CHAPTER II

GEOLOGICAL SETTING
AND
FIELD CHARACTERS
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GEOLOGICAL SETTING AND FIELD CHARACTERS

2.1 INTRODUCTION

This chapter deals with the nature of outcrops, mode of occurrence, contact relations, structural relations of different lithological units, their frequency, the relationship between them and the variation within the single lithological unit of the Masanikere area.

The gabbro-anorthosite suite of rocks are of prime importance in so far as V-Ti-Fe-Cu ore mineralisation in this area is concerned. The other rock types of the area are granitic gneisses, schists, quartzites, ultramafic rocks and dolerite dykes. All the rock types have good outcrops in the field.

2.2 LITHOSTRATIGRAPHY

Based on the relationship of schists with ultramafics, gabbro-anorthosite suite, V-Ti-magnetite ore bands and granitic gneisses of the Masanikere area, the author has proposed a reconstructed lithostratigraphic succession for the Masanikere area modified after Chayapathi (1976) and is given in Table 4.
QUARTZ VEINS
DOLERITE DYKE
V-TI-MAGNETITE ORES WITH MAGNETITE-GABBRO, GABBRO, GABBROIC ANORTHOSITE
ANORTHOSITE
ULTRAMAFICS (SERPRENTINITE, TREMOLITE-ACTINOLITE SCHIST, TALC-CHLORITE SCHIST)

CHITRADURGA GROUP OF THE DHARWAR SUPERGROUP
QUARTZ-CHLORITE-CALCITE SCHISTS WITH INTERBEDS OF QUARTZITE

------------------ UNCONFORMITY ------------------

GRANITIC GNEISS (PENINSULAR GNEISS COMPLEX)

Table 4. Reconstructed lithostratigraphic succession of the Masanikere area modified after Chayapathi (1976).

The lithological units of all varieties of the Masanikere area are identified based on their field and petrographic characters and they are described under the following broad divisions:

2.3 Gneisses
2.4 Schists
2.5 Quartzites
2.6 Ultramafics
2.7 Gabbro-anorthosite suite
2.8 V-Ti-magnetite deposits
2.9 Dolerite dyke.

2.3 GNEISSES

The granitic gneisses of the Masanikere area were shown as Champion Gneiss in the geological map of Mysore, prepared
by the State Department of Mines and Geology (1915) and are now found to be part of the Peninsular Gneissic Complex.

Granitic gneisses are the most widely distributed rock types which occupy a large portion of the area. Well exposed outcrops of these rocks form island like domal masses (Fig.2.1), ridges (Fig.2.2), mounds and big boulders at different places. Typical exposures are found near Gangondahalli, Masanikere, east of Taverekere villages, to north western portion, near Ubrani, Gourapur, west of Maghyathahalli, west of Taverekere villages, to south west portion near Durvigere and scanty exposures near Dandur and Haralahalli villages of the area under investigation. Of these occurrences of granitic gneisses, the Ubrani gneiss and the adjoining Taverekere gneiss are prominent in the area. Field relations between these granitic gneisses and low grade supracrustals represented by quartz-chlorite-calcite schists, interbeded with quartzites, indicate that the gneisses exhibit unconformable relationship with overlying quartz-chlorite-calcite schist, which is observed in several places, viz., Ubrani, Taverekere, Durvigere and Gangondahalli villages. Quartz-chlorite-calcite schist is the basal bed which overlies the granitic gneiss at Chikmalur but locally the contact is marked by an arkosic rock.

2.4 SCHISTS

Schists are the well exposed low grade supracrustal
rocks enclosing the bands of quartzite of the area. These lithological units occur in the form of patches, discontinuous and parallel bands (Fig. 2.3 & 2.4) with variable dips and strikes from one place to another (as shown in the geological map). They are more conspicuously exposed towards east and south of Masanikere village, west and south of Taverekere, south and north east of Ubrani, north and east of Maghyathahally, east and north east of Gangondahalli, and north of Haralahally villages. The schists are surrounded by island like domal masses (Fig. 2.1) and mounds of granitic gneisses which do not show any intrusive relationship with the schists. The critical association of minerals like 'quartz + chlorite + carbonate' in the schists of the area indicate that all the rocks are metamorphosed under greenschist facies suggesting that they are formed at moderate pressures and relatively lower temperatures in the presence of abundant water.

Though there is not much variation in the mineral assemblage of the schists, it is found convenient to classify them into (1) quartz-chlorite-calcite schist and (2) quartz-chlorite schist.

2.4.1 Quartz-chlorite-calcite schist

Of the two varieties of schists, quartz-chlorite-calcite schist is the most predominant and extensively distributed rock type in the area. It is very difficult to demarcate the clear cut boundaries between the varieties of
schists in the field.

Mineralogically, the rock is composed essentially of quartz, chlorite and calcite, with minor amounts of magnetite crystals. Parallelism of flakes/scales of chlorite, lenticular grains of quartz and calcite, contributes to the overall well defined schistosity of the rock.

2.4.2 Quartz-chlorite schist

This variety of schist is less abundant when compared to quartz-chlorite-calcite schist of the area. The rock is green in colour, fine grained and brittle. It also shows well developed schistosity due to the parallel arrangement of quartz and chlorite. Quartz and chlorite are the essential minerals with minor amounts of magnetite porphyroblasts and accessory calcite. Chlorite occurs as flakes/scales, aligned parallel to the plane of schistosity.

2.5 QUARTZITES

Quartzites of the area under investigation, form conspicuous metasedimentary units of the Chitradurga Group of the Dharwar Supergroup in the Shimoga schist belt. Well exposed outcrops of quartzites occur as discontinuous bands of variable length and width at several places and are found interspersed with the quartz-chlorite-calcite schists and intruded into the granitic gneisses of the area.
Five quartzite bands have been recognised in the area: of these, three prominent quartzite bands are exposed and interspersed with schists and the other two bands are noticed in the basement granitic gneiss complex of the area.

A prominent quartzite band is exposed within the quartz-chlorite-calcite schist, about 3 km. NE of Gangodahalli village, trending almost NE with a variable width of 40 to 60 m. and length of about 2 km.

Another prominent quartzite band (Fig.2.5) is exposed and interspersed with quartz-chlorite-calcite schist about 700 m. south of Masanikere village. This quartzite band varies in its width from 35 to 55 m. It is striking NW direction with a strike length of 1.5 Km.

In addition to these quartzite bands, a less prominent band is noticed in the quartz-chlorite-calcite schist, towards NNE of Gangondahally. This band is located about 3 km. NNE of this village and is striking almost NW with a strike length of 600 m. and a variable width of 30 to 50 m.

Two quartzite bands of small areal extent are found to occur interspersed with the granitic gneiss around Gangondahally. These quartzite bands are parallel bands with a width of 45 m. and length of about 500 m. One of them occupies the hillock $\triangle 3080$, situated 1.5 km. north of Gangondahally village.
2.6 ULTRAMAFICS

The ultramafics of the study area are highly recrystallized and possesses metamorphic mineral assemblages. They are represented by serpentinite, tremolite-actinolite schist and talc-chlorite schist.

Of these varieties, serpentinites are prominently exposed as parallel and discontinuous bands and lensoid bodies in the ridge (Fig. 2.6) located 1.5 km. east of Masanikere village and in the ridges situated 2.5 km. south of Masanikere village. Serpentinites are closely associated with tremolite-actinolite schist and talc-chlorite schist. They exhibit gradational relationship with the associated gabbro-anorthosite suite of rocks in the field.

Tremolite-actinolite schist is closely associated with serpentinites. It occurs as small patches and lensoid bodies exposed along the flanks of the ridge which is located 1.5 km. east of Masanikere village.

Talc-chlorite schist is exposed as small bands showing gradational contacts with tremolite-actinolite schist. It is restricted to the plains about 1.5 km. west of Chirnahally village and 1/2 km. south of Masanikere village. The outcrops are of unmappable size.

The bore hole data of Masanikere indicates that ultramafics are alternating with gabbro-anorthosite layers
and parallel and closely spaced bands/layers of V-Ti-magnetite (Vasudev and Srinivasan, 1979).

The filed relations of ultramafics indicates that they are intrusives into the quartz-chlorite-calcite schists of the study area.

2.7 GABBRO-ANORTHOSITE SUITE

Anorthosites of Karnataka occur along a prominent arcuate zone, extending for a few hundreds of kilometers in length and 40-50 Km. in width, from south of Mysore through Nuggihalli and Masanikere (Map. 6) to North Kanara and further beyond to Ratnagiri in Maharashtra. This arcuate zone broadly defines a progressive vertical zonation of the crust from northwest to southeast, with the younger supracrustal rocks in the north and the ancient supracrustal belts associated with high-grade gneisses in the south. This zone embraces significant chromiferous ultramafic belts and has been recognised earlier as a prominent geotectonic feature of the Karnataka craton (Pichamuthu, 1956; Srinivasan and Srinivas, 1972; Swami Nath et al. 1976).

Anorthosites of this arcuate zone have been grouped under two tectonic associations as (i) anorthosites of mafic-ultramafic complexes and (ii) anorthosites of layered type in the Archaean high-grade terrain (Ramakrishnan et al. 1978).

In Karnataka craton(Map.6a), ultramafic-mafic complexes(minor anorthositic components) occur at
Masanikere(35), Nuggihalli(34), Holenarasipur(33) and Sindhuvalli(32); the layered anorthosites of Hullahalli(30) and Konkanahundi(31) occur in the high grade terrain. Significantly all these occurrences are confined to the N-S major arcuate belt in the high pressure western block (Rollison et al., 1981) and are localized along a major lineament; the absence of anorthositic rocks in the intermediate pressure eastern tectonic block is strikingly conspicuous. The two blocks seperated by an east-dipping late Archean thrust, have suffered different P-T histories and represent two distinctive basic types of metamorphism possibly reflecting an original difference in crustal thickness (Leelanandam and Narasimha Reddy, 1988).

The anorthosite suite of rocks of Masanikere area can be grouped under the first type i.e. anorthosites of mafic-ultramafic complexes.

A number of gabbro-anorthosite bodies of varying dimensions from less than 1 sq.kms. to 2.5 sq.kms. carrying several lenses and bands of V-Ti-magnetites and disseminations of sulphides are noticed in the area. These rocks with V-Ti-magnetite ore bodies are emplaced as lensoid narrow elongated bodies within the quartz-chlorite-calcite schists. The gabbro-anorthosite rocks occur as parallel bands, patches and lenses exposed (Fig.2.7 & 2.8) 1 Km. east and 1.5Km. south and also 3 Kms. southwest of Masanikere village. Small out crops of these rocks are also noticed l
Km. west of Taverekere village and 1.5 Km. east of Magyathahally village. They exhibit gradational relationship with ultramafics near Masanikere and Chirnahally villages. They are highly deformed and metamorphosed under greenschist facies metamorphism.

These rocks are classified based on their field, petrographic and mineralogical variations as magnetite-gabbro, gabbro, anorthositic gabbro, gabbroic anorthosite and anorthosite. They exhibit gradational relationship within them as has been noticed in the bore hole logs of the study area.

2.7.1 Magnetite-gabbro

Out crops of magnetite-gabbro cannot be made out on the surface. It is recognised only in drill cores. Plagioclase and V-Ti-magnetite are the essential constituents with small amounts of hornblende, pyrite and chalcopyrite. The V-Ti-magnetite crystals get segregated to form bands/layers in the rock. Pyrite and chalcopyrite occur as disseminations throughout the rock.

2.7.2 Gabbro

Out crops of gabbro are noticed towards west of Magyathahally and south and east of Masanikere villages. It is highly deformed and metamorphosed. It consists essentially of plagioclase and hornblende with minor magnetite and calcite.
2.7.3 Anorthositic gabbro

The gabbro grades on to anorthositic gabbro with a decrease in the content of hornblende. It is composed essentially of plagioclase with subordinate amounts of hornblende and accessory minerals like magnetite and calcite.

2.7.4 Gabbroic anorthosite

With a decrease in the amount of hornblende, anorthositic gabbro grades on to gabbroic anorthosite. Plagioclase is the chief constituent with a small amount of hornblende and accessories like magnetite and chalcopyrite.

2.7.5 Anorthosite

Anorthosite is composed principally of plagioclase with accessories like hornblende, calcite, magnetite, pyrite and chalcopyrite.

Anorthositic gabbro, gabbroic anorthosite and anorthosite bodies are well exposed as patches and parallel bands near Masanikere village bordering the V-Ti-magnetite ore bands (Fig.2.7 & 2.9). In the field, it is very difficult to demarcate the boundaries between these rock types. These bodies occupy the eastern and southern flanks of the Veeranna Gudda (Δ 3313', Fig.2.10) in the area.
2.8 V-Ti-Magnetite Deposits

The V-Ti-magnetite deposits of Karnataka have come to be explored in detail in recent years. These deposits occur within the early Precambrian gabbro-anorthosite members spatially associated with ultramafic rocks emplaced in the platformal miogeosynclinal regions of the Dharwar greenstone belts. The spatial association of quartzite-limestone-phyllite assemblage with V-Ti-magnetite bearing igneous suite points to their platformal or miogeosynclinal tectonic setting (Vasudev and Srinivasan, 1979). The V-Ti-magnetite deposits of Karnataka are confined to the 'Dharwar type' greenstone belts and they are not reported to occur in 'Keewatin type' greenstone belts as distinguished by Ramakrishnan et al. (1976).

In the Masanikere area, V-Ti-magnetite deposits are associated with gabbro-anorthosite suite of rocks and they are distributed over an area of about 83 sq.kms. in the southeastern part of the Shimoga schist belt. These deposits with the gabbro-anorthosite suite of rocks exhibit intrusive relationship with quartz-chlorite-calcite schists. Several V-Ti-magnetite ore bodies occur both as parallel and discontinuous bands exposed prominently in the ridges and the hilly regions of the area. The ore bands have different trends with variable amounts of dip. The major ore bodies have 3 to 50 m. of surface width and length of 0.5 to 1 km. The ore bodies are confined to magnetite-gabbro which grades on to gabbro, gabbroic anorthosite and anorthosite with the
depletion of chloritized hornblende and magnetite. Exploration by drilling carried out by Geological Survey of India at Masanikere has indicated that V-Ti-magnetite deposits consist of a number of parallel and closely spaced bands of magnetite and magnetite bearing gabbro-anorthosite layers alternating with tremolite-actinolite schist and serpentinites. These ore bodies are co-folded with these host rocks, indicating that the ore bodies are conformable layered type.

Mineralogic studies of V-Ti-magnetite deposits reveal that they are composed of both oxide and sulphide assemblages as follows:

2.8.1 Oxides

Oxides are represented by hoegbomite, magnetite, ulvöspinel, pleonaste, ilmenite, rutile, hematite (martite), maghemite and goethite. Megascopic identification of these minerals in the massive V-Ti-magnetite ore is not possible as these minerals are fine grained in nature and some of them are highly altered. However, they are confirmed by ore microscopic studies and they are described in detail in Chapter IV.

In this chapter an attempt is made to give the geological setting, mode of occurrence, physical characters and ore localities of V-Ti-magnetite ore and the associated sulphides.
2.8.1.1 V-Ti-magnetite ore

The regional geological mapping of the area under investigation has revealed that the occurrence of several V-Ti-magnetite ore bodies that are well exposed and located near the prominent villages of Masanikere (75° 59' -13° 51') Taverekere (75° 58' -13° 51'), Magyathahally (75° 56' - 13° 53') and Ubrani (75° 55' -13 51') in Channagiri taluk, Shimoga district (as shown in the geological map of the Masanikere area, Map.5). The ore localities are as follows:

Masanikere deposit

Masanikere deposit consists of four V-Ti-magnetite bands which occur on the ridges located 1 Km. east and 3 Kms. northeast of Masanikere village. Of all the deposits, Masanikere deposit is the biggest in the area.

One of these V-Ti-magnetite bands is confined to Δ 3313 which is locally named as Veeranna Gudda (Fig.2.10). The V-Ti-magnetite band extends over a strike length of nearly 1 Km. with surface width of 5 to 52m. The ore band has deep westernly dip of 65 to 85 (Fig.2.12). The main magnetite body runs in NNE-SSW direction and the float ore pebbles have been noticed over an area of 36.5 hectares on the western slopes of Δ 3313.

There are two parallel V-Ti-magnetite bands confined to the ridge located 3 Kms. NE of Masanikere village. These
ore bands vary in length from 500 to 550 m. and in width from 25 to 30 m. These two ore bands strike in NNE-SSW direction with dips of 65° to 75° west.

In addition to these three prominent ore bands, a small ore band is located 2.4 Kms. ENE of Masanikere village. This ore band trends in NNE-SSW direction with a strike length of about 300 m. and width of 10 to 20 m.

The ore bands of Masanikere deposits are highly deformed and weathered. The ore bodies are traversed by two sets of joints and the resultant blocks are rectangular (Fig.2.11). The fresh ore samples are hard, compact, medium grained, steel grey in colour with black streak and metallic lustre. The ore is strongly magnetic. The ore bodies are weathered giving brown colouration and reddish brown streak. The ore samples of weathered bodies are feebly magnetic.

Taverekere deposit

Taverekere deposit consists of four V-Ti-magnetite bands which occur as parallel and discontinuous bands confined to the prominent ridges which trend in NNE-SSW direction, located towards west and SSW of Taverekere village. These ore bands are exposed intermittently over a strike length of 1 Km. and they are located 400 m. west and 1.8 Km. SSW of Taverekere village. The ore bands have easternly dips ranging from 35° to 70° (Fig.2.13). The exposures of the ore bodies are deformed and traversed by two sets of joints resulting in rectangular blocks. The ore bands are
slightly weathered compared to the other ore bands of the other deposits of the area. The fresh ore samples collected from this deposit are hard, compact, fine grained, steelgrey in colour with metallic lustre and black streak (Fig.2.15). The ore sample of the fresh bands is strongly magnetic. The ore samples of slightly weathered ore bodies are light brown in colour and moderately magnetic. Float ore pebbles and boulders are found to be scattered along the flanks of ore ridges. They have also been carried down to plains and valley regions where they are uniformly distributed.

Magyathahally deposit

Magyathahally deposit consists of two discontinuous V-Ti-magnetite bands with a strike length of 675 m. and 600 m. and width of 5 to 25 m. respectively.

The ore bands are confined to NNW trending ridge which is located about 1 Km. east of Magyathahally village. These ore bands are striking in NNW-SSE direction with variable dips of 25° to 40° towards east. The float ore is scattered uniformly on the western flank of the ridge and also on the plains around the ridge. The ore bodies are weathered and deformed. The weathered ore samples are reddish brown in colour. The exposures of this deposit are also traversed by two sets of joints which gives rise to rectangular blocks of the ore bodies.
Ubrani deposit

Ubrani deposit consists of four V-Ti-magnetite bands which occur both as discontinuous and parallel bands located towards south, north and northeast of Ubrani village.

One of these ore bands is prominent which occurs as discontinuous ore bodies confined to three ridges locally identified as Soppinamathi (Δ 2977'), Nadlamathi (Δ 3020'), and Konemathi (Δ 3100'). These ridges together are striking in NE-SW direction. The surface exposures of ore bands are traversed by two sets of joints resulting in rectangular blocks. The ore bodies of three ridges are described in detail as follows:

Soppinamathi

The ridge Soppinamathi is located at a distance of about 0.75 Km. NW of Ubrani village. The ore band is confined to the ridge portion striking N 40° E with dips of 30° to 60° to the east. The ore body is exposed over a strike length of 430 m. and width of 20 to 30 m. The ore is compact, fine grained and massive in habit. It is greyish black in colour. The float ore is found scattered on the dip slope side of this ore band.

Nadlamathi

This ridge is located 1 Km. north of Ubrani village and NE of Soppinamathi. The V-Ti-magnetite is confined to this
ridge and is running for a length of 270 m. with an average width of 25 m. The ore is slightly weathered at places, light reddish brown in colour and coarse grained. It is laminated and feebly magnetic. The ore band strikes in NE direction with a dip of 50° to east. Float ore is distributed uniformly towards the eastern flank of the ore band.

Konemathi

The Konemathi ridge is located 1.6 Km. NNE of Urbani village. The V-Ti-magnetite band is confined to ridge portion and is extending over a strike length of 450 m. in NE direction and with a width of 25 to 35 m. The ore is weathered on the surface out crops and it is light brown in colour.

There are two parallel V-Ti-magnetite bands exposed on small ridges located about 1.6 Km. NE of Ubrani village. The ridges on which the ore bands occur, are locally identified as Gubemardi (A 2942) and Hulimardi (A 2993). The ore bands are exposed discontinuously over a strike length of 1200 m. along NNE-SSW direction with 28° to 66° dip towards west.

Gubemardi

Gubemardi is located 1.4 Km. NE of Ubrani village and it forms the western band of the two parallel ore bands. The ore band is exposed discontinuously over a strike length
of 550 m. with a width of 8 to 15 m. The ore band strikes in NE direction and dips at an angle of $55^\circ$ to the east.

Hulimardi

The V-Ti-magnetite band is confined to Hulimardi ridge and forms the eastern band. The ore band strikes in NE over a length of 450 m. with a width of 8 to 12 m.

The ore is massive, fine grained, greyish black in colour and feebly magnetic. The ore bodies are traversed by two sets of joints. The float pebbles and boulders are distributed in between Gubemardi and Hulimardi ridges. The float is weathered giving light reddish brown colouration.

In addition to these major ore bands, there is another small ore band exposed 1 Km. SSW of Ubrani village. This band is confined to the ridge ($\Delta 2981$) portion running in NE direction with a dip of $40^\circ$ to the east. This ridge is locally identified as ultramathi. The ore band runs for a strike length of 250 m. with a width of 20 m. The ore is fine grained, massive and weathered. It is feebly magnetic.

2.8.1.2 Sulphides

Iron and copper sulphide mineralisation is confined to V-Ti-magnetite ore bodies and magnetite-gabbro and to some extent to anorthosites of Masanikere area, which is indicated in the core samples collected from bore holes drilled by the Geological Survey of India. Sulphides are not noticed in the surface outcrops of V-Ti-magnetite ore.
bodies and gabbro-anorthosite suite of rocks. However, presence of sulphide mineralisation in the magnetite ore bands and gabbro-anorthosite suite of rocks is indicated by malachite stains and encrustations on the ore bodies of surface exposures of the area. Though, sulphide assemblage is represented by pyrite, chalcopyrite, sphalerite, pyrrhotite, cubanite and covellite, it is not possible to identify all these sulphide minerals except pyrite and chalcopyrite, as other sulphides are fine grained and occur in small proportions in the ore bodies and also gabbro-anorthosite suite of rocks. A detailed ore microscopic descriptions of sphalerite, pyrrhotite, cubanite and covellite are given in Chapter IV. Only pyrite and chalcopyrite which are identified megascopically are described in the following pages.

Pyrite

Pyrite is the most abundant primary sulphide mineral among the sulphide assemblages of the area. The mineral is yellowish white in colour and euhedral in outline. It occurs as disseminations in the V-Ti-magnetite ores, magnetite-gabbro and anorthosite, in close association with chalcopyrite and magnetite. Grain size varies from coarse to fine.

Chalcopyrite

Next to pyrite, chalcopyrite is the abundant sulphide
mineral in magnetite-gabbro, anorthosite and magnetite ore bodies of the area. It is disseminated throughout these lithological units in the form of subhedral to anhedral grains. It is greenish golden yellow in colour showing tarnishing effects when exposed to the air. It is closely associated with pyrite and magnetite.

2.8.1.3 Details of exploratory drilling

Of the four V-Ti-magnetite deposits of area around Masanikere, the Masanikere deposit is the biggest in the area and it was taken up for a detailed investigation by Geological Survey of India. The area has been mapped on 1:2000 scale with 5 m. contour interval. The main magnetite body near Masanikere village, extends over a strike length of 1 Km. Trenches were excavated (Fig.2.16) across the ore body at 150 m. intervals to expose the contacts and to collect groove samples. Pits were excavated on a rectilinear grid of 150 m. x 30 m for assessing the float ore.

The results of preliminary investigation by Geological Survey of India, indicates that magnetite ore bands are of good widths with an average $V_{2O_5}$ content of 1% and float ore persisting to appreciable depths, consequently drilling was undertaken to test the magnetite body in two levels at 60 m. and 100 m. below the surface. The bore holes are being drilled to a strike interval of 150 m. The bore hole data has indicated that the magnetite body occurs as numerous
parallel bands with width varying from 0.3 to 4.5 m. The cumulative width of magnetite bands varies from 13.2-19.3 m.

Ore reserves

Ore reserves of Masanikere, Taverekere, Magyathahally and Ubrani deposits were given by Chayapathi (1976) as follows:

Masanikere deposit

(a) Insitu ore: Based on the data obtained from the bore holes and extrapolating the same to a vertical depth of one hundred meters, a reserve of 4.18 million tonnes has been estimated from the Masanikere deposit. Nearly one third of this could be considered as quarriable reserve, upto a depth of 30 m.

(b) Floatore Reserves of float ore, as proved by pitting on 150 m. x 30 m. grid over an area of 36.5 Kms. is 5.35 lakh tonnes to depths varying from 0.3 to 1.8 m.

Magyathahally deposit

This deposit has a length of about 700 m. and width of about 10 m. and depth of 50 m. (assumed). Reserves estimated are 0.8 million tonnes with vanadium metal content of 0.59%.

Taverekere deposit

Length of the deposit is about 1 Km. with a width of
about 5 m. and depth assumed to be 50 m. Reserve estimation of this deposit is about 0.58 million tonnes with vanadium metal content of 0.3 to 0.89%.

Ubrani deposit

Length of the deposit is about 500 m. and width about 10 m. and depth assumed to be 100 m. In this deposit reserves estimated are about 1.16 million tonnes with vanadium metal content of 0.59 to 0.75%.

2.9 Dolerite dykes

Dolerite occurs as dykes cutting across the gneisses and schists of the study area. There are only two dolerite dykes observed in the area. A dolerite dyke is found to occur 1.6 Km. north of Gangondahally village in the lower flank of the ridge striking S60° E with a strike length of 300 m. and a width of 20 to 25 m. This dyke occurs within the granitic gneisses of the area.

Another dolerite dyke cutting across the schists is seen exposed in the low-lying land, 1.6 Km. NNE of Gangondahally village. This dyke is trending in N 20° W with a strike length of about 250 m. and width of 10 to 20 m.
MAP 5. GEOLOGICAL MAP OF MASANIKERE AREA

LEGEND

- DOLERITE DYKE
- V-TI-MAGNETITE BANDS WITH GABBRO-ANORTHOSITES
- ULTRAMAFICS
- QUARTZ - CHLORITE - CALCITE SCHISTS
- QUARTZITE BANDS
- GRANITIC GNEISS

TO BHADRINATH

13°49'
76°54'

TO CHANNAGIRI

13°54'

1.6
3.2 KM

TO TARIKERE

Map 6 - Anorthosites of Karnataka.
Map 6a. Geological map of the Karnataka craton (after Rollinson et al., 1981) showing anorthosite occurrences (no. 29-35).
Fig. 2.1 Island like domal masses of granitic gneisses exposed 1 km. west of Taverekere village.

Fig. 2.2 Ridges of granitic gneiss seen 1 1/2 km. East of Gangondahally village.
Fig. 2.3 Discontinuous and parallel bands of quartz-chlorite-calcite schist exposed 2 km. southeast of Masanikere village.

Fig. 2.4 Parallel bands and patches of quartz-chlorite schist.
Fig. 2.5 A prominent quartzite band exposed about 700 m. south of Masanikere village.

Fig. 2.6 Lensoid bodies and bands of serpentinites exposed in the ridge located 2.5 km. south of Masanikere village.
Fig. 2.7 Parallel bands and lenses of gabbroic anorthosite exposed on the ridge (Veeranna gudda) east of Masanikere.

Fig. 2.8 Patches of gabbros exposed near Masanikere bordering the V-Ti-magnetite ore bodies.
Fig. 2.9 Close up view of anorthosite bodies exposed South of Masanikere village.

Fig. 2.10 General view of Veeranna gudda (A-331) where V-Ti-magnetite ore bodies and gabbro-anorthosite bodies are exposed towards east and southeast of Masanikere village.
Fig. 2.11 Two sets of joints developed in the V-Ti-magnetite ore bodies resulting in the formation of rectangular blocks.

Fig. 2.12 Bands of V-Ti-magnetite ores with steep dips towards west, exposed on the top of Veeranna gudda.
Fig. 2.13 Gently easterly dipping V-Ti-magnetite ore bands exposed in the ridge located west of Taverekere village.

Fig. 2.14 Parallel bands of V-Ti-magnetite ores exposed towards northeast of Ubrani village.
Fig. 2.15 Fresh outcrops with bouldery nature of V-Ti-
magnetite ores exposed in the ridge located east
of Taverekere village.

Fig. 2.16 Trench excavated in V-Ti-magnetite ore ridge
(Veeranna gudda) east of Masanikere village by
Geological Survey of India.