The economic importance of industrial minerals

Mike O’Driscoll
Editor
Industrial Minerals, UK
Industrial Minerals

- the authoritative monthly magazine for global non-metallic minerals & their markets
- covering the industrial minerals market since 1967
- reference books, directories, conferences
- www.indmin.com
Outline

1. What are industrial minerals?

2. Why are industrial minerals so important?

3. Why are industrial minerals important to the EU economy?

4. Challenging times ahead
What are industrial minerals?

- mined & processed from naturally occurring minerals
- processed direct from naturally occurring minerals/waste
  = synthetic industrial minerals
- exploited for their non-metallurgical value
- non-metallic, non-fuel minerals for an extremely wide range of industrial & domestic applications
  = industrial minerals
What are industrial minerals?

Typical examples of natural IM:

- clays
- silica sand
- talc
- limestone/ chalk
- gypsum
- pumice
- potash
What are industrial minerals?

Typical examples of synthetic IM:

- mullite
- aluminas
- silicon carbide
- ppt calcium carbonate
- spinel
- soda ash
- fused minerals

made from:

- bauxite, kaolin
- bauxite
- quartz + coke
- lime & CO₂
- magnesite + alumina
- salt + limestone + coal + ammonia
- alumina, magnesia, spinel
What are industrial minerals?

Examples of IM that also have a *metallurgical* value:

<table>
<thead>
<tr>
<th>non-met. value</th>
<th>metal value</th>
</tr>
</thead>
<tbody>
<tr>
<td>bauxite</td>
<td>cement, abrasives</td>
</tr>
<tr>
<td>chromite</td>
<td>foundry sand, chemicals</td>
</tr>
<tr>
<td>rutile</td>
<td>white pigment</td>
</tr>
<tr>
<td>zircon</td>
<td>ceramics, glass</td>
</tr>
<tr>
<td>manganese</td>
<td>batteries, pigments</td>
</tr>
<tr>
<td>quartz</td>
<td>glass, ceramics</td>
</tr>
<tr>
<td>stibnite</td>
<td>flame retardants</td>
</tr>
</tbody>
</table>
Why are industrial minerals so important?
Why are industrial minerals so important?

Industrial minerals in your kitchen
Why are industrial minerals so important?

### IM in your kitchen

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass/glasses/ light bulbs</td>
<td>silica sand, limestone, soda ash, borates, feldspar, lithium</td>
</tr>
<tr>
<td>Ceramic tiles/mugs/ plates etc.</td>
<td>kaolin, feldspar, talc, wollastonite, borates, alumina, zirconia</td>
</tr>
<tr>
<td>Paint</td>
<td>TiO₂, kaolin, mica, talc, wollastonite, GCC, silica</td>
</tr>
<tr>
<td>Plastic white goods</td>
<td>talc, GCC, kaolin, mica, wollastonite, flame retardants (ATH, Mg(OH)₂)</td>
</tr>
<tr>
<td>Wooden flooring</td>
<td>treatment materials- borates, chromite</td>
</tr>
<tr>
<td>Drinking water</td>
<td>treatment materials- lime, zeolites</td>
</tr>
<tr>
<td>Wine/beer</td>
<td>diatomite, perlite filters</td>
</tr>
<tr>
<td>Salt</td>
<td>salt</td>
</tr>
<tr>
<td>Sugar</td>
<td>lime in processing</td>
</tr>
<tr>
<td>Detergents/soap</td>
<td>borates, soda ash, phosphates</td>
</tr>
<tr>
<td>Surfaces</td>
<td>marble, granite</td>
</tr>
<tr>
<td>Books</td>
<td>kaolin, talc, GCC, lime, TiO₂ in paper</td>
</tr>
<tr>
<td>Oven glass</td>
<td>petalite, borates</td>
</tr>
<tr>
<td>Heating elements</td>
<td>fused magnesia insulators</td>
</tr>
<tr>
<td>Wallboard/plaster</td>
<td>gypsum, flame retardants</td>
</tr>
<tr>
<td>Metal pots/cutlery</td>
<td>mineral fluxes &amp; refractories in smelting</td>
</tr>
</tbody>
</table>
Why are industrial minerals so important?

**Main consuming market mineral sectors**

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasives</td>
<td>Foundry</td>
</tr>
<tr>
<td>Absorbents</td>
<td>Glass</td>
</tr>
<tr>
<td>Agricultural</td>
<td>Metallurgy</td>
</tr>
<tr>
<td>Cement</td>
<td>Paint</td>
</tr>
<tr>
<td>Ceramics</td>
<td>Pigments</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Paper</td>
</tr>
<tr>
<td>Construction</td>
<td>Plastics</td>
</tr>
<tr>
<td>Oil well drilling</td>
<td>Refractories</td>
</tr>
<tr>
<td>Electronics</td>
<td>Flame retardants</td>
</tr>
<tr>
<td>Filtration</td>
<td>Welding</td>
</tr>
</tbody>
</table>
Why are industrial minerals so important?

Mineral to end use market

Mineral → ilmenite
Intermediate product → titanium dioxide white pigment
Intermediate market → white paint manufacturer
End use market → automobiles/DIY
Why are industrial minerals so important?

Mineral to end use market

**bentonite clay**
- cat litter manufacturer
- pet owners
- drilling mud manufacturer
- oil producer
- foundry sand binder
- auto engine producer

**talc**
- cosmetics manufacturer
- babies/beautiful people
- plastics compounder
- garden furniture/auto dash
- papermaker
- magazine publisher
Why are industrial minerals so important?

Mineral to end use market

**silica sand**
- glassmaker → abrasive manufacturer → ceramic manufacturer
  - beer bottles → sand blasting buildings → tiles/sinks/toilets

**zeolites**
- foot odour control → retail

**emery**
- abrasive manufacturer → emery boards/sandpaper

**diatomite**
- filter manufacturer
  - wineries/breweries
Why are industrial minerals so important?

- Mineral consuming market existence & its performance directly affects demand for mineral raw materials, ie. industrial minerals

- no market demand = no mineral supply
  = no mineral development
Why are industrial minerals so important?

"Without a market, an industrial mineral deposit is merely a geological curiosity"
Why are industrial minerals so important?

- centres of high population
- their economy - the driver
- directly influence demand for IM
Why are industrial minerals so important?

Mine to market supply chain

- supply sector
- logistics sector
- consuming market sector
Why are industrial minerals so important?

Mine to market supply chain

<table>
<thead>
<tr>
<th>SUPPLY</th>
<th>LOGISTICS</th>
<th>MARKET</th>
</tr>
</thead>
<tbody>
<tr>
<td>exploration</td>
<td>trading</td>
<td>direct market mineral consumer</td>
</tr>
<tr>
<td>mineral finance</td>
<td>port handling</td>
<td>intermediate market mineral consumer</td>
</tr>
<tr>
<td>plant engineering</td>
<td>mineral inspection</td>
<td>end market mineral consumer</td>
</tr>
<tr>
<td>mining</td>
<td>freight</td>
<td></td>
</tr>
<tr>
<td>processing</td>
<td>warehousing/distribution</td>
<td></td>
</tr>
</tbody>
</table>

SUPPLY

DEMAND
Why are IM important to the EU economy?

Price comparison of metals & IM
US$/tonne unless indicated

<table>
<thead>
<tr>
<th>Metals</th>
<th>Industrial minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold 392/oz</td>
<td>Salt 15-18</td>
</tr>
<tr>
<td>Silver 6.23/oz</td>
<td>Silica sand 14-25</td>
</tr>
<tr>
<td>Aluminium HG 1,645</td>
<td>Olivine 50-110</td>
</tr>
<tr>
<td>Copper A 2,760</td>
<td>Dead burned magnesia 140-210</td>
</tr>
<tr>
<td>Zinc 1,014</td>
<td>Zircon 400-490</td>
</tr>
</tbody>
</table>

Source: LME; Mineral PriceWatch
Factors influencing IM pricing

- source of mineral
- volume
- grade/end use – i.e. quality of mineral, dictated by desired end use
- further processing required
- freight/shipping – can be 50-70% of final delivered cost of mineral
- port handling
- warehousing/storage
- mineral inspection
- insurance
- relationship of buyer & seller
### Why are IM important to the EU economy?

#### US metals & IM production 2003

<table>
<thead>
<tr>
<th>Metals</th>
<th>Volume</th>
<th>Value</th>
<th>Industrial minerals</th>
<th>Volume</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium</td>
<td>2.7m.</td>
<td>4,000m.</td>
<td>Crushed stone</td>
<td>1,490m.</td>
<td>8,600m.</td>
</tr>
<tr>
<td>Gold</td>
<td>266</td>
<td>2,900m.</td>
<td>Sand &amp; gravel</td>
<td>1,158m.</td>
<td>6,366m.</td>
</tr>
<tr>
<td>Copper</td>
<td>1.1m.</td>
<td>2,000m.</td>
<td>Lime</td>
<td>18.2m.</td>
<td>1,017m.</td>
</tr>
<tr>
<td>Zinc</td>
<td>770,000</td>
<td>664m.</td>
<td>Soda ash</td>
<td>10.6m.</td>
<td>800m.</td>
</tr>
</tbody>
</table>

Source: USGS
**Why are IM important to the EU economy?**

**EU IM production & share of world supply 2002**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>EU IM production</th>
<th>Share of world supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregates*</td>
<td>2,520m.</td>
<td>-</td>
</tr>
<tr>
<td>Gypsum</td>
<td>28.2m.</td>
<td>28%</td>
</tr>
<tr>
<td>Salt</td>
<td>52.4m.</td>
<td>25%</td>
</tr>
<tr>
<td>Feldspar</td>
<td>7.3m.</td>
<td>52%</td>
</tr>
<tr>
<td>Magnesite</td>
<td>6m.</td>
<td>30%</td>
</tr>
<tr>
<td>Kaolin</td>
<td>5.7m.</td>
<td>27%</td>
</tr>
<tr>
<td>Potash</td>
<td>4.5m.</td>
<td>16%</td>
</tr>
<tr>
<td>Bentonite</td>
<td>3.7m.</td>
<td>31%</td>
</tr>
<tr>
<td>Talc</td>
<td>1.3m.</td>
<td>16%</td>
</tr>
</tbody>
</table>

* sand & gravel, and crushed rock

Source: BGS
Why are IM important to the EU economy?

Multinational IM leaders based in Europe

- Carmeuse, Belgium
- Imerys, France
- Lhoist Group, Belgium
- Luzenac Group, France
- Omya, Switzerland
- S&B Industrial Minerals, Greece
- SCR-Sibelco, Belgium
- Süd-Chemie AG, Germany
- Treibacher AG, Austria
- WBB Minerals, UK
Why are IM important to the EU economy?

Major EU consuming market sectors

- Ceramics
- Chemicals
- Glass
- Paints
- Paper
- Plastics
- Refractories
Why are IM important to the EU economy?

Ceramics

- Sales: €26,800m.
- Employs: 227,000
- World share: 30% production
- Growth: tiles, 4%

- baddaleyite
- ball clay
- borates
- celestite
- feldspar
- fluor spar
- halloysite
- kaolin
- limestone
- lithium minerals
- nepheline syenite
- petalite
- plastic clay
- quartz
- rare earths
- silica sand
- soda ash
- spodumene
- talc
- wollastonite
- zircon
Why are IM important to the EU economy?

Chemicals

- Market value: €457,000m.
- Output: €527,000m.
- Employs: 1.7m.
- No. co.s: 25,000
- Share of EU manufacturing ind. gross value: 12%
- Share of EU GDP: 2.4%
- Other: EU hosts 15 of world’s top 30 co.s
- Growth: 3%

- borates
- phosphates
- celestite
- pyrites
- chromite
- rare earths
- fluor spar
- salt
- iodine
- soda ash
- limestone
- sodium sulphate
- lithium
- sulphur
- magnesia
- zirconia
- nitrates
**Why are IM important to the EU economy?**

**Glass**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>28.8m. tonnes</td>
</tr>
<tr>
<td>Market size</td>
<td>28.2m. tonnes</td>
</tr>
<tr>
<td>Employs</td>
<td>175,701</td>
</tr>
<tr>
<td>Growth</td>
<td>flat glass, 3.5%</td>
</tr>
</tbody>
</table>

**Raw Materials**

- borates
- dolomite
- dolime
- feldspar
- fluor spar
- kaolin
- lime
- limestone
- lithium carbonate
- lithium minerals
- nepheline syenite
- petalite
- quartz
- rare earths
- silica sand
- soda ash
- sodium sulphate
- spodumene
- zircon
Why are IM important to the EU economy?

Paint

- Paint sales: 5.4m. tonnes
- Paints mkt value: €15,400m.
- Powder coating output: 360,000 tonnes
- Powder coating mkt size: 330,000 tonnes
- Growth: 0.5%

Industrial minerals:
- alumina trihydrate
- ilmenite
- barytes
- iron oxide
- bentonite
- kaolin
- brucite
- manganese
- celestite
- mica
- chromite
- ppt calcium carbonate
- diatomite
- quartz
- feldspar
- rutile
- ground calcium carbonate
- silica sand
- gypsum
- talc
- huntite
- wollastonite
- hydromagnesite
Why are IM important to the EU economy?

**Paper**
- **Ann. turnover:** €400,000m.
- **Output:** 91m. tonnes
- **Mkt. size:** 82.3m. tonnes
- **Employs:** 250,000
- **Plants:** 1,260
- **World share:** 28% paper & board
- **Growth:** 1.5%

**Plastics**
- **Employs:** >1m.
- **Total sales:** €159,000m.
- **Turnover:** €135,700m.
- **Raw materials turnover:** €29,000m.
- **Market size:** 38.1m.
- **EU per capita:** 94.8kg
- **Growth:** 6% 2000-2002; 3% 2001-2002
Why are IM important to the EU economy?

Refractories

Sales: €3,000m.
Employs: 27,000
Growth: 2-3%

andalusite
bauxite
fused alumina
alumina
chromite
dolomite
graphite
kyanite
fused magnesia
dead burned magnesia
sintered mullite
fused mullite
olivine
pyrophyllite
refractory clays
silica sand
fused silica
silicon carbide
sillimanite
sintered spinel
fused spinel
zircon
fused zirconia
Why are IM important to the EU economy?

- IM are critical raw materials supporting EU market sectors
- add value to end products
- demand is consistent and long term
Why are IM important to the EU economy?

IM contribution to UK economy 2001

• 290m. tonnes extracted

• contributed £25,665m. (€38,497m.); 2.9% of UK total GVA (£885,000m.)

• BGS: “…manufacturing and construction, which are heavily dependent on minerals and metals, together contributed a further £100,000m. (€150,000m., 11% of UK total GVA) to the GVA in 2001”

• UK GVA per employee 2001: £54,583 (€81,874)
**Why are IM important to the EU economy?**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Value added per employee (€ thousands per employee)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chemicals products</td>
<td>93</td>
</tr>
<tr>
<td>2. Transport equipment</td>
<td>64</td>
</tr>
<tr>
<td>3. Paper &amp; printing products</td>
<td>63</td>
</tr>
<tr>
<td>4. Electrical and optical equipment</td>
<td>61</td>
</tr>
<tr>
<td>5. Other non-metallic mineral products</td>
<td>54</td>
</tr>
<tr>
<td>6. Machinery and equipment n.e.c.</td>
<td>52</td>
</tr>
<tr>
<td>7. Food products; beverages and tobacco</td>
<td>52</td>
</tr>
<tr>
<td>Average</td>
<td>51</td>
</tr>
<tr>
<td>8. Rubber and plastic products</td>
<td>50</td>
</tr>
<tr>
<td>9. Basic metals and fabricated metal products</td>
<td>49</td>
</tr>
<tr>
<td>10. Wood and wood products</td>
<td>37</td>
</tr>
<tr>
<td>11. Textiles and textile products</td>
<td>30</td>
</tr>
<tr>
<td>12. Leather and leather products</td>
<td>28</td>
</tr>
</tbody>
</table>

*Source: CEFIC/Eurostats*
Changing times

- EU enlargement
- IM trade trends
- New markets
Changing times

EU enlargement

- Enlarged population 450m.
- Product demand
- New sources development
- Manufacturing shift
Changing times

IM trade trends

The China factor
Changing times

IM trade trends

The China factor

• China’s growth economy
• Domestic market demand has soared
• Increased costs & shortages in power supply
• Increased costs & shortages in internal freight
• Increased costs & shortages in ocean freight
Changing times

IM trade trends

The China factor

= increased costs & shortages of Chinese IM exports to EU

= opportunity for EU IM producers to fill gap
Changing times

New markets

• Fuel cells
The economic importance of industrial minerals

Changing times

New markets

• Nanomaterials
Summary & conclusions

- IM are high volume, low value, but vital commodities
- IM are prerequisite raw materials for a wide range of industrial and domestic products
- Market demand drives IM supply
- EU IM supply chain employs people & businesses
- IM support and add value to EU industrial sectors
- EU IM industry future in EU enlargement, EU consuming markets, exports, & new growth markets
The economic importance of industrial minerals

Thank you for your kind attention