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Paleoclimate History and Antiquity of Thar

R.P. Dhir*

ICAR-Central Arid Zone Research Institute, Jodhpur 342 003, India

Abstract: The presence of climate-responsive landforms, namely lakes, aeolian and fluvial transported sediments termed sheetwash aggradations and relicts of pre-existing surfaces in the Thar Desert, have generated a wealth of paleoclimate information. Aeolian dynamism has dominated the past ~250 ka (kilo years before present) with episodes of aggradation at 17-13, 30-21, 70-60, 100-80, 140-130, 170-160 and ~250 ka. Most of these episodes were followed by extended periods of landscape stability and soil development, including redistribution of carbonates with in a stratigraphic context. The preceding period i.e., from ~250 to 600 ka was characterized by episodic sheetwash deposition. Deep sections show a stack of aggradations each generally with a discrete calcrete formation. Extensive spatial mobility of carbonates and pronounced pedogenic calcrete development suggest dominance of a distinctly semi-arid climate that was significantly wetter than the present. Relict surfaces are from ~600 ka to 1600 ka. Extraordinary landscape-scale mobility of carbonates is demonstrated by regoliths with massive carbonate enrichment and by the evolved nature of carbonate fabric. Both these attest to their extended antiquity and to a pronounced semiarid with possibility of even wetter episodes during this period. Summing up, studies suggest that for a major part of the past two million years this region enjoyed a semi-arid climate, significantly wetter than the present and that aeolian activity typical of a desertic environment appeared in a much later part of the of the Quaternary. Much has been learnt but scope exists for further refinement.

Key words: Thar paleoclimate, desert antiquity, calcretes in Thar, climate-responsive surfaces of Thar.

Presence of a Thar, a desertic tract, within a sub-continent gifted with a strong monsoon regime is an environmental peculiarity. However, when looked from the west, the region is an easterly limit of the vast mid-latitude desert belt from Sahara through Arabia and Iran. This fringe location makes Thar a potential area to record past extent and strength of monsoon wind circulation regime, the establishment of which is considered to be eight million years ago at least (Gupta *et al.*, 2004). Thar desert should experience an amelioration of its aridity and, shrinkage of its size whenever monsoon regime was strong and conversely, its weakening should have led to an accentuated aridity. Quite early in geomorphological investigations in Thar, it became apparent that sand dunes, a dominant landform in Thar, are stable with evidence of weathering and soil formation and those in vicinity of rocky outcrops are deeply incised. This was inferred to mean that the dune building had happened sometime in the past and possibly in a drier and windier climate than the present and that their stability resulted from a subsequent climate amelioration (Pandey *et al.*, 1964). Discovery of Middle Paleolithic stone tools in obstacle dunes, off the western flank of the foothills of Aravalli Mountains, while confirming above suggested that this dune building happened at least tens of thousands of years ago (Allchin *et al.*, 1978). Disorganization of past drainage system in central Luni basin (Ghose, 1964) and westward shift and break up of proto-Saraswati drainage system up in the north suggested significant changes in hydrological regime (Ghose *et al.*, 1979; Kar and Ghose, 1984). Palynological and hydrological evidences collected dring from salt lakes 1970's (Singh *et al.*, 1974) showed also considerable fluctuations in lake levels and in composition of vegetation surrounding these lakes.

Since these studies a lot of investigational effort has gone into paleoclimate reconstruction in the region. Results of these studies have been extensively published (Singhvi 2004), and a recent review by Dhir and Singhvi (2012) provides an overview of the present understanding of the evolution of the Thar Desert. The present article is another effort with some dimensional elaborations.

*E-mail: dhirrp08@gmail.com
Present address: 498 Defence Colony, Kamla Nehru Nagar, Jodhpur 342 009, India