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Study of Petrography and Ore Mineralisation of Buddini Area, Lingasugur Taluk, Hutti-Maski Schist Belt, Raichur District, Karnataka, India

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Abstract: ***Gold ore mineralization in greenstone belts is most diverse and widespread in space and time. Archean greenstone belts contribute significantly to the bulk production of gold and other economic mineral deposits of the world. The important minerals that are found in greenstone belts are As, Sb, Cu, Pb, Zn, Hg, W, Te, Fe, Au, Ag, etc. This report thus aims to understand the mineralization zones in the Hatti Maski Schist Belt region using modern techniques of petrographic studies which includes sample collection, rock slide preparation and analysis under a petrological microscope.***

Keywords: Mineralisation, Mining, Prospecting, Greenstone Belts, Schist Belts, Petrography, Ore studies, Lithology, Stratigraphy

1. Introduction

The Archean greenstone belts occurring in various cratonic areas have a high potential for gold mineralization followed by other valuable deposits. The greenstone belts mainly comprise of volcanic and sedimentary sequences and to some extent are comparable from one craton to another in their mode of sedimentation, geochemical characters and stratigraphy. Greenstone belts found in the Archaean cratons generally range in age between 3.5 Ga and 2.5 Ga. These belts usually comprise of mafic/ultramafic volcanic sequences of tholeiitic-komatiitic character followed by volcanics of intermediate to acidic composition. Some of these greenstone belt assemblages have been compared to modem ophiolitic complexes.

The mineralization in Archean belts is manifested by certain parameters such as:

- Rocks which are 2.7 billion years old (on the basis of intrusion of granites).
- Host rocks are iron rich basalts and BIFs.
- Gold mineralization is structurally controlled: high density transaction shear zones, fold closures and contacts.
- Wall rock alteration.
- Presence of Diapiric granites, etc.

Dharwar craton forms one of the important Precambrian shield areas in the world. It is an important Archean greenstone terrain and several views are expressed regarding its origin and evolution in terms of stratigraphy, lithology, geochemistry and metallogeny, which have direct bearing on tectonic environment, crust-mantle interaction, mantle composition and sediment deposition. Dharwar craton comprises of two distinct parts, eastern block and western block separated by 1.4 to 1.5 kilometres thick steep N-S to NW-SE trending shear zone which runs along the eastern margin of the Chitradurga schist belt.

1.1 Objective of the present work

Lack of previous knowledge on this aspect promoted the investigator to make detailed study about the geology and mineralization in that area. In addition to this, sampling will be carried out to understand the ore petrography of the study area. The present work will be conceived with an objective of resolving several aspects mentioned below.

- To bring out detailed field study report to establish basement cover relationship, geology, structure and stratigraphy of the area.
- To describe the characteristics of the constituent lithological units.
- Detailed petrography includes ore petrography and to characterize lithology and mineralization.
- To understand the geological history and evolution of the Hutti-Maski schist belt based on field and laboratory observations.

1.2 Methodology

The methodology adopted in this work can be divided into two parts viz. (1) Petrographic studies and (2) Mineralization studies. The petrographic study involves the preparation of thin sections of all rock types which include host rocks, ore veins and wall rock alteration samples from the schist belts of Hutti Maski in the eastern Dharwar region, and observe them under transmitted light microscope mainly to decipher the texture, mineralogy, type of alteration and grade of metamorphism. This study also involves preparation of polished sections of ore veins and wall rock alteration samples for the observation of different ore minerals present under reflected light microscope. Systematic sampling of mineral bearing litho-units of the mineralized zones was carried out for the laboratory investigation. A study on geology and structure of different auriferous zones, which host gold-sulfide quartz reef, was also carried out. Mineralization study of the area has been carried out to know the mineralogy, texture of the gold and sulfide ores and other gangue minerals.

1.3 Sample Processing

About 2-3 Kg of freshest possible rock samples were collected from surface outcrops in the Hutti Maski area for meaningful interpretation. The samples were reduced to small bits in the field itself. After that, the reduced sample weighing ~500gms was carried back to the department. After the preparation of the sample, it was send to laboratory (Geological Survey of India Laboratory, Bengaluru) for preparation of thin sections and polished sections.

1.4 Location and Accessibility

The area selected for the present study is located in the northeastern part of Hutti-Maski Schist Belt. The Belt is located in the northern part of Karnataka state covering parts of Devadurga, Manvi, Lingsugur and Sindhnur taluks of Raichur District. The study area is bounded by latitude 15° 58' 31" N and longitude 76° 39' 51.2": E in parts of Survey of India toposheet no 57A/9 [D43E9].

The location has good access to various parts of the belt. The nearest railway head station is Raichur, which is the district headquarters situated on the Mumbai-Chennai broad gauge line of South Central Railway Sindhnur-Lingsugur- Gulbarga road (NH-13) passes through the western fringes of the area. The Raichur-Kavital-Lingsugur road provides access to the central part of the belt. The Raichur - Sirwar- Chinchergi- Hutti road runs across the northeastern part of the belt. The interior villages are accessible by a network of fair weather roads, canal roads and foot tracks.

1.5 Physiography and Drainage

The areas of Hutti-Maski schist belt was earlier known as a part of 'Doab' which lies between two rivers i.e. Tungabhadra in the south and Krishna in the north. The Hutti-Maski greenstone belt and its adjoining granitoids can be divided into two valleys separated by a geomorphic high along Basapur-Pamankallur-Anwari-Chinchargi-Uti segment. The highest point in the area is A593 meter hill situated about 600 meters from Topaldoddi village towards N60° E. The lower elevation along the nalla course is about 360 meters and undulating type of terrain is present with regional slope towards north is seen in the northern part of the Hutti-Maski schist belt. Occasional knolls, floodplains and rolling topography are seen towards the southern part of the Hutti-Maski schist belt. Regional slope towards the north is seen in the northeastern part of the Hutti-Maski schist belt. Occasional knolls, floodplains and rolling topography are seen towards the southern part of the Hutti-Maski schist belt. The Maski halla, Hire halla and Sindhnur halla are the major streams present in the area. These streams have NNW - SSE course and most of them are seasonal. The change in density pattern is observed from north to south. The southern sector of the schist belt is full of network of streams with a few distributaries canals from Tungabhadra River. The drainage system in gneissic terrain is dissected by parallel to sub-parallel streams.

2. Thin Section Studies

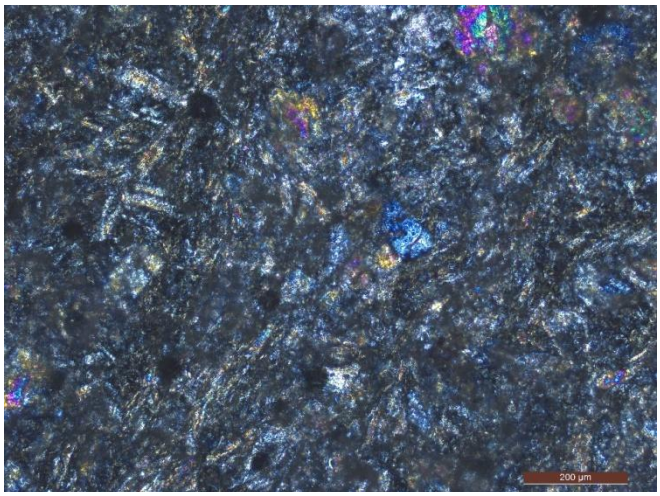


PLATE TS1
Epidote-Chlorite-Actinolite association showing relict intergranular texture in Crossed Polarized Light

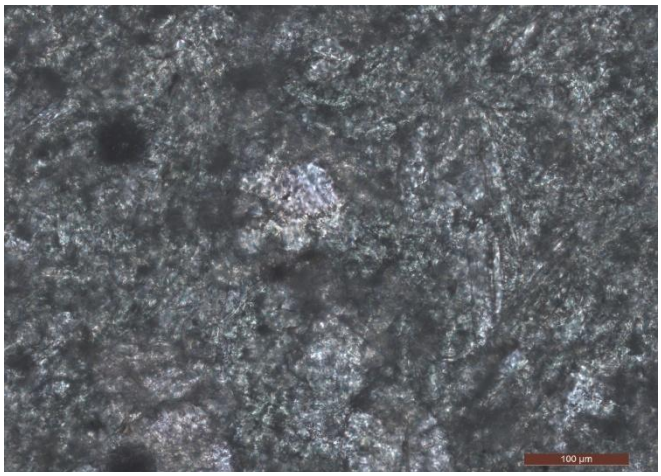
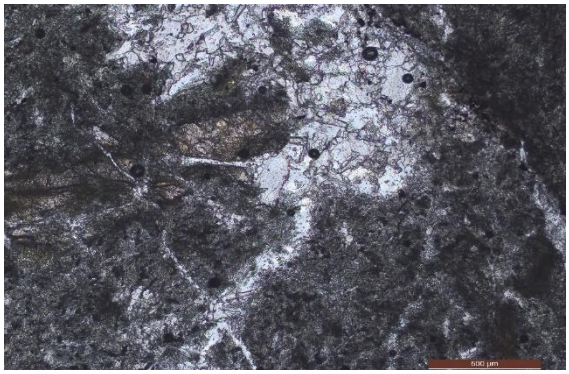


PLATE TS2

Epidote-Chlorite-Actinolite-Quartz association in Plane Polarized Light



PPL

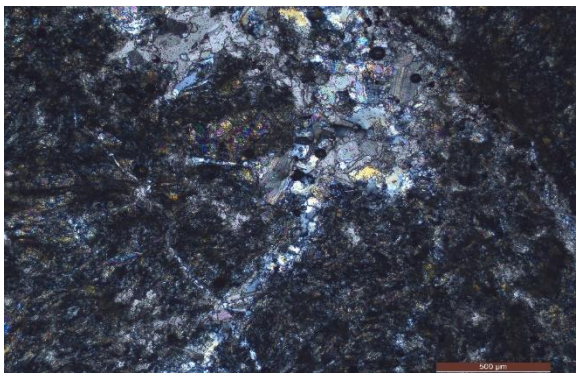


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PLATE TS3

Quartz Carbonate Veins in Metabasalt in respective Plane Polarized light and Crossed Polarized Light

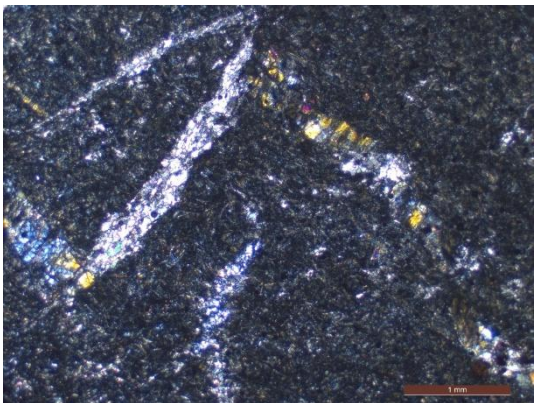
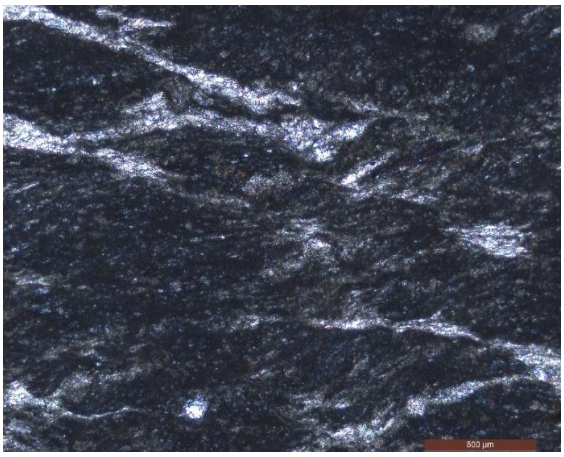


PLATE TS4

Quartz Epidote Carbonate Veins

PLATE TS5

S-C Fabric where late quartz carbonate veins are filling dominantly parallel to the C planes and at places at the S planes under Plane Polarized Light



XPL

PLATE TS6

S-C Fabric where late quartz carbonate veins are filling dominantly parallel to the C planes and at places at the S planes under Plane Polarized Light and under Crossed Polarized Light respectively

3. Polished Section Studies

PLATE PS1

Relict Arsenopyrite completely altered to Goethite studied under Reflected Light

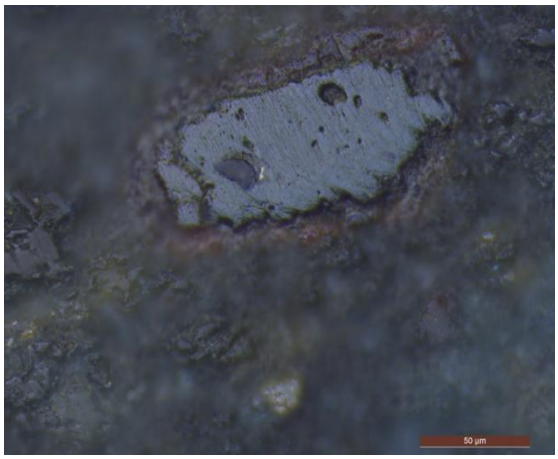


PLATE PS2

Relict Arsenopyrite completely altered to Goethite studied under Reflected Light

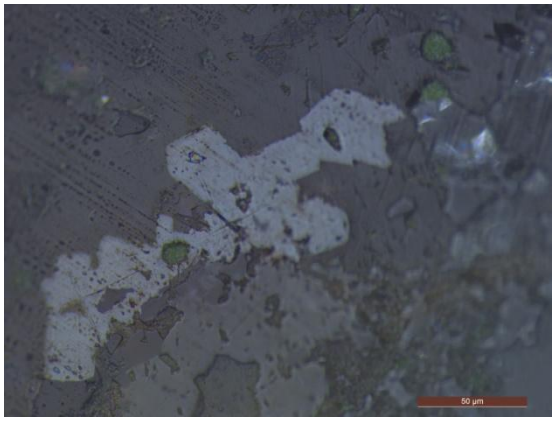


PLATE PS3
Relict Arsenopyrite completely altered to Goethite studied under Reflected Light

4. Conclusion

The Dharwar supercrustal block is deposited unconformably over a sialic basement of tonalitic and granitic "Peninsular Gneiss". The supracrustal rocks of Dharwar group are exposed as number of schist belts; prominent among them are: Bababudan, Western Ghat, Chitradurga, Shigegudda, Shimoga-North Kanara-Goa, Sandur, Kolar&Hutti schist belts. Total thickness of these Dharwar schist belts is estimated to be 60 to 70 km. Age of the Dharwar Supergroup rocks is tentatively fixed in the range of 3.0-2.6 b.y.o.

In many places, the contact is covered by soil developed from sheared lithologies. The mafic rocks in the north eastern part of the schist belt near the granitic contact are of higher metamorphic grade i.e., middle to upper amphibolite facies, represented by well recrystallized amphibolites and that on the southern and western contacts are of a relatively lower grade represented by chlorite carbonate schist. There are quartz and carbonate veins in the chlorite schist and the quartz vein show the development of pinch and swell structures, indicating that the deformation continued beyond vein formation.

Thin section studies carried out on the metavolcanics of the Hutti Schist Belt indicate that the mafic volcanic rocks represented by three different textural varieties of amphibolites and chlorite schist form the predominant rock types in the belt. Minor amounts of intermediate and acid volcanics are found interleaved with the amphibolites in the northern part of the belt. The amphibolites are grouped into three different rock types on the basis of their texture, such as (1) the medium grained schistose amphibolite (2) the fine grained massive amphibolite and (3) the coarse grained spotted amphibolite and they occur in abundance in that order. Quartz and feldspar are granulated giving a smudgy appearance. Some of the calcic plagioclase has altered to c1inozoisite.The textural relation seems to suggest that the rocks suffered a period of brittle deformation after they were metamorphosed to amphibolite grade. Some of the metabasalts have retained their original igneous texture with plagioclase forming the matrix and the clinopyroxene as phenocrysts in them. Some of the clinopyroxene phenocrysts have been altered to actinolite by static metamorphism and that is followed by the fluid alteration by which the actinolite was partially converted into biotite. The Ca and AI released as a result of this fluid alteration have resulted in the formation of epidote.

The lithology of the study area is composed of metabasalts, ampibolites and minor meta-sedimentary rocks which indicates intense metamorphism and hydrothermal activity in the area. It also shows the presence of both primary structures (pillow and vesicular structures) and deformational structures (folding and shearing) in different litho-units. The thin section study carried out over the study area indicates the dominance of chalcopyrite, arsenopyrite, goethite and magnetite over other minerals. Magnetite and goethite are the ores of iron and hence carries economic value. The folding and shearing of the mineral grains shows the different stages of deformation. The textural relation seems to suggest that the rock suffered a period of brittle deformation after which they were metamorphosed to the amphibolite grade. The presence of arsenopyrite indicates high temperature reductive environment which is caused by retrograde metamorphism that might have occurred over the area.

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