Chapter 3
U-Ti-Fe ORES
INTRODUCTION

V-Ti-Fe ores associated with the mafic-ultramafic suite of rocks have been a subject of considerable attention in the last few years because of their economic concentration of vanadium, and such deposits have been reported from various parts of the world. They mainly occur in the layered igneous complexes such as Bushveld complex of South Africa (Wager and Brown, 1968; Willemsse, 1969; Reynolds, 1985a; Von Gruenewaldt et al., 1985) and Skaergaard intrusion of Greenland (Vincent and Phillips, 1954) and as stratiform bodies in Adirondack (Buddington et al., 1963) and Duluth complex of USA. Also, in the areas of Allard lake, St. Ubrain of Canada (Lister, 1966), Suwalki district of north east Poland (Speczik et al., 1988), Rodsand deposit of More in western Norway (Sanetra, 1985), Oursi region of upper Volta, west African shield (Neybergh et al., 1980), Karhujupukka (Karvinen et al., 1989) and Attu Island (Lamoen, 1977) deposits of Finland.

The most important source of vanadium in India is the titaniferous magnetite with a low percentage of the metal, the average vanadium content ranging from 0.1% to 2.0%. Such deposits occur in Dublabera-Katwar Pahar in Singhbhum district, Bihar (Dunn and Dey, 1937; Dasgupta, 1968, 1969), Kumardubhi, Betjharan and Amdebera in Mayurbhanj district of Orissa (Roy, 1955), and Nausahi in keonjhar district of Orissa (Mukharjee, 1958; Chakraborty, 1959a, b), Tiruvur, Krishna district of Andhra Pradesh (Riyazulla et al., 1990), Pokampatty in the Dharmapuri district of Tamil Nadu (Subba Reddy, 1981).
In Karnataka the V-Ti-Fe deposits occur in the Channagiri taluk, Devaranarsipur and Sakrebyle areas of Shimoga district (Seetaram, 1973; Vasudev and Srinivasan, 1979), Nuggihalli schist belt of Hassan district (Chakraborty, 1961; Varadarajan and Pande, 1965; Naganna and Phene, 1969; Jafri et al., 1983) and Madangere (Uttangi, 1982; Devaraju et al., 1989), Morahalli and Mulemane of North Kanara district. Very recently, Ranganathan et al. (1991) and Shafeeq Ahmed and Kariyanna (1991) have reported the occurrence of titanomagnetite west of Kurihundi village in Nanjangud taluk of Mysore and in Joida taluk of North Kanara district, respectively.

Six V-Ti-Fe deposits of Karnataka, viz., Masanikere, Tavarekere, Ubrani, Magyatahaalli, Devaranarsipur (Shimoga district) and Mulemane (North Kanara district) have been chosen in this study for detailed investigation. The location of the deposits is shown in figures 2, 3 & 4.

DESCRIPTION OF THE INDIVIDUAL ORE DEPOSITS

1. Tavarekere deposit: is located 0.5 to 2.0 km W and SSW of Tavarekere village and occurs as parallel, discontinuous bands of variable sizes (50-600 m in length, 10-30 m wide) running for over a total length of 1.5 km and confined to the low mounds with a general trend of NNE-SSW and dip varying from 40° to 65° to the east (Plate-5A). The ore is hard, compact, steel grey in colour with two sets of joints. The ore body west of Tavarekere village strikes NS, but the strike direction changes southwards and at Virapur it is N25°W. This is closely associated with magnetite
gabbro which is clearly exposed between the ore bands. The other rock types met with are quartz-chlorite schist, actinolite-chlorite schist and quartzite.

2. Masanikere deposit: is the biggest in the area, located along the ridge (Iranna gudda A1005), about 1 km east of Masanikere village, constituting a number of closely spaced parallel bands of Magnetite separated by magnetite gabbro. The main ore band runs in a NNE-SSW direction for about a km with a variable width of 5-50 m. The dip varies between 55° and 76°W. The ore is medium to coarse grained, reddish brown in colour and highly weathered. The western flank of the ridge has a good spread of float ore.

About 1 km south of Iranna gudda, a number of small lenses of magnetite occur within gabbro. These ore bodies have sharp, almost vertical contacts with the gabbro (Plate-5B) and are only a few feet in thickness. Similar occurrences of magnetite are also seen on the hillock (A1030), to the east of the village Gangodahalli, which is an extension of the Masanikere deposit. The other rock types closely associated are quartz-chlorite-carbonate schists, quartzite and dolerite dykes. The magnetite bodies are confined to magnetite gabbro.

3. Ubrani deposit: The main deposit occurs in three discontinuous bands with a strike length of about 2 km and confined to the ridges identified locally as 'Soppimatti', 'Nadlimatti' and 'Konematti' located about 1 km NW, 1.2 km NNW and 1.75 km N of Ubrani village respectively. The ore bands (25-40 m wide) strike N45°E and dip 45-60° towards east. The ore is...
compact, fine grained, greyish black in colour and moderate to feebly magnetic. The magnetite bands are traversed by two sets of joints resulting in rectangular blocks. The flanks of the hillocks are covered with soil and no exposures of rocks are seen associated with the ore bands. Drilling by the State Department of Mines and Geology has indicated the presence of gabbro, chlorite schist, amphibolite and talc-chlorite schist (1972-73 Administrative report of the Department of Mines and Geology) at depth. The float ore is scattered on the western flanks of the ridges. Towards north east of komematti also, magnetite occurs forming small ridges.

There are three ore bands constituting the small ridges about 1.5 and 2.0 km NE of Ubrani village. The ridges are locally called 'Gubemardi' and 'Hulimardi'. The ore body is exposed discontinuously over a length of 1.5 km in about NNE-SSW direction and dips 47-50°E. The ore zone is about 10 m wide. Also to the south west of Ubrani village 3 small bands of magnetite occur which are fine grained, feebly magnetic, reddish brown in colour and much altered.

4. Magyatahalli deposit: To the east of Magyatahalli village V-Ti-Fe ores occur as discontinuous bands for a distance of 2.5 km. Based on mineralogy, the Magyatahalli ores can be divided into two types:

i) The compact magnetite ores, and

ii) the chlorite-rich magnetite ores.

The location of these ores is shown in the geological map.
In the southern portion of the deposit and to the west of Malleswara village the chlorite-rich magnetite ores occur on the low mounds and are made up of only magnetite/titanomagnetite and chlorite in different proportions, exposed for a distance of 1 km with a surface width of 50 m. Compact magnetite ores are also in close association with the chlorite-rich ores on either sides and occur as small lenses (upto 10 ft in length).

Towards the north of the deposit, the ores are hard, highly jointed, moderately magnetic, 10-30 m thick with a dip of 30-50° towards east. Field observations suggest that the Magyatahalli ore bodies could be the northern extension of the Tavarekere ore deposit. Float ore is unimportant. Actinolite-chlorite schist, gabbro and anorthosite are the closely associated rock types.

5. Devaranarsipur deposit: occurs forming low mounds of lenticular exposures and discontinuous bands scattered near Devaranarsipur village. The thickness and the strike length of the individual exposures show large variation and the ore bodies run in north easterly and north westerly directions with dips varying from 40-70°, west and east respectively. Major portion of the area surveyed is covered by pyroxenite and the exposures are confined to the eastern margin of the magnetite ore bodies. The other litho-units encountered are serpentinite, mica schist, steatite and quartzite. The largest ore body is well exposed (Plate-6A) over the isolated mound south of Devaranarsipur village and the flanks of the entire mound are covered by float ore. The length of the individual bands ranges from 25 m to 100 m...
with width up to 25 m. The ore is hard, compact, medium-coarse grained, highly magnetic and contains abundant chlorite.

The other two occurrences of the area lie towards the northern and south eastern portion of Devaranarsipur village. The maximum length and thickness of the northern band are 90 m and 8 m respectively. The south eastern band is located south of the tramway leading to Bhadravati and is confined to the low ground and occurs as very small lenses. The ore is massive, medium grained, brownish in colour and moderately magnetic.

6. Mulemane deposit: in the Ankola taluk of North Kanara district is confined to the gabbro-anorthosite-peridotite occurring near the village Mulemane on the Karwar-Hubli main road. Locally the main V-Ti-Fe ore body of this area is in direct contact with the peridotite/serpentinites. The main ore body is dyke like and can be traced discontinuously right from the State highway No.17, near Mulemane village, in a north westerly direction for over a length of 1 km. The ore is composed of massive blocks of coarse grained magnetite (Plate-6B) with diaspore and kaolinite occurring within the cracks and along the grain boundaries. The thickness of the ore body varies from 20 m to 30 m. In the eastern and southern portions of the deposit, patches of gabbro of variable sizes and shapes are exposed. Small lenses of magnetite are seen within the gabbroic outcrops. The other rock types encountered are granitic gneisses, phyllites, quartzites, epidiorite and dolerite dykes. The epidiorite dykes are found cross-cutting the ore body.