

CURRENT PROBLEMS IN RESEARCH

The Hasanlu Project

Archeologists, working with natural scientists,
delineate life in a 1000 B.C. town of Azerbaijan.

Robert H. Dyson, Jr.

The aim of any archeological project is to attack the unknown. In the case of the Hasanlu project carried out over the past 5 years by the University of Pennsylvania Museum, the Metropolitan Museum of Art of New York City, and the Archaeological Service in Iran, the "unknown" is the entire pre- and proto-historic period of southern Azerbaijan, Iran. While exploration has proceeded in a general way on this overall problem, a more specific objective has been the elucidation of the chaotic and mysterious period that just preceded the arrival of the Medes and Persians—that is to say, the first half of the 1st millennium B.C. In pursuing this objective the project (it is hoped) in part exemplifies archeology as systematic scholarship, for it employs the natural sciences on key problems as working tools which contribute toward a better evaluation of the evidence and a keener judgment of its significance (1). The following brief review indicates the steps by which this objective is being pursued and the degree to which success has been achieved (2, 3).

Geographical Setting

The initial framework for any archeological problem is the geographical setting of the site to be studied. This setting determines the limitations and the opportunities—the nonavailability or availability of local raw materials, water, and land, as well as the degree

of isolation from or contact with foreigners resulting from the presence of travel barriers and accessible trade routes. In the case of Tepe Hasanlu, the site chosen for exploration, these factors may be summarized briefly.

The site, which is a high mound, is located in the center of a basin-like valley adjoining the Qadar River in the general region known as "Solduz," just southwest of the great salt lake Urmia (more recently called Rezaieyeh) (Fig. 1). The valley is separated from the lakeshore by a low range of hills. The slopes surrounding the valley are devoid of forest, and little rain falls except during the late spring. During the remainder of the year agriculture is carried on through the use of canal water brought several miles from the Qadar River and discharged into low mud flats, where temporary lakes are formed. These lakes are a favorite haunt of wild ducks and other water birds in large quantities. In particularly dry years, when there is little snow in the mountains to feed the Qadar, the lakes dry up. The bottom of the valley is filled with grey clay, sand, and gravel, while ledges of white limestone and more rarely red sandstone project from some of the nearby hills. Poplar trees and small groves of fruit trees, such as apple and apricot, are grown in the villages. In the winter the snow blows down into the valley, and wild boars from the mountains root through the fields in search of food.

The present inhabitants raise grain

(wheat and barley, chiefly), some vegetables, and many grapes. They raise a few chickens, more water buffalo (for milk and for use as draft animals), and even more sheep. The landlords also keep horses. So long as water is available and the administration of its distribution functions effectively, the land yields a rich harvest. The area is shielded from its neighbors to the north by the salt lake, a thick and viscous body of water subject to sudden high winds. To the west the high wall of the Zagros Mountains rises to about 14,000 feet above sea level, the valley itself being at about 4900 feet (4). To the south lie the mountains of Kurdistan. The isolation of the area is broken, however, by the trade routes which cross from Iraq (ancient Assyria) in the west, via the Rowanduz and Kel-i-shin passes, to the east (central Iran) along the Qadar River, and from the Caucasus and Rezaieyeh in the north to Kurdistan in the south, along the western shore of the lake and southward through a series of interconnecting mountain valleys. This geographical position thus provides the first element in the cultural dynamics of the area: a partial isolation with a consequent tendency toward local development, yet full exposure to intrusions from the four directions, the north and east being somewhat more open than the west (5).

Historical Background

The known history of Azerbaijan province documents the shifting influences, particularly of a political and military nature, which traveled these geographical routes from time to time. Since the 9th century B.C. this area has been successively invaded by Assyrians, Urartaeans, Assyrians, Scythians, Medes, Achaemenian Persians, Greeks, Parthians, Sassanians, tribesmen of the caliph Uthman, Abbasids, Buwayhids, Seljuk Turks, Ildijiz Atabeks, Mongols, Ilkhans, Jalays, Turkomans of the Black Sheep, Turkomans of the White Sheep,

The author is field director of the Hasanlu project and assistant curator of the Near Eastern Section of the University of Pennsylvania Museum, Philadelphia.

Safavids, Ottoman Turks, Kajars, Russians, and Pahlavis. The dates of these invasions and the directions from which the invaders came are given in Table 1 (6).

Aside from providing an indication of the nature of the relationship with surrounding areas, the available history also provides us with a more detailed frame of reference for the period in which our archeological problem falls—the early 1st millennium B.C. This period is vague, owing to the fact that it is seen only indirectly, through the records of the Assyrian and Urartean

kings (7, 8). Because this history is described in foreign annals rather than local records we refer to this period in Iran as “protohistoric.”

The records indicate that the area to the south of Lake Urmia was in general occupied by tribal groups loosely organized at first under a hereditary leader aided by his nobles. Gradually, under Assyrian influence, this governing structure appears to have become more formal and to have acquired the trappings of a true monarchy. The capital, Izirtu, was probably near modern Saqqiz. The number of villages and

towns listed in the annals of the conquering Assyrian kings indicates quite clearly that while part of the population may have been pastoral, living in tents (especially in the high summer pastures), there was, nevertheless, a substantial settled population as well. It seems probable that the pattern of life was somewhat similar to that of present-day Kurds, among whom part of the population moves to the high pastures during the summer and returns to spend the winter in the villages of the lower valleys. The annals refer to the burning of small towns as well as

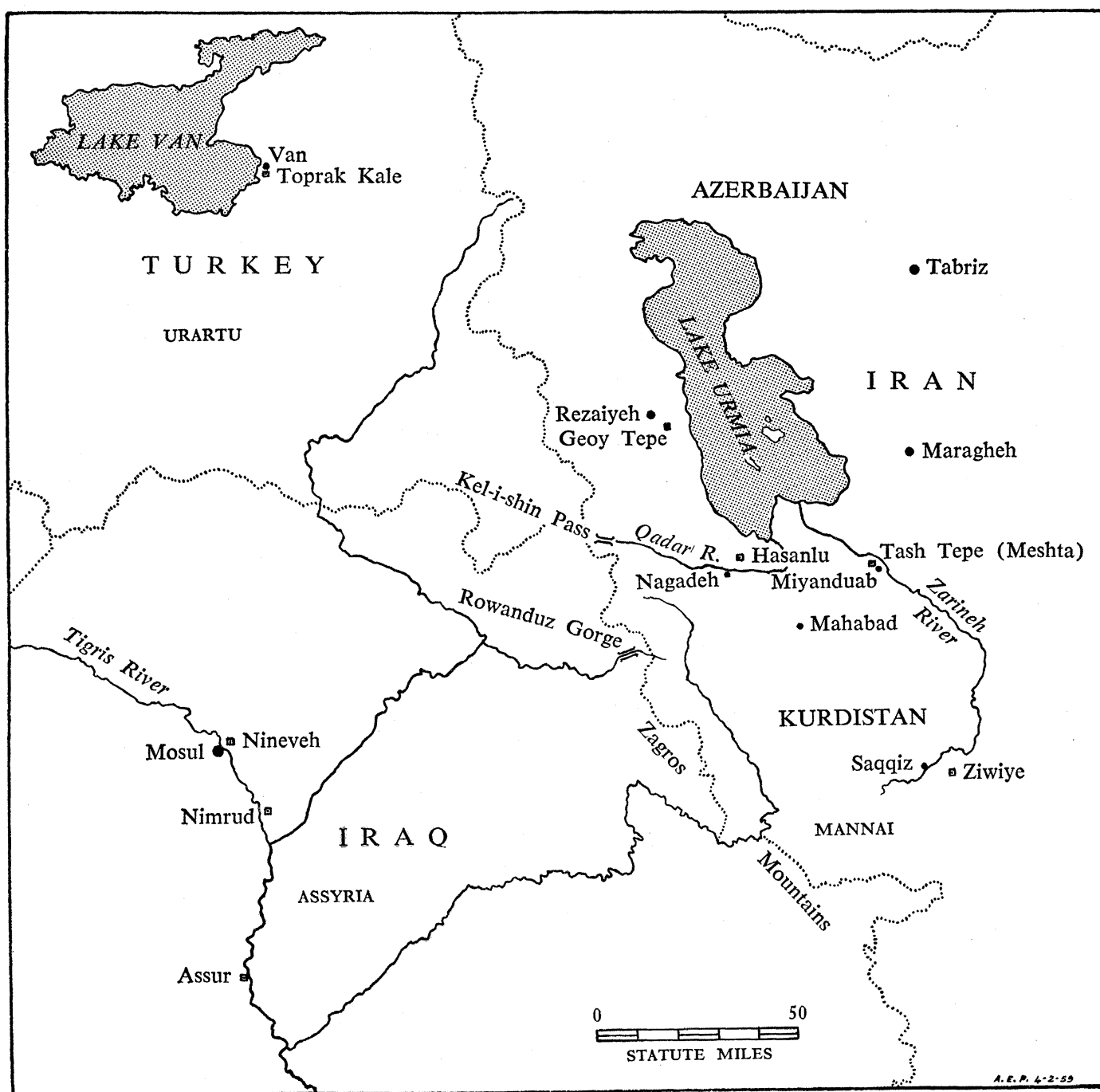


Fig. 1. Map of northwestern Iran, showing Hasanlu and some related sites.

the burning and pulling down of fortified citadels.

From these pieces of evidence we may educe a settlement pattern involving a scattering of fortified citadels located in the fertile valley areas or in commanding positions in the hills, each with a number of small associated villages and pasture lands. The economy would have been partly agricultural and partly one of husbandry, with luxury goods largely imported from the more advanced centers of Assyria and Urartu (the area around Lake Van in eastern Turkey). Some local manufacturing of goods would have been done by artisans, who often no doubt copied the more fashionable styles from abroad. Most of these goods would have been concentrated in the hands of the nobles. The latter, to judge by their names and the names of their towns, spoke a dialect of Hurrian, a language which spread widely over the Near East in the late 2nd millennium B.C. During the part of their history about which we are informed (from about 850 B.C. onward), these people, the Mannaeans, were constantly on the defensive against their more powerful Assyrian and Urartean neighbors to the west and north. Their history is one of alliance and counteralliance, attack and counter-attack, all in an effort to retain their independence. In the end they were overwhelmed from a different direction and absorbed by the Medes, who had established themselves to the southeast in the region of modern Hamadan. After about 600 B.C. the Mannaeans were completely absorbed by the Indo-European newcomers.

Stratigraphic Sequence

The next step in the investigation was the stratigraphic excavation of the mound in order to obtain a series of associated groups of artifacts and architecture. By digging downward from the surface and removing one soil layer at a time in selected areas, the sample cultural remains of the different periods of time have been recovered to a depth of 27 meters, beginning with the latest "Islamic" material and going backward to the earliest neolithic levels of the 6th millennium B.C. This sequence of cultures has been established on the high Citadel Mound in the center of the site and at three small neighboring sites. The lower mound (8½ meters) surrounding the Citadel, called for convenience the "Outer Town," proves to

Table 1. Invasions of the present Azerbaijan province of Iran, over 28 centuries.

Invader	Date	Direction from which invaders came
	B.C.	
Assyrians	~850	West
Uartaeans	~800	North
Assyrians	714	West
Scythians	650-625	North
Medes	625-550	Southeast
Achaemenian Persians	550-331	Southeast
Greeks	331	West
Parthians	150	East
	A.D.	
Sassanians	226-651	Southeast
Tribesmen of caliph Uthman, Abbasids, Buwayhids	651-1055	West
Seljuk Turks, Ildijiz, Atabeks	1136-1225	North and east
Mongols, Ilkhans	1256-1349	North and east
Jalayrs	1340-1411	West
Turkomans of the Black Sheep	1378-1469	North and east
Turkomans of the White Sheep	1469-1478	North and east
Safavids	1500-1750	East
Ottoman Turks	1514-1603, 1724-1732	North
Kajars	1750-1925	East
Russians	1915-1917, 1941-1946	North
Pahlavis	1925 to the present	East

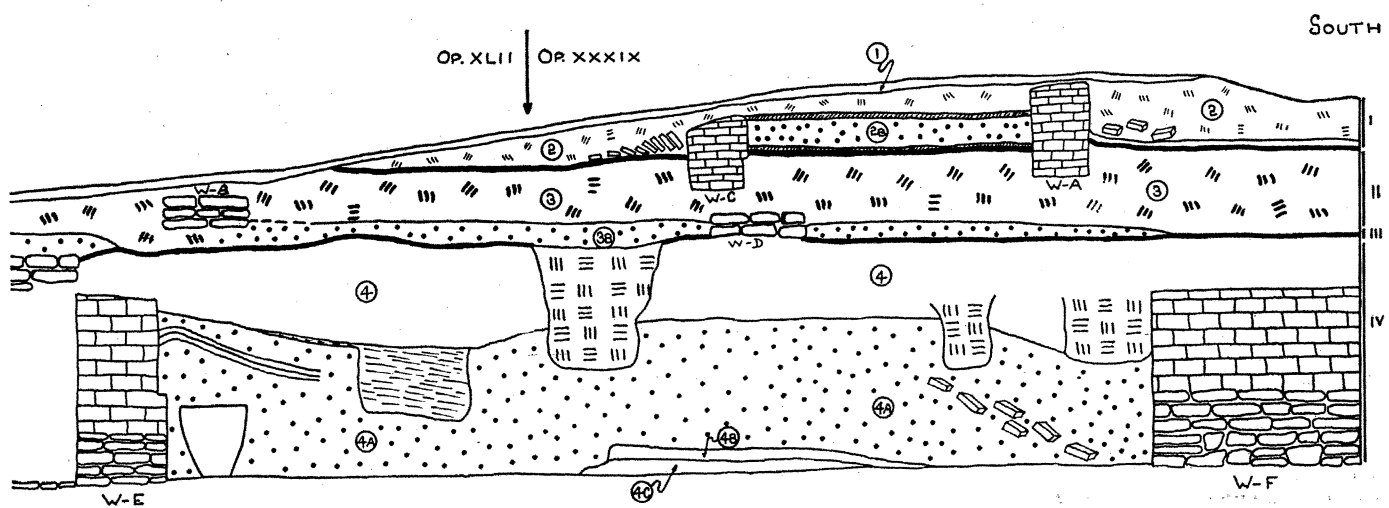
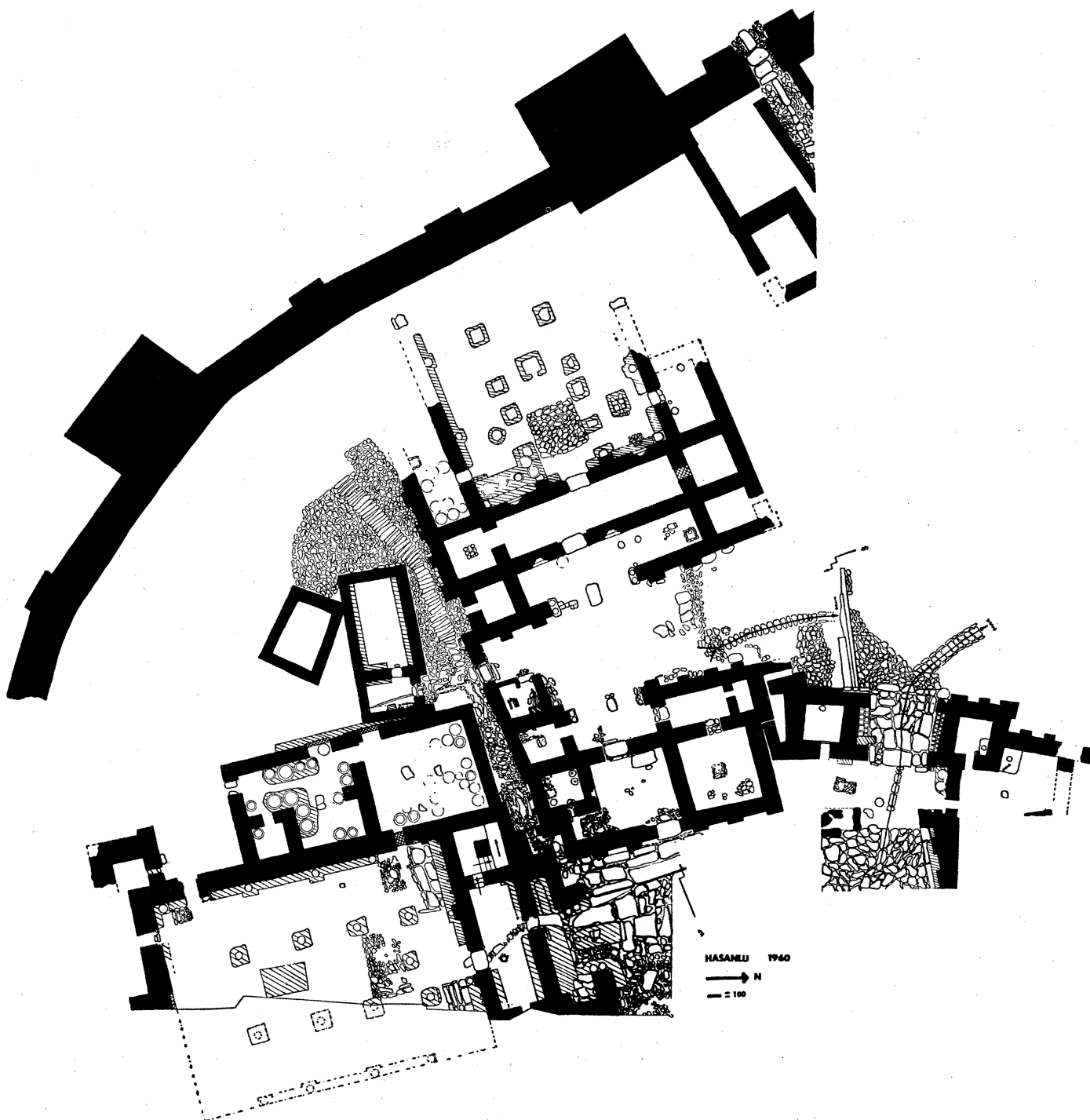
be much younger; its lowest level, which rests on virgin soil, corresponds with an intermediate level in the much longer sequence of the Citadel Mound. Apparently at a certain point in time (which we estimate to be around 2200 B.C.) the central mound had become inconveniently high (through its growth upward due to incessant leveling and rebuilding of mud-brick houses), and people began settling around its base.

The major excavations to date have been carried out in the southwestern quadrant of the Citadel Mound. This area has been cleared through four major periods of construction. These architectural periods, numbered I through IV from the youngest to the oldest, correspond to ceramic phases (that is, groups of soil layers containing fragments of the same distinctive pottery) which were first recognized in trial soundings or test pits. Period I is known to be Islamic by its plain pottery and small bricks, as well as by the local tradition that standing walls were still visible less than 100 years ago. Below this level lies the "Mystery" phase (period II), a period of dull, plain buff-and-red wares, stone cist graves, and the foundation of a large building. Below this lies a stratum (period III) of small rooms set against the inside of a reused fortification wall. The pottery includes some red burnished ware and finely made buff pottery painted with small hanging triangles, hence the working name, Triangle Ware phase. And finally (period IV), the Grey Ware phase—the period of the building of the fortifica-

tion wall, with its towers, and the large buildings with pillared halls lying within (Fig. 2). A cross section (Fig. 3) shows the sequence of these periods as seen on an unexcavated face or balk of the site. Below lie the remains of an even earlier, Button-base phase (tentatively called period V), named after the burnished grey vessels with tiny bases. Burials belonging to both the Button-base and the Grey Ware phases are found in a cemetery area around the northern edge of the Outer Town. The relative positions of the graves show that material from the Button-base phase is lower, and therefore earlier in date. Given all of this information, the problem remains of how to relate this stratigraphic sequence to the major problem of the early 1st millennium B.C.—the clarification of cultural conditions in the country just prior to the arrival of the Medes and Persians—and to the local framework of known geography and history.

Relative Chronology

The first step taken in this direction was the comparison of the sequence at Hasanlu to the sequences already known at adjacent sites. By this process of typological comparison the general relative positions of the individual phases were estimated and some idea as to their historical position was obtained through the known history of the compared sites. Thus, for example, the finely made burnished grey ware



vessels of the type seen in Fig. 4, with loop handle and small disk base, were compared with similar forms known from Tepe Sialk A in central Iran; from Tepe Giyan I, to the south in Luristan; and from Geoy Tepe B, immediately to the north near Rezaiyeh (9, 10). Such similarities relate the ceramics of this phase to the general tradition of central and western Iran in the late 2nd millennium B.C. This correlation is supported by the presence of a few button-base vases of buff pottery painted with simple lines. These forms belong to a tradition found in Mesopotamia during the latter part of the 2nd millennium B.C. at the sites of Nuzi, Assur, and elsewhere (11). The pottery of this phase thus relates the local culture to cultures in the two directions from which influence would be expected, given the geography, and confirms the period of that influence as being about 1200–1000 B.C.

The objects found in the burned ruins of period IV are even more revealing as to relative date. The pottery includes rare glazed vessels of late Assyrian type, along with other items obviously of Assyrian inspiration if not of Assyrian origin. Glazed wall tiles, beads of paste, small stamp seals in the form of crouching lions, fragments of ivory with incised rampant goats and rams flanking a sacred tree, a piece of gold foil with the figure of a man in the act of lustrating, and a fragment of a carnelian bead bearing part of a prayer in Akkadian cuneiform are among the items that show a close relationship with the Assyria of the 9th century B.C. Figure 5 shows a sacred-tree scene of Assyrian style cut into the surface of a vase fragment of blue frit, a material often called "Egyptian blue" (12). Other objects of this material were also found: beads, a small wall tile, cylinder seals (13). Similar items are known from Egypt to Assyria, and subsequently the material was found in quantity in Iran in the Achaemenian period. Its introduction to Iran remains one of the interesting problems facing archeologists

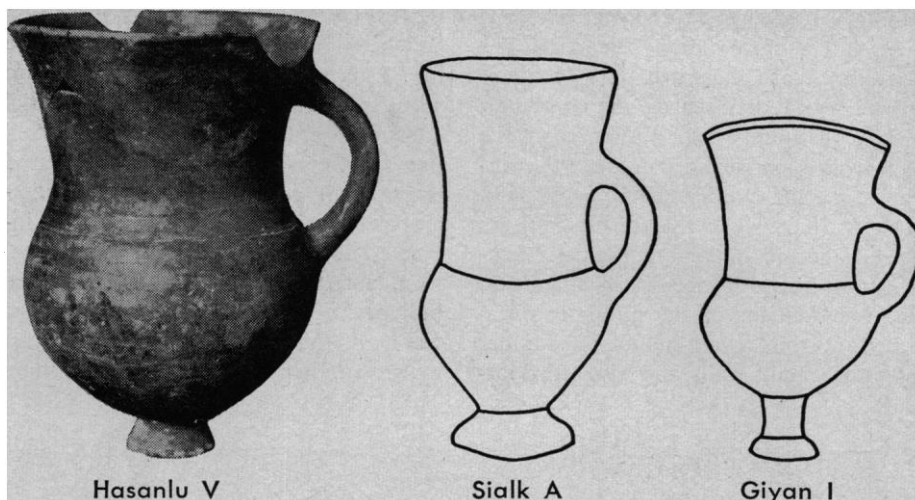


Fig. 4. Typological comparison of pottery, linking a burnished-grey-ware vessel of the Button-base phase at Hasanlu with similar items at Tepe Sialk and Tepe Giyan.

who investigate this period and area.

Most striking of all the finds, for purposes of comparison, are cylinder seals of Late Assyrian type showing archers and griffons, which link Hasanlu to the West. The common pottery of the period, on the other hand, is burnished grey-black and continues an earlier tradition of firing in a reduced atmosphere. The identifying shape is a vessel with a long pouring spout, always found one to a grave but also found in ruined buildings. These vessels pour very well and are decorated in numerous ways by incising, grooving, ribbing, and so on. A similar type has been found in the cemetery of Sialk B in central Iran. This form, and smaller objects in metal, such as horse trappings, relate Hasanlu IV to Sialk B to the east, in contrast to the western, Assyrian-style objects.

The artifacts thus again illustrate influences from both east and west. Significantly, however, the Sialk B material is composed of a mass of additional elements foreign to Hasanlu, including elaborately painted vases suggestive of Anatolian connections. At the same time Hasanlu IV is not specifically Assyrian. Clearly, therefore, a somewhat locally specialized culture is represented by this period, which we estimate as about 1000 to 800 B.C.

In the period following the great fire which ended Hasanlu IV, all of the older types of pottery have disappeared, along with the building style. The few fragments of pottery recovered, and one trilobate copper arrowhead, show some relationship to the artifacts reported from the Persian Village at Susa (14), far to the south. This typological similarity would appear to indicate that in

this period, the Triangle Ware phase, we are about to enter, or have entered, the Achaemenian period, the first fully historical period in Iran (15). The degree of typological change suggests either a lapse of time or a change of population between the Grey Ware phase and the Triangle Ware phase.

Absolute Chronology

While these typological comparisons allow us to fit our major periods into the known structure of relative chronology, they do not provide any precision in terms of actual calendar dates, owing to the absence of written records. True, the objects from the burned buildings of the Grey Ware phase do correspond closely to similar items in Assyria dating to the reign of Shalmaneser III in the middle of the 9th century B.C., and the Persian Village remains are dated by tablets to between 600 and 400 B.C. But it would be useful to have an independent check on these interpretations. At this point physics comes to the rescue of archeology through the method of radiocarbon analysis. From the samples of ash, charred grain, and structural timber collected during the excavations a series of assays have been made by E. K. Ralph of the University of Pennsylvania's carbon-14 laboratory. The results of tests run to date are summarized in Fig. 6 (16). Four stratigraphically placed samples are from the Button-base phase (period V), six are from the Grey Ware phase (period IV), and three are from the Triangle Ware phase (period III). The dates obtained for the Button-base phase average 1151 ± 49 B.C. and fall directly

Figs. 2 and 3 (facing page). (Top) Plan of excavations of period IV (9th century B.C.) of the Hasanlu Citadel at the end of the 1960 season. (Bottom) Section through periods I to IV on the Hasanlu Citadel, areas XLII and XXXIX. I: 1, turf; 2, collapse of walls W-A and W-C; 2B, trash. II: 3, collapse of wall W-B. III: 3B, ashy occupation, wall W-D. IV: 4, erosion deposits from collapsed Burned Building II; 4A burned brickly collapse of Burned Building II, walls W-E and W-F. Width of section, 14.60 meters.

within the estimated date range obtained by relative chronology. The dates for the Grey Ware phase are more problematical. It may be seen on the chart that they consistently fall earlier than the typological correlation in the 9th century B.C., the average being 989 ± 32 B.C. At first sight this result appears at variance with the typological result. It is not, however, necessarily unexpected. The remains of the buildings excavated at this level include a number of poorly built walls and blocked door-

ways as well as numerous areas which had been robbed of paving *before* the fire. This evidence indicates that there was a passage of time between the initial construction (as measured by the carbon samples) and the fire (as measured by the artifacts). A change in function and perhaps in political control is indicated for the Citadel during the period, and it is quite possible that the builders of the Citadel fortifications were not the defenders of it in its last days. Another possibility is that some

of the wooden beams used had been salvaged from earlier buildings and thus yield dates somewhat earlier than those of the buildings in which they were found.

A further question remains, involving the three dates of the Triangle Ware phase, which average 564 ± 38 B.C., well within the estimated chronological range. One of these samples came from a storeroom that was built into the ruins of period IV and filled with grain charred, apparently, as a result of a later local burning. This temporary re-occupation immediately preceded the building of the Triangle Ware phase buildings and followed a period of erosion of the older ruins. One of the perplexing problems remaining to be solved is the date of the burning of Hasanlu and the end of the Grey Ware phase. Until charred grain from the harvest of the year of the burning is discovered, we have no appropriate samples to test. To date, all of the storage jars appear to have held wine or beer rather than grain, as shown by the black rings around their interiors marking the level of the contents during the fire, and by a lack of charred material inside.

In another line of chronological investigation use is made of the new technique for measuring the age of glass through the effects of weathering on its surface (17). Whether or not the glass beads and small fragments at present available will prove useful in this regard is a question now being reviewed by Robert H. Brill of the Corning Glass Museum.

Local Population

As indicated in the section on the historical background, some of the local 9th century population probably spoke a form of the Hurrian language, along with other scattered groups in the Zagros Mountains, reaching as far south as the country of Elam around Susa and stretching westward through eastern Turkey and northern Mesopotamia. A continuity of local populations from the Button-base through the Grey Ware phase at Hasanlu is suggested by a similarity in burial customs (the earlier burials have a drinking vessel as a standard item in the grave; the later burials, a pouring pitcher), the lack of any appreciable time gap in either the visible stratigraphic record or the radiocarbon dates, and the continuing use of the same cemetery areas. It is thus



Fig. 5. "Egyptian blue" vase fragment. A stylistic link with the Assyrians is provided by motifs on decorated objects such as this.

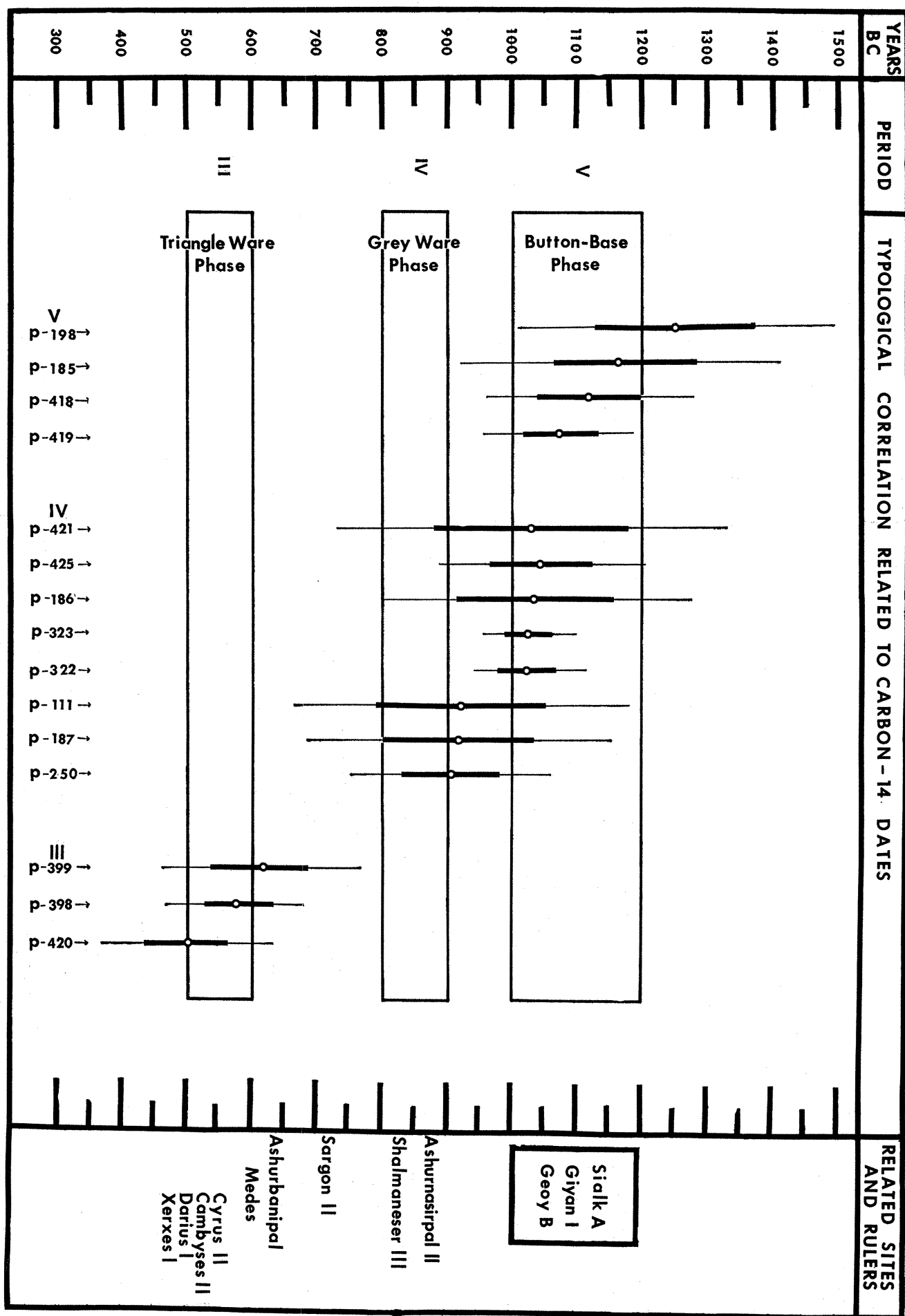


Fig. 6. Chart showing the estimated dates for periods III, IV, and V at Hasanlu, based on typological comparisons as related to a series of preliminary radiocarbon dates run by the University of Pennsylvania's carbon-14 laboratory.

possible to suggest tentatively that Hurrian may have already been spoken at Hasanlu as early as 1200 B.C. although whether by the whole population or by only selected individuals remains problematical (one grave found had *only* Mesopotamian "Hurrian" period tumblers in it).

Men and women of the Grey Ware phase are depicted on a number of objects found: a silver beaker, ivory fragments, a fragment of sculptured wood, a bronze tetrapod stand (Fig.

7), and metal fragments. They are shown as having large fleshy noses. The men wore their hair long and had full beards. The women, seen only on the Hasanlu gold bowl, braided their hair and wrapped it around their heads. It is possible that the bowl was produced during the earlier, Button-base phase, in view of some of its stylistic connections (18). People are shown occasionally wearing sandals, dressed in long robes or short kilts fastened at the waist with belts, the women with necklaces, the

men with fillets around their heads. Small fragments of textiles (at present being studied by Harold Burnham of the Royal Ontario Museum's textile department) were preserved by charring and appear to include both fine and coarse weaves. The possibility that some of them at least were dyed red is presented by the identification of one of the shells found as *Murex brandaris* Linné imported from the Mediterranean. This mollusk was commonly used for the production of "royal purple" (19). In medieval times Azerbaijan was also famous for textiles dyed red from the *kirmiz* insect (hence *crimson* and *carmine*) which feeds on the oak trees in the area (19a). It is possible that this source of dye was already known, but we have no material evidence to prove it (20). Sargon of Assyria lists, among the spoils collected on his famous eighth campaign in this area from the sacking of the city of Musasir (somewhere west of Hasanlu in the mountains) in the 8th century B.C., "130 multicolored garments and tunics of linen; of blue wool and of wool woven in the scarlet of the countries of Urartu and Kilhu" (8).

As for the actual physical characteristics of the population, the skeletal remains are now being studied by William Bass of the University of Kansas. A preliminary review of the individuals excavated in the 1957 and 1958 seasons (a total of 28) shows that five of the six males from periods IV and V are dolichocranic, or long-headed, as is the adult male from period I (Islamic). The five males from period IV have cranial indices ranging from 66.32 to 75.84. The latter measurement is of the one slightly mesocranic individual, who also has a mesorrhinic or medium nasal index of 48.00. The one other individual on whom the nasal index could be measured proved to be leptorrhinic (index of 45.83). These individuals thus would seem to fit into the general prehistoric population presently known from western Iran at Hasanlu, Geoy Tepe, Tepe Sialk, and Tepe Giyan (9, 21). It is notable that at both Tepe Sialk B in central Iran and at Shah Tepe I on the shore of the Caspian Sea, the population, in contrast to that of Hasanlu, became markedly brachyranic or even hyperbrachyranic in the 9th to 8th century B.C.

The remains of 22 additional individuals have been added to this study group from the last two seasons' work and will provide a wider basis for more



Fig. 7. One leg of a bronze tetrapod stand after being cleaned electrolytically at the University of Pennsylvania Museum.

detailed study. Almost all periods are represented by at least one individual. Skeletal remains of the earlier periods were multiplied by the work of T. Cuyler Young, Jr., during the 1961 season; hence it should ultimately be possible to make some long-range observations on the local population.

Local Economy

The population at Hasanlu was supported by an economy which, it would seem, was not unlike that of the Assyrians (stripped of its imperial aspects). The fields around the Citadel-town yielded crops of hulled barley (evidently of more than one type), bread wheat (*Triticum vulgare*), and millet (*Panicum miliaceum*). Hans Helbaek of the Danish National Museum, who identified the plant remains, comments that the barley probably contains both two-row and six-row spikes with a dense-spike type among the six-row barley, but no detailed study has yet been made. Among the barley grains, he reports, are some larger than any he has seen before. Iron hoes and sickle blades were among the tools used in the field. The vineyards of Hasanlu, then as now, yielded grapes (*Vitis vinifera*), which were undoubtedly dried in the sun as raisins as well as used for the making of wine. The husbandry practiced was also similar to that of today; cattle, sheep, and goats are most abundant among the animal remains. That horses were used is shown by the presence of one skeleton and of bits and harness bosses and buttons. Horses are shown on a silver beaker, pulling a chariot as well as being led riderless among the prisoners following the chariot (3, 22). On the Hasanlu gold bowl, on the other hand, are depicted what appear to be asses rather than horses (18). Boars' tusks show that wild pig was hunted then as today. We may guess that the game birds in the lakes were also the target of hunters, who possibly used the small pyramidal bone arrowheads which are occasionally found. To date, no remains of wheeled vehicles have been found, but their use is indicated by the chariot scene on the silver beaker and by the three chariots on the gold bowl. Moreover, wheeled vehicles were obviously needed to transport the large slabs of building stone (some as much as 3 meters long) from the rock ledges in the hills 10 or more miles away, and

to bring in the harvested grain from the surrounding fields. A road of hard packed clay flanked by stone-lined drains and "pavements" leads up the west slope of the mound.

The size and elaborate nature of the structures so far excavated on the Citadel indicate that they belonged to the ruling hierarchy rather than to private individuals. Indeed, Hasanlu was not much of a town in the ordinary sense of the word, although a few scattered private houses appear to have stood around the Outer Town area. One of these, the Artisan's House, excavated for us in 1959 by George F. Dales, Jr., consisted of a large square room entered through two small vestibules. Outside in the courtyard stood a small kiln. The building itself was of sun-dried mud-brick set on rock foundations; it was probably only a single story high. The house had been burned in the sacking, and its collapsed debris showed that a large number of heavy pottery storage jars had been stored on what must have been a flat roof. Inside the house, scattered on the floor, were sherds of fine black table ware. The occupation of the owner was indicated by the presence of a crude medium-sized crucible for pouring molten metal, together with fragments of open-face and two-piece molds for casting ingots, axes, and jewelry. We are thus assured that some craftsmen lived in the area, as well as farmers and herders.

Certainly some of these craftsmen were the potters who produced the fine burnished grey-black pottery by firing it in a reducing atmosphere. That it is possible to produce similar fine pottery from local washed clay was demonstrated experimentally by Frederick Matson during a visit to the site in 1960. At the present time Matson is undertaking a technical study of the composition of the frit and glazes of Hasanlu at the ceramic laboratory at Pennsylvania State University. Eric Parkinson at the University Museum is also testing the glazes on several different types of objects—tiles, vases, beads, and so on—to ascertain whether or not the same type of glaze was used on different objects; in preliminary examination he has found no significant differences between the glazes used.

Several of the graves found contained the bodies of adult males with their weapons—bronze daggers and spears, iron maceheads, and in one instance flat bronze arrowheads—indi-

cating that professional soldiers also occupied the Citadel (although all of the male population undoubtedly served in this capacity when needed). Other, fallen warriors have been found entombed in the remains of the burned buildings. Some of these men appear to have been wearing garments of colored leather or textile, as areas of red have been found underlying arm bones. The red often lies beneath a thin layer of powdery yellow. An attempt to analyze this material by the Museum chemist, Eric Parkinson, ended in failure, as no organic material remained. The conclusion reached was that "the colors may have been due to yellow or red ochre, possibly mixed with copper oxide."

Among these warriors may well have been some of the ruling nobles. However, to distinguish nobles from ordinary soldiers is, at the present state of our knowledge, impossible. Equally difficult is identification of any of the remains as those of priests. In this respect it is of interest to note that most of the 44 skeletons found burned and crushed on the floor of the great pillared hall of Burned Building II in the 1960 excavations were of preadolescent and early adolescent females, as indicated by their costumes. Since the building may have served a religious function (another point difficult to prove conclusively without excavation in other quarters of the Citadel), it is possible that these poor souls, trapped in the flaming building, may have been somehow connected with religious activities in the Citadel. On the other hand, they may only have been children of the ruling families. Problems of interpretation such as these make archeology a scholarly rather than a purely scientific pursuit.

The Citadel itself (Fig. 8) was completely surrounded by a massive fortification wall consisting of a heavy foundation of roughly fitted limestone blocks, preserved in places to a height of 2.60 meters, upon which rested a superstructure of large mud-bricks (39 by 39 by 36 and 36 by 36 by 13 cm). The base of the wall was 3.20 meters wide, and the estimated height (calculated with Sargon's descriptions as a guide) would have been about 9 meters. At spaced intervals around the walls were narrow stone reinforcement piers. Between every two of these stood a defensive tower.

To date, four structures have been cleared inside the walls: two buildings

with pillared halls (Burned Buildings I and II), a two-room Bead House, and a one-room South House. The two major burned buildings are separated by a narrow paved street, South Street. All of the open paved areas are provided with drains to carry off rainwater through underground stone-lined channels. Unfortunately the terminal area for these drains has been destroyed by later digging so that we do not know whether the runoff was collected. Drains from the high northwest area flow under a street leading out through the West Gate, and down the slope. The wall foundations and paving were all of limestone slabs. The wooden columns, which were a half meter in diameter, rested on stone base blocks and were of *Populus* sp. (23).

Among the other wooden specimens identified were the remains of a small wooden bowl (*Crataegus* sp., or hawthorn), a shaped fragment with a hole through it (*Cupressus* sp., or cypress), the wooden core (*Populus* sp.) of a bird figure covered with an overlay of copper plates and the shafts of two bronze maceheads (one of *Buxus sempervirens* or common box tree, the other of *Malus* sp. or *Pyrus* sp., apple, pear, or crab apple). The *Buxus* identification is of particular interest, since Sargon lists as part of the loot he carried off from Musasir, "sticks of ivory, ebony, of boxwood with [their] knobs [maceheads?]" (8, p. 53).

Foreign Trade

While much that has been found at Hasanlu in the Grey Ware levels is of local manufacture, as is shown by the quite distinctive styles in decoration (Fig. 7), many of the raw materials for these products had to be imported. This is particularly true of metal ores such as copper, tin, silver, and gold. At the same time the imitation locally of foreign styles shows that the craftsmen had at their disposal actual imported objects, or had traveled widely enough to have seen the originals. The glazed wall tiles, for example, are provincial copies of the tiles seen in the palaces of the kings of Assyria (24). On some of the ivory and metal fragments are scenes in imitation of standard Assyrian scenes.

The imitation of decorative style is relatively easy to trace. Not so the source of the metals used. The process of tracking sources is slow, owing to the need to analyze metal objects and samples of ores. In one instance we have pretty good evidence of the importation of ore. The beads and buttons which, in the field, we took to be cast native silver proved, upon analysis by Eric Parkinson in the University Museum laboratory, to be almost pure antimony, containing a little copper, calcium, magnesium, and possibly strontium. The discovery is of particular interest in that antimony and antimony bronze were common in the Tiflis and

Kuban areas of the Caucasus after the 10th century B.C., especially in the graves of the Redkinlager on the Aksatfa, a tributary of the Kura River (25; 26, p. 263). The metal is brittle and easily pulverized. It was apparently cast in small open molds to make the buttons and beads found at Hasanlu. It seems quite probable that these were imported from the Caucasus, although antimony is also known to occur near Takht-i-Suleiman in Afshar province, southeast of Azerbaijan.

The star-shaped maceheads found among the ruins may also indicate foreign contact. These special forms are of cast bronze and represent one among a number of types, the others being somewhat simpler. The star form is of particular interest, as it is also reported from the Caucasus area in the Gandša-Karabulag culture, which is dated slightly earlier than Hasanlu IV (27).

Whether the four star-shaped maceheads found to date at Hasanlu represent imports, locally manufactured articles, or weapons of the attackers we cannot determine. In an effort to shed some light on this question, Parkinson made a spectroscopic analysis of four maceheads, including one that was star-shaped. He reports that "in each sample copper and tin were predominant. Silicon, probably in very small amount, was identified in all except one . . . where its presence was doubtful, and each probably had traces of calcium

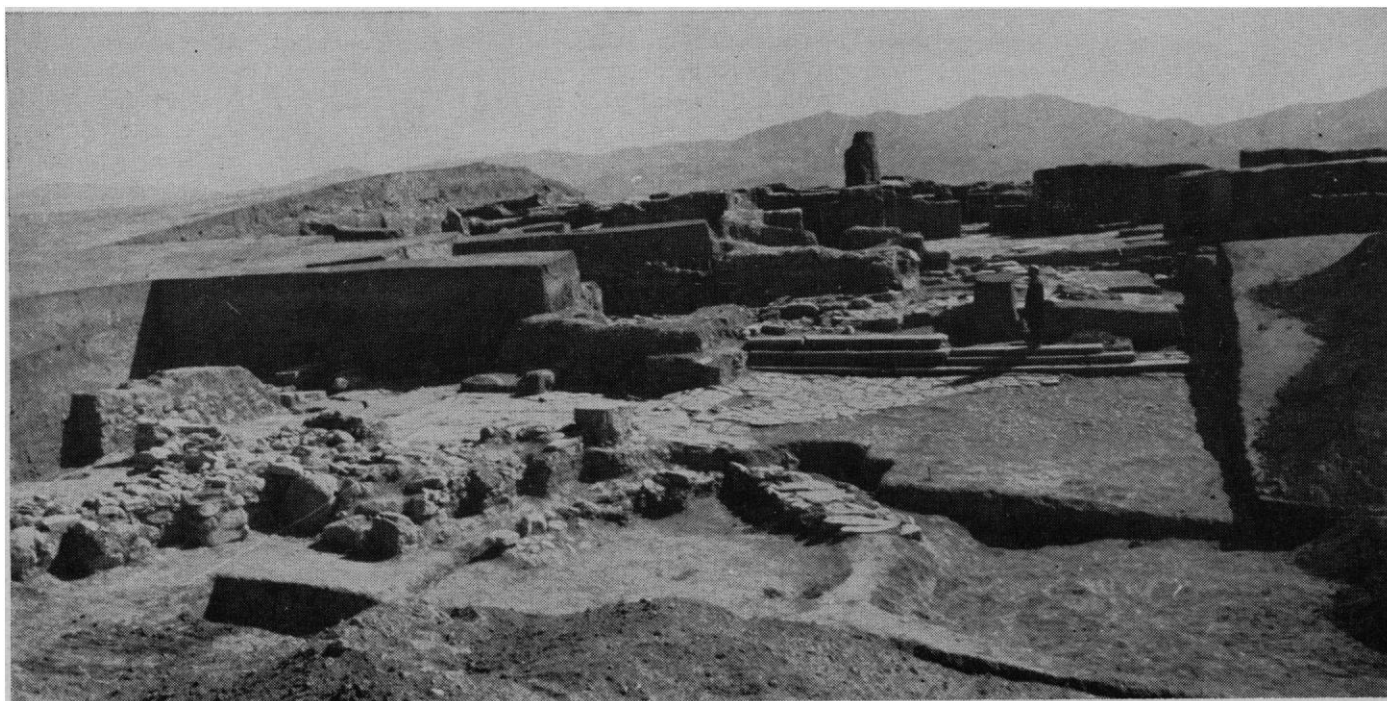


Fig. 8. View of the excavated area at Hasanlu, looking south. The original surface level is marked by the top of the pinnacle in the center. The level of period IV corresponds to the paved area, steps, and courtyard in center background, which forms the center of Burned Building I. A covered stone drain is in center foreground.

and magnesium. The star-shaped mace-head (Has 60-943) showed two lines which were attributable to zinc, which the others lacked. . . . The indication of zinc . . . may be significant, but it should be noted that only the two principal lines of zinc were identified, so that in any case it could have been present only in very small amount." It may be added that zinc was lacking not only in the other three maceheads but also in a dagger from the Button-base phase (28). From the qualitative spectrographic analysis of the dagger (No. 58-4-11), the following estimates for the base metal were derived: copper and tin (the major components), over 5 percent; arsenic, 0.1 to 0.9 percent; silicon, iron, nickel, and antimony; 0.01 to 0.09 percent; and magnesium, lead, and silver, 0.001 to 0.009 percent. Of four other specimens run at the same time, from the collection of W. O. D. Pierce, only one proved to contain zinc. In this sample (a shaft-hole axe of known Caucasian type), the zinc proved to be a major component, along with the tin and copper. The remaining components in the axe were as follows: silicon, magnesium, and aluminum, 0.1 to 0.9 percent; iron, lead, and silver, 0.01 to 0.09 percent; and nickel, 0.001 to 0.009 percent. No calcium, arsenic, or antimony was found. Again, it is interesting to note that the other specimens, which were of Luristan type, did not contain zinc. Nor is zinc reported in the analyses of Luristan objects published by Desch in *A Survey of Persian Art* (29). According to Forbes (26, Fig. 57) zinc is found at Tabriz, and farther north at Kara Dag and elsewhere in the Caucasus. The next step in this study will be to examine the other star-shaped maceheads to determine whether they too contain zinc. Clearly, much work remains to be done on metal in this period before any solid conclusions can be reached (30).

Conclusion

The aim of this article has been to indicate some of the work in progress, both in the field and in the laboratory, in connection with the Hasanlu project. Since this work is still going on, no definitive conclusions can be reached in regard to the many special studies which our raw data have made possible.

Nevertheless, in terms of the initial aim of elucidating a period which, before this project was undertaken, was

virtually unknown in this area, we feel that important preliminary results have been achieved. A general stratigraphic sequence has been built up through careful excavation and documentation in the field. This sequence provides a guide for approximately 5000 years of pre- and protohistoric time. It has been successfully related to both relative and absolute chronology in a general way. A surface survey in the area has confirmed the historically indicated pattern of local citadels and scattered villages in the early 1st millennium B.C. The contents of burials and buildings excavated on the Citadel and in the Outer Town at Hasanlu illuminate the way of life of the period. The picture which emerges coincides well with the inferences already drawn from indirect historical references. Information of a technical nature has been, and is being, made available to the fields of botany, zoology, ceramics, physics, physical anthropology, and metallurgy, among others; this information will contribute fundamentally to the known history of technology and to the improvement of research methods within these fields. Most important of all, the study of Hasanlu contributes toward our own understanding of the immense ranges of experience already explored by the human mind even in protohistoric times. In the pursuit of these objectives, in the pursuit of archeology, certainly scholarship and science go hand in hand.

References and Notes

1. For a general commentary on tactics and strategy in archeology, see R. E. M. Wheeler, *Archaeology from the Earth* (Oxford Univ. Press, London, 1954).
2. Previous explorations have been reported as follows: M. T. Mustafavi, *Nagsh-e-Negar Magazine*, No. 6 (1959) (translated for the project by P. Barzin); A. Stein, *Old Routes of Western Iran* (Macmillan, London, 1940); and A. Hakimi and M. Rad, *Guzarishhā-yi bāstānshināsi I* (Archaeological Museum, Teheran, 1950) (translated for the project by P. Barzin). Preliminary reports on recent excavations have appeared as follows: R. H. Dyson, Jr., *Illustrated London News* 236, 132 (1960); —, *ibid.* 239, 534 (1961); —, *Archaeology* 13, 118 (1960); Anon. *Life* 46, 50 (1959); V. E. Crawford, *Metropolitan Museum of Art Bull.* 1961, 84 (November 1961).
3. R. H. Dyson, Jr., *Illustrated London News* 236, 250 (1960).
4. These data were kindly supplied by Dr. Erich F. Schmidt. Reference is made to Tepe Hasanlu under the name of Khasani in his *Flights Over Ancient Cities of Iran* (University of Chicago Press, Chicago, 1940), p. 69. The exact location of the site is recorded in Schmidt's files as 37°N and 45°27'E.
5. As far as we know there is no detailed geography dealing specifically with this area of Iran. As a rule, Azerbaijan is treated under Iran in general, and in a general way in travelers' accounts and general geographies. A brief summary may be found in G. Le Strange, *The Lands of the Eastern Caliphate* (Cambridge Univ. Press, Cambridge, England, 1905).
6. W. L. Langer, *An Encyclopedia of World History* (Houghton Mifflin, Boston, 1956); R. Roovink et al., *Historical Atlas of the Muslim Peoples* (Djambatan, Amsterdam, Netherlands, 1957); W. R. Shepherd, *Historical Atlas* (Barnes and Noble, New York, 1956).
7. D. D. Luckenbill, *Ancient Records of Assyria and Babylonia* (Univ. of Chicago Press, Chicago, 1926); G. A. Melikishvili, *Vestnik Drevnei Istarii* 1, 57 (1949) (translated for the project by M. Van Loon).
8. F. Thureau-Dangin, *Une Relation de la Huitième Campagne de Sargon* (Geuthner, Paris, 1912).
9. T. Burton Brown, *Excavations in Azerbaijan, 1948* (Murray, London, 1951).
10. G. Conteneau and R. Ghirshman, *Fouilles du Tépé-Giyan près de Néhavend, 1931 et 1932* (Geuthner, Paris, 1935); R. Ghirshman, *Fouilles de Sialk près de Kashan 1933, 1934, 1937* (Geuthner, Paris, 1938, 1939).
11. B. Hrouda, *Istanbuler Forschungen* (Mann, Berlin, 1957), vol. 19.
12. F. R. Matson, in E. F. Schmidt, *Persepolis* (Univ. of Chicago Press, Chicago, 1957), vol. 2, pp. 134-135.
13. Samples of this material are being analyzed by Dr. F. R. Matson at Pennsylvania State University.
14. R. Ghirshman, *Mémoires de la Mission Archéologique en Iran*, No. 36 (1954).
15. G. C. Cameron, *History of Early Iran* (Univ. of Chicago Press, Chicago, 1936).
16. These dates are based on an effective half-life value of 5800 years. This value is based on measurements of samples of known age run in the University of Pennsylvania's carbon-14 laboratory. There is, therefore, some difference between these dates and those published in R. H. Dyson, Jr., *Archaeology* 13, 129 (1960). No half-life error is included in the present calculations. For a discussion of the reasons for adopting the new half-life value, see E. L. Kohler and E. K. Ralph, *Am. J. Archaeol.* 65, 357 (1961).
17. R. H. Brill, *Archaeology* 14, 18 (1961).
18. E. Porada, *Expedition* 1, 19 (1959).
19. The shell identifications were made by Dr. T. Abbott of the Academy of Natural Sciences, Philadelphia. Other shells came from the Red Sea (*Engina mendicaria* Linné, *Columbella fulgurans* Lamarck), Red Sea or Indian Ocean (*Charonia tritonica* Linné, *Conus* sp., *Olivia* sp.), Red Sea or Persian Gulf (*Murex virgineus* Röding), Persian Gulf (*Strombus decorus* subsp. *persicus* Swainson), and Mediterranean (*Conus mediterraneus* Brugineve, *Nassarius gibbosulus* Linné). The last-named shell is also found in the Black Sea.
- 19a. G. Le Strange, *The Lands of the Eastern Caliphate* (Cambridge Univ. Press, Cambridge, England, 1905), p. 57.
20. R. J. Forbes, *Studies in Ancient Technology* (Brill, London, 1950), vol. 4, pp. 102-3.
21. G. Morant, *Biometrika* 30, 130 (1938); H. Vallois, in R. Ghirshman, *Fouilles de Sialk près de Kashan 1933, 1934, 1937* (Geuthner, Paris, 1939), vol. 2, p. 178.
22. Anon., *Archaeology* 12, 171 (1959).
23. Wood samples from the buildings were identified through the courtesy of B. Francis Kukachka, acting chief of the Forest Products Laboratory, U.S. Department of Agriculture, Madison, Wis.
24. W. Andrae, *Colored Ceramics from Assur* (Kegan Paul, Trench, Trubner, London, 1925), Fig. 41.
25. R. J. Forbes, in *History of Technology* (Oxford Univ. Press, London, 1954), vol. 1, p. 588.
26. —, *Metallurgy in Antiquity* (Brill, London, 1950).
27. F. Hançar, *Eurasia Septentrionalis Antiqua* 9, 62 (1934), Fig. 17; C. F. A. Schaeffer, *Stratigraphie Comparée et Chronologie de l'Asie Occidentale* (Oxford Univ. Press, London, 1948). Recently a number of these maceheads have been excavated by E. Negahban near Rudbar in northern Iran for the Archaeological Service of Iran.
28. The analysis of the dagger was made by Lucius Pitkin, Inc., through the courtesy of W. O. D. Pierce.
29. A. U. Pope, Ed., *A Survey of Persian Art* (Oxford Univ. Press, London, 1938), vol. 1, p. 278.
30. J. E. Burke of the Research Laboratory of the General Electric Company, Schenectady, N.Y., has agreed to help in some of the work that involves bronze.