

HOW TO AVOID METAL SUPPLY SHORTAGES IN THE UK



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At a time of concerns over shortages of commodities such as oil, and of fear posed by climate change, the potentially damaging threat of metal shortages is apparently being ignored. Geological occurrences of metals are very unevenly distributed around the world. Some are concentrated in single countries that may not be politically friendly to the UK and some have specific essential uses with no known substitutes. Metals are used extensively in manufactured goods and with the lack of a stakeholder body to monitor and take an overview of metal supply it is unclear which metals are likely to have restricted availability in the near future.

MATERIALS - WARNING OF SHORTAGES

Although the world's metals are ultimately finite, an imminent crisis in metal supply in the UK is more likely to be due to a complex interplay of a broad range of factors.

Geology Availability of metals depends not only on their abundance but also their geological distribution. For example, copper is found in different geological settings including in giant low grade deposits called 'porphyries' occurring in collision zones such as those around the Pacific rim, as well as in black shale associated with hydrothermal fluids in large sedimentary basins such as near Duluth in the USA, in volcanogenic massive sulphide deposits formed from fossil black smokers as in the Ural mountains and in large igneous magma systems associated with nickel as in Noril'sk in Northern Siberia. Similarly, gold occurs in many different types of rocks in many countries. In contrast, other metals have a very restricted geological distribution occurring in specific geological rock types in only a few countries. For example, major platinum deposits occur in just two countries; the Republic of South Africa and northern Siberia.

Exploration Metal availability is increased by discovery of new ores. This depends on utilising knowledge and expertise to produce exploration success. Exploration often focuses around old mining sites, or is undertaken in areas of similar geology to other known deposits and in

new types of geology where models predict ores. Exploration is easier in some climatic zones such as deserts and more difficult in forests and jungles but it may become easier after deforestation (e.g. the Amazon) or ice retreat (e.g. Greenland). The search for metals is influenced by the structure of the exploration industry and the distribution of geological expertise for each metal. Exploration is conventionally carried out by individual mineral prospectors or small sized junior companies that sell-on their findings to large multinational mining companies who are able to finance development and mining operations.

Reserves Ore deposits, by their very nature, are partially hidden subsurface. The calculated size and grade of any deposit are only an estimate of the actual resource based on the quality and abundance of the available data. This gradually improves as a deposit is evaluated prior to extraction. Companies tend to prove reserves of metals for a period of say 15-30 years into the future. This does not indicate that the metal will run out at the end of this period, just that it is uneconomic to explore for more metals further ahead than this. Intensity of exploration for a metal will decrease if sufficient resources are known but it will increase as scarcity occurs and prices rise.

Exploitation It is essential to be able to extract the metals from their ores. The host minerals for metals vary in many different ways such as composition, the

size of the grains and the way different grains lock together. In turn, the ease with which the metal-bearing minerals are separated from 'waste' minerals also varies markedly. New technologies can make ores available and allow waste tips and lower grade ores to become resources. As metals become scarcer lower grade ores and multiple metal production from polymetallic deposits may become economic; some metals may be economic to mine only as by-products of others. Mineral processing and refining often consist of a series of procedures that may not be completed at the extraction site. Partially processed ore is routinely shipped to other sites, often in other countries, for final processing or smelting. Exploration in geographically remote, politically unstable or hostile areas may be impossible and even known ores maybe inaccessible. Arguably today's world is characterised by conflict and this affects exploration, exploitation and raw materials supply. High transport costs for a bulky ore can be prohibitive whereas low bulk precious metals can be transported with ease.

Legislation The intensity of exploration is governed by politics within a country. Permission for mining in different countries may vary dramatically. For example uranium mining may be limited due to environmental concerns. Regime change in countries may or may not make conditions more favourable for exploration and mining. Many countries have government owned mining

operations and may encourage joint ventures, charging royalties for the extraction. Thus governments and multinational companies in different countries influence or control the supply of metals. Access to information on resources may be restricted where metals are strategic and confined to only a few countries that have favourable geological formations to host individual metals. Countries with strategic metals may restrict supply and others may buy whole mines in foreign countries to ensure their supply needs are met. Some countries maintain secrecy about their metals whereas in others resources are poorly known and unexplored. Some countries, where governments are restrictive, have not been subject to major exploration recently and hold potential for new discoveries.

Recycling Increasingly in developed countries infrastructure is being put in place for collecting and recycling metals. This increases sustainability and reduces pollution and dispersion of these metals into the environment. Metals from anthropogenic sources rather than natural ores are increasingly being considered but the contained metals are often present in different mineralogical forms than in natural ores and present new challenges for recovering the valuable constituents.

Demand There may be dramatic increases in demand as new uses are found for particular metals or reduction as substitutes are discovered. Shortages may occur due to a time lag between rising demand and the period required to increase mining output; a new discovery of ore may take decades to develop into a producing mine. Rapid industrialisation in emerging

countries may dramatically change demand patterns causing overall shortages.

SKILLS – WARNING OF SHORTAGES

Training and Education My interest in this area of study is derived from 30 years studying the processes that concentrate metals in geological environments. I currently run the only undergraduate degree in Exploration and Resource Geology in the UK at Cardiff University. There is a great demand for this course by very bright, practical, well travelled young people who often have links with the exploration industry. However, numbers currently being trained in the UK are small compared to former times. We used to be a major well respected exporter of exploration geologists but this has dwindled as the mining industry has been reduced in the UK; yet it still seems a legitimate role for the UK. Sourcing metals is global and needs to be understood at all scales from continental exploration to 1 micron scale mineralogy. Teaching in universities should be research-led. Funding for research into exploration is not easy to obtain in the UK as this academic research is seen as too applied for Research Councils to fund and too far from the market for companies to fund. As a consequence much time is spent raising funds by pretending that the research is for something else, often either blue sky or environmental. There is no high profile body nourishing this type of UK science that forms the middle ground between blue sky and applied research. A stakeholder group would help to inspire and facilitate young people to enter this field.

THE DEBATE

Do we leave these risks of metals shortages entirely to the market or try to intervene to smooth out the risk extremes? Should there be a network of stakeholders? This would monitor the overall demand for metals, identifying and suggesting solutions to foreseeable weaknesses in the overall supply chain? If so, how should such a network be managed? Which stakeholders should be involved and what questions should be addressed? Should we support the unfashionable? Climate change has potentially far reaching consequences and research should be funded but should we lose sight of possible supply problems for metals? Does the UK wish to support training and education of young people to go into the global exploration industry to maintain our interest in the supply chain of metals? Should there be an interconnected mineral exploration knowledge base in the UK including geological, geochemical, geophysical and mineralogical theory and practical detective skills for locating mineral deposits? Should there be an expansion of research to create models to predict and locate more resources and to develop new technologies and collaborations to process new ores? Should the UK have the capacity to promote a world wide debate to consider the rapidly changing distribution of metal availability? New initiatives for assessment of 'impact' of research in UK universities indicate that there is a growing interest in the use of applied science but does this area of metals availability have access to the research funds that it needs? Should public understanding of mineral exploitation be promoted? Although sustainability

is accepted to be desirable there appears to be a lack of public awareness of the essential role of the exploration and mining industry in maintaining living standards. If we are alerted to shortages in metal supply we may be able to take actions to secure continuous supplies before there is a crisis and so be forewarned of possible future shortages. Access to research funds will support the development, on more than one front, of strategies to hedge against future shortages. This will help both to maintain our living standard in the UK and assist the whole of civilisation to use the world's resources more sustainably for the prosperity of everyone.

STAKEHOLDERS

Some knowledge of metal supply was previously held in DTI and the British Geological Survey, and maybe now some is held by the EU. Large international companies are likely to have confidential information and data should be present within the London Metal Exchange. Some rather fragmented research is being done in Universities with a few teaching economic geology and mining especially at MSc level. The end users of metals such as manufacturers of cars, IT and electronics are likely to be aware of metal supplies. Such a group of stakeholders would in effect be a 'metals availability forum,' real or virtual, that would be able to develop an overview of metal supply, joining up currently disparate information.

