NON—RENEWABLE MINERAL RESOURCES

Inaugural address by

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Contd. from Previous issue, p. 38

Significant advances have been made in this type of technological research, and certain results have already been achieved. The possibility of using low grade iron ores such as banded ferruginous quartzites has increased the iron ore reserves a thousand-fold. 100 years ago metallic aluminium was unknown, but it is at present the metal of the 20th century, the metal most used in high speed cars, supersonic planes, and in space craft. Today, the metal is being extracted from not only bauxite, but also from ordinary clays. In the year 1700 the mineable grade of copper was 13 per cent; a hundred years ago copper could not be extracted from ores containing less than 4 per cent; today it is profitable to mine lean ores containing as little as 0.5 per cent because cheaper methods of extraction have been continually developed. The technological aspects of extraction have advanced to such an extent, that it is possible now to strip the ore of its copper content, without any fuel being burnt to melt the gangue

The first plant to extract magnesium from sea water went into operation less than 50 years ago. Today, the metal is obtained almost exclusively from sea water. A cubic mile of average sea water is estimated to contain 6 million tons of magnesium, more than has been produced in the entire history of the world. This seems to be one mineral that is in no danger of being exhausted.

Titanium is another of our most abundant metals. There is more titanium in the earth's crust than there is copper, lead, zinc, tin, and nickel put together It has been known for at least two centuries but the employment of metallic titanium as a useful metal dates only from 1948.

Nickeliferrous laterite beds have been known for some time; they are much more widespread than the sulphide deposits and easier to mine. But it is only recently that commercially feasible ways have been found to extract the nickel from them. As a result, the nickel reserves of the world have been increased many times, and the nickel mining industry will be less concentrated geographically, and industrially.

With almost every metal this story is repeated" of widening use, of the discovery of new sources, and better methods of extraction. Here, as in other fields, ingenuity and research have been great multipliers of our natural resources.

The record of the last few decades has shown that during that period mineral supply was kept well ahead of long term growth in mineral consumption. There is no reason therefore to apprehend that the process of technological development that has been operating so well will come suddenly to an end. New developments are bound to take place more rapidly with higher rates of consumption, and the steepest exponential curve of all is the growth of human knowledge. More important than the discovery of new deposits are the technological advances which enable us to work lower quality and less conventional materials. Whereas a new discovery adds only a new mine, a new technology for utilising lower quality resources can open up deposits across the world.

Population growth, resources depletion, and environmental deterioration are inter-connected and could lead to a crisis of survival for humanity. The following are some of the steps which should be taken to avoid this threat: (1) Control of population growth; (2) Reduction in wasteful consumption of materials; (3) Discovery of new deposits; (4) Development of low-grade deposits; (5) Development of new types of deposits, such as gypsum and anhydrate for sulphur, clays and high-alumina rocks for aluminium, oil-shale and bituminous sands for petroleum; sea-bed nodules for manganese, nickel, copper, and cobalt; (6) Increase in scrap and waste recovery; (7) Synthesis and substitution; (8) Check on environmental deterioration; and (9) Development of nuclear energy.

What is actually won from rock and sea will be the result of persistent and imaginative research, inspired invention, bold and skilful experimentation, and intelligent application and management. Mineral processing and beneficiation are, therefore, of fundamental significance at the present time, and it is to discuss such matters of great importance to mineral industry that this symposium has been organised. I am happy that so many technologists interested in these matters are gathered here. I have very great pleasure in inaugurating this conference and wishing you all success in your deliberations. *(Concluded)*