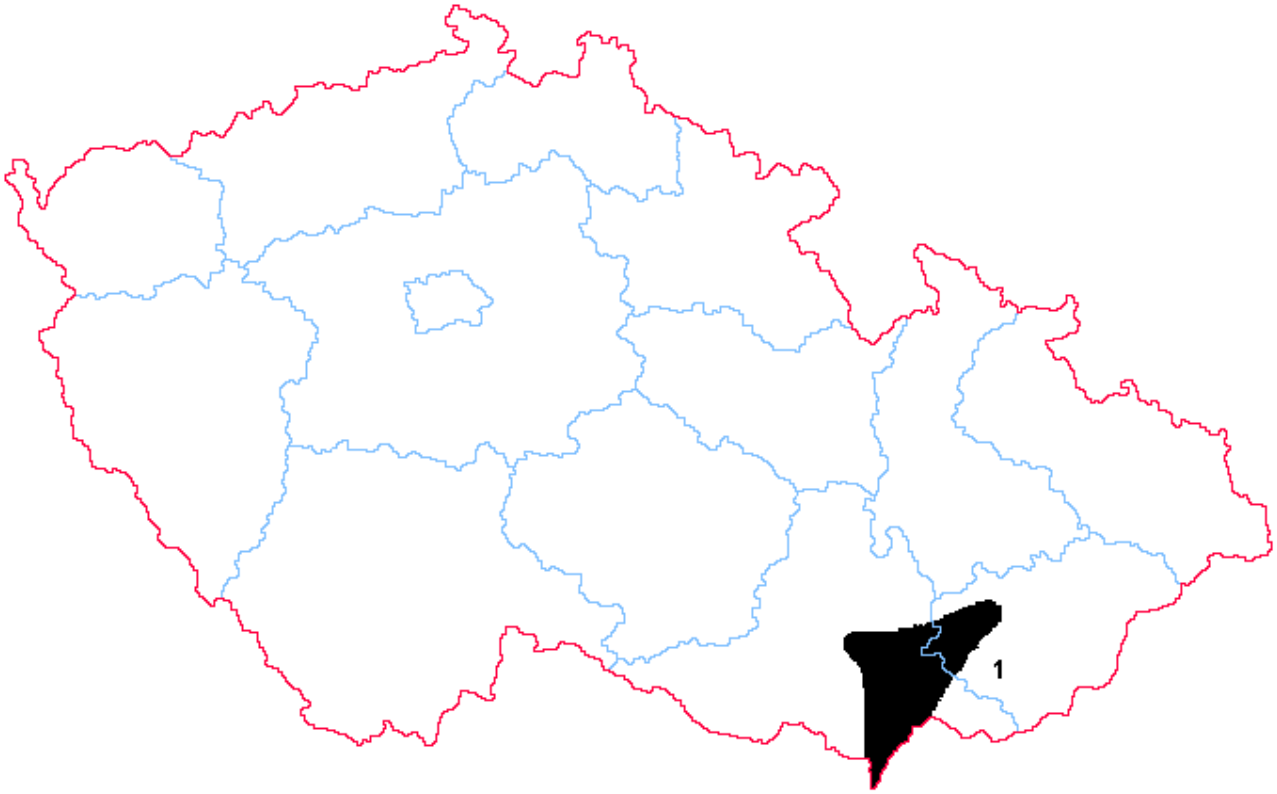
All-round oil industrial use is evident and new applications are still under way. Nevertheless, energy generation, petrochemical and chemical industries are the principal oil consumers.

2. Oil resources of the Czech Republic

- Oil deposits of the Czech Republic are confined to the Vienna - Moravia oil and gas-bearing province. The deposits are distributed over a great number of individual oil-bearing structures and producing horizons situated at the depth going down to 2,800 m. The most productive oil-bearing rocks are represented by sandstones of the Middle and/or the Upper Badenian. The largest deposit of this area (Hrušky), whose major part has already been extracted, serves as an underground gas storage.
- Another region in which oil is anticipated to occur lies in the Moravian part of the Carpathian foredeep, where oil exploration still continues. The most important accumulations occur particularly in the weathered crystalline and Paleozoic rocks. Light, sulphur-free, paraffin to paraffin - naphtene oil prevails in this field. Uhřice and Kloboučky (in the Ždánice region) are the only oil deposits in this area.

Three grades of oil were extracted in 2000 with specific gravity from 856 to 930 kg/m^3 at 20°C, 20-33° API and with content of sulphur 0.08-0.32 wt %.

3. Registered deposits and their location in the Czech Republic



1 The Vienna basin and Carpathian Fordeep

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

Year	1996	1997	1998	1999	2000
Deposits – total number	25	25	22	23	22
exploited	16	16	17	17	15
Total mineral resources, kt	48 430	47 942	37 846	37 647	37 463
economicproved reserves	12 048	11 584	11 403	11 233	11 055
economic probable reserves	23 588	23 400	13 499	13 498	13 496
potentially economic resources	12 794	12 958	12 944	12 916	12 912
Mining production, kt	155	159	172	176	168

3560 kt of reserves are presented as mineable, i.e. 9.5% of all reserves and 14.5% of economic reserves.

5. Foreign trade

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

Raw material	1996	1997	1998	1999	2000
Import, kt	7 725	7 023	6 948	5 997	5 819
Export, kt	85	92	104	109	111

6. Prices

5819 kt of crude oil were imported in 2000 on average price of CZK 7486 per ton. 81.9% were imported from Russia, 8.7% from Kazakhstan and 8.3% from Algeria. In comparison with the year 1999, when crude oil was imported on average price of CZK 3680 per ton, the import prices were two times higher in 2000. That was caused by a vehement incresase of crude oil prices on the world market and by a significant decrease of the CZK rate to USD. Because the Czech Republic invested in purchase of crude oil and natural gas about 90 % of all finances for purchase of mineral raw materials in 2000, all national economy was influenced.

111 kt of crude oil were exported on average price of CZK 5231 per ton (52.5% to Slovakia, 27.6% to Austria and 19.9% to Poland) in 2000.

7. Mining companies in the Czech Republic as of December 31, 2000

Moravské naftové doly, a.s. Hodonín

8. World production

World crude oil production fluctuated between 3 – 3,5 milliards tons in the last years. In 90's the crude oil production in Russia significantly decreased. The production volume was greatly influenced by OPEC, whose members agreed on a production limit of 1,7 mill bbl a day in 1999 to confront the low prices. The fall in mining production was 2,1 mill. bbl a day together with other four non-OPEC members. The trust influenced significantly the world market also in 2000, when a deficiency of the raw material showed, therefore crude oil prices vehement decreased. The following countries represented the major producers of crude oil (according to the Welt-Bergbau-Daten - WBD):

Year	1996	1997	1998	1999 e	2000 e
Mining production, mill. t	3 237	3 474	3 512	3 500	3 000

Main producers (1998; according to WBD):

Saudi Arabia	11.5 %	China	4.6 %
USA	11.4 %	Venezuela	4.5 %
Russia	9.8 %	Norway	4.5 %
Iran	5.5 %	Great Britain	4.0 %
Mexico	4.8 %	Canada	3.7 %

9. World crude oil market price

Crude oil represents a commodity which is extremely sensitive to the global political climate and development. In the last decade it was sold for the highest price in 1990. 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 about by 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 threetimes and they fluctuated 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 was more times increased and even if at year-end the total mining production of this trust was more higher than in times of the price crisis at the beginning of 1999. The OPEC decreased a lot of crude oil reserves in particular countries and provoked impress of raw material deficiency. At the beginning of September 2000, price of Brent was around USD 37 and of Dubai USD 31 – 32 per barrel.

The major world stock 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°).

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	1996	1997	1998	1999	2000
A	23,66	19,06	11,86	17,77	28,79
B	24,13	18,68	12,04	17,21	26,39

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 by fuel based on plants.

NATURAL GAS

1. Characteristics and use

Natural gas is a mixture of low-molecular-weight paraffin series hydrocarbons, principally methane, ethane, propane, and butane, with small amounts of higher weight hydrocarbons. Natural gas also frequently contains nitrogene, carbon dioxide, and hydrogene sulphide. Methane (CH_4) is normally the major constituent. 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).

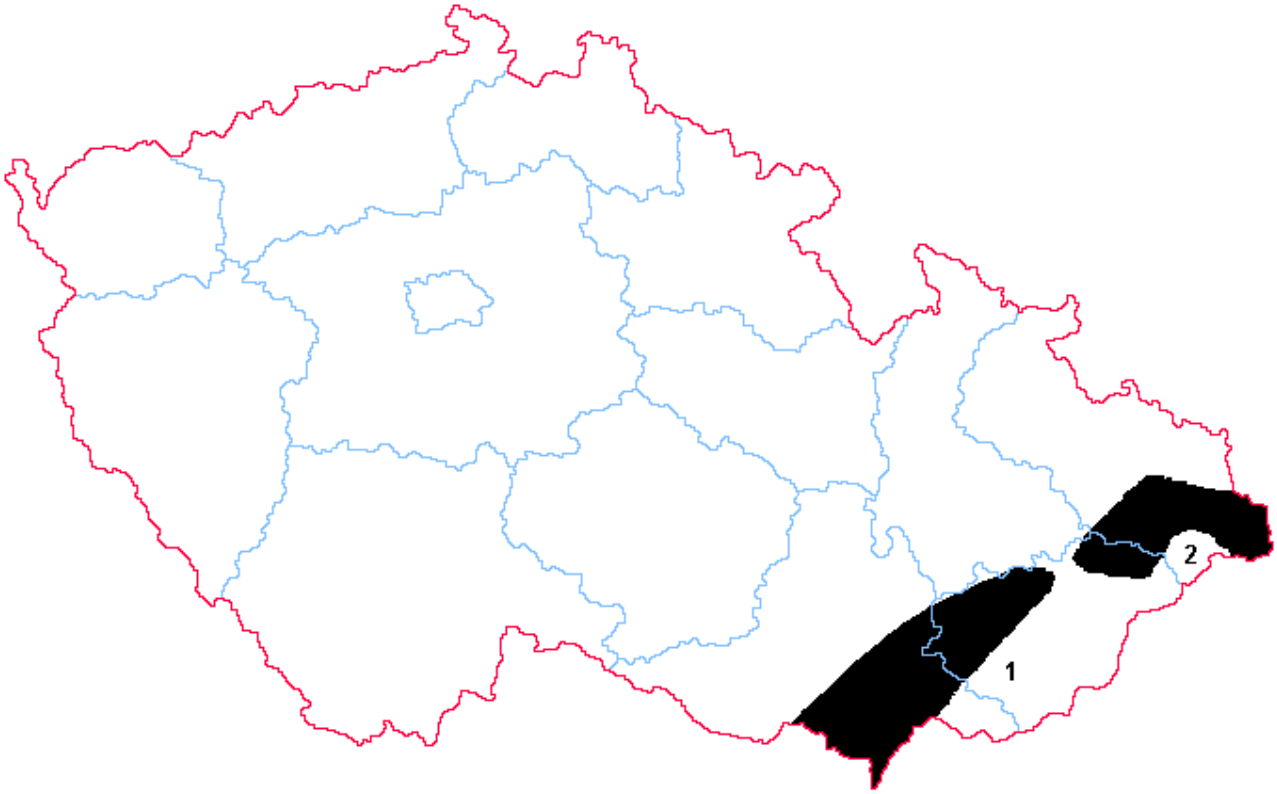
Natural gas world proven reserves were estimated at more than 140 trillions of m^3. The greatest part of proven reserves is situated in the territories of Russia - 32.2 % and Iran - 14.9 %.

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

2. Natural gas resources of the Czech Republic

- 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 from 87.2 to 98.8 % of CH_4, its caloric 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 is considered as a promising area for the occurrence of natural gas. The composition of local gas deposits varies considerably. The Dolní Dunajovice deposit is characterized by high content of methane (98 %), whereas the deposit Kostelany-west 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 confined to the weathered and tectonically affected Carboniferous paleorelief. The origin of these gas deposits developed close to the top of the Carboniferous morphological elevations has not been explained yet. Ideas about the gas to have originated during coalification of the local coal seams has little support and its origin is rather considered to be connected with the young processes, which led to the origin of natural hydrocarbons. This applies particularly to the gas deposits of Žukov, Bruzovice and Příbor. Part of the Příbor gas deposit is used as an 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. Its 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.

3. Registered deposits and their location in the Czech Republic



1 South Moravian region
2 North Moravian region

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

Year	1996	1997	1998	1999	2000
Deposits – total number	54	67	59	62	62
exploited	29	31	30	36	31
Total mineral resources, mill. m3	17 083	21 141	20 888	15 500	15 392
economic proved reserves	4 252	4 146	4 005	3 948	3 898
economic probable reserves	10 743	14 908	14 789	9 404	9 372
potentially economic resources	2 088	2 087	2 094	2 148	2 123
Mining production, mill. m3	146	118	137	143	118

7880 mill. m^3 of reserves are presented as mineable, i.e. 51.2% of all reserves and 59.4% of economic reserves.

5. Foreign trade

271121 – Natural gas

Raw material	1996	1997	1998	1999	2000
Import, mill. m3	9 499	9 524	9 496	9 207	9 550
Export, mill. m3	1	1	0	0	0

6. Prices

9550 mill. m^3 of natural gas in gaseous state were imported in 2000 (77.7% from Russia, 21.1% from Norway, 1.2% from Germany). Average price was CZK 4059 on thousand m^3. Like in case of crude oil, the import prices were two times higher in 2000. That was caused by a vehement incresase of crude oil prices on the world market and by a significant decrease of the CZK rate to USD. Export was insignificant.

7. Mining companies in the Czech Republic as of December 31, 2000

Moravské naftové doly, a.s. Hodonín
OKD, Důlní průzkum a bezpečnost Paskov, a.s.
UNIGEO, a.s. Ostrava
Důlní průzkum Stonava s.r.o., Ostrava

Besides natural gas production there was another major activity of Moravské naftové doly - construction of underground storage. Storage in Dolní Bojanovice with capacity 400 mill. m^3 started to operate in October 1999. Underground storage in Uhřice with capacity of 180 mill. m^3 should start operation in 2001. Another underground storage with capacity about 200 mill. m^3 will be built in Dambořice.

The Czech import company Transgas owned six underground storages (Dolní Dunajovice, Tvrdonice, Štramberk, Lobodice, Háje u Příbrami and Třanovice) with capacity about 1.9 milliard m^3 in territory of Czech Republic in 2000. Transgas has used also a rented capacity in Slovakia (500 mill. m^3) and in Germany (500 mill. m^3).

8. World production

World natural gas production persisted on the level of about 2,300 bill. 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. The major producing countries were as follows (according to the Welt-Bergbau-Daten - WBD):

Year	1996	1997	1998	1999	2000 e
Mining production, mlld. m3	2 352	2 311	2 335	2 350	2 390

Main producers (1998; according to WBD):

Russia	25.3 %
USA	22.9%
Canada	6.9 %
Great Britain	3.6 %
Indonesia	3.6 %

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 25000 mill. m^3 per year. It represented from 4 to 6 % of all methane emissions

from both natural and man-made sources of methane in the world. Of the given 25,000 mill. m^3 about 1,600 mill. m^3 of gas - i.e. approximately 6 % - 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, United Kingdom, USA, Australia, France and Ukraine.

9. World market prices

General increase in natural gas consumption was accompanied by decrease in costs of transport payed by consumers for imported gas (approximately 75 % of gas is transported through pipelines and about 25 % in tankers in liquified state). Natural gas prices are negotiated and are quoted in USD per mill. Btu. Natural gas price at a customer in Europe that had been still fluctuating between USD 3.6 and 4 per mill. Btu in l985, 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 - 2.9 per mill.Btu in 1999. Natural gas prices were increasing 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.

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 energetics. However, natural gas itself represents economically and ecologically effective substitute for all other mineral fuels.

INDUSTRIAL MINERALS -GEOLOGICAL RESERVES AND MINING PRODUCTION

Industrial minerals represent - after mineral fuels - the most important group of raw materials in the territory of the Czech Republic. In this group the largest reserves are of limestones, kaolin, clays and natural sand. Other industrial minerals represent smaller nevertheless important raw material potential of the national economy. Kaolin, dimension stone, natural sand, clays and limestone are also important export commodities.

Mining of industrial minerals – reserved deposits

Raw material	Unit	1996	1997	1998	1999	2000
Graphite	kt	30	25	28	22	23
Pyrope-bearing rock	kt	39	49	43	54	62
Kaolin	kt	2 798	2 982	3 049	5 183	5 573
Clays	kt	738	759	1 030	636	601
Bentonite	kt	59	110	125	160	280
Feldspar	kt	211	243	266	244	337
Feldspar substitute (phonolite)	kt	38	33	33	24	24
Silica raw material	kt	4	13	1	3	0
Glass and foundry sand	kt	2 209	1 763	1 642	1 697	1 814
Fusible basalt	kt	90	103	96	89	14
Diatomite	kt	35	42	35	37	34
Limestones of them:	kt	10 610	11 010	11 169	11 378	11 376
Highpercentage limestones	kt	N	4 536	4 526	4 673	4 784
Other limestones	kt	N	6 474	5 215	5 189	5 138
Dolomites	kt	N	294	389	325	430
Corrective sialic additives	kt	643	540	260	296	267
Gypsum	kt	443	241	222	136	82
Dimension stone*	thous. m3	190	258	305	250	270

* About 50 thous. m^3 of dimension stone were exploited in non-reserved deposits in 2000.

Lifetime of industrial reserves (economic proved mineable reserves) after the decrease of reserves by mining production incl. losses in registered deposits per year 2000 (A) and the average annual decrement of reserves in period 1996-2000 (B) was as follows:

Raw material	Lifetime - A (years)	Lifetime - B (years)
Graphite	59	53
Pyrope-bearing rock	30	37
Kaolin	34	48
Clays	327	261
Bentonite	171	328
Feldspar	102	132
Silica raw material	-	726
Glass and foundry sand	129	129
Fusible basalt	506	90
Diatomite	132	122
Limestones	139	142
of them:		
highepercentage limestones	136	142
other limestones	159	156
Dolomites	188	193*
Corrective sialic additives	1247	830
Gypsum	1278	466
Dimension stone	297	316

* of average decrease in 1997 – 2000

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. Fluorspar is accompanied usually by other minerals like quartz, barite, calcite, etc. 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% 0.1-0.3% S);
c) ceramic grade (80-96% of CaF_2, up to 3% SiO_2).

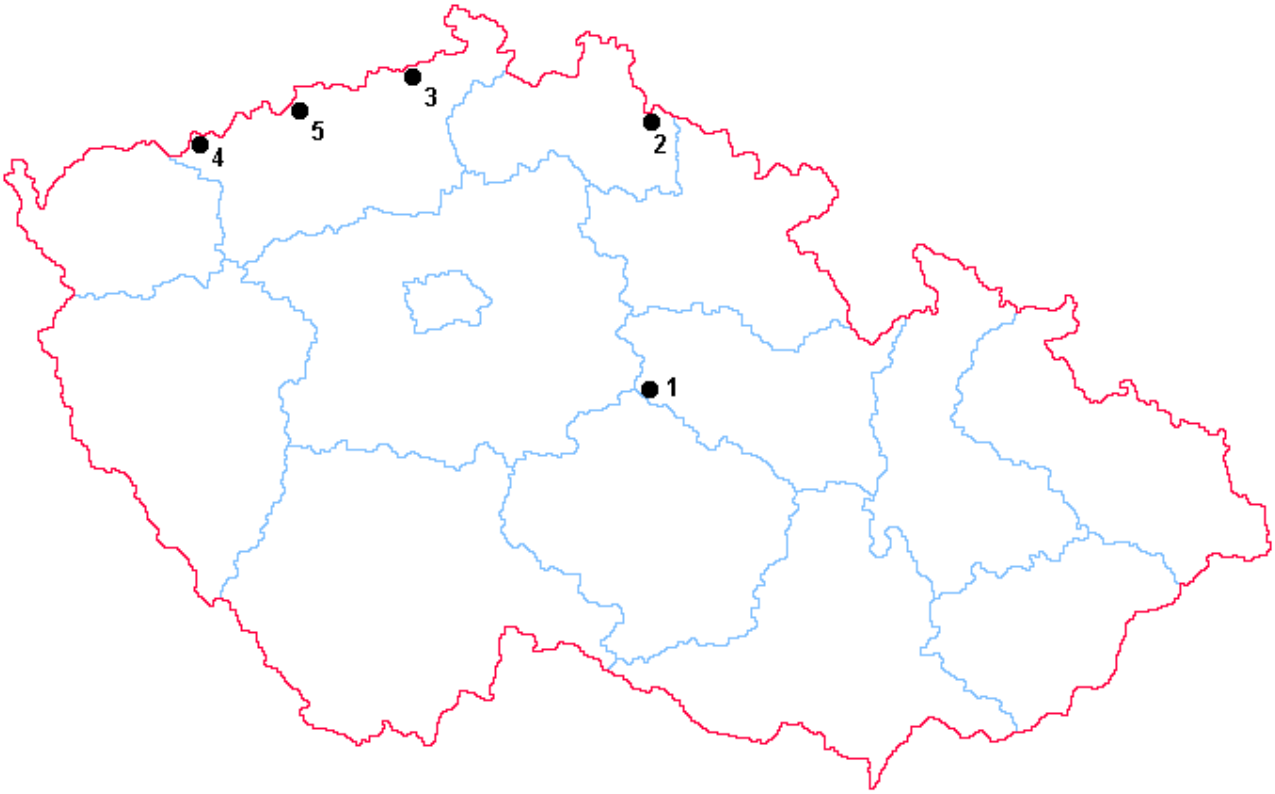
More than half of the fluorspar production is used in chemical industry for production of fluorine (F), hydrofluoric acid (HF), NaF and synthetic cryolite. Fluorine is an important component of chlorofluorocarbons and other chemicals used in refrigerants and other agents. Metallurgical industry of alumina also consumes relatively large volumes of fluorspar (1/3 of the total fluorspar production). Other applications are 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 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-SW) lineaments direction. However, relative proportions of single minerals are considerably variable in individual deposits and even within single veins.

Majority of fluorspar deposits exhibits vertical zonation. Primary zonation is characteristic of abundant barite in upper parts and increasing content of fluorite with depth. However, this primary zoning is preserved only in relatively small layers or bodies, because it is overlain by younger minerals which exhibit a pulsating character. Such a secondary zonation is due to an influx of fluids along fractures and faults and after re-opening of the old vein filling. Secondary zonation results in upgrading or reduction of the vein filling as far as the content of fluorite is concerned. The Moldava deposit, for instance, shows considerable enrichment in fluorspar.

3. Registered deposits and their location in the Czech Republic



1 Běstvina
2 Harrachov
3 Jílové u Prahy
4 Kovářská
5 Moldava

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

Year	1996	1997	1998	1999	2000
Deposits – total number a)	7	6	6	5	5
exploited	0	0	0	0	0
Total mineral resources, kt	3 477	3 078	3 078	2 193	2 193
economic proved reserves	35	0	0	0	0
economic probable reserves	997	584	584	0	0
potentially economic resources	2 445	2 494	2 494	2 193	2 193
Mining production, kt	0	0	0	0	0

Note:
a) deposits with balanced fluorspar content

5. Foreign trade

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

Raw material	1996	1997	1998	1999	2000
Import, t	42 418	30 954	27 231	14 754	12 893
Export, t	2 231	4 796	7 064	6 769	7 359

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

Raw material	1996	1997	1998	1999	2000
Import, t	N	20 578	14 712	16 235	19 010
Export, t	14 951	17 894	17 763	5 750	6 299

6. Prices

19 010 t of acid-grade fluorspar were imported from China (99.8 %) on average price of CZK 4555 per ton in 2000. 12 893 t of metallurgical and ceramic grades were imported from China (72.7 %) and from Mexico (27.3%) on average price of CZK 4645 per ton.

6299 t of acid-grade fluorspar were exported to Germany (28.4%), to Poland (18.7%) and to Israel (18.0%) on average price of CZK 7096 per ton. 7359 t of metallurgical and ceramic grades were exported to Slovakia (91.5%) on average price of CZK 6077 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

No mining companies were operating on the territory of the Czech Republic to extract fluorspar in 2000.

8. World production

The world production was increasing untill 1989 when 5,529 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 mining production increased insignificantly from the minimum of 4031 kt in 1993 on 4670 kt in 1998. Fluorspar production is decreasing again in the last two years. Data according to Mineral Commodity Summaries (MCS) and the Welt-Bergbau-Daten (WBD):

Year	1996	1997	1998	1999	2000 e
Mining production, kt (MCS)	4 140	4 620	4 670	4 510	4 480
Mining production, kt (WBD)	3 966	4 416	4 766	N	N

Main producers (1999; according to MCS):

China	53.2 %
Mexico	12.5 %
South Africa	4.8 %
Spain	2.9 %
Morocco	2.4 %
Italy	2.4 %

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. 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. 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

Commodity/Year	1996	1997	1998	1999	2000
A	112,50	112,50	112,50	112,50	112,50
B	-	-	-	115,00	115,00
C	150,00	135,00	135,00	132,50	132,50
D	92,50	92,50	95,00	95,00	95,00
E	125,00	120,00	120,00	120,00	120,00

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, nitrogene, 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 volcaniclastic (stratabound) deposits. World barite reserves are estimated at 303 mill. t.

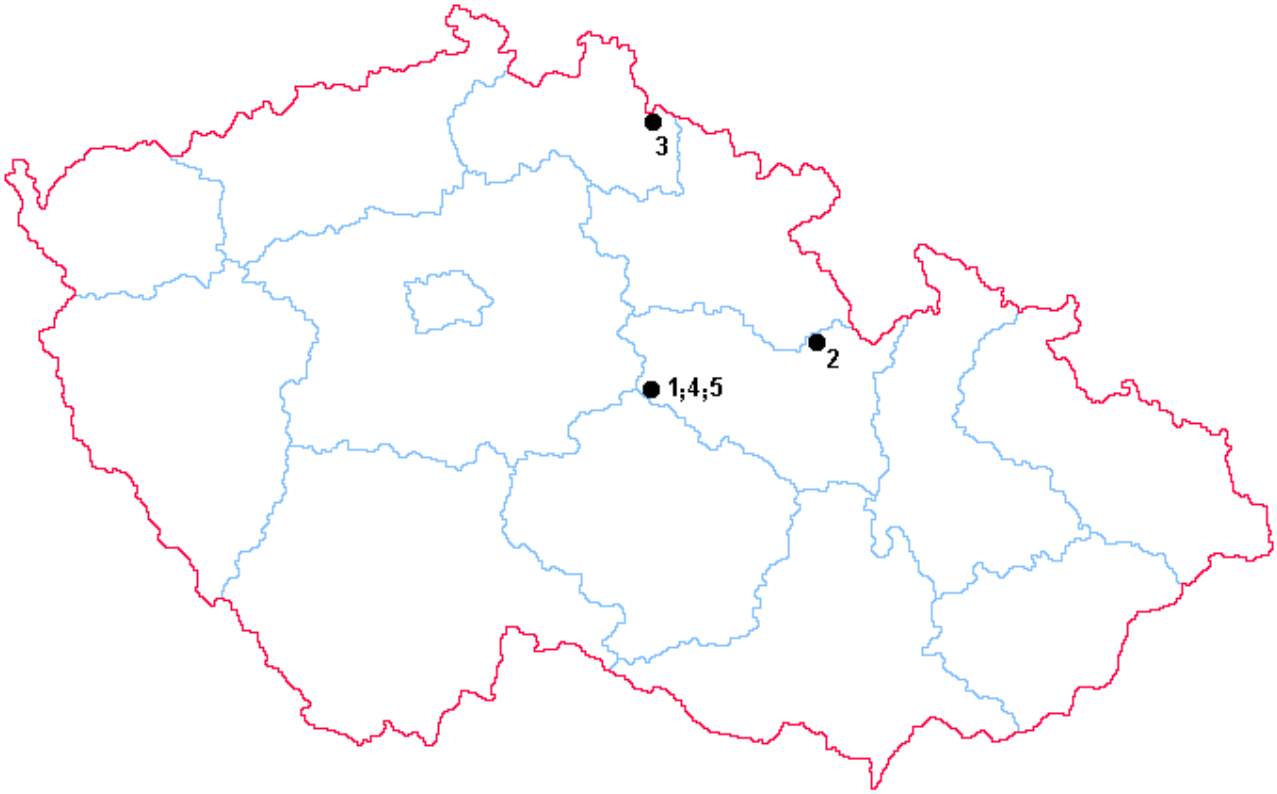
Barite is widely used because of its specific properties such as whiteness, high density, chemical resistance, absorption of X-rays and gamma radiation, etc. Barite is used in glassmaking to produce special glass, in ceramic glazes, porcelain enamels, paints, plastics, fireworks (signal flares, detonators,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

2. Mineral resources of the Czech Republic

Barite deposits of the Czech Republic belong to the vein, stockwork, 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.

- 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 orders trending mostly NW-SE and NWN-SES, which are often filled with an older quartz or quartz-hematite mineral assemblage. Younger polymetallic (base metal) and the latests quartz mineralization, which downgrades the vein fillers in deeper parts is common, too (e.g. the Mackov and Bohosouvá deposits). The deposits are mostly of the early Alpine or Variscan age and to much lesser extent of Precambrian or late Alpine age. Earlier mined deposit of Pernárec (1924-1960), then the deposits Mackov, Moldava-Vápenice and Kovářská in the Krušné hory Mountains, Bohousová, Harrachov and Běstvina belong to the above mentioned type of the deposit.
- 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 sediments of the Barrandian and the Železné hory Mts. Proterozoic (Krhanice in the Sázava river basin, Křižanovice) and in the Devonian of the Jeseníky Mountains (Horní Benešov, Horní Město-Skály).
- A barite mineralization is known from the Květnice deposit near Tišnov in the Moravicum, where barite was mined during World War II.

- **3. Registered deposits and their location in the Czech Republic**



1 Běstvina
2 Bohousová
3 Harrachov
4 Křižanovice
5 Liboměřice

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

Year	1996	1997	1998	1999	2000
Deposits – total number a)	8	9	9	6	6
exploited	0	0	0	0	0
Total mineral resources, kt	2 920	2 920	2 920	1 309	1 309
economic proved reserves	44	0	0	0	0
economic probable reserves	1 407	927	927	0	0
potentially economic resources	1 469	1929	1 929	1 309	1 309
Mining production, kt	0	0	0	0	0

Note:

a) deposits with balanced barite content

5. Foreign trade

251110 – Natural baryum sulphate (barites)

Raw material	1996	1997	1998	1999	2000
Import, t	14 692	10 882	7 981	9 288	8 730
Export, t	10	50	70	33	204

6. Prices

8730 t of barite were imported from Slovakia (84.0 %), from Germany (5,8 %) and from Great Britain (3.6%) on average price of CZK 4761 per ton in 2000. 204 t were exported to Poland (92.8%) and to Slovakia (6.3%) on average price of CZK 4612 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

No mining companies were operating on the territory of the Czech Republic to extract barite in 2000.

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). In the last years, the production is increasing again. Data by various international yearbooks are relatively variable. Data on the world mining production according to Mineral Commodity Summaries (MCS) and World Mineral Statistics (WMS):

Year	1996	1997	1998	1999	2000 e
Mining production, kt (MCS)	4 460	6 930	5 890	5 660	5 700
Mining production, kt (WBD)	5 400	8 000	6 300	4 500	N

Main producers (1999; according to MCS):

China	49.5 %
India	10.6 %
USA	7.7 %
Morocco	5.8 %
Iran	3.0 %

9. World market prices

Barite prices are under pressure of surplus offer, particularly regarding the offer of cheap Chinese and Indian barite. Chinese barite acquired the leading position in world production already in the seventies, being used not only in drilling muds but also in other sectors of various industries. Prices of barite of various grade and origin are quoted monthly in the Industrial Minerals magazine in GBP/t or USD/t. 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 Ground, white, paint grade, 96 - 98 $BaSO_4$, 99 % 350 mesh, GBP/t, del UK
D Unground, OCMA/API bulk, SG 4.2, USD/t, FOB Morocco
E Ground, bagged, USD/t, FOB Morocco

Commodity/Year	1996	1997	1998	1999	2000
A	53,50	51,50	45,00	43,00	44,50
B	52,50	53,50	51,00	43,50	49,50
C	207,50	207,50	207,50	207,50	207,50
D	41,00	41,00	41,00	40,00	40,00
E	77,50	77,50	80,00	80,00	80,00

10. Recycling

Barite is actually continuously recycled when used in drilling muds. 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 muds. 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 is an important technical mineral exhibiting perfect basal cleavage, fair electric and heat conductivity, 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. 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.

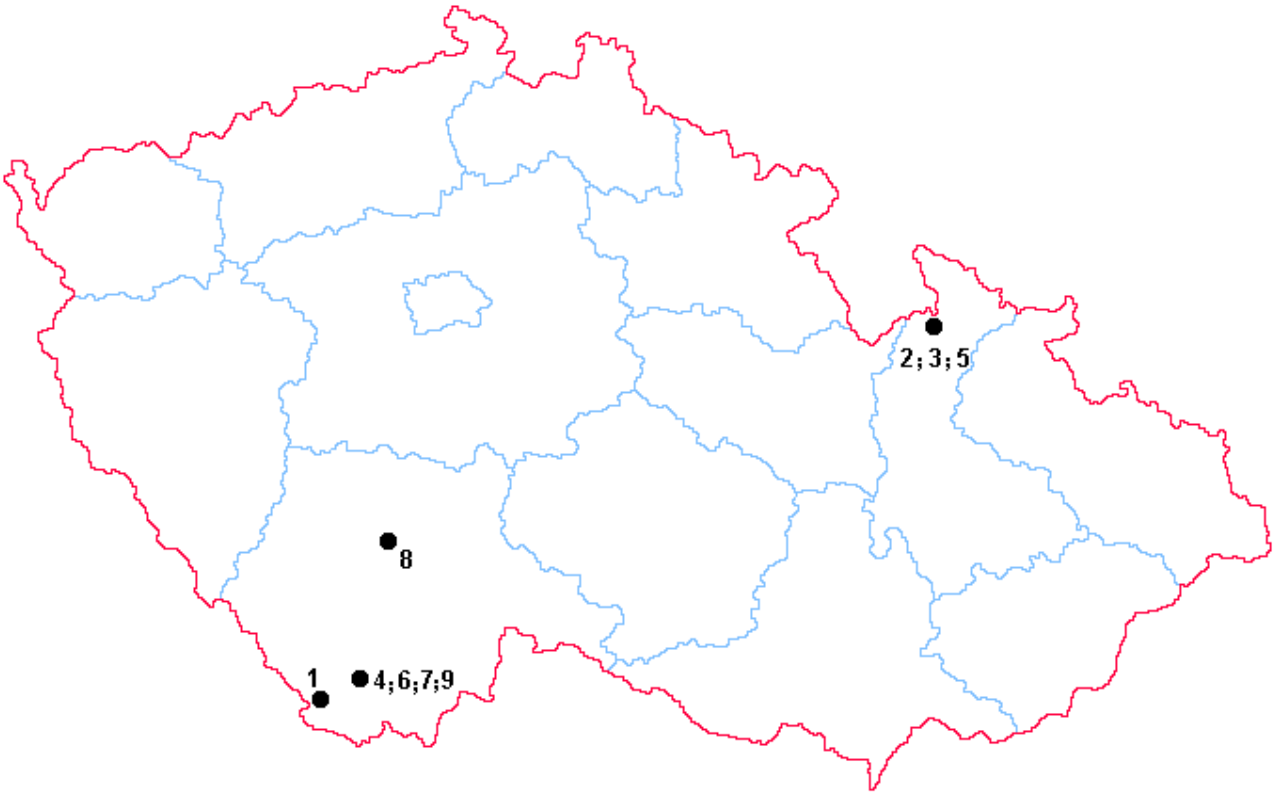
Graphite deposits can be divided into early magmatic, contact metasomatic, metamorphogenic (metamorphic and metamorphosed) and residual deposits. World reserves of graphite are estimated at 21 mill. tons. Use of graphite is based upon its physical and chemical properties. It is used in foundry industry,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

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 South Bohemian Moldanubicum, then in the 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, not mined deposits: Bližná, Spolí, Český Krumlov-Rybářská street). Other less important deposits occur in the Votice-Sušice Varied Group (not mined deposit at Koloděje nad Lužnicí-Hosty) and in the Chýnov mica schists (Černovice subeconomic deposit). South Bohemian graphitic rocks have a character of graphite-rich gneisses, quartzites and carbonates.
- 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 volatile constituents and less sulphur in graphitic layers in limestones than those in graphitic schists and phyllites. The major deposit of graphite in the Moravicum is Velké Tresné, which was abandoned in 1966. 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.

3. Registered deposits and their location in the Czech Republic



Amorpous graphite
1 Bližná
2 **Velké Vrbno-Konstantin**
3 Branná-Medvědí důl
4 Český Krumlov-Rybářská street.
5 Velké Vrbno

Crystalline flake graphite:
6 **Český Krumlov-Městský vrch**
7 **Lazec**
8 Koloděje n. Luž.-Hosty

Combined graphite:
9 Spolí

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

Year	1996	1997	1998	1999	2000
Deposits – total number	17	16	16	15	15
exploited	4	4	4	3	3
Total mineral resources, kt	15 201	14 378	14 926	14 448	14 412
economic proved reserves	2 092	2 054	2 012	1 437	1 401
economic probable reserves	4 369	3 780	4 370	4 154	4 154
potentially economic resources	8 740	8 544	8 544	8 857	8 857
Mining production, kt	30	25	28	22	23

5. Foreign trade

2504 Natural graphite

Raw material	1996	1997	1998	1999	2000
Import, t	1 180	634	839	734	975
Export, t	2 723	2 831	2 670	2 501	2 712

6. Prices

975 t of graphite were imported from China (50.4 %), from Great Britain (23.4 %) and from Germany (10.6 %) in 2000. Average import prices were CZK 31 908 per ton. 2712 t of graphite were exported to Germany (59.5 %), to Poland (13.4 %) and to Slowakia (7.8 %) on average price of CZK 20 383 per ton. Average domestic prices of foundry graphite fluctuated according to their quality between CZK 8 900 and 13 400 per ton. Average price was CZK 10 525 per ton. Prices of domestic flotation graphite fluctuate between CZK 5200 and 39 000 per ton (average price of CZK 22 000 per ton). Prices of chemically treated graphite (purity 99.5-99.9% C) fluctuate from CZK 50,300 to CZK 93,100 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

Grafitový důl, a.s., Český Krumlov
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. Mining production in the Czech Republic reached 685 kt in 1999, i. e. around 3.2 % of the world production. Data according to Mineral Commodity Summaries (MCS) and the Welt-Bergbau-Daten (WBD):

Year	1996	1997	1998	1999	2000 e
Mining production, kt (MCS)	644	575	605	685	720
Mining production, kt (WBD)	700	598	658	N	N

Main producers (1999; according to MCS):

China	40.9 %
India	21.2 %
Brazil	8.8 %
Mexico	6.4 %

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. Prices of natural graphite are published monthly in the Industrial Minerals magazine and quoted in USD/t CIF UK ports. Average prices of traded grades of graphite at year-end were as follows:

A Crystalline lump, 94 % C
B Crystalline large flake, 90 % C
C Crystalline medium flake, 90 % C
D Crystalline small flake, 80/95 % C
E Amorphous powder, 80/85 % C

Commodity/Year	1996	1997	1998	1999	2000
A	750	750	650	660	660
B	500	515	515	515	515
C	415	390	390	390	390
D	385	385	385	385	385
E	260	260	260	228	228

Since 1993 the magazine Industrial Minerals has quoted also synthetic graphite with 99.93% content of C. Its price was USD 2.23 per kg at year-end 1993; was continuously increasing and reached USD 2.55 per kg FOB Swiss border at year-end 1996. In the last years, the price fluctuated 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.

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 artificial 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 mostly used for personal adornment. The most important qualities of gemstones are beauty, durability, colour, transparency, high lustre, brilliance, attractiveness, rarity, etc. 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 low-quality gemstones are 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 transistors, infrared optics, bearings, lasers, etc.

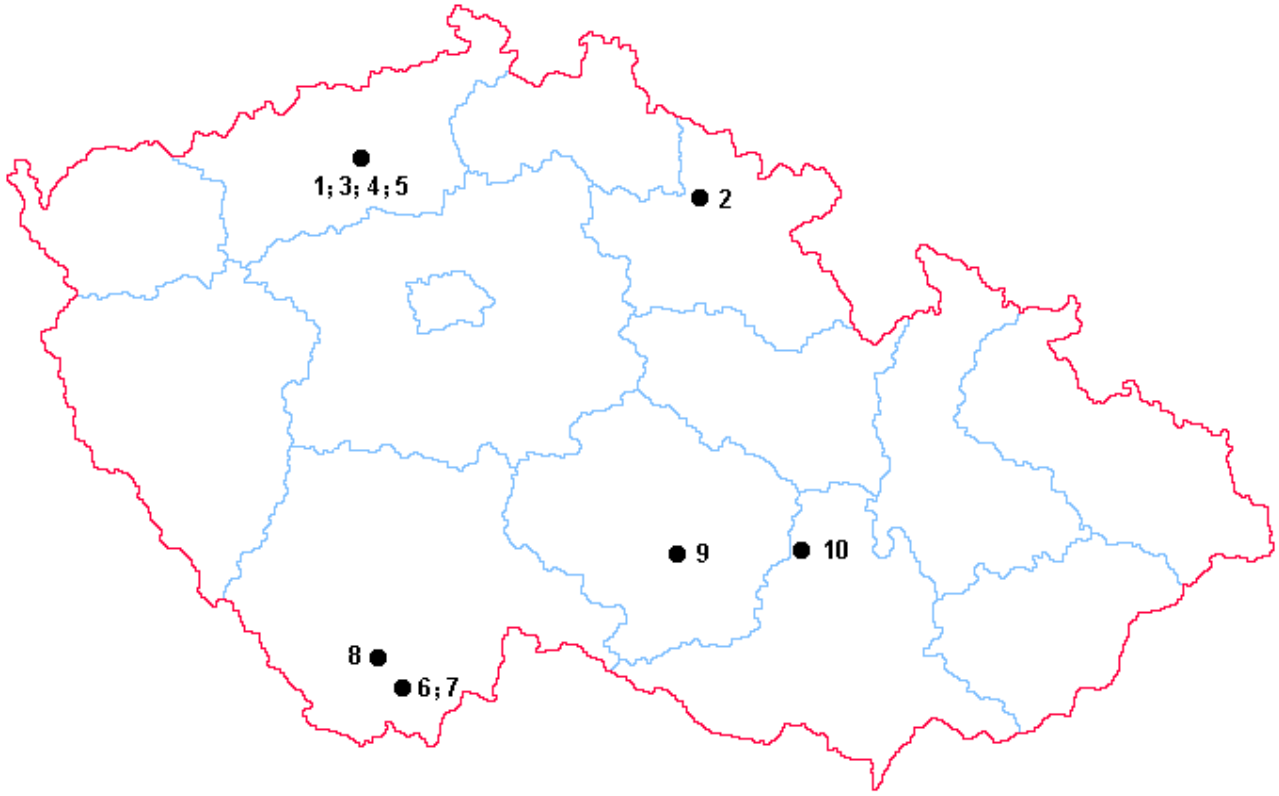
2. Mineral resources of the Czech Republic

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 piedmont basin (the deposit Vestřev). Stones of large size are used as gemstones, smaller grain sizes as abbrazives.
- 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 sands in southern Bohemia, in a belt which extends from Vodňany to České Budějovice and to the Kaplice region. Green-brownish moldatives occur in south-western Moravia, along the Jihlava river, in a belt extending from Telč to Třebíč and further to Moravský Krumlov. Moldavites, particularly those from southern Bohemia, are due to their attractiveness used in jewelry (mostly in their natural form). Industrial accumulations were verified at Besednice, Ločenice and Vrábče in southern Bohemia. Moldavites weren't mined systematically during last five years.
- 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 envelopes 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 long, occurs in a tectonic breccia confined to the Bíteš gneiss, which shows some hydrothermal alteration.

It seems to be obvious that industrial mining for gemstones has small extent and will never play any important role in economy.

3. Registered deposits and their location in the Czech Republic



Pyrope-bearing rock:
1 **Podsedice**
2 **Vestřev**
3 Linhorka-Staré
4 Podsedice-Dřemčice
5 Třebívlice

Moldavite-bearing rock:
6 **Ločenice**
7 Besednice
8 Vrábče-Nová Hospoda

Other gemstones:
9 Bochovice
10 Rašov

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

Year	1996	1997	1998	1999	2000
Deposits – total number a)	5	5	5	5	5
exploited b)	2	2	2	3	3
Total mineral resources, kt a)	23 072	23 019	22 900	22 845	22 785
economic proved reserves	3 630	3 583	3 501	3 455	3 408
economic probable reserves	12 920	12 914	12 910	12 901	12 888
potentially economic resources	6 522	6 522	6 489	6 489	6 489
Mining production, kt a)	39	49	43	54	62

Note:
a) pyrope-bearing rock
b) two deposits of pyrope, one deposit of moldavite

5. Foreign trade

7103 – Precious or semi-precious stone

Raw material	1996	1997	1998	1999	2000
Import, kg	38 045	31 278	23 966	25 573	19 168
Export, kg	4 806	3 279	2 405	1 527	1 102

6. Prices

19 168 kgs of gemstones were imported from South Africa (51.6 %), from Germany (16.9 %) and from Brasil (12.8%) in 2000, average price was circa CZK 881 per kg. At the same time, 1102 kgs of gemstones were exported to Slovakia (51.4 %), to Croatia (14.2 %) and to Poland (13.4 %). Average export price was CZK 3404 per kg. In these numbers diamonds are not included.

7. Mining companies in the Czech Republic as of December 31, 2000

Granát - družstvo umělecké výroby Turnov
TRL s.r.o, Kutná Hora
FONSUS první těžební a.s., Praha

8. World production

World production of industrial diamonds reached about 64 mill. carats in 1998. The main producer was Australia – 38.6%, followed by Zaire – 22.8%, Russia 16.5%, South Africa – 10.2% and Botswana – 9.3%. These countries covered more than 97% of the world production.
World production of gem-quality diamonds was estimated at 54 mill. carats in 1998. Also in this case in the first place was Australia – 30.3%, followed by Botswana - 25.6%, Russia – 19.5%, South Africa – 8.0 % and Zaire – 6.7%. These five countries covered practically 90% of the world production.
World capacity of garnet production (mostly for industrial application) was 272 kt in 1999. The largest mining capacity was in Australia – 42.6 %, further producers were USA - 22.3 %, India – 20.2 % and China – 7.4 %.

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, FOT mine Idaho, USA (Commodity A). Average prices in USD/t with minimum 20 t at yearend were as follows:

Commodity/Year	1996	1997	1998	1999	2000
A	210	210	210	210	210

10. Recycling

Gemstones in jewelry are not 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 jewelry can be combined and replaced. Pyrope can be replaced by almandine, amethyst and similar 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) whitish rock, containing substantial amount of the kaolinite group 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, like granitoids, arkoses, gneisses, etc. These so-called residual kaolins can be transported, thus forming sedimentary kaolins. The deposits are concentrated in feldspar rocks in which the kaolinization had occurred. The titanium-bearing kaolin originated of autometamorphic granites with high Ti-minerals content. World economic reserves of kaolin are estimated at about 12000 mill. tons.

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.

2. Mineral resources of the Czech Republic

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

- Kaolin for production of porcelain and fine ceramics (KJ); requirements: purity, rheological properties, strength after drying, pure white-fired colour (content of Fe_2O_3+TiO_2 max. 1.6 %), refractoriness min. 33 PCE (1,730°C), sieve residue on the screen 0.063 mm max. 2 %.
- Kaolin for ceramics manufacturing (KK) has no specifically defined parameters and is used in many ceramic recipes. Specially appreciated are white-fired colour, 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 %) and in plastics.
- Titanium-bearing kaolin (KT) - contains over 0.5 % TiO_2 and this type of kaolin occurs only in the Karlovy Vary region. Tests have proven 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 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.

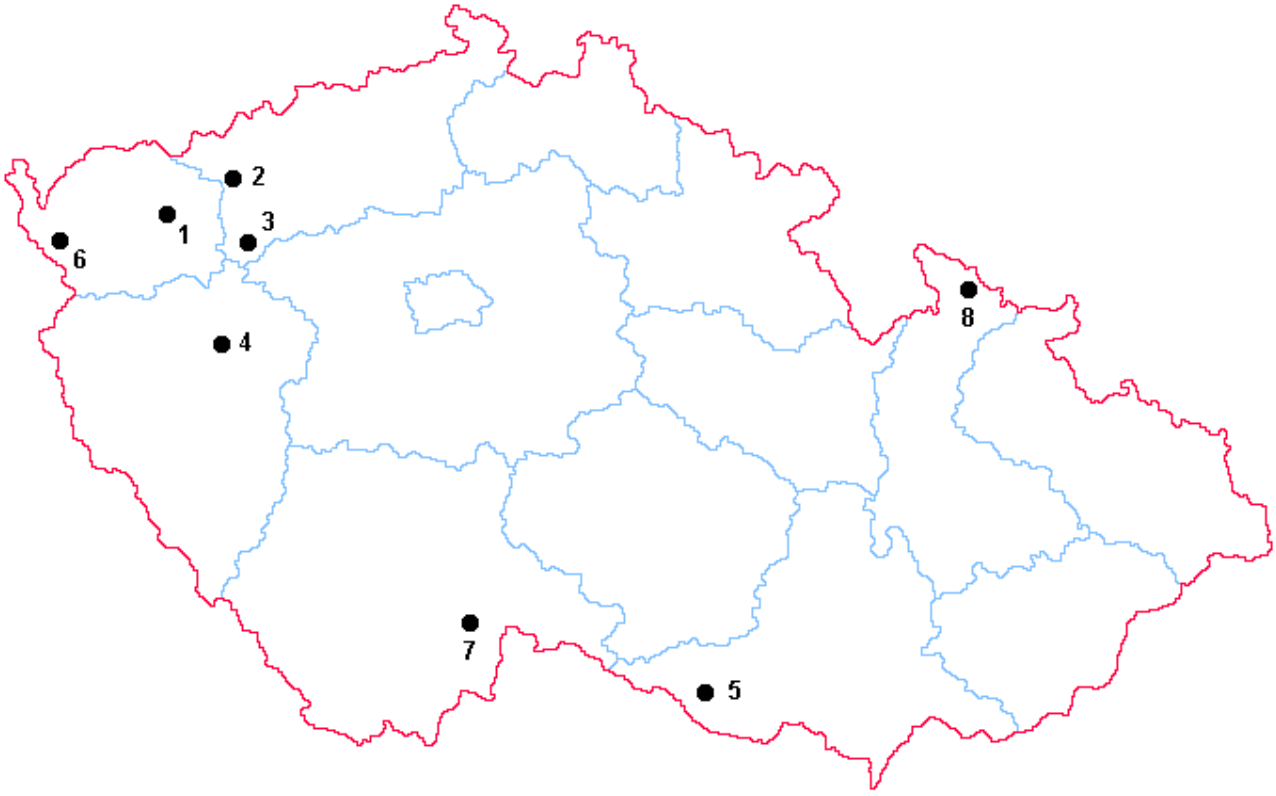
All kaolin deposits in the Czech Republic originated by kaolinitic weathering of feldspar rocks. The major kaolin deposits are located in the following areas:

- 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.

- The Kadaň region - kaolins of this area originated from granulite gneiss of the Krušné hory crystalline complex. This kaolin is of the KK and KP grades.
- The Podbořany region - parent rock is feldspathic sandstone of the Líně formation belonging to the Central Bohemian Carboniferous to Permian. There occur all aforesaid grades of kaolin here. The KJ kaolins are used as an additive into the Karlovy Vary kaolins in production of porcelain because of their rheological properties.
- 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.
- The Znojmo region - these kaolins originated mostly from granitoids of the Dyje massif, to a lessen 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.
- The Cheb basin - these kaolins originated through kaolinization of granites of the Smrčiny massif. There is only one deposit here (KK, KP).
- The Třeboň basin - less important deposits, local kaolins originated from granites and biotite paragneisses of the Moldanubicum. Only ceramic kaolins (KK) are present.

All kaolin deposits of the Czech Republic are extracted by open-pit mining operations.

3. Registered deposits and their location in the Czech Republic



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

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

Year	1996	1997	1998	1999	2000
Deposits – total number	71	74	66	65	70
exploited	11	11	12	11	11
Total mineral resources, kt	1 236 135	1 213 915	1 148 848	1 137 513	1 152 423
economic proved reserves	282 252	279 722	276 537	263 721	257 451
economic probable reserves	575 381	567 527	529 649	526 900	493 525
potentially economic resources	378 502	366 666	342 662	346 892	401 447
Mining production, kt a)	2 798	2 982	3 049	5 183	5 573

Note:

a) raw kaolin, total production of all technological grades;
kaolin refined - water-washed - represents about 25% of above mentioned mining production

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

Kaolin for production of porcelain and fine ceramics (KJ)	1999	2000
Deposits – total number	28	27
exploited a)	4	5
Total mineral resources, kt	196 963	243 811
economic proved reserves	55 087	54 163
economic probable reserves	73 276	103 652
potentially economic resources	68 600	85 996
Mining production, kt	382	443

a) exploited deposits of KJ: Božičany – Osmosa – jih, Bystřice – Hájek, Jimlíkov, Krásný Dvůr, Mírová;

Kaolin for paper industry (KP)	1999	2000
Deposits – total number	22	22
exploited a)	6	6
Total mineral resources, kt	409 312	407 178
economic proved reserves	117 211	117 132
economic probable reserves	206 937	189 616
potentially economic resources	85 164	100 430
Mining production, kt	4 768	5 085

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

5. Foreign trade

2507 – Kaolin and other kaolinitic clays, whether or not calcined

Raw material	1996	1997	1998	1999	2000
Import, t	5 903	10 085	16 028	13 412	17 649
Export, t a)	361 947	398 257	418 948	428 342	440 554

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

6. Prices

Average prices of ceramic grade in the domestic market fluctuated depending on quality between CZK 2000-3500 per ton. Average export prices were CZK 3600-3900 per ton. Paper filling kaolin has been sold at CZK 1600-1850 per ton and average export price has been CZK 3000 per ton. 17 649 t of kaolin and other kaolinitic clays (item 2507 of the customs tariff) were imported in 2000 (58.3 % from Great Britain, 21.6 % from Germany and 15.8 % from Ukraine). Average import price was CZK 4344 per ton. 440 554 t of kaolin and other kaolinitic clays were exported to Germany (36.3 %), to Slovakia (15.3 %), to Austria (12.3 %), to Netherlands (9.1 %) and to Belgium (5.4 %) on average price of CZK 2527 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

Keramika Horní Bříza, a.s.
KSB s.r.o., Božičany
Chlumčanské keramické závody, a.s.
Kaolin Hlubany, a.s. Podbořany
Severočeské doly, a.s. Chomutov
Sedlecký kaolín, a.s. 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. In spite of these misleading facts we can estimate that the world production since 1984 ranged above 20 mill. tons per year, and in 1990 according to the Welt-Bergbau-Daten (WBD), it obviously reached its top (27,760 kt). After the fall to 20 960 kt in 1993, the world production of kaolin has been slowly increasing again. Numbers in the World Mineral Statistics (WMS) are higher (27 900 kt in 1999).

Year	1996	1997	1998	1999	2000 e
Mining production, kt (WMS)	26 900	27 100	27 500	27 900	N
Mining production, kt (WBD)	23 623	24 363	26 155	N	N

Main producers (1999; according to WBD):

USA	36.1 %	Iran	4.0 %
Germany	12.9 %	China	3.8 %
Great Britain	9.2 %	India	2.7 %
Russia	5.4 %	Colombia	2.7 %
Brazil	5.3 %	Czech Republic	2.3 %

The Czech production of kaolin reached 5.0% of the world production according to the prelimitary data in 2000.

Note:
Data of production share of the Czech Republic are variable in various yearbooks. Welt-Bergbau-Daten publishes number of only 2.3 % for 1998, World Mineral Statistics - 4 %. The renowned publication The Industrial Minerals HandyBook publishes even 8% as a share on the world production of 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. Average prices of traded commodities in GBP/t, FOT ex-Cornwall, GB at year-end were as follows:

A Kaolin refined, filler
B Kaolin refined, coating
C Kaolin refined, ceramic grade
D Kaolin refined, porcelain grade

Commodity/Year	1996	1997	1998	1999	2000
A	62,50	62,50	62,50	50,00	52,50
B	97,50	97,50	100,00	72,50	76,50
C	60,00	60,00	60,00	62,50	62,50
D	102,50	102,50	102,50	105,00	105,00

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 a filler (insulation materials, pigments, glass fibres), the situation is analogous.
- In production of refractory materials and applications in the building industry, kaolin can be successfully substituted by other materials with adequate properties.

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 (argillite).

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 bond (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 underlaying 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.

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

- The Kladno-Rakovník Carboniferous to Permian - the deposits contain mostly high grade refractory claystones (shales) (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).
- 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 with slightly lower quality).
- Cretaceous sediments in the vicinity of Prague - these clays are suitable as a highly refractory opening material (JZ) and refractory bond clays (JO), as well as whiteware clays (JP).
- The Louny Cretaceous - these clays are suitable as whiteware clays (JP) and other refractory clays (JO), but particularly as ceramic clays (JN).

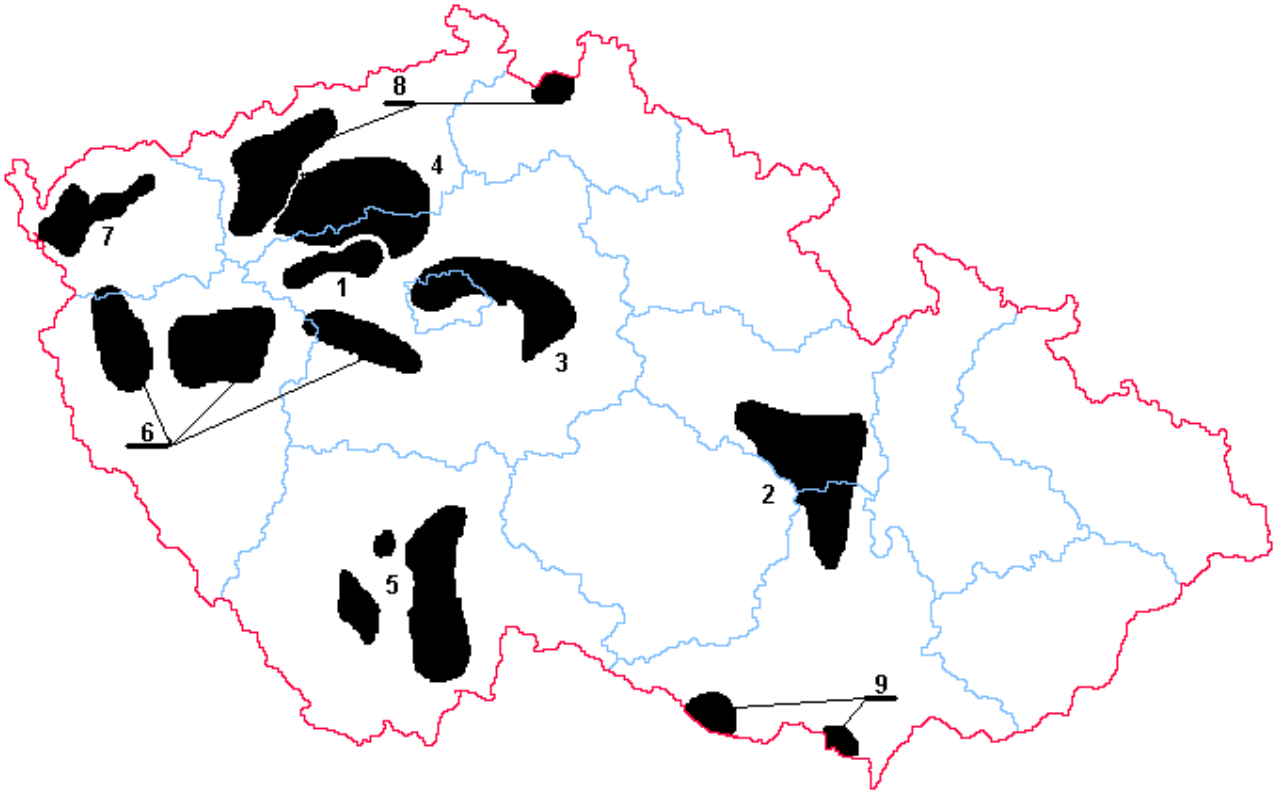
- South Bohemian basins - medium or high grade refractory clays, suitable for use as bond

clays (JO), whiteware clays (JP) and non-refractory clays (JN).

- The Plzeň basin and Tertiary relics of Central and Western Bohemia - mostly medium grade refractory clays, classified as bond clays (JO) and ceramic clays for production of floor and wall tiles, as well as for stoneware (JN).
- The Cheb and Sokolov basins - more significant is the Cheb basin containing important bond clays (JO), whiteware clays (JP), refractory and sintering clays (JO, JN), etc.
- North Bohemian and the Žitava basins - apart from high aluminous underlaying clays (JA), there are also overlaying ceramic (mostly sintering and tile) clays (JN).
- Tertiary and Quaternary sediments in Moravia - mostly ceramic (sintering and tile) clays (JN).

Clays and claystones in the Czech Republic are extracted by open-pit mining operations.

3. Registered deposits and their location in the Czech Republic



1 The Kladno-Rakovník Carboniferous to Permian
2 Moravian and East Bohemian Cretaceous sediments
3 Cretaceous sediments around Prague
4 The Louny Cretaceous
5 South Bohemian basins
6 The Plzeň basin and Tertiary relics of Central and Western Bohemia
7 The Cheb and Sokolov basins
8 North Bohemian and the Žitava basins
9 Tertiary and Quaternary sediments in Moravia

4. Basic statist ical data of the Czech Republic as of December 31

Year	1996	1997	1998	1999	2000
Deposits – total number	136	134	113	120	116
exploited	30	29	26	27	22
Total mineral resources, kt	981 614	1 239 926	1 035 854	1 059 999	1 057 361
economic proved reserves	257 861	258 133	247 216	227 678	231 689
economic probable reserves	697 642	696 792	512 483	526 568	528 712
potentially economic resources	268 111	285 001	276 155	305 753	296 960
Mining production, kt	738	759	1 030	636	601

5. Foreign trade

2508 – Other clays (except expanded clays), andalusite, kyanite, sillimanite, also fireclay, mullite, chamotte or dinas earth

Raw material	1996	1997	1998	1999	2000
Import, t	13 907	14 865	23 136	34 376	38 457
Export, t	220 802	206 053	188 535	184 242	174 212

6. Prices

Different quality of clay and schistose clay in the market gives variable prices. For example, crude refractory clay is delivered at CZK 170 - 750 per ton, average price is CZK 540 per ton, dried refractory clay reaches CZK 860 – 1 840 per ton, average prices are about CZK 1 200 per ton. 8837 tons of refractory clay were imported from Poland (88.4 %) and from Germany (11.0 %) in 2000. Average import price was CZK 1947 per ton. At the same time, 46 784 tons of refractory clay were exported to Germany (31.8 %), to Slovakia (25.8 %) and to Austria (22.9 %) , average price was CZK 1520 per ton.

Prices of crude sintering clay fluctuate between CZK 170 - 665 per ton, average price is CZK 400 per ton. Dry sintering clay is sold at CZK 1 000 per ton. Prices of crude bleaching clay fluctuate from CZK 350 to CZK 1 630 per ton, average price is about CZK 1 300 per ton if they are crude, prices of dry bleaching clay reach up to CZK 1 375 – 2 950 per ton, average price is about CZK 2 160 per ton. Average prices of other crude clays are CZK 230 per ton, prices of dry ones are about CZK 1 300 per ton. 6093 tons of other clays were imported from Germany (92.8 %) and from Austria (2.6 %) in 2000 at average price CZK 1912 per ton. 57 957 tons of other clays were exported to Germany (80.9 %), to Austria (8.1 %) and to Slovakia (4.2%), average export price was CZK 780 per ton.

5954 t of fire clay were imported from Ukraine (57.5 %), from Germany (35.2 %) and from the USA (5.8 %) at average price CZK 2528 per ton in 2000. Export was realized at CZK 2386 per ton, its volume was 36 595 tons. 52.2 % were exported to Germany, 19.2 % to Hungary and 8.7 % to Italy.

Prices of crude schistose clay in the domestic market fluctuate between CZK 400 - 551 per ton. Calcined schistose clay is sold at CZK 1 400 – 3 200 per ton. 377 tons of mullite were imported from Netherlands (47.6%), from Hungary (42.7%) and from Germany (6.9 %) in 2000. Average price was CZK 26 779 per ton.

7. Mining organizations in the Czech Republic as of December 31, 2000

KEMAT Skalná, s.r.o.
KERAMOST a.s., Most
Calofrig a.s., Borovany
České lupkové závody a.s., Nové Strašecí
Keramika Horní Bříza a.s.
RAKO a. s., Rakovník
Moravské šamotové a lupkové závody a.s., Velké Opatovice
Kaolin Hlubany a.s., Podbořany
RAKO - Lupky s.r.o., Lubná u Rakovníka

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 is slowly but steadily growing.

9. World market prices

Average prices of most of the clays were steadily growing. Prices of some of the clays are quoted each month in the Industrial Minerals magazine. 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

Commodity/Year	1996	1997	1998	1999	2000
A	97,50	106,50	106,50	106,50	106,50
B	86,00	86,00	88,00	112,00	112,00
C	45,00	45,00	45,00	45,00	45,00
D	100,00	100,00	105,00	105,00	105,00
E	162,50	162,50	184,80	162,50	162,50

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 fireclay and similar materials, the clays can be successfully substituted by a number of refractory materials - andalusite, mullite (including 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 buff-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

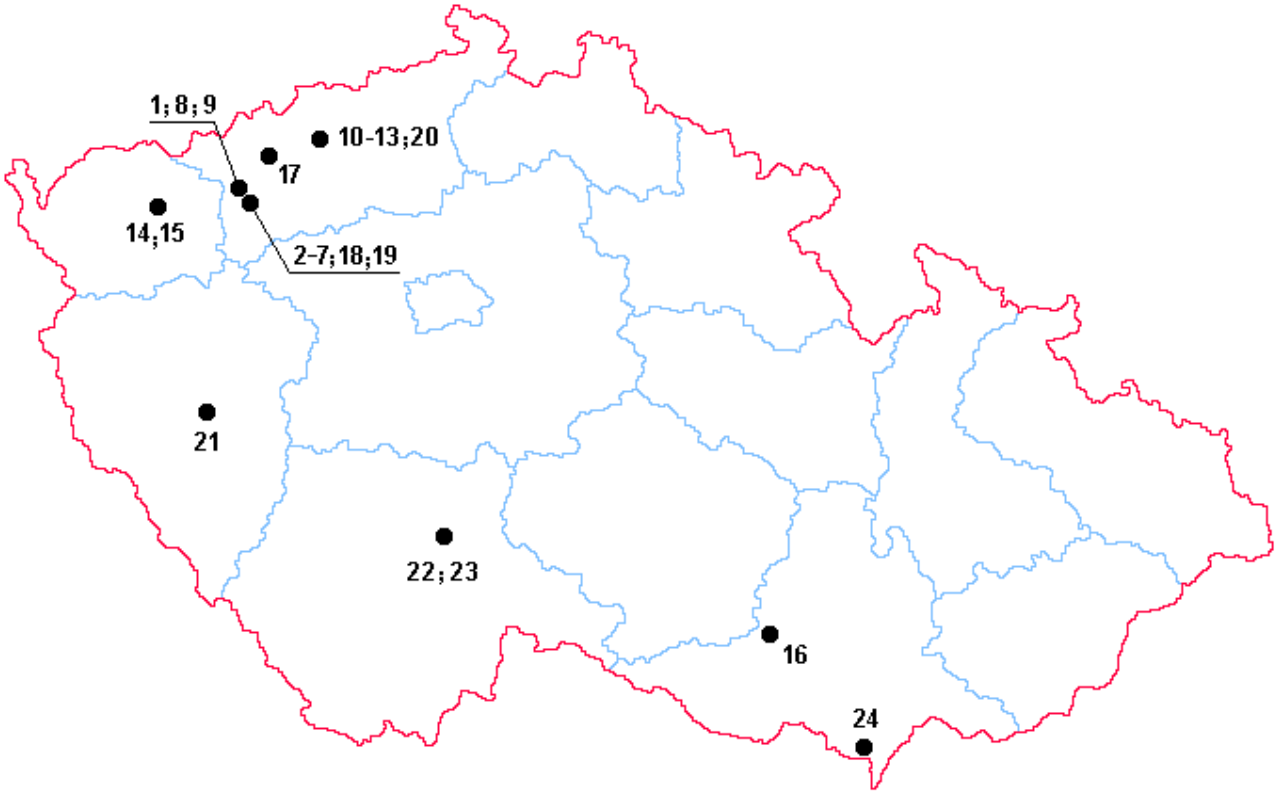
1. Characteristics and use

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 are added to one tonne of dry iron ore to form pellets), as an adsorbent (decolorizing mineral, catalysis, refining, filtration, drying, waste water treatment, pesticide carrier), in drilling muds, 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 (catlite) and pesticide carrier.

2. Mineral resources of the Czech Republic

The most important bentonite deposits in the Czech Republic are in the eastern (The Kadaň and Podbořany region) and western margin of the Doupovské hory Mts. (Hroznětín region) and the České středohoří Mountains (particularly the Most region). These areas include almost all bentonite deposits and reserves of the Czech Republic. Less important are deposits in Tertiary basins (The Plzeň region, South Bohemian basins, the Cheb and Sokolov basins) and Miocene sediments of the Carpathian Neogene in southern Moravia, with their mostly montmorillonite clays. All bentonite deposits in the Czech Republic originated by weathering of volcanic rocks. Mining, mineral processing and use of bentonite in the Czech Republic started only in the late 50's, particularly due to its use in the foundry industry. The mining culminated at the beginning and end of the 80's. Large portion of bentonite from deposits of the Doupovské hory and České středohoří mountains 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.

3. Registered deposits and their location in the Czech Republic



Foundry bentonite:

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

Other bentonite:

17 Chomutov-Horní Ves
18 Krásný Dvůr-Vys. Třebušice
19 Račetice
20 Obrnice-Vtelno-Rudolice
21 Dnešice-Plzeňsko-south
22 Maršov
23 Rybova Lhota

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

Year	1996	1997	1998	1999	2000
Deposits – total number	23	24	24	24	27
exploited	4	4	3	3	3
Total mineral resources, kt	231 184	231 110	248 273	294 260	268 298
economic proved reserves	51 611	51 460	51 378	51 753	50 995
economic probable reserves	160 171	160 162	143 594	156 037	133 816
potentially economic resources	19 402	19 488	53 301	86 470	83 487
Mining production, kt	59	110	125	160	280

5. Foreign trade

250810 - Bentonite

Raw material	1996	1997	1998	1999	2000
Import, t	5 394	7 162	9 175	11 750	12 887
Export, t	21 644	20 608	23 305	26 059	32 853

6. Prices

12 887 t of bentonite were imported from Slovakia (50.8 %), from Greece (34.4 %) and from Germany (11.1%) at average price CZK 3165 per ton in 2000. 32 853 t were exported to Germany (53.9 %), to Austria (34.3 %) and to Slovakia (10.0 %). The average export price was CZK 2707 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

KERAMOST a.s., Most

8. World production

Annual world production of bentonite is about 12 mill. tons. The production has been for a long period higher than 9 mill.t/year, and according to the Welt-Bergbau-Daten, the highest production were 10 170 kt in 1998 (statistically closed year). Numbers in World Mineral Statistics (WMS) are higher.

Year	1996	1997	1998	1999	2000 e
Mining production, kt (WMS)	10 700	11 200	11 400	11 500	N
Mining production, kt (WBD)	9 630	9 852	10 170	N	N

Main producers (1998; according to WBD):

USA	37.6 %
Russia	12.3 %
Greece	11.3 %
Italy	5.9 %
Turkey	5.6 %

9. World market prices

Bentonite prices have been slightly fluctuating in limited time periods in the last few years. Some sorts (commodity C, D) rose in price in 2000. According to quotation of the Industrial Minerals magazine there were the following average prices on the world market at year-end:

A Wyoming, foundry grade, 85 % <200 mesh, bagged, 20-ton lots, GBP/t, del GB
B Wyoming, crude, bulk, rail cars, USD/st, FOB ex-works
C Wyoming, foundry grade, bagged, rail cars, USD/st, FOB ex-works
D Wyoming, API, bagged, rail cars, USD/st, FOB ex-works

Commodity/Year	1996	1997	1998	1999	2000
A	135,00	135,00	120,00	135,00	135,00
B	32,50	32,50	42,50	42,50	42,50
C	35,00	35,00	50,00	40,00	59,00
D	35,00	35,00	38,50	38,50	43,00

10. Recycling

Bentonite can be recycled on a very limited scale only.

11. Possible substitutes

In moulding sands, bentonite can be replaced by bonding agents containing graphite, synthetic polymers, or other clay minerals. Drilling muds 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, bentonite is replaced by burnt lime, polymers and other binders.

FELDSPAR

1. Characteristics and use

Feldspar raw materials are rocks with the prevalent portion of minerals of the feldspar group or their mixtures 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 (albite, oligoclase, andesite). 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. The major impurity represents high content of iron in the feldspar structure (unremoveable) or in the form of admixture (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.

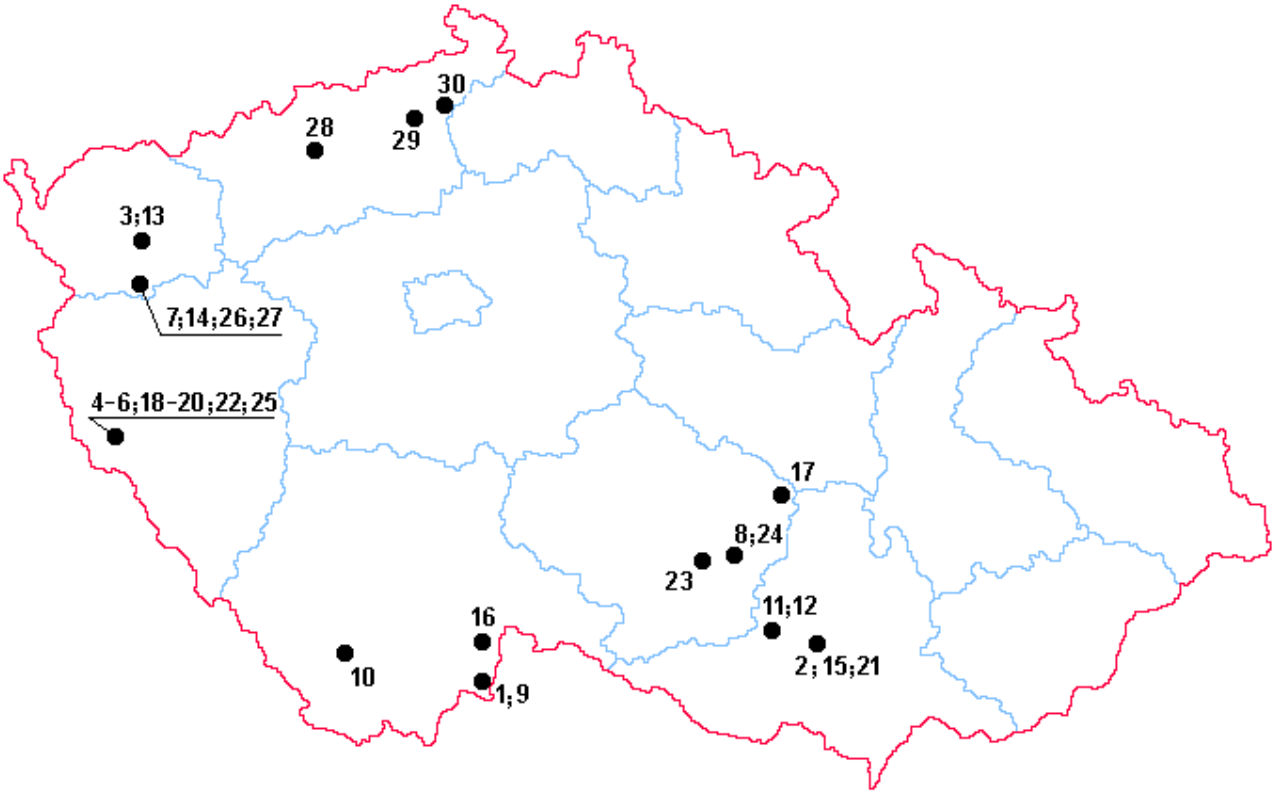
For the same purposes are used also feldspar substitutes, which are rocks with alkalies confined to some other minerals (mostly nepheline - anhydrous sodium-potassium alumo-silicate). Nepheline syenites are particularly used abroad to substitute for feldspar raw materials.

2. Mineral resources of the Czech Republic

Feldspar deposits in the Czech Republic are represented mostly by feldspar sand and gravel, leucocratic granitoids and pegmatite bodies.

- Recently, the most significant have been feldspar deposits originated in source areas of granitic rocks rich in feldspar phenocrysts. The most important of them are the area along the upper course of the river Lužnice and the area south of Brno (sediments of the river Jihlava). The sediments are Quaternary fluvial feldspar gravel sands, suitable for production of glazes, household china, sanitary ceramics, glass, etc.
- Very important source of feldspar are leucocratic granitoids (granites and granite porphyries, diorites), mostly fine- to medium-grained. They have been explored at many localities occurring in various granite massifs (Chvaletice, Blanice region, Babylon, Blatno, etc.). Besides potential deposits (western Moravia), this category also includes already mined deposits in western Bohemia. The material is used in production of sanitary ceramics, colored glass, porcelain, grinding wheels, etc.
- In the past, the only source of feldspars used to be pegmatite deposits occurring in many regions. The Poběžovice - Domažlice region is characterized by pegmatites with an admixture of dark minerals. These pegmatites exhibit a balanced proportion of sodium and potassium feldspars. The material is medium to low grade. However, there are also sodium feldspar deposits which can be used in production of glazes and clear glass. In other areas, prevailing minerals in pegmatites are potassium feldspars. The Tepelské vrchy region, with quite large deposits of high grade feldspars and low content of impurities, seems to be very promising. Quite promising is also the Písek region, with zoned pegmatites, only slightly affected by metasomatic processes. Smaller deposits are known in the area of Humpolec, in western Moravia, etc.
- As a substitute for feldspars in the Czech Republic, there are used mainly Tertiary volcanic rocks of the České středohoří Mountains - nepheline phonolites. Because of high content of colouring oxides, they are used in the glass and ceramics industry only as a melting agent for color mixtures. High alkali content (10-10.5% Na_2O and 3.5-5% K_2O) facilitates lowering of melting temperature and shortening of burning period.

3. Registered deposits and their location in the Czech Republic



Feldspar raw materials:

1 **Halámky**
2 **Hrušovany near Brno**
3 **Krásno-granite**
4 **Luženičky**
5 **Mračnice**
6 Ždánov
7 Beroun-Tepelsko
8 Bory-Olší
9 Halámky-Tušť
10 Chvalšiny
11 Ivančice-Letovisko
12 Ivančice-Němčice
13 Krásno-Vysoký Kámen
14 Křepkovice
15 Ledce-Hrušovany near Brno
16 Majdaléna
17 Malé Tresné
18 Meclov 2
19 Meclov-airfield
20 Meclov-west
21 Otov-Červený vrch
22 Smrček
23 Velké Meziříčí-Lavičky
24 Zámělíč
25 Zhořec 1
26 Zhořec 2-the Hanov zone

Feldspar substitutes:

27 **Želenice**
28 Tašov-Rovný
29 Valkeřice-Zaječí vrch

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

Feldspar

Year	1996	1997	1998	1999	2000
Deposits – total number	36	36	29	27	28
exploited	6	6	6	7	5
Total mineral resources, kt	87 207	86 872	81 913	122 360	77 846
economic proved reserves	40 373	40 038	37 921	80 249	35 738
economic probable reserves	41 857	41 857	40 368	38 173	35 755
potentially economic resources	4 977	4 977	3 624	3 938	6 353
Mining production, kt	211	243	266	244	337

Feldspar substitutes

Year	1996	1997	1998	1999	2000
Deposits – total number	3	3	3	3	3
exploited	1	1	1	1	1
Total mineral resources, kt	200 311	200 277	200 242	200 217	200 192
economic proved reserves	0	0	0	0	0
economic probable reserves	200 311	200 277	200 242	200 217	200 192
potentially economic resources	0	0	0	0	0
Mining production, kt	38	33	33	24	24

5. Foreign trade

252910 - Feldspar

Raw material	1996	1997	1998	1999	2000
Import, t	3 923	5 685	5 474	6 317	7 658
Export, t	67 570	55 011	57 546	62 273	85 931

252930 – Leucite, nepheline and nepheline syenite

Raw material	1996	1997	1998	1999	2000
Import, t	80	68	337	465	697
Export, t	0	0	5	0	0

6. Prices

7658 t of feldspar were imported from Germany (74.0 %), from Italy (13.2 %) and from Finland (9.4 %). Average feldspar import price were CZK 3256 per ton in 2000. 85 931 t of feldspar were exported to Poland (46.2 %), to Slovakia (27.0 %) and to Hungary (20.0 %). Export price was CZK 1397 per ton. 697 t of leucite, nepheline and nepheline syenite (item 2529 30 of customs tariff) were imported from Norway (44.7 %), from Netherlands (27.5 %) and from Germany (24.2 %) at average price CZK 7509 per ton in 2000.

7. Mining companies in the Czech Republic as of December 31, 2000

Calofrig a.s., Borovany
KMK Granit s.r.o., Sokolov
Chlumčanské keramické závody, a.s.
Brněnské papírny s. p., Předklášteří
KERAMOST a.s., Most (feldspar substitutes)

8. World production

Annual world production (including nepheline syenite and aplite) is about 6,9 mill. tons. The production continues to rise owing to an increase of use in metallurgy and other industrial branches. Numbers according to Mineral Commodity Summaries (MCS) and the Welt-Bergbau-Daten (WBD):

Year	1996	1997	1998	1999	2000 e
Mining production, kt (MCS)	6 750	8 050	8 080	8 980	9 100
Mining production, kt (WBD)	7 853	7 971	8 525	N	N

Main producers (1999; according to MCS):

Italy	29.0 %
Turkey	12.2 %
USA	9.7 %
France	6.7 %
Thailand	5.6 %

Nepheline phonolites were mined in France, Germany and in the Czech Republic. The largest producers of the nepheline syenite were Canada, Norway and Russia.

9. World market prices

Average 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. Average feldspar prices at year-end were as follows:

A Ceramic grade, powder, 300 mesh, bagged, GBP/t, ex-store GB
B Sand, glass grade, 28 mesh, GBP/t, ex-store GB
C South African, ceramic grade, bagged, USD/t, FOB Durban
D South African, micronised, bagged, USD/t, FOB Durban

Commodity/Year	1996	1997	1998	1999	2000
A	182,50	182,50	182,50	182,50	182,50
B	99,00	99,00	99,00	99,00	99,00
C	140,00	140,00	150,00	150,00	150,00
D	235,00	235,00	205,00	205,00	205,00

10. Recycling

At glass recycling, 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 confined to other minerals than feldspars, like nepheline syenites or nepheline phonolites in the Czech Republic. These replace feldspars 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 hydrate, clays, talc, spodumene, pyrophyllite or their mixtures.

SILICA MINERALS

1. Characteristics and use

Silica raw materials 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 sands by siliceous cement), silicified sandstones, siliceous rocks, quartz sand and gravel, and vein and pegmatite quartz. The grade is established by various standards. The observed parameters are the content of SiO_2 and refractoriness. Impurities are represented by high Al_2O_3, Fe_2O_3, and/or other oxides. Silica raw materials are used in production of ferroalloys in 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 boulders are used in production of pure silica glass, UV glass and optical glass (fibre).

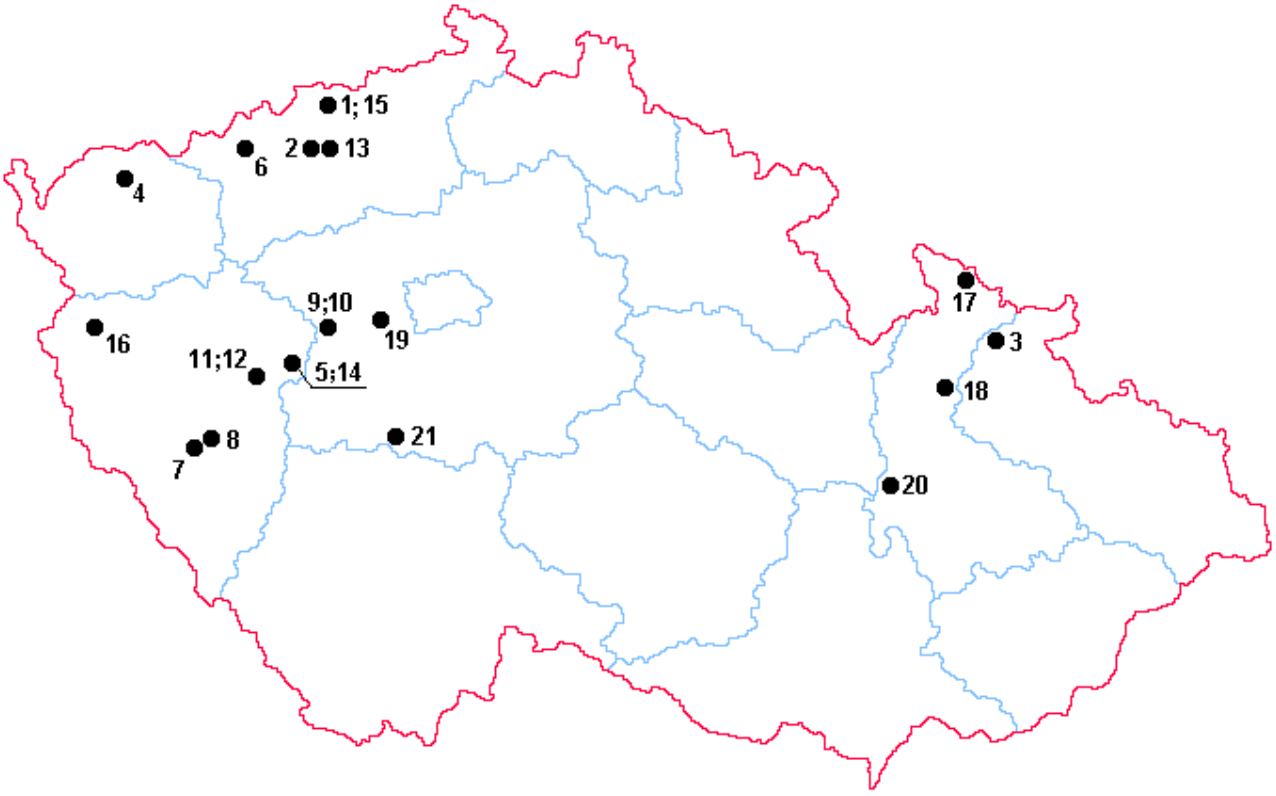
2. Mineral resources of the Czech Republic

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 deposits are confined especially to the occurrences of the Tertiary "amorphous" quartz, Cretaceous "crystalline" quartz and Ordovician quartz, to lesser extent to the occurrences of vein quartz and lidites of the Upper Proterozoic.

- Vein quartz deposits can be found almost all over the territory of the Czech Republic, and they can be divided into the following genetic groups:
  Quartz deposits in pegmatites (N. Moravia) - suitable for production of porcelain, ferrosilicon, silicon.
  Quartz dikes (silicified fault zones) - suitable for ceramic industry (the Tachov region, S. Bohemia, the Jeseníky mountains).
  Quartz veins related to granitoid massifs (the Karlovy Vary massif, the Žulová massif)
- Deposits of "amorphous" quartzite (quartz grains are cemented by a very fine quartz matrix) originated through silicification of Tertiary and Upper Cretaceous sediments in northern and western Bohemia (The Most region - mined deposit of Stránce, the Chomutov and Podbořany regions). Quartzite is a traditional material for production of dinas and can be also used for production of silicon metal.
- Neoid silicification of Cretaceous sandstones gave origin to important deposits of "crystalline" quartzites (isometric grains of quartz) in the Teplice region (mined deposit of Jeníkov-Lahošť). Quartzites are suitable for metallurgy but also for production of dinas.
- Among Paleozoic quartzites, the Ordovician quartzites of the Barrandian zone appear to be the most important. They are classified as of a lower grade for production of ferrosilicon and dinas.
- Because of their size and grade, very promising seem to be deposits of the Upper Proterozoic lydites, especially in the Rokycany and Přeštice regions. Tests showed that the material is suitable for production of siliceous alloys, and to a lesser extent for production of dinas.
- As a potential source of silica are considered also quartz sand and gravel in alluvial deposits of the Labe and Dyje rivers, and in the Cheb region.

- Only milky white vein quartz (after mineral processing) is considered to be suitable for production of special glass. It occurs in the Central Bohemian pluton (The Příbram region - metamorphosed island zone), and in hydrothermal veins which were metamorphosed together with the country rocks (phyllites) in the Prostějov region.

3. Registered deposits and their location in the Czech Republic



Quartz - quartzite:

1 **Jeníkov-Lahošť**
2 **Stránce**
3 Bílý Potok-Vrbno
4 Černava-Tatrovice
5 Drahoňův Újezd-Bechlov
6 Chomutov-Horní Ves
7 Kaliště
8 Kbelnice
9 Kublov-Dlouhá Skála
10 Kublov-Velíz
11 Kyšice-Pohodnice
12 Litohlavy-Smrkový vrch
13 Lužice-Dobrčice
14 Mníšek pod Brdy
15 Sklená Huť
16 Střelná
17 Tachov-Světecká Hora
18 Velká Kraš
19 Vikýřovice
20 Železná

Quartz for special glass:

21 Dětkovice
22 Krašovice

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

Year	1996	1997	1998	1999	2000
Deposits – total number	23	23	22	21	21
exploited	2	2	2	2	2
Total mineral resources, kt	54 025	54 012	49 170	36 607	36 607
economic proved reserves	7 565	7 552	5 365	5 479	5 479
economic probable reserves	30 285	30 285	27 168	27 309	27 309
potentially economic resources	16 175	16 175	16 637	3 819	3 819
Mining production, kt	4	13	1	3	0

5. Foreign trade

2506 – Quartz (except natural sands), quarzite

Raw material	1996	1997	1998	1999	2000
Import, t	21 339	80 250	40 966	50 864	27 841
Export, t	270	172	119	93	68

6. Prices

27 841 t of quartz and quartzite were imported in Czech Republic from Germany (66.8 %), from Slovenia (20.1 %) and from Poland (12.5 %) at average prices CZK 2556 per ton in 2000. 68 t of quartz and quartzite were exported to Austria (33.7 %), to Slovakia (29.5 %) and to Italy (16.1 %). Average export price was CZK 1325 per ton. Lump quartz was sold at CZK 45 - 177 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

In 2000 no companies were operating in the Czech Republic to extract silica raw materials.

8. World production

Among many known silica raw materials (except sands), 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 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 was becoming stabilized in follow years: 1995 – 435 t, 1996 – 435 t, 1997 – 450 t.

9. World market prices

Silica materials (except for glass and foundry sands) 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.

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.
In production of ferrosilicon, the quartz is irreplaceable, but the final product, ferrosilicon, can be replaced by other materials. Also dinas can be replaced by other types of lining.

GLASS SAND

1. Characteristics and use

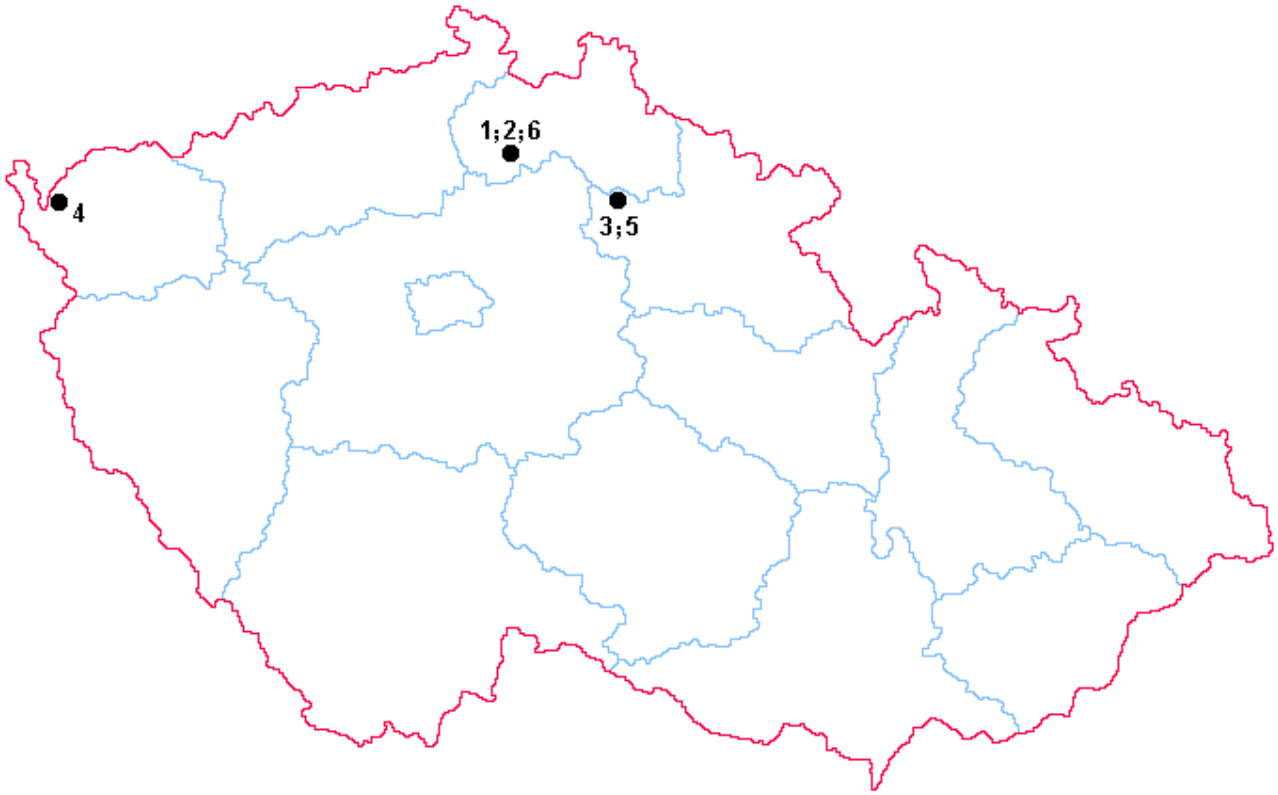
Glass sands are granular, pale or even white coloured rocks (quartz sands or sandstones), which are used, after processing, as a raw material for production of glass. Required parameters (grain size, mineral and chemical composition) vary according to the type of glass. Sands of required grade do not usually occur in the nature, therefore the sands have to be dressed by crushing, washing (to remove floating particles) and sorting (to reach the required grain size). To obtain high grade glass sands, it is necessary to apply more sophisticated methods of mineral dressing (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. Sands for glass melting are used for preparation of glass batches for production of sheet glass, packing glass 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 sands of higher grade are used for production of non-transparent silica glass (max. 0.0020 % Fe_2O_3) and the top quality sands (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 sands are 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 sands in the Czech Republic are located in the Lužice (Srní, Provodín) and Jizera (Střeleč) regions of the Bohemian Cretaceous basin. The raw material consists of weakly consolidated quartz sandstones of the Coniacian (Střeleč) and Middle Turonian (Provodín, Srní) age. The Střeleč glass sand is of top world quality. Other deposits within the Bohemian Cretaceous basin are less important, or they are located in areas with special environmental considerations. Unconventional deposit at Velký Luh is composed of Pliocene gravel sands of the Cheb basin (redeposited material from the kaolinized Smrčiny granite). Sands from all aforesaid deposits require mineral dressing in order to meet rigid specifications (washing, sorting, electromagnetic separation, flotation, etc.).

3. Registered deposits and their location in the Czech Republic



Glass sands:

1 **Provodín** *
2 **Srní 2** *
3 **Střeleč** *
4 **Velký Luh** *
5 Mladějov *

* glass and foundry sand deposits

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

Year	1996	1997	1998	1999	2000
Deposits – total number	5	5	5	6	6
exploited	4	4	4	4	4
Total mineral resources, kt	242 397	241 190	239 739	280 986	278 945
economic proved reserves	96 497	95 730	94 912	92 170	91 190
economic probable reserves	28 968	28 938	28 855	67 071	66 945
potentially economic resources	116 932	116 522	115 972	121 745	120 810
Mining production, kt	1 130	994	827	980	985

5. Foreign trade

250510 – Silica sands and quartz sands

Raw material	1996	1997	1998	1999	2000
Import, t	127 952	67 188	57 967	50 013	121 549
Export, t	692 336	436 931	763 007	855 506	599 843

6. Prices

Technological point of view and quality needs both specify mineral prices. Domestic prices of glass sand – wet fluctuate between CZK 280 and 770 per ton. Glass sand - dry prices are about CZK 990-1540 per ton. Prices of filtration sand were: wet CZK 375 - 550 per ton, dry CZK 740-910 per ton. 121 549 t of silica sand (item 2505 10 of the customs tariff) were imported in Czech Republic at average price CZK 512 per ton in 2000. Silica sand was imported from Slovakia (81.2%), from Germany (15.0 %) and from Belgium (2.3 %). Also 599 843 t of silica sand were exported to Austria (34.3 %), to Germany (30.3 %) and to Slovakia (19.6 %) at average price CZK 343 per ton.

7. Minin g companies in the Czech Republic as of December 31, 2000

Sklopísek Střeleč - EXIMOS, a.s., Mladějov
KEMAT Skalná, s.p.
Provodínské písky, a.s.

8. World production

World statistics provides only data on production of sands for industrial uses (glass production, foundry industry, abrasives etc.). 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. Since this year the volume of production has been decreasing again. Numbers of world mining production according to Mineral Commodity Summaries (MCS):

Year	1996	1997	1998	1999	2000 e
Mining production, kt (MCS)	117	119	110	107	107

Main producers (1999; according to MCS):

USA	27.0 %
Paraguay	9.3 %
Germany	6.5 %
France	6.1 %
Austria	5.6 %

9. World market prices

Quartz sand for industrial use was traded on European market at average price GBP 11.00 per ton at the beginning of the 90's. In 1995 the price increased to GBP 13.50 per ton. The prices increased to GBP 15.00 per ton in 2000. Prices of sands quoted by the Industrial Minerals magazine in GBP/t EXW GB at year-end were as follows:

A Glass sand, flint, container

Commodity/Year	1996	1997	1998	1999	2000
A	13,50	13,50	13,50	13,50	15,00

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 basically the only 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

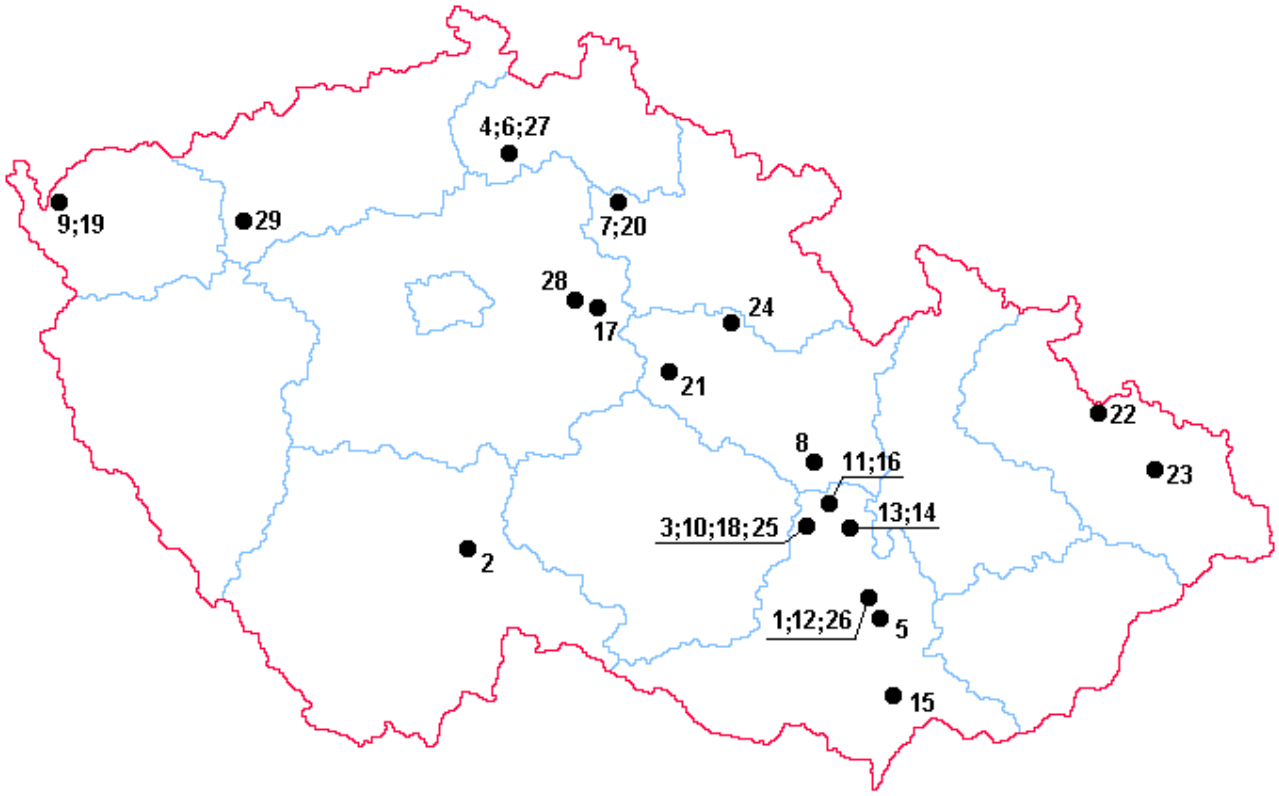
Foundry sands are granular, pale coloured rocks, being used directly or after mineral dressing for production of foundry moulds and cores. The required properties include sufficient resistance to high temperatures and strength (depends on quality and quantity of the binding component), and suitable grain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

Natural quartz sands are 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 sands (material of lower grade), but they can also form separate deposits in other parts of the Bohemian Cretaceous basin (Cenomanian sandstones of the Orlice-Žďár region, which are often glauconitic sands). Less important are aeolian sands (the Labe river basin and the Lower Moravian depresion) and Pliocene sands of the Cheb basin; only of local importance are fluvial sands (Lžín), glacial sands (Palhanec), etc. Foundry industry also uses sands, which are a waste product of kaolin refining (Krásný Dvůr).

3. Registered deposits and their location in the Czech Republic



Foundry sands:

1 **Blansko 1-Jezírka**
2 **Lžín**
3 **Nýrov**
4 **Provodín** *
5 **Rudice-Seč**
6 **Srní 2** *
7 **Střeleč** *
8 **Svitavy**
9 **Velký Luh** *
10 **Voděrady**
11 Babolky
12 Blansko 2-Mošná
13 Boskovice
14 Boskovice-Chrudichromy
15 Čejč-Hovorany
16 Deštná-Dolní Smržov
17 Kluk-Mostkový Les
18 Kunštát-Zbraslavec
19 Kytlické Mlýny
20 Lomnička
21 Načešice
22 Palhanec-Vávrovice
23 Polanka nad Odrou
24 Rokytno-Bohumileč
25 Rudka u Kunštátu
16 Spešov-Dolní Lhota
27 Srní *
28 Zvěřínek-Polabí
29 Krásný Dvůr **

* glass and foundry sand deposits
** waste sand of kaolin refining

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

Year	1996	1997	1998	1999	2000
Deposits – total number	37	37	32	32	29
exploited	13	12	14	13	10
Total mineral resources, kt	485 745	488 212	469 370	445 791	450 670
economic proved reserved	163 208	166 207	160 409	159 740	165 580
economic probable reserves	106 421	105 849	97 335	101 432	101 218
potentially economic resources	216 116	216 156	211 626	184 619	183 872
Mining production, kt	1 079	769	815	717	829

5. Foreign trade

250510 – Silica sands and quartz sands

Raw material	1996	1997	1998	1999	2000
Import, t	127 952	67 188	57 967	50 013	121 549
Export, t	692 336	436 931	763 007	855 506	599 843

6. Prices

Prices of foundry sands were lower than prices of glass sands, they reached in 2000: wet CZK 235-260 per ton, dry CZK 970-1320 per ton. 121 549 t of silica sands (item 2505 10 of the customs tariff) were imported from Slovakia (81.2 %), from Germany (15.0 %) and from Belgium (2.3 %) at average price CZK 512 per ton. Also 599 843 t of silica sands were exported to Austria (34.3 %), to Germany (30.3 %) and to Slovakia (19.6 %) at average price CZK 343 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

Provodínské písky, a.s.
Sklopísek Střeleč - EXIMOS, a.s., Mladějov
Moravské keramické závody a.s., Rájec
Jaroslav Sedláček – SEDOS, Drnovice
Moravské šamotové a lupkové závody a.s., Velké Opatovice
KEMAT Skalná, s.r.o.
SETRA s.r.o., Brno

8. World production

World statistics provide data on production of sands for industrial use (glass production, foundry industry, abrasives etc.). 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 and since this time it has been decreasing slowly again. Numbers of world production volume according to Mineral Commodity Summaries (MCS):

Year	1996	1997	1998	1999	2000 e
Mining production, kt (MCS)	117	119	110	107	107

Main producers (1999; according to MCS):

USA	27.0 %
Paraguay	9.3 %
Germany	6.5 %
France	6.1 %
Austria	5.6 %

9. World market prices

Average price of foundry sand for industrial use on the European market was steady (9.75 GBP/t) at the beginning of the 90's, an increase came in 1995. Next price increases came in 1999 (12.50 GBP/t) and in 2000 (14.50 GBP/t). Also glass sand prices increased in 2000. Prices of sands quoted by the Industrial Minerals magazine in GBP/t EXW UK at year-end were as follows:

A Foundry sand, dry, bulk

Commodity/Year	1996	1997	1998	1999	2000
A	11,50	11,50	11,50	12,50	14,50

10. Recycling

Foundry sands used in moulding are 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 sands 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 are sedimentary and metamorphic rocks containing $CaCO_3$ (calcite or aragonite). Primary and secondary admixtures in limestones are dolomite, silicates, phosphates, etc. Limestones originated through chemical, biological and mechanical processes or their combination. 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 and hard crystalline marbles. Limestones occur in practically all sedimentary geological formations at their metamorphosed equivalents worldwide.
Limestones are used for production of building materials (lime, cement, mortar mixtures, granulated gravel, dimension and building 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, sands, 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 occur 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;
- 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 a 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 processingof agricultural land and forest soils;

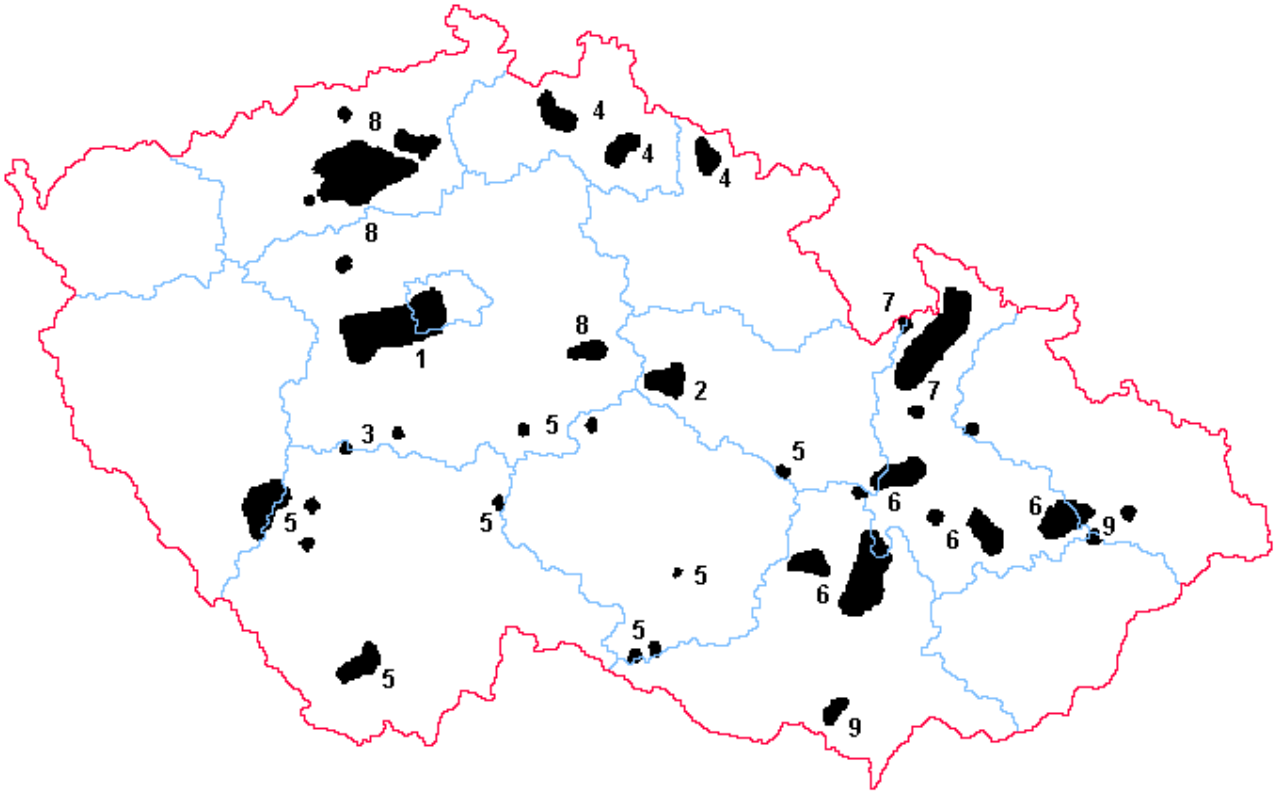
Limestone deposits in the Czech Republic are concentrated in the following main areas:

- The Devonian of the Barrandian zone - 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 confined to 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%).

- The Paleozoic of the Železné hory Mountains - relatively small area with important deposits. The local material is composed of the Podolí crystalline limestones (VV grade, 95 % $CaCO_3$) and less pure darker marbles of VO grade (90 % $CaCO_3$).
- Central Bohemian metamorphosed "islands" - small isolated areas with rather pure metamorphosed limestones (mostly VV a VO grades).
- Crystalline complex of the Krkonoše-Jizerské hory Mountains – medium-size deposits, mostly in the form of lenses confined to phyllites and mica-schists. These are crystalline limestones, often with variable contents of $MgCO_3$ (dolomitic limestones to calcitic dolomites) and SiO_2 (mostly VO and VZ grades).
- Moldanubicum – small-size deposits of crystalline limestones, forming bands or lenses in metamorphic rocks. They occur particularly in the Šumava part of the Moldanubicum. Dolomitic limestones or dolomites usually accompany the limestones here. The majority of local limestones are of VZ and VO grades.
- The Moravian Devonian - represents the most important region with limestone deposits of various size in Moravia. The Vilémovice limestones (VV grade, 96-97 % $CaCO_3$) occur in almost all deposits. Even then represented are the Křtiny, Hády and Lažánky limestones (VO). They are mostly registered as corrective sialic additives for cement production.
- The Silesicum (the Branná group), the Zábřeh group and the Orlické hory Mts.-Kladsko crystalline complex - smaller deposits of crystalline limestones forming bands in metamorphic rocks. Local 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).
- 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).
- Outer Klippen belt of the Western Carpathians - limestones form tectonically isolated blocks in surrounding rocks (so-called "clippen").The limestones are of a very high grade, with an average content of $CaCO_3$ 95.0-98.0 %, and $MgCO_3$ about 1.0 % (VV).
- Other deposits are only of local importance, as far as production and reserves are concerned.

All deposits of limestones and raw materials for production of cement are extracted in the Czech Republic by surface mining.

3. Registered deposits and their location in the Czech Republic



1 The Devonian of the Barrandian zone
2 The Paleozoic of the Železné hory Mountains
3 Central Bohemian "island" zone
4 The Krkonošsko-Jizerské hory Mts. crystalline complex
5 Bohemian, Moravian and the Šumava part of the Moldanubicum
6 The Moravian Devonian
7 Silesicum (the Branná group), the Orlické hory Mts. - Kladsko crystalline complex and the Zábřeh series.
8 The Bohemian Cretaceous basin
9 Outer Klippen belt

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

Limestones – total number

Year	1996	1997	1998	1999	2000
Deposits – total number	116	103	108	101	101
exploited	28	26	29	29	24
Total mineral resources, kt	6 066 998	4 865 893	4 896 250	4 901 599	4 889 640
economic proved reserves	2 074 634	1 926 060	1 895 614	1 902 269	1 885 936
economic probable reserves	3 416 250	2 446 023	2 504 844	2 305 245	2 309 619
potenitally economic resources	576 114	493 810	495 792	694 085	694 085
Mining production, kt	10 610	11 010	11 169	11 378	11 376

Due to the importance and differences in technological use and prices, high-percentage limestones (VV), corrective sialic additives for cement production (CK) and other limestones (VO) have been stated separately.

Raw material	VV		VO		CK	
Year	1999	2000	1999	2000	1999	2000
Deposits – total number	30	30	48	48	15	15
exploited	12	12	13	13	3	3
Total mineral resources, kt	1 762 212	1 757 026	2 430 394	2 371 163	745 920	745 653
economic proved reserves	775 915	766 290	1 001 372	996 141	335 379	335 112
economic probable reserves	809 579	814 018	982 230	928 230	226 390	226 390
potentially economic resources	176 718	176 718	446 792	446 792	184 151	184 151
Mining production, kt	4 673	4 784	5 189	5 138	296	267

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

5. Foreifn trade

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

Raw material	1996	1997	1998	1999	2000
Import, t	511 694	622 654	411 348	299 509	303 940
Export, t	88 263	151 462	199 871	239 049	305 304

2522 – Quicklime, slaked and hydraulic lime o/t calcium oxide and hydroxide

Raw material	1996	1997	1998	1999	2000
Import, t	581 406	441 869	416 430	231 819	54 430
Export, t	198 939	201 054	173 220	201 499	192 306

2523 – Portland, aluminou, slag, supersulphate and sim hyd cement

Raw material	1996	1997	1998	1999	2000
Import, t	335 497	482 106	431 265	659 023	673 542
Export, t	1 419 364	1 319 781	1 482 167	1 559 165	1 493 773

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. Average prices of lump high-percentage limestone fluctuated between CZK 150 – 200 per ton in 2000.

Prices of bulk cement fluctuated depending on the quality between CZK 1680–2450 per ton. Prices of ground lime were CZK 765–2280 per ton, piece-lime CZK 1365–1750 per ton. Lime hydrate was sold at CZK 1630–2415 per ton. Prices of crushed limestone depending on $CaCO_3$ content were CZK 145–925 per ton, its average price was CZK 370 per ton.

304 kt of limeston for cement and for lime were imported practically exclusively from Slovakia at average price CZK 154 per ton in 2000. Also 305 kt were exported to Germany (50.6 %), to Poland (39.3 %) and to Austria (8.6 %) at average price CZK 454 per ton. 54 kt of lime were imported practically also exclusively from Slovakia at CZK 1217 per ton in 2000. 192 kt of lime were exported to Germany (81.0 %), to Austria (16.3 %) and to Slovakia (2.4 %), average price was CZK 1481 per ton. At the same time, 674 kt of cement were imported from Slovakia (89.7%) and from Poland (8.3 %) at average price CZK 1745 per ton. 1494 kt of cement were exported to Germany (63.2 %), to Poland (31.6 %) and to Slovakia (5.1 %), average price was CZK 1348 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

Limestones:

Českomoravský cement a.s., Beroun
Velkolom Čertovy schody a.s., Tmaň
Lafarge Cement, a.s., Čížkovice
Cementárny a vápenky Prachovice, a.s.
Cement Hranice, a.s.
Lomy Mořina, s.r.o.
Vápenka Vitošov s.r.o., Leština
Kotouč Štramberk, s.r.o.
HASIT a.s. - ŠVO, Velké Hydčice
OMYA a.s, Vápenná
Krkonošské vápenky Kunčice, a.s
Lom Skalka, s.r.o., Ochoz u Brna
Vápenka Vitoul, s.r.o.,Mladeč
Českomoravské vápno, s.r.o., Mokrá
Kamenolom a vápenka Malá dohoda, s.r.o.
JHF Heřmanovice, s.r.o.
AGIR s.r.o., lom Skoupý
Agrostav Znojmo, a.s.

Corrective sialic additives for cement production:

Cement Hranice, a.s.
Českomoravský cement a.s. Beroun
Velkolom Čertovy schody a.s., Tmaň

8. World production

Overall data on production of limestones in the world are missing. 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, Japan, USA, Russia, Rep. of Korea, India and Germany, which together produced more than 70 % of the world production of cement. China, USA, Germany, Japan, Mexico and Brazil have produced about 60% of the world lime production.

9. World market prices

Prices of limestones are not quoted. Since the limestones are generally well available in a wide assortment of grades, prices are set upon agreement. Prices of lime on the US market in 1995 - 1999 fluctuated between USD 56 - 58 per ton.

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 use. 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, limestones can be replaced by various mixtures of carbonates. 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 neutralization 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.

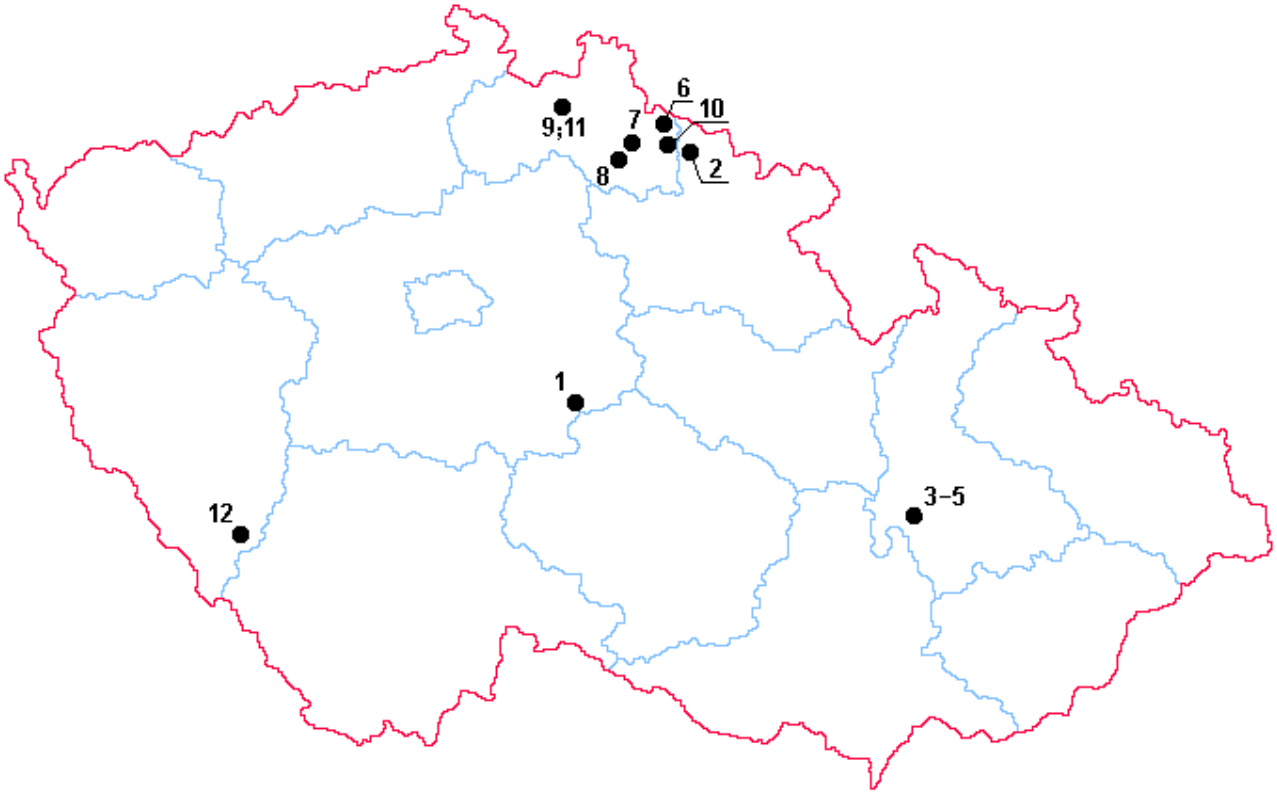
Pure dolomite is important material for glass, ceramic and chemical industries. Dolomitic rocks are used in production of dolomitic lime, hydrates, magnesium cements, magnesia refractories, in desulphurization of power station waste gases. They are also used as dimension stone and in production of fertilizers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

2. Mineral resources of the Czech Republic

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

- Crystalline complex of the Krkonoše-Jizerské hory Mountains – crystalline calcitic dolomite and dolomite deposits in the form of flags and lenses. This locality 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 Horní Lánov contains mineral with 32% of CaO and nearly 19% of MgO in average.
- Šumava and Bohemian Moldanubicum - it contains several smaller pure dolomite deposits (Bohdaneč, Jaroškov) and calcitic dolomite deposits (Podmokly, Krty).
- Crystalline complex of the Krušné hory Mountains - several deposits near Kovářská and Přísečnice.
- Moravian branch of the Moldanubicum with small but high-quality dolomite occurrences (Dolní Rožínka).
- Barandian – a typical dolomite deposit (Velká Chuchle) already mined-out.
- The Orlické hory - Kladsko crystalline complex and Velké Vrbno group - several smaller occurrences of dolomitic rocks (Bílá voda).
- Moravian Devonian near Olomouc – with two large deposits of Lažany calcitic dolomites (Hněvotín, Bystročice), associated with Vilémovice limestones (VO). Average content of Mg in bozh deposits is 17%. Another medium-sized deposit of calcitic dolomites of Lažany – group occurs near Čelechovice of Haná.

3. Registered deposits and their location in the Czech Republic



1 **Bohdaneč**
2 **Lánov**
3 Bystročice
4 Čelechovice na Hané
5 Hněvotín
6 Horní Rokytnice
7 Jesenný-Skalka
8 Koberovy
9 Kryštofovo údolí
10 Křížlice
11 Machnín-Karlov
12 Podmokly

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

Year	1997	1998	1999	2000
Deposits – total number	13	13	12	12
exploited	2	2	2	2
Total mineral resources, kt	582 578	517 635	510 566	511 206
economic proved reserves	84 868	84 276	79 709	81 159
economic probable reserves	410 307	347 802	336 617	335 807
potentially economic resources	87 403	85 557	94 240	94 240
Mining production, kt	294	389	325	430

5. Foreign trade

2518 – Dolomite, dolomite calcined, roughly trimmed, merely cut, aglomerated

Raw material	1996	1997	1998	1999	2000
Import, t	521 590	646 783	583 698	563 579	1 202 601
Export, t	2 413	20 312	11 900	14 329	10 046

6. Prices

Prices of lump dolomite are CZK 150 per ton, prices of dolomite aggregates reach depending on granularity CZK 90 - 180 per ton. Ground lime dolomite with 39 - 40% $MgCO_3$ content are sold in bulk at CZK 280 - 340 per ton. 1203 kt of dolomite were imported practically exclusively from Slovakia at average price CZK 160 per ton in 2000. 10 kt only were exported to Germany at an uncommonly high price CZK 791 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

Krkonošské vápenky Kunčice, a.s.
UNIKOM a.s., Kutná Hora

8. World production

Dolomite production and consumption are not statisticaly followed in the world market.

9. World market prices

World market prices are not given in the international statistical surveys.

10. Recycling

Dolomite is not recycled, with the exception of scrap glass.

11. Possible substitutes

Dolomite as source of Mg is substituted by magnezite, by Mg obtained from the sea water and salt brines and by brucite.

GYPSUM

1. Characteristics and use

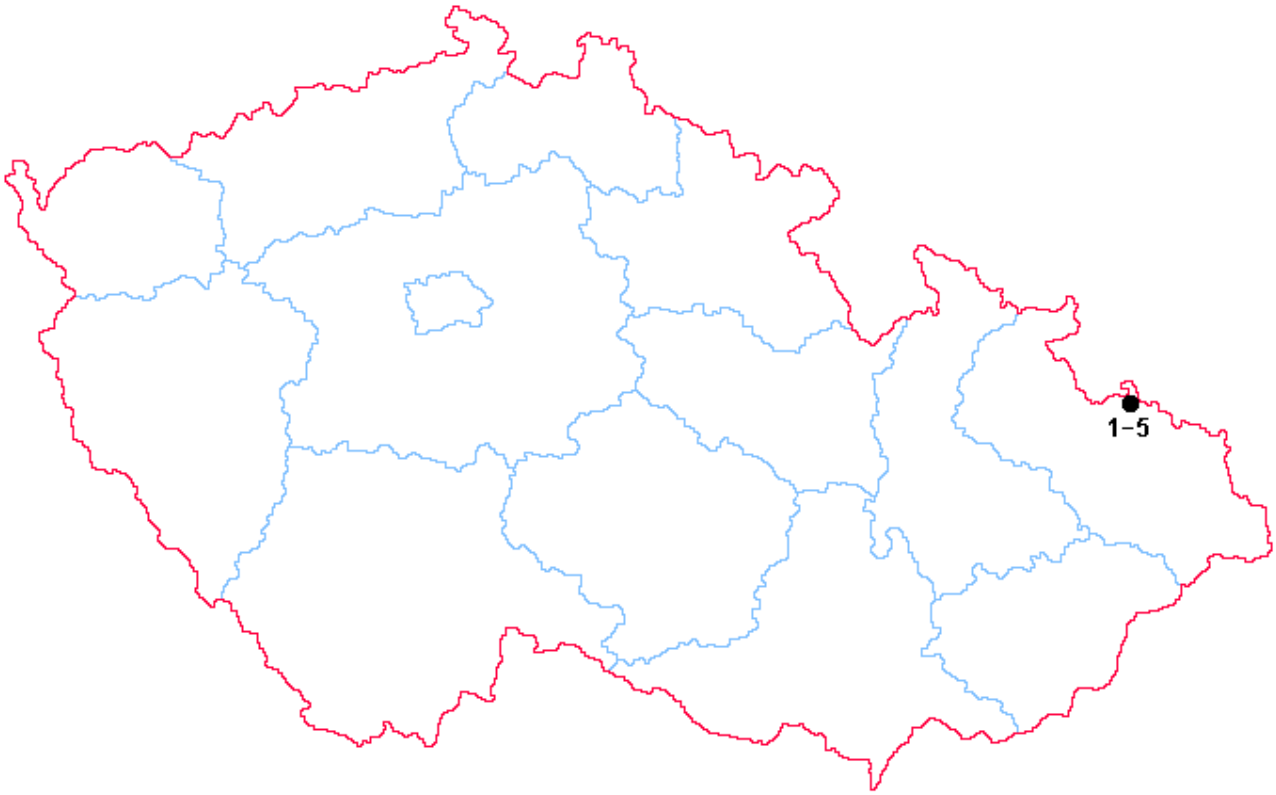
Gypsum is a sedimentary rock, consisting mostly or completely of monoclinic mineral gypsum ($CaSO_4.2H_2O$), which is usually colourless or white. The rock often contains impurities (clay minerals, quartz, iron oxides, limestone, dolomite, anhydrite, etc.). The majority of gypsum deposits was formed 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. tons.

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. Average content of gypsum in the rock is 70-80 %. The impurities are mostly clays and locally sands. Layers near the surface 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-south.

3. Registered deposits and their location in the Czech Republic



1 **Kobeřice-south**
2 Kobeřice-north
3 Rohov-Strahovice
4 Sudice
5 Třebom

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

Year	1996	1997	1998	1999	2000
Deposits – total number	5	5	5	5	5
exploited	1	1	1	1	1
Total mineral resources, kt	505 612	505 273	505 051	504 825	504 833
economic proved reserves	120 485	120 146	119 924	119 788	119 706
economic probable reserves	302 990	302 990	302 990	302 990	302 990
potentially economic resources	82 137	82 137	82 137	82 137	82 137
Mining production, kt	443	241	222	136	82

5. Foreign trade

252010 – Gypsum, anhydrite

Raw material	1996	1997	1998	1999	2000
Import, t	22 088	27 283	34 531	25 760	8 628
Export, t	86 176	59 715	68 351	107 478	68 115

6. Prices

Average price of extracted domestic gypsum was about CZK 250 per ton in 2000. 8628 t of gypsum and anhydrite were imported from Germany (95.5 %) and from Poland (3.4 %) at average price CZK 1678 per ton. 68 115 t of gypsum and anhydrite were exported to Slovakia (57.2 %), to Germany (33.9 %) and to Austria (8.9 %) at average price CZK 369 per ton.

7. Mining companies in the Czech Republic as of December 31, 2000

GYPSTREND, s.r.o., Kobeřice

8. World production

World production of gypsum (including anhydrite) has been for a long time in the range of 80,000-100,000 kt, with the highest mining production in 1995 (96 141 kt). The production is closely related to building activities, the reduction of which caused also a temporary reduction of mining for gypsum after 1989. Mining production numbers of USGS yearbooks Mineral Commodity Summaries (MCS) are higher than those of the Welt-Bergbau-Daten (WBD).

Year	1996	1997	1998	1999	2000 e
Mining production, kt (MCS)	99 700	104 000	107 000	107 000	110 000
Mining production, kt (WBD)	94 588	92 838	92 558	N	N

Main producers (1999; according to MCS):

USA	20.9 %
Iran	9.1 %
Canada	8.9 %
China	8.3 %
Spain	7.0 %
Mexiko	6.4 %

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 of flue gas in thermal power stations, chemical industry), production of which highly exceeded the demand. Average prices of crude gypsum (commodity A) in GBP/t EXW UK at year-end quoted by the Industrial Minerals magazine were as follows:

Commodity/Year	1996	1997	1998	1999	2000
A	9,00	9,00	9,00	9,00	9,00

10. Recycling

Waste wallboards from construction sites are recycled in a limited volume.

11. Possible substitutes

Natural gypsum is replaceable to some extent by a waste gypsum for example from production of phosporic acid, titanium dioxide and flue gas desulfurization (FGD). The latter one is the only more videly 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" and/or "decorative stone". Architectural specifications for dimension stone concern primarily esthetic qualities such as design, surface appearance, etc. Important requirements include mineralogical composition, strenght, weather resistance, color fastness, 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

- Dimension stone used in buildings, curbing and other applications mostly involves igneous rocks, much less other rocks (basalt columns, dike rocks). Deposits, similarly to those of crushed and broken stone, are confined to the Central Bohemian pluton and Moldanubian pluton, the Nasavrky massif, eventually other plutonic bodies of the Bohemian Massif (Štěnovice massif, Žulová pluton, etc.).
- Architectural and sculpture dimension stone also included mostly marbles and plutonic rocks - granites and granodiorites - which occur in the Central Bohemian and Central Moldanubian plutons, the Štěnovice, the Krkonoše-Jizerské hory Mts., the-Jeseníky Mts. and Nasavrky massifs in Bohemia, and in Třebíč and Žulová massifs in Moravia. 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 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 zone 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. Schists of the Moravian-Silesian Paleozoic are used as lining, covering and paving material, and as expanded materials. Grey waches of the Culm were often used, too.
- Crystalline limestones and dolomites – marbles - are the most videly 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-Jizerské hory Mts. crystalline complex and Orlické hory-Kladsko Mts. crystalline complex, the Svratka anticline, in the Silesicum, and in the Branná group (Silesia). Proterozoic phyllites of Western Bohemia (the Střela valley) and the Železný Brod crystalline complex and also of Northern Moravia and Silesian Culm are used for roofing and wall lining (the waste as a filler). Serpentines 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.

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

Year	1996	1997	1998	1999	2000
Deposits – total number	186	188	175	174	167
exploited	74	72	74	76	75
Total mineral resources, thous. m3	238 807	233 982	231 740	214 241	204 001
economic proved reserves	97 233	96 643	94 234	85 710	85 436
economic probable reserves	110 164	104 136	104 315	96 404	86 099
potentially economic resources	31 410	33 203	33 191	32 127	32 466
Mining production in reserved deposits, thous. m3 a)	190	258	305	250	270
Mining production in non-reserved deposits, thous. m3 b)	N	N	N	50	50

Note:

a) decrease of mineral resources by mining production

b) estimate

5. Foreign trade

Items: 2514, 2515, 2516, 6801, 6802, 6803 *

Raw material	1996	1997	1998	1999	2000
Import, kt	566	172	292	488	110
Export, kt	188	833	579	903	445

***** Items definitions in the chapter Minerals in the Czech foreign trade

6. Prices

Price relations of dimension stone products depend on mineral quality and on level of processing. For example: prices of granite blocks fluctuate between CZK 4300 - 15000 per m^3 depending on block volume; prices of granite paving cubes fluctuate from CZK 2150 to CZK 4180 per ton (average price is CZK 3100/t); prices of granite curbs reach up to CZK 800-1700 per running meter (average price is CZK 1200/running m). Crude sandstone blocks are sold at CZK 4300 - 15000 per m^3 (average price is CZK 10000/m^3).

Prices of polished panel boards made of granite, syenite or other igneous rocks fluctuate between CZK 2000 - 4500 per m^2 depending on thickness of the board. Panel boards with blasted finish made of the same material reach up to CZK 1400 - 3000/m^2. Ground finish sandstone boards are sold at CZK 1350 - 3350 per m^2 depending on their thickness and rock colour; the price of cut sandstone boards (30 cm thick) reach up to CZK 4900 per m^2. In contrast, sandstone prisms are sold at CZK 950 per ton.

Domestic marble (of Supíkovice and Lipová) is sold at CZK 1200 - 1750 per m^2 as polished panel or pavement boards. Prices of imported marble (for instance Carrara) reach up to CZK 1800 - 2600 per m^2. Polished granite parapets are sold at CZK 447-790 per running meter; marble parapets at CZK 390-740 per running meter. Price of polished bench top boards made of granite and other igneous rocks is CZK 3500 - 5000 per m^2. Marble bench top boards are sold at CZK 2700 - 6700 per m^2.

Prices of schist stone-cutting products are different. For instance, roofing is sold depending on shape-piece size at CZK 200 - 600 per m^2. Price of schist revetment is about CZK 300 per m^2; schist pavement is sold at about CZK 350/m^2.

349 m^3 of slate (item 2514 of the customs tariff) were imported at average price CZK 32 244 per

m^3. 1875 m^3 of marble and travertine (item 2515 of the customs tariff) were imported in 2000. Average price was CZK 20 865 per m^3. Also 4719 m^3 of granite, porphyry and sandstone (item 2516 of the customs tariff) were imported; average price was CZK 14 934 per m^3.
539 m^3 of natural stone products (setts, curbstones and flagstones - item 6801) were imported at average price CZK 6665 per m^3 ; 18 928 m^3 of cut stone (item 6802 of the customs tariff) were imported at average price CZK 16 573 per m^3 . 42 449 m^2 of worked slate and articles of slate (item 6803) were imported at average price CZK 461 per m^2.
131 m^3 of slate (item 2514 of the customs tariff) were exported at average price CZK 7710 per m^3. 213 m^3 of marble and travertine (item 2515 of the customs tariff) were exported at average price CZK 9310 per m^3. 8934 m^3 of granite, porphyry and sandstone were exported at average price CZK 6303 per m^3. 111 thous. m^3 of natural stone products (setts, curbstones and flagstones - item 6801) were exported at CZK 4498 per m^3. Export of cut stone reached up to 42 thous. m^3. Average export price was CZK 5408 per m^3. Also 6.5 thous. m^2 of worked slate and articles of slate were exported at average price CZK 824 per m^3.

7. Mining companies in the Czech Republic (reserved deposits) of December 31, 2000

REVLAN s.r.o., Horní Benešov
Českomoravský průmysl kamene a.s., Hradec Králové
Průmysl kamene a.s., Příbram
KAVEX-GRANIT HOLDING a.s., Tábor
Slezský kámen a.s., Jeseník
GRALOM s.r.o., Drahnětický Málkov
Kámen Ostroměř, s.p.
HERLIN, s.r.o., Příbram
Česká žula s.r.o., Strakonice
MEDIGRAN s.r.o., Plzeň
RALUX s.r.o., Uhelná
Granit Lipnice s.r.o., Dolní Město
DCK – Družstvo cementářů a kameníků Holoubkov
VADAMO s.r.o, Nečín
Ligranit s.r.o., Liberec
Q – Granit s.r.o., Turnov
STRABAG ČR a.s., České Budějovice
REKO Renata Kohlová, Přerov
COMPLETINVEST s.r.o. - Břidlicový důl Vítkov-Lhotka
SLEZSKÁ ŽULA s.r.o., Uhelná
Agroplast a.s., Liberec
Kámen Hudčice s.r.o.
Lesostavby Šumperk, a.s.
Lom Matula Hlinsko, s.r.o.
Špaček - kamenolomy s.r.o., Štěnovice
Jindřich Zedníček, Kamenná
Petr Babický, Vrchotovy Janovice
Kámen Zbraslav, s.r.o.
UNIGRANIT s.r.o., Písek
GRANIO s.r.o., Chomutov
Pražský kamenoservis s.r.o., Praha 10
Jihokámen v.d., Písek
Kamenoprůmyslové závody s.r.o., Šluknov
Krákorka a.s., Červený Kostelec
Moravská těžební a.s., Hlubočky
Mramor, s.r.o., Dobřichovice

Slate – B.D.S.O. a.s., Staré Oldřůvky
Josef Krýsl, Sušice
Matro s.r.o., Praha 2
Mšenské pískovce s.r.o., Mšené-lázně
COMING PLUS a.s., Praha 5
K – Granit s.r.o., Jeseník

The most important mining organizations in non-reserved deposits of 31.12.2000
UNIEXPORT Plzeň, s.r.o.
KOKAM s.r.o., Kocbeře
HERKU – kamenolomy s.r.o., Sušice
Leon Geko, s.r.o., Kolín
LIVIA, s.r.o., Kutná Hora
INTERGRANIT, s.r.o., Příbram
Lom Horní Dvorce, s.r.o.
GRALOM, s.r.o., Drahenický Málkov

8. World production

Production of dimension stone hasn't been monitored in a long term. According to the Industrial Minerals magazine, world production in 1994 reached 36,346 kt. Main producers were Italy, China, Spain, India and Greece. These countries produced more than 56 % of the world production.

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. All types can be replaced by synthetic materials, ceramics, metals, glass, etc. However, an opposite tendency has been evident recently – a growing interest in natural materials.

BUILDING MATERIALS - GEOLOGICAL RESERVES AND MINING PRODUCTION

There are very high geological reserves of building materials - building stone, sand and gravel and brick clays - in the Czech Republic. The building stone and the sand and gravel are also important export commodities.

Mining of building materials (decrease of mineral reserves volume by mining)

Raw material	Unit	1996	1997	1998	1999	2000
Building stone	thous. m3	9 891	10 845	9 528	9 442	9 451
Sand and gravel	thous. m3	12 350	11 727	9 279	8 181	7 740
Brick clays	thous. m3	1 972	2 074	2 124	1 934	1 653

Lifetime of industrial reserves (economic proved mineable reserves) based on the decrease of reserves by mining incl. losses in registered deposits per year 1999 (A) and on the average annual decrement of reserves in period 1996-2000 (B) was follows:

Raw material	Lifetime A (years)	Lifetime B (years)
Building stone	120	115
Sand and gravel	129	101
Brick clays	167	141

Building materials production data presented by 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 building materials before 1998 was higher than following numbers.
Since1999 the non-reserved deposit production has been observed in the form of Hor statements (MPO)1-01. These data precise significantly the idea of total building material production (building 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.

Mining production of building material in non-reserved deposits is follows:

Raw material	Unit	1999	2000
Building stone	thous. m3	850	660
Sand and gravel	thous. m3	4 600	4 900
Brick clays	thous. m3	60	190

BUILDING STONE

1. Characteristics and use

Building 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 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 building stone can be found throughout the Bohemian Massif. Western Carpathians are rather poor in building stone.

- The major source of building stone are igneous rocks (particularly granites and quartz-diorites). 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 rather small importance.
- Volcanic rocks represent the major source of stone for production of crushed aggregates in the Czech Republic. Paleovolcanic deposits occur only in the Barrandian zone (suitable arealso consolidated pyroclastics), in the Krkonoše piedmont basin and in the Intrasudetin 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, 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 Cretaceous basin and eastern Sudetes and in the Železný Brod region.
- Among the sedimentary rock deposits there prevail the ones of clastic sediments (siltstones, greywackes, etc.). Culmian greywackes of the Nízký Jeseník Mountains and the Drahanská vrchovina plateau are the most inportant source of building stone. Similar rocks also occur in the Proterozoic of the Barradian zone, Moravian Devonian and the flysh belt of the Western Carpathians.
- Deposits of chemical and organic origin are represented by carbonates (the Lower Paleozoic of the Barrandian zone, the Moravian-Silesian Devonian) and siliceous rocks (lydites or cherts in the Upper Proterozoic of the Pilsen region).
- Metamorphic rock deposits, represented by crystalline schists or gneisses, which are exclusively confined to crystalline complexes of the Bohemian Massif - the so-called Moldanubicum, Moravicum, Silesicum, crystalline areas of the Slavkovský les, W. Sudetes, Kutná Hora and Domažlice, granulite massifs of southern Bohemia and the Bor granulite massif, 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 (hornfelds, schists) occurring along the contact of the Central Bohemian and the Nasavrky plutons with Late Proterozoic and Paleozoic sediments.

3. Registered deposits in the Czech Republic

Because a large number of building stone deposits in the Czech Republic, they are not listed.

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

Year	1996	1997	1998	1999	2000
Deposits – total number	346	343	342	344	340
exploited	186	182	179	179	181
Total mineral resources, thous. m3	2 378 271	2 367 537	2 376 21	2 376 858	2 372 692
economic proved reserves	1 186 079	1 172 557	1 182 970	1 188 276	1 182 536
economic probable reserves	1 045 345	1 040 769	1 038 492	1 030 133	1 032 825
potentially economic resources	146 847	154 211	154 809	158 449	157 331
Mining production in reserved deposits, thous. m3 a)	9 891	10 845	9 528	9 442	9 451
Mining production in non reserved deposits, thous. m3; b)	N	N	N	850	660

Note:

a) decrease of mineral resources bymining production

b) estimate

5. Foreign trade

251710 – Pebbles, gravel, broken or crushed stone

Commodity	1996	1997	1998	1999	2000
Import, kt	260	711	429	489	256
Export, kt	1 025	805	2 703	662	814

6. Prices

Prices of crushed aggregates fluctuate depending on mineral quality and granularity between CZK 30-300 per ton. Average price is CZK 160/t. Current price of quarried stone is CZK 95-200 per ton; price of regulation quarried stone is CZK 290-350 per ton. Facing stone is sold at CZK 370-1490 per ton.

256 kt of pebbles, gravel, broken or crushed stone were imported from Slovakia (89.2 %) and from Germany (6.2 %) at average price CZK 94 per ton in 2000. 814 kt were exported to Germany (46.0 %), to Austria (43.1 %) and to Poland (10.7 %) at CZK 107 per ton.

7. Mining companies in the Czech Republic (reserved deposits) of December 31, 2000

Spojené štěrkovny a pískovny a.s., Brno
TARMAC Severokámen a.s., Liberec
STRABAG ČR a.s., České Budějovice
Západokámen Plzeň, a.s.
Hájek s.r.o., Opava
Silnice Hradec Králové, a.s., divize 06
Lomy s.r.o., Brno
Kámen a písek s.r.o., Český Krumlov
Kámen Zbraslav, s.r.o.
STONE s.r.o., Kamenolom Všechlapy

Basalt s.r.o., Měrunice
Max Boegl & Josef Krýsl k.s., Sušice
Štěrkovny s.r.o., Dolní Benešov
Granita s.r.o., Skuteč
Hanson ČR a.s., Veselí nad Lužnicí
Silnice Jihlava, a.s.
IPS a.s., Praha 10
Berger Bohemia a.s., Plzeň
Lafarge Kamenivo s.r.o., Praha 8
DOBET s.r.o., Ostrožská Nová Ves
Štěrkovna HEROUS s.r.o., Lhota Rapotina
VIA - VODA s.r.o., Hrubá Voda
SHB Bernartice, s.r.o.
PETRA – lom Číměř, s.r.o.
Silnice Nepomuk, a.s.
GOS – Granit Ořechov, s.r.o.
Kamenolom Císařský a.s., Šluknov
BES s.r.o., Benešov
Silnice Znojmo, a.s.
Železniční průmyslová stavební výroba Uherský Ostroh, a.s.
Agroplast a.s., Liberec
Kámen Brno, s.r.o.
Jaromír Slaný, Polnička
Žula – Rácov s.r.o., Batelov
Lomy Mořina, s.r.o.
ATS - Silnice s.r.o., Libá
Stavby silnic a železnic a.s., Praha 1
Sokolovská uhelná, a.s.
Silniční stavitelství Praha, a.s.
Weiss s.r.o., Děčín
RENO Šumava s.r.o., Prachatice
PIKASO s.r.o., Praha 4
EKOZIS Zábřeh, s.r.o.
BERON s.r.o. – v konkurzu, Čerčany
Karlovarské silnice a.s., Karlovy Vary
Formanservis s.r.o., Dobřejovice
ROSA s.r.o., Drásov
Froněk s.r.o., Rakovník
SOL-EX s.r.o., Valšov
Ivo Hutira, Omice
ZD Šonov u Broumova
Štěrk a písek s.r.o., Praha 5
CEFEUS s.r.o., Praha 2
Kozákov, družstvo se sídlem v Záhoří
Stavebniny – František Matlák, Lažánky
Silnice Čáslav – Holding, a.s.
Stavby Prunéřov – Jan Hamáček, Kadaň
MŠLZ a.s., Velké Opatovice
Agrostav Znojmo, a.s.
Thorssen s.r.o., Kamenolom Mladecko
NATRIX a.s., Rohatec
Zábřežská lesní a.s., Zábřeh na Moravě

Pavel Dragoun, Cheb
JAMEL s.r.o., Velké Přítočno
Josef Žirovnický, Vlašim
VKBM. s.r.o., Lom Mikulovice
Lesní společnost Jihomoravské lesy a.s., Prostějov
LOM KUBO – Rudolf Vít, Malé Žernoseky
Libinská AGRO a.s., Libina
Kamenolom Zderaz s.r.o., Proseč
Jihočeské lesy České Budějovice, a.s.
SETRA s.r.o., Brno
Podnik ekologické výstavby a.s., Chomutov

The most impotrant mining organization in non-reserved deposits of 31.12.2000
Sokolovská uhelná, a.s.
Kámen Zbraslav, s.r.o.
ZUD, a.s., Zbůch
ROSIS, s.r.o., Opava
LB, s.r.o., Nová Role
Kamenolom Doubravice, s.r.o.
Granita, s.r.o., Skuteč
Lesy České republiky, s.p., Hradec Králové
Jihočeské lesy České Budějovice, a.s.
EKOFIM, s.r.o., Praha 4
TS služby, s.r.o., Nové Město na Moravě
Lesostavby Frýdek Místek, a.s.
EKOZIS Zábřeh, s.r.o.
SENECO, s.r.o., Polná
Valašské lesotechnické meliorace, a.s.
Vojenské lesy a statky ČR, s.p., Praha 6

8. World production

World production of the building stone has not been monitored. The highest mining production in EU state on a long term Germany and France (both cca 170 mill. t per year).

9. World market prices

Average prices of crushed rock aggregates on the world market 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.

11. Possible substitutes

Building stone (crushed and broken stone) can be replaced, depending on their use and grade, by gravel sands, synthetic aggregates, slags and various waste materials.

SAND AND GRAVEL

1. Characteristics and use

Sand and gravel belong to the principal construction materials worldwide. Sand and gravel represent loose sediments originated by transport and deposition of more or less reworked rock fragments of certain size (gravel 2 to 128 mm, sand 0.063 to 2 mm), which are products of the weathering of rocks. They consist mostly of pebbles and boulders of resistent rocks and minerals (quartz, feldspar, quartzite, granite, etc.), to a smaller extent of less resistent 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. Sands are 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 usable deposits occur particularly in river basins of large streams.
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 confined to 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 sands 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 sands 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) are utilized more often. Weathered sandstones of the Bohemian and Moravian Cretaceous sediments and sands 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.

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

Year	1996	1997	1998	1999	2000
Deposits – total number	215	220	219	214	214
exploited	73	74	80	76	80
Total mineral resources, thous. m3	2 421 049	2 402 970	2 349 188	2 309 617	2 285 417
economic proved reserves	1 271 932	1 276 994	1 259 653	1 252 271	1 209 477
economic probable reserves	889 269	877 106	848 248	826 261	820 161
potentially economic resources	259 848	248 870	241 287	231 085	255 779
Mining production in reserved deposits, thous. m3 a)	12 350	11 727	9 279	8 181	7 740
Mining production in non-reserved deposits, thous. m3; b)	N	N	N	4 600	4 900

Note:

a) decrease of mineral resources bymining production
b) estimate

5. Foreign trade
250590 – Other sands (natural sands of all kinds, also coloured, except sands containing metals and except silica sands and quartz sands)

Raw material	1996	1997	1998	1999	2000
Import, kt	N	1 661	225	247	130
Export, kt	N	83	17	12	11

251710 – Pebbles, gravel, broken or crushed stone

Raw material	1996	1997	1998	1999	2000
Import, kt	N	711	287	326	171
Export, kt	N	805	1 801	442	543

6. Prices
Prices of extracted aggregate fluctuate depending on granularity from CZK 30 to CZK 200 per ton, average price is about CZK 93 per ton. Prices of pitsand have reached up to CZK 45 per ton, prices of washed sand have fluctuated between CZK 60 - 120 per ton.
130 kt of sand were imported from Slovakia (72.6 %) and from Poland (26.0 %) at average price CZK 250 per ton in 2000. 11 kt were exported to Slovakia (62.2 %), to Germany (13.7 %) and to France (11.8%) at CZK 458 per ton. 171 kt of aggregate were imported from Slovakia (89.2 %) and from Germany (6.2 %). Average import price was CZK 141 per ton. 543 kt of aggregate were exported to Germany (46.0 %), to Austria (43.1 %) and to Poland (10.2 %) at average price CZK 160 per ton.

7. Mining companies in the Czech Republic (reserved deposits) of December 31, 2000

Spojené štěrkovny a pískovny a.s., Brno
Tarmac Severokámen a.s., Liberec
Hanson ČR a.s., Veselí nad Lužnicí
Kámen Zbraslav, s.r.o
Calofrig a.s., Borovany
DOBET s.r.o., Ostrožská Nová Ves
ILBAU s.r.o, Praha
GZ - SAND s.r.o., Otrokovice
TEKAZ s.r.o., Cheb
Václav Maurer, Lužec nad Vltavou
TVARBET Moravia a.s., Hodonín
MPC s.r.o., pískovna Račiněves
RASTRA AG-CZ a.s., Pardubice
Družstvo DRUMAPO, Němčičky
PIKASO s.r.o., Praha 4
ALAS Morava s.r.o., Mohelnice
Zemědělská společnost Kratonohy, a.s.
Brněnské papírny s.p., Předklášteří
Štěrkovny s.r.o., Dolní Benešov
Městské lesy Hradec Králové
Pískovna Sojovice, s.r.o.
Vojtěch Tomi, Praha 9
DMP a.s., Pardubice
Pískovna Černovice s.r.o., Brno
Max Boegl & Josef Krýsl k.s., Sušice
Těžba štěrkopísku s.r.o., Brodek
KEMAT s.r.o., Skalná
TAPAS Borek s.r.o., Stará Boleslav
KM Beta Moravia s.r.o., Hodonín
Agropodnik Humburky, a.s.
Pískovna Doubrava, s.r.o., Kostomlaty
Pískovny Dobříň, a.s., Roudnice nad Labem
Sušárna Kratonohy a.s.
ZD Třebechovice pod Orebem – v likvidaci
ZOD Zálabí, Ovčáry
NZPK s.r.o., Podbořany
Silnice Klatovy, a.s.
UNIM s.r.o., Všestudy u Veltrus
Zechmeister s.r.o., Valtice
Pískovny Hrádek, a.s., Hrádek nad Nisou
Západokámen Plzeň, a.s.
Kaolin Hlubany, a.s.
ZOD Brniště
Sokolovská uhelná, a.s.
Vojenské stavby a.s., o.z. Baraba, Praha
Stavitelství-Dvořák F., Dolní Dunajovice
Oldřich Psotka, Mikulovice u Jeseníka
1. Stavební a.s., Litoměřice
Josef Šeda – TAUM, Turnov
Berger Bohemia a.s., Plzeň

The most important mining organizations in non-reserved deposits of 31.12.2000

Pískovny Dobříň, a.s., Roudnice nad Labem
Pískovny Hrádek, a.s., Hrádek nad Nisou
GZ – Sand, s.r.o., Otrokovice
AGKV, s.r.o., Chbany
Spojené štěrkovny a pískovny, a.s.
ZEPIKO, s.r.o., Brno
Lubomír Kruncl – Glarea, Travčice
Vojtěch Tomi, Praha 9
Písek – Beton, a.s., Veltruby – Hradištko
Písek Žabčice, s.r.o.
Vltavské štěrkopísky, s.r.o., Chlumín
AGRO Brno – Tuřany, a.s.
Budějovické štěrkopísky, s.r.o.
Plzeňské štěrkopísky, s.r.o., Křimice
Pískovna Klíčany HBH, s.r.o.
Rovina Písek, a.s., Písek u Chlumce
Písky – J. Elsnic, s.r.o., Postoloprty
AG Skořenice, a.s.
Kámen Zbraslav, s.r.o.
ROBA štěrkovny Nové Sedlo, s.r.o.
ACHP, s.r.o., Hradec Králové
Ing. Bohuslav Pešta – EKOBET
Severočeské pískovny a štěrkovny, s.r.o., Roztyly
ObecSABIA, s.r.o., Bohušovice nad Ohří
Grábštejn, s.r.o., Jablonec nad Nisou
Agrodružstvo Klas, Staré Ždánice
Luděk Měchura, Šardice
Ing. Josef Novák – NOBI, Praha 5
ZD Tuchoraz
VIKING Holoubkov, s.r.o.
HUMECO, a.s., Most – Kopisty
Ing. Václav Luka, Chotouň
IPS – BELAP, s.r.o., Žizníkov Konětopy
ZEPOS, a.s., Radovesice
STAVOKA Hradec Králové, a.s.
Ladislav Peller – Těžba, úprava surovin, Praha
BEST, a.s., Rybnice
META Servis, s.r.o., Černošice
Obec Police
UNIGEO, a.s., Ostrava
AGROSPOL Hrádek, s.r.o.
Kobra Údlice, s.r.o.
Vlastimil Beran, Daleké Dušníky
VHS Břeclav, s.r.o.
Lesy České republiky, s.p., Hradec Králové
DMP a.s., Pardubice
Vratislav Matoušek, Tursko
Jiří Černý, Šumperk
ZD Moravany
Profistav, s.r.o., Litomyšl

Technické služby města Strakonice
Václav Merhulík, prodej a těžba písku, Lety
LIKOD, s.r.o., Boršice u Buchlovic

8. World production

The world production of sand and gravel is not statistically monitored. The annual production of the USA was fluctuating between 708 –1 080 mill. t in the last ten years. The production of all the EU states reached 1 115 mill. t in 1995. The highest mining production in EU states has Germany (about 400 mill. t per year) and France (about 200 mill. t per year).

9. World market prices

Average prices of sand and gravel on the world market are not published. In the USA, prices of sand and gravel were fluctuating between USD 4,30 – 4,73 per ton in 1995 – 1999.

10. Recycling

Similar to all building materials, recycling is problematic and is important for concrete only.

10. Possible substitutes

Coarser fractions of sand and gravel can be replaced by crushed aggregate, artificial aggregate, slags, etc. Finer fractions, i.e. sands, cannot be replaced because of reduced strenght of the final products. Substitution of sand and gravel on large scale is questionable also from the economic point of view.

BRICK CLAYS

1. Characteristics and use

Raw materials for production of bricks include a variety of mostly sedimentary rocks such as loess, loams, clays and claystones, marls, weathered shales, etc. The raw material must contain two main components - plastic and filler - which are proportional in the material itself, or the optimum ratio of which 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 material, serves as a plasticizing agent or a foller component. Harmful substances in production of bricks are mostly carbonates, gypsum, siderite, organic matter, larger fragments of rocks, etc.
Deposits of materials for brick production are common all over the world and they are not registered.

2. Mineral resources of the Czech Republic

Quaternary loams of various origin represent the basic material for brick production in the Czech Republic. The source of natural corrective materials are mostly pre-Quaternary sediments.

- Deposits of Quaternary raw materials (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 confined to sediments of aeolian, deluvio-aeolian and/or glacial origin (N.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 elements.
- Neogene pelites are a common pre-Quaternary material 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 detrital minerals, in the Vienna basin and the Carpathian foredeep also by higher content of soluble salts. They have been utilized 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 utilized in E and SE Moravia. They represent weathered parts of flysch layers of outer nappes of the Western Carpathians. Impurities are efflorescence-forming salts and layers of sandstones. They are used for production of solid or perforated bricks.
- Upper Cretaceous clays and claystones (often calcareous) are used as a raw material for brick production in areas of the Bohemian Cretaceous basin and in south Bohemian basins. Marls, marlstones and sands are used as corrective materials. The material is suitable even 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 less exacting building elements.
- Carboniferous to Permian pelites and aleuropelites are used for brick production in Carboniferous to Permian basins and furrows of Bohemia and Moravia. These deposits are characterized by the occurrence of sandstones and by complex structure. The material can be used also for production of roof tiles and thin-walled elements.
- The Late Proterozoic and Early Paleozoic weathered slates and their residues are used for production of bricks around Prague, in the Plzeň and Rokycany regions, etc. Impurities are solid detritus and pyrite. They are not suitable for production of exacting brick elements.

3. Registered deposits in the Czech Repunblic

There are large numbers of brick clay deposits registered in the Czech Republic and thus they are not listed in this overview. Their distribution over the Czech territory is rather random and consequently some regions are short of these materials (e.g. Českomoravská vrchovina plateau).

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

Year	1996	1997	1998	1999	2000
Deposits – total number	210	206	203	185	161
exploited	81	73	69	62	58
Total mineral resources, thous. m3	706 743	700 259	686 012	657 728	623 814
economic proved reserves	323 574	318 599	320 053	303 321	285 100
economic probable reserves	303 379	302 439	273 825	268 779	261 913
potentially economic resources	79 790	79 221	92 134	85 628	76 801
Production in reserved deposits, thous.m3	1 972	2 074	2 124	1 934	1 653
Production in non-reserved deposits, thous. m3; a)	N	N	N	60	190

Note:
a) estimate

5. Foreign trade

Neither brick clays nor brick products have been registered in foreign trade statistics of the Czech Republic.

6. Prices

Price of brick clays in the domestic market was about CZK 500/t in 2000. En-tout-cas is offered at CZK 1500/t.

Prices of full bricks fluctuate depending on their quality (expecially frost resistance) and producer. They are sold at CZK 3.30-5.40 a piece. Average price is CZK 4.40/piece. Light full bricks were sold at CZK 3.40-3.70 a piece. Average price of drainage bricks was CZK 5.40 - 11.50/piece. Average price of drainage bricks for ceiling was CZK 14.70 – 18.80/piece. Roofing is sold at CZK 17.80-23.40 a piece. Brick blocks "Porotherm" are offered at CZK 50 a piece.

7. Mining companies in the Czech Republic (reserved deposits) of December 31, 2000

WIENERBERGER CP a.s., České Budějovice
TONDACH Česká republika s.r.o., Hranice
České cihelny Josef Meindl s.r.o., Stod
Flachs Alois - Hurdis, Hodonín
Hevlínské cihelny s.r.o., Hevlín
Jirčany, a.s., Dolní Jirčany
Cihelna Kinský s.r.o., Kostelec nad Orlicí
CIDEM Hranice, a.s.
ZAT invest a.s., Příbram
HELUZ cihlářský průmysl, v.o.s., Dolní Bukovsko
Cihelna Hodonín, s.r.o.

Abrhámova cihelna s.r.o., Kunovice
CL s.r.o., Praha 3
MP Cihelna s.r.o. – v likvidaci, Bozkovice
Cihelna Klíma s.r.o., Vrátkov
Cihelna Žopy s.r.o., Holešov
Bratři Řehounkové-cihelna Časy s.r.o.
Cihelna Polom, s.r.o.
PARALAX a.s., Praha 8
Cihelna Malenovice s.r.o.
Cihelna Chmeliště, s.r.o., Pardubice
KEMAT s.r.o., Skalná
STAMP s.r.o., Náchod
Karel Hrabčuk – HRAKA, Ústí nad Orlicí
Cihelna Huráb s.r.o., Boskovice

The most important mining organization in non-reserved deposits of 31.12.2000
WIENERBERGER CP, a.s., České Budějovice
Agrodružstvo Morkovice
Vlastimil Bělák, cihelna Bořinov
Cihelna Ivančice, a.s.
THERKOM, s.r.o., Krnov
Rochovská cihelna, s.r.o., Brozany
Bohumil Křesťan, Bohdalov
Ladislav Konečný, cihelna Šitbořice
Ing. Jiří Hercl, cihelna Bratronice, Kyšice
ŠAMO Vratislavice, s.r.o.

8. World production
Production of brick clays is not monitored on the global scale.

9. World market prices
Brick clays are not a subject of the world trade.

10. Recycling
Brick clays cannot be recycled, but the final products - bricks, tiles, 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, this material is irreplaceable. Other types of bricks can be produced from other materials (calcareous-acid bricks, agloporite, gas silicates, etc.). Various natural and artificial materials such as quartz, lime, powder aluminium, artificial aggregates, cinder and flue ashes of thermal power plants, tailings, etc. can be used for production of the afore mentioned building elements

MINING PRODUCTION IN NATURE PROTECTED AREAS

Activities in specially protected areas of the Czech Republic (national parks, protected landscape areas, national nature reserves, nature reserves, national nature monuments and nature monuments) are regulated by Act No 114/1992 Sb. on nature and landscape protection. According to this Act, all mining in national parks (with exception of building stone and sand mining for construction in the territory of the national park), in the 1st 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 autorization. Civil activities in the field of environmental protection represent the main reason.

Specially protected areas in the Czech Republic

Ammount/Year	1996	1997	1998	1999	2000
Total number	1 784	1 847	1 948	1 998	2 032
national parks (NP)	3	3	3	3	3
protected landscape areas (CHKO)	24	24	24	24	24
others	1 757	1 820	1 921	1 971	2 005

The area of specially protected large-scale areas (NP and CHKO) has been 11,535 square kilometers, of which the area of prohibited mining of minerals has amounted to 19.3 %. The area of NP and CHKO has amounted to 14.6 % 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 mining claims were defined before establishment of the protected areas. Mining production in CHKO's was on decline after 1989. This fact is illustrated in following tables. Mining was realized in 17 CHKO only in 2000 . As to impact of mining in protected landscape areas there has been unfavourable situation in CHKO Český kras (limestone mining).

Mining of reserved mineral deposits in CHKO, kt

Mineral	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Gemstones	31	45	34	30	21	36	44	39	44	49
Graphite	21	10	14	12	13	15	21	25	20	17
Hard coal	467	463	443	426	454	424	512	386	322	386
Natural gas	0	1	10	3	2	1	1	1	0	1
Clays	165	141	141	116	105	137	140	0	70	75
Glass, foundry sands	7	2	8	7	8	6	5	2	0	0
Feldspar	115	132	146	125	125	152	163	174	197	231
Limestone	3 124	3 122	2 998	2 992	2 327	2 730	3 440	3 772	3 462	3 637
Dimension stone	79	80	87	26	21	21	28	52	50	102
Building stone	5 212	3 414	3 082	3 016	2 943	3 202	3 435	3 125	1 975	3 169
Sand and gravel	3 032	2 328	2 861	2 562	2 329	2 459	2 470	1 983	2 016	1 532
Brick clays	229	146	140	11	20	16	67	56	27	0
Total	12 317	9 742	9 823	9 140	8 263	9 062	10 186	9 615	8 183	9 199
Index, 1990 = 100	76	60	61	57	51	56	63	59	51	57

Note:
Conversion to tons: natural gas (1000000 m^3 = 1 kt), dimension and building stones (1000m^3 = 2.7 kt) sand and gravel and brick clays (1000 m^3 = 1.8 kt)

Mining of reserved mineral deposits in CHKO, kt

CHKO/Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Beskydy	52	44	66	4	5	8	16	30	24	5
Bílé Karpaty	165	54	43	62	30	41	49	64	43	35
Blanský les	1 075	744	507	472	489	577	644	493	608	606
Broumovsko	72	69	86	70	75	86	99	98	104	152
České středohoří	1 579	1 918	1 764	1 746	1 583	1 755	1 909	1 666	1 296	1 314
Český kras	2 669	2 771	2 677	2 858	2 345	2 715	3 223	3 549	3 634	3 577
Jeseníky	98	36	90	120	193	109	210	179	159	261
Jizerské hory	8	8	3	5	4	2	1	5	4	3
Kokořínsko	25	20	16	0	0	0	0	0	0	0
Křivoklátsko	930	921	918	803	779	706	918	848	748	824
Litovelské Pomoraví	189	414	313	218	0	32	389	572	344	102
Moravský kras	222	413	412	137	167	254	311	303	184	186
Pálava	51	57	39	50	46	64	60	54	36	56
Poodří	92	45	47	0	0	16	22	18	27	0
Slavkovský les	28	17	18	26	28	35	42	42	88	108
Šumava	68	48	46	41	50	30	25	36	76	35
Třeboňsko	2 130	2 442	2 981	2 659	2 426	2 576	2 591	2 115	1 781	1 655
Žďárské vrchy	81	78	53	78	56	42	56	59	46	151
Železné hory	62	63	61	81	70	103	90	98	96	134
Total mining production (round)	9 596	10 162	10 140	9 430	8 346	9 151	10 655	10 229	9 298	9 204

Impact of mining in CHKO, t/km^2/year

CHKO/Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Beskydy	44	37	56	3	3	6	13	25	21	4
Bílé Karpaty	231	76	60	87	42	57	71	89	60	49
Blanský les	5 070	3 509	2 391	2 226	2 306	2 721	3 037	2 325	2 825	2 858
Broumovsko	175	168	209	170	182	209	241	239	254	371
České středohoří	1 485	1 804	1 659	1 642	1 489	1 650	1 795	1 567	1 219	1 236
Český kras	**20 851**	**21 648**	**20 914**	**22 328**	**18 320**	**21 210**	**25 179**	**27 726**	**28 387**	**27 945**
Český ráj	0	0	0	0	0	0	0	0	0	0
Jeseníky	131	48	120	161	259	146	282	240	214	351
Jizerské hory	21	21	8	13	10	5	3	13	11	8
Kokořínsko	92	74	59	0	0	0	0	0	0	0
Křivoklátsko	1 480	1 466	1 461	1 278	1 240	1 124	1 461	1 350	1 191	1 312
Litovelské Pomoraví	1 968	4 312	3 260	2 270	0	333	4 052	5 958	3 583	1 063
Moravský kras	2 362	4 394	4 383	1 457	1 777	2 702	3 309	3 223	1 957	1 979
Orlické hory	0	0	0	0	0	0	0	0	0	0
Pálava	614	686	469	602	554	770	723	650	434	675
Poodří	1 121	548	573	0	0	195	268	219	329	0
Slavkovský les	43	26	28	40	43	54	65	65	138	177
Šumava	99	70	67	59	72	43	36	52	0	37
Třeboňsko	3 042	3 488	4 258	3 798	3 465	3 680	3 701	3 021	2 544	2 364
Žďárské vrchy	114	110	74	110	78	59	78	83	65	213
Železné hory	218	221	214	285	246	362	316	345	338	472

Note: as critical there is considered an impact exceeding 10,000 t/km^2/year

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 (expression by value) minerals and products is demonstrated by the specification of 38 items of the Customs tariff in nomenclature HS-4:

Definitions of available customs tariff items used in this yearbook

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 in 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 form 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, whether or not agglomerated
Fluorspar	252921 252922	Fluorspar, containing by weight 97 % or less of calcium fluoride Fluorspar, containing by weight more than 97 % of calcium fluoride
Barite	251010	Natural baryum sulphate (barites)
Graphite	2504	Natural graphite
Kaolin	2507	Kaolin and other kaolinitic clays, whether or not calcined
Clays	2508	Other clays (except expanded clays No. 6806), andalusite, kyanite, sillimanite, also fireclay, mullite, chamotte or dinas earth
Bentonite	250810	Bentonite
Feldspar Feldspar substitute	252910 252930	Feldspar Leucite, nepheline and nepheline syenite
Silica minerals	2506	Quartz (except natural sands), quartzite
Glass and foundry sands	250510	Silica sands and quartz sands

Limestones	2521	Limesone flux, limestone and other calcareous stone, for lime or cement manufacturing
Dolomite	2518	Dolomite, dolomite calcined, roughly trimmed, merely cut, aglomerated
Gypsum	252010	Gypsum, anhydrite
Dimension stone	2514	Slate, whether or not roughly trimmed or sawed or merely only into blocks or rectangular slabs
	2515	Marble, travertine, ecaussine and other calcareous monumental or building stone, density 2.5 or higher, and alabaster, whether or not roughly trimmed or sawed or merely cutted only into blocks or rectangular slabs
	2516	Granite, porphyry, basalt, sandstone and other monumental or building stone, whether or not roughly trimmed or merely cutted into blocks or rectangular slabs
	6801	Setts, curbstones and flagstones of natural stone (except slate)
	6802	Worked monumental and building stone (except slate and slate products, except products No. 6801; little stones for mosaics or tasselated pavements or similar objects, whether or not on beds; artificially coloured
	6803	granules, chippings and dust of natural stone (including slate)
		Worked slate and articles of slate or of agglomerated slate
Building stone	251710*	Pebbles, gravel, broken or crushed stone in general used for concreting and gravelling of roads, railroads etc., flint and hard head whether or not heat-treated
Sand and gravel	250590	Other sands (natural sands of all kinds, also coloured, except sands containing metals and except silica sands and quartz sands)
	251710*	Pebbles, gravel, broken or crushed stone in general used for concreting and gravelling of roads, railroads etc., flint and hard head whether or not heat-treated

[1)] *Code of the customs tariff*
** item included in one commodity only*

Definitions 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 (including table and denatur), pure sodium chloride
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 oleum
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)
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 minerals and mineral products statictically significant in % share of FOB expression of value:

	Country/Year	1996*	1997*	1998	1999	2000
Export	Germany	37,4	27,8	26,5	36,6	34,9
	Slovakia	20,2	22,8	23,3	19,6	23,2
	Austria	22,1	24,2	21,6	22,0	19,7
	Poland	8,0	8,8	13,7	8,6	8,7
	Hungary	7,7	7,7	9,2	6,5	7,9
	others	4,6	8,7	5,7	6,7	5,6
Import	Russia	79,5	71,8	74,6	65,9	67,8
	Norway	N	N	N	7,5	9,7
	Ukraine	5,4	6,2	8,2	6,3	5,3
	Kazakhstan	N	N	N	1,7	4,6
	Algeria	N	N	N	3,3	4,2
	Poland	5,9	7,6	3,1	4,2	3,4
	Slovakia	1,5	1,8	0,5	2,8	1,7
	Germany	3,3	3,4	2,0	4,3	1,5
	others	4,4	8,2	11,6	4,0	1,8

** there was used another methodology of calculation in 1996-1997*

Note: An interesting deflection arose in the import structure according to the countries and price in the period of 1999-2000. The reasons were the radical price increase of natural oil and the decrease of CZK towards USD at the same time.

Important commodities of the Czech export of mineral substances were in the last four years: hard coal – 46.5 %, coke – 11.3 %, cement – 9.7 %, brown coal – 9.1 % and kaolin – 5.5 % in 2000.
Main import commodities were at the same time: crude oil – 45.3 %, natural gas – 40.3 % and iron ore – 7.0 % (average % share of import of mineral commodities value). Detailed data are given in the following table.

Export and import of raw materials in mill. CZK

Raw material		Customs tariff code	1996	1997	1998	1999	2000*
Ores and concentrates total	import		5 137	6 525	7 131	4 818	6 759
	export		31	26	19	64	7
Fe - ores and concentrates	import	2601	5 088	6 469	7 088	4 770	6 701
	export		3	5	3	5	0
Mn – ores and concentrates	import	2602	42	52	26	32	56
	export		0	1	1	9	0
Ni – ores and concentrates	import	2604	6	1	6	13	1
	export		0	0	0	2	0
Cu – ores and concentrates	import	2603	0	0	0	0	0
	export		2	1	1	1	0
Pb – ores and concentrates	import	2607	0	0	0	0	0
	export		0	0	1	0	1
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	1	3	11	2	0
	export		26	19	13	48	6
Ag – ores and concentrates	import	261610	0	0	0	1	1
	export		0	0	0	0	0
Au – ores and concentrates	import	261690	0	0	0	0	0
	export		0	0	0	0	0
Fuels total	import		52 489	57 250	42 794	42 191	83 596
	export		14 293	14 405	13 722	11 868	11 798
Uranium – ores and concentrates	import	261210	0	0	0	N	N
	export		N	N	N	N	N
Crude oil	import	2709	28 377	28 454	19 937	22 068	43 562
	export		277	327	389	470	577
Natural gas	import	271121	21 229	26 579	21 300	18 994	38 769
	export		220	211	2	2	2
Hard coal	import	2701	2 882	2 216	1 557	1 124	1 265
	export		9 827	10 586	10 746	9 097	9 383
Brown coal	import	2702	1	1	0	5	0
	export		3 969	3 281	2 585	2 299	1 836
Industrial minerals and building m. - total	import		1 086	922	1 030	975	1 096
	export		2 506	2 696	2 861	2 735	2 930
Fluorspar	import	252921 252922	136	161	164	118	146
	export		11	127	153	77	89
Barite	import	251110	51	45	37	40	42
	export		0	0	0	0	1

Graphite	import	2504	20	20	25	25	31
	export		55	61	62	58	55
Kaolin	import	2507	29	43	69	62	77
	export		793	898	948	1 013	1 118
Clays	import	2508	86	79	97	122	137
	export		307	315	332	319	293
Bentonite	import	250810	23	29	37	41	41
	export		69	70	82	85	89
Feldspar	import	252910	14	20	18	21	25
	export		82	67	78	93	120
Glass and foundry sands	import	250510	33	31	25	37	62
	export		184	191	219	208	206
Limestones	import	2521	60	76	58	42	47
	export		46	82	96	113	139
Gypsum	import	252010	12	16	24	27	14
	export		36	30	17	20	25
Dimension stone	import	2514-6 6801-3	520	295	349	414	458
	export		568	633	724	767	792
Building stone	import	251710	43	34	35	21	24
	export		167	105	73	64	87
Sand and gavel	import	250590 251710	60	73	92	67	57
	export		189	117	77	67	92
Raw materials total	import		58 711	64 697	50 955	47 984	91 451
	export		16 829	17 127	16 602	14 667	14 735

Note: data of 2000 are round off numbers reported by The Czech Statistical Office

Export and import of other chosen raw materials in mill. CZK

Raw material		Custom tariff code	1999	2000*
Al – ores and concentrates	import	2606	59	50
	export		0	0
Ti – ores and concentrates	import	2614	229	274
	export		0	0
Nb, Ta, V and Zr – ores and concentrates	import	2615	56	55
	export		0	1
Coke	import	2704	657	1 595
	export		2 632	2 482
Salt	import	2501	900	773
	export		39	42
Sulphur	import	2503, 2802	264	284
	export		13	22
Sulphuric acid oleum	import	2807	22	29
	export		54	44
Natural phosphates	import	2510	125	127
	export		0	3
Phosphoric substances	import	2809	218	195
	export		14	9
Nitrogenous fertilizers	import	3102	1 051	1 465
	export		1 157	1 586
Phosphatic fertilizers	import	3103	97	71
	export		3	1
Potassic fertilizers	import	3104	322	396
	export		2	5
Fertilizers of more elemen ts	import	3105	445	587
	export		446	663
Magnesite	import	251910	8	8
	export		1	0
Quicklime	import	2522	112	66
	export		289	285
Cement	import	2523	1 013	1 175
	export		2 141	2 014
Total	import		5 578	7 150
	export		6 791	7 157

Note:
- zero data of value report on exports or imports smaller than 0.5 mill. CZK
zero data of share in % express the share smaller than 0.5 %
- expression of value proceeds out of the declared goods tariff value internationally marked FOB (without foreign trade direct costs)
- data on exports and imports are round off numbers reported by The Czech Statistical Office ; data are precised continuously

IMPORTANCE OF MINERALS IN THE CZECH NATIONAL ECONOMY

In the last few years, structure changes in the Czech economy, especially in industry, have influencedboth the role and the importance of branches of extracting and processing 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 1.5% in 2000. On the other hand, the quota of mineral production within all industrial pruduction has not changed much. There was a small decrease from 6.9% in 1993 to 3.3% in 1999.

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 ores, baryte and fluorspar. The mining of coal has been limited significantly in many regions. The mining of uranium ores (registered in mineral fuels) was strictly limited.

There was an important increase of bentonite and feldspar in 2000. Also brown coal, kaolin and foundry sands production increased. The production of limestone has been increasing gradually since 1995. It stagnated on the level of 11.3 mill. t in 2000. Mining production of gypsum decreased significantly in 1999 in consequence of surplus of waste gypsum arising during desulphurizing of thermal power stations. Also mining production of uranium and clays decreased. In reserved deposits production of building stone stagnated, in non-reserved deposits it decreased partially. A part of sand and gravel and above all brick clays are exploited more and more in non-reserved deposits.

Importance of minerals is not limited by these numbers only. 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 Czech economy. In 2000, the same volume of these raw materials was purchased for two times higher price than in 1999. Main export commodities among raw materials were black coal, brown coal, coke and cement in 1997. Added can be also export of ceramic and glass products.

Mining industry has to a large extent negative impact on the environment. That is why production restrictions in many deposits has a positive effect on landscaspe 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 about the half level in 2000 compared to 1990. However, there still exist protected landscape areas where restrictions have not been materialized and even when an extent of mining has increased. In this category belong: Český kras, Třeboňsko and České středohoří, Křivoklátsko and Blanský les. The protected landscape area of Český kras has the index of landscape mining afflict more than ten times higher than the other protected areas.

We have to note a limited lifetime of our most important resources of mineral fuels represented by deposits of brown and hard coal. Especially alarming is a short lifetime of brown coal reserves following from area restriction. These limits have arisen during the struggle to recover the atmosphere and to stabilize the territory of the North Bohemia. The Czech Republic is not without prospects as gold deposits concerns. 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.