ABSTRACT

The Chattisgarh Group unconformably overlies the Archean basement. The group is divided into five stratigraphic units in order of antiquity : Chandarpur, Charmuria, Gunderdehi, Khairagarh and Raipur Formations, which exhibit repetitive association of sandstone, limestone and shale. All the formations belonging to this group conformably overlie the older ones. The nature of contact, particularly between limestone and shale is gradational.

The Chandarpur Formation is subdivided into two parts: a lower basal polymictic conglomerate-subarkosic sandstone and an upper quartz arenite. The Charmuria Formation conformably succeeds the Chandarpur Formation and is predominantly made up of grey-black, well bedded limestone with intercalated shales. The limestone becomes purple and shaly towards the top and merges with the purple shale of the next succeeding Gunderdehi Formation. The Gunderdehi shale contains thin interbeds of sandstone (quartz arenite) towards the top. The Khairagarh Formation made up of quartz arenite, is exposed in patches with poorly defined upper and lower boundaries. The lower part of the sandstone is thin bedded and is very similar to the upper sandstone beds of the Gunderdehi Formation. The Raipur Formation, youngest in the Chattisgarh Group, consists of limestone, shale and sandstone. In general the Raipur shales occur as thin lenses within the limestone. The sandstone, limestone and shale, that make up the Raipur Formation are intimately interbedded particularly along the Kharun river section.

The sandstones are dominantly medium to coarse grained, moderate to well sorted, highly mature quartz arenites. The provenance is interpreted to be a craton consisting of plutonic igneous rocks and low to medium grade metamorphic rocks. Further, the sandstones appear to be of second generation. All the sandstones exhibit shallow water sedimentary structures like cross-bedding and mud cracks. The depositional environment of the sandstones represents a near shore beach environment.

All the shale units are predominantly made up of quartz, calcite, feldspar, and clay minerals. The clay mineralogy of the shales remains constant in all the formations and consists of illite as the dominant clay mineral with minor chlorite. Illite crystallinity indices indicate anchimetamorphic condition although 1Md is the dominant illite polymorph. Illite is considered to have been derived from preexisting sedimentary source

and the transformation of 1Md to 2M must have been a very sluggish process in nature.

The grey-black to black colour of the limestone and shale is considered to be due to two reasons: a) Fe^{+2}/Fe^{+3} ratio and b) organic carbon in the form of organic matter. The quantity of organic carbon in the shales and limestones is in conformity with the suggested amounts for the older shales and limestones. Further, the organic functional groups identified appear to be very similar to the organic compounds found in recent sediments.

Petrographically, the Charmuria limestone exhibits uniform texture, composed of dark, often crinckled and discontinuous laminae of lime mud. Interlaminar areas are generally occupied by lighter coloured micrite and rarely microspar. Occasionally thin bands of laminated intraclastic limestone is interbedded. Significant amounts of non-carbonate minerals occur as lenses between the interlaminar areas. Authigenic pyrite cubes having discordant relationship with the laminae are frequent.

The limestone exhibits tubular burrow-like structures with open ends towards the top and have discordant relationship with the laminae. Based on internal architecture and relationship to the host rock six types of micro-burrows are recognized and are compared with the known ichnogenera : a) Monocraterion of Glossifungites/Rhizocorallium assemblage, b) Skolithos, c) Polybessurus and a few problematic structures ascribed to microbial action.

The crinckled laminations are considered algal, resembling Stratifera/Weedia type of horizontal stromatolite. The micrite is interpreted to be the original microcrystalline ooze precipitated as a result of chemical and biochemical processes in sea water of negligible energy which permitted preservation of algal laminae. The detrital particles within the laminae derived from the nearby shore line, were caught by the mucillage of algal mat. Three SMF-types 19, 20 and 24 are recognizable in limestone, all of which representing the Facies Zone-8 of Wilson (1975).The Charmuria limestone thus represents a typical tidal flat/shelf environment of restricted circulation (lagoon).

Based on field relations and primary sedimentary textures and structures the Raipur limestone is divisible into following lithofacies : Structureless lime mud facies, Stromatolitic lime mud facies, Limeclast conglomerate, Laminated lime mud, Pellet limestone. Of these Stromatolitic lime mud is the most predominant facies while the rest occur as minor lenses within it.

The Raipur limestone exhibits various SMF-types of different Facies Belts (Wilson,1975). The depositional environment is considered to represent a broad tidal flat with its micro-environments: supratidal flats/lagoon, intertidal flats and shallow subtidal flat.

Both, the Charmuria and the Raipur limestones are presently made up of low Mg-calcite with minor amounts of quartz, feldspar, and pyrite. However, dolomite predominates as the mineral phase in the dolomitized limestones. In both the limestones, the acid insoluble residues largely consist of quartz, with minor amounts of feldspar and clay minerals illite and chlorite.

Based on Ca/Mg and CaO/MgO ratios the Charmuria samples belongs to the slightly dolomitic limestone/limestone category, whereas, the Raipur samples dominantly belong to dolomitic limestone category. The trace element distribution, in particular Sr and Mn suggest that the original mineralogy of the limestones could have been Mg-calcite which subsequently altered and stabilized as low Mg-calcite during diagenesis on exposure to meteoric conditions. Further, the trace element distribution is atleast, in part, controlled by the supply of the detrital clastics.

Dolomitization is restricted to the Raipur limestone only. The formation is dolomitized in patches but dolomitization has effected all the lithofacies excluding laminated lime mud. A replacement origin for the Raipur dolomite is clearly established because of: a)dolomite rhombs with clouded cores, and b) ghost outlines of primary textures and structures. A late diagenetic replacement seems more likely because the dolomitization was concentrated along weak planes such as stylolites and inter-laminar areas.

The characteristic association of highly mature sandstone, limestone and shale suggests primarily a cratonic/platform sequence. In the Chattisgarh basin the above sequence is repeated in time. Despite minor small scale movements due to epeirogeny, the overall tectonic setting is one of stability.

Key words : Proterozoic, Chattisgarh Group, Madhya Pradesh, Chandarpur Formation, Charmuria Formation, Gunderdehi Formation, Khairagarh Formation, Raipur Formation, Sedimentology, Diagenesis, Lithofacies, Illite crystallinity, Illite polymorphs, Chlorite crystallinity, Micro-burrows, Stromatolites, Microfacies, Tidal flat, Dolomitization, Organic functional groups, Tectonic realms, Craton.