ABSTRACT

The ancient sediments of the uppermost stratigraphic interval (Bhander Group) of the Vindhyan Supergroup (?Pre-Cambrian) have been investigated in the western lobe of the main Vindhyan basin with a view to reconstruct their depositional environments, paleogeography, dispersal patterns and sediment source.

The Bhander Group of study area, 335 m thick, comprises four mutually conformable formations: Ganurgarh Shale, Bhander Limestone, Sirbu Shale and Bhander Sandstone in the ascending order. Each formation has been divided into two or more units on the basis of lithologic and sedimentary characters. The lower half of Bhander Group (Ganurgarh Shale, Bhander Limestone, Sirbu Shale) is characterized by fine clastic-carbonate mudstone lithologic association, parallel laminations, mud cracks, and absence of large-scale current- and wave-formed structures. Small channel-fills occur in some units. Flaser-bedded sandstones and shales mark the transition from the lower half of Bhander Group to the upper half. The latter comprises Bhander Sandstone which occurs in two markedly different facies — sheet and channel facies.

Petrographic study of the arenites has demonstrated their high textural and compositional maturity. They are generally fine grained,
well sorted and almost entirely composed of siliceous constituents. Glauconite occurs in some samples as glauconitized clay pellets. The carbonates comprise four main constituents: intraclast(s), minite, sparry calcite and carbonate silt. Nine environmentally significant microfacies have been recognized. Most microfacies contain early dolomite.

The depositional environments have been interpreted by analogy with "process-response" models of modern environments, and on the basis of Walther's Law of Facies. By and large, Bhandar Group sediments were deposited in a shallow marginal tidal environment as is attested by features indicating processes of evaporation, exposure and desiccation, and late-stage emergence ebb outflow. Other evidences of tidal activity include bivalved-bipolar dip orientation of cross-stratification, multimodal frequency distribution of cross-stratification set thicknesses and graded bedding in algal mat carbonate mudstones. The marine influence on sedimentation is further indicated by the presence of glauconite in sandstones. The lower half of Bhandar Group was deposited mainly from suspension in supratidal and high tidal flat environments. Small channel fills were formed in gullies and small tidal channels of high tidal flats. The transitional flaser-bedded sandstone-shale sequence resulted from alternate deposition of clay from suspension and sand by bedload transport in the mid flat environment. The upper half (Bhandar Sandstone) was deposited on low tidal flats, beaches and bars. The associated large channel fills have been interpreted as tidal channel and inlet deposits. Tectonic stability seems to have prevailed throughout the deposition of
the entire sequence.

Orientation of ripple crests, rill marks, elongate tidal channel sand bodies, and the general trend of Sirbu Shale isopachs together suggest an east-southeast - west-northwest oriented shore line. Lateral facies changes and a combination of criteria, such as transgressive relationship and "fining-shoreward" textural distribution interpreted for the Sirbu Shale-Bhander Sandstone sequence, and the slope of lithologic boundary between the two formations evidence a north-northeast directed paleoslope.

Sediment dispersal patterns have been interpreted by relating paleocurrents to the inferred shore line and paleoslope. Such interpretations are, by and large, redundant in the case of the lower half of Bhander Group since it is mainly a suspension load deposit. However, the meagre paleocurrent data obtained from small channel-fills suggest that bedload sediment transport occurred in small channels mainly in the onshore and offshore directions, and to some extent across-slope. In the upper half of Bhander Group, the sediments were mainly dispersed by west-northwest directed longshore currents; onshore and offshore currents played a subordinate role.

The predominant west-northwest directed sediment dispersal pattern, and a matching of the inferred source composition with the composition of pre-Vindhyan rocks suggest that the provenance consisted of low-grade meta-sediments of Bijawar and Gwalior Series, and Bundelkhand granite.