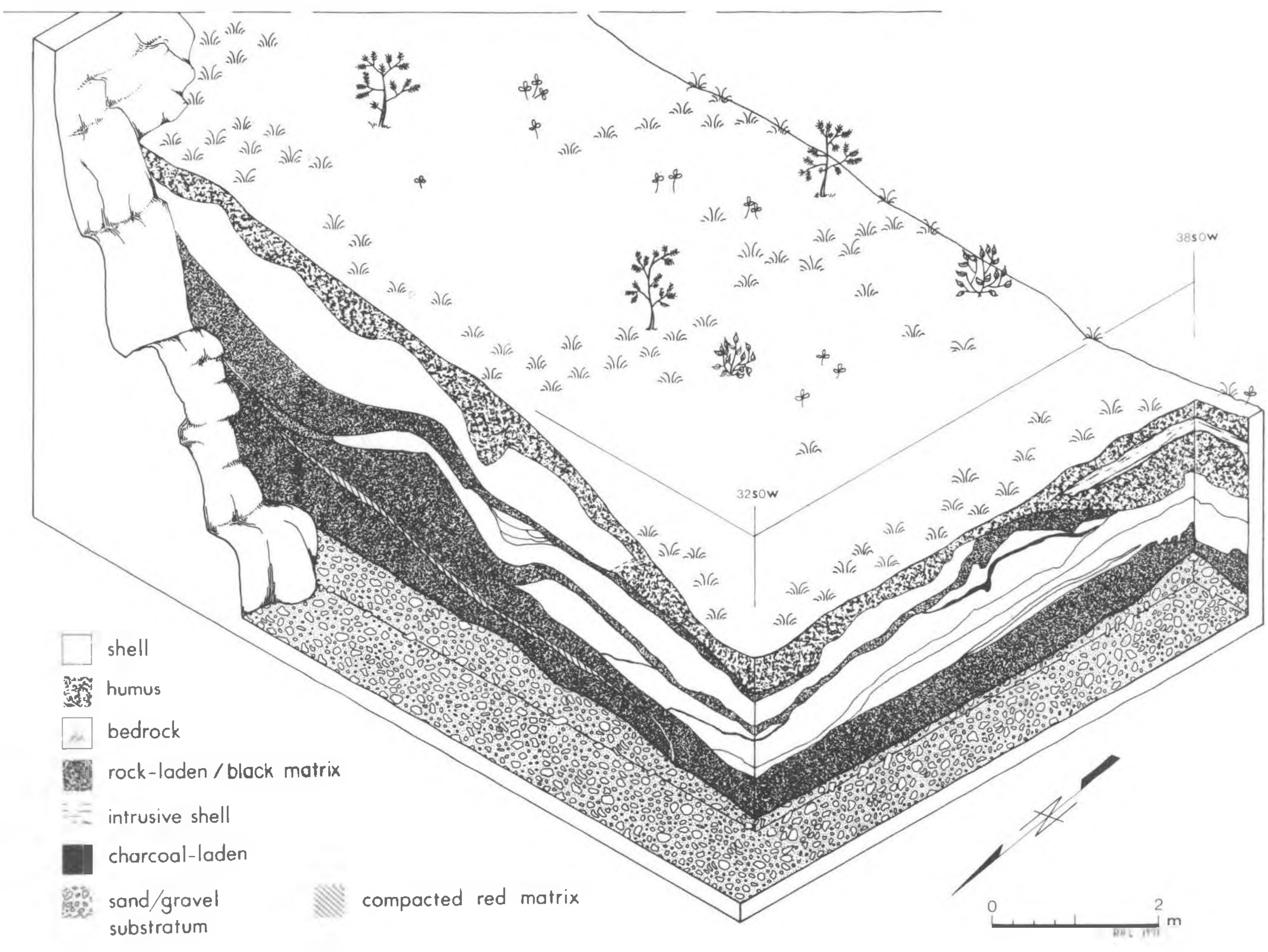
Studies in

BELLA BELLA PREHISTORY



Department of Archaeology
Simon Fraser University
Publication Number 5

Organized and Edited by
James J. Hester
Sarah M. Nelson

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STUDIES IN BELLA BELLA PREHISTORY

Organized and Edited by James J. Hester and Sarah M. Nelson

DEPARTMENT OF ARCHAEOLOGY

SIMON FRASER UNIVERSITY

PUBLICATION NUMBER 5

BURNABY, BRITISH COLUMBIA

1978

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Kathryn Conover
James J. Hester
Roger Luebbers

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JAMES J. HESTER

INTRODUCTION

When I first became interested in Northwest Coast archaeology, a review of the literature revealed that no other major culture area of North America was so poorly known archaeologically. At the same time the ethnographic cultures of the region had been intensively studied and the opportunity to use the direct historic approach seemed promising. The selection of the Bella Bella region as the focus of studies came about through discussion and correspondence with other archaeologists working on the coast. The National Museum of Canada had ongoing research on the Queen Charlotte Islands and the Skeena river mouth. Simon Fraser University was initiating research in the Bella Coola region. The geographically intermediate and archaeologically little known Bella Bella region seemed an obvious choice.

Research was initiated during June of 1968. This preliminary season was devoted to exploratory efforts as a guide to future research. At the inception of the work, none of the researchers had prior experience in the area, nor much experience in the survey and excavation of shell middens, consequently during the first week of the season we initiated a survey to locate prehistoric sites. Our first efforts consisted of motoring along the shoreline looking for any obvious remains or unusual topographic or vegetational features. We would then go ashore to examine likely areas. We also examined other areas selected at random to learn if we were overlooking any sites. The dense vegetation combined with the steepness of the shoreline quickly convinced us that more efficient survey methods had to be developed. We were recording less than one site per day, yet were expending great amounts of energy. We therefore began a systematic program of interviewing residents about the location of sites. Many local people knew the locations of pictographs and petroglyphs; but their knowledge of midden locations was less precise. One man in particular, Willie Gladstone, of the Bella Bella band, at that time 82 years old, proved to be a mine of information. He provided us with more than fifty site locations, and marked our navigational charts with additional comments regarding site type and distinctive features. We then proceeded to visit and record each location. At the conclusion of the field season we had recorded 51 sites and had yet to investigate an additional 31 sites reported by local residents. Additional efforts during 1968 included test excavations at Namu and Kisameet. The survey (Fig. 1) from its inception in 1968 has been directed by J. Anthony Pomeroy who is preparing a separate report on this aspect of our project.

In 1969 the field party was based at the town of Namu. The midden there, one of the largest in the area, is located in the centre of the community and has built upon it a 60-room bunkhouse, now abandoned, which was made available for use as a field laboratory. Excavations at Namu during the 1969 season revealed a sequence of occupation beginning with a microblade component at least 6000 years of age and extending through a long record of a fishing, shellfish gathering, and sea mammal hunting adaptation, one of the most recent levels of which was radiocarbon dated at 2800 B.P. Inasmuch as all the 1969 excavations at Namu were conducted at the rear of the midden, it was anticipated that more recent levels would be found in the front of the midden, an assumption which was verified by the 1970 excavations. The findings at Namu also included a large number of burials in the midden fill. Burial patterns included partly or wholly disarticulated interment in bundle-fashion; extended and flexed inhumations, and burned bone fragments which may represent intentional cremation. Other activities during 1969 included a small excavation at Kisameet Bay and the initiation of an ecological sampling program similar to that pioneered by Meighan (1959, 1970) and his students (Meighan, et al. 1958a, 1958b). During the academic year 1969-70 ecological samples were processed

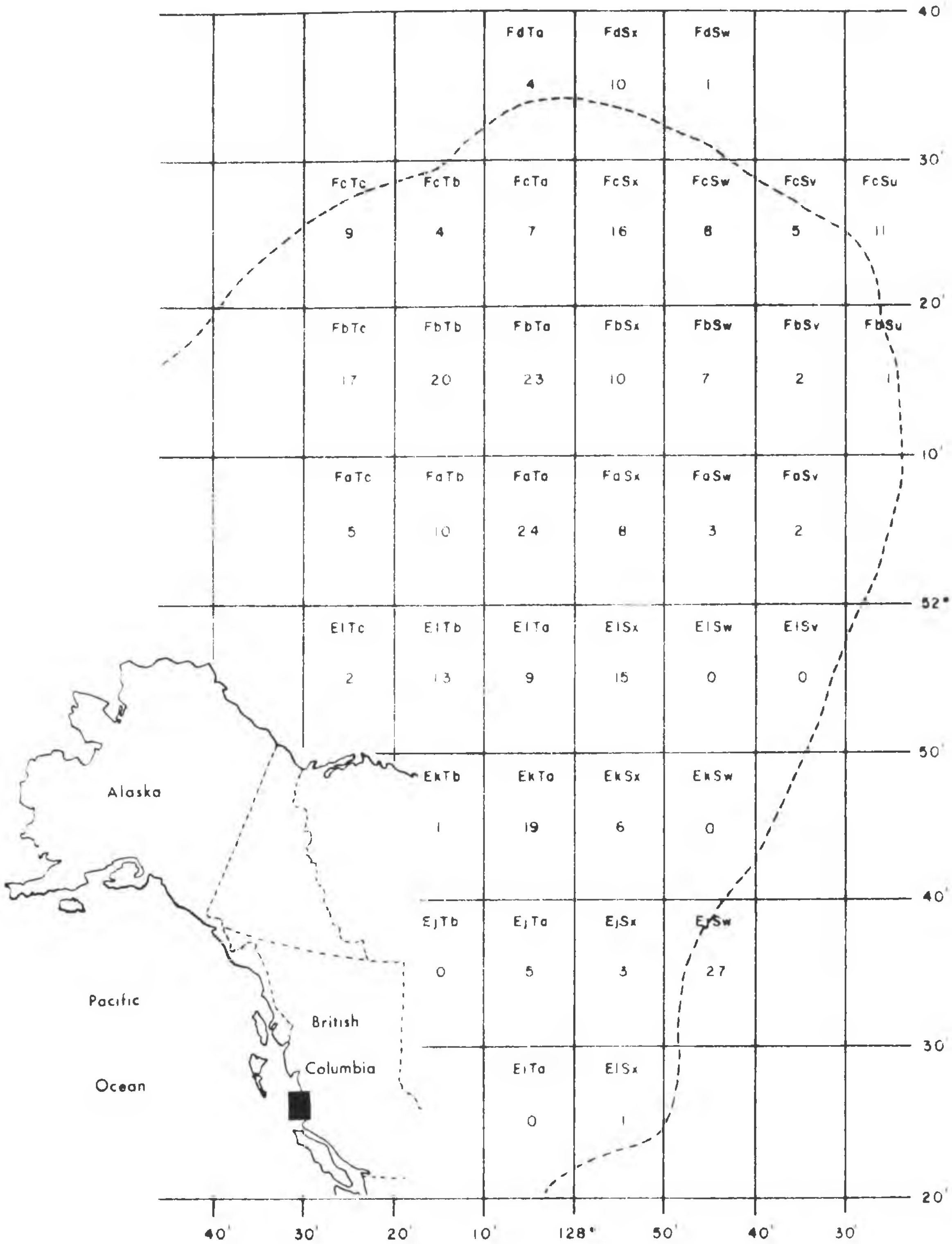


Fig. 1 Survey area. Number of sites located in each grid square are indicated.

primarily to recover microfauna, and the recovered materials were shipped to various specialists for identification.

The 1970 field season featured a continuation of projects begun during the preceding season. Major excavations on the front portion of the midden at Namu revealed strata covering the most recent 3000 years. The survey was continued, bringing the known site total to 185. A new emphasis involved the detailed sampling of strata utilizing a newly designed methodology. These intensive profile samples, described in later sections, were collected from several trenches at Namu as well as from the sites at Kisameet Bay and Roscoe Inlet 1A. Other research activities included the interviewing of the older Bella Bella Indians by cultural anthropologists. The Indians were asked about the seasonal use of sites and the specific food collection and food preparation techniques employed at each site. At Namu, the excavation in the front of the midden, some 6 metres in depth, revealed an occupation extending over the past 3000 years. This front trench overlapped in age with the rear deposits and could be correlated with them. The site at Roscoe Inlet was excavated in order to provide modern information on the site as well as to provide additional information on the findings reported by Drucker (1943).

A number of environmental studies were also undertaken. Aerial survey of the inland lakes revealed that bogs are common. In one test a minimum depth of five feet of bog deposits was indicated. Several exposures of laminated fine grained clay beds were located, as well as beds of alluvial gravels.

Ancillary studies include a detailed study by Michael Finnegan (1973) of the Bella Bella skeletal remains from our excavations as well as the burials from other nearby localities. Local rock art sites were recorded and integrated into a larger study of rock art of the entire Northwest Coast by Ruth Smelser. Studies of the historical and ethnographic culture of the Bella Bella were conducted during the 1970 season by Kerry Feldman and Kerry Pataki.

PRIOR RESEARCH

Archaeological research in the Bella Bella region undertaken prior to our work is limited to a two week exploratory survey carried out in 1938 by Philip Drucker and Richard Beardsley (Drucker 1943). Their survey reported a total of 20 sites, some of which were not visited but were only described to the researchers by Indian informants. Three sites, termed Roscoe Inlet, Roscoe Inlet 1A, and Kilkitei Village, were tested with trenches. The artifacts from the excavations and survey along with other specimens from the Northwest Coast in museum collections were described in a typology.

One justification for Drucker's and Beardsley's work was the opportunity to apply the direct historic approach to archaeology.

> An attempt to apply the direct historical approach to a new archaeological field ordinarily must be based on the records of the period of early European contacts, utilizing them to determine tribal distributions and to identify sites. For the Northwest Coast, however, historic records are less essential though of unquestionable value as a check and guide, because of the fact that the native cultures there persisted little modified much longer than in many other parts of the New World. The nature and effects of European contacts on the Northwest Coast differed markedly from those in other areas. The chief difference rests in the fact that there have been no major populational movements, voluntary or enforced since earliest historic times. Even despite the steady numerical decrease of population, and the tendency for survivors of decimated groups to assemble in central or stronger villages, the sites of early historic times (and many of them go well back into the prehistoric period) are not only still known and occasionally utilized, but are also considered the property of the rightful heirs of the past occupants. Most of these sites in British Columbia have been set aside by the Canadian Government as Indian Reserves. Consequently, the identification of historic horizons with ethnically known groups does not constitute anywhere near as difficult a problem as in the Plains or the Southeast. Any tolerably well-informed modern native can tell to what ethnic group, and what division within the group, a given site belongs; indeed, he can ordinarily point out a number of the older people who were born there [Drucker 1943 p. 25].

Drucker's comments must be somewhat modified for the Bella Bella of 1970. The relocation of peoples from various reserves to the old village at Bella Bella took place in the 1880's. Therefore few Bella Bella living in 1938 were born in the original villages. The modern village of New Bella Bella was established in 1897. It grew out of the period of Hudson's Bay trade and missionization, and was not a continuation of a prehistoric settlement. Today few living Bella Bella remember life prior to that date. Nonetheless Drucker's statement is true in a general sense as ownership of specific reserves is still vested in individual families. In addition many economic practices from prehistoric and historic periods persist.

Concurrent with the present project other research has been in progress. The National Museum of Canada has conducted extensive excavations in Prince Rupert Harbour under the direction of George MacDonald. Beginning in 1968, Simon Fraser University has had archaeological parties working in the Bella Coola region under the direction of Roy Carlson and Philip Hobler. It is anticipated that some culture trait distributions will be common to both the Bella Bella and Bella Coola regions. As yet, most of these findings from nearby projects are unpublished although preliminary statements appear in MacDonald (1969), Carlson (1970, 1972), and Hobler (1970, 1972).

THE PROBLEM

The major emphases of the project have been ecological in nature, as the majority of our data consists of bones, shells, soil, etc., rather than either cultural features or artifacts. The problems researched have also been structured by the nature of the ethnographic literature. The ethnology of the Northwest Coast has been extensively studied over the past eighty years. These studies have revealed that the native Indian cultures of the area were among the most elaborate and complex aboriginal cultures in North America (Swanton, 1905; Boas, 1889; Niblack, 1890; Codere, 1950; Drucker, 1955). Of special interest to anthropologists is the high level of culture that was achieved by peoples practising an economy featuring hunting, fishing, and gathering. Normally such cultural attainment has been restricted to peoples with an agricultural economy. A current problem is the determination of the antiquity and origins of the ethnographic pattern.

In his 1943 report Drucker provides us with an admirable summary of the general ethnographic characteristics of Northwest Coast culture. Inasmuch as these features are typical for the Bella Bella region we will quote Drucker's description nearly in its entirety. This section by Drucker may be viewed as a hypothetical culture pattern for the prehistoric inhabitants of the Bella Bella region. Our archaeological data will provide evidence to test in part the historical validity of Drucker's ethnographic reconstruction as it applies to the Bella Bella.

Though there were numerous minor differences of culture between the various groups, a few major trends and patterns were common to all. Economically, dependence was not only on fish, but on species — particularly salmon — seasonably available. This brought about a series of annual movements of each group, for a settlement adjacent to a salmon stream might not be conveniently located for digging clams when the salmon run was over or for the herring fishery, or, in late spring and summer, for halibut fishing and sea-mammal hunting. Each tribe, and often each lineage within the tribe, had a series of sites used at different times during the year. Some ranked as important settlements, while others were little more than camps in use but a short season. Within the territory claimed by each tribe there would, therefore, normally be a considerable number of sites, large and small.

Of no little importance is the fact that the chief staple, salmon, could be obtained in great quantity, and was fairly easy to preserve. A surplus could be put up at the fall fishing that would last well through the winter, or to the time of the herring or olachon run. Not only did this almost inexhaustible food source support a dense population, and allow for leisure time in which the native arts could be developed to the peak for which Northwest Coast culture is justly famous, but it permitted the assembling of large groups in the winter villages ... for a season of festivity and ceremonial. It was here that carved ornaments and masks and the like were made and used, and here that the great potlatch houses stood.

The dwellings of both Tsimshian and Northern Kwakiutl conformed to the general areal pattern: they were large rectangular structures of split planks. Specifically, they were of the northern type, nearly square in plan with the side planking morticed into slotted plates between the corner posts, and gabled roofs. Southern Kwakiutl houses are known to have changed in type during the late historic period. The old type was long and narrow, the roof, gabled or occasionally of "shed" type, supported by massive posts and beams against which the planking was laid up. These southern houses were usually stripped of their planking when time came to move to fishing stations, the planks being taken along to be used there. All the groups constructed houses at important fishing places similar in plan to those at the winter village, although sometimes smaller and usually less carefully built. Among minor patterns, we may note frequent use of pile dwellings, use of cribwork foundations to compensate for inequalities in ground level, and sporadic occurrence of central pits (often "stepped", having four levels) throughout our region.

Like all Northwest Coast groups, Tsimshian and Kwakiutl emphasized woodworking in their manufactures. The presence of a variety of trees — straight splitting, easily worked red cedar, the finer-grained yellow cypress and alder, and the tough elastic yew — made possible the use of wood for a great number of purposes, and permitted the development of a trend toward woodworking unique in western North America. Not only were there dwellings of wood, but the all-essential canoes that made possible efficient exploitation of the country were cedar dugouts, and food vessels and spoons, storage containers, quivers, and a great deal of the ceremonial paraphernalia — rattles, drums, masks, and headdresses — were made of wood... Stone mauls, handheld among Southern Kwakiutl, both handheld and hafted among their northern kin and the Tsimshian, served to drive wooden or whalebone wedges; stone-bladed splitting and planing adzes (the former a Tsimshian tool), and hafted stone chisels were for cutting and planing. Drills with bone points were used to make holes for lashings or dowels at joints. For fine carving, it is probable that knives of beaver teeth were used, although steel blades were adopted so early that no modern natives are sure of the ancient implement. Sandstone and shark or dogfish skin gave smooth finish. With these tools, and a few simple techniques, the natives were able to make neatly and often beautifully finished objects for whatever purpose they required.

A glance at a collection of tools and weapons from the region makes apparent the pattern of preference for bone, horn, and shell for cutting edges. Arrow, harpoon, and spear points were made most often of these materials. Women's knives were usually the sharpened shells of the large mussel *Mytilus californianus.* Most noteworthy is the dearth of chipped stone. The stone projectile points, and occasional stone knives, were of ground slate. Stone mauls, adzes, and celts were pecked to shape and polished. That the absence of chipped stone was a matter of cultural preference, not environmentally conditioned, is indicated by the fact that stone suitable for flaking occurs in the region, although perhaps not in vast quantities.

The trees that furnished material for so many articles of manufacture were the source of another product, textiles. Dress consisted of furs and woven robes and capes. In such a humid climate native leathers are of little service. Neither Tsimshian nor Kwakiutl equalled the Tlingit or Coast Salish in excellence of their woven goods (though traditionally the Tsimshian are supposed to have invented the Chilkat blanket), but they were able to make technologically rather simple robes of shredded cypress bark. The inner layers of the bark were stripped off, soaked, beaten with a heavy grooved mallet, loosely spun, then twined together on a suspended warp loom. Sometimes mountain-goat wool was woven, but less was used than by Coast Salish or the Chilkat Tlingit. The bark of the red cedar was utilized for making the ubiquitous checkerwork mats, used for a thousand purposes – to sleep and to sit on, to cover canoes, to gamble or cut fish on, to wear as a rain cape. Checkerwork baskets of red-cedar bark met nearly as many needs. The same bark was hackled with a whalebone "shredder' to make ceremonial insignia, bandages, cradle padding, and, in the days of muzzleloaders, gun wadding.

The Kwakiutl and Tsimshian were important centers of ceremonialism on the Northwest Coast. Their rituals were for the most part dramatic performances at which supernatural beings and deeds were represented realistically. Deities, spirits, and other beings were personified by masked dancers, who performed to an accompaniment of carved rattles, wooden drums, and wooden whistles. Elaborate and ingenious devices were made to reproduce supernatural events. Great wooden birds flew from one end of the house to the other, a supernatural mink might come up through the floor, run across the room, and disappear, a human dancer would be dragged down into the ground by a spirit from the underworld. Shamanism, too, had a wealth of regalia and tricks that depended on mechanical contrivances.

The social system of our region is of interest on several counts. First of all, the area was heavily populated. Estimates in terms of number of persons per square mile mean little in a region where just the shoreline was habitable, but even such figures indicate a large population. Kroeber (1934, p.12) has calculated the prehistoric density of the Northwest Coast from the Straits of Georgia north to be 26.3 per 100 square kilometers. At the winter villages, where numbers of clans or lineages assembled, large groups were the rule. Within the group, individuals occupied fixed statuses of graduated rank, the system of grading closely linked with heritage and wealth. Token wealth consisted of "coppers" and copper ornaments, *Dentalium* shells, furs, and slaves, all of which were articles of trade. The chief source of copper was far to the north (though there appear to have been several places in the interior from which placer copper was obtained); the dentalia came from the west coast of Vancouver Island. The wide occurrence of these particles throughout the area and in neighboring regions points to a network of trade routes – channels by which not only token wealth but other culture items could be transmitted.

Along with the system of graduated status in part based on ancestry was a marked interest in historical tradition. Genealogies were systematically remembered, to be recited on formal occasions. These family legends, which purport to cover the family's history from the time of its earliest ancestors, are far more than a recital of personal names and relationships – they tell also of war and conquest, and of movements of families from one place to another. The places referred to are actually long-abandoned village sites. So matter-of-fact and internally consistent are these relations, and above all, so consistent are those of one family line with the traditions of their neighbors, that no ethnographer who has worked in the area has denied their historic value. Coast Tsimshian traditions trace the spread of the several tribes coastward and north and south along the seaboard from an ancient site above the canon of the Skeena – Temlaxam. Heiltsukan folk-history brings these people from the landlocked heads of long inlets, Rivers Inlet, Dean and Burke Channels, through a series of movements down to the outer coasts and northward. . . .

Differences in social position were reflected in the treatment accorded the dead. Men of standing were accorded great honor; the bodies of the aged, and of slaves, were disposed of with a minimum of formality. The Northwest Coast as an area is one in which there was great diversity in mortuary customs. Among the Tsimshian, bodies of chiefs were sometimes put in caves in cedar boxes, but most people were cremated; while "the body of a slave was thrown out on the beach." Interment is reported by some informants, denied by others. Kwakiutl did not practice cremation. Among the northern groups, small gravehouses were built, and bodies of relatives were put in them from time to time. Among Southern Kwakiutl, a common mode was to put the cedar box containing the body in the branches of a tree. Cave (or better, rock shelter) burials were also common. All the groups destroyed quantities of property, at least at the death of a person of note. Much of it was burned, although in late historic times valuables were placed at or near the grave. Granite-ware dishes, Hudson's Bay blankets, and even sewing machines and gramophones, may be seen scattered about near recent graves. Mortuary potlatches, often involving the setting up of a memorial pole, may be construed as another form of the prevalent property destruction. More recently, erection of an expensive tombstone has been equated with the mortuary potlatch and memorial column. [Drucker, 1943]

RESEARCH GOALS

Within the limits of this archaeological and ethnographic background the initial research goals developed for the Bella Bella project were as follows:

1. Construct an archaeological regional sequence of cultural units.
2. Test the validity of the concept that site density and size are related to one of three zones of differing environmental potential identified within the Bella Bella region.
3. Test the relative importance of the "salmon run" and "fur trade" hypotheses of the origin of wealth in Northwest coast culture.
4. Examine the potential of using ecological factors as diagnostic characteristics suitable for the definition of archaeological phases.
5. Develop a set of methodological techniques specifically applicable to midden archaeology.

RESEARCH METHODOLOGY

The research methods we have employed have been developed to cope with the specific problems, both logistical and data recovery, that we have faced. The major problem areas have been: site location and initial sampling for descriptive purposes, site excavation techniques suitable for data recovery and interpretive purposes and ecological sampling.

Site Location and Description

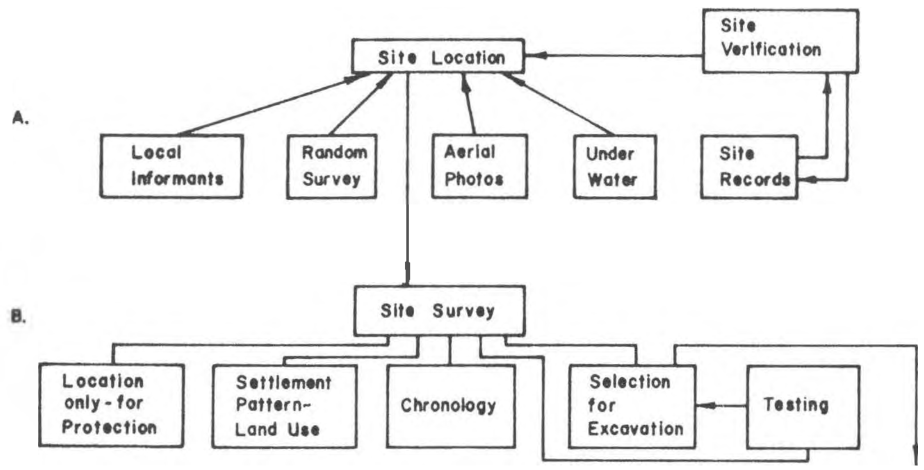
We have previously described our initial efforts at site location. Since Pomeroy has continued the survey after the termination of the rest of the project, a full survey report will be presented elsewhere.

Site Excavation

Typical sites on the Northwest Coast consist of masses of food debris and soil distributed in a linear band parallel to the marine beach on which they are situated. Termed "shell mounds" because of their high content of marine shell, the middens are a complex record of cultural activities and environmental events, and the obvious component of shell is only a portion of the meaningful data available for study if suitable techniques are employed. The typical site possessed a single row of houses strung out along the beach with the development of the midden resulting from disposal of debris on the front sides of the houses toward the water. This pattern results in a seaward building of the midden deposits with strata dipping toward the waterline and the oldest layers occurring at the rear or uphill portions of the site. House remains are difficult to locate from surface features, especially since the sites are covered with dense vegetal growth, ranging from second growth shrubbery to fully regenerated forest. The middens contain huge volumes of food debris and a limited quantity of artifacts, with cultural features rare and indefinite. In this situation, standard archaeological techniques based on the collection of a large sample of artifacts, and excavation following cultural features cannot be employed. One alternative, the excavation of large volumes of midden debris in order to obtain a large enough artifact sample to be statistically valid, requires the utilization of enormous quantities of labor (a resource which was not available to us). The approach adopted in our current project has emphasized the fact that the primary data preserved in the middens is ecological in nature and therefore techniques of collection and analysis of these data should be stressed.

The procedure of digging excavation units by level is essential. Use of either arbitrary levels or real stratigraphic levels is theoretically possible. In practice neither method is wholly satisfactory. The real levels are difficult to identify, except in retrospect, through examination of the pit walls. It is possible that even a stratum which appears to be homogenous may have within it a number of different components masked by one major element. For example, the shellfish remains in the Bella Bella sites excavated visually mask the other materials. Arbitrary levels are equally inadequate in that they may combine more than one real unit into a mixed composite sample. We have experimented with the use of both methods. Excavations conducted during 1968 and 1969 utilized arbitrary levels, while the 1970 excavations experimented with the definition of natural stratigraphic levels. The difficulty has been in defining which levels are meaningful for archaeological purposes. The levels are either broad units with a general similarity in content which represent considerable time, or thin laminae representing intervals of time so brief as to be considered episodic in nature. This problem is further compounded by the fact that these laminae change laterally in a fashion similar to facies change in geological deposits. These problems have impressed us as ones which cannot be resolved by standard archaeological techniques. For example the facies changes prohibit us from publishing our stratigraphic profiles as representative of the deposits throughout the site. Such a standard archaeological inference would be fallacious. We are aware that our diagrams of trench walls are no more than our interpretations of the visible strata at that point and therefore have limited site-wide significance. In addition, we found that different investigators would group the strata into somewhat different clusters. A final problem we encountered was the definition of meaningful natural levels during excavation. We have compared the levels used during the excavation of FS 10 with the profile drawn after it was excavated. The differences between these two interpretations serve to point out

SITE SURVEY



ATTENDANT PROBLEMS

a Site Size
b Site Depth
c Age and Culture Pattern
d Site Composition
e Non Diagnostic Artifact Types
f Environmental Relationships

METHODS

a Forest Clearing
b Coring
c Facing Up + Profiling
d Column Sampling
e. Resistivity Survey
f. Mapping From Air Photos-Especially Infra Red
g Shell Chronology

Fig. 2 Research problems in Northwest Coast archaeology.

the *arbitrary* nature of our attempt to excavate by natural levels. Detailed discussion of these approaches are presented in the sections by Luebbers and Conover.

In any event, excavation was conducted in 2 metre squares utilizing either arbitrary or natural levels. Therefore the provenience of individual specimens can be tied to these excavation units.

We also attempted to follow horizontally what seemed to have been walking surfaces or occupation floors. These efforts were for the most part unproductive.

Cultural features in general were rare. We did locate some fire hearths, both stone-lined and pit type, and also some clusters of small pebbles. We located one possible house floor with decayed wood planking. However, in general the major cultural features in the middens were burials.

The majority of the items recovered were particulate, well scattered throughout the midden debris, and included both artifacts and food remains. Therefore we focused much of our attention on the development of suitable sampling techniques. The development of these sampling techniques was, of course, relevant to the major problems we were researching. Inasmuch as we focused on only a few of the potential archaeological problems it is appropriate here to indicate how we integrate our research methodology into an overall methodology applicable to similar sites wherever they occur. This has been attempted in the following set of diagrams, Figures 2 through 6.

This view of the archaeological reconstruction of prehistoric cultures is based upon two basic premises.

1. The concordance of content and context data including all midden components, not just artifacts, provide a more stable basis for the reconstruction of past cultural patterns.

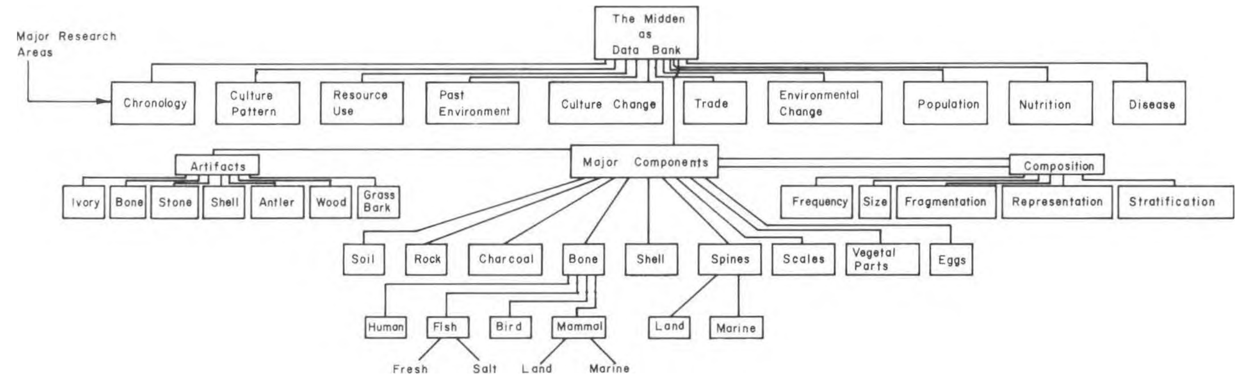


Fig. 3 Site excavations.

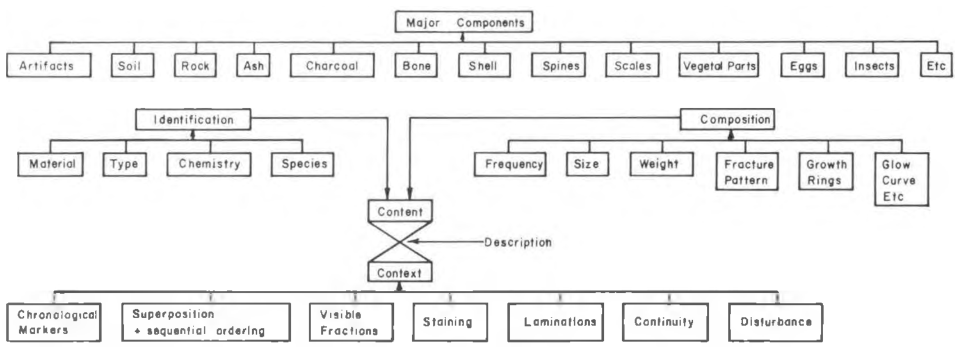


Fig. 4 Methodology - The intersection or concordance of these lines of evidence provides the basic referents for the identification of prehistoric cultural patterns, *i.e.* trade, technology, etc. Description is based on the combination of content and context data. Content data are the specific components as identified in the laboratory. Context refers to the conditions of their occurrence in the site.

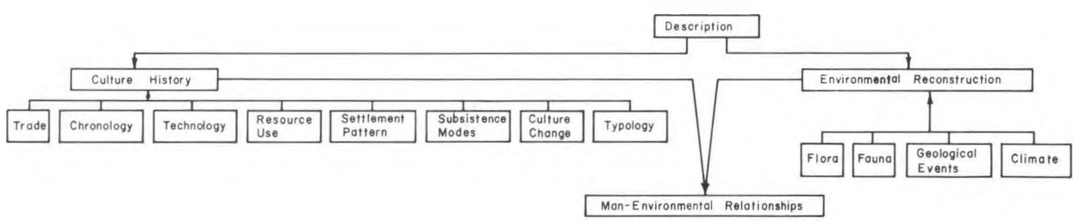


Fig. 5 Cultural-historical integration.

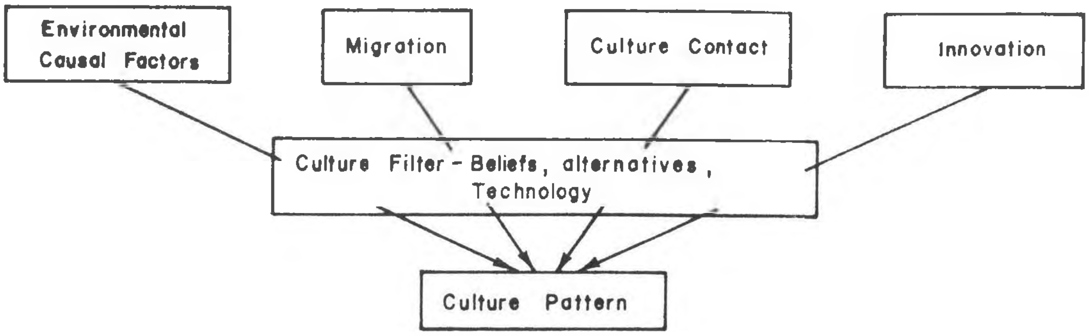


Fig. 6 Causal factors filtered by beliefs, technology, etc. lead to the establishment of the cultural pattern.

2. Archaeological research through survey and excavation provides a wealth of problems suitable for investigation. This concept leads to the development of specific methodologies to recover data related to specific problems. It further negates the concept of "the archaeology' of a site. There are many archaeologies or archaeological reconstructions and they are in large part the result of the interests and research design of the investigator. In this volume the major emphases of Luebbers are site stratigraphy, identification of stratum boundaries, burial patterns, artifact types and artifact wear patterns. Conover's approach focuses on the acquisition of matrix sample content data in the laboratory and the correlation of these data with the context in which these samples were found in the site. Both authors describe the methodologies they employed in some detail and I will not paraphrase their views here.

The present volume includes several major aspects of the regional prehistory, the description of excavations, research methodology, artifactual and burial analyses, matrix context analysis, and preliminary regional chronology. A multitude of problems are revealed by the collection of these data. Our publication of these papers is viewed as a necessary expedient. Most of the included works pertain to the actual data recovered rather than to the resolution of research problems. This approach meets the needs of our colleagues to have access to the material for comparative studies while it is yet reasonably new. In addition, much relevant Northwest Coast archaeology has yet to be published even in preliminary form. We will have at least made this effort to report our basic findings.

Excavations: Stratigraphy And Artifacts

ROGER LUEBBERS

INTRODUCTION

Initial survey data suggested that human habitation occurred in three different but mutually inter-related zones along an east-west transect; the "fiord headwater", "protected coastal waterway", and "exposed island coastline" areas of occupation (Hester 1968). The central zone, the protected coastal waterways, had the greatest site density and was geographically the largest of the three zones. Those zones to the east and west, it was suggested, owed their low site density and small site sizes to the naturally harsh climatic conditions or rough terrain, and were occupied probably on a seasonal basis. More specifically, the survey evidence suggested that extensive archaeological excavation results could be used ' to examine the potential of ecological factors being used as diagnostic characteristics for the definition of archaeological phases" (Hester 1968:1).

Selection of Namu (Fig. 7) as the initial place to apply this approach was arbitrary although testing during the 1968 site survey had revealed deep cultural deposits. Two additional sites, ElSx 3 at Kisameet Bay and FbSx 6 near Roscoe Inlet, were subsequently excavated in order to obtain comparative data, particularly cross-section and midden matrix samples. No other site in the region, however, was handled so intensively as was Namu, and, in retrospect, Namu is distinctive in having the deepest continuum of dated cultural deposits of any site on the Coast.

SITE SITUATIONS

The Namu midden, and two additional sites selected and sampled on the basis of their differing physiographic settings, (Figs. 7, 8) will be described here. These two sites include Kisameet Bay, ElSx 3, sampled during each of our three field seasons, and the site in Roscoe Inlet, FbSx 6, which we sampled in 1970. The latter was also tested by Drucker in 1938 at which time it was referred to as Roscoe Inlet 1A (Drucker 1943). Information from these last two sites provides the background necessary for our comparative discussions.

Namu: ElSx 1

The town of Namu, at site ElSx 1 in Figure 7 (north lat. 51°51'32", west long. 27°51'50"), is located on the mainland shore of Fitzhugh Sound approximately two miles south of King Island. The first white habitation recorded for the village began in 1893 when the Robert Draney family established a fish cannery (Lyons 1969). In 1909 a sawmill was built in order to provide lumber for salmon cases and building projects. Throughout the following years, the facilities grew and underwent frequent ownership changes until 1928 when the present owners, British Columbia Packers Ltd., took over the operations. An extensive fire in January 1962 destroyed a large portion of the plant facilities, and the company was forced to rebuild and retool the major portion of the complex. Introduction of more modern machinery and processing techniques after the fire enabled the cannery to increase production output while dropping employment levels. At present, the physical structures include, besides the processing facilities, large two-storey bunkhouses, family cottages for employees, an oil dock, an electric power plant, a fresh water supply, recreation and mess halls, and a system of boardwalks permitting access to each of these. The labour force serving

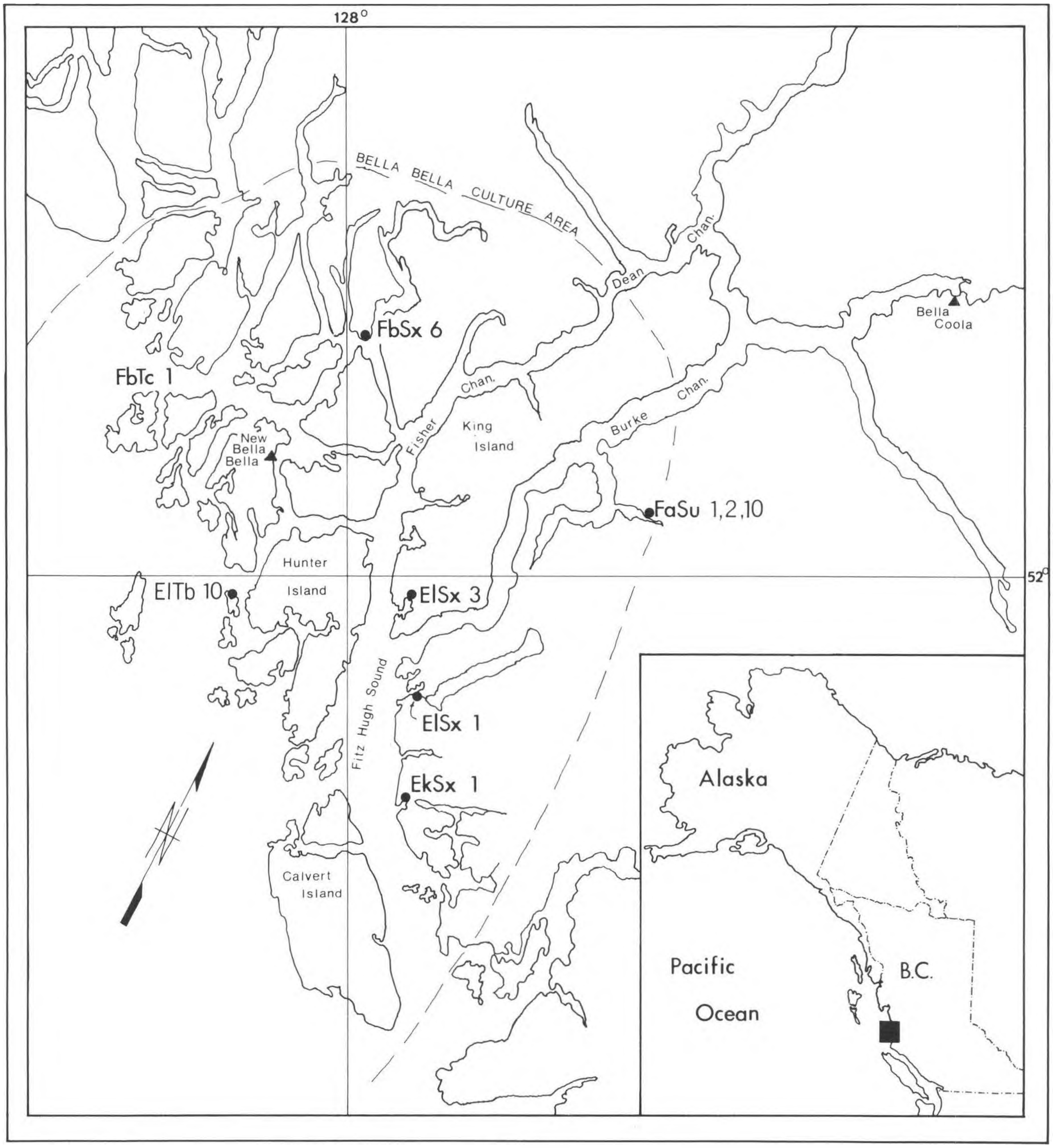


Fig. 7 Location of excavated sites ElSx 1, ElSx 3, and FbSx 6, within the Bella Bella Culture Area. Triangle indicates the village of New Bella Bella. Map information taken from Canadian Hydrographic service Chart 3744.

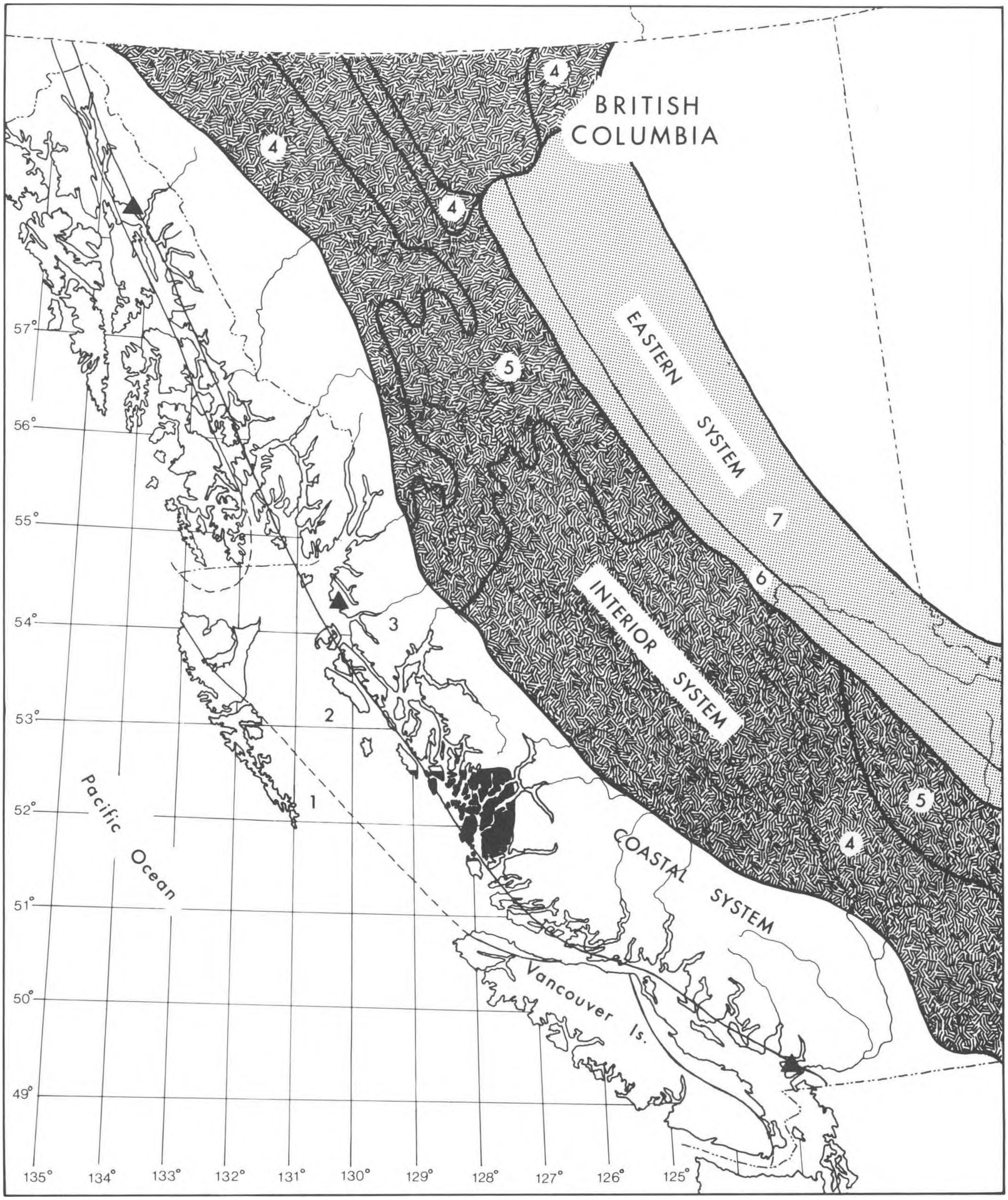


Fig. 8 Physiographic systems of British Columbia. Blackened area represents research region. North to south, triangles represent cities of Juneau, Prince Rupert, and Vancouver.

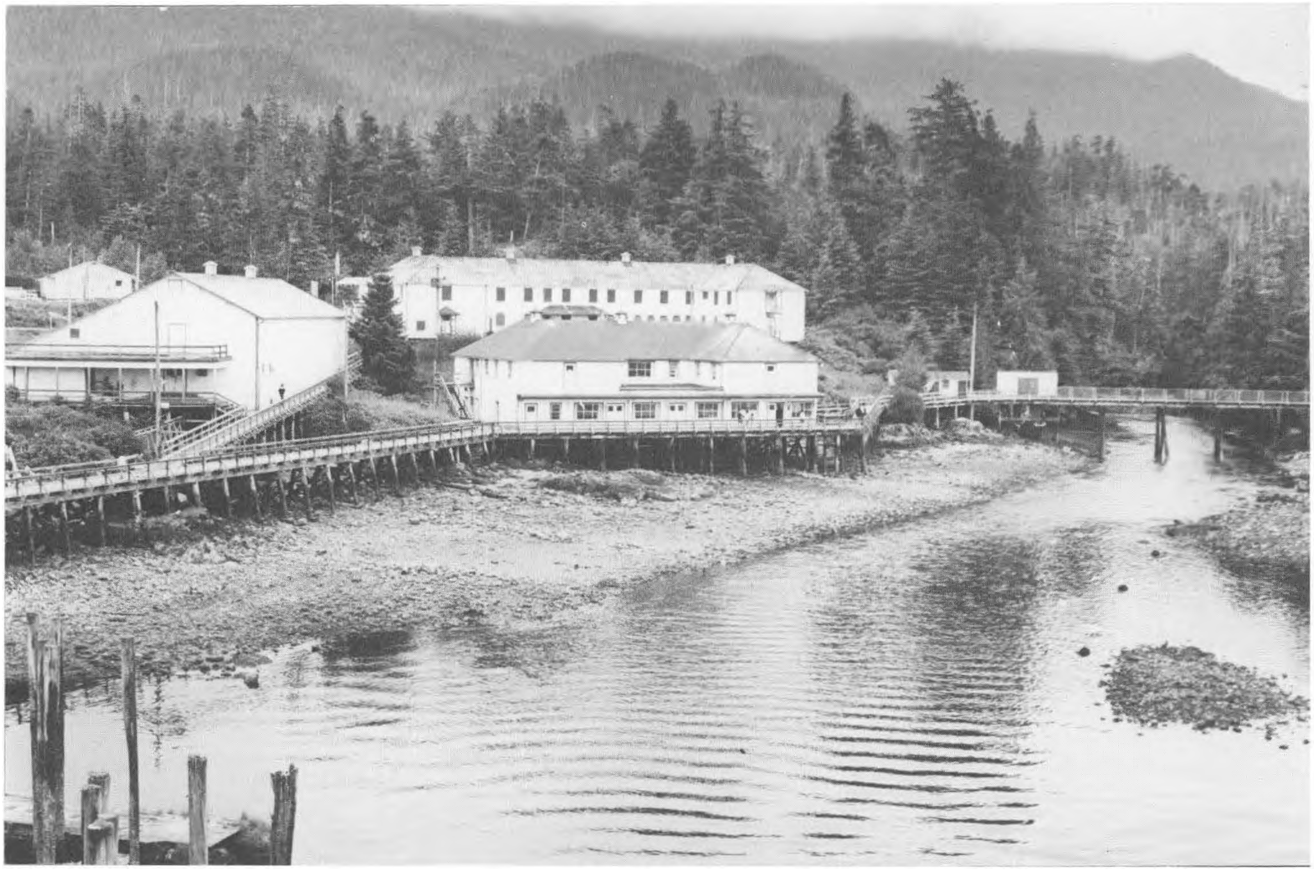


Fig. 9 View of ElSx 1 (1968) from Namu Harbor, facing east during approximate mean low tide. The Namu mess hall/cafeteria is in the foreground and the two-storey bunkhouse rests atop the midden in the background. The Namu River flows on the right and the cannery facilities are immediately off the picture to the left.

the facility is composed primarily of Bella Bella Indians who either work in the cannery or bring in fish during the summer fishing season. These people leave the town after the season and return home to New Bella Bella. Personal accounts from several Bella Bella Indians indicated that an Indian village existed on the site as recently as thirty to fifty years ago, inhabited only in the summer months. Certain older individuals were able to point out the former location of their homes, now covered by recent cannery structures.

The shell midden deposits (Figs. 9 and 10) lie beneath a large abandoned bunkhouse (built in 1946) situated immediately north of the mouth of Namu River. We have not been able to establish the original limits of the midden. Modern construction is the primary contributing factor to this situation. The cannery rests upon stone debris dynamited from the adjacent shore and cliffline, while nearby buildings, recreation fields and so on have replaced or disturbed unknown amounts of the midden deposits. Midden debris occurs on the high cliffs overlooking the river and can be traced from the excavated area up to termination by modern construction just north of the locale illustrated in Figure 10. The inland boundaries terminate abruptly at the face of a 7–8 metre bedrock exposure behind the abandoned bunkhouse. The excavations also terminated at this boundary. The extent to which these deposits continue northward along the shoreline could not be determined, due to recent alteration of the area. Employing traditional midden morphologic terms, that part of the midden at the shoreline is considered its front with its long axis parallel to the shoreline. Missing the midden's length dimension, we have been unable to calculate its volume.

Alteration of the existing midden material has occurred in a variety of ways. Construction for the foundation and furnace room of the abandoned bunkhouse disturbed deep portions of the site, while levelling fill was taken from one

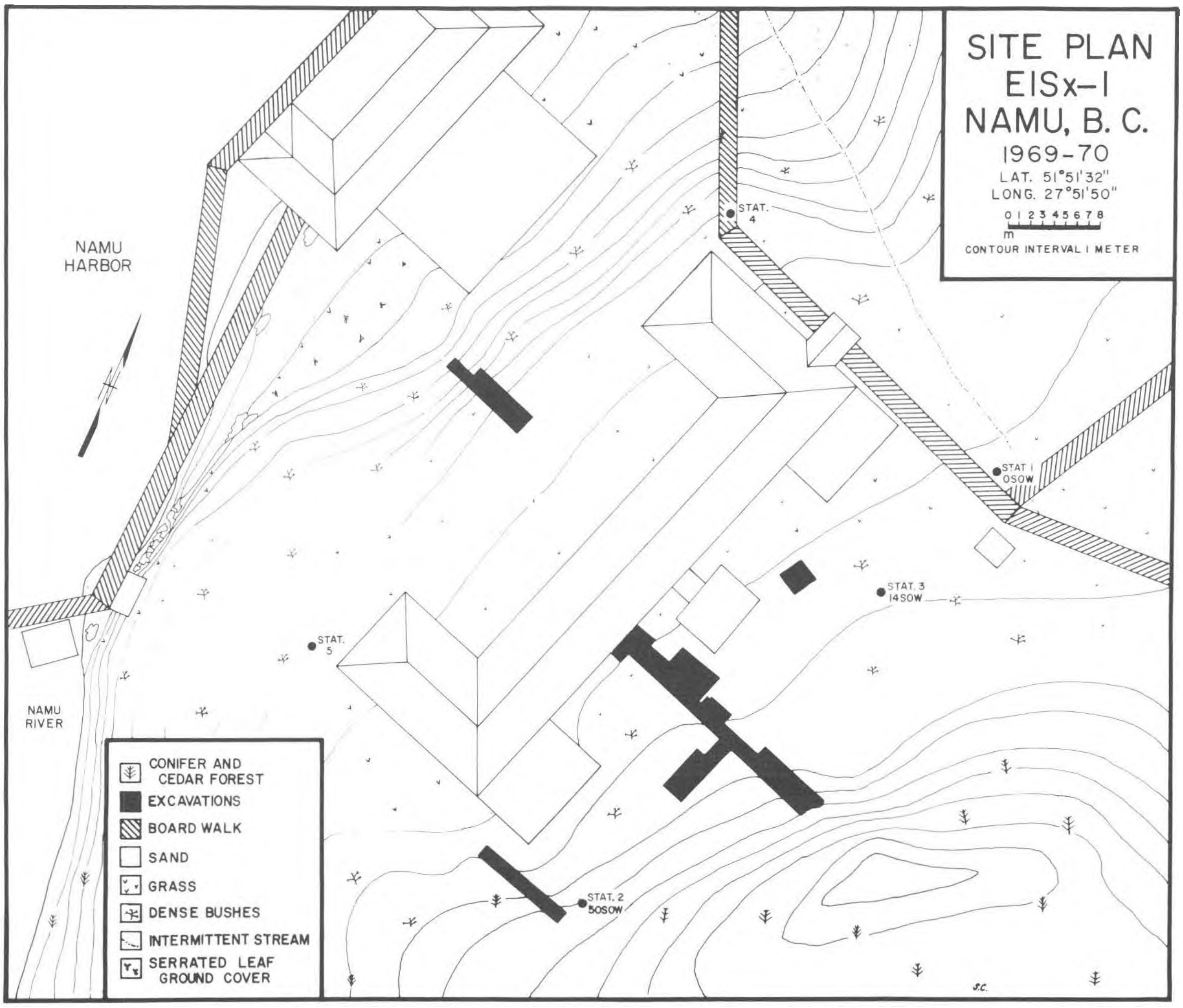


Fig. 10 Site plan of Namu, ElSx 1.

area of the site and re-deposited on another.

Construction of a mess hall at the midden's present shoreline removed unknown quantities of the site. The steep, deep front slope has been eroded by tidal activity resulting in an undeterminable loss; maximum high tide, which invades the Namu River mouth, currently inundates 2.5 metres of this front slope. Finally, modern garbage and refuse deposits, presumably from the bunkhouse occupation, and a possibly earlier shallow house depression in the rear portions of the site, attest to the nature of recent surface disturbances.

Encroaching upon the site proper from the rear is a forest of large old trees, which because of recent logging are outnumbered by trees one-fourth their age. Floral cover in this area is typical of the region as a whole. Around the midden boundaries hemlock varieties *Tsuga heterophylla* and *T. mertensia*, *Thuja plicata* (red cedar), *Picea sitchensis* (Sitka spruce) and *Alnus ruba* (red alder) exhibit mature growth. On the site itself, immature growths of alder and hemlock were cut down prior to excavation. For the most part, *Sambucus cerulea* (elderberry), *Rubus spectabilis* (salmonberry), *Rubus parviflorus* (thimbleberry), and *Gaultheria shallon* (salal) constituted the primary elements of the undergrowth removed to facilitate access. Grasses,

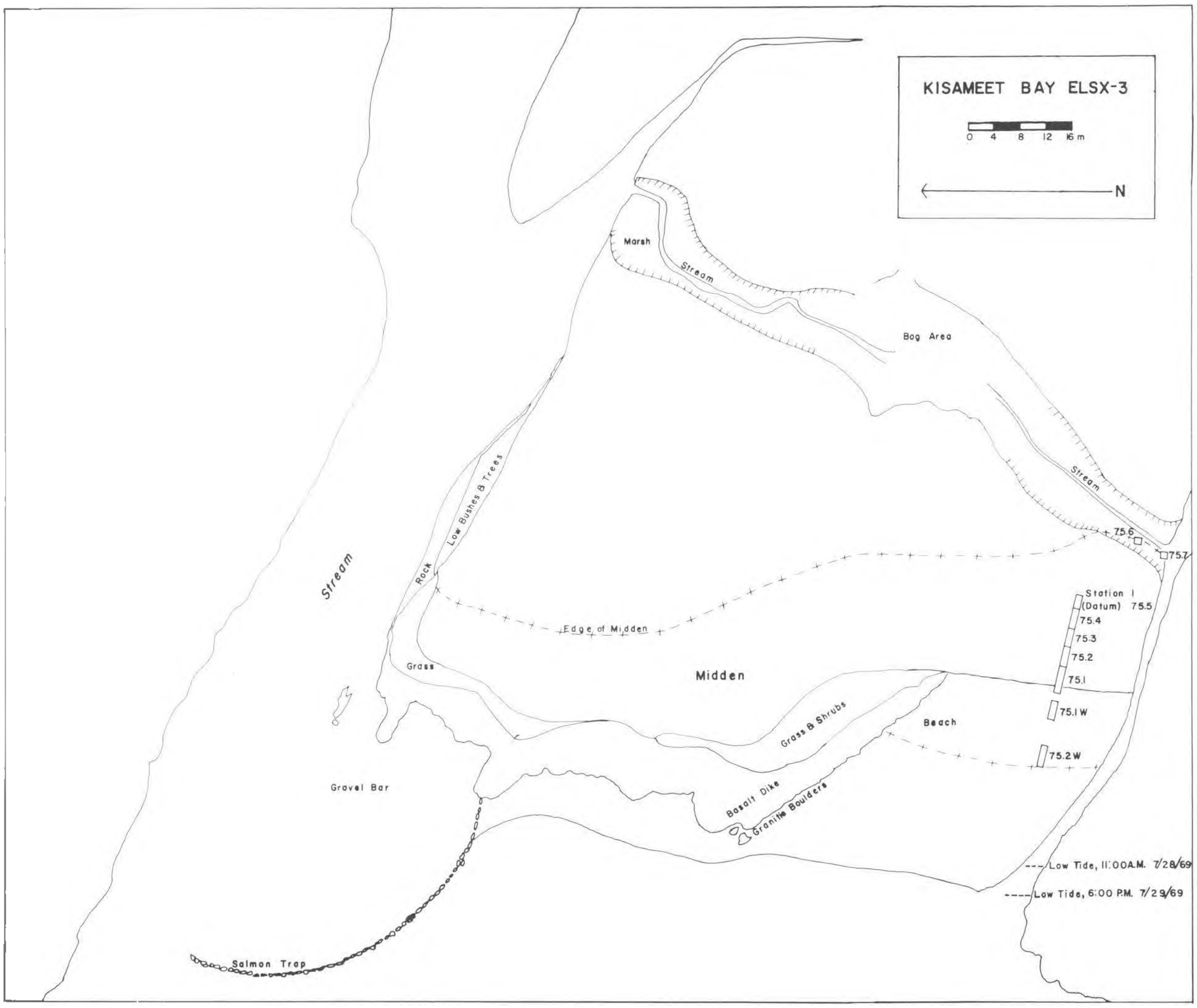


Fig. 11 Schematic plan of shell midden site, ElSx 3 at Kisameet Bay.

ferns, and mosses, while not identified, were present in number outside the midden limits.

The bedrock outcrop is an important morphologic feature of the site. It also can be found at the same elevation to the north just off the site plan and to the southeast overlooking Namu River. Behind its exposure in the rear of the site, the forest emerges from a marshy floor, the water from which drains intermittently to the north and also through the shell deposits themselves. The marshy environment lies 2 to 3 metres above the top horizon in the rear of the site.

Immediately north of Namu, the deep fiord waters of Burke and Fisher Channels join and enter Fitzhugh Sound. Burke Channel, with an average depth of over 400 metres, carries waters from a major river, the Bella Coola. Fisher Channel, which is merely a seaward extension of Dean Channel, is fed by a number of fiord head streams and is as deep and long as Burke (Pickard 1956:49). The banks of both fiords and Fitzhugh Sound are steeply sloping with abruptly vertical stone cliffs occasionally interrupting the dense forest cover which otherwise grows down to the water's edge. Mountains rise directly above the fiord walls, becoming higher and more rugged to the east along Burke Channel and north along Fisher Channel. In more protected coves and bays where small freshwater streams empty into the channels, small narrow areas of the shoreline exhibit shallow sand and gravel beach deposits. More commonly, the tidal zone is readily apparent as a multi coloured band on nearly vertical rock exposures.

The mountain relief around Namu bordering Fitzhugh Sound is low and rounded, typical of the seaward regions of the fiord system. This low altitude range behind Namu includes 3000-4000 foot peaks at its greatest extent, all heavily forested. Drainage within these mountains proceeds from the north into a series of lakes, terminating in the largest, Lake Namu, before emptying into Namu Harbour. The lake is about 9-10 miles in length and lies approximately 25-50 feet above mean tide. Flow from the lake via Namu River fluctuates on a seasonal basis, with the river bed reported to be virtually dry on very rare occasions. The river bed is about 1/4 mile long, narrow and full of large boulder rapids. Sand deposits occur within the harbour and to a greater extent on the shores of a tiny island which connects with the Namu shoreline during maximum low tide. Shellfish are currently gathered from this beach.

Kisameet Bay: ElSx 3

The shell midden at Kisameet Bay (Fig. 11) is located on one of the innermost coves of King Island, an area designated as an Indian reserve in the late 1800's. Logging during the earlier parts of this century has left some trees topped while surface depressions and clearings demonstrate recent habitation. Unlike the Namu midden, this midden rises above a gently sloping beach of sand and shell to a height 2-1/2 metres above mean high tide. Two streams of water flow through the site; a major stream drains from Kisameet Lake and empties immediately to the north of the site while an intermittent stream carries a little water along its south margin. The bay area in front of the site offers greater protection against severe climate and tides than does Namu Harbour.

The floor within the Bay near the site contains coarse, angular stones which host a fair-sized mussel population. Closer to the river and on a few of the small islands in the cove, limited sand deposits line the shore. Basement sediment below the cultural deposits, while similar in size and shape to the basement level at Namu, contained only limited amounts of sand, was loose and not compacted, and gave no appearance of lateral size sorting.

The primary objective in excavating this midden was to collect environmental information without resorting to full scale excavation. Hence in 1968 exploratory samples were taken from a preliminary cut; in 1969 additional stratigraphic and artifactual samples were removed from an 8 metre trench, and the midden's boundaries were established, and in 1970 when the initial trench was again extended, a more intensive inquiry into the stratigraphy was initiated in order to provide comparability with the Namu investigation.

Roscoe Inlet: FbSx 6

Located on the mainland shore where Return Channel joins Johnson Channel, this shell midden (Fig. 12) was first excavated by Drucker (1943). He labelled it "Roscoe Inlet 1A" to separate it from an adjacent extension of the same deposit. Our interest with this site, as with Kisameet, was to investigate different habitation sites according to the tripartite zonation model discussed in the introduction. In order to achieve as close a correspondence with Drucker's observations as possible, the 15-foot long 1970 trench was located parallel to and 7 feet from the 1938 trench. Only half this trench was excavated to the sterile substratum, but correspondence between the nearly 10-foot deep deposits explored previously was achieved.

The site shares physiographic similarities with the Namu midden. Both rise approximately 25-35 feet above mean tide at their bases; both are enclosed by rock outcrops, and freshwater flows near each. Unlike other sites, lake water drainage is not present at the Roscoe Inlet site; rather, local

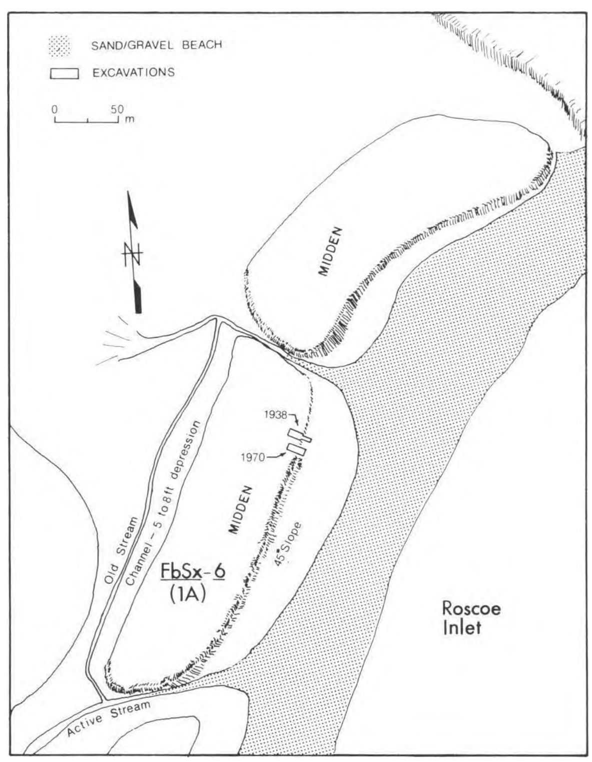


Fig. 12 Schematic plan of shell midden FbSx 6, at Roscoe Inlet. After Drucker (1943) and Pearson (1970).

precipitation and melt water from winter ice provide the stream sources. No fine sediments were found in the neighbouring cove. Coarser materials lined the cove's floor, in contrast to Namu and Kisameet. After repeated efforts, the field crew determined that fish and shellfish could not be easily found. Therefore the current marine environment surrounding this prehistoric deposit is markedly different from those surrounding the other two sites.

Our next step was to compare each of these sites in terms of the results of our analysis, and in relationship to the chronology developed for each.

EXCAVATIONS

Organization

The 1969 Namu excavations developed stratigraphic profiles of the midden parallel and perpendicular to the present shoreline in order to detect intrasite accumulation patterns along these two major intersecting axes. A grid system with a north-south major axis (Fig. 13) forming a perfect rectangle with its sides approximately parallel to those of the abandoned bunkhouse was established with a Brunton transit. Station 1, designated "0 metres south and 0 metres west" is the primary point of reference. The straight line between stations 1 and 2 was utilized as the primary excavation north-south axis. Station 3, located along this axis, is the primary datum plane in the profile labelled "Rear Trench (West Portion)". The line of sight above Station 3 in the "Rear Trench (East Portion)" profile drawing is a secondary datum plane, the station for which is not illustrated because its location is in Station 3's reference terms. No precise elevation or bench mark was referred to for our excavations, however.

Placement of the primary north-south excavation axis involved a simple arbitrary choice. The east-west trench on the other hand, coincided with an existing vertical exposure. This bank, created by bunkhouse construction, forms the south face of the trench designated FS 4. Due to vertical displacement of the stratigraphic units in this portion of the midden, no stratigraphic controls could be exercised in 1969, when the area was first exposed. During the 1970 operations, sampling operations and measurements of this area were accompanied by accurate transit readings. For this reason, the site plan (Fig. 13) is a schematic representation of the total terrain. However, physical orientation and horizontal relationships between the excavated units are true and accurate. The location and elevation of each of these units and all depth measurements (except those occurring in the westernmost portions of the "Rear Trench") were determined by the transit.

Excavations at Kisameet were carried out along an axis reaching from shoreline to midden centre (Fig. 11). Two stations were set up to create a datum plane for the excavation. No grid system similar to that at Namu was established, however. Along the major excavation axis at the rear of the midden, two small exposures were made to locate the site's inland perimeters (pits FS 6 and FS 7). Deposits ranged in depth from 2.5 metres at midden centre to .50 metre in the exposure made in the present tidal zone.

The recording of excavated material utilized a hierarchical system indicating relative placement of any given item within the site. From the site plan locating each excavated unit at Namu (Fig. 13), it then becomes possible to place the item stratigraphically in the midden sequence. A complete designation for a specimen collected, for example, reads as follows:

("Field Sample")	FS 2.13C.3
("Field Sample Column")	FSC 2.13C.3

The terms may be interpreted in the following manner:

1. The heading FS refers to specimens collected during routine excavation whereas FSC pertains to a specific column from which controlled sampling took place. The distinction serves to identify sample sources during storage.

2. The first number or decimal place following the letters FS or FSC refers to the excavation unit – pit or trench number. These were numbered chronologically as they were dug and appear in Fig. 13.

3. The second decimal place can contain two types of information. The number itself indicates the level (in the case of artificial levels) or the stratum (in the case of natural strata), and each of these sequences begins with the top of the midden. The letter refers to a specific feature encountered at that level or stratum, such as a burial, a hearth, etc.

4. The third decimal place refers to the specific item, whether an artifact, a charcoal sample, or human remains. Feature designation receives its own sequence of numbers in the third decimal place.

Hence, the designation FS 2.13C.3 might refer to an artifact recovered with the burial, feature C., somewhere within the thirteenth level below surface in pit FS 2. Should "FSC" replace "FS" in the same designation,

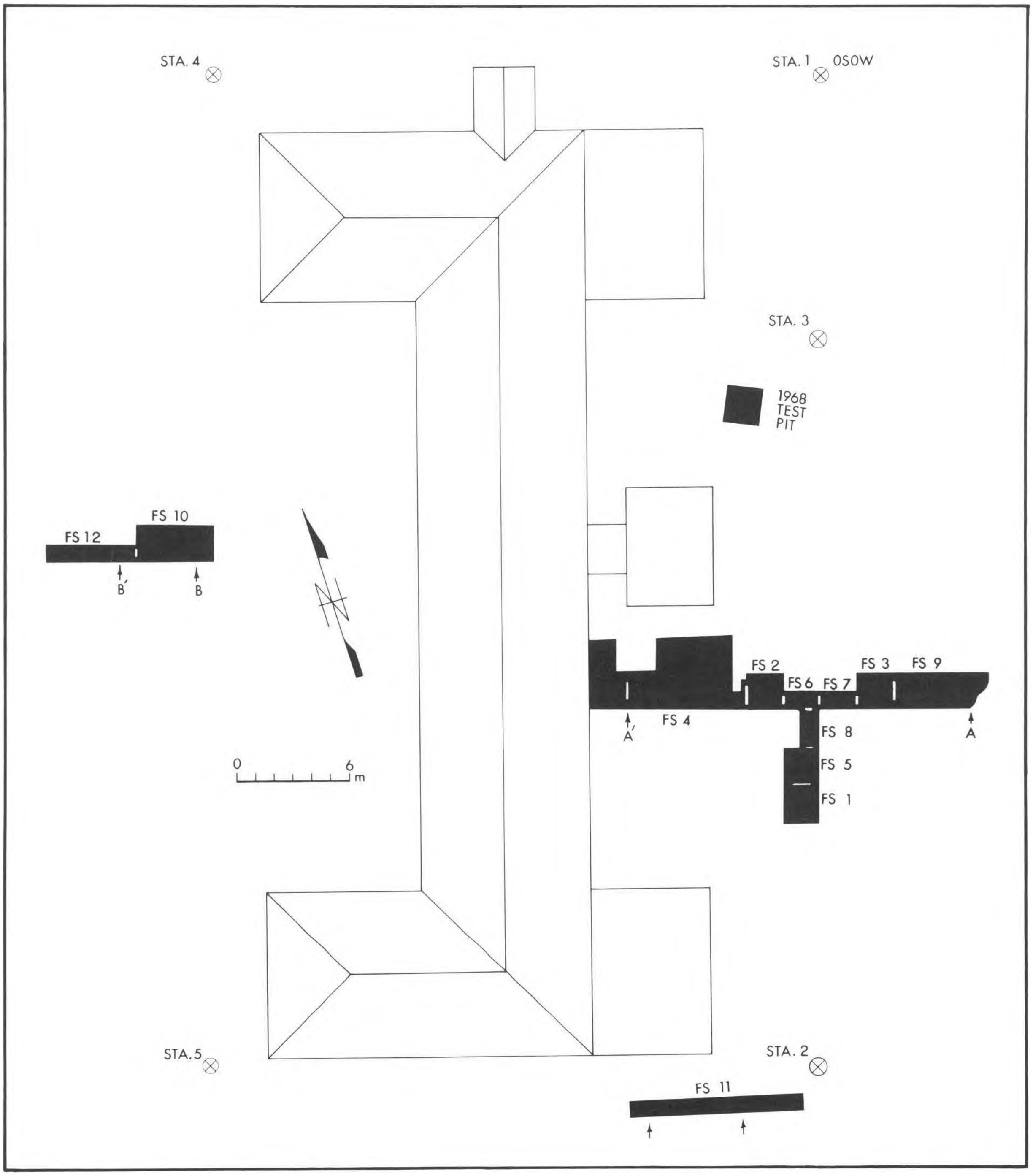


Fig. 13 Designation and relationship of excavated units at Namu. The largest U-shaped outline is the abandoned bunkhouse on top of the midden. ElSx 1

specific reference would be made to a unique vertical area (Column) within pit FS 2.

Numbering of each pit was established in the order each was excavated. Table I should be read along with Figure 14 to clarify this ordering and explain the approach employed in each case.

Table I: Excavation controls by unit at Namu.

Excavation Unit.	Type of Excavation Control:	Year Excavated:
Test Pit	artificial levels	1968
FS 1-8	artificial levels	1969
FS 9-10	natural strata	1970
FS 11	no control by level	1970
FS 12	natural strata (entrance trench to FS 10)	1970
FS 4	no control by level (transit readings only)	1969-1970

The excavation units fall into size groups based on field operational decisions. The basic size, set by the ability of one excavator to handle it, was the 2 x 2 metre pit. The 1968 Test Pit and units FS 1-3 were the sources from which controlled samples were taken during the first two field seasons. In order to avoid local biases in the evidence, these last three units were spaced as far away from each other along the two intersecting axes as our strategy would allow. When limitations posed by time became apparent, the connecting excavation units were reduced to 2 x 1 metre trenches to assure that stratigraphic continuities could be observed. No stratigraphic control was exercised during excavation of trench FS 11 because we wanted merely to examine stratigraphic profiles in that portion of the site and did not have the manpower to maintain excavation levels.

We employed similar excavation strategies in 1970. However our emphasis on natural strata definition subordinated concern for basic pit dimensions in the interest of isolating each individual stratum as it was being removed. For this reason units FS 9-10 were 2 x 4 metre trenches. Because an entrance trench was required for FS 10, FS 12 became 3 x 1 metres. Table II summarizes the pit dimensions and provides a volumetric record of our excavations from 1968 to 1970 at Namu.

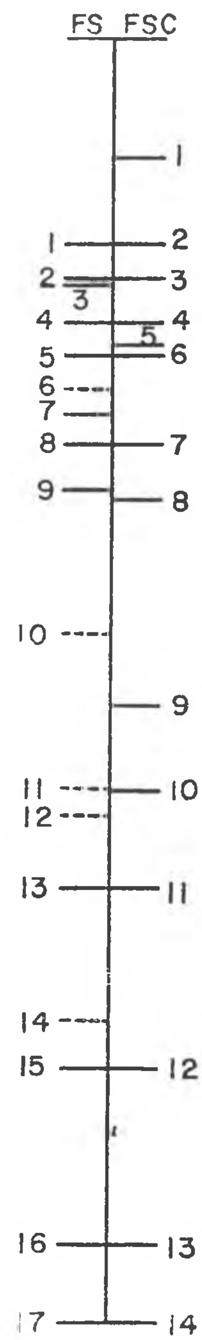


Fig. 14 Correspondence between excavation units and natural stratum units. Dotted lines represent arbitrary boundaries, while solid lines represent natural strata boundaries. EISx 1

Table II Volumetric and removal descriptions by excavation unit

SITE	EXCAVATION UNIT	YEAR	DIMENSIONS L W D		VOLUME	MEANS OF REMOVAL
EISx 1	1968 Test Pit	1968	2 x 2 x 2.1m	=	8.4 m^3	artificial levels
	FS 1	1969	2 x 2 x 2.1m	=	8.4 m^3	artificial levels
	FS 2	1969	2 x 2 x 2.1m	=	8.4 m^3	artificial levels
	FS 3	1969	2 x 2 x 2.3m	=	9.2 m^3	artificial levels
	FS 4	1969/1970	6 x 2 x 2.3m	=	24.0 m^3	bulk/natural strata
	FS 5	1969	2 x 2 x 2.1m	=	8.4 m^3	artificial levels
	FS 6	1969	2 x 2 x 2.0m	=	4.0 m^3	artificial levels
	FS 7	1969	2 x 1 x 2.1m	=	4.2 m^3	artificial levels
	FS 8	1969	2 x 1 x 2.0m	=	4.0 m^3	artificial levels
	FS 9	1970	4 x 2 x 2.4m	=	19.2 m^3	natural strata
	FS 10	1970	4 x 2 x 6.2m	=	49.6 m^3	natural strata
	FS 11	1970	9 x 1 x 2.0m	=	18.0 m^3	bulk
	FS 12	1970	3 x 1 x 2.5m	=	7.5 m^3	natural strata
	TOTAL VOLUME REMOVED				173.3 m^3	
EISx 3	FS 1	1968	4.05 x 1.0 x 2.3m	=	9.3 m^3	artificial levels
	FS 1W	1969	3.00 x 1.0 x 1.0m	=	3.0 m^3	bulk
	FS 2	1969	3.00 x 1.0 x 2.5m	=	7.5 m^3	artificial levels
	FS 2W	1969	3.28 x 1.0 x .5m	=	1.6 m^3	bulk
	FS 4	1970	4.60 x 1.5 x 2.5m	=	17.3 m^3	natural strata
	FS 6	1969	1.00 x 1.0 x 1.0m	=	1.0 m^3	bulk
	FS 7	1969	1.00 x 1.0 x .6m	=	.6 m^3	bulk
	TOTAL VOLUME REMOVED				40.3 m^3	
FbSx 6	FS 1	1970	4.6 x 1.5 x 3.7m	=	25.5 m^3	natural strata
EkSx 1	FS 1	1969	.5 x 1.0 x 4.0m	=	2.0 m^3	artificial levels
FbTc 1	FS 1	1969	.5 x 1.0 x 2.8m	=	1.4 m^3	artificial levels

Techniques

The exploratory nature of our research design led initially to excavation by artificial levels. Subsequent exposure provided indisputable evidence of stratigraphic superpositioning. Our decision in 1970 was to implement an excavation strategy emphasizing these stratigraphic units. The techniques designed to acquire these data are discussed below.

The provenience data recovered from each excavated unit depended upon the technique of excavation. Artifacts and specific samples removed from artificial levels were measured and mapped according to the three spatial axes needed to locate them. Recognition of the natural stratigraphy was not systematic during excavation, nor did we record stratigraphic boundaries until completion of excavation. The natural stratum excavation technique, in contrast, required the excavator to determine stratigraphic boundaries during excavation. When material was uncovered *in situ* it was mapped and recorded. With these data at hand, the excavator maintained a single "in-progress" profile drawing onto which were recorded stratigraphic boundaries and radiocarbon sample locations as they were determined. These drawings became the basis for all our stratigraphic control.

Radiocarbon samples collected in either manner utilized full descriptive and stratigraphic control. Of particular emphasis was the condition in which they were found – randomly scattered pieces, several small associated fragments, or a single chunk. Each sample was wrapped in aluminum foil and then placed in a plastic bag. The only samples selected for assay were single portions of charcoal at least three times the laboratory's minimal size requirements, with one exception.

The primary difficulty encountered in our excavation procedure was the delineation of natural stratum boundaries. In order to maintain comparability and standardization in the criteria employed to identify natural strata, the writer identified all stratigraphic boundaries used during the excavations at Namu and Kisameet. Contamination of levels was rigorously avoided and level boundaries were maintained except in one case where severe weather and limited time diminished our control.

Taking advantage of the 1969 profile drawings, the 1970 excavation of FS 9 by natural strata became a simple operation. The very deep trench FS 10 was not excavated as simply however, despite its fairly clear stratigraphy. Some disparity does exist between the natural level boundaries and those established by excavation. Hence, some boundaries separating excavated units were arbitrarily established. In order to clarify stratum identity, a Field Sample Column was located on the profile wall (see profile drawing "Front Trench") and the area sampled according to natural stratum boundaries. Figure 14 illustrates the correspondence between the excavated units and those sampled in the column. While not perfect, the correlation appears to be quite high. Therefore the samples need not be discarded. In conclusion we believe the excavator achieved close to a 100% correspondence between the natural strata identified during excavation and those observed on the completely exposed face.

Location of artifacts *in situ* was uncommon due to the masking qualities of the soil matrix. For this reason, excavation midden material was screened in the field. The adhesive quality of the matrix, however, precluded "dry" screening. We used water under pressure directed through two screens; an expanded-steel sheet and a 2 mm wire screen. A wheelbarrow was pushed up the ramp and its contents unloaded onto the nested screens. After all the finer material was washed through the larger meshed screen and its contents examined, the hinged screen frame was folded over and emptied. The finer material caught on the bottom screen was again washed then examined for pertinent material. With a screen crew of four, considerable material was processed quickly retaining at the same time large portions of the finer sized material.

Midden removal from the deep (ca. 6 metres total) levels of FS 10 was solved through reliance on the rich junk piles of Namu. A series of troughs was built out of lumber, old tin, and plastic. This flume extended downslope from the lip of FS 10. A heavy set of screens and an overlooking platform (for the water hose operator) was constructed at the base of the flume at shoreline. Water was introduced at the top, transporting shovel-loads of midden down to the nested screens. Because the metal troughs were open at the top, the hopper at the trench opening could be moved up or down the slope to meet changing excavation needs.

Despite the strong water pressure, very little crucial material was lost or damaged in screening. The one exception was the fragmentation of delicate mussel shell implements and ornaments, which rarely were recovered intact even if found *in situ*.

STRATIGRAPHIC CONSIDERATIONS

Methodology

Our stratigraphic examinations, in the field and in the laboratory, were directed to determine content, rate and mode of deposition, layer distributions, environment of formation, and the nature of numerous time-and-space-specific events we term depositional episodes. Several factors made it difficult to maintain standardization at all three sites. In particular, archaeologic features confused stratum delineation; textural differences were caused in part by fluctuations in water content; differential or very diffuse lighting created misleading visual cues; and even moss growth generated unique patterns on the exposed walls according to specific moisture and sunlight relationships. In short, the day-to-day stratigraphic observations varied considerably.

The excavators eventually realized that major stratigraphic trends were not present at every point within the cultural deposits. Furthermore, major depositional events could not always be reconstructed from such points. In an attempt to cope with this situation, in 1970 we reexamined the wall profile of FS 4. Discrepancies were noted between the 1970 and 1969 records of the unit's stratigraphy. We then carefullly controlled excavation of the profiled face to determine the extent of isolated concentrations or minor depositional episodes, the nature of suspected interfaces between major episodes, and the origin of intrusive materials. Here, as elsewhere in the site, our Field Sample Columns provided additional stratigraphic data. In this manner we were able to establish critical strata-selection criteria for FS 4.

Our stratigraphic analytical procedure may best be described as multi-factor. It defines a wide variety of stratigraphic descriptive data which is then integrated through the patternings of the deposits revealed through excavation. Knowledge so derived permits identification of those layers most significant to the reconstruction of the site's depositional history, and leads to simplification of the drawn profile.

A multi-factor approach remains flexible by virtue of not requiring that all factors be applied to any one situation. Features unique to a particular stratigraphic sequence or level in the site often constituted the principal strata-determinants in those situations, but might not appear in other parts of the site. For example, some patterns of

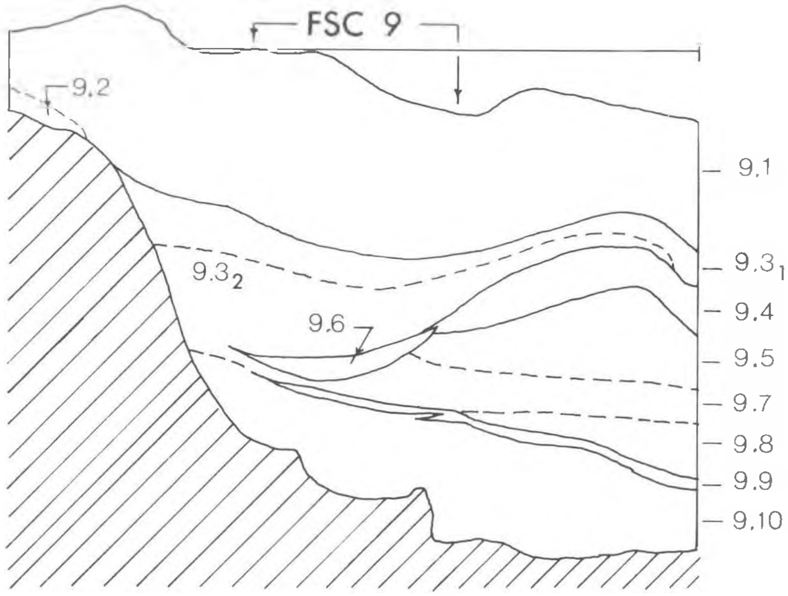


Fig. 15 Location of strata identified in Field Sample Column 9 (FSC 9) in "Rear Trench". Solid line indicates natural stratum boundary, dashed line indicates artificial boundary. ElSx 1

discontinuity or continuity were interrupted by horizontal layers of black matrix. In other cases there was concentration of a few specific components. Each situation confused the identification of major strata. The inter-dependence of factors further complicated decisions as to which factor was most diagnostic. Colour, a frequently used criterion, was often dependent upon content – but not always. Colour variation in some cases resulted from a localized staining or from fine laminæ of one midden component (*e.g.,* iron and organic stains, and lenses of purple mussel shell). In addition, daily fluctuations in water content in the midden layers created coloration patterns.

We conclude from our study of midden accumulation that confusion between strata boundaries most often arose because of almost indiscernable intrusions from above, localized disturbances, or minor episodes, all of which disrupted the patterning characteristic of the stratum as a whole.

The stratigraphic examinations undertaken at two of these Field Sample Column locations are related here to illuminate the multi factor approach as well as the nature of the site's stratigraphic units.

FSC 9 contains segments of all major stratigraphic units present in the ' East Portion" of the rear trench deposits (Fig. 15). Content and colour contrasts between successive strata in this area are striking. The first major unit below the surface humus, FS 9.1, was a light-coloured mixture of moderately fragmented shell and fine ashy material. Localized concentrations of shell exhibiting unique internal patternings were isolated and infrequent within the stratum. Humic intrusions were also at a minimum. The lower boundary was abrupt except where bedrock intruded upward into the shell layer. FS 9.2 is considered a localized depositional event peculiar to FS 9.1. The next unit immediately below, FS 9.3 is distinctive in both colour and content being rock-laden, and virtually shell-less, with a soil matrix. The layer was excavated as a single unit despite internal differences in coloration. According to laboratory analysis there was no content variation between the differently coloured areas. However lab numbers were assigned to distinguish the two sub-samples from this stratum, FS 9.3, and FS 9.3_2. The third major stratigraphic unit from the top, FS 9.4, contained more shell than FS 9.1 (about 75% shell) and possessed abrupt upper and lower boundaries. There was little shell fragmentation with nearly complete valves occurring in occasional clusters. To categorize the sharp distinction between shell-containing and non-shell-containing layers, we used the terms ' shell layer" and "black matrix". The black matrix extending below FS 9.4 to the sterile sand/gravel substratum was

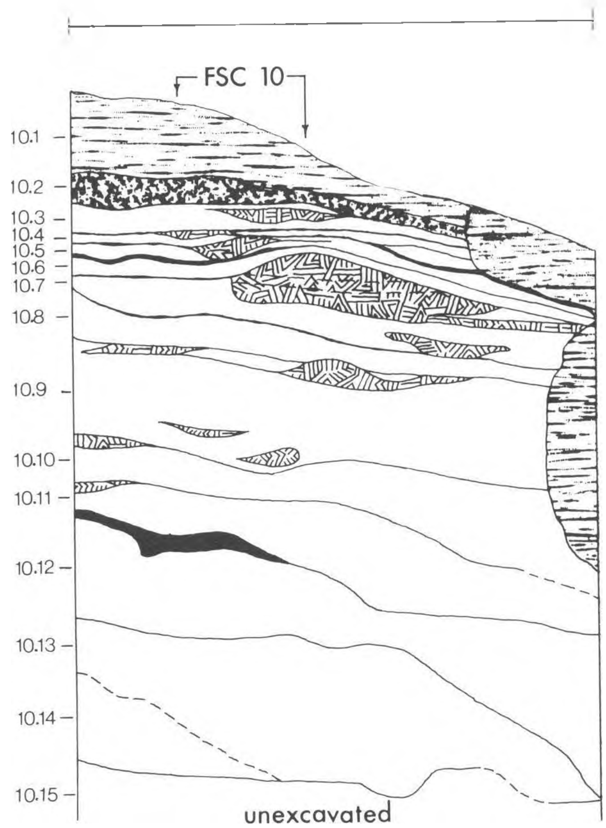


Fig. 16 Location of strata identified in Field Sample Column 10 (FSC 10) in "Front Trench". Solid line indicates natural level stratum boundary, dashed line indicates artificial boundary. ElSx 1

excavated by arbitrary layers, the only evidence for internal stratification being a compact red matrix labeled FS 9.9. Hence FS 9.5, 9.7, 9.8 and 9.10 represent subdivisions of the black matrix. The presence of a heavy rock concentration accounts for the distinction between FS 9.7 and FS 9.8 (see dotted line on profile drawing) and its significance will be discussed below. Adjacent to the shell layer FS 9.4 was a red stained area, FS 9.6 which was similar in content to FS 9.4 except for very fine red material mixed with the pulverized shell matrix. We speculate that this originated in the same manner as the compacted red matrix, an iron oxide precipitate.

The second column, FSC 10, is located in the "Front Trench", and presented different problems in layer definition (Fig. 16). In trench FS 10 the correspondence between excavated layers and natural layers was not perfect, although close (see Fig. 14). Although all stratigraphic units in this portion of the site are shell layers, the confusion arose from several overlying large hearths whose boundaries appeared intermixed. Colour distinctiveness was nowhere as sharp as in the "Rear Trench", being generally one of various shadings from white to grey. Content differences were even less distinctive than colour. The final procedure involved almost equal weighting given to colour, content status (particularly fragmentation and homogeneity of mixture), layer compaction and artifact content changes observed during excavation. The depositional history of the FSC 10 strata will be discussed in more detail below. The profile drawing of this area presents, however, only the 'corrected' stratigraphic succession, that determined after excavation of the trench was complete.

In summary, our method requires first exposure and then detailed *in situ* examination of a midden cross-section. In situations presenting unfamiliar patternings, the *in situ* study must be supported by a controlled stratum sample analysis producing content descriptions and relationships.

A detailed description of the stratum matrix with explanation of criteria used for selection accompanied the removal of each stratigraphic unit, especially during sampling of the "Field Sample Column" locations. This information, derived from *in situ* evidence and combined with the laboratory analysis of content provides our knowledge of the stratum reality. Use of this knowledge permitted a more graphic representation in the profile drawings and a more accurate reflection of 'stratum reality" than is usual in similar reports.

Written descriptions of midden deposits frequently fail to provide comparable evidence on all levels of measurement and perception. To overcome this problem, visual controls have been designed into the profile drawings. The field drawings record the stratigraphic layers and sequences. The laboratory analysis of components was standardized by Conover for routine sample examination with component categories being established in terms of weight percentages.

The laboratory procedure involved the screening of the 35 lb. (dry) standardized sample through a system of 4 mm and 2 mm square mesh screens. The 2 mm and smaller debris was not systematically identified, as testing demonstrated that the 4 mm debris provided an adequate representation of all major stratum components.

Occasionally the material passing through the 2 mm square mesh screen (termed "residue") represented 70–80% of the total sample weight. When this situation occurred, a subjective assessment was made as to its basic ingredients by weight.

In this manner, suits of column samples were examined and rock and shell weights were established. It soon became apparent that stratum differences pertained not only to perception but also to content. For example, the increase of shell in shell-bearing strata is accompanied by an almost

Table III Assayed radiocarbon dates

SITE	PROFILE CODE NO	LABORATORY NUMBER	OUR SAMPLE DESIGNATION	MATERIAL SAMPLED	YEAR ASSAYED	AGE IN YEARS BP	BASE DATE (HALF-LIFE)
ElSx 1	1	GaK-3119	FS 9. 3.31	charcoal	1970	2440 ±100	5570 yrs.
	2	GaK-3118a	FS 9. 1.20	shell	1970	1880 ± 90	"
	3	GaK-3120	FS 9.10. 5	charcoal	1970	7800 ±200	"
	4	GaK-3244	FS 9.11. 1	charcoal	1970	9140 ±200	5568 yrs.
	5	GaK 2714	FS 3.12. 3	charcoal	1969	2810 ±100	5570 yrs.
	6	GaK-2713	FS 2. 5. 1	charcoal	1969	2880 ±100	"
	7	GaK 2717	FS 4. G. 9	charcoal	1969	4290 ±120	"
	8	GaK-2715	FS 4. O.34	charcoal	1969	3400 ±100	"
	9	GaK-2716	FS 4. O.31	charcoal	1969	4540 ±140	"
	10	GaK-3121	FS 10. 4. 1	charcoal	1970	480 ± 80	"
	11	GaK 3122	FS 10.8C. 1	charcoal	1970	680 ± 90	"
	12	GaK 3123	FS 10.11. 3	charcoal	1970	980 ±100	"
	13	GaK-3124	FS 10.11.90	charcoal	1970	1840 ± 80	"
	14	GaK 3125	FSC 10.12	charcoal	1970	1470 ± 80	"
ElSx 3	15	N 788	FS 2.10B.1	charcoal	1969	1810 ±100	5568 yrs.
	16	N 789	FS 2.17C.1	charcoal	1969	2290 ±110	"
FbSx 6	17	GaK 3126	FS 1. 3. 2	charcoal	1970	2140 ±100	5570 yrs.

proportional decrease in stone materials. For this reason our tripartite separation of the shell layers into $\geqq$ 75%, $\geqq$ 25% and $\geqq$ 5% shell groups is rather arbitrary.

In conclusion, the profile drawings are an integration of both subjective and objective information and provide a visual summary of the stratigraphic evidence. One consequence of this method is that basic relationships in content, tone, and texture of each stratigraphic unit are illustrated, thus eliminating involved written descriptions.

Not all information placed on the drawings is actually obtained from the profile face. In most cases, the location of a radiocarbon sample or burial is extrapolated from the adjoining excavation unit. In the specific case of burial FS 4.h,I,J the interment was displaced laterally .50 metres east in order to assure its appearance on the profile drawing.

Table III provides a listing of the radiocarbon information available. The profile code numbers at the left occur in the profile drawings beginning in the "Rear Trench, East Portion" and are numbered east to west on each of the three drawings.

Data and Conclusions

Particular attention has been directed towards the genesis of the sterile sand matrix under the Namu midden. With respect to its origin, it should be apparent that complex problems of the late or post-Pleistocene glacial events remain to be resolved. Figure 17 provides a transverse section of the site as it is known from excavation. The illustration combines two parallel east-west excavation axes for purposes of simplicity. Deeply weathered surfaces of the bedrock formation (Fig. 18) exposed at the rear of the site exhibit erosional patterns identical to those appearing on similar exposures in the present tidal zone. Along an axis perpendicular to the shoreline (Fig. 19) the sandy sterile substratum exhibits size sorting: angular gravels at the base of the outcrop, a predominantly compacted sand matrix approaching the bunkhouse, and large rounded boulders loosely cemented into this sand matrix beneath the bunkhouse. No sand matrix was uncovered in FS 11; only bedrock.

The morphologic similarities between the present beach and the sand and outcrop formation beneath the midden argue strongly for a different sea-stand existing prior to occupation of the site.

With respect to the origin and time of deposition of the beachlike substratum it seems probable that the matrix is outwash debris from the direction of Lake Namu and that subsequent tidal or stream activity created the beach morphology some time prior to the arrival of human occupants.

All deposits occurring above the sterile substratum appear to be direct or indirect products of cultural activity (Fig. 20). The most striking feature in the ' Rear Trench" is the stark contrast of the black basal midden layers with the overlying heavy shell-bearing units. This contrast reflects content differences. Almost invariably, the non-shell matrix contains ash and charcoal, bone remains, and sand and possible humic material, all relatively small in size. In the

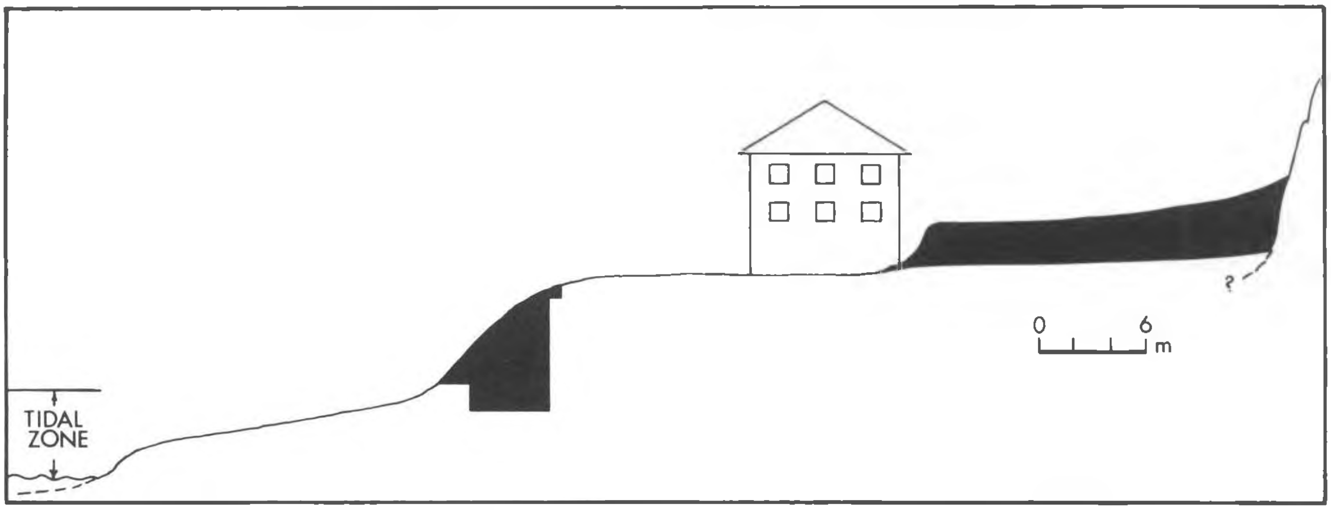


Fig. 17 Schematic cross-section of ElSx 1 with excavated areas in black; facing north.

shell-bearing layers, while shell may comprise the largest single constituent by weight, non-shell material is present in weights ranging from 1% to perhaps 85% per standardized sample. In order of frequency, major shellfish species present throughout the Namu midden are *Saxidomus giganteus, Schizothaerus nuttallii capax, Balanus cariosus, Thais lamellosa,* and *Mytilus edulis.* It is the presence of shellfish remains, therefore, which gives the layer its contrasting white appearance.

The contact zone between the black matrix and the sterile substratum has yielded charcoal radiocarbon dated 9140 ± 200 (see profile "Rear Trench, East Portion"). This zone possesses a sharp boundary featuring a slight upward intrusion of the yellow sand component. The upper contact zone of the black matrix is equally sharp, except for infrequent localized shell intrusions from above.

The black layer was clearly visible in FS 8, FS 5, and FS 1 along the north-south axis in the rear of the site. No evidence of this layer was uncovered in FS 11. Downward intrusions and intermixtures of shell into this black matrix were particularly frequent in FS 5 and the most shoreward portions of FS 2 and FS 4, resulting in distinct localized mixtures of shell within the black material. Radiocarbon sample 5 (2810 ± 100 radiocarbon years) as well as adjacent hearths located at or near this interface further suggest mixture of cultural material.

Due to its greater antiquity material recovered from the black matrix has undergone long weathering processes. Scattered randomly in the upper part of this layer but clustered in loosely associated groups along a line (dashed line on profiles) were large disintegrating stones of granite, gneiss, schist, and occasionally slate and sandstone. Each had contributed through disintegration to the granular texture of the matrix. Despite the presence of sand and weathered stone, however, the black stratum exhibited slick, sticky qualities suggesting a very fine, clay component. Bone was also recovered in quantity. Table IV presents the humic content of these strata, determined by igniting small oven-dried quantities of the matrix at 550°C for two hours.

Table IV Humic content in black matrices

Age	Unit	% Humus
2440 1880BP	FS 9.3[1]	11.5
2880-4540?BP	FS 9.5[1]	13.3
4540 7800BP	FS 9 9	22.7
7800-9140BP	FS 9.10	28.9

Within the black matrix near the bedrock outcrop, is a water saturated zone the top of which is a "compacted red-brown matrix". This matrix is characterized as a very hard, abrupt to diffusely delineated zone of cementation containing small amounts of reddish to yellow ferric oxides. Toward the west its boundaries dip downward and almost come in contact with the sterile sand. At the east end of the trench it turns upward and becomes less distinct. Artifactual material within the red zone is identical typologically to that found above and below it. *In situ* examination suggests the constituents within the surrounding black matrix are identical to those of the ' compacted red matrix". Finally, the distal portion of a microblade uncovered 30 cm above the red zone fit a fragment recovered 20 cm below the zone. The zone was sufficiently cemented to have prevented any vertical displacement through it after its formation. We conclude from this evidence that the zone did not exist during the deposition of the black matrix. We believe that the ' compacted red matrix" represents a zone of oxidation where iron in solution precipitated out and was deposited, consequently cementing and staining the zone. This precipitation may be a relatively modern event (Walker 1971).

Three small hearths/lenses located one metre west of radiocarbon sample 5 were the only evidence for internal stratification within this black matrix. They were superpositioned with the lower hearth resting on a zone of loosely associated stone. No horizons could be detected in association with these hearths, however, nor did any other evidence support intralevel separations. Had stratification originally existed within the black matrix several factors could have obliterated the evidence. The present flow of ground water below the red zone probably has reduced any internal variation. In addition, much of the zone in contact with bedrock was saturated, a condition most typical of the rear portions of the site. It seems probable that later stratigraphic units (shell) at this contact point have moved laterally downslope due to solifluction.

It is also possible that stratification never existed. Unfortunately, we have no evidence to clarify this situation. The possibility that the remains found within the matrix were originally deposited elsewhere and then redeposited where we found them seems untenable. Some articulation occurred in skeletal material, and we found no evidence of abrasion or fragmentation of specimens through rolling.

The upper boundary of the western portion of the black

Fig. 18 View showing relationship between midden deposits and weathered bedrock exposure in "Rear Trench, East Portion" of ElSx 1.

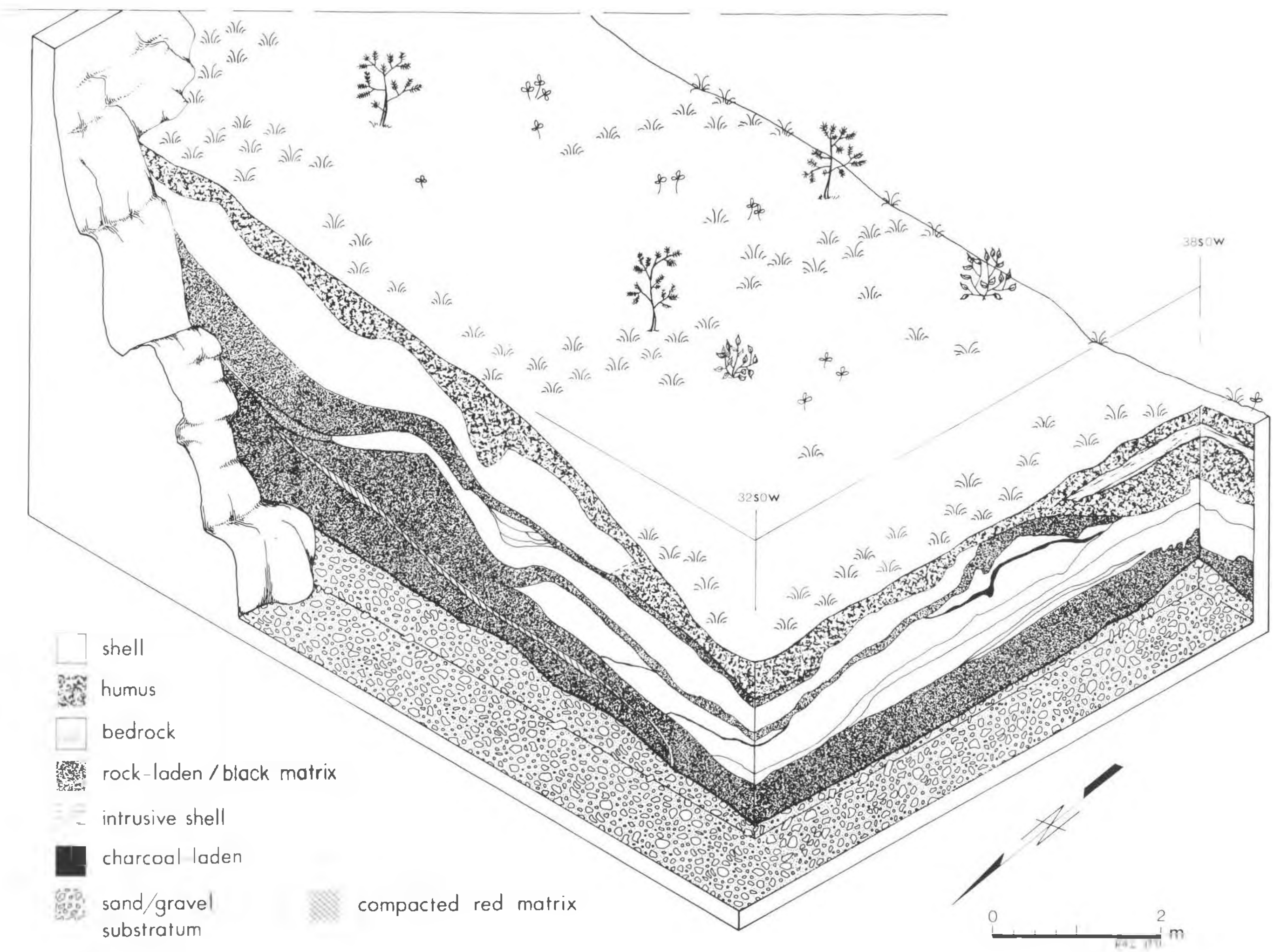


Fig. 19 Diagrammatic view of Rear Trench deposits at site ElSx 1, Namu, B.C.

matrix possessed a sharp contact with shell layers above. This is an apparent shoreward interruption of the unit by a sequence of shell-bearing layers which in part rest on sterile sands. This feature could be explained by the presence of a terrace beneath the bunkhouse. Large water-worn boulders occur beneath the bunkhouse floor. In addition a steep drop of the substratum occurs between the bunkhouse and the present shoreline. The shoreward interruption may represent an early transgression of tidal waters which removed portions of the black matrix and the then-develop-

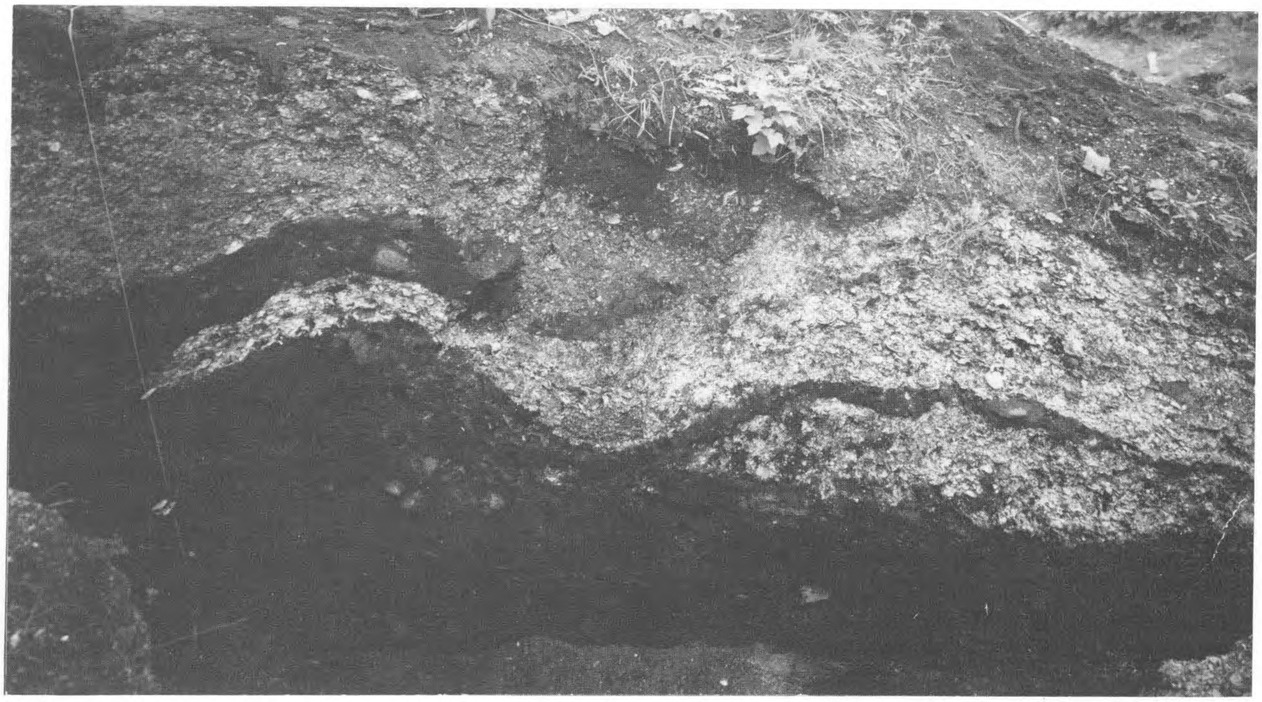


Fig. 20 View of south face (FS 9 and FS 3) in "Rear Trench, East Portion". Note three superpositional hearths below second black convolution in black matrix. ElSx 1

ing earliest shell deposits in the area. The suggestion that high tidal waters were responsible for this erosion is supported by the absence of channeling or other evidence of terrestrial erosion. Furthermore, a terrace with its higher elevation would have protected some deposits from tidal erosion. The nature of the black matrix is especially important since one-half the site's depositional history is contained within it. Undoubtedly, the flow of ground water plus tidal action must have been strong agents in the deterioration of stratigraphic evidence. The hearths, however, provide indisputable evidence of stratification within the upper regions of the matrix where radiocarbon sample 5 occurs. It is clear in the profiles that the shell layers over this sample were deposited later (ca. 2810 BP) than the earliest shell date of 4540 BP. The radiocarbon sample is considered associated with events related to the shell layers above and hence dates those events. Two dates of 7800 BP and 9140 BP from the mid and lower sections, respectively, date the black matrix.

The shell-bearing layer found at Namu dated 4540 ± 140 BP ("Rear Trench, West Portion") records the earliest depositional event following the black matrix. From the western extent of the exposure, the shell progresses horizontally in overlapping units until it terminates in the "East Portion" and is subsequently covered by another black stratigraphic unit. These overlapping events occur within a single stratigraphic unit resulting from 1100 years of deposition, according to radiocarbon sample 9 (3400 ± 100 BP).

The events following are marked by a black organic matrix alternating with a shell matrix. While the shell unit between the two convoluted black units contains much whole shell, the unit nonetheless conforms to the shell-in-fine-matrix pattern mentioned above. Of interest in this portion of the profile exposure is the convoluted distortion exhibited by the two black organic units and the shell-bearing units. There are two possible explanations for this configuration.

During excavation of the lowest black convolution (in FS 3), the regular sinuous configuration was found to continue across the pit. With the subsequent exposure in FS 9, morphologic similarities were demonstrated not only with

FS 9.5 but to stratigraphy above and to both sides of FS 3. We conclude that stratigraphic configuration at or near the rock outcrop is the result of continual mechanical pressures which have shaped or distorted the sequences through soil flow.

The top portion of the midden and the overlying humic levels at the rear of the site may not record the last depositional events for that portion of the site. Recent construction and habitation could have been responsible for removal of the upper units with recent humic buildup terminating the sequence. Rough sawed wooden planks within humus and the general irregular configuration of the contact between humic and midden deposits bear witness to the state of disturbance and suggest that the midden's top is truncated. Radiocarbon sample 2, dated at 1880 ± 90, is considered to represent the final dated phase of occupation at the rear of the site. The stratigraphic overlap between the Front and the Rear portions of the site is dated at around 1880 BP, with the top of the rear portion corresponding to the lower layers in FS 10. These two units are similar in texture, content, and morphologic configurations (Fig. 15).

We were unable to expose the basement upon which the Front layers were deposited in FS 10 due to the lack of time and the presence of ground water. A transit reading determined that we were within 65 cm of a probable bedrock basement exposed at the shoreline only a few metres away. At these levels petroleum odor was accompanied by petroleum "slicks" floating on the water. This condition is best explained by the invasion of tidal water containing petroleum discharges from local boat traffic. The ground water on the other hand, flowed from the uphill portion of the trench.

All shell-bearing layers discussed up to this point in the depositional sequence were delineated by thin black charcoal layers. In the basal portions of FS 10, these black layers became sharply defined in thickness and horizontal distribution revealing two distinct structural patterns for the shell layers. The first of these two structural patterns contained thick, short lateral distributions of irregularly contoured shell layers with fragmented shellfish remains in a homogenous mixture with ash and charcoal. The fragmented shells were mixed with infrequent concentrations of whole shells. A few small, thin hearths occurred in this sequence. This pattern is represented by all shell deposits in the rear of the site, beginning at 4540 BP, and all those in the Front Trench up to 980 BP, when the second pattern becomes apparent.

The latest sequence of deposits is charaterized by thin flat shell layers containing concentrations of species – specific shellfish remains in direct association with hearths. Fragmentation of shell is less severe than in the first pattern. Often nearly whole specimens occur. In addition, ash and charcoal are not mixed throughout these layers but are primarily confined to the charcoal layers separating each unit. The hearths are superimposed upon each other through time. This pattern began at 980 BP and continued until the final deposit. Inasmuch as the final radiocarbon date of 480 ± 90 BP dates the fourth stratigraphic unit below the midden's original top, we consider the final phases of deposition date within the last 200 years. Support for this conclusion includes the recovery of organic membranes of clam and even fully articulated fish in the uppermost layers. These finds occurred in small clusters resting on living floors near hearths. No historic materials were uncovered in association, however.

Immediately above the aboriginal midden are two layers associated with recent site construction and leveling operations. The first to be deposited represents recent habitation before the bunkhouse was built, as rifle shells with 1907 stamps were found. This debris may represent Indian occupation. The final phase involved construction of the bunkhouse and contains a wide range of modern debris.

The sloping contours of these Front stratigraphic units are especially noteworthy. Beginning at the bottom of FS 10 and the entrance trench FS 12, the short, thicker shell deposits exhibit a downhill slope accompanied by thinning. As subsequent layers were deposited, it appears that slumping occurred only at the front edge of the laterally advancing midden. Hence the surface contours become more horizontal for successive stratigraphic units. The upper units of this front trench meet the sloping midden front almost horizontally (Fig. 21).

In summary, two distinct depositional phases are visible in the Namu midden; the first involves a non-shell matrix, and the second a predominantly shell matrix. The first matrix records deposition unlike that of later units and contains dissimilar artifactual evidence. Nonetheless we know very little about specific events within the sequence between 9140-4540 BP. There is, in addition, evidence of an unconformity between the black matrix and the succeeding shell layers.

FEATURES

Burials

At Namu, interments conformed to three basic configurations according to the number of individuals involved and the pnysical relationship between burial locations. The first, the single, contained one interred body per grave site. The multi-individual pattern includes several individuals intro-

Fig. 21 View of south face, FS 10 and FS 12, in "Front Trench". Horizontal line is level while sequence of wooden markers along vertical line indicates strata boundaries established in FSC sampling sequence. Aboriginal deposits terminate immediately below topmost black layer at left on face. ElSx 1

duced during a single interment. The sequential multi-individual pattern is characterized by a number of individuals buried at different times within the same burial pit. An individual is considered extended within the pit when all limbs are arranged roughly parallel to the body axis, although the lower legs are commonly doubled at the knees. In contrast, in the flexed position, the knees are tightly drawn into the chest area and the arms casually placed somewhere within the pelvic area, often embracing the lower limbs, and the vertebral column arches forward. Bundle burials display no natural anatomical arrangement and appear to be little more than piles of bone. Whenever the arrangements appeared to have been drastically disturbed by post-depositional events, the interment was termed a bundle burial.

Body orientation conformed to a variety of patterns, but none seemed to be influenced by the burial type, sex, or number of individuals involved. A north-south orientation, with head in either direction, was the most common pattern. Where several individuals appeared together, all conformed to a single general orientation, but not necessarily north-south. The direction a body faced was difficult to determine owing to post-burial fragmentation and movement. Obviously, the flexed condition of an individual could predetermine the direction it faced, but in extended burials it would appear the facing was a highly variable result of circumstances. In no case was an individual found buried face down.

Determination of the time at which interments occurred was difficult. In two examples, much of the overlying stratigraphy was missing, hence the evidence of introduction was missing as well. In the course of excavation care was exercised once a burial was discovered and in every situation the profile walls were examined for additional burial evidence. We have concluded that the burial pits were shallow and rarely intruded through more than one complete stratigraphic unit. The most common pattern suggested that the burial pit was introduced into a stratum for which deposition had recently ceased and through a part in which deposition had just been initiated. Using this information the Namu burials have been assigned to the stratigraphic unit immediately above the burial. While inaccuracies are possible through use of this assumption, there is no evidence that burial pits penetrated stratigraphic units to a depth of more than one metre (Table V).

Assigning artifacts to specific burials was not difficult. In the first place most burials were devoid of artifactual associations. Where artifacts were uncovered, however, they primarily consisted of body ornaments. With the specific finds in parentheses, these occurrences are: FS 4.H, FS 2.12E, FS 4.K.11, (clam shell disk beads) and FS 11.1A (amber beads— see Fig 41). Two lanceolate points (see Fig. 32a b) uncovered 3 cm below individual FS 9.OA may have been associated with that individual. Groups of cobbles, from two to twenty, were found near the cranial and neck areas of all burials except FS 4.G.6,8, FS 4.H I,J, FS 6.13A, and FS 1.13D. Very large boulders covered individuals FS 4.G 6 8 and may have covered FS 4.J, I,H. Table V provides a complete listing of burial data. Two specific burial locations "Rear Trench, West Portion" will be discussed in detail in order to provide data to illustrate the interpretative remarks.

Burial FS 4.H,I,J (Fig. 22) represents a multi-individual interment containing a ca. 50-year-old male and two females, about 15 and 30 years old. Oriented along a north-south axis, each individual lay extended with limbs intermingled with those of the others. The adults' crania were fragmented, although probably intact at the time of interment. The 15-year-old female's cranium was completely crushed.

With the exception of a possible clam shell pendant associated with the 15-year old, all artifacts recovered from the burial (Fig. 40) were in direct association with the male. Clustered about the head, neck, pectoral and wrist areas were strands of clam and mussel shell disk beads totalling approximately 4000 individual beads. A concentration of red ochre was located next to the mandible in the neck region in direct contact with two ivory "gambling pieces" and a possible clam shell pendant. Grouped at each shoulder were caches of bone and stone tools fashioned for marine hunting. A bone projectile point (specimen 1, Fig. 40) was found in the male's back embedded between two thoracic vertebrae and penetrating through the spinal cord canal.

Table V **Descriptive breakdown of all Namu interments excavated in 1969-1970**

Field Design	Burial Type	Age**	C^1	Sex**	C^2	Time of Interment
1.11B.1	Bundle	40-50	(4)	M	(2)	4540 BP(?)
1.13D.1	Bundle	40-50	(6)	?		7800-4540 BP
2.11C.1	Flexed	15-17	(2,3)	M	(2)	3400 BP
2.12E.1	Extended	35-45	(4,5)	F	(2)	3400 BP
4.B.1	?	5-6	(3)	?		3400-1880 BP
4.C.1	Extended	35-45	(4,5)	M	(2)	3400-2880 BP
4.G.1	Flexed	25-35	(4)	F	(1,2)	3400-3000 BP
$4.G.2_1$	Bundle	45-55	(4,5)	M	(1,2)	3400-3000 BP
$4.G.2_2$	Bundle	40-50	(4,5)	M	(2)	3400-3000 BP
4.G.3	Bundle	16-18	(2)	?		3400-3000 BP
4.G.4	Flexed	45-55	(6)	M	(1)	3400-3000 BP
4.G.5	Flexed	7-8	(3)	?		3400-3000 BP
4.G.6	Extended	30-35	(2,5)	F	(1,2)	4290-3400 BP
4.G.7	Flexed	5-6	(3)	?		3400-3000 BP
4.G.8	Flexed	16-17	(2,3)	F	(1,2)	4290-3400 BP
4.H.1	Extended	45-55	(4,5)	M	(1,2)	3800 2880 BP
4.I.1	Extended	15-16	(2,3)	F	(1,2)	3800-2880 BP
4.J.1	Extended	28-38	(4,5)	F	(1,2)	3800-2880 BP
$4.K.1_1$*	Flexed	35-45	(4,5)	F	(2)	3400-2880 BP
$4.K.1_2$*	Bundle(?)	adult		M	(2)	3400-2880 BP
$4.K.1_3$*	Bundle(?)	subadult		?		3400-2880 BP
5.11P.1	Bundle	45-55	(5)	F	(2)	3400-2880 BP
5.11P.2	Bundle	neonatal	(3)	?		3400-2880 BP
6.13A.1	?	?		?		?
8.12A.1	Flexed	50-60	(4)	F	(1,2)	3400-2880 BP
8.12B.1	Extended	adult		?		3400-2880 BP
9.OA.1	Bundle	4	(3)	?		1800 BP
9.3B.2	Bundle	17	(2)	F	(3)	2440 BP
11.1A.2	?(Cairn)	15-17	(2)	?		Recent

C^1 Age Criteria
1) public symphyseal (Todd method)
2) epiphyseal closure
3) dental eruption sequence
4) suture closure
5) dental attrition
6) porosity of femoral cortical bone

C^2 Sex Criteria
1) pelvic structure
2) cranial morphology
3) discriminant analysis

* = individuals heavily charred

** = assigned by Michael Finnegan

The burial series FS 4.G.1-8 contains nine individuals who were buried within the same pit. On the basis of stratigraphic evidence we believe they were interred at two separate times. The pit itself, cut into the sterile substratum, contained all nine individuals. This group lay immediately below individuals FS $4.K.1_1$-1_3. In addition, FS 4.C.1 and FS 4.B1 were present as single individual interments resting on or near sterile at the periphery of burial pit FS 4.G. At least three major phases of interment were represented at this single burial place.

The earliest phase contained two females: an extended 30-35-year-old and a flexed 16-18-year-old (Fig. 23). The

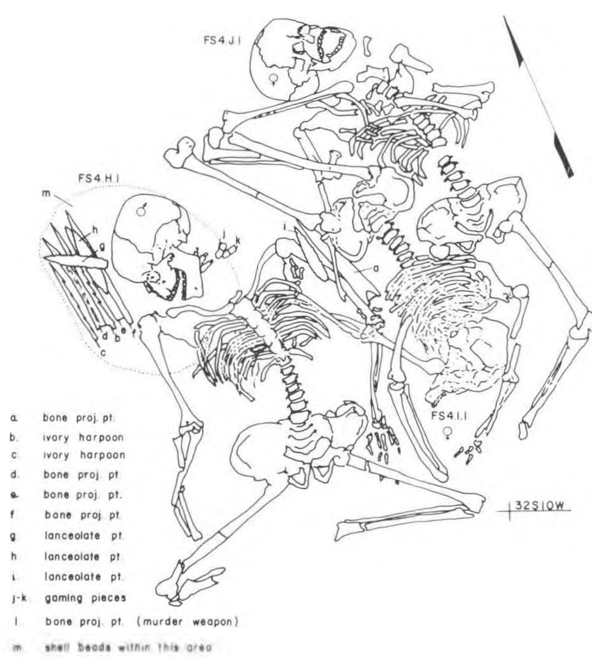


Fig. 22 Multiple burial, FS4.H,I,J, ElSx 1. Artifact letters refer to Figure 40.

bodies rested on the sandy substratum while one large boulder was placed over the flexed individual and two were placed over the extended one.

The second phase contained seven individuals in either bundle or flexed arrangement. During this interment the original pit boundaries were exposed and in one area enlarged to accommodate the larger number of bodies. However, disturbance of the initial interment did not occur. An interesting episode in this phase is evident in the arrangement of two children cradled in the arms of an adult male, all three in a loosely flexed position (Fig. 24). The remaining four individuals lay to the right of the trio in both bundle and flexed arrangements. A small number of river cobbles was in association with this group. Owing to the interwoven complexity of the skeletal remains, association with specific individuals could not be determined.

Inclusion of the following complex as the third and final phase of interment is a matter of some inference. Individuals FS 4.K.1_1-1_3 lay directly above the burial pit FS 4.G, but 20-25 cm separated the interments and conclusive stratigraphic evidence of their association was missing. The presence of burials FS 4.C and FS 4.B at the pit's edge lends credence to the argument that this area existed as a cemetery plot. The ' K" series is thus considered the terminal manifestation of a three-phase interment.

Two of the three individuals in the third phase were completely charred and the third, a fully flexed and articulated 35-45-year-old female, was charred on 70% of the body. Eighty charred clam shell disk beads were in direct association. It was determined that a very intense localized fire was built on top of the three individuals, which cremated the skeletal evidence, and baked the midden matrix below. The uncharred portions of the female were unaffected due to the fact that they were not in contact with the heat but rather were facing outward. The other two bodies, while not reduced to ashes, were severely fragmented and failed to provide evidence of their relative positions or ages.

We know these represent a formal interment from their position and association. The question still to be answered is whether the burning represents intentional cremation or is the result of accident or utilitarian activity. If the cremation denotes formal practice, why was one individual only partially cremated? Obviously the evidence at hand is limited. Considering the number, positioning, and close proximity of individuals plus the presence of beads, the writer speculates that cremation in this case was an aspect of burial custom.

Examination of each individual at Namu reveals a further distinction between body positions and articulation. Bundle burials at Namu were observed to have little articulatory positioning; often ribs and vertebral elements were

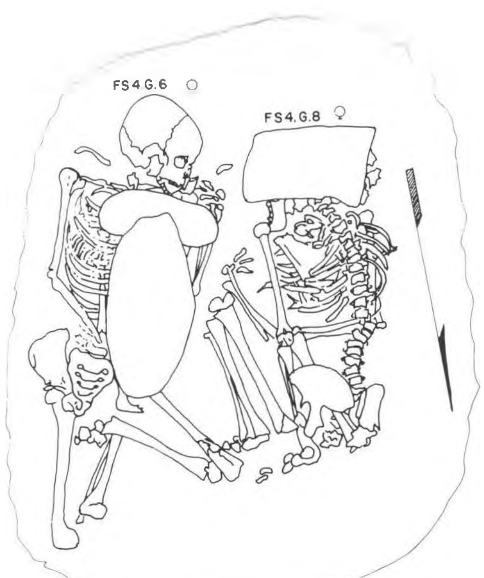


Fig. 23 Multiple burial complex, FS4.G.6,8 within sandy substratum as outlined by dashed line; first interment.

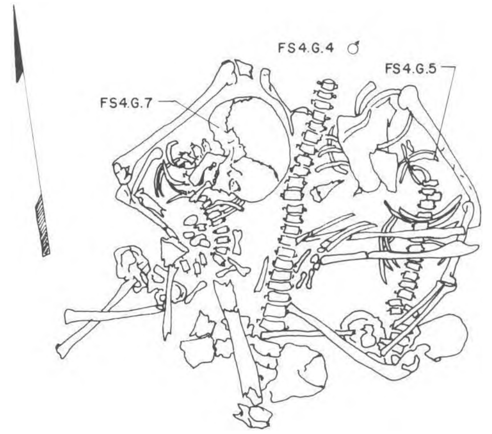


Fig. 24 Multiple burial above FSv.G.6,8 and within sandy substratum; second interment.

missing. Flexed individuals always exhibited articulated vertebral columns with frequent natural alignment of the pelvic and pectoral girdles. Long bones in certain cases were not always found to be articulated and in two cases humeri and femora were transposed in position and bundled with the remaining long bones. The extended pattern, while displaying isolated occurrences of disarticulation (always of the extremities), never exhibited disarticulation of the trunk or fore-limb elements.

Re-evaluation of the multiple burials reveals that in each case at least one individual within a complex is fully articulated and extended. In burial FS 4.H,I,J three bodies are extended and articulated. In sequence FS 4.G.6,7 one body is fully articulated and extended. The same is true of FS 8.12A&B. Of the remaining individuals in the "G" series, the only fully articulated individuals, FS 4.G.4,5,7 are not extended, but otherwise conform to this pattern.

Our interpretations rest, in part, upon burial patterns observed in the historic period mummies located in burial caves within the Bella Bella area. In these situations, the body is commonly bound in a flexed, seated position either outside of or within a burial box. This position is identical to those observed at Namu. Frequently these individuals exhibit evidence of post-mortem dismemberment.

The Namu interments therefore may represent a combination of both primary and secondary burials where, it is suggested, deceased individuals were interred together, with the death of one being very recent. The recently deceased person was placed in the extended position alongside individuals who might be either macerated or totally without flesh.

The adult male and the two children cradled within his arms, FS 4.G.4,5,7 represent a primary interment in direct association with FS $4.G.1,2_1,2_2,3$ which in turn are secondary flexed and bundle burials. FS 4.H.I.J on the other hand, were all primary interments. Burials FS 8.12A and B and FS 4.G.6,8 also exhibit this pattern.

How do we interpret this evidence? Evidence of violence in FS 4.H,I,J is present within the spinal column of H, and in the general disorder of the bodies. The associated artifacts with the male indicate he possessed considerable rank and status. It seems evidence that the "patriarch" was killed and placed in the grave with his weapons. The two other individuals may have met similar violent deaths and then were interred alongside the male. We would like to know who these individuals were and how they were related. The age and sex grouping suggests a family group, but slaves and servants were known to have been treated in a similar fashion in historic times. At any rate we believe that a series of related events led to the demise of these three individuals and their subsequent placement in the grave.

On the other hand, the appearance of the three individuals, FS 4.G.4,5,7 could be explained as death by calamity or stress. Drowning, disease, warfare, and so on hence became suspected causes of death, but whichever, it seems probable that all three succumbed to the same cause. After burial, other individuals were introduced.

A summary of the burial information from Namu provides a number of revealing facts. Of the 29 individuals uncovered, 19 were located within a 6 metre circle, and of these, 17 occur in multiple interments. Furthermore, assuming that the dating is correct, 24 individuals fall within the 4290-2880 BP time range. These numbers point out that specific burial areas were used and re-used during a relatively short time period. Finally, it seems possible that these were relatives or people known to each other, and that when the last members died, the whole group was buried together. Hence, small interment groupings may have been formed on the basis of the special circumstances surrounding each death and each group. Quite clear is the fact that those individuals who were doing the burying had intimate knowledge of the burial area and were familiar with the history of its occupants.

Other Features

A series of thin, well compacted layers of fragmented shell was uncovered in FS 5. These were separated by other layers of loosely compacted shell. The formation extended across most of the pit. At least five distinct layers were readily recognized. Each had a harder surface than the surrounding matrix. Dispersed across each of these surfaces were small concentrations of whole shellfish remains and clusters of fragmented sea urchin spines. Several of these layers appear to have been associated with hearthside activities, and two well-defined hearths were located. The hearths measured 25 x 35 cm, and were basin shaped. Yellow ash was concentrated within each. Charcoal and grey ash covered the adjacent surface and separated it from the adjoining matrix.

The most reasonable explanation of these layers is that they are the result of people walking over the surface as they made use of the hearths. Although irregular in contour, the layers are relatively flat and uniform in thickness. No architectural structures were found in association with these working areas.

The "Front Trench", FS 10, yielded a series of compacted shell layers in the final 70 cm of deposition which resemble those found in FS 5. Again well-defined hearths were in association and at least one hearth could be assigned to each of the seven layers. Small concentrations of shellfish surrounded the hearths, while quantities of ash and charcoal separated each layer from the next.

These hearths are yellow or beige in the centre with a grey to black periphery. No internal stratification or striations were detected. Unlike those found at the rear of the site, hearths in FS 10 are typically thick – up to 35-40 cm in depth. The black charcoal layer emanating from each hearth can be recognized throughout the pit's walls. The charcoal fragments within these layers are small and frequently reveal the original size of the wood source. The small quantities of grey ash suggest that the temperature of the fire was not high. These hearths and their associated layers are illustrated on the profile drawings (Appendix D).

Immediately above but in contact with radiocarbon sample 10, a thin, compacted layer of wooden debris was found and tentatively identified as cedar. Because of its fragile nature, a section was removed for examination. This revealed that the matrix contained flat thin chips of irregular shape and short (10 x 25 cm) "shingles" of uniform thickness and shape. There was no apparent arrangement of these forms. The matrix seemed to be an intermixture of both chips and "shingles" aligned flat on the ground. While the wood may have been a part of a house floor (no architectural structure was found) it may also have been refuse from a work area where canoes or house beams were being crafted, the chips being the by-product of these operations.

These features from the rear and the front of the site provide additional evidence of habitation patterns. The hearths' colour and deep homogenous cores testify to intense heat and prolonged use. The chacoal layers emanating from these hearths however, involving small brush, limbs and perhaps grass, were not the result of intense fires. The fact that these layers formed boundaries between depositional events indicates that these events and the cultural activities associated with the hearths were periodically terminated. The charcoal layers strongly suggest that the site was periodically burned off, possibly to rid it of debris and low vegetation. The hearths were associated with work areas and the compacting of the shell matrix surfaces is believed to be the result of people walking to and from the fire. The episodic nature of these events is inferred from the pockets of shellfish next to the hearths; barnacle here, clam there, mussel in between.

ARTIFACTS

Our sample includes all suspected 'artifactual" material removed from the excavations at the Namu, Kisameet Bay, and Roscoe Inlet sites. After cleaning, this sample was examined under a 75x (max.) stereoscope in order to establish criteria to distinguish *manufactur*ing marks from those resulting from *use*. At this stage in the operation, items which did not display either kind of mark were discarded as unusable for the objectives at hand. The remaining artifacts were termed "the collection".

In distinguishing between manufacture and use-related marks, functional attributes were also identified. This was in fact quite simple since manufacturing marks were found to be fairly consistent in pattern, reflecting grinding, cutting, and polishing. This procedure enabled the writer to establish the function of a specific artifact on grounds other than form alone, although form provided the initial clue as to where to look for what kind of evidence.

After wear patterning evidence was initially recognized, the artifacts were separated according to constituent materials and classified according to culturally significant functions. These were in part based on Semenov's functional categories as well as intuitive criteria established at two functional levels : tools whose functions were complexly related to form, and those whose form-function relationship was simple. Tools classified functionally as needles or adzes, for example, are simple. Hooks and the various projectile elements were considered functionally more complex in terms of manufacture, assembly, and deployment. At this stage in the process groups of classified artifacts were microscopically examined to re-assess evidence of wear.

Microscopic examination revealed that some individual artifacts within each class displayed wear patterning which did not fit functional attributes assigned to that class. Furthermore it revealed that imprecise distinctions were being made between certain form criteria. Particular bone tools, for example, included in hand tool categories on the basis of form, showed evidence of hand polish, whereas others possessed patterns which disclaimed use in the hand. Consequently, a re-evaluation of the form-function relationships was performed and the tools re-examined.

A solution to this problem involved the subdivision of some tools into type classes according to already established functional modes. For example, while barbs function in similar manners, they vary in attachment, material and whether used in conjunction with a spear, a line, or an arrow. The same is true of the less complex awl, which may perform a wide range of perforating operations on differing materials. Just what these specific requirements are and how they influence tool manufacture is one of our research goals. Once having generated the subdivided groupings, we perceived the patterns of form and function of each designated group which was verified by their wear patterns.

Only at this stage in the classification system then, were the tools given classificatory status on the basis of form-function relationships. Once in the class, and where appropriate, a final "label" was assigned for that function-specific class. Under the functionally related group of "Barbed Bone Projectile Element," one finds the "Wide" and the "Single Barb-Points" – each a descriptive type of the projectile's presumed procedural mode as defined by Rouse (1970:192). Each is functionally related to the other, but was used in some unknown distinctive manner. Similarly, the "Awls" or the "Utilized" and "Developed Flakes" and "microblades" are distinguished according to form-function.

At the conclusion of this procedure, and only then, the classes were ordered according to the radiocarbon chronology, thus avoiding the weaknesses of the "historic type". Also at this stage artifactual samples from ElSx 3 and FbSx 6 were introduced into the collection. This inclusion was made only when the time span for each class coincided with those generated by the Namu collection. In retrospect, this restriction was not necessary due to the fact that none of the classificatory units conflicted chronologically from site to site. All artifactual units developed for the other two sites therefore were admitted into the collection.

A count of the complete collection from all three sites is presented in Table VI. A breakdown according to the fragmentation of bone artifacts helps explain why only 25% of this collection was assigned to formal classes. After all, our method requires the individual artifact to have preserved evidence of both its original form and its function as indicated by wear patterns. Without reliable evidence of both the specimen was not assigned to an artifact class. Therefore, in the instances in which only a shaft segment remained, the inclusion of that artifact into the classification could not be justified. It would of course be possible to use descriptive terms typical of many archaeological reports such as "pointed bone object" or "shaft", but these fail to convey meaningful information of the sort sought here.

Table VI Artifact count of entire collection
(the term 'complete' means diagnostically complete)

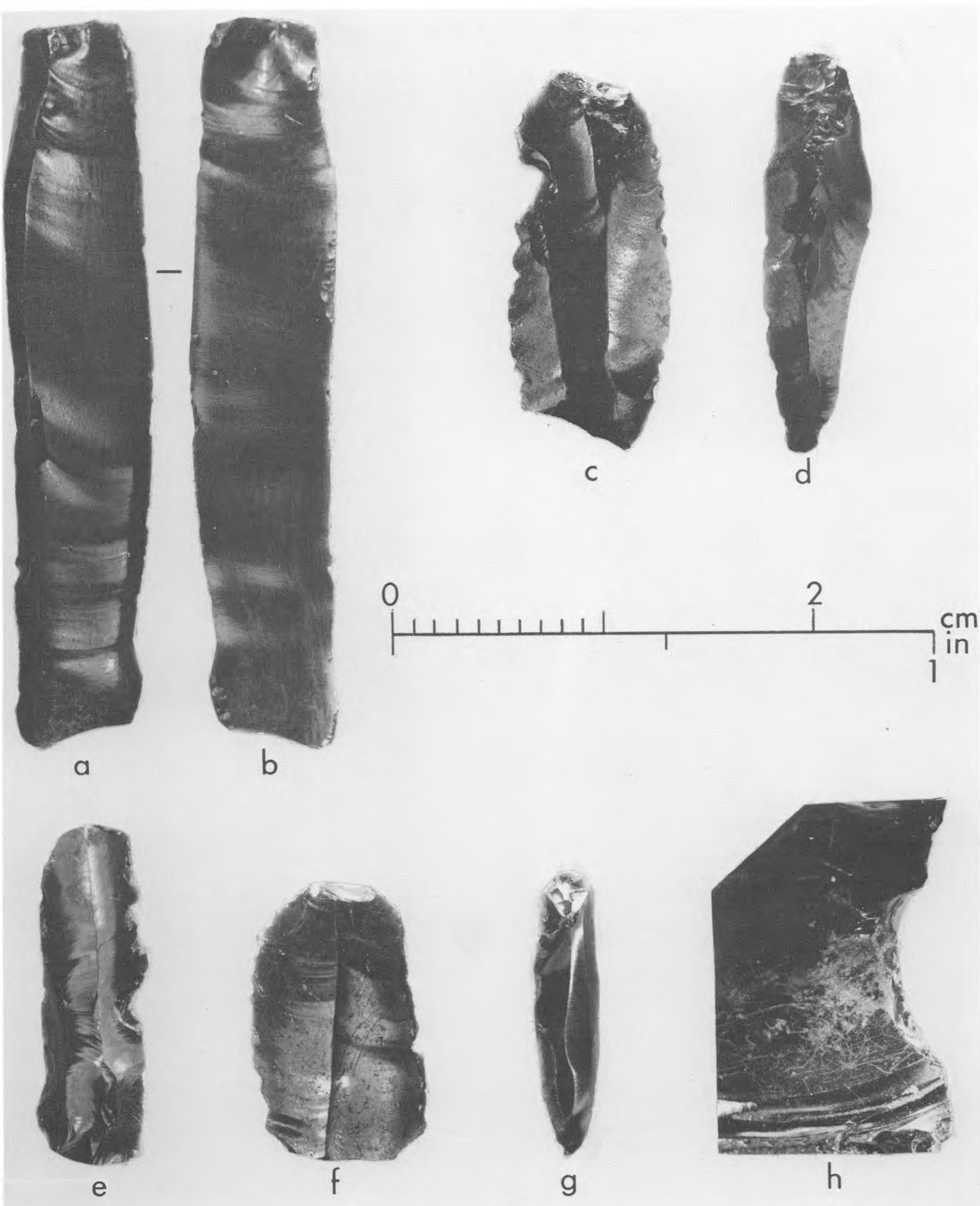
Material	Fragmentation	No. of Artifacts
Bone	(75.3%)	
	complete	215
	ant./post.frag.	790
	midshaft frag.	265
	indeterminable form	8
Stone	(23.5%)	
	complete	195
	other	203
Shell	(1.2%)	
	fragments	21
	Total Artifacts	1697

Evidence of manufacturing techniques in bone is abundantly clear. Most bone implements are fashioned from land mammal long bones, primarily deer. Other utilized bone elements include ulnas, mandibles, and ribs. Sea mammal bone is also present, but identification of it is more difficult, due to extensive alteration during manufacture. Long bones typically are split or divided longitudinally prior to manufacture into the desired tool form, while other skeletal elements are commonly not fragmented.

The process of splitting long bones for the production of tools is not completely understood. Certain evidence

Fig. 25 Range of evidence from obsidian microlithic collection. *a-b* parallel sided microblade (dorsal and ventral views respectively); bilateral edge grinding and chipping at distal end; localized ventral lateral use-chipping or battering; striking platform intact and laterally wide; trapezoidal cross-section; 9140 BP. 3.16.1*. *c* dorsal view with distal end missing; proximal battering and constricted platform; moderate bilateral edge use-chipping; 7800 BP. 3.15.4. *d* dorsal view of microflake; no evidence of use-chipping or abrasion; severe proximal and dorsal battering along arris; 7800 BP. 9.10.123. *e* dorsal view of microblade with both proximal and distal ends missing; bilateral use-chipping with apparent extensive retouch to single lateral edge; trapezoidal cross-section; 7500 BP. 9.10.42. *f* dorsal view of microblade with only proximal end intact; narrow and extensively prepared platform; moderate bilateral edge use-chipping and dorsal surface striations; triangular cross-section; 7800–6000 BP. 9.8.22. *g* dorsal view of complete microflake; proximal battering and no evidence of use marks; 7800–5000 BP. 9.7.12. *h* magnified view (not to scale) of surface abrasion occurring immediately behind obsidian graver/scraper edge (see specimen *n* figure 28); 1470 BP.

* *Artifact numbers given serve to identify the provenience of each artifact illustrated.* ElSx 1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suggests the use of splitting wedges while other evidence implies that bone was crushed with a stone while being held against an anvil. Whichever technique was employed, long splinters were the initial tool blanks. Another pattern typical of thick, heavier long bones, like those of large sea mammals, is the technique of cutting very deep longitudinal grooves in the whole or halved bone section. Evidence of cutting includes manufacturing marks plus the recovery of rhombic cross-sectioned grinding tools. After the grooves were completed, each bone segment was broken along the thin walls of attachment hence producing roughly ground "blanks" to be crafted into complex tools, such as fixed barbed points (see Fig. 33).

Surface striations on implements suggest that the tool blank was ground to its final shape with grinding and burnishing stones. The grinding marks are either transverse or about 45 degrees to the long axis, very rarely coinciding with it. Inasmuch as the difference between a ground surface and a polished one is determined by the coarseness of the abrader, it is difficult to recognize the intent of the craftsmen in this regard. Fresh bone and antler ground on Namu burnishing stones in the laboratory exhibited very smooth and almost polished surfaces. Yet from this experiment it seems probable that coarser stones were employed whenever considerable material was to be removed.

The cutting of an artifact to shape is rare and appears only in specialized tools such as points (fixed and composite barb types) and hooks. In these cases, the barbs seem to have been shaped at the barb base by cutting with a very sharp tool, but often final grinding and polishing obscures their markings. Bone blanks exhibit cutting at both ends where the bone was originally sectioned, the articulatory processes then being discarded. There is good evidence to suggest that as harpoons were being made a portion of the blank at the posterior end was left unaltered. This portion served as a handle, and then was cut off after completion of the point.

Two general kinds of manufacturing techniques were applied to stone : shaping by percussion, or by grinding and polishing. In some cases, both were employed on a given artifact. A distinction is made between the grinding and polishing of celts. Again, two celts show a shine which must be regarded as a polish, while other celts exhibit only grinding although the material could have taken a polish. Incidental to this observation is the fact that slate, which was prevalent in the site, exhibited no signs of intentional polishing or grinding.

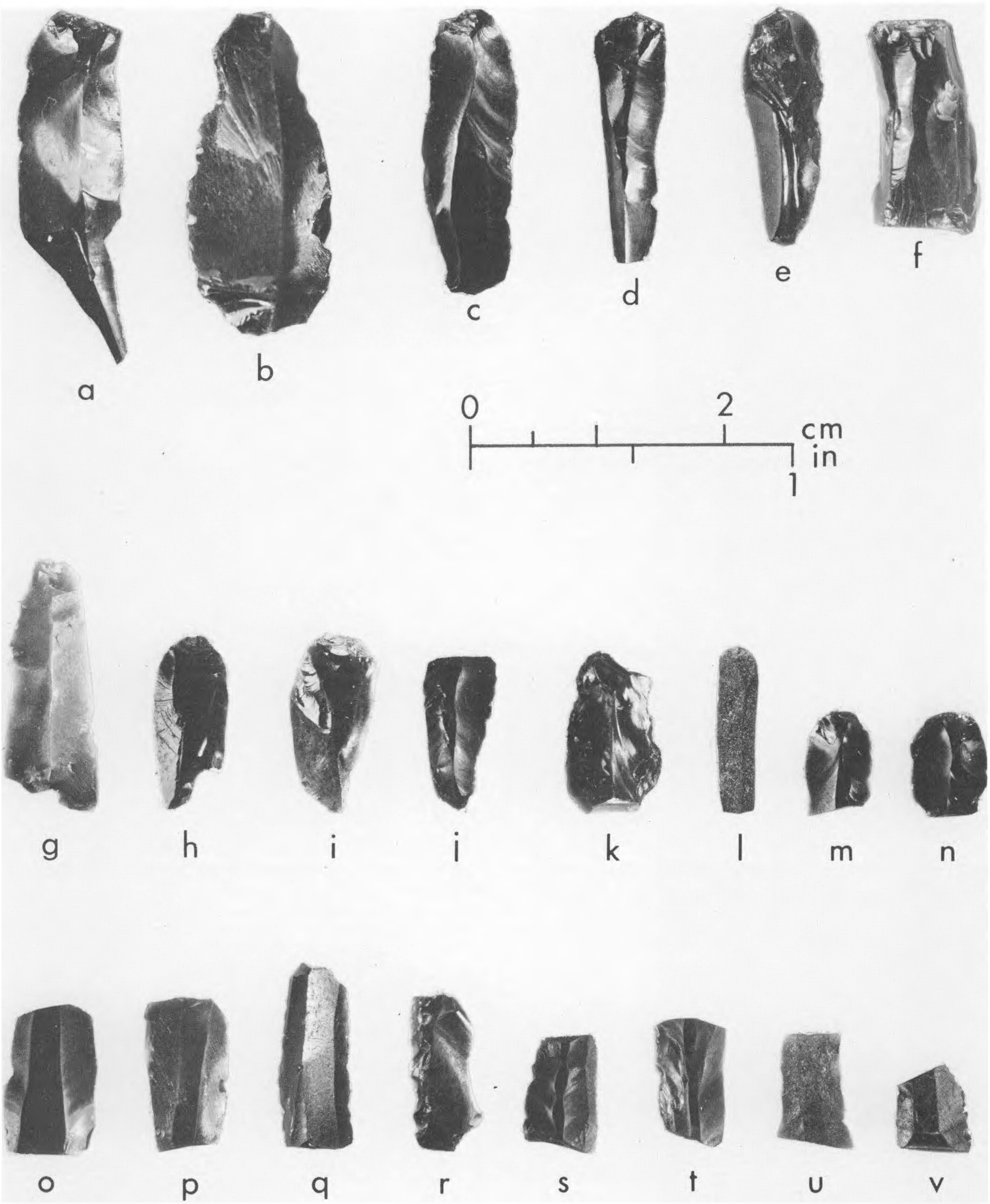
Microblades (Figs. 25, 26)

Namu microblades are obsidian tools exhibiting prepared striking platforms with the bulb of percussion commonly intact, a slightly convex ventral face, and a multi-faceted dorsal face. Sides may be parallel or may converge distally. Whether trapezoidal or triangular in cross-section, each is relatively thin, with two exceptions discussed below. Commonly one or both ends are missing, the fracture nearly straight and perpendicular to the long axis. Table VII summarizes this information.

Manufacture of microblades involves not only production of the blade itself, but many chips and flakes as well. Some are mere debitage, whereas others appear to have been put to use. Those believed to be discards are labelled "Microflakes" and appear in Figures 25, 26.

Microflakes which show use are labelled "Utilized Microflakes" to distinguish them from those possessing edge retouch. The latter are referred to as "Developed Micro-

Fig. 26 Obsidian microliths (dorsal views). *a* complete microblade with wide striking platform intact exhibiting battering; slight to moderate bilateral edge chipping which is also present laterally along the distal spur; triangular cross-section; 7800 BP. 9.10.96. *b* Microflake; no striking platform or concloidal fracture; bilateral edge chipping; rhomboid cross-section; 1850 BP. 10.11.144. *c* Developed microflake with platform and battering at proximal end; possible lateral use-chipping; distal end missing with end retouch into sharp cutting edge - use striations and abrasions present; triangular (midpoint) and trapezoidal (distal) cross-section; 9140 BP. 3.16.8. *d* Utilized microflake with broad platform – limited battering; no evidence of use patterns; distal tip missing; triangular cross-section; 7800 BP. 9.10.106. *e* nearly complete utilized microflake, broad platform with moderate battering; use-chipping to single lateral edge; distal tip missing; triangular cross-section; 9140 BP. 3.17.5. *f* multi-faceted blade with proximal-distal ends removed; proximal end battering; edge chipping to single lateral edge; light grey colour; thick trapezoidal cross-section; 9140 BP. 3.16.9. *g* proximal fragment of microflake with limited platform battering; no evidence of use patterns; triangular cross-section; 7800 BP. 9.10.169. *h* proximal fragment microflake with limited platform battering; no evidence of use patterns; trapezoidal cross-section; 9140 BP. 8.14.4. *i* developed microflake with proximal end retouch; trapezoidal to triangular cross-section; 7800 BP. 9.10.105. *j* distal fragment of developed microflake with distal tip retouch and slight bilateral use-chipping; trapezoidal cross-section; 7800–5000 BP. 9.7.10. *k* proximal fragment of utilized microflake with slight bilateral use-chipping; trapezoidal cross-section; 7800–6000 BP. 9.8.26. *l* proximal fragment of microflake (poorly vitrified); no evidence of use marks; triangular cross-section; 7800–5000 BP. 9.7.17. *m–n* proximal fragments of microflakes with limited platform battering; no evidence of use marks; trapezoidal cross-sections; 7800 BP–5000 BP. 9.10.52 + 9.7.7. *o* Microblade medial fragment with possible use chipping; trapezoidal cross-section; 7800 BP. 8.14.3. *p* Microblade medial fragment with possible use-chipping trapezoidal cross-section; 7800–5000 BP. 9.7.14. *q* Microblade medial fragment with steep bilateral edge retouch; trapezoidal cross-sections; 6800–4540 BP. 4.11.16. *r* Microblade proximal fragment with severe, steep lateral retouch to single edge; platform removed, but most of bulb of percussion intact; triangular cross-section; 7800 BP. 9.10.122. *s–t* two fragments comprising single microblades – proximal/distal ends missing; use-chipping and retouch on single edge; trapezoidal cross-section; 7800 BP. 9.10.53. *u* Microblade medial fragment with no evidence of use marks or retouch; poorly vitrified; trapezoidal cross-section; 7800 BP. 8.13.1. *v* microblade medial (?) fragment with extensive bilateral ventral edge retouch; trapezoidal cross-section; 7800 BP. 9.8.28.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flakes", but neither is necessarily regarded as a direct by-product of microblade manufacture.

Table VII Namu microblades. quantitative attributes

	Attribute	No.	Range	Mean	s.d.
Total Collection	(mm)	39			
	length		4.3-35.5	14.0	6.0
	width		3.0 8.8	6.1	1.3
	thickness		.9-3.0	1.7	.59
	T/W index		17.1-46.6	27.7	8.5
Complete Specimens	(mm)	6			
	length		11.6-23.0	17.0	4.3
	width		3.0-7.9	5.4	1.7
	thickness		1.4-2.7	1.7	.53
Prox./Distal Squared	(mm)	17			
	length		7.1-27.0	13.5	5.5
	width		4.1-8.8	6.1	1.2
	thickness		.9 3.0	1.8	.58

Figure 25 illustrates the range in form, manufacturing evidence and wear marks within the collection under higher magnification than the following artifact plates. Figure 26 illustrating a large number of microblades, again shows the range of variation. Wear evidence is well represented in individual microblades and provides limited clues regarding function. We infer that the high frequency of distal-proximal squaring (26o-v) relates to hafting requirements. Retouch and wear marks typically occur along lateral edges when present. Specimens 25e and 26r represent cases of extreme lateral retouch and wear. On the other hand, many specimens exhibit only slight, but patterned, lateral edge chipping, the result of use. Surface abrasions are concentrated on a few microblades. These do not appear to be associated with the tool's manufacture.

Specimen 25a is unlike all other microblades at Namu by virtue of its uniform parallel lateral edges, wide striking platform, and length (35.5 mm), all of which reflect the form of the core from which it was struck. In addition it possesses bilateral edge chipping and grinding of these edges. The grinding created two flat straight contracting edges at the basal (distal) end. No other grinding is present on the tool.

Battering of the striking platform's dorsal face is a common attribute. In most cases this battering is neither severe nor widespread. In a few cases a small portion of the proximal end has been removed, along with some of the bulb of percussion, hence removing most of this battering. Specimen 25f represents the best example of a well defined and battered platform, while 25d has a less well defined but more severely battered platform.

An examination of the proximal ends of specimens 25d and g and 26 d and e raises questions concerning their manufacture. While proximal battering is frequent, the appearance of other proximal edges suggests that the striking platform may not have been prepared in all specimens. In the Aleutians a distinction has been noted between prismatic blades and "ridge flakes" recovered at Anangula (Laughlin and Aigner 1966:42-3). This evidence supports an argument for the simultaneous production of microblades and microflakes.

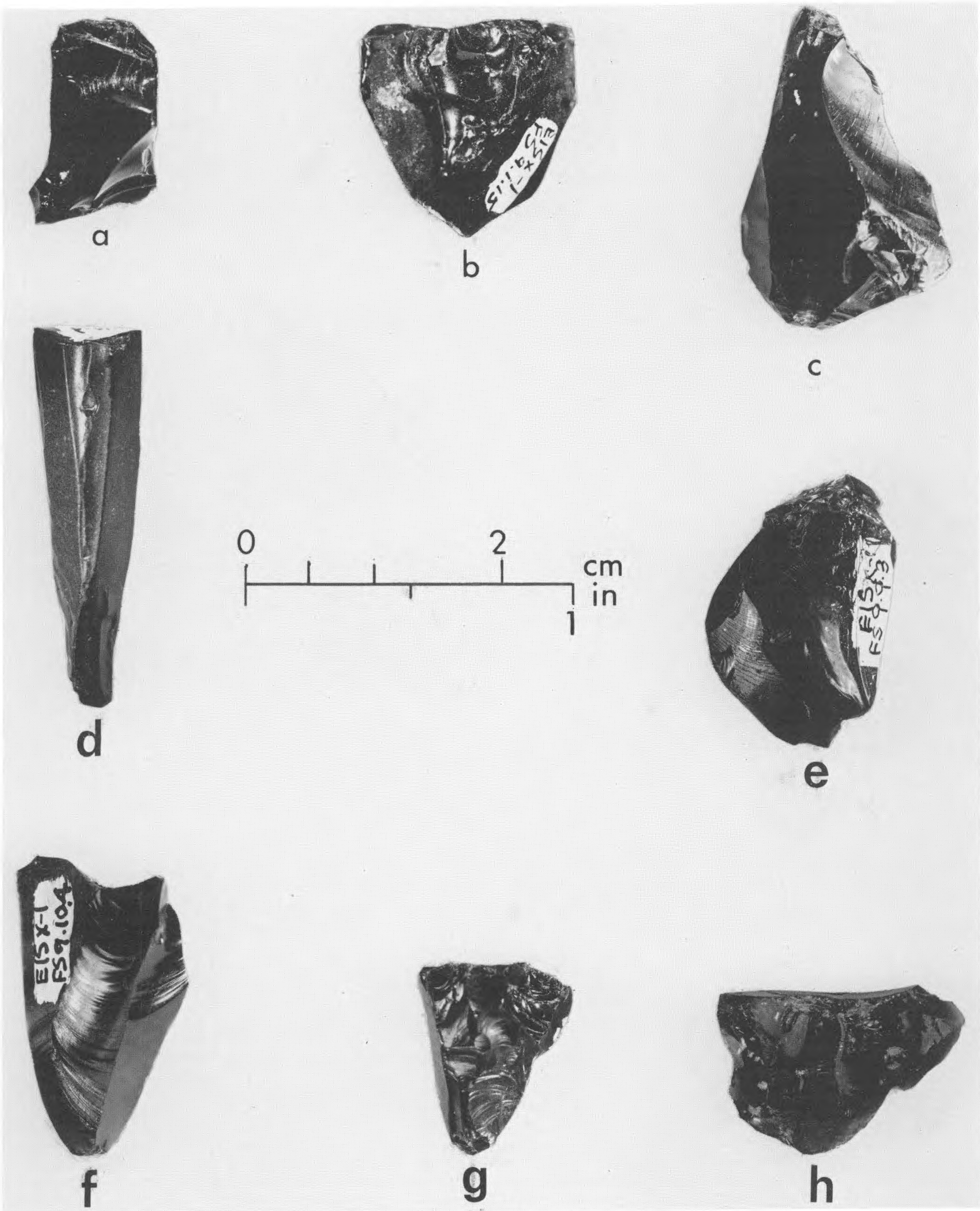
On the basis of wear patterns, the functional role of the Namu microblades was one of cutting, like that of a chisel or knife. Two modes of hafting are suggested in this collection on the basis of retouch and wear patterns appearing on mutually exclusive areas on the microblade's edges. The first involves inserting the obsidian into the side of a shaft and fastening it either by a friction fit or some type of adhesive. Only a single lateral edge shows use in this style. Hafting of the microblade at either of its ends, with binding or cementation securing it, comprises the second pattern. Specimen 26f is an example of the second pattern. This "straight pen haft" was described by Giddings (1964:272) and proposed for microblades by Sanger (1968b:201).

Bone material recovered from our excavation fails to provide any information on hafting. The fact that distinct hafting techniques were employed is inferred from presence of both lateral and distal edge retouch, but we don't know if this indicates separate functional roles for each. The high frequency of distal/proximal squaring supports this inference, but might also be the result of accidental fracturing.

Microcores

The collection of microcores (Fig. 27) is small and cannot easily be characterized. Most are fragmentary, irregular in form, and exhibit few, if any, platform preparation marks. Facet scars appear on single faces and rarely exceed two in number. Specimens b, e, and f are unifacial on the reverse side as illustrated indicating that a single blow

Fig. 27 Obsidian Microcores. *a* irregular flakecore fragment; single faceted platform with very little evidence of platform preparation; 2440 BP. 9.3.5. *b* irregular flake core fragment with moderate surface erosion; no evidence of platform preparation, although a single faceted platform face is present 1880 BP. 9.1.15. *c* irregular core with wide facet scars; single point platform; bipolar battering; 9140 BP. 3.17.6. *d* regular prismatic microcore; hexagonal cross-section; uniform surface pitting; proximal end missing; possible battering to keel 980 BP. 10.10.9. *e* core fragment (?); reverse face unifacial; severe proximal battering with irregular facet scars; 9.9.3. *f* irregular core fragment; bipolar battering, single facet platform; 7800 BP. 9.10.4. *g* prismatic core fragment; irregular surface scars with apparently arbitrary placement; distal tip battering; 7800 BP. 9.10.39. *h* irregular core fragment (?) exhibiting positive scars from pressure tool located across single facet platform; no evidence of bipolar battering; 1840—1470 BP. 10.13.51.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removed them from their parent source. Distal end battering (the end opposite the platform) exists in specimens c, f, and g (the term used by Sanger is "keel'). Platform battering is present in a, b, c, e(?), f, g, h. The striking platforms of specimens b, f, g, h are single faceted, slightly concave and exhibit no grinding or battering on the surface. The remaining specimens have irregular platforms (when present) with no flat surfaces, and are characterized by severe battering.

The microcores are assumed to be the source of microblades and may even have produced microflakes. The form of these cores and the nature of their striking platforms are unexpected,however, if we assume the microblades in the collection were produced from them. With the possible exception of specimen d, most of these microcores could not have produced the parallel sided microblades such as 25a, 25e, or 26f, 26l, and 26o-v. Instead, they could have produced more tapered irregularly shaped microblades such as 25d, 26c, g, or i. On the basis of its nearly parallel fluted scars however, 27d conceivably could have produced parallel sided microblades such as 25a.

As mentioned above, evidence of prepared striking platforms is not always convincing. Still unclear is the extent to which the core was prepared for blade removal. If we are to accept the specimens in Figure 27 as microcores, the evidence for platform preparation is very limited. Most exhibit no tablet but rather a single irregularly shaped facet or point from which flakes or blades were struck. This evidence suggests that both flakes and blades were struck from similar if not the same cores. Hence, any microcore could yield tools in a variety of shapes and forms. Thus, the production of micro-' ridge flakes' is plausible.

We conclude from these observations that either few of these specimens are in fact prepared microcores, or that two forms of microcore exist at Namu. Because only one microblade type is present — namely, those with portions of the striking platform intact and with even, parallel sides—we prefer the former conclusion. Rather than cores, these specimens (with the possible exception of 27d) would appear to be by-products of core preparation, including rejuvenation flakes and tablets.

The radiocarbon age of microcore 27d (980 BP) was totally unexpected and at variance with the distribution of other microblades and cores. It should be noted however, that the entire surface is pitted and weathered, especially along exposed ridges. This condition is rare in the obsidian collection as a whole, thus its presence suggests stratigraphic displacement. Typologically, this tool is similar to those from an older stratigraphic unit. Owing to the uncertainty of its placement, the microcore is assigned to the latest unit from which other cores were recovered.

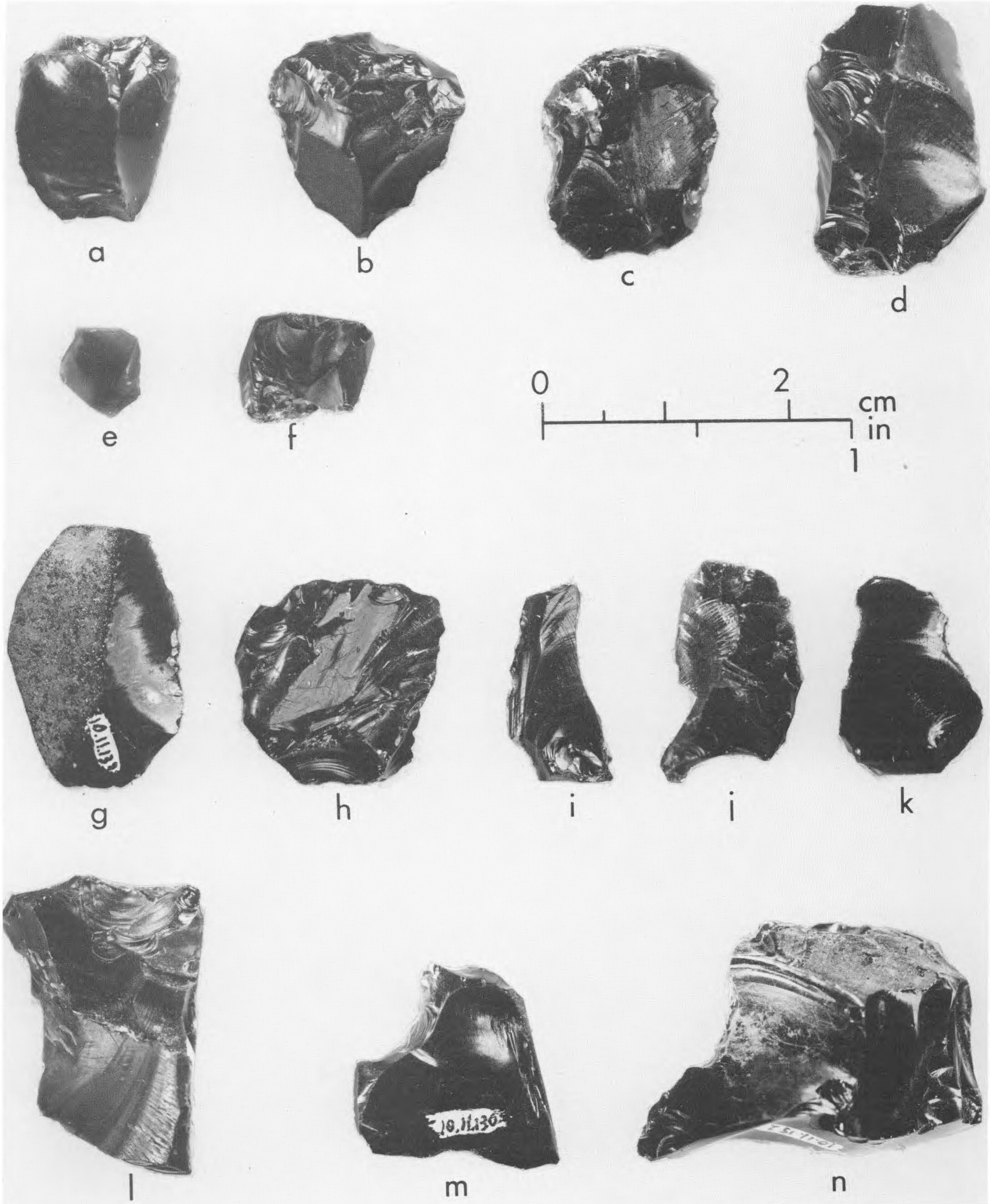
Utilized and Developed Flakes, Scrapers, and Gravers of Obsidian

Utilized flakes occur in a wide variety of forms, the most common being an amorphous, unifacial flake, irregular in cross-section. Wear patterns are limited to localized chipping or abrasion on an otherwise sharp edge. These flakes are frequently large enough to be held between the fingers. The limited wear suggests they were utilized briefly. We infer that they were used to cut or incise bone or wood.

Flakes altered by secondary retouching after removal from the core are considered to be developed flakes fashioned for a specific task. The end scrapers and gravers are included within this classificatory distinction. The end scrapers (Fig. 28) are thick, unifacial flakes whose proximal (anterior) leading faces are obtuse, multifaceted, and curvilinear. Their working edges are sharp. The wear patterns include abrasion and battering located along the edge. Lateral and distal (posterior) edges are heavily retouched so that the posterior portion of the tool is narrower than the anterior, as viewed in plan.

Specimens l-n comprise another kind of scraper with a function similar to that of a spoke shave. Like the end scraper, its leading face is obtuse and concave. The wear patterns of n indicate that it was drawn across the surface of the material being crafted sustaining considerable surface abrasions. The shape of n suggests that it was formerly a projectile point, the base of which was then used

Fig. 28 Obsidian end scrapers, developed and utilized flakes. End scrapers: *a* complete, with steep proximal edge; triangular cross-section; distal percussion damage during initial flake removal; bilateral edge chipping suggests hafting method; date unknown. 4.0.50. *b* identical to *(a)* above except distal battering absent and cross-section is thick triangle; 1850 BP. 10.14.13. *c* complete, with extensive bilateral edge modification; cross-section roughly plano-convex; 1840–1470 BP. 10.13.27. *d* similar to *(a)* above except cross-section is roughly trapezoidal; 1470 BP. 10.11.154. Utilized and developed flakes: *e* utilized graver/chisel with retouched and use-abraded straight cutting edge; 9140–7800 BP. 3.16.7. *f* developed flake fragment of unknown function; bifacially developed edge exhibits cutting abrasion marks; 9140–7800 BP. 3.16.6. *g* utilized flake with localized edge use-chipping; 1470 BP. 10.11.133. *h* utilized flake with limited evidence of use marks; surface weather-polished; 1840 BP. ? *i* developed flake with moderate retouch to single lateral edge; no evidence of use marks; 1470 BP. 10.11.130. *j* developed knife with unifacial converging retouch along lateral and proximal edge; slight use abrasion marks; 1470 BP. 10.11.136. *k* utilized flake with localized bilateral edge chipping; no sign of proximal wear; 2440 BP. 9.3.37. *l* developed scraper/spoke shave with retouched and use damaged proximal edge; distal end removed and lateral corner abrasion patterns suggest hafting technique, 1470 BP. 10.11.143. *m* developed scraper/spoke shave with moderate edge use-abrasion; 1470 BP. 10.11.130? *n* developed spoke shave with intensive use abrasion patterns on surfaces immediately distal to cutting edge; retouch pattern around edges suggest this specimen may have been a projectile point now re-fashioned; 1470 BP. 10.11.152.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as a scraper after being broken. These tools are presumed to have been used on both wood and bone.

Core Flakes

Core flakes (Fig. 29) are so named because they were removed from large cores. They are unifacial, relatively thin flakes exhibiting an unprepared striking platform (at the bottom in the photographs). Crude secondary flaking frequently occurs around the periphery terminating at the platform. No evidence of wear appears on these flakes, however. Specimen g, a developed flake, indicates a possible final form of the core flakes. It is unifacially retouched and shows possible wear along much of its curvilinear edge. Evidence of the removal of large flakes from these specimens suggests that they may also have functioned as flake cores.

Choppers, Cores, and Developed Flakes

The occurrence of large heavy choppers is common to many Northwest Coast sites. Those occurring at Namu do not conform to a particular form but are bifacially flaked and battered, usually along a single working edge (Fig. 30a, b). The form of the parent material dictated somewhat the final shape and thickness of the tool, as no flakes were removed from the central portions, but instead were struck only from the periphery. Bipolar battering is localized in a, while it occurs across the entire edge in b. The sizes and weights suggest that these specimens were used in two hands, rather than one. The function of these tools is unclear. A chopping motion is implied from the wear on these specimens only if we assume that soft nonabrasive material was processed. The choppers could have been used to crush bone or fibrous material.

Large Prismatic Cores

Only five large prismatic cores were recovered at Namu (Fig. 30 d-e). These cores possess wide flat platforms located at both ends from which flakes were struck. Specimen d exhibits preparation scars at a single location along the edge. The scars resulting from flake removal typically extend completely across the core and terminate at its distal end. On the basis of size and form of these cores, it appears that core flakes (Fig. 29) were struck from them.

Developed Flakes

Developed flakes (Fig. 30 h-j), possess specialized attributes. Specimen h is a unifacial flake, the anterior portion of which has been retouched to form a concave edge. Within a narrow range of cutting angles, this tool has experimentally been determined to be an effective cutting instrument. Specimen i is a unifacial flake on which a scraping edge was fashioned on a single lateral side; its face is obtuse and multifaceted from repeated resharpening. Like h, it was used to create rounded and smooth surfaces. Most edges were dulled to make it fit more comfortably in the hand, or to provide a more secure haft. Specimen j is an asymmetric, unifacial flake. However, its wear is insufficient to provide evidence of its function.

Burnishing Stones and Utilized Flakes

Burnishing stones were important in the manufacture of bone implements. Those in the collection (Fig. 31) exhibit a uniform granular structure. Longitudinal striations concentrated at either end, but occurring throughout, indicate the mode of operation. Specimen a is of irregular shape, is relatively hard being an intrusive stone, and was not formally shaped. Specimens b and c are bifacial, have granular abrasive surfaces exhibiting two distinct grits, and the edges of both ends were formally shaped. Generally, the ends are tapered, and the edges thin.

Surface polishing and manufacturing marks indicate that the final preparation of a bone artifact was accomplished by a tool which could remove bone and polish it at the same time. The burnishing stone can be used for both operations since a fine bone powder is produced which when rubbed into the bone structure enhances the polish and the tool's resistance to deterioration. Damaged tools can be sharpened in the same manner.

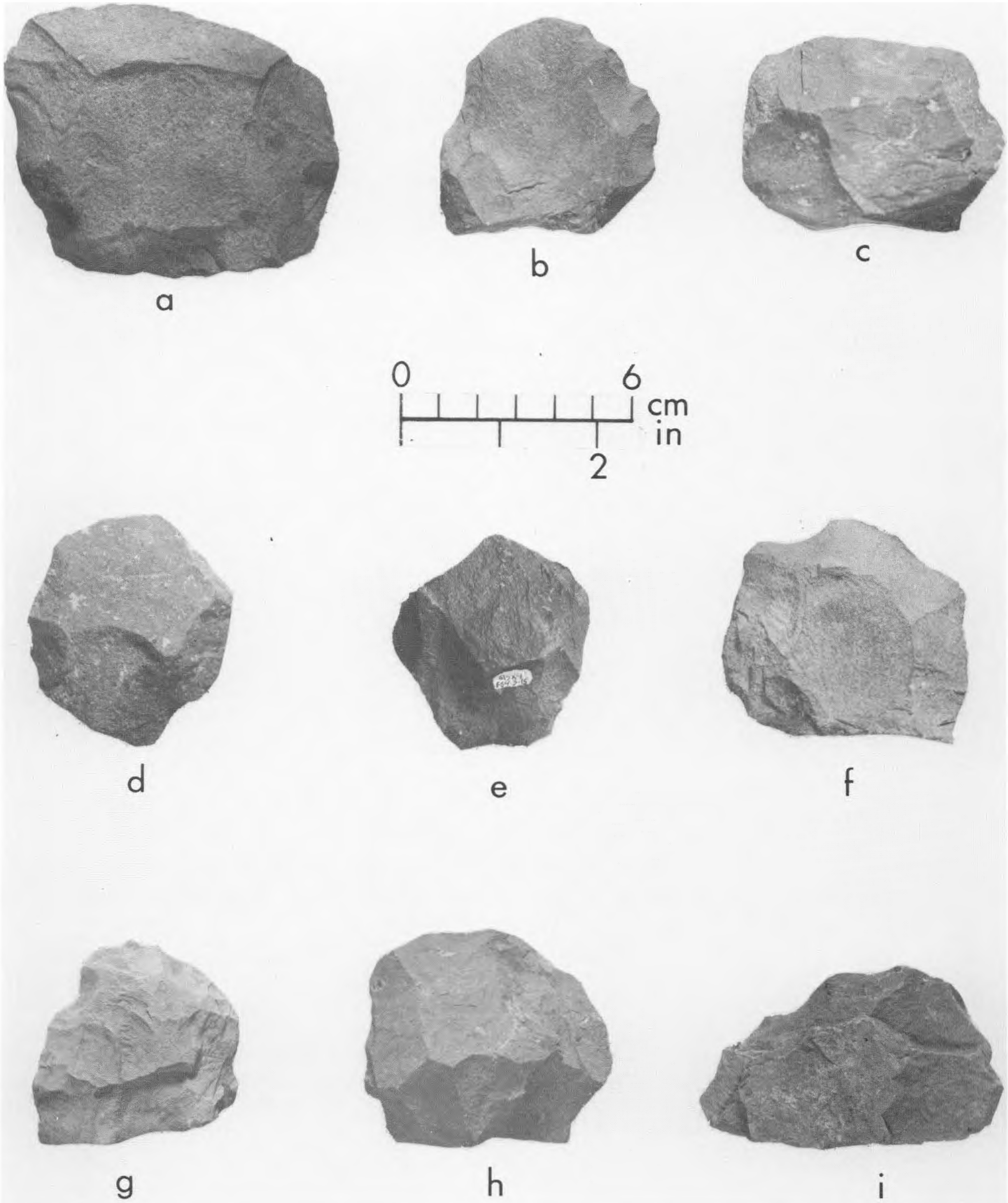
Utilized Flakes

Utilized flakes, (Fig. 31 d-h) are unifacial flakes with slight wear in localized areas along the flakes' edges. The dorsal facets are regular with their edges converging along the mid-point. The cross-sections, therefore, are triangular. Large prismatic cores such as d-e, are believed to be the sources from which these flakes were struck. Use evidence takes the form of abrasion.

Crude Bifacial Projectile Points

Crude bifacial projectile points were recovered from the earliest depositional phases of the Namu midden and exhibit a wide range of forms (Fig. 32 n, p-t). The distinguishing characteristics of these as a group include small irregular shape, thick rhombic cross sections with high

Fig. 29. Core flakes. *a* unifacial flake (material unidentified); 1840–1470 BP. 10.13.35. *b* basalt bifacial flake; 1880 BP–present. 1.2.3. *c* bifacial flake (material unidentified); date unknown. ? *d* granitic bifacial flake; date unknown. ? *e* basalt bifacial flake; 2440 BP. 9.3.15. *f* basalt unifacial flake; 1880 BP. 9.1.41. *g* developed unifacial flake (material unidentified); 7800 BP. 9.10.12. *h* unifacial flake (material unidentified); 7800 BP. 9.10.127. *i* unifacial flake (material unidentified); 7800 BP. 9.10.125.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central ridges and comparatively rough, angular edges and surfaces. The stone material from which these points are made is also more variable than is the case later in time. No evidence of wear was observed nor is there any formal shaping or modification of the posterior portions to indicate the type of haft.

Leaf-shaped Projectile Points

Leaf-shaped projectile points (Fig. 32 c,d,e,g,m,o) are thinly biconvex in cross-section and exhibit a posterior constriction presumably for hafting. The edge flaking along parallel to converging sides is delicately executed, creating sharp lateral edges as well as a sharp anterior tip. To a degree the parent material influenced the angularity of the surface flakes. Specimens c and e are especially delicate and sharp, while d and m, which are basaltic, are less refined. Specimen t is thick and exhibits deeper surface scars and clearly is different in degree. The range of lengths observed in this collection is smaller than in the crude projectile point group.

Lanceolate Points

The lanceolate projectile points are generally composed of large, long slate or basalt blades with rhombic or biconvex cross sections (Fig. 32a,b,h-j). The anterior tips and both lateral edges are very sharp and well made. Only a is wide and flat, with a constricted tanged stem. Bases on the remaining points are gently curvilinear, with the exception of h, which is pointed and sharp. Remnants of the striking platform remain in the posterior base of j.

Specimens h-j were uncovered with burial FS 4.H and are presumed to be evidence of his importance and one means by which he obtained a livelihood. No wear was observed on the blades, nor were they damaged. Specimens a and b were found in close proximity and are believed to be associated with burial FS 9.OA, an infant. The anterior tip and the two faces behind it are abraded and worn smooth, as are certain other scar ridges on its surface. Both blades are thin in cross-section and their edges remain very sharp.

Barbed Bone Harpoons and Fixed Barbed Points

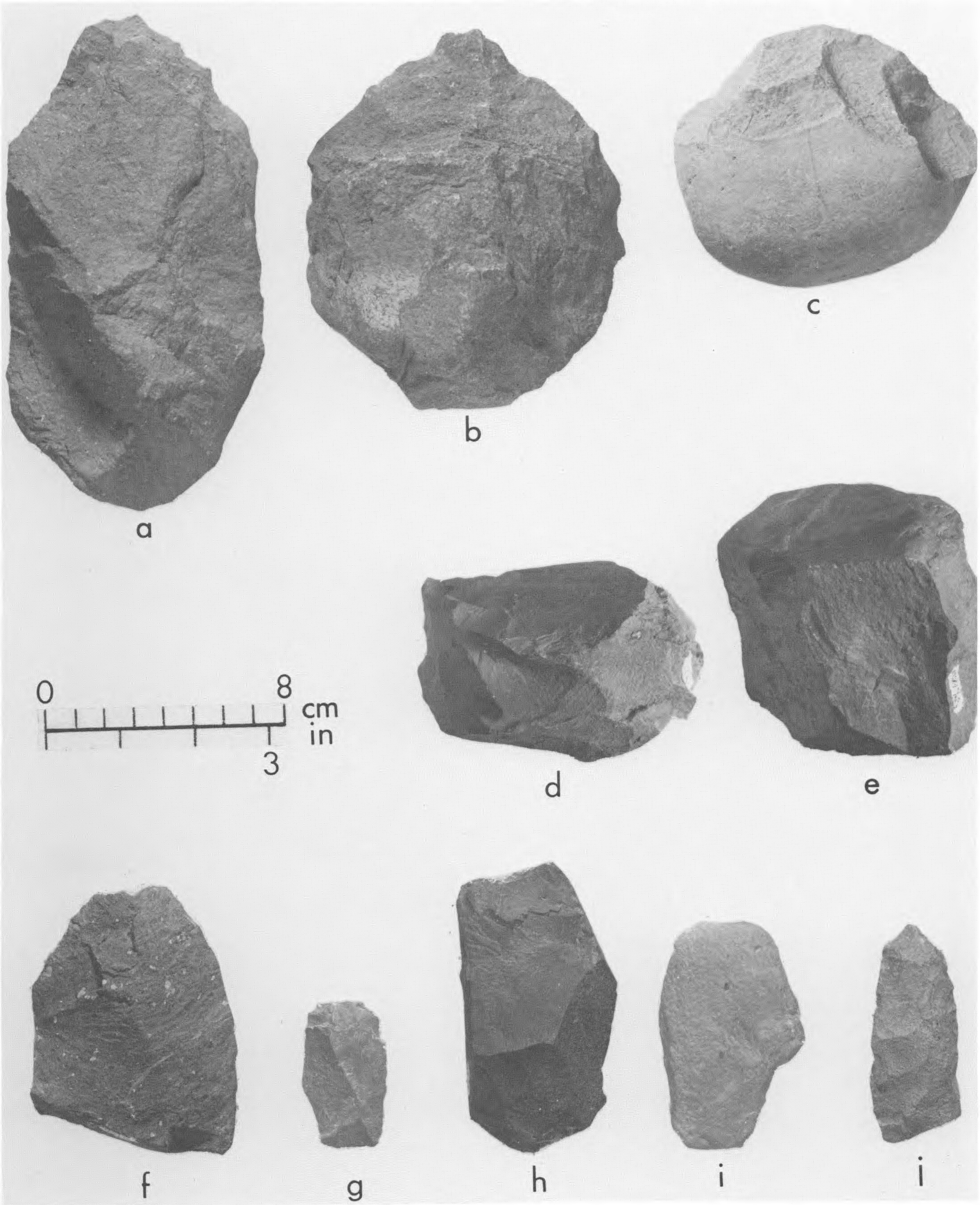
The barbed projectiles (Figs. 33, 34, and 40b and c) occur in a wide variety of forms; all were studied as a group. They appear in chronological order in the illustrations. Basal stems present in complete specimens taper posteriorly. Cross-sections at the midpoints range from flat rectangular (34g) through ovoid (34c), to irregular (33a and b). Where intact, anterior tips and barbs are pointed but rarely sharp. Wear patterns occur on the front leading edges of each barb and at the anterior tip. Occasional evidence of hafting (compression scars) or line attachment is apparent on certain artifacts (33k and 34h). Except when indicated, all of these projectile heads are bone. The preservation of these artifacts is conditioned by the length of time each was buried within the midden with deterioration increasing with age. In 33i j and k however, these oldest heads are well preserved due to the fact that their surfaces were finely worked, perhaps with a burnishing stone. Specimen 33f, which is nearly as old as the three others, was uncovered in the more erosive black matrix and hence experienced chemical weathering. The outer layers of bone in 34i have exfoliated as a result of *in situ* weathering.

Barbs project toward the rear and with the exception of 34a and 34b, extend beyond the width of the body as seen in plan view. Barbs on the two exceptions are located at the tip only and taper forward in diminishing sizes. Only one example of serrated barb edges is present (42h). The widths of barbs at their bases commonly conform to the shafts' widths, except for those of 34n which are inset and 33a and b whose body dimensions are irregular. Manufacture marks at the base of each barb suggest that a burnishing stone was used to "file" the posterior edges flat and smooth. An extreme example of this can be seen in 33h-j and in many line guards.

Line guards are present on all harpoon heads whose posterior portions are intact. They occur in three forms. The most common form is a series of cuts located on one or both lateral edges immediately anterior to the basal stem. The second most common pattern is the unnotched basal stem in which a basal constriction separates two extended nodules. Specimens 33f, 33k, 33h, and possibly 34n are examples. Specimen 33k fits into a tapering socket in the shaft as indicated by compression scars at the posterior shoulder and tip. The third pattern consists of attachment with the line being inserted through a hole, as seen in 34e.

Four harpoon heads (33e and h-j) resemble each other. Of special note is their wide outward flaring barbs and

Fig. 30 Choppers, cores, and developed flakes. Large hand choppers: *a* bifacially flaked with slight secondary edge retouch; (material unidentified); pre-4540 BP. 2.12.1. *b* bifacially flaked at anterior edge (material unidentified); 7800–4540 BP. 1968 T. Pit Lev. 13. *c* bifacially flaked cobble with edge battering (material unidentified); 7800–4540 BP. 2.13.2. Large prismatic cores: *d* prepared platform with localized multiple flake scars (material unidentified); 2440 BP. 5.4.1. *e* unprepared (fortuitous), multi-faceted platform (material unidentified), 2880–1840 BP. 10.16A.9. Large utilized flakes: *f–g* basalt; no evidence of use marks; 3400–1840 BP (see figure 31). Lev. 13. 1968 T. pit. 10.13.84. Large developed flakes: *h* Developed scraping edge with positive retouch (material unidentified); 1840–1470 BP. 10.13.49. *i* Developed scraping or cutting edge (material unidentified), 1840 BP. 10.14.10. *j* Developed asymmetric knife edge; basalt (?); 7800–4540 BP. 7.12.1.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identical line attachment guides. Each barb is further accentuated by deep forward curving incisions at its base.

Bone Projectile Points

The presence of single element bone projectile points (Fig. 35a and b) is uncommon in the Namu collection and their provenience is uncertain. Basically these points resemble certain stone counterparts in that they have biconvex cross-sections, moderately wide shoulders which taper to an anterior tip, and some type of basal stem (specimen 35a). Whereas the posterior portions of b are missing, its lateral edges are thin and sharp. Moderate tip damage is the result of percussion in both artifacts. The small sample and fragmented condition limit our assessment of their functional roles.

Toggle Valves

Our collection of toggle harpoons contains two valves and one pre-formed antler blank. The elements are described in many ethnographic accounts. In form they conform closest to Drucker's "Type 1 composite harpoon" (1943:39-40). Each valve constitutes half of the body of a composite harpoon head, the posterior portion of each functioning as a barb while the posterior cavities form a socket for the shaft once the components are assembled. The anterior cavity could have received rounded shafts, possibly a sharpened bone.

Composite Projectile Point Heads

This class contains complexly formed elements resembling the "Class B fixed bone projectile points" (Drucker 1943:39), which ethnographically are arrow and dart points. Most of those illustrated (Fig. 35e-m) were recovered from ElSx 3, although four came from Namu. In form they are sharply pointed, parallel-sided shafts with a thin and constricted segment approximately three-quarters of the length behind the tip and a concavity at the posterior end. This end is tapered and may be outwardly beveled (35g, h, and j). The natural cavity of the bone is retained to become a distinctive feature of the tool. Some outward flaring of the posterior segment is noted (35g and l). With two exceptions, i and m, the anterior tip exhibits extensive damage by percussion. Severe tip damage is a common occurrence suggesting that resharpening was necessary. By virtue of its outstanding length and very sharp tip, specimen 11m is in prime condition and almost unused. The continual process of resharpening would result in shorter forms, such as 11i, which shows a freshly sharpened tip. These projectile points may have been elements of a composite harpoon head.

Bone Wedges

Bone wedges are not common in the collection, and are represented by three poll ends. These wood-working tools are made from dense land or sea mammal bones with the surfaces roughly finished (Fig. 36a) or completely finished (36b and c). The anterior edge is beveled or symmetrically tapered in side view, with the edge and shoulder exhibiting compression scars and slight burring due to percussion.

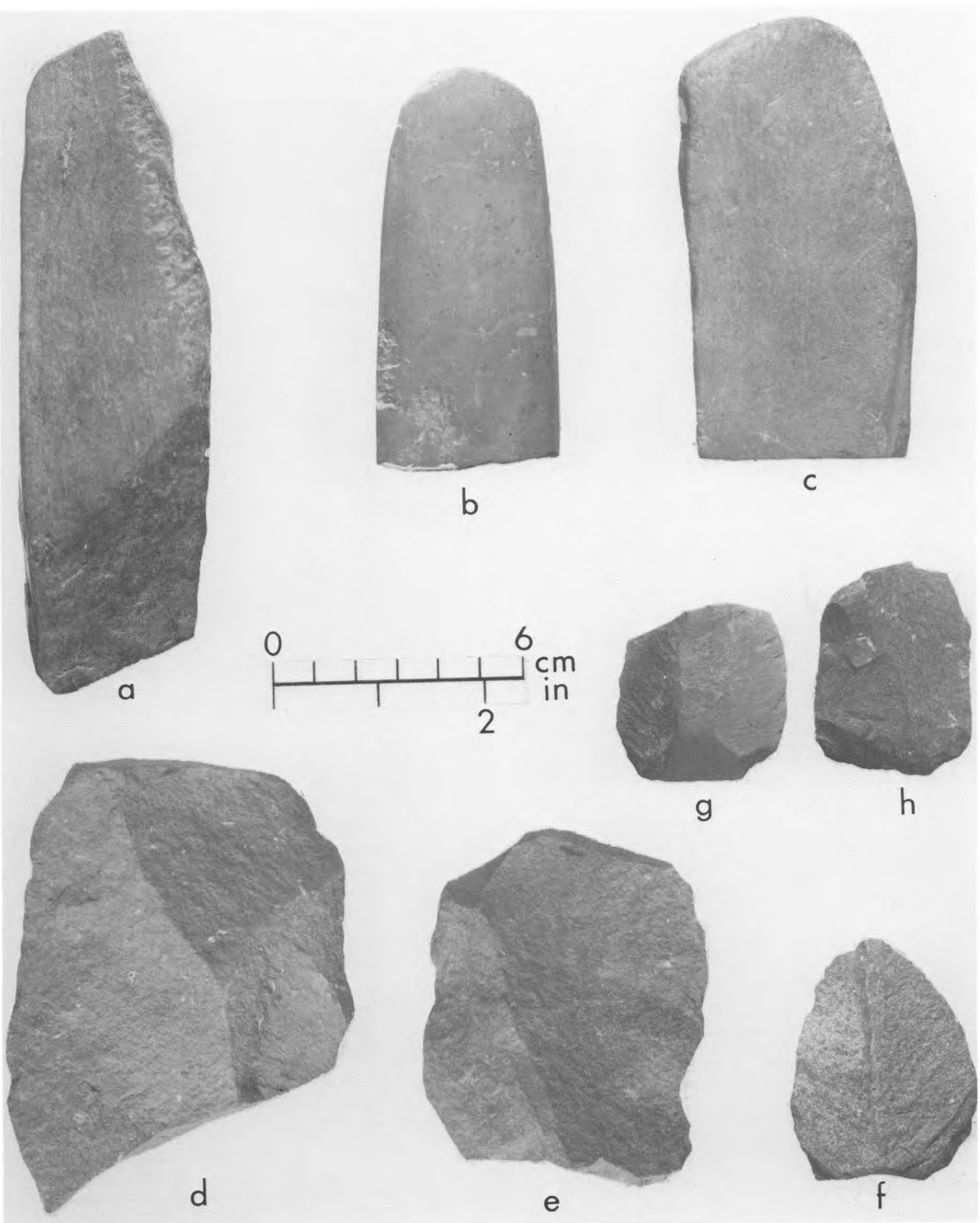
Ground and Polished Celts

A distinction is made between two celt forms on the basis of the presence of surface polish. The ground and polished celts (Fig. 36d, e) are larger and more massive than those without polish. They have thick regular cross-sections and symmetrically tapered faces which converge sharply at the anterior edge. All surfaces have been ground smooth and polished. The lateral edges received less polish, while the basal edges are obtuse but curvilinear in plan view. All wear appears as severe damage to the working edge and shoulder and there is no indication of wear polish from hafting. Specimen 36e has deep natural surface contours with pitting, while 36d's surface has been completely modified. A single posterior face on each celt has beveled corners.

Ground Celts

Ground celts, (Fig. 36f-h) are smaller and thinner than the ground and polished celts and exhibit cross-sections ranging from rectangular to ovoid. Poll ends are intact, regular, curvilinear, and obtuse. Lateral edges were prepared only on specimens with a rectangular cross-section. Few are sufficiently complete to enable reconstruction of form, but it is clear that a wide range of forms exists. All the celts were made from similar stone material. All fragments are fractured on both poll and bit ends, although 36h exhibits flake scars created by lateral blows. This specimen was refashioned into a cutting instrument and these blows may have been caused by that process. The fragmentation patterns of celts produced fractures occurring at either end, but located laterally at each edge. This pattern suggests the celts were end-hafted so that the axes of celt and shaft were parallel. Assembled, the mode of operation may have involved the use of large stones or

Fig. 31 Burnishing stones and utilized flakes. Burnishing stones: *a* very fine-grained, hard irregular surface; 980 BP. 10.10.7. *b* coarse and fine-grained surfaces — formal shape; ElSx 3; 1860—1200 BP. 2.7.1. *c* coarse and fine-grained surfaces — formal shape; 1470 BP. 10.12.76. Large Utilized Flakes: *d–h* unifacial basaltic flakes with possible evidence of localized use marks along lateral edges. No secondary retouch — occasional surface abrasions. 3400—1470 BP. *d* 9.1.11; *e* lev. 13 T. pit; *f* 10.13.34; *g* 9.3.16; *h* 10.11.156.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heavy timber to drive the celt into wood or bone, thus splitting it. The smaller ground celts received greater damage than the larger ground and polished forms particularly in the posterior areas.

Mussel Shell Adzes

A sharp, beveled bit end is the diagnostic feature of the parallel sided shell adze (Fig. 36i-k). The fragile nature of the shell is responsible for the lack of complete specimens. The size and shape of the adze may be a result of the form of the material, *Mytilus californianus.* Lateral edges are straight and rounded, except in 36k which has a beveled edge.

Bone Barb-points

Many sharpened bone points are grouped together due to similar morphology, tip patterns, and wear. These are considered to be elements of composite tools and are termed barb-points because they could perform as either points or barbs, or both. A description of each group follows.

Outcurving Barb-points

Outcurving barb-points (Fig. 37) possess a gently curving posterior point which is either blunt (h) or pointed (f and g). The form is due to the natural curvature of the bone, but is accentuated by posterior beveling and anterior thinning of the same face. Lateral edges are either parallel, in which case the shaft is narrow, or forward tapering, in which case the shaft is comparatively wide. The natural internal channel of the bone is always retained and seems to be essential to the assembling of the head. Severe percussion damage to the tip occurs in a single case (h), whereas slight percussion and abrasion are typical for the group as a whole. Two specimens exhibit midshaft polish.

Square-end Barb-points

The diagnostic feature of the square-end barb-points (Fig. 37, l-x) is the slightly tapering, square posterior end of the shaft, which is more finely shaped than other barb-points. The midshaft cross-section of these tools is rectangular and regular. The anterior portion features round, symmetrical shoulders with moderate tapering and a sharp tip. Wear patterns occur only at the anterior tip and consist of polish or abrasion. The posterior edges are frequently rounded but rarely beveled (r). Posterior thinning is common.

Posterior Beveled Barb-points

The lateral extent of the bevel distinguishes the beveled barb-point (Fig. 37y-ee) from the square end barb-point. Involving the entire posterior face of the shaft, the bevel begins at the wide mid-shaft and terminates posteriorly at a sharp edge. The reverse face remains straight, with occasional thinning. Lateral edge development is irregular. The anterior morphology consists of a sharp symmetrical point and moderately tapering shoulders. Wear patterns, limited to the anterior tip, include moderate percussion and abrasion. Specimen cc exhibits identical midshaft side notches.

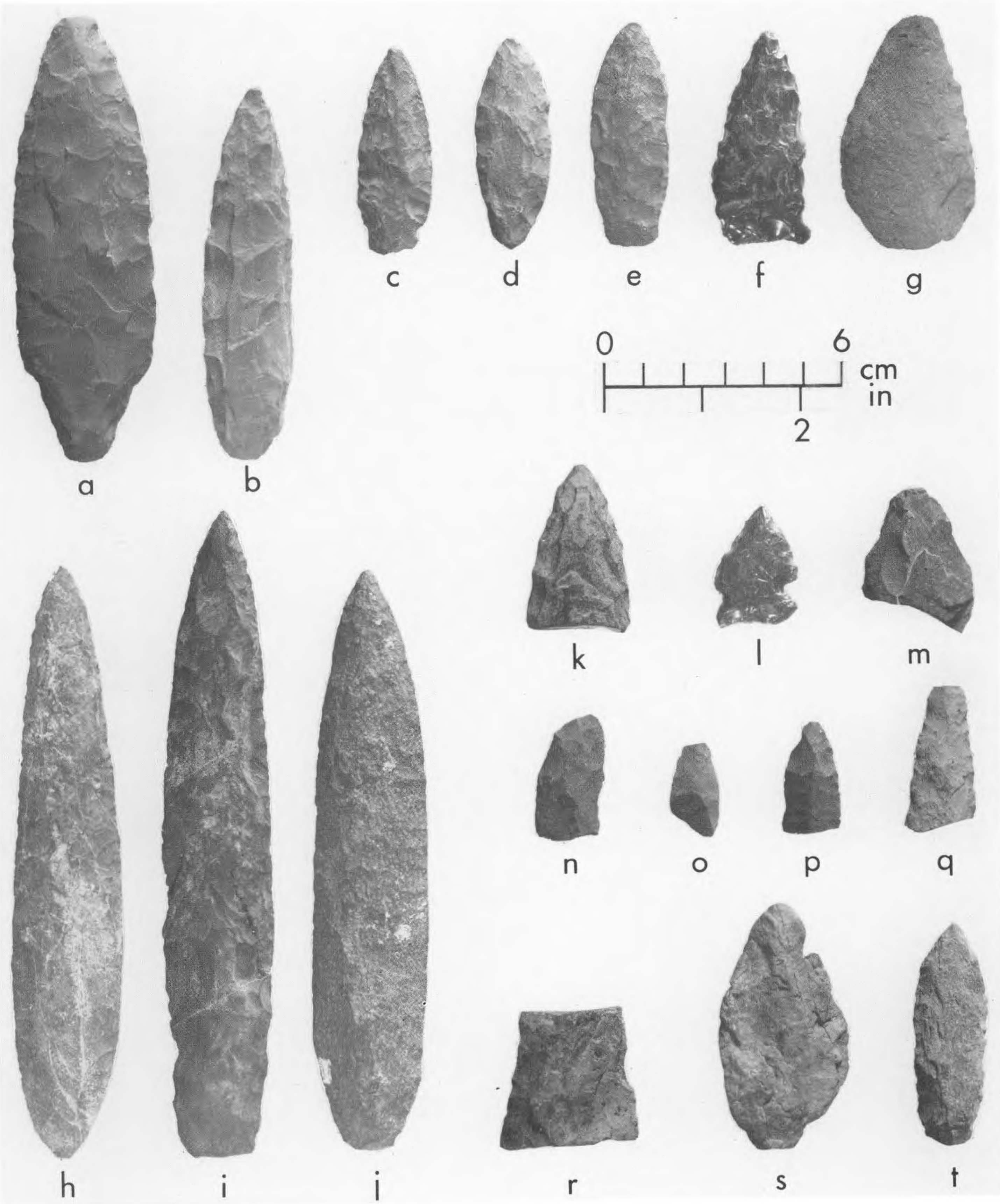
Simple Barb-points

Simple barb-points (Fig. 37ff-kk) are double-ended, short, symmetrical shafts. Tip form and wear patterns are identical thus it appears both ends were simultaneously functional. The midshaft cross-section is ovoid. Specimen ff exhibits a patterned surface stain and associated wear pattern suggesting the shaft was hafted in a fixed position about 45 degrees to its axis with a small portion of the anterior (?) tip exposed. Specimen kk shows similar but less conclusive evidence.

Wide Barb-points

Wide barb-points (Fig. 37a-e) are characterized by a wide, curvilinear midshaft and an irregularly thick cross-section. Little shaping is in evidence on the surface other than on the irregular, symmetrical tips. No percussion damage is present but limited resharpening has occurred.

Fig. 32 Stone projectile points (all bifacial). *a* slate, tanged base lanceolate point; extensive bifacial surface abrasion at tip; biconvex cross-section; 1880 1600 BP. 9.OA.3. *b* slate; round base lanceolate point; no evidence of wear; biconvex cross-section; 1840 BP. 9.0.12. *c* slate, side notched, straight base leaf-shaped point; slight tip abrasion, biconvex cross-section; 1840 BP. 10.14.1. *d* Basalt; constricted stem, leaf-shaped point no evidence of wear; biconvex cross-section; 980 BP. 10.10.10. *e* slate; square base leaf-shaped point; very sharp edge — no evidence of wear; biconvex cross-section; 2440 BP. 9.3.1. *f* obsidian; corner-notched point; fragmented base— no evidence of wear; biconvex cross-section; 1470 BP. 10.11.98. *g* vitreous; (base missing) leaf-shaped point; biconvex cross-section; 2440 BP. 9.3.35. *h* slate constricted base lanceolate point; no evidence of wear; rhombic cross-section; 4000—3000 BP. 4.H.8. *i* slate; square base lanceolate point; no evidence of wear rhombic cross-section; 4—3000 BP (?). 4.H.20. *j* basalt; constricted base lanceolate point no evidence of wear; rhombic cross-section; 4—3000 BP (?). 4.H.5. *k* slate; base missing(?); biconvex cross-section; 2880—1840 BP. 10.16A.1. *l* obsidian; side notched point, concave base; no evidence of wear; biconvex cross-section; date unknown. 10.1.2. *m* basalt; leaf shaped point (base missing); tip battered; biconvex cross-section; 2880—2440 BP. 9.4.3. *n* material unidentified; asymmetric point fragment; 7800 BP. 9.10.141. *o* material unidentified; leaf shaped point fragment; biconvex cross-section; 2440 BP. 9.3.29. *p* basalt; parallel sided point (base missing); rhombic cross-section; no evidence of wear; 9140—7800 BP. 9.10.138. *q* material unidentified; base and tip missing; rhombic cross-section; 7800 BP. 9.10.19. *r* slate; base and tip missing; rhombic cross-section; heavy localized edge battering; 7800—4540 BP. 3.12.4. *s* cryptocrystalline; crude-leaf-shaped point; no evidence of wear; rhombic cross-section; 7800—4540 BP. 4.0.18. *t* basalt; crude leaf-shaped point, slight edge abrasion on shoulders; roughly rhombic cross-section; 7800—4540 BP. 5.12.2.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Bone Awls

Bone awls (Fig. 38) are one of the most frequent hand tools in the collection. On the basis of wear patterns they must have served a wide variety of functions.These could include sewing, perforating, enlarging holes, cutting cedar bark, and preparing food. Despite the need for specific tip forms the bone awl is functionally simple. The most common source for these tools was the simple long bone shaft or splinter, which was then sharpened. Another common bone, the ulna, easily lent itself to certain tasks. A grouping of these tools according to form, tip type, and wear patterning reveals some correlation between form and function.

Wide Back Awls

Wide back awls (Fig. 38a-c) are flat and posteriorly broad. The tapering lateral edges have been use-rounded and abraded near the tip. The posterior end is rounded and polished by hand use. The posterior portion of c possesses abrasions suggesting that both ends were functionally significant. There was no evidence of hafting.

Ulna Awls

Ulna awls, made typically from deer ulnæ, are common artifacts in the collection. They occur in a variety of shapes depending upon the original bone form and the degree of resharpening. Tips are broad in the larger ulnæ, while the smaller variety (38d-f) are narrow and sharp. The natural shape of the original ulna in f and g has been severely altered, with the former receiving an unusual amount of surface polish. Hand use-polish occurs frequently at the posterior end and around the high articulatory surfaces and ridges. A single specimen (g) exhibits bifacial engraved surface decoration.

Square End Awls

Square end awls (Fig. 38j-o) are constructed from simple bone shafts and splinters. They are characterized by a sharp symmetrical tip and shoulder and a square and often beveled posterior end. Tips possess long slender tapering shoulders, with wear patterns suggesting use in perforation. Hand use-polish is neither extensive nor frequent.

Simple Awls

Simple awls are made (Fig. 38p-t) from slender bone shafts or simple bone splinters. Except for rudimentary shaping of rough edges along the shaft, the only modified portion of the tool is the symmetrical sharp tip. A limited amount of hand use-polish is present on the other end but this is not developed as a pattern. Specimens r and t display more extensive tip and shoulder polish, with the lateral edge of the latter exhibiting what appear to be remnants of barbs.

Fishhook Barb-points

Fishhook barb-points (Fig. 39a-f) are short, cylindrical bone shafts with very sharp tips and square blunt ends. The entire surface is modified, and in specimens c and d a single deep transverse notch appears near the rear end, which has been cut and ground. We infer that these tools were fishhook elements from historic photographs and descriptions of composite hooks. These specimens were fixed into a curved bone or wooden hook shaft.

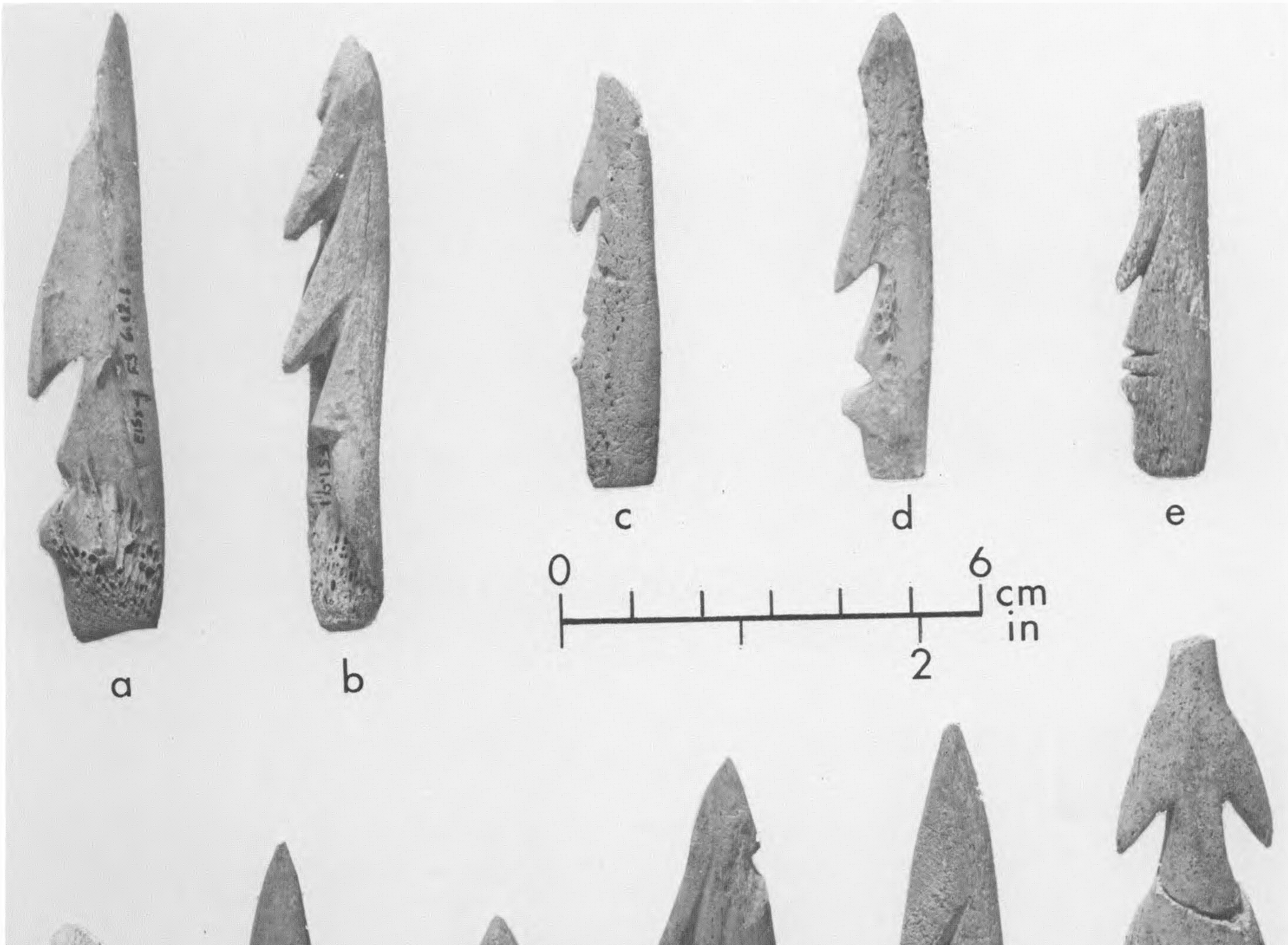
Double Ended Barb-points

A large quantity of double ended barb-points was recovered from Namu (Fig. 39g-v). Their cross-sections range from square or rectangular (o and t) through ovoid (n) to irregular (g). Where complete specimens were found, tips are identical at both ends. They have sharp, asymmetrically tapering shoulders, and are usually thin. Artifacts g, k, and o exhibit dark patterned surface staining at the midshaft or at one end which appears to be a resinous material. Probably these barb-points served a wide variety of purposes.

Other Artifacts

Not illustrated is a large collection of beach cobbles exhibiting localized battering. These range from 8 cm in diameter to about 15 cm. Irregular forms were frequent. Two such stone fragments (mauls) were formally shaped into long cylindrical forms and exhibited bipolar battering and abrasion, on their comparatively flat, pointed ends. Four fragments of fine needles with eyes were uncovered.

Fig. 33 Fixed bone points *a* posterior unilaterally barbed fragment; unilateral line attachment guide; 4540–3400 BP. 6.12.1. *b* complete; unilaterally barbed point; severe anterior tip damage; unilateral line attachment guide; 3400–2800 BP. 1.9.1. *c* posterior; unilaterally barbed fragment; unilateral line attachment guides; finely finished surfaces; 3400–2800 BP. 4.0.8. *d* complete; unilaterally barbed point; unilateral line attachment guide; moderate percussion damage to anterior tip; 3400 BP(?). 4.0.9. *e* posterior; unilaterally barbed fragment; unilateral line attachment guides; finely finished surfaces; 3400-2800 BP. 1.9.1. *f* posterior; unilaterally barbed fragment; sea mammal bone unilateral line attachment guide; severe surface deterioration; 3400–2810 BP. 3.11.2. *g* anterior; unilaterally barbed fragment; bilateral edge polish; 3400 BP. 4.0.14. *h* complete; unilaterally barbed point; severe surface deterioration; unilateral line attachment guides; 2810 BP. 2.8.7. *i* complete; unilaterally barbed point; unilateral line attachment guides; finely finished surfaces; 2880 1880 BP. 5.6.1. *j* identical to specimen *(i)* above. 3.13.1. *k* posterior; bilaterally symmetric barbs; finely finished surfaces; bilateral polish patterns on barbs define direction of use; localized transverse polish marks ahead of posterior forward-pointing barbs suggest line attachment position; biconvex or ovoid cross section; 4500–3400 BP. 4.0.32.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A small manibular fragment of bighorn sheep bearing a single molar was recovered, with cusps filed to a single sharp point. In addition, two or three curved bone fishhooks were found with single barbs at the anterior tips. Finally, a finely polished flat bone fragment with a series of randomly located holes documents the use of a drill.

Figure 40 presents artifacts uncovered from burial FS 4.H (excluding a possible clamshell pendant too fragile to restore). No evidence of use was observed on these tools. On the basis of the overall configuration of the assemblage these tools were designed for marine hunting. Lateral edges of a are thin but rounded as is the pointed tip. The natural bone channel is deeply carved at the posterior end. Natural bone surfaces are intact on the ventral face, except at the posterior end, which is an altered articulatory surface. Specimens e and f are identical in form and presumably in function. Lanceolate points g-i are thought to be projectile points used either in a composite association with a harpoon head or in a single fixed haft. It is possible that these blades could have been used as hafted knives. Specimens j and k, which are located with a large concentration of ochre and a shell pendant, each exhibit an incised line on the concave and convex faces. In ethnographic accounts (Davis 1949: Plates 129 and 130; Miles 1963. Plates 10:18 and 10:19) these are gaming pieces. The bone projectile point (1) is the weapon extracted from the spinal column of burial FS 4.H.1. It shows staining indicative of hafting.

The inclusion of this assemblage of artifacts with the deceased male reflects its role as a tool inventory required for a hunt. For example, 40a could have been attached to a shaft either as a single or composite element, to be used as a killing implement. The two ivory harpoon heads were probably hafted singly with a line attachment. The three remaining bone implements would appear to be blades, again hafted.

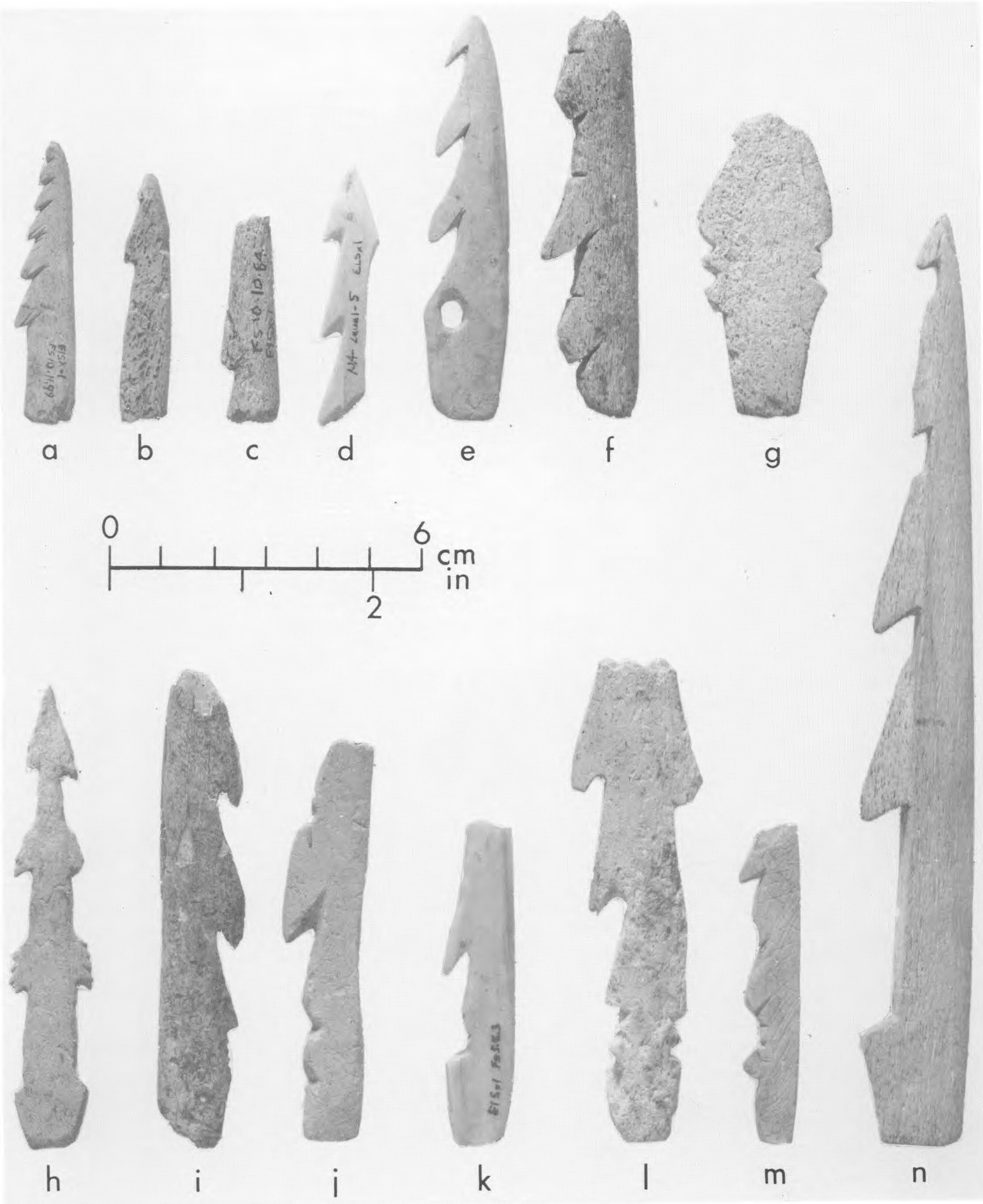
It is difficult to classify objects as ornaments without knowing how they were used. For purposes of this examination, we will use the term "ornamental" to emphasize the biases on the part of the investigator. From this point of view, very few ornamental objects were recovered. At least one disk bead, two pendants (41a) and several fragments were made of jet. Specimen 41b which is made from highly polished flat bone may also have been a part of a pendant or a pinhead. It closely resembles a duck with its upper bill missing.

A large number of artifacts could not be classified due to their unique form. Still fewer were selected for illustration (Fig. 42). The tip of the grizzly bear rib, g, is wide and flatly pointed, smooth, and sharp. The posterior articulatory surfaces have been reduced and exhibit considerable hand use-polish. Specimen f is uniformly thick through its length, except at the base where initial thinning is suggested. In side view the tool is slightly curvilinear. Specimens i and j represent bone artifact "blanks" or "pre forms". In particular, specimen j involves three of a total of 10 such blanks recovered together accompanied by a group of small cobbles. One of these coarse grained stones was fractured to form a thin rhombic cross-section. The "blanks" were cut out of the sea mammal long bone section with this tool. Reassembled, a set of five of these blanks constituted a section of halved long bone.

CONCLUSIONS

The distribution of each class of artifacts was plotted along a linear scale graduated in units of 600 years. Figure 43 presents the results of this operation from all three site collections. Terminal settlement at Namu and at Kisameet Bay is assumed to have been around 200 BP, and at Roscoe Inlet at 1500 BP, although the date of 2140 BP comes from very near the surface of the deposits. Where an uncertain date is assigned to termination or initiation of a class, a question mark accompanies the plot. Class totals appearing above each sequence may exceed artifacts actually

Fig. 34 Fixed bone points. *a* anterior, unilateral barbs; no surface polish, slight tip use-rounding; 1470 BP. 10.11.99. *b* anterior, unilateral barbs; no surface polish, moderate tip damage; rectangular cross-sections; 2880—2440 BP. 8.6.1. *c* midshaft fragment; unilateral barbs slight surface polish; ovoid cross-sections; 980 BP. 10.10.64. *d* anterior, unilateral barbs (?); extensive surface polish; 2880 BP—present. 1968 lev. 5. *e* complete detachable head; unilateral barbs; slight bilateral edge use polish; date unknown. 10.0.6. *f* midshaft fragment; unilateral barbs; sea mammal bone; biconvex, rectangular cross-section; 1470 BP. 10.12.2. *g* posterior fragment; bilateral, asymmetric barbs; bilateral line attachment guides; flat rectangular cross-section; sea mammal bone; date unknown. 11.0.4. *h* complete bilaterally symmetric head; serrated barb edges; moderate surface deterioration; 1470 BP. 10.11.97. *i* posterior, unilaterally barbed fragment; FbSx 6; unilateral line attachment guides; extensive surface polish despite exfoliated state; 2140 BP. 1.3. *j* posterior, unilaterally barbed fragment; unilateral line attachment guides; moderate surface deterioration; 1840 BP. 10.14.24. *k* posterior, unilaterally barbed fragment unilateral line attachment guides; extensive surface polish; 1880 BP. 5.4.3. *l* posterior, bilaterally asymmetric barbs; bilateral line attachment guides; sea mammal bone; flat, rectangular cross-section; moderate surface deterioration; 2800—1840 BP. 10.16.4. *m* posterior, unilaterally barbed fragment cross-hatched bifacial surface incisions; unilateral line attachment guides; 1470 BP. 10.11.100. *n* complete, unilaterally barbed head; sea mammal bone (?); barbs emerge from squared, flat edge and exhibit use polish on leading edges no use-pattern evidence suggests method of hafting or attachment; all surfaces moderately polished; 1470 BP. 10.11.2.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illustrated. This occurs because several artifacts were recovered without provenience data. In addition, class membership in "Double-ended Barb Points" and "Fixed Barb Points" was too large to plot each specimen.

A major assumption underlying our interpretation of artifact distribution is that functional roles of these classes indicate economic exploitation patterns of the settlements. The micro-environment involved in each instance is identified through constituents from each stratum, including both artifactual and non-artifactual material. It is proposed from such considerations that significant shifts in the exploitation patterns will be reflected in these data. Finally, when the mode of subsistence – which is an expression of the interaction of tools and environment at a specific locale– changes in character, so too does the economic structure of the community.

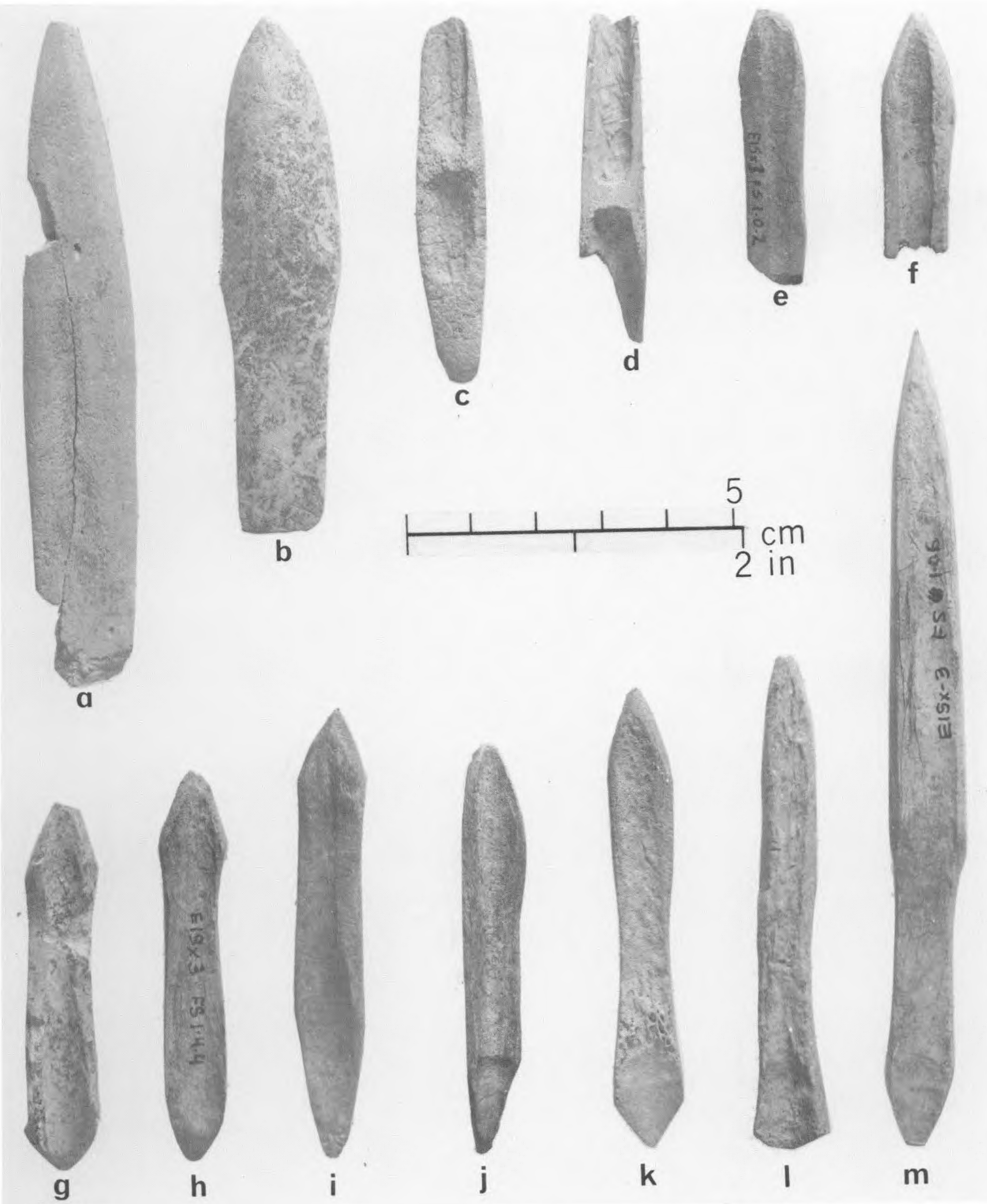
Three major trends are seen in Figure 43. The first involves a brief but specialized lithic industry emerging early in the Namu sequence. The second trend, with a sparse but functionally diverse inventory, began approxi-

Fig. 35 Bone projectile head elements. Single element projectile points. *a* bifacially ground; posterior portion missing; thin ovoid cross-section; 1470–980 BP. 12.9–11.10. *b* bifacially ground, parallel stem; biconcave cross-section; date unknown. 10.0.18. Toggle valves: *c* outcurving posterior; extensive surface deterioration; antler; date unknown. 10.0.30. *d* outcurving posterior (terminus missing); 480 BP —present. 10.2.7. Composite Projectile Point Heads: *e* anterior fragment with severe tip use damage; ElSx 3; date unknown. 1.0.2. *f* anterior fragment with slight tip use damage; 2440–1840 BP. 10.16.6. *g* complete element with extensive anterior tip use damage and surface deterioration; posterior terminus slightly beveled; 480 BP. 10.5.8. *h* complete element; posterior terminus completely beveled; ElSx 3; 1000 BP–present. 1.4.4. *i* complete element with extensive anterior shoulder polish; posterior terminus thin and tapered.; 480 BP. 10.4. *j* complete element; posterior terminus tapered and beveled; ElSx 3; date unknown. 0.0.2. *k* complete element; considerable medial constriction with thin posterior terminus; ElSx 3; 1860–1000 BP. 2.7.2. *l* complete element; blunt posterior terminus with no medial constriction; ElSx 3; 1860 BP—present. 1.5.3. *m* complete element before wear and retouch has reduced length; anterior tip very sharp and shoulder polished; ElSx 3; date unknown. 1.0.6.

Fig. 36 Wedges, celts, and adzes. Bone wedges: *a* sea mammal bone; abraded and blunted anterior edge; posterior missing; tapered with rough rectangular cross-section; 1640–1470 BP. 12.12–14.67. *b* sea mammal bone; very slight anterior end use-damaged; plano-convex cross-section; polished surfaces; approx. 4540–3400 BP. 5.10.2. *c* land mammal bone; severe anterior tip use damaged, posterior missing; ovoid cross-section; 1840 BP. 10.15.18. Ground and Polished Celts: *d* dark green material unidentified; all surfaces finely smoothed and polished; posterior end flat; biconvex rectangular cross-section; Approx. 4280 BP. 1.8.1. *e* dark green material unidentified; natural indentation present all surfaces polished; biconvex, rectangular cross-section; 4540–3400 BP. 2.13.1. Ground celts: *f* light green, fine-grained material unidentified; severe anterior/posterior damage (source undetermined); no polish present; ovoid cross-section; date unknown. 10.0.5. *g* light green, fine-grained material unidentified; severe use (?) damage to anterior edge; posterior end square and flat; roughly biconvex rectangular cross-section; 680 BP—present. 10.6.3. *h* light green, fine-grained material unidentified; severe damage to all surfaces and edges retouched anterior and lateral edges suggest reuse as knife – limited original ground surfaces intact; date unknown. 10.1.28. Mussel shell adzes: *i* fire tempered (charred); complete anterior edge beveled, single lateral edge remnant and posterior terminus intact 1470 BP. 10.11.196. *j* external anterior surface beveled; bilateral edges square in section view, posterior missing. 1470 BP. 10.11.193. *k* anterior edge and single lateral edge beveled; 1840–1470 BP. 10.13.69.

Fig. 37 Bone Barb-points. Wide barb-points: *a* date unknown. 12.0.4. *b* 2360–1860 BP; ElSx 3. 11.12.4. *c* 2360–1860 BP. 2.12.2. *d* 1840–1470 BP. 10.12.4. *e* 1840–1470 BP. 10.12.7. *f* 1470 BP. 12.9–11.6. *g* 1840–1470 BP. 10.13.25. *h* 1840–1470 BP. 10.14.26. *i* date unknown. 10.0.13. *j* 680 BP. 10.8.11. *k* 2360–1860; ElSx 3. 2.11.5. Square end barb-points: *l* 680 BP. 10.8. *m* 1470 BP. 10.11. 27. *n* 1840–1470 BP. 12.12–14.23. *o* 2310–1860 BP; ElSx 3. 1.11.1. *p* 680 BP. 10.8.7. *q* 4300–3200 BP; ElSx 3. 2.15.1. *r* 1840–1470 BP. 10.13.21. *s* 2140 BP; FbSx 6. 1.3.3. *t* 1840–1470 BP. 12.12–14.20. *u* 1470–980 BP. 10.10.31. *v* 1840BP. 10.15.7. *w* 980 BP. 10.10.41. *x* 1840 BP. 10.14.42. Posterior Beveled Barb-points: *y* 2880 BP. 2.7.1. *z* 200 BP. 10.1.34. *aa* 200 BP. 10.1.35. *bb* 980 BP. 10.10.36. *cc* date unknown. 10.0.42. *dd* 2360 BP; ElSx 3. 2.16.2. *ee* 3400 BP. 1968 lev. 13 #5. Simple barb-points: *ff* 1840 BP. 12.12–14.31. *gg* 1470 BP. 10.12.23. *hh* 1240–1470 BP. 10.12–14.27. *ii* 1470 BP. 10.11.7. *jj* date unknown, 10.0.17. *kk* 1470 BP. 10.12.18.

Fig. 38 Bone awls. Wide back awls: *a–c* anterior tips slightly use polished and abraded; posterior edges each square to slightly convex; some evidence of lateral shoulder use polish; 2880–480 BP. *a* 10.7.4, *b* 10.11.68, *c* 1968 lev. 14, # 3. Ulna awls: *d Procyon lotor* ulna; extensive tip and shoulder polish; 980–680 BP. 10.9.6. *e* species unidentified; moderate tip use damage; shaft cross-section circular; ElSx 3; 1860–1200 BP. 2.7.4. *f* species unidentifiable; extensive polish to all surfaces; extremely sharp tip; date unknown. 10.0.3. *g* cervid ulna; blunt, use rounded tip; geometric surface incisions to both faces; date unknown. 4.0.1. *h* cervid ulna; sharp, broad tip; 2880–1880 BP. 1968 lev. 13 #1. *i* cervid ulna; extensive alteration to all original surfaces; sharp, thin shaft and tip; date unknown. 0.0. Square end awls: *j–o* sharp to slightly use rounded tips, moderate mid-shaft shaping, posterior terminus square and often beveled; 2880 BP—present. *j* 12.8.6; *k* level 6 # 2; *l* 10.9.11; *m* lev. 3 # 5; *n* 10.12; *o* 10.15.9. Simple awls/gouges: *p–t* sharp to slightly use rounded tips, slight mid-shaft shaping and very limited posterior alteration; specimen *(r)* and *(t)* from ElSx 3; 3400 BP—present. *p* 10. 12.12; *q* 11.0.14; *r* 2.7.3; *s* 4.k.3; *t* 1.2.16.



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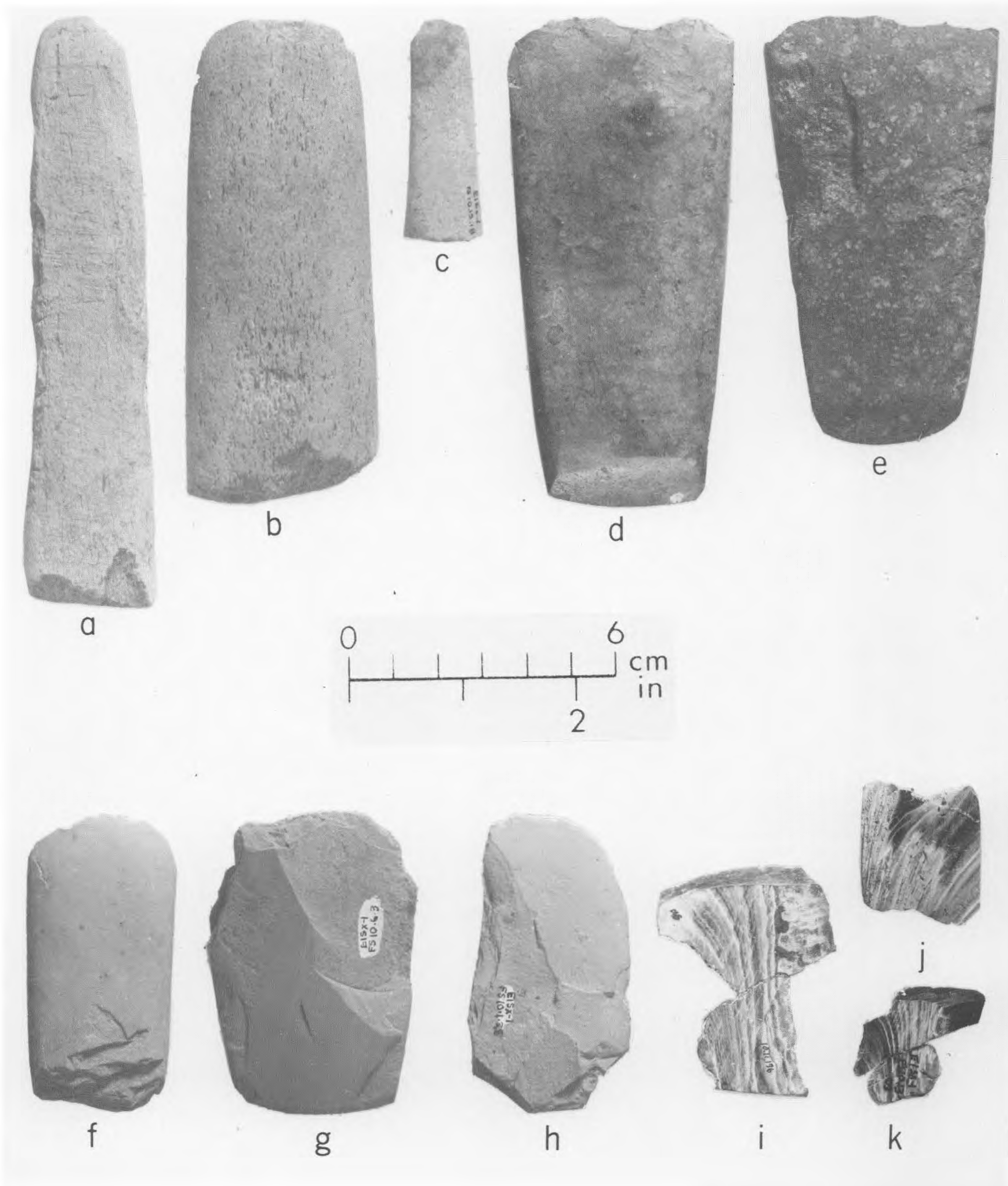

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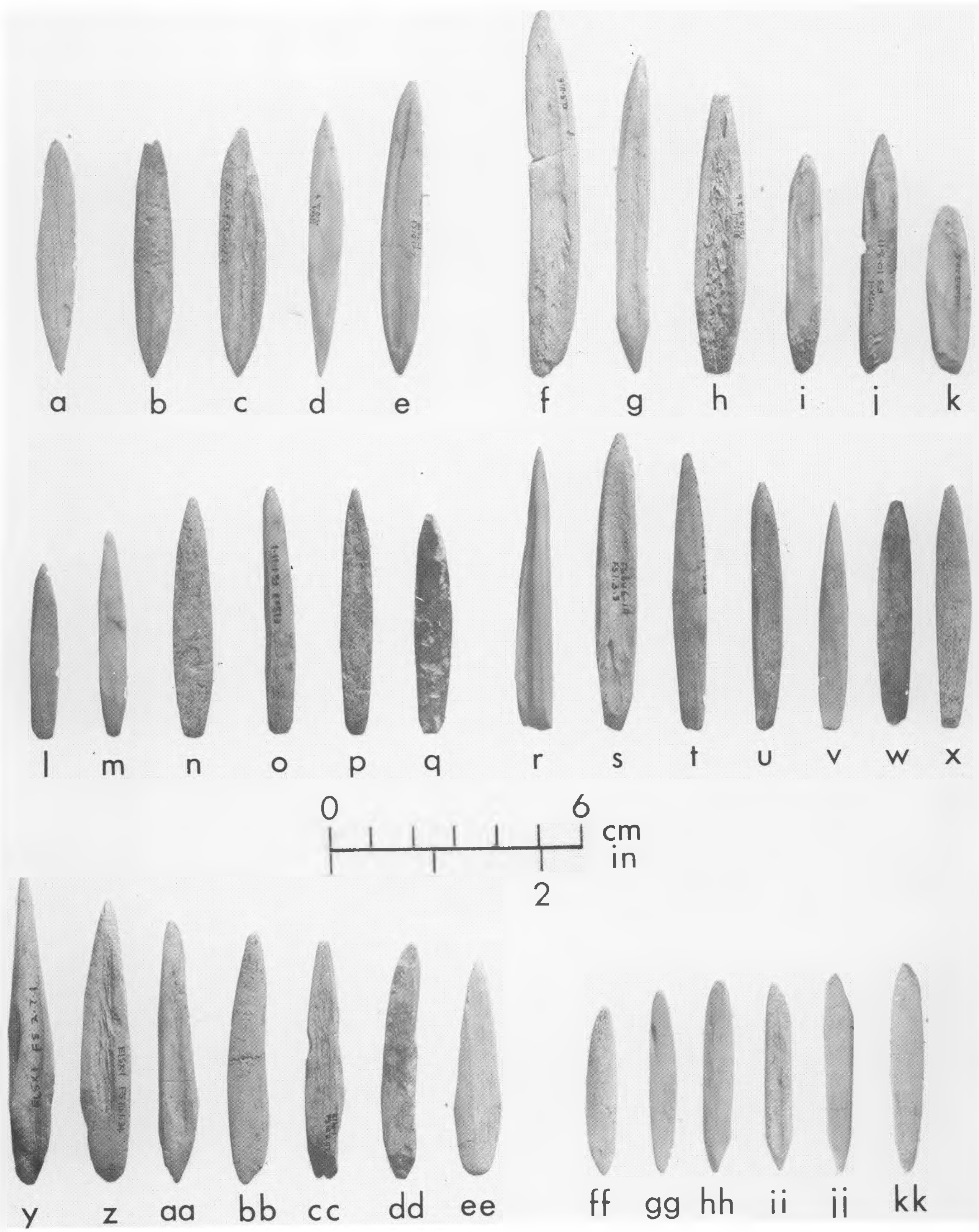
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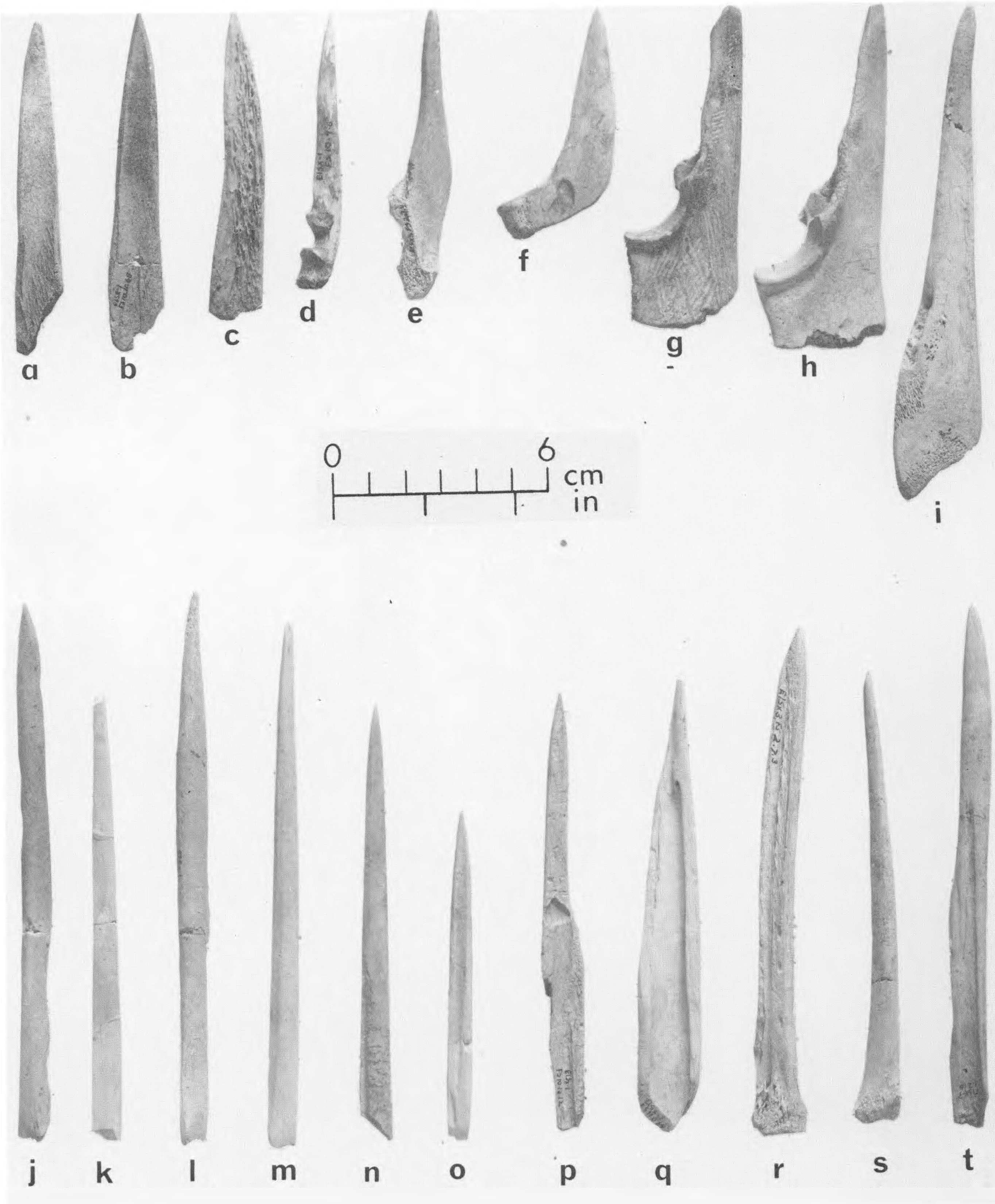
Fig. 37



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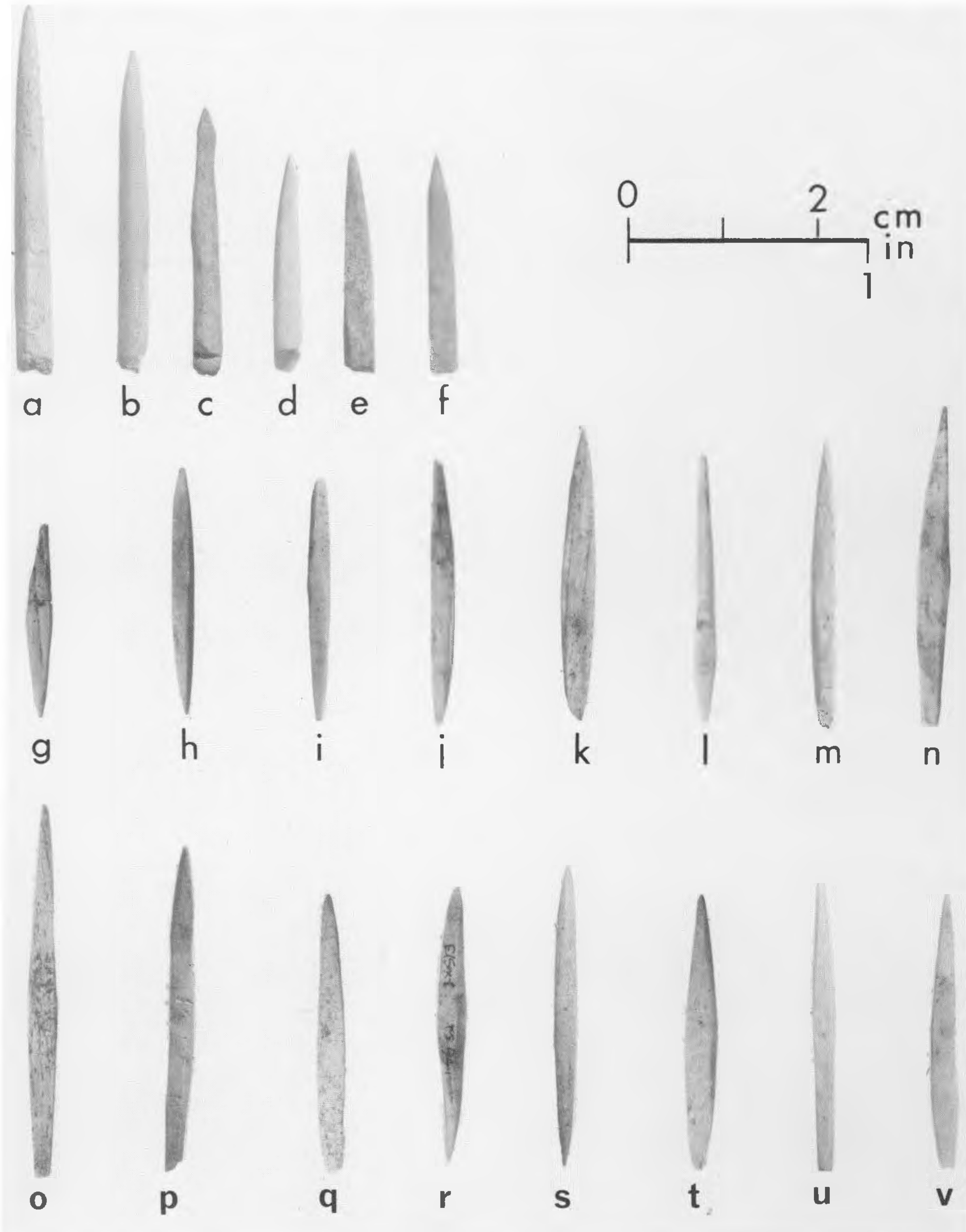


Fig. 39 Bone barb-points. Fishhook barb-points: *a–f* moderately tapering anterior tips with slight tip abrasion; posterior end (present in all but one case) square and in two cases, *(c)* and *(d)*, a deep transverse notch is present; 2440–1470 BP. *a* 10.11.46; *b* 10.19.63; *c* 10.11.49; *d* 10.11.57; *e* 10.14.57; *f* 10.11.56. Double ended barb-points: *g–v* identically shaped tips with limited medial shaping. Use damage rarely occurs to both ends and is not related to percussion blows. Specimen *(g)* exhibits patterned staining to single end; specimens *(j)*, *(k)*, and *(o)* exhibit midshaft patterned staining each suggestive of hafting or line attachment practices. Cross-section varies from circular to square; 2800–980 BP. *g* 10.10.38; *h* 10.11.39; *i* 10.14.62; *j* 10.10.39; *k* 10.11.66; *l* 10.12.4; *m* 10.15.16; *n* 12.12–14.13; *o* 10.10.26; *p* 10.11.111; *q* 10.13.1; *r* 9.4.1; *s* 10.10.49; *t* 10.10.37; *u* 10.13.78; *v* 12.12–15.5.

mately 4540 BP and dominated the picture until nearly 3000 BP. This trend is seen as a diversification of the functional attributes of equipment as well as an increase in numerical size of the inventory. In a real sense, new tools appear to have been added to an existing range without removal or substitution. Membership grew until a climax was reached 1470 years ago. Not until about 1000 BP did this second trend collapse with a decline in number and function of the tools. A third site-wide trend took the settlement to European contact.

From Figure 43, it can be seen that earliest at Namu is a lithic industry composed of obsidian microblades, crude bifacial projectile points, large cores and core flakes, and possibly large pebble choppers. Recovered with these tools was a small amount of basaltic and obsidian debitage. The assemblage is confined to the shell-less matrix in the rear of the site below the unit designated FSC 9.5 (see Fig. 5) and is assigned to the 9140-7800 BP time period. It is expected however, that future dating could reveal that the microblade tradition lasted until 6000-5000 years ago. This inference is based on the fact that the 7800 BP date marks the midpoint of the deposit.

Absence of bone tools in the earliest period is not a result of differential preservation. Nonartifactual bone material was recovered from the black matrix in context with the microblades. Can we then assume that the first occupation phase at Namu did not include a bone industry? Our answer is based on limited evidence. Internal stratigraphy was not present in the black matrix. The distribution of microblades did not indicate a vertical or horizontal pattern in their occurrence. Site utilization patterns hence are not reconstructed for this time period. All we know for sure is that bone tools are not a part of the habitation record we excavated.

The abrupt appearance of a bone tool industry, featuring well-developed barbed harpoons, coincides with deposition of the shell-bearing layers dated 4540 BP. One harpoon (see Fig. 33k) from the uppermost zone of the black matrix is responsible for the question mark in that tool class in Figure 43. Ulna and wide back awls, burnishing stones, and ground and polished stone celts also are a part of the complex accompanied by obsidian gravers, scrapers, and developed flakes. About 3400 BP, this tool assemblage expanded to include greater quantities of tools, some with new functional characteristics. The existing inventory seems to have undergone little alteration. It is interesting to note that for the time period between 4540 and 3400 BP, no stone projectile points were recovered.

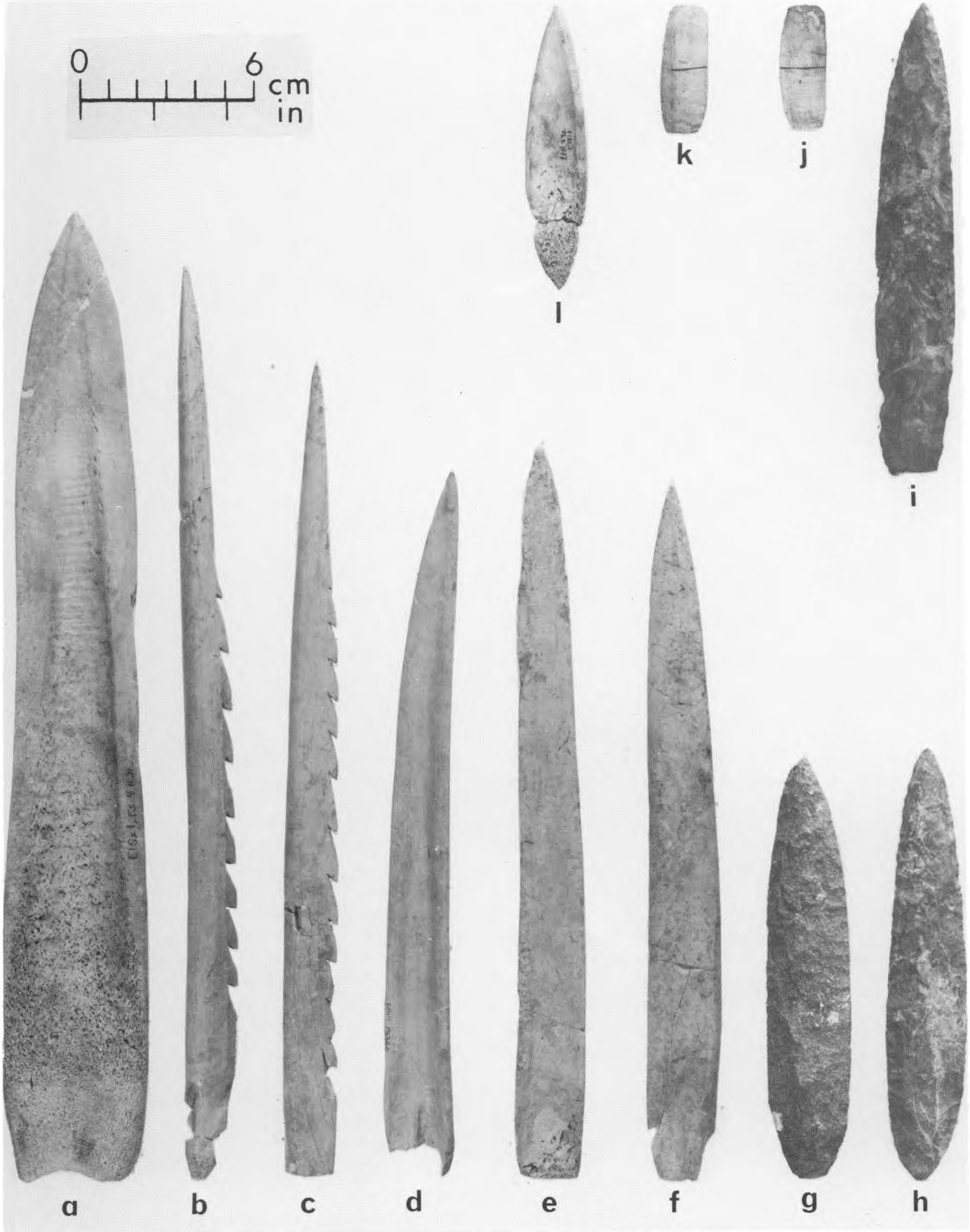
The tool inventory began to expand between 3000 and 2880 BP, with the proliferation of several types of barbed points, hunting and fishing equipment. Manufacturing tools, such as bone wedges and celts, accompanied this expansion. Large choppers, crude projectile points, lanceolate projectile points, and microblades declined or disappeared altogether. Yet addition rather than subtraction of tools forms the trend, such that by 1880 BP the inventory began to climax with a full array of both simple and complex tool forms, a wide variety of fishing gear, including hooks, spear points, and several specialized harpoon types. Tools used in wood working (i.e., celts, wedges, shell adzes) or in making other tools (burnishing stones) also increased. By 1470 BP this trend was in full bloom featuring every tool class present during the settlement's history, except certain microliths.

After 1470 BP, almost all specialized tools disappeared. Ground celts, leaf-shaped stone projectile points, some hand awls and a few barb-point types continued but declined towards the end of that period of habitation. At approximately 1750 A.D. the site's terminal occupation is seen to include only a limited tool inventory of a very generalized nature. Close similarities in the inventories exist between the final occupation at Namu and ElSx 3 in Kisameet Bay.

We have some concluding reservations regarding the temporal arrangements of these form-function classes. Their distribution in time is determined by the radiocarbon dates assigned to the stratigraphic unit from which they were recovered. The accuracy of this assignment and the integrity of the dates themselves influence our inferences. Such chronological confusion does exist in the "Front Trench". Of the three carbon samples, 12 (980 BP), 13 (1840 BP), and 14 (1470 BP), number 14 would appear inaccurate and erroneous in light of the chronological consistency maintained by samples 10-12. However, we also conclude that long periods of time do not exist between one stratigraphic unit and the next. Since there is no stratigraphic evidence of a hiatus between samples 12 and 13, the latter date (1840 BP) seems questionable.

During excavation of FS 10, the strata from which

Fig. 40 Artifacts associated with burial FS 4.H. *a* Bone projectile head (composite?); no evidence of wear — heavy tip polish and extensive alteration to posterior base, no evidence to suggest hafting. *b–c* walrus ivory harpoon heads; string attachment grooves present in specimen *(b)*; no evidence of wear or use damage. *d* bone spear point (?) thick cross-section; extensive surface polish. *e–f* bone spear points or knives; thin cross-section with extensive surface alteration; identical patterned stains to basal portions suggest fixed hafts; anterior edges sharp. *g–i* stone lanceolate points (see Plate 8); rhomboid cross-section. *j–k* ivory gaming pieces (?); single transverse incision appears on concave and convex faces of *(j)* and *(k)* respectively. *l* bone projectile point (murder weapon); penetration of vertebral column created differential staining at anterior shoulders. Transverse patterned stain at posterior shoulder suggests fixed haft. Overlying stratigraphic units were missing — adjacent units produces a time range of 3400—2880 BP. This burial is being assigned to that range.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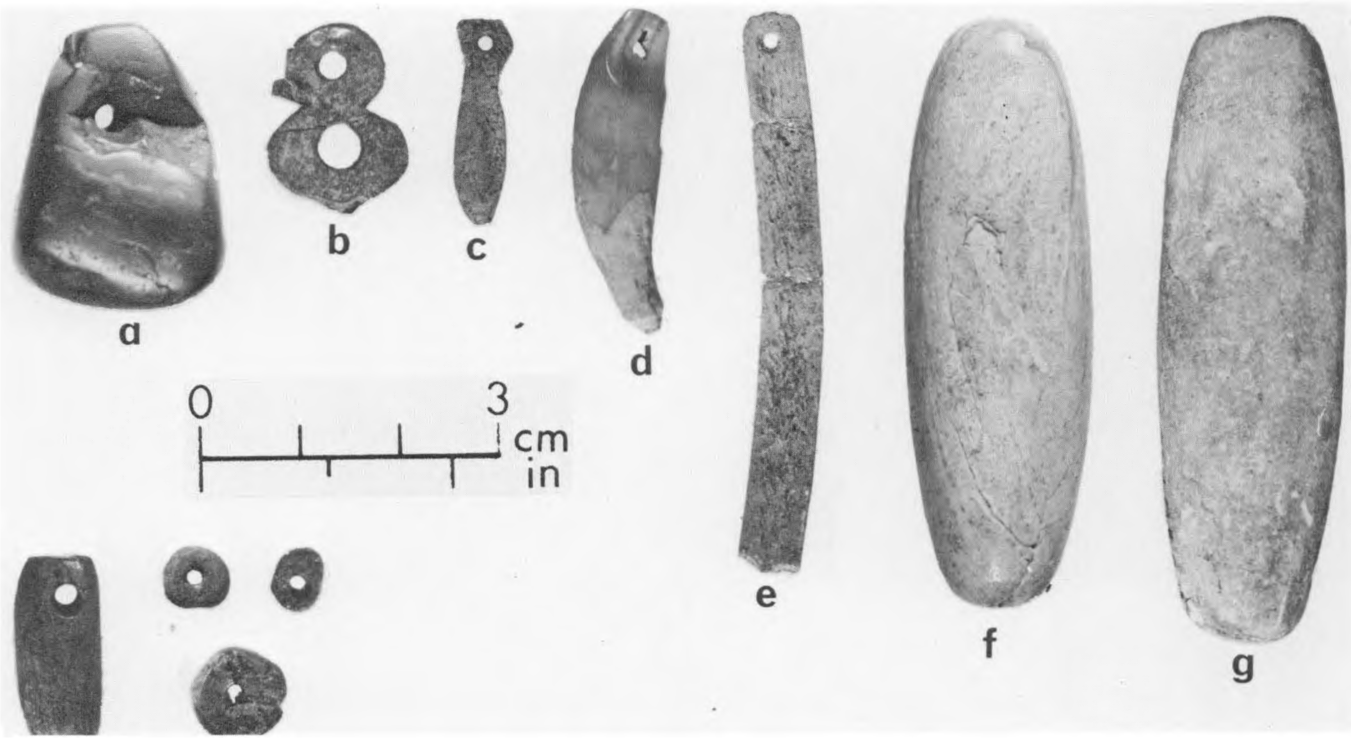


Fig. 41 Miscellaneous ornaments. *a* drilled pendant; jet; 680 BP. *b* duck (?) pin head; bone; 680 BP. *c* fish pendant (salmon); bone; 1470–980 BP. 10.10.16. *d* pendant; canine *(Canis);* 1840 BP. 10.15.21. *e* bone pendant (?) 1470 BP. 10.11.85. *f* ivory "plug"; heavily polished, ovoid cross-section; 3400–1880 BP. 4.0.3. *g* stone "plug"; not polished, ovoid cross-section; 3400–1880 BP. 4.6.12. *h* amber beads; cylindrical and disk chaped; recent. 11.OA.

radiocarbon samples 12 and 13 came were excavated as a single unit, although two natural strata later were discerned. Hence, the artifacts recovered could be assigned to either time period. The question is therefore which of the two dates indicates the age of the tool assemblage. The excavators distinguished a vertical clustering of tools within FS 10.10, enabling some clarification of the actual associations during laboratory analysis. Yet a clear separation of the two layers' contents has not been possible.

To rectify the discrepancy between samples 13 and 14 without recourse to further dating, I have accepted the possibility that an inversion between the samples has taken place. Correcting this sequence so that FSC 10.10 dates 1470 BP and FSC 10.12 (Sample 14) dates 1840 BP, in retrospect more closely agrees with our observations of the midden morphology. Obviously, uncertainty remains between FSC 10.9/FSC 10.10 association despite the correction.

In summary, two major components were identified at Namu: 1) a microlithic component exhibiting no evidence of a bone tool industry despite an inference based on functional grounds that one should be present, and 2) a bone tool industry adapted to a specialized form of maritime exploitation. A marked difference is seen between these two components in their morphology, associated faunal remains, and artifacts. The nature of the first habitation, which features microblades, is not clear but extensive site utilization is not presently indicated, nor does the tool assemblage indicate a pattern of marine exploitation. The second major component features a tool assemblage emphasizing over the past 4500 years a heavy reliance upon shellfish, fish and marine mammals, as well as a wide variety of land mammals. The mode of subsistence at Namu during this period exhibits a proliferation of marine adapted tools climaxing between 1880 and 1470 years ago, when the mode shifts away from intensive utilization. After 1470 there was a shift from a proliferated tool inventory to an obliquiated one. This suggests a change in the economic activities of Namu and hence subsistence intensity.

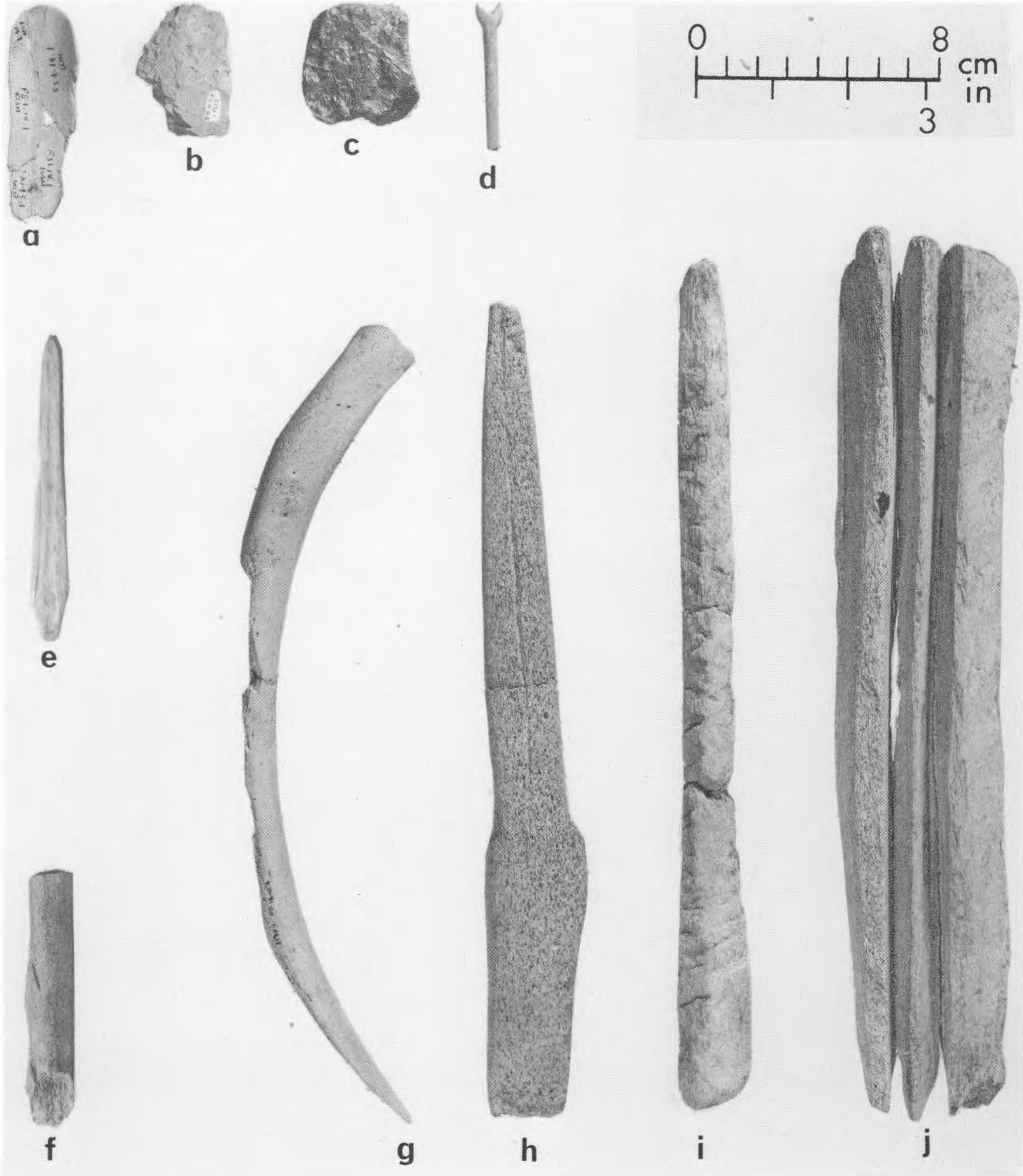


Fig. 42 Miscellaneous artifacts. *a* bone spoon (?); 4540–3400 BP. 1.14.1. *b* charred slate; bifacially developed flake; date unknown. 11.0.5. *c* pigment (galena); multiple surface abrasions; 480 BP–present. 1968 lev. 2. *d* bone; unknown function (ElSx 3); 1860 BP. 1.10.2. *e* bone projectile point; date unknown. 11.0.12. *f* bone harpoon (?) midshaft; ElSx 3; 1860–1600 BP. 2.9.4. *g* bear rib; finely polished, pointed shaft; 1470 BP. 10.11.4. *h* sea mammal bone; finely shaped shaft – damage to tip; ElSx 3; date unknown. 1.1.2. *i* sea mammal bone; tool blank (?) – deep transverse surface cuts; 980 BP. 10.10.60. *j* sea mammal bone; tool blanks (?) – before separation; 980 BP. 10.10D. 1-9.

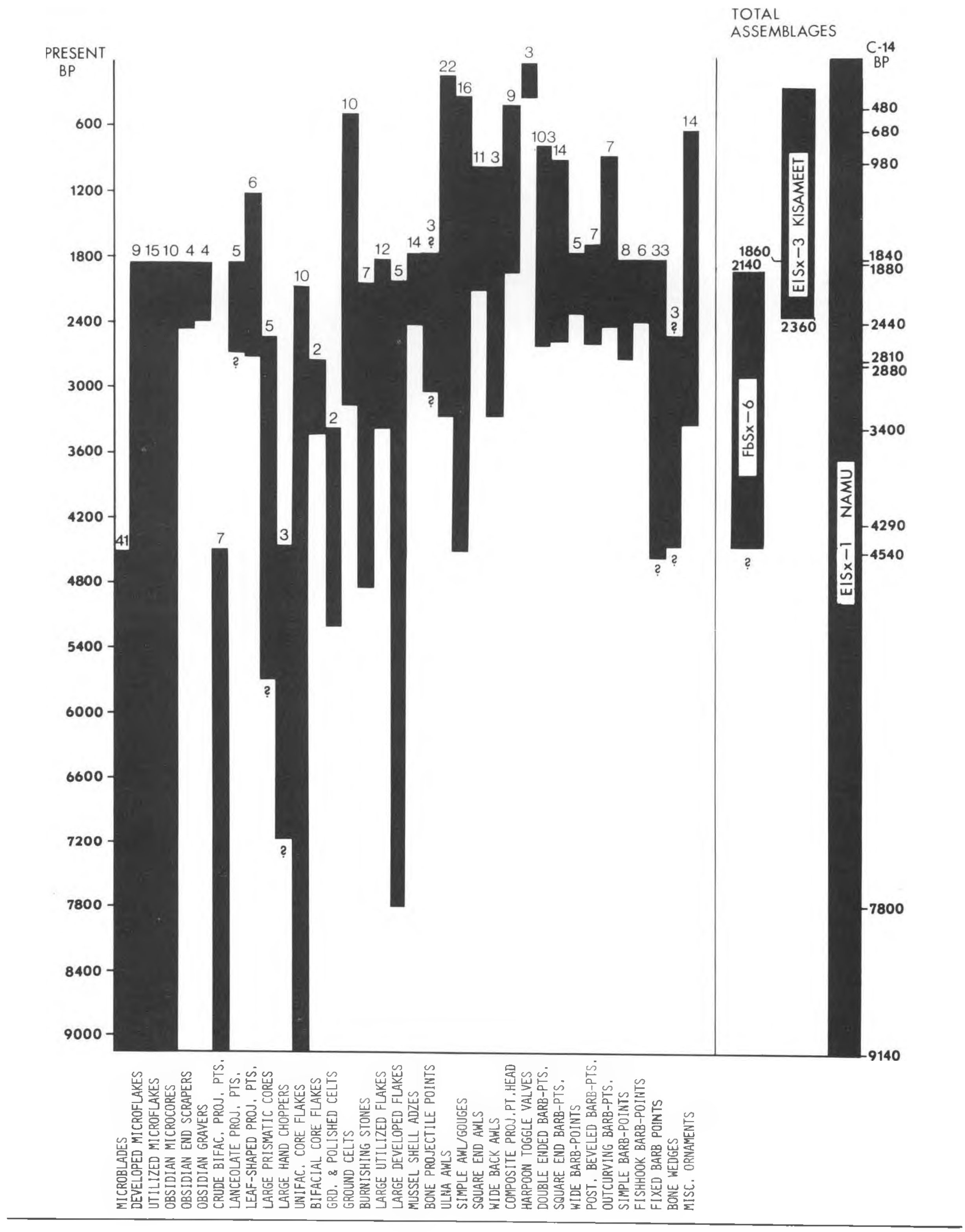


Fig. 43 Distribution of each class of artifacts through time.

Matrix Analyses

KATHRYN CONOVER

INTRODUCTION

My concern has been with treatment of the predominant class of site debris — shell, rock, soil, ash, charcoal, bone, and plant remains — here referred to as non-artifactual materials. Acknowledging the precedents set by investigations in similar site situations elsewhere in the world (Cook and Treganza 1947:135; Meighan 1959:404), it is a major thesis of this report that study of non-artifactual site data provides dimensions of aboriginal life incompletely reflected by artifacts. Furthermore, it is the position of both this report and that of Luebbers (this volume), that integration of artifactual and non-artifactual information permits a cultural reconstruction not fully attainable through interpretation of either kind of data alone.

Our intent is to perform such an integration, employing the artifactual information and the non-artifactual data recovered from the shell middens ElSx 1 in Namu Harbour and ElSx 3 in Kisameet Bay. The immediate objective is reconstruction of the sequence of site utilization and subsistence patterns for each midden. The study is basically a diachronic examination of subsistence history at each, with implications for inter- and extra-site relationships in terms of specific aboriginal settlement formats.

An ultimate objective is recommendation of a specific investigatory approach designed to answer the archaeological problems which, as a result of this research, are now known to be encountered on the coast. The unexpected structural complexity and great time depth of the sites we investigated underscores the need for such an approach. The key to the productiveness of the approach is the coordination of critical sets of site data: artifacts, stratigraphic observations, vertebrate data, midden matrix data, and radiocarbon dates — each acquired and analyzed in a prescribed manner. Northwest Coast archaeology has usually given only cursory treatment to other than artifactual materials, ignoring the fact that midden sites of the Northwest contain the potential for reconstruction of community behaviour patterns. Both intra- and inter-site settlement patterns, as well as diachronic and synchronic statements, may be derived from the midden when it is viewed as possessing structural as well as content features indicative on many levels of aboriginal community life.

MATRIX SAMPLING

The success of the small sample approach depends upon the midden matrix constituents fulfilling three analytic criteria: abundance, even distribution, and fine fragmentation (Meighan, *et al.*, 1958a:4). Should a constituent not meet these criteria well, the results would be less reliable.

We used the matrix sampling approach to generate basic stratum constituent proportions and matrix fragmentation data. While I feel the proportional relationships of constituents seen in the samples are valid, with the exception of shell and rock, no constituent meets the sampling criteria well enough for finer treatment. Consequently, our shellfish species distributions could be adequately computed from matrix sample data. Our artifact and vertebrate species distributions, however, had to be compiled from the large quantities of stratum matrix removed during regular excavation. This matrix is referred to as a field sample. If we had been able to give quantitative treatment to all debris in all field samples, rather than just the artifact and vertebrate debris, we would have been able to account for one hundred percent of data from the excavation area. At present then, our data composite for each stratum is made up of artifactual data, radiocarbon data, and stratigraphic observations (covered by Luebbers). The vertebrate data and matrix sample data are treated in following sections.

Matrix sample collection procedure involves the following questions: Where to locate the sampling area within the excavation area, where to locate the individual sample within the sampling area, what size to make each sample, and how many samples to take.

The intent behind selection of matrix sampling areas was to gain insight into the characteristic composition and disposition of the major strata. The sampling areas at Namu were chosen to enable us to span the site history. Thus we have sample suites FS 1, FS 2, and FS 3 from the extremes of the 1969 excavation area at Namu; suites FS 9, FSC 9, FS 10, and FSC 10 from the extremes of the 1970 excavation area; and FSC 4 from the centre. The 1968 test pit at Namu was located in an attempt to provide a representative preliminary view of midden strata. Its location is comparable on the east-west axis to that of units FS 2 and FS 4. The four suites from Kisameet all represent the same area of the midden – the eastern portion of the east-west trench well away from its front slope. The single suite from Roscoe Inlet represents that site's front slope.

Matrix sampling traditionally has involved two kinds of samples, referred to as columnar samples and mixed samples, denoting the conditions of collection procedure (Treganza and Cook 1948:288; Greengo 1951:2; Meighan, *et al.*, 1958a:4,11) without reference to specific sample size or context requisites. Both are processed for content in the laboratory, and because transport of large chunks of matrix from site to lab is inconvenient, most laboratory samples are small.

Columnar samples have been preferred in recent years, as they provide volume as well as weight measurements. Briefly, these are samples extracted from isolated columns of site matrix. At shallow sites, the whole column may be considered a single sample (Treganza and Cook 1948). At deeper sites, the column may be cut up at arbitrarily determined intervals – with six, ten, and twelve inch intervals common (Meighan *et al.*, 1958a:4). Measurement of the *in situ* volume permits later calculations with the sample constituent. These include estimations of proportions of the major constituents in the site as a whole, usually stated in terms of cubic metres or feet of the constituent. This estimate may be converted into quantity of edible flesh, for faunal remains; quantity of wood burned for fuel, ash in the matrix; and so on. The choice to sample in a manner permitting volumetric information depends upon the plans for use of the analytic results. As sampling and analysis of small columns is not too time-consuming, the columnar approach is often used even though no volumetric calculations are planned. Indeed, most original column samples are cut to a dry work weight before processing ever begins (Meighan, *et al.*, 1958a:4).

More of a problem to process is examination of entire excavation units (Curtis 1959, 1961, 1965; Koloseike and Paterson 1963; Chartkoff 1966; Fredrickson 1969). Few projects, however, can afford the man-power needed for fine analysis of columns 3' x 3' or larger.

The alternative to columnar sampling is sampling without volume control. The so-called mixed samples are quantities of matrix taken "at random" from the site and to represent the site matrix at that point. This was Gifford's (1916) approach. His samples were rarely taken from one vertical plane, and his determination of sample representativeness was based on archaeological judgment. Later investigators standardized usage by sampling several times from single vertical planes – usually at arbitrarily established sampling intervals. In shallow sites each excavation unit might be represented by only one mixed sample, taken somewhere within the unit, avoiding localized deposits (Cook and Treganza 1947). In more complex situations, the mixed samples might be removed at standard intervals from a cleared face of each excavation unit. Except for lack of volume data, these suites of mixed samples were in many cases comparable with column samples.

This last version of the mixed sampling approach was what we used in 1968 and some 1969 collections at our sites. All samples were taken from fifteen centimetre intervals throughout the depth of the sampled units. A number of the suites were collected after complete excavation of a unit, and were extracted from the 15 cm artificial levels marked on one wall. Other suites are composed of samples taken during excavation, each from somewhere within each level. Those suites taken during excavation are prefixed with an FS; those taken after with an FSC.

Mixed samples taken in 1970 were only collected from major strata. Matrix characteristic of the stratum as a whole was collected, avoiding archaeological features such as burials, fire hearths, and boulders. Some areas of the site, however, posed problems of stratum perception. Both samples and stratigraphy recorded during excavation of such areas (*e.g.*, FS 10 at Namu) were re-evaluated after exposure of the full profile of the unit. Occasionally revision of the record was necessary when we had sampled a mixture of strata (*e.g.*, suite FS 10).

An alternative sampling procedure overcame this problem: natural stratum samples were collected from the profile after excavation (FSC). A metre-wide sampling area was marked on the exposure, and a sample was taken from each stratum, throughout the unit's depth with no restrictions on how deep into the wall we might go for the sample. Prior to collection the area was isolated on three sides from surrounding matrix. While this procedure avoids the stratum perception problem, it is subject to the same problem inherent in all columnar sampling: we are likely to encounter at least one localized feature which will bias the sample from that stratum. This applies to certain of our samples (*e.g.*, FSC 4.7 from Kisameet and the upper FS 10 samples from Namu) which include atypical debris.

None of these considerations regulate the sample size. We sought samples large enough to represent the matrix constituents and yet small enough to transport to our laboratory. In the literature, recommended sample sizes are uniformly small, between one and eight pounds. Larger samples were handled in the field, as with our field sample processing for artifacts and bone. Initially our artificial level samples were taken to fill a quart-sized plastic bag. When dried, we had samples ranging from 300 grams (suite FSC 1 at Kisameet) to 1100 grams (FSC 1 from EkSx 1) Table XXXV (Appendix C). By the close of the 1969 field season, it seemed clear that samples of this size would not produce the full range of constituent data desired.

As discussed above, the key sampling criteria are that the sampled matrix constituents must be abundant, finely fragmented, and evenly distributed. However, no specific guidelines were set on these criteria. The site situation must determine the answers.

It appeared that only shell would meet the criteria; the soil/rock component might also, but we lack direction in the interpretation of its cultural significance. Everything else was considerably more rare. Bone was the third most abundant constituent, after shell and rock. A larger sample would clarify the results for all constituents, including shell, since its presence in small and large samples from the same stratum could then be compared. Consequently, we began the 1970 sampling by collecting large quantities of matrix from each natural stratum. In some cases these weighed over 100 pounds wet each; none weighed under 18 pounds, and those few which were this small represented an unavoidably small stratum sampling area. When dried, we reduced as many as possible to a uniform thirty-five pound work weight.

At Namu in 1970 two excavation units (FS 9 and FS 10) were sampled twice. In 1969, both Namu and Kisameet produced two-suite collections from units excavated by artificial levels (suites FS 2 and PS 2A at Namu; and FS 2 and PS 2 at Kisameet). We believed the examination of several samples from one stratum would permit definition of the range of variation present in that stratum. This is an ideal which we would like to have incorporated in all of the sampling. Since we were unable to fulfill this objective for all suites, this point remains a source of criticism of our sample results.

In summary, our excavation activities were undertaken to expose the site in cross-section along the short axis, in order to discover the sequence of site depositional history. The first step in recording this sequence was observation of *in situ* strata utilizing standardized criteria. This observation provided the empirical bases for location of matrix sampling areas and the individual sample selection in 1970. Maintenance of the contextual dimensions of the sample data was of prime consideration to its laboratory analysis.

SAMPLE CONTENT

Considerations of time and sample representativeness determined which of the collected sample suites were to be analyzed. Of first consideration were those larger matrix samples representing natural strata, all those collected in 1970. I chose to analyze the best of these: suites FS 9, FSC 9, FSC 4, and FSC 10 from Namu and suite FSC 4 from Kisameet. The large suite FS 10 collected from the Namu Front Trench during excavation does not precisely represent the stratigraphy perceived after exposure of the profile. We cannot therefore be certain of the content-context relationship for all parts of the suite. The smaller suite from the Roscoe Inlet midden, FBSx 6, was severely damaged by water during a storm while in transit from the site to Namu. On these grounds, it was removed from consideration.

Several smaller sample suites collected prior to 1970 from artificial level excavation were analyzed. Suite FSC 1 from Kisameet and the 1968 test pit suite from Namu were fully examined. The analyses of these five suites must be used with caution due to the difficulty inherent in making content-context relationship statements with samples from artificial level excavation.

The collected matrix samples were transported wet from Namu to the laboratory in Boulder. Those selected for analysis were dried at either room temperature for several weeks, or in a drying oven at 180°F. for one to two days. The literature on midden sampling showed no established drying time or preferred temperature. If mentioned at all (*e.g.*, Treganza and Cook 1948:288), air-drying was generally employed to reduce the moisture content of all samples to a comparable status. An exceptional inquiry into sample moisture content conducted on New Zealand midden material indicated that the greatest amount of moisture was held by the finer debris in each sample, that termed "residue" by most analysts and usually left unprocessed (Terrell 1967:49-51). His information on differential moisture retention among constituents indicates that aspect should pose no problems, in that residue is rarely a concern in analysis. He concludes that for most purposes it is not necessary to dehydrate samples before constituent analysis on a weight basis. His findings served as the rationale for our proceeding without further concern for sample dehydration once the matrix became dry enough to sieve. The greatest moisture content occurs in the finer-than-two millimeter debris which served as our residue. Therefore, the weights and weight-percentages for that fraction should be used with this in mind. Terrell's samples contained an average of 60% of the total sample moisture content in material this fine. For his matrix, this would mean residue moisture accounted for an average of 2.4% of total sample weight.

The dried samples in each suite were in most cases cut to a standard dry weight. These weights ranged from 300 grams per sample in the FSC 1 suite from Kisameet, to 35 pounds per sample for all suites collected in 1970. Given the premise that chosen sample weight, whatever it is, is adequate for reflection of constituent proportions, conversion to a standard work weight is mere convenience. Thus, we used both large and small sized samples to make statements about stratum content. Exceptions are that we chose not to cut the raw sample weights in EkSx 1 and FbTc 1 suites, but rather used the original weights to derive proportions.

Deviations in working weights among a standardized suite derive from several sources. Samples FSC 9.4_2 and FSC 10.10 are each considerably greater than the suite standard of 35 pounds per sample. These were inadvertently processed uncut in the confusion of changing the laboratory location midway through analysis. A number of samples are significantly underweight by suite standards, due to small size of the parent matrix. These were noted in the preceding section on sample context, and include FS 9.6, FSC 9.6, FSC 9.4_1 at Namu and FSC 4.3 and FSC 4.5 at Kisameet. Other causes of underweight samples include inability to estimate how much wet matrix in the field would convert to 35 pounds dry; and inadequate measuring equipment. The fact that we must work with both pounds and grams require a single scale which could accommodate both weighing needs. As it was, we used two different scales which were available to us, the larger of which could not respond below one-quarter pound. The gram scale was adequate for small measurements up to several thousand grams and permitted readings to one-tenth gram. Conversion between the two was necessary but introduced error.

The isolation of matrix sample constituents was facilitated with mechanical separation of the dried and weighed sample into manageable portions. Large visually identifiable material was separated from debris too small to be identified without recourse to magnification or chemical treatment. Thus, while in theory all the sample matrix could be analyzed in terms of constituent proportions, in practice only the larger materials were so treated. We were particularly interested in the proportional status of those large constituents observable *in situ*, as previous investigators (Cook and Treganza 1947:137; Davidson 1964; Greenwood 1961a, 1961b; Meighan 1970) suggested they produced a fair picture of overall midden content proportions.

The same studies recommended the size of matrix portions to be analyzed and portions to be set aside. The segregation of samples traditionally, and for us, involves using a set of super-imposed or nested standard sieves, with uniform sized openings, on a motor-driven shaker which imparts both a circular and a tapping motion to the sieves. The equipment we used included the W.S. Tyler Company (Cleveland) mechanical shaker and the U.S. Bureau of Standards test sieves. The sieve with the largest aperture size is placed on top with smaller screens in descending order below and a catch-pan on the bottom. A flat lid closes the system after sample matrix has been introduced at the top. While the set-up will take all of a small sample in one sieving, the 35 pound samples had to be taken in several sievings each. To my knowledge, a larger standard system is not available for laboratory use, although field set-ups along similar lines have been made (Chartkoff 1966).

No set sifting time is suggested in the literature, although when dealing with friable constituents time in screening ultimately has a detrimental effect on particle size. Most of our samples were shaken less than three-quarters of a minute. Samples not sufficiently sifted in a minute's time were still too damp for processing and were returned to the drying oven.

Previous studies suggested a choice of sieves for the segregation. The choices made by a number of investigators involved in this work, indicates a preference for the 1/8 inch and 1/4 inch aperture screens. Although equipment is not often discussed in reports of sample analysis, I suspect that many have used similar standardized systems in the laboratory. The aperture dimensions expressed in inches are thus conversions from original dimensions expressed in millimetres on the sieves. At any rate, neither the Tyler Company nor the U.S. Bureau of Standards sets contains sieves of precisely 1/4 inch or 1/8 inch apertures. With reference to these sizes, however, investigators choose a critical screen – which sets the size limit on debris to be sorted and studied. Cook and Treganza (1947:137) preferred the 1/8 inch mesh:

> . . . the critical screen size, one-eighth inch, was selected because it retains those particles the nature of which can be detected with reasonable ease with the naked eye. Smaller screens would of course segregate more material but a binocular microscope would be necessary for separation of individual particles, an operation which would preclude the use of sufficiently large samples. With rock, bone, or any other discrete constituent the particle size obviously grades consistently from very large through the readily visible to the microscopic and even the ultra-microscopic. Hence we can never determine by purely mechanical means the absolute total of any component in the entire sample. It is obligatory to draw the line at some standard and convenient screen size and to express results in terms of such dimensions.

Davidson (1964:155) reports a 10% increase in accuracy of estimate when using material this small, and many people prefer the extra expenditure of time necessary to gain that advantage. Various estimates indicate the task can take more than twice as much time using 1/8 inch screen as the next larger screen size (Davidson 1964; Chartkoff 1966; Koloseike 1970). Therefore, the screen with a 1/4 inch aperture size is favored by many (Greenwood 1961a, 1961b; Meighan 1970). Still larger screens are used to filter out very large debris.

The best foundation on which to make the screen size decision is a test-processing of site matrix. In our situation, it was discovered that shellfish species could not be easily identified from fragments smaller than four millimetres. As this size fell between the two favored critical screen sizes of 1/8 inch and 1/4 inch, it became our choice for critical screen size. The two millimetre screen was used in conjunction to help handle the huge quantities of residue produced in sieving the larger matrix samples. While neither the two millimetre fraction nor the residue was formally analyzed, both were superficially examined for a subjective impression of major constituent proportions. These examinations suggest that the four millimetre fraction contains a fair picture of stratum matrix content.

As anticipated from field observations, the soil component of black matrix deposits passes through even the two millimetre screen to become a major constituent in residue. Table XXXV in Appendix C provides the weights and percentages of the total sample from each stratum represented by the four millimetre, two millimetre, and residue fractions. Almost 90% of the black matrix is finer than would be caught by the four millimetre screen and these samples consistently exhibit great residue quantities (Table VIII).

Black matrix samples at Namu reveal on the average a four millimetre screen retention of 11% of the total sample (10% for the ancient basal black matrix strata alone). But of this four millimetre debris, the bulk is rock. In fact, if those strata high in organic conglomerate (indicated by an asterisk in Table VIII) are corrected for that constituent, all strata observed as black matrix exhibit a greater than 90% rock contribution to the total four millimetre fraction weight. The correlation between high residue proportion, four millimetre rock content, and black matrix is quite good. The only discrepancy at Namu is stratum FS 9.6 in the Rear Trench, whose finely pulverized shell produced an analytic result much like a black matrix stratum. This deposit is a peculiarity of the rock outcrop region, and as a rule such shell decomposition is rare. Heavy sampling of fine hearth debris is the cause of the black matrix-like reading for stratum FSC 10.7. Shell admixture is considered to cause the uncharacteristic readings of black, charcoal-laden strata FS 4.5 and FS 4.3 at Kisameet. Although we have not established that recent humic and charcoal deposits behave as black matrix strata, the assumption is made that the black matrix deposits were at one time humic.

Table VIII Sample Breakdown Correlations (B)

STRATUM	STATUS	% of RESIDUE IN TOTAL SAMPLE	% OF ROCK IN 4 mm FRACTION
FS 9 3	B	91 %	97 %
FSC 9.10^2	B	90 %	96 %
FSC 9. 3^2	B	88 %	99 %
FS 9. 7	B	82 %	99 %
FS 9 10	B	81 %	97 %
FS 9. 3$_1$	B *	78 %	76 %
FSC 4. 8	B	78 %	98 %
FS 9. 8	B	77 %	93 %
FSC 10 7	(1)	77 %	93 %
FSC 10 3	S	77 %	46 %
FSC 9.5-7 8	B *	75 %	97 %
FSC 10. 9	S	75 %	61 %
FSC 10.12	S	74 %	82 %
FSC 4. 7	S	74 %	73 %
(K) FSC 4 14	S	73 %	74 %
(K) FSC 4.10	S	72 %	80 %
FSC 10 10	S +	71 %	61 %
FS 9 6	(2)	70 %	98 %
FSC 10.11	S	70 %	57 %
FSC 10. 5	S	68 %	41 %
FSC 10. 6	S	68 %	77 %
FSC 9. 6	(2)	68 %	91 %
(K) FSC 4. 9	S +	67 %	84 %
FSC 9 3$_1$	B *	67 %	93 %
FSC 4. 4	S	66 %	59 %
FS 9. 5	B	66 %	99 %
FSC 10. 4	S	65 %	33 %
(K) FSC 4.11	S	65 %	78 %
FSC 4. 5	S	63 %	45 %
FSC 4. 6	B - *	63 %	36 %
FSC 10.14	S	63 %	32 %
(K) FSC 4. 7	S	62 %	85 %
(K) FSC 4 13	S	62 %	55 %
(K) FSC 4.12	S	61 %	73 %
(K) FSC 4. 8	S	61 %	65 %
FSC 4. 3	S	59 %	15 %
FSC 9. 4$_1$	S	59 %	28 %
FSC 10. 8	S	57 %	62 %
(K) FSC 4 3	(3) - *	57 %	43 %
FSC 10 2	S	56 %	44 %
(K) FSC 4. 5	(3) - *	55 %	25 %
FS 9. 2	S	55 %	31 %
FS 9 1	S	53 %	25 %
FSC 10. 1	S	49 %	43 %

As Table IX illustrates correlation between four millimetre fraction proportion and the proportion of shell in that fraction, while not perfect, is suggestive. The "pure shell" deposits stand out clearly and the shell less deposits cluster at the opposite end of the distribution. The wide range in between reflects a great variety of shell-soil mixtures with differing degrees of fragmentation. Several shell-bearing strata exhibit smaller four millimetre retentions than black matrix strata, a feature apparent in even *in situ* observation of the deposits. Explanations of the occasional high fragmentation of shell constituents in strata include continual or heavy compaction and reworking of the deposits through heavy utilization of the surface during accumulation. It is certain that the more loosely associated, shell-heavy deposits like FS 4.6 at Kisameet and FS 9.1 at Namu never saw the surface activity which is evidenced in the upper shell strata of the Namu Front Trench. This suggests those strata with high four millimetre contents and concommittant high four millimetre shell contents represent areas of the site utilized more for dumping than habitation.

Table IX Sample Breakdown Correlations (S)

STRATUM	STATUS	% of 4 mm FRACTION IN TOTAL	% of SHELL IN 4 mm FRACTION
(K) FSC 4. 2	S	65 %	80 %
FSC 10.13	S	54 %	94 %
FS 9. 4	S	52 %	89 %
(K) FSC 4. 4	S	51 %	78 %
FSC 9. 4_2	S +	47 %	82 %
FSC 10.15	S	44 %	18 %
(K) FSC 4. 6	S	41 %	94 %
FSC 9. 1	S -	39 %	91 %
FS 9. 2	S	34 %	69 %
FS 9. 1	S	33 %	74 %
(K) FSC 4. 3	(3) - *	33 %	51 %
FSC 10. 1	S	30 %	56 %
(K) FSC 4. 5	(3) - *	30 %	50 %
FS 9. 5	B	25 %	TRACE
FSC 10. 8	S	25 %	38 %
FSC 4. 3	S	24 %	84 %
FSC 10. 2	S	24 %	34 %
(K) FSC 4. 7	S	21 %	14 %
(K) FSC 4.13	S	21 %	45 %
FSC 9. 4_1	S - *	21 %	72 %
(K) FSC 4. 9	S	20 %	15 %
FSC 10. 14	S	18 %	54 %
FSC 10. 6	S	18 %	19 %
(K) FSC 4.12	S	18 %	26 %
(K) FSC 4.11	S	17 %	21 %
(K) FSC 4. 8	S	17 %	33 %
FSC 4. 6	B -	17 %	2 %
FS 9. 6	(2) -	17 %	1 %
FSC 4. 4	S	16 %	39 %
FSC 9. 5-7-8	B	16 %	TRACE
FSC 9. 3_1	B -	16 %	TRACE
FSC 10. 4	S	15 %	61 %
FS 9. 3_1	B *	15 %	TRACE
FSC 10.10	S +	15 %	37 %
FSC 10.11	S	14 %	41 %
FSC 10. 5	S	14 %	57 %
FSC 10.12	S	14 %	18 %
FSC 10. 7	(1)	13 %	3 %
FSC 4. 5	S	13 %	54 %
FS 9. 8	B -	13 %	TRACE
FSC 9. 6	(2) - *	13 %	TRACE
(K) FSC 4.10	S	12 %	19 %
(K) FSC 4.14	S	11 %	26 %
FSC 10. 9	S	11 %	37 %

The graphs on the following pages illustrate the patterns of particle size through time. Fragmentation is viewed here as a function of antiquity and utilization. I include antiquity because our data do not permit us to rule out that possible influence over the status of the oldest shell deposits, most of which exhibit low four millimetre retention. Other than the FS 9.6 anomaly, however, no other causal factor is identified as consistently as areal utilization during and after deposition.

As expected, the two millimetre curve is rather flat. When the 1968 suites from both Namu and Kisameet were originally processed, both one millimetre and half millimetre sieves were used, and both produced similarly flat curves. Residue is generally predominant – except in those "pure shell" strata noted above. The four millimetre and residue curves are nearly mirror images in most cases. Unlike the curves for the 1970 (natural stratum) suites, those for the 1968 and 1969 (artificial level) suites are less revealing of trends. With no supporting stratigraphic data, the FbTc 1 and EkSx 1 confusion is impossible to unscramble. The 1968 curve from Kisameet, however, suggests that some of the problem lies in sample interval sizes, which were all 15 centimetres in this case. According to our records on the 1968 data, the upper portions of the FSC 1 sequence at Kisameet should mirror those in FSC 4, reflecting the shell-black-shell-black alternation in the top metre of midden debris. The 15 centimetre sampling interval seems inappropriate in this case to catch the dramatic distinctions of this sequence. One of the most interesting manipulations of these initial sample data is illustrated in Figure 44 which compares the curves for the four millimetre fraction with those of the four millimetre shell. This is expressed not in terms of its contribution to the total four millimetre weight, but rather in terms of its contribution to total sample weight. The paralleling of the curves suggests a real relationship between shell content and particle size in the strata but at the same time, a relationship which includes the complementary pattern produced in black matrix or non-shell strata.

A second stage of processing produced the shell and other constituent data. The four millimetre fraction was hand-sorted for its constituents, which were placed in the following classes:

1) shell
2) rock
3) bone
4) charcoal
5) plant remains (primarily rootlets)
6) artifacts
7) an 'organic conglomerate"

The frequency distributions for these constituents are given in Table XXXV in Appendix C and are diagrammatically represented in the following graphs. In interpretation of these figures it may be said that whether or not the four millimetre fraction is a true reflection of stratum constituent proportions, the four millimetre debris from all the samples is at least internally comparable. Therefore, we

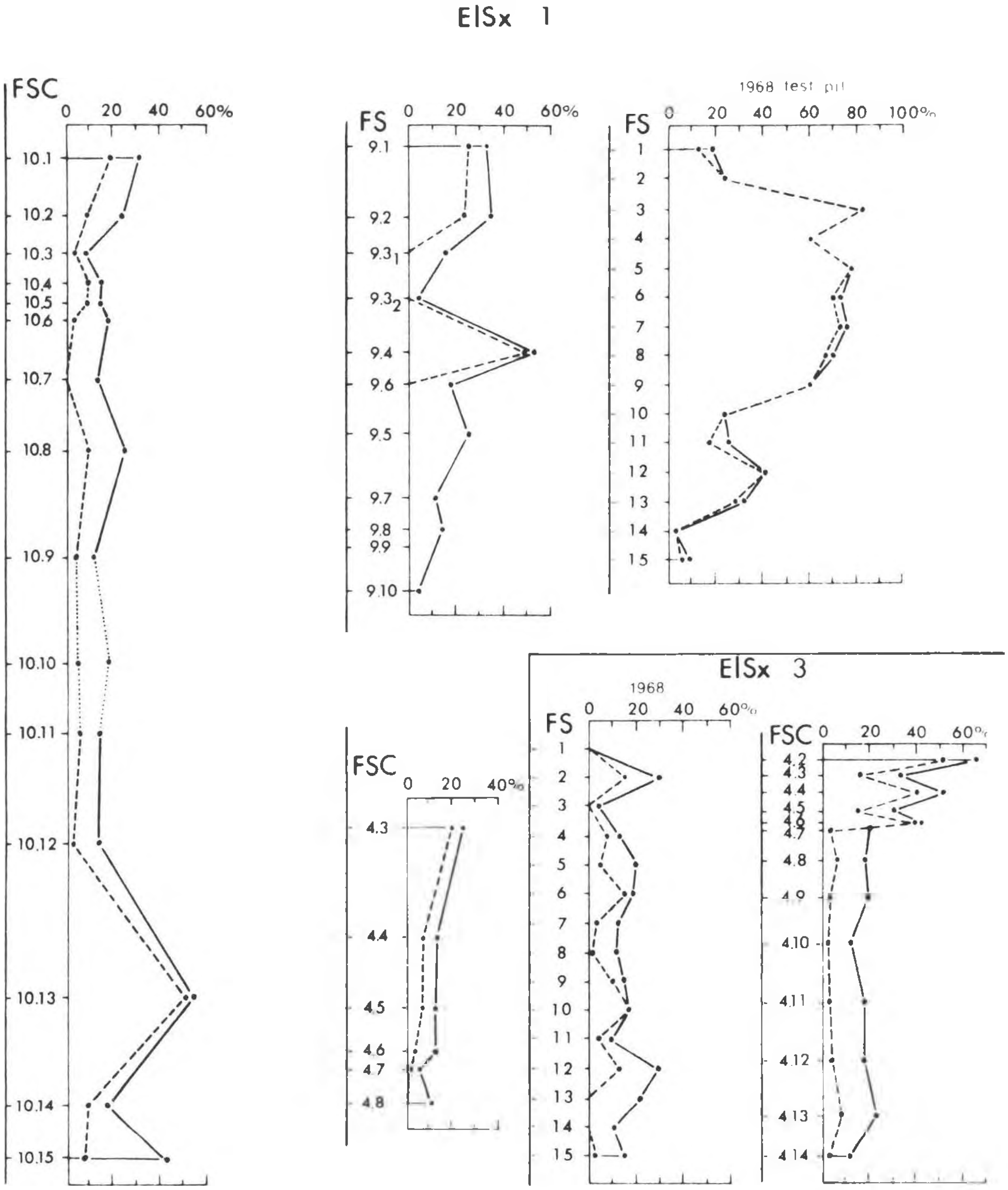


Fig. 44 Correlations between four millimetre shell (dashed line) and four millimetre total (solid line) distributions in terms of perçentage of total sample weight per level.

may discuss trends and changes in four millimetre content through time – completely aside, if necessary, from implications for total stratum change. It is, of course, our contention that this debris is reflective of the stratum, and indicative of site utilization.

Among the seven constituent classes, only shell and rock occurred consistently and in quantity enough for manipulation of sample statistics. The low readings for other constituents agree with the *in situ* stratum observations. Except for occasional large-sized bones or artifacts, their proportional representations are probably quite fair. As with the four millimetre fraction and residue curves, the four millimetre rock and shell curves present distributional mirror images in most sequences. Tables VIII and IX demonstrate that black matrix and shell strata behave characteristically with respect to shell and rock content. Data for this stage of analysis is not available for the FS 2A suite, and primary data from EkSx 1 and FbTc 1 suites are not graphed.

Samples from the 1968 test pit suite show the trend in shell content suggested by the four millimetre fraction curve. Although this distribution is not at complete odds with observed sample context, nor with that from FS 4, what it signifies in terms of site utilization is not certain. What is required are stratigraphic associations for each sample. The high shell content and high four millimetre retention suggest an area seeing little intense use but considerable shell disposal; during the period dated by analogy with FS 4 as the 1000 years prior to 1800 BP.

Total sample breakdown in shell and rock from the FSC 1 suite at Kisameet is similar to the natural stratum trends seen in the FSC 4 sequence for the site. It fails in this only at the top of the exposure where strata are too thin to be separated in artificial level extraction. The curves from the four millimetre analysis, however, are quite confusing, for when rock and shell are expressed in terms of their contribution to total four millimetre fraction weight, we get only the barest suggestion of the trend we know to be present. Even the Namu 1968 test pit suite produces a clearer picture of the distribution it should reflect. Expressing these data relative to the total sample (the broken line on the graphs) erases some confusion, but the situation remains unexplained, unless we suggest that the 300 gram sample is too small for recovery of meaningful data.

In general, the percentage of four millimetre constituents relative to total four millimetre weight dramatically emphasizes the natural trends in the deposits. This technique applies for all suites but the problematical FSC 1 from Kisameet, which seems to be uninterpretable. This evidence suggests that trend determination may not be possible using such small samples as those from FSC 1 at Kisameet.

With examination of Figure 45 the graph comparing the FS 9 and FSC 9 suites' shell and rock curves, we encounter the sample size problem from another angle. The reconstructed strata column contains the strata according to superpositioning. As described previously, in collecting suite FS 9 we sampled the area's top shell deposit in two places, producing samples FS 9.1 and FS 9.2. Suite FSC 9 contains only one sample from the deposit which is slightly underweight, about 86% of the weight of the other two samples from the deposit. Theoretically, the three samples from stratum FS 9.1 should produce the same proportions in constituent analysis. In fact, the results are similar as Table X illustrates. The greatest discrepancy lies with the underweight sample, and is present in both the total sample breakdown and the four millimetre breakdown figures – but not in shellfish species proportions. Perhaps we are dealing here with the minimum effective sample size.

A second such group sampled from stratum FS 9.4, contains two deviations from the suite standard sample weight of 35 pounds: sample FSC 9.4_1 represents only 31% of the standard, while sample FSC 9.4_2 is overweight by about 25%. Again, the greatest discrepancy lies with the underweight sample; in this case even the shellfish species distributions are affected.

These observations account for the curve differences as graphed and further suggest the possibility of size limits for sample sensitivity to the stratigraphic situation. No other three-sample sets exist in the collection however, to test these observations further.

A third processing stage generated the shellfish species data provided in Table XXXVI in Appendix C and diagrammed in Figures 46-52. Tables XXXII and XXXIII in Appendix B identify the species taxonomically and locate their habitats within the littoral. Two distribution curves are given for each constituent: one (solid line) in terms of percentage of total four millimetre shell weight, the other (broken line) reflects the four millimetre fraction weight as a percentage of total sample weight.

The fragmented state of most midden shell prevents identification to species. For example, the main distinctions of *Saxidomus giganteus* and *Schizothaerus capax* can occur at the hinge. Therefore the two are graphed together here. While they share habitats, *Schizothoerus* seems somewhat the less common today.

Similar difficulties arose over segregation of *Mytilus edulis,* the small bay mussel, from the much larger sea mussel, *Mytilus californianus.* While both are edible, the larger species provided raw material for artifact and ornament manufacture. Both are fragile and few intact pieces larger than a quarter of an inch remain. These are deteriorated so that it is impossible to separate the thick-shelled *M. californianus* from the delicate *M. edulis.* The two are therefore considered together here. My guess is there is a predominance of bay mussel, *M. edulis.* A considerable amount of pulverized and powdered mussel appeared in both the two millimetre and residue fractions, a fact observed by others (Gifford 1916; Greengo 1951). The mussel contribution to four millimetre composition is therefore smaller than its actual contribution to the stratum as a whole.

Barnacle posed another identification problem because of fragmentation. It is difficult to segregate the three or four species possibly present. The bulk of barnacle at the sites is of a large species of acorn barnacle. Historic records indicate *Balanus nubilus* was the edible large barnacle

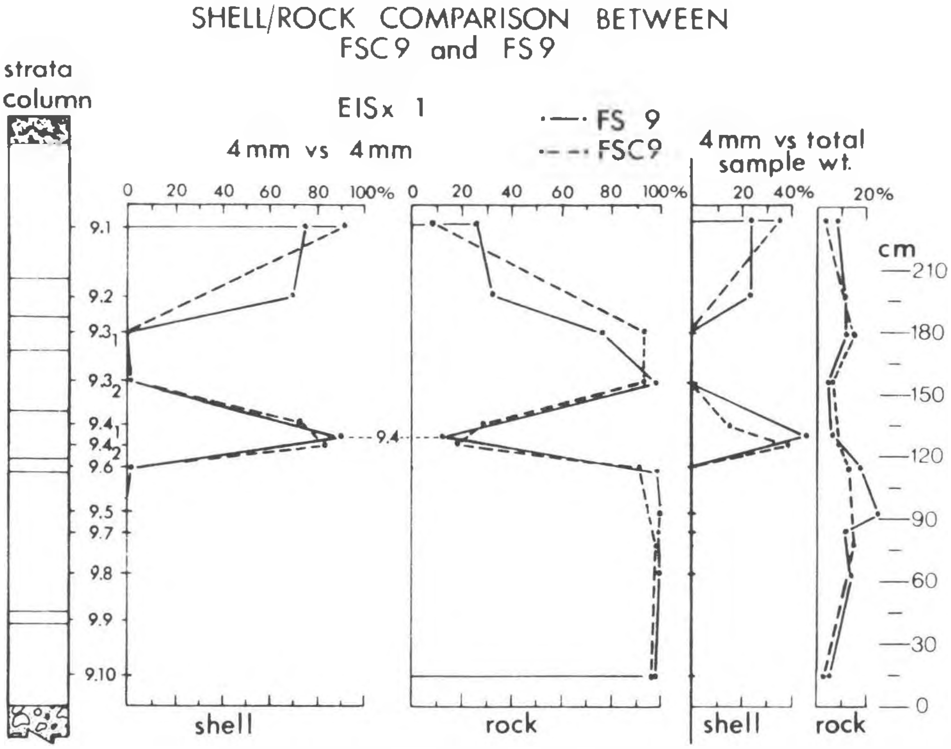


Fig. 45 Comparison between shell and rock content of the four millimetre fraction for suites "FS 9" and FSC 9", EISx 1. Graphs at left express proportions in terms of total four millimetre fraction weight. Graphs at right express proportions in terms of total sample weight. Strata column integrates both sequences according to stratigraphic superpositioning.

Table X Comparison of sample breakdown between three samples from the same stratum

STRATUM FS 9 1	FS 9.1	FS 9.2	FSC 9.1	mean	average variance from mean	average variance as % of the mean
sample weight (lbs.)	34.40	34 50	30.10			
% Residue	53 %	55 %	46 %	51 %	± 3.7	7%
% 2 mm fraction	13 %	11 %	15 %	13 %	± 1.3	10 %
% 4 mm fraction	33 %	34 %	39 %	35 %	± 2.3	7 %
% of shell in 4 mm	74 %	69 %	91 %	78 %	± 8.7	11 %
% of rock in 4 mm	25 %	31 %	7 %	21 %	± 9.3	44 %
% of *S.* in 4 mm shell	66 %	61 %	61 %	63 %	± 2.3	4 %
% of *B.* in 4 mm shell	24 %	33 %	30 %	29 %	± 3.3	11 %

STRATUM FS 9.4	FS 9.4	FSC 9.4_1	FSC 9.4_2			
sample weight (lbs.)	35.10	11.00	44.40			
% Residue	37 %	59 %	40 %	45 %	± 9.0	20 %
% 2 mm fraction	11 %	20 %	13 %	15 %	± 3.7	24 %
% 4 mm fraction	52 %	21 %	47 %	40 %	± 12.7	32 %
% of shell in 4 mm	89 %	72 %	82 %	81 %	± 6.0	7 %
% of rock in 4 mm	11 %	28 %	18 %	19 %	± 6.0	31 %
% of *S.* in 4 mm shell	73 %	53 %	78 %	68 %	± 10.0	15 %
% of *B.* in 4 mm shell	25 %	40 %	19 %	28 %	± 8.0	29 %

S. represents large clams *Saxidomus* and *Schizothaerus;*
B. represents the barnacle *Balanus.*

favoured by coastal inhabitants. Its preferred habitat is the hold-fast of kelp, where the barnacles congregate and even grow on top of each other. Kelp broken loose in storms is washed ashore, barnacles and all, where it is easily attainable. A close cousin is *Balanus altissimus,* occupying rocks above low tide and thus even more accessible. No indication of edibility is given, however, for the latter. The large size of the archaeological barnacle remains suggests that we have one or both species · *B. cariosus,* (inedible?) are included as well, as it grows currently in the intertidal zone. *B. cariosus* is the only coastal species with a membranous base, and, in fact, we find little evidence of bases, broken or whole, among the site remains. The size of the archaeological shell appears to exceed that of *B. cariosus.* A few remains of the tiny species *Balanus balanus* occur in the site, possibly representing unintentional collection while pursuing other intertidal species.

Barnacle is preserved as well as the larger clamshells in site deposits, but once the shell begins to exfoliate, it becomes difficult to segregate even clam from barnacle. Fragments smaller than those held on the four millimetre screen for both species appear simply as white shell. This affects the smaller clam *Protothaca* and the cockle *Clinocardium* as well. Once the cross-hatching of *Protothaca* or the ribs of *Clinocardium* have been weathered, they too appear as unidentifiable white shell fragments. The purple-grey shell of mussel, which also fluoresces under ultraviolet light, is identifiable even as residue, although it is impossible to extract in that powdery state. The tiny gastropods *Bittium* and *Littorina* are identifiable although they are less than four millimetres in size. Their contribution to the collection is minimal, however.

The presence of some species has interesting ecological implications. The barnacle genus *Coronula,* present in small numbers at both Namu and Kisameet, only grows imbedded in the skin of whales. A few fragments of small *Dentalium* shell occur. The nearest beds of that genus lie to the south, near Vancouver Island. This shell served as a trade good in the south, and it is possible that trade may explain its presence. *(Dentalium* occurs in levels FSC 10.5 at Namu and FS 4.5 and FS 4.6 at Kisameet.) A single fragment of abalone, *Haliotus kamtschatkana,* was found in the basal layer at Kisameet. A single fragment identifiable as crab claw was recovered from stratum FS 10.13 at Namu. Both species are currently present near the site and might be expected in the midden, although both leave quite fragile remains.

A wide range of littoral habitats is represented by the collection. The majority of the six predominant species are classed as intertidal. *Saxidomus, Protothaca,* and *Clinocardium* occur in the sandy tidal flats of fiord channel estuaries. *Schizothaerus* prefers the sand near the low tide mark.

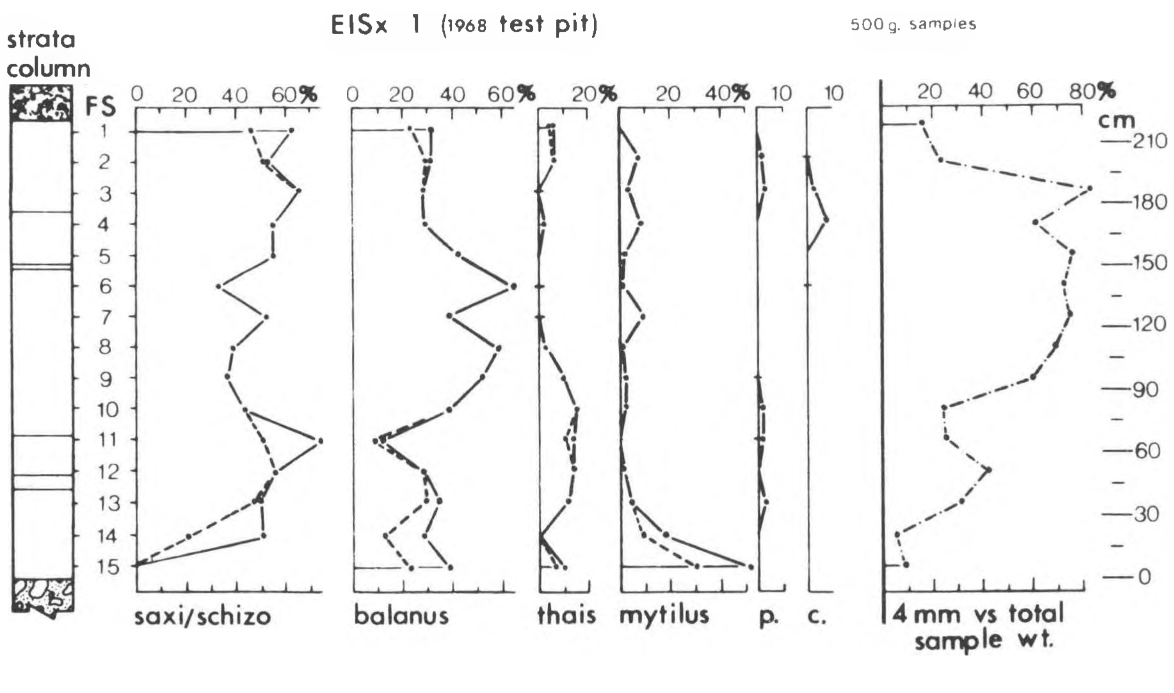


Fig. 46 Shellfish species distributions in terms of percentage of total four millimetre shell weight (solid line) and total four millimetre fraction weight (dashed line) per level. Dash-dot curve at right depicts the distribution of the four millimetre fractions in terms of total sample weight per level. See Appendix C for raw data.

Thais lamellosa prefers the intertidal zone of sheltered, rocky shores. The shell of each *Thais* reflects its habitat: rough-water dwellers exhibit thick, smooth shells, whereas animals growing in more sheltered waters exhibit delicate and many-frilled shells. Both types of shells are present in the collection. The small bay mussel prefers quiet waters below half-tide mark in rocky or gravelly areas of the intertidal zone. The larger sea mussel lives in the intertidal zone of rocky or surf-washed areas on the open coastline. The two largest *Balanus* species occur at or below low tide: *B. nubilus* on kelp hold-fasts and *B. altissimus* on rocks. The smaller barnacle species occupy shells and rocks higher up in the intertidal zone.

Other intertidal zone occupants in the collection include the tiny limpets and periwinkles, both of which grow on stones, pilings, and grasses. The abalone occurs in colonies on rocky beaches at and below maximum low tide. The small gastropod *Bittium* occurs in similar circumstances. Sea urchins live in rock crevices and tidal pools exposed only at low tide.

A single coastal bay may produce a majority of these species. At the ElSx 14 site near Namu, for example, lowest tide provides access to *Thais,* sea urchin, barnacles, limpets, periwinkles, and clams all living within yards of each other. The modern Bella Bella report that in historic times the people generally had favoured collecting locales for the major species. Large sea mussels were once collected from a rocky cove in the Namu area at some distance from the Namu Harbour beaches. Athough the beaches near the site may produce all clam species, other nearby beaches may produce more of certain species. A number of locales seem to have produced the archaeological shell. While we may hypothesize that all were collected near the site proper, we cannot identify which came from specific beds nor isolate which were transported from a greater distance. In view of the great quantities of shell collected to produce sizeable quantities of meat, it seems unlikely that great distances are involved in transport of barnacle and clam to the site. If historic patterns are applicable, the presence of the shell in the site suggests that the meat was extracted there. Historic practices regarding barnacle, however, included steaming the animals from their shells where they grew, thus reducing shell transport. This further suggests local availability for site shellfish species.

The wide variety of littoral and forest fauna sought by the site inhabitants supports the idea that the people we

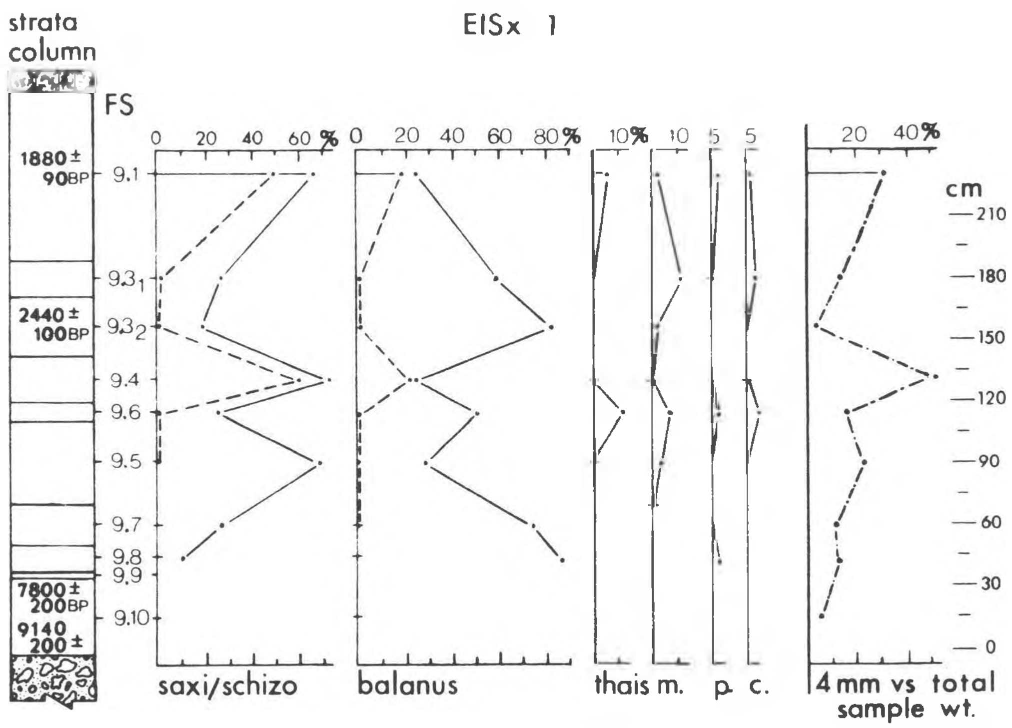


Fig. 47 Shellfish species distributions in terms of percentage of total four millimetre shell weight (solid line) and total four millimetre fraction weight (dashed line) per level. Dash-dot curve at right depicts the distribution of the four millimetre fractions in terms of total sample weight per level. See Appendix C for raw data.

are dealing with were opportunistic in their intensive exploitation of these zones (Shenkel 1971:1). In light of the abundance of fauna in given habitats, it seems that decline in the availability of a utilized resource led in general not to pursuit of that resource in a new area, but rather to change in emphasis of resources exploited in the original area (Luebbers 1971). This might particularly hold in situations involving gradual change in availability of one of two almost equally exploited species – such as barnacle and large clam at Namu and Kisameet. The possibility must be considered in explaining the shellfish and mammal species distribution trends.

As the graphs emphasize, the great bulk of site shell is clam and barnacle, with *Thais* and mussel ranking third and fourth. For much of their distributions, clam and barnacle almost mirror each other, and distinctive trends do seem to be present. The earliest occurrence of shell is that in layer FS 4.7 at Namu, dated about 4540 BP. The presence of shell in black matrix strata are felt to reflect contamination. Presence of a single shell fragment in a black matrix stratum sample must necessarily read as 100% for that species in the sample, greatly distorting the trends illustrated by the solid curve, as the graphs for suites FS 9 and FSC 9 reveal.

Suites FSC 4 and FSC 10 from Namu and FSC 4 from Kisameet contain numerous consecutive shell-bearing deposits in which site trends may be seen. Briefly, barnacle reaches a peak early in site history, accompanied by another rock-dweller, *Thais*; clams of all kinds peak later. Peaks in the occurrence of mussel are more difficult to define owing to its fine fragmentation.

In the oldest shell strata at Namu, the top four species are present in important quantities, with barnacle, *Thais*, and mussel more frequent than clam. *Protothaca* and cockle are not recorded. By 2800 BP however, clam predominates over all, as seen in FS 4 and FS 9 strata. Total shell volume increases in the site at this time, and the less common species increase in frequency, including the cockle and *Protothaca*. Clam, barnacle, and *Thais* reach peak proportions at Namu prior to 1800 BP, with clam and barnacle in nearly equal quantities. Decline in frequency of barnacle and *Thais* after this time accompanies a general site decline in shell quantities. Clam dominates the trio throughout the remainder of site history, showing a slightly greater increase

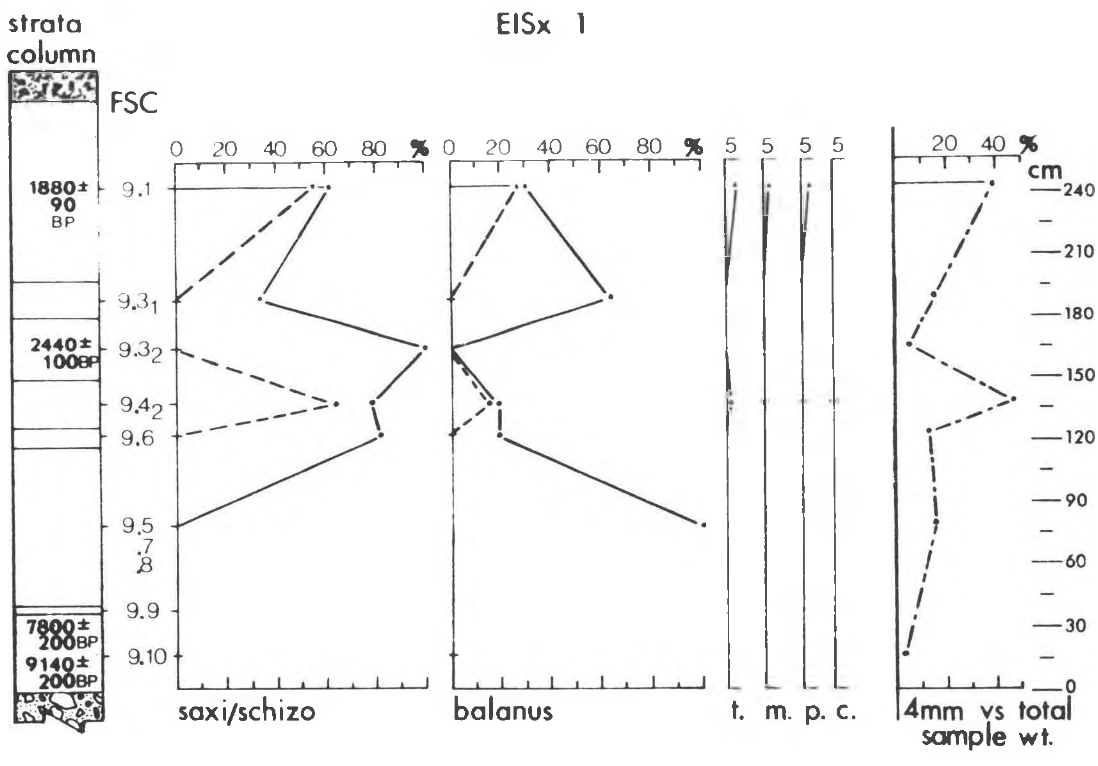


Fig. 48 Shellfish species distributions in terms of percentage of total four millimetre shell weight (solid line) and total four millimetre fraction weight (dashed line) per level. Dash-dot curve at right depicts the distribution of the four millimetre fractions in terms of total sample weight per level. See Appendix C for raw data.

than either of the others between 1800 BP and present. *Thais* all but disappears before 680 BP. Finally, the most recent, younger-than 480 BP strata at Namu exhibit increases for all species, particularly clam and barnacle. Mussel at Namu exhibits two peaks – one prior to 3400 BP accompanying the first barnacle and *Thais* peaks, and one at 480 BP, when other species are making rather insignificant showings. Between the two peaks, mussel remains in the background and does not even participate in the general increase in shell debris between 2880 and 1880 BP. Cockle and *Protothaca* occur in such small quantities that it is difficult to identify trends. It does seem, however, that they follow the large clams' trends more than those of *Thais* or barnacle. Considering the shared habitat, the similarity of clam species' distributions is perhaps to be expected. One might also explain the similar *Thais* and barnacle distributions in the same manner.

The Kisameet distribution gives another aspect of the picture. Unlike Namu, at Kisameet between 2290 BP and 1810 BP there is no great increase in shell at the site.

Barnacle and *Thais* move together, reaching a peak soon after 2290 BP and generally but slowly declining over the next thousand years – matching the Namu trend of roughly the same time. The large clams throughout this period are scarcely present, and neither cockle nor *Protothaca* are recorded. Clam apparently was not processed or discarded at Kisameet during this period. Mussel during this time behaves much as at Namu, with a rather even distribution throughout.

Considerably more recent than 1810 BP at Kisameet, we see a dramatic change in species occurrences, again resembling Namu. The large clams increase and predominate. Cockle and *Protothaca* appear in the collection. *Thais* declines and abruptly disappears, as at Namu. Barnacle reaches a third peak, still dominated by clam, as at Namu. How late the Kisameet deposits extend toward the present is unknown, however. The stratigraphic situations for upper Namu and upper Kisameet deposits are very similar. The fact coupled with the similarity in species trends suggest we are dealing with the last 1000 or even 700 years at both sites.

With respect to shell species within this upper stratigraphic pattern, both sites' curves for clam and barnacle exhibit sharp peaks and declines. These reflect both soil admixture and inclusion of hearth debris in samples of the thin strata, and the sampling of pockets of species-specific shell. Because of humic admixture and the possibly redeposited status of strata FSC 10.1 and FSC 10.2 at Namu, it is best to treat their sample results with caution. Nonetheless, an ' upper shell pattern" apparently correlates with the upper stratigraphic pattern, which exhibits considerable clam and barnacle disposal throughout, significant mussel

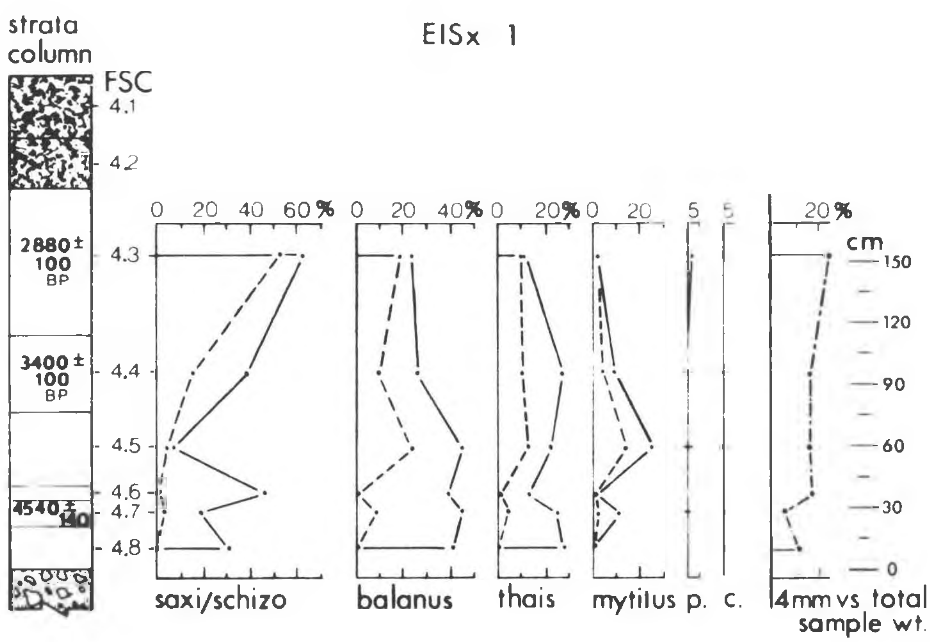


Fig. 49 Shellfish species distributions in terms of percentage of total four millimetre shell weight (solid line) and total four millimetre fraction weight (dashed line) per level. Dash-dot curve at right depicts the distribution of the four millimetre fractions in terms of total sample weight per level. See Appendix C for raw data.

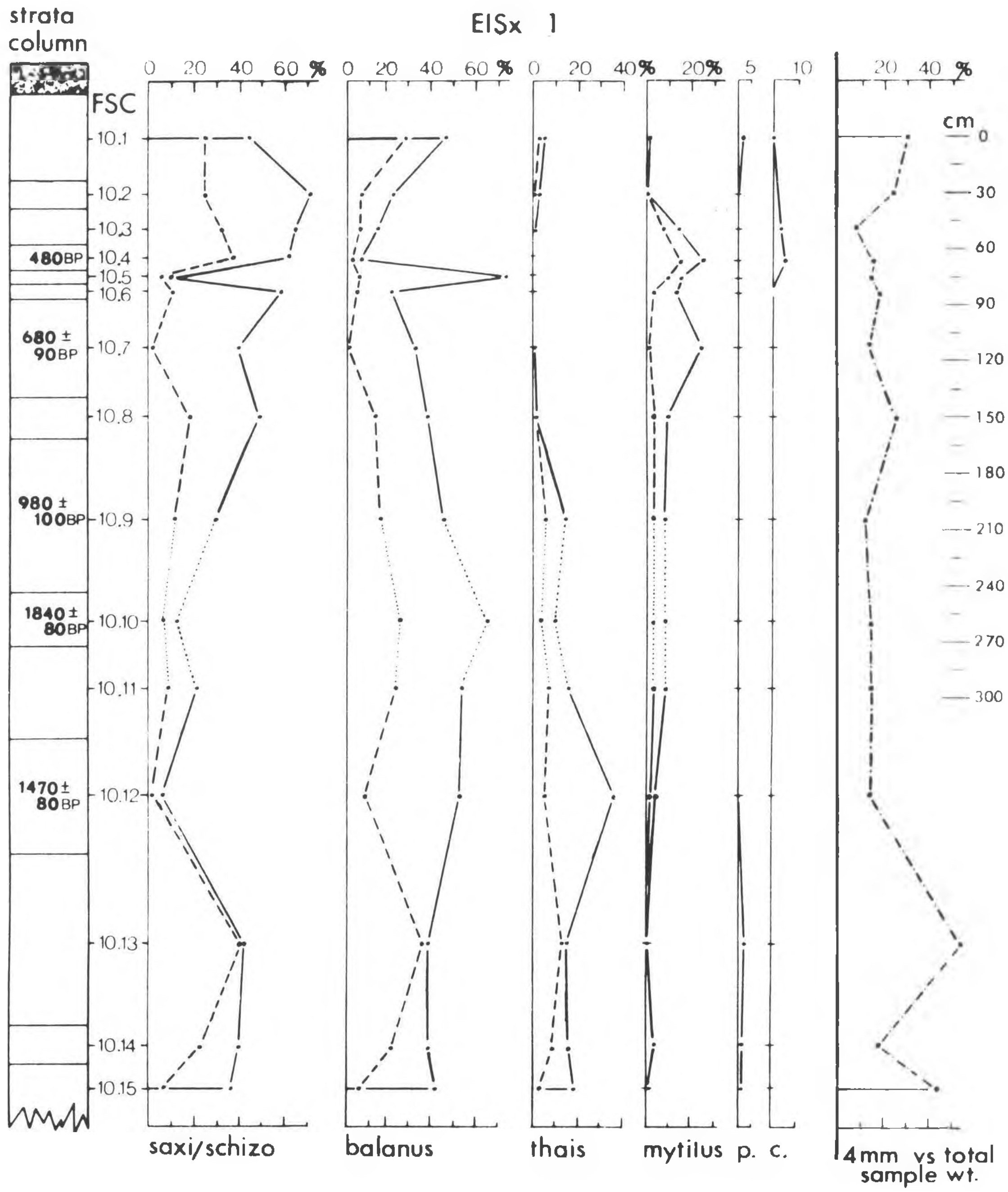


Fig. 50 Shellfish species distributions in terms of percentage of total four millimetre shell weight (solid line) and total four millimetre fraction weight (dashed line) per level. Dash-dot curve at right depicts the distribution of the four millimetre fractions in terms of total sample weight per level. See Appendix C for raw data.

followed by early disappearance of the species, and virtually no *Thais* after the initial strata in the period.

Turning last to the small samples from the artificial levels of unit FS 1 at Kisameet and the 1968 test pit at Namu, we find suggestions of the trends illustrated by the natural stratum suites. Levels 9 or 10 through 14 in the 1968 test pit may well correlate with basal shell strata in FS 4, dating 3400 BP or older. The samples, however, do

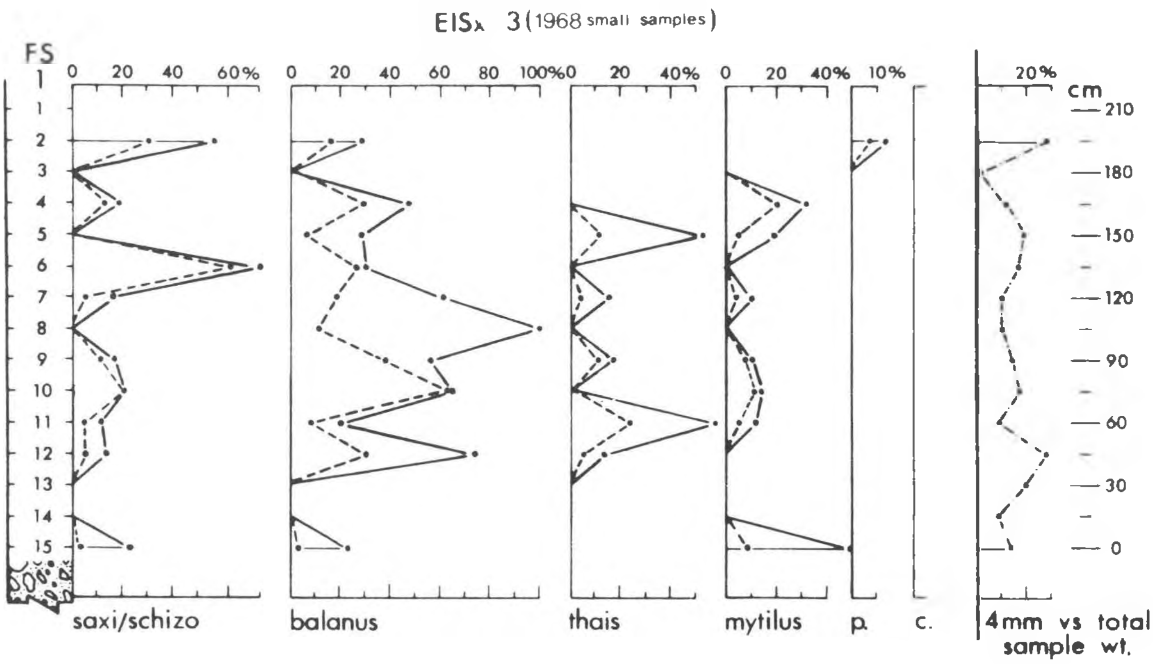


Fig. 51 Shellfish species distributions in terms of percentage of total four millimetre shell weight (solid line) and total four millimetre fraction weight (dashed line) per level. Dash-dot curve at right depicts the distribution of the four millimetre fractions in terms of total sample weight per level. See Appendix C for raw data.

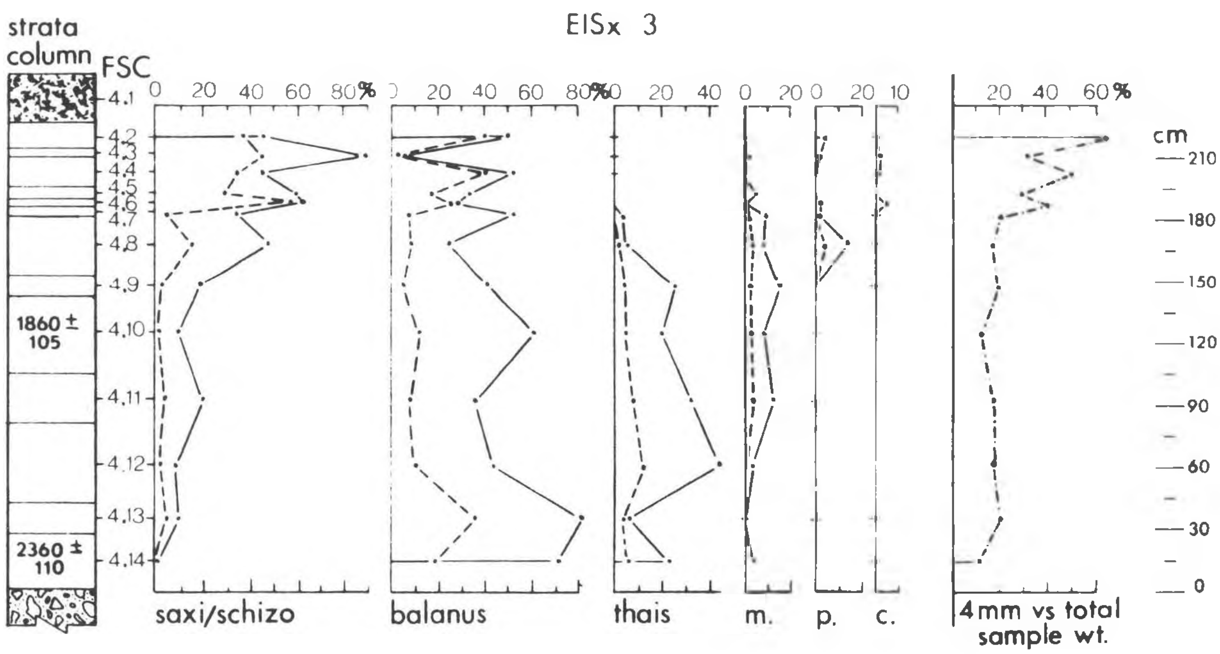


Fig. 52 Shellfish species distributions in terms of percentage of total four millimetre shell weight (solid line) and total four millimetre fraction weight (dashed line) per level. Dash-dot curve at right depicts the distribution of the four millimetre fractions in terms of total sample weight per level. See Appendix C for raw data.

not reveal quite the same picture as those from FS 4. The top four species are present in some quantity, mussel shows its first peak in these deposits, and *Thais* indicates one as well – all as in the FS 4 situation. Clam however predominates over all. There is also *Protothaca* present in these early strata; and a small early barnacle peak does not match the distribution suggested in FS 4.

In shell deposits possibly dating between 3400 BP and 1800 BP in the 1968 test pit, clam and barnacle behave more characteristically. Clam continues to increase toward a peak throughout, and barnacle peaks within the period of maximum shell content and then begins to decline. *Thais* is similar to the barnacle trend but has more dramatic peaks and declines than those in the FS 4 sequence. Mussel is more regular in distribution than *Thais* and therefore resembles the FS 4 sequence.

The Kisameet correlation is much rougher. Barnacle is predominant, and *Thais* makes an early and strong showing as in the FSC 4 suite. The peaks in species distributions in the FSC 1 and FSC 4 suites match well. The exaggerated peaks and declines throughout the FSC 1 curve obscure the rather smooth trends present as seen in the FSC 4 sequence, and the distinction between lower and upper stratigraphic patterns is virtually lost.

Summary

What significance may therefore be implied from these curves? Do we have a meaningful covariation which is habitat-related – as between clam and barnacle or between inhabitants of tidal sands and rock-dwelling species? There is the strong suggestion at least of a predominance of barnacle and *Thais* early in site history giving way to a later increase and dominance of clams. This increase through time in the abundance of beach-dwelling species coincides with a maturing of locally exploited estuaries. As clams became more abundant the inhabitants would change their collection habits – possibly even preferring clam for its greater accessibility. The time difference between the first large clam peaks at Namu and Kisameet might be then explained in terms of a difference in maturity of the respective estuaries, the Kisameet locale being much younger. If the clam peaks coincide or follow estuary maturation, then that status did not occur until after 3400 years ago at Namu and 1800 years ago at Kisameet. Furthermore, both sites exhibit a simultaneous increase in clam in the last 1000 years, a similarity not presaged by prior depositional differences nor by their presently distinct estuarine conditions. The answer must be derived from both the cultural and environmental data.

VERTEBRATE REMAINS

Bones, like artifacts, help us understand the aboriginal technology and economy. Such remains have potential in the explanation of aboriginal community-ecosystem relationships and the history of the paleoenvironmental situation (Heizer and Cook 1956:229,235). Unlike artifacts, vertebrate materials are not effectively studied one by one. Small quantities of bone are of limited interpretive value. By comparison with the quantities of bone recovered from middens elsewhere, our vertebrate sample is prohibitively small for full interpretative treatment. In the matrix samples from Namu and Kisameet, bone averaged less than 1% of the total debris. Of this quantity, less than one-quarter is identifiable to family or genus.

Keeping in mind the caution necessitated by the small size of the collections, we will consider the faunal data to elaborate upon our separately derived stratigraphic observations, artifactual data, and matrix sample data.

With exception of the few most abundant species, the occurrence of other species in our collections may mean no more than fortuitous exploitation of available individuals. A great many are edible, and many provide good pelts, hides, quills, or feathers, or suitable bone, antler or ivory for fashioning implements. In our speculations about uses of these species, the historic pattern recorded for coast inhabitants will serve as our guide.

Vertebrate remains caught by the field screens were classed as bird, fish, or mammal and sent to appropriate specialists for further identification. Lynn Harper has studied the fish remains, and Dr. Howard Savage of the Royal Ontario Museum, Toronto, is responsible for the avian study. Dr. Charles Repenning of the U.S. Geological Survey at Menlo Park, California, analyzed the mammal materials, and his identifications form the heart of the following discussion of site faunal evidence.

Approximately 24% by weight, nearly 1800 specimens, of the mammal bone collected at Namu was identifiable to family level. At Kisameet, only unit FS 2 was comparably examined, producing 112 identifiable mammal specimens. The informally collected faunal materials, from FbSx 6, EkSx 1, and FbTc 1 were identified where possible and together constitute 134 specimens.

Our analytic objective has been to quantify the relative occurrence, and presumably the exploitation, of each animal. Because of the wide size range of these animals, we decided that a species-by-bone-weight figure would not be as useful as species-by-number-of-bones. In analyzing bone from a given stratum, Dr. Repenning was frequently able to match fragments from one bone. In presenting a stratum-by-stratum identified bone count for each species we are thus producing a count of individual bones rather than one of many fragments of the same bones (the single exception consists of teeth from one jaw). Bone counts appear in Appendix A.

Attempts to estimate the numbers of animals represented by the collections were dissuaded by several factors. The best collection, that from Namu, involves only 1800 specimens scattered over 9000 years of depositional history. Secondly, the majority of the bone is too fragmented and decomposed to be identified, and some strata have only such bone. Third, bone for the most part does not meet our criteria of abundance and even distribution. Furthermore, in the historic tradition resource processing and utilization involved several sites at once. Thus we cannot be certain how an animal represented by a few bones in the collection was actually used. And finally there is the problem of correlating data collected by artificial levels to the corresponding natural levels — a difficulty affecting almost half the Namu collection and all of the Kisameet collection.

The following graphs (Figs. 53-62) illustrate the distribution of mammal species, by number of identified bones per level for each of ten excavation units at Namu and for FS 2 at Kisameet. Units FS 4, FS 11, and FS 12 at Namu were not systematically examined for remains, although bone recovered from those areas is included in the 1800 specimen site total. Bone from the surface is included, as is bone collected during facing of profiles. At Kisameet, only FS 2 bone is graphed, although bone informally collected from other parts of the site contributes to the site total.

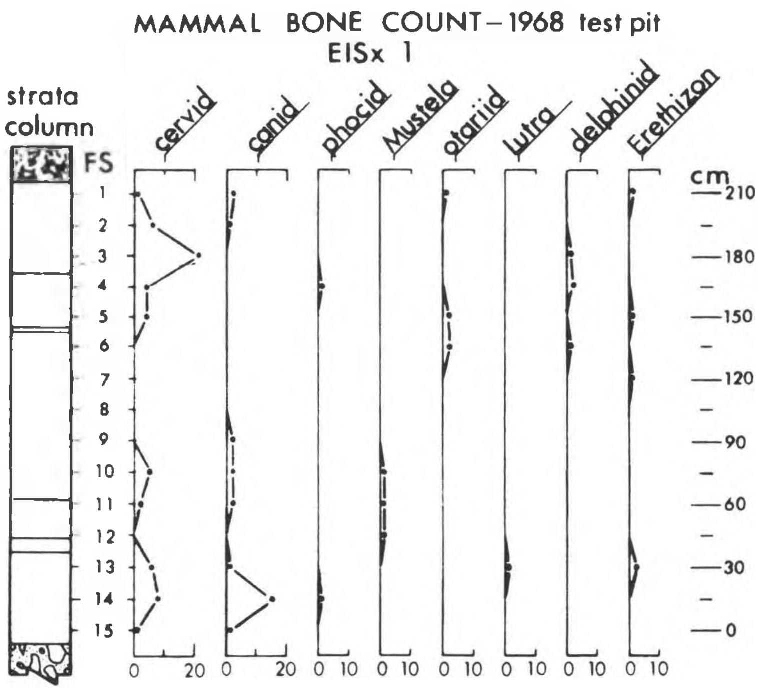
In each graph, the schematic strata column at left presents the major stratigraphic boundaries observed on the excavation unit walls after excavation. All graphs except those for units FS 9 and FS 10, Namu, illustrate bone recovered in the 1968-1969 excavations in fifteen centimetre levels, surface to substratum, in each pit. Units FS 9 and FS 10 were excavated in 1970 according to natural strata. It is often difficult to be positive about the exact stratigraphic correlation of bone removed from a fifteen centimetre level. Familiarity with the site situation, however, permits such assignment. When possible, the correlation of strata and radiocarbon dates is indicated.

In addition to the bone counts, we have some pertinent comments by Dr. Ian McTaggart Cowan of the University of British Columbia, bearing upon the presence of certain species in the collections (Cowan 1971: personal communication). His remarks provide a framework for the following presentation. A most important point of Dr. Cowan's comments is his suggestion of trade as a causal factor for the presence of some species. Taken in conjunction with Wilmeth's report suggesting trade in obsidian, the presence of "unexpected" species may reflect trade with inhabitants of the Bella Coola valley. Thus, the presence of exotic species may have little to do with local environments.

In the discussion below, I have indicated the rough ratios of body parts for many species. I must emphasize that these are *not* anatomical ratios, since most of the latter would be smaller than the ratios presented here. With the exception of avian data, anatomical ratios were not systematically recorded during analysis. Those species heavily

Fig. 53

Mammal species distributions, the 1968 Test Pit, ElSx 1. Bone counts in absolute numbers. Correlation between natural strata and artificial excavation intervals approximate.



represented by teeth — each of which, if not in a jaw, counts as one bone — will exhibit the greater discrepancy between anatomical and absolute ratios. In the same context, those species predominantly represented by teeth, digits, or vertebrae will be over-represented. Reference to the anatomical ratios and "weight" of body parts might reduce the seeming abundance of deer, canid, phocid, river and sea otters, and otariids. The apparent representation of delphinids would be significantly decreased, whereas the use of anatomical ratio in mink representation would make little difference.

Bighorn Sheep

The bighorn sheep has been found for many years in the areas of the Chilcotin, inland from your study area. The nearest examples would be in the mountains adjacent to Taseko Lake. The Bella Coola people may have hunted in there but it is just as possible that they got the material from the Athabascans of the Chilcotin area by trade, as they did so much of the obsidian, which came from the same general region [Cowan 1971].

We have only two sheep bones from Namu — a mandible section shaped as an artifact, and a cheek tooth, both from lower shell-bearing strata of FS 10. The fragments occur in different strata and thus might represent two animals. At Kisameet, a juvenile animal's horn core was found midway in the deposits, and a tooth, scapula fragment and phalanx occurred in a lower shell-bearing stratum. The radiocarbon dates suggest the ages of the enclosing strata to be between 2100 and 1800 years BP. Bone numbers for the species are so few that I hesitate to attempt further speculation on their significance.

Mountain Goat

Mountain goat, though they are not perhaps found today in the immediate vicinity of Bella Coola and Namu, are widespread along the coast. I don't know of any one of the inlets that does not have mountain goats on the adjacent mountains and on many of them, the goats come down to the beach during periods of heavy winter snow. [Cowan 1971].

We recovered goat only from FbSx 6, from one of the oldest shell-bearing strata. Both a horn core and a metacarpal fragment were found. The meaning of their presence is difficult to assess because of the small numbers. The midden lies only a few miles from the present goat habitat.

Deer

The coast black-tail *(Odocoileus hemionus columbianus)* is available up and down the coast the entire length of the province and on almost all the offshore islands. The larger race, *O. h. hemionus,* or mule deer, is available on the interior plateau, and a small population comes down close to Hagensborg in the wintertime [Cowan 1971].

Cervids are the predominant animals in both the Namu and Kisameet collections. While the identification "cervid" may, as Dr. Repenning cautions, include some specimens of bighorn sheep, mountain goat, moose, or elk, by far the majority of identified bones are deer. Dr. Repenning was

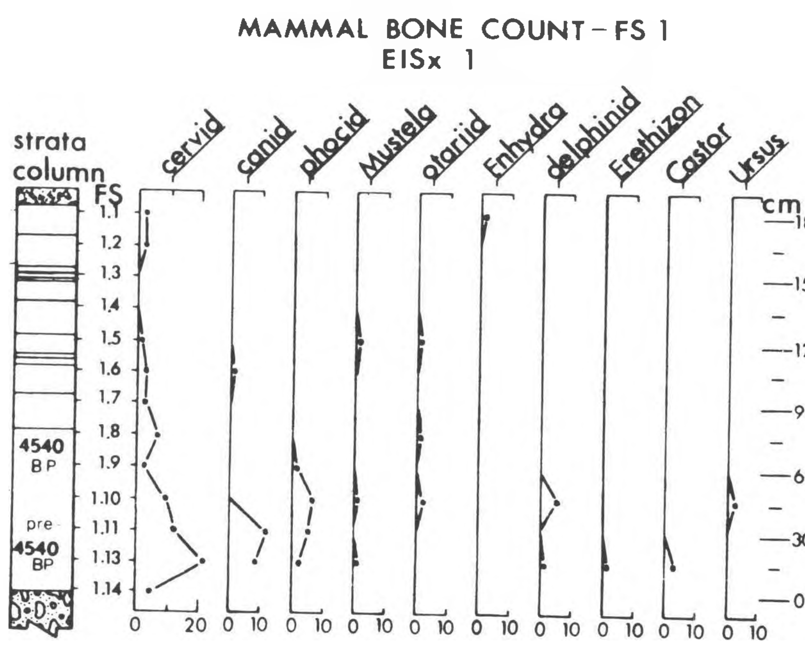


Fig. 54

Mammal species distributions, pit FS 1, EISx 1. Bone counts in absolute numbers. Correlation between natural strata and artificial excavation intervals approximate.

cautious in assigning species and even identifications at the generic level to cervid remains because of the difficulty in distinguishing between them. It is thus possible that our collections contain both coast black-tail and mule deer. The present local availability of the black-tail implies that the majority of cervid in the sites should be that race. The presence of mule deer could be due to trade or inland hunting. Both adults and fawns are present. The latter suggest procurement some time in the first six months or so of the animal's life, after birth in June. Bones from head (including antlers) and limbs are almost equally represented, while other body parts are scarce. In this connection, it must be remembered that assignment of rib fragments and other bones of trunk to even family level is often impossible. Examination of the sites' unidentifiable bone suggests that most of it is predominantly cervid as well. Deer were the most common species throughout site history – and are found at Namu even in deposits dated 7800 BP and older.

Lynx

In looking at the carnivores, every one of them would be available locally at some time or another. The genus *Lynx* is represented in that area by the bobcat, though rather casual in occurrence, and the Canada lynx, which is abundant during periods of rabbit "peaks" in the interior, and then immediately after the crash of the rabbit population, the lynx spread out widely and appear as far as the tide-line all up and down the coast where the interior populations are closely adjacent [Cowan 1971].

There were only two specimens (premolars) identifiable as belonging to the genus *Lynx*. These come from the bottommost stratum at Kisameet, dated 2290 BP. At Namu, one bone tentatively identified as *Felis* (cougar ?) comes from an older shell-bearing stratum in the Rear Trench. This latter species occurs in the Namu vicinity today.

Canids

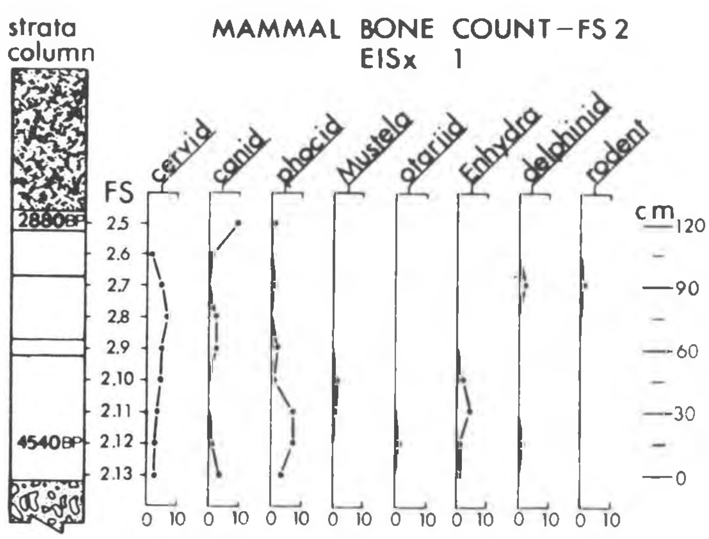
Among carnivores represented, canids predominate; and they are second only to deer in frequency of occurrence in the total mammal collection. Canids identified with certainty to species are all domestic dog, at Namu and FbSx 6; dog was not identified at Kisameet. Coyote remains may possibly be present, and wolf is suggested at Kisameet. As with cervids, it is difficult to isolate the species with such fragmented material. Both pups and adults are present, and canid, if not dog, appears throughout the Namu deposits.

For the canid collection as a whole (all sites), head bones outnumber limb bones three to one and other body parts fifty to one. In at least three cases at Namu, we uncovered a fully articulated skeleton. Dr. Repenning attempted to discover, through reconstruction of one of the many fragmented skulls, indications of purposeful fracturing to gain access to the brains for eating. The skull was too shattered for conclusive judgment. Dogs may have been used for food, wool, hunting, as pets or for all four. They undoubtedly scavenged the midden for garbage, and were responsible for some of the observed ancient disturbance of site deposits.

In view of their primarily inland ranging habits, the presence of coyote in the collections may be fortuitous. Wolf are more common than coyote on the coast. They also follow their prey in their seasonal movements between high country and lower forests. Although wolf may have been purposely hunted, it seems more likely they indicate occasional individuals encountered during local hunts or animals felt to be too close to the community for comfort.

Fig. 55

Mammal species distributions, pit FS 2, ElSx 1. Bone counts in absolute numbers. Correlation between natural strata and artificial excavation intervals approximate.



Mink, Weasel and Marten

Mink *(Mustela vison)* was common throughout the Namu deposits, with head and limb bones comparably represented, although no bones from the trunk were found. At Kisameet, on the other hand, only one mandible fragment was found, just below modern humus. Mink are common today at the shoreline and seem little bothered by nearby human presence. The weasel *(Mustela erminea)* is represented in the topmost humus (redeposited midden ?) stratum at Namu by a single mandible. Four fragments identified as marten come from widely scattered locations at Namu. All three of these small mustelid species are available locally today. It may be suggested they were aboriginally sought for their pelts.

Otter

Both river and sea otter remains were identified in the collection. Sea otter *(Enhydra)* occurs at all sites except FbSx 6. In the largest collection, from Namu, limb bones outnumber head bones four to one, and a few trunk bones are present. At one time sea otter inhabited the entire British Columbia coast, frequenting kelp beds, rock islands, reefs, and shallow waters. At Namu, we find sea otter remains throughout the deposits.

The river otter *(Lutra)* is best represented at Namu, with similar frequencies of head and limb bones. A stratum pre-dating 1810 BP at Kisameet produced one skull, the only specimen from that site. The animal inhabits both land and freshwater and is abundant on the coast near freshwater ponds and streams. Based upon historic analogy, both sea and river otter were probably sought for their pelt. These were important trade items in the post-contact period. The fur trade was the reason for the drastic decline in the sea otter within the historic period.

Raccoon

The raccoon *(Procyon)* appears scarce along the coast as far north as Namu, but I do have records from there and there is every reason to believe that this is not something new [Cowan 1971].

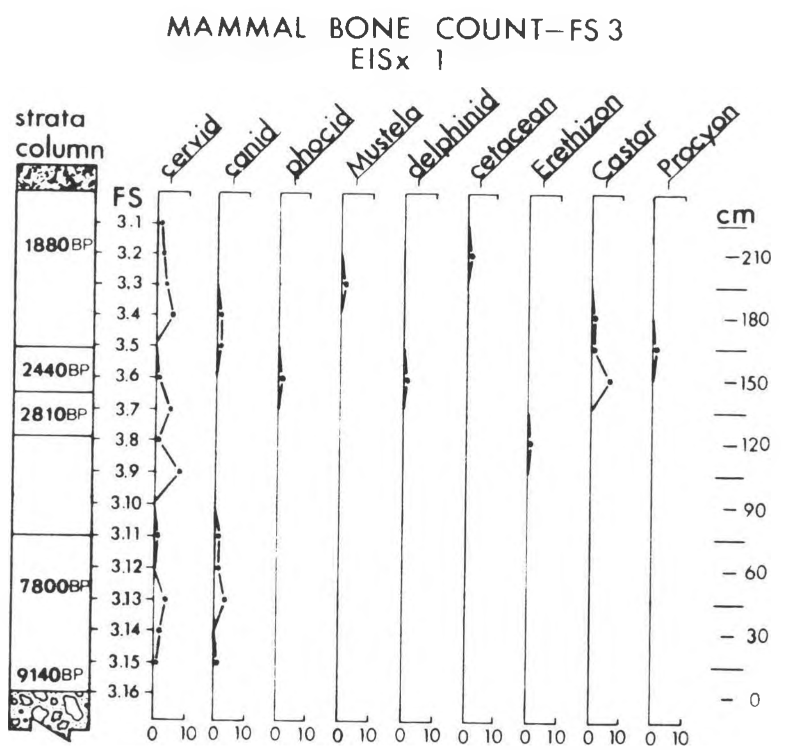
The presence of raccoon does pose a problem, in that despite its rather rare occurrence along the coast, it is common in the Namu collection – and present at FbSx 6 and Kisameet as well. Raccoon at Namu is represented by completely articulated skeletons as well as fragments. It is suggested that the raccoon may have been a tolerated competitor with the dog for site refuse. It is also possible that the animals were kept as pets. Five fragments occur from a Kisameet stratum more recent than 1810 BP. One bone was found in a shell-bearing stratum just below humus at FbSx 6. At Namu, raccoon remains occur in deposits dated from 2440 BP to the present.

Wolverine

From an upper level in the 1968 test excavation at

Fig. 56

Mammal species distributions, pit FS 3, ElSx 1. Bone counts in absolute numbers. Correlation between natural strata and artificial excavation intervals approximate.



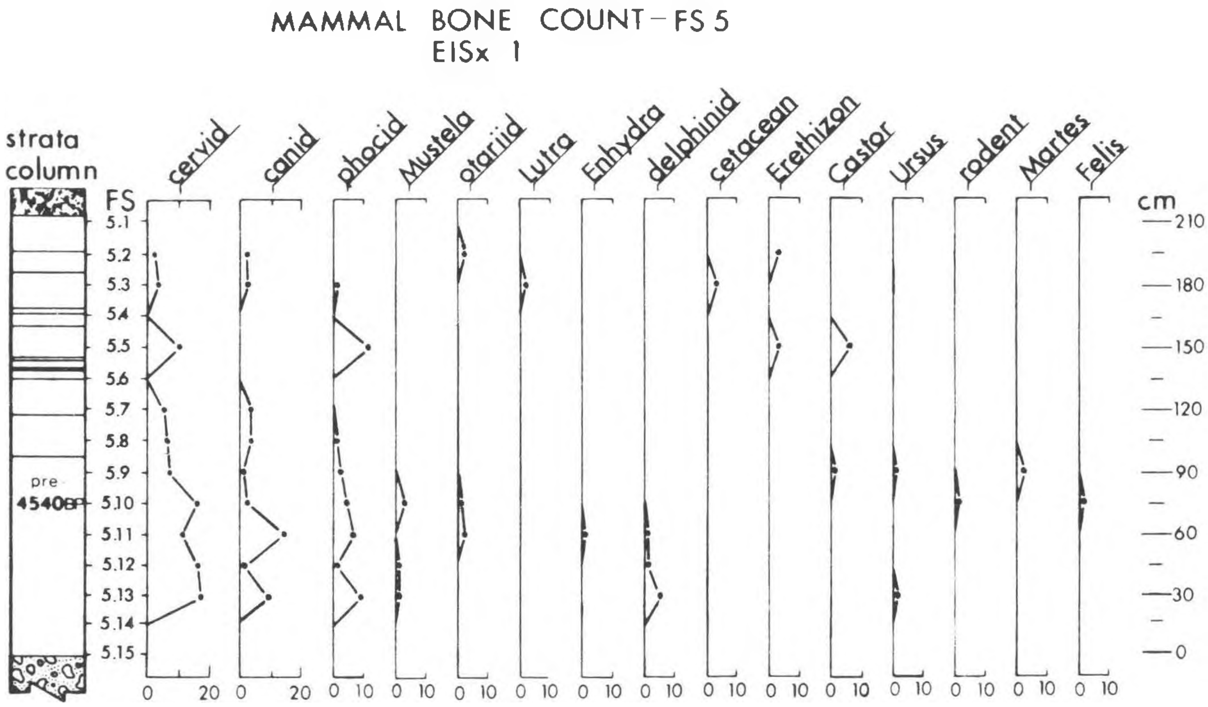


Fig. 57 Mammal species distributions, pit FS 5, ElSx 1. Bone counts in absolute numbers. Correlation between natural strata and artificial excavation intervals approximate.

Namu a single fragment of a femur was identified as wolverine *(Gulo)*. No other area at Namu or any other site sampled produced evidence of the species. The wolverine prefers mountainous regions of the Coast Range and is rare on the coast proper, although specimens have been reported from Bella Coola (Cowan and Guiguet 1962:324).

Bear

Black bear were identified from six levels in the Rear Trench at Namu which dates 4540 BP or earlier. The species is presently common on the coast. Fragments assigned to grizzly from both FS 9 and FS 10 were identified by Dr. W.H. Burt, the University of Colorado Museum. Bones used in artifact manufacture at Namu include grizzly ribs. In general, however, bear remains of either species are far too rare and scattered to suggest a rationale of procurement.

Cetaceans and Pinnipeds

The cetaceans and pinnipeds present no problems of availability. *Phoca* and *Eumetopias* are year-round residents. *Callorhinus* is represented every winter by varying numbers of young individuals close in shore. The species is also available to pelagic hunters during the spring migration in April, May and June. I have seen Indians coming in with them from within 20 miles off-shore during May. The only problem animal there is the walrus and this is really a puzzler. We have no way of knowing what the ancient distribution of walrus was. It could have been found much farther south than it presently occurs. On the other hand, there was almost certainly a trade up and down the coast in walrus ivory but I would be more skeptical of trade being involved if the bony elements of the skeleton were what you were finding [Cowan 1971].

In fact, we found only teeth of walrus. In deposits later than 680 BP at Namu, we recovered two cheek teeth, one of which was juvenile. The age of this juvenile animal is not known. If quite young, without sizeable tusks, why would it have been traded? What environmental differences are suggested? In light of the recent age of the specimens, I would tend to rule out environmental difference in favour of either trade or fortuitous catch of single animals out of their common range. The only other walrus evidence in the site occurs in the form of harpoons and ivory gaming pieces (?) found in a 4000 year-old burial.

Among pinnipeds in the collections, hair or harbour seal is predominant, with limb bones outnumbering head bones two to one, and a few other body parts represented. Phocid remains occur throughout Namu deposits, on the surface at FbSx 6, and in deposits younger than 1810 BP at Kisa-

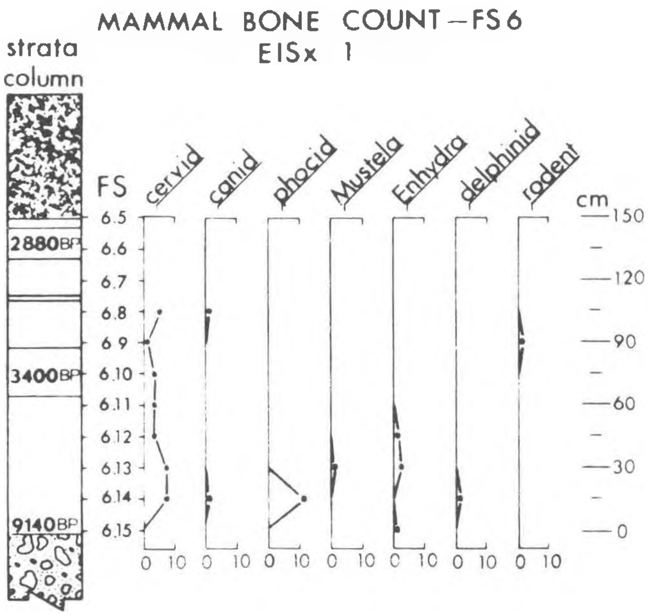


Fig. 58 Mammal species distributions, pit FS 6, ElSx 1. Bone counts in absolute numbers. Correlation between natural strata and artificial excavation intervals approximate.

meet. Adults are most common, although remains of a pup were found in strata more recent than 480 BP at Namu. Their frequence and local availability suggest that they were regularly hunted.

Sea lion *(Eumetopias)* is also principally represented by limbs, with teeth and a few vertebrae the only other remains. Fur seal *(Callorhinus)* is represented by five teeth at Namu, dated between 2800 and 1800 BP, and by limbs and skull fragments in surface collection from the more seaward FbTc 1 site. One fragment of a fetal otariid, species unidentifiable, was recovered at Namu. According to Mathisen, Baade, and Hopp (1962) the northern sea lion give birth between May 24th and June 27th. These dates imply the Namu female was taken prior to then, probably in early May.

Delphinid remains are common at all sites except EkSx 1. In the Namu collection, bones of the skull and teeth outnumber other elements more than six to one. Scapula, rib, and vertebra fragments also occur. Within the whole mammal collection, petrosa, the hard rounded portion of the tympanic bulla, from delphinids, deer, hair and fur seal, dog and river otter are found separate from the rest of the temporal bone. In the case of delphinid petrosa, which occur with considerable frequency, some exhibit a smooth "polish" and rounding through abrasion. Dr. Repenning comments that:

. . . an unusually large percentage of the delphinid records in the material from your middens were based upon such specimens and many of them were similarly abraded. Although the bone is dense and more durable than other parts of the skeleton, there are only two of these bones per porpoise skeleton and the high percentage in the middens is curious. Furthermore, the abrasion is the sort that one often sees when an isolated petrosum is found washed upon the beach, and as a rule the (rest of the) midden bones were not abraded [Repenning 1969].

His point is that the inhabitants may have brought such petrosa back from the beach entirely apart from the hunting of delphinids. What the petrosa were used for is unknown. None recovered indicate any shaping or perforation by man.

No remains specifically identifiable as whale were found. Among the two dozen "cetacean" bones from Namu some may be of one of the coastal whale species. While whale-hunting may have been pursued, it seems unlikely that the carcasses were transported to Namu. The presence of whale in that site could be accounted for by utilization of a stranded individual.

Rodents

Among the rodents, the porcupine *(Etethizon)* is not usually abundant on the coastal slope of the mountains but becomes abundant as soon as you enter the jack pine areas *(Pinus contorta)* of the region around Anahim Lake and eastwards [Cowan 1971].

We have relatively large quantities of porcupine from Namu, and they are present in the much smaller collections from Kisameet, FbSx 6, and FbTc 1. Teeth and jaws outnumber limbs nearly three to one, with incisors the most common remains, and elements other than jaw or limbs unrepresented. Given the inland occurrence of these animals, I cannot explain their presence in such numbers unless a flourishing trade is responsible, or porcupine hunting inland was a frequent pursuit. The abundance of teeth suggests these were the culturally desirable elements, although the presence of limbs indicates they brought back more than just jaws. In the same context, absence of other body parts seems puzzling when so many strata contain the species. The remains are distributed at Namu throughout and at Kisameet and FbSx 6 in the upper strata.

Beaver *(Castor)* was recovered at Namu in strata older than 1800 BP. As with porcupine, both limbs and teeth are present. The absolute quantities are too small for speculation on their significance. The animal ranges the entire coastal slope and the near-shore islands. Thus, its presence in the collection is not unexpected.

In summary, Cowan comments that:

. . . in this assortment, just three species suggest any substantial contact with the interior plateau. There are the

MAMMAL BONE COUNT–FS 7 & FS 8
EISx 1

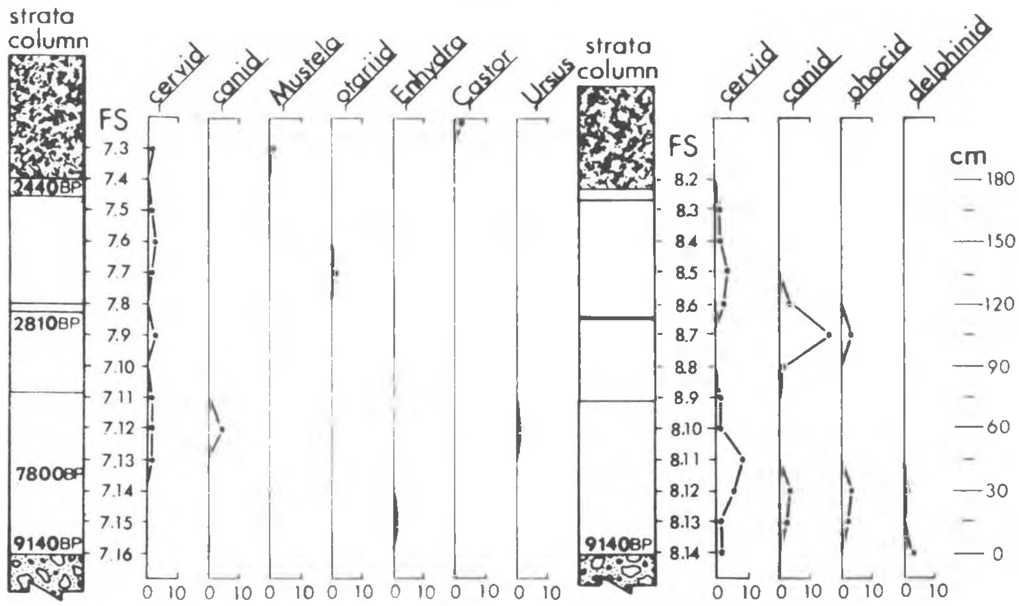


Fig. 59 Mammal species distributions, pits FS 7 and FS 8, EISx 1. Bone counts in absolute numbers. Correlation between natural strata and artificial excavation intervals approximate.

MAMMAL BONE COUNT–FS 9
EISx 1

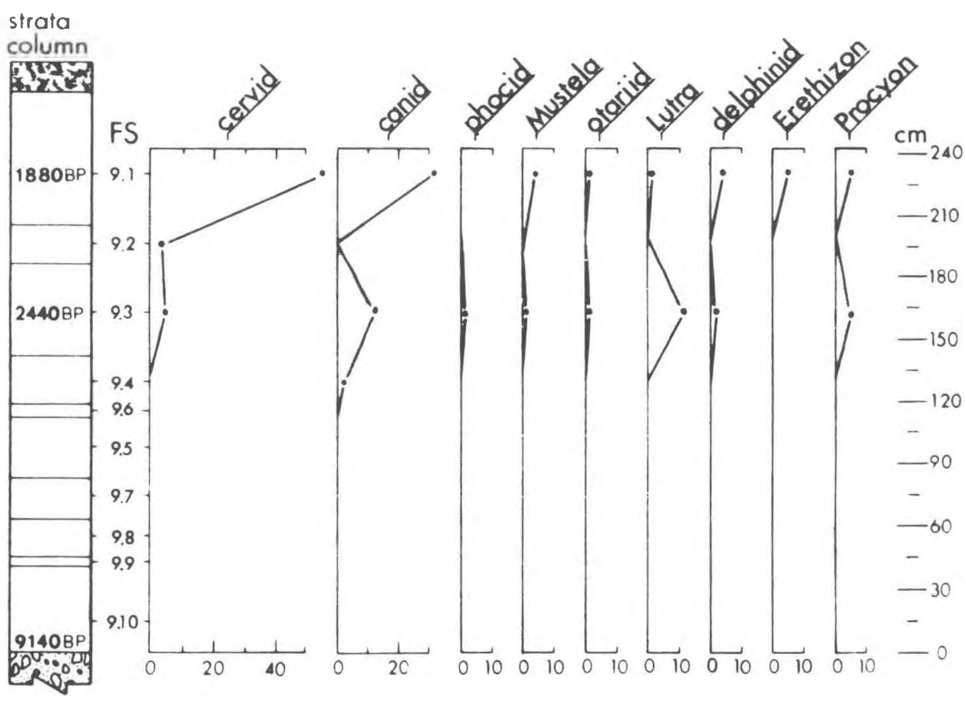


Fig. 60 Mammal species distributions, pit FS 9, EISx 1. Bone counts in absolute numbers.

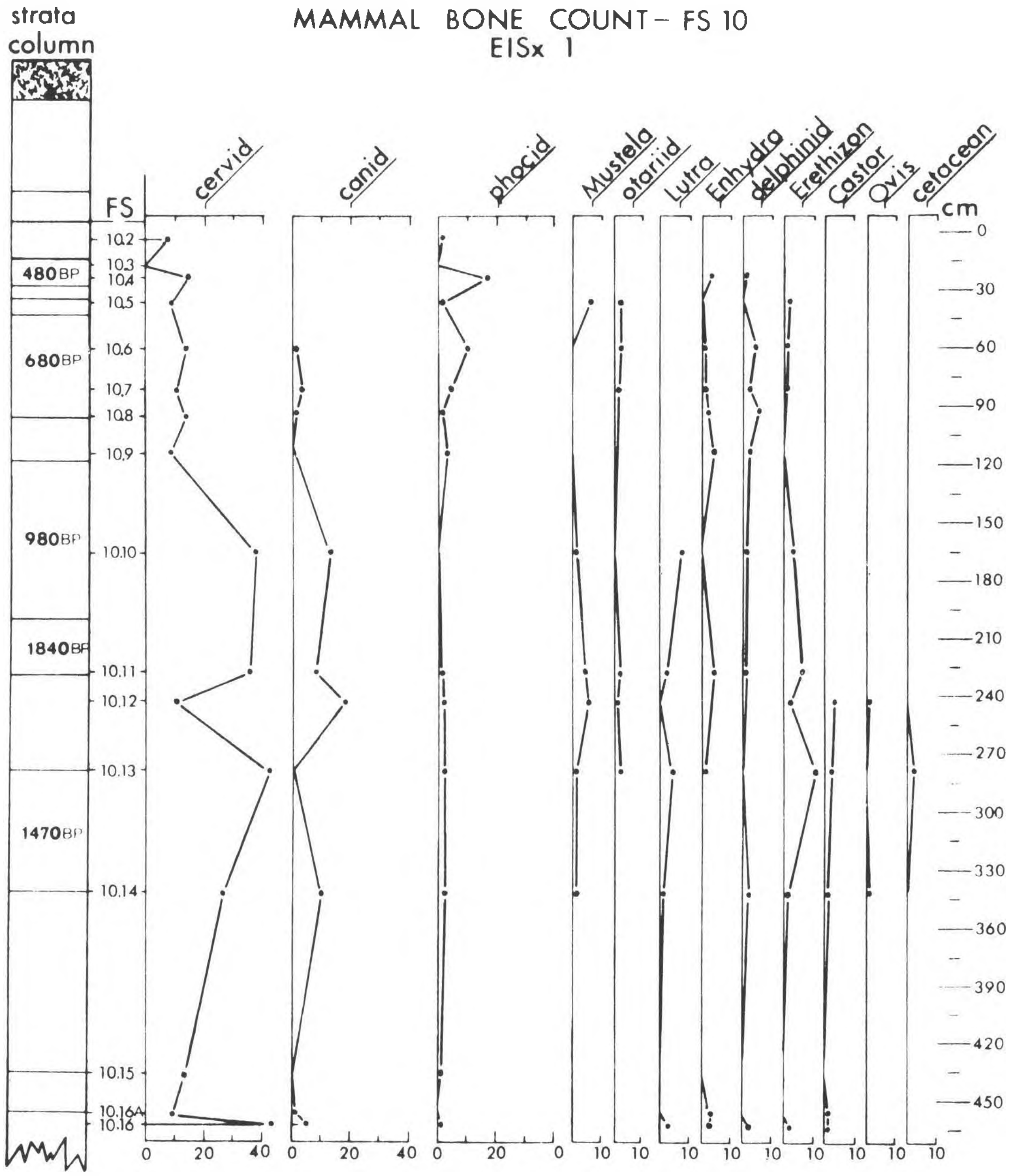


Fig. 61 Mammal species distributions, pit FS 10, EISx 1. Bone counts in absolute numbers. Strata column illustrates FS sequence, not FSC sequence, as data were collected during excavation rather than after.

sheep, the lynx, and the porcupine. The lynx and porcupine do occur from time to time on the coastal slope and would probably occur reasonably regularly toward the head of the Bella Coola valley. The sheep never come west of the grassland ranges of the interior [Cowan 1971].

In these discussions, I have suggested where formal hunting practices, trade or accident might explain the presence of unexpected species. The problem species such as lynx, walrus, and sheep are all too rare to justify speculations about environmental change. Porcupine, on the other hand, is so widely distributed at Namu that, as with raccoon, one wonders if it were not present locally. If, however, porcupine requires a jack-pine habitat and could not thrive in a coastal forest situation such as that at Namu now, then we must seek cultural rather than environmental causes for explanation, especially when a number

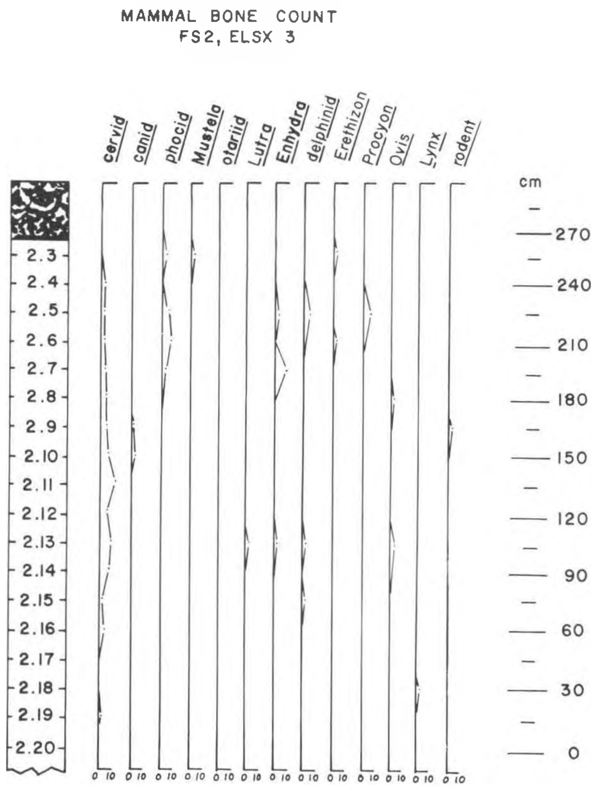


Fig. 62 Mammal species distributions, pit FS 2, ElSx 3. Bone counts in absolute numbers. Correlation with natural strata not attempted.

of remains occurred in deposits dating within the past several hundred years.

By bone count, land mammal remains at Namu outnumber sea mammal nearly five to one; at Kisameet, the ratio is over two to one. The species of most frequent occurrence and greatest numbers at Namu are cervids, canids, phocids, and delphinids – with cervids and phocids present throughout site history. Canids are present from the earliest deposits until 680 BP, and delphinids present from the earliest layers until 480 BP. The sea otter and mink also occur for most of Namu history. At Kisameet, cervids, phocids, sea otter and delphinid predominate – and among these, only cervids occur throughout the site's 3000 year history in quantity. The small FbSx 6 collection also indicates a cervid predominance, with lesser amounts of canid. At the more seaward FbTc 1 midden, otariids dominate the collection. At EkSx 1, sea otter outnumber other species. How accurate a reflection of food preferences these informal collections from FbSx 6, FbTc 1, and EkSx 1 are remains to be seen. A higher frequency of large marine mammals, otariids and delphinids, is expected at sites in more exposed portions of the coast, such as FbTc 1.

The heaviest exploitation of land mammals is focussed on the Coast Forest. If the canids were domestic dog, then land hunting emphasized deer, with some interest in procuring both raccoon and mink. Trade or far-ranging hunting expeditions may have brought porcupine and bighorn sheep to the site. Fortuitous encounter or specialized hunting may be responsible for the presence of river otter, beaver, black and grizzly bear, cougar, lynx, wolverine, marten and weasel.

In marine animal exploitation, the Coast Littoral was the area of concentration, with the fur seal the only pelagic species hunted. Phocids appear to have been the primary objective throughout the recorded prehistory. Delphinids and sea otter were also target species, and fur seal and sea lion were occasionally hunted. Neither Namu nor Kisameet were well situated for hunting the last two species. The small hair seal, on the other hand, is locally abundant. Walrus offers the only real suggestion of trade.

The uses of these species are surveyed in the literature (Boas 1897; Drucker 1955). Deer were used for food only in times of starvation by the historic Southern Kwakiutl. The hide was instead the desired resource. We discovered indications of cutting on deer bone specimens only on the limbs, and possibly at the base of one antler. Of these limb bones, the shafts were usually missing. Bones of the feet and vertebrae were intact and identifiable; scapulae are common, but in all cases the thin, platey portion was broken out. Very few pieces of the cranium were identified. These patterns suggest tool manufacturing as the majority of bone tools are of deer long bone or metapodials.

Mountain goat, hunted by the Wikeno peoples (a Bella Bella group) with dogs, is reported to be the only mammal whose flesh was dried for winter. Its horns and wool were prized and tallow was preserved for winter consumption. Black bear and cougar were sought for the skin, with a deadfall being the means of capture. The literature does not indicate hunting of grizzly. In fact, the opinion held is that sea mammal flesh was the preferred meat.

In applying these ideas to our data, it must be recalled that these records pertain to the historic situation. Determination of how far back in time that situation is present is therefore one of our primary concerns.

BIRD DATA FROM KISAMEET

Eighty avian specimens were recovered from FS 2 at Kisameet, and all were identified by Dr. Savage to at least taxonomic family. Identifications and bone counts are provided in Appendix A. Distribution of the remains is illustrated in Figure 63. Of the seventeen species identified, all are medium or large birds capable of providing meat as

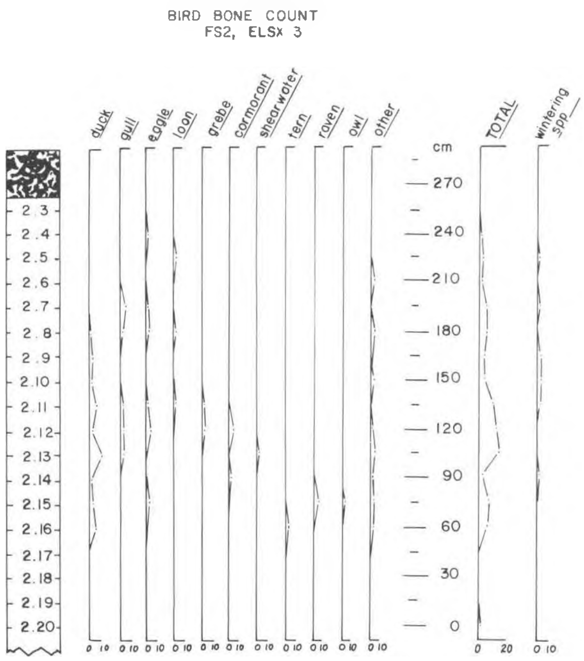


Fig. 63 Bird species distributions, pit FS 2, ElSx 3. Bone counts in absolute numbers. Correlation with natural strata not attempted.

food. Dr. Savage suggests a minimum number of twenty-one individual birds are present in the collection. Ducks are most common (33 bones), with bones of the wing or pectoral extremity ten times as common as bones of the leg or four to one by corrected anatomical ratio. Savage comments that:

> . . . the occurrence of wing extremity bone over four times more frequently than the leg elements indicates a different usage of the former. The presence of the large pectoral muscle mass is suggested as giving this area and the adjacent wing a favoured position when the bird was being prepared as food. Discarding of the backbone, legs and feet elsewhere than in the village midden may be inferred.
>
> Such a discarding of the non-wing portion of the ducks also suggests a plentiful supply of food during the times of occupation of the site, . . . [Savage 1970].

Gulls also exhibited the wing-over-leg bone predominance. Their smaller numbers, however, make interpretation uncertain.

Our best evidence of seasonal site usage comes from five species of birds known currently to winter at the site. These are the Red-necked and Horned Grebes, the King Eider, and the Glaucous and Herring Gulls. The distribution of these species suggests a fall-to-spring site utilization for the lower half of the Kisameet strata (levels FS 2.7 through FS 2.16). All other species may be present at any time of the year. In summary, Kisameet avian materials support winter occupation for at least the early portion of site history (strata dated 2290 BP to less than 1810 BP). Site utilization during other seasons of the year is not supported or discredited by the other bird remains. It may be noted, however, that most of the bone recovered came from these strata. Strata more recent than FS 2.7, the last to contain a wintering species, had very little bird bone of any kind.

DATA INTEGRATION

The varieties of context and content information for the sites may be correlated to produce an archaeological interpretation of site history. There are two aspects to data treatment at this stage. One involves the data integration, aligning the various sets of site data and identifying critical attributes. The other step involves explaining the meaning of the various trends in the data sequences in terms of site habitation history. Figures 64 and 65 compile basic data sets according to vertical and horizontal relationships. The composite graphs in Figures 66 and 67 illustrate the correlation in terms of major trends at Namu and Kisameet. These are in fact the graphic end-products of this research. How the alignments in these last two figures were made and the pattern boundaries determined is the topic of this section.

Graph Format

All varieties of site data are to some extent included in the composite illustrations. Stratigraphic observations are least represented in the graphs. How these data influenced pattern determination will be discussed in the text. On each composite graph, the strata column at left represents the full sequence of site deposits perceived in the excavation units. The Namu column is a composite, as the strata do not all occur in a single vertical profile. The Kisameet column represents the strata as they actually occur in the FS 4 area. The numbers immediately to the right of the column indicate the strata used in the reconstruction — and in compiling the shellfish distributions to their right. Where two stratum designations occur together, the illustrated stratum represents both, for they are considered to represent the same period of deposition in different locations. Only strata studied in 1970 represented by the large natural stratum matrix samples, are involved in construction of the strata column and the shell and shellfish species distributions.

Radiocarbon dates are located in the strata producing them or inferred to correspond to them. Stratum FS 4.3 very probably is no more recent than the 2880 BP date suggested for it. Although it may be older (but no older

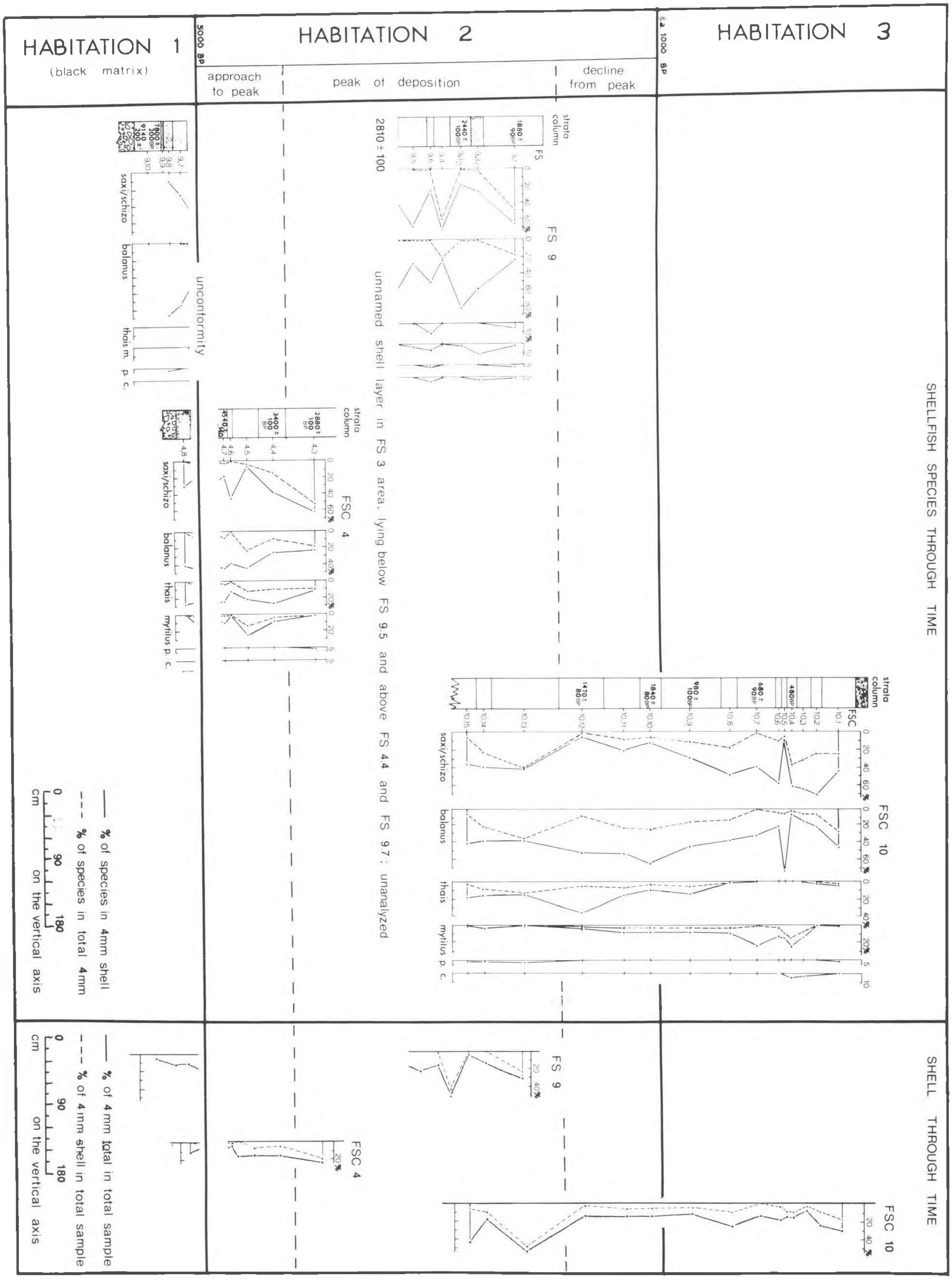


Fig. 64 Data compilation chart A: unit by unit correlation of Namu shell data. See Fig. 44 and Figs. 47 through 50, and Tables 35 and 36 in Appendix C, for primary data used in this illustration. This correlation is the basis for the schematic profile, shell through time curve, and shellfish species identified pie charts in Fig. 66. Refer to discussion of Fig. 66 on placement of stratum FS 9.5 in the sequence.

than the preceding stratum dated at 3400 BP), its content and physical status suggest it belongs to the period producing strata FS 9.4 and FS 9.1, beginning at 2880 BP. In other words, its content and configuration are congruous with a pattern with established boundary dates. Stratigraphically it is separated from other deposits in the pattern, and its spatial relationship to them is difficult to define. Temporally, we simply know it is younger than 3400 BP.

That the basal strata of unit FS 10 (*i.e.,* FSC 10.13 and FSC 10.12) date 1840 BP and older is based on acceptance of the 1840 BP date for stratum FSC 10.10 as being more reliable than the 1470 BP date for stratum FSC 10.12. By this reasoning strata below FSC 10.10 are 1840 years or older. Content and configuration data suggest stratum FSC 10.13 is part of the pattern reflected by FS 9.1. If the 1840 BP date on FSC 10.10 is correct then the basal FS 10 strata may be considerably older, perhaps as much as 2440 BP. A definitive resolution of this problem is impossible without further radiocarbon assays.

Deletion of strata FS 9.9, FS 9.6, and FS 4.6 is based on their status as localized features of less than site-wide significance. Stratum FS 4.8 is a black matrix deposit considered to correspond to FS 9.8. Its inclusion in the graph would signify no difference in data distributions. Elimination of the black interruptions FS 9.5 and FS 9.3_1/FS 9.3_2 derives also from their uncertain site-wide significance. As it stands, we have illustrated stratum FS 9.5 with the basal black matrix strata because it lies in that sequence in the FS 9 area. Both this first non-shell interruption of shell deposition at Namu, and the one following it around 2440 BP (FS 9.3_1 and FS 9.3_2) are difficult to interpret in site-wide terms because of their disappearance in the western portion of the Rear Trench. Thus, while stratum FS 9.5 is illustrated, strata FS 9.3_1 and FS 9.3_2 are excluded as probable localized episodes of non-shell deposition affecting only the eastern parts of the Rear Trench. The placement of either on the column would only interrupt the illustrated shell distribution, not change it.

The Kisameet radiocarbon date placements are based on correlations between the illustrated FS 4 strata and the FS 2 artificial levels from which the dates come.

The graphs' single distribution curves, "Shell through Time", illustrate the most important stratum content data for use in pattern determination – fragmentation, as indicated by four millimetre retention, and shell quantities. The four millimetre curve is expressed in terms of what percentage that size shell represents of the total (thirty-five) pound sample.

The pie charts of "Shellfish Species Identified" are composed of species data from the same matrix samples producing the "Shell through Time" curve. Only the abundant large clam and barnacle species are consistently reliable in their occurrence; other species generally are present in quantities too small to establish patterns. The pie charts express each species' percentage of the total four millimetre shell weight, per sample. The figures on each chart are averages of the proportions for all samples in the group. Illustrated in this manner, the species distributions indicate the gradual change in occurrence of the predominant species, barnacle and large clam.

Pie charts illustrating the distribution of "Mammal Species Identified" likewise represent averages for all strata included in the group. Data come from field screening of excavation unit matrix rather than from the stratum samples. The figures represent all units producing bone in 1969 and 1970. The 1968 test pit bone, the FS 4 (1969) bone, and FS 11 bone from Namu were not collected in a comparable manner and are not included. At Kisameet, only unit FS 2 was systematically examined for bone content and graphed.

The "Habitats Exploited" charts to the right involve the same data with a different internal grouping. All species are assigned to either the Coast Forest or Coast Littoral (Cowan's biotic provinces). The pie charts illustrate two ways of looking at mammal distributions by habitat. The solid line divides the habitats by numbers of *bones* in each; the dashed line divides them by numbers of species in each. Thus, considering the top Namu chart for example, we have a 55% Coast Forest representation by absolute bone count – but only 44% representation by species count. The numbers to the right of these charts are the bone counts involved in the calculations.

Following the same groupings adhered to in presentation of shellfish and mammal data is a general indication of artifact trends throughout Namu history. The same trends are believed to occur at Kisameet and are therefore not illustrated on that graph. Treatment of artifacts in illustration is similar to that of the mammal data as all of the 1969 artifacts reflect artificial level excavation.

The Kisameet graph contains in addition the avian distributions determined by Dr. Savage, and follows his conclusions in emphasizing the occurrence of wintering species. Bone counts appear immediately to the right; species counts are included within the bars.

Data Groupings

At this point it is appropriate to consider how the four-fold Namu and two-fold Kisameet data groupings or divisions of site history were achieved. As indicated previously, such decisions are based on clusterings of strata sharing locational, temporal, content and configuration features such that we feel we are dealing with a succession of deposits reflecting a particular pattern of site utilization. Our interest therefore is in determining the nature of these patterns and when they change. The observations for Namu suggest the

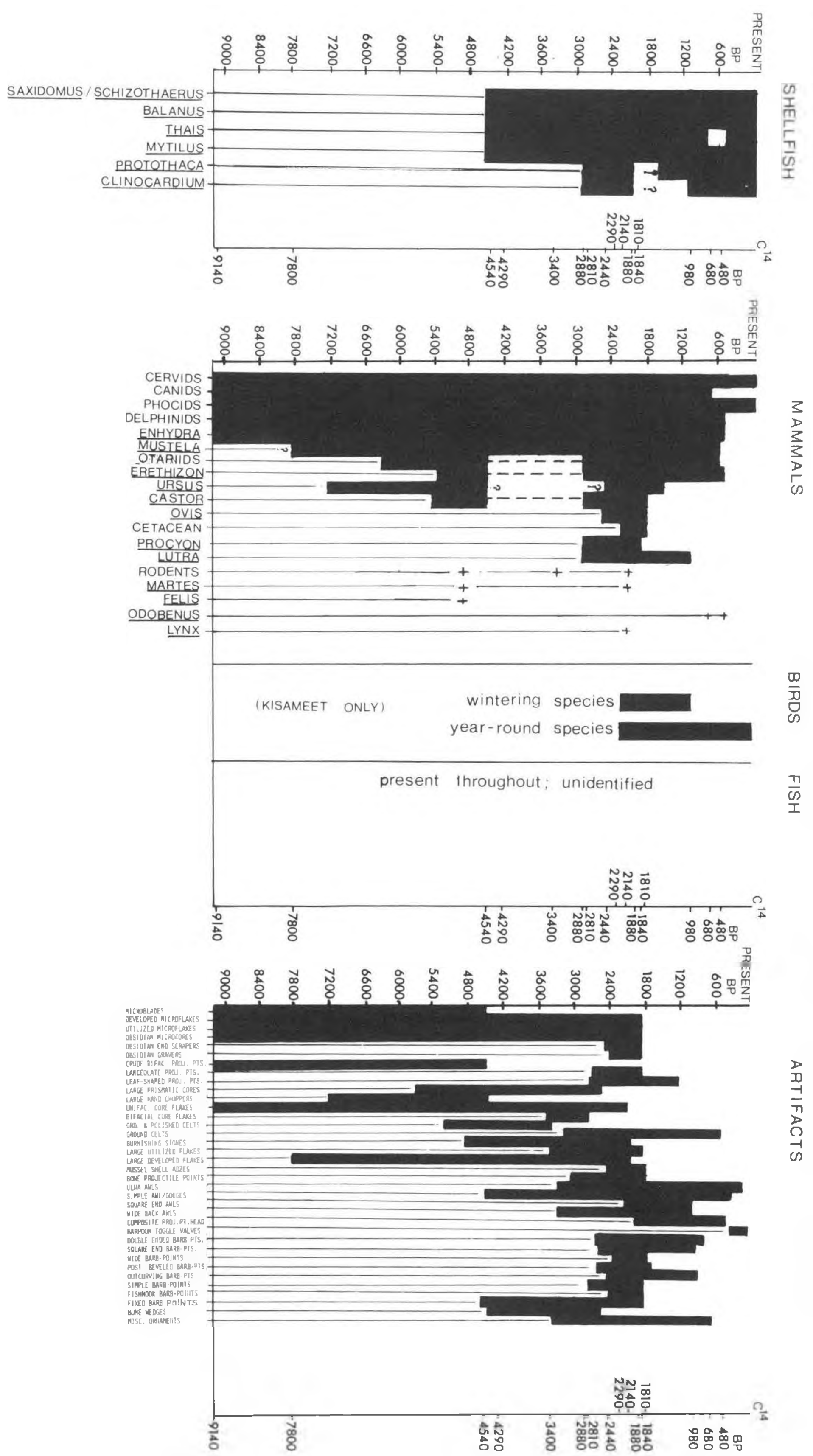


Fig. 65

Data compilation chart B: data distributions. Graphs include both Namu and Kisameet data, unless otherwise stated.

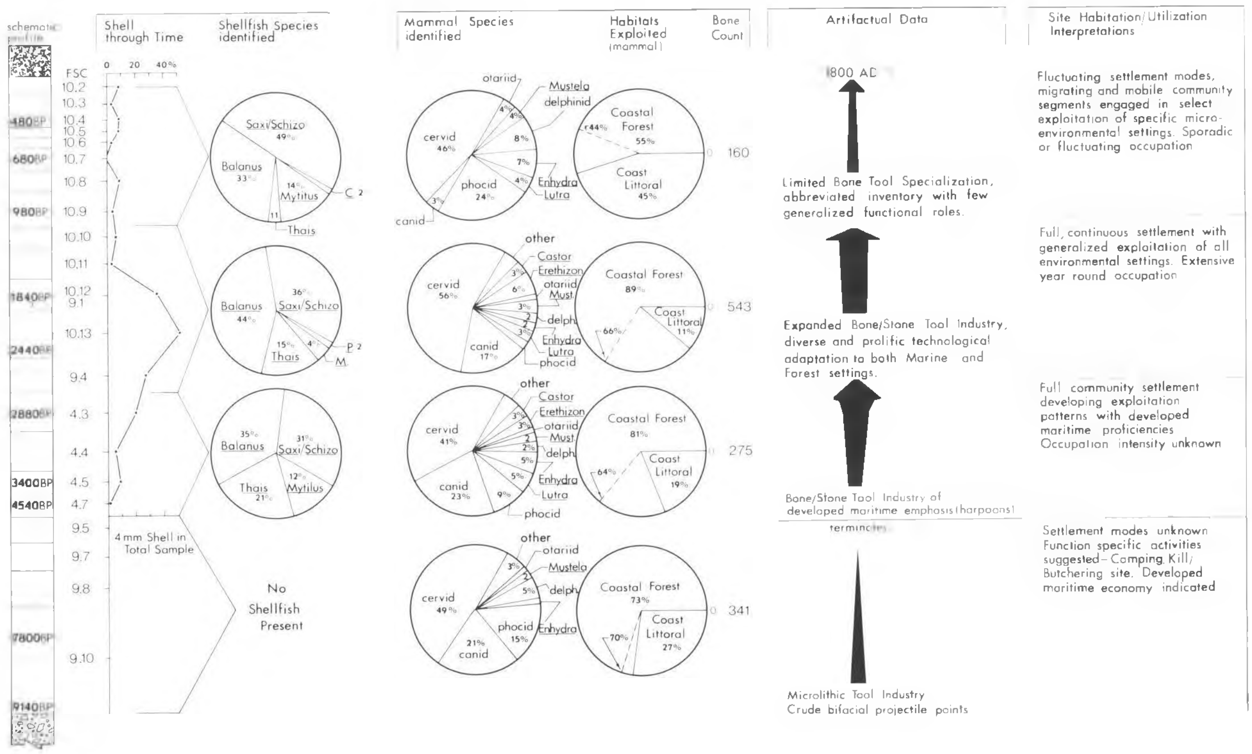


Fig. 66 Summary conclusions and data integration at ElSx 1, Namu, B.C.

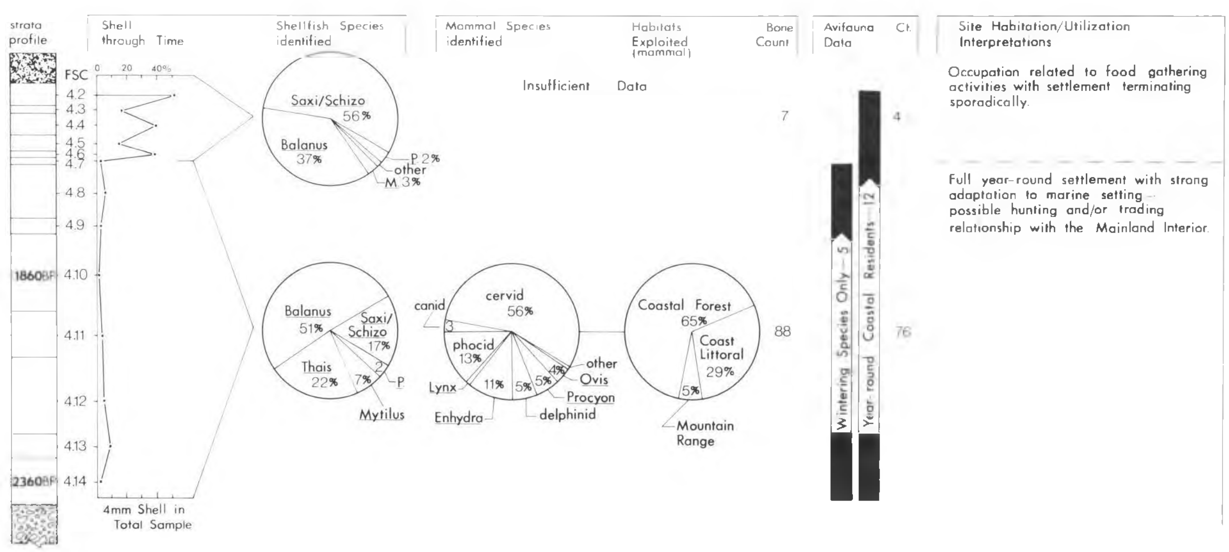


Fig. 67 Summary conclusions and data integration for ElSx 3, Kisameet Bay, B.C.

following succession of patterns:

1) *At 9140 BP or slightly earlier:* initiation of deposition of the black matrix.
2) *At 4540 BP or before.* the initiation of shell deposition for the site. All previous deposition (from 9140 BP) is non-shell, and exceptionally uniform in content and configuration throughout.
3) *At 2880 BP:* a peak in shell deposition producing thick, unmixed strata of low fragmentation and high shell content. The peak is maintained until at least 1800 BP, after which there is a decline in quantity of shell deposited, an increase in matrix fragmentation, compaction, and homogeneity.
4) *At 980 BP:* an unprecedented stratigraphic morphology appears which typifies all subsequent site deposits. Strata are thin, horizontal, compact, and rather low in shell content. They include clusters of superimposed hearths in direct association with small concentrations of pure shell, generally of one or two species throughout. Thin black bands of charcoal-laden humic debris separate the strata and hearths and visually emphasize the pattern.

At Kisameet, stratigraphic observations suggest only one boundary, separating a pattern similar to the youngest at Namu from an earlier one involving thick, homogeneous deposits of high fragmentation and relatively low shell content. No stratum of the youngest Kisameet pattern is dated. The site's most recent date comes from midway through the initial pattern and dates 1810 BP. Since the younger pattern is similar to the Namu deposits of 980 BP and younger, we believe the upper Kisameet pattern is of equivalent age.

The Kisameet stratigraphy poses no problems in the definition of patterns. Namu on the other hand, offers several problem areas, notably at the 2880 BP boundary and among strata representing the decline from peak deposition between 1800 and 980 BP. This latter situation involves a radiocarbon reversal. For the strata deposited between 1800 and 980 BP, we consider their distinctions as insufficient for separate pattern status on the basis of stratigraphic observations. They are definitely not typical of the post-980 BP morphology, but are more similar to the preceding deposits and therefore are grouped with them.

What then do the other data suggest concerning these stratigraphic patterns? At Namu, they concur. The site's black matrix deposition, dated between 9140 BP and possibly as late as 5000 BP, contains unique data. Its obsidian microlithic industry, is exclusive to those strata, and the absence of the specialized bone tool industry so typical of shell strata is as outstanding as the complete absence of shell. Is this representative of a completely different initial habitation at Namu? The pie charts of the mammal species distributions reveal a certain uniformity of species proportions throughout site history. At Namu the fauna strongly suggest maritime orientation prior to 4540 BP. Whereas many fish species and all shellfish species common in middens can be acquired through exploitation of the littoral and rivers, procurement of seal, sea lion, sea otter, and dolphin requires a formal system of marine exploitation involving watercraft and specialized equipment. This system is as well in evidence at the basal black strata, as it is in the subsequent shell-bearing deposits.

What then do we make of the accompanying artifact inventory? The abundance of unworked bone indicates the absence of bone tools is not due to poor preservation. The microliths and crude projectile points must have been usable in marine hunting as well as in hunting on land. As insets in a composite projectile head of bone or wood, for example, obsidian blades enhance entry of the point into the prey. As part of a composite head, or alone, stone points were used in historic times as lances or pikes (Drucker: 1955:45-48) employed in marine hunting and fishing.

In summary then, the features of the black matrix isolate it from subsequent shell deposits in terms of specific site utilization practices, but not in terms of either general technology or economy. The specific character of the microlithic industry, and the long-term use of the site for other than shell deposition suggest the black matrix represents a unique version of maritime life in the sequence of Namu habitation.

Subsequent deposits at Namu are predominantly shell-bearing and exhibit a characteristic bone tool industry with a developed maritime emphasis. Within this expanse of shell deposition from 4540 BP to the present, we can isolate two distinctive depositional patterns. These two are separated from each other and from the black matrix by two less well-defined periods of deposition, the earlier of which is considered for individual pattern status here and in the graphs. The "shell through Time" curve illustrates the resulting subdivision of the Namu shell sequence. The patterns are described as follows:

4540 – 2880 BP

The initial period of shell accumulation is represented by three and possibly four samples from the FS 4 area, where the sequence begins at 4540 BP. A date of 3400 BP marks a middle deposit, and the top stratum in the sequence is dated around 2880 BP on the basis of stratigraphic correlation. The content data from these strata are relatively scarce to use in reconstruction of a utilization pattern for the period. The distinctiveness of the subsequent and preceding deposits, however, suggests there was difference in site occupation. I have described the sequence as representing an approach to the peak of site utilization indicated in succeeding deposits. The developed bone tool industry typical of the peak period had already appeared full-blown with the earliest shell stratum of this initial sequence, if with fewer tool types and smaller quantities. The quartet of shellfish staples — barnacle, clam, *Thais,* and mussel — also appear in characteristic proportions, with barnacle and *Thais* losing an early predominance to a slowly increasing clam representation. There is the beginning of a proliferation of mammal and shellfish species as the deposits gradually assume the configuration of strata of the following period. The initially low shell content of the matrix increases with a corresponding decrease in matrix fragmentation. The comparatively high compaction, high fragmentation, and even constituent distribution of these early strata prompts suggestion that during their deposition the exposed midden surfaces were involved in rather heavy utilization. The low shell, bone, and artifact contents suggest, further that the utilization was less intense than in later periods with respect to the frequency and variety of activities involved.

2880 — 980 BP

The peak in deposition of quantities of shell, in proliferation of faunal species and numbers, and in proliferation of artifact types and numbers, appears by 2880 BP and extends to 1880 BP in the Rear Trench and to 1840 BP in the Front Trench at Namu. As the "Shell through Time" curve illustrates, many of the strata in this pattern appear as pure shell. At the 2880 BP boundary and throughout the subsequent thousand year peak period we see an increase in the number of new artifact types produced and a reduction in the disappearance of types. A great variety of activities is represented, from formal procurement systems for land and sea fauna involving very specialized items, to tool manufacture using relatively simple equipment. Working in bone, stone, and shell is evidenced; and wood-working is suggested by inference from other implements. The low fragmentation, low admixture, and low compaction of matrix of these deposits suggests less heavy utilization of exposed site surfaces. Rapid build-up may account for much of the preservation. The great quantities and variety of debris suggest more intense interaction with the site during occupation.

The peak period proper seems separated from the next distinctive stratigraphic pattern by three thick Front Trench strata whose content features are most similar to those of the initial shell sequence. The artifacts show continuities from the preceding peak period inventory, but there is a dramatic decrease in both types and numbers, and no new types appear until well into the succeeding depositional period. In response to decrease in shell on the whole, absolute quantities of shellfish species also decline, although proportions are similar to those of the peak period, with clam and barnacle predominant. Numbers of mammal species present in this brief transition period maintain their peak period quantities, and absolute quantities exhibit a surprising peak. This feature of the mammal inventory is in fact the only aspect of the period which is truly distinctive. Temporal boundaries are established at 1800 and 980 BP. On the basis of species proportions and artifact continuities, the deposits are grouped with the peak period strata and mark its decline rather than an approach to the subsequent pattern.

980 BP — present

The site's final distinctive stratigraphic pattern is apparent in the upper Front Trench. The pattern first appears in the upper portions of the stratum dated 980 BP, and continues to present midden surface in a succession of thin, compact deposits containing the site's heaviest concentration of fire hearths and pockets of species-specific shell. The deposits are separated by thin bands of charcoal-laden matrix emanating from the hearths. The number of types of artifacts has sharply declined, as have artifact numbers. Numbers of species have declined for both shellfish and mammals. Clam finally achieves definite dominance over barnacle, and mammals of the Coast Littoral biotic province are predominant over those of the Coast Forest in numbers of species exploited. The strata characteristics are derived from intensive hearth-side activities resulting in the compaction of basic stratum matrix and the presence of unmixed piles of food refuse. The latest date on the sequence is 480 BP, from the fourth stratum below humus. Absence of contact period artifacts suggests the site may have been abandoned during that period.

The comparative simplicity of the Kisameet sequence and the small amounts of usable content data make its pattern definition rather clear-cut. Stratigraphic observations, shell quantities and fragmentation through time, shellfish species proportions, and avian data demark a boundary between two patterns: an initial sequence of strata low in shell content and exhibiting a definite barnacle predominance, and a subsequent sequence of alternating shell-bearing and humic strata exhibiting an equally dramatic clam predominance. Mammal material involves the same species as seen at Namu, with the same predominance of deer. Only the older pattern is represented sufficiently by these materials, however. Avian material was identifiable throughout, with the only distinction being between species which occur in the area throughout the year and those which winter there only. The occurrence of wintering species in the earlier pattern but not in the recent one suggests the site may not have been utilized in the same manner. Matrix fragmentation, compaction, mixture, and stratum configuration differences between the two patterns further indicate utilization distinctions. The shell-heavy strata of the upper pattern suggests light utilization of their exposed surfaces. The debris is relatively unbroken and loosely distributed across the site surface – unlike the compact horizontal distribution of strata of the initial site sequence. As at Namu for the same time periods, the deposition is shell-bearing throughout with the youngest sequence of deposition featuring narrow charcoal-laden bands.

Summary of Distributional Trends

Within the Namu depositional sequence overall, we find a basic dichotomy between an ancient period of non-shell deposition, characterized by microlithic industry, and a succeeding period of shell deposition with its own distinctive bone and stone tool industry emphasizing a variety of harpoon head elements. The two periods appear to exhibit nearly equal durations, of 4000 or 5000 years each. While no trends in artifact distribution are detectable in the non-shell deposits, very definite ones appear within the stratified shell sequence. That sequence may be divided into at least three successive sequences of deposition, each characterized by its own complex of content and morphologic phenomena. Outstanding among these is an apparent peak in the associated artifacts between 2880 and 1800 BP. This peak is evidenced as well in faunal species and in a great increase in quantities of site debris (particularly shell) at the same time. Deposits immediately preceding and following peak deposition exhibit gradual trends to and from peak characteristics. Equally distinctive is the final site depositional sequence whose strata suggest in form and content rather specific habitation activities rather than the wide range illustrated by peak period data. Trends in faunal debris have also been defined. There is a steady increase in predominance of beach-dwelling clams *Saxidomus/Schizothaerus* over rock-dwellers *Thais* and barnacle throughout the 4540 year history of site shell deposition at Namu. The Kisameet data express this trend over a 3000 year period in even sharper terms. Among mammal data at Namu, the trend is a gradual increase in predominance of marine fauna over forest fauna in terms of numbers of species exploited. Both trends culminate in deposits of the last stratigraphic pattern. We should not overdramatize the significance of the pattern distinctions as these trends persisted throughout site history, essentially unaltered by peak period deposition or declines, or for the mammal data, by the dramatic distinctions between the black matrix and shell occupations.

Conclusions: Early Tool Traditions In Northwest North America

JAMES J. HESTER

THE NAMU-KISAMEET SEQUENCE

It should be pointed out that Luebbers declined to isolate sequential cultural units in his discussion of the artifacts. He perceived the strong evidence of continuity present in the collections and preferred to emphasize this fact rather than to break this continuum into what he regarded as arbitrary subdivisions. In my approach I will not depart from Luebbers' data but will simply divide them into a series of cultural units, each characterized by some artifactual differences. By emphasizing this change, rather than the continuity which is also present, it is possible to identify several sequential units which I will term "components". We do know that similar units of culture content are known from the Grant Anchorage site (Milbanke Sound), McNaughton Island, and Kwatna. The degree of correspondence is at present unknown, due to limited artifactual analysis. Future comparative analysis should lead to firm groupings on a regional basis, and the definition of cultural phases.

Namu I – 9140 BP – 6000 BP or later

The first of the components we have isolated is specifically different from the others in that it covers approximately 4000 years. We assume that further research will permit the definition of internal subdivisions more comparable to the later units. This unit occupies a long enough time period to be identified as a "tradition". The artifact classes present include:

- microblades
- developed microflakes
- utilized microflakes
- obsidian microcores
- crude bifacial projectile points
- unifacial core flakes

present in the later half of the tradition are:

- large hand choppers
- large prismatic cores

found only in this component are:

- microblades
- crude bifacial projectile points
- large hand choppers

Whereas our total cultural information is limited, the economy featured a mixed reliance on both the hunting of land mammals and sea mammals. According to Conover (Fig. 66) the reliance by environmental zone was Coastal Forest 73% and Coastal Littoral 27%. In addition salmon are present throughout all levels, although in low frequency, indicating that fishing was also part of the economic pattern.

Namu II – 4500 BP – 3400 BP

This component initiates the reliance on shellfish as a major economic pursuit. As Conover points out, the species preferred were the rock dwellers, barnacle, *Thais,* and mussel, with clams of lesser importance. Hunting continued to be mixed with a slight increase in the land mammal frequency. The Coastal Forest representation is 81% and Coast Littoral 19%. Although our fish data are incompletely analyzed, fishing increased in quantity of bones present and in species. Salmon is the most prevalent genus. Burial patterns include extended inhumation with offerings of implements and ornaments; flexed inhumations, and bundle burials, both with limited offerings. Several of the flexed burials had large boulders dropped onto the bodies prior to covering with earth. Three bodies also show burning – possible evidence of cremation. The burials were single, in multi-individual graves, and in sequential multiple graves.

Artifact distributions include:

appearance of bone tools – specifically simple awl/-gouges, bone wedges, fixed barb points, fishhook barb-points. Ground and polished celts also appear and are the only artifact type which is not found in the succeeding component.

Namu III – 3400 BP – 2800 BP

The economy continues the pattern established in Namu II. The major distinction is an increase in the total reliance on shellfish. Fish also increase in frequency and species. The burial patterns are the same as in Namu II.

The artifact inventory is marked by the presence of:

bifacial core flakes
ground celts
large utilized flakes
bone projectile points
ulna awls
wide back awls
miscellaneous ornaments

At the end of the period of this component the following artifact types disappear:

large prismatic cores
bone wedges

Namu IV – 2880 BP – 1860 BP

This component is marked by the peak in shellfish utilization. Clams have increased to 36% of total shellfish, although barnacle is still most common (44%); mussel have nearly been eliminated. In mammal remains reliance on Coastal Forest species increased to 89% with only 11% Coastal Littoral. Fish remains increase with salmon still predominant. The burial pattern includes only bundle burials. The artifact inventory includes the following:

obsidian end scrapers
obsidian gravers
lanceolate projectile points
leaf shaped projectile points
mussel shell adzes
double ended barb-points
square end barb-points
wide barb-points
posterior beveled barb-points
outcurving barb-points
simple barb-points
fishhook barb-points

Artifacts not found in the succeeding component include:

developed microflakes
utilized microflakes
obsidian end scrapers
obsidian gravers
lanceolate projectile points
unifacial core flakes
burnishing stones
large utilized flakes
large developed flakes
mussel shell adzes
bone projectile points
wide barb-points
simple barb-points
fishhook barb-points
fixed barb points

Kisameet I and Namu V – 1860 BP – 980 BP

These components are characterized by environmental adjustment. The total amount of shell decreases rapidly reaching a level of about 10% of the 4 mm debris shortly after 1800 BP, about one fourth of its prior high. There is a dramatic increase in rock dwellers to 80% of the total at Kisameet with clams responsible for only 17%, down from their high of 36% in the preceding component. These adjustments would seem to substantiate Luebbers' concept of a period of lower sea level. Deer are the most common mammals hunted (56%) and seals second (13%). The breakdown of reliance on mammals by environmental zone is Coastal Forest (65%) and Coast Littoral (29%), the Coast Mountains (5%) provided an appreciable amount of the total for the only time in the entire prehistoric sequence. Fishing is at its peak with our first evidence of major utilization of species other than salmon, *i.e.* rockfish, rock greenling, ratfish, dogfish, ling cod, herring, and sand sole. Salmon is still the most prevalent genus accounting for half to three fourths of all identified fish bones.

The artifactual inventory is unique in that these components are marked primarily by continuation of existing artifact types. Only one new type is introduced. Continuing artifact types are:

leaf shaped projectile points
ground celts
ulna awls
simple awl/gouges
square end awls
wide back awls
double ended barb-points
square end barb-points
outcurving barb-points
bone wedges

The only new artifact form is the composite projectile point head.

Several artifact types are not found in later components;

these include:

square end awls
wide back awls
square end barb-points
outcurving barb-points

No burials were encountered so the burial pattern is unknown.

Kisameet II and Namu VI – 980 BP – 480 BP

The major feature of these components was the increasing reliance on shellfish with the predominant species being clam, rather than rock dwellers. The mammal exploitation records a shift from Coastal Forest utilization, down to 55%, to increasing reliance on the Coast Littoral – 45%. Fishing continued to be important but possibly less so than in the preceding components. No burials were found.

Artifacts record a continuing reduction in the number of types present. No new types were introduced. Types present include:

ground celts
ulna awls
simple awl/gouges
composite projectile point heads

Midway in the deposits containing these components double-ended barb-points and miscellaneous ornaments disappear. At the top of the deposits the following disappear:

ground celts
simple awl/gouges
composite projectile point-heads

Namu VII – 480 BP to 140 BP (1833 A.D.)

This component is inadequately represented in our excavations. Only a small number of artifacts were recovered. They include ulna awls and one new form – harpoon toggle valves.

The period of historic contact, most of which is synonymous with the ethnographic present, was initiated in 1833, based on the construction of the Hudson's Bay post at Ft. McLoughlin. Although Vancouver's expedition traversed the region in 1792, it did not have the lasting impact that the fort did. The date of 1897 marks the removal of the village from Old Bella Bella to New Bella Bella, and represents the beginning of the modern era. We did not dig an historic period site, nor were any historic artifacts recovered that pertain to this period. At Namu our historic objects were all of 20th century derivation.

Our definition of components of these sites, Namu and Kisameet, is based on limited data; however these data do provide evidence of cultural change. We view these subdivisions as possessing some cultural reality. Their utility is seen in their provision of a tentative local chronology which may be tested by future work.

Although our fish bone data are still being analyzed, it is possible to ascertain some major trends. These are that while salmon was utilized throughout our prehistoric record, salmon increases in frequency from early to late. Therefore the period of major reliance on salmon, approximating that of the ethnographic present, appears to date back to 1800 BP. Just prior to this rise in salmon frequency there occurred a major reliance on shellfish utilization which was dominant from 4540 to 1880 with the period of peak utilization dated 2880 – 1880. The implication is that as shellfish utilization declined, salmon utilization increased.

Early Tool Traditions

Within this long record we need to identify the sources of the traditions represented. The methodology we have employed consists of examining the archaeological literature in search of radiocarbon dated "early" examples of diagnostic artifacts.* These data have been plotted on a series of maps, and sites of equivalent age have been connected by lines. The resultant isochronic lines, where reasonably complete, permit an assessment of the point of origin of each of these major traditions and their spread through time and space. As a means of documenting this spread we have selected certain artifact classes as representative of a particular tradition. We have simplified our approach by not attempting to deal with linked traits, cultural complexes, or assemblages. The resultant maps are expected to represent a distillation of the relevant data to permit a clearer assessment of cultural diffusion. Our approach then is synthetic and generalizing at the broadest level. The artifact classes we have selected are the following: microblades, pebble tools, bifacially flaked projectile points, ground slate implements, socketed base toggling harpoons and labrets.

Microblades

The earliest artifactual manifestation at Namu consists of microblades. This is not necessarily the earliest tradition in the region, as pebble tools may be even earlier. The occurrence of microblades at Namu however fits rather well into the distribution of microblades in time and space (Fig. 68). According to the distribution data currently available, microblades are early in three localities in north-

* *Data presented in this section were in large part compiled by students enrolled in a seminar in Northwest Coast prehistory. I gratefully acknowledge the contributions made by Larry Nordby, Larry Parish, and Jean Afton. Responsibility for the positions of the isochronic lines on the maps is my own.*

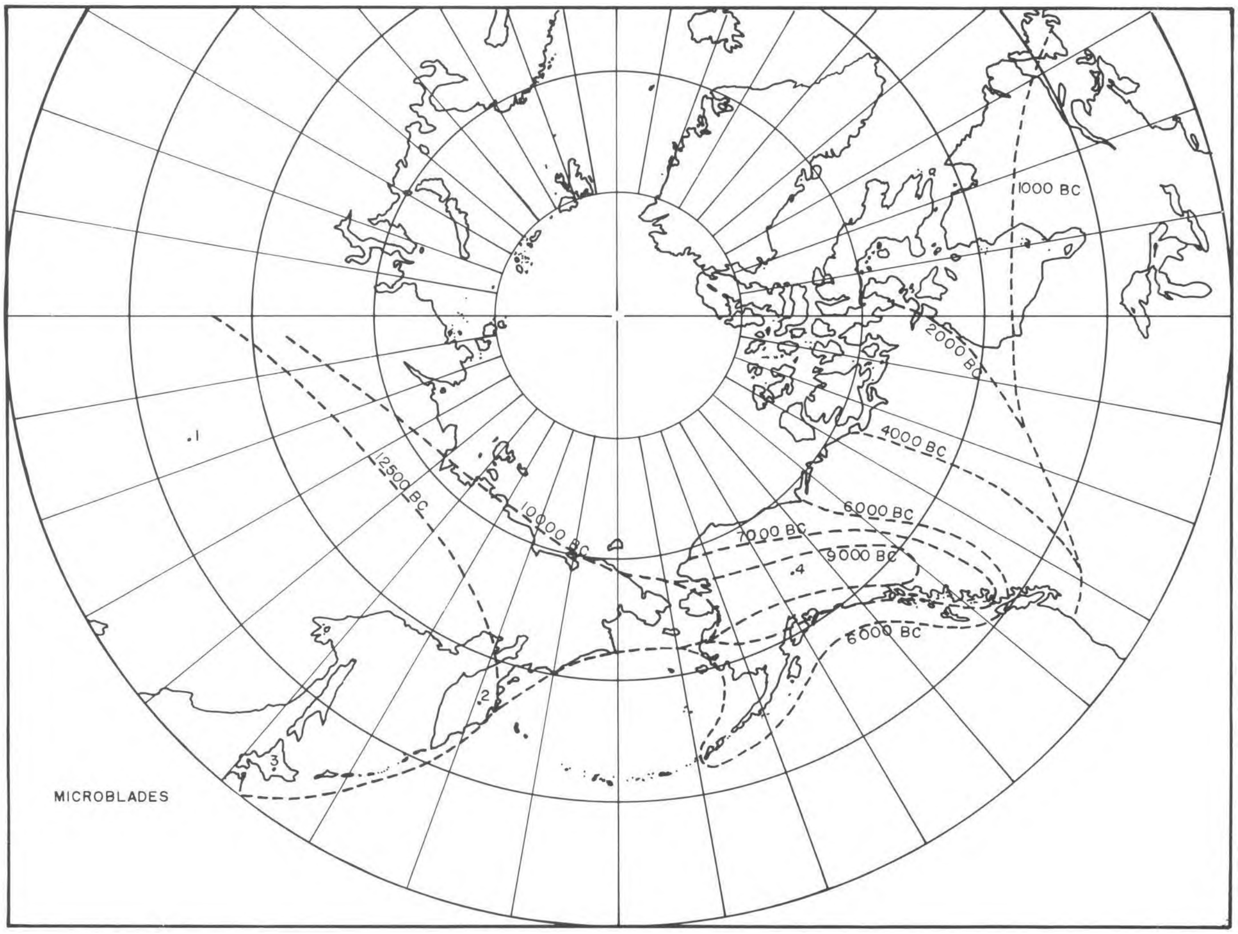


Fig. 68 Microblade distribution.

eastern Asia: the Baikal region, the Ushki site of Kamchatka, and several sites in Japan including Shirataki, Okedo, Fukui Cave and others. The transition from Late Palaeolithic blade industries into those featuring microblades at these sites appears to have occurred by 12,500 B.C., according to radiocarbon and obsidian chronologies (Table XI). It is assumed that the ultimate area of origin of microblades lies to the west and south of these sites, beyond the geographic focus of the present article. Our next isochronic line (10,000 B.C.) is entirely hypothetical as we have had little research in the Siberian areas bordering Bering Strait. However, such a hypothetical line seems reasonable as we have dated occurrences at Healy Lake, Alaska at 9150 B.C. and at Ice Mountain, British Columbia (9000 B.C.). By 7,190 B.C. we find the earliest microblades at Namu. Another 7000 B.C. occurrence is at Groundhog Bay, Alaska. By 6000 B.C. we can include the Akmak complex, the Anangula site, the Anaktuvuk Pass sites, the Queen Charlotte Islands sites, and others. Thus by this time we may visualize a distribution which includes most of Alaska, the Aleutian chain, and much of the B.C. Coast. By 4000 B.C. we perceive the maximum southern extension of the microblade distribution with sites in northeastern Washington State at Ryegrass Coulee, Veratic cave, etc. The distribution further includes sites in central Alberta indicating a spread to the east. After 4000 B.C. the spread of microblades proceeded rapidly to the east reaching the western edge of Hudson's Bay by 2000 B.C. By this time the distribution is stabilized along its southern periphery with all new territory occupied being to the north and east. By 1000 B.C. microblades are found all the way east to Labrador and north to Greenland. On the Northwest Coast proper the temporal distribution is as yet unclear. At Namu we have no specimen dated later than 2620 B.C., although they occur as late as 370 A.D. at the Whalen Farm site.

Table XI Radiocarbon dates and age estimates of microblade sites

Site	Radiocarbon	Estimates
Krasnyi Iar, on the Angara		18,000 B.C.
Shirataki - Toma H		12,150 B.C.
Cheremushnik		8–9,000 B.C.
Okedo		10,850 B.C.
Verkholenskaia Gora Levels I–III		8–10,000 B.C.
Tachikawa Loc 1		10,350 B.C.
Ulan Khada Levels IX–XI		6–2,000 B.C.
Ushki site, Khamchatka	8410 ± 350 B.C.	
Afontova Gora II	9385 ± 270 B.C.	
Fukui complex, Japan	10,750± 350 B.C. to 9380 ± 260	
Malta – horizon II	12,800± 120 B.C.	
Kokorevo I	12,500 ± 150 to 10,990 ± 270 B.C.	
Ice Mountain, N.B.C.	9000 B.C.	
Ust Belaia	7010 ± 60 B.C.	
Trail Creek		7,000 B.C.
Denbigh Flint	3974 ± 600 B.C.	3,000 B.C.
Akmak Complex		6,500 B.C.
Anangula Island		6,500 B.C.
Anaktuvuk Pass		8,000–2,000 B.C.
Healy Lake		8,150 B.C.
Queen Charlotte Islands		6,000 B.C.
Ground Hog Bay 2	8230 ± 800 B.C.	
Early Mountain		1,300 B.C.
N.T. Docks		2,100 B.C.
Natalkuz Lake		500 B.C.
Southwest Yukon		
Taye Lake	1770 ± 330 B.C.	2,000 B.C.
	2780 ± 320 B.C.	
Gladstone	1270 ± 140 B.C.	3,000 B.C.
Little Arm	1150 ± 70 B.C.	4,000 B.C.
Champagne	970 ± 140 B.C.	6,000 B.C.
Nesikep Creek VII		3,500 B.C.
Drynoch Slide	5580 B.C.	5,580 B.C.
Milliken Site		900 B.C.
Gulf of Georgia		
Whalen II	A.D. 370 ± 140	
Marpole	400 B.C. ± A.D. 179	
Locarno Beach	940 ± 140 B.C. C480 B.C.	
Montague Harbor	1210 ± 130 B.C.	
Columbia Plateau		
Lehman	4700 ± 110 B.C.	4,500–1,500 B.C.
Ryegrass Coulee	4530 ± 80 B.C.	4,500–1,500 B.C.
Veratic Cave	4328 ± 299 B.C.	4,500–1,500 B.C.
	3920 ± 120 B.C.	4,500–1,500 B.C.
	3720 ± 120 B.C.	4,500–1,500 B.C.
Weis Rockshelter	2700 ± 70 B.C.	4,500–1,500 B.C.
Sourdough Creek	2250 ± 125 B.C.	4,500–1,500 B.C.
Schaake Village	1260 ± 150 B.C.	1,500–0 B.C.
Indian Dan	1070 ± 150 B.C.	1,500–0 B.C.
Hymer Orchard	830 ± 190 B.C.	1,500–0 B.C.
Schaake Village	830 ± 190 B.C.	1,500 0 B.C.
Three Springs	810 ± 240 B.C.	1,500–0 B.C.
Ivugivik		2,000–1,000 B.C.
Hudson Bay Sites		155 B.C.–A.D. 100

(These dates have been compiled from Giddings 1964, Borden 1968, Mitchell 1968, Browman and Munsell 1969, Sanger 1964, Campbell 1962, Taylor 1962, Meldgaard 1962, MacNeish 1964, Khlobstin 1969, Medvedev 1969 Aksenov 1969a, 1969b, Fladmark 1971, Klein 1971, Hayashi 1968, Morlan 1967, Ackerman 1968, Smith 1971.)

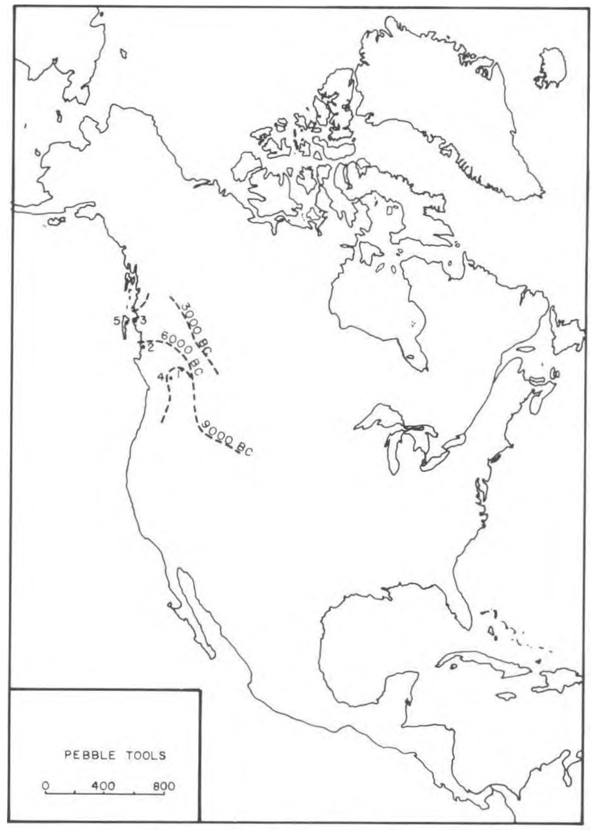


Fig. 69 Pebble tool distribution.

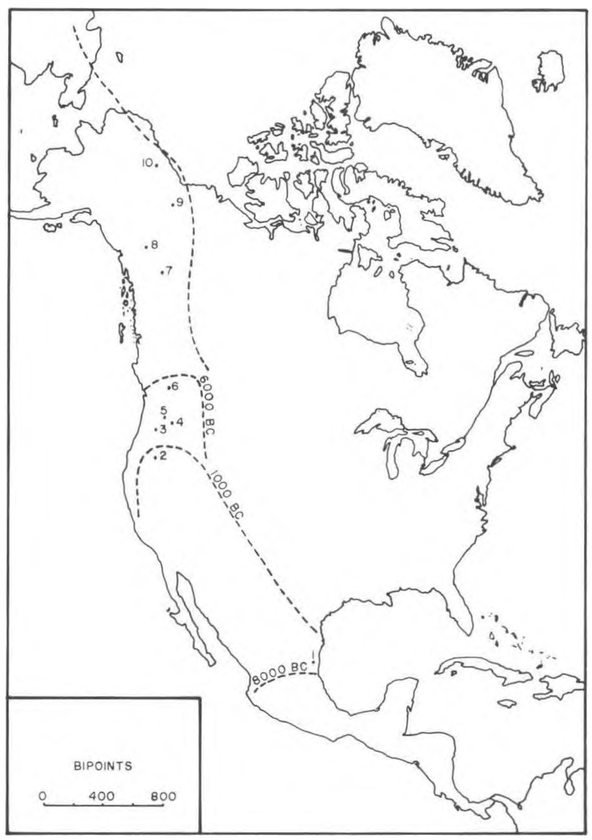


Fig. 70 Bifacial point distribution.

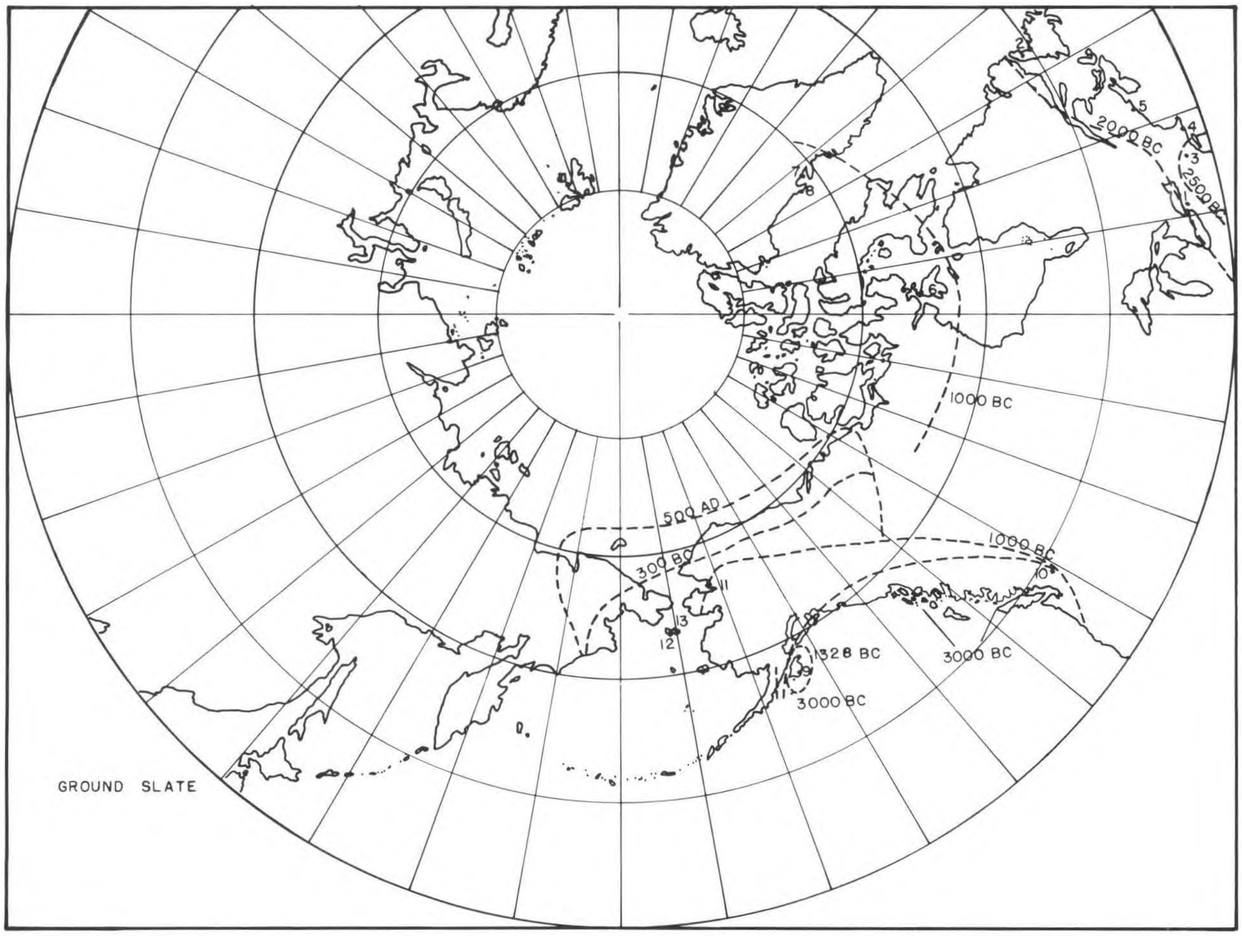


Fig. 71 Ground slate distribution.

Pebble Tools

Our poorest data concerns the distribution of pebble tools (Table XII). This may be due to the lack of interest in them by archaeologists as well as the difficulty of seriating and dating the implements themselves. The earliest occurrence of pebble tools (mostly large flakes) at Namu is dated 5850 B.C. ± 200. Prior to this date the North American distribution of pebble tools indicates that they occur earlier in sites to the south and east of Namu (Fig. 69). Early occurrences are at Wilson Butte Cave, 12,600 B.C. and at the Milliken site, 9,000 ± 900 B.C. and 7100–6200 B.C. With so little valid data to work with it is impossible to construct an accurate map. On the basis of the North American data the distribution through time seems to be from south to north extending from the San Dieguito area north into the Yukon. However this distribution does not take into account the Old World chopper-chopping tool complex and its distribution through time or similar industries in South America termed pre-projectile point by Krieger (1964) and chopper tradition by Willey (1972).

Bifacial Points

Our data on the distribution of bifacial points – the Lerma, Cascade and other forms – is again inadequate. Bifacial points are early in South America (Ayampitin ca. 8000 B.C.) as well as in Mesoamerica (Tamaulipas 7320 ± 500 B.C.). Other early occurrences are Ft. Rock Cave, Ore. (7103 ± 350 B.C.), Five Mile Rapids, Ore. 6–8000 B.C.), Lind Coulee, Wash. (6750 B.C.), and Milliken, B.C., (7050 B.C.). At Namu crude bifacial points date from the beginning of the occupation – ca. 7000 B.C. The points thus dated imply a south to north movement of the tradition with the earliest examples originating in South America. The distribution seems to be limited to the Cordillera. Farther north and extending into Siberia are sites with both bifacial points and microblades which have been termed the Denali complex. These sites include the Alaskan Campus

Table XII Radiocarbon dates of pebble tool sites

Sites	Radiocarbon Dates
Milliken site	7100–6200 B.C.
Wilson Butte Cave	12,600 B.C.
San Dieguito complex	9–7000 B.C.
Namu	5850 ± 2000 B.C.
Glenrose, B.C.	before 5000 B.C.
Prince Rupert Harbour	3000 B.C.
Lower Fraser river	2250 B.C.
Queen Charlotte City	2215 ±135 B.C.
Kulpo culture in Korea	late Palaeolithic
Fisherman Lake, Ft. Heard region –	guess dates up to 13,500 B.C.
Bayrock, Alberta	ca. 9000 B.C.
Caribou Island, Central Alberta	not securely dated

(Compiled from Fladmark 1971, Borden 1968, Larichev and Grigorenko 1969, Bryan 1969.)

Table XIII Radiocarbon dates of bifacial point sites

Sites	Radiocarbon Dates
Tamalipas Sierra	7320 B.C. ± 500 B.C.
Ft. Rock Cave	7103 ± 350 B.C.
Five Mile Rapids	6 8000 B.C.
Lind Coulee	6750 ± B.C.
Ryegrass Coulee	4530 ± 80 B.C.
Milliken, B.C.	7050 B.C.
Klondike site	undated
Kluane complex	undated
Flint Creek	undated
Kayuk	undated
Ground Hog Bay	8230 ± 800 B.C.
Lake Baikal	10,500 B.C.
Healy Lake	9–6550 B.C.
Onion Portage (Palisades I)	4000 B.C.
Glenrose, B.C.	before 5,000 B.C.

(Compiled from Borden 1968, Butler 1961, Loy 1973, Ackerman 1968.)

Table XIV Radiocarbon dates of ground slate sites

Site	Radiocarbon Dates
Frontenac Island	2980 ± 260 B.C. to 1723 ± 250 B.C.
Port au choix, Newfoundland	2340 B.C.
Bannerman site, Hudson Valley	2524 ± 300 B.C.
Wapanucket No. 6, Mass.	2300 ± 300 B.C.
Ellsworth Falls, Maine	2009 ± 310 B.C.
Dorset T1, Southampton Is.	675 to 103 B.C.
Sarqaq layer, Jakobshavn	790 ± 100 B.C.
Sarqaq site, Disko Bay	810 ± 100 B.C.
Kodiak	1328 B.C.
Marpole	400 B.C
Choris	1000 B.C.
Okvik	308 B.C.
Old Bering Sea	300 B.C.

(Compiled from Ritchie 1962, Dumond 1968, Borden 1962, Griffin 1960.)

Table XV Radiocarbon dates of toggling harpoon sites

Site	Radiocarbon Dates
Port au Choix	2340 B.C.
Igloolik	1948 B.C., 1602 B.C.
Cape Krusenstern	1800–1500 B.C.
Buchanan Site	1040 B.C.
Independence II	1000 B.C.
Chaluka Level IV	946 B.C.
Point Moller	1010 B.C.
Choris	1000 B.C.
Ust Belaia	900 B.C.
Yukon Island	748 B.C.
Native Point	675 B.C.
Locarno Beach	476, 493 B.C.

(Compiled from Rainey and Ralph 1959, Taylor 1967, Bandi 1969, Aigner 1966, Denniston 1966, McCartney 1969, Chard and Workman 1965, Borden 1962 Willey 1966.)

Table XVI Radiocarbon dates of labret sites

Site	Radiocarbon Dates
Chaluka	1800 ± 180 B.C.
Kodiak Is.	1328 B.C. + 61
Marpole	943 B.C. C14 400 B.C.
Katchemak Bay I	748 B C. C-14
Choris	700 B.C.
Okvik	308 B.C.
Old Bering Sea	300 B.C. guess
Ipuitak	331 to 660 A.D. ± 200
Birnirk	500–900 A.D. guess

(Compiled from McCartney 1969, Jennings 1968, Bandi 1969.)

site, Ushki Layer VI, Verkholenskaia Gora II and III, Ust Belaia XIII–V, Anangula, Shabarakh Usu, Ulan Khada, and others. If this distribution represents related phenomena then we could hypothesize a North American introduction into NE Asia of bifacially flaked points. The time of such an introduction is unclear but it could be as early as 7000 B.C. On the other hand valid data is still woefully inadequate (Table XIII).

Ground Slate

Another major class of implements on the Northwest Coast are those made of ground slate: points, knives, etc. The major occurrence of ground stone implements at Namu consists of celts (not slate) appearing about 3000 B.C. The distribution of ground slate elsewhere does not fit a particularly conformable pattern. Ground stone in the Archaic of the Ohio valley dates back to 4000 B.C. (Griffin 1960). Later occurrences in the Laurentian complex of New England date about 3000–2500 B.C., and at Port au Choix, Newfoundland 2340 B.C. Other early occurrences include the Koniag level at Kodiak (1328 B.C.), Choris (1000 B.C.), and at the mouth of the Fraser (943

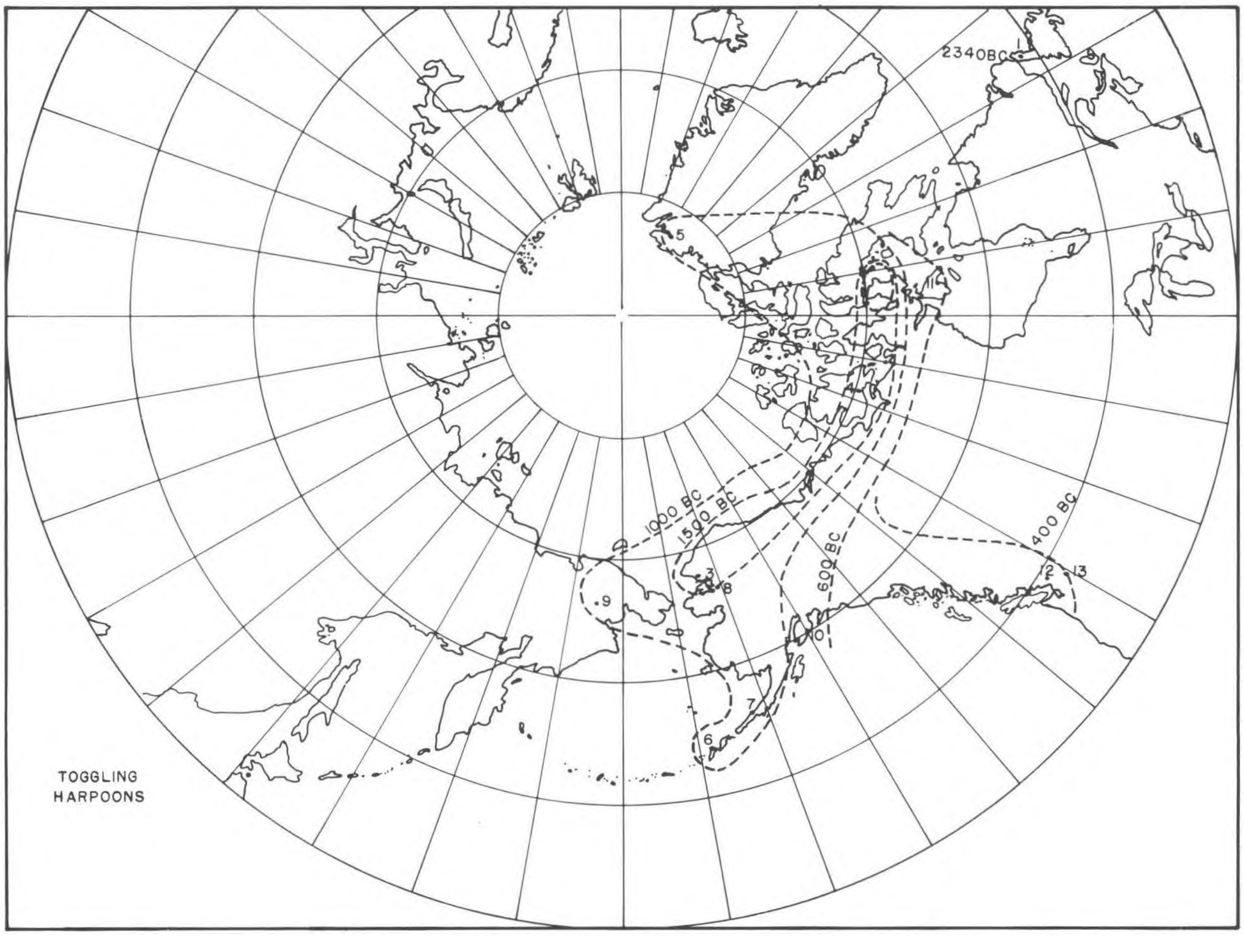


Fig. 72 Toggling Harpoon distribution.

B.C.). Articles by Borden (1962) and Dumond (1968) clearly describe the post 1000 B.C. spread of ground slate as a south to north movement across Alaska. In the east the earliest documented occurrences are in the Sarqaq and Dorset levels dated about 6–800 B.C. The present known distribution implies two centres of origin, one in New England and the other on the Northwest Coast. This implied dual origin may be the result of inadequate information concerning the distribution of ground slate in the Prairie Provinces (Table XIV, Fig. 71).

Toggling Harpoons

Socketed base, one piece, toggling harpoons were not recovered from Namu although their presence there was to be predicted. However the two piece composite toggling type appears there about 700 B.C. The presumed distribution of toggling harpoons is from the eastern Arctic west to Alaska and Siberia and then south to the Northwest Coast (Fig. 72). The earliest occurrences are at Port au Choix (2340 B.C.), and at Igloolik (1948 B.C.), followed by Cape Krusenstern, Alaska, (1800–1500 B.C.). Other Early Alaskan sites are Point Moller (1010 B.C.), and Choris (1000 B.C.), with the Siberian site of Ust Belaia, (900 B.C.), of similar age. At the same time the trait had spread to Northern Greenland (Independence II 1000 B.C.). Dated sites in the Aleutians are only slightly later, Chaluka Level IV, 946 B.C. The spread to the Northwest Coast appears to have taken place between 748 B.C. (Yukon Island) and the occurrence at Locarno Beach 493 B.C. (Table XV).

Labrets

Labrets also were not recovered at Namu although they should occur there. Among all the tool classes studied, labrets have the most restricted occurrence. They appear to be only associated with Northwest Coast, Aleutian, and Western Eskimo cultures. According to dated sites they occur earliest in the Aleutians ca. 1500 B.C. then spread down the Northwest Coast to the mouth of the Fraser by

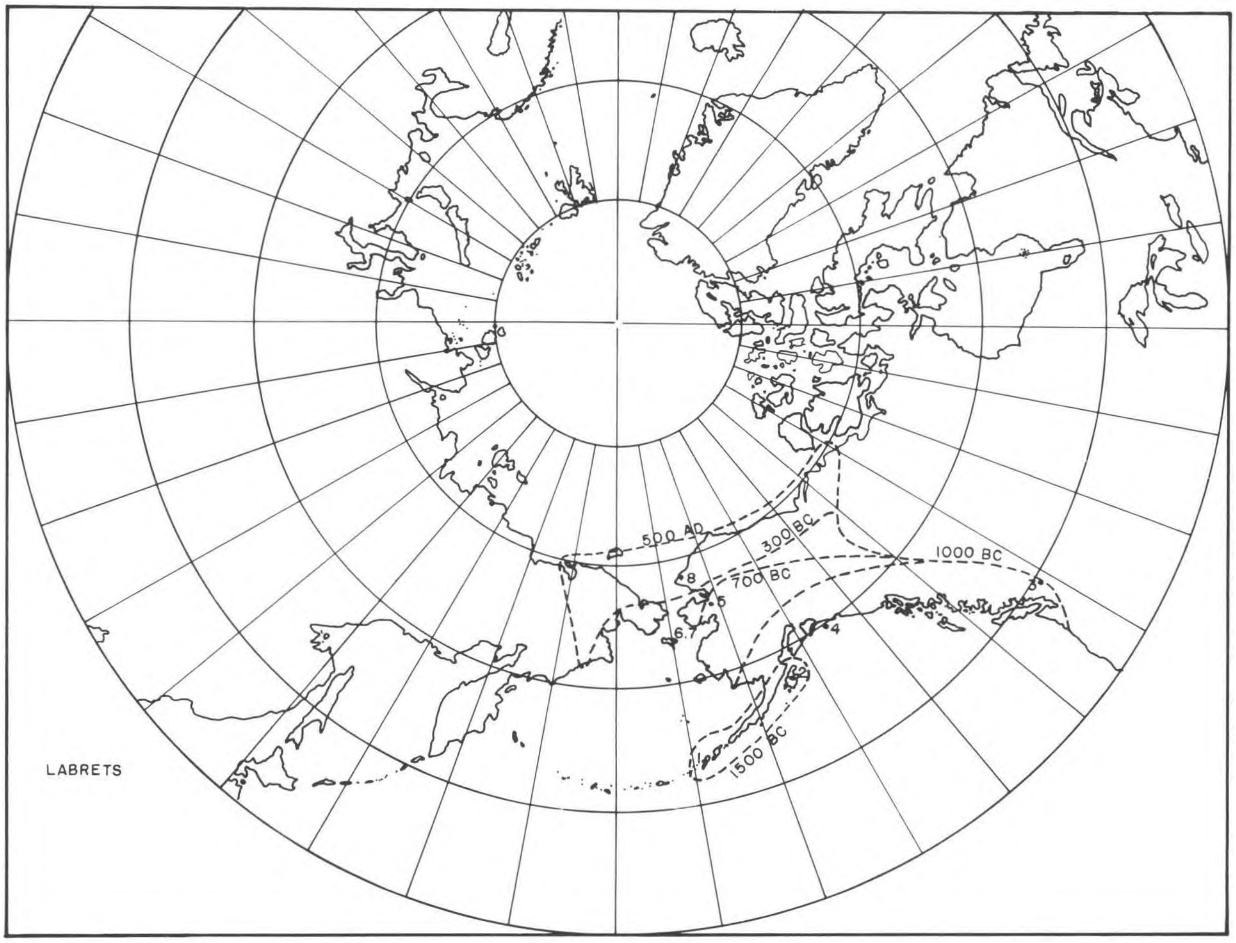


Fig. 73 Labret distribution.

1000 B.C. and north to Choris (Fig. 73) Subsequent movement is north and then both east and west along the Arctic Ocean with the trait reaching the Arctic north slope by 500 A.D. (Table XVI)

CONCLUSIONS

The evidence from Namu suggests that it is a unique site, in that it has presented us with such a complete record of cultural influences over more than 9000 years. Several tool traditions occur early there and their presence suggests that the cultural influences felt there through time were many, varied, and were introduced from several different directions.

Two of these traditions, represented by pebble tools and bifacial points seem to be only vaguely understood due to inadequate study. What is perhaps most needed are future studies focused on those traditions. The ground slate distribution suggests that more research in the Prairie Provinces could help clarify that problem. The microblade distribution is best known, with toggling harpoons and labrets nearly as well documented. Several major conclusions are suggested by the present survey:

1. We have not identified a single origin of Northwest Coast culture, but instead multiple origins of the component elements.
2. We should consider all our data in light of the probable northward spread of culture elements after deglaciation.
3. No single trait examined in the present survey occurs earliest on the Northwest Coast.
4. We may view Northwest Coast culture as part of a wide-

spread Circumpolar Cultural tradition.

5. There is the possibility of travel by boat at even the earliest time level. The early distributions of microblades in insular locations, Japan, the Queen Charlotte islands, etc., is easily explained by postulating water transport. The invoking of lowered sea level with the requisite land bridges is a more complex explanation.

In our analysis, we have utilized the artifactual data from Namu as our data base. However we have sought to place its component parts in the wider context of the known cultural traditions of Northwestern North America. The results of this comparative approach have been of value as they help place our findings in perspective. What emerges as the most significant result of our work at Namu is that although the cultural record there is both long and complex, Namu was the recipient rather than the originator of these cultural influences.

The excavations have revealed much about the prehistoric subsistence patterns and the technology utilized in subsistence activities. The patterns of resource utilization may be inferred from the data we have recovered. These patterns and the relationships between the cultural practices and various environmental factors through time are the focus of our continuing studies. It seems appropriate to review the cultural practices we have identified and trace their prehistoric time depth. This chronology of cultural elements, presented in Figure 74 provides an assessment of the time depth associated with a number of the cultural elements that were incorporated within the classic Northwest Coast ethnographic culture pattern. These data indicate to some degree the way in which the classic pattern developed through time, primarily through accretion.

The trait complexes through time graphed in Figure 74 are inferences based on data of varying indicative quality. The economic pursuits are inferred from bones, shells, etc. present as food debris. Tool technologies are indicated by the actual presence of such tools. Other activities are inferred from the uses to which the tools were put. Woodworking is inferred from the presence of ground stone celts and bone wedges, basketry or matting from the awls. Differential status was implied by the presence of ornaments and the elaborate burial group with offerings (FS 4. h,I,J). Hostilities are suggested by the fact that a bone point was found sticking into the vertebrae in burial FS 4.H. Perhaps our most tenuous inference is that of the use of watercraft. The coast is rugged and water transport would have greatly facilitated its settlement. Further, watercraft would have been most useful in sea mammal hunting, a tradition evidenced throughout the prehistory of the region. Dogs are present in quantity throughout the strata. They are so common, the second most common mammal species, that one is led to infer that they served some economic function. Two possible functions would be for food or for wool. The burials without offerings, but with large boulders dropped on them, imply persons of low status. It is possible these represent slaves, although we cannot prove such an inference. Although our data are incomplete, it is apparent that the economic base of patterned reliance on multiple food resources antedates by thousands of years on the Northwest Coast, the classical ethnographic emphases on status, rank, hereditary privilege, wealth, conspicuous consumption, and a developed art style. In our data, elements of this classical pattern appear after 3800 BP and the various elements appeared at different times. According to our comparative studies these elements were introduced from several different directions and from cultures of differing types. Our reconstruction of Northwest Coast prehistory is predicated upon the concept that basic to that culture pattern was the multiple resource subsistence strategy. Other elements exhibited in the ethnographic pattern are the result of a complex history of cultural contacts with adjacent regions as well as indigenous developments. Our view is thus that the ethnographic pattern represents an amalgamation and integration of these indigenous and introduced traits. Northwest Coast prehistory should be viewed as a continuum which included mechanisms for assimilation of new traits. It remained flexible and adaptive as the historic evidence indicates. The exact chronology of the adoption or loss of specific trait complexes is yet to be compiled. What is important to recognize here is that the cultural pattern had as its core the subsistence pattern. This base was augmented through time by the addition of new trait complexes. At this writing the mechanisms at work seem to have included accretion and synthesis. In the Bella Bella region at least, the cultural pattern seems to have been more the result of introduced ideas rather than their local development.

Reasons for the acceptance of introduced patterns, the failure of indigenous traits to be widely disseminated beyond the Northwest Coast culture area, and the final collapse of the Northwest Coast culture pattern lies beyond the scope of our present study.

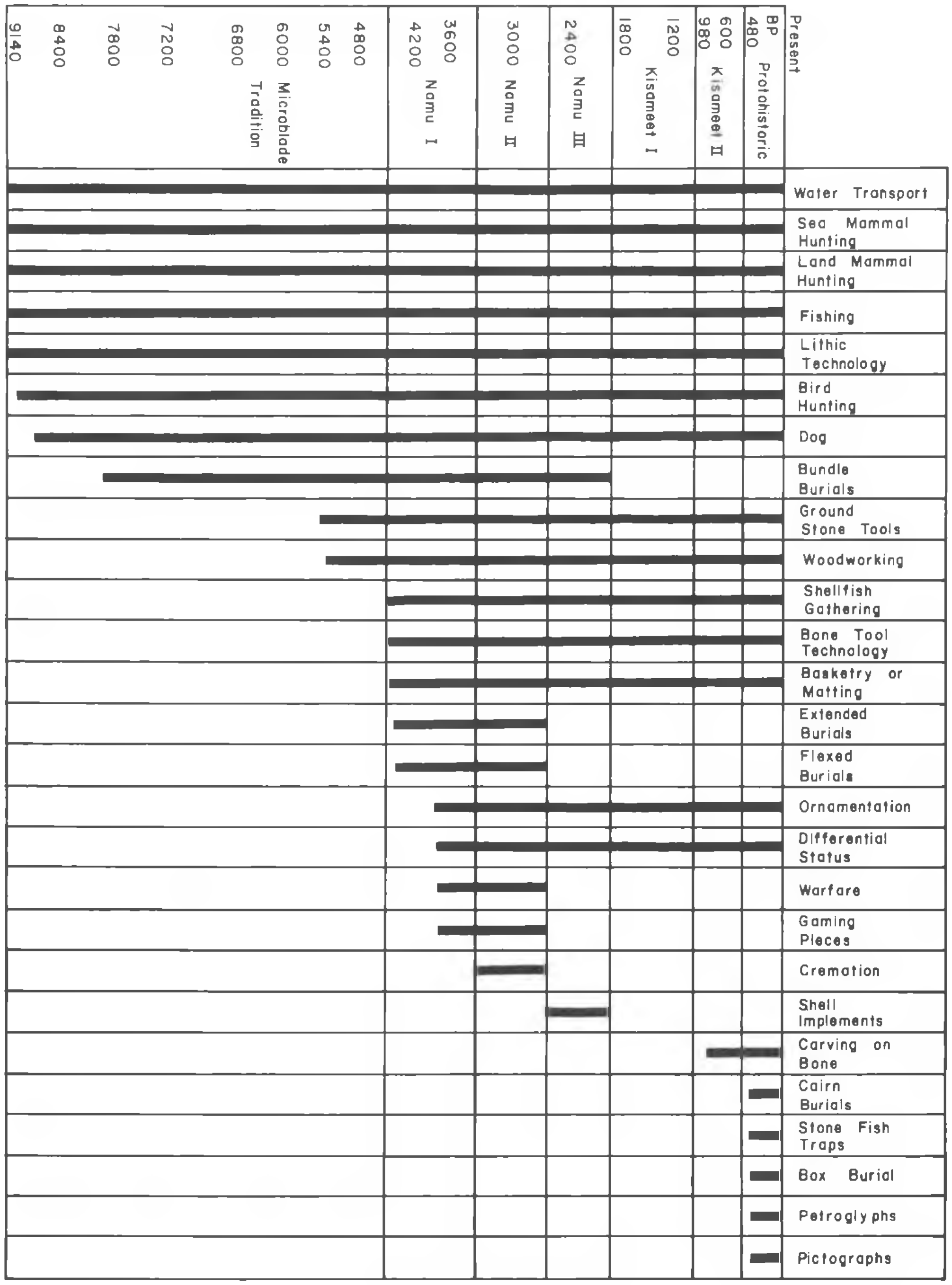


Fig. 74 Trait complexes through time.

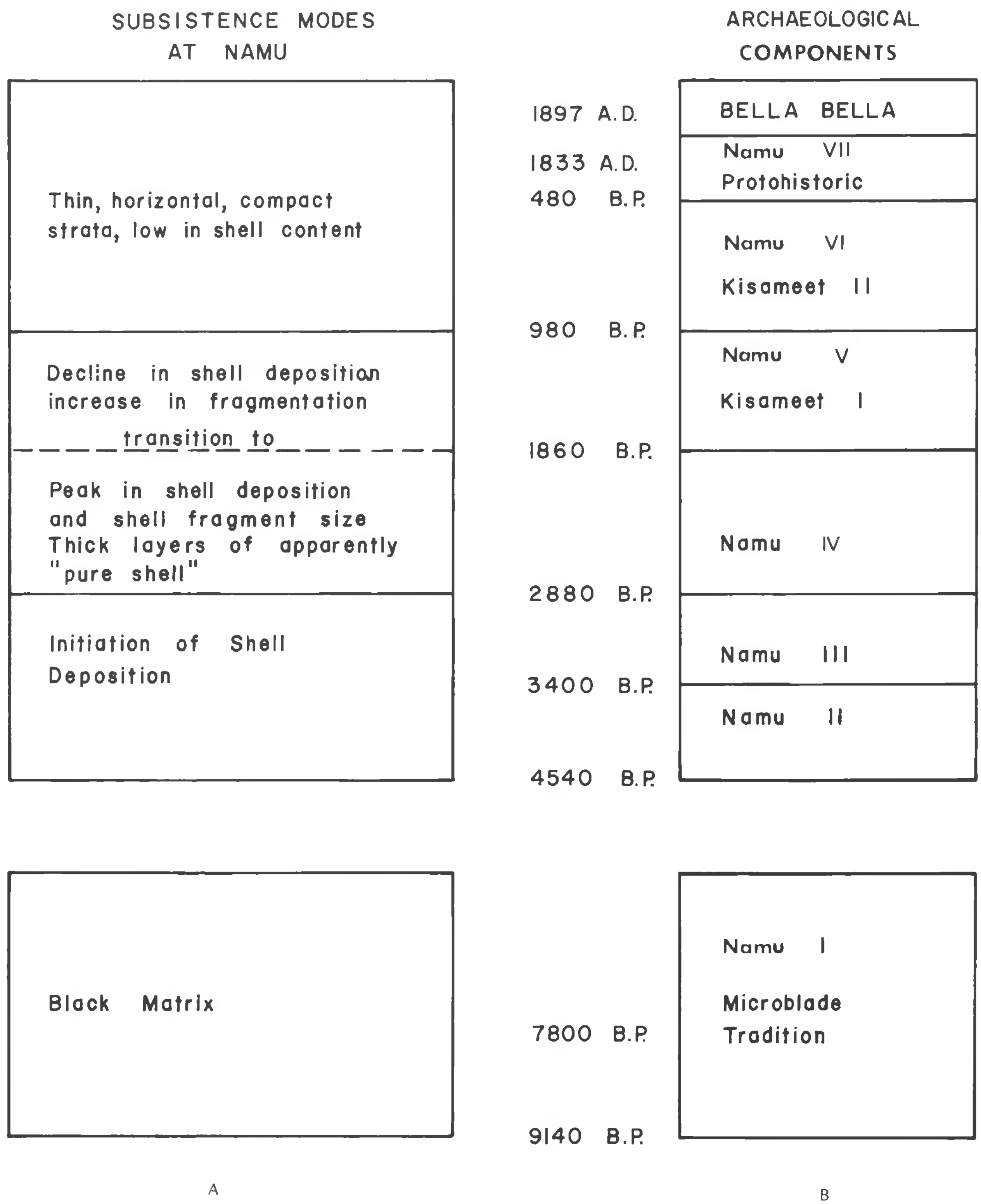


Fig. 75 Definition of subsistence modes from environmental remains (A) and archaeological components from diagnostic artifacts (B). While the former has been demonstrated to be possible, the latter is chronologically more sensitive.

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APPENDIX A

Vertebrate Data

Tables XVII through XXVII provide the primary bone count data used in construction of the mammal distribution graphs presented earlier. These figures derive entirely from Dr. Repenning's identifications. Copies of his original reports are filed with Bella Bella Prehistory Project records, the Department of Anthropology's Environmental Archeology Laboratory, University of Colorado. Table XXVIII provides the total bone counts by species for all investigated sites producing bone data. It should be kept in mind concerning this information that only the Namu and Kisameet collections result from formal efforts and full-scale excavation. Collections from the other middens derive from the modern surface as well as from midden exposures. Table XXIX indicates the proportions of identifiable to unidentifiable bone, by weight, for nine of the Namu excavation units. Figures are not yet available for Kisameet data. All tables to this point pertain only to mammal materials.

Table XXX lists the avian species identified at Kisameet by Dr. Savage. Table XXXI provides the primary bone count data used in construction of the bird distribution graph. A copy of Dr. Savage's report is filed at the University of Colorado with other Project records. All figures derive directly from his calculations.

Table XVII ElSx-1 Mammal bone counts: 1968 test pit

1968 TEST PIT	cervid	canid	phocid	*Mustela*	otariid	*Lutra*	*Enhydra*	delphinid	*Erethizon*	*Castor*	*Ursus*	*Gulo*	Total by level:
Level 1	1	2	0	0	1	0	0	0	1	0	0	0	5
2	6	1	0	0	0	0	0	0	0	0	0	0	7
3	21	0	0	0	0	0	0	1	0	0	0	1	23
4	4	0	1	0	0	0	0	2	0	0	0	0	7
5	4	0	0	0	2	0	0	0	1	0	0	0	7
6	0	0	0	0	2	0	0	1	0	0	0	0	3
7	0	0	0	0	0	0	0	0	1	0	0	0	1
8	- - - - - NOT REPRESENTED IN COLLECTION - - - - - -												
9	0	2	0	0	0	0	0	0	0	0	0	0	2
10	5	2	0	1	0	0	0	0	0	0	0	0	8
11	2	2	0	1	0	0	0	0	0	0	0	0	5
12	0	0	0	1	0	0	0	0	0	0	0	0	1
13	6	1	0	0	0	1	0	0	2	0	0	0	10
14	8	15	1	0	0	0	0	0	0	0	0	0	24
15	1	1	0	0	0	0	0	0	0	0	0	0	2
Total by species:	58	26	2	3	5	1	0	4	5	0	0	1	105

Table XVIII ElSx 1 Mammal bone counts FS 1

FS 1	cervid	canid	phocid	*Mustela*	otariid	*Lutra*	*Enhydra*	delphinid	*Erethizon*	*Castor*	*Ursus*	*Gulo*	Total by level.
FS 1. 0	4	0	0	0	0	0	0	0	0	0	3	0	7
FS 1. 1	2	0	0	0	0	0	1	0	0	0	0	0	3
FS 1. 2	2	0	0	0	0	0	0	0	0	0	0	0	2
FS 1. 3	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 1. 4	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 1. 5	1	0	0	1	1	0	0	0	0	0	0	0	3
FS 1. 6	2	1	0	0	0	0	0	0	0	0	0	0	3
FS 1. 7	2	0	0	0	0	0	0	0	0	0	0	0	2
FS 1. 8	6	0	0	0	1	0	0	0	0	0	0	0	7
FS 1. 9	2	0	1	0	0	0	0	0	0	0	0	0	3
FS 1.10	9	0	6	1	2	0	0	5	0	0	2	0	25
FS 1.11	12	11	5	0	0	0	0	0	0	0	0	0	28
FS 1.12	21	8	2	1	0	0	0	1	1	2	0	0	36
FS 1.13	4	0	0	0	0	0	0	0	0	0	0	0	4
FS 1.14	0	0	0	0	0	0	0	0	0	0	0	0	0
Total by species.	67	20	14	3	4	0	1	6	1	2	5	0	123

Table XIX EISx 1 Mammal bone counts: FS 2

FS 2	cervid	canid	phocid	*Mustela*	otariid	*Enhydra*	delphinid	rodent	Total by level:
FS 2. 0	3	0	0	0	0	4	0	1	8
FS 2. 1	0	0	0	0	0	0	0	0	0
FS 2. 2	0	0	0	0	0	0	0	0	0
FS 2. 3	0	0	0	0	0	0	0	0	0
FS 2. 4	0	0	0	0	0	0	0	0	0
FS 2. 5	0	9	1	0	0	0	0	0	10
FS 2. 6	1	1	0	0	0	0	0	0	2
FS 2. 7	4	0	1	0	0	0	2	1	8
FS 2. 8	6	2	0	0	0	0	0	0	8
FS 2. 9	4	2	2	0	0	0	0	0	8
FS 2.10	4	0	1	1	0	2	0	0	8
FS 2.11	3	0	7	1	0	4	0	0	15
FS 2.12	2	1	7	0	1	1	1	0	13
FS 2.13	2	3	3	0	0	1	0	0	9
Total by species:	29	18	22	2	1	12	3	2	89

Table XXI EISx 1 Mammal bone counts: FS 5

FS 5	cervid	canid	phocid	*Mustela*	otariid	*Lutra*	*Enhydra*	delphinid	cetacean	*Erethizon*	*Castor*	*Ursus*	rodent	*Martes*	*Felis*	Total by level:
FS 5. 0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
FS 5. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 5. 2	2	2	0	0	2	0	0	0	0	3	0	0	0	0	0	9
FS 5. 3	3	2	1	0	0	2	0	0	3	0	0	0	0	0	0	11
FS 5. 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 5. 5	10	0	11	0	0	0	0	0	0	3	6	0	0	0	0	30
FS 5. 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 5. 7	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	8
FS 5. 8	6	3	1	0	0	0	0	0	0	0	0	0	0	0	0	10
FS 5. 9	7	1	2	0	0	0	0	0	0	0	1	1	0	2	0	14
FS 5.10	16	2	4	3	1	0	0	0	0	0	0	0	1	0	1	28
FS 5.11	11	14	6	0	2	?	1	1	0	0	0	0	0	0	0	35+
FS 5.12	16	1	1	1	0	0	0	1	0	0	0	0	0	0	0	20
FS 5.13	17	9	9	1	0	0	0	5	0	0	0	1	0	0	0	42
FS 5.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 5.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total by species.	94	37	35	5	5	2	1	7	3	6	7	2	1	2	1	208+

Table XX EISx 1 Mammal bone counts: FS 3

FS 3	cervid	canid	phocid	*Mustela*	delphinid	cetacean	*Erethizon*	*Castor*	*Procyon*	Total by level.
FS 3. 1	1	0	0	0	0	0	0	0	0	1
FS 3. 2	2	0	0	0	0	1	0	0	0	3
FS 3. 3	3	0	0	1	0	0	0	0	0	4
FS 3. 4	5	1	0	0	0	0	0	1	0	7
FS 3. 5	0	1	0	0	0	0	0	1	1	3
FS 3. 6	1	0	1	0	1	0	0	6	0	9
FS 3. 7	5	0	0	0	0	0	0	0	0	5
FS 3. 8	1	0	0	0	0	0	1	0	0	2
FS 3. 9	8	0	0	0	0	0	0	0	0	8
FS 3.10	0	0	0	0	0	0	0	0	0	0
FS 3.11	1	1	0	0	0	0	0	0	0	2
FS 3.12	0	1	0	0	0	0	0	0	0	1
FS 3.13	4	3	0	0	0	0	0	0	0	7
FS 3.14	2	0	0	0	0	0	0	0	0	2
FS 3.15	1	1	0	0	0	0	0	0	0	2
FS 3.16	0	0	0	0	0	0	0	0	0	0
Total by species:	34	8	1	1	1	1	1	8	1	56

Table XXII EISx-1 Mammal bone counts: FS6

FS 6	cervid	canid	phocid	*Mustela*	*Enhydra*	delphinid	rodent	Total by level:
FS 6. 5	0	0	0	0	0	0	0	0
FS 6. 6	0	0	0	0	0	0	0	0
FS 6. 7	0	0	0	0	0	0	0	0
FS 6. 8	5	1	0	0	0	0	0	6
FS 6. 9	1	0	0	0	0	0	1	2
FS 6.10	3	0	0	0	0	0	0	3
FS 6.11	3	0	0	0	0	0	0	3
FS 6.12	3	0	0	0	1	0	0	4
FS 6.13	7	0	0	1	2	0	0	10
FS 6.14	7	1	11	0	0	1	0	20
FS 6.15	0	0	0	0	1	0	0	1
Total by species:	29	2	11	1	4	1	1	49

Table XXIII ElSx-1 Mammal bone counts: FS 7

FS 7	cervid	canid	*Mustela*	otariid	*Enhydra*	*Castor*	*Ursus*	Total by level:
FS 7. 2	0	0	0	0	0	2	0	2
FS 7. 3	1	0	1	0	0	0	0	2
FS 7. 4	0	0	0	0	0	0	0	0
FS 7. 5	1	0	0	0	0	0	0	1
FS 7. 6	2	0	0	0	0	0	0	2
FS 7. 7	1	0	0	1	0	0	0	2
FS 7. 8	0	0	0	0	0	0	0	0
FS 7. 9	2	0	0	0	0	0	0	2
FS 7.10	0	0	0	0	0	0	0	0
FS 7.11	1	0	0	0	0	0	0	1
FS 7.12	1	4	0	0	0	0	1	6
FS 7.13	1	0	0	0	0	0	0	1
FS 7.14	0	0	0	0	0	0	0	0
FS 7.15	0	0	0	0	1	0	0	1
FS 7.16	0	0	0	0	0	0	0	0
Total by species:	10	4	1	1	1	2	1	20

Table XXIV ElSx 1 Mammal bone counts: FS 8

FS 8	cervid	canid	phocid	*Lutra*	delphinid	cetacean	Total by level:
FS 8. 2	?	?	?	?	0	?	?
FS 8. 3	1	0	0	0	0	0	1
FS 8. 4	1	0	0	0	0	0	1
FS 8. 5	3	0	0	0	0	0	3
FS 8. 6	2	3	0	0	0	0	5
FS 8. 7	0	16	3	0	0	0	19
FS 8. 8	0	1	0	0	0	0	1
FS 8. 9	1	0	0	0	0	0	1
FS 8.10	1	0	0	0	0	0	1
FS 8.11	8	0	0	0	0	0	8
FS 8.12	5	3	3	0	1	0	12
FS 8.13	1	0	2	0	0	0	3
FS 8.14	1	1	0	0	3	0	5
Total by species	24+	24+	8+	?	4	?	60+

Table XXV ElSx 1 Mammal bone counts: FS 9

FS 9	cervid	canid	phocid	*Mustela*	otariid	*Lutra*	delphinid	*Erethizon*	*Procyon*	Total by level:
FS 9. 1	55	31	0	4	1	1	4	5	5	106
FS 9. 2	3	0	0	0	0	0	0	0	0	3
FS 9. 3	4	12	1	1	1	12	2	0	5+	38+
FS 9. 4	0	2	0	0	0	0	0	0	0	2
FS 9 5	0	0	0	0	0	0	0	0	0	0
FS 9. 6	0	0	0	0	0	0	0	0	0	0
FS 9. 7	0	0	0	0	0	0	0	0	0	0
FS 9. 8	0	0	0	0	0	0	0	0	0	0
FS 9. 9	0	0	0	0	0	0	0	0	0	0
FS 9.10	0	0	0	0	0	0	0	0	0	0
Total by species	62	45	1	5	2	13	6	5	10+	149+

Table XXVI ElSx-1 Mammal bone counts: FS 10

FS 10	cervid	canid	phocid	*Mustela*	otariid	*Lutra*	*Enhydra*	delphinid	cetacean	*Erethizon*	*Castor*	*Procyon*	*Ovis*	rodent	*Odobenus*	*Martes*	*Rattus*	Total by level:
FS 10. 1	43	10	0	1	1	0	0	6	0	3	0	0	0	0	0	0	1	65
FS 10. 2	7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
FS 10. 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 10. 4	14	0	17	0	0	0	3	1	0	0	0	0	0	0	1	0	0	36
FS 10. 5	8	0	1	6	2	0	0	0	0	2	0	1	0	0	0	0	0	20
FS 10. 6	13	1	10	0	2	0	1	4	0	1	0	0	0	0	0	0	0	32
FS 10. 7	10	3	4	0	1	0	1	2	0	1	0	0	0	0	1	0	0	23
FS 10. 8	13	1	1	0	0	0	2	5	0	0	0	0	0	0	0	0	0	22
FS 10. 9	8	0	3	0	0	0	4	2	0	0	0	0	0	0	0	0	0	17
FS 10.10	37	13	0	1	0	7	0	1	0	3	0	0	0	0	0	0	0	62
FS 10.11	35	8	1	4	1	2	4	1	0	6	0	0	0	0	0	1	0	63
FS 10.12	10	18	2	5	1	0	0	0	2	2	3	0	1	0	0	0	0	44
FS 10.12–15	22	7	1	0	0	0	2	0	0	1	0	0	0	1	0	0	0	34
FS 10.13	42	0	2	1	2	4	1	0	0	11	2	0	0	2	0	0	0	67
FS 10.14	26	10	2	1	0	1	0	2	0	1	1	0	1	0	0	0	0	45
FS 10.15	13	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
FS 10.16A	9	1	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	14
FS 10.16	43	5	1	0	0	3	2	2	0	2	1	0	0	0	0	0	0	59
Total by species	353	77	47	19	10	17	23	26	2	33	8	1	2	3	2	1	1	625

Table XXVII ElSx 3 Mammal bone counts: FS 2

FS 2	cervid	canid	phocid	*Mustela*	otariid	*Lutra*	*Enhydra*	delphinid	*Erethizon*	*Procyon*	*Ovis*	*Lynx*	rodent	Total by level:
FS 2. 0	5	1	2	0	1	0	0	4	0	0	0	0	0	13
FS 2. 3	0	0	2	1	0	0	0	0	1	0	0	0	0	4
FS 2. 4	3	0	0	0	0	0	0	0	0	0	0	0	0	3
FS 2. 5	2	0	4	0	0	0	2	2	0	5	0	0	0	15
FS 2. 6	2	0	5	0	0	0	0	0	1	0	0	0	0	8
FS 2. 7	3	0	2	0	0	0	7	0	0	0	0	0	0	12
FS 2. 8	4	0	0	0	0	0	0	0	0	0	1	0	0	5
FS 2. 9	4	1	0	0	0	0	0	0	0	0	0	0	1	6
FS 2.10	5	2	0	0	0	0	0	0	0	0	0	0	0	7
FS 2.11	9	0	0	0	0	0	0	0	0	0	0	0	0	9
FS 2.12	4	0	0	0	0	0	0	0	0	0	0	0	0	4
FS 2.13	7	0	0	0	0	1	1	1	0	0	3	0	0	13
FS 2.14	6	0	0	0	0	0	0	0	0	0	0	0	0	6
FS 2.15	1	0	0	0	0	0	0	1	0	0	0	0	0	2
FS 2 16	2	0	0	0	0	0	0	0	0	0	0	0	0	2
FS 2 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 2.18	0	0	0	0	0	0	0	0	0	0	0	2	0	2
FS 2.19	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Total by species:	58	4	15	1	1	1	10	8	2	5	4	2	1	112

Table XXVIII Identified Mammals

Site:	Animal:	Number of Fragments:	% of Total
ElSx 1	cervids	867	57
	canids	313 +	17
	phocids	163	9
	Procyon	74 +	4
	delphinids	61	3
	Erethizon	57	3
	the following species each represents 2% or less of the total number of mammal bones identified at Namu.		
	Enhydra	47	
	Mustela (mink)	47	
	Lutra	37	
	otariids	34	
	Castor	32	
	cetaceans	25	
	Ursus	9	
	misc. rodents	8	
	Martes	4	
	Odobenus	2	
	Ovis	2	
	Rattus	1	
	Felis	1	
	Mustela (weasel)	1	
	Gulo	1	
	Total identified:	1786	
	land mammal:	1453	81%
	sea mammal	332	19%

Site:	Animal:	Number of Fragments:	% of Total
ElSx 3	cervids	58	52
	phocids	15	13
	Enhydra	10	9
	delphinids	8	7
	Procyon	5	4
	Ovis	4	4
	canids	4	4
	the following species each represents 2% or less of the total number of mammal bones identified at Kisameet:		
	Erethizon	2	
	Lynx	2	
	Mustela (mink)	1	
	Lutra	1	
	misc. rodents	1	
	otariids	1	
	Total identified:	112	
	land mammal:	78	70%
	sea mammal	34	30%

Table XXVIII Identified Mammals (continued)

Site:	Animal:	Number of Fragments:	% of Total
FbSx 6	cervids	59	75
	canids	7	9
	Erethizon	4	5
	phocids	4	5
	each of the following represents 2% or less of the site total:		
	Oreamnos	2	
	delphinids	2	
	otariids	1	
	Procyon	1	
	Total identified:	79	
	land mammal	72	91%
	sea mammal.	7	9%

Site:	Animal:	Number of Fragments:	% of Total
FbTc 1	otariids	19	50
	delphinids	9	24
	Enhydra	4	10
	phocids	3	8
	cervids	2	5
	Erethizon	1	3
	Total identified:	38	
	land mammal:	3	8%
	sea mammal:	35	92%

Site:	Animal:	Number of Fragments:	% of Total
EkSx 1	*Enhydra*	10	59
	cervids	6	35
	phocids	1	6
	Total identified	17	
	land mammal	6	35%
	sea mammal.	11	65%

\+ indicates a species occurring as virtually complete skeletons in some cases; exact bone count for whole skeleton not provided; thus, species count of fragments appears lower here than is actually the case

Table XXIX Mammal bone from excavation units at ElSx 1, by level

Unit & Level	Total Bone	Identifiable Bone		Unidentifiable Bone	
FS 1. 1	45.3 g	3.5 g	(8%)	41.8 g	(92%)
FS 1. 2	8.2	3.4	(41%)	4.8	(59%)
FS 1. 3	7.0	NONE	(0%)	7.0	(100%)
FS 1. 4	NONE	NONE	(0%)	NONE	(0%)
FS 1. 5	50.3	24.5	(48%)	25.8	(52%)
FS 1. 6	47.0	19.0	(40%)	28.0	(60%)
FS 1. 7	45.4	1.7	(4%)	43.7	(96%)
FS 1. 8	99.1	10.2	(10%)	88.9	(90%)
FS 1. 9	125.3	11.4	(9%)	113.9	(91%)
FS 1.10	688.5	42.7	(6%)	645.8	(94%)
FS 1.11	1013.4	228.1	(23%)	785.3	(77%)
FS 1.12	771.3	175.9	(22%)	595.4	(78%)
FS 1.13	7.5	7.5	(100%)	NONE	(0%)
FS 2. 1	1.3	NONE	(0%)	1.3	(100%)
FS 2. 2	NONE	NONE	(0%)	NONE	(0%)
FS 2. 3	NONE	NONE	(0%)	NONE	(0%)
FS 2. 4	8.9	NONE	(0%)	8.9	(100%)
FS 2. 5	211.7	32.9	(15%)	178.8	(85%)
FS 2. 6	51.4	42.9	(83%)	8.5	(17%)
FS 2. 7	174.5	8.5	(5%)	166.0	(95%)
FS 2. 8	200.4	41.9	(21%)	158.5	(78%)
FS 2. 9	279.9	42.0	(15%)	237.9	(85%)
FS 2.10	135.2	9.9	(7%)	125.3	(93%)
FS 2.11	202.2	2.6	(1%)	199.6	(99%)
FS 2.12	345.4	150.1	(43%)	195.3	(57%)
FS 2.13	123.4	13.4	(11%)	110.0	(89%)
FS 3. 1	*			9.0	
FS 3. 2	*			121.7	
FS 3. 3	19.5	3.1	(16%)	16.4	(84%)
FS 3. 4	83.9	23.6	(28%)	60.3	(72%)
FS 3. 5	40.2	4.6	(11%)	35.6	(89%)
FS 3. 6	118.7	43.0	(36%)	75.7	(64%)
FS 3. 7	*			27.7	
FS 3. 8	55.8	2.0	(4%)	53.8	(96%)
FS 3. 9	34.9	4.7	(13%)	30.2	(87%)
FS 3.10	13.9	NONE	(0%)	13.9	(100%)
FS 3.11	80.4	9.3	(12%)	71.1	(88%)
FS 3.12	*			117.5	
FS 3.13	77.0	39.0	(51%)	38.0	(49%)
FS 3.14	*			72.6	
FS 3.15	*			54.6	
FS 3.16	33.5	NONE	(0%)	33.5	(100%)
FS 5. 1	20.1 g	NONE	(0%)	20.1 g	(100%)
FS 5. 2	98.1	29.6	(30%)	68.5	(70%)
FS 5. 3	113.4	51.9	(46%)	61.5	(54%)
FS 5. 4	45.4	NONE	(0%)	45.4	(100%)
FS 5. 5	147.0	27.0	(18%)	120.0	(82%)
FS 5. 6	9.5	NONE	(0%)	9.5	(100%)
FS 5. 7	95.6	32.2	(34%)	63.4	(66%)
FS 5. 8	155.3	27.5	(18%)	127.8	(82%)
FS 5. 9	248.3	28.3	(8%)	220.0	(92%)
FS 5.10	347.9	165.9	(48%)	182.0	(52%)
FS 5.11	1037.9	341.1	(33%)	696.8	(67%)
FS 5.12	308.7	39.5	(13%)	269.2	(87%)
FS 5.13	717.2	240.0	(33%)	477.2	(67%)
FS 6. 1	NONE	NONE	(0%)	NONE	(0%)
FS 6. 2	NONE	NONE	(0%)	NONE	(0%)
FS 6. 3	NONE	NONE	(0%)	NONE	(0%)
FS 6. 4	NONE	NONE	(0%)	NONE	(0%)
FS 6. 5	13.2	NONE	(0%)	13.2	(100%)
FS 6. 6	8.6	NONE	(0%)	8.6	(100%)
FS 6. 7	21.3	NONE	(0%)	21.3	(100%)
FS 6. 8	*			47.9	
FS 6. 9	53.3	3.3	(6%)	50.0	(94%)
FS 6.10	118.1	17.1	(14%)	101.0	(86%)

Table XXIX Mammal bone from excavation units at ElSx 1, by level *(Continued)*

Unit & Level	Total Bone	Identifiable Bone		Unidentifiable Bone	
FS 6.11	209.3	26.5	(13%)	182.8	(87%)
FS 6.12	118.8	21.3	(18%)	97.5	(82%)
FS 6.13	248.8	5.3	(2%)	243.5	(98%)
FS 6.14	217.7	79.2	(36%)	138.5	(64%)
FS 6.15	*			3.3	
FS 7. 1	NONE	NONE	(0%)	NONE	(0%)
FS 7. 2	*			5.9	
FS 7. 3	30.2	6.4	(21%)	23.8	(79%)
FS 7. 4	NONE	NONE	(0%)	NONE	(0%)
FS 7. 5	58.4	32.2	(55%)	26.2	(45%)
FS 7. 6	*			11.2	
FS 7. 7	332.3	324.4	(98%)	17.9	(2%)
FS 7. 8	18.1	NONE	(0%)	18.1	(100%)
FS 7. 9	22.9	8.3	(36%)	14.6	(64%)
FS 7.10	3.3	NONE	(0%)	3.3	(100%)
FS 7.11	15.2	3.3	(22%)	11.9	(78%)
FS 7.12	71.6	13.1	(18%)	58.5	(82%)
FS 7.13	*			16.2	
FS 7.14	5.3	NONE	(0%)	5.3	(100%)
FS 7.15	*			14.8	
FS 7.16	.9	NONE	(0%)	.9	(100%)
FS 8. 1	NONE	NONE	(0%)	NONE	(0%)
FS 8. 2	143.0	143.0	(100%)	NONE	(0%)
FS 8. 3	10.2	.8	(8%)	9.4	(92%)
FS 8. 4	15.5	12.0	(88%)	3.5	(12%)
FS 8. 5	32.2	11.8	(37%)	20.4	(63%)
FS 8. 6	62.4	29.0	(46%)	33.4	(54%)
FS 8. 7	10.0	2.8	(28%)	7.2	(72%)
FS 8. 8	*			14.6	
FS 8. 9	19.8	8.1	(42%)	11.7	(58%)
FS 8.10	57.4	8.4	(15%)	49.0	(85%)
FS 8.11	138.5	48.4	(35%)	90.1	(65%)
FS 8.12	149.7	27.2	(18%)	122.5	(82%)
FS 8.13	124.1	31.1	(25%)	93.0	(75%)
FS 8.14	77.6	23.2	(30%)	54.4	(70%)
FS 9. 1	1422.8	488.6	(34%)	934.2	(66%)
FS 9. 2	4.3	4.3	(100%)	NONE	(0%)
FS 9. 3	431.1	231.7	(54%)	199.4	(46%)
FS 9. 4	*			39.6	
FS 9. 5	9.4	NONE	(0%)	9.4	(100%)
FS 9. 6	2.9	NONE	(0%)	2.9	(100%)
FS 9. 7	NONE	NONE	(0%)	NONE	(0%)
FS 9. 8	NONE	NONE	(0%)	NONE	(0%)
FS 9. 9	NONE	NONE	(0%)	NONE	(0%)
FS 9.10	NONE	NONE	(0%)	NONE	(0%)
FS 10. 1	743.2	379.2	(51%)	364.0	(49%)
FS 10. 2	96.7	28.8	(30%)	67.9	(70%)
FS 10. 3	NONE	NONE	(0%)	NONE	(0%)
FS 10. 4	390.7	213.8	(55%)	176.9	(45%)
FS 10. 5	176.4	58.7	(33%)	117.7	(67%)
FS 10. 6	249.2	74.1	(30%)	175.1	(70%)
FS 10. 7	275.6	102.0	(37%)	173.6	(63%)
FS 10. 8	411.0	122.8	(30%)	288.2	(70%)
FS 10. 9	226.8	78.2	(35%)	148.6	(65%)
FS 10.10	888.0	363.3	(41%)	524.7	(59%)
FS 10.11	948.8	311.5	(33%)	637.3	(67%)
FS 10.12	842.8	201.9	(24%)	662.9	(76%)
FS 10.13	748.7	89.6	(12%)	671.3	(88%)
FS 10.14	871.9	171.8	(20%)	700.1	(80%)
FS 10.15	341.3	46.6	(14%)	294.7	(86%)
FS 10.16	1322.6	481.8	(36%)	840.8	(64%)

* indicates bone from this level not weighed yet; in each case, identifiable bone was present.

Table XXX Avian species from ElSx 3

Ducks . . .	33 fragments	
Anas platyrhynchos		Mallard
Anas sp.		surface-feeding duck
Aix sponsa		Wood Duck
* *Somateria spectabilis*		King Eider
Melanitta deglandi		White-winged Scoter
Melanitta perspicillata		Surf Scoter
Oidemia nigra		Common Scoter
Aythyinae sp.		diving duck species
Lophodytes cucullatus		Hooded Merganser
Anatidae sp.		medium sized duck species
Anatidae sp.		medium to small duck
Gulls . . .	12 fragments	
* *Larus hyperboreus*		Glaucous Gull
Larus glaucescens		Glaucous-winged Gull
* *Larus argentatus*		Herring Gull
Larus sp.		large gull species
Larinae sp.		medium-sized gull species
Sterninae sp.		tern species
Eagles . . .	9 fragments	
Haliaeetus leucocephalus		Bald Eagle
eagle sp.		Bald or Golden Eagle
Ravens . . .	4 fragments	
Corvus corax		Common Raven
Loons . .	4 fragments	
Gavia immer		Common Loon
Gavia sp.		Loon species
Cormorants . . .	3 fragments	
Phalacrocorax pelagicus		Pelagic Cormorant
cormorant sp.		cormorant species
Owls .	3 fragments	
Bubo virginianus		Great Horned Owl
Grebes . . .	2 fragments	
* *Podiceps grisgena*		Red necked Grebe
* *Podiceps auritus*		Horned Grebe
Shearwaters . . .	1 fragment	
Puffinus sp.		shearwater species
Unidentified . . .	9 fragments	

* indicates a species which only winters at Kisameet. All other species are year-round residents.

Table XXXI ElSx 3 Bird bone counts: FS 2

FS 2	ducks	gulls	eagles	loons	grebes	cormorants	shearwater	terns	ravens	owls	misc.	Total by level	Wintering species:
FS 2. 4	0	0	1	0	0	0	0	0	0	0	0	1	0
FS 2. 5	0	0	0	2	0	0	0	0	0	0	0	2	0
FS 2. 6	0	0	0	0	0	0	0	0	0	0	1	1	0
FS 2. 7	0	5	1	0	0	0	0	0	0	0	0	6	1
FS 2. 8	1	1	1	1	0	0	0	0	0	1	1	6	0
FS 2. 9	2	0	0	0	0	0	0	0	0	1	0	3	1
FS 2.10	3	0	0	0	0	0	0	0	0	0	1	4	0
FS 2.11	6	1	1	1	1	0	0	0	0	0	0	10	2
FS 2.12	3	2	4	0	1	2	0	0	0	0	1	13	2
FS 2.13	10	2	0	0	0	0	1	0	0	0	2	15	1
FS 2.14	1	0	0	0	0	1	0	0	0	0	1	3	0
FS 2.15	2	0	1	0	0	0	0	0	3	1	1	8	0
FS 2.16	5	0	0	0	0	0	0	1	0	0	1	7	1
FS 2.17	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 2.18	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 2.19	0	0	0	0	0	0	0	0	0	0	0	0	0
FS 2.20	0	0	0	0	0	0	0	0	1	0	0	1	0
Total by species:	33	11	9	4	2	3	1	1	4	3	9	80	8

APPENDIX B

Shellfish Data

The following identification and habitat data come primarily from the references by Morris (1966), Keen (1963), Cornwall (1955), and Griffith (1967). Dr. John Chronic, University of Colorado (geology), helped with the preliminary identifications. All subsequent work was done by the writer.

Table XXXII Archaeological shellfish species

TAXON			COMMON NAME	HABITAT
PHYLUM:	Mollusca			
CLASS	Gastropoda			
FAMILY:	Acmaeidae			
	Acmaea spp.		limpets	intertidal
FAMILY:	Haliotidae			
	Haliotis kamtschatkana		northern abalone	low tide & below
FAMILY:	Littorinidae			
	Littorina sitkana		Sitka littorine	intertidal
FAMILY:	Cerithidae			
	Bittium eschrichtii		threaded bittium	low tide
FAMILY:	Thaisidae (Purpuridae)			
	Thais lamellosa		wrinkled purple	intertidal
	Thais canaliculata		channeled purple	intertidal
FAMILY.	Neptuneidae			
	Searlesia dira		dire whelk	low tide & below
plus – one or two species of land snails, possibly *Haplotrema* or *Vespericola (Polygyra)*				
CLASS:	Pelecypoda			
FAMILY:	Mytilidae			
	Mytilus edulis		edible (bay) mussel	intertidal rocks
	Mytilus californianus		sea mussel	intertidal rocks
FAMILY:	Cardiidae			
	Clinocardium nuttallii		cockle	intertidal
FAMILY:	Veneridae			
	Saxidomus giganteus		butter clam	intertidal sand
	Protothaca staminea		little-neck clam	intertidal sand
FAMILY:	Mactridae			
	Schizothaerus capax		horse clam	intertidal sand
PHYLUM:	Arthropoda			
CLASS:	Crustacea			
FAMILY.	Balanidae			
	Balanus altissimus	(?)	acorn barnacle	low tide
	Balanus nubilus	(?)	acorn barnacle	below low tide
	Balanus cariosus	(?)	acorn barnacle	intertidal
	Balanus balanus		acorn barnacle	intertidal
FAMILY:				
	Coronula reginae	(?)	whale barnacle	flesh of whale
PHYLUM:	Echinodermata			
CLASS				
FAMILY:				
	Strongylocentrotus spp.		sea urchin	tide pools

Table XXXIII Econiche data for molluscan and crustacean species recovered during project excavations

GENERIC UNIT	NICHE DATA:
Acmaea	Several species are probably present, most too fractured and weathered for species assignment. Limpets are herbaceous gastropods. All in the collection are less than 1 inch in greatest dimension. The animals live attached to stones and grasses in the intertidal zone, with some species ranging well above the high tide mark and others occurring out to 35 fathoms in depth.
Bittium	The species here seems to be *eschrichtii*, a tiny spiralled snail occurring on rocky beaches in lower portions of the intertidal zone. It may also occur in salt marshes, among algae, and on oyster beds.
Haliotis	The species identified is *kamtschatkana*, an herbivorous gastropod living in colonies on rocky beaches or surf washed rocks, at and below low tide mark. Some occur out to 6 fathoms. Length averages 6 inches, and the species is edible.
Littorina	Species *sitkana* identified. This small, herbivorous snail grows up to 3/4 inch, living on rocks, pilings, kelp or eel grass throughout the intertidal zone. Many species are semi-aerial and able to spend about half their time out of the water. Also edible.
Thais	The species *lamellosa* is the most common whelk in British Columbia's intertidal zone today. It grows to 1-1/2 — 3 inches in height, with the shell exterior reflecting its habitat: thick and smooth for rough-water dwellers, and delicate and many-frilled for animals in sheltered waters. It prefers rocky beaches in the intertidal zone, and is usually found among barnacles and mussels. It is carnivorous, living on other molluscs. Breeding is in winter, at which time the animals congregate at the low tide mark. Eggs, called "sea oats", are laid on undersides of rocks. Animal is edible. The different species *T. canaliculata* is smaller (to 1 inch in height), also carnivorous, with much the same habits and preferences. Shell sculpture is made up of alternating large and small spiral cords.
Searlesia	The species *S. dira* is a carnivorous scavenger living on rocks of rocky beaches at the low tide mark and below. Height up to 1-1/2 inches.
Clinocardium	The species is an equivalved mollusc growing to 4-1/2 inches in greatest dimension. It rarely lives more than seven years, with a summer breeding season, beginning at age two years. It prefers sand-to-mud beaches in both deep water and in the intertidal zone, and is often found in eel grass flats and near the surface of tidal flats, where it is a shallow burrower. Edible.
Mytilus	The species *edulis* is an inequilateral bivalve, growing to 2 inches. It breeds from May to December particularly during the warm months. It lives in dense patches in the intertidal zone, attached to rocks or gravel by strong byssal threads. Edible. The species *californianus* grows to 10 inches, occurs in rocky or surf-washed areas of the open coastline, or in sheltered arms adjoining the sea. Edible, BUT can cause paralytic shellfish poisoning. The species is also inequilateral.
Protothaca	The species *staminea* grows to 2-1/2 inches, living in the intertidal zone of gravel-to-mud beaches in protected bays and is particularly abundant halfway between high and low tide marks. It reaches maximum size at age ten years, and grows very slowly. Breeding is in summer. The clam is a burrower. Edible.
Saxidomus	A deeper burrower than *Protothaca*, the species *giganteus* occurs in the intertidal zone s lower third, on sandy or gravelly beaches. It prefers well protected beaches and is stunted if grown on exposed beaches. It may occur as deep as 30 feet. It grows to 5 inches in good habitats, breeds in summer, and is edible.
Schizothaerus	The species *capax* grows to 8 inches and is nearly equilateral. Spawning is in winter. This clam is also a burrower, preferring gravelly bottoms in the intertidal zone. Edible.
Dentalium	The species *pretiosum (= indianorum)* may be the one present. It occurs in sheltered bays from 5 to 650 fathoms, shallowly buried in the sea floor. South of Puget Sound the animal is narrower, more fragile, and more curved. Was a trade and monetary item. Must be dredged up from the bottom.
Balanus	The species *cariosus* and *nubilus* both large acorn barnacles — the former growing to 1-1/4 inches in diameter and 2-1/2 inches in height. *Cariosus* has a membranous base and grows much crowded on rocks in the intertidal zone. Sculpture of exterior responds both to exposure to rough water and to crowding: the shell has many downward-pointing spines and a "thatched" appearance in favorable conditions, and tends to lose both spines and its conical shape when crowded. The species *nubilus* is the largest found on the North American Pacific coast. It occurs below low tide, usually in 10 to 20 feet of water, and occasionally down to 30 fathoms. The base is calcareous and porous. The rib sculpture is eradicated by eroisïon in adults. Often found in large colonies of individuals growing on one another; frequently grows on the holdfasts of kelp. It was the edible barnacle eaten by aboriginal inhabitants after fire roasting. An environmental variant of *nubilus*, *B. altissimus*, occupies the rocks above low tide and may also have been eaten aboriginally. Smaller acorn barnacle species also seem present, including the species *crenatus* (growing below low tide and occasionally into the tidal zone, on rocks, mussels, larger barnacles), and the species *balanus* (growing to 1-3/8 inches in height and diameter, in the intertidal zone), and the tiny species *glandulus* (to 1/2 inch in height and abundant on rocks on the intertidal zone). The remains of these smaller species are badly fragmented and difficult to identify.
Coronula	This barnacle grows imbedded in the skin of whales (particularly the humpback variety). Species possibly present include *reginae* (with size of up to 2-1/2 inches in diameter and 3/4 inch in height), and *diadema* (growing up to 3 inches in diameter, and are small in early summer, larger in late summer, with a life cycle of less than one year).

APPENDIX C

Primary Sample Data

Table XXXIV inventories all matrix samples collected during the three years of Project operations in the field. Tables XXXV and XXXVI contain the raw weights and weight-percentages of matrix constituents used in compiling the graphs in the paper by Conover.

Symbols used in the tables have the following meanings:

TRACE (t) — less than 1/10 of 1 gram (less than 1%);
* — samples in the EkSx 1 suite whose four millimetre fraction was damaged during processing;
a — a percentage of the total sample's weight;
b — a percentage of the total four millimetre fraction's weight;
c — a percentage of the total four millimetre shell's weight;

Table XXXIV Inventory of Laboratory Samples

SITE:	SUITE DESIGNATION:	EXCAVATION UNIT REPRESENTED:	YEAR TAKEN:	TOTAL NO. OF SAMPLES:	EXCAVATION LEVELS:	SAMPLE DRY WEIGHT:
ElSx 1	1968 Test Pit	1968 Test Pit	1968	15	artificial	500 grams
	FS 1	FS 1	1969	13	artificial	*
	FS 2	FS 2	1969	13	artificial	*
	FS 3	FS 3	1969	15	artificial	*
	PS 2A	FS 2	1969	10	artificial	600 grams
	FS 9	FS 9	1970	13	natural	35 pounds
	FSC 9	FS 9	1970	9	natural	35 pounds
	FSC 4	FS 4	1970	10	natural	35 pounds
	FS 10	FS 10	1970	17	natural	*
	FSC 10	FS 10	1970	15	natural	35 pounds
ElSx 3	FSC 1	FS 1	1968	14	artificial	300 grams
	FS 2	FS 2	1969	17	artificial	*
	PS 2	FS 2	1969	17	artificial	*
	FSC 4	FS 4	1970	14	natural	35 pounds
FbSx 6	FSC 1	FS 1	1970	9	natural	*
EkSx 1	FSC 1	FS 1	1969	24	artificial	497-1120 g
FbTc 1	FSC 1	FS 1	1969	18	artificial	357-686 g

* indicates samples not yet cut to dry weights and analyzed.

TABLE XXXV Breakdown of Samples By Size

1968		TOTAL SAMPLE BREAKDOWN (grams)				4 mm FRACTION BREAKDOWN (grams)							
SITE	STRATUM	TOTAL	RESIDUE a	2 mm a	4 mm a	TOTAL	SHELL b / a	ROCK b / a	BONE b / a	CHARCOAL b / a	PLANT b / a	"ORGANIC" b / a	ARTIFACTS b / a
ElSx 1 (1968 Test Pit)	Level 1	493.3	309.0 (62%)	103.0 (21%)	81.3 (17%)	81.3	60.3 (74%/13%)	21.0 (26%/ 4%)	TRACE (t / t)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	Level 2	496.3	278.0 (56%)	96.3 (19%)	122.0 (24%)	122.0	116.6 (96%/23%)	5.4 (4%/ 1%)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	Level 3	499.7	38.6 (8%)	43.8 (9%)	417.3 (83%)	417.3	413.3 (99%/82%)	4.0 (1%/ 1%)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	Level 4	499.2	110.6 (22%)	88.2 (18%)	300.4 (60%)	300.4	300.3 (99%/60%)	TRACE (t / t)	TRACE (t / t)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	Level 5	500.3	68.3 (14%)	53.0 (11%)	379.0 (76%)	379.0	378.9 (99%/76%)	NONE (n / n)	TRACE (t / t)	NONE (n / n)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	Level 6	498.1	101.7 (20%)	38.5 (8%)	357.9 (72%)	357.9	351.9 (98%/70%)	6.0 (2%/ 1%)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	Level 7	500.9	64.1 (13%)	58.0 (12%)	378.8 (75%)	378.8	369.8 (98%/74%)	9.0 (2%/ 2%)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	Level 8	498.4	98.0 (20%)	56.5 (11%)	343.7 (69%)	343.7	330.9 (96%/66%)	13.0 (4%/ 3%)	NONE (n / n)	NONE (n / n)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	Level 9	495.1	138.8 (28%)	56.2 (11%)	300.1 (60%)	300.1	299.8 (99%/60%)	NONE (n / n)	TRACE (t / t)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	Level 10	496.0	266.0 (54%)	107.8 (22%)	122.2 (24%)	122.2	122.2 (100%/24%)	NONE (n / n)	NONE (n / n)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	Level 11	499.3	291.1 (58%)	85.9 (17%)	122.3 (25%)	122.3	86.1 (70%/17%)	33.7 (27%/ 7%)	TRACE (t / t)	2.5 (2%/ t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	Level 12	498.7	203.4 (41%)	87.5 (17%)	207.8 (42%)	207.8	204.3 (98%/41%)	3.5 (2%/ t)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	Level 13	497.9	255.1 (51%)	90.3 (18%)	152.5 (31%)	152.5	142.7 (94%/29%)	6.8 (4%/ 1%)	1.5 (1%/ t)	1.5 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	Level 14	498.7	415.0 (83%)	59.5 (12%)	24.2 (5%)	24.2	10.7 (44%/ 2%)	13.5 (56%/ 3%)	NONE (n / n)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	Level 15	497.0	354.6 (71%)	100.3 (20%)	42.1 (8%)	42.1	24.2 (57%/ 5%)	9.7 (23%/ 2%)	5.7 (13%/ 1%)	2.5 (6%/ t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
ElSx 3	FSC 1. 2	297.9	167.3 (56%)	44.8 (15%)	85.8 (29%)	85.8	45.3 (53%/15%)	35.0 (41%/12%)	TRACE (t / t)	5.5 (6%/ 2%)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 3	296.1	255.0 (86%)	36.8 (12%)	4.3 (2%)	4.3	TRACE (t / t)	4.2 (99%/ 1%)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 4	289.7	192.5 (66%)	63.6 (22%)	33.6 (12%)	33.6	20.4 (61%/ 7%)	11.0 (30%/ 4%)	TRACE (t / t)	2.2 (7%/ t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 5	298.4	169.9 (57%)	69.7 (23%)	58.8 (20%)	58.8	12.7 (21%/ 4%)	42.9 (73%/14%)	1.6 (3%/ t)	1.6 (3%/ t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 6	293.9	192.0 (65%)	49.5 (17%)	52.4 (18%)	52.4	44.8 (85%/15%)	7.6 (15%/ 3%)	TRACE (t / t)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 7	297.9	212.5 (72%)	54.1 (18%)	31.3 (11%)	31.3	9.6 (31%/ 3%)	21.7 (69%/ 7%)	TRACE (t / t)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 8	299.0	204.3 (68%)	62.5 (21%)	32.2 (11%)	32.2	3.5 (11%/ 1%)	28.7 (89%/10%)	TRACE (t / t)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 9	298.4	177.0 (59%)	76.7 (26%)	44.7 (14%)	44.7	30.2 (67%/10%)	14.5 (33%/ 5%)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1.10	302.6	166.4 (55%)	74.8 (25%)	61.4 (20%)	61.4	50.3 (82%/17%)	1.0 (2%/ t)	NONE (n / n)	10.1 (16%/ 3%)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.11	293.8	196.4 (67%)	70.0 (24%)	27.4 (9%)	27.4	11.6 (42%/ 4%)	14.4 (53%/ 5%)	TRACE (t / t)	TRACE (t / t)	1.4 (5%/ t)	NONE (n / n)	NONE (n / n)
	FSC 1.12	295.6	149.8 (51%)	59.7 (20%)	86.1 (29%)	86.1	35.7 (41%/12%)	48.2 (56%/16%)	2.2 (2%/ 1%)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.13	298.5	161.4 (54%)	74.6 (25%)	62.5 (21%)	62.5	NONE (n / n)	59.0 (94%/20%)	1.7 (3%/ t)	1.8 (3%/ t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.14	299.0	219.0 (73%)	51.5 (17%)	28.5 (10%)	28.5	TRACE (t / t)	28.4 (99%/ 9%)	TRACE (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1.15	299.9	184.9 (62%)	69.6 (23%)	44.7 (15%)	44.7	7.1 (16%/ 2%)	36.4 (81%/12%)	TRACE (t / t)	1.2 (3%/ t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)

TABLE XXXV Continued

1969		TOTAL SAMPLE BREAKDOWN (grams)				4 mm FRACTION BREAKDOWN (grams)							
SITE	STRATUM	TOTAL	RESIDUE a	2 mm a	4 mm a	TOTAL	SHELL b / a	ROCK b / a	BONE b / a	CHARCOAL b / a	PLANT b / a	"ORGANIC" b / a	ARTIFACTS b / a
FbTc 1	FSC 1. 1	675.5	496.6 (73%)	58.0 (9%)	120.9 (21%)	120.9	62.5 (52%/11%)	57.3 (47%/10%)	.1 (t / t)	.9 (t / t)	.1 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 2	446.1	231.4 (52%)	67.0 (15%)	147.7 (33%)	147.7	80.7 (55%/18%)	65.3 (44%/15%)	.1 (t / t)	1.1 (1%/ t)	.5 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 3	445.9	229.3 (51%)	84.7 (19%)	131.9 (30%)	131.9	110.8 (84%/26%)	19.1 (14%/ 4%)	.6 (t / t)	1.2 (1%/ t)	.2 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 4	408.7	141.8 (35%)	49.2 (12%)	217.7 (53%)	217.7	200.5 (92%/49%)	14.9 (7%/ 4%)	1.4 (t / t)	.7 (t / t)	.2 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 5	470.0	220.9 (47%)	89.5 (19%)	161.6 (34%)	161.6	115.2 (71%/25%)	44.5 (27%/ 9%)	.7 (t / t)	1.2 (1%/ t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 6	459.0	272.7 (59%)	72.4 (16%)	113.9 (25%)	113.9	60.4 (53%/13%)	49.2 (43%/11%)	3.1 (3%/ 1%)	1.2 (1%/ t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 7	440.0	273.2 (62%)	85.2 (19%)	81.6 (19%)	81.6	56.4 (69%/13%)	22.5 (27%/ 5%)	1.5 (2%/ t)	1.1 (1%/ t)	.1 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 8	477.4	281.4 (59%)	75.8 (16%)	120.2 (25%)	120.2	75.5 (63%/16%)	42.1 (35%/ 9%)	1.3 (1%/ t)	1.3 (1%/ t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 9	439.4	195.8 (45%)	107.6 (24%)	136.0 (31%)	136.0	121.5 (89%/28%)	13.9 (10%/ 3%)	.3 (t / t)	.3 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1.10	483.1	229.2 (47%)	66.1 (14%)	187.8 (39%)	187.8	75.9 (40%/16%)	110.7 (59%/23%)	.9 (t / t)	.3 (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.11	450.4	350.6 (78%)	76.2 (17%)	23.2 (5%)	23.2	8.0 (34%/ 2%)	14.6 (63%/ 3%)	.1 (t / t)	.4 (2%/ t)	.1 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.12	451.6	316.9 (70%)	76.6 (17%)	58.1 (13%)	58.1	1.1 (2%/ t)	56.3 (97%/12%)	TRACE (t / t)	.6 (1%/ t)	.1 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.13	357.0	240.2 (67%)	77.5 (22%)	39.3 (11%)	39.3	3.1 (8%/ 1%)	32.2 (82%/ 9%)	1.0 (3%/ t)	2.9 (7%/ 1%)	.1 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.14	686.4	369.7 (69%)	137.3 (20%)	79.4 (11%)	79.4	19.7 (25%/ 3%)	57.1 (72%/ 8%)	1.1 (1%/ t)	1.5 (1%/ t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1.15	488.8	289.7 (59%)	97.9 (20%)	101.2 (21%)	101.2	6.7 (7%/ 1%)	89.9 (89%/19%)	.5 (t / t)	4.1 (4%/ 1%)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.16	598.0	313.0 (52%)	108.8 (18%)	176.2 (30%)	176.2	75.5 (42%/13%)	100.1 (57%/17%)	TRACE (t / t)	.6 (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.17	542.4	326.1 (60%)	113.0 (21%)	103.3 (19%)	103.3	49.1 (47%/ 9%)	54.2 (53%/10%)	NONE (n / n)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1.18	608.2	163.7 (27%)	34.0 (5%)	410.5 (68%)	410.5	.5 (t / t)	409.9 (99%/68%)	NONE (n / n)	NONE (n / n)	.1 (t / t)	NONE (n / n)	NONE (n / n)
EkSx 1	FSC 1.24	657.6	416.2 (63%)	103.8 (16%)	137.6 (21%)	137.6	125.7 (91%/20%)	8.9 (6%/ 1%)	1.3 (1%/ t)	1.6 (1%/ t)	.1 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.23	754.2	344.7 (45%)	95.4 (13%)	314.1 (42%)	*							
	FSC 1.22	900.8	321.6 (36%)	81.6 (10%)	497.6 (54%)	497.6	408.3 (82%/45%)	88.7 (17%/ 9%)	NONE (n / n)	.1 (t / t)	.5 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.21	954.6	476.3 (50%)	116.7 (12%)	361.6 (38%)	361.6	260.4 (72%/28%)	88.9 (25%/ 9%)	8.2 (2%/ 1%)	2.0 (t / t)	2.1 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.20	774.2	197.6 (25%)	89.1 (11%)	487.5 (64%)	487.5	476.3 (99%/63%)	8.4 (t / t)	2.3 (t / t)	.5 (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.19	684.2	496.2 (72%)	99.3 (15%)	88.7 (13%)	88.7	34.3 (39%/ 5%)	50.8 (57%/ 7%)	2.2 (2%/ t)	.7 (1%/ t)	.7 (1%/ t)	NONE (n / n)	NONE (n / n)
	FSC 1.18	592.0	408.6 (69%)	114.9 (20%)	68.5 (11%)	68.5	34.9 (51%/ 6%)	30.9 (45%/ 5%)	1.1 (2%/ t)	1.1 (2%/ t)	.5 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.17	587.5	369.7 (63%)	95.9 (16%)	121.9 (21%)	121.9	84.7 (69%/14%)	33.0 (27%/ 6%)	2.6 (2%/ t)	.4 (t / t)	1.2 (1%/ t)	NONE (n / n)	NONE (n / n)
	FSC 1.16	591.6	269.6 (47%)	89.5 (15%)	232.5 (38%)	232.5	202.7 (87%/33%)	28.2 (12%/ 5%)	.8 (t / t)	.8 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1.15	643.3	250.7 (39%)	89.9 (14%)	302.7 (47%)	302.7	269.1 (89%/42%)	32.0 (11%/ 5%)	.5 (t / t)	.7 (t / t)	.4 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1.14	732.3	260.1 (35%)	95.8 (13%)	376.4 (52%)	376.4	361.2 (96%/50%)	15.1 (4%/ 2%)	NONE (n / n)	.1 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1.13	784.8	163.7 (21%)	78.2 (10%)	542.9 (69%)	542.9	523.7 (96%/67%)	19.1 (3%/ 2%)	TRACE (t / t)	.1 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1.12	726.5	145.0 (20%)	64.2 (9%)	517.3 (71%)	*							
	FSC 1.11	783.3	219.0 (29%)	127.1 (16%)	437.2 (55%)	437.2	411.4 (94%/53%)	25.7 (4%/ 2%)	NONE (n / n)	.1 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1.10	765.7	163.8 (21%)	91.6 (12%)	510.3 (67%)	510.3	453.5 (89%/60%)	56.6 (11%/ 7%)	.1 (t / t)	.1 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 9	753.7	138.3 (18%)	66.1 (9%)	549.3 (73%)	549.3	522.5 (95%/69%)	25.5 (5%/ 4%)	.3 (t / t)	1.0 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 8	579.8	204.6 (35%)	84.1 (15%)	291.1 (50%)	291.1	258.3 (89%/45%)	31.8 (10%/ 5%)	.1 (t / t)	.9 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 7	694.7	138.2 (20%)	55.2 (8%)	501.3 (72%)	*							
	FSC 1. 6	497.2	313.8 (63%)	66.4 (13%)	117.0 (24%)	117.0	84.8 (73%/18%)	28.4 (24%/ 6%)	1.3 (t / t)	2.3 (2%/ t)	.2 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 1. 5	727.5	389.2 (53%)	85.3 (12%)	253.0 (35%)	253.0	240.0 (95%/33%)	12.3 (5%/ 2%)	.5 (t / t)	.2 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 4	789.9	560.8 (71%)	98.4 (12%)	130.7 (17%)	130.7	83.2 (64%/11%)	47.5 (36%/ 6%)	NONE (n / n)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 3	617.0	495.5 (80%)	59.1 (10%)	62.4 (10%)	62.4	29.7 (48%/ 5%)	32.6 (52%/ 5%)	.1 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 2	647.5	423.3 (65%)	61.3 (10%)	162.9 (25%)	162.9	20.7 (13%/ 3%)	142.2 (87%/22%)	NONE (n / n)	NONE (n / n)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 1. 1	1120.4	820.3 (73%)	41.3 (4%)	258.8 (23%)	258.8	5.7 (2%/ t)	253.1 (98%/23%)	NONE (n / n)	TRACE (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
ElSx 1	PS 2A. 4	598.3	467.0 (78%)	47.3 (8%)	84.0 (14%)								
	PS 2A. 5	599.6	358.7 (60%)	126.5 (21%)	114.4 (19%)								
	PS 2A. 6	598.7	339.2 (57%)	114.0 (19%)	145.5 (24%)								
	PS 2A. 7	597.9	267.5 (45%)	124.8 (21%)	205.6 (34%)								
	PS 2A. 8	599.0	287.6 (48%)	128.0 (21%)	183.4 (31%)								
	PS 2A. 9	599.0	282.8 (47%)	141.8 (24%)	174.4 (29%)								
	PS 2A.10	599.3	294.7 (49%)	124.4 (21%)	180.2 (30%)								
	PS 2A.11	599.3	428.0 (71%)	87.4 (15%)	83.9 (14%)								
	PS 2A.12	598.8	399.4 (67%)	106.0 (18%)	93.4 (15%)								
	PS 2A.13	598.8	415.6 (69%)	65.1 (11%)	118.1 (20%)								

TABLE XXXV Continued

1970		TOTAL SAMPLE BREAKDOWN (lbs.)				4 mm FRACTION BREAKDOWN (grams)							
SITE	STRATUM	TOTAL	RESIDUE a	2 mm a	4 mm a	TOTAL	SHELL b / a	ROCK b / a	BONE b / a	CHARCOAL b / a	PLANT b / a	"ORGANIC" b / a	ARTIFACTS b / a
E1Sx 1	FS 9. 1	34.40	18.30 (53%)	4.50 (13%)	11.60 (33%)	5245.5	3876.0 (74%/24%)	1303.8 (25%/ 8%)	9.5 (t / t)	5.1 (t / t)	3.9 (t / t)	47.2 (1%/ t)	NONE (n / n)
	FS 9. 2	34.50	18.90 (55%)	3.80 (11%)	11.80 (34%)	5351.2	3693.8 (69%/23%)	1634.0 (31%/11%)	9.9 (t / t)	5.4 (t / t)	.4 (t / t)	7.7 (t / t)	NONE (n / n)
	FS 9. 3_1	34.30	26.70 (78%)	2.40 (7%)	5.20 (15%)	2340.3	11.5 (t / t)	1783.1 (76%/11%)	NONE (n / n)	49.4 (2%/ t)	.8 (t / t)	495.5 (21%/ 3%)	NONE (n / n)
	FS 9. 3_2	34.40	31.20 (91%)	1.80 (5%)	1.40 (4%)	627.5	5.7 (1%/ t)	611.5 (97%/ 4%)	NONE (n / n)	9.2 (1%/ t)	.1 (t / t)	1.0 (t / t)	NONE (n / n)
	FS 9. 4	35.10	13.00 (37%)	3.90 (11%)	18.20 (52%)	8245.8	7361.7 (89%/46%)	880.2 (11%/ 5%)	.8 (t / t)	.8 (t / t)	2.3 (t / t)	NONE (n / n)	NONE (n / n)
	FS 9. 5	34.80	22.50 (66%)	3.00 (9%)	8.80 (25%)	3973.3	18.8 (t / t)	3948.3 (99%/25%)	NONE (n / n)	6.2 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FS 9. 6	23.50	16.50 (70%)	2.90 (12%)	4.10 (17%)	1860.6	21.0 (1%/ t)	1826.9 (98%/17%)	1.0 (t / t)	11.6 (t / t)	.1 (t / t)	TRACE (t / t)	NONE (n / n)
	FS 9. 7	34.20	27.90 (82%)	2.50 (7%)	3.80 (11%)	1745.4	4.5 (t / t)	1734.9 (99%/11%)	.2 (t / t)	5.8 (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FS 9. 8	31.60	24.40 (77%)	3.00 (9%)	4.20 (13%)	1924.4	2.8 (t / t)	1910.3 (99%/13%)	1.7 (t / t)	9.6 (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FS 9.10	34.30	27.90 (81%)	4.70 (14%)	1.70 (5%)	772.3	TRACE (t / t)	748.9 (97%/ 5%)	NONE (n / n)	23.4 (3%/ t)	NONE (n / n)	NONE (n / n)	TRACE (t / t)
E1Sx 1	FSC 9. 1	30.10	13.80 (46%)	4.70 (15%)	11.60 (39%)	5275.1	4815.4 (91%/35%)	358.0 (7%/ 3%)	18.4 (t / t)	8.6 (t / t)	7.2 (t / t)	67.5 (1%/ t)	NONE (n / n)
	FSC 9. 3_1	23.80	16.00 (67%)	4.10 (17%)	3.70 (16%)	1674.9	4.4 (t / t)	1549.7 (93%/15%)	1.9 (t / t)	20.5 (1%/ t)	NONE (n / n)	98.4 (6%/ 1%)	NONE (n / n)
	FSC 9. 3_2	34.50	30.20 (88%)	2.20 (6%)	2.10 (6%)	962.4	1.3 (t / t)	958.0 (99%/ 6%)	NONE (n / n)	3.1 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 9. 4_1	11.00	6.50 (59%)	2.20 (20%)	2.30 (21%)	1063.6	762.8 (72%/15%)	294.8 (28%/ 6%)	2.7 (t / t)	3.3 (t / t)	TRACE (t / t)	NONE (n / n)	NONE (n / n)
	FSC 9. 4_2	44.40	17.90 (40%)	5.70 (13%)	20.80 (47%)	9444.7	7767.0 (82%/39%)	1670.9 (18%/ 9%)	3.1 (t / t)	3.7 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 9.5-7-8	35.00	26.20 (75%)	3.10 (9%)	5.70 (16%)	2579.5	.6 (t / t)	2494.7 (97%/15%)	NONE (n / n)	8.3 (t / t)	8.4 (t / t)	67.5 (3%/ t)	NONE (n / n)
	FSC 9. 6	19.90	13.50 (68%)	3.70 (19%)	2.70 (13%)	1225.5	1.6 (t / t)	1112.1 (91%/12%)	TRACE (t / t)	7.3 (t / t)	NONE (n / n)	104.5 (9%/ 1%)	NONE (n / n)
	FSC 9.10	27.10	24.30 (90%)	1.90 (7%)	.90 (3%)	403.0	1.7 (t / t)	388.1 (96%/ 3%)	NONE (n / n)	13.2 (3%/ t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
E1Sx 1	FSC 4. 3	34.10	20.00 (59%)	5.90 (17%)	8.20 (24%)	3744.8	3144.8 (84%/20%)	582.2 (15%/ 4%)	13.1 (t / t)	4.5 (t / t)	.2 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 4. 4	35.30	23.30 (66%)	6.30 (18%)	5.70 (16%)	2583.7	1019.5 (39%/ 6%)	1518.0 (59%/ 9%)	41.6 (2%/ t)	3.3 (t / t)	1.3 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 4. 5	34.00	21.40 (63%)	8.30 (24%)	4.30 (13%)	1965.8	1060.7 (54%/ 9%)	878.6 (45%/ 7%)	23.8 (1%/ t)	2.0 (t / t)	.7 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 4. 6	31.70	20.10 (63%)	6.20 (20%)	5.40 (17%)	2436.8	47.7 (2%/ t)	889.4 (36%/ 6%)	20.8 (1%/ t)	114.9 (5%/ 1%)	45.6 (2%/ t)	1318.4 (54%/ 9%)	NONE (n / n)
	FSC 4. 7	34.40	25.50 (74%)	6.70 (19%)	2.20 (6%)	999.7	169.9 (17%/ 1%)	728.9 (73%/ 4%)	90.5 (9%/ t)	10.2 (1%/ t)	.2 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 4. 8	35.20	27.60 (78%)	3.70 (11%)	3.87 (11%)	1757.4	3.2 (t / t)	1729.2 (98%/11%)	22.7 (1%/ t)	2.3 (t / t)	NONE (n / n)	NONE (n / n)	TRACE (t / t)
E1Sx 1	FSC 10. 1	37.40	18.50 (49%)	7.50 (20%)	11.40 (30%)	5161.1	2877.1 (56%/17%)	2229.5 (43%/13%)	22.6 (t / t)	9.5 (t / t)	20.6 (t / t)	NONE (n / n)	1.8 (t / t)
	FSC 10. 2	29.00	16.40 (56%)	5.60 (19%)	7.00 (24%)	3171.8	1092.0 (34%/ 8%)	1397.4 (44%/11%)	20.6 (1%/ t)	45.9 (1%/ t)	127.4 (4%/ 1%)	NONE (n / n)	488.5 (15%/ 4%)
	FSC 10. 3	35.10	26.90 (77%)	5.70 (16%)	2.50 (7%)	1136.8	560.8 (49%/ 3%)	520.4 (46%/ 3%)	9.4 (t / t)	44.0 (4%/ t)	2.2 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 10. 4	34.30	22.20 (65%)	6.90 (20%)	5.20 (15%)	2366.6	1438.2 (61%/ 9%)	774.6 (33%/ 5%)	28.3 (1%/ t)	75.0 (3%/ t)	NONE (n / n)	34.8 (1%/ t)	15.7 (1%/ t)
	FSC 10. 5	34.70	23.70 (68%)	6.20 (18%)	4.80 (14%)	2198.5	1260.7 (57%/ 8%)	911.5 (41%/ 6%)	7.0 (t / t)	19.3 (1%/ t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 10. 6	34.20	23.10 (68%)	4.90 (14%)	6.20 (18%)	2812.2	529.0 (19%/ 3%)	2160.2 (77%/14%)	10.9 (t / t)	110.3 (4%/ 1%)	NONE (n / n)	NONE (n / n)	1.8 (t / t)
	FSC 10. 7	34.70	26.90 (77%)	3.30 (9%)	4.50 (13%)	2065.1	58.4 (3%/ t)	1931.2 (93%/12%)	47.9 (2%/ t)	27.6 (1%/ t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 10. 8	34.90	19.90 (57%)	6.40 (18%)	8.60 (25%)	3909.3	1472.3 (38%/ 9%)	2420.6 (62%/16%)	9.0 (t / t)	7.1 (t / t)	.3 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 10. 9	34.80	26.00 (75%)	4.80 (14%)	4.00 (11%)	1790.0	667.3 (37%/ 4%)	1089.2 (61%/ 7%)	21.3 (1%/ t)	12.2 (1%/ t)	NONE (n / n)	NONE (n / n)	TRACE (t / t)
	FSC 10.10	41.00	29.00 (71%)	5.75 (14%)	6.25 (15%)	2151.5	797.7 (37%/ 5%)	1318.4 (61%/ 9%)	27.8 (2%/ t)	7.6 (t / t)	NONE (n / n)	NONE (n / n)	TRACE (t / t)
	FSC 10.11	34.80	24.50 (70%)	5.40 (15%)	4.90 (14%)	2218.1	905.2 (41%/ 6%)	1260.6 (57%/ 8%)	43.9 (2%/ t)	8.4 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 10.12	34.30	25.40 (74%)	4.20 (12%)	4.70 (14%)	2154.8	382.3 (18%/ 3%)	1770.4 (82%/11%)	1.8 (t / t)	.3 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 10.13	34.30	11.40 (33%)	4.20 (13%)	18.70 (54%)	8483.5	7956.1 (94%/51%)	501.7 (6%/ 3%)	22.0 (t / t)	3.7 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 10.14	35.80	22.30 (63%)	7.20 (20%)	6.34 (18%)	2874.6	1541.8 (54%/10%)	922.8 (32%/ 6%)	401.0 (14%/ 6%)	7.2 (t / t)	1.8 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 10.15	35.50	13.80 (39%)	6.20 (17%)	15.50 (44%)	7019.5	1281.1 (18%/ 8%)	5705.3 (81%/36%)	20.0 (t / t)	11.8 (t / t)	1.3 (t / t)	NONE (n / n)	NONE (n / n)
E1Sx J	FSC 4. 2	34.60	9.30 (27%)	2.90 (8%)	22.40 (65%)	10,173.2	8152.3 (80%/52%)	2011.7 (20%/13%)	4.0 (t / t)	5.2 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 4. 3	24.50	14.00 (57%)	2.50 (10%)	8.00 (33%)	3609.4	1829.2 (51%/17%)	1561.1 (43%/14%)	37.5 (t / t)	68.2 (2%/ 1%)	1.7 (t / t)	111.7 (3%/ 1%)	NONE (n / n)
	FSC 4. 4	34.60	13.50 (39%)	3.30 (9%)	17.80 (51%)	8063.9	6285.0 (78%/40%)	1677.8 (21%/11%)	97.5 (1%/ t)	2.7 (t / t)	.9 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 4. 5	12.80	7.10 (55%)	1.80 (14%)	3.90 (30%)	1749.0	882.0 (50%/15%)	433.0 (25%/ 8%)	17.0 (1%/ t)	11.7 (1%/ t)	6.7 (t / t)	398.6 (23%/ 7%)	NONE (n / n)
	FSC 4. 6	33.20	13.80 (41%)	5.60 (17%)	13.80 (41%)	6258.5	5889.9 (94%/39%)	364.2 (6%/ 2%)	1.3 (t / t)	3.1 (t / t)	NONE (n / n)	NONE (n / n)	TRACE (t / t)
	FSC 4. 7	34.70	21.50 (62%)	5.80 (17%)	7.40 (21%)	3366.7	469.1 (14%/ 3%)	2869.9 (85%/18%)	21.4 (1%/ t)	6.3 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 4. 8	35.40	21.50 (61%)	8.00 (23%)	5.90 (17%)	2668.6	881.2 (33%/ 6%)	1743.7 (65%/11%)	39.0 (1%/ t)	4.3 (t / t)	.4 (t / t)	NONE (n / n)	NONE (n / n)
	FSC 4. 9	38.60	26.00 (67%)	4.90 (13%)	7.70 (20%)	3473.7	529.8 (15%/ 3%)	2907.2 (84%/17%)	28.4 (1%/ t)	8.3 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 4.10	36.10	26.10 (72%)	5.80 (16%)	4.20 (12%)	1908.8	365.2 (19%/ 2%)	1529.3 (80%/10%)	12.0 (1%/ t)	2.3 (t / t)	NONE (n / n)	NONE (n / n)	TRACE (t / t)
	FSC 4.11	34.40	22.40 (65%)	6.10 (18%)	5.90 (17%)	2688.0	556.9 (21%/ 4%)	2096.2 (78%/13%)	26.7 (1%/ t)	5.3 (t / t)	.5 (t / t)	NONE (n / n)	2.4 (t / t)
	FSC 4.12	33.80	20.60 (61%)	7.10 (21%)	6.10 (18%)	2782.2	731.1 (26%/ 5%)	2028.0 (73%/13%)	16.3 (1%/ t)	3.1 (t / t)	1.3 (t / t)	NONE (n / n)	2.4 (t / t)
	FSC 4.13	34.00	21.20 (62%)	5.70 (17%)	7.10 (21%)	3225.5	1439.5 (45%/ 9%)	1776.1 (55%/12%)	5.2 (t / t)	4.7 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)
	FSC 4.14	35.50	26.00 (73%)	5.50 (16%)	4.00 (11%)	1805.1	467.0 (26%/ 3%)	1336.5 (74%/ 8%)	.9 (t / t)	.7 (t / t)	NONE (n / n)	NONE (n / n)	NONE (n / n)

TABLE XXXVI 4mm Shell by Species

1968		4 mm SHELL BREAKDOWN (grams)						
SITE	STRATUM	TOTAL	Saxidomus-Schizo. c / b / a	Balanus species c / b / a	Thais lamellosa c / b / a	Mytilus species c / b / a	Protothaca c / b / a	Clinocardium c / b / a
ElSx-1	Level 1	60.3	37.8 (63%/46%/ 8%)	18.7 (31%/23%/ 4%)	3.8 (6%/ 4%/ 1%)	TRACE (t / t / t)	TRACE (t / t / t)	TRACE (t / t / t)
	Level 2	116.6	62.4 (53%/57%/14%)	36.1 (31%/29%/ 7%)	6.9 (6%/ 5%/ 1%)	8.5 (7%/ 6%/ 1%)	1.7 (1%/ 1%/ t)	1.0 (t / t / t)
	Level 3	413.3	267.2 (65%/64%/53%)	113.1 (27%/27%/22%)	1.7 (t / t / t)	10.5 (3%/ 2%/ 2%)	10.5 (3%/ 2%/ 2%)	10.3 (2%/ 2%/ 2%)
	Level 4	300.3	165.0 (55%/54%/33%)	83.6 (28%/27%/17%)	5.7 (2%/ 1%/ 1%)	23.2 (8%/ 7%/ 4%)	1.3 (t / t / t)	20.4 (7%/ 6%/ 4%)
	Level 5	379.9	209.5 (55%/55%/42%)	160.6 (42%/42%/32%)	TRACE (t / t / t)	8.8 (2%/ 2%/ 2%)	TRACE (t / t / t)	NONE (n / n / n)
	Level 6	351.9	117.5 (33%/32%/23%)	227.3 (65%/63%/45%)	1.0 (t / t / t)	4.3 (1%/ 1%/ 1%)	NONE (n / n / n)	1.8 (t / t / t)
	Level 7	369.8	190.9 (52%/50%/38%)	139.8 (38%/36%/28%)	2.5 (t / t / t)	34.7 (9%/ 9%/ 7%)	NONE (n / n / n)	NONE (n / n / n)
	Level 8	330.9	128.3 (39%/37%/26%)	191.2 (58%/55%/38%)	6.5 (2%/ 2%/ 1%)	3.9 (1%/ t / t)	TRACE (t / t / t)	NONE (n / n / n)
	Level 9	299.8	107.7 (36%/36%/22%)	155.5 (52%/52%/30%)	29.6 (10%/10%/ 6%)	5.0 (2%/ 2%/ 1%)	TRACE (t / t / t)	2.0 (t / t / t)
	Level 10	122.2	53.3 (44%/44%/11%)	46.2 (38%/38%/ 9%)	18.3 (15%/15%/ 4%)	2.1 (2%/ 2%/ t)	2.3 (2%/ 2%/ t)	NONE (n / n / n)
	Level 11	86.1	63.3 (73%/52%/13%)	9.7 (11%/ 8%/ 2%)	12.0 (14%/10%/ 2%)	TRACE (t / t / t)	1.1 (t / t / t)	NONE (n / n / n)
	Level 12	204.3	114.0 (56%/55%/23%)	57.9 (28%/28%/12%)	28.8 (14%/14%/ 6%)	3.6 (1%/ 1%/ t)	TRACE (t / t / t)	NONE (n / n / n)
	Level 13	142.7	72.5 (50%/47%/15%)	44.7 (31%/29%/ 9%)	16.4 (11%/10%/ 3%)	5.1 (3%/ 3%/ 1%)	4.0 (3%/ 3%/ 1%)	NONE (n / n / n)
	Level 14	10.7	5.5 (51%/23%/ 1%)	3.0 (28%/12%/ 1%)	TRACE (t / t / t)	2.2 (20%/ 9%/ t)	NONE (n / n / n)	NONE (n / n / n)
	Level 15	24.2	NONE (n / n / n)	9.1 (38%/22%/ 2%)	2.4 (10%/ 6%/ t)	12.7 (52%/30%/ 2%)	NONE (n / n / n)	NONE (n / n / n)
ElSx 3	FSC 1. 2	45.3	26.0 (57%/30%/ 9%)	13.4 (29%/15%/ 4%)	NONE (n / n / n)	TRACE (t / t / t)	5.9 (13%/ 7%/ 2%)	NONE (n / n / n)
	FSC 1. 3	TRACE	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)
	FSC 1. 4	20.4	4.0 (19%/12%/ 1%)	9.7 (47%/29%/ 3%)	TRACE (t / t / t)	6.7 (32%/20%/ 2%)	NONE (n / n / n)	TRACE (t / t / t)
	FSC 1. 5	12.7	NONE (n / n / n)	3.5 (28%/ 6%/ 1%)	6.7 (32%/11%/ 2%)	2.5 (19%/ 4%/ 1%)	NONE (n / n / n)	NONE (n / n / n)
	FSC 1. 6	44.8	31.3 (70%/59%/11%)	13.5 (30%/25%/ 4%)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)
	FSC 1. 7	9.6	1.5 (16%/ 5%/ t)	5.7 (59%/18%/ 2%)	1.4 (15%/ 5%/ t)	1.0 (10%/ 3%/ t)	NONE (n / n / n)	TRACE (t / t / t)
	FSC 1. 8	3.5	TRACE (t / t / t)	3.5 (100%/11%/1%)	TRACE (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)
	FSC 1. 9	30.2	5.0 (17%/11%/ 2%)	17.0 (56%/38%/ 5%)	5.0 (17%/11%/ 2%)	3.2 (10%/ 7%/ 1%)	NONE (n / n / n)	NONE (n / n / n)
	FSC 1.10	50.3	10.8 (21%/17%/ 4%)	32.5 (65%/53%/11%)	NONE (n / n / n)	7.0 (14%/12%/ 2%)	NONE (n / n / n)	NONE (n / n / n)
	FSC 1.11	11.6	1.3 (11%/ 5%/ t)	2.3 (20%/ 8%/ 1%)	6.7 (58%/24%/ 2%)	1.3 (11%/ 5%/ t)	NONE (n / n / n)	NONE (n / n / n)
	FSC 1.12	35.7	4.6 (13%/ 5%/ 1%)	26.5 (74%/30%/ 9%)	4.6 (13%/ 5%/ 1%)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)
	FSC 1.13	NONE	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
	FSC 1.14	TRACE	NONE (n / n / n)	TRACE (t / t / t)	TRACE (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)
	FSC 1.15	7.1	1.6 (23%/ 4%/ 1%)	1.6 (23%/ 4%/ 1%)	TRACE (t / t / t)	3.9 (54%/ 8%/ 1%)	TRACE (t / t / t)	TRACE (t / t / t)

TABLE XXXVI Continued

4 mm SHELL BREAKDOWN (grams)						
Thais canaliculata c / b / a	*Littorina* c / b / a	*Acmaea* species c / b / a	*Strongylocentrotus* c / b / a	*Coronula* species c / b / a	Land snail c / b / a	Other c / b / a
NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	1.1 (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	1.9 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	1.0 (t / t / t)
NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)

TABLE XXXVI Continued

1970		4 mm SHELL BREAKDOWN (grams)						
SITE	STRATUM	TOTAL	Saxidomus-Schizo. c / b / a	Balanus species c / b / a	Thais lamellosa c / b / a	Mytilus species c / b / a	Protothaca c / b / a	Clinocardium c / b / a
FlSx 1	FS 9. 1	3876.0	2562.8 (66%/49%/16%)	917.8 (24%/18%/ 6%)	185.3 (5%/ 4%/ 1%)	78.7 (2%/ 1%/ t)	95.0 (2%/ 1%/ t)	35.0 (1%/ 1%/ t)
	FS 9. 2	3693.8	2235.9 (61%/42%/14%)	1210.8 (33%/23%/ 8%)	137.3 (4%/ 3%/ 1%)	30.6 (t / t / t)	60.3 (2%/ 1%/ t)	16.2 (t / t / t)
	FS 9. 3_1	11.5	3.1 (27%/ t / t)	6.7 (58%/ t / t)	NONE (n / n / n)	1.4 (12%/ t / t)	TRACE (t / t / t)	.3 (3%/ t / t)
	FS 9. 3_2	5.7	1.1 (19%/ t / t)	4.5 (79%/ 1%/ t)	NONE (n / n / n)	.1 (2%/ t / t)	NONE (n / n / n)	NONE (n / n / n)
	FS 9. 4	7361.7	5397.7 (73%/65%/34%)	1837.3 (25%/22%/12%)	19.3 (t / t / t)	30.0 (t / t / t)	13.2 (t / t / t)	61.3 (1%/ 1%/ t)
	FS 9. 5	18.8	12.9 (69%/ t / t)	5.4 (29%/ t / t)	TRACE (t / t / t)	.5 (3%/ t / t)	NONE (n / n / n)	NONE (n / n / n)
	FS 9. 6	21.0	5.4 (26%/ t / t)	10.5 (50%/ 1%/ t)	2.5 (12%/ t / t)	1.3 (6%/ t / t)	.5 (2%/ t / t)	.8 (4%/ t / t)
	FS 9. 7	4.5	1.2 (27%/ t / t)	3.3 (73%/ t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
	FS 9. 8	2.8	.3 (11%/ t / t)	2.4 (86%/ t / t)	NONE (n / n / n)	NONE (n / n / n)	.1 (3%/ t / t)	NONE (n / n / n)
	FS 9.10	TRACE	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
ElSx 1	FSC 9. 1	4815.4	2926.6 (61%/56%/21%)	1436.1 (30%/27%/11%)	172.1 (3%/ 3%/ 1%)	79.0 (2%/ 2%/ 1%)	159.7 (3%/ 2%/ 1%)	36.2 (t / t / t)
	FSC 9. 3_1	4.4	1.5 (34%/ t / t)	2.8 (64%/ t / t)	NONE (n / n / n)	.1 (2%/ t / t)	NONE (n / n / n)	NONE (n / n / n)
	FSC 9. 3_2	1.3	1.3 (100%/t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
	FSC 9. 4_1	762.8	408.5 (53%/38%/ 8%)	302.3 (40%/29%/ 6%)	14.9 (2%/ 1%/ t)	35.5 (5%/ 4%/ 1%)	TRACE (t / t / t)	1.3 (t / t / t)
	FSC 9. 4_2	7767.0	6077.4 (78%/64%/31%)	1458.6 (19%/16%/ 7%)	115.2 (1%/ 1%/ t)	67.3 (t / t / t)	34.5 (t / t / t)	11.3 (t / t / t)
	FSC 9.5-7-8	.6	NONE (n / n / n)	.6 (100%/t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
	FSC 9. 6	1.6	1.3 (81%/ t / t)	.3 (19%/ t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
	FSC 9.10	1.7	1.4 (82%/ t / t)	.3 (18%/ t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
ElSx 1	FSC 4. 3	3144.8	1950.7 (62%/52%/12%)	737.5 (23%/19%/ 5%)	336.1 (11%/ 9%/ 2%)	49.6 (2%/ 2%/ t)	62.1 (2%/ 2%/ t)	4.5 (t / t / t)
	FSC 4. 4	1019.5	386.4 (38%/15%/ 2%)	261.3 (26%/10%/ 2%)	279.0 (27%/10%/ 2%)	90.6 (9%/ 4%/ 1%)	.9 (t / t / t)	.5 (t / t / t)
	FSC 4. 5	1060.7	79.4 (7%/ 4%/ 1%)	482.0 (45%/24%/ 4%)	232.8 (22%/12%/ 2%)	263.7 (25%/14%/ 2%)	.3 (t / t / t)	.8 (t / t / t)
	FSC 4. 6	47.7	22.1 (46%/ 1%/ t)	18.5 (39%/ 1%/ t)	6.4 (13%/ t / t)	.7 (1%/ t / t)	NONE (n / n / n)	NONE (n / n / n)
	FSC 4. 7	169.9	30.5 (18%/ 3%/ t)	77.1 (45%/ 8%/ t)	43.0 (25%/ 4%/ t)	19.3 (11%/ 2%/ t)	TRACE (t / t / t)	TRACE (t / t / t)
	FSC 4. 8	3.2	1.0 (31%/ t / t)	1.3 (41%/ t / t)	.9 (28%/ t / t)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)
ElSx 1	FSC 10. 1	2877.1	1254.5 (44%/25%/ 7%)	1354.3 (47%/26%/ 8%)	151.8 (5%/ 3%/ 1%)	30.5 (1%/ 1%/ t)	69.3 (2%/ 1%/ t)	11.8 (t / t / t)
	FSC 10. 2	1092.0	791.4 (72%/25%/ 6%)	249.8 (23%/ 8%/ 2%)	17.6 (2%/ 1%/ t)	8.3 (t / t / t)	7.8 (t / t / t)	16.6 (2%/ 1%/ t)
	FSC 10. 3	560.8	367.8 (66%/32%/ 2%)	94.3 (17%/ 8%/ 1%)	1.4 (t / t / t)	79.5 (14%/ 7%/ t)	3.3 (t / t / t)	14.5 (3%/ 1%/ t)
	FSC 10. 4	1438.2	885.5 (62%/38%/ 6%)	118.0 (8%/ 5%/ 1%)	1.5 (t / t / t)	361.3 (25%/15%/ 2%)	3.3 (t / t / t)	66.7 (5%/ 3%/ t)
	FSC 10. 5	1260.7	128.5 (10%/ 6%/ 1%)	909.3 (72%/ 7%/ 6%)	8.3 (t / t / t)	186.6 (15%/ 9%/ 1%)	1.7 (t / t / t)	22.5 (2%/ 1%/ t)
	FSC 10. 6	529.0	312.8 (59%/11%/ 2%)	123.4 (23%/ 4%/ 1%)	7.2 (1%/ t / t)	75.0 (14%/ 3%/ t)	6.5 (1%/ t / t)	4.1 (t / t / t)
	FSC 10. 7	58.4	23.4 (40%/ 1%/ t)	19.3 (33%/ 1%/ t)	.6 (1%/ t / t)	14.3 (24%/ 1%/ t)	.5 (t / t / t)	.3 (t / t / t)
	FSC 10. 8	1472.3	721.1 (49%/18%/ 4%)	572.8 (39%/15%/ 4%)	33.5 (2%/ 1%/ t)	130.7 (9%/ 3%/ 1%)	9.4 (t / t / t)	.5 (t / t / t)
	FSC 10. 9	667.3	198.0 (30%/11%/ 1%)	310.0 (46%/17%/ 2%)	99.3 (15%/ 6%/ 1%)	53.2 (8%/ 3%/ t)	2.3 (t / t / t)	3.1 (t / t / t)
	FSC 10.10	797.7	105.6 (13%/ 5%/ 1%)	529.8 (66%/24%/ 3%)	88.0 (11%/ 4%/ 1%)	72.0 (9%/ 3%/ t)	1.1 (t / t / t)	1.1 (t / t / t)
	FSC 10.11	905.2	195.0 (22%/ 9%/ 1%)	490.7 (54%/22%/ 3%)	141.0 (16%/ 7%/ 1%)	72.3 (8%/ 3%/ t)	3.3 (t / t / t)	1.5 (t / t / t)
	FSC 10.12	382.3	21.5 (6%/ 1%/ t)	203.2 (53%/10%/ 2%)	139.2 (36%/ 6%/ t)	17.2 (4%/ 1%/ t)	.2 (t / t / t)	TRACE (t / t / t)
	FSC 10.13	7956.1	3369.0 (42%/39%/21%)	3084.4 (39%/37%/20%)	1191.0 (15%/14%/ 8%)	67.1 (t / t / t)	201.3 (3%/ 3%/ 2%)	19.6 (t / t / t)
	FSC 10.14	1541.8	610.0 (40%/22%/ 4%)	604.3 (39%/22%/ 4%)	249.6 (16%/ 9%/ 2%)	47.3 (3%/ 2%/ t)	28.2 (2%/ 1%/ t)	.7 (t / t / t)
	FSC 10.15	1281.1	469.5 (37%/ 7%/ 3%)	535.9 (42%/ 8%/ 3%)	229.5 (18%/ 3%/ 1%)	18.8 (1%/ t / t)	24.1 (2%/ t / t)	2.4 (t / t / t)
ElSx 3	FSC 4. 2	8152.3	3719.5 (46%/37%/24%)	4059.6 (50%/40%/26%)	.5 (t / t / t)	44.4 (t / t / t)	310.8 (4%/ 3%/ 2%)	13.2 (t / t / t)
	FSC 4. 3	1829.2	1621.5 (89%/45%/15%)	96.8 (5%/ 3%/ 1%)	.5 (t / t / t)	24.6 (1%/ 1%/ t)	41.7 (2%/ 1%/ t)	43.4 (2%/ 1%/ t)
	FSC 4. 4	6285.0	2812.2 (45%/35%/18%)	3265.9 (52%/41%/21%)	1.9 (t / t / t)	18.5 (t / t / t)	25.6 (t / t / t)	159.3 (2%/ 2%/ t)
	FSC 4. 5	882.0	529.7 (60%/30%/ 9%)	301.8 (34%/17%/ 5%)	2.5 (t / t / t)	39.7 (5%/ 3%/ 1%)	1.3 (t / t / t)	5.8 (t / t / t)
	FSC 4. 6	5889.9	3674.1 (62%/58%/24%)	1651.5 (28%/26%/11%)	50.2 (t / t / t)	86.1 (1%/ 1%/ t)	101.9 (2%/ 2%/ 1%)	321.4 (5%/ 5%/ 2%)
	FSC 4. 7	469.1	157.6 (34%/ 5%/ 1%)	242.7 (52%/ 7%/ 2%)	13.2 (3%/ t / t)	43.8 (9%/ 1%/ t)	10.9 (2%/ t / t)	1.6 (t / t / t)
	FSC 4. 8	881.2	422.5 (48%/16%/ 3%)	223.3 (25%/ 8%/ 2%)	46.3 (5%/ 2%/ t)	70.6 (8%/ 3%/ t)	115.3 (13%/ 4%/ 1%)	2.4 (t / t / t)
	FSC 4. 9	529.8	97.7 (18%/ 3%/ 1%)	215.5 (41%/ 6%/ 1%)	134.4 (25%/ 4%/ 1%)	80.8 (15%/ 2%/ t)	1.4 (t / t / t)	TRACE (t / t / t)
	FSC 4.10	365.2	38.1 (10%/ 2%/ t)	222.5 (61%/12%/ 1%)	73.3 (20%/ 4%/ t)	30.7 (8%/ 2%/ t)	.5 (t / t / t)	NONE (n / n / n)
	FSC 4.11	556.9	111.3 (20%/ 4%/ 1%)	198.3 (36%/ 8%/ 1%)	179.0 (32%/ 7%/ 1%)	65.5 (12%/ 3%/ t)	2.3 (t / t / t)	NONE (n / n / n)
	FSC 4.12	731.1	63.3 (9%/ 2%/ t)	320.3 (44%/11%/ 2%)	322.1 (44%/11%/ 2%)	25.1 (3%/ 1%/ t)	NONE (n / n / n)	NONE (n / n / n)
	FSC 4.13	1439.5	148.8 (10%/ 5%/ 1%)	1170.9 (81%/36%/ 7%)	111.0 (8%/ 4%/ 1%)	7.3 (t / t / t)	1.0 (t / t / t)	.5 (t / t / t)
	FSC 4.14	467.0	6.1 (1%/ t / t)	338.5 (72%/19%/ 2%)	108.3 (23%/ 6%/ 1%)	14.7 (3%/ 1%/ t)	NONE (n / n / n)	TRACE (t / t / t)

TABLE XXXVI Continued

4 mm SHELL BREAKDOWN (grams)						
Thais canaliculata c / b / a	Littorina c / b / a	Acmaea species c / b / a	Strongylocentrotus c / b / a	Coronula species c / b / a	Land snail c / b / a	Other c / b / a
NONE (n / n / n)	1.4 (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	TRACE (t / t / t)	TRACE (t / t / t)
TRACE (t / t / t)	.4 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	2.3 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
.7 (t / t / t)	1.2 (t / t / t)	.2 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	.8 (t / t / t)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
.3 (t / t / t)	2.2 (t / t / t)	.1 (t / t / t)	.2 (t / t / t)	2.9 (t / t / t)	TRACE (t / t / t)	TRACE (t / t / t)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	.3 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
TRACE (t / t / t)	2.7 (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	TRACE (t / t / t)	TRACE (t / t / t)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
.6 (t / t / t)	2.3 (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	1.3 (t / t / t)	.1 (t / t / t)	NONE (n / n / n)
.1 (t / t / t)	.7 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	1.4 (t / t / t)	NONE (n / n / n)	.3 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
.1 (t / t / t)	2.6 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	2.2 (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)
.5 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)
NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	1.9 (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	2.9 (t / t / t)	.1 (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	.8 (t / t / t)
TRACE (t / t / t)	TRACE (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
TRACE (t / t / t)	1.3 (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	3.0 (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)
.9 (t / t / t)	.5 (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	TRACE (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)
.1 (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	1.1 (t / t / t)	NONE (n / n / n)	.3 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
.5 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
.5 (t / t / t)	3.4 (t / t / t)	.6 (t / t / t)	2.0 (t / t / t)	17.0 (t / t / t)	.1 (t / t / t)	.1 (t / t / t)
NONE (n / n / n)	1.7 (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	TRACE (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)
NONE (n / n / n)	.3 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	.6 (t t / t)	TRACE (t / t / t)	NONE (n / n / n)
NONE (n / n / n)	.5 (t / t / t)	.1 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	1.4 (t / t / t)	2.3 (t / t / t)
NONE (n / n / n)	.2 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	.5 (t / t / t)
.5 (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)	TRACE (t / t / t)	1.0 (t / t / t)
1.2 (t / t / t)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)
NONE (n / n / n)	3.8 (t / t / t)	.3 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	.6 (t / t / t)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)
TRACE (t / t / t)	.8 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	.1 (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
TRACE (t / t / t)	.3 (t / t / t)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)
NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)	TRACE (t / t / t)	NONE (n / n / n)	NONE (n / n / n)	NONE (n / n / n)

APPENDIX D

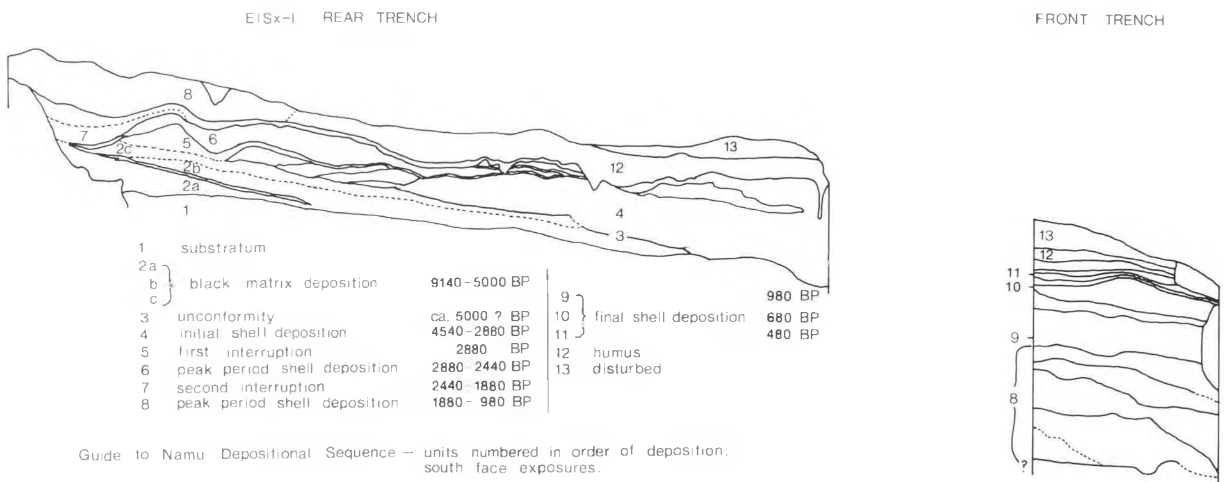
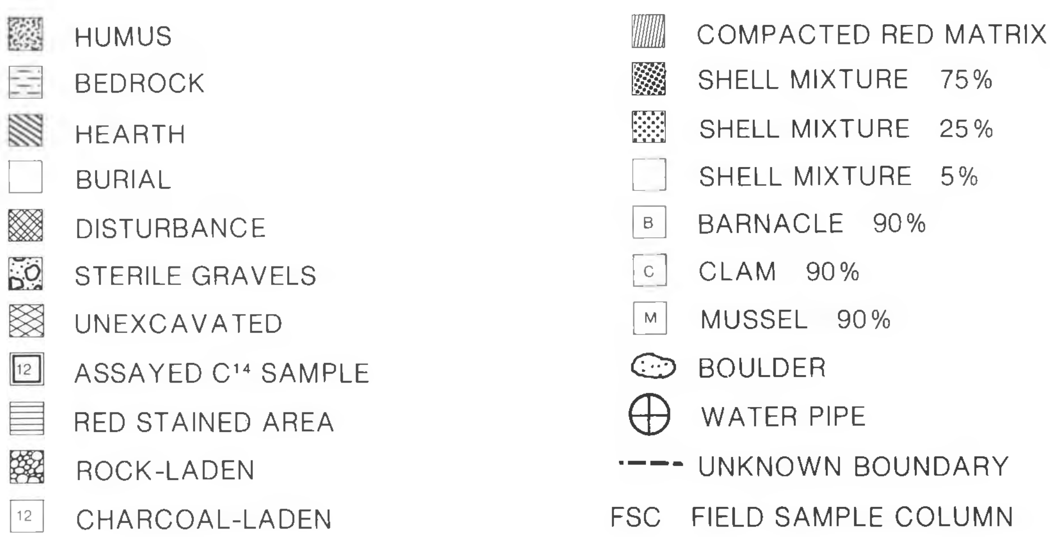


Fig. 76 Guide to Namu Depositional Sequence.



KEY TO FIGS. 77 AND 78

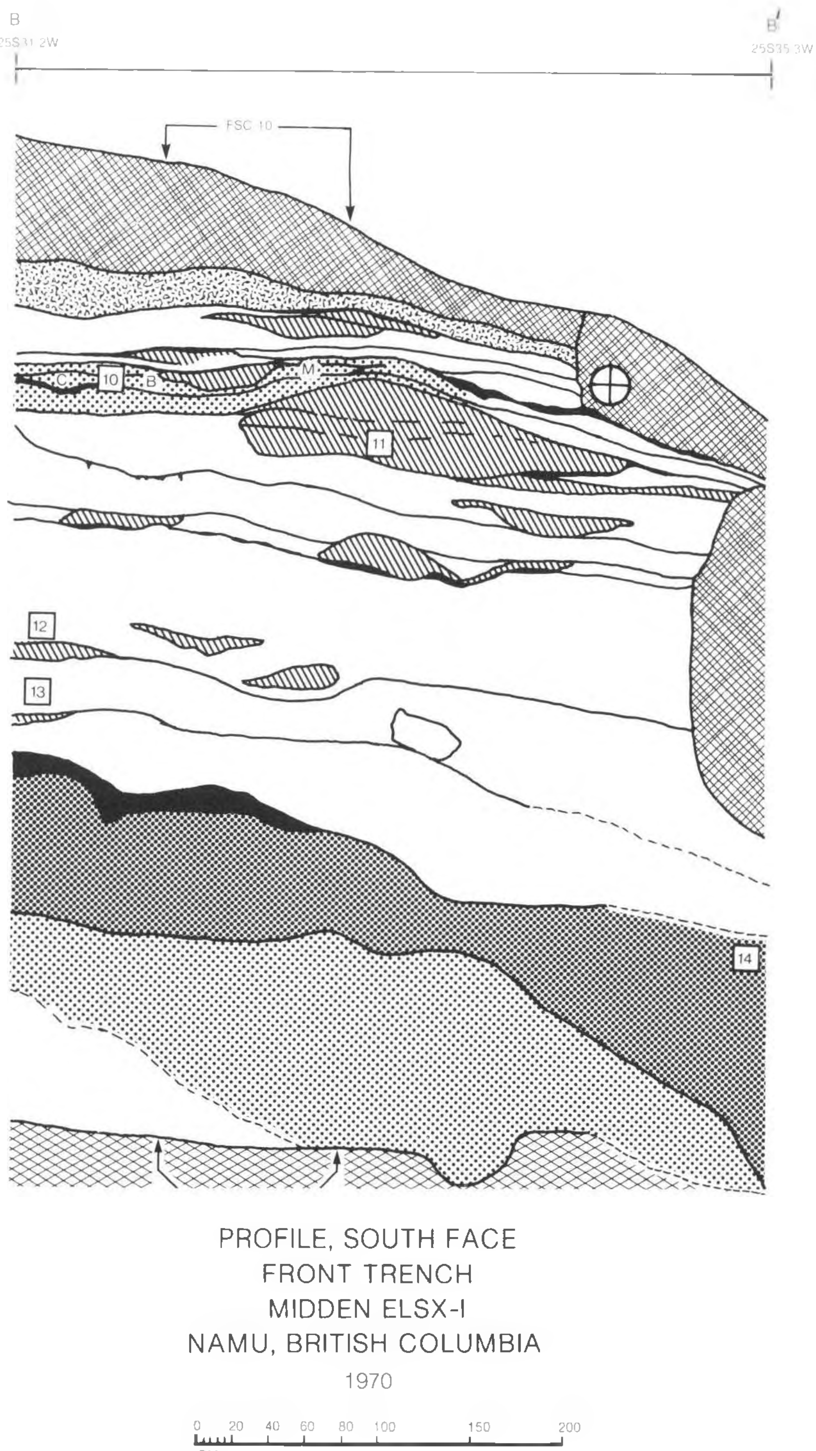
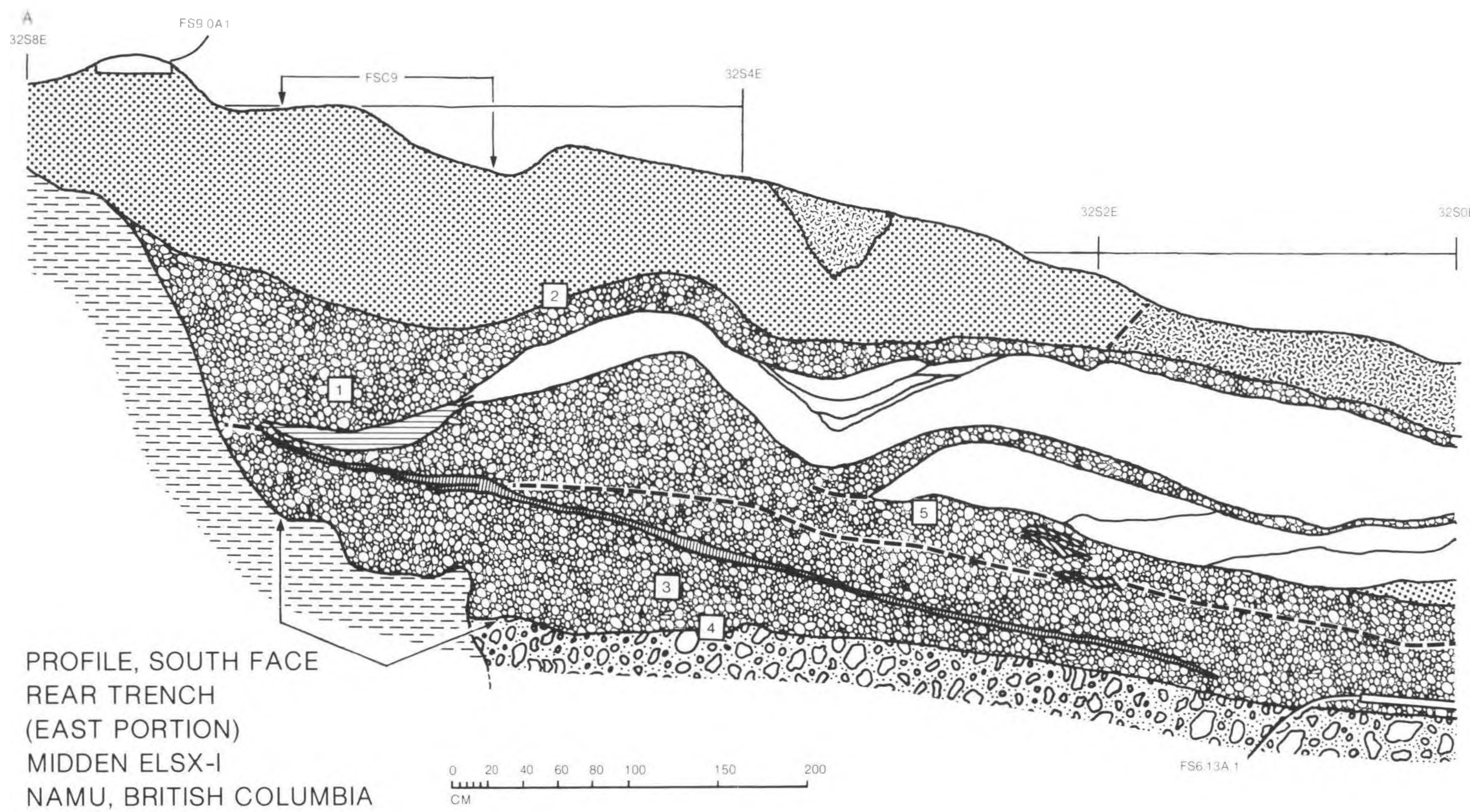


Fig. 77. South wall, front trench, ElSx 1.



PROFILE, SOUTH FACE
REAR TRENCH
(EAST PORTION)
MIDDEN ELSX-I
NAMU, BRITISH COLUMBIA
1969-70

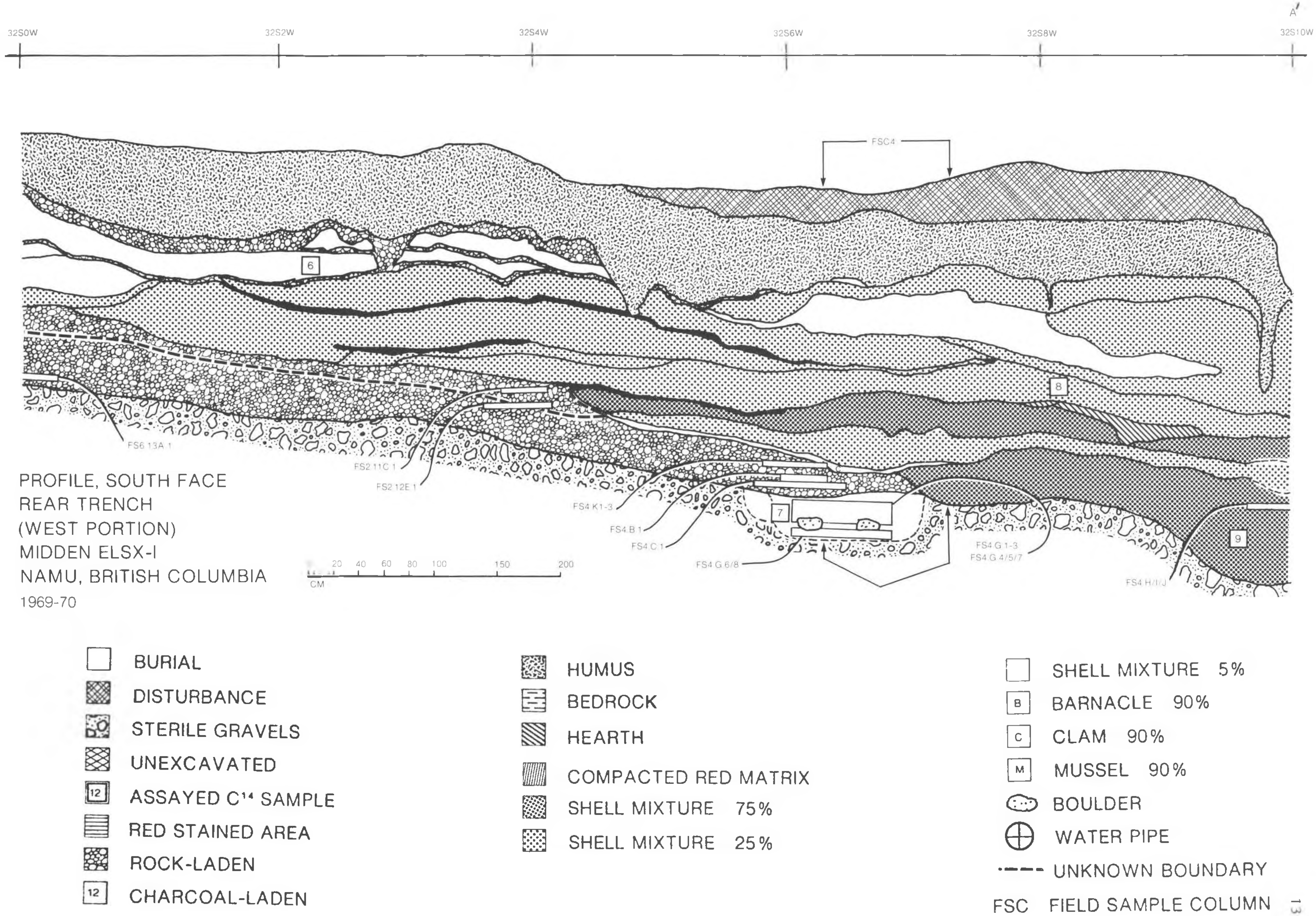


Fig. 78 South wall, rear trench, ElSx 1.

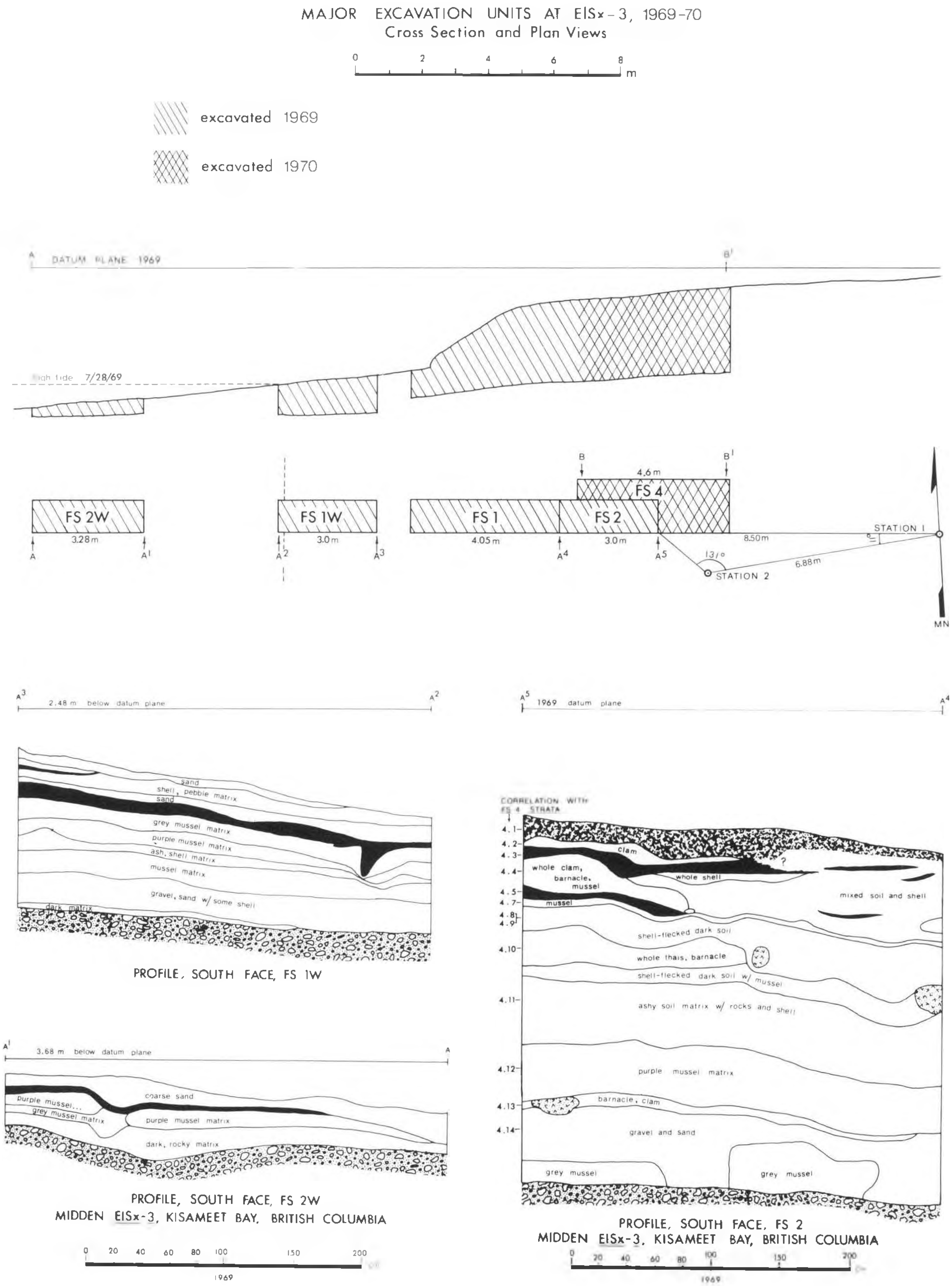


Fig. 79. Cross-section and sample profiles, Kisameet, ElSx 3.

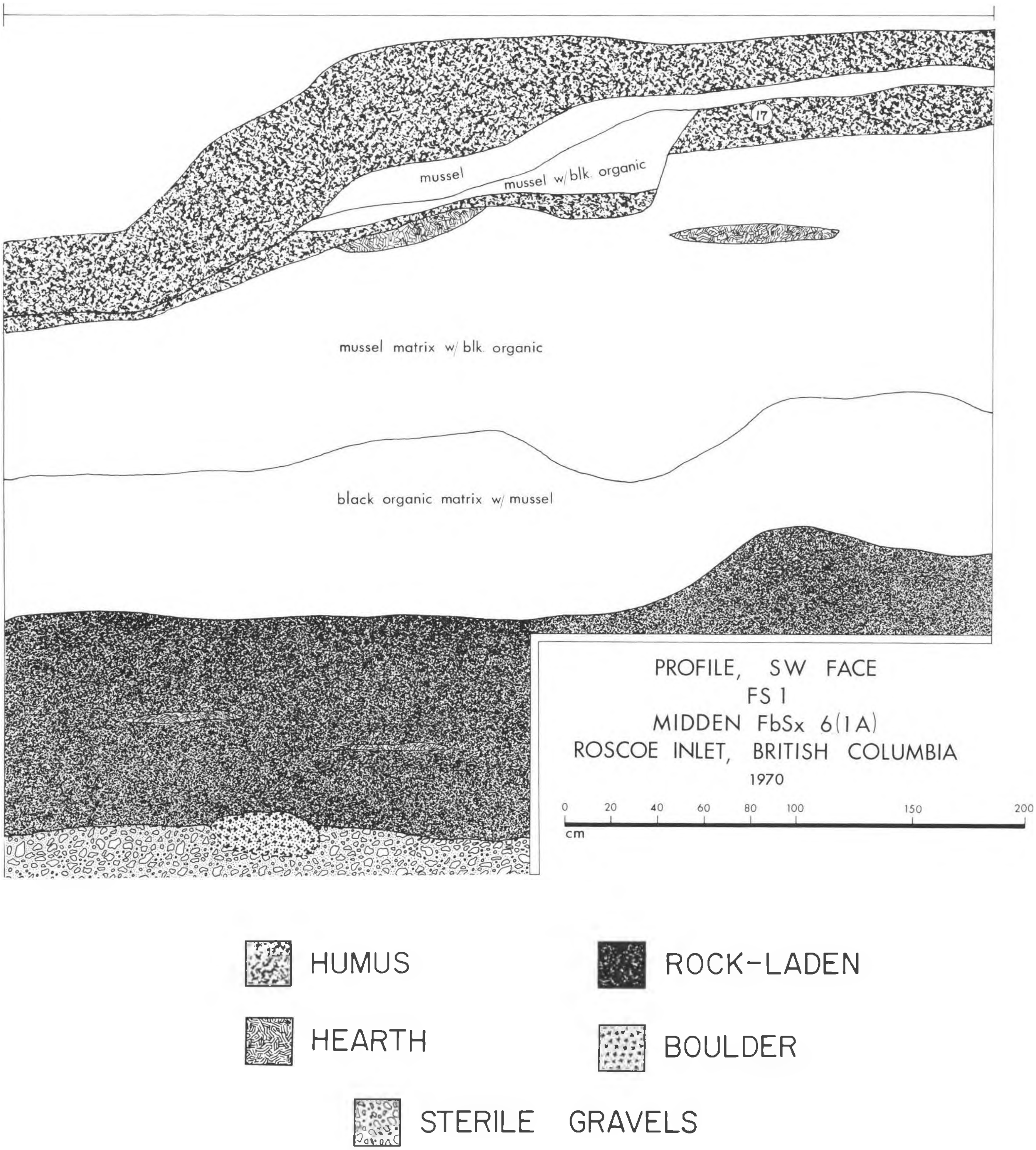


Fig. 80 Profile, Roscoe Inlet, FbSx 6.

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