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“The Archaeological Setting of Buddhist Monasteries in Ancient India”

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FIELD REPORT

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Contents

PROJECT B: "The Sanchi Dams Project: a pilot study of ancient dam and lake deposits for geological dating and archaeobotanical analysis"

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Dates of project: 15th December 2003 – 10th January 2004

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Introduction

This project involved archaeo-environmental fieldwork at a group of ancient irrigation dams in around the well-known Buddhist hilltop complex at Sanchi, a UNESCO World Heritage site in Madhya Pradesh, India. Their initial documentation took place between 1998 and 2001 during a survey aimed at situating the Buddhist monuments at Sanchi within their wider archaeological landscape (Shaw 2000; 2001; In Press-a) The present pilot project was carried out as a collaboration between the Madhya Pradesh Directorate of Archaeology, Archives and Museums (Bhopal) and the Vidisha Research Group. The principal research design for the present pilot project was to establish a model for the chronology and function of the dams already documented in the area, and to test earlier hypotheses regarding the relationship between changes in agriculture and the environment during the late centuries BC, and wider cultural processes such as urbanization, state-formation and the spread of new religions (Shaw and Sutcliffe 2001; 2003a; 2003b). The study involved the collection of trial samples of buried sediments from selected dam sections and reservoir beds, in order to assess their suitability to OSL (Optically Stimulated Luminescence) [1] dating techniques as well as pollen and phytolith analysis. Samples were obtained using relatively low-impact methods such as cleaning up existing sections caused by road cuttings, and sinking cores and limited soundings, partly because more invasive techniques were not permitted within the terms of our collaborative agreement, but also because of the preliminary nature of the project: it is expected that

[1] OSL refers to the levels of luminescence (light) emitted on exposure to light as the result of released energy accumulated in crystalline materials through the action of ionising radiation from natural radioactivity. When a sediment is exposed to sunlight prior to deposition, the OSL acquired over geological time is removed; the luminescence "clock" is thus set to zero. The OSL then accumulates in response to the ionising radiation received during the burial period of the sediment. The level of OSL observed in ancient samples is thus dependent on the absorbed radiation dose, and hence can be related to the time elapsed since last heating/illumination once the dose received per year (during burial) has been calculated (http://www.rlaha.ox.ac.uk/lumin/lumindx.html.)

the results of this study will provide the foundation for a longer term, multi-disciplinary excavation-based project.

Background

Sixteen ancient dams were documented during earlier survey work carried out over approximately 750 sq km around Sanchi. The dams consist of earthen cores with stone facing on the upstream side, and vary in height from 1 to 6 m, in length from 80 to 1400 m, and in reservoir volume from 0.03 to 3.0 m^3x10^6. In spite of their variety, they appear to have been constructed to a height sufficient to ensure that the reservoir volume would be in accordance with the volume of runoff from the upstream catchment of each site. Preliminary *terminus ante quem* dates of between 1st century BC and 5th century AD were provided by *nāga* (serpent) sculptures located on or near some of the embankments (Shaw and Sutcliffe 2001, 68-71; 2003b, 84-5; Shaw In Press-b). Other chronological pointers were provided by morphological factors such as stone-facing type, and the dates of associated settlements and Buddhist sites. Analysis of surface remains and local hydrology led to a number of hypotheses regarding chronology function, associated crop usage, as well as their relationship to the urban sequence at Vidisha, and the history of Buddhism at Sanchi and neighbouring sites. These may be summarized as follows: i) the earliest phase of construction, based largely on associated archaeological remains, is datable to between 3rd and 1st century BC, with others up to 5th century AD or later; ii) they were built to provide irrigation, possibly for rice, as a response to the increased population levels suggested by the distribution of habitational and Buddhist sites in Vidisha's hinterland; iii) their configuration in relation to the wider archaeological landscape provides an empirical basis for suggesting that they were part of a cultural package that accompanied the spread of Buddhism, urbanization and the development of centralized state polities between c. 3rd and 1st centuries BC; and iv) similarities with inter-site patterns in Sri Lanka, where monastic landlordism is attested from c. 2nd century BC onwards, have led to the suggestion that the Sanchi dams were underlain by reciprocal exchange networks between the *sangha* and the local laity.

Sanchi Dams Pilot Study

The current pilot study sought to test these hypotheses by applying two main methods: a) obtaining undisturbed sections through selected dams in order to study dam morphology, and to obtain geological (OSL) and archaeological (eg., ceramics) samples for dating the construction of the dam; and b) sinking cores within selected reservoir beds in order to gauge sedimentation depth, and to collect geological samples for establishing a date-range over which the reservoirs were in use. Samples of organic-rich ancient lake deposit were also collected for the purpose of environmental reconstruction through pollen and phytolith analysis. The crucial question that this component of the project sought to answer was "were the Sanchi dams built to irrigate pre-existing crops such as wheat, or were they part of a new agrarian system such as wet rice cultivation"? Further insights into dam function and associated land-use are provided by detailed contour mapping and satellite remote sensing currently being carried out as part of a separate, but related project.[2] Intensive survey shed new light on the position of spillways and sluices, while contour measurement at intervals of 1 m helped to clarify uncertainties about the relationship between upstream and downstream levels, as well as refine earlier hydrological calculations regarding volume and runoff ratios. Further, satellite remote sensing holds the possibility of identifying palaeochannels or distribution channels associated with the reservoirs.

Geological dating of ancient irrigation structures

Dams are extremely difficult to date due to the nature of their construction: the fact that building material is often quarried from several places, with frequent bouts of restoration, makes dating of associated charcoal, wood or ceramics fairly suspect. In south Asia, the dating of ancient reservoirs has for the most part relied on inscriptions and architectural (particularly sluice) typologies, with very little application of scientific methods (Venkayya 1906; Parker 1909; Brohier 1934 (reprint 1979); Davison-Jenkins 1997). In more recent years, considerable progress has been made in the dating of Sri Lankan irrigation systems following advances in quaternary soil analysis (Myrdal-Runebjer 1994; Risberg *et al.* 2002). Of most relevance to the current study, however, are recent studies drawing on OSL to date ancient irrigation structures. For the most part, these have focused on canals such as for example the Mekong delta project in southern Cambodia (Bishop *et al.* 2004). In such cases, OSL provides an opportunity for dating the excavation of the canal, 'because such excavation (or reexcavation) should 'bleach' the sediments at the excavated surface as it is dug" (*Ibid*., 321).

A similar concept lies behind the use of OSL for dating dams: either we are dating the moment that the underlying soil was plunged into darkness by the laying of the dam, or we are dating the moment the sediment used in the body of the dam was excavated from its original context. In both cases, we are measuring the amount of OSL accumulation, or time elapsed, since the sediment's last

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[2] Both components are being carried out as part of a BASIS funded project entitled "Mapping dams, settlements and Buddhist sites in central India". The project is being organised as a collaboration between the Vidisha Research Group (Principal Researcher: Julia Shaw) and Durham University (Graham Philip and Anthony Beck).

exposure to light. However, the reliability of such methods is dependent on a number of variables, the most obvious being the original provenance or mode of excavation of the dumped material within the dam. Further, for OSL to work, chystalline materials (eg., sand) need to be present within the sample, and thus, not all areas are suitable for this type of dating. This may cause variable success rates even across the present study area, with the Sanchi dam, for example, contained much higher levels of sand than the Devrajpur dam. The pilot study was thus aimed at assessing the area's suitability to OSL methods, before embarking on a larger-scale project in the future.

OSL samples were collected from dam sections as well as dried up reservoir beds. In the first instance, existing sections caused by modern road cuts through the embankment were cleaned up in order to identify the interface between the dam base and the underlying buried soil surface. Samples were taken from both above and below this horizon. Samples were collected in light-resistant plastic tubes hammered into the section and dug out using a trowel. Cores were also drilled in selected reservoir beds, using a screw-head hand auger (0.25 x 0.10 m hollow head), with OSL samples collected both above and below the interface between the lake bottom and the underlying pre-dam deposit. Samples were collected by removing a sufficiently large lump of sediment from the auger head so as to ensure that the inner portion remained unexposed to light. This was then wrapped in aluminium foil and placed in a light resistant bag.