Archeology in the Soviet Union

Some characteristics and recent achievements of a leading center of research are recounted.

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The Soviet Union today is probably the major center of archeological research, in terms of personnel, support, organization, amount of fieldwork, and published output. This activity is concentrated almost entirely within the boundaries of one country in contrast to the more cosmopolitan pattern common elsewhere. Although many of the findings are primarily of local interest, there is much that is of broader significance for the world scientific community. Unfortunately, even Western scholars aware of the potential importance of Soviet results are often discouraged by the language barrier or do not know where to seek sources of information. The obstacles tend to be greatly exaggerated. Many Soviet archeological publications are widely available, and increasing efforts are being made in this country and in England to provide information in English (*1*).

Science of Archeology in the Soviet Union

Archeology in the U.S.S.R. is academically a part of history, which is itself considered one of the sciences, "the science of the development of human society." Our separate concept of "prehistory," which falls by default to the discipline of anthropology, does not exist. History books in the Soviet Union begin with the earliest trace of human activity in the area concerned, and the opening chapters are written by archeologists. However, since archeology is distinguished by clearly defined missions and specific methods of scientific investigation, it operates for practical purposes as a separate discipline and has its own institute within the Academy of Sciences. In marked contrast to our own fragmentation of archeology into prehistoric (that is, anthropological), classical, biblical, Egyptian, medieval, historic, and others—a fragmentation carried to still greater extremes in Western Europe—Soviet archeology is a single unified discipline dealing impartially with everything from the first humans to the Russian colonization of Siberia. Its most distinctive feature is very substantial governmental support and encouragement, with its correlate of a high degree of organization and advance planning. Like everything else in the Soviet Union, archeology has its 7-year plans, though in actual practice the control of planning and activities primarily reflects the persuasive powers of the archeologists themselves and hence ultimately their own interests. Another correlate of this support is the number of full-time positions for archeologists, who are able to devote themselves to research with little or no teaching or other distractions.

The U.S.S.R. was a pioneer in salvage archeology. As early as the 1920's construction funds were specifically earmarked by law for that purpose. The availability of such funds funnels a large proportion of fieldwork into construction zones. The scope of this activity today is unmatched even in the United States. As a random example—one of scores of field expeditions in 1966 to 1967—the Sayan-Tuva Archeological Expedition which carried out salvage investigations in the reservoir area of the future Sayan Hydroelectric Station in central Tuva was composed of some 150 staff personnel organized into six sections. Equal attention was to be paid to remains of all prehistoric periods. In addition to the 67 Paleolithic sites discovered, investigations were carried out on sites of the Bronze Age, Scythian, Hun-Sarmatian, and ancient Turkish periods, and medieval Uigur towns. Other areas of activity included petroglyphs, epigraphy, aerial surveys, and the ethnography and physical anthropology of the modern Tuva population. This region was almost unknown archeologically a decade ago.

In general, any site is excavated on as large a scale as possible. There has long been a stress on total excavation as an ideal, for the purpose of recovering settlement plans and reconstructing patterns of economic and social life—an approach now becoming fashionable in the West. The use of multidisciplinary teams of specialists in the field is also nothing new in the U.S.S.R. Particularly distinctive of Soviet archeology, however, is the effort devoted to the identification of archeological cultures with historical tribes and peoples as a contribution to the study of what is termed "ethnogenesis"—the formation and historical development of the various ethnic groups of the U.S.S.R. This is a major interest of current Soviet scholarship. Other areas of interest such as the economy of ancient societies, the origins and early development of farming and pastoralism, ancient cultural relationships and influences, and the like are shared in common with anthropological archeologists in this country.

Archeology, being a less politically sensitive area than other social sciences, has been characterized in recent years by relative objectivity and a maximum possibility for cooperation with Western colleagues that is more typical of the natural and physical sciences. The subject matter is now viewed in world context, and there is great interest in, and awareness of, relevant foreign work. Theoretically and methodologically, Soviet archeology can be equated in broad terms with Western archeology on the professional level—terminology, procedures, and approaches are entirely familiar. Graduate training is comparable to that in the West. Although problems of evaluation cannot be disregarded, ideological overtones survive today principally in popular works for a general audience (*2*).

The great amount of fieldwork carried out annually all over the country is for the most part reported with exemplary speed, at least in preliminary fashion, and the output of eventual definitive monographs is impressive (*3*). In addition, a very ambitious corpus of all existing archeological materials in the U.S.S.R. is now under way, planned to run to 300 volumes over a 20-year period (*4*). Also noteworthy has been the

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publication of complete bibliographies of the archeological literature (*5*), of gazetteers of archeological sites by region or period (*6*), rosters of expeditions (*7*), and especially of generalizing works (*8*). Much of this output now appears under the imprint of "Nauka," the publishing house of the Academy of Sciences. An unusual amount of popular writing is done by leading scholars, with the result that the general reading public in the U.S.S.R. has a far better idea of what archeology is and what it contributes to historical understanding than is the case in this country.

Despite the centralization of major undertakings in the Academy of Sciences in Moscow (with a branch in Leningrad), there is an increasing amount of local activity. Each constituent republic of the U.S.S.R. has its own Academy of Sciences, including at least a subsection devoted to archeology with a staff which may be largely of the local nationality: for example Ukrainian, Estonian, Georgian, Kazakh, or Uzbek. In some cases, reports even appear in the local language, to the added distress of the foreign scholar. The autonomous republics and areas within the Russian Republic also have their own research institutes which include archeology. The growing army of competent young archeologists trained in recent years is now finding employment outside the major centers in the numerous local museums and universities, and in branch research institutions established by the Academy in more remote locations such as Yakutsk and Magadan. This development has further expanded the opportunities for fieldwork, an increasing amount of which is now locally based. The new Siberian center of the Academy at Novosibirsk, for example, is already an important focus of archeological activities.

In general there has been an effort throughout the U.S.S.R. to fill in the once numerous "blank spots" in this vast territory and to set up at least a preliminary outline of cultural development and chronology for each area. This goal has now been largely realized.

Archeological chronology in the Soviet Union still lags behind most of the rest of the world, due to the inadequate number of laboratories available for radiocarbon dating. There are indications that some improvement may be in sight but, for the present, Soviet archeologists are badly handicapped in interpreting their finds and fitting them into the overall framework of human history. The available dates generally represent only a single sample from a given site, and should be evaluated accordingly (*9*).

The U.S.S.R. has, however, been one of the most active centers of recent work in dendrochronology (dating by tree rings), and a major interest in this field is developing. The method has been applied to the famous frozen tombs of the Altai, to a number of sites scattered over northwestern European Russia, and most spectacularly to the medieval city of Novgorod (*10*). Pollen analysis (palynology) is also well developed and extensively used for the reconstruction of past climatic and vegetation history and for the correlation of sites with these.

Geological dating of Pleistocene cultures, until recently distorted by the erroneous correlations of the dominant figure V. I. Gromov, has at last been placed on a sound footing by younger workers and equated with that in the rest of Europe. As a result of recent studies it is also now possible to correlate at least the later stages of Siberian glaciation for the first time with events elsewhere, and a framework of Pleistocene chronology is beginning to emerge that will greatly aid the prehistorian in this hitherto difficult area (*11*). Older Soviet archeologists still have an unfortunate tendency to use the traditional 19th-century French Paleolithic culture stages, largely inappropriate to the picture in the U.S.S.R., as chronological periods.

The application of the techniques of the physical sciences to archeology is also an area of active interest. Laboratories have been in existence for some time in the Institute of Archeology for chemical, spectroscopic, and microanalysis of metals and pottery. Experiments have also been carried out in dating pottery by archeomagnetism (*12*).

The most interesting laboratory work at the Institute, however, is in the field of prehistoric technology, primarily lithic, under the direction of S. A. Semenov. Aside from his extensive experimental work in ascertaining methods of manufacture and use of prehistoric tools along lines not essentially dissimilar to those currently applied by several workers in the West, Semenov has pioneered in the study of traces of use on tools as revealed by the microscope; from these traces, he has made attributions of the original function or mode of use of the tools. Fortunately, his most relevant report has now appeared in English translation and is arousing well-merited interest here (*13*).

A survey of reports in English of major Soviet archeological findings down to 1955, which covers the whole country and is intended for the general reader, is readily available (*14*). This was the pioneering era of spectacular discoveries and great surprises. Nothing since, for example, can equal the frozen princely tombs of the Altai, now so well known to the world. The past dozen years, in contrast, have comprised a period of detailed and intensive work, developing and consolidating knowledge of cultural development in all parts of the U.S.S.R. The amount of information is tremendous, but less often newsworthy to the uninitiated. Briefly sketched below is simply a selection of recent developments and findings that seem most likely to interest scholars in this country. It makes no pretense at being representative or accurately reflecting the totality of recent work.

European Russia

It is increasingly evident that European Russia was not occupied by man until the Upper Pleistocene. Since the Mediterranean area, western Europe, and even neighboring Romania had formed part of the human habitat for at least 500,000 years, we must assume that ecological factors made the Russian Plain off limits until later levels of technological development and adaptive capabilities had been achieved. Convincing evidence of human activity in the Middle Pleistocene is restricted to the Caucasus area. The only reasonably well-dated site in the U.S.S.R. occupied before the Riss glaciation is the lower level of Kudaro I cave in South Ossetia with an Acheulean industry and a warm fauna pointing to a probable Holstein (Mindel-Riss) interglacial age. Six other sites in the Caucasus area may also belong here. The oldest settlements on the South Russian Plain (Volgograd, Molodova I and V) represent variants of the Mousteroid technological tradition and presumably populations of Neanderthaloid type; they may be assigned to the early part of the Early Würm. It is probable that the first human occupation of European Russia took place during the latter part of the preceding Eemian (Riss-Würm) interglacial, derived both from east-central Europe and from the Caucasus region. The site of Khotylevo near Bryansk, about which little has yet been reported, may date from this time, and was thought until recently to be the northernmost Mousteroid site in the U.S.S.R. But in 1967 a startling discov-

ery was made at Krutaia Gora on the Pechora River only 175 kilometers from the Arctic Circle. Here, at a depth of 9.5 meters underlying a later camp of Upper Paleolithic mammoth hunters (at 4.5 meters), was found an occupation level that yielded 20 artifacts that in morphology and technique must evidently be assigned to the Mousteroid tradition. Geologists believe the deposit to be of Eemian age. Even if it should prove to fall into some later phase of mild climate, Krutaia Gora is nevertheless of considerable significance as by far the northernmost evidence of human occupation in the world during the Pleistocene (*15*).

The Molodova I and V open sites in the Dnestr River valley are probably the most important Mousteroid sites studied in the U.S.S.R. Aside from the excellent geological context, particular interest attaches to the probable remains of dwellings (perhaps the oldest man-made structures reported) and to a number of artifacts evidently used for grinding purposes (*16*).

There have been several notable Upper Paleolithic discoveries in recent years. The first indubitable Pleistocene paintings to be found in the U.S.S.R., in Kapovaia Cave in the southern Urals, were the subject of study in 1960–64 (*17*). The animal figures of the upper level of the cave, all executed in red, include seven mammoths and two rhinoceroses; most of the other identifiable figures are of horses. Since they are situated in the depths of the cave 300 meters from the entrance, in an area of very difficult access, their purpose is assumed to be similar to that of the paintings in the cave sanctuaries of France and northern Spain. Like most of the Spanish cave paintings, the range of size and relative scale of the figures varies, and there are no apparent compositions. In the lower level of the cave were found stylized geometrical signs, believed to belong to the same period. These are the first Pleistocene paintings to be found outside of western Europe; the numerous caves of central Europe, lying in between, have yielded no traces.

It has long been postulated that the late Pleistocene big-game hunters of the north Eurasian plain must have been equipped with adequate tailored garments of the general sort worn by Arctic hunters of modern times, but definite evidence of this was lacking until the 1964 discovery of the burial of a man of general Cro-Magnon type at the Sungir site near the city of Vladimir. Because the garments of the deceased had been richly decorated with ivory beads, it was possible to reconstruct their form as a pullover shirt with round neck and a pair of trousers with boots. There was also trace of some other upper garment or head covering. The age of the find has been confirmed as occurring before the final Würm glacial maximum, and is probably at least 30,000 years old (*18*).

The year 1966 saw the fourth season of excavation at the Vyzovsk site on the upper Pechora River at 65° north latitude—the northernmost Paleolithic site in the world until discovery of Krutaia Gora in the year after. Vyzovsk was a large camp of mammoth hunters (98 percent of bone remains are from this species); finds include remains of a dwelling constructed of mammoth bones. The artifacts show resemblances to the lower (fifth) level at the famous Kostienki I site in southern Russia and to Sungir, suggesting a similar age prior to the Würm maximum age. In the Upper Paleolithic horizon at Krutaia Gora, downstream on the Pechora, some of the artifacts were made of obsidian. The nearest known sources of obsidian are over 1700 miles to the south, in the Caucasus and Carpathians (*15*, *19*).

The outstanding achievement of Soviet archeology in the postwar years has been the pioneering scientific excavation of a historical city, Novgorod, a major center of medieval Russian culture in the 13th and 14th centuries. By 1962, after 12 years' work, an area of 9000 square meters had been excavated to an average depth of 5.5 meters. The perpetually damp ground of the locality had resulted in a remarkable preservation of wood and other organic remains. Some 500 dwellings and over 600 other log structures were uncovered. It also necessitated the use of timber-corduroy streets which had a useful life of 7 to 30 years before it was necessary to cover them with a new construction. Up to 28 levels of such superimposed streets were identified, and it proved possible to correlate the structures with the street levels and to date both by means of dendrochronology. Over 1000 tree-ring graphs were made from timbers and were assembled into a chronological scale spanning from the 10th through the 15th century, the entire period of occupation of the city. This chronology was translated into absolute dates by tying it in with timbers from a number of historically dated churches of the later periods. Of particular interest was the recovery of almost 400 documents written on birchbark that dealt mostly with socioeconomic matters. In addition, immense quantities of food remains and items of material culture were obtained. The description, analysis, and interpretation of these finds have been reported in great detail and with exemplary promptness. Happily, a book is now available in English which ably summarizes these results (*20*). The Novgorod excavations are a prime example of historical archeology at its best, with documents and archeology supplementing one another and enhancing the values of both as historical evidence leading to the reconstruction of social and economic changes in a major city.

Central Asia

Available evidence suggests that the earliest human occupation of Soviet Central Asia is represented by scattered finds of crude pebble tools restricted to the mountainous areas of the east and southeast. They are impossible to date, since virtually all are surface finds. Examples of late survival of archaic lithic techniques are characteristic of this same area, so that age ascriptions on a purely typological basis are open to question. However, it would appear likely that the area was initially aligned with eastern Asia and with the Soan industries of the neighboring Punjab in terms of technical traditions and, presumably, ecological patterns. Only in the extreme southwest of Soviet Central Asia is there any trace of the Acheulean handax tradition of the Mediterranean-African sphere.

Many Mousteroid sites now supplement the famous cave of Teshik-Tash with its burial of a Neanderthal child, and this continues to be the best represented stage of Pleistocene human occupation. However, finds are distributed almost entirely in or near mountain regions. Both open sites and workshop areas as well as caves are now known. Along one stretch of the Syr-Daria River between Naukat and Leninabad alone some 15 localities have been discovered. The general picture suggests either that the most extensive human occupation of central Asia took place at this time, or that this cultural-technical tradition may have persisted here until the end of the Pleistocene (as was the case in Anatolia and other mountainous areas), unaffected by developments on the Eurasian plain to the north and west. These Mousteroid industries evidently reached the region from the Near East, and their estimated age is similar to comparable

sites in the West. However, more precise dating is rendered difficult by the fact that fauna found in the sites is, with rare exceptions, of modern type, indicating environmental conditions approximating those of today. It is now felt that an earlier and a later stage of these industries can be distinguished on stratigraphic and technological grounds (*21*, pp. 23–49).

Cultural remains classifiable as Upper Paleolithic in the usual sense are remarkable for their absence in view of the propinquity of central Asia to the great arena of activity at this time on the Eurasian plain. Only one major site thought to fall in this period has been excavated, at Samarkand. Geological opinion assigns it to the late Pleistocene, but more precise dating is not feasible. Stone technology here is very reminiscent of the Siberian Paleolithic, especially in the sense of a strong Mousteroid component, and relationships have been proposed accordingly; but I would suggest that it may equally reflect late survival of the local Mousteroid tradition. Only in the extreme west of the region, near the shores of the Caspian Sea, is there any trace of influence from the classical Upper Paleolithic cultures (Aurignacoid tradition). Only at the very close of the Pleistocene, or perhaps not until the early Holocene, do outside influences, in this case coming up from the Near East, penetrate into central Asia. They are represented by a lithic tradition of small tools, prismatic cores, and blades which has its northernmost outpost at the site of Khodzha-Gor in the Isfara River valley (Tadzhikistan) (*21*, pp. 50–59).

A surprising development of recent years has been the discovery of evidence of human occupation of the high mountainous region of the eastern Pamirs in very early postglacial times. The open sites, often situated on glacial moraines, lie at elevations of 9750 to 13,600 feet (2860 to 4245 meters) above sea level. While most are represented by surface finds, the occupation horizon at Osh-Khona was excavated *in situ* and yielded a radiocarbon date of 9530 years ago. Osh-Khona is located at 13,600 feet (4245 meters) in what is today a very severe environment, only 15 kilometers distant from the snout of a modern glacier and some 30 kilometers from Mount Lenin, the second highest peak in the U.S.S.R. The prehistoric inhabitants were using birch and juniper for fuel, the nearest stands of which today are 100 kilometers away, indicating a milder climate in the area at that time. Evidently the sites represent summer camps of hunters attracted by the abundant game in the alpine pastures. The lithic technology combines purely Siberian Paleolithic techniques based on pebble cores and producing crude heavy tools, with microcores, blades, and small arrowpoints. The discoverer V. A. Ranov considers that these sites are most likely the western margin of an Inner Asian high mountain culture, technologically conservative, which may be expected to turn up in the future in Tibet and Chinese Central Asia (*21*, pp. 67–69).

During the early Holocene and later, two major culture areas can in general be discerned in Soviet Central Asia. The western one, characterized by small tools and obviously influenced from the Near East, developed on the one hand into the pottery-using, hunting-fishing cultures of the Aral Sea and vicinity (for example, the Kel'teminar culture), and on the other into the first farming culture of southern Turkmenia (Dzheitun). Recent work shows that this culture area extended far north into the southern Urals, whose postglacial inhabitants show no affinities either with the Mesolithic cultures of European Russia, or with Siberia. The second central Asian culture area comprises the mountainous regions of the east, where the tradition of heavy tools from pebble cores persisted, first in the Pamir sites and later in the so-called "Mountain Neolithic" Hissar culture of Tadzhikistan. Approximately 100 sites of the latter have been found in recent years. Radiocarbon dates range from 5150 B.C. (Tutkaul) to 2210 B.C. (Ak-Tangi). No evidence of farming has come to light, and thus the economy of the Hissar culture is assumed to have been based upon hunting-gathering, despite the occurrence of some sizable settlements. Pottery is present in the later phases. Tutkaul, near Nurek in southern Tadzhikistan, is one of the best-studied Stone Age sites in the U.S.S.R. Complete excavation of the settlement, covering about 2 acres (almost 1 hectare), was finished in 1967. Under the two Hissar horizons here, and separated by 2 meters of sterile soil, was a Mesolithic site whose age is estimated at 12th to 10th millennia B.C. Human remains —the first to be found from the Hissar culture—are of Europeoid type (*21*, pp. 59–75; pp. 145–148).

The first farming population in Soviet Central Asia is represented by the Dzheitun (Djeitun) culture, known from a number of sites in the Ashkhabad area of southern Turkmenia which lie in a strip between the desert and the foothills of the Kopet Dagh range. The culture is believed to reflect not an immigrant group, but rather an acculturated local Mesolithic population which had taken over farming and related elements from the Near East. This is indicated by the lithic technology and the continuing importance of hunting. Pottery is present from the beginning. Since a late phase is radiocarbon dated at 5036 B.C., the main part of the Dzheitun culture evidently belongs in the 6th millennium B.C. The village of Dzheitun itself consisted of 35 to 40 houses at any one time, giving an estimated population of 200 to 240. In general, the culture can be seen as yet another regional variant of the basic village farming pattern stretching from Greece to Afghanistan (*21*, pp. 76–92; *22*).

The subsequent Eneolithic stages in Turkmenia (Namazga I–III) show a steady evolution out of Dzheitun. Many sites have been excavated, and this period is now known in some detail, so that changes in house types and settlement plans can be studied. Close cultural parallels both with neighboring Iran (Sialk, Hissar) and with Pakistan and Afghanistan indicate contact and relationship in both directions (*21*, pp. 76–92; *22*).

Beginning in 1964, Soviet archeologists turned their attention to the subsequent Bronze Age sites in the area. During the Early Bronze Age (about 2600 to 2100 B.C.) elements of urban civilization begin to be visible. This development reached its peak in the Middle period (about 2100 to 1900 B.C.) under stimulus from Mesopotamia. However, the growth of urbanism and its related socioeconomic patterns was handicapped by the limited agricultural potential of southern Turkmenia, with its inadequate sources of water for irrigation. Thus the development never got beyond a point roughly comparable to that of the Uruk phase in Mesopotamia. Of interest is the evidence of trade and influence from the Indus valley, showing that this moved overland to the northwest and not just by sea to the Persian Gulf. This incipient urban development came to a halt and a period of decline set in during the Late Bronze Age. The causes of this interesting phenomenon are not yet clear, but both economic problems and the impact of the restless Indo-European peoples from the steppe to the north may well have been involved. Further progress in central Asia seems to have been halted for some 1400 years (*22*).

Major contributions to an understanding of the later and historic periods in central Asia have also been made by Soviet archeologists. Information on this is readily available in English (*23*).

Siberia

The known Siberian Paleolithic sites have been thought to be no older than the last glacial maximum (about 20,000 years ago), although any dating was tenuous. The latest Paleolithic industries were accepted as often postglacial. Now there are hints of much earlier human occupation in the form of possible very crude artifacts in old but undatable geological contexts (Ulalinka Creek near Gornoaltaisk, Altai region, and Filomoshek on the Zeia River, Middle Amur basin) as well as a definite flake blade with faceted platform from deposits ascribed to the Tazov (Riss) glaciation near Rubtsovsk in the Altai foothills. Of later age, but evidently prior to the last glaciation, are very recent finds of artifacts with an early form of mammoth in a cave in the Vladivostok region. Neighboring Mongolia was settled, presumably during the Early Würm, by populations with Mousteroid industries of western affinities who evidently came from Soviet Central Asia. There is as yet no evidence that they penetrated Siberia. Subsequently, Mongolia is characterized by industries with heavy tools made from split pebbles. This tradition, plus a strong survival of Mousteroid elements, forms the major component of the Siberian Paleolithic and hence points to Mongolia as the primary source of the latter. A strong influence from the Aurignacoid big-game hunters of the Eurasian steppe to the west is already evident, however, in all the earlier Siberian Paleolithic settlements (*24*).

Radiocarbon dates have now appeared for a number of the well-known sites. Mal'ta near Irkutsk, long considered the oldest, has produced a date on fossil bone of 14,750 ± 120 years ago (GIN-97), while Afontova Gora II on the Yenisei, assumed on no very good grounds to be younger, has a date of 20,900 ± 300 (GIN-117) on a sample apparently from just below the main (lower) horizon. The nature of the geological and other evidence from the site makes it difficult either to confirm or discredit an age of this general magnitude. Dates on the Kokorevo group of Yenisei sites range from 15,460 to 12,940 years ago, which is consistent with other evidence. Extensive excavations were carried out at Kokorevo I during 1961–66, 800 square meters being uncovered.

Of particular interest to New World archeologists is the newly discovered Diuktai Cave on the middle Aldan River, a tributary of the Lena, where bifacial pressure-flaked projectile points and knives are said to be associated with mammoth fauna. This is the first reported occurrence of bifacial points of Pleistocene age in Siberia in what seems to be a reliable context. Further details are not yet available. Of perhaps equal interest owing to its proximity to the Bering Strait area is Ushki Lake in central Kamchatka, one of the more important archeological localities ever found in Siberia. Repeated occupations of the locality over a long period from the late Pleistocene until historic times have produced a series of stratified sites with the successive occupations sealed off from one another by falls of volcanic ash. Pollen profiles provide a continuous history of vegetation. The oldest level (VII), dated at 14,300 years ago, contains hearths and a grave from which the human remains had unfortunately decomposed completely. (The published radiocarbon date of 21,-100 ± 900 is now dismissed by the excavator as erroneous.) The cultural remains show little resemblance to anything elsewhere. A later Paleolithic complex is represented in levels VI and V, the latter dated at 10,360 ± 350 (Mo-345). Remains of semisubterranean dwellings, wedge-shaped cores, and bifacial foliate points and knives are reported. The complex is said to have no close parallels as a whole, but to show similarities in a number of traits to southern Siberia (especially the Kokorevo III site on the Yenisei) and in a few others to preceramic Japan (*25*).

An important recent development has been the discovery and excavation of sites which fill the previous hiatus between the Paleolithic and the ceramic "Neolithic," especially in the Baikal region. The most important of these is the 14-level Ust'-Belaia settlement on the Angara River, which has now been extensively investigated. In 1967 a cult burial of a dog was found here underlying a level dated at 8960 years ago. Although local excavators speak of a "Meseolithic" stage, these sites in general show a combination of Paleolithic survivals along with the first appearance of subsequent "Neolithic" traits, but little that is distinctive of this segment of time alone (*26*).

A series of stratified sites recently studied on the Aldan River makes a convincing periodization of the ceramic complexes of the boreal forest zone possible for the first time. The earliest of these is now radiocarbon-dated at 4025 B.C. at the Belkachi I site, and is characterized by pottery with net or mat impressions (*27*).

Investigations in the Magadan area have brought to light an early maritime sea-hunting culture on the north shore of the Sea of Okhotsk, currently designated "Ancient Koryak," which was unrelated to that of the Bering Sea Eskimos but shows some curious parallels to early Aleutian culture. It is very likely that this is the source of the puzzling Okhotsk culture which appears suddenly in northernmost Japan in the 1st millennium A.D., obviously brought by sea from somewhere far to the north (*28*).

One of the major undertakings ever carried out in Eskimo archeology is the complete excavation of the prehistoric cemeteries at Uelen and Ekven on the Siberian shore of Bering Strait. Through the 1965 field season, 228 burials had been opened spanning all phases of Eskimo prehistory but predominantly from the earlier (Old Bering Sea) stage. In addition to a major collection of skeletal material there was a rich harvest of artifacts and art objects, including the first wooden mask from the Old Bering Sea stage and no less than 617 toggle harpoon heads which provide the basis for chronological and cultural classifications in this region. The earlier reconnaissance work of Rudenko (*29*), on which American scholars have depended heavily, has been modified in many respects. Okvik has been shown to be a culture related to Old Bering Sea and contemporary with its later phases, while the following Birnirk and Punuk were again contemporary and distributed north and south of Bering Strait, reflecting adaptation respectively to sealing and whaling (*30*).

References and Notes

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Defoliation in Vietnam

The ecological consequences of the defoliation program in Vietnam are assessed.

Fred H. Tschirley

An assessment of ecologic consequences of the defoliation program in Vietnam was undertaken at the request of the U.S. Department of State. This article is based on a report made as a part of an overall review of the defoliation and crop destruction programs in Vietnam.

The timetable for completion of the policy review required submittal of a report 1 month after my arrival in Vietnam on 15 March 1968. The period from mid-March to mid-April was the end of the dry season when many tree species are naturally defoliated. This added to the difficulty of determining the effects of herbicides on vegetation.

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The dry season, the short time available, and the difficulty of making on-the-ground observations were restrictive for an ecologic evaluation. Thus, this report is not a detailed analysis, but an assessment based on the observations that were possible and on discussions with foresters and others knowledgeable about the local situation. The observations were supported by scientific reports and personal research experience in ecology and the effect of herbicides on vegetation in temperate and tropical America.

There were no constraints placed on what I was permitted to see in Vietnam nor on what I reported. Some areas and vegetative types could not be visited because there was not adequate time, or because safety could not be assured in areas of military activity. In other areas, inspections were limited to aerial observations because the sites were not sufficiently secure to permit ground assessments. Civilian and military elements of the U.S. mission in Vietnam gave me all the help and cooperation that was possible. The military provided aircraft for aerial surveys of defoliated and nondefoliated forests, arranged transport to Special Forces camps and a security force for observations from the ground, arranged briefings on all aspects of the defoliation program, and made available whatever records I wished to see on where and when forests were sprayed with defoliants. Civilian elements of the U.S. mission provided background information based on their experiences in Vietnam, aircraft for additional aerial surveys, introductions to Vietnamese foresters, and background material needed for writing my report. Probably the best indication of the lack of constraints on my activities was that the report which I prepared was released, without a word having been changed, by the U.S. mission in Saigon.

This article is essentially the same as the report I prepared in Vietnam. Some material has been deleted because of space limitations, but my observations and conclusions do not differ from the original report.

Defoliated Areas Surveyed

Time did not permit a survey of all the defoliated areas in Vietnam. Therefore, my observations were limited to those areas where large blocks of forest had been sprayed with herbicides. The ecologic consequences of the defoliation program would be ex-