Industrial Minerals in the Czech Republic

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Koněprusy VČS – West 2015: Limestone
Industrial Minerals – Contents

- Mineral reserve base of the Czech Republic
- Mine production of the Czech Republic
- Industrial minerals (IM) resources, mine production, export & import
  - Kaolin (KN)
  - Clays (JL) & bentonite (BT)
  - Feldspar (ZS)
  - Silica sand (PI)
  - Limestone (VA), dolomite (DL) & minerals for cement production (VO, VJ, CK)
  - Gypsum (SA) & other industrial minerals
- Summary
Mineral Reserve Base of the Czech Republic

Total Mineral Resources: 55,420 Mt

- Metallic Ores: 16.7%
- Mineral Fuels
- Industrial Minerals
- Construction Minerals (reserve deposits)
- Construction Minerals (non-reserve deposits)
Share of Mine Production of the Czech Republic

- Mineral Fuels: 49.4%
- Industrial Minerals: 13.7%
- Construction Minerals: 36.9%
Industrial Minerals Mine Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Kaolin, Clays, Bentonite</th>
<th>Silica Minerals</th>
<th>Carbonates + Cement Prod.</th>
<th>Others</th>
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Kaolin Resources

- **Sources:** alteration of rocks rich in feldspar – granitoids, sandstone, arcosite, rhyolite, gneiss etc. – kaolinite as a main mineral

- **Use:** paper industry (coating & filler), filler (plastics, rubber, paint, fiberglass), ceramics, refractory, cosmetics, pharmaceutical etc.

- **Reserves & resources (crude):**
  - Geological: 1.18 Gt
  - Exploitable: 98.2 Mt
  - **Mine production:** 3 – 3.5 Mt
  - **Export:** 400 – 500 kt
  - **Import:** 15 – 20 kt

- **Czech resources – regions:**
  - 1 Karlovy Vary – granite
  - 2 Kadaň – gneiss
  - 3 Podbořany – sandstone
  - 4 Plzeň – sandstone
  - 5 Znojmo – granite, gneiss
  - 6 Cheb – granite
  - 7 Třeboň – granite, gneiss
  - 8 Vidnava – granite
Kaolin Production

Crude kaolin: 5% world mine production
Beneficiated kaolin: 3% world production

Ths. tonnes

0 500 1000 1500 2000 2500 3000 3500 4000


Crude Kaolin  Beneficiated Kaolin
Kaolin Export & Import

Ths. tonnes


Kaolin Export

Kaolin Import

6/14/2016 Industrial Mineral Resources in the Czech Republic
Kaolin Deposits

Jimlíkov 6 (Karlovy Vary Region) 2016: kaolin (KJ,KK,KT) – granite

Ruprechtov – Hroznětín (Karlovy Vary Region) 2016: kaolin (KJ,KK,KT) – granite, bentonite (BT)
Kaolin Deposits

Krásný Dvůr – Podbořany (Podbořany Region) 2016: kaolin (KJ, KK, KZ) – arcose, sandstone

Rokle (Kadaň Region) 2014: kaolin (KP) – gneiss
Clays Resources

- **Use:** ceramics, refractory, filler (paper, plastics, paints), building industry, sealants, oil filtration etc.

- **Reserves & resources:**
  - Geological: 924 Mt
  - Exploitable: 42.8 Mt

- **Mine production:** 450 – 500 kt

- **Export:** 250 – 290 kt (incl. BT)

- **Import:** 70 – 80 kt (incl. BT)

- **Czech resources – regions:**
  - 1 Kladno-Rakovnik Carbonifer.
  - 3 Prague Cretaceous
  - 4 Louny Cretaceous
  - 5 South-Bohemian Basin
  - 6 Plzeň Basin
  - 7 Tertiary relicts – C. Bohemia
  - 8 Tertiary relicts – W. Bohemia
  - 9 Cheb & Sokolov Basins
  - 10North-Bohemian Basin
  - 11Zittau Basin
  - 12Moravian Tertiary & Quarternary
Bentonite Resources

- **Sources:** weathered volcanics products – montmorillonite as a main mineral – sorption capacity, internal swelling, plasticity, binding capacity
- **Use:** binding agent, refractory, filler (paper, plastics, paints), building industry, sealants, oil filtration etc.
- **Reserves & resources:**
  - Geological: 307 Mt
  - Exploitable: 30.5 Mt
- **Mine production:** 200 – 250 kt
- **Export:** within clays
- **Import:** within clays
- **Czech resources – regions:**
  - 1 České středohoří Mts.
  - 2 Doupovské hory Mts.
  - 3 Sokolov Basin
  - 4 Maršov u Táboru
  - 5 Dnešice – Plzeňsko – jih
  - 6 Ivančice – Réna
  - 7 Poštorná
  - 8 Rybova Lhota
Clays & Bentonite Production

2% world mine production

Ths. tonnes


1600 1700 1800 1900

1500 1400 1300

1200 1100 1000

900 800 700 600 500 400 300 200 100 0

Clays Bentonite

6/14/2016 Industrial Mineral Resources in the Czech Republic
Clay Deposits

Nová Ves 2 (Cheb Tertiary Basin) 2011: ball clay (JO)

Vyšehořovice (Prague Cretaceous Region) 2013: refractory clay (JO)
**Bentonite Deposits**

Božičany – Černý vrch (České středohoří Mts. Region) 2016: Ca-Mg bentonite (BT)

Božičany – Osmosa – South (Sokolov Basin Region) 2011: bentonite (BT), kaolin – granite
Feldspar Resources

- **Sources**: pegmatites, granitoids, feldspar-bearing sediments, nephelinic phonolites („feldspar substitutes“)
- **Use**: fluxing agent (ceramics, glass, glaze, enamel, casting powder), filler (plastics, paints)
- **Reserves & resources**:
  - Geological: 70.2 Mt
  - Exploitable: 24.3 Mt
- **Mine production**: 400 – 450 kt
- **Export**: 140 – 170 kt
- **Import**: 5 – 6 kt
- **Czech resources**:
  - Sediments – regions:
    - 1 Lužnice river
    - 2 Syrovice-Ivaň terrace
    - 3 Ivančice
  - Pegmatites – regions:
    - 4 Poběžovice
    - 5 Teplá
    - 6 Dolní Bory
  - **Granitoids**:
    - 7.1 Krásno – Vysoký Kámen
  - **Other feldspar types**
    - 9 – 11 Nephelinic phonolites
Feldspar Mine Production

Ths. tonnes


KNa-feldspar (Syrovice-Ivaň ter.)  KNa-feldspar  NaCa-feldspar  Nepheline phonolite

2 % world mine production
Feldspar Deposits

Krásno – Vysoký Kámen 2012: K-Na feldspar (ZS) – aplite granite, feldspathite

Halámky – Krabonoš 2012: K feldspar (ZS) – feldspathic sand & gravel
Feldspar Deposits

Luženický 2013: Na-K feldspar (ZS) – pegmatite

Ždánov 2016: Na-Ca feldspar (ZS) – pegmatite
Silica Minerals Resources

- **Sources:** quartz sand & sandstone, quartzite, quartz pebbles, veins & crystals
- **Use:** glass batches, foundry moulds & cores, ceramics, refractory, ferrosilicon, Si-metal, technical & building sand etc.

- **Reserves & resources:**
  - Geological:
    - 255 Mt glass sand
    - 409 Mt foundry sand
  - Exploitable:
    - 78.4 Mt glass sand
    - 78.2 Mt foundry sand

- **Mine production:**
  - 900 kt glass sand
  - 400 kt foundry sand

- **Export:** 400 – 500 kt
- **Import:** 250 – 300 kt

- **Czech resources:**
  - 6 Střeleč
  - 4,5 Sní, Provodín
  - 8 Velký Luh
  - 1,2,3,7,9 Blansko region
  - 19,20 North Moravia region
Silica Minerals Mine Production

Ths. tonnes

Glass sand: 1% world mine production
Silica Sand Export & Import

Ths. tonnes


Silica Sand Import

Silica Sand Export
Silica Sand Deposits

Silice 2011: glass & foundry sand (PI) – quartz sandstone

Střeleč 2015: glass & foundry sand (PI) – quartz sandstone

Srní – Okřešice 2011: glass & foundry sand (PI) – quartz sandstone
Carbonates Resources

- **Use:** desulphurization, building material production (lime, cement, mortar mixtures, crushed & dimension stone), metallurgy, chemical, food, glass, ceramics, agriculture etc.

- **Reserves & resources:**
  - Geological:
    - 1.4 Gt high-purity limestone
    - 3.4 Gt other + dolomite
  - Exploitable:
    - 726 Mt high-purity limestone
    - 622 Mt other + dolomite
  - **Mine production:**
    - 4.5 Mt high-purity limestone
    - 5 – 6 Mt other + dolomite
  - **Czech resources – regions:**
    - 1 Barrandian Devonian
    - 2 Železné hory Mts. Paleozoic
    - 3 Central Bohemian Islet Zone
    - 5 South Bohemian & Moravian Moldanubicum
    - 6 Moravian Devonian
    - 7 Silesicum (Branná Group), Olické hory Mts.-Klodsko Crystalline Complex and Zábřeh Group
    - 8 Bohemian Cretaceous Basin
    - 9 Western Carpathians Outer Clippen Belt
Limestone & Dolomite Mine Production

Ths. tonnes


Lime, cement: 1 % world production

High-purity limestone
Other limestone
Dolomite
Cement correction
Limestone Deposits

Koněprusy - VČS East (Barrandian Devonian) 2011: high-purity (VV) & other limestone (VO)

Úpohlavy – Chotěšov (Bohemian Cretaceous Basin) 2009: other limestone (VJ)
Limestone Deposits

Vítošov – Lesnice (Zákřská Group) 2011: high-purity limestone (VV)

Mokrá – West (Moravian Devonian) 2012: high-purity (VV) & other limestone (VO)
Other Industrial Minerals Resources 1

• Fluorspar-baryte ore:
  Reserves & resources:
  Geological: 5 Mt, Exploitable: 0 Mt
  Mine production: 0 kt
  Import: 15 kt (FT) + 7 kt (BA)

• Diatomite:
  Reserves & resources:
  Geological: 2.5 Mt, Exploitable: 1.8 Mt
  Mine production: 30 – 40 kt
  Import: 8 – 9 kt
  Export: 3 – 3.5 kt

• Graphite ore:
  Reserves & resources:
  Geological: 14.2 Mt, Exploitable: 1.1 Mt
  Mine production: 0 kt
  Import: 5 kt
• Gypsum:
  Reserves & resources:
  Geological: 504 Mt, Exploitable: 104 Mt
  Mine production: 10 – 20 kt
  Import: 50 – 100 kt
  Export: 50 – 100 kt (incl. FGD SA)

• Pyrope-bearing rock
  Reserves & resources:
  Geological: 19.4 Mt, Exploitable: 2 Mt
  Mine production: 20 – 30 kt

• Wollastonite
  Reserves & resources:
  Geological: 3.6 Mt, Exploitable: 1 Mt
  Mine production: 1 – 2 kt
Diatomite: 1 % world mine production
Gypsum Mine Production

Ths. tonnes

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750


Gypsum
Fluorspar & Graphite Mine Production

Graphite: 3% world reserves
Fluorspar: 0.8% world reserves
Industrial Minerals – Summary 1

- **IM**: 16.7 % – total reserve base, 13.7 % – mine production
- **Kaolin (KN)**: stable production (both crude + beneficiated), large reserves + resources, limited exploitable reserves in higher grade kaolin (KJ, KP), important export commodity
- **Clays (JL)**: mine production decrease, large reserves + resources, limited exploitable reserves in ball clay (JO), higher in refractory (JZ), export commodity
- **Bentonite (BT)**: stable mine production, huge reserves + resources, limited exploitable reserves, export commodity
- **Feldspar (ZS)**: stable mine production, limited geological + exploitable reserves (lower in sedimentary + pegmatite types), important export commodity
- **Silica sand (PI)**: glass sand (PK): stable mine production, limited exploitable reserves; foundry sand (PS): decrease mine production, average exploitable reserves; both: large reserves + resources, export + import
Industrial Minerals – Summary 2

- **Limestone (VA), dolomite (DL):** slight decrease of mine production, especially in other limestone (VO, VJ), large reserves + resources, limited exploitable reserves in all carbonates, higher import than export

- **Diatomite (DT):** stable mine production, limited geological reserves + exploitable reserves (only single deposit), higher import than export

- **Gypsum (SA):** mine production drop (replacement by FGD SA), large reserves + resources, average exploitable reserves, both export + import

- **Others:**
  - **Fluorspar-barite (FB):** minor reserves, limited resources
  - **Graphite (GT):** limited reserves, promising resources
  - **Wollastonite (WI):** limited reserves + resources
  - **Fusible basalt (CT):** large reserves + resources
  - **Pyrope-bearing rock (PH):** quite large reserves + resources (Czech speciality)
Industrial Minerals – Summary 3

- **Total dependance – import:** salt, phosphates, asbestos, talc, graphite, sulphur, magnesite, perlite, fluorspar, barite, andalusite, sillimanite
- **Partial dependance – import:** pure feldspar, quartz, special clays+kaolin+bentonite, dolomite
- **Self-sufficiency:** ceramic clays, bentonite, diatomite, glass+foundry sand, minerals for cement production
- **Self-sufficiency + exports:** kaolin, feldspar, clays, silica sand, bentonite, gypsum (FGD)
- **Large reserves + resources:** kaolin, ceramic+brick clays, bentonite, gypsum, nephelinic phonolites
- **Possible prospective resources:** feldspars in granitoids, fusible rocks, bentonite
Industrial Minerals – Conclusions

• Minerals including industrial minerals are unmoveable and predominately unrenewable natural mineral accumulation; proven deposits and prospective resources have to be strictly protected.

• Mining activity secures prosperity, but always means important intervention into the geological condition, thus the environment. Environment-friendly and suitable mining methods, comprehensive use of all raw materials and subsequent appropriate reclamation and remediation minimize impacts.

• Most of industrial minerals can not be recycled neither substituted – only several products are recyclable, e.g. glass (cullet), ceramic fragments. Production of prospective and traditional industrial minerals should be supported.
End of the Presentation

More information:

http://www.geology.cz