CHAPTER II

THE KOLAR SCHIST BELT

Geology

The Kolar Schist Belt lies about 80 km east of Bangalore city in South India. The South Indian Craton which includes the Dharwar Craton or the Karnataka Craton, is divided into three major provinces based on their tectonic style, stratigraphy and metamorphic grade such as, 1) southern high grade province, 2) central greenstone-granite province, and 3) north eastern province (Fig. 2.1). The central greenstone-granite province of the craton has been subdivided into two blocks by Swami Nath et al. (1976) on the basis of the difference in metamorphic grade and structural complexity, namely Eastern and Western blocks with respect to central band of intrusive granite known as the Closepet granite. The Eastern block consists of narrow linear volcanic-dominated greenstone belts and the Western block consists of broad, very large sediment-dominated greenstone like geosynclinal piles. Eastern belts are believed to be older and are thought to be equivalent to Sargur supracrustals. Western belts are believed to be younger than the Eastern block belts and are known as the Dharwar supergroup. One of the important aspects of the schist belts of the Eastern block is their associated economic gold mineralization.
Fig. 2.1: South Indian Craton and its major provinces
It is to this block the well-known Kolar Schist Belt belongs, which is one of the important gold bearing belts, followed by Hutti, Ramagiri and Kadiri.

Although gold is being systematically mined for the last several decades from the schist belts of the craton, very little is known about the stratigraphic and time relationships between the Eastern block schist belts and the surrounding Peninsular Gneisses in general. However, the stratigraphic and time relationship of the schist belts of the Western block are relatively well-known and have been accepted as post-dating the dominant gneisses of the craton suggesting an ensialic setting for the Western block belts. The Kolar Schist Belt is believed to have been formed before any sialic crust formation in the craton, most probably as primitive oceanic type crust (Swami Nath et al. 1976; Naqvi et al. 1978) and thus these authors believe that the Kolar belt is one of the oldest schist belts in the Dharwar Craton. Radhakrishna (1983) also believes that the Kolar is one of the oldest belts in the Dharwar Craton. However, Ramakrishnan et al. (1981) proposed that the Sargur type supracrustals could be the oldest followed by Peninsular Gneisses and the Dharwar supergroup which includes an older Bababudan group and an younger Chitradurga group.
They consider the Kolar Schist Belt is equivalent to Bababudan. However, Drury et al. (1984) disagree with these two schools and proposed that all the greenstone belts/schist belts are younger to the major components of the Peninsular Gneisses in the Dharwar Craton. Thus, the exact stratigraphic position of Kolar Schist Belt in the Dharwar Craton is not clear.

Vinogradov et al. (1964) based on their dating of galena from the Kolar Schist Belt suggested an age of 2900 ± 200 Ma for the Kolar amphibolites. Bhalla et al. (1978) based on Rb/Sr dating on all several gneissic rocks around the Kolar Schist Belt suggested an age of 2800-2900 Ma. S. Balakrishnan (personal communication) based on Nd-Sm systematics on komatiitic rocks of the Kolar Schist Belt suggests a probable age of 2840 Ma for the best fit isochron; however, his suggestion needs further confirmation by Pb-Pb method, because of the possible mantle heterogeneities for the sources of the Kolar komatiitic rocks (Balakrishnan et al. 1985).

Recently, E. Krostad (personal communication) based on U-Pb dating of zircons and sphenes from the enveloping gneisses of the Kolar belt suggested an age of 2620 ± 1 Ma for the western side gneisses and 2529 ± 1 Ma for the eastern side gneisses. This age data indicate that
atleast some components of the gneisses around Kolar
could be younger to atleast some rocks of the schist
belt; unequivocal field relations of these gneisses to
the amphibolites are obscured by intense N-S shearing
and mylonitization that had affected both the gneisses
and the schist belt.

The Kolar Schist Belt is a narrow, about 2 to 4
km width, linear about 80 km long, N-S trending Archean
greenstone belt (Fig. 2.2). It extends from Srinivaspur
(13°21': 78°13') in the north to Mallappakonda (12°46':
78°14') and beyond in the south where it pinches out as
tails and then breaks up further into several rafts. It
mainly consists of metavolcanics with very little sedi-
ments. Among the volcanics it consists predominantly of
mafic volcanics with pillow structures, which are repre-
ented by various textural types of amphibolites. Along
the eastern margin of the belt, a fine grained, leucocra-
tic and well foliated felsic gneiss unit occurs, known
as the Champion Gneiss, which could probably represent
metamorphic felsic volcanics. Banded iron formation,
possibly the only chemical sedimentary component, occurs
as multiply and tightly folded unit all along the western
margin of the belt, almost continuously from south of
Mallappakonda to a few kilometers north of KGF. Banded
**INDEX**

- Lofrite (Lofrite)
- Potassic granite (Potassic Granite)
- Greenstone and several including quartz-monzonite and pegmatite
- Banded-horizontally chert interbedded with graphitic phyllite
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- Massive meta-basalt interbedded with meta-gabbro and subordinate graphitic chert
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**Geological Features**

- Strike and dip of foliation & schistosity
- Strike and dip of bedding
- Plunge of minor synform
- Plunge of minor antiform

**Faults**

- Gold mines
- Champion gneiss with polymeric components

**Fig. 2.2**

**GEOLOGICAL MAP OF KOLAR GREENSTONE BELT**

**KARNATAKA**
iron formation also occurs as discontinuous patches on the eastern margin in association with Champion Gneiss and also at several places within the belt. Immediately to the east of western banded iron formation, in the central part of the belt near Kolar Gold Fields mining area, and also intercalated with banded iron formation, thin beds of graphitic/sulfidic schist occur, interbedded with tuffaceous amphibolites. Based on the chemistry of these units, Behera (1983) suggested that these graphitic schists were metamorphosed carbonaceous argillite. The belt is surrounded and apparently intruded by granitic gneisses varying in composition from tonalitic to granite (Viswanatha and Ramakrishnan, 1981; Balakrishnan and Rajamani, 1986). A multiply deformed, polyphase migmatitic unit occurring along the western margin of the belt constitutes the Peninsular Gneisses (Viswanatha and Ramakrishnan, 1981). Near the western margin of the belt, this unit encloses several enclaves of older supracrustals locally known as Sakarsanahalli formations which are believed to be equivalent to the Sargur group (Viswanatha and Ramakrishnan, 1981). The belt is surrounded on both sides by diapiric tonalitic to granodioritic bodies known as the Bisanattam granite. A K-granitic pluton known as the Patna granite intrudes the belt in the northern part. The belt is considered as the multiply-folded synform with a
northernly plunge and is sliced by three sets of major transverse fault systems. The Kolar Schist Belt is cut and interlayered with dolerite dykes throughout the terrain. The belt has undergone a middle amphibolite facies metamorphism at least in the central part (Rajamani et al. 1981). The stratigraphy of the rocks in and around the belt, as proposed by Viswanatha and Ramakrishnan (1981) is shown in table 2.1.

The mafic volcanics are texturally represented by mainly four types of amphibolites such as schistose, massive, granular and fibrous. Among these varieties massive amphibolite with 300-500' width extends in the N-S direction along the central part of the belt. The massive amphibolite pinches out towards Mallappakonda. The belt has been divided into western and eastern parts in the KGF area with respect to this central massive amphibolite unit. The schistose amphibolite forms the general country rock. Beds of granular amphibolite are numerous, alternating with schistose amphibolite and are parallel to the general strike of the belt.

Chemically these mafic volcanics are mostly tholeiitic and komatiitic in nature, the former being much more dominant than the latter. Unlike komatiitic rocks from other greenstone belts of the world, Kolar
<table>
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<tr>
<th>DEHWAR SUPERGROUP (?)</th>
<th>KOLAR GROUP</th>
<th>SARKARSAHALLI ASSOCIATION</th>
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<tbody>
<tr>
<td>Basic Dykes</td>
<td>Dolerite, norite, diorite porphyry</td>
<td>Ultra-mafic rocks</td>
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<td>Gold Lodes</td>
<td>Quartz veins</td>
<td>Ironstone (locally manganiferous)</td>
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<td>Patna Granite</td>
<td>Porphyritic potassic granite</td>
<td>Veined calc-silicate rock and veined mafic amphibolite</td>
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<td>Bisnattam Granite</td>
<td>Diapiric tonalite to granodiorite</td>
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<td>Gold Field Volcanics</td>
<td>Metabasalt, hypersthene basalt, basaltic andesite, pyroxenite and gabbro with ironstone and black shale</td>
<td>Cordierite – anthophyllite rock</td>
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<td>Champion Gneiss</td>
<td>Wackes, felsic volcanics and pyroclastic rocks with ironstone and polymict conglomerate</td>
<td>Cordierite – sillimanite – corundum quartzite and mica schist, fuchsite quartzite</td>
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<td>Yerrakonda Formation</td>
<td>Ironstone and graphitic schist with gabbro and pyroxenite</td>
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<td>Kalhalli Amphibolite</td>
<td>Schistose and fissile amphibolite with pyroxenite, gabbro and ironstone</td>
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<td>Peninsular Gneiss</td>
<td>Migmatitic gneisses</td>
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--- Base not seen ---
komatiitic rocks were shown to have been derived by low per cent partial melting of incompatible element enriched mantle sources (Rajamani et al. 1985). In view of the importance of these komatiitic rocks as possible source for gold (Rajamani, 1982) detailed petrogenetic and isotopic studies are being carried out.

Balakrishnan and Rajamani (1986) studied the felsic gneisses including the Champion Gneiss and they have found unusually higher chromium and nickel abundances in the Champion Gneiss for their MgO and SiO₂ contents. Based on their geochemical studies they suggested that the Champion Gneiss could have been derived by low per cent melting of komatiitic amphibolite at mantle depths.

Banded iron formation is typically a banded ferruginous quartzite in the central part of the belt. Along the western margin of the belt it is interlayered with amphibolites and graphitic/sulfidic schists. In the southern part near Mallappakonda, the banded iron formation is a finely banded magnetite quartzite and towards north in the central part of the belt this unit of magnetite pinches out and it is replaced by thick banded ferruginous quartzite (Behera and Rajamani, 1985). Similar ferruginous quartzite units occur at several places within the belt as at Yerrakonda.
More details on the geology, structure, metamorphism and petrogenesis of the schist belt have been extensively discussed in Narayanaswami et al. (1960), Ziauddin (1967), Anantha Iyer and Vasudev (1979), Rajamani et al. (1981, 1985), Viswanatha and Ramakrishnan (1981), and Balakrishnan and Rajamani (1986).

Mineralization

The geology and genesis of gold mineralization in the Kolar Schist Belt was studied earlier by several workers (Pryor, 1923; Bourdon, 1946-47; Narayanaswami et al. 1960; Anantha Iyer and Vasudeva Murthy, 1970, 1976; Ziauddin et al. 1980; Safonov et al. 1980, 1984). The geology and structure of the auriferous lodes were discussed earlier by Narayanaswami et al. (1960). Gold occurs within the belt both as gold-quartz lodes and as gold-sulfide lodes associated with amphibolites as in Kolar Gold Fields and with banded iron formations as at Mallappakonda. Fifteen parallel lodes including six quartz lodes in the eastern part of the schist belt and nine sulfide lodes and graphitic sulfide lodes in western part of the belt have been reported by Narayanaswami et al. (1960). The lodes are subparallel and occur at intervals of 200' to 600' across the strike. Narayanaswami et al. (1960) observed that the gold-quartz lodes
are composed exclusively of quartz, native gold and minor oxides including scheelite, magnetite and ilmenite and sparse sulfides including galena, pyrrhotite, pyrite, arsenopyrite and chalcopyrite. The sulfides and oxides apparently constitute less than 1 volume per cent of the lode matter and are very localised in their occurrence and distribution. The sulfide lodes on the contrary contain 3-10 volume per cent sulfides which include pyrrhotite, arsenopyrite, pyrite, chalcopyrite and minor galena; pyrrhotite and arsenopyrite together make up more than 90 volume per cent of the sulfides. Ziauddin et al. (1980) also studied the gold bearing lodes and classified them on the basis of their mineralogy into two types, such as (1) Gold-quartz lodes with or without impregnation of minor sulfides in the ultramafic-mafic metavolcanics, and (2) strata bound/stratiform deposits with or without quartz vein in the banded iron formation of sulfide or oxide type. Gold is more abundant in the former than in the latter and the reported gold content in the former is about 7-10 dwt/tonne, while in the latter it is 5-6 dwt/tonne. Narayanaswami et al. (1960) after extensive field studies, suggested that structural features such as shears, fissures, faults, fold hinges and stratigraphic contacts played an important role in localising hydrothermal gold mineralization. Based on
the geochemistry of the country rock and the alteration zones around gold-quartz lodes in Kolar, Anantha Iyer and Vasudeva Murthy (1976) suggested that the constituents of the ore body were derived from the surrounding country rocks, towards the waning stages of Dharwar orogeny. Ziauddin et al. (1980) suggested that the rocks of the Peninsular Gneissic complex underlying the greenstone belt could be potential sources for gold. However, the basis of this suggestion has not been explained adequately. Vasudev (1982) studied the graphitic sulfide deposits of the Kolar Schist Belt and suggested that the sulfide bands are co-folded with the host rocks and exhibit structures and textures indicative of deformation and metamorphism of the ores and the host rocks isofacially. Safonov et al. (1980) carried out sulfur isotope studies on few sulfide minerals of the Champion lode and suggested a magmatic source for sulfur. Safonov et al. (1984) also carried out fluid inclusion studies on quartz from the Champion lode and suggested a temperature of ~300°C for the ore solutions. It is noted here that not much attention has so far been given to the geochemistry of the ore. This aspect is particularly important in understanding the physico-chemical conditions of gold deposition (Kerrich, 1980). As a part of our major study on the origin and evolution
of Kolar Greenstone Belt and its associated gold mineralization, we studied the gold ore deposits for their field, detailed mineralogical and geochemical aspects to understand their nature and genesis.

Geology of Lodes: Present Study

In the Kolar Schist Belt, gold occurs both as gold-quartz-sulfide lodes and as gold-quartz-carbonate veins associated virtually with all the rock components of the belt. On the basis of intensity of gold mineralization and mining activity, the belt can be conveniently divided into three parts along the strike, namely North Kolar Schist Belt (NKSB), Central Kolar Schist Belt (CKSB) and South Kolar Schist Belt (SKSB) (Fig. 2.3). Dominant gold mineralization and therefore, extensive mining is confined to the Central Kolar Schist Belt. New gold lodes with economic concentrations of gold have been discovered in the South Kolar Schist Belt, whereas in the North Kolar Schist Belt gold mineralization appears to be rather poor and uneconomic to sub-economic (Gokul et al. 1980).

North Kolar Schist Belt

The North Kolar Schist Belt, which lies north of KGF area has been subjected to extensive weathering and lateritization processes at many places and therefore,
Fig. 2.3: Kolar Schist Belt and its major blocks.
the area is covered with thick profile of soil and lateritic cappings, concealing the geology of the belt. In addition, the area is being drained by the local Palar river system. Geological Survey of India has carried out drilling operations and traced minor auriferous zones. Here gold occurs sporadically as auriferous carbonaceous sulfidic cherts in association with amphibolites. These auriferous lodes are parallel to the schistosity of the amphibolites and vary in strike length from a few metres to about 200 m with an average width of about 1 m as reported by Gokul et al. (1980) and these ores are rather uneconomic. However, in the southern part of North Kolar Schist Belt, particularly in Manigatta area, gold occurs both as gold-quartz-sulfide lodes and as gold-quartz-carbonate veins and are relatively rich in their gold concentration. The gold-sulfide lodes at Manigatta have relatively higher amounts of sulfides mostly pyrrhotite, arsenopyrite, pyrite with moderate amounts of magnetite. The gold-quartz-carbonate veins have stringers of scheelite. All these ore zones at Manigatta seem to be subeconmic in nature. It was not possible to obtain drill core samples from the Geological Survey of India for any geochemical study.
Central Kolar Schist Belt

Gold mineralization is most intensively developed in the Central Kolar Schist Belt, the area lying in between Patna intrusive body in the north and Bisanattam intrusive body in the south. In the Central Kolar Schist Belt, there are several parallel, N-S running gold lodes occurring both as gold-quartz-sulfide lodes and as gold-quartz-carbonate lodes within the amphibolites (Fig. 2.4). The auriferous sulfide layers are mostly confined to the western part of the central massive amphibolite and the gold-quartz-carbonate lodes are present in the eastern part. This assymmetry in the nature of gold-mineralization in the Kolar Schist Belt is rather interesting and to be understood.

Here, in the Central Kolar Schist Belt, a minimum of four horizons of auriferous sulfide lodes occur within a 1.5 km thick section of the amphibolites. All these auriferous sulfide layers are stratiform associated with banded magnetite-chert interlayered with mafic volcanics. These lodes from west to east within the western part are known as West Prospect lode, Oriental lode, McTagaart West, McTagaart East. The width and length of all these lodes are variable and all of them are parallel to each other and inturn parallel to the schistosity of the host
Fig. 2.4: Distribution of gold sulfide lodes and gold quartz lodes in the Central Kolar Schist Belt.
amphibolite. These ore lodes are commonly confined to the stratigraphic contacts of the various varieties of amphibolites. They have commonly a strike length of a few kilometers. These lodes consist of bands/layers of sulfides, cherty-quartz, oxides and mafic minerals, and the width of these bands varies from west to east. These lodes grade into unmineralized sulfide iron formations towards west, which are closely associated with thin bands of graphitic/sulfidic schists. All these lodes are cut by the central Mysore fault system and are being mined to a depth of about 1.5 km. The average gold values for the sulfide lodes is approximately 4-5 ppm. The geology and detailed field observation of various lodes is described below.

West Prospect lode:

West Prospect lode occurs at the western margin of the schist belt, approximately 600 m west of the Oriental lode. It occurs in association with massive amphibolite interlayered with graphitic-sulfidic schists. Banded sulfidic chert with mafic intercalations forms the main ore body. The general strike of the ore zone is N-S and the dip is usually steep and varies from 60° to 80°. The lode extends for about 1 km along the strike with width variable between 2 m and 10 m. It consists
of fractured quartz veins and finely laminated cherty bands within the massive amphibolite. The lode is finely layered and is interbedded with banded iron formation and graphitic schists, which are in turn intimately associated with amphibolites. The lode contains approximately upto 10-15 volume per cent sulfides with minor oxide phase. The ore bodies exhibit primary depositional features like laminations in sulfides and chert and the ore zones are parallel to the schistosity of the host amphibolite (Fig. 2.5). The ore zones at many places has monomineralic fine grained sulfide laminae. The sulfide rich laminae show very small folding and penecontemporaneous slumping around fragments of amphibolite. At places remobilization of sulfides particularly pyrrhotite due to deformation into fine fractures cutting the schistosity of the host amphibolite is also observed.

Oriental lode:

Oriental lode is one of the main ore zones in the well known KGF mining camp, occurring about 400 m west of the McTagaart West lode or 800 m west of the central massive amphibolite. This lode is localized along or near the contacts of schistose amphibolite with massive amphibolite in association with banded iron formation which is interlayered with mafic volcanics. The general
Fig. 2.5: Photograph of hand specimen (sample # KGF 22) showing laminated nature of the ore. Sulfides and cherty quartz occurring as distinct bands parallel to the schistosity of the host rock.
strike of the lode is N10°W and dips at over 70°W near the surface and at depth the dip almost becomes vertical. It extends about 2 km along the strike and the width of the lode varies from 10 cms to over 6 m in places with the average width being around 1.6 m. This lode is strongly banded with alternate layers of cherty quartz and amphibolite (Fig. 2.6). The sulfides occur as distinct bands mostly confined to amphibole bands. Significant amounts of oxide phase occur as distinct bands closely associated with sulfide bands. The lode has approximately 3 to 10 volume per cent sulfides along with minor graphite. The ore exhibits very strong layering, layers varying in width between 1 to 5 mm. This layering in sulfides, silicates and chert is much more pronounced in folded structures. Vein quartz and calcite veins are commonly seen in the ore zones. Many of the cherty layers are very thin between a fraction of a mm to 0.5 cms in thickness and persists for long distances.

McTaggart West:

This lode occurs about 800 feet west of the famous Champion lode immediately to the west of the central massive amphibolite. It is associated with granular amphibolite and interlayered with banded iron formation. The strike of the lode is N-S and extends about 1 km
Fig. 2.6: Photograph of hand specimen (sample # KGF 2036) showing the strongly banded nature of the ore. Sulfide bearing mafic minerals and cherty quartz occur as distinct bands.
along the strike with almost vertical dips. This lode is very narrow with the width ranging from mere stringers to nearly 1 to 2 m. This lode occurs as subparallel en echelon lenses with a dextral shift. The ore zones consist approximately 5 to 8 volume per cent sulfides. The ore at places has exceptionally higher quantities of oxide phase. The sulfides and oxides occur as well banded layers. This lode is similar to Oriental lode in its morphological and mineralogical features. However, the occurrence of magnetite as broad distinct monomineralic layers is a significant feature in McTagaart West lode (Fig. 2.7).

Gold-Quartz lodes:

A series of parallel gold-quartz-carbonate reefs occur on the eastern part of the belt running generally parallel to the schistosity of the host amphibolite and parallel to each other. Starting the series from east to west they are known as the Muscoom lode and its branches, the Champion lode and its branches, and the Mundys lode. All of them are associated with amphibolites. These lodes are essentially fissure veins and show sharp contact with the host rock. The entire lode system is generally parallel to the strike of the belt and extend for several kms. Individual veins are commonly less than
Fig. 2.7: Photograph of hand specimen (sample # KGF 41) showing the banding of magnetite and pyrrhotite. Occurrence of magnetite as broad bands is distinctly seen.
1 m in width and many of them cut the schistosity of the host amphibolite at many places. All these lodes are arranged in an en echelon branching pattern. These lodes terminate abruptly and pick up after some interval. These lodes are being mined systematically for the last one hundred years and the portions of these lodes have been mined out to a depth of approximately 3.4 km and the present average gold content is about 10 ppm. The geology and field observations of some of these lodes are as follows:

Champion reef lode: Nearly 90 weight per cent of the gold mined so far in Kolar Schist Belt has come from gold-quartz-carbonate lodes particularly from the famous Champion reef, which has been mined continuously for the last 100 years, over a strike length of about 10 km and upto approximately 3.4 km down dip. It occurs east of the central massive amphibolite and lies approximately 150 m east of Mundys lode. The Champion lode in the CKSB area is localised essentially in the tufted amphibolite and particularly along the stratigraphic contacts. It consists essentially of a series of en echelon veins, lenses, stringers of quartz with branching and horse tailing. This lode has sharp contact with the host amphibolite and the lode extends remarkably for several
kms along the strike and is generally very narrow in width ranging approximately 1 cm to less than 1 m. The lode generally trends parallel to the regional schistosity particularly in KGF area and dips either eastwards or westwards at 65° to almost vertical. However, these lodes cross cut the schistosity and contacts of the various metavolcanic units at high angles in many places. The ore zone includes fragments of country rock amphibolite and the quartz-veins in them give the appearance of fracture-filling.

Mysore Mine ore lodes:

In southern part of the Central KSB mineralization was discovered and developed in the Mysore mine area. Mineralization here appears to be the extensions of the northern part sulfide ore zones of the CKSB. However, these ore zones are poorly developed and sub-economic. Gold mineralization occurs over a strike length of about 250 m in association with banded iron formation within mafic volcanics. Here four distinct gold-sulfide lodes are present striking N-S. All these lodes are parallel to each other and are parallel to the schistosity of the host amphibolites. These four sulfide lodes from east to west in the field are known as I, II, III and IV. All these lodes are from 100 m to
220 m apart across the strike and all of them are occurring towards west of the central massive amphibolite band. Individual lodes are narrow and are relatively limited in their strike length. At places mafic volcanics and graphitic schists are closely interlayered with these ore zones particularly in the western most ore zones. Ore zones are highly cherty in appearance and are highly deformed and disturbed by later shearing and faulting events. The sulfide content of these ore zones is approximately 5 volume percent in the western most lodes and tends to decrease gradually in the eastern lodes.

South Kolar Schist Belt

In the South Kolar Schist Belt, gold mineralization is present in association with all the rock components of the schist belt namely banded iron formation associated with amphibolite, with mafic volcanics and also with felsic volcanics. Here gold-quartz-sulfide lodes seem to be the more dominant type although gold-quartz lodes are also known to occur in the Champion Gneiss. In the South Kolar Schist Belt gold mineralization has been recently discovered in Mallappakonda and Chigarikunta areas in the Chittoor district of Andhra Pradesh and are situated about 25 km south of
KGF area. The geology and the field observations of these lodes are as follows:

Mallappakonda: In Mallappakonda, gold mineralization is associated with banded, cherty, sulfidic iron formation and amphibole-quartzite occurring within amphibolites (Fig. 2.8). The mineralized zones occur over a strike length of about 500 m trending N-S with near vertical dips. The ore zones occur as parallel en echelon lenses with sinistral disposition. The width of the ore zones varies from a meter to as much as 40 m in few cases. The ore zones show greater width in the northern part and split into various lodes along the strike towards south. The width of the individual lodes reduces progressively towards south and they peter out further south as shown in Fig. 2.9.

The ore at Mallappakonda essentially constitutes well laminated amphibole-sulfidic quartzite, in which amphibole and cherty quartz occur as distinct laminae. Sulfide minerals are preferentially concentrated within the amphibole bands. The ore zones at Mallappakonda are characterised by profuse sulfide content approximately 25 volume per cent of the ore zones. Sulfides also generally occur as distinct bands. In Mallappakonda area the ore is almost indistinguishable from the host
Fig. 2.9: Morphology of the Mallappakona ore lodes.
rock (BIF), except it is characterised by an increase in the concentration of sulfides.

Chigarikunta area: In Chigarikunta, gold mineralization occurs in association with mafic volcanics as well as with felsic volcanics of the area. The presence of mineralized zones have been discovered over a strike length of 3 km extending from Chigarikunta in the north to the Nandimadugu in the south. Mineralization is persistent intermittently and is confined to mafic volcanics in the northern part and comes closer to mafic-felsic contact, in the southern part with sinistral shifts. For convenience the mineralized zone is divided into five blocks, namely Block I to Block V (Fig. 2.10). Among these the Block I and III zones are prominent ones.

In the northern part, gold mineralization occurs in the form of sulfidic metacherts within the amphibolite. It extends over a strike length of about 400 m with the average width of about 1.5 m. The general strike of the ore zone is from N-S to NNE-SSW with steep easterly to subvertical dips. The sulfides in the ore zones occur as stratiform layers and make up up to 30 volume per cent of the lode matter.

Block III is also known as Chigarikunta Centenary Block and is located immediately south of Block II. Here
GEOLOGICAL MAP OF CHIGARGUNTA GOLD DEPOSIT

LEGEND

/ Ore zones
VV Amphibolite [Meta basalt]
--- Metagabbro
/// Champion Gneiss
Metapyroxinite

.. Dyke
/// Mine development
O Shaft
□ Old pit

Fig. 2.10
mineralization is present over a strike length of about 1 km. In northern part of the Block III mineralized zone is confined to the amphibolite horizon. As one proceeds to the south it follows the contact of the amphibolite and Champion Gneiss. The mineralized zone is parallel to the regional schistosity, is highly micaeous and contains chlorite, vein quartz with approximately 10 volume per cent sulfides. Among the sulfides pyrite is the dominant phase and is distorted, smeared parallel to the schistosity of the host amphibolite (Fig. 2.11).

About 200 m east of the Chigarikunta ore zones gold occurs in association with Champion Gneiss. These auriferous zones are mainly quartz veins with minor to trace amounts of sulfides, essentially pyrite. Wall-rock alteration is commonly seen along the ore zones.

The field work was carried out in four consecutive summers beginning from 1981, initially to understand the field distribution and geological setting of various gold ore bodies in the belt followed by sample collection for mineralogical and geochemical studies. Because of the systematic mining for gold over the last one hundred years in Kolar Schist Belt, several ore lodes have been accessible for detailed field studies and for
Fig. 2.11: Photograph of hand specimen (sample # CCB-NS) showing the occurrence of sulfides (pyrite) parallel to the schistosity of the host amphibolite.
systematic sampling along the strike and dip of the various ore lodes. Representative grab samples of various ore lodes have been collected from underground mine workings along the strike of the ore lodes and also along the dip of the ore lodes in various levels (Table 2.2). Because of extreme variation in the distribution of sulfide mineralogy and gold content even within a single ore body, our typical samples weigh from 5 kg to 10 kg. A large number of samples were possible from the sulfide lodes, whereas there was considerable constraint in sampling the rich gold-quartz lodes. Therefore, we could collect samples of gold-quartz lodes essentially from the branches of main ore bodies of the Champion and Mundys lodes. The locations of many of the samples used in this study are shown in figure 2.12. The amount of sulfide content and also the individual proportions of various sulfide minerals were estimated based on the visual observation on large number of hand specimen samples and also in polished ore mounts.
Table 2.2: Details of the samples studied

<table>
<thead>
<tr>
<th>Area</th>
<th>Ore deposit</th>
<th>Levels from which samples were collected</th>
<th>Number of samples studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Kolar Schist Belt</td>
<td>West Prospect lode</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Oriental lode</td>
<td>24, 28, 32, 33, 34, 42, 51, 54, 64</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>McTaggart West lode</td>
<td>14, 32, 44, 54, 64, 69</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Mysore mine lode</td>
<td>25</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Mundys lode</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Champion reefs</td>
<td>32, 51, 69</td>
<td>9</td>
</tr>
<tr>
<td>South Kolar Schist Belt</td>
<td>Mallappakonda lode</td>
<td>1, 2, 3</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Chigarikunta lode</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>147</td>
</tr>
</tbody>
</table>
Fig. 2.12: Field locations of the samples studied.
Fig 2.12 (contd)

Plan of 17th level in CR mine

Mundys lode

- 38
- 37
- 36
- 35
- 34
- 33
- 32
- 31
- 30
- 29
- 28
- 27
- 26

Tennants shaft

Mysore mine - 25th level

Champion lode

Level -51
- 24
- 25
- 26
- 27

Level -69
- 28
- 29
- 30

Level -32
- 1807

Lode - IV
- 3
- 4

Lode -III
- 8
- 10

Lode -II
- 11

Lode -I
- 7
- 9
- 5

Edgers shaft

N
Fig 2.12 (contd)

Mallappakonda level - I

Mallappakonda lode level - II

North Drive 50 m

Adit RL 857 m

Adit RL 830 m

South Drive 100 m

South Drive 53 m

Chigasikunta lode level - I

Mallappakonda lode level - III

North Drive 55 m

RL 803 m

South Drive 40 m

North Drive 110 m

Adit RL 735 m

South Drive 53 m

North Drive 50 m

9A 9B

10 16

11

13

14

15

12

10 16

9A 9B

15

14

12

13

11

12

13

14

15

12

10

9

7

11

12

11