

Abstract

Lower Gondwana sediments comprising of Talchir, Karharbari, Barakar, Barren measures and Raniganj formations (Upper Carboniferous to Permian) were studied in detail in Giridih basin; Barakar and Taratanr basins, respectively South-West and South-East of Giridih; Burhai basin North-East of Giridih; in Ithkuri basin West of Giridih; and in Jamunia river section of Jharia basin.

The general stratigraphic relations and the detailed petrography of each formation (comprising of thin section study, grain size distributions, heavy minerals and clay mineralogy) are presented.

The study reveals that the earliest sediments belong to the Talchir formation which starts with a basal boulder conglomerate complex (15m to 30m) that is generally followed up by a mauve sandstone-needle shale member (30m to 60m) and these in turn by chloritic arkoses (80m). The boulder conglomerate complex comprises of one or more individual beds of conglomerate which are stratified themselves, being interstratified with and varying laterally into mauve and/or green shales, mauve and green siltstones and sandstones. The sedimentary structures encountered in this member are faceted and partly rounded pebbles with concave surfaces and snubbed edges, abundant ripple marks, cross bedding, usually penecontemporaneously deformed varved silts and clays, rafted boulders, and shrinkage cracks. The sandstones as well as the matrix of conglomerate are medium to fine well sorted sands that carry abundant pink feldspar which is fresh and unaltered.

The sedimentary environment was deciphered from all these to be glacier front deposition, mainly outwash deposits varying laterally into and interstratified with glaciolacustrine deposits in small ice marginal lakes. Alternations of boulder conglomerate-sandstone-shale represent oscillations of the glacial front.

The overlying mauve sandstone-needle shale member shows extensive mud cracks, ripple marks and well developed secondary structures like calcareous and chert nodules. The mauve sandstones thus indicate, that they are shallow water deposits laid down in glacial streams that were subject to periodic uncovering of their channels. Clastic dykes are occasionally seen in shales.

The top most member, in the Talchir formation, is the chloritic arkose that shows extensive current bedding and scour and fill structures that show opposite orientations in succeeding laminae, which often show slight contemporaneous deformation, probably due to aqueous slumping. This member may perhaps be interpreted as an outwash deposit laid down by

braided streams confined to broad valleys, the glacier having retreated far back. The climate seems to have warmed up somewhat as indicated by the slightly altered nature of feldspars.

The Talchir formation is succeeded in Giridih basin, by the Karharbari formation with a slight unconformity represented by a thin conglomerate band. The succeeding Barakar, Barren measures and Raniganj formations are all conformable. The lithologies of all the formations are similar without exception in all the basins and consist of essentially grey arkoses, micaceous and carbonaceous shales and coal seams. The arkoses are extensively cross bedded and enclose channel sands and lenses of quartzose conglomerates. The Karharbari arkoses are greyish but the arkoses in Barakar and Barren measures formations are slightly iron stained which forms in the latter formation as distinct limonitic and hematitic nodules.

From the above it may be concluded that all these formations have accumulated in shallow waters in an active tectonic environment with rising source areas and sinking depositional basins. The various lithologic units that constitute these formations suggest an intracratonic basin association, possibly Zeugogeosynclinal in character but with the total absence of evaporites.

Nature of basins: In conformity with the Gondwana basins in general, these basins show natural unfaulted junction on one side, while the other side shows faulted junction with the Archaeans. One interesting observation was that in the three basins that contain Talchir formation only, namely, Burhai, Taratanr and Barakar, there are comparatively fewer intra basinal faults and intrusives are totally lacking.

It is therefore suggested that the Talchir formation accumulated in tectonic natural depressions or valleys deepened in some cases by glacial scour. Tectonic control is likely to have been established at the end of Talchir deposition. The deposition of Karharbari, Barakar, Barren measures and Raniganj formations took place in an active tectonic environment, which controlled the rise in the source areas and subsidence in depositional basins. From the grain size studies, there is some evidence to believe that the tectonism was most active during the deposition of Karharbari and Barakar formations but began to wane during the accumulation of Barren measures and Raniganj formations.

In practically all cases, the basins of deposition have shrunk at the end of Talchir period possibly because of the onset of tectonism and wide spread block faulting which restricted the basins of deposition for the younger formations.