

SOUTH ASIAN RADIOCARBON DATINGS; CALIBRATION AND COMPUTER GRAPHICS

David Liversage*

Now that American and European laboratories working independently have arrived at identical calibration curves for radiocarbon dates, it is no longer possible for even the most conservative archaeologist to disregard calibration.

Here I have taken most of the South Asian archaeological dates from *Radiocarbon* and calibrated them according to the 20-year calibration curve of Pearson and Stuiver (1986), using Stuiver's computer program (Stuiver and Reimer 1986). I have then displayed these using a graph program that makes them easy to view and grasp. 373 datings are used in the displays out of a total database of 433 datings. Datings are only presented here if they have a clear cultural attribution. Dates on bone have been omitted owing to the problems of collagen extraction with sub-tropical samples.

It is generally familiar knowledge that every carbon-14 date has a standard deviation expressed as a \pm value. This does not give the minimum and maximum values possible, but does say something about how far the date is expected to differ from the central value. Unfortunately the actual error is probably larger than the standard deviation theory would predict. This conclusion is a by-product of the study of the very large number of tree-ring dates of known age that have been made to produce the calibration curves.

Owing to the zig-zags of the calibration curve some dates have more than one possible calibrated value, and there is no way of telling which is correct. One has therefore to assume it could be any of them, and the area of possibility of the date becomes very much enlarged and acquires an irregular shape. There is no "correct" way of dealing with this problem and such dates cannot be ignored. The expedient used here has been to treat the median of the possible calibrations as the calibrated date, but clearly such dates have a wider expected error than the others.

These facts make it clear that the nice little triangles and squares that appear in the graphics should really be thought of as dirty smudges, larger for some dates than others. For these reasons it is necessary to think statistically and use a large number of dates as there is no mechanism that would make them all consistently either too early or too late.

Therefore, they should be expected to accumulate around the correct area, however far out individual dates may sometimes be. Mortimer Wheeler would no doubt have said the dates should be marshalled in squadrons.

Fig. 1 shows early dates from the Indo-Iranian highlands in west Pakistan and Afganistan. Three dates from the middle of the 5th millennium BC show settlement already present, and indeed dates from Mehrgarh (not included here) go much further back. The early layers at Mundigak are from the middle of the 4th millennium BC. The datings shown here are mostly previous to the Kot Dijian, but some overlap.

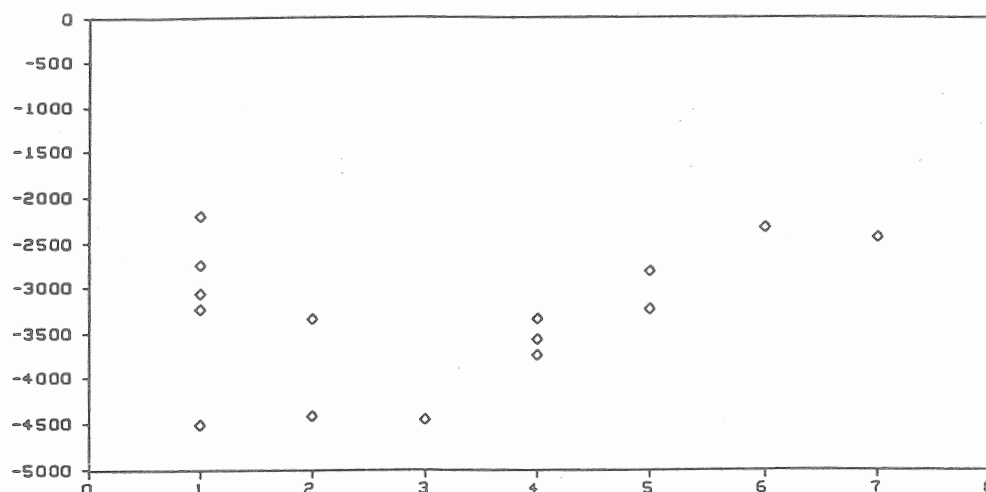


FIGURE 1: CALIBRATED EARLY DATES FROM AFGHANISTAN AND PAKISTAN
1, Deh Morasi; 2, Rana Ghundai; 3, Kile Gul Mohammed; 4, Mundigak; 5, Damb Sadaat; 6, Niai Buti; 7, Nindowari.

The Harappan Complex

In Fig. 2 are shown dates from the whole Harappan complex, consisting of the "Pre-Harappan", "Mature Harappan" and "Post-Harappan", represented by different symbols. Owing to the smudging effect mentioned the symbols for the cultures may be assumed to overlap more than the actual cultures did. The dates show that the Pre-Harappan should not be thought of as a single culture, but as regional groups with different time ranges. Some indeed are contemporary with the Mature Harappan, and in these cases the appropriateness of calling them Pre-Harappan at all may be called in doubt.

Amri and Kot Diji go further back than the others. The Amri date is from period I of the site and must come from near the beginning of the settlement. As the dates from Kot Diji itself appear to succeed the construction of the citadel, fortified citadels must already have existed in Pre-Harappan times.

The Mature Harappan in Sind is represented by Mohenjo Daro and Allahadino. The series from Mohenjo Daro are from Dales' excavation and all samples should have about

the same real age. The diagram illustrates nicely how the dates get smudged out and seem to cover a longer period than they really do. Moving eastwards, Kalibangan gives a splendid series that presumably embraces the local Pre-Harappan, Mature Harappan, and Post-Harappan, though only the first two are mentioned in the dating lists. The samples submitted as Pre-Harappan lie earlier on the whole than those submitted as Harappan and the big overlap is due to the statistical effects. The actual Harappan and Pre-Harappan at Kalibangan naturally did not overlap. The "Pre-Harappan" of Kalibangan is a later culture than the Kot Dijian and does not appear until the middle of the first half of the 3rd millennium BC. As this is confirmed by Sothi and Banawali, we may take it to be a fact that the Pre-Harappan of northern India was a later culture than the Kot Dijian. Two other dates from Banawali are very late, and belong possibly to a retarded Post-Harappan, while the post-Harappan dates from Sanghol and Bara lie about where expected. The relative chronology of the Kot Dijian, Kalibangan, and Mature Harappan cultures as indicated by C14 agrees perfectly with what Casal had earlier deduced from the pottery (Casal 1969).

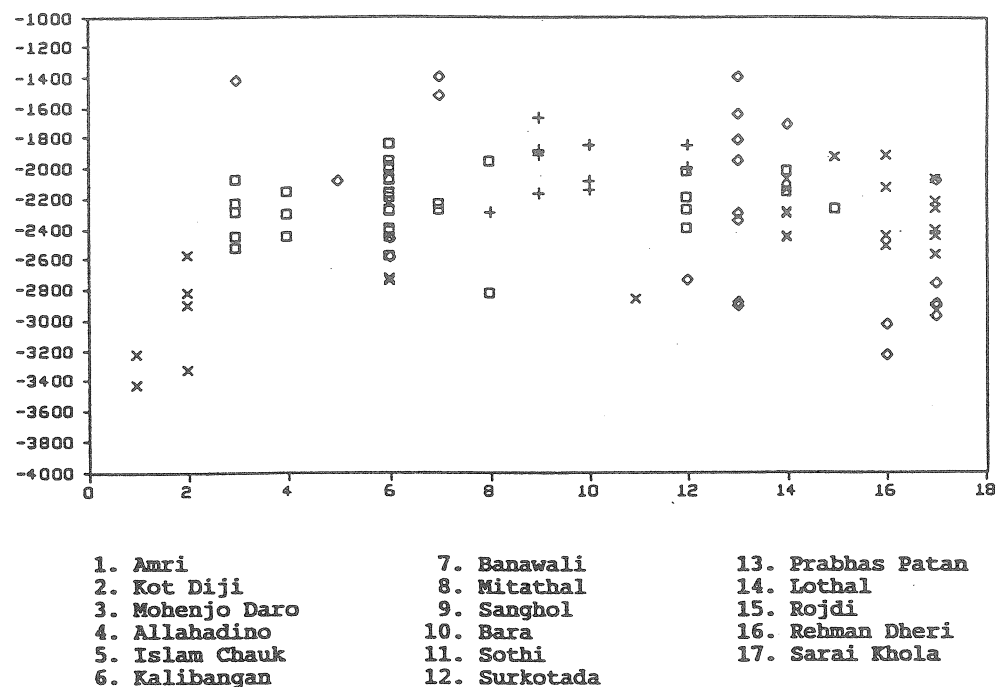


FIGURE 2: CALIBRATED DATES FROM THE HARAPPAN COMPLEX

x = Pre-Harappan; □ = Mature Harappan; + = Post-Harappan; ◇ = Unspecified.

In Gujarat there is a perfect series from Surkotada with unspecified presumed Pre-Harappan, Harappan, Post-Harappan and Chalcolithic in the right order and at the same

time as in northern India. There is a similar, but longer sequence at Prabhas Patan, where the cultural attributions of the samples are not given, but are presumably the same. Lothal, on the other hand, begins later, and it looks as though the entire settlement, including the initial flood debris, belongs chronologically to the Mature Harappan.

At Rehman Dheri and Sarai Khola we have the situation that samples submitted as Kot Dijian belong chronologically to the Mature Harappan, and at Sarai Khola the samples submitted as "Neolithic" date to the Kot Dijian. The series are internally consistent, and perhaps a retarded regional pottery style has led to excessively early archaeological datings. Collectively the datings place the climax phase of the Harappan culture in the second half of the 3rd millennium BC, which agrees well with the dates of the trade contacts with Mesopotamia.

Cultures of the Deccan

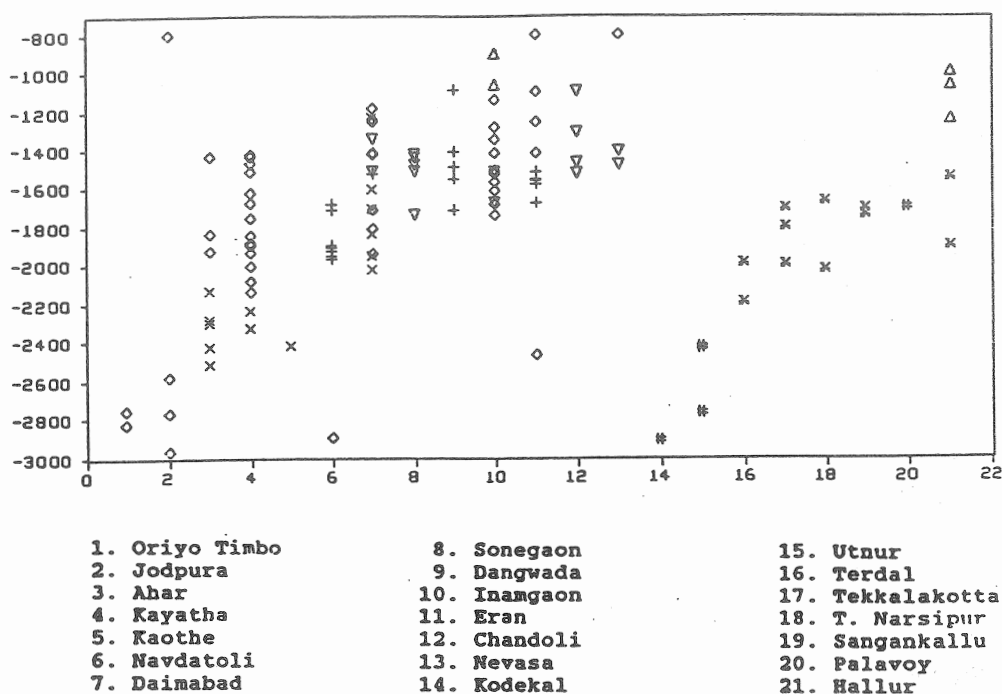


FIGURE 3: CALIBRATED DATES FROM THE DECCAN NEOLITHIC/CHALCOLITHIC
 x = Early North Deccan; + = Malwa; v = Jorwe; Δ = Late Jorwe; # = Ash Mounds;
 * = South Deccan Neolithic/Chalcolithic; ◇ = Unspecified.

The datings from the Neolithic/Chalcolithic of a huge area of the Deccan are shown in Fig. 3. There are enough dates to make it exceedingly likely that there were pottery-making settlements before Mature Harappan times far beyond the ambit of the

Harappan culture. Two datings from Oriyo Timbo near the Gulf of Cambay, supposed to apply to Post-Harappan "lustrous red ware", cannot apply to this but show very early pottery settlement. There are good early series of dates from Ahar and Kayatha and one date from Kaothe. Dates so early that they must be totally unconnected with the Harappan sequence are indicated at Jodpura, but I have not much information. I have used the term "Early North Deccan" to cover the cultures using Aharian, Sawalda and Kayatha wares. The three sites these wares were named after were occupied while the Harappan flourished, but samples attributed to Sawalda and Kayatha wares at Daimabad are so much younger that it seems that the equation of the pottery must be wrong. The Malwa culture at Navdatoli falls very nicely into a few centuries after 2000 BC. The deviant very early sample from Navdatoli is unexplained, but was found some distance above the original surface associated with Malwa ware. There is also a deviant early date at Eran. A date for the Malwa culture at Eran agrees with Navdatoli, but there is a series from Dangwada where "Malwa" ware is distinctly younger and contemporary with Jorwe. This also calls for further study of the pottery.

Jorwe comes out as it should, later than Navdatolian Malwa. The sites in question are Sonagaon, Chandoli, and Nevasa. The Jorwe culture occupied the middle of the 2nd millennium BC. Late Jorwe is only dated at Inamgaon, and seems to be substantially later. Summing up, there were important non-Harappan village cultures in the north Deccan from at least 2500 BC., while further south the Malwan appeared around 2000-1900 BC and was replaced by the Jorwe culture around 1600 BC. The degenerate phase of the Jorwe is not well dated, but at Inamgaon began around 1100 BC.

Turning to the southern Deccan, represented by the right-hand part of Fig. 3, there are enough dates to show that the ashmounds go back to the first half of the 3rd millennium BC. This shows that there were cattle herders in remote parts of the Indian peninsula contemporary with the Kot Dijian. There are three datings from Utur, but two are so close together that they look like one in the diagram. It is not until shortly before 2000 BC that we have other dated sites in the South. The southern Neolithic/Chalcolithic had a long life without a great deal of change during the existence of the Malwa and Jorwe cultures. Upper layers at Hallur, described as "transitional", look as though they might be contemporary with the Late Jorwe. The spread of the dates from Tekkalakotta is consistent with a unitary short-occupation (apart from the secondary Iron Age settlement, which is not radiometrically dated). Also, the samples from Sangankallu should be close together in time as they were taken from adjacent layers.

The Ganges Cultures (Fig. 4)

Chopani Mando has produced unique pottery and an unexpectedly early date which we hope will be confirmed from further sites. The Gangetic Neolithic/Chalcolithic takes off properly in the first half of the 2nd millennium BC. There is a splendid stratigraphical series at Chirand showing steady development from a possibly Mesolithic basal deposit with rich bone and antler work right through to the Iron Age. Through the kindness of

Sita Ram Roy I had the opportunity to examine some of the material, and found the sequence to be clearer than emerges from the few publications.

Shorter stratigraphies similar to that of Chirand are available at Sohagaura and further downstream at Bharatpur and Mahisdal. At all these sites there appears to have been a slow and steady development in the pottery from fairly simple beginnings to greater sophistication. Nearly the whole part prior to the PGW is described as Black and Red Ware (BRW), but this could certainly be subdivided. Late stages of BRW downstream are indicated by short series or single dates from Bahiri, Sonpur and Sringerapuram and upstream from Atranjikhhera. If there was any contact between the Aharian and the Gangetic BRW it could only have been between late Ahar and a very early part of the Ganges culture, and it is a question whether the similarities in the pottery have not been overestimated.

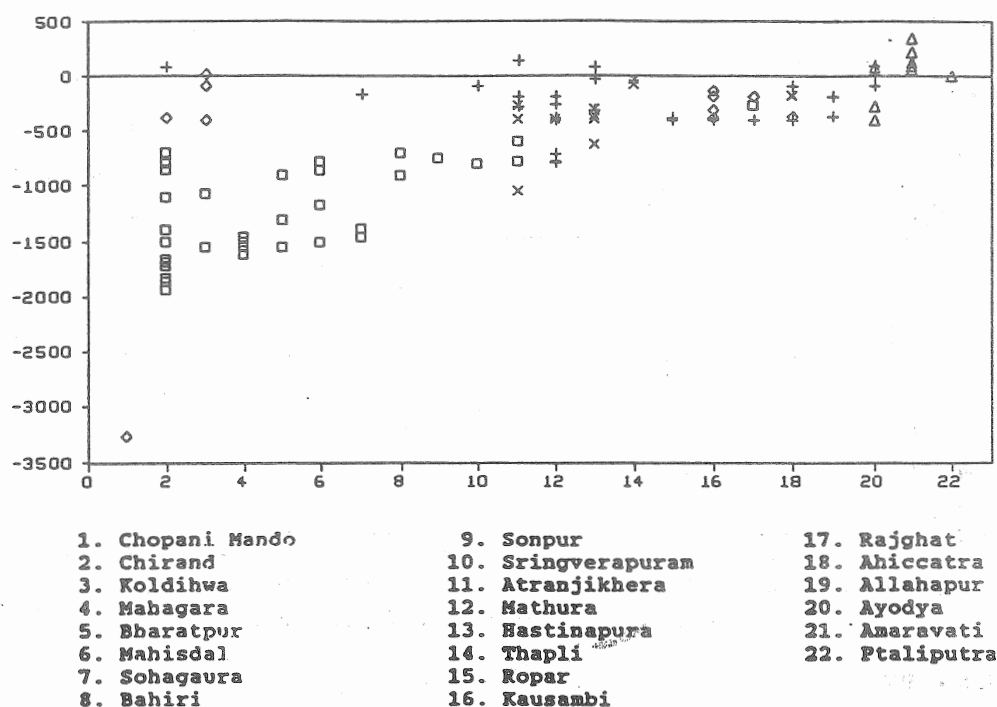


FIGURE 4: CALIBRATED DATES FROM THE GANGES CIVILIZATION, MAIN SHEET

□ = BRW/Chalcolithic; x = PGW; + = NBP; △ = Early Historical; ∇ = Unspecified.

The marginally situated twin sites of Koldihwa and Mahagara are placed by several dates in the mid-2nd millennium BC. Some 7th-6th millennium BC dates from Koldihwa do not fit into the picture at all and must be of charcoal fished up from some underlying Mesolithic.

Figure 5 shows on a larger scale the part of the same diagram around the culmination of the Ganges Culture. Datings of the Painted Grey Ware (PGW) or Northern Black Polished Ware (NBP) to before the middle of the millennium at Mathura and Hastinapura stand too isolated to accept, and these high quality mass-produced wares can hardly have come into use before the fifth century BC. Unfortunately, owing to the "smudging" effect, radiometric dating cannot be used to confirm the stratigraphically demonstrated sequence from PGW through NBP to Early Historical because the differences in time are too small. Only at Atranjikhhera and Hastinapura do the first two even come in the proper order. The average of the PGW dates is 380 BC and of the NBP dates 303 B.C., but this procedure cannot be recommended. From the calibrated datings it looks as though the NBP continued in use for longer than is generally supposed, namely to about AD 1, but the transition to the "Early Historical" (as defined by the end of production of the fine NBP wares) is also unclear from the diagram. Two excessively early historical dates from Ayodya must in all events be discounted. The Amaravati series fits in very well where it should.

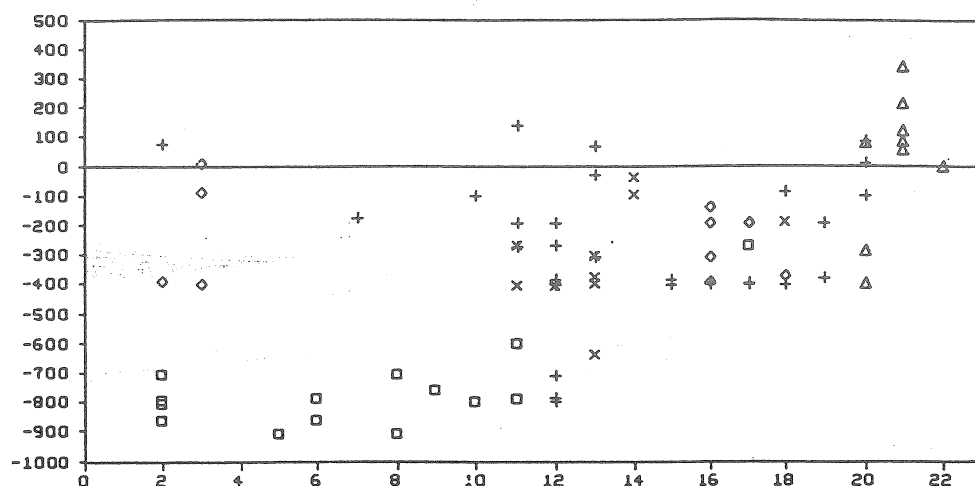


FIGURE 5: CALIBRATED DATES FROM THE GANGES CIVILIZATION, MAGNIFIED PART
Same site numbers and symbols as in Fig. 4

SUMMARY

The dates largely support the model of the main events of Indian prehistory presented by the author to the South Asian Archaeology meeting in Denmark, except that there are some early dates from the North Deccan which I was then unacquainted with. The cultures of the Indo-Iranian highlands go very far back, but there was no spread of food production and adaption to the very special conditions of the Indus lowlands until the 4th millennium BC. The early Indo-Iranian cultures themselves should be seen as part of the Southwest Asian cycle and there is little sign of even a Mesolithic occupation of the Indus lowlands before the Pre-Harappans.

It is a surprise to find how far food production and the use of pottery were in existence in Peninsular India even in the early days of the Harappan sequence, though there are no signs of close relationship to this sequence. The people of the ash mounds might have been the first to domesticate Indian *zebu* cattle, and food-producing villagers with pottery seemingly unrelated to that of the Harappan complex appeared in the northern Deccan in the early 3rd millennium BC at Ahar. There is clearly a great deal here that still needs to be worked out by archaeologists.

Both the Indus and the Deccan cultures were in a sense transitory cultures that disappeared leaving no permanent legacy. But at around 2000 BC, still in the time of the Late Harappan, a riverine culture began taking form along the Ganges and its tributaries and developed without a break into the major civilization that produced the Buddhist and Hindu religions and preserved the Vedas.

REFERENCES

- Casal, J.-M. 1969. *La Civilization de l'Indus et ses Énigmes*. Paris: Fayard.
- Pearson, G.W. and Stuiver, M. 1986. High-precision calibration of the radiocarbon time-scale, 500-2500 BC. *Radiocarbon* 28: 839-62.
- Stuiver, M. and Reimer, P.J. 1986. A computer program for radiocarbon age calibration. *Radiocarbon* 28:1022-30.