WE NEED TO TALK ABOUT THE MINERALS SECTOR

KEN SEVERS LOOKS AT TRANSFERRING YOUR SKILLS TO A BOOMING SECTOR

THE hallmark of chemical engineering is its 'industrial versatility', allowing graduates to work in many varied fields.

As the mining sector continues to grow around the world, lamenting a shortfall in engineers as it goes, it is worth considering the skills that you could bring to the sector.

You need only to compare the range of unit operations that are taught to undergraduates in both chemical engineering and extractive (or primary) metallurgy, to recognise the opportunity.

To name a few generalisations, there are reaction kinetics, size reduction, mineral dressing, heat transfer, transport of materials, solids-liquid separation, chemical equilibria, gas adsorption, solvent extraction, ion exchange, gas-solid systems and electro-chemistry. And as if that wasn't enough, there are also strong elements of materials of construction and project engineering. Indeed chemical engineering (reading like the index for *Perry's Handbook*) could have been designed for the mining and metals industry!

Metallurgy is frequently associated mainly with smelting and other molten-metal processes but these technologies are actually more for secondary metallurgy, namely the actual use of the metals recovered in pure form, from ores, by primary metallurgy.

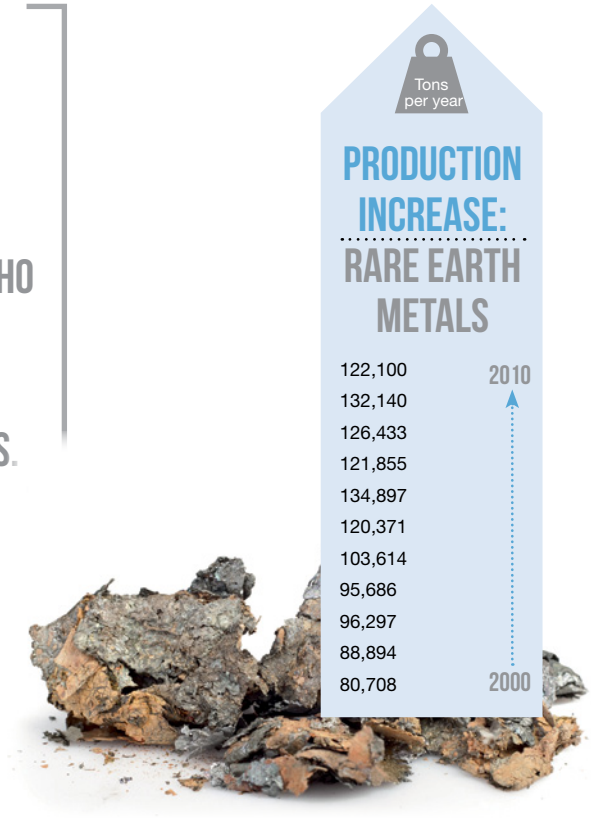
Although smelting and roasting do feature strongly in extractive processes, there is also a heavy dependence on hydrometallurgical and bacteriological processes in the various media of water, acids, alkalis, halides and gases. Indeed most common metals (other than perhaps iron and tin) are recovered hydrometallurgically or are subsequently purified that way.

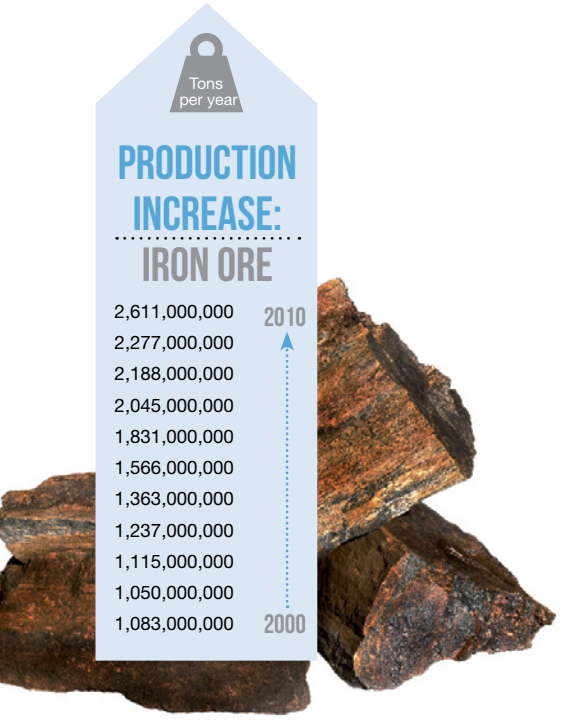
Typically, extractive metallurgy takes place where the ore is mined, leading to well-paid careers and huge opportunities to see the world. Major mining countries include Australia, Brazil, Canada, Chile, China, and onwards, through the alphabet, across continents.

Mongolia is currently increasing in importance and normally most areas of the world have some or other mineral resource to offer. Britain seems to have 'had its day' with tin and copper, although there is currently a potential resurgence in the fields of tin and tungsten.

Even the oceans are rich in minerals, with the best known resource being deep-sea nodules of Manganese-Copper-Nickel-Cobalt. After decades of discussion, practical efforts are now being made to recover the nodules – equipment and processes are being developed. Dedicated deep-sea miner Nautilus plans to begin operating a copper-zinc-gold recovery plant off Papua New Guinea by the end of 2013. Excavation of the mineral deposits from the sea bed

THE MINING AND EXTRACTIVE METALS INDUSTRY OFFERS UNLIMITED SCOPE FOR CHEMICAL ENGINEERS WHO COME EITHER STRAIGHT FROM UNIVERSITY OR AS EXPERIENCED ENGINEERS.





is an onerous task; but once reclaimed, the mineral nodules will most likely need chemical engineering to separate out the various valuable components.

The richness of terrestrial ores varies dramatically but generally, grades are decreasing. The higher grades are available underground but operations gave way to larger-scale and thus cheaper lower-grade surface operations. However, as these latter deposits are exhausted, attention returns back beneath the earth.

In due course, there will be more impetus for sea-bed mining. It is worth noting that major mining companies are not well represented in ocean mining so the profile of the industry could change. But no matter from where they are recovered, by whom, or at what grades, chemical engineering will ultimately treat the resulting ores.

The landmark innovations in mineral and metallurgical processing have been the processes of flotation in the 1920s, flash smelting in the late 1940s and then solvent extraction for copper in the late 1960s (solvent extraction in the uranium industry had already been in use for decades).

More recently, solvent extraction has been supplemented by ion exchange and molecular recognition; and no doubt other chemical engineering processes will continue to be developed.

Solvent extraction replaced the process of 'cementation' of copper from a copper sulphate medium by addition of scrap iron. Solvent extraction is a much cleaner and more efficient system, in several (including some unexpected) respects. When, in the early 1970s, a cementation plant was to be built in Zambia, as an interim to newly-developed solvent extraction, tons and tons of scrap was stockpiled in readiness. A 'count' of the stock a few months before operations began showed that much of the metal had been stolen away from site to build local houses. Salicylaldoximes and other solvents have no such public attraction.

So, chemicals are more secure, unless one considers the several misfortunes that have occurred with the use of sodium cyanide for gold recovery. Even with cyanide systems though, when properly designed and operated, they remain safe, despite the environmental opposition. Like in all other industries, chemical engineers in the extractive metals industry have the technology to do the job efficiently, cost effectively and safely.

In conclusion, the mining and extractive metals industry offers unlimited scope for chemical engineers who come either straight from university or as experienced engineers. It is a career choice that should be considered early on.

KEN SEVERS (KENSEVERS@AOL.COM), NOW RETIRED, WAS FORMERLY WITH THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY, ANGLO-AMERICAN, RIO TINTO AND AMEC