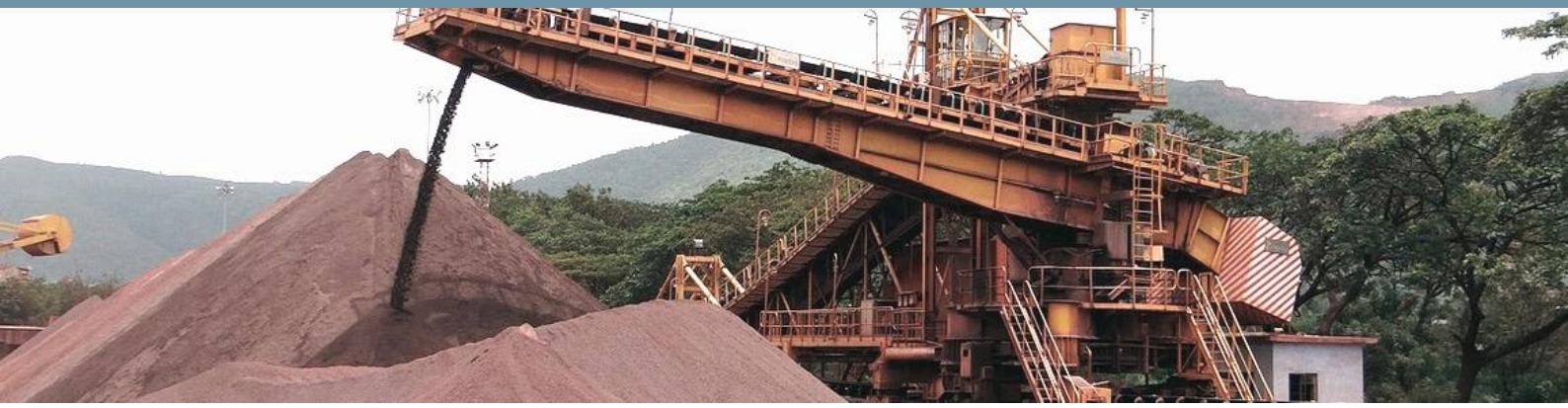
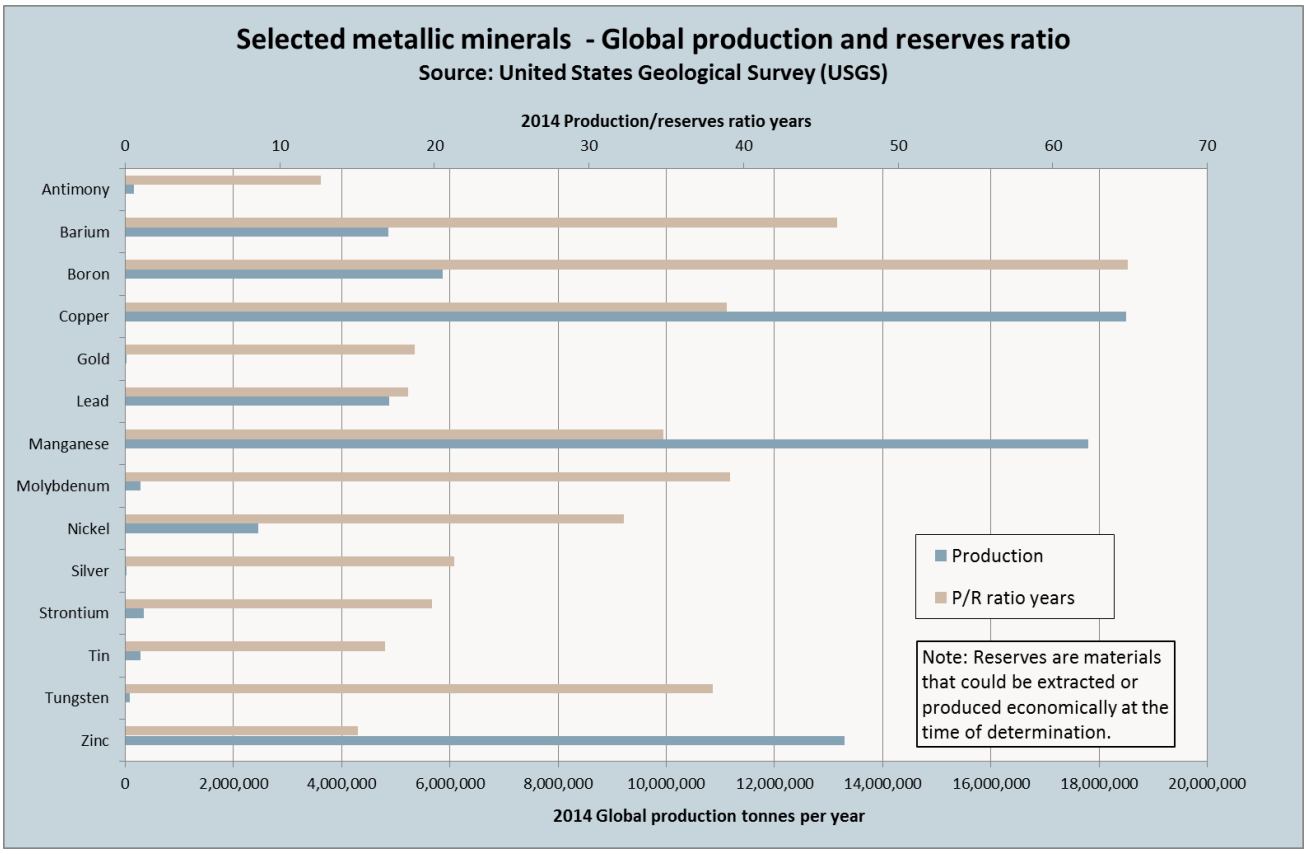


Minerals

Minerals are naturally-occurring substances formed by geological processes. A large proportion of construction materials, and the raw materials for a substantial number of industrial goods, are of geological origin. Minerals in the soil are also essential for the production of food. Gems, such as diamonds, and precious metals, such as gold, are materials of geological origin that are also highly prized as currency media and indicators of status.

Some minerals are relatively abundant, but many are only found in small quantities or in a few places.[1] Although a few minerals continue to be formed by ongoing geological processes, the majority are effectively non-renewable resources because the geological processes forming them take place very infrequently or very slowly. Any mineral which takes millions of years to form is effectively non-renewable on a human time scale.



Large-scale extraction and conversion of minerals involves large amounts of energy to remove the material from the ground, to separate out the useful components and to transport them to the point of use or the conversion plant. In many cases, including manufacture of the majority of metals, it is also necessary to convert the mineral into a chemically useful form — another energy-intensive process.

Production of cement and concrete from limestone is particularly problematic in this respect. The process releases environmentally-damaging CO_2 in two ways: firstly, as a result of the energy used for the thermal decomposition of the calcium carbonate of which limestone is composed, and secondly through release of the CO_2 that was originally chemically bound as carbonate within the calcite itself.

Especially when mineral deposits are very thinly spread out, extraction and conversion create large amounts of waste, leading to further environmental problems, particularly when these wastes contain toxic materials. Mineral extraction and separation often use large amounts of water, and result in severe pollution of water resources if not well managed.

As the more easily-won deposits become depleted, the financial and energy costs, as well as the direct environmental impact of extracting the remaining minerals, increase. Many economically important but relatively rare minerals are found in only a few places. This can be a great opportunity for local people, but in developing countries the opportunities are not always shared equitably. Poverty can remain, and too often conflict results.

Much modern technology depends on using increasing amounts of scarce resources, in particular of rare metals. Once the accessible deposits have been exhausted, manufactured goods which depend on these substances become increasingly expensive to produce and, in extreme cases, it may no longer be possible to meet the demand for them.

As with energy, the situation is inherently unsustainable so long as people's expectations continue to rise and our numbers continue to increase. More information about elements and element groups needed to maintain industrial economies is provided in the British Geological Survey Risk List.[2]

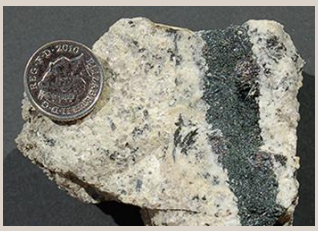
Examples of metallic minerals


Barium ore


Chromium ore


Copper ore


Gold ore


Tin ore


Tungsten ore


Lead ore


Iron ore

(Photo credit: Dr G.T.R. Droop D.Phil (Oxon.))

References

Internet references accessed 17/04/2016

[1] http://minerals.usgs.gov/minerals/pubs/commodity/

[2] www.**bgs**.ac.**uk**/downloads/start.cfm?id=3075

