European rock and role

The EU's position in global mineral supply, commodity trends, EU industries and policies, and future challenges are examined by *Linda Hetherington* and *Andrew Bloodworth*

EUROPE IS A major global producer of industrial minerals, with around 117m. tonnes extracted in the European Union in 2007. The industry makes an estimated direct contribution of €13,000m. ($17,460m.) to the European GDP (IMA Europe), although the value added by downstream industrial consumers of these commodities is much larger.

The EU is responsible for one third of world feldspar and perlite production, yet has little or no production of certain other industrial minerals. Table 1 compares EU production of a wide range of industrial minerals with the total world production in 2007.

Over the past five years production trends showed a decrease or no change for 14 of the 23 commodities listed in Table 1; but change was within ±10% for the majority of minerals. Production of feldspar, however, was up by 57% – largely due to increased production from Italy, the second largest producer in the world (21%) after Turkey.

Production of lithium minerals in Portugal, the sole producing country in the EU, increased by 42% in five years. Strontium mineral production in Spain, the main European producer, more than doubled between 2003 and 2005; however post-2005 production declined, and its 2007 tonnage (at 143,000 tpa) was below that produced in 2003.

The most dramatic falls in production were of barytes, bromine, fluorspar and graphite.

Graphite production continued to fall, from 35,000 to 15,000 tpa, due to declining production in the Czech Republic and operations closing in Germany and Romania.

Barytes production, also in long-term decline, fell from 411,000 tpa in 2003 to 279,000 tpa in 2007, through the cumulative effect of reduced output in all producing countries apart from Slovakia.

Bromine production declined from 25,600 tpa to an estimated 100 tpa when the bromine plant on Anglesey, Wales, closed after 51 years. This operation extracted bromine from sea water but closed due to a significantly reduced market for its product, dibromoethane, which was used in leaded petrol. Meanwhile, production in Germany and France is believed to have ceased at the same time.

Imports & supply security

Although concerns over energy minerals and metals have attracted more headlines recently, security of supply of industrial minerals also presents a challenge to European producers and consumers alike.

Europe is a major trading region and imports are vital for complete or partial supply of a wide range of industrial mineral commodities. Figure 1 can only be considered as a rough guide to import needs.

Owing to the nature of trade and production statistics, which do not always provide the level of detail necessary to examine the market for different chemical and physical properties of industrial minerals (defined by their end-use), an adequate supply for certain applications may be masked by a shortfall for other uses.

A similar limitation arises when natural and artificial products are not separated by their trade codes, as is the case with gypsum.

Of the commodities listed in Table 1, where trade figures can be obtained, the EU is a net importer of the majority. The EU is a net exporter of sulphur and titanium oxides.

Substantial quantities of industrial minerals are, at present, imported from countries with rapidly emerging economies, including Brazil, Russia, India and China (so-called BRIC countries).

Trends suggest that supplies from BRIC and similar countries may become increasingly constrained as domestic consumption rises, driven by growth and demand from indigenous manufacturing companies. The situation may eventually represent an opportunity for European mineral producers, through exports to emerging economies outside Europe as well as increased demand from European consuming industries that are concerned about security of supply.

However, in the short-term, the general pattern remains one of retrenchment and closure in the face of low-cost imports from the BRIC countries and elsewhere. Fluorspar and kaolin are good examples of major European industrial minerals which, as a result of market globalisation, conform to this pattern.

Fluorspar

With its 2007 production levels estimated at 3.2m. tpa, China dominates the world

fluorspar market (estimated to be 5.7m. tpa). During the period 2003–07, Chinese exports of fluorspar fell from 952,000 to 536,000 tpa, with year-on-year reductions in both >97% and <97% calcium fluoride. In this same period, Chinese imports grew tenfold from 4,000 to 34,000 tpa.

Meanwhile, EU net imports of fluorspar increased by 95,000 tpa while the region's imports from China fell by 55,000 tpa owing to increased demand from the domestic industry.

In January 2008 **IM** reported a reduction in the Chinese fluorspar tonnage allocated for export, indicating that this trend – accompanied by rising prices – seems likely to continue (see *IM January '08, p.9*). With an annual consumption of 1m. tonnes, Europe will need to find other fluorspar sources to satisfy demand.

Increased imports from various countries, particularly Mexico, Namibia and South Africa, have been important in maintaining supply, together with increased intra-EU trade. EU production of fluorspar fell during this time span, ceasing altogether in France and Italy.

The example of the French fluorochemical sector illustrates this industry's dependence on indigenous production of its main raw material. French production of fluorspar supported an important downstream fluorochemical industry, with the raw material produced almost entirely from a single company, the Société Générale de Recherches et d'Exploitations Minières (Sogerem), which operated three mines. Following a gradual decline in production, the company announced the closure of its fluorspar operations in June 2006, with the loss of around 80 jobs.

The competitiveness of France's downstream fluorochemical industry was highly dependent on indigenous fluorspar production and subsequently, less than a year later, the major chemical producer, the Arkema Group, announced the closure of its fluorochemical operations with the loss of around 226 jobs.

Kaolin

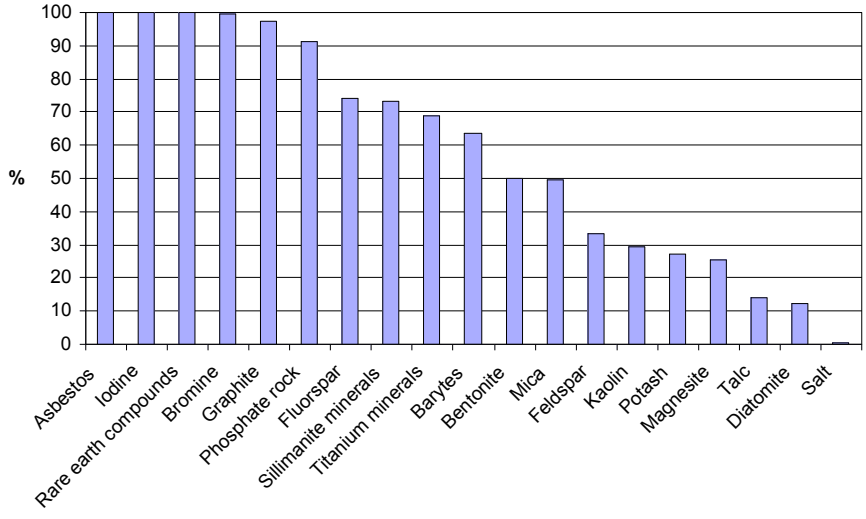
The EU, with an annual production of over 5m. tpa, is the second largest producer of kaolin after the USA, which produced 7.3m. tonnes in 2007 – yet it does not produce sufficient tonnages to meet present demand.

Although production in many European countries has increased, this is still less than the fall in the UK's output. As the economies of developing countries grow, so too does their use of paper. China, which is an increasingly significant exporter of kaolin, also imports large quantities to produce paper for domestic consumption.

Kaolin production in Brazil increased by 60% over the last decade, exerting competitive pressure on the UK hydrous kaolin operations at Lee Moor, in Devon, which were scheduled to close in 2007. Sibelco, which already owns several neighbouring quarries, agreed to lease the quarry from the existing owner, Imerys, which has retained staff at the site to operate a calcining heat treatment plant.

Brazilian exports of kaolin increased from 1m. to 2.4m. tonnes over ten years, and 40% per cent of this material was imported by the EU. At present, imports from Brazil contribute around 15% of EU apparent consumption. Brazil exports almost no manufactured kaolin products.

Figure 1. Net imports for a selection of industrial minerals as a percentage of apparent consumption for the EU in 2007.



Source: European Mineral Statistics, British Geological Survey

EU trade policy

In 2006, the European Commission proposed a programme for the competitiveness of the EU[1]. In *Global Europe: Competing in the world* it was stated that the EU should show a commitment to opening up the markets in emerging countries, which account for an increasing share of global trade. This approach has already shown benefits in terms of development and combating poverty. European industry should have access to energy, raw materials and metals resources which should not be restricted other than for environmental or security reasons.

The EU is endeavouring to work more closely with China, its largest trading partner, through the transition caused by its rapid growth, and is considering the China factor in EU policymaking. The EU and China have agreed to review their 1985 trade and economic cooperation agreement in order to establish a balanced partnership.

In the present agreement both parties grant each other favoured treatment in various matters pertaining to trade and, amongst many other points, it includes development of economic cooperation in industry and mining.

The Commission hopes to reduce discriminatory and restrictive practices within the internal markets of other countries with the aim of opening them up to European suppliers. It is also keen to ensure that the trade defence instruments of partners are transparent and compliant with international rules.

Critical minerals

A mineral commodity may be defined as 'critical' if there is high risk of disruption to supply and the impact of the loss of supply would have a serious impact on an industry. During the world wars there were concerns related to supply of critical mineral and metal resources.

[1] Global Europe: Competing in the world http://europa.eu/scadplus/leg/en/lvb/r11022.htm

From the 1970s to the 1990s these were of interest for political reasons partly related to the Soviet Union, and partly because the apartheid-governed South Africa dominated the supply of certain strategic metals. Other experts had concerns that resources would be used up. The geoscience agencies of several countries worked together to gather information on the major sources of strategic mineral raw materials and published detailed inventory information. Industrial minerals included in these studies are lithium minerals, natural graphite, phosphate rock and rare earth oxides, although the issue of criticality is generally of less concern with respect to industrial minerals as, compared to metals, many are easier to substitute.

The topic of critical minerals is of renewed interest in many countries and in many industrial sectors, in response to the rapid economic growth of the BRIC countries accompanied by the recent unprecedented high mineral commodity prices. In the case of Europe, this is also connected with high import dependence.

Many new studies of critical minerals are being undertaken worldwide, including the US Geological Survey report on *Minerals, Critical Minerals and the US Economy*. Current and looming supply issues related to rare earths provide a good illustration of some of these issues.

Rare earths

World production of rare earths is not well known as many countries do not report their data, but it is clear that China is the leading producer of rare earth minerals, possibly producing 90–95%. Second-generation thermal barrier coatings in aerospace applications are rare earth doped, and although the UK industry considers rare earths not to be critical at present, they may be in a few years' time.

Renewable energy technologies also require rare earths in permanent magnets and superconductors. Increasing use is also anticipated in the other sectors, which include catalytic converters, petroleum refining catalysts, alloys, ceramics, and rare earth phosphors in audiovisual, computing, lighting and telecommunication manufacture.

The 2007 Roskill report, *The economics of rare earths and yttrium*, forecasts an annual growth in world demand of 8-11%, compared to Chinese consumption of rare earths increasing at a rate of 25% per annum during 2004–07, and predicts that within 5–10 years China may only be meeting domestic demand.

Table 1. EU production of industrial minerals in 2007 ('000s tonnes). Some of these data are estimated. Source: *European Mineral Statistics 2003–07*, BGS.

	Thousand tonnes	% change in 5 years	EU as % of world
Feldspar	7,833	+57	35
Perlite	1,266	0	34
Bentonite, fuller's earth, attapulgite, sepiolite	3,898	+10	20
Gypsum (natural)	30,317	+11	20
Kaolin	5,051	–4	20
Salt	48,180	–4	20
Diatomite (including moler)	326	–18	16
Talc	1,330	+6	16
Sillimanite minerals	65	+5	15
Strontium minerals	142	–7	15
Potash (K_2O content)	4,597	–2	14
Magnesite	2,949	–5	13
Mica	36	–9	12
Sulphur	8,189	+3	12
Titanium minerals (TiO_2 content)	441	+3	7
Wollastonite	46	–2	7
Fluorspar	237	–34	4
Lithium minerals (Li content)	744	+41	4
Barytes	279	–32	3
Bromine	0.1	–100	<1
Graphite	3	–77	<1
Phosphate rock	831	+4	<1
Asbestos	no production	–100	0
Borates	no production		
Iodine	no production		
Natural sodium carbonate	no production		
Nepheline syenite	no production		
Rare earth minerals	no production		
Vermiculite	no production		

Source: British Geological Survey

The Chinese government adjusted export duties twice in 2007 with the aim of controlling the quantities of rare earth oxides and metals being exported. Higher export duties were introduced and import taxes cancelled at the start of 2008 in order to encourage the development of rare earth-consuming industries and to conserve the country's natural resources. Although other operations are likely to reopen to meet the global demand at increased prices, none of these is in Europe.

EU non-energy raw materials policy

In June 2007, the Commission (DG Enterprise and Industry) published a working document on the competitiveness of the EU non-energy extractive industry. This analysed the availability of non-energy raw materials within the EU and examined the different drivers of a competitive extractive industry in Europe.

In light of concerns regarding increased raw materials costs and security of supply, the DG Enterprise and Industry undertook a public consultation of future non-energy raw materials policy. This initiative was directly relevant to the European industrial minerals sector. The aim was to examine the various factors that affect the EU's long-term, sustainable supply of raw materials. The results of the survey were published on their website and contributed to the Communication from the Commission to the European Parliament and the Council, *The*

raw materials initiatives – meeting our critical needs for growth and jobs in Europe.

This Communication, published in November 2008, proposes that the EU agrees:

- on an integrated raw materials strategy to ensure access to raw materials with undistorted conditions from other producing countries;
- to facilitate sustainable supply of minerals within Europe;
- to reduce consumption of primary raw materials through resource efficiency, use of secondary raw materials, reuse and recycling.

The Commission has proposed the launch of a European Raw Material Initiative which requires engagement from the EC, member states and industry. There are 10 points in this Initiative, including diplomatic engagement with resource-rich countries, identifying and challenging trade distortions, promotion of sustainable access to raw materials in policy, improving regulation on access to land, and promoting all aspects of resource efficiency.

In an initiative linked to this topic, EuroGeoSurveys, an association representing 33 European geological survey organisations, held a series of workshops for a wide range of stakeholders to assess what raw materials information is available and where gaps need to be filled in order to provide a knowledge base that would inform and advise policy makers.

The Commission is encouraging greater networking between the national geological surveys to facilitate the exchange and use of data. The Communication also recommends that geological surveys should have greater involvement in land-use planning and has proposed a platform for exchange of best practice.

Environmental challenges

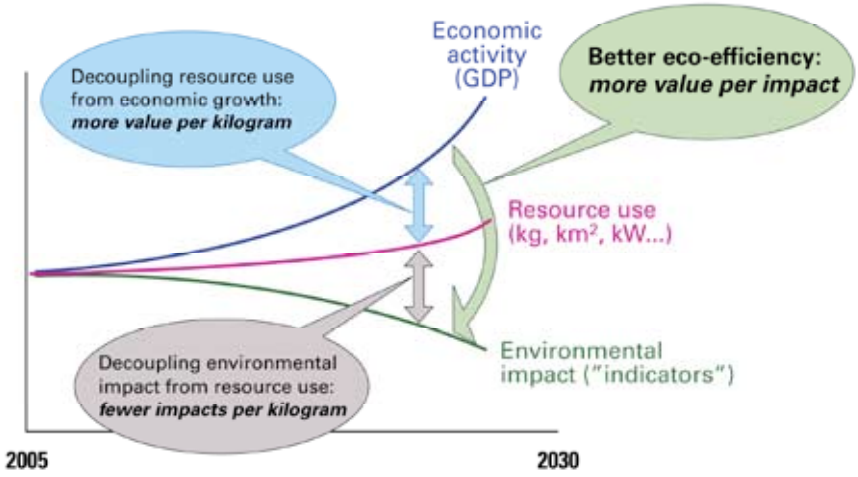
In common with the global mining industry, the European industrial minerals sector faces a number of environmental challenges over the coming decades.

Designations and land-use

Over 26,000 protected areas are included in the Natura 2000 environmental designation network (approximately 850,000 km^2), comprising more than 20% of total EU territory. The number and area of environmental and landscape designations is likely to continue to grow into the future as competition from other forms of land-use (including minerals extraction) intensifies. Minerals can only be worked where they occur, and conflict with environmental designations is inevitable.

In a relatively small, densely-populated area such as Europe, a robust and equitable spatial planning system is essential in ensuring a balance between the need to protect the environment and the needs of the economy for mineral raw materials.

Figure 2. Decoupling resource use from economic growth and environmental impact. Redrawn with permission[2].



Sustainable development & resource efficiency

Any new European strategy on the sustainable use of mineral resources is likely to encompass the concept of *resource efficiency*, which aims to decouple economic growth from resource consumption (Figure 2).

The overall effect of increasing *eco-efficiency* (the gap between economic growth and resource use) is to reduce impact on the environment. This is likely to be achieved by increased energy efficiency, greater use of renewable raw materials and energy, smarter use of non-renewable resources and greater levels of re-use and recycling.

The industrial minerals sector faces particular issues with regard to *smarter* use and re-use/recycling. The sheer diversity of specifications and end-uses is both a challenge and an opportunity for the industry to address the issue of *smarter* resource use. Calculating the whole life environmental impact of industrial mineral raw materials used in manufacturing relative to other process inputs will be a starting point for this process.

The fact that many industrial minerals are valued for their physical and/or chemical properties means that opportunities for substitution and/or recycling are variable and often complex. Their intrinsic properties are often destroyed in use and thus, unlike aggregates and metals, are not available for recycling.

In general it is more difficult to recycle minerals, such as fertilisers, which are valued for their chemical properties. A major exception is waste glass where all the ingredients – ie. silica-soda ash-lime – are reusable as glass when processed by crushing, cleaning, remelting and moulding.

For some industrial minerals, large tonnages of alternatives are available. Desulphogypsum derived from the removal of sulphur dioxide from coal-fired power stations has entirely replaced natural gypsum in plasterboard manufacture. However, the process requires large quantities of high purity limestone, thus the demand for one industrial mineral has been transferred to another.

[2] http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52005SC1684:EN:NOT. Commission staff working document - Annexes to the Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions - Thematic Strategy on the sustainable use of natural resources {COM(2005 670 final} /* SEC/2005/0670 */

Carbon footprint

The drive to mitigate climate change, through reducing carbon dioxide emissions to the atmosphere, is one of the biggest challenges facing the global mining industry. Extraction, processing and transport of minerals are responsible for significant levels of anthropogenic CO_2 emissions. The response of industry, policy makers and regulators to this challenge is in its infancy but growing rapidly. The impact of this response on the future of the European industrial minerals sector is difficult to predict.

Initiatives such as carbon trading are intended to promote efficient use of resources, although ultimately these schemes will only be effective if they are enacted on a global scale.

A major portion of recent climate change policy debate has centred on the impact of regional schemes (such as in the EU) on the relative competitiveness of trading blocks. Schemes should minimise negative economic impacts that might render EU industry uncompetitive with the consequent externalisation of carbon dioxide emissions to other trading blocks such as the BRIC countries.

Coupled with concerns over security of supply, another impact of climate change mitigation might be a trend towards more localisation of supply of industrial minerals. The carbon footprint associated with international and inter-continental transport of industrial mineral products may, in the long term, lead to increased levels of local supply. This might be driven by regulatory initiatives such as eco-labelling of products, as well as more strategic concerns regarding supply vulnerability.

Future considerations

The EU is a particularly important producer of bentonite, feldspar, kaolin, natural gypsum, perlite and salt. There is, however, a high level of dependence on imports of a number of other commodities, including barytes, fluorspar, graphite and rare earth compounds.

Concerns regarding security of supply for certain critical industrial minerals are growing, driven mainly by high levels of economic growth in the BRIC countries. The industrial minerals sector also faces major environmental challenges in the coming decades, including competition for land, the need to improve resource efficiency and the need to reduce its carbon footprint.

The Commission is currently examining the influence of these and other issues on the EU's long-term, sustainable supply of raw materials. One point of concern is the need for an adequate EU knowledge base on non-energy raw materials in order to monitor and forecast strategic policy and market developments. At present there are areas with little or no reliable data, including, for example, the consumption of mineral commodities (including those used in imported manufactured goods), recycling, and carbon footprints.

It is vital that policy is based on sound information in order to avoid subsequent problems. The importance of good quality, consistent and relevant data for measuring and understanding economic and environmental impacts cannot be understated. Although lower prices towards the end of 2008 eased concerns somewhat, this is a long-term problem that needs to be addressed now.

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