A petroleum ether extract of another batch of the plant collected during the summer of 1967 did not yield enhydrin but gave elemental sulphur and the orange-red oil besides a good yield of a long chain aliphatic ester (m.p. 84-86°). A subsequent chloroform extract, did, however, contain enhydrin as shown by TLC but it could not be isolated in a pure state.

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RADIOCARBON DATES OF KALIBANGAN SAMPLES

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KALIBANGAN, the well-known Harappan site on the river Ghaggar, has been extensively excavated (Ghosh, 1960–63) by B. B. Lal and B. K. Thapar under the aegis of the Archæological Survey of India. The site was extensively sampled for both Kalibangan I and II periods. The C^{14} dates of the samples collected from this site and a brief discussion thereof are presented in this article.

All samples are cleaned manually first to get rid of extraneous matter including visible rootlets, and then treated with dilute HCl to remove soluble carbonates. Wherever possible, NaOH pretreatment was also given to remove any humic acid present. Samples are counted in the form of methane in gas proportional counters. For modern reference standard 95% activity of N.B.S. oxalic acid was used. Processing procedures have been described in detail earlier (Agrawal *et al.*, 1965).

All dates are given in years B. P. The first date is based on radiocarbon half-life of 5568 yrs.; the second, within brackets, is based on the value of 5730 yrs.

Discussion

Kalibangan provided a very rich site for extensive sampling. A sizable number of samples was dated not only to determine the time-spreads of the two cultures, but also to study the internal consistency and factors responsible for divergences, if any. As the excavations were scientifically controlled, any ambiguity due to stratification errors could largely be avoided. The only errors which could arise at this site were those due to humic acid and such other factors.

The Kalibangan Period I dates are all consistent, except for TF-240. Due to the presence of structures above, good levels with proper soil-cover generally could not be tapped for sampling the Period I sequence. Most of the samples are derived from the periphery of the mound. Thus humus contamination coupled with the inherent errors of the order of ± 100 yrs. can easily magnify such short-time brackets; the spread therefore could be smaller but in no case larger.

Kalibangan has by now been extensively dated (Agrawal and Kusumgar, 1966). For Kalibangan II (Harappan) a consistent sequence of dates exists for the early and middle phases. This helps in selecting the meaningful dates from the scatter of late phase.

We would discuss below the factors which could affect the dates at Kalibangan site.

The role of soil-cover in preserving the samples against contamination has been recognized. Sites that have been deserted thousands of years before, like Kalibangan, get humic acid from organic decay right up to the time of excavations. Samples near this surface will get the maximum amount of youngest humic complexes. However, sites with continuous occupation up to the modern times will not be affected much as the difference in the humic acid activity and that of the sample from late historical levels will not be significant.

Two youngest dates were obtained for TF-138 and TF-244—both the samples were just near the surface. As these samples were fragile, NaOH pretreatment for the removal of humic acid too could not be given. Also, samples from the periphery of the mound (with nominal soil-cover), especially from KLB-1, did show some contamination. On the other hand, TF-607 and TF-608, which were collected purposely from under a deep soil-cover (~ 4·5 m.), gave the earliest dates for early Harappan phase at Kalibangan. On the whole, C^{14} dates for Kalibangan Period I and the early and middle phases of Period II are internally consistent; only late phase of Period II shows scatter.

Faulting of strata does allow upper material to percolate to the lower levels. Clear evidence of subsidence was reported by the excavator in the sections above the levels from which TF-162 and TF-240 derived. Both of these samples show younger than archæologically expected ages.

While "humic" contamination tends to make the dates younger, "post-sample-growth error", on the other hand, makes them older. For example, if a tree of 200 years age is felled and charcoal from its periphery and core dated separately—the two samples should show a difference of 200 years though derived from the same tree. Slightly older dates for TF-25 and TF-153 from Kalibangan may be due to post-sample-growth error. For example, samples from Karla (TF-185, TF-171 and BM-92) which were derived from the core portions of big trunks all gave older ages.

Our conclusions from these studies are that charred grain and charcoal from short-lived trees, from strata preserved by sufficient soil-cover, make ideal samples for C^{14} dating.

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C^{14} DATES WITH SAMPLE DESCRIPTIONS

Kalibangan, Rajasthan India

Kalibangan (Lat. 29° 25′ N., Long. 74° 05′ E.), District Sri Ganganagar, is a well-known Harappan site. The site was identified by A. Ghosh and is being excavated by B. B. Lal and B. K. Thapar since 1961.

There are two cultural periods at the site. The excavators prefer to call them Kalibangan I*, the earlier period and, Kalibangan II*, the Harappan period. The same terminology has been used in this paper.

TF-138, Kalibangan II, 3075 ± 100
(3165 ± 105)

Charcoal from Trench KLB-2, Locus A 7, Qdt. 4, Layer 3, Depth 0·9 m., Field No. KLB-2, A7/C/1962-63-1. Comment: sample derives from the uppermost levels of the mound. Deposit covered by a thin Layer (2) on the slope. Late phase.

TF-244, Kalibangan II, 3250 ± 90
(3340 ± 95)

Charcoal from Trench KLB-2, Locus E 2, Qdt. 4, Layer 2, Depth 0·35 m., Field No. KLB-2, E 2/C/1963-64-4. Comment: sample derives from the uppermost levels of the mound. Covered by Layer (1) 15 cm. thick. Late phase.

TF-143, Kalibangan II, 3510 ± 110
(3615 ± 110)

Wood from Trench KLB-2, Locus YA 1, Qdt. 3, Layer 2, Depth 0·25 m., Field No. KLB-2, YA 1/C/1962-63-8. Covered by 10 cm. deposit of Layer (1). Late phase.

TF-149, Kalibangan II, 3675 ± 140
(3780 ± 145)

Charcoal from Trench KLB-2, Locus ZE 1, Qdt. 4, Layer 3, Depth 0·65 m., Field No. KLB-2, ZE 1/C/1962-63-15. NaOH pretreatment was also given. Comment: late phase.

TF-153, Kalibangan II, 3910 ± 110
(4025 ± 110)

Charcoal from Trench KLB-2, Locus XB 7, Qdt. 2, Hearth sealed by layer 1, Depth 0·25 m.,

*These periods should be distinguished from the identical names of the two mounds of Kalibangan.

Field No. KLB-2, XB 7/C/1962-63-20. Comment: late phase (?). Older date may be due to post-sample growth error.

TF-152, Kalibangan II, 3615 ± 85
(3720 ± 90)

Charcoal from Trench KLB-2, Locus XB 9, Qdt. 4, Layer 5, Depth 0·95 m., Field No. KLB-2, XB 9/C/1962-63-18. NaOH pretreatment was also given. Comment: soil-cover about 80 cm. Middle phase.

TF-142, Kalibangan II, 3635 ± 100
(3740 ± 105)

Charcoal from Trench KLB-2, Locus XB 8, Qdt. 4, Layer 4, Depth 1·15 m., Field No. KLB-2, XB 8/C/1962-63-7. Comment: middle phase.

TF-141, Kalibangan II, 3705 ± 110
(3810 ± 115)

Charcoal from Trench KLB-2, Locus A 7, Qdt. 3, Layer 7, Depth 1·64 m., Field No. KLB-2, A 7/C/1962-63-6. Comment: middle phase.

TF-163, Kalibangan II, 3910 ± 100
(4030 ± 105)

Charcoal from Trench KLB-1, Locus YE 1, Qdt. 4, Layer 2 R, Depth 0·47 m., Field No. KLB-1, YE 1/C/1962-63-13. Comment: early phase.

TF-607, Kalibangan II, 3930 ± 120
(4040 ± 125)

Charred wheat and charcoal bits from Trench KLB-2, Locus A-8, Qdt. 2, Layer 18. Depth 4·10 m., Field No. KLB-2, A-8/C/1965-66-9. Comment: early phase.

TF-608, Kalibangan II, 3910 ± 110
(4025 ± 110)

Charred wheat, from Trench KLB-2, Locus A-6, Qdt. 2, Layer 18, Depth 4·50 m., Field No. KLB-2, A-6/C/1965-66-10. Comment: early phase.

TF-605, Citadel Fortification, 3810 ± 105
(3925 ± 110)

Charcoal from Trench KLB-1, Locus ZB-9, Qdt. 3. Layer 10, Depth 1·65 m., Field No. KLB-1, ZB-9/C/1965-66-7. NaOH pretreatment was also given. Comment: seems to be well covered. Sample belongs to late phase of citadel fortification.

TF-154, Kalibangan I, 3665 ± 110
(3770 ± 115)

Charcoal from Trench KLB-1, Locus ZC 2: Layer 8, Depth 2·7 m., Field No. KLB-1, ZC 2/C/1962-63-2. Comment: late phase.

TF-165, Kalibangan I, 3800 ± 100
(3915 ± 105)

Charcoal from Trench KLB-1, Locus XD-1, Qdt. 1 and 2, Layer 2 R, Depth 2·35 m., Field No. KLB-1, XD 1/C/1962-63-15. Comment: late phase.

TF-156, Kalibangan I, 3740 ± 105
(3850 ± 110)

Charcoal from Trench KLB-1, Locus XE 1, Qdt. 1, Layer 2, Depth 0·8 m., Field No. KLB-1, XE 1/C/1962-63-5. NaOH pretreatment was also given.

TF-161, Kalibangan I, 3930 ± 100
(4045 ± 105)

Charcoal from Trench KLB-1, Locus YF 2, Qdt. 2, Layer 3, Depth 1·4 m., Field No. KLB-1. YF 2/C/1962-63-11. Comment: middle phase.

TF-162, Kalibangan I, 3940 ± 100
(4055 ± 105)

Charcoal from Trench KLB-1, Locus XE 1, Qdt. 2, Pit 1 sealed by Layer 3, Depth 1·85 m., Field No. KLB-1, XE 1/C/1962-63-12, Comment: early phase. Substantial subsidence in the section evident (B.K.T.).

TF-241, Kalibangan I, 4090 ± 90
(4205 ± 95)

Charcoal from Trench KLB-1, Locus XD 1, Qdt. 1, Pit 4 sealed by Layer 2, Depth 2·75 m., Field No. KLB-1, XD 1/C/1963-64-1, Comment: early phase.

TF-157, Kalibangan I, 4120 ± 110
(4240 ± 120)

Charcoal from Trench KLB-1, Locus YF 2 Qdt. 3, Layer 5, Depth 1·2 m., Field No. KLB-1 YF 2/C/1962-63-7. Comment: early phase.

TF-155, Kalibangan I, 4195 ± 115
(4320 ± 120)

Charcoal from Trench KLB-1, Locus ZB 2, Layer 9 B, Depth 3·40 m., Field No. KLB-1. ZB 2/C/1962-63-3. Comment: sample from just above the natural soil; 3·3 m., soil-cover Early phase.

TF-240, Kalibangan I, 3610 ± 110 (3715 ± 115)

Charcoal from Trench KLB-1, Locus XD 1, Qdt. 1, Pit 3 sealed by Layer 3, Depth 2·50 m., Field No. KLB-1, XD 1/C/1963–64–1. NaOH pretreatment was also given. Comment: date is younger than expected archæologically.

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MOULDS AND MEN

"MOULDS and men are going to proceed till the end of time very much in each other's company." Moulds, the tiny and often microscopic fungi which will grow on almost anything, are, ironically, best known to the public through their ability to produce chemical weapons, such as antibiotics, so valuable in the fight against disease. These drugs have given moulds the reputation of being the friends of man, but in fact they are just about the toughest and most adaptable parasites that human beings have to cope with.

Moulds are more truly parasitic than most of the plants called parasites, because they contain no chlorophyll. They are unable to trap the Sun's energy and use it to convert water and carbon dioxide into more complex compounds. Instead, they obtain the ready-made chemical building-blocks from somewhere else, by using a method of feeding known as saprophytic. This is done with a network of tiny white threads called a *mycelium*. These threads can be found on jam, bread or old golf shoes. The threads, properly called *hyphæ*, absorb food continually all over their surfaces, but unfortunately such familiar foods are only a tiny fraction of the substances which fungi have learnt to dissolve and absorb in their continual hunt for food. The latest problem brought about by ravening fungi is the damage they cause to electronic equipment.

Modern circuits are often miniaturised to the point where the components are so closely packed that they cannot be cleaned. The connections between them are usually made from wires covered with polyvinyl chloride plastic, or with cotton, both of which are food to fungi. Not only do moulds destroy insulation and cause short-circuiting in this way, they also form their network of mycelium inside black boxes full of electronic equipment and these threads conduct electricity enough to spoil the working of delicate equipment.

Moulds have also been making a special nuisance of themselves in optical instruments. They feed on the leather cases of such instruments and spread to the lubricating greases and sealing compounds used to keep other forms of life out. They also eat the surface lacquer finishes of the glass. They corrode metal parts and even etch away the glass itself. Fungi in the tropics are now seriously delaying the progress of medical research by their attacks on all kinds of instruments, including microscopes.

What is the answer to this growing problem of the ubiquitous mould? One suggestion which has been tried is to use high doses of radiation for fungal control. But the moulds which are now learning to attack most of the new plastics as easily as dry rot attacks wood pose a problem, because radiation powerful enough to kill them is also liable to alter the chemical properties of the plastics.—(*Courtesy*: British Information Service, British High Commission in India.)