More transparency required from the funding agencies

In India we need more transparency in the processing of research project proposals that are sent to different funding agencies such as DBT, DST, MNES, MOEn, etc. While some agencies do acknowledge the receipt of proposals, others do not. Again, while some agencies inform about the outcome of the proposals for funding, others do not. However, comments or the grounds on which a proposal has been rejected, if that were the case, are never mentioned. To make the whole affair more transparent it should be made mandatory that the comments or grounds of rejection of proposals should be intimated to the PIs. This would make the PIs focus on the areas that the funding agency is interested in or get information about the aspects in the project proposal that the funding agency did not think of supporting. However, the names of the experts need not be revealed.

V. VENKATESWARA SARMA

G1, Ganpath Villa,
67, Padmavathy Nagar,
Virugambakkam,
Chennai 600 092, India
e-mail: sarmavv@yahoo.com

Palaeochannels and settlements of the Harappan period in Kalibangan, Rajasthan based on geophysical investigations

The Harappan civilization was part of the Vedic civilization (6–3.5 Ky BP), whose remains are found at several places in western India and adjoining Pakistan[1,2], the most important sites being Harappa and Mohenjodaro in Pakistan, and Kalibangan, Sirsa, etc. in India (Figure 1)[3]. The cause for its disappearance or migration is poorly recorded. However, the most popular belief is the disappearance of river Saraswati along the banks of which this civilization flourished. Rivers Ghaggar in India and Hakra in Pakistan that flow with considerably reduced water supply are presently considered remanents of the once mighty River Saraswati. It is therefore believed that due to uplift along the Himalayan front either the river Saraswati was cut-off from its perennial sources of water from the Himalayan glaciers[4] or its main source was diverted eastwards[3].

The Holocene has experienced periods of deglaciation following the Pleistocene glaciations after 12 Ky BP[5] and Neoglaciation after 6 Ky BP, when large rivers discharged water from the Himalayan glaciers into the Gangetic plains; one of them being river Saraswati. However, subsequently during the 3.6–3.9 Ky BP, there was warm and arid climate when the population along this river migrated eastwards[3]. Several attempts have been made to delineate palaeochannels in this region that might be related to river Saraswati. The most important in this regard is the discovery of freshwater at a depth of 50–55 m in Cholistan, Pakistan, based on airborne electromagnetic surveys. Palaeochannels have been identified in this region based on the dating of well water for the period 1.8–6 Ky BP[6], that might be related to the Harappan and Pre-Harappan civilizations in this region. As electromagnetic survey was the most

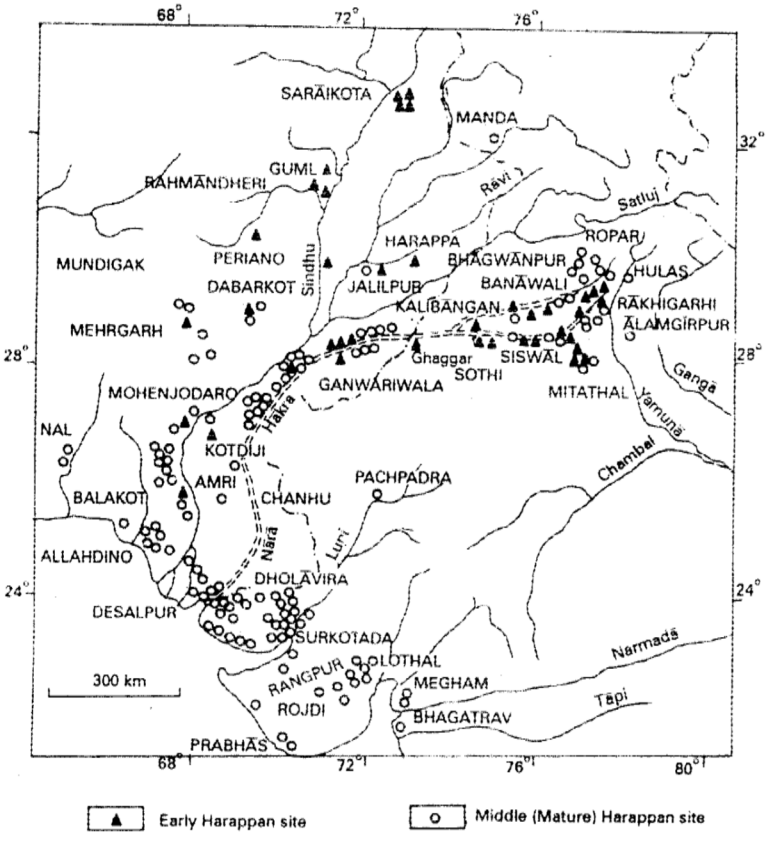

Figure 1. Early and middle Harappan sites in northwestern India and eastern Pakistan showing a concentration of settlements along rivers Ghaggar–Hakra–Nara[3,7].

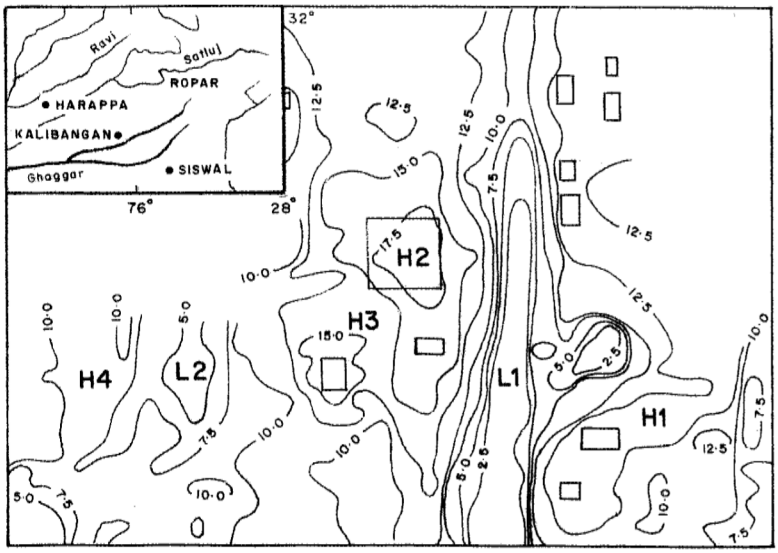

Figure 2. Equiresistivity map of a part of the Harappan site in Kalibangan (Rajasthan) at a contour interval of 2.5 Ohm. (Inset) Kalibangan at the break of river Ghaggar.

successful in identifying palaeochannels of Saraswati in this region, we used the more popular and simple electrical method of resistivity measurements at the surface to investigate palaeochannels in Kalibangan, one of the biggest settlements of the Harappan civilization on the Indian side (Figure 1). Some Pre-Harappan settlements have also been identified in this region by the Archeological Survey of India (ASI)[2].

First some magnetic and resistivity profiles were recorded over known excavated settlements in Kalibangan. These profiles suggested that magnetic signals were quite weak, of the order of 1 nT, and difficult to separate from noise in unknown regions; but resistivity values were significant. We therefore planned to use resistivity surveys to delineate shallow settlements in this region. As the settlements in this region are buried under a thin cover of soil and sand, we carried out a resistivity survey over a grid using Wennar configuration with electrode separation of 2 and 3 m in an unknown area, adjacent to known sites, as suggested by ASI. Due to constant electrode separation, resistance values were plotted directly at the central point of the electrode configuration and contoured (Figure 2). As shown in Figure 2, there is a channel type of feature in the central part with low value of resistance (*L1*), and high resistance features (12–17 Ohm; *H1* and *H2*) along the flanks of the channel. The sections with low resistance indicate palaeochannels as they contain more moisture compared to surrounding regions, while high resistance sections may represent human-based constructions like houses, burial ground, etc. A similar low resistivity (*L2*) feature was also observed in the western part, with high resistance (*H3* and *H4*) features along the flanks that may represent another settlement. This one being deeper may represent Early Harappan civilization, as both occur in the same region at different levels. The present investigation suggests that simple, low-cost resistivity surveys can be used to delineate palaeochannels in this region, some of which may contain potable water that can be used for societal needs.

1. Lal, B. B., *India 1947–1997: New Light on the Indus Civilization*, Govt of India, New Delhi, 1998, pp. 116–123.
2. Thapar, B. K., *South Asian Archeol.*, 1971, **7**, 85–104.
3. Valdiya, K. S., *Saraswati*, Universities Press India Pvt Ltd, Hyderabad, 2002, pp. 1–116.
4. Mishra, D. C. *et al.*, *Mem. Geol. Soc. India*, 2008, **68**, 151–172.
5. Radhakrishna, B. P., *Mem. Geol. Soc. India*, 1999, **42**, XV–XVII.
6. Nair, A. R., Navad, S. V. and Rao, S. M., *Mem. Geol. Soc. India*, 1999, **42**, 303–314.
7. Joshi, J. P. and Bisht, R. S., *India and the Indus Civilization*, National Museum Institute, 1994.

D. C. MISHRA*
K. MALLICK

National Geophysical Research Institute, Hyderabad 500 007, India
**e-mail: dcm_ngri@yahoo.co.in*