Průmysl stavebních a chemických surovin a jejich zdroje

Stavební a chemické suroviny

Fertilizers and chemical industrial minerals:
limestone, dolomite, lime
phosphate, salt, potash, sulfur, N and N-comp., jiné minerály pro zemědělství a chem.prům.:
fluorit, jod,

Construction and manufacturing industrial minerals:
cement, aggregate – crushed stone, sand, gravel, dimension stone, gypsum

Fillers, extenders, pigments, filters:
clays, asbestos, diatomite, talc + pyrophyllite, barite, mica, zeolites, mineral pigments

Abrasive and refractory minerals:
diamonds, other ….
graphite, kyanite, and …

Vápence, dolomity, vápno

- vápence – $CaCO_3$
- dolomity – $CaMg(CO_3)_2$
- slínovce
- CCD – carb. compenzation depth, dnes pod cca 4300m se netvoří vápence
- CaO – vápno, z vápenců, celková produkce má vysokou hodnotu – při výrobě se spotřebovává velké množství energie
- použití: čištění vody, výroba oceli, odsíření,

Výroba vápna

Pálení vápence probíhá při teplotě 900 - 1100°C podle následující rovnice:

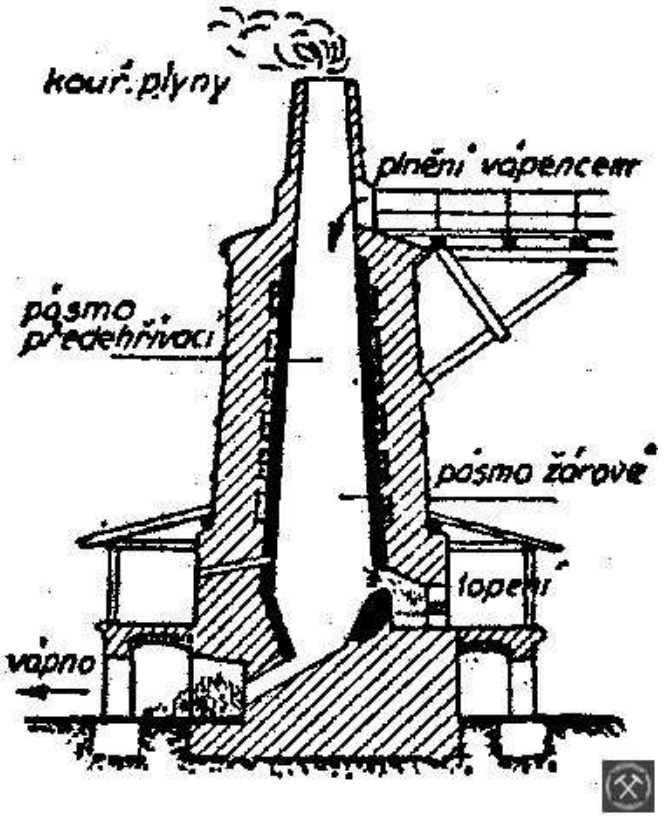
$CaCO_3 \rightarrow CaO + CO_2$

Hašení vápna

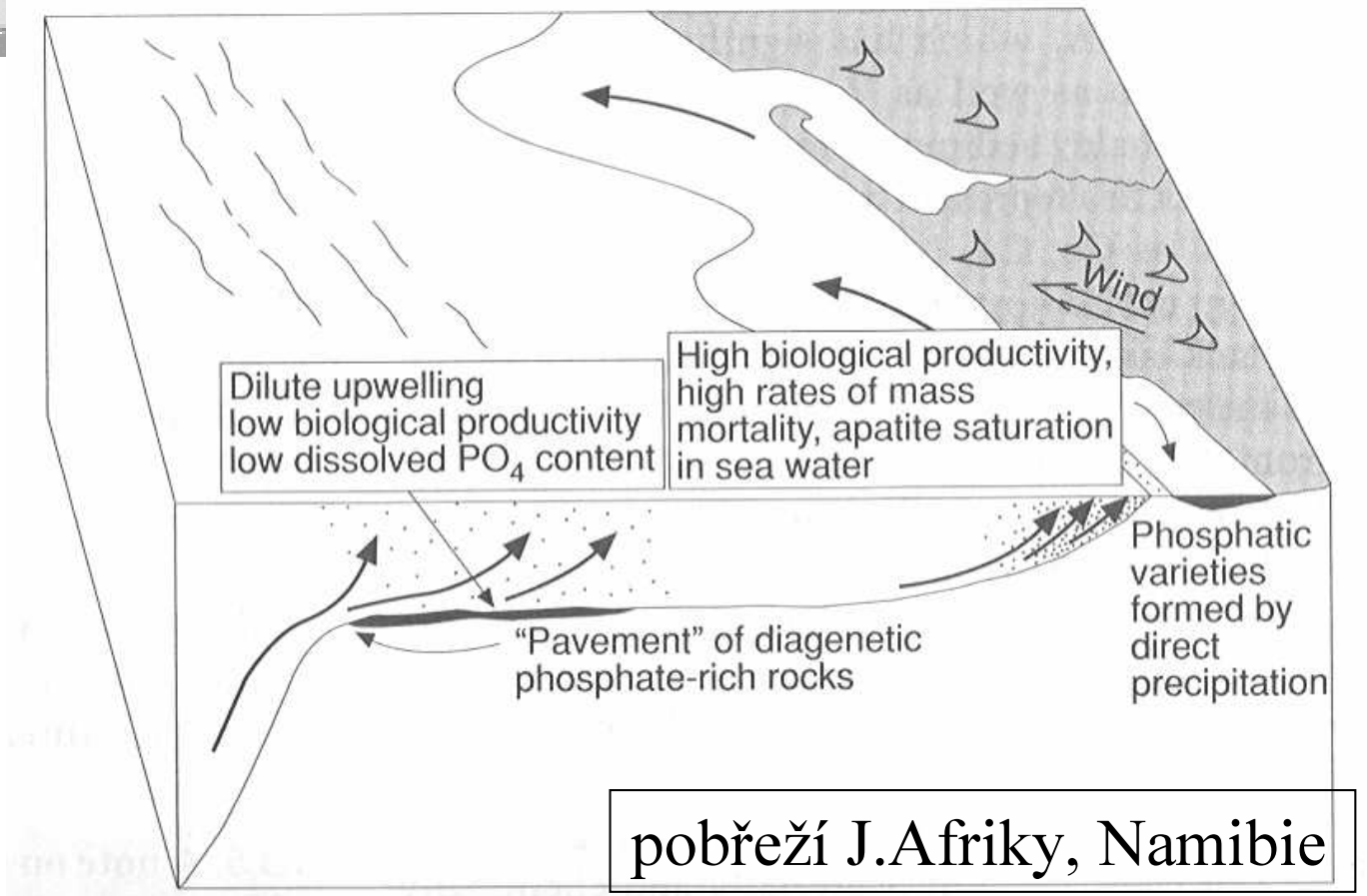
$CaO + H_2O \rightarrow Ca(OH)_2$

Tvrdnutí vápna

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$



Fosfáty



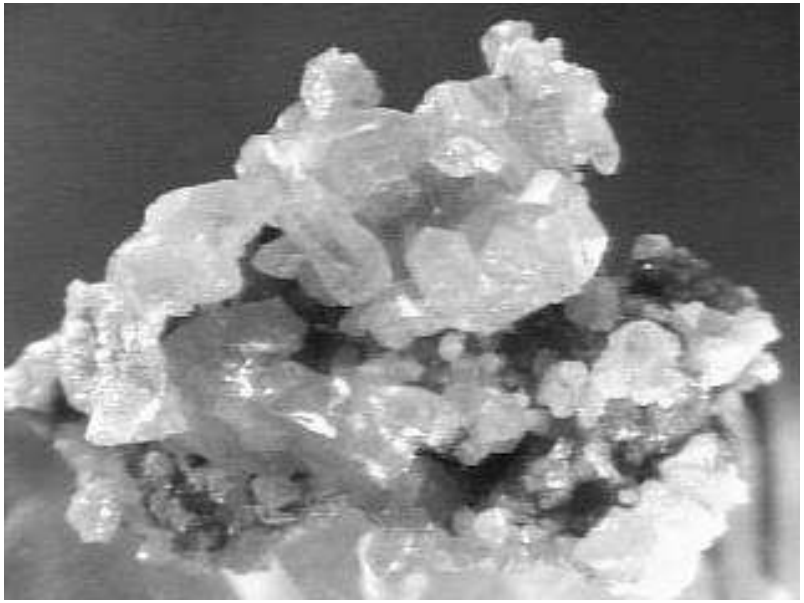
pobřeží J.Afriky, Namibie

- ložiska magmatická – apatit Ca5(PO4)3(OH,F,Cl)
- ložiska sedimentární – fosfority (biochemická, biogenní)

Halit, draselné soli

- minerály:
  sylvín KCl
  carnalit KCl . $MgCl_2$. $6H_2O$
  kainit KCl . $MgSO_4$. $3H_2O$
- polyhalit, epsomit,
- produkce: SNS, Kanada 26% těžby, téměř polovina zásob, Německo 17%, USA 6%, Izrael 4,9%

Síra

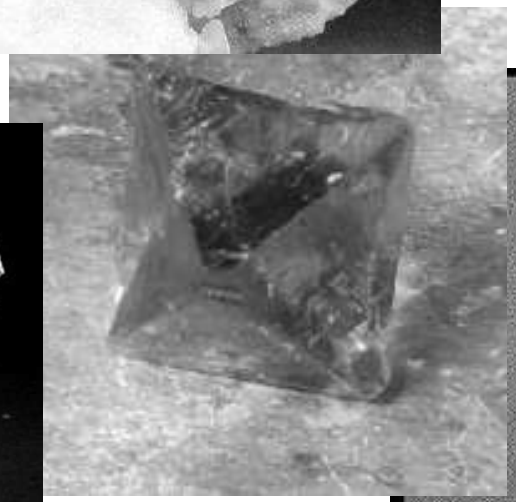


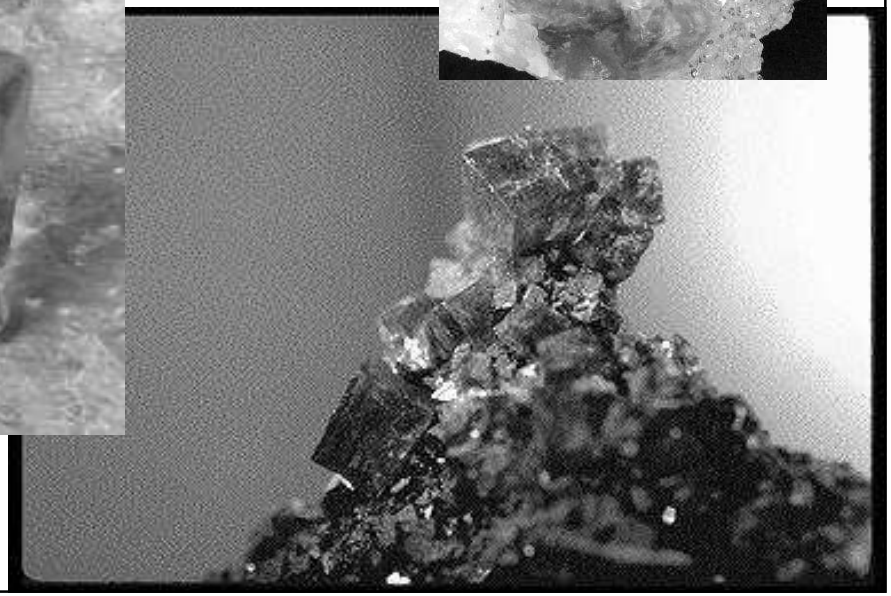
ložiska: infiltrační, biochemická, vulkanogenní, vznik při zpracovávání sulfidů, při úpravě zem. plynu a ropy

těžba: „Frasch method“ – vtláčení páry a rozpouštění síry

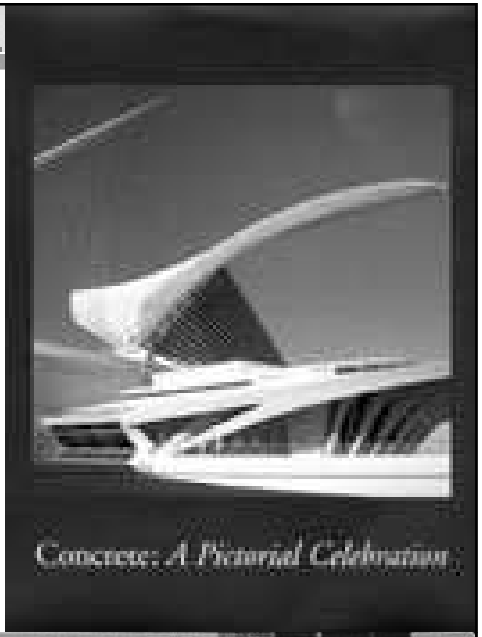
Hlavní producenti: země zpracovávající uhlovodíky, rudy, těžba přírodní síry: Polsko, Texas

Fluorit – CaF_2



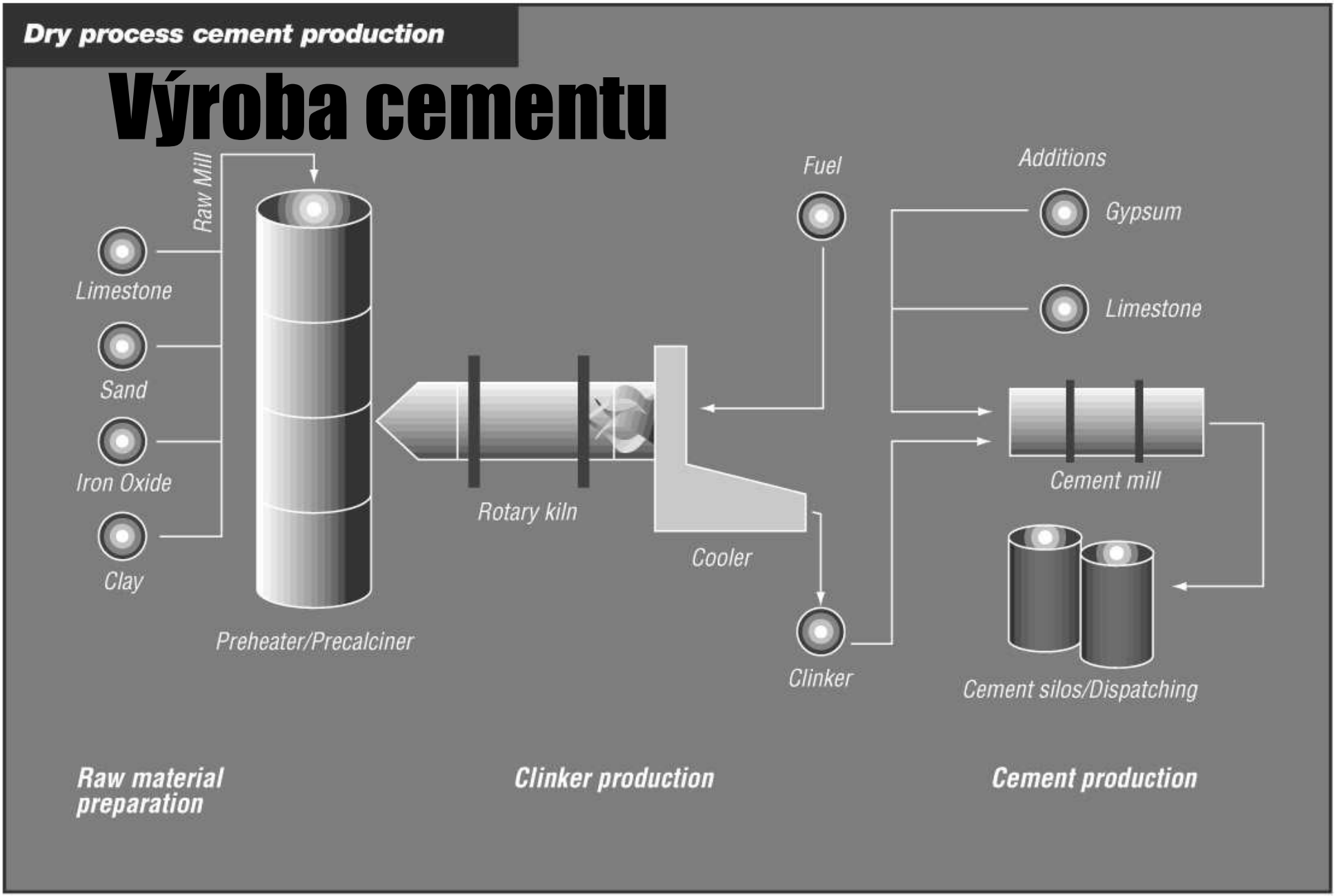


Cement



	Country	1999	2000	2001	2002	2003[e]
	Total	1 600 000	1 660 000	1 730 000	1 840 000	1 950 000
1	China	573 000	597 000	661 040	725 000	813 190
2	India[e]	90 000	95 000	100 000	102 000	110 000
3	United States, including Puer	87 777	89 510	90 450	91 266	94 329
4	Japan	80 120	81 097	76 550	71 828	71 000
5	Korea, Republic of	48 157	51 255	52 046	55 514	59 199
6	Spain, including Canary Islar	35 782	38 115	40 512	42 500	42 000
7	Russia	28 400	32 400	35 300	37 700	41 000
8	Italy	37 299	38 925	39 804	40 000	38 000
9	Brazil	40 270	39 208	38 927	38 027	37 980
10	Indonesia	23 925	27 789	31 300	34 640	35 000
34	Belgium	7 277	7 150	7 500	8 000	8 000
47	Austria	3 817	3 776	3 863	3 800	3 800
52	Czech Republic	4 241	4 093	3 550	3 500	3 500
57	Slovakia	4 718	3 045	3 123	3 100	3 100

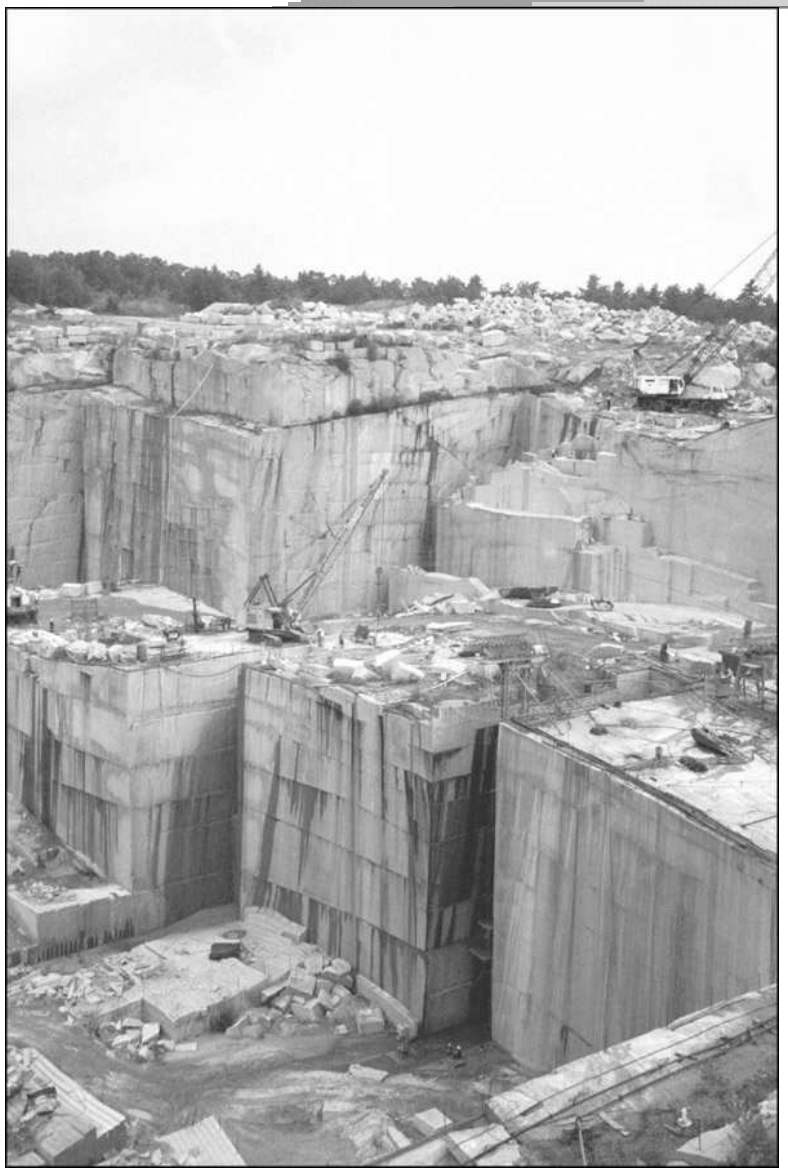
Výroba cementu



Drcené kamenivo, štěrk, písek

Stavební kámen

dimension stone

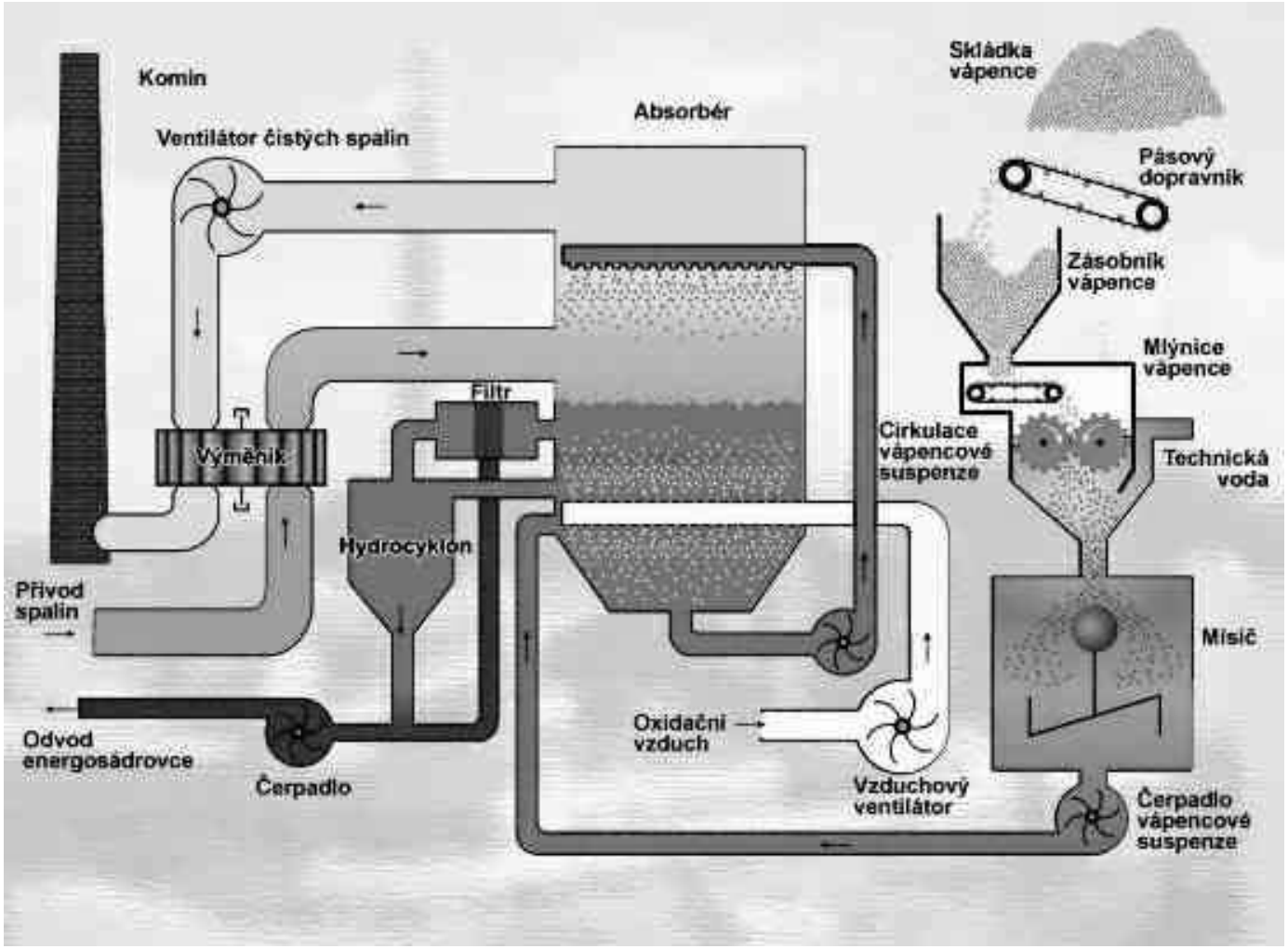


Sádrovec

Hlavní producenti (rok 1998):

USA	18,3 %
Írán	9,6 %
Thajsko	9,2 %
Kanada	9,2 %
Španělsko	8,9 %
Čína	7,9 %

Odsíření


Komín
Ventilátor čistých spalin
Absorbér
Skládka vápence
Pásový dopravník
Zásobník vápence
Mlýnice vápence
Filtr
Výměník
Cirkulace vápencové suspenze
Technická voda
Hydrocykion
Přívod spalin
Míšič
Oxidační vzduch
Odvod energosádrovce
Čerpadlo
Vzduchový ventilátor
Čerpadlo vápencové suspenze

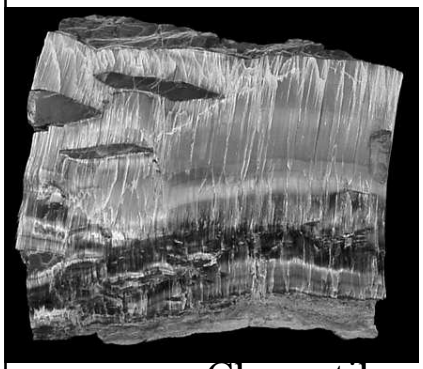
Jíly

jíly – žáruvzdorné, keramické

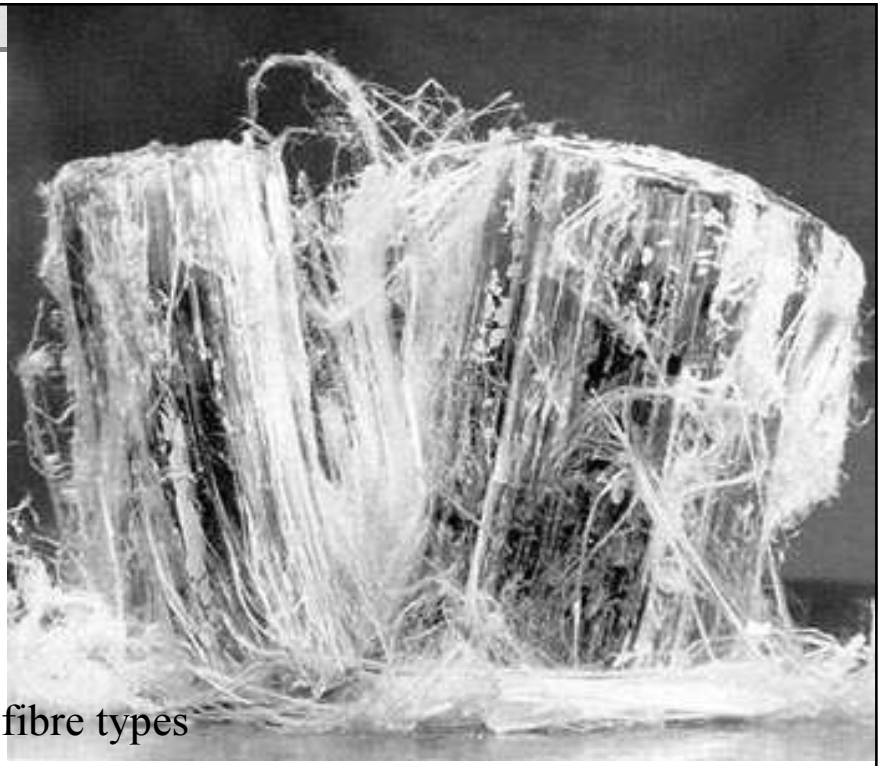
montmorilonitové jíly (bentonit)

kaolín

Asbesty

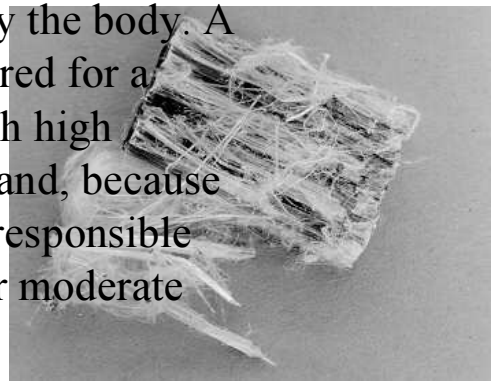


$Mg_3(Si_2O_5)(OH)_4$



Chrysotile and asbestos amphiboles : two different fibre types

Chrysotile comes from the serpentine group, whereas the other fibre types, tremolite, amosite, crocidolite, actinolite and anthophyllite, are part of the amphiboles group. All these fibres are non-flammable. The major difference between chrysotile and amphiboles is related to its chemical composition, its acid-resistant properties and its effects on health. In contrast with amphiboles, Chrysotile does not persist in the lungs after inhalation; it is quickly eliminated by the body. A prolonged exposure to high concentrations of chrysotile fibres is required for a clinical manifestation of pulmonary damage to appear. In the past, such high exposures were frequent; it is no longer the case today. On the other hand, because of their toxicity and their high biopersistence, amphiboles are mainly responsible for mesothelioma and pulmonary deceases even caused after a short or moderate exposure. Today, chrysotile is the only asbestos fibre commercialized.



Asbest - produkce

World production
Estimated production (tonnes) for 1999
Russia 870 000
China 360 000
Canada 220 000
Brazil 210 000
Kazakhstan 200 000
Zimbabwe 170 000
Other 50 000
Total 2 080 000
Sources: Natural Resources Canada, U.S. Geological Survey, The Chrysotile Institute

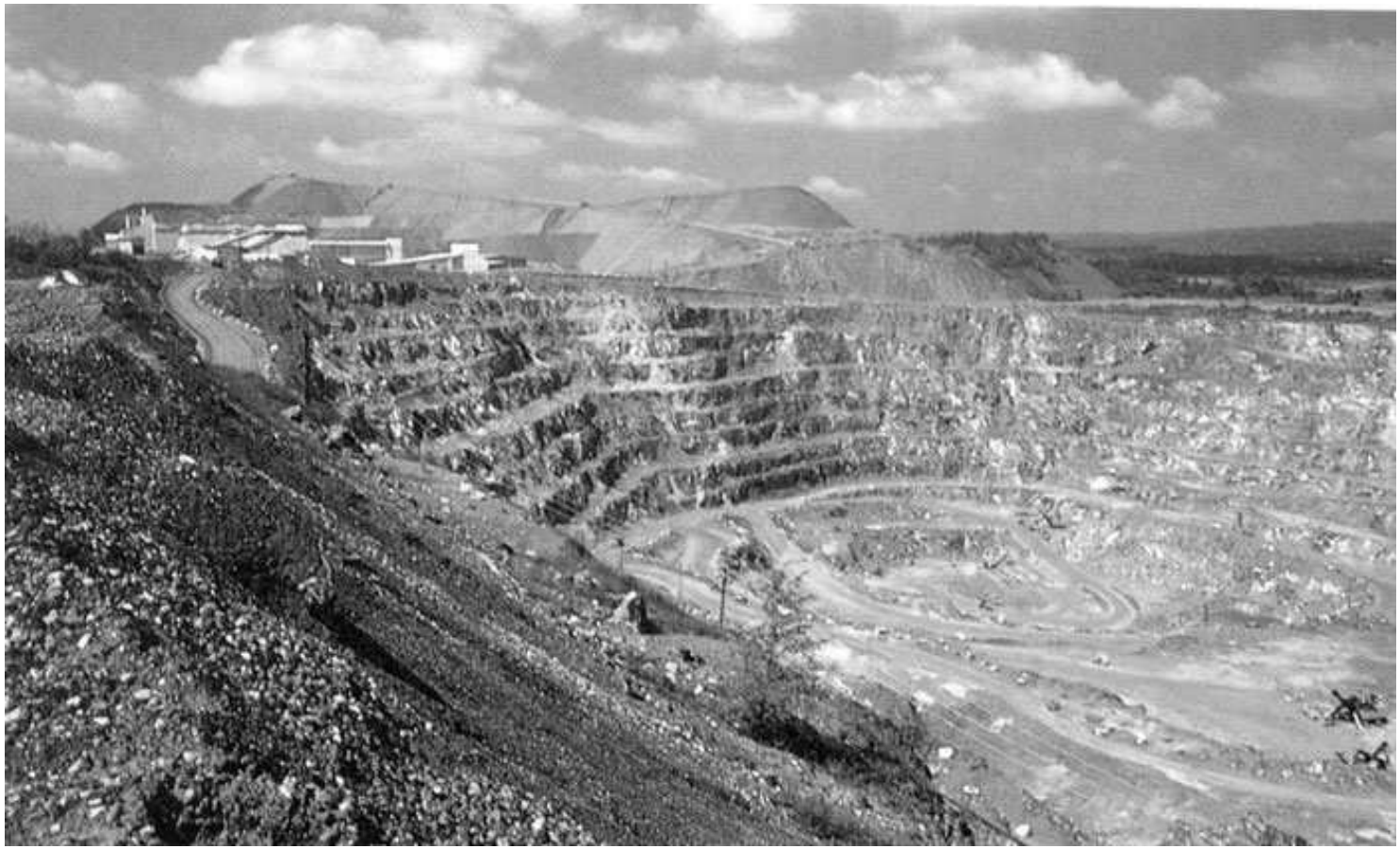
World consumption
Estimated consumption (tonnes) for 2003
Far East 880 000
Russia and Central Asia 530 000
Middle East and Indian sub-continent 320 000
Africa 80 000
Central and South America 180 000
North America 50 000
Europe 40 000
Total 2 080 000
Source: The Chrysotile Institute

Těžba v Brazílii

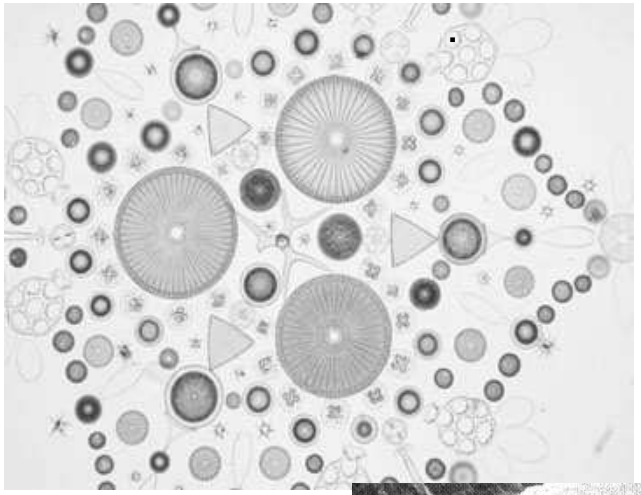
Cana Brava - Brazílie

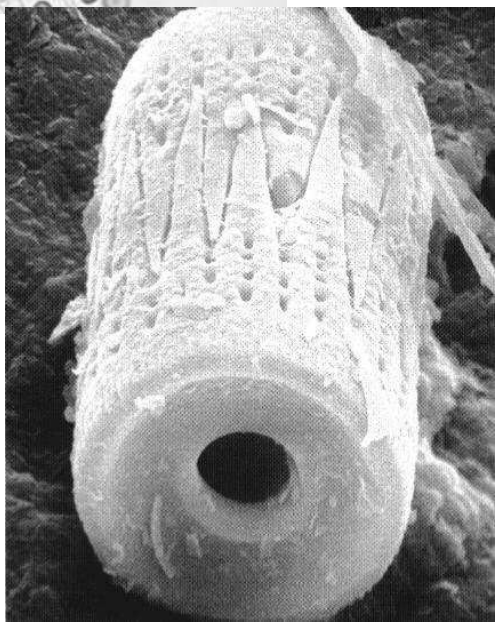
Kanada

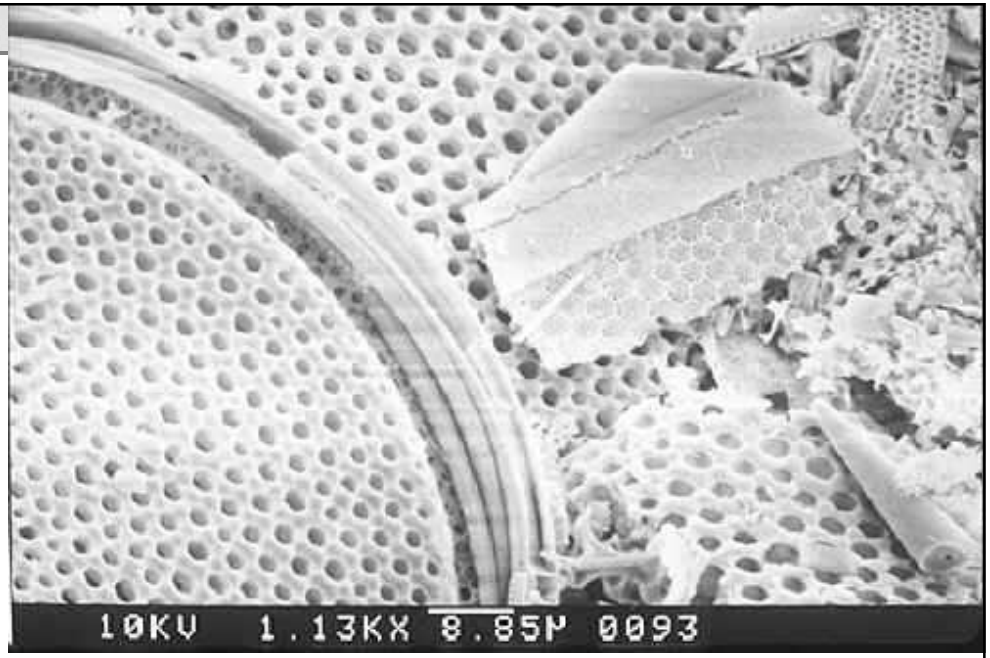
LAB Chrysotile - Canada



Diatomit







A scanning electron microscope image of diatom skeletons clearly showing their porous nature (image by Dr. Rick Behl).

Monterey Formation diatomite

Diatomit - použití

USES

Oil, water and chemical absorbent
Pet litter
Fertiliser (anti-caking) agent
Pesticide manufacturing
Horticultural potting mix and soil conditioner
Hydroponic medium
Agricultural chemical carrier
Dessicant
Filtration for food and beverage manufacturing
Swimming pool filtration
Filler for paint/rubber/plastics
Lightweight building material
Cement and concrete additive
Refractory
Mild abrasive

Diatomit

DIATOMITE: WORLD PRODUCTION, BY COUNTRY [1, 2]

(Thousand metric tons)

Country	1999	2000	2001	2002	2003[e]
Algeria	3	3 [e]	3	3	3
Argentina	34 [r]	18 [r]	28 [r]	23 [r]	20
Australia[e]	20	20	20	20	20
Brazil, marketable[e]	13 [r]	13 [r]	13 [r]	13 [r]	13
Chile	14	13	23	30 [r]	30
China[e]	340	350	350	370	380
Colombia[e]	4	4	4	4	4
Commonwealth of Independent States[e, 3]	80	80	80	80	80
Costa Rica	18	35	26	26	25
Czech Republic	37	34	83 [r]	28 [r]	30
Denmark[e, 4]	185	234 [r]	231 [r]	231 [r]	232
France[e]	80	75	75	75	75
Iceland	28	28	30 [r]	31 [r, e]	30
Iran[e, 5]	4 [6]	5	5	5	5
Italy[e]	25	25	25	25	25
Japan[e]	190	190	180 [r]	180 [r]	180
Kenya	1 [r]	(7) [r]	(7) [r]	1 [r]	1
Korea, Republic of	30	34	28	21 [r]	21
Macedonia[e]	5 [r]	5	5	5	5
Mexico	65	96	69	62 [r]	60
Peru[e]	35	35	35	35	35
Poland	1	1	1	1	1
Portugal[e]	2	2	2	2	2
Romania	12	9	10 [r]	20 [r]	20
Spain[e, 8]	36	35	35	35	35
Thailand	2	(7)	1 [r]	1 [r]	1
United States[9]	747	677	644	624	620 [6]
Total	2 010 [r]	2 020 [r]	2 010 [r]	1 950 [r]	1 950

[e]Estimated. [r]Revised.

[1]World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown. Purity and moisture content are generally not reported or estimated.

[2]Table includes data available through April 4, 2004.

[3]Information is inadequate for formulation of reliable estimates for individual countries.

[4]Data represent "extracted moler" (reported cubic meters times 1.5). Contains about 30% clay.

[5]Data are for Iranian years beginning March 21 of that stated.

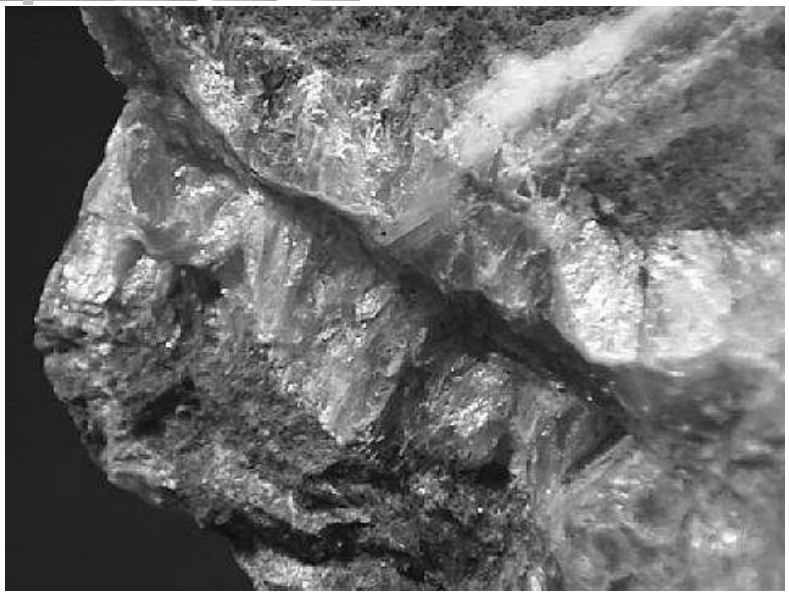
[6]Reported figure.

[7]Less than 1/2 unit.

[8]Includes tripoli.

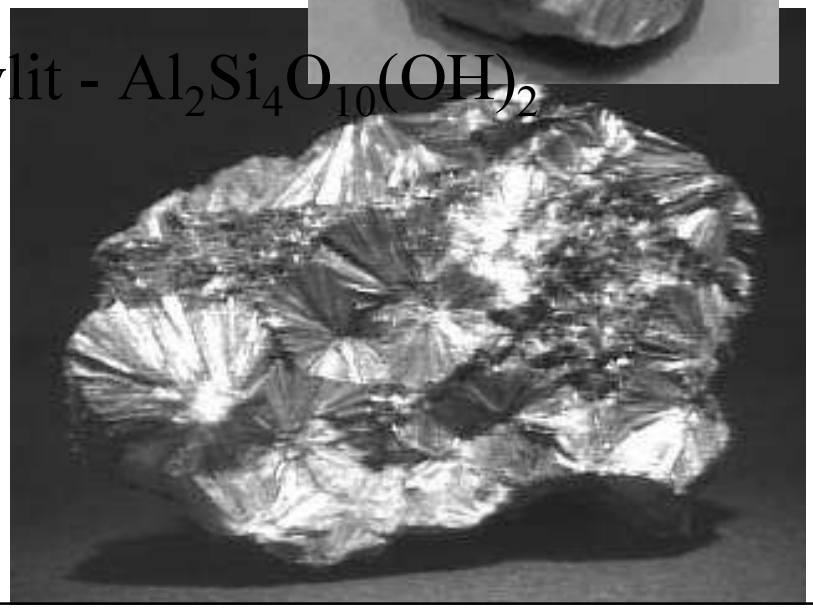
[9]Sold or used by producers.

Mastek a pyrofylit



$Mg_3Si_4O_{10}(OH)_2$

pyrofylit - $Al_2Si_4O_{10}(OH)_2$



Mastek, pyrofylit - použití

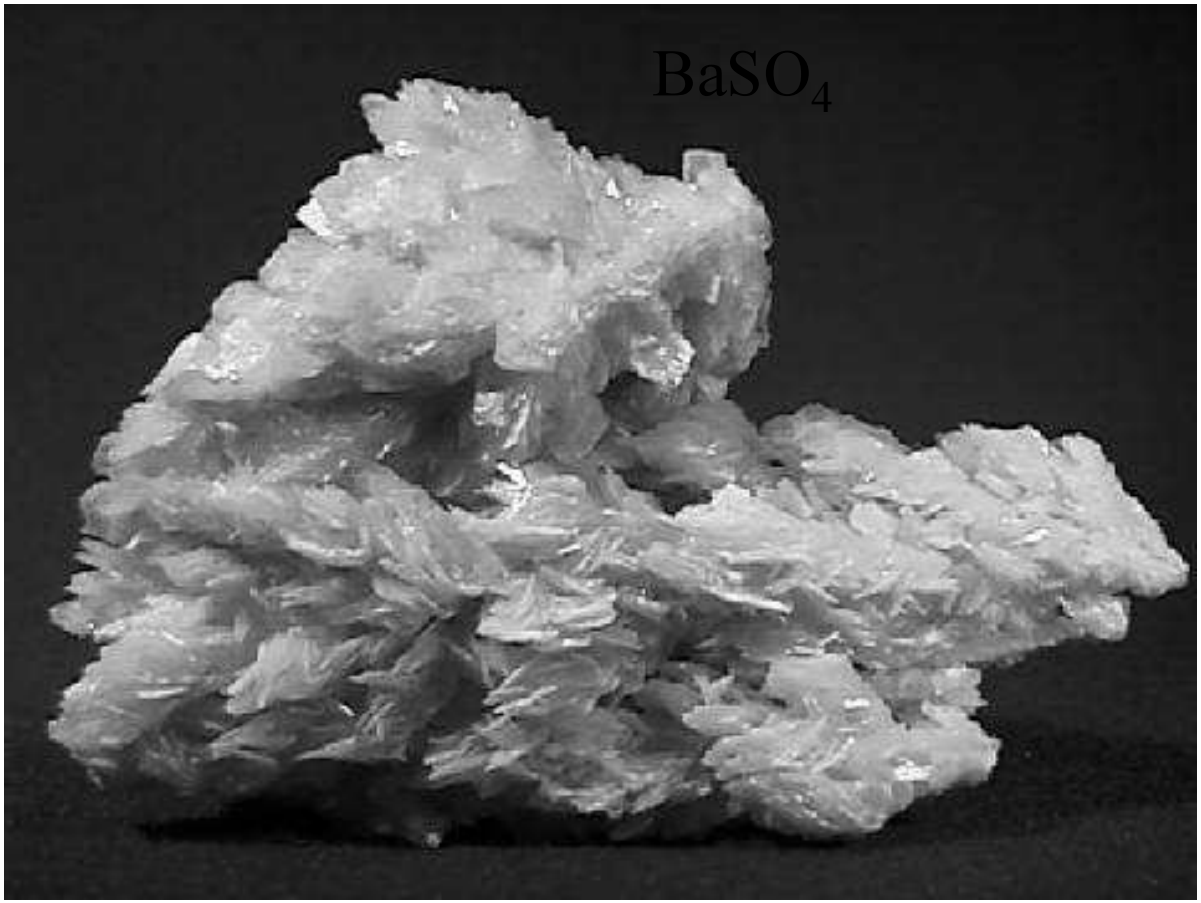
Uses

Ground talc is used as an ingredient in ceramics, paper, paint, roofing, plastics, cosmetics, talcum and baby powders, and a variety of other assorted uses such as making rubber and plastics.

Ground pyrophyllite is used in the production of ceramics, heat-resistant products called *fractories*, and paint.

Soapstone was once used to make chemical-resistant sinks and countertops for laboratories. Before the days of furnaces, blocks of soapstone were heated on stoves and used as bed warmers.

Baryt

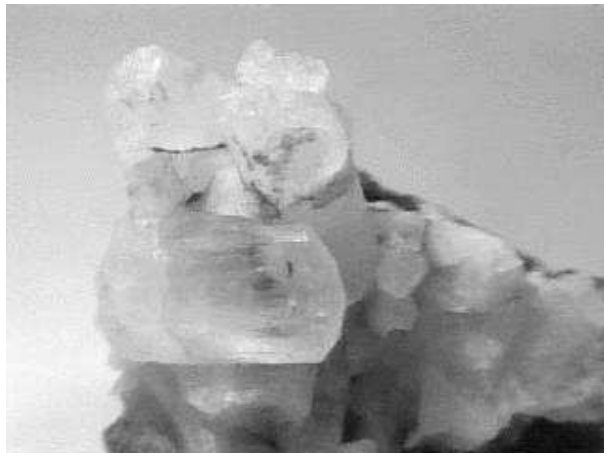


Baryt

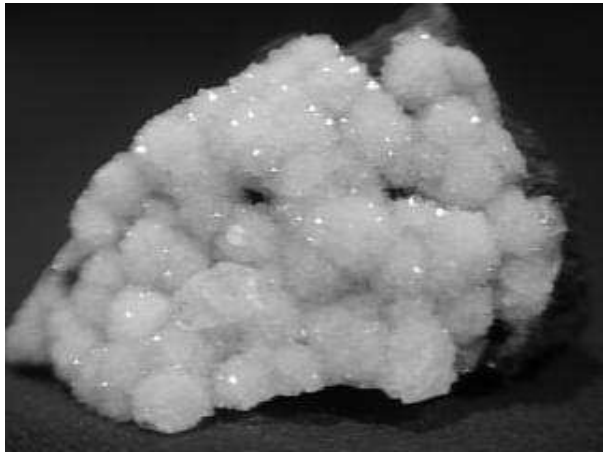
produkce ve světě v tunách

Country	1999	2000	2001	2002	2003[e]
China[e]	3 500 000	3 500 000	3 600 000	3 100 000	3 500 000
India	360 000	840 000	850 000	600 000	700 000
United States[8]	434 000	392 000	400 000	420 000	468 000
Morocco	328 945	343 557	471 102	469 934	356 394
Mexico	157 953	127 420	142 017	163 620	255 961
Iran[3]	183 850	185 000	195 539	179 652	150 000
Thailand	76 092	56 180	23 559	137 469	130 000
Germany, marketable Ba_2SO_4[e]	120 000	120 000	120 000	120 000	120 000
Turkey, run of mine	150 058	120 893	53 373	106 843	110 000
Bulgaria[e, 6]	120 000	120 000	100 000	90 000	75 000
France	75 000	75 000	75 000	75 000	75 000
Korea, North[e]	70 000	70 000	70 000	70 000	70 000
Russia[e]	60 000	60 000	60 000	60 000	60 000
United Kingdom	59 000	55 000	60 000	60 000	60 000
Brazil, beneficiated	44 906	53 741	54 790	54 895	55 000
Algeria	50 150	51 925	43 020	51 733	49 995
Kazakhstan[5]	13 300	14 000	45 000	46 000	40 000
Belgium[e]	30 000	30 000	30 000	30 000	30 000
Spain, marketable Ba_2SO_4	26 000	26 000	26 000	26 000	26 000
Italy[e]	25 000	25 000	25 000	25 000	25 000
Pakistan	20 505	21 234	22 000	25 000	25 000
Canada	123 000	67 000	23 000	19 000	23 000
Australia[e]	18 000	20 000	20 000	--	20 000
Burma	24 651	30 370	--	18 000	20 000
Georgia[e]	15 000	15 000	15 000	15 000	15 000
Slovakia, concentrate	16 000	14 000	14 000	11 000	14 000
Total world	6 160 000	6 490 000	6 590 000	6 020 000	6 520 000

Zeolity



natrolit – $Na_2Al_2Si_3O_{10}$-$2H_2O$



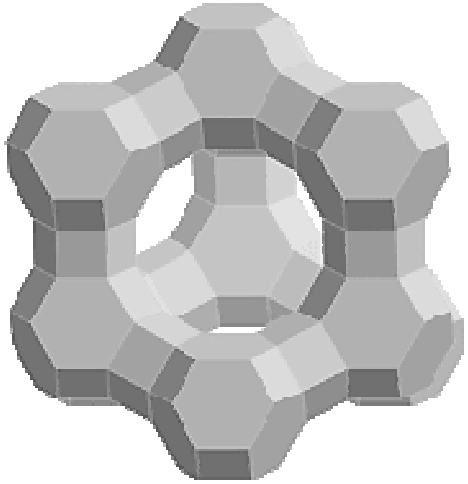
phillipsit - $KCaAl_3Si_5O_{16}$ - $6H_2O$

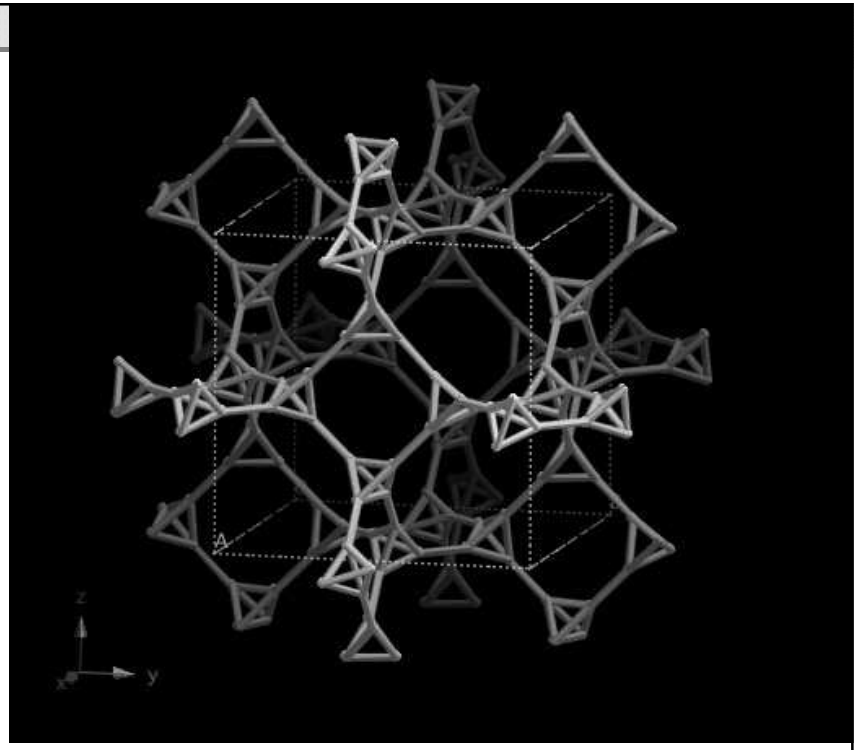
klinoptylolit

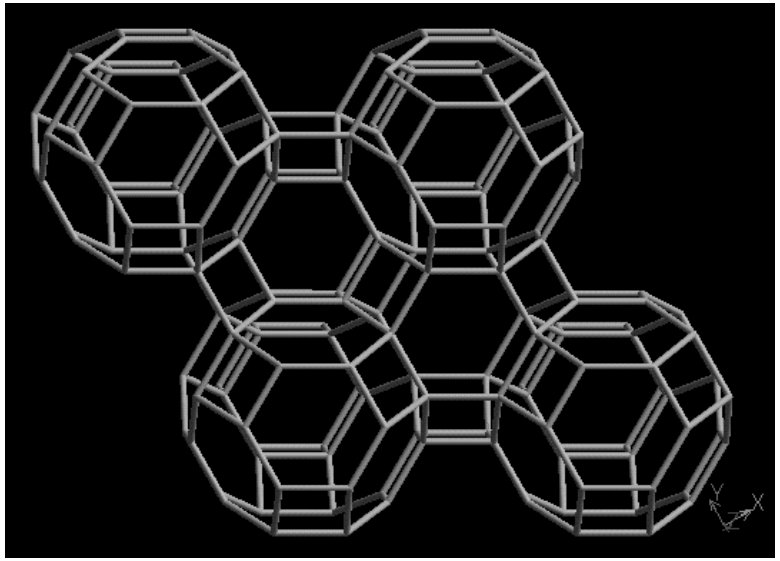
chabazit

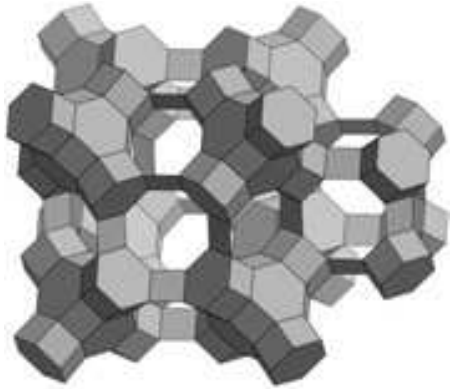
stilbit

Struktury zeolitů

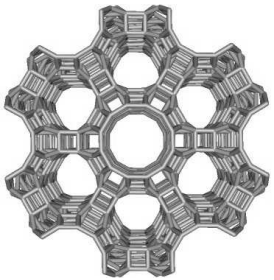


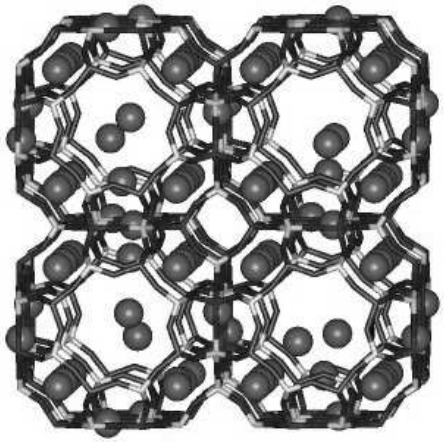






Zeolity - využití

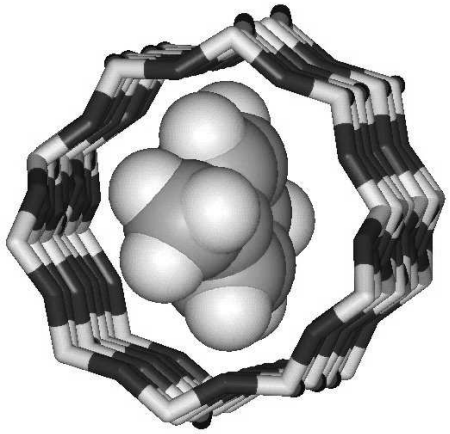




Sodium Zeolite A, used as a water softener in detergent powder

Ion Exchange

The loosely-bound nature of extra-framework metal ions (such as in zeolite NaA, right) means that they are often readily exchanged for other types of metal when in aqueous solution. This is exploited in a major way in water softening, where alkali metals such as sodium or potassium prefer to exchange out of the zeolite, being replaced by the "hard" calcium and magnesium ions from the water. Many commercial washing powders thus contain substantial amounts of zeolite. Commercial waste water containing heavy metals, and nuclear effluents containing radioactive isotopes can also be cleaned up using such zeolites.



The shape of para-xylene means that it can diffuse freely in the channels of silicalite

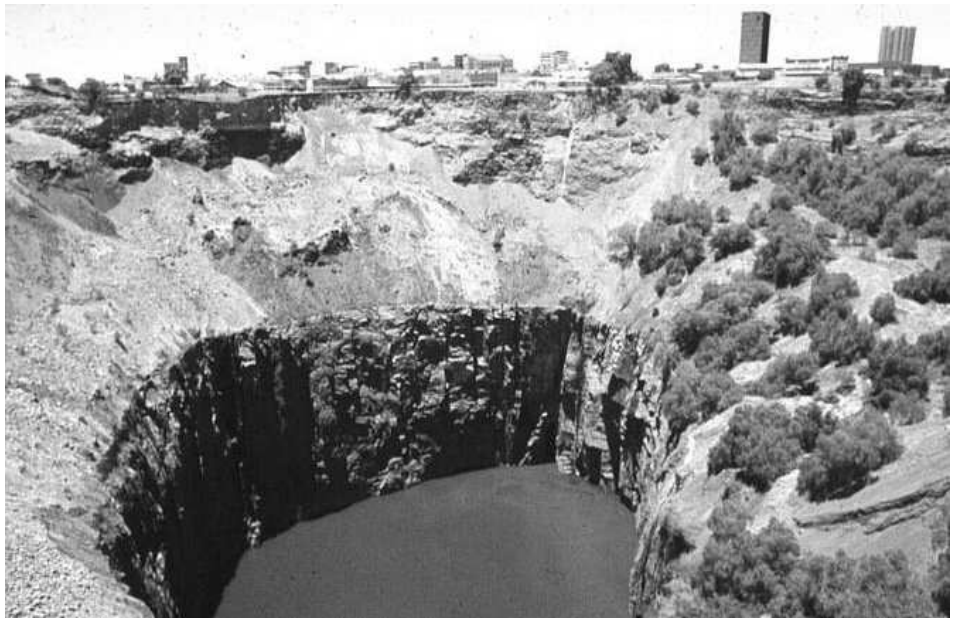
Adsorption and Separation

The shape-selective properties of zeolites are also the basis for their use in molecular adsorption. The ability preferentially to adsorb certain molecules, while excluding others, has opened up a wide range of molecular sieving applications. Sometimes it is simply a matter of the size and shape of pores controlling access into the zeolite. In other cases different types of molecule enter the zeolite, but some diffuse through the channels more quickly, leaving others stuck behind, as in the purification of *para*-xylene by silicalite.

Abrazíva

- „high grade“: diamant, korund, granát,
- silikátová (kvarcity, silicity, křemen, diatomit, pemza)
- ostatní (bauxit, magnezit, živec, křída, kaolín, mastek, SiC,

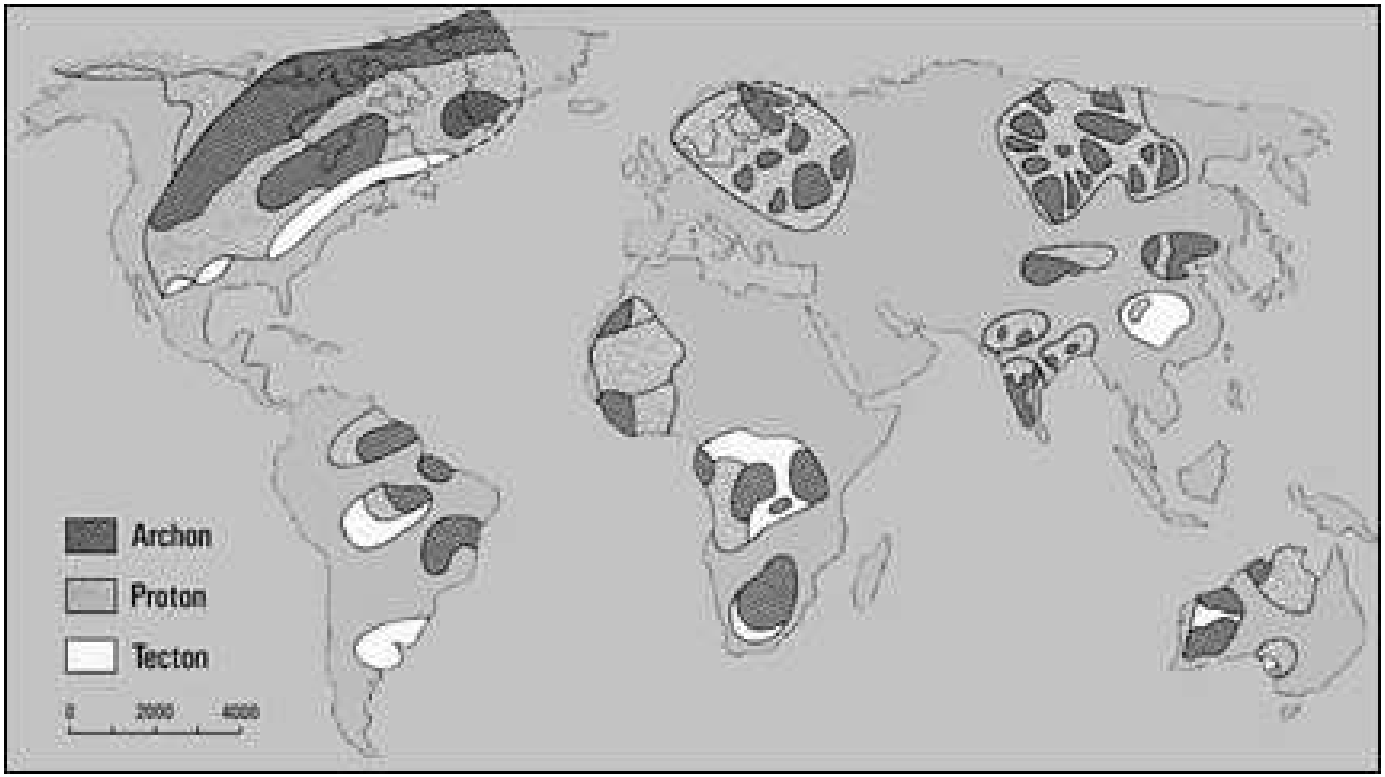
Diamanty



Nejhlubší povrchový důl na diamanty
Big Hole v Kimberly

Argyle, Austrálie

Diamantonosné terény



Mapa distribuce ložisek diamantů (Levinson et al., 1992).

Těžba diamantů

mine de Jwaneng (kimberlite; Botswana)

Země	Karáty (v tisících)	Cena ($ m)
Angola	5871	803
Austrálie	26070	294
Botswana	26416	2194
Brazílie	550	22
Čína	150	15
Ghana	450	11
Guinea	754	128
Jižní Afrika	11301	1145
Kanada	3685	531
Kongo	19637	496
Namíbie	1502	322
Rusko	20500	165
Sierra Leone	375	68
Tanzánie	191	28
Venezuela	325	41
Celkově	**110176**	**7253**

Diamanty – ložiska ve světě