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Research Article

MINERAL POTENTIALITIES OF KADIRI SCHIST BELT, EASTERN DHARWAR CRATON, SOUTH INDIA – AN OVER VIEW

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ABSTRACT
The Kadiri Archaean granite greenstone terrane of eastern block of Dharwar Craton is having unique tectono-magmatic-metamorphic and metallogenic characters in Southern Peninsular Indian Shield. The Belt is unique in having larger area occupied by metaacid volcanics with relatively minor proportions of metabasalt, meta andesite and thin bands of iron formation. The mineralogy of the constituent litho -units indicate that the rocks have undergone greenschist facies of metamorphism. It is endowed with rich mineral resources like gold, molybdenum, tungsten, silver, uranium, quartz-feldspar, cordierite-biotite rich meta tuffs, dimension stone granites, etc. which can be located by integrated multidisciplinary surveys.

Key Words: *Kadiri Schist Belt, Gold, Mineralization*

INTRODUCTION

The Archaean granite greenstone terrane of eastern block of Dharwar Craton (EDC) is having unique tectono-magmatic-metamorphic and metallogenic characters in Southern Peninsular Indian Shield. It is endowed with rich mineral resources like gold, diamond, uranium, iron, manganese, corundum, pyrophyllite, quartz-feldspar, dimension stone granites etc. EDC represents a calc-alkaline arc granitoid batholiths (Chadwick *et al.,* 2000) with accreted segments of intervening narrow linear greenstone belts of inner arc type, which along with intrusive synkinematic granitoids finally accreted on to the western block of Dharwar Craton.

The schist belts are intruded by voluminous emplacements of late-archaean synkinematic gregarious bodies of calc-alkaline granitoids showing wide compositional variations with wide spectrum of rock types ranging from ultramafic-mafic to felsic compositions and closely associated.

The granitoids are classified into four suites from older to younger i.e. 1) Tonalite Trondhjemite Granodiorite (TTG) suite 2) Tonalite Granodiorite Monzogranite (TGM) suite 3) Monzogranite Syenogranite (MS) suite and 4) shear controlled post orogenic/anarogenic (A-type) suite of minor occurrence by Gopalan and Suresh (2004).

Magma mingling and mixing and accompanying fractional crystallization process are attributed to the origin of TGM suite.

Greenstone belts/schist belts are invariably subjected to regional scale sinistral ductile shearing mostly along their eastern contacts with the granitoids forming major discontinuities and some of them form as late Archaean sutures/terrane boundaries in the EDC (Drury, 1984).

Dharwar Craton is divided into Western Block and Eastern Block (Swaminath *et al.,* 1976; Swaminath and Ramakrishnan, 1981; Rollinson *et al.,* 1981). Kadiri Greenstone Belt is located to the South West of Cuddapah Basin in the Eastern Dharwar Craton (Figure 1).

The Greenstone Belts of Eastern Karnataka and southern Andhra Pradesh are well known for their gold mineralization and the region in frequently referred to as “Eastern Gold Province”.

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Figure 1: Location map of the study area

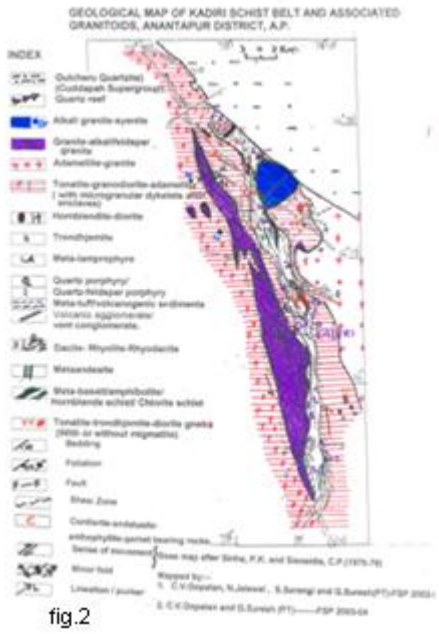

Figure 2: Geoloical map of the study area

The three important gold producing mines namely Kolar, Hutti and Ramgiri are located in this province. The Kadiri Schist Belt also lies in this province covering parts of Anantapur and Chittoor districts. It runs for a strike length of over 80 km in an approximate North-South direction from Dorigallu (Lat. 14^0 25'30"; Long $78^0$02') in the north to Gollapalli (Lat $13^0$44'; Long $78^0$09'30") in the south. The width of the belt varies in different localities with a minimum of 0.8 km to a maximum of 4.8 km covered in the Government of India Toposheet Nos. 57 J/3, J/4, K/1and K/2 and geologically mapped on 1:50,000 scale (Figure 2). It lies 50 kms north of auriferous Kolar Schist Belt trending NNW-SSW in the northern part and N-S in the southern part and occupies an area of 200 sq km.

Geological Setting

The Kadiri Schist belt comprises predominantly of acid volcanic rocks with minor amounts of basic volcanics. It is in juxtaposition with granitoids on either side. Acid volcanics are represented by rhyodacite, rhyolite, quartz porphyry and quartz feldspar porphyry. Metabasalt, meta andesite and basic tuffs constitute the basic volcanics. Impersistent bands of Banded Iron Formations (BIF) within acid volcanics occur as minor intercalations. Impersistent but conspicuous volcanic conglomerate horizon occurs in conformable relationship with acid volcanics of the belt. The above litho-units are intruded by younger granitoids, dolerite and gabbro dykes and pegmatite and quartz veins. The granitoids include Tonalite-Trondhjemite-Granodiorite (TTG) suite, Tonalite-Granodiorite-Monzo-granite (TGM) suite, Monzogranite-Syenogranite (MS) Suite and post-orogenic granites (Alkali Granites).

The Kadiri Schist Belt is unique in having larger area occupied by meta-acid volcanics and hence represents the higher stratigraphic level in greenstone model (Anhaeusser *et al.*, 1969). The enclaves of the pre-existing country rocks i.e., schist belt components mainly metabasalt are seen in both TGM suite and MS suite. The cross-cutting relationship of Alkali Granites with TGM and MS suites suggest that the last phase of granitic injection which perhaps may be correlated with pegmatite veins is present abundantly in granitoids.

Numerous basic dykes are present as intrusives in all the formations representing the last phase of igneous activity in the area. The abrupt change in the course of dykes near granite schist contact indicates their tectonic nature. Often along the contact epidotization and sericitization are noticed (Reddy, 1992). The quartz reefs are nearer to the granite schist belt contact but get truncated at the schist belt. This abrupt

truncation of the quartz reefs at the margins of the schist belt suggests faulted contact (Ramamurthy and Anandmurthy, 1994). There is no direct field evidence to suggest that the greenstones were laid in sialic basement. Presence of granitoid clasts in volcanic conglomerate (indirect yet a strong evidence) points to the existence of sialic crust on which the components of the schist belt were deposited.

Detailed field and petrographic studies revealed that the litho units of the belt are subjected to considerable amount of shearing and faulting in different directions. Unlike the other greenstone belts of the state, the Kadiri Schist Belt is unique in having larger area occupied by meta acid volcanics with relatively minor proportions of metabasalt, meta andesite and thin bands of iron formation. The mineralogy of the constituent litho units indicates that the rocks have undergone greenschist facies of metamorphism.

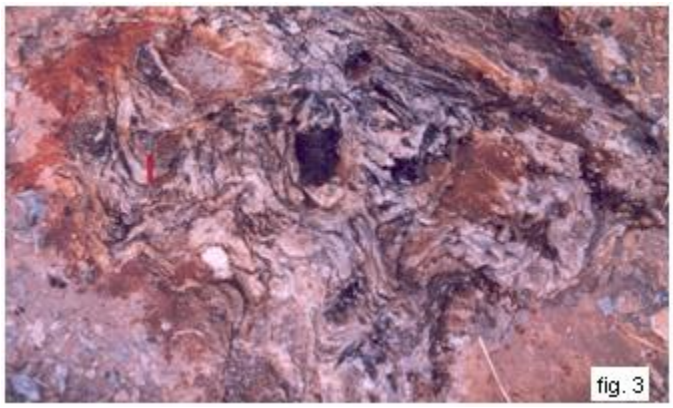

Figure 3: Silicification in dispositioned shear zones

Disposition of shear zones wall rock alteration zones at the contact of acid and basic volcanics, sericitisation, pyritisation at places, silicification in dispositioned shear zones (figure 3), granitic emplacements in the juxtaposition to and at places within the schist belt and numerous parallel shear zones are some of the positive indications for the possible gold mineralization in the area (Ramamurthy and Anandamurthy, 1994). During the recent work carried out by the officers of Geological Survey of India, it is found that besides gold, tungsten, silver and molybdenum mineralization is found to be associated with gold lodes in Kolar, Ramagiri and Penakacherla Schist Belts. Aero radiometric data indicated the connection between Kolar and Kadiri Schist Belts.

Figure 4: Volcanic conglomerates with potential for uranium

A study of the shear zones contact zones and quartz veins in the Kadiri Schist Belt helps to delineate the promising mineralizing zones for gold, molybdenum, tungsten and silver. For uranium, conglomerate is the main host rock. Therefore the volcanic conglomerates of the area are to be carefully studied for demarcating uranium mineralized zones (figure 4).

Mineralisation

The prominent minerals occurring in and around the schist belt can be enlisted as follows;

Figure 5: Dolerites quarried as dimension stone granites

Dimension Stone Granites: The gneisses and granitoids having a wide distribution in this area are quarried as building stones and road metal at Kummaravaripalli, around Nallagutlapalli, west and south of Charupalli and Kadiri Bramhanapalli. The granitoids quarried along with the exfoliation surfaces or the large rolled boulders are cut into slabs and blocks. Of-late, the sheared meta-rhyodacite of Kadiri Schist Belt located at SW of Kalasamudram or east of Charupalle is extensively quarried for dimensional stone by M/s Pallava granites, Chennai and being marked and exported to Spain etc as "web green marble" which upon polishing gives rise to a spectacular design like web of spider of different shades of colours due to fillings of close knitted micro-veinlets of epidote, silica, fluorite, actinolite etc. Hence, the meta-acid volcanics of the schist belts assume greater importance in dimension stone granite point of view. In the area between Kadiri and Kolar, hornblendite-diorite-lamprophyres (sweet green), dolerite (black granite) (figure 5) and granites-gneisses (madanapalle white and yellow granite) are being quarried as dimension stone granites.

Figure 6: Brecciated Quartz Reefs

Figure 7: Cordierite-Biotite rich meta tuffs

Quartz: The contact of schist belt and adjoining granitoids is faulted at many places as indicated by the presence of sheared and brecciated quartz reefs trending NNW-SSE to NW-SE. Large veins of brecciated quartz reefs (figure 6) are present in the schist belt which can be utilized for making glass sand. The important localities are Charupalli, east of Kadiri town, Molakavemula, etc. The quartz reefs form high hills in the area and exhibit extensive oxidations resulting in Iron, Limonite and rarely arsenopyrite, chalcopyrite and pyrrhotite (Reddy, 1992).

Gold: Quartz-pegmatite vein, mapped to the west of Rachavaripalli, emplaced within rhyodacite, seems to be auriferous (Ramamurthy and Anandamurthy, 1994). Many of the samples have analysed Au values ranging from 25 ppb to 2800 ppb. In Erradoddi area, the samples have analysed Au values ranging from 30 ppb to 2500 ppb. Along with gold, the associated elements show the following ranges in the area as Cu from 10 to 340 ppm, Pb from 10 to 70 ppm, Zn from 10 to 265 ppm, Ni from 10 to 115 ppm, Co from 10 to 45 ppm, Cd and Ag less than 10 and 2 ppm respectively. However, absence of proper host rock, structurally favourable zones and grey greasy quartz indicate that the lithology/structure of Kadiri Schist Belt is less conductive for gold mineralization (Kazmi, 1986).

Conclusion

The Hutti-Jonnagiri-Julakalva-Kadiri-Kolar Schist Belt defines an important suture/crustal weak zone hosts deposits of gold (both syngentic and remobilized epigenetic types), and minor deposits/occurrences of basemetals, molybdenite and scheelite (based on the works of GSI). Fracture controlled minor hydrothermal type epigenetic uranium occurrences are recorded within the differentiated younger granite plutons occurring in the vicinity of this suture i.e. within basement granites occurring below unconformity contact of Cuddapah basin as per the reports of AMD. These minerals are localized along hydrothermally altered shear zones and fractures and occur as disseminations/veinlets in greenstone belt or associated calc-alkaline granitoids and precisely along the contact zones. The contact zones not only acted as loci for the mineralization but also acted conduits for the emplacements of A-type granites, syenites, lamprophyres and alkali-metasomatism. Thus these zones are potential for the search of Nb, Ta, P, F and other REE mineralization. Besides the post-Cuddapah basin faults and shears (reactivated basement quartz reefs and major lineaments hosting kimberlites etc) which cut across the suture are also important to search for the mineralization such as specularite, basemetal, uranium and minerals related to alkali metasomatism such as fluorite, barites, spodumene-beryl etc. the suture line is criss-crossed by pre-Cuddaapah mafic dyke swarms emplaced along tensional zones which at places probably acted as favourable locii for the precipitation of minerals such as uranium, sulfides etc. the calc-alkaline granitoids (granodiorite) are important for the search of porphyry type Cu-Mo-Au mineralization. The hornblendite-diorite/gabbro-anorthosite associated with TGM suite and meta ultramafites of schist belts are worthy

candidates for the search of Cr-Co-Ni-Pt and related mineralization. The cordierite biotite rich meta tuffs and granitoids are also prominent in the region (Figure 7). Geophysically this suture line at its central part lies in NW-SE trending magnetic anomaly zone and circular high gravity zone found at SW margin of Cuddapah basin (Gopalan and Suresh, 2004). In view of the importance of Hutti-Jonnagiri-Julakalva-Kadiri-Kolar Schist Belt with reference to mineral potentialities as described above, integrated multidisciplinary surveys with high precision are suggested for the location of mineral deposits along this suture line.

REFERRENCES

Anhaeusser CR, Mason R, Viljoen MJ and Viljoen RP (1969). Reappraisal of some aspects of Precambrian field geology, *Bulletin of the Geological Society of America* **80** 2175.

Chadwick B, Vasudev VN and Hegde GV (2000). The Dharwar craton, southern India, interpreted as the result of late Archaean oblique convergence. *Precambrian Research* **99** 91–111.

Drury SA (1984). A Proterozoic intracratonic basin, dyke swarms and thermal evolution in South India. *Journal of the Geological Society of India* **25**(7) 437– 444.

Gopalan CV and Suresh G (2004). Unpublished report on specialized thematic mapping on the granite greenstone terrain in the gap area between Julakalva and Kadiri schist belts of Anantapur and Chittoor districts. *GSI Reports* 1-41.

Kazmi SMK (1986). Report on preliminary investigation for gold in Kadiri Schist Belt, Anantapur District, A.P., Unpublished Progress Report, GSI.

Ramamurty S and Anandamurty S (1994). Preliminary investigations for gold in Kadiri Schist Belt, Anantapur Dist., A.P., Unpublished Progress Report, GSI.

Reddy KN (1992). Preliminary geochemical surveys for gold in Kadiri Schist Belt, Anantapur and Chittoor Districts, A.P., Unpublished Progress Report, GSI.

Rollinson HR, Windley BF and Ramakrishnan M (1981). Contrasting high and intermediate pressures of metamorphism in the Archaean Sargur schists of southern India. *Contributions to Mineralogy and Petrology* **76** 420-429.

Swaminath J, Ramakrishna M and Viswanatha MN (1976). Dharwar stratigraphic model and Karnataka craton evolution. *Records of the Geological Survey of India* **107**(2) 149-175.

Swaminath J and Ramakrishnan M (1981). Early Precambrian Supracrustals of Southern Karnataka, *Memoirs of the Geological Survey of India* **112** 308.