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Gold mineralization in Chitradurga schist belt, Dharwar Craton, India

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Gold mineralization in Chitradurga schist belt is spatially associated with two transcrustal shear zones, Chitradurga Eastern Shear Zone (CESZ) and Chitradurga Central Shear Zone (CCSZ) [1]. Evidence of continuum in gold and associated sulphide mineralization is observed from volcanism to metamorphism accompanied by deformation. Copper mineralization near Ingaladhalu, hosted in the subaqueous volcanic package has been classified under 'massive volcanogenic' sulphide deposits [2]. Hydrothermal gold and sulphide mineralization along favourable structural loci associated with CESZ and CCSZ has been recorded over space and time. Along its entire stretch the CCSZ is characterized by a wide zone of intense carbonatisation. No regionally extensive zone of carbonatisation is associated with CESZ though such alteration is often associated in prospect scale. Auriferous quartz carbonate lodes are localized along zones of dialatation like second order structures and contacts of litho units of contrasting competency. Lode gold mineralization though form a coherent group as far as source of the mineralizing fluid is concerned, shows wide variation with regards to lithological and structural controls. Overprinting of the structural fabric of second phase of deformation (D_2) on some of the lodes associated with CCSZ clearly constrain the gold mineralisation event as D_1. However lodes localized along second order structure related to CESZ ought to be syn-to late D_2 which is the event of CESZ development. This brings the debate of multi stage fluid focusing and precipitation to the fore. There is a clear zoning of metal along the Yerehalli-Ingaldhalu-C.K.Halli Sulphide Belt coincident with CCSZ in its southern part. Yerehalli and Ingaladhal in southern parts exhibit dominantly copper and sulphide mineralisation. In the central part near Gonur and G.R.Halli, lode gold mineralisation accompanied by argentiferous galena is recorded where as in the northern part near C.K.Halli, antimony and gold bearing lodes are present. Primary geochemical halos surrounding gold lode is generally of restricted width. It represents enrichment or depletion of ore bodies by certain elements as a result of introduction or redistribution of these elements during ore formation. The gold only lodes of C.K.Halli are characterized by a strong positive correlation between gold and arsenic and invariably accompanied by depletion of zinc in the ore zone.

The gold-argentiferous galena lode of G.R. Halli on the contrary exhibit slight appreciation in zinc and arsenic value and accompanied by enrichment of boron. In the southernmost part near Yerahalli the sulphide mineralisation is virtually devoid of any significant gold content. It however has a very wide geochemical halos characterized by moderate enrichment of arsenic, antimony, zinc, copper and boron. Ore petrographic studies carried out in the gold prospects associated with CCSZ clearly revealed that the pyrrhotite was first sulphide mineral to crystallise from mother sulphide solution. The presence of relict irregular grains of pyrrhotite in arsenopyrite and idiomorphic crystals of pyrite within spongy pyrrhotite indicates break down of pyrrhotite to pyrite and marcasite. Development of arsenopyrite is subsequent phenomenon, being the product of influx of arsenic into hydrothermal system. Occurrence of gold grains mostly in arsenopyrite proves the affinity of gold to arsenic. The paragenetic sequence established is as follows:

Pyrrhotite→Pyrite+Marcasite→Arsenopyrite→Chalcopyrite→Galena→Sphalerite.

The $\delta^{34}S$ values for arsenopyrite and pyrite from G.R.Halli and C.K Halli gold prospects associated with CCSZ exhibits restricted range with values veering around an average values of +4.45‰ and +4.91‰ respectively suggesting that they have similar genetic source. The above isotopic values correspond to the sulphides of modern hydrotherms and their narrow range suggests a single source of sulphur.

References

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