ABSTRACT

The present study deals with lithofacies, paleocurrent analysis, textural and mineralogical composition, provenance, depositional history, paleogeography and tectono-sedimentary evolution of the Mesozoic Gondwana rocks of Satpura basin.

The geology of study area was rechecked and locally remapped and three formations were duly delineated on the basis of their distinct lithology, inter-relationship and structural setting. The Gondwana rocks are here represented by Pachmarhi (Early Triassic), Denwa (Middle to Late Triassic) and Bagra (Late Jurassic to Early Cretaceous) Formations in ascending order.

Altogether fourteen lithofacies were recognised, with eight lithofacies in Pachmarhi and Denwa sequence and six lithofacies in the Bagra Formation. Each lithofacies was described for texture, sedimentary structure, morphology, and association.

Paleocurrent study of Pachmarhi, Denwa and Bagra Formations were undertaken to examine paleodrainage and paleoslope pattern during deposition of each formation. The study is based on 798 readings of cross-bedding foreset dip azimuths recorded from Pachmarhi (359), Denwa (201) and Bagra (238) sandstones. The azimuthal
data show that the Pachmarhi and Denwa sediments were deposited by river systems draining uniformly and dominantly from southeast to northwest. However, during Bagra sedimentation the debris flows and paleocurrents brought in terrigenous debris and sand from north-northwest to south-southeast. Thus, the Bagra sedimentation demonstrates a reversal of paleoslope and paleocurrents in contrast to Pachmarhi and Denwa Formations, signifying that the sediments of the two sets of formations, viz. Pachmarhi and Denwa and those of Bagra were derived from different sources situated in opposite directions.

Petrographically, five types of sandstone constitute the Mesozoic Gondwana rocks of the study area. They are mainly quartzarenite, subarkose, litharenite, sublith -arenite and arkose. Three types of detrital matrix (ortho-, proto-, and pseudomatrix) and three types of cementing material (silica, iron oxide, and carbonate), locally, occupy the pore spaces of framework constituents in varying proportion. Heavy mineral assemblage includes, commonly tourmaline, zircon, rutile, garnet, kyanite and biotite in Pachmarhi and Denwa Formations. The species present in Bagra Formation are epidote, kyanite, garnet, hornblende, sillimanite, tourmaline, spinel, biotite, muscovite, rutile and actinolite.
Generalised facies models provide a basis for reconstructing the depositional environment of each formation. The Pachmarhi Formation by and large comprises conglomeratic lenses and pebbly, coarse to medium grained, and profusely cross-bedded to horizontally bedded multistorey sandstone bodies with paucity of fine clastics. This predominantly arenaceous assemblage is evidently the product of longitudinal bars and locally diagonal/transverse bars of low sinuosity braided streams. The unimodal paleocurrent with high vector strength (75%) and lower current variability (S. D. 47%) suggest low sinuous sandy streams (braided), akin to Platte-type or broadly speaking Saskatchewan-type river model of Andrew Miall (1977, 1985). However, the fining upward sequence of lithofacies and fan-shaped unimodal distribution of paleocurrents of the overlying Denwa Formation suggest deposition broadly by a meandering river system.

The succeeding Bagra Formation consists of matrix-supported conglomerate (Gms-facies), followed by clast-supported conglomerate (Gm-facies), pebbly coarse sandstone and finally by mudstone and shale in upper part. The textural characteristics of poorly sorted Gms facies, including subangular to angular clasts set in sandy/muddy matrix, suggest its deposition by viscous debris flows in proximal reaches of alluvial fan close
to margins in the north. The associated clast-supported conglomerate (Gm) facies occupies medial part of the outspreading fans towards south. The distal facies further south is characterised by pebbly, coarse to medium grained cross-bedded sandstone, with the overlying mudstone and shale forming upper part. These characters suggest deposition of Bagra Formation as an alluvial fan-braided river complex.

At least two major tectonic events signify the course of sedimentation of Mesozoic Gondwana rocks in the study area. The occurrence of conglomerate, pebbly gritty coarse sandstone in the basal part of Pachmarhi Formation, as against the underlying fine clastics of the Upper Permian Bijori Formation, suggest the first tectonic event heralding the onset of Pachmarhi sedimentation which continued uninterruptedly through Denwa, in the subsiding alluvial plains receiving sediments dominantly from southeast of the study area.

Following a break in sedimentation after Middle to Late Triassic (Denwa), the second major tectonic event is manifested by deposition of Late Jurassic-Early Cretaceous Bagra conglomerate and sandstone-shale facies in down faulted graben (? half graben) along the northern margin of the basin. The polymictic coarse clastic debris and sandy sediments were derived from
uplifted highlands to the north and transported southward. This tectonic event resulting in the reversal of cratonic slope may be related to fragmentation of Indian subcontinent from Antarctica in the Late Jurassic/Early Cretaceous time followed by doming and rifting prior to eruption of Deccan Trap. Indeed, Bagra sedimentation preceding the eruption of Deccan Traps (Paleocene) marks the termination of Gondwana sedimentation in this part of Peninsular India.