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AN ARCHAEOLOGICAL SURVEY OF THE OUTER SHUMAGIN
ISLANDS, ALASKA, 1984.

L. LEWIS JOHNSON

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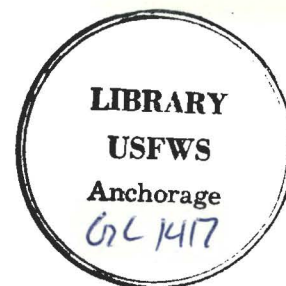
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Abstract. Archaeological sites on the Shumagin Islands could provide evidence decisive for the solution of important problems in the prehistory of the Northeast Pacific, such as: 1) the route of migration of the earliest human inhabitants of the area; 2) the nature of the cultural boundary between Aleuts and Koniag-Eskimos; 3) the locus of the genetic change from Paleo- to Neo-Aleut, and 4) the degree of cultural variation from one end of the Aleutian Cultural zone to the other.

Research in the Outer Shumagin Islands in 1984 was designed to discover whether sites existed whose study could provide solutions to these problems. The survey revealed that the occupants of Simeonof and Chernabura Islands were distinctly Aleut rather than Koniag, that at least one Shumagin site has considerable depth and that Simeonof, at least, has a high site density. These results indicate that further work will prove valuable and have led to the planning of a major expedition to undertake a detailed study of the Outer Shumagin Islands.

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INTRODUCTION

In 1966, William Workman wrote that "available published material from the Aleutians is scarce and the easternmost Aleutians in particular have been sadly neglected" (1966:145). This is an especially unfortunate state of affairs as three critical problems concerning Aleut prehistory can only be attacked in the east: 1) the location of early migration routes into the north Pacific zone; 2) the change in the physical form of the Aleut population from Paleo-Aleut to Neo-Aleut; 3) the establishment, nature and maintenance of the cultural boundary between Aleuts and Koniag Eskimos.

As the easternmost islands that can be considered part of the Aleutian Island Chain, The Shumagin Islands, situated south of the Alaska Peninsula (Fig. 1), are ideally located for investigating these problems. First, due to glacial lowering of sealevel, the south shore of the Alaska Peninsula lay in the vicinity of Chernabura and Simeonof islands when the early Aleuts reached Anangula Island (Aigner 1974, Laughlin 1980; see Fig. 2). As Chernabura and Simeonof have uplifted during the Recent epoch (Winslow n.d.), evidence of early migrations may be preserved on them. Second, Laughlin and Aigner hypothesize that the genetic shift from Paleo-Aleut to Neo-Aleut occurred "in the

eastern Aleutians, between Unalaska and the Shumagin Islands" (1975:198). Thus, Shumagin research may elucidate this process. Third, in the early historic period the boundary between Aleut and Eskimo was located at approximately 159° west longitude (Dumond 1974; Fig. 1), just to the east of the Shumagin Islands. Thus, the Shumagins are an ideal locale for studying the establishment and maintenance of this boundary.

The potential of sites in the Shumagin Islands to provide answers to these questions coupled with an historic indication of heavy occupation in the area, led me to undertake a brief survey of the Outer Shumagins in the summer of 1984. The survey was constrained by the schedule of the geophysicists with whom I travelled. I surveyed in the region of Saddler's Mistake on Nagai Island and on the west coast of Simeonof Island and tested at the Chernabura Spit Site on Chernabura Island (Fig. 3). Despite its limited extent, the survey indicated that further research in the Shumagins will be rewarding. To put my observations in context, I will briefly indicate the known and probable sites on the Outer Shumagins prior to my survey.

SHUMAGIN ISLAND SITES

HISTORICAL RECORD

The Shumagin Islands, the first Aleutian Islands found by Vitus Bering on his second voyage of discovery, were sighted on August 30th, 1741 (Golder 1922:1:140). The map which Fleet Master Safron Khitrov made of the islands during the ship's stay in them is clearly a map of the Outer Shumagins, which allows us to identify the islands discussed with great confidence (see Fig. 4). Through examining the reports of Kitrov and Georg Wilhelm Steller, the expedition naturalist, the approximate locations of three late prehistoric Aleut sites can be identified: one on the south shore of Turner Island, one on the northwest shore of Bird and the last on the west shore of Chernabura or the south end of Simeonof (Golder 1922:1:142; 2:150). In addition, the Natives whom the Russians sighted off Bird Island sat in their bidarkas with extended legs (Golder 1922:2:96). This clearly indicates that the people from Bird Island were Aleuts rather than Koniag Eskimos, since the latter kneel in their bidarkas (Laughlin 1962:121).

Between 1741 and 1839, reports on the Shumagins are few and those that exist do not mention specific site locations (see Berkh 1823; Dall 1870). In 1839, however, Ivan Veniaminov published Notes on the Islands of the Unalashka District, the most important ethnographic source on the

Aleuts. The first complete English translation of Veniaminov, by Lydia T. Black and R. H. Geoghegan, was not published until 1984. This event is particularly critical for Shumagin research because prior partial translations (Hrdlicka 1945; Jochelson 1925, 1933; Lantis 1970), while mentioning that the twelve former settlements on the Shumagins had been reduced to one, did not mention that Veniaminov had located each of the former settlements by island.

Seven of the twelve villages noted by Veniaminov are located on the Outer Shumagin Islands which are the immediate object of my research. Veniaminov lists three villages on Nagai, one on Simeonof and one on an islet off Simeonof (1984:132). Chernabura had had two villages and in Veniaminov's time was used as a temporary camp by sea otter hunters. Also,

on each of the four land necks of Chernoburoi Island is a moderately large mound [kholmik] or pyramid, about 4 arshins high, which the Aleuts call [hladgun. These mounds, composed of small round pebbles, were formed because in former times some of the old men, wanting to know how long they would live, brought the stones and threw them on top of the pile. If the stones remained on top, then this meant that they would live for a long

time, but if the stones rolled down then it meant they would die soon.

(1984:133)

Veniaminov lists no settlements on Turner or Bird Island, which may indicate that the Islanders who encountered Bering's men were at temporary summer camps rather than at permanent villages. These reports locate 9 or 10 sites on the outer Shumagins, depending on whether the site seen by Steller on Chernabura or Simeonof (Golder 1922:2:150) is one of the villages mentioned by Veniaminov.

Subsequent to Veniaminov's time the population of the Shumagins waxed during the cod fishing era and the Second World War and waned in between and subsequently. Today Unga has a few inhabitants and there is a sizable settlement at Sand Point on Popov. No one lives in the Outer Shumagins although until quite recently a hermit, Glen Woodward, lived on Simeonof. To the detriment of archaeological sites, cattle and horses have run wild on Simeonof and Chernabura.

ARCHAEOLOGICAL RECORD

Prehistoric research in the Shumagins has been minimal. Dall's (1870, 1873, 1875, 1878) and Pinart's (1875; Lot-Falck 1957; Robert-Lamblin 1976) publications on a burial cave on Unga were the only archaeological reports from the Shumagin Islands prior to Allen McCartney's survey in 1973.

McCartney spent May 30-June 19, 1973 on the M/V Aleutian Tern. During this period, he circumnavigated all of the Shumagin Islands from a distance of 50-200m offshore. The identification of archaeological sites was hindered by the ship's distance offshore; however, in the Outer Shumagins McCartney confirmed the existence of 8 sites and tentatively identified 4 others. In summarizing his survey, McCartney states that site areas are restricted in the Shumagins; that the relatively few sites known reflects a low population density, that the dearth of large midden sites suggests a "smaller population size or less intensive occupation than is typically known for the Aleut or Koniag" (1973:12), and that there appears to be no very old archaeological material in the Shumagins. The site inventory for the Outer Shumagins prior to my 1984 survey is completed by a burial site on Nagai reported by Stein (1977:2:s:490). In the summer of 1985, O. W. Frost pinpointed Bering's landing sites by comparing topographic description to terrain, and also located a prehistoric site with extensive middens on Big Koniuji Island. All the currently known prehistoric sites in the Outer Shumagins are listed in Table 1 and located on Figure 4.

TABLE 1. KNOWN AND SUSPECTED SITES IN THE OUTER SHUMAGIN ISLANDS.

ISLAND	DEFINITE SITES	POSSIBLE SITES	REFERENCE
Nagai	1		McCartney 1973
		3	Veniaminov 1984
		1	Stein 1977
		1	Johnson 1984
Turner		1	Golder 1922
Big Koniuji	1		Frost 1985
		1	McCartney 1973
Bird		1	Golder 1922
		1	McCartney 1973
Chernabura		1	Golder 1922
		2	Veniaminov 1984
	1	2	McCartney 1973
Simeonof		1	Veniaminov 1984
	6		McCartney 1973
	6		Johnson 1984
TOTAL	15	12-16	

1984 SURVEY

RESULTS

I spent two weeks in the Shumagin Islands in 1984. That time included 4 days on Nagai at Saddler's Mistake, 3 days on Chernabura and 1 1/2 days on Simeonof (Fig. 4). On Nagai and Simeonof I surveyed, locating 1 possible site on the former and 6 on the latter. The site on Nagai was located on the shore of an unnamed harbor on the North shore southwest of Saddlers Mistake. I found what appeared to be barabara circles in a cinquefoil meadow. While ground squirrel diggings revealed no bone or stone chips, the soil was dark and the depth of the site subsequently examined on Chernabura suggests that further investigation of this area is warranted. I also found an isolated harpoon point on the dunes at Saddlers Mistake (Fig. 10a). On Simeonof, I followed cattle paths around the west end of the island, from the south point to the north end. Chuck Deters, Regional Historic Preservation Officer, U.S. Fish and Wildlife Service, had recently checked McCartney's sites along the north shore of Simeonof to the east of the point and had tested at one of them (personal communication, June, 1984). Having located eroded portions of sites along the paths, I discovered that inland sections closely resembled the possible site on Nagai, having a cover of cinquefoil rather than Umbellifera. Barabara outlines varied in size,

ranging from ca. 13 by 9m at SIM 1^a to ca. 3-4m in diameter at SIM 6. At those sites which were eroding, I saw mammal and fish bone, periwinkles, limpets, other shell fragments, charcoal and lithic remains. I surface collected for diagnostic artifacts and gathered a carbon sample from one uneroded section of cliff face at SIM 1B.

On Chernabura, I surface collected and tested at the Chernabura Spit Site to attempt to identify its period of occupation and to discover whether any deposits remained in situ and how deep they were. I dug a 50cm wide trench 7m down the face of the dune at CHN 2, the small island end of the site, from the surface to clayey soil and rocks on the bottom. A cultural layer began ca. 110cm from the terrace surface and continued down to ca. 220cm. This was divided into two by a sterile layer of sand between ca. 150-160cm. The deposit was composed of periwinkles, chiton, limpet and mussel shells, fish, bird and mammal bones and a couple of lithic flakes. Given the plethora of material found on the beach below this cliff, I hypothesize that the majority of this part of the site has eroded away. At CHN 1, the main island section of the Chernabura Spit Site, there is a vegetated mound separated by a low area from a sand covered mound plus further concentrations of cobbles which may be thoroughly eroded mounds. Burials are also eroding out onto the beach. I dug a test in the eroded face of the vegetated part of CHN 1 which had reached 305cm below the surface at the time I had to leave. The cultural deposit began with a

minor midden layer from -210cm to -245cm. The main cultural deposit encountered began at -285cm and was continuing when I closed the trench. The main deposit included lithic and bone artifacts as well as food remains, fish fins, bird and mammal bone, chiton, periwinkle and mussel being recognisable.

The lithic artifacts from Simeonof and Chernabura form a typical Aleutian series, including blades and blade cores, many unifacially retouched artifacts and chipped projectile points (see Figs. 5-12). Also typical of the Aleutians is the bone work found on Chernabura: splitting wedges (Fig. 7b,f), harpoon styles (Figs. 5k,l & 7a) and the fishhook (Fig. 5o). Finally, the presence of obsidian and the low proportion of ground stone forms a strong contrast to Kodiak industries (William Laughlin and Allen Harper, personal communication, July 1985).

INTERPRETATION

Despite the short time I spent in the Shumagins, I was able to shed light on a number of critical issues. First, the stress on blade manufacture and unifacial marginal retouch in my collections from Chernabura and Simeonof suggests that the Shumagin sites may extend back in time and thus preserve evidence of early migration routes. Second, skeletal material is found at the Chernabura Spit Site. While the surface remains appear to be Neo-Aleut (William

Laughlin and Allen Harper, personal communication, July 1983), Paleo-Aleut remains may be found deeper in the site. Third, as mentioned above, the artifactual remains seem distinctively Aleut rather than Koniag.

In addition to their intrinsic characteristics, the materials found seem typically Aleutian in sharing features with many other industries while having their own regional distinctiveness. Table 2 indicates the associations I have been able to find between my Shumagin material and artifacts in available publications. It shows that similar tools are found from the Near Islands to the base of the Alaska Peninsula, dating from ca. 6000 to ca. 400 years ago. On the other hand, I have not been able to find any tools strongly similar to the spear shaft in Figure 7a or the labret in Figure 7e. The collection from SIM 1B (Figs. 9; 12) also seems quite unusual in its details, although clearly Aleut overall.

I have also found my preliminary results to be at variance with those of McCartney on some issues. First, McCartney comments on the inexplicable dearth of sites in the Shumagins (1973:11). My survey raised the number of sites on a 7 km stretch of Simeonof Island from 2 to 8, which suggests that the dearth is due more to the paucity of field studies than to an absence of sites. At least on Simeonof, many sites are not marked by stands of dark green Umbellifera but rather have a cover of yellow cinquefoil not

TABLE 2. SPECIFIC TOOL RESEMBLANCES BETWEEN OUTER SHUMAGINS AND ALE

SHUMAGIN SITE	FIGURE	OTHER SITE	LOCATION	ROUGH DATE B.P.
Chernabura 1	5a	Brooks River Falls	Upper Peninsula	1350-950
		Shemya and Attu	Near Islands	2450-450
	5b	Krugloi Beach	Upper Peninsula	1350-950
		Izembek 1	Lower Peninsula	925
		Izembek 3, House 1	Lower Peninsula	1235
		Port Moller	Mid-Peninsula	2950-1900
	5c	Izembek 1	Lower Peninsula	925
	5d	Takli Cottonwood	Upper Peninsula	2950-1900
		Late Ocean Bay 1	Kodiak Island	4600-4400
	5k	Unalaska	Fox Islands	1950-450
		Port Moller	Mid-Peninsula	2950-1900
	5o	?	Eastern Aleutians	?
Chernabura 2	8a	Takli Alder	Upper Peninsula	5950-4950
		Shemya	Near Islands	2450-450
	8b	Izembek 2	Lower Peninsula	760
Simeonof 1	9b	?	Rat Islands	1350-450

UTIANS, ALASKA PENINSULA AND KODIAK.

REFERENCE

- Dumond 1971:Fig. 6d
McCartney 1984:Fig. 14f
Dumond 1971:Fig. 7a
McCartney 1974:Fig. 4d
McCartney 1974:Fig. 8b; 1984:Fig. 6
McCartney 1984:Fig. 4a
McCartney 1974:Fig. 4c; 1984:Fig. 6j
Dumond 1971:Fig. 5e
Clark 1984:Fig. 3e
McCartney 1971:Fig. 3D
McCartney 1984:Fig. 51
McCartney 1969:Plate 1r, last
Dumond 1969:Fig. 3g
McCartney 1974:Fig. 7E; 1984:Fig. 14e
McCartney 1974:Fig. 15a
McCartney 1977:Fig. 93f, g

noticeably different from the surrounding terrain. This lack of vegetation contrast makes site identification by remote observation more difficult. Chuck Deters (personal communication, November 1985) hypothesizes that the lack of Umbellifera is due to its being unable to withstand trampling by cattle. However, the absence of Umbellifera on the possible Nagai site, where there are no cattle, suggests that factors besides cattle may be involved.

McCartney also found no large midden sites and no old material in the Shumagins. However, my test excavation in the Chernabura Spit Site had reached a depth of 3m and I was in the middle of a rich cultural layer when my transportation arrived to take me away. Furthermore, the blade core, blades and finely made points from the Small Island end of the Chernabura Spit Site (CHN 2; Figs. 6 & 8) suggest that this site may have some time depth to it (radiocarbon dating for these sites is in process). This possibility is strengthened by the Holocene uplift history of the Islands, with tilting placing portions of past Simeonof and Chernabura coastlines well above current sea level (Winslow n.d.).

The work on Simeonof and Chernabura proved interesting in other ways as well. First, in discussing the Izembek materials, McCartney stated: "Once slate grinding begins in the Katmai-Kodiak region, at the expense of stone flaking, the adjacent areas which have slate tend to be the areas which show a strong ground stone industry" (1974:79).

Veniaminov mentions the presence of slate deposits on Nagai and Big Koniuji (1984:22,131) while my collections from neighboring Simeonof and Chernabura do not show a strong ground stone industry. Thus we must rethink the relationship between culture and resources, at least as far as the use of lithic resources goes. Second, one of the highly eroded mounds on the Chernabura Spit Site was covered with a layer of periwinkle shells and they were also found in the Chernabura deposits, seeming to contradict David Yesner's statement that periwinkles were not eaten by the Aleuts (1981:155). Third, on the small island at the north end of Chernabura, a possible umqan (Aigner and Veltre 1976) was found. Finally, the relationship of the two Chernabura sites across an eroding spit from one another seems quite comparable to the situation found by Turner and Turner (1974:28) on Akun between the Chulka and Hot Springs sites.

ALEUT-ESKIMO BOUNDARY

On the north shore of the Alaska Peninsula, a linguistic boundary divided the Aleut from the Aglegmiut Eskimo; on the south shore and in the north Pacific, the separation was between Aleut and Koniag Eskimo. Although the existence of a linguistic border between Aleut and Eskimo was recognized by the earliest Russian explorers, events in the Russian colonial epoch obscured it. The Russians moved the Aleuts around a great deal, first,

because only Aleuts could efficiently hunt the precious sea otter, and second, because the population declined so greatly that the Russians had to consolidate the remaining natives in order to efficiently exploit them. In addition, despite their recognition of the linguistic difference between the Aleuts and the Koniags, the Russians tended to call all of the Pacific Islanders "Aleuts."

The present fragmentary archaeological record from the Aleut /Eskimo boundary area is neither consistent nor easy to interpret. On the north side of the Alaska Peninsula, the archaeological remains do not point to a distinct boundary. Work at the Hot Springs Site at Fort Moller (Dumond et al. 1975; McCartney 1969; Okada and colleagues, various; Weyer 1930; Workman 1966; 1984) and at sites around Izembek Lagoon (McCartney 1974; Turner and Turner 1974) has not resulted in a clear division of Aleut from Eskimo: sites on the northwest end of the Peninsula seem distinctly transitional. To the south, however, the Outer Shumagin sites seem clearly Aleut while the sites on Kodiak Island are definitively Koniag.

Ecologically, the situation is reversed. On the north, Bristol Bay is the southern limit of reliable winter sea ice, while Port Moller never encounters sea ice (Yesner 1983). Between Bristol Bay and Port Moller, the irregular presence of sea ice prohibits the development of shellfish beds while discouraging an ice hunting adaptation. To the south of the Alaska Peninsula, on the other hand, there is

no discernible ecological boundary along the entire length of the Pacific Coast and the bordering ocean.

Bringing together the archaeological and ecological records, Yesner (1985) has suggested that the boundary between Aleuts and Aglegmiut Eskimo on the north side of the Alaska Peninsula coincides with this marginal ecological zone in which neither typical Eskimo nor typical Aleut resources are reliable from year to year. Thus, Aleut and Aglegmiut were separated by a natural buffer zone which neither could exploit regularly. Ethnohistorically, this can be recognised in the fact that the Aleuts considered the Aglegmiuts to be "friends," archaeologically by the mixing of Aleut and Eskimo technologies. On the other hand, Yesner does not find this ecological buffer zone in the south. I hypothesize that the southern boundary was maintained by active cultural conflict in the absence of any ecological differentiation. Three kinds of evidence support this interpretation: 1) linguistic: the very word Koniag is Aleut for "enemy" (Milan 1974:16, footnote); 2) ethnohistoric: Veniaminov states that Shumagin villages dwindled due primarily to the depredations of the "Koniags or Kad'iak Islanders, their bitterest enemies" (1984:128); 3) archaeological: the clear, one might almost say defiant, Aleut character of the Shumagin industries. Thus, boundaries were maintained in quite different ways on the two sides of the peninsula, by intermittent sea ice in the north and by competition and aggression in the south.

In evaluating this hypothesis, the Shumagin Islands, lying on the boundary between Aleut and Koniag, are of critical importance. The definite Aleut character of the materials I collected on the Shumagins, which contrasts so strongly with the transitional character of the Izambek Lagoon and Port Moller assemblages on the north side of the Alaska Peninsula, supports the hypothesis of differential boundary maintenance. Proof of the hypothesis must await further research in the Shumagin Islands.

SUMMARY AND CONCLUSIONS

The Shumagin Islands are particularly important archaeologically because of their location on the border between Eskimo and Aleut cultural zones. My 1984 survey of the Outer Shumagin Islands has revealed that site density is higher than previously thought; that the occupants of the sites found on Chernabura and Simeonof were distinctly Aleut rather than Koniag, and that at least one Shumagin site has appreciable depth. It also showed that archaeological sites on the Shumagins are not necessarily marked by Umbelliferas, that Shumagin Aleuts, at least, did use periwinkles, and that the Chernabura Spit Site does still retain significant deposits. These results indicate that the area merits further study and they have already forced a re-evaluation of boundary relationships between Aleut and Koniag Eskimo which will be clarified by future work in the area.

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FIGURE CAPTIONS

Figure 1: Location Map. Shumagin Islands, Peninsular and Aleutian sites mentioned in text, and historic Eskimo-Aleut Boundary.

Figure 2: Late Pleistocene Sea Levels in the Shumagin Island Region. Underwater contours indicate representative past beach lines.

Figure 3: Outer Shumagin Islands.

Figure 4a: Saffron Khitrov's Map of the Shumagin Islands, Sept. 3, 1741 (Golder 1922:2:76).

Figure 4b: Modern Map of the Shumagin Islands at approximately the same scale (1:1,000,000; from Alaska Geographic vol. 7:3, 1980)

Figure 5: Artifacts from the Main Island end of the Chernabura Spit Site. a-d: Projectile Points; e, f: point fragments; g: end retouched piece; h: flake retouched bifacially on left edge, unifacially on right; i: bladelet;

j: ground slate ulu fragment; k,l bone harpoons; m: engraved bone tube; n: cut bone; o: bone composite fish hook prong.

Figure 6: Core, Blades and Unifacially Retouched Stone Tools from the Small Island end of the Chernabura Spit Site.

a: blade core; b-f: bladelets; g,j-l: flakes with right lateral marginal retouch, j and k broken; h: broken flake or blade with fine marginal retouch on both edges; i: flake or blade unifacially retouched to a point, broken; m: burin; n, p-r: blade-like flakes with dorsal marginal retouch around most of margins; o: flake fragment with retouch along left lateral edge.

Figure 7: Bifacially Retouched Stone Tools from the Small Island end of the Chernabura Spit Site. a,b: projectile

points; c-f: projectile point fragments; g: broken flake/blade with bimarginal retouch on both long edges; h: rectanguloid with bimarginal fine retouch on all but proximal edges; i: flake fragment with bimarginal retouch on distal end; j: completely bifacially retouched nubbin; k: broken piece with rough bimarginal retouch; l,m: bifacially retouched rectanguloids.

Figure 8: Ground Stone and Bone Tools from the Small Island end of the Chernabura Spit Site. a: bone harpoon; b,f: bone wedges; c,h,i: cut bone fragments; d: ground slate ulu fragment; e: jet labret; g: worked bone object.

Figure 9: Artifacts from Simeonof Site 1B. a-c: projectile points; d-g, i: projectile point fragments; h: broken piece with alternate marginal retouch; j-o: blades, some with edge nibbling; p: microblade core; q,r: fragments with bimarginal retouch on left edge; s: flake with distal dorsal retouch; t: flake fragment with steep dorsal retouch on both lateral edges; u: obsidian flake fragment; v: blade fragment, dorsally retouched on left edge, bimarginal retouch on left edge; w: ground slate ulu fragment; x: flake fragment with distal dorsal retouch; y: bifacially retouched stem fragment.

Figure 10: Artifacts from Nagai and Simeonof. a: harpoon; b,c,f: flakes; d: flake with marginal dorsal retouch; e: pseudo-levalllois core.

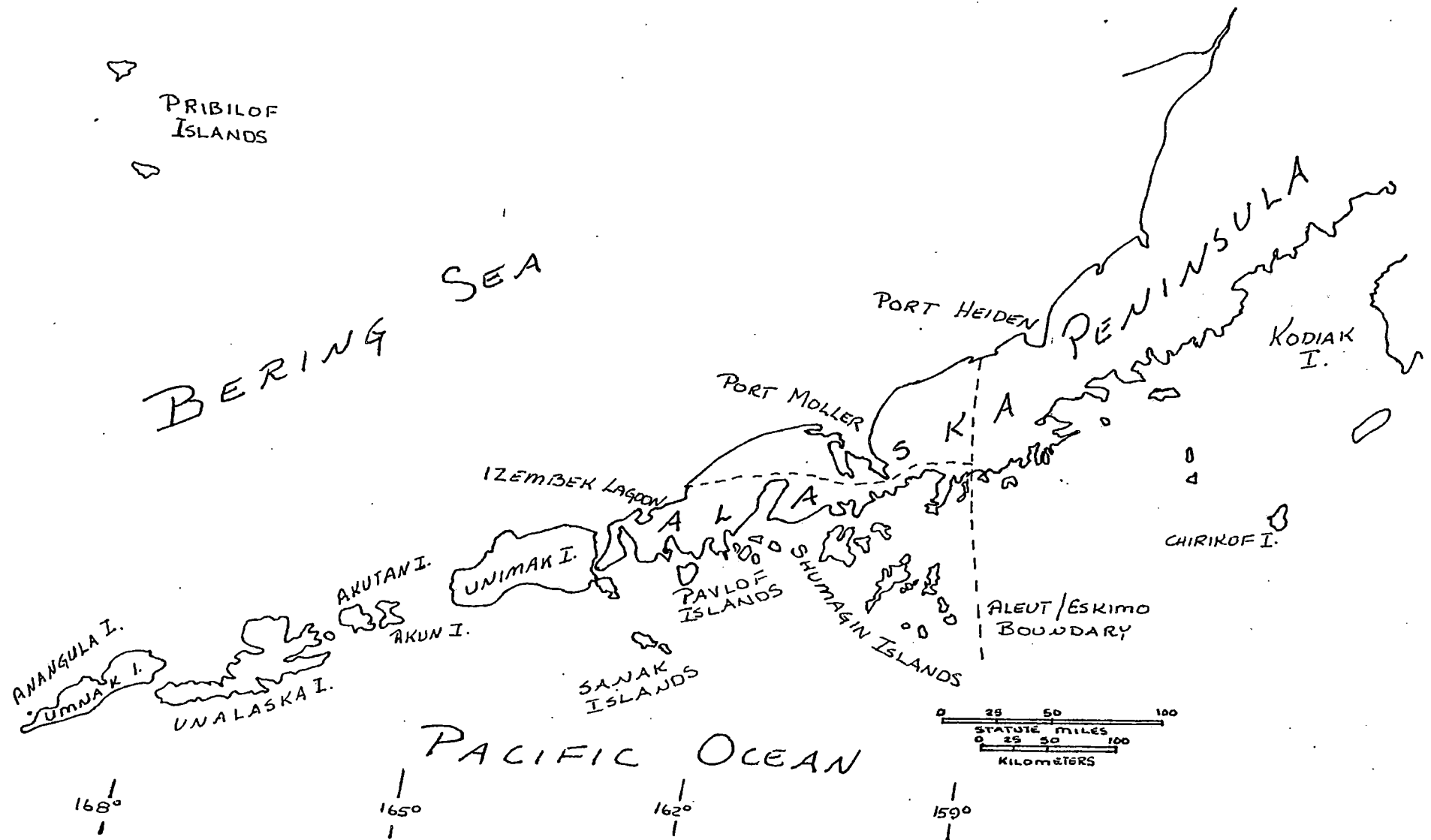
Figure 11: Artifacts from the Small Island end of the Chernabura Spit Site. a: blade core (see Fig. 6a); b-f: unimarginal retouched blades(see Fig. 6n, n, p, 1, q). Nos. b and f are upside down from photo.

Figure 12: Cores from Simeonof. For Sim 1B, see Figure 9p. For Sim 3, see Figure 10e.

FOOTNOTE

1 Field numbers for sites are quoted throughout. Alaska Heritage Resources Survey numbers are in process.

Figure 1



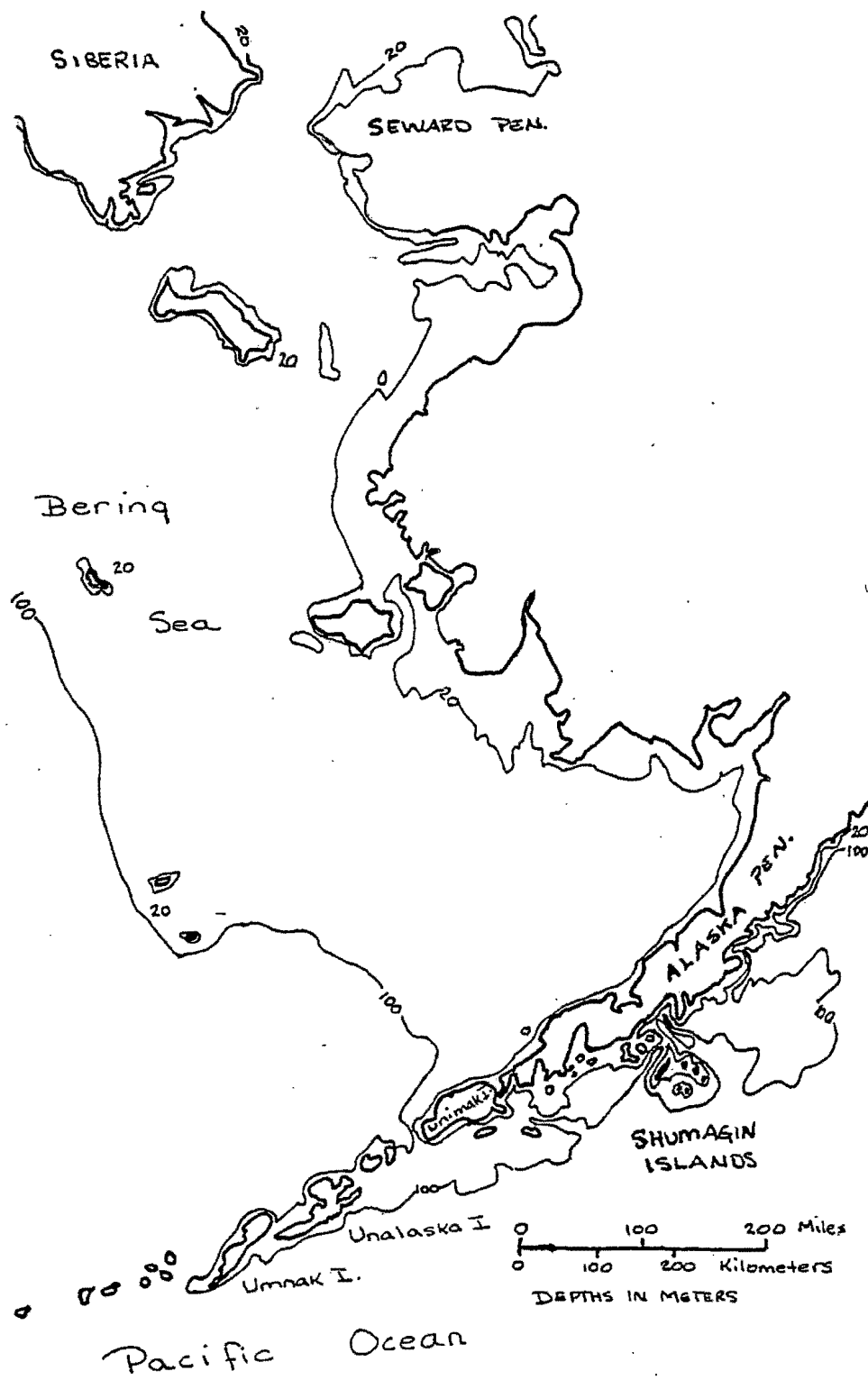
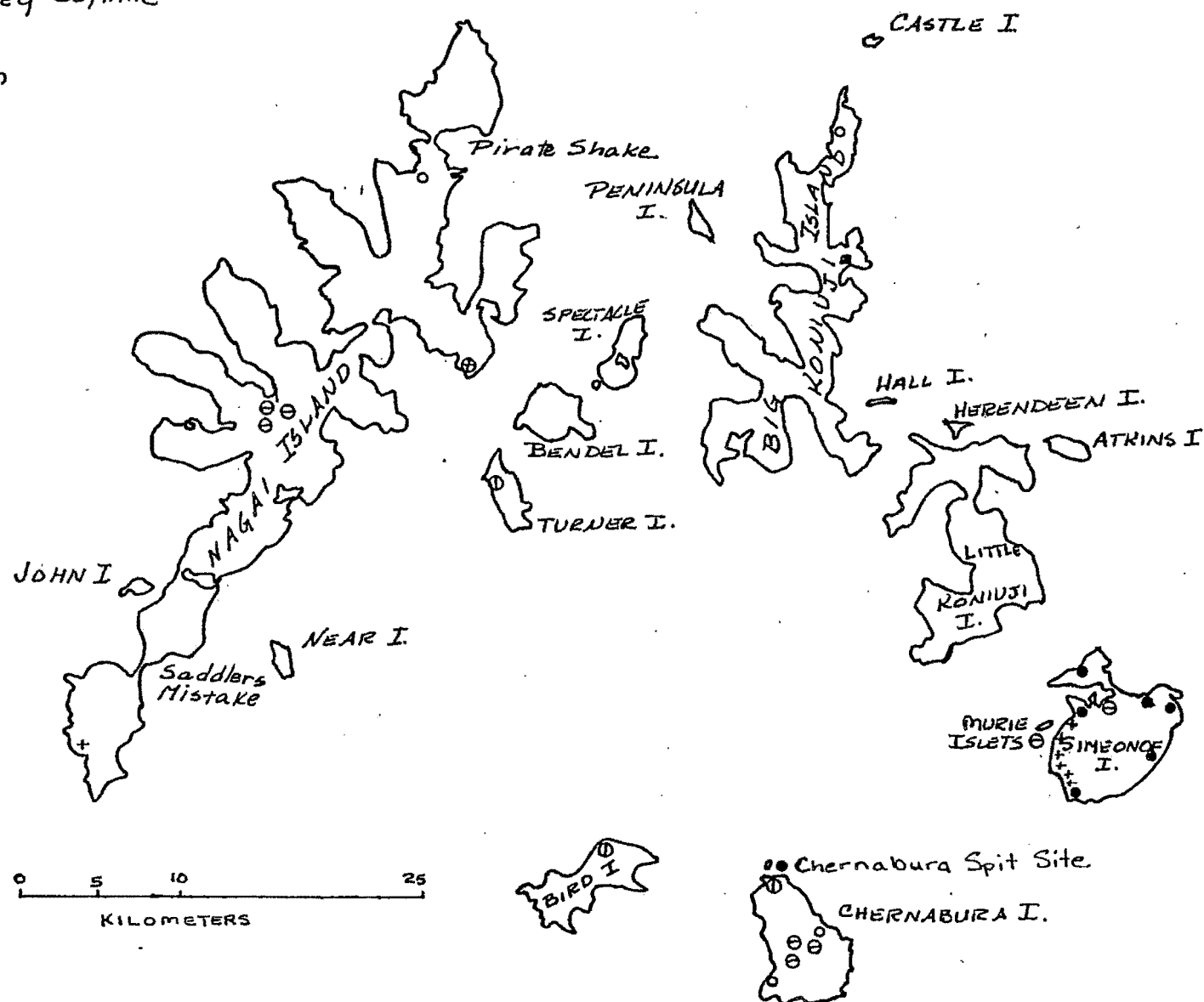


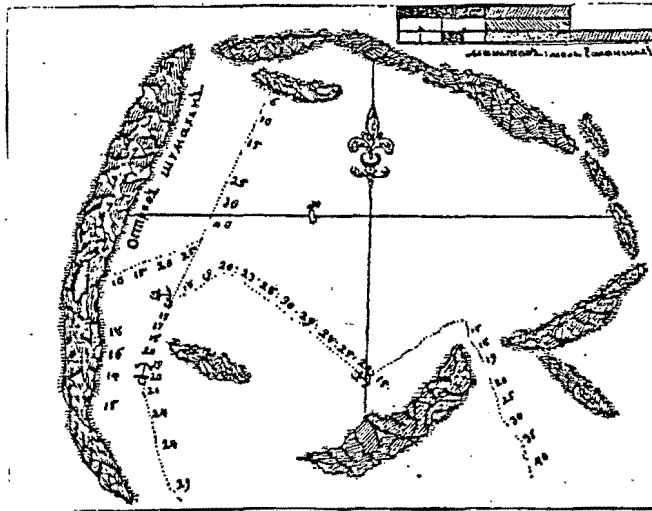
Figure 2

SITE KEY

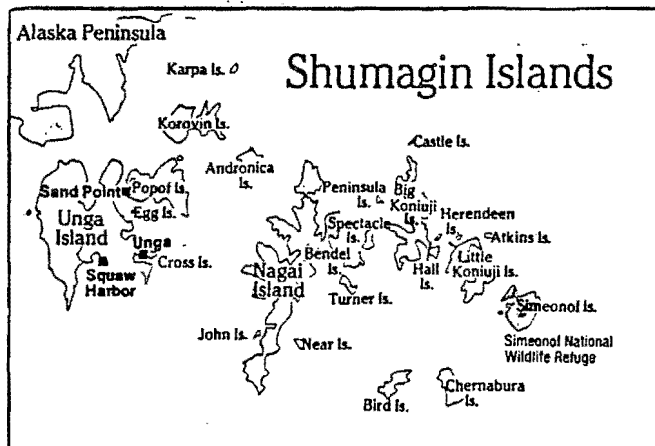
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- ⊖ Veniaminov
- McCartney possible
- McCartney definite
- ⊕ Stein
- + Johnson
- Frost

Figure 3





a



b

Figure 4

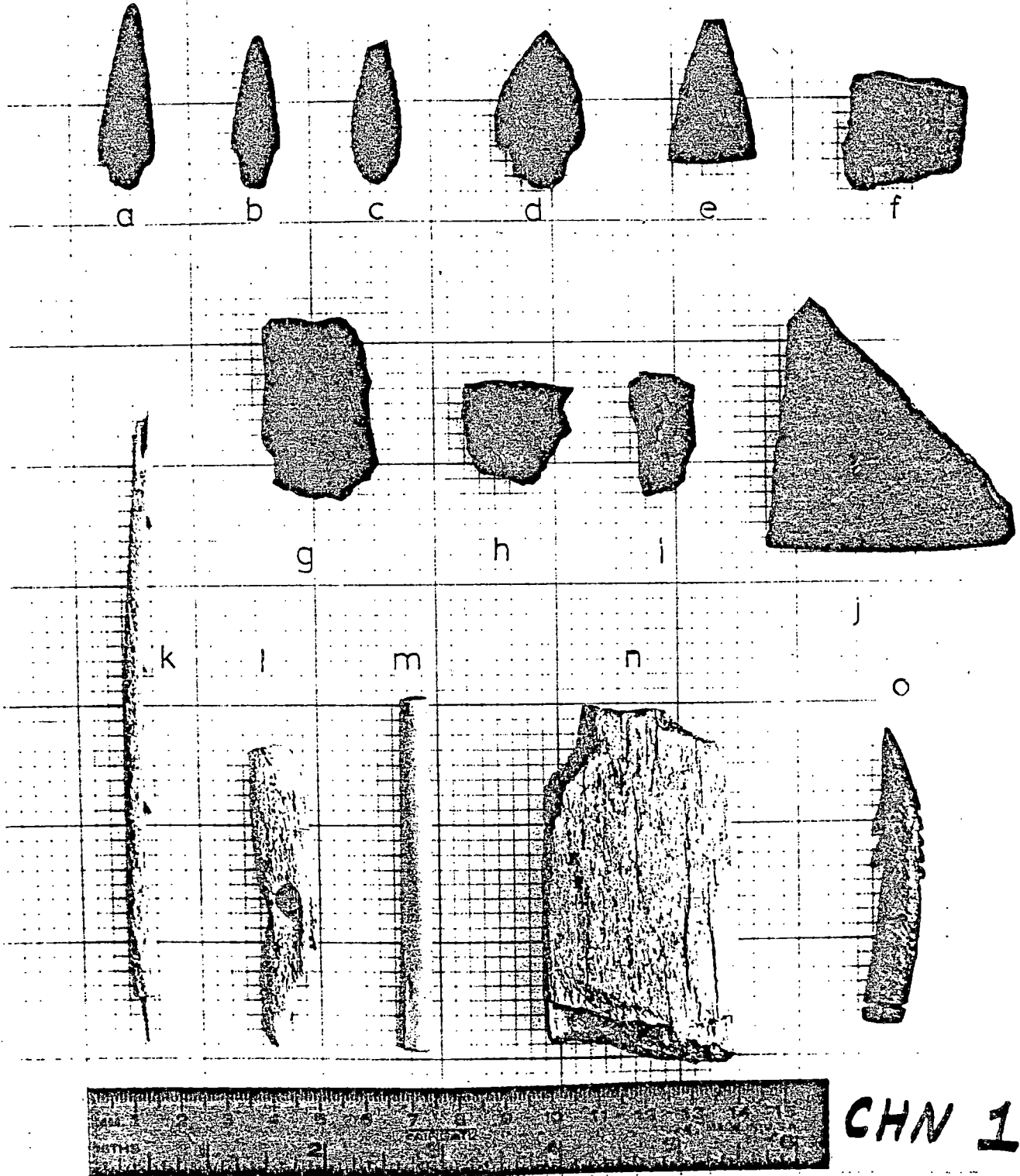
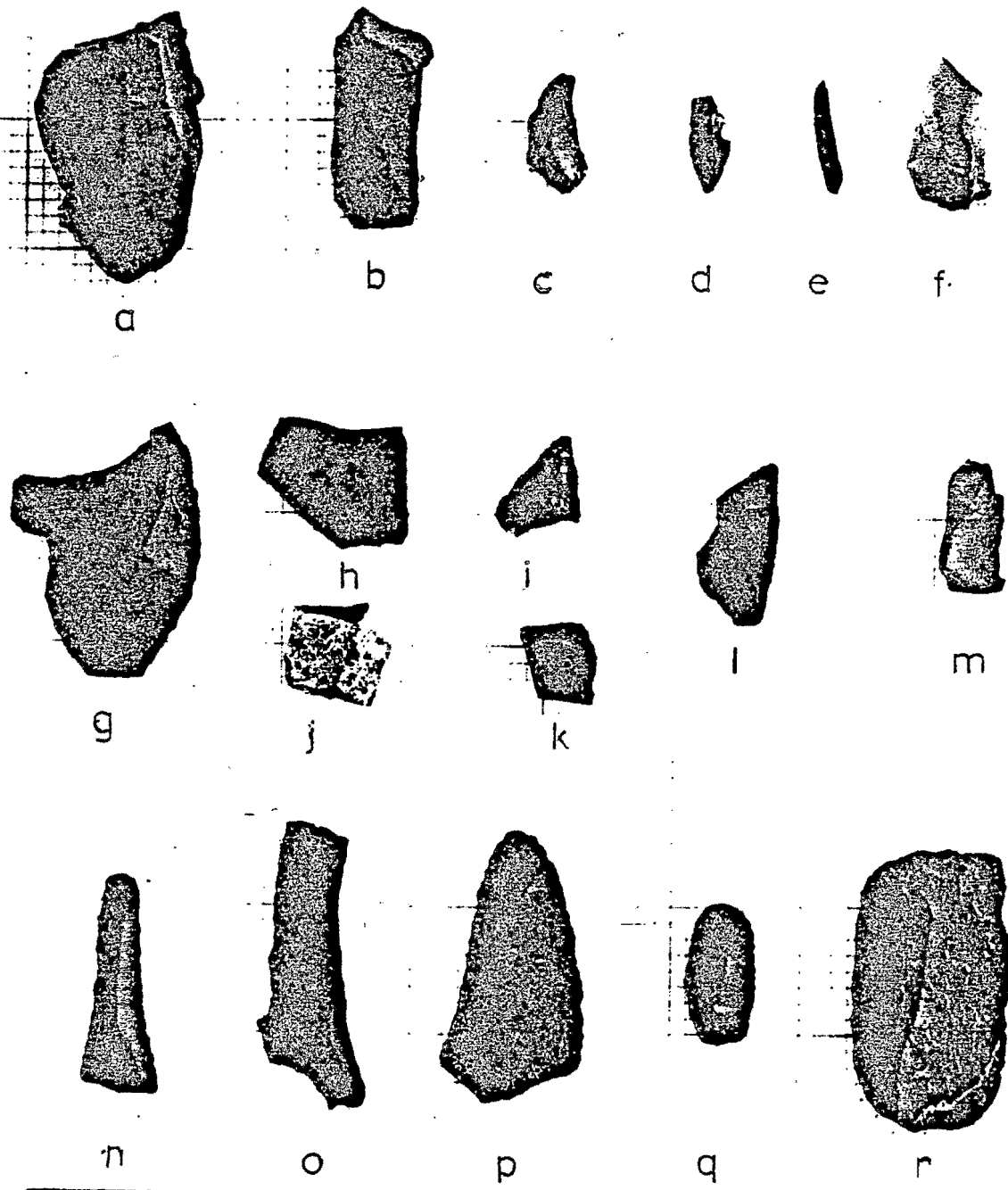


Figure 5



CHN 2

Figure 6

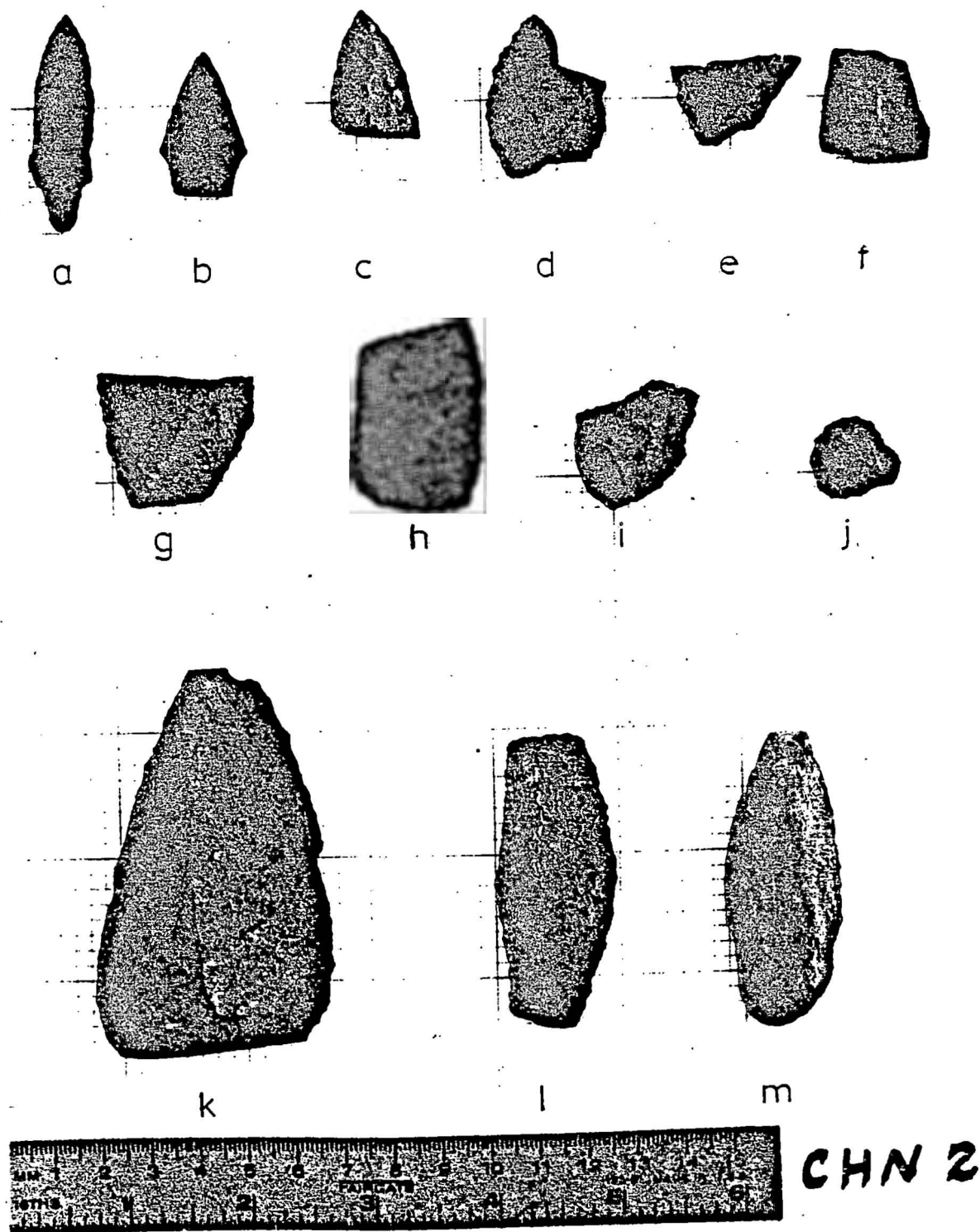


Figure 7

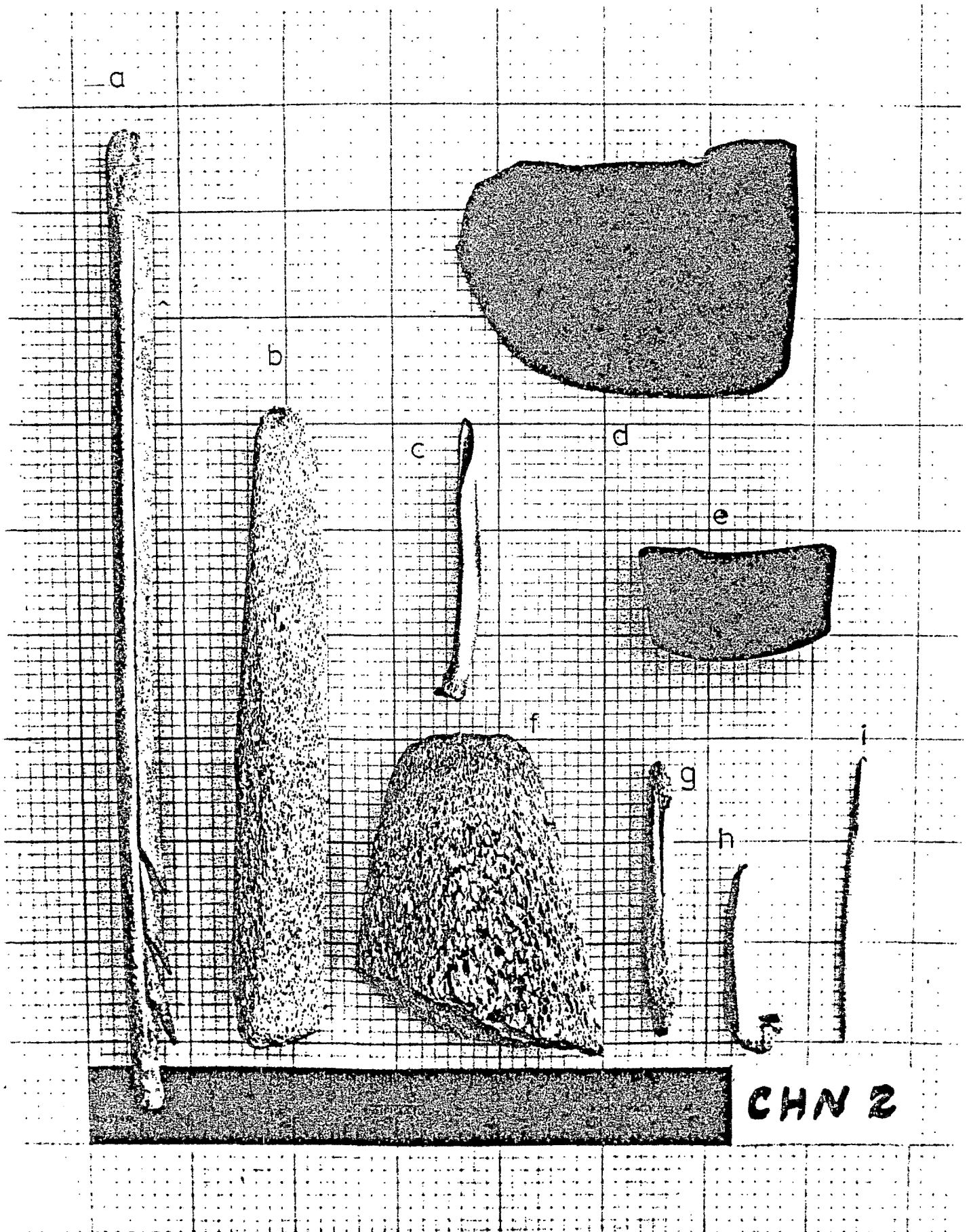
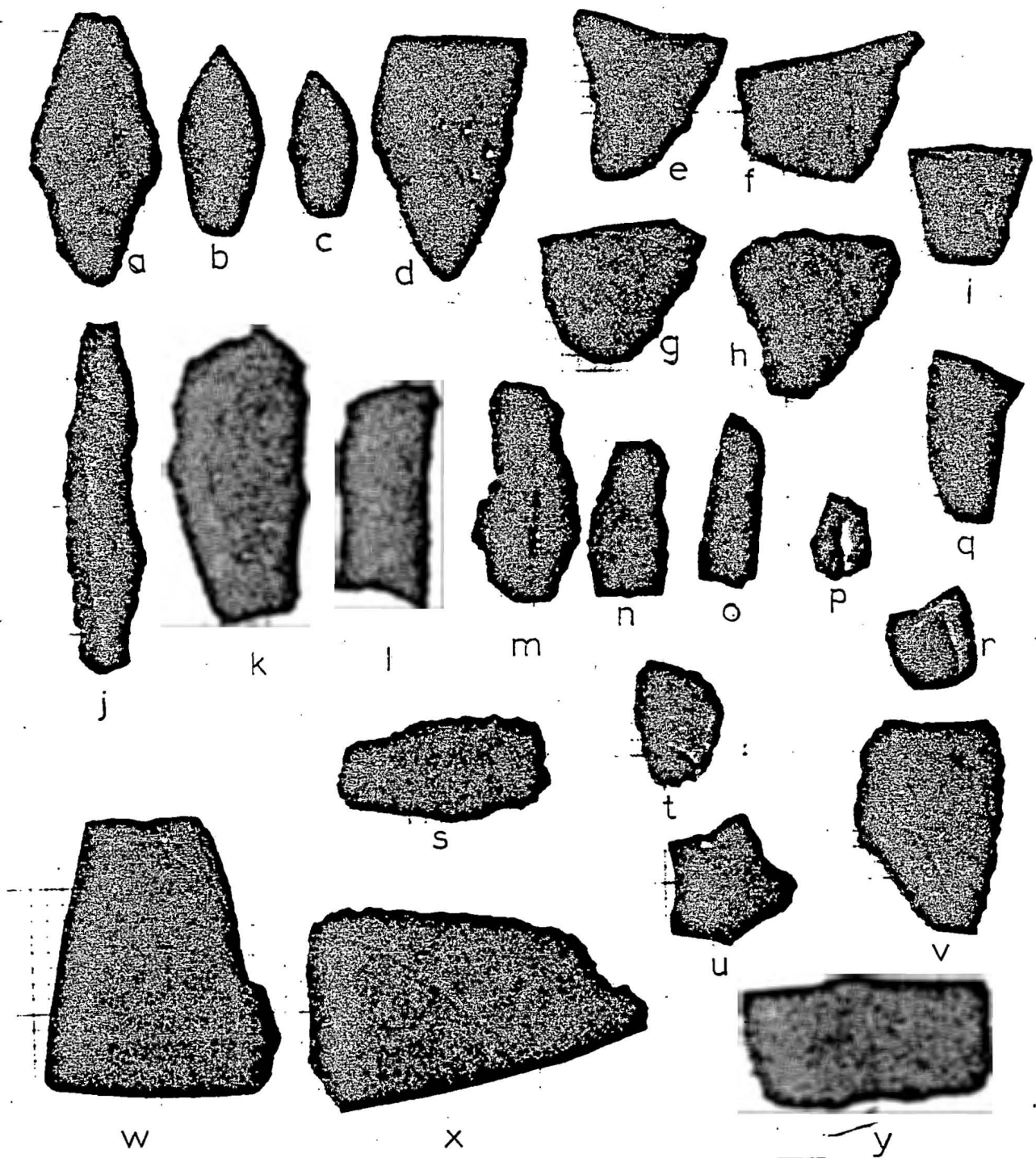


Figure 8



SIM 1B

Figure 9

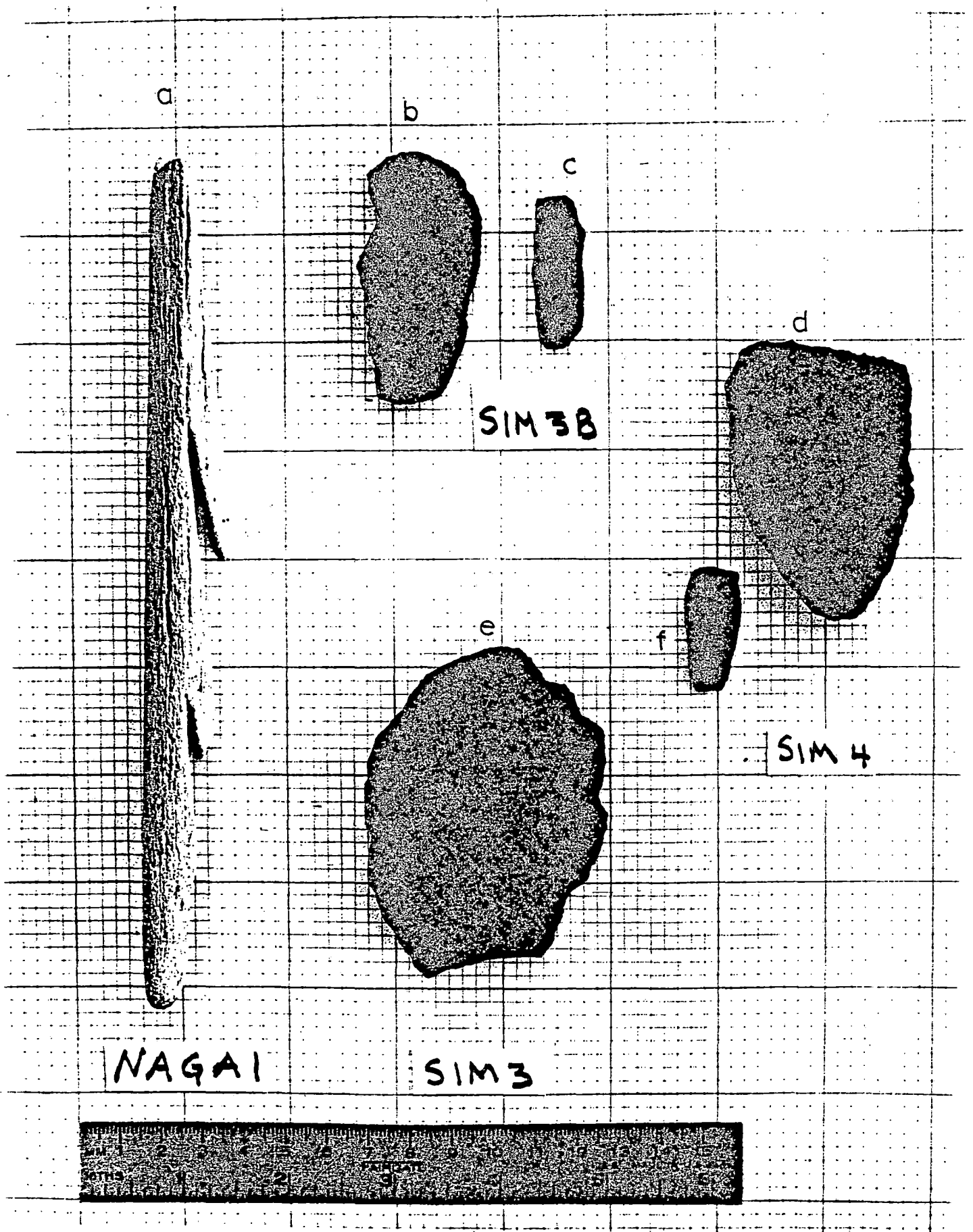
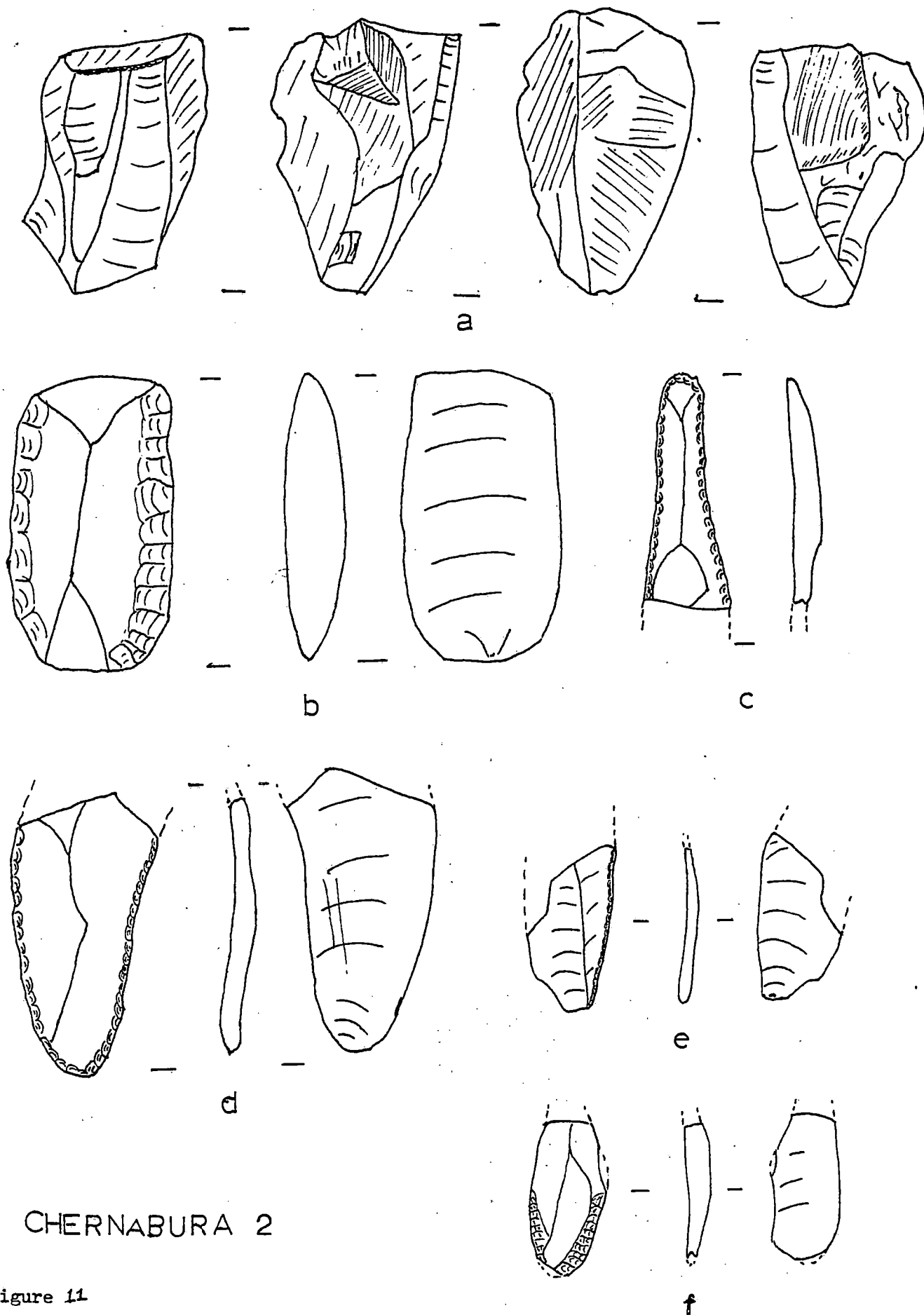
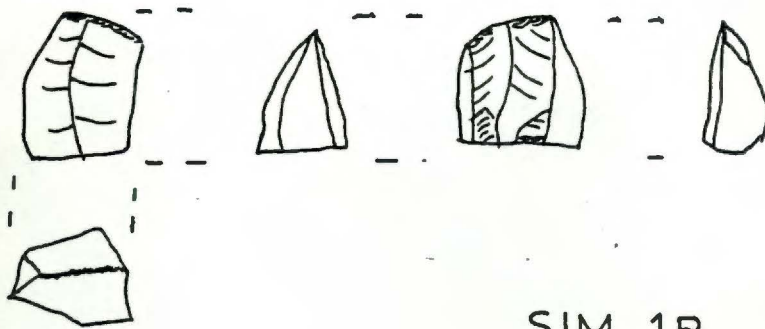


Figure 10

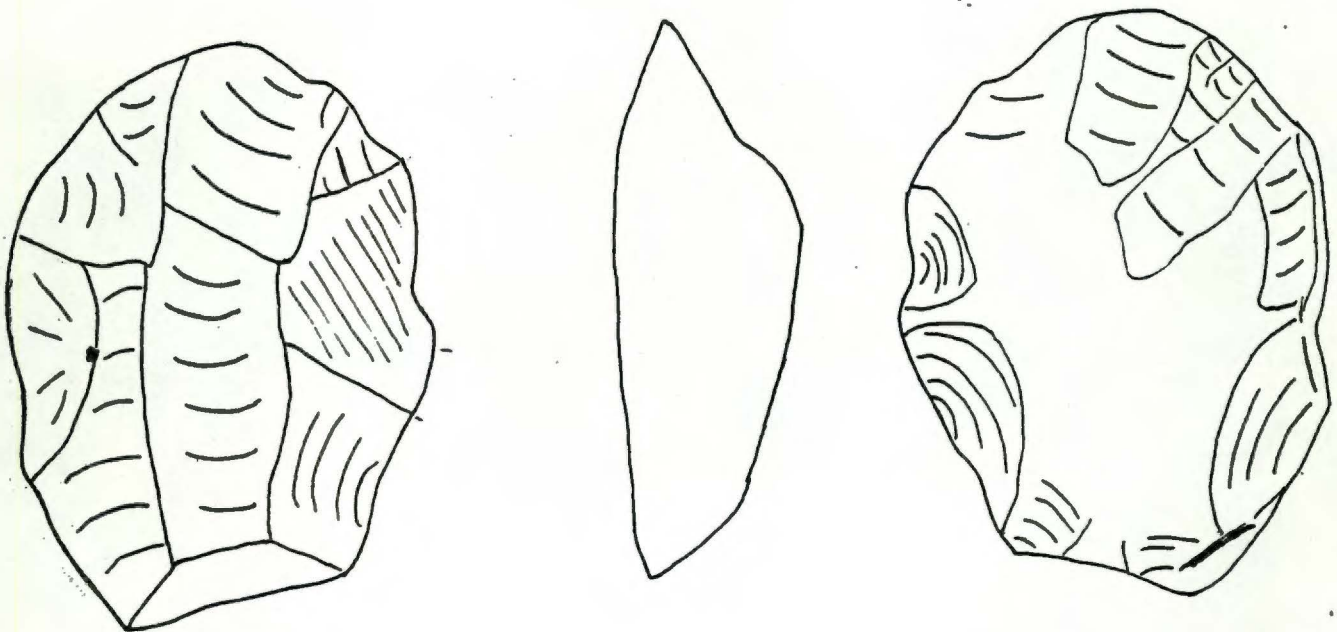


CHERNABURA 2

Figure 11



SIM 1B



SIM 3

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Figure 12