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Further Human Cranial Remains Excavated in 1974 at the Hot Springs Village Site, Port Moller, Alaska Peninsula

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In addition to the four human skeletal remains recovered in 1972 (OKADA & OKADA, 1974) and reported by OKADA & YAMAGUCHI (1975), at least three more human cranial remains have been excavated by H. OKADA and his crew at the Hot Springs village site, Port Moller, Alaska Peninsula, during the second season of 1974 (OKADA, 1975; OKADA *et al.*, 1976), and deposited again with the Department of Anthropology of the National Science Museum in Tokyo for osteological treatments and analysis.

First the archaeological provenance of the materials will be described briefly by H. O., then will follow the osteological descriptions and some statistical analyses by B.Y.

Provenance of the Materials

The outline of the site was described before (OKADA & YAMAGUCHI, 1975). The 1974 field survey was conducted by H. OKADA, A. OKADA (Kunitachi Music College), Y. KOTANI (Kumamoto University), and K. HATTORI (Hachioji City Museum), with the assistances of K. HATTORI, N. KUBO, Y. MIYATSUKA, M. SUGITA, K. YAJIMA, M. ARAMAKI, N. SHIONOSAKI, and J. YOSHIZAKO. The field party spent three weeks at the Hot Springs village site from July 16 to August 4.

Two 2×4 m trenches, J–4 and T–4, were cut at the top of the highland close to the cliff, with six people working on them. The rest of the party excavated a large house near the southeastern tip of the cliff. The house, named Highland House-2 (HHO2), was 12.5×7.5 m in size, quadrangular in ground plan, with more or less rounded corners. It was approximately twice as large as ordinary houses in this site. The floor had been dug into the bed of loam. Structural features observed on the floor included a fireplace, eight probable main post-holes, three clay bowls, four small grave pits, and many storage pits. One of the grave pits (Burial 1) was found just outside the eastern wall, while three others were dug into the house floor. The former, sealed off by a slab stone, yielded a complete cranium only. The latter also yielded cranial

or mandibular fragments alone. All these pits were too small to accommodate the entire human body.

The house yielded 650 bone and 600 stone artifacts. Knives were the most popular among the stone implements. The bone and ivory objects included finely made items such as labret, human image, pendant, etc.; hunting gears like fish spear, harpoonhead, arrowhead; and such household tools as pins, wedges, shovels and so on. A large number of blanks and re-worked materials seemed to suggest the original character of the house. It might have been a communal house, if not a qazgi, where men had worked together in manufacturing and repairing tools.

A charcoal sample from the fireplace has been dated 1440±75 B.P. (Gak 5415). The date is very close to that of Lowland House-1, where the four human skeletal remains were recovered in 1972 season.

Osteological Descriptions

Human remains were found in four grave pits in and just outside the house (HH02): an almost complete cranium alone in Burial 1, only a mandible in Burial 2, a very fragmentary skull in Burial 3, and badly decayed fragments of two crania in Burial 4. The right maxilla from Burial 4 closely resembles the left maxilla from Burial 3, and, moreover, these seem to fit the mandible from Burial 2. Thus the minimum number of individuals is presumed to be three.

Burial 1 (Mature male cranium)

The remain consists of the well-preserved cranium of a mature male (Figs. 1～4).

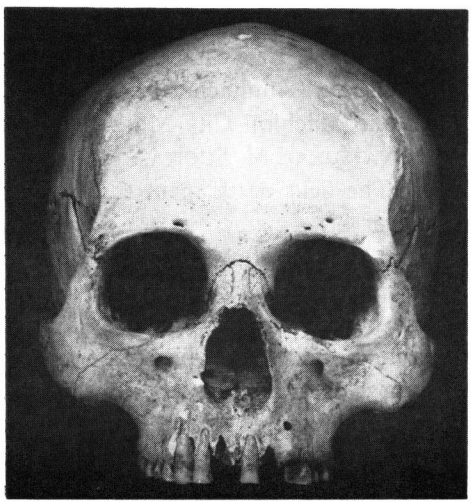

Fig. 1. Frontal aspect of the HHO2 Burial 1 cranium.

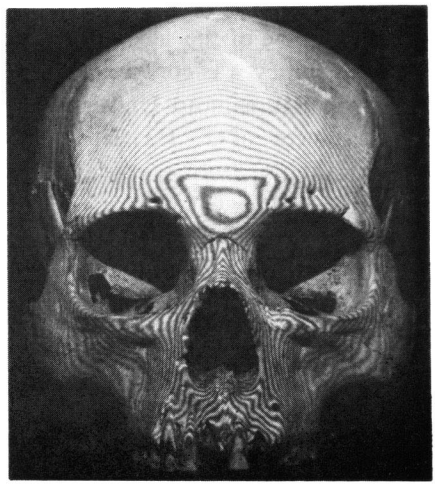

Fig. 2. Moiré contourograph of 1 mm intervals on the Burial 1 cranium.

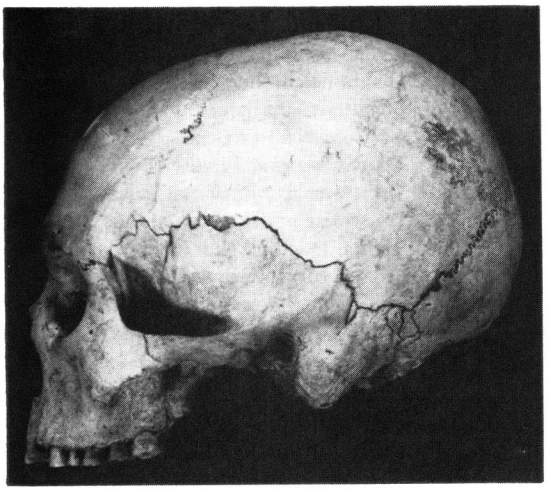

Fig. 3. Lateral aspect of the HHO2 Burial 1 cranium.

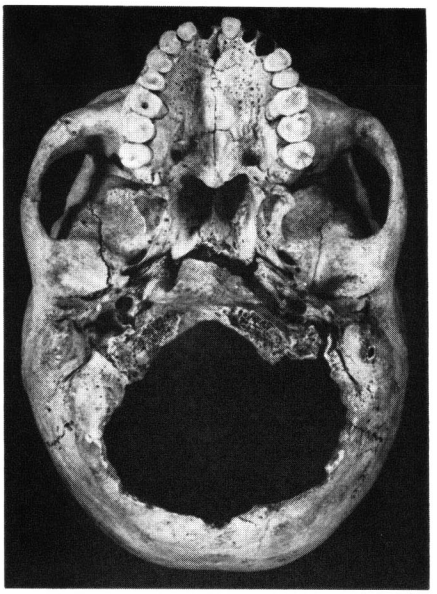

Fig. 4. Basal aspect of the HHO2 Burial 1 cranium.

Measurements and indices are given in Table 1.

Neurocranium. Vertically ovoid. Cranial index 78.9 (mesocranial). Height indices ortho- and metriocranial. Frontal and parietal bosses moderate. Coronal and sagittal sutures mostly closed except the external complicate part of the coronal; lambdoid suture entirely open externally as well as internally.

Glabella Broca's grade III; superciliary arches moderate. Metopism absent. Supra-orbital foramen and frontal notch present bilaterally. Supra-orbital nerve grooves present on the left. The frontal bone slightly elevated median-sagittally (Fig. 2), in line with the slight median angulation of the parietal bones. Parietal arc shorter and more curved than frontal arc. Temporal lines indistinct. Parietal foramen absent. Nuchal lines faint. Asterionic bone present on the left. No indication of Inca bone. Pterion H-shaped. Parietal notch bone present bilaterally. Aural exostosis and tympanic dehiscence absent on both sides. Tympanic plate slightly thickened.

Inferior part of squama and condylar parts of the occipital bone widely damaged, probably for some purpose, with only the anterior margin of the foramen magnum left intact (Fig. 4). The break widens toward inside rather than outside. Hypoglossal canal, foramen ovale and foramen spinosum normal bilaterally. Foramen pterygo-spinosum absent on both sides.

Table 1. Craniometry of the Hot Springs HHO2 Burial 1 mature male material.

MARTIN's No.	Measurements		MARTIN's No.	Measurements and Indices	
1	Glabello-occipital length	180	80	Length of maxillary dental arch	(53)
5	Basion-nasion length	102	80–3	Upper molar length	(29)
8	Maximum breadth	142	8 : 1	Length-breadth index	78.9
9	Minimum frontal diameter	97	17 : 1	Length-height index	73.3
10	Maximum frontal diameter	114	17 : 8	Breadth-height index	93.0
11	Biauricular breadth	130	20 : 1	Auriculovertical index	61.7
12	Maximum occipital breadth	117	9 : 10	Transverse frontal index	85.1
13	Mastoideal breadth	106	9 : 8	Transverse frontoparietal index	68.3
17	Basion-bregma height	132	12 : 8	Transverse parietooccipital index	82.4
18	Vertical vault height	134	27 : 26	Sagittal frontoparietal index	96.1
20	Auriculo-bregmatic height	111	29 : 26	Frontal curvature index	89.0
21	Vertical auricular height	112	30 : 27	Parietal curvature index	88.5
23	Horizontal circumference	517	(1+8+17)/*3*	Cranial module	151.3
24	Transverse arc	313	48 : 45	Upper facial index	(50.0)
26	Frontal arc	127	52 : 51	Orbital index (mf)	75.6
27	Parietal arc	122	52 : 51a	Orbital index (d)	79.1
29	Frontal chord	113	54 : 55	Nasal index	46.0
30	Parietal chord	108	54 : 45	Transverse nasofacial index	16.7
32	Frontal profile angle	79	61 : 60	Upper alveolar index	(119.6)
40	Basion-prosthion length	(102)	63 : 62	Palatal index	(70.8)
43	Upper facial breadth	105	64 : 63	Palatal height index	((38.2))
45	Bizygomatic diameter	138	40 : 5	Gnathic index	(100.0)
46	Mid-facial breadth	109	(40+45+48)/*3*	Upper facial module	((103.0))
48	Upper facial height	(69)	40 : 1	Longitudinal craniofacial index	(56.7)
49	Posterior interorbital breadth	21	48 : 18	Vertical craniofacial index	(51.5)
50	Anterior interorbital breadth	18	45 : 8	Transverse craniofacial index	97.2
51	Orbital breadth (mf)	45	9 : 45	Jugofrontal index	70.3
51a	Orbital breadth (d)	43	Facial flatness measurements and indices[1]		
52	Orbital height	34		Frontal chord (IOW)	96.3
54	Nasal breadth	23		Frontal subtense	16.2
55	Nasal height	50		Frontal index of flatness	16.8
57	Minimum breadth of nasalia	5		Simotic chord	5.2
57–2	Upper breadth of nasalia	8		Simotic subtense	2.6
60	Length of upper alveolar arch	(56)		Simotic index	50.0
61	Breadth of upper alveolar arch	67		Zygomaxillary chord	109.5
62	Palatal length	48		Zygomaxillary subtense	28.0
63	Palatal breadth	(34)		Zygomaxillary index	25.6
64	Palatal height	(13)	Zygomatic measurements and indices[2]		
72	Total profile angle	(82)		Minimum horizontal arc	67
72–5	Prosthion angle (∠n-pr-ba)	(71)		Minimum vertical arc	56
73	Nasal profile angle	83		Horizontal chord	58.9
74	Alveolar profile angle	(75)		Maximum subtense	12.1
77	Nasomalar angle	144		Curvature index	20.5

Note: Measurements in parentheses are estimated values. Indices based on one or two estimates are denoted by single or double parentheses.

1) For definitions, see YAMAGUCHI (1973). 2) WOO (1937).

Facial skeleton. Upper face mesene and mesognathous. Orbits rectangular with round corners and inclined transverse axes. Nasal bridge rather narrow, pinched, and sagittally concave. Zygomatic bones large, but horizontally less curved than those of the Greenland Eskimo measured by Woo (1937). Malar tuberosity and transverse zygomatic suture absent bilaterally. Zygomaxillary tuberosity developed moderately, with only slight zygomaxillary and inframaxillary fossae observable. Malar verticality absent. Indices of facial flatness exceptionally large for an arctic Mongoloid cranium. Body of maxilla low, with moderately deep canine fossa and notched infrazygomatic crest. Infra-orbital foramen single and infra-orbital suture absent bilaterally. Piriform aperture narrow (leptorrhine), with blunt lower margins. Alveolar process short and slightly prognathous (Fig. 2). Maxillary tori present on the lingual side of the M_2 and M_3 alveoli. Low and broad palatine torus present along the median palatine suture.

Maxillary dentition. Right I_1 and left I_2 and C are missing due to post-mortem loss; otherwise complete. Attrition advanced, with enamel of occlusal surface worn away except in M_3, and pulp cavity exposed in right M_1. Wear of anterior teeth horizontal, whereas that of posterior teeth oblique (*ad palatum*). Lingual root of left M_1 entirely exposed with marked hypercementosis.

Burial 2 (Mature male mandible)

The remain consists only of an almost complete mandible of a mature male, with right C lost *post mortem* (Fig. 5). Measurements and indices are given in Table 2.

Mandible. Incisor fossa (incurvatio mandibularis anterior) distinctly formed on both sides of mental protuberance (Fig. 6). Mandibular body generally low, and lowered posteriorly. Mental foramen single and located below P_2. Lower border almost straight, with slight praeangular notch. Angle developed and slightly everted. Ramus low, broad and inclined. Strong ridges for medial pterygoid insertion developed on the medial surface. Mylohyoid groove bridged by a bony plate on the left. Moderate mandibular tori present on both sides.

Mandibular dentition. Right C lost *post mortem,* right M_3 congenitally absent;

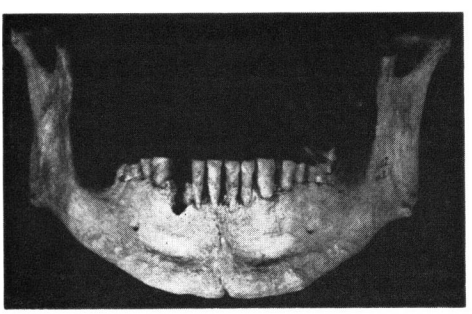

Fig. 5. HHO2 Burial 2 mandible.

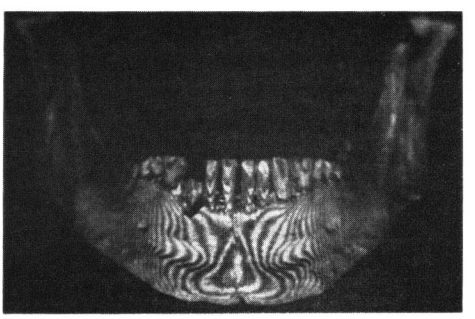

Fig. 6. Moiré contourograph of 1 mm intervals on the Burial 2 mandible.

Table 2. Measurements and indices of the Hot Springs HHO2 Burial 2 mature male mandible.

MARTIN's No.	Measurements		MARTIN's No.	Measurements and Indices	
65	Bicondylar diameter	135	—	Height of ramus, vertical	49
66	Bigonial diameter	119	71	Minimum breadth of ramus	40
68	Mandibular length	81	79	Mandibular angle	130
69	Height of symphysis	(34)	80a	Length of mandibular dental arch	(51)
69–1	Height of body	30	80–3	Molar length	(30)
69–3	Thickness of body, projective	19	68 : 65	Breadth-length index	60.0
70	Height of ramus (direct)	57	66 : 65	Breadth index	88.1
70a	Height of ramus (mandibulometer)	56	71 : 70	Ramus index	70.2

otherwise complete. Tooth wear advanced, with enamel of occlusal surface lost entirely. Wear of anterior teeth and of M_3 nearly horizontal, while that of other teeth oblique (*ad palatum*). Pulp cavity of right M_2 exposed widely, and an abscess cavity present on the buccal side.

Burial 3 (Fragmentary mature male cranium)

Major part of frontal bone, two-thirds of right parietal, some portions of occipital squama, nasalia, zygomatic bones, and alveolar process of left maxilla with three teeth are all of the material recovered.

Minimum frontal diameter 100, frontal arc 122, frontal chord 113, and frontal curvature index 92.6. Frontal bosses indistinct; glabella grade III; metopism absent; superciliary arches moderate. Zygomaxillary tuberosity marked. Attrition of P_1, P_2, and M_1 oblique and extremely advanced. Wear reaches the neck of each tooth on the lingual side. Pulp cavity of M_1 exposed, with three roots hypercementotic, and alveolus widely eroded around the lingual root.

Burial 4 (Cranial fragments)

The remain consists of less than 20 small fragments of ill-preserved incomplete crania, representing at least two individuals. Only a fragmentary right maxilla deserves a brief description.

Maxilla (*a*). Likely to fit the left maxilla from Burial 3 and the mandible from Burial 2. Piriform aperture bounded inferiorly with sharp crest. Four right posterior teeth from P_1 through M_2 and root of I_1 preserved. The crown of I_1 probably lost traumatically with only the tip of the root left in the alveolus. Posterior teeth worn obliquely (*ad palatum*) up to the neck on the lingual side.

Summary of the Cranial Morphology

The cranium and the mandible from Burials 1 and 2 show most of the craniological traits described by OSCHINSKY (1964) as components of the total morphological pattern of the Eskimo skull, namely, sagittal keel, pinched narrow nasal bones, thickened tympanic plates, anterior projection of the zygomaxillary tuberosities, zygomaxillary

fossae, inframaxillary fossae, gonial eversion, mandibular torus, and large horizontal facial angles. However, none of these characters in the present materials is expressed to the full extent, as illustrated by OSCHINSKY. It was also the case with the 1972 skulls. This confirms our view expressed on an earlier occasion that the morphological pattern of the Hot Springs remains is closer to the generalized form of the Western Eskimo rather than to the specialized forms of the Central and Eastern Eskimo in Canada and Greenland.

Comparative Analyses

Distance Analysis of Metrical Characters

In calculating distances of the 1972 materials from various Alaskan cranial series measured by HRDLIČKA (1942), only eight cranial measurements were available for the analysis, because the basion was missing in two out of three Hot Springs 1972 adult crania and three measurements pertaining to that point had to be omitted. Now that the fourth adult cranium in a good condition has been added to our material, averages of eleven cranial measurements based on two well-preserved crania, i.e. of 1972 Burial 2 and 1974 Burial 1, have become available to the distance analysis. These eleven new averages are given in Table 3, along with the male means of eight cranial series of the Eskimo, Aleut and Koniag, quoted from DEBETS (1951). Not only the Eskimo from southwestern Alaska but also those from northern Alaska and western Greenland have been included this time.

The PENROSE's distances between the Hot Springs crania and the other series are given in the lower part of the same table. It is noteworthy that the Hot Springs crania are again closest to the southwestern Alaskan Eskimo and farthest from the Koniag and the Aleut. The anomalously large distances from the Aleut and Koniag may partially be due to HRDLIČKA's *a priori* sorting of the more brachycranial materials (LAUGHLIN & MARSH, 1951; LAUGHLIN, 1963). These two series are in sharp contrast with other Eskimo series in their remarkable widening of the neurocranium as well as of the facial skeleton. The pre-Aleut and the pre-Koniag are much closer to the Hot Springs series, but not as close as other Alaskan Eskimo series from Seward Peninsula and Point Barrow. In other words, even the pre-Aleut and the pre-Koniag are as remote from the Hot Springs series as the Greenland Eskimo. In sum, the Hot Springs crania are more intimate with the homogeneous and widely dispersed Eskimo rather than with their close neighbours.

Likelihood Analysis of Discrete Traits

The likelihood ratio analysis of the non-metrical discrete cranial traits, as described in our previous article (OKADA & YAMAGUCHI, 1975), has again been applied to the 1974 Burial 1 cranium. Incidences of thirteen traits have been analyzed, with OSSENBERG's data of the Alaskan Eskimo and the Aleut cranial series being used as controls. The likelihood that the cranium was drawn from the Alaskan Eskimo population has turned

Table 3. Distance analysis between the Hot Springs crania and eight other cranial series[1] of the Eskimo, Aleut and Koniag.

HRDLIČKA's measurements	Hot Springs '72–2,'74–1	Southwest Alaska*	Seward Peninsula*	Point Barrow*	Western Greenland**	Aleut*	Pre-Aleut*	Koniag*	Pre-Koniag*	S.D.***
Cranial length	**181.5**	182.9	186.2	187.6	188.6	179.7	185.7	173.3	178.8	*6.4*
Cranial breadth	**140.0**	140.3	136.7	137.8	135.0	149.8	141.9	149.7	139.1	*4.1*
Cranial height	**132.5**	135.7	137.9	136.6	138.3	127.8	131.2	134.4	138.4	*4.8*
Basal length	**105.0**	104.5	105.4	140.9	106.3	99.5	102.7	101.3	103.2	*3.2*
Facial length	**102.5**	102.1	103.6	102.7	140.5	103.8	103.7	96.5	101.0	*4.0*
Facial breadth	**135.5**	140.6	140.5	141.4	139.8	144.0	143.7	144.8	139.4	*4.9*
Upper facial height	**74.5**	77.5	77.3	77.5	77.1	75.3	75.6	74.7	77.9	*4.6*
Orbital height	**36.5**	36.2	36.6	36.2	36.5	36.2	36.4	35.6	36.3	*1.7*
Orbital breadth	**41.5**	41.3	41.7	41.7	40.7	41.4	41.6	41.1	41.0	*1.6*
Nasal height	**53.5**	54.1	54.2	54.8	53.5	52.5	53.2	52.8	53.9	*2.7*
Nasal breadth	**23.5**	23.9	23.6	23.6	23.0	25.5	25.9	25.0	25.0	*1.5*
PENROSE's distances[2] from the Hot Springs averages:										
C_H^2		0.2007	0.3679	0.3716	0.5494	1.3455	0.6148	1.4542	0.4098	
C_Q^2		0.0551	0.1067	0.1096	0.0565	0.0464	0.1216	0.0044	0.0299	
C_Z^2		**0.1602**	**0.2873**	**0.2882**	**0.5423**	**1.4290**	**0.5426**	**1.5949**	**0.4178**	

1) Quoted from DEBETS (1951).
2) PENROSE (1953–54), CONSTANDSE-WESTERMANN (1972).
* Measured by HRDLIČKA (1942).
** Measured by FÜRST & HANSEN (1915) and modified by DEBETS (1951).
*** Standard deviations of the Asiatic Eskimo (DEBETS, 1951).

out 2.037×10^{-3} and that from the Aleut 1.117×10^{-3}. The likelihood ratio (Eskimo/Aleut) 1.82 is again in favour of the Alaskan Eskimo. Such was also the case with each of four crania excavated in 1972.

Recently, a method of allocating some few individuals to one of two or more groups by means of non-metrical variants in the skeleton has been proposed by SJØVOLD (1975), as follows.

Assume that a large known group consists of N individuals and Ai of which possess trait no. i, $i=1,2,\ldots,k$. Likewise, of the n individuals in the small sample, a_i possess trait no. i. The joint probability that, for all values of i, exactly a_i individuals in a small sample of n individuals possess trait no. i, given the fractions of the variants in the greater sample from which the small sample may be thought to derive, can be written

$$\Pr(a_1\cap a_2\cap \ldots\ldots \cap a_k)=\prod_{i=1}^{k}\binom{n}{a_i}\left(\frac{A_i}{N}\right)^{a_i}\left(1-\frac{A_i}{N}\right)^{n-a_i},$$

if the traits are independent from each other and N is sufficiently large.

Now, the incidence patterns of 16 non-metric cranial traits for the 1974 Burial 1 cranium and Burial 2 mandible are given in Table 4. Beside those are given the frequencies of the traits in total Hot Springs skulls and the proportions in the large samples of the Alaskan Eskimo and of the Aleut quoted from OSSENBERG (1969).

Table 4. Data for the likelihood analysis of non-metrical discrete cranial characters.

	Discrete traits	Hot Springs '74*		Hot Springs Total Incidence**	Proportions*** in	
		B1	B2		Alaskan Eskimo	Aleut
1	Metopism	−	V	0/5	0.029	0.050
2	Os japonicum, incl. trace	−	V	0/5	0.219	0.282
3	Infraorbital suture	−	V	4/5	0.618	0.541
4	Tympanic dehiscence	−	V	0/3	0.274	0.566
5	Foramen spinosum, defective	−	V	0/3	0.185	0.125
6	Marginal for. of tymp. plate	−	V	0/3	0.080	0.316
7	Pterygospinous bridge	−	V	0/2	0.074	0.042
8	Mylohyoid bridge	V	+	1/3	0.049	0.257
9	Parietal notch bone	+	V	2/4	0.292	0.198
10	Epipteric bone	−	V	0/2	0.219	0.173
11	Parietal foramen	−	V	2/5	0.527	0.450
12	Postcondylar canal	V	V	2/2	0.849	0.792
13	Supraorbital foramen	+	V	4/5	0.603	0.573
14	Supratrochlear foramen	−	V	1/5	0.234	0.148
15	Frontal grooves	+	V	5/5	0.280	0.326
16	Multiple mental foramina	V	−	2/4	0.097	0.103

* Incidence on the left side was recorded preferentially when both sides were observable.

** Total of 1974 and 1972 materials (OKADA & YAMAGUCHI, 1975).

*** Quoted from OSSENBERG (1969).

The likelihood that the Hot Springs series was drawn from the Alaskan Eskimo population, calculated by the above formula, is 3.566×10^{-10}, and that from the Aleut is 7.354×10^{-11}. The geometric mean $\sqrt[16]{\prod \Pr(a_i)}$ is 0.257 and 0.233, respectively. Though the difference is again slight, the probability is higher for the Hot Springs series to belong to the Alaskan Eskimo population than to belong to the Aleut population, as long as these 16 discrete traits are concerned.

Summary and Conclusion

The archaeological provenance of the human cranial remains excavated during the second season of 1974 at the Hot Springs village site, Port Moller, Alaska Peninsula, was briefly described by H. O. It was followed by osteological descriptions and statistical analyses by B. Y. The material consists of an almost complete cranium, a mandible, and some other incomplete cranial fragments representing at least three individuals altogether.

The total morphological pattern of the cranium from Burial 1 and of the mandible from Burial 2 coincides with unexaggerated form of that of the Eskimo skull, as described by OSCHINSKY (1964).

The results of statistical analyses of metrical and non-metrical characters again confirm the closer relationship of the Hot Springs series with the Alaskan Eskimo than with the Aleut or the Koniag. The 1974 materials from the Hot Springs village site thus corroborate the conclusions drawn by us from the 1972 materials (OKADA & YAMAGUCHI, 1975).

Acknowledgment

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