

NONMETRIC EXAMINATION OF PALEOANTHROPOLOGICAL FINDINGS FROM EASTERN MONGOLIA, 2003

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ABSTRACT. *In this paper, we present the results of cranial nonmetric examination of paleoanthropological findings discovered during archaeological excavations in Eastern Mongolia in 2003. The 18 more or less well preserved skulls were studied for the presence or absence of 81 nonmetric cranial traits from which 55 were observed in the sample, considerably varying in frequencies of their occurrence. The observed frequencies and percentages of the traits are compared to those of Siberian, Far East Asian and Circum Pacific region populations. The nonmetric examination of the series suggest that ancient populations from Eastern Mongolia, specially, the population from Tahilgat, Tsuvraa and Sant sites, Khulenbuir sum, Dornod aimag is very distinct in their biological features expressed by some specific nonmetric cranial traits.*

INTRODUCTION

Cranial nonmetric, i.e. epigenetic variation, is quite popular in analyzing osteological remains at the population level and has successfully been used to evaluate the evolutionary relations and biological affinities among ancient populations (Finnegan and Marcsik, 1979; Ishida and Dodo, 1992; 1993; 1997; Kozintsev, 1972, Ossenbergl, 1990; Sutter, Mertz, 2004; Wenger, 1974). The theoretical basis of any such investigation is that 1) the traits are highly genetic in nature; 2) that populations vary in frequencies between even closely related populations; 3) that some consistency is seen without regard to environmental variation; 4) the traits do not vary significantly with age; 5) show little sex difference; 6) show little correlation between the traits used; and 7) are easily defined and have the advantage of being scoreable for highly fragmented skeletal materials.

These above assumptions have been tested on many ancient and contemporary populations from Europe, North America and Northeast Asia and were discussed concerning their ethnogenesis and biological relationships with the populations from the contiguous regions. However, ancient populations inhabited the territory of Mongolia have not been studied by its non-metric or epigenetic traits so far, whereas the comparative craniometrical and osteological study of the

paleoanthropological materials from different historical periods of Mongolia have been done to a certain extent (Tumen, 1977; 1985; 1987; Tumen et al., 2002).

According to the results of the craniometrical studies of ancient populations inhabited the territory of modern Mongolia, there were two different morphological types during Neolithic period: the ancient population from the western Mongolia is characterized with remarkable Caucasoid morphological features, while in the eastern Mongolia, Mongoloid morphological features were existed predominantly. However, the human remains from the Bronze and early iron ages in the western Mongolia show more pronounced Mongoloid traits, than it seen at earlier ages. (Tumen, 1985).

In this paper we present the results of cranial non-metric examination of paleoanthropological findings discovered during archaeological excavations in Eastern Mongolia in 2003 under the research project "Eastern Mongolia" financed by KFAS (Korea) and ARC (NUM, Mongolia). The skeletal remains unearthed in the area of Eastern Mongolia are particularly important because they can shed light on the ethnical feature of the population lived in Eastern Mongolia during different historical periods. The analysis of the series is equally important in small and large series because in this way we can get better acquainted with the aspect of the analyzed population, furthermore the questions of biological or genetic relationship can be approached.

MATERIALS AND METHODS

Archaeological excavations in 2003 are carried out in several sites of Eastern Mongolia: Takhilgat, Tsuvraa and Sant mountains in Hulunbuir sum, Dornod aimag, Tsagaanmorit and Nugaar sites in Tsenkhermandal sum, Aurag ruin–Rashaan tolgoi in Delgerkhaan sum and Duulga mountain in Jargalkhaan sum, Khentii aimag. By surface structure and archaeological findings uncovered in burials along with the human remains, the graves are identified as belonging to Bronze, Xiongnu and Mongolian period (Z.Batsakhan, 2005; D.Navaan, 2005). An extensive description of the excavated graves and sites can be found also in the Project report, 2003 (Report "Ancient civilization of Eastern Mongolia", 2003).

Paleoanthropological materials uncovered during field expeditions consist of 25 individuals of both sexes and different ages, ranging from infantile I to senile. The Table 1 provides information on the location and archaeological periods of the sites, and sex and age at death of paleoanthropological remains examined by their epigenetic traits.

The 18 more or less well preserved skulls were studied for the presence or absence of 81 nonmetric cranial traits. The traits were selected based on their successful use by other researchers in biodistance studies, and their scoring procedures and descriptions are well known in the literature (Finnegan and Marcsik, 1979; Hauser and DeStefano, 1989; Movsesyan et al., 1975).

Table 1. Distributions of the examined paleoanthropological findings from Eastern Mongolia according to sex, age and historical period

Inventory number	Sex	Age	Site, Grave No.	Location	Historical period
AT-558	Male	Mature	Tsuvraa, Gr. 55	Hulunbuir sum, Dornod aimag	Mongolian period
AT-559	Female	Adult	Takhilgat, Gr. 6	Hulunbuir sum, Dornod aimag	Mongolian period
AT-560	Female	Adult	Takhilgat, Gr. 1	Hulunbuir sum, Dornod aimag	Mongolian period
AT-561	Female	Adult	Takhilgat, Gr. 4	Hulunbuir sum, Dornod aimag	Mongolian period
AT-564	Female	Juvenile	Takhilgat, Gr. 10	Hulunbuir sum, Dornod aimag	Mongolian period
AT-565	Male	Senile	Rashaan tolgoi, Gr. 2	Delgerkhaan sum, Khentii aimag	Bronze age
AT-566	Female	Adult	Duulga Uul, Gr. 7	Jargaltkhaan sum, Khentii aimag	Xiongnu period
AT-567	Male	Mature	Takhilgat, Gr. 12	Hulunbuir sum, Dornod aimag	Mongolian period
AT-569	Male	Mature	Sant, Gr. 4	Hulunbuir sum, Dornod aimag	Xiongnu period
AT-570	Female	Adult	Takhilgat, Gr. 2	Hulunbuir sum, Dornod aimag	Mongolian period
AT-571	Female	Mature	Takhilgat, Gr. 8	Hulunbuir sum, Dornod aimag	Mongolian period
AT-572	Male	Mature	Tsuvraa, Gr. 1	Hulunbuir sum, Dornod aimag	Mongolian period
AT-573	Female	Mature	Takhilgat, Gr. 11	Hulunbuir sum, Dornod aimag	Mongolian period
AT-577	Female	Mature	Takhilgat, Gr. 11	Hulunbuir sum, Dornod aimag	Mongolian period
AT-579	Male	Adult	Takhilgat, Cave grave	Hulunbuir sum, Dornod aimag	Mongolian period
AT-581	Female	Adult	Takhilgat, Gr. 3	Hulunbuir sum, Dornod aimag	Mongolian period
AT-582	Female	Juvenile	Tsagaanmorit, Gr. 3	Tsenkhermandal sum, Khentii aimag	Mongolian period
AT-616	Male	Juvenile	Nugaar, Gr. 1	Tsenkhermandal sum, Khentii aimag	Mongolian period

Nonmetric cranial trait frequencies were calculated using the "individual count" method described by Turner and Scott (1977), where if an individual exhibited asymmetry in the expression of a given trait, the greatest level of expression is used. This scoring procedure assumes that a single genotype is responsible for any given trait's expression, and that when asymmetry exists among bilateral traits, the side exhibiting the maximum expression is closest to the true underlying genotype for the trait. The procedure also maximizes sample sizes; in cases where a given trait is

observable for one antimere but not the other, the observable side is counted as the maximum expression for that trait.

RESULTS AND DISCUSSION

From the list of 86 examined non-metric traits 55 were observed in the sample of paleoanthropological findings, discovered during archaeological expeditions in Eastern Mongolia in 2003, considerably varying in the frequencies of their occurrence. The incidences of the traits observed in more than one case, and their frequencies and percentages are presented in the table 2.

Table 2. Incidences of nonmetric traits observed in the sample of paleoanthropological findings from Eastern Mongolia, 2003

No	Non-metric traits	N	Frequency	%
1.	supraorbital foramen complete	19	12	63.2
2.	frontal foramen present	18	8	44.4
3.	trochlear spine	15	2	13.3
4.	infraorbital suture left	7	2	28.6
5.	multiple zygomatico-facial foramen	9	6	66.7
6.	marginal tubercle	11	9	81.8
7.	parietal notch bone present	14	2	14.3
8.	asterionic bone present	15	5	33.3
9.	epipteric bone present	12	2	16.7
10.	parietal foramen present	14	4	28.6
11.	lambdoid ossicles present	12	5	41.7
12.	biasterionic suture vestige	13	2	15.4
13.	highest nuchal line	13	9	69.2
14.	occipital torus	14	10	71.4
15.	occipital foveola	14	12	85.7
16.	occipital foramen	11	6	54.5
17.	palatine torus	13	9	69.3
18.	maxillary torus	13	3	23.1
19.	accessory lesser palatine foramina	9	6	66.7
20.	sutura incisive	12	2	16.7
21.	foramen ovale incomplete	11	2	18.2
22.	foramen spinosum open	11	8	72.7
23.	foramina Civinini	5	4	80.0
24.	foramen of Vesalius	10	8	80.0
25.	foramen of Huschke	17	8	47.1
26.	digastric groove doubled	10	5	50.0
27.	posterior condylar canal patent	5	3	60.0

Cranial nonmetric examination of paleoanthropological findings from Eastern Mongolia

28.	hypoglossal canal bridging	7	2	28.6
29.	pharyngeal fossa	7	5	71.4
30.	mastoid foramen absent	13	3	23.1
31.	mandibular torus	18	10	55.6
32.	accessory mental foramen	18	3	16.7

The highest frequency among the examined epigenetic traits is observed for marginal tubercle, occipital foveola, foramina Civinini and foramen of Vesalius. These traits are found in more than 80.0% of the sample. More than a half of the findings showed the following traits: supraorbital foramen complete, multiple zygomatico-facial foramen, highest nuchal line, occipital torus, occipital foramen, palatine torus, accessory lesser palatine foramina, foramen spinosum open, digastric groove doubled, posterior condylar canal, pharyngeal fossa and mandibular torus. Their frequencies were 50.0 – 80.0%. Frontal foramen, lambdoid ossicle, foramen of Huschke were present in 41.7 - 47.1% of the examined individuals, while asterionic bone was present in one third and infraorbital suture, parietal foramen, maxillary torus, hypoglossal canal bridging and mastoid foramen absent were in one fourth of the sample.

Quite low frequency (13.3-18.2 %) was observed for trochlear spine, parietal notch bone and epipterice bone, biasterionic suture vestige, sutura incisive, foramen ovale incomplete and accessory mental foramen.

The lowest frequency – only one case is observed for the following traits, as frontal groove, cribra orbitalia, accessory infraorbital foramen, frontal process of temporal squama, parietal process of sphenoidal bone, ovale-spinosum confluence, doubled mandibular foramen and mylohyoid groove bridging. Trace expressions of partition of zygomatic bone (*Os japonicum*) and condylar facet are observed in one case, as well. The frequencies of the wormian bones at coronal, sagittal, and lambda sutures are similarly low; each of the traits occurred per one case.

Regarding the expressions and locations of some traits, we could observe the followings:

- Zygomaxillary tubercle was mostly of trace expression (75.0%) and situated in maxilla (66.7%) rather than in zygomatic bone or in the suture.
- Marginal tubercle was absent in 9.5%, weak in 23.8%, medium in 14.3% and strong in 4.8% of the sample.

- Postglenoidal process expression is: weak in 28.6%, medium in 47.6%, strong in 9.5%.
- Only one case of "X" form of the pterion was observed on the left, and one "X" and "K" forms on the right side were observed in the sample.
- No case of sagittal sinus groove flexing left was found.

A comparison of the results gained from the eastern Mongolian samples with those of Ishida and Dodo found among Siberian and Far East ancient and modern populations (1992) and Circum Pacific region populations (1993; 1997) can be summarized as follows:

The percental frequencies of the occurrences of the frontal groove and condylar canal in Eastern Mongolian sample are 0.059 and 0.600, lower than that found among Siberian and Far East population – 0.068-0.346 and 0.736-0.971 respectively. Occurrence of the frontal groove in Eastern Mongolian sample from 2003 is close to those of Evenki (0.068) and condylar canal occurrence approaches the data of Mongolian sample as cited by Ishida and Dodo (1992):

The frequency of occurrence of parietal notch bone is rather low (0.143), but it is more than the data of Aleut (0.123), Buryat (0.133) and Amur (0.118) and approaches the data of Kazakh (0.168) and Mongolian sample (0.183) (Ishida and Dodo, 1993; 1997).

The incidences of supraorbital foramen (0.632), ossicle at lambda (0.077), biasterionic suture vestige (0.154), transverse zygomatic suture (0.111), and mandibular torus (0.556) in the Eastern Mongolian series are intermediate between low and high limits of Siberian Far East population data. Frequency of the supraorbital foramen occurrence is rather consistent among Siberian population (0.583-0.785), while occurrence of ossicle at lambda (0.002-0.175), biasterionic suture vestige (0.022-0.280), transverse zygomatic suture (0.010-0.289), and mandibular torus (0.259-0.981) are more variable. Occurrence of ossicle at lambda in Eastern Mongolia, 2003 sample is near to Baikai population value (0.078), biasterionic suture vestige is – to Ekven (0.162), transverse zygomatic suture – to Buryat (0.108), and mandibular torus – to Yukagir (0.500) values.

Percentages of hypoglossal canal bridging (0.286) and foramen of Huschke (0.471) in Eastern Mongolian sample are higher in comparison with Siberian and Far East population average (0.279 and 0.437). Frequency of hypoglossal canal bridging of our sample is close to that of Chukchi (0.295) and foramen of Huschke – to Ekven (0.466) and Northern Chinese (0.461) data.

The frequencies of occurrence of asterionic bone (0.333), ovale-spinosum confluence (0.182) and foramen of Vesalius (0.800) in Eastern Mongolia, 2003 series exceed the upper limit of Siberian and Far East population data range (0.052-0.217; 0.015-0.109; 0.172-0.590).

Several traits, such as metopic suture, precondylar tubercle, paracondylar process, pterygo-spinous foramen, medial palatine canal, clinoid bridging, mylohyoid bridging and sagittal groove flexing left, observed with more or less frequencies among Siberian, Far East and circum Pacific populations, have not completely been observed or observed incomplete expression of the traits in the studied Eastern Mongolian sample.

CONCLUSION

From this small series far reaching conclusions cannot be drawn, the nonmetric examination of the paleoanthropological findings from different sites in the Eastern Mongolia shows their high diversity. Comparatively high incidence of occurrence of some traits (for instance, mandibular torus) among the findings from Tahilgat, Tsuvraa and Sant sites, Khulenbuir sum, Dornod aimag may propose about their distinct biological features, unique among the other ancient populations of Eastern Mongolia.

The further detailed investigation of ancient populations from different historical periods of Eastern Mongolia, and comparative statistical analysis of the data with those obtained from the nonmetric studies of Siberian and other Asian ancient and modern populations will be important in elucidating the problem of ethnogenesis and migration of Asian ancient and modern populations.

ACKNOWLEDGEMENTS

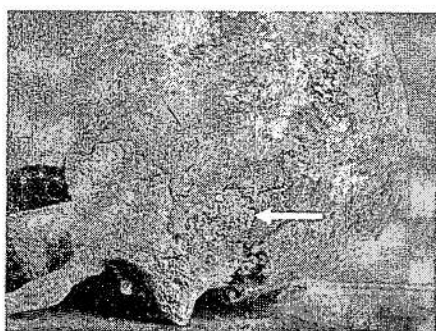
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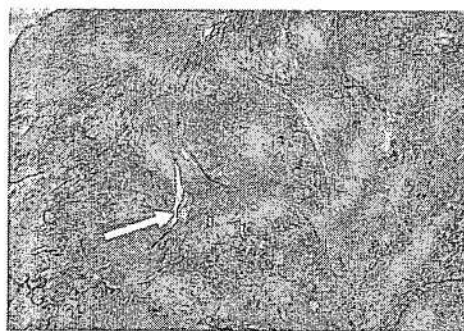
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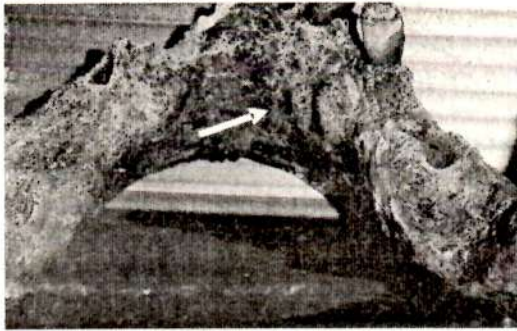
INCIDENCES OF CRANIAL NONMETRIC TRAITS IN
EASTERN MONGOLIAN SAMPLE, 2003



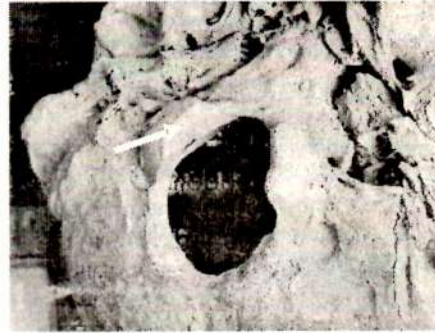
AT-559. Ossicle at asterion



AT-561. Foramen of Huschke



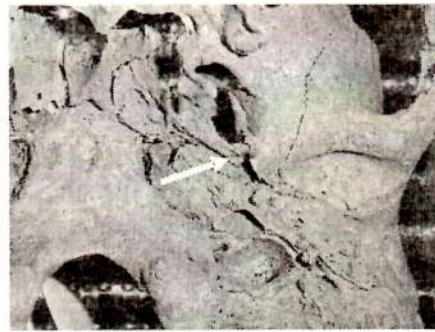
AT-561. Mandibular torus



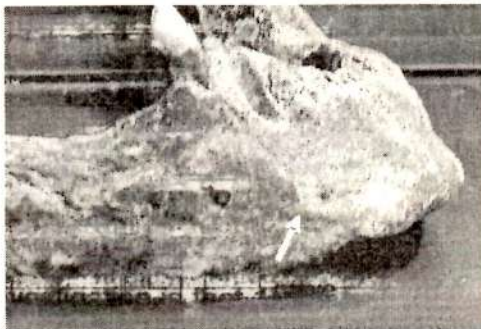
AT-566. Condylar facet doubled



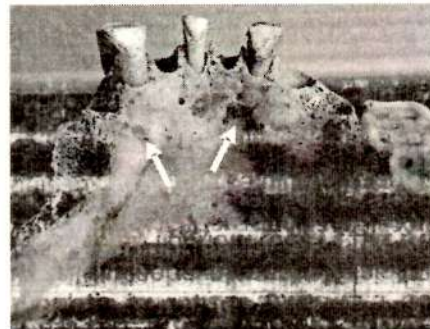
AT-566. Epipteric bone (right)



AT-566. Foramen spinosum open



AT-567. Accessory mental foramen



AT-571. Mandibular torus



AT-569. Os Japonicum



AT-572. Epipteric bone

**ДОРНОД МОНГОЛЫН ЭРТНИЙ ХҮН АМЫН ЭПИГЕНЕТИК
СУДАЛГААНЫ ҮР ДҮНГЭЭС**

2003 оны археологийн хээрийн судалгаагаар малтан олсон эртний хүний 25 олдвороос бүрэн ба бүрэн бус 21 толгойны ясанд эпигенетикийн 81 шинжээр судалгаа хийхэд 55 шинж янз бүрийн давтамжтайгаар тохиолдож байв. Эдгээр шинжүүдийн харьцангуй давтамжийг гадаадын судлаачдын Сибирь, Алс Дорнод, Номхон далайн хойд эргийн бүс нутгийн уугуул суугчдад хийсэн судалгааны үр дүнтэй харьцуулахад Дорнод Монголын янз бүрийн бүс нутгийн эртний хүн ам биологи онцлогийн хувьд харилцан адилгүй тус бүрийн өвөрмөц шинжтэй болох нь харагдлаа.

Ялангуяа, монголын болон Сибирь, Алс Дорнод, Номхон далайн хойд эргийн бүс нутгийн популяцуудтай харьцуулахад Дорнод аймгийн Хөлөнбуйр сумын Тахилгат, Цувраа, Сантын амны эртний хүний олдворт *torus mandibularis* зэрэг шинж өндөр давтамжтай тохиолдож байгаа нь уг хүн ам түүхэн тухайн үеийн бусад хүн амаас ялгарах өөрийн гэсэн онцлог бүхий нийтлэг байсныг харуулж байна.