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GEOCHEMICAL CHARACTERS AND TECTONIC EVOLUTION OF THE CHITRADURGA SCHIST BELT: AN ARCHAEAN SUTURE (?) OF THE DHARWAR CRATON, INDIA.

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The Chitradurga schist belt extending for about 450 km in a NS direction and 2-50 km across, is one of the most prominent Archaean (2.6 b.y.) tectonic features of the Indian Precambrián terrain, comprising about 2 to 10 km thick sequence of volcanosedimentary rocks. The basal unit of this belt is composed of an orthoquartzite-carbonate facies, unlike many other contemporary greenstone belts of the Gondwana land which begin with a basal mafic-ultramafic sequence. Eighty percent of the belt is made up of detrital and chemogenic sediments, their sucession commencing with a poorly preserved quartz pebble basal conglomerate and current bedded quartzites which, in turn, rest on tonalitic gneisses, the latter having been further remobilized alongwith the schist belt. Deposition of current bedded mature arenites indicate the existence of platformal conditions near the shore line. Polymictic graywacke conglomerates, greywackes, shales, phyllites, carbonates, BIFs (oxide, carbonate and sulfide) BMF's (Banded Maganese Formations) and cherts thus constitute the main sedimentary rocks of the belt. The polymictic conglomerates contain debris of rocks of older greenstone sequences, as well as an abundant measure of folded quartzites, BIF's and gneissic fragments which represent earlier orogenies.

Four different types of greywackes are recognised in the belt from N to S. Most of these have been derived from the surrounding tonalitic gneisses which contained older greenstone sequences as enclaves of various dimensions. However, the younger sequences in the north contain debris from the intrabasin volcanism also. The K-granites and gneisses are found to be progressively abundant in the source area of these graywackes as indicated by the granitic component of the debris of the younger graywackes sequences. Their REE patterns are characterized by both positive and negative Eu anomalies, the latter especially in the interbedded shales with grewackes. Geochemistry of the graywackes and chemogenic sediments thus indicate their deeper oceanic environment of formation. Although stratigraphic relation between the shallow water and deeper water sediments is uncertain, the basal orthoquartzites-carbonate sequences indicating platformal environment perhaps represent a facies change due to shallow water conditions along the shore line, and the greywacke suite those of deeper water away from it. Similar facies change is observed in the BIF's from shallower oxide to deeper sulfide facies.

The ultramafic rocks, mostly found in the lower sections of the belt, show pillow structures and spinifex texture and are komatiitic in composition. The mafic, intermediate and acid volcanics are found as detached outcrops in presumably higher stratigraphic sections and show tholeiitic and calc alkaline affinities, probably produced by 5-15% melting. The ultramafic lavas were produced by deeper mantle melting source, the geochemical characteristics belonging to the oceanic class.

Most of the rock suites in the belt have been metamorphosed to greenschist facies. However, its eastern margin is found to be in thrust contact with the higher amphibolite facies rocks (700°C at 6-7 Kbr), and the southern part near Mysore consist of predominantly ultramafic rocks metamorphosed to amphibolite and granulite facies. The northern part of the belt near Gadag is least metamorphosed. Irrespective of the grade of metamorphism or of inferred ages of the various stratigraphic groups, the belt shows a remarkable structural homogeneity of 3 phases of deformation from N to S and E to W and a convexity towards East. Both major and minor F1 folds are tight isoclinal with shallow to steep plunges and subvertical to subhorizontal axial planes. The variation in the attitude and orientation of the F1 axes has been controlled by the F2 episode which has coaxially folded both the subparallel bedding and the first generation axial plane schistocity cleavage. Only at F1 hinges the intersection between S1 and S2 is discernible. F3 is found as general warps on F2 limbs. The F1 axial plane schistocity cleavage and F2 crenulation charge are generally dipping (horizontal to subvertical) towards the east. High grade rocks on the eastern margin have been thrust westwards over the low grade central part. Structural data indicate considerable crustal shortening along the belt. Inversion of stratigraphic sequence is reflected, at many places by the younging directions obtained from current bedding, graded bedding and pillow couvexities. Horizontal compression and collision tectonics therefore, appear to have played a significant role in the development of the structural configuration of the belt.

As the 3000 m.y. old gray banded gneisses, found on the eastern and western sides of the Chitradurga schist belt are similar, the existing observations suggest the following two possible models: i) The belt developed in a rift on the juvenile Archaean continental crust which collapsed upon loading by sediments, resulting in a shallow subduction and horizontal compression. (ii) The belt evolved on an "Oceanic" crust between two juvenile continental blocks to the East and West. Shallow subduction and horizontal movement of the Eastern block would then result in the present structural geometry and consequent welding of the two along this probable suture.