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Palaeoclimate and Depositional Environment of Sediments from Eastern part of Satpura Gondwana Basin, Central India

MAHAJAN Manjusha¹, Mugal Vijay¹, Chaurpagar Savita¹, Khangar, R. G.¹, Khasdeo, L.¹

1 Geological Survey of India, Central Region, Nagpur. manjusha_2412@yahoo.com

The Satpura Gondwana basin is exposed in the westernmost part of the peninsular India. It extends east-west 200 Km in length and north-south 60 km in width, exposing ~5 km thick sequence of Gondwana sediments. It is a rift valley demarcated by Son-Narmada south fault and Tapti north fault in Central India. The Indian Gondwana basin has the longest range of stratigraphic record spanning from Permian to Cretaceous [1]. The lower Gondwana sequence comprise of Talchir, Barakar, Motur and Bijori formations of early Permian to late Permian age and upper Gondwana sequence comprising of Pachmarhi, Denwa, Bagra and Jabalpur formations of early Triassic to Jurassic age. The present sedimentological, clay mineralogical and palynological study of different formations has carried out to deduce palaeoclimate and depositional environment of the sediments.

The XRD analysis of clay minerals reveals that the presence of illite and chlorite in Talchir Formation suggests cold-dry, glacial period, however, the sediments from Barakar to Bijori formations revealed the presence of illite and smectite indicating cold, sub-humid to warm, sub-humid climate. The chlorite as major mineral reported from Pachmari Formation, suggesting cold-dry pulses within warm, humid condition and the illite reported from overlying Denwa, Bagra and Jabalpur formations, suggests cold, sub-humid to semi-arid climate. Coal-carbonaceous shale from Barakar Formation and carbonaceous shale bearing Bijori Formation indicative of luxuriant growth of vegetation suggests humid climatic conditions. Talchir Formation comprises glacio-marine deposits and the rest of the Satpura Gondwana succession largely represents a variety of fluvial depositional regime [2]. The compositional maturity study of sandstone indicated stratigraphic variation as immature–sub-mature –mature–immature for Talchir–Barakar to Pachmari–Denwa–Bagra formations respectively suggests the changing paleoclimatic condition during Gondwana i.e. glacial, cold, arid–temperate, humid–warm, sub-humid – cold, semi-arid. This characteristic cyclical variation of the compositional maturity indicates cyclical changes in climate associated with the Permian Triassic drift of the landmass through different latitudinal zones and the overall change in global climate [3]. Grain size analysis study revealed that most of the sediments from Talchir to Jabalpur formations are strongly fine skewed, moderate to well sorted and leptokurtic to very leptokurtic nature which suggests fluvial depositional environment. The palynological study revealed that the palynomorphs yielded from the Talchir Formation indicates dry climate. The overall palynomorphs recovered from lower Gondwana formations suggest warm, sub-humid climate whereas, for upper Gondwana formations sub-humid to semi-arid climate. Fungal spores and diversified alchritarchs are recovered from sediments of Bijori to Jabalpur formations suggesting changing climatic conditions from intensely humid to increasingly dry. This indicates hydrological changes mainly fresh water input, suggests fluvio-lacustrine depositional environment.

The clay mineralogical and palynological studies indicate the changing climatic conditions from cold-dry; warm, sub-humid to semi-arid however, the compositional maturity of the sediments suggests climate cyclically changed from cold, arid; temperate, humid; warm, sub-humid to cold, semi-arid successively in ascending order from Talchir to Jabalpur formations. The grain size analysis coupled with palynological

studies indicates that Gondwana succession starting from Talchir to Jabalpur formations represents a fluvial to fluvio-lacustrine depositional environment for the sediments of the eastern part of the basin.

References:

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