# The Iranian Prehistoric Project

## New problems arise as more is learned of the first attempts at food production and settled village life.

Robert J. Braidwood, Bruce Howe, Charles A. Reed

*Abstract.* Many indications point toward the hill flanks of the Fertile Crescent in southwestern Asia as the scene of the earliest development of effective food production and a village-farming-community way of life, some 10,000 years ago or less. In its 1959–60 field season, with a staff made up of both cultural and natural historians, the Iranian Prehistoric Project reclaimed further evidence of this important transitional step in human history. This is a short interim report, based entirely on an in-the-field assessment of the materials.

The Iranian Prehistoric Project (*1*), with essentially the same senior staff as that of the old Iraq-Jarmo projects (*2, 3*), spent a field year in the intermontane valleys of the Zagros Mountains near Kermanshah in Iran, from September 1959 through June 1960. The expedition's field collections reached Chicago late in 1960, and work on the processing and interpretation of these materials is now beginning. The goal of this expedition, as of the previous ones, was the reclamation and interpretation of evidence for the earliest appearance of an effective food-producing and village-farming-community way of life.

Various circumstances dictated the shift from the somewhat lower valleys (about 2500 feet) of essentially the same environmental zone in Iraqi Kurdistan (*2*, pp. 9–17, 25–31) to the valleys of Shahabad, Mahidasht, and Kermanshah, at an elevation of about 4500 feet and extending from about 33°45′N to 34°45′N and from 46°15′E to 47°15′E. Since the prehistory of this part of Iran was largely unknown, we commenced our field season with a surface survey for both caves and open-air sites, and we maintained some survey activity until the late spring of 1960. Over 250 prehistoric sites were thus located, and their surface materials were tentatively classified into eight rough chronological groups or models (*4*), which must represent—in a very general way—a time span of culture history from about 100,000 years ago to about 5000 years ago. Sites yielding surface materials suggesting the time range from about 15,000 to about 8000 years ago—the interval during which the swing to effective food production and village-farming communities must have occurred—were well represented, and several of these were selected for excavation in the spring of 1960.

The rock shelter called Warwasi, about 12 km northeast of Kermanshah, yielded a sequence of flint industries from a phase of the Mousterian through a sequence of blade tools which included both Baradostian and Zarzian levels. On the basis of the field classification of these materials alone, there is reason to suspect little typological disconformity in this developing sequence, which probably ends at about 10,500 years ago.

### Asiab

A small low mound called Asiab, overlooking the Kara Su river about 6 km east of Kermanshah, yielded a flint industry probably contemporary with, although hardly an exact technotypological counterpart of, the Karim Shahirian of Iraqi Kurdistan. There are some coarser, ground-stone artifacts in the Asiab assemblage, also beads, pendants, and bracelet fragments of marble, and numerous small clay objects, including a few enigmatic figurines. Roughly one-quarter of a large more-or-less round and shallow basin appeared (estimated diameter, about 10 m), perhaps the floor of some kind of semisubterranean structure. Two red-ochre-stained burials, many animal bones, and great quantities of river clams, but virtually no land snails, were found at Asiab.

For Near Eastern prehistory at least, the exceptional find at Asiab was great quantities of what we interpreted to be coprolites. Should these indeed prove to be coprolites and to be human, they will be an invaluable clue to the diet of a group of people who had already achieved a somewhat settled way of life on the basis of intensified regionalized food collecting, and who also should have been on the road to "incipient agriculture." These objects we are calling coprolites are definitely of the size and shape of human coprolites, and they occur in great concentrations within the living area at Asiab, which circumstance also would indicate a human origin. Coprolites of wild animals would not be expected to occur there, and we have no evidence for domestic animals at Asiab.

Pending future radioactive-carbon determinations, our suggested date for Asiab is somewhere between 11,000 and 9000 years ago, in general conformity with the $C^{14}$ determination for the similar cultural stage recorded at Zawi Chemi Shanidar in Iraqi Kurdistan (*5*).

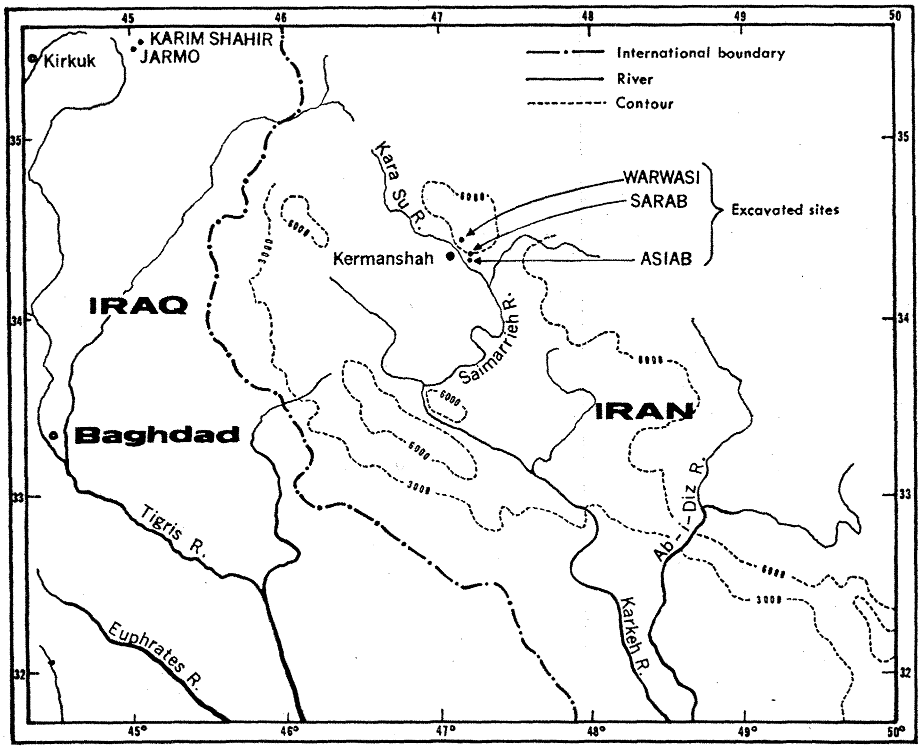
### Sarab

At another low small mound, called Sarab, which lies about 7 km east-northeast of Kermanshah, an assemblage of prehistoric materials was excavated which, in part, strongly recalls artifactual elements of the village-farming-community assemblage at Jarmo in Iraqi Kurdistan. In fact, the pottery, the clay figurines, the finer work in ground stone, and the flint and obsidian industries might be said to be typological advances over their Jarmo counterparts within the same general technological traditions. But in contrast to Jarmo (which had rather well built,

Dr. Braidwood is Oriental Institute professor of Old World prehistory, and professor in the department of anthropology, University of Chicago, Chicago, Ill.; Dr. Howe is research associate in paleolithic archaeology, Peabody Museum, Harvard University, Cambridge, Mass.; and Dr. Reed is associate professor of zoology at the College of Pharmacy, University of Illinois, Chicago.

rectilinear, mud-walled houses of several rooms), Sarab appears to have had very informal, semi-pit structures at best (perhaps with reed-covered roofs), and the site does not give the impression of year-round permanency, as did Jarmo. Nor have we yet firm indications of the presence of wheat or barley, an important element of the Jarmo assemblage, although it is possible that traces of these cereals may yet appear as molds in lumps of earth (*6*). The site did yield many animal bones, and the field identifications gave firm indications of the presence of domesticated goats at least, a standard element at Jarmo (*7*). Also, as at Jarmo, there was a great concentration of shells of a local land snail, *Helix salomonica*, undoubtedly gathered for food. A smaller number of "coprolites" also appeared on Sarab.

But Sarab does not, it seems, fit the theoretical picture of an early village-farming community nearly as neatly as did Jarmo. Hence it raises some very interesting problems of culture history and problems regarding prevailing theory as well. Until counts of the Sarab radiocarbon samples have been made, our guess is that the site must date to about 9000 to 8000 years ago.




The Iranian Prehistoric Project: During the 1959–60 field season the project's expedition excavated three sites, Warwasi, Sarab, and Asiab, near Kermanshah, in search of evidence on the development of village farming communities by early man. The new sites are south and east of the previously excavated sites at Jarmo and Karim Shahir (top left), in Iraqi Kurdistan. [Based on a U.S. Air Force long-range navigation chart, 1:3,000,000]

## Natural Scientists in the Field

From January 1960 onward, the natural scientists on the expedition staff joined the field party. Charles A. Reed (University of Illinois), zoologist, continued his collections, particularly of the Mammalia, begun in Iraqi Kurdistan in 1954–55, and he also was in charge of the osteological materials from the various excavations. Herbert E. Wright (University of Minnesota), geologist, concentrated during this field season on the collection of pollen cores; he reports, as his laboratory studies begin, that the prospects for an assessment of the climatic patterns of the area are very good. Wright and his graduate assistants were also able to take samples in several other parts of the Near East. Jack R. Harlan (Oklahoma State University and U.S. Department of Agriculture), botanist, collected broadly (with emphasis on the cereals), secured samples from the excavations, and, at the end of our field season, continued his collecting eastward into Afghanistan, Pakistan, and India, returning in February 1961, via Abyssinia. Harlan has passed on to us his in-the-field impression that, as far as the ecological situation in Asia is concerned, the locale for the effective domestication of the wheat-barley cereals does not lie east of Kurdistan.

As the "coprolites" began to appear at Asiab, Hans Helbaek (Danish National Museum), paleoethnobotanist, was once more able to rejoin the staff for a fortnight. Frederick R. Matson (Pennsylvania State University), specialist in technological history and preparational techniques, arrived later in the spring and undertook further detailed ceramic studies, collected raw clays, secured radiocarbon samples from the various sites, and did one short sounding excavation of a later prehistoric site, as did Cornelius Hillen (Middle East Institute, Rotterdam). For a short while, also, we were joined by Albert A. Dahlberg (University of Chicago), dental anthropologist, who undertook examinations of human teeth, both from the excavations and of the contemporary inhabitants. Dahlberg is interested in the possibility that both the conformation and the wear of teeth may reflect the dietary change which must have accompanied the appearance of food production. Finally, functioning as an ethnologist throughout the year, Patty Jo Watson (University of Chicago) undertook studies of the contemporary villages of the area, especially from the point of view of their material goods and agricultural routine.

## Preliminary Conclusions

Since the laboratory processing of the materials is only now under way, it is too early to speak of absolute results. Our immediate post-field impression does include a feeling that the Kermanshah valleys *may* lie slightly too high to have been in the optimum part of the environmental zone for utilization, by incipient agriculturists, of the potential plant and animal domesticates. Further, with respect to the origin of food production, while our field work so far certainly does not incline us toward explanations which link postulated climatic fluctuations with early food production in a causative sense (*2*, p. 175), we are bearing in mind recent suggestions (*8*) that an abrupt climatic swing occurred about 11,000 years ago.

It is true that the now desiccated stretches of the Zagros hill flanks, at elevations from about 1000 to 2500 feet, have not yet been adequately examined. A new survey is now being planned which will link the higher Kermanshah valleys with the alluvium of the Khuzestan plain, by traverses along various tributaries of the Karkheh River. *If* incipient agriculture had its earliest beginnings at these lower levels, to be shifted upslope rather abruptly just after 11,000 years ago because of an onset of desiccation, the traces of "incipient" settlements at the lower altitudes should certainly appear during such an intensive survey.

#### References and Notes


1. These projects have been joint ventures of the Oriental Institute of the University of Chicago and the Baghdad School of the American Schools of Oriental Research. In Iran, we were joined by the Institute of Archeology of the University of Teheran. The projects have received aid from the National Science Foundation (for the participation of the natural scientists), from the department of anthropology of the University of Chicago, the Penrose Fund of the American Philosophical Society, the Wenner-Gren Foundation for Anthropological Research, and (for Dr. Dahlberg) the U.S. Public Health Service. In Iran we benefited from the interest and aid of the Iranian Government's Antiquities Service, the National Iranian Oil Company, the Khuzestan Development Service, the Kampsax Engineering Company, and interested Iranian and American officials, missionaries, and private citizens. Robert J. Braidwood served as general director of the project for the University of Chicago; Bruce Howe (Peabody Museum, Harvard University), as associate director, represented the American Schools; and Ezat O. Negahban served for the University of Teheran.
2. R. J. Braidwood and B. Howe, *Prehistoric Investigations in Iraqi Kurdistan*, vol. 31 of *Oriental Institute Studies in Ancient Oriental Civilization* (Univ. of Chicago Press, Chicago, 1960).
3. R. J. Braidwood, *Science* **127**, 1419 (1958); **131**, 1536 (1960).
4. R. J. Braidwood, *Advance. Sci.* **17**, 214 (1960); *Illustrated London News* **237**, 695 (1960).
5. R. S. Solecki and M. Rubin, *Science* **127**, 1446 (1958).
6. H. Helbaek, *ibid.* **130**, 365 (1959).
7. C. A. Reed, *ibid.* **130**, 1629 (1959).
8. W. S. Broecker, M. Ewing, B. C. Heezen, *Am. J. Sci.* **258**, 429 (1960).


24 March 1961

## Electrophoretic Analysis of Immobilization Antigens of Paramecium aurelia

*Abstract.* The isoelectric points of the immobilization antigens A, B, and D of strain 51 of *Paramecium aurelia* (variety 4) have been determined to be 4.0, 3.9, and 4.3, respectively.

When paramecia are placed in homologous antisera, an immobilization reaction takes place which may result in the death of the animals if they are exposed to sufficiently high concentrations. Beale (*1*) and Preer and Preer (*2*) have demonstrated that the immobilization antigens are associated with the cilia and body wall. Preer (*3*) has isolated the immobilization antigens and has shown that they constitute the major soluble protein in the cilia. Investigations by Sonneborn (*4*) have shown that within a given strain there can be produced a series of alternative serotypes whose individuals contain one of a number of specific antigens. Previous genetic analysis has revealed the interaction of the cytoplasm, genes, and environment in determining the antigen expressed [see Beale (*5*) for a detailed review].

Transformation from one serotype to another may occur spontaneously or may be induced by a variety of conditions (*4*). It is, however, possible to obtain and maintain large quantities of animals of a pure serotype under specified conditions.

Although each serotype within the homozygous strain 51 may readily be distinguished serologically, certain cross reactions occur. Preer (*6*) has reported the occurrence of groups into which the antigens may be placed dependent upon their cross reactions. For example, 51 A and 51 B show a weak cross reaction, while neither cross reacts with 51 D.

In light of the genetic control over antigen production and specificity, it is of interest to gain an understanding of the structural differences that exist on a molecular level as a direct reflection of the differences that exist among the respective genes. This report is concerned with the electrophoretic properties of the proteins as the first step in characterizing chemically the structural differences between certain of the immobilization antigens which can be produced by the homozygous strain 51.

The electrophoretic behavior of the immobilization antigens A, B, and D of strain 51 of *Paramecium aurelia* (variety 4) was studied with a Perkin-Elmer model 38 Tiselius apparatus. The electrophoresis buffers employed in all runs were 0.1 ionic strength and were prepared by the method described by Miller and Golder (*7*) with a *p*H range of 2.6 through 11.5. The specific antigens were isolated by Preer's technique (*3*). In order to facilitate comparison, mixtures, rather than the individual proteins were subjected to electrophoresis. Mixtures were prepared so that they consisted of two parts of A and one part of B; other mixtures consisted of two parts of A and one part of D. One component was made twice as concentrated as the other to aid in identification. Identification was confirmed by taking samples from their respective zones in the Tiselius cell and identifying them serologically.

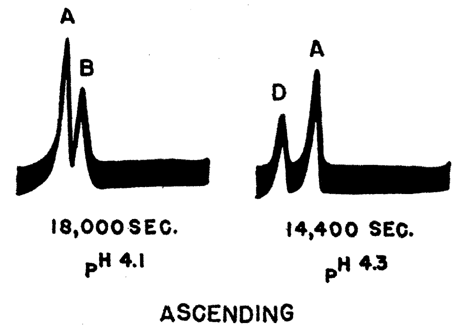



Fig. 1. Tracings of the ascending electrophoretic patterns of 2:1 mixtures (stock 51) of antigens A and B, and A and D, respectively.

Figure 1 represents tracings of the electrophoretic patterns of mixtures of A and B, and A and D. Mobilities were calculated, and complete curves for A and D appear in Fig. 2. The isoelectric points of A, B, and D were determined to be 4.0, 3.9, and 4.3, respectively. The isoelectric point of antigen A is in agreement with the estimate made by Preer from paper electrophoresis (*8*).

Antigens A and B separated only after prolonged electrophoresis at *p*H values near their respective isoelectric points, demonstrating a close similarity in their net charges. This similarity is reflected by the closeness of their isoelectric points. A and D, on the other hand, showed separation at all *p*H values run between 2.6 and 11.5. The electrophoretic behavior parallels the ammonium sulfate solubilities and immunological relationships reported by Preer (*7*). As previously mentioned, antigens A and B cross react, while neither shows any cross reactivity with antigen D. Antigens A and B possess the same ammonium sulfate solubility, while antigen D exhibits a higher ammonium sulfate solubility.

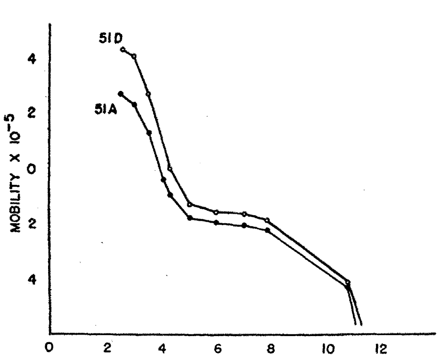



Fig. 2. Calculated mobility curves for antigens 51 A and 51 D.