

1.0 Introduction

Iron makes five percent of the earth's crust, and is not found in its elementary form, but in the form of chemical compounds with other elements in hundreds of minerals of importance. It is the most wanted ferrous metal having wide applications in several industries. Iron plays a vital role in development of any country. Iron and its alloys, specially steel, are mainly used in civil and engineering industries without which the entire mankind could not have come to the modern age of high quality living. The demands of iron and its alloys are increasing in the developing countries in the sphere of various applications, such as power, transportation, machinery, defence, railways, heavy engineering plants and communication. All these factors together have placed this metal and its alloys in a very important position among all metals.

In the world, natural occurrences of iron ores are abundant, but not in native form. The pure metal is silvery white, highly magnetic, ductile and malleable. In this monograph, general geology, mineralogy and classification with genesis have been described. Various aspects on prospecting and exploration, mineralogical classification and physical characteristics of iron ores have been discussed in detail including assessment of commercial importance. The choice of exploration methods for iron ore not only depends on mineralogical and geological characteristics of the ore, but also on size of deposits. The geological mapping, aerial photography, geochemistry and geophysics are dealt in a comprehensive manner. Besides specific exercises have been attempted to highlight the different aspects of the iron ore deposits. The iron ore deposits and their distribution in different regions of the world under various geological conditions and its

concentration in pre-Cambrian age have also been discussed. Resources of iron ore of important countries along with the reserve position have also been described. India ranks sixth in the world in respect of recoverable iron ore reserves. Even though the in situ reserve of iron ore is about 17 billion tonnes, the recoverable reserve is about 12.7 billion tonnes.

Indian reserves are predominantly distributed in pre-Cambrian formation. Further, the country is having more than 60 percent of the world's high grade iron ore reserves. This enables the country to export a large quantity of iron ore. Thus, this mineral's contribution to the Nation's foreign exchange earnings, is praiseworthy. Indian iron ore deposits are available as haematite, magnetite, limonite and siderite, of which haematite is recognised as the high grade ore.

Mining and production of iron ore in India during the year 1995-96 was reported from 689 leases covering an aggregate area of 111,160 ha comprising 267 working mines including 36 under public sector undertakings. The principal producers of iron ore under Central Public Sector Enterprises are SAIL, KIOCL, NMDC and IISCO. Presently, India is producing more fines than lumpy ores at the ratio of 60:40 but earlier the case was reverse. For the conservation of this mineral, the fines, which were not much in use earlier, are being utilized in steel plants in the form of sinters/pellets. As the Union Government has brought in new legislations to strengthen conservation of minerals including iron ore, the use of fines and sub-grade ores has started.

Iron ore is the most important raw material for making pig iron, sponge iron and steel too.

To cater to different product needs, many steel plants and ferro-alloys industries have been set up in India. Iron ore in different form is also used in other industries like cement, foundries, paint and glass. Since 60s, India has been exporting iron ore and the domestic consumption was hardly 50% of the total ore produced every year. But, during 1993-94, India exported 26.8 Mt iron ore and consumed about 24Mt. Now the scenario is fast changing - it is estimated that by the year 2000, the domestic consumption may rise to 55 Mt while export may lag behind at 31 Mt. This changing situation is due to establishment of new steel plants and by A.D. 2000, country's crude steel production is expected to go up to about 37 Mt. So, iron ore production in the country will be steadily rising due to high demand in the domestic market and dependence on export market will be considerably reduced. This is a good sign as export market is never found stable.

In the world scenario, Brazil, China and Australia are the important iron ore producing countries. Production of iron ore in these countries has improved due to technical development which in turn has given the advantage of low cost production of r. o. m.

Owing to the demand for iron ores of specific chemical composition and physical characteristics, almost all the iron ores mined today, need certain treatments, preparation, beneficiation/agglomeration, etc. so as to make them suitable for various applications. And due to this need of strict specification, enough technological developments have taken place in the field of iron ore beneficiation. Earlier, iron ore beneficiation was restricted to crushing and washing, and subsequently agglomeration (sintering and pelletisation) came into existence. Now entire chain of processing of iron ore includes crushing, grinding, blending, washing and wet scrubbing, gravity separation, magnetic separation, flotation and agglomeration. All

these aspects of iron ore processing have been discussed in Chapter 10.

Damage to the environment is an important negative aspect incidental to mining. Iron ore mining in India causes more damage to the environment as all the iron ore mines in the country are being mined by opencast method which causes more destruction/disturbance to the surface than mining by underground method. In India, about 14% of the total lease area or 15,000 ha of iron ore mines is distracted/disturbed. Keeping this in view, this environmental problem of the mining, specially by opencast method, iron ore mining should be planned and executed in such a way that environmental pollution would be minimum and damages unavoidably caused should be mitigated to the extent technology and economy permit. An afforestation should be, as a whole, single largest activity towards environmental management policy.

Earlier, iron ore market was mainly in developed countries including Japan. But due to high industrialization in Asian countries, specially China and to some extent Korea and India, the situation has changed. Now, more iron ore will be consumed in these countries. About 47 percent of the world's steel consumption will be in these countries compared to 34 percent in 1990. In next 4-5 years, production share is likely to rise from 31 to 40 percent. Due to rise in the Asian market, the future of export of iron ore is bright. Further, India is going to enhance the capacity of steel production to 37 Mt by the turn of this century, which is creating big demand of iron ore in the domestic market. On one hand, export market is steady and on the other hand domestic consumption of iron ore is increasing. The combined effect will boost iron ore production in India. Apart from discussion on market, various factors controlling market and forecast of iron ore are discussed in Chapter 11.