ABSTRACT

The present thesis embodies results of sedimentological and geochemical investigations on the metamorphosed volcanosedimentary sequence of Bailadila Group, exposed around Bacheli, Bastar District, M.P. Based on field relations and structural disposition, the Bailadila Group is divided into three Subgroups, comprising five formations in all, separated by local unconformities. The lowest formation, viz. Bhansi Formation consists of metabasalts and metapelites. The metabasalts compositionally vary between tholeiitic basalt to basatic andesites, have been inferred to be accumulated on an ensialic rift in predominantly subareal environment. The metapelites conformably overlying the metabasalts vary between andalusite bearing and non-andalusite pelites. However, petrographic studies reveal that andalusite in pelites is a result of thermal metamorphism. Major, trace and rare earth element geochemical patterns further substantiate to their common provenance.

A thick psammite - pelites unit named as Bacheli Metasiliciclastic Formation conformably overlying the Bhansi metapelites is represented by quartz wacke, lithic wacke, arkosic wacke and quartz arenites. This Formation is overlain by ferruginous - tuffaceous shale-chert lithology included under East Ridge Shale Formation. A thick horizon of conglomerates above East Ridge Shale Formation records a local unconformity, and is overlain by ferruginous shales and banded iron formation.
This metasedimentary sequence is represented by four facies associations, viz. (1) Shelf, (2) Fan-delta, (3) Basin plain and (4) Alluvial fan facies associations, grouped under two major fining upward sequences representing transgressive systems tract. The lower transgressive systems tract is represented by fan-delta - basin plain facies associations, while the upper transgressive cycle is represented by alluvial fan-shelf facies associations.

Variation in major, trace and REE geochemical patterns in different formations point to differing provenance and weathering effects. REE abundances of Bhansi metapelites and Bacheli psammites showing negative Eu-anomaly and LREE enriched patterns, suggest to an evolved continental provenance for these sediments. Continental block provenance and passive margin tectonic setting is also supported by geochemical discrimination diagrams. Low abundance of trace and rare earth elements in ferruginous-tuffaceous shales points to volcanoclastic contribution into these shales, whereas interbedded chert beds might have been formed by chemical precipitation of silica derived from subaqueous weathering of tuffaceous matter. Average major element composition of the Bailadila BIF is comparable to Orissa BIF. However, low abundance of trace and REE in BIF do not correspond to either Algoma or Lake Superior type. Further, a strong positive correlation of REE with SiO and strong negative correlation with FeO, Al2O3, TiO2 and K2O points to differing
sources of silica and iron in this BIF. Strong positive Eu-anomaly (characteristic of hydrothermal waters) suggests hydrothermal source of the REE and Si in this BIF, while Fe might have been delivered by riverine influx.

Based on above investigations, four stages in the evolution of Bailadila Basin are recognised. First stage accounts for rifting of the ensialic crust and emplacement of basaltic lava, followed by terrigenous mud accumulation. In the second stage, an upliftment of the source region due to cooling following rifting resulted in the increased supply of coarse clastic and their deposition in the fan-delta system. Peneplaination and subaerial felsic volcanic vents in the source area provided volcanic detritus which was accumulated in the basin plain environment. In the third stage of basin evolution, upliftment of the basin margin resulted in cannibalization of these sediments into alluvial fan environments, however, eustatic sea level rise resulting in transgression hampered the coarse sediment supply resulting in shelf environments, and deposition of fine terrigenous mud. Precipitation of banded iron formation on this platformal setting was controlled by physicochemical processes. The final stage (stage IV) is marked by upliftment and deformation of the sequence and intrusion of post-Bailadila granites.