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Geochemical Characteristics and Tectonic Setting of the Archaean Metavolcanics and Clastic Metasediments of the Gadag Gold Field, Southern India

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The 2.76 Ga to 2.50 Ga old Gadag greenstone belt in Western Dharwar Craton contains a series of volcano-sedimentary assemblages. The assemblage is dominated by acid to basic through intermediate volcanic rock sequences with intercalated high-Mg basalts, ultramafic sills, shallow water clastic and chemical sediments. The basalts have 5-14% MgO and mantle normalized signatures ranging from slightly LREE depleted, through essentially flat to light REE enriched. The high Mg basalts with 12-19% MgO are of Al – undepleted and LREE depleted type. The presence of high Mg basalt derived from an enriched source and the strong contrast in its REE profiles in comparison with those of the associated bimodal volcanic suite of rocks is consistent with a plume model for their generation, the high Mg basalts having possibly originated in the plume core and the bimodal suite by a remelting of the entrained upper mantle material. The aerially extensive high Mg basalt – tholeiite association may also represent an accreted ocean plateau derived from a mantle plume. In the Zr – Ti / 100 – Sr/2 and Ti – Zr diagrams, the metavolcanics plot within MORB and IAT fields, reflecting a possible combination of geochemical features, while in the TiO_2 – FeO (t) / MgO and Ti – Cr diagrams, these rocks plot exclusively in the IAT field which appears to be more realistic in view of the lithological associations and the geological setting of this belt. The associated polymictic conglomerates containing pebbles of gneiss, granites, quartzite, chert, banded iron formation, mafic to felsic volcanics and lithic-greywackes containing fragments of chert, quartzite, vein quartz and metavolcanics reflects a sialic provenance with an arc and active continental margin type settings. The maturity index of the lithic-greywackes is very low (0.3) compared to the chlorite phyllites and quartz – sericite phyllites which are chemically immature. The geological setting, associated rock types, their structure coupled with geochemical characteristics indicates through various tectonic discrimination diagrams that the lithic-metagreywackes have continental island arc + active continental margin; chlorite phyllites have continental island arc + oceanic island arc and the quartz – sericite phyllites have active continental margin + passive margin tectonic settings, juxtaposed by accretionary processes. The gold mineralisation in the Gadag gold field, characterized by hydrothermal wall-rock alteration and quartz vein-sulphide mineralisation indicating greenschist facies mineral assemblages is closely related to shear zone channelised retrograde metamorphism, post dating the amphibolite facies peak regional metamorphism.