

Preface

An international symposium on the 'Evolution of Deserts' was held at the Physical Research Laboratory, Ahmedabad during 1992. Enthused with the success of this meeting and recognising the overall scientific potential and the societal relevance of a study of Deserts, the Indian Department of Science and Technology (DST) invited a few scientific groups to synergize and work on a major, coordinated programme towards the understanding of the ideological evolution of the Thar Desert in India. These groups discussed various aspects of such a study and a comprehensive programme of research entitled '**Quaternary Stratigraphy and Palaeoenvironmental History of the Thar Desert**' was submitted to the DST in 1994–95. Under DST's initiative this programme was formally initiated in 1996–97, as a coordinated research programme – **Intensified Research Activity in High Priority Areas** – in Earth Sciences. The participating institutions were the Physical Research Laboratory, Ahmedabad; the Central Arid Zone Research Institute, Jodhpur; the Geology Department, Delhi University, Delhi; Deccan College, Pune; the RSIC, IIT, Mumbai and the Bhabha Atomic Research Centre, Mumbai. A geologist from the Geological Survey of India, Western Region also joined the group—thus it was a truly multi-institutional, multi-expertise effort. This was perhaps the first such experiment in India. In this group, each of the Principal Investigators had a specific expertise to contribute and despite initial doubts, the group worked in perfect synergy and with amazing cooperation. The basic mandate that the group took upon itself was to present the sedimentary record of the Thar Desert in as much a detail as possible and authenticate it with rigorous chemical, petrographic, sedimentological, isotopic and other laboratory and field characterization as possible. Good chronometric controls based principally on the Optical Dating Methods and some on the Electron Spin Resonance Techniques formed a key input to the project. The nature of sedimentary record of the Thar implied sub-structuring of the programme into three major projects, viz.,

- Proxy measures of paleoenvironmental and paleomonsoonal changes in western India using aeolian and lacustrine records of Thar Desert and its margins.
- Alluvial sequences of Luni basin and Quaternary environmental history.
- Characterization and genesis of calcretes – their geomorphic and paleoenvironmental significance.

The special section on the Thar Desert in this issue of the **Proceedings of the Indian Academy of Sciences (Earth and Planetary Sciences)** presents five overviews, summarizing the results from these sub-projects. These reviews are derived from, and build on, over forty publications that emerged out of these projects. These also draw on the previous results to provide a context to the discussions of new results. Each review is thus a comprehensive state-of-the-art appraisal on each sub-area. In addition, we refer to four important contributions that are not covered in these reviews:

- The reconstruction of the paleoflood record of R. Luni for the past millennium by Kale *et al* (2000).
- The development of ESR dating of calcretes, which opens a new possibility in arid zone research by Kailath *et al* (2000) and,
- Geoarcheological studies that demonstrated that man was present mostly during more humid interludes by Mishra *et al* (1999, 2003).

The first review on aeolian sedimentation record of the Thar by Singhvi and Kar basically summarizes the dunal record of the region with a chronometric data-base and brings out key aspects of the age of aeolian sands, periods of their accumulation, their climatic/monsoon connection and the impact of human activity on dune migration rates. For the sake of completeness a survey of dune forming factors is also provided. An important inference of this present study is that a phase lag of a few ka exists between the peak in aeolian aggradations and climatic cycles. This negates earlier textbook concepts on the synchronicity of desert expansion and contraction episodes with global climatic cycles,

and makes it necessary to revisit the chronometric assignments in other deserts. This is needed to make a more realistic assessment of changes in desert albedo through time.

The second review by Deotare *et al* is on the lacustrine sedimentation records of two lakes, Bap-Malar and Kanod in the core desert, and reconstructs the changes in the lake hydrology during the last 15 ka. The study documents the full cycle of changes in lake hydrology from a desiccation state to a perennial state to an ephemeral state. The authors have used multiproxy data including pollen analysis, grain-size, stable-isotopic and AMS radiocarbon ages. A comparison with the other lake records from eastern parts of the Thar desert indicates that there existed a phase lag of up to a thousand years in the hydrological changes between the lakes of core desert and the western part of the desert, as compared to the eastern Thar. Analogously a phase lag of a few centuries is seen in the aeolian aggradation epochs and lake hydrological changes.

The third review by Bajpai attempts hydrogeomorphological evolution of the Luni basin by blending subsurface stratigraphy with remote sensing images and Bouger anomaly data. Based on these, Bajpai identifies major depo-centers and elucidates the controls of tectonics/lineaments in the overall evolution of the region. In addition, lithological variability has been used to reconstruct potential ground water recharge areas and other mining resources.

The fourth review by Jain and Tandon deals with late Quaternary history of Luni, Mahi and Sabarmati rivers. This contribution builds on previously reported detailed stratigraphical studies by the authors and now attempts an intra-basin geological correlation using facies logs and sedimentological parameters and shows that it is possible to define stratigraphic developments in terms of fluvial response to high amplitude changes in climate (principally the monsoon). The study also hypothesizes that there exists an unusually large hiatus between the Quaternary sediments and the underlying older sediments. The reason for and implications of this needs to be tested.

The final review by Dhir *et al* deals with an account of detailed study on calcretes in the central western Thar. Calcretes are an omnipresent feature of the stratigraphy of Thar and are perhaps the least studied formations. This study provides detailed characteristics of the calcretes, their bulk and spot geochemistry using an electron probe

microanalysis and isotopic analysis on phase constrained samples, and discusses their types and mode of evolution. The paper, provides for the first time, an event chronometry of calcretes of the region and in a sense completes the understanding of Thar during the Quaternary.

Overall, all the five overviews present a major advance in our understanding of the Thar and these at the same time also serve as an appetizer for more intensive research in the region. Areas in the extreme west (near the border) and the eastern margins are yet unexplored and so are paleosands reaching out to Delhi and beyond. We hope to follow some of these in due course of time. To an extent, these reviews and the DST programme enabled the preparation of a basic framework on which detailed, more intense studies can now be launched. In this, we hope that these reviews will serve as a datum for substantive high-resolution work. The possibilities are exciting and their scope is perhaps endless.

On a more personal note, as Coordinator of the programme I would like to put on record my deepest appreciation to all the investigators for their total commitment to the programmes, their cordiality, their patience with my lapses and their transparency. I personally feel both humble and enriched with the experience of working and leading a group of scientists so accomplished as them. The realization of the benefits of synergy between minds, people and institutions makes it imperative to suggest more such coordinated programmes on theme/regions which will certainly bring wholesome dividends than perhaps isolated, individual efforts. I finally thank the DST for making this happen.

- Kailath A J *et al* 2000 Electron Spin Resonance characterization of calcretes from Thar Desert for dating applications; *Radiation Measurements* **32** 371–383
- Kale *et al* 2000 Sedimentary records and luminescence chronology of late Holocene paleofloods in the Luni river, Thar Desert, northwest India; *Catena* **40** 337–358
- Mishra *et al* 1999 Prehistoric cultures and late Quaternary environments in the Luni Basin around Balotara; *Man and Environment* **24** 38–49
- Mishra S and Rajaguru S N 2003 Late Quaternary paleoclimates of western India: A geoarchaeological approach. *Mausam* **52** 285–296

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