# NON-RENEWABLE MINERAL RESOURCES

*Inaugural address by*

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The first indication of the dawning of the special intelligence in our hominid ancestors was their selection of mineral substances (flint, obsidian) that were capable of being made into effective tools. The discovery of the metals, gold and copper, and the method of alloying copper with tin or zinc to make the harder bronze, were the next major advances. Thus, we have had the Stone Age followed by the Copper and Bronze ages, and the present Machine Age or the Age of Metals. In fact, mankind's progress is measured in minerals. In every phase of modern life, whether it is agriculture, construction, industry, transportation, communication, or household, minerals play an essential role, and our economy is becoming increasingly dependent on minerals. As an example it may be mentioned that the modern telephone system, uses as many as 17 essential minerals.

Minerals are wasting assets. A tonne of ore removed from the earth is a tonne lost for ever They are, therefore, non renewable resources. It is necessary to recognise that almost all workable mineral deposits are special concentrations that have formed during the long course of the history of the earth's crust and hence are not readily replaceable.

Rapidly growing populations, higher standards of living, and the great proliferation of goods and services required and produced in the modern industrial society, all these have contributed to the rapidly expanding demand for mineral-based materials and energy sources. Today's world population is 4 000 million and the growth rate is 2 per cent. Using exponential growth, this number will double itself in just 35 years. The most disconcerting feature of mineral resources is their exhaustibility. Metals, minerals, and fuels are consumed at such a rapid rate that we are now faced with the threat of an uncontrollable decline in industrial capacity which will ultimately lead to complete disaster. Our geological resources such as minerals, energy, water etc, would be depleted not only because of the increase in population but also because of the increase in per capita consumption. Due to increase in population alone, the world 70 years hence would need four times the present annual supply of minerals.

A recent Club of Rome project on the Predicament of Mankind has concluded that "if the present growth trends in world population, industrialisation, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached some time within the next 100 years".

On the other hand, there is the optimistic view that there is really no cause for anxiety. It is argued that the exponential growth either of population or consumption of minerals cannot go on indefinitely; that as nations move into a post-industrial phase, their intensity of use of mineral commodities tends to decrease; that relative demands decline after a point with increase in per capita income; and that population and consumption have to stabilise at some time or other.

According to the Cornucopia Concept there is no cause for anxiety since technology would take care of the world's requirements, and so the idea of running out of mineral supplies is unrealistic since astronomical tonnages of lower grade ores exist. Growth will not be restricted by a scarcity of mineral resources; these resources are unlimited and there will be enough for all; that mineral supplies will keep pace with demand even if world population per and capita consumption continue to grow indefinitely; that higher rates of production are economically and geologically possible; that even by existing technologies we could extract thousands of times the known reserves of most metals from the sea; and that as technology of extraction improves we can obtain materials from low quality sources such as even ordinary rocks. Eventually, the time may come when common rocks such as granite will be looked upon as ores. Average granite contains sufficient uranium and thorium to pay energy-wise for the processing of the rock. 100 tones of average igneous rock contain in addition to other useful elements, 8 tons of aluminium, 5 tons of iron, 1200 lbs of titanium, 180 lbs of manganese, 70 lbs of chromium, 40 lbs of nickel, 30 lbs of vanadium, 20 lbs of copper, 10 lbs of tungsten, and 4 lbs of lead.

*To be Contd. in Vol. No. 26-4 1977.*