Cranial Nonmetric Trait Database

User Guide

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INTRODUCTION

Inspired by the example of the late Dr. W.W. Howells of Harvard University who published his life-time's worldwide collection of cranial measurements on the internet, I here offer my files of cranial nonmetric data as a freely available resource. The tables were constructed in the program Excel. They are available also in comma-delimited format (comma-separated values, CSV) from which the user can import them into any program of choice. The tables can be used to study the morphological features themselves; i.e. patterns of variation according to age, sex, side and population, as well as intertrait correlation and the effects of artificial cranial deformation. Additionally, I have tried to provide sufficient provenience to facilitate exploration of various ethnogenetic problems. Investigators can pull the tables apart and re-assemble the component samples in any way appropriate to their particular purpose. Additionally, researchers are encouraged to explore methods of biodistance analysis alternative to the Smith's Mean Measure of divergence (MMD) used in my own ethnogenetic studies.

Reflecting my own long-time ethnogenetic research interest, the regions best represented in the tables are the Arctic and Northwestern North America. Since 1991 many of these museum collections have been repatriated under the terms of NAGPRA (Native American Graves Protection and Repatriation Act) and are no longer available for original research. Therefore, I hope that this website may be particularly useful in supplementing existing osteobiological records for the Native peoples of these regions.

ACKNOWLEDGEMENTS

My fascination with skeletal morphology and variation was fostered by graduate studies 1958-1969 at the University of Toronto's Department of Anatomy under the supervision of Dr. James E. Anderson. Jim, in turn, had been influenced greatly by his mentor in Anatomy, Dr. John Boileau Grant. I dedicate this website to their memory.

Queen's University, Kingston, Ontario (1973-1998) and the University of Alberta, Edmonton (1969-1973) where I taught Anatomy, provided support for my research. Summer 2000 with a travel grant from Central Washington University, Ellensburg, I recorded data for a collection of remains from the Plateau region of North America. During 2001-2002 with a visiting research professorship at Tohoku University, Sendai, Japan, I was able to explore questions of northeast Asian ethnogenesis using nonmetric cranial traits. Grant support by The National Science and Engineering Research Council, the Boreal Institute of the University of Alberta, and The Canada Council are acknowledged in my published articles.

The collaboration over many years of Bill Orme, Kingston computing programmer, in making MMD and other calculations has been indispensable for my research. Debra Komar, Queen's Anatomy graduate student, 1994-1996, working from the original paper records, transcribed all my data up to that point to electronic files in the program PARADOX. I am grateful for her care and accuracy in completion of this huge task.

My major objective e to put all the data on a website has been realized through endorsement by Queen's University Libraries, with the approval and encouragement of Sharon Murphy, Head, Academic Services. The expertise and work required to transcribe the data files and to design the website was provided by Jeff Moon, Data and Government Information Librarian, and his associate, Alexandra Cooper. I am indebted to them for their meticulous oversight and enthusiastic collaboration on the project.

The original paper records also may be consulted by researchers. These are in filing cases stored in Queen's University Archives, under the auspices of Paul Banfield, Queen's University Archivist.

Throughout my research career I have studied collections at many museums and other institutions in North America and abroad; I gratefully acknowledge the assistance of their curators and other institutional staff.

As for the more than 8000 individuals represented in these files whose remains I have been privileged to study: I hope that their descendants will recognize the gratitude and respect with which I make these data available for posterity.

Record Layout

Record count = 8016
Number of Variables = 84

Columns 2 - 7 contain provenience for the crania. Arranged in nested order from broadest to most specific the columns provide information for each individual according to geographical origin, culture period, and cultural or tribal affiliation.

For records marked "not confirmed" there was not enough documentation to definitely identify the tribe or band.

GP1 – World Region

NA	Native America and Greenland
AS	Northeast Asia
EU	Eurasia
AF	Africa
SP	South Pacific

GP2 – Major Region, Country

Native America and Greenland

AR	Arctic
NW	Northwest, Native America
NE	Northeast, Native America
SW	Southwest, Native America
SA	South America

Northeast Asia

JA	Japan
NEA	Continental Northeast Asia

Eurasia

ARM	Armenia	EU	Europe	IC	Iceland
BR	Britain	FR	France	IN	India
BV	Bavaria	GE	Germany	IT	Italy
CZ	Czechoslovakia	HU	Hungary	RU	Russia

Africa

AM	African Americans
E	East Africa
N	North Africa (Sudan)
S	Southern Africa
W	West Africa

GP3 – Country, Specific Region

AL	Aleutian Islands	NAL	North Alaska
AT	Athapaskan territories	NFL	Newfoundland
AU	Australia	NIG	Nigeria
C	Central Japan	NMV	Northern Mississippi Valley
CAM	Cameroon	NN	Northern North Japan Tohoku District: Akita, Iwate, Aomori prefectures
CAN	Canada		
CAR	Central Arctic	NPC	North Pacific Coast
CH	Chile	NZ	New Zealand
CHAT	Chatham Island	ONT	Ontario
CHN	North China	PEC	Pecos
EAR	Eastern Arctic	PLN	Plains
GAB	Gabon	PLT	Plateau
GHA	Ghana	PT	Patagonia
HK	Hokkaido	S	Southern Africa
ILL	Illinois	SAL	South Alaska
IND	India	SIB	Siberia
KEN	Kenya	SIE	Siena
LIB	Liberia	SLS	St. Lawrence Island, Siberia (Chukotka)
MON	Mongolia	SUD	Sudan
MQ	Marquesas	TAN	Tanzania
N	North Japan Tohoku District: Fukushima, Yamagata, Miyagi prefectures	TF	Terra del Fuego
		USA	United States of America
		W	West Japan

GP4 – General Culture Period, Population or Tribe

ABR	Aborigines (Australia)
AI	Ainu
AK	Alaska, Athapaskans
ANC	Ancient Period (Kerma)
ARCH	Archaic Period
ARIK	Arikara
AS	Assiniboin
ATQ	Antique Age (Armenia)
BK	Birnirk
BL	Blackfoot
BRZ	Bronze Age (Armenia)
C	Central Aleut
CA	Canada, Athapaskans
CH	Cheyenne
CHU	Chukchi
CK	Chinook
CLA	Classical Period (Kerma)
DK	Dakota Sioux
DK-nc	Dakota Sioux – not confirmed
DO	Dorset
E	Eastern Aleut
EDO	Edo Period Japanese birth dates approximately 1600-1874
HD	Haida
IK	Ipiutak
IP	Inupik speakers
IRN	Iron Age (Armenia)
JOM	Jomon
KHO	Khoisan
KO	Kodiak Islanders
LW	Late Woodland Period
MAN	Manchurians
MAO	Maori
MDV	Mediaeval Period
MID	Middle Period (Kerma)
MM	Middle Missouri Period
MON	Mongolians
MOR	Moriori
MRQ	Marquesans
MW	Middle Woodland Period
NM	Namu
NP	Nez Perce
OB	Old Bering Sea
OKH	Okhotsk
ONT	Ontario, 19th Century British origin
OR	Oregon Athapaskans
PMJ	Post-Meiji Japanese birth dates 1875 and later
PR	Prince Rupert Harbour
PU	Punuk
PUE	Pueblo
ROM	Roman Period (Hungary)
SH	Sahaptin
SL	Salish
SW	Southwest Athapaskans
TH	Thule
TL	Tlingit
TUN	Tungus
W	Western Aleut
YAY	Yayoi
YKG	Yukaghir
YM	Yamhill
YP	Yupik speakers

GP5 – Specific Culture Period, Archaeological Designation, or Sub-tribal Affiliation

Site – Specific Site

Specific site as stated in the documents of the curating museum.

CatalogNo – Museum's catalog number

Catalog number of the skull assigned by the museum

Museum

Name of the curating institution, date(s) of my survey.

AMNH	American Museum of Natural History, New York 1975, 2003
CHB	Department of Anatomy, Chiba University School of Medicine, Chiba City, Japan 2002
CMC	Canadian Museum of Civilization, Gatineau, Quebec 1963, 1965, 1976, 1980, 1991, 1993, 1994
CWU	Central Washington State University, Ellensburg, Washington 2000
FM	Field Museum, Chicago, Illinois 1975
IEA	Institute for Ethnography, Armenian Academy of Sciences, Yerevan 1994
IESP	Institute for Ethnography, Russian Academy of Sciences, St. Petersburg 1981
KYO	Kyoto University, Faculty of Science, Laboratory of Physical Anthropology, Japan 1981
KYU	Department of Anatomy, Faculty of Medicine, Kyushu University, Fukuoka, Japan 2002
LPR	Laboratory for Plastic Reconstruction, Russian Academy of Sciences, Moscow 1981
MUN	Memorial University of Newfoundland, St. John's, Newfoundland 1993
NSM	National Science Museum, Tokyo 1981, 2002
O	United States National Museum, Smithsonian Institution, Washington, D.C. 1963, 1964, 1970
O4	United States National Museum, Smithsonian Institution, Washington, D.C. 1995
PAN	Panum Institute, Copenhagen 1995
PMH	Peabody Museum, Harvard University, Cambridge, Massachusetts 1994

QU	Department of Anatomy, Queen's University, Kingston, Ontario 1975
ROM	Royal Ontario Museum, Toronto, Ontario 1958-1960
SAP	Department of Anatomy, Sapporo Medical University, Sapporo, Japan 2001
SEN	Department of Anatomy and Anthropology, Tohoku University School of Medicine, Sendai, Japan 2001-2002
SFU	Department of Anthropology, Simon Fraser University, Burnaby, British Columbia 1989
SIEN	Department of Anatomy, University of Siena, Japan 1985
STT	St Thomas Church, Belleville, Ontario 1991
TKM	University of Tokyo, University Medical Museum, Tokyo 1981
TKO	University of Tokyo, University Museum, Tokyo 1981, 2002
UAB	Department of Anthropology and Department of Anatomy, University of Alberta, Edmonton, Alberta 1971-1972
UAF	Department of Anthropology, University of Alaska, Fairbanks, Alaska 1995
UCT	Laboratory of W.S. Laughlin, University of Connecticut, Storrs, Connecticut 1997
UG	Department of Anthropology, University of Geneva 1995
UIN	Department of Anthropology, University of Indiana, Bloomington, Indiana 1964
UMA	Department of Anthropology, University of Manitoba, Winnipeg, Manitoba 1964
UMN	Department of Anthropology, University of Minnesota, Minneapolis, Minnesota 1964
UOR	University of Oregon, Museum of Natural History, Eugene, Oregon 1994
WHO	W.H. Over Museum, Pierre, South Dakota 1964

AgeC – Age cohort

0	Neonate to five years
1	Six to eight years
2	Nine to eleven years
3	Twelve to fifteen
4	Sixteen to twenty
5	Twenty-one to twenty-nine
6	Thirty and older
8	Child
9	Adult

AgeY – Age at death in years

Age estimated by a physical anthropologist.

Age in years followed by “d” indicates documented age at death for an Anatomy dissecting-room subject, or individual retrieved from a cemetery.

Sex

0	Male
2	Indeterminate
4	Female

Deformation Variables

Deformation data were originally coded in the variable **DeformOriginal**. This variable was recoded into two new variables **- DeformGrade** and **DeformLRS**. This was done to separate information about deformation itself and the side it appeared on (left, right, symmetrical). The original variable, **DeformOriginal**, was retained on the dataset.

DeformOriginal

0	Undeformed
1	Minimal deformation
2	Slight deformation
3	Moderate deformation
4	Extreme deformation
1L	Minimal deformation – left side
2L	Slight deformation – left side
3L	Moderate deformation – left side
4L	Extreme deformation – left side
1R	Minimal deformation – right side
2R	Slight deformation – right side
3R	Moderate deformation – right side
4R	Extreme deformation – right side
1S	Minimal deformation – symmetrical
2S	Slight deformation – symmetrical
3S	Moderate deformation – symmetrical
4S	Extreme deformation – symmetrical

DeformGrade – Grade of deformation

0	Undeformed
1	Minimal deformation
2	Slight deformation
3	Moderate deformation
4	Extreme deformation
5	Deformation – no gradation
999	Presence or absence of deformity was not recorded

DeformLRS – Side of most pronounced occipital flattening (left, right, symmetrical)

L	Left side > right side
R	Right side > left side
S	Symmetrical deformation
[blank]	Symmetry/asymmetry of deformation was not recorded
NO-OBS	Presence or absence of deformation was not recorded

Trait List

See **TRAITS: DESCRIPTION AND CRITERIA FOR SCORING** descriptions of the traits.

METO	Metopic suture
APIC	Apical bone
INCA	Os inca
OMBL	Occipito-mastoid ossicle, left
OMBR	Occipito-mastoid ossicle, right
ASTL	Asterionic ossicle, left
ASTR	Asterionic ossicle, right
PNBL	Parietal notch bone, left
PNBR	Parietal notch bone, right
POSL	Posterior condylar canal absent, left
POSR	Posterior condylar canal absent, right
PCTB	Precondylar tubercle(s)
ODON	Odonto-occipital articulation
TRFS	Transverse fissure of basiocciput
PHAR	Pharyngeal fossa
HYPL	Hypoglossal canal bridged or double, left
HYPR	Hypoglossal canal bridged or double, right
PCPL	Paracondylar process, left
PCPR	Paracondylar process, right
ICCL	Intermediate condylar canal, left
ICCR	Intermediate condylar canal, right
SQSL	Parietal process of temporal squama, left
SQSR	Parietal process of temporal squama, right
SPSL	Squamoparietal synostosis, left
SPSR	Squamoparietal synostosis, right
MARL	Marginal foramen of tympanic plate, left
MARR	Marginal foramen of tympanic plate, right
TYML	Tympanic dehiscence, left
TYMR	Tympanic dehiscence, right
FSPL	Dehiscent wall of foramen spinosum or foramen ovale, left
FSPR	Dehiscent wall of foramen spinosum or foramen ovale, right
LPFL	Foramen in lateral pterygoid plate, left
LPFR	Foramen in lateral pterygoid plate, right
CIVL	Pterygospinous bridge complete (foramen of civinini), left
CIVR	Pterygospinous bridge complete (foramen of civinini), right
PTBL	Pterygobasal spur or bridge, left
PTBR	Pterygobasal spur or bridge, right
CLNL	Clinoid bridging, left
CLNR	Clinoid bridging, right

SOFL	Supraorbital foramen, left
SOFR	Supraorbital foramen, right
FRGL	Frontal groove(s), left
FRGR	Frontal groove(s), right
TRSL	Trochlear spur, left
TRSR	Trochlear spur, right
OPTL	Accessory optic canal, left
OPTR	Accessory optic canal, right
ORBL	Orbital suture variant, left
ORBR	Orbital suture variant, right
CONL	Infraorbital suture variant, left
CONR	Infraorbital suture variant, right
JAPL	Transversozygomatic suture, left
JAPR	Transversozygomatic suture, right
M3UL	Upper third molar congenitally absent, left
M3UR	Upper third molar congenitally absent,right
MENL	Accessory mental foramen, left
MENR	Accessory mental foramen, right
MHBL	Mylohyoid bridge, left
MHBR	Mylohyoid bridge, right
BUCL	Retromolar foramen, left
BUCR	Retromolar foramen, right
M3LL	Lower third molar congenitally absent, left
M3LR	Lower third molar congenitally absent, right
TRML	Three-rooted mandibular first molar, left
TRMR	Three-rooted mandibular first molar, right
ATAL	Atlas bridging, condylar process to posterior arch, left
ATAR	Atlas bridging, condylar process to posterior arch, right
ATBL	Atlas bridging, condylar to transverse process, left
ATBR	Atlas bridging, condylar to transverse process, right

TRAITS: DESCRIPTION AND CRITERIA FOR SCORING

Descriptions of the traits and bibliographical references are provided in my published articles, 1969 to 2006 (see **PUBLICATIONS**); also in Hauser, G. and G.F. DeStefano. 1989. **Epigenetic Variants of the Human Skull**, Schweizerbart, Stuttgart. For some traits, definitions and description provided by other authors are cited (see **BIBLIOGRAPHY**).

The traits are classed in six categories:

1. *Sutural Variants*
2. *Traits Related to Nerves, Arteries and Veins*
3. *Variations at the Craniovertebral Border*
4. *Hypostotic Traits*
5. *Hyperostotic Traits*
6. *Dental variants*

These categories are not mutually exclusive; traits in categories 1 – 3 generally have a secondary classification as either 4 *hypostotic* or 5 *hyperostotic*, while certain traits classed primarily as *hyperostotic* also have a relationship to nerves or blood vessels.

Some well-known traits have been excluded from the files. These are the *tori* (maxillary, mandibular, palatal and auditory) likely to be strongly influenced by behaviour or environmental factors. Others traits generally familiar to researchers I have found too ambiguous in expression, too difficult to score, or simply too invariant to be useful in ethnogenetic studies.

Scoring of Traits

General rule for all traits:

- trait present = 1
- trait absent = 0
- presence or absence of trait indeterminate = 9

The exception to this rule is where a trait is scored 2 or 3 indicating degree of expression or sub-type of the feature.

1. Sutural Variants

METO Metopism

An interfrontal suture persisting after the normal age (~ 8 years) for closure is scored **1**. The common case where only the supranasal portion persists is scored **0**.

INCA Os inca

A persisting mendosal (biasterionic) suture dividing the occipital squama into an upper and lower portion is scored **1**. The upper portion may be subdivided into segments (**Epigenetic Variants**, Fig 15, i-w), presence of one or more of which is scored **1**. A lateral trace of the biasterionic suture is scored **0**.

APIC Os apicis (apical bone)

Any ossicle at lambda (**Epigenetic Variants**, Fig. 15, a-d) is scored as **1**. The distinction between this feature and the median segment of an Os inca (**Epigenetic Variants**, Fig 15, t) depends on size.

OMB Occipito-mastoid bone

An ossicle of any size in the occipito-mastoid suture and which does not touch asterion is scored **1**.

AST Asterionic bone

An ossicle of any size touching asterion is scored **1**.

PNB Parietal notch bone

An ossicle of any size in the parietal notch is scored **1**.

SPS Squamo-parietal synostosis

Fusion of the squamo-parietal suture in whole or part is scored **1**. Partial fusion involving the posterior one-third is the most common expression of this rare anomaly (Ossenberg, 1976, Pl. 2D).

ORB Orbital suture variant

The inferior orbital fissure is situated between the floor and lateral wall of the orbit. The anterior end of the fissure is usually bounded bythe junction of the maxilla with the zygomatic bone, scored **0**. Alternatively, a tongue of the greater wing of sphenoid intrudes to form a spheno-maxillary contact or short suture at this site, a variant scored **1** (Kozintsev, A.G. 1992. "Ethnic Epigenetics: a New Approach". **Homo** 43: 213-244). This site can be examined either by looking into the orbit from the frontal aspect, or by examining the sutures in the anterior wall of the infratemporal fossa. My data are based on the latter approach.

CON Infraorbital suture variant

Confluence of the infraorbital suture with the zygomaxillary suture at or below the orbital margin is scored **1**. (**Epigenetic Variants**, Fig. 11 b,c; Ossenberg 2006, Fig. 3; Kozintsev AG 1992. "Ethnic Epigenetics: a New Approach". **Homo** 43: 213-244). In cases where the infraorbital suture appears to be obliterated – a normal age change – its remnants can sometimes be made visible by wetting the area.

JAP Os japonicum

A complete transversozygomatic suture dividing the bone into an upper portion and a lower (*Os japonicum*) portion is very rare in most populations (with the exception of the indigenous populations of Japan) and is scored **2**. A posterior trace of the suture 2mm or more in length is scored **1**.

2. Traits Related to Nerves, Arteries and Veins

POS Postcondylar canal

A *postcondylar canal* which in life transmits a vein communicating between the sigmoid sinus and the suboccipital plexus is usually present bilaterally. A right or left side in which a canal or foramen of any size pierces the condylar fossa is scored **0;** absence of the postcondylar canal on that side is scored **1.**

SQS Squamous style

The parietal process of the temporal squama is essentially a bony manifestation of an arterial variant. The middle temporal artery normally arises from the auriculotemporal, pierces the temporalis fascia and then runs up deep to the temporalis, its course marked by a vertical groove on the side of the cranial vault above the root of the zygomatic arch. The variant is the origin of the middle temporal artery from the middle meningeal in the middle cranial fossa. The anomalous artery then exits the skull via a "squamoparietal canal" formed between the beveled surfaces of the squamoparietal suture. The canal usually, though not in every case, extends upwards for a short distance by means of a flat style-like projection of the squama. Above its point of exit the artery etches a telltale pattern of branching groves on the parietal bone while the normal vertical groove above the zygomatic root is usually (not always) absent (1969, p 114; 1976, Pl 2B; **Epigenetic Variants** p. 191 and Pl xxviii a). This variant is scored **1.** Other variants involve branches of the middle meningeal directly piercing the temporal squama or the parietal bone; however, these are extremely rare and were not recorded.

MAR Marginal foramen of the tympanic plate

(1969, p 48; 1976, Pl 4B)

This bony foramen during life encloses the auriculotemporal nerve branch just before it pierces the cartilage of the external auditory meatus to supply the skin lining the meatus. The lateral margin of the tympanic plate, though rough and porous in all individuals, in some cases shows a distinct groove at the mid-point of its inferior surface; the groove is scored **0**. The variant scored **1**results from bony spicules growing from the edges of a well-defined groove and meeting to form a foramen. Spurs which do not quite meet are scored **0**. In order to see the canal which is more or less sagittally oriented the skull must be tilted obliquely from the basal view (from which *tympanic dehiscence* is observed).

LPF Lateral pterygoid plate foramen

(1969 p. 136; 1976 Pl 3 A, B)

This is a round or oval foramen 1-2 mm in diameter piercing the lateral pterygoid plate close to its posterior border and roughly at its mid-point or, more superiorly, near the roof of the infratemporal fossa. During life it transmits the mandibular nerve branch and/or vascular structures supplying the medial pterygoid muscle.

SOF Supraorbital foramen

A branch of the frontal nerve and associated vessels supplying the skin of the forehead and scalp in some crania exit the orbit through a bony foramen or canal piercing the superior orbital margin. In some cases the canal is deep, its external opening as much as 15 mm above the orbital margin; deepest canals tend to occur in the lateral, rather than in the middle or supratrochlear portion of the margin. More commonly the feature is a foramen seemingly formed when spicules of bone growing from the edges of a deep notch meet; these tend to occur in the middle portion of the margin or towards its medial end. Any such canal or foramen which communicates between the roof of the orbit and the external surface of the frontal bone is scored **1.** Two or more such features on the same side are scored **2.** A deep notch in the orbital margin – even where the spicules of bone *almost* meet – is scored **0.** Openings for diploic veins are scored **0.**

FRG Frontal grooves

(**Epigenetic Variants** p. 48; Pl VII a, b)

Frontal grooves scored **1** are usually single, sometimes multiple, grooves impressed into the lateral portion of the frontal bone by branches of the supraorbital nerve and/ or vessels running upwards from the orbital margin to enter the skin of the forehead and scalp. Frontal grooves often occur in association with a deep supraorbital canal, but they also occur independently of the presence of a canal or foramen. In some cases, vague meandering grooves run transversely on the frontal bone; such cases are scored **0.**

OPT Accessory optic canal

(1969 p. 118; 1976 PL I A, B)

This rare anomaly is essentially a bony manifestation of an ophthalmic artery variant. Normally, the ophthalmic artery branches off the internal carotid immediately after the latter pierces the dural roof of the cavernous sinus; it then enters the orbital cavity through the optic canal, lying on the floor of the canal below and lateral to the optic nerve. In the anomalous case the ophthalmic artery arises from the cavernous portion of the internal carotid and enters the orbit through an *accessory optic canal* or notch in the stout postero-inferior root of the lesser wing of the sphenoid which forms the floor of the optic canal. The complete *accessory optic canal* is a round canal approximately 2 mm in diameter piercing the floor of the optic canal, scored **2.** An incomplete *accessory optic canal* scored **1** is the case where the floor of the optic canal is either notched or deficient; i.e. abnormally slender. According to the position and orientation of the accessory optic canal (or notch) it appears that the postero-inferior root of the lesser wing during development is obstructed by, and must chondrify around, the anomalous ophthalmic artery.

MEN Mental foramen double

The mental nerve and associated vessels arise in the mandibular canal and exit the mandible via the mental foramen to supply the skin of the lip and chin region. Usually there is a single mental foramen, scored **0.** The case of two or more foramina is scored **1.**

BUC Retromolar foramen

(Ossenberg, 1987)

This trait relates to variations in the course and connexions of the buccal nerve, a branch of the anterior division of the mandibular nerve carrying sensory fibres from the cheek and buccal gingiva. The buccal nerve usually passes medial to the tendon of the temporalis at its attachment to the coronoid process and temporal crest. In some individuals sensory nerve branches from the molar roots run upwards to pierce the bone of the retromolar fossa and join the buccal nerve (1987, Fig 2A). In some cases, in its passage backwards from the cheek, the buccal nerve (or part of it) pierces the bone of the retromolar fossa, receives accessory sensory branches from the molar roots and then joins the inferior alveolar nerve close to the opening of the mandibular canal (1987, Fig 2B). Any *retromolar foramen* as described above is scored **1.** Very rarely, the buccal nerve runs through a conspicuous *temporal crest canal* whose anterior opening is in the upper portion of the retromolar fossa and whose posterior opening is behind the temporal crest (1987, Fig 2C); this rare anomaly is scored **2.**

3. Variations at the Craniovertebral Border

The exoccipital and supraoccipital portions of the occipital bone develop in paraxial mesoderm with four somites serially homologous with those of the atlas and axis vertebrae. The basiocciput, including the anterior portions of the occipital condyles, develops from the parachordal cartilages surrounding the cranial end of the notochord. Certain morphological traits at the craniovertebral border result from variations in the number, or in the normal pattern of fission and coalescence, of these primordial elements (Barnes, Ethne. 1994 **Developmental Defects of the Axial Skeleton in Paleopathology**. University Press of Colorado; Ossenberg 1969, p. 145-185; Wackenheim, Auguste. 1974. **Roentgen Diagnosis of the Craniovertebral Region***.* New York, Springer-Verlag).

PCTB Precondylar tubercles

(1969 p. 161 - ; **Epigenetic Variants** p. 134 -; Fig 22 b, c; Pl XIXg; Pl XX f, h)

Precondylar tubercles are bilateral small bony protuberances on the basiocciput near the anterior margin of the foramen magnum. As a manifestation of the occipital vertebra they are thought to result from "cranial shift" at the craniovertebral border; i.e. the cartilaginous primordia of the occipital bone fail to integrate completely, so that the anterior margin of the foramen magnum retains morphological features reminiscent of the anterior arch of the atlas (Barnes 1994). Precondylar tubercles vary; but most cases are small discrete paired tubercles, usually of unequal size, situated close to the midline and separated from each other by a narrow gap. In other cases paired bony ridges extend medially towards each other from the antero-superior portions of the condyles. Very rarely, the condylar articular suface extends medially onto such a precondylar ridge for articulation with an anomalous anterior arch of atlas. Any such bony tubercle or ridge is scored **1.** (The *Basilar tubercle* (1969 p.165) is a median protuberance extending backwards into the foramen magnum and, as it theoretically represents an ossified notochord remnant, it is a trait distinct from the PCT. This feature was scored but not included in my tables).

ODON Odonto-occipital articulation

(1969 p. 157)

This is a rare oval facet 5-6 mm wide on the anterior margin of the foramen magnum for articulation with the tip of the odontoid process, scored **1.** It is flat or shallowly concave and, in contrast to the condyles, is barely raised above the plane of the foramen magnum. (This trait is distinct from *Condylus tertius* (**Epigenetic Variants,** Fig. Pl XXg) **-** also a rare anomaly **-** which articulates with a facet on the anterior arch of the atlas and is located on the basiocciput anterior to the foramen magnum. *Condylus tertius* was not recorded separately in my studies, though it is possible that a few cases were scored as *Precondylar tubercles).*

TRFS Transverse fissure of basiocciput

(1969, p.159 - ; Barnes, 1994 p. 84, Fig. 3.25)

This rare anomaly is a transversely oriented slit or dehiscence penetrating the basiocciput on one or both sides. Sometimes the slit is isolated within the occipital bone; more often it extends laterally to the petro-occipital synchondrosis giving the basiocciput a "waisted" appearance. Any such feature is scored **1.** Barnes (1994) places this anomaly among those resulting from cranial border shift.

PHAR Pharyngeal fossa

(1969, p. 168 -; 1976, Pl 5A; **Epigenetic Variants**, p. 137; Pl XX b, f)

Pharyngeal fossa is a median fovea in the basiocciput anterior to the pharyngeal tubercle. The smallest is a shallow pit about 1 mm in diameter barely indenting the bone and is scored **1.** Any pit more conspicuous than the minimal expression is scored **2**. The largest tend to be tub-shaped and may be up to 3 mm in both circumference and depth. A related variant, extremely rare and scored **3**, is called the *Median basilar canal;* it tunnels obliquely from its external opening at the site of the *Pharyngeal fossa* to its internal opening on the clivus of the skull. The fossa and the canal may be related to remnants of the notochord.

HYP Hypoglossal canal bridged or double

(1969, p. 145- ; **Epigenetic Variants**, p. 120-)

The hypoglossal (anterior condylar) canal gives passage to cranial nerve XII and occasional vascular structures. It is usually single and undivided. The presence of two hypoglossal canals; or a case where the canal is partly occluded by a bony bridge – whether at the internal or the external aperture or anywhere within the canal - is scored **1.** Any partial expression of a bridge (spurs) is scored **0.** This trait is one of the manifestations of the occipital vertebra theoretically resulting from incomplete coalescence of the occipital somites; i.e. cranial border shift.

PCP Paracondylar process

(1969, p. 151 - ; 1976 Pl C, D; **Epigenetic Variants**, p. 128 -, Pl XIX g)

Lateral to the posterior portion of the occipital condyle the surface of the jugular process giving attachment to the rectus capitis lateralis muscle is usually flat or gently convex, and fairly smooth in texture. In some crania a *Paracondylar process* projects from this surface. The feature scored **1** is the minimal expression of the PCP, a very small conical tubercle or eminence. A conspicuously large process; or one of any size with an articular facet for the transverse process of the atlas (or with an epitransverse process, Barnes 1994 p. 89) whether the articular facet on the PCP is discrete from **-** or continuous with - that of the occipital condyle is scored **3.** In subadults the PCP may bear a flattened corrugated facet resembling the epiphyseal surface at the end of a growing limb bone, suggesting a temporary cartilaginous joint with the atlas or with a separate PCP epiphysis; such a feature is scored **3**. Any process larger than the minimal expression but not qualifying for a **3** is scored **2.**

Paracondylar processes (and *Precondylar tubercles)* are often involved in cases of the rare anomaly *Atlanto- occipital assimilation.* I described cases of this anomaly in the cranial series I examined but have not included it in the tables. According to Barnes (1994) *Atlanto-occipital assimilation* represents caudal shift at the cranio-vertebral border. However, *Paracondylar process* by itself likely represents persistence of the transverse element of the occipital vertebra; i.e. cranial shift at the border. Because of the range of expressions of PCP, some of which involve reciprocal anomalies of the atlas, perhaps it would be best to classify all such expressions including *Atlanto-occipital assimilation* neither as cranial shift nor as caudal shift, but more generally as hypoplasia at the craniovertebral border.

Because of its wide range in expression I have found *Paracondylar process* to be one of the most difficult features to score and, out of exasperation, many times contemplated scrapping it. Yet, I persisted in recording it not only because of its inherent morphological and clinical significance, but also because with scoring refinements PCP may prove to be a powerful population discriminator.

ATA Atlas bridging, type A

A bony bridge on the atlas extending from the condylar process to the posterior arch and spanning the groove for the vertebral artery (**Epigenetic Variants**, Fig. 17h) is scored **1.** Incomplete bridges - spurs which do not meet – (**Epigenetic Variants**, Fig.17 e-g) are scored **0.**

ATB Atlas bridging, type B

A bony bridge on the atlas extending from the condylar process to the transverse process and spanning the groove for the vertebral artery (**Epigenetic Variants**, Fig.17d) is scored **1.** Incomplete bridges – spurs which do not meet (**Epigenetic Variants**, Fig. 17, a-c) - are scored **0.** Both types of bridging can occur on the same vertebra. An atlas bridge of either type occasionally forms a synovial articulation with a *Paracondylar process.* According to Barnes (1994) atlas bridges are thought to result from caudal shift at the craniovertebral border (but see the note above under PCP).

4. Hypostotic traits

These features represent arrested morphogenesis; i.e. retention of a fetal or immature stage beyond the age when development is normally completed and adult morphology attained (Ossenberg, 1970).

TYM Tympanic dehiscence

(1969, p. 34-; **Epigenetic Variants**, p. 143-)

At birth the tympanic membrane is very superficial on the skull, framed by a C-shaped bony ring. Subsequently, growth laterally from the anterior portion of the C-shaped ring forms the floor of the auditory meatus. Up to the age of about five years there is a normal developmental dehiscence in the floor of the meatus which is gradually filled in by tiny finger-like processes of bone derived from its margins which give it a transitory cribriform appearance. The tympanic plate attains its full lateral growth during in adolescence by which time the dehiscence normally has been obliterated. Except for its rough and porous lateral margin, the mature tympanic plate normally is not perforated. The feature scored **1** is an aperture in the middle of the plate ranging in size from a pinhole, to a dehiscence as large as 5 mm. The margins of the larger ones often have a jagged or lacerated appearance. In some cases the dehiscent area is cribriform, in other cases may consist of two or more pinholes.

FSP Deficient wall of the foramen spinosum and / or ovale

(1969, p. 38; **Epigenetic Variants**, p. 149-)

The roots of the sphenoid greater wing in the region of foramen rotundum and the pterygoid canal are preformed in cartilage; the other portions of the greater wing ossify in membrane. Early in the human fetus neither the foramen spinosum nor foramen ovale are differentiated: the mandibular nerve, middle meningeal artery and associated structures make their exit from, or entry to, the middle cranial fossa through the foramen lacerum medium as in the adult forms of other mammals. Subsequently, bone encroaches on and surrounds the neurovascular structures thereby separating the foramen ovale, foramen spinosum (and occasionally an emissary foramen of Vesalius anterior to foramen ovale) from each other and from the sphenopetrous fissure. Various expressions of arrested morphogenesis in this region are recognized: foramen ovale and spinosum are confluent, either foramen communicates with the sphenopetrous fissure, both foramina open into the fissure, or any combination of these deficiencies. The communications vary from the merest suture-like slit, to large deficiencies in the walls. Foramen spinosum confluent with sphenopetrous fissure is the trait most commonly seen. Any such variant is scored **1.**

5. Hyperostotic Traits

These features are characterized by an excess of ossification over the normal condition; i.e. ossification into structures normally membrane, cartilage, ligament or dura (Ossenberg 1969, 1970).

ICC Intermediate (lateral) condylar canal

(1969, p. 74- ; 1976, Pl. 6 A, B; **Epigenetic Variants**, p. 126-)

A small vein commonly connects the beginning of the internal jugular and the anterior condylar (hypoglossal) emissary vein with the postcondylar emissary vein or suboccipital plexus. This vein runs backwards in a groove lateral to the base of the occipital condyle. In some crania a bony crest from the lateral lip of the groove grows medially to fuse with the base of the condyle whereby the groove for all of its length - or more commonly for a short portion - is converted to a canal one to two mm in diameter. Any such canal is scored **1.** A spur or crest which fails to fuse with the condyle is scored **0.** Because of the orientation of the ICC its openings especially in the case of a long canal of small diameter easily escape notice; the skull should therefore be tilted slightly to an oblique position to make the observation.

CIV Pterygospinous bridge (Foramen of Civinini)

(1969, p. 50 - ; 1976, Pl 3 A, B; **Epigenetic Variants**, p.156-)

The pterygospinous ligament stretches from a point near the middle of the posterior border of the lateral pterygoid plate to, or to some point near, the spine of the sphenoid. The variant scored **1** is complete ossification of this ligament. A case where spurs extend towards each other but do not actually join is scored **0.** The *Pterygospinous bridge* forms a foramen, more or less sagittally oriented, and situated below and medial to the foramen ovale. This anomalous bony foramen varies in size and shape according to the extent of ossification of the structures forming its margins (i.e. the plate, ligament and spine) and may be subdivided into two or more apertures, completely, or partially by means of bony spurs. The trait LPF (*Lateral pterygoid plate foramen)* often occurs with a *Pterygospinous bridge,* but can also occur independently.

PTB Pterygobasal bridge

(1969, p. 53 - ; 1976, Pl 3 C,D; **Epigenetic Variants**, p. 156 -, Pl XXIV g, h, i)

A ligament commonly stretches from the posterior border of the lateral ptyerygoid plate near its root, to a point on the greater wing of sphenoid lateral to the foramen ovale. The ligament likely gives attachment to fibres of the upper head of the lateral pterygoid muscle, and stretches below and protects the masseteric and deep temporal branches of the mandibular nerve. Occasionally, as they course laterally from the foramen ovale on the greater wing of sphenoid these nerves for a short distance lie in an approximately 5 mm wide shallow sulcus. Independent of the presence or not of a sulcus, the ligament may ossifiy completely or partially. Minimal expression scored **1**, is a tiny sharp forward- pointing spur on the greater wing lateral to the foramen ovale; also scored **1** is the case where a shallow sulcus is present and deepened slightly by a bony spur or crest seemingly pinched up from its posterior margin. Full expression scored **3** is either complete ossification of the ligament or spurs that *almost* connect, with only a slit-like gap between them. An expression larger than minimal yet not sufficient to merit a **3** is scored **2.** Though situated close to each other on the roof of the infratemporal fossa *Pterygospinous bridge*, situated medial to the foramen ovale, cannot be confused with *Pterygobasal bridge* which lies lateral to the foramen; they are distinct and independent traits.

CLN Clinoid bridges

(1969, p. 57 - ; 1976, PL 5 C, D; **Epigenetic Variants**, p. 162, Pl XXIV b, c)

On each side of the sella turcica the clinoid processes – anterior, posterior and middle (inconstant) – are normally joined by "ligaments" of the dura reinforcing the attachments of the tentorium cerebelli. The anomalous case is where two or three of the clinoid processes are joined by a bony bridge instead of by dura. When the anterior and middle processes are so joined the carotico- clinoid canal is formed, enclosing the internal carotid artery as it bends upwards to pierce the dural roof of the cavernous sinus: this variant, *AM,* is scored **1.** A bridge uniting the anterior and posterior processes, *AP,* is scored **2.** The case where all three processes are joined, *AMP,* is scored **3.** Also included in these categories are cases in which the bridge appears to be interrupted; i.e. slender bony bars with flattened ends approach each other so closely that they appear to form a tiny joint. Any lesser spur expression is scored **0.** The region of the sella turcica is observed with a pen-light and dental mirror inserted through the foramen magnum.

TRS Trochlear spur

(1969, p. 62- ; 1976, PI 1 C; **Epigenetic Variants**, p. 64, PI IXf)

This variant is a small spine on the upper medial wall of the orbit at the site of attachment of the fibrocartilaginous pulley for the tendon of the superior oblique muscle of the eyball. It represents ossification into one of the two ligaments –most commonly the ligament of the posterior-superior horn - attaching the cartilaginous arc of the pulley to the frontal bone. The bony spur varies from barely perceptible to well-developed: any expression is scored **1.**

MHB Mylohyoid bridge

(1969, p.66- ; 1974; 1976, Pl 6 C, D; **Epigenetic Variants**, p. 234-)

Ossification of the sphenomandibular ligament at its insertion on the medial surface of the mandibular ramus converts the mylohyoid groove to a bony canal enclosing the mylohyoid nerve and vessels, a variant scored **1.** The mylohyoid canal varies in length from 2 to 25 mm and may be interrupted into two or more segments. Rarely, the mylohyoid canal opens superiorly at the level of the mandibular foramen. In this case its opening is often shielded by an extension backwards of the lingula (the extension also representing ossification into the sphenomandibular ligament). Such high-opening mylohyoid canals, especially if they are long ones, can easily be overlooked. Mylohyoid bridges starting at the level of the mandibular foramen were noted separately on my scoring sheets but included with the other MHB variants scored **1** in the tables.

6. Dental Variants

Three dental variants were included in my survey. These were chosen because, unlike most morphological features of the crown for which scoring requires unworn teeth and the expertise of a dental anthropologist, these are fairly easy to assess and are observable in most crania.

M3U Upper third molar suppressed

Congenital absence or suppression of the third molar is scored **1.** A juvenile case where the molar crown had still been forming in its crypt at time of death is scored **0**; as is any case where the molar is present, or where the empty socket shows it had fallen out post-mortem, or where the alveolus shows evidence that the molar had been lost ante-mortem. A peg-shaped third molar or one greatly reduced in size was noted on my scoring sheets but entered in the tables as **0.**

M3L Lower third molar suppressed

The same protocol as above applies to scoring M3L.

TRM Three-rooted mandibular first molar

(Turner, C.G. II. 1971. "Three-rooted Mandibular First Permanent Molars and the Question of American Indian Origins". **American Journal of Physical Anthropology** 34: 229-242)

Normally the first permanent mandibular molar has two roots: this case is scored **0.** The variant scored **1** is the presence of an extra, distolingual root. This variant is scored most easily by counting the root sockets in the case where the tooth had been lost. When the molar was still in the jaw, gently rocking the tooth will usually permit it to be elevated sufficiently to observe the roots at the level of their bifurcation. The extra root usually, but not always, angles more towards the lingual surface of the alveolus than does the mesial root. X-rays to assess TRM were not used in my survey.

I started to record T*RM* routinely in 1981. However, I had the opportunity in the 1990's during visits to the USNM and CMC, to re-examine samples scored previously and update these for *Orbital suture variant, Infraorbital suture variant* as well as for *Three-rooted mandibular first molar*.

INTRAOBSERVER SCORING REPLICABILITY

The measure of how consistently from one recording session to the next a researcher has followed the protocol for recording a trait present or absent is extremely important, though few workers have formally analyzed this (Molto, J.E. 1979. "The Assessment and Meaning of Intraobserver Error in Population Studies Based on Discontinuous Cranial Traits". **American Journal of Physical Anthropology** 51: 333-344). It has often been asserted that one of the advantages of discontinuous variants for anthropological research is the ease with which they can be scored and standardized. This is not a valid assumption: the wide range of expression in size and/or position of several of the traits means that it can be difficult to establish a cut-off point for presence/absence. Compounding the difficulty is that archaeological remains are often incomplete, damaged, or affected by preservatives and storage methods. My research with nonmetric traits has occupied a span of some forty years. The usefulness of these data to other researchers will depend on their confidence in my scoring consistency. Results and discussion of my analysis are in Ossenberg, N.S. 2011. *Intraobserver Scoring Replicability*. [unpublished article].

Inter-observer replicability is even more problematic. If a researcher should wish to compare or amalgamate his data with mine he would have to ensure that our protocols are identical. Some of the museum samples represented in my Tables are still available for study. I suggest that the best way to ameliorate inter-observer error would be for him to record one or more of these samples following my protocol for each trait as detailed above; and then compare his present/absent scores with mine.

GEOGRAPHIC SAMPLES

The Cranial Nonmetric Trait Database is based on 27 files organized by geographic region. Each of the original files is indicated by a bullet.

NATIVE AMERICA AND GREENLAND (NA) (GP1)

Arctic (AR) (GP2)

- **Arctic 1 – South Alaska (SAL)** (GP3)
  Alaska Peninsula to Golovin Bay

GP4	GP5	Sample Size
	Port Moller	8
Yupik –speakers (YP)	Naknek River	61
Yupik –speakers (YP)	Nushagak River	72
Yupik –speakers (YP)	Kuskokwim River, middle	66
Yupik –speakers (YP)	Kuskokwim River, lower	62
Yupik –speakers (YP)	Nelson Island	32
Yupik –speakers (YP)	Nunivak Island	107
Yupik –speakers (YP)	Hooper's Bay	29
Yupik –speakers (YP)	Yukon River, middle	43
Yupik –speakers (YP)	Yukon River, lower	51
Yupik –speakers (YP)	Norton Sound	39
Yupik –speakers (YP)	Golovin Bay	100
	Total	**670**

- **Arctic 2 – St. Lawrence Island, Siberia (Chukotka) (SLS)** (GP3)
  The assignment of the USNM St Lawrence Island remains to Old Bering Sea, Punuk or recent Yupik-speakers was based on the 1996 report of the Repatriation Office.

  According to an article by H.-G. Bandi and R. Blumer (*Investigations by Swiss Archaeologists on St. Lawrence Island, Alaska*. 2002. In: **Archaeology of the Bering Strait Region**, edited by D.E. Dumond and R.L. Bland, University of Oregon Anthropological Papers no. 59: 25-59.) most of the remains excavated by Hans-Georg Bandi and colleagues and curated at the University of Geneva belonged to the Punuk cultural group. A few were associated with Old Bering Sea cultural objects. I assigned the individual crania in my files according to this information. Importantly, the extensive radiocarbon dates provided by R. Blumer (*Radiochronological Assessment of Neo-Eskimo Occupations on St. Lawrence Island*. In: **Archaeology of the Bering Strait Region**, edited by D.E. Dumond and R.L. Bland, University of Oregon Anthropological Papers no. 59: 61-106.) indicate that Old Bering Sea and Punuk were to a large extent contemporaneous but distinct sociocultural units on St. Lawrence.

  Of the many burials in the Ekven Cemetery, Chukotka, I recorded data for 77. I placed these all in a single "Old Bering Sea" file. However, according to an article by M.M. Bronshtein and K.A. Dneprovsky (*The Northeastern Chukchi Peninsula during the Birnirk and Early Punuk Periods.* In:

Archaeology of the Bering Strait Region, edited by D.E. Dumond and R.L. Bland, University of Oregon Anthropological Papers no. 59: 153-166.) the representation of cultural groups in this cemetery is much more complicated including elements of Punuk and Birnirk as well as Old Bering Sea.

GP4	GP5	Sample Size
Old Bering Sea (OB)	St. Lawrence Island	17
Punuk (PU)	St. Lawrence Island	120
Yupik-speakers (YP)	St. Lawrence Island	129
Old Bering Sea (OB)	Siberia Chukotka	77
Yupik-speakers (YP)	Siberia Chukotka	80
	Total	**423**

- **Arctic 3 – North Alaska (NAL)** (GP3)
  Seward Peninsula to Point Barrow

GP4	GP5	Sample Size
Inupik- speakers (IP)	Kauwerak	52
Inupik- speakers (IP)	Wales	40
Inupik-speakers (IP)	Shishmarev	72
Ipiutak (IK)	Point Hope, Ipiutak	56
Inupik-speakers (IP)	Point Hope, Tigara	61
Inupik-speakers (IP)	Point Hope, recent	50
Birnirk (BK)	Point Barrow, Birnirk	44
Inupik-speakers (IP)	Point Barrow, recent	86
	Total	**461**

- **Arctic 4 – Central Arctic (CAR)** (GP3)
  Mackenzie Delta to Ellesmere Island

GP4	GP5	Sample Size
Inupik- speakers (IP)	Mackenzie	70
Inupik- speakers (IP)	Caribou	16
Inupik-speakers (IP)	Copper	12
Ipiutak-speakers (IP)	Netsilik	3
Thule (TH)	Hudson's Bay	140
Inupik-speakers (IP)	Sadlermiut	104
Inupik-speakers (IP)	Baffin	14
Inupik-speakers	Iglulik	58
	Total	**417**

- **Arctic 5 – Eastern Arctic (EAR)** (GP3)
  Quebec, Labrador, Newfoundland, Greenland

GP4	GP5	Sample Size
Inupik-speakers (IP)	Labrador	120
Inupik-speakers (IP)	Quebec	2
Dorset (DO)	Newfoundland	6
Inupik-speakers (IP)	Greenland West North Greenland Polar	45
Inupik-speakers (IP)	Greenland West Central - Upernavik area	58
Inupik-speakers (IP)	Greenland West South – Uumannalik area	36
Inupik-speakers (IP)	Greenland East South – Ammassalik area	69
Inupik-speakers (IP)	Greenland East North – Scoresbysund area	61
	Total	**397**

Northwest (NW) (GP2)

- **Athapaskan Territories (AT)** (GP3)

GP4	GP5	Sample Size
Alaska, Athapaskans (AK)	Southeast	12
Alaska, Athapaskans (AK)	Yukon River	82
Canada, Athapaskans (CA)		19
Oregon, Athapaskans (OR)		45
Southwest Athapaskans (SW)	Apache	28
Southwest Athapaskans (SW)	Navajo	26
	Total	**212**

- **Aleutian Islands (AL)** (GP3)
  Radiocarbon dates for certain individuals in the Shiprock, Umnak and Kagamil files have been noted in the Field 7 (**Site**). These dates are from: Coltrain, J.B., M.G. Hayes and D.H. O'Rourke. 2006. *Hrdlička's Aleutian Population-Replacement Hypothesis: A Radiometric Evaluation*. **Current Anthropology** 47, No.3 (June 2006): 537-548.

GP4	GP5	Sample Size
Eastern	Shumagin Islands	13
Eastern	Amaknak Island	36
Eastern	Unalaska Island	35
Eastern	Shiprock	47
Eastern	Umnak Island	120
Central	Kagamil Island	130
Central	Andreanov Islands	53
Central	Rat Islands	53
Western	Near Islands	54
	Total	**541**

- **North Pacific Coast (NPC)** (GP3)

GP4	GP5	Sample Size
Kodiak	Lower – Blue	46
Kodiak	Middle – Red	92
Kodiak	Upper - Black	72
Tlingit		50
Prince Rupert Harbour		85
Haida		18
Haida	Central, East	43
Haida	Central, West	30
Haida	North	38
Haida	South	31
Namu		29
	Total	**534**

- **Plateau (PLT)** (GP3)

  Most Plateau heads had been shaped in infancy by cradleboard and bandages producing the fronto-occipital (sometimes the fronto-lambdoid) type of artificial cranial deformation. For each individual I assessed, deformation was recorded as: **DEF** (deformed), or **UDF** (undeformed); or, more specifically as degrees (0, 1, 2, 3, 4); and **L** (posterior flattening more pronounced on the left; frontal bone flattening greater on the right), **R** (posterior flattening more pronounced on the right; frontal bone flattening greater on the left), or **S** (symmetrical). This information is in Field 13 (**DeformOriginal**).

GP5	Sample Size
Chinook	36
Nez Perce	63
Sahaptin	57
Salish	63
Yamhill (Kulapaya)	21
Total	**240**

- **Plains (PLN)** (GP3)

  Historic 19th century tribes of the northern Plains.

GP4	GP5	Sample Size
Arikara		71
Assiniboin		33
Blackfoot		15*
Cheyenne		29
Dakota		8
Dakota	Santee	30
Dakota	Santee – not confirmed	2
Dakota	Teton	81
Dakota	Wiciyela	18
Dakota	Wiciyela – not confirmed	9
	Total	**296**

*Frequency data for 82 Blackfoot crania are contained in the paper files. Unfortunately, in several instances, multiple individuals were scored on a single recording form whereby it was not possible to separate the individuals for entry into electronic files. Therefore only 15 Blackfoot records are represented in the electronic files.

- **Northern Mississippi Valley (NMV)** (GP3)

  These remains were retrieved from burial mounds in the region of the northeastern Plains' periphery (Minnesota, North and South Dakota, and neighbouring parts of Manitoba and Ontario). References providing archaeological provenience are cited in Ossenberg, N.S. 1974. In *Origins and Relationships of Woodland Peoples: The Evidence of Cranial Morphology*. In: **Aspects of Upper Great Lakes Anthropology: Papers in Honor of Lloyd A. Wilford**, edited by Elden Johnson. St. Paul, Minnesota Historical Society: 15-39.

  Archaeological classification of sites is subject to disagreement and revision (Myster, Susan M.T. 2001. **Ten Thousand Years of Population Relationships at the Prairie-Woodland Interface: Cranial Morphology in the Upper Midwest and Contiguous Areas of Manitoba and Ontario**, Ph.D. Thesis, University of Tennessee: Knoxville, Tennessee). Provenience provided in my database will permit researchers to re-assemble the archaeological sites according to their own preferred taxonomic framework.

GP4	GP5	Sample Size
Late Woodland period	Arvilla phase, north	86
Late Woodland period	Arvilla phase, south	80
Late Woodland period	Blackduck phase, north	64
Late Woodland period	Blackduck phase, south	45
Late Woodland period	Devil's Lake phase	36
Late Woodland period	Manitoba phase	85
Late Woodland period	Melita phase	45
Late Woodland period	Mille Lacs phase	59
Late Woodland period	phase indeterminate	34
Middle Missouri tradition	Big Stone phase	12
	Total	**546**

Northeast (NE) (GP2)

- **Northeastern North America**
  Illinois, Ontario, Newfoundland
  Of the Illinois Hopewell crania 37 showed deformation of the bifronto-occipital type, while 63 were judged by me to be undeformed (Ossenberg, Nancy S. 1970. *The Influence of Artificial Cranial Deformation on Discontinuous Morphological Traits*. **American Journal of Physical Anthropology** 33 (3): 357-371.).

GP3	GP4	GP5	Sample Size
Illinois (ILL)	Middle Woodland period	Hopewell	100
Ontario (ONT)	Late Woodland period	Iroquois	72
Ontario (ONT)	Middle Woodland period		3
Newfoundland (NFL)	Archaic period	Maritime	41
		Total	**216**

Southwest (SW) (GP2)

- **Pecos**
  Pecos Pueblo
  Checking my deformation categories for Pecos against those on Hooton's original file cards, I noticed that my assessment usually placed a cranium in a higher category; i.e. where Hooton had assigned a +, mine would be ++. Provenience for the crania with respect to location in the site or Glaze (i.e. time-level) was taken from Morgan, M.E. 2010. **Pecos Pueblo Revisited: The Biological and Social Context.** Papers of the Peabody Museum of Archaeology and Ethnology 85, Harvard University, Cambridge, Massachusetts.

GP3	Sample Size
Pecos Pueblo (PEC)	168

South America (SA) (GP2)

- **South America**

GP3	Sample Size
Chile (CH)	34
Patagonia (PT)	12
Terra del Fuego (TF)	14
Total	**60**

<u>NORTHEAST ASIA (AS)</u> (GP1)

Analysis based on the Northeast Asian samples is presented in Ossenberg, N.S., Dodo, Y., Maeda, T. and Kawakubo, Y. 2006. *Ethnogenesis and Craniofacial Change in Japan from the Perspective of Nonmetric Traits*. **Anthropological Science** 114, no. 2: 99-115.

Japan (JA) (GP2)

- **Jomon (JOM)** (GP4)

  Jomon sites are grouped according to geographic region. Hokkaido (HK), North (Tohoku District), Central (Tokai and Kanto Districts), West (Kyushu, Shikoku, Chugoku and Kinki Districts). These are middle to final Jomon period sites with dates ranging from about 3500 BC to 300 BC. Epi-Jomon sites in Hokkaido are later, roughly 300 BC to 700 AD.

GP3	GP5	Sample Size
Hokkaido (HK)	Epi-Jomon	27
Hokkaido (HK)		34
North (N)		62
Central (C)		61
West (W)		83
	Total	**267**

- **Ainu (AI)** (GP4)

  The Ainu sites in Hokkaido were aggregated geographically: Northeast (Kushiro, Nemuro, Abashiri and Soya provinces, and Kunashiri Island), Southeast (Hidaka and Tokachi provinces), West (Rumoi, Ishikari and Shiribeshi provinces).

GP3	GP5	Sample Size
Hokkaido (HK)	Northeast (NE)	50
Hokkaido (HK)	Southeast (SE)	36
Hokkaido (HK)	West (W)	31
Hokkaido (HK)		31
	Total	**148**

- **Japan**

  Wajin Japanese samples were defined regionally and according to historic period. The boundaries of North, Central and West regions are identical to those stated above for Jomon. Additionally, North (Tohoku District) was subdivided into: North (N) a southern portion (Fukushima, Yamagata and Miyagi prefectures) and Northern North (NN) a northern portion (Akita, Iwate, and Aomori prefectures).

  Some individuals represented in this table had been retrieved from archaeological sites. Others had been University Anatomy dissecting-room subjects; and for those subjects whose age had been documented, age at death in years is entered in Field 11 (AgeY) and indicated as "d".

GP3	GP4	GP5	Sample Size
Northern North Japan (NN)	Edo Period (EDO)	Middle Period (birth dates 18th Century)	42
Northern North Japan (NN)	Post Meiji Period (PMJ) (birth dates 1875+)		12
North Japan (N)	Edo Period (EDO)	Late Period (birth dates 1800-1874)	78
North Japan (N)	Post Meiji Period (PMJ) (birth dates 1875+)		75
Central (C)*			47
Central (C)	Medieval Period (MDV)		69
Central (C)	Edo Period (EDO)	Early Period (birth dates 17th Century)	52
Central (C)	Edo Period (EDO)	Middle Period (birth dates 18th Century)	36
Central (C)	Edo Period (EDO)	Late Period (birth dates 1800-1874)	29
Central (C)	PMJ (birth dates 1875+)		87
West (W)	Yayoi (YAY)		31
West (W)	Edo Period (EDO)	Middle Period (birth dates 18th Century)	45
West (W)	Edo Period (EDO)	Late Period (birth dates 1800-1874)	46
West (W)	PMJ (birth dates 1875+)		61
		Total	**710**

*These 47 individuals are dissecting-room subjects from the University of Tokyo. Though I did not record documented age at death for these, they likely would have had birth dates spanning Late Edo to early post-Meiji Periods.

- **Continental Northeast Asia (NEA)** (GP2)

GP3	GP4	Sample Size
North China (CHN)	Manchuria (MAN)	72
Mongolia (Mon)	Mongolia (MON)	62
Siberia (SIB)	Chukchi (CHU)	54
Siberia (SIB)	Okhotsk (OKH)	37
Siberia (SIB)	Tungus (TUN)	83
Siberia (SIB)	Yukaghir (YKG)	27
	Total	**335**

EURASIA (EU) (GP1)

- **India (IN)** (GP2)
  These crania were imported from India by the University of Alberta for student use in Anatomy courses.

GP3	Sample Size
India (IND)	129

- **Armenia (ARM)** (GP2)
  "Catalog numbers" represent the numbered order in which I scored the Armenian series crania.
  The Museum catalog numbers were not clear.

GP5	Sample Size
Bronze Age (BRZ)	74
Iron Age (IRN)	42
Antique Age (ATQ)	20
Total	**136**

- **Europe (EU)** (GP2)

GP2	Sample Size
Bavaria (BV)	7
Czechoslovakia (CZ)	13
Europe, unspecified country (EU)	4
France (FR)	1
Germany (GE)	7
Russia (RU)	14
Total	**46**

- **Hungary (HU)** (GP2)

GP4	Sample Size
Roman Period (ROM)	10
Medieval Period (MDV)	58
Total	**68**

- **Italy (IT)** (GP2)
  These are crania of Anatomy Department dissecting-room subjects curated at the University of Siena. The subject's documented age at death is entered in Field 11 (AgeY) .

GP3	Sample Size
Siena (SIE)	88

- **Iceland (IC)** (GP2)
  Hafrsfjarthor Churchyard. 1200-1563 AD, excavated by Stefansson.

GP4	Sample Size
Medieval (MDV)	51

- **Britain (BR)** (GP2)
  Ontario, Canada
  Burials were archaeologically excavated from the pioneer cemetery, 1821-1873, of St. Thomas Anglican Church in Belleville, Ontario, Canada as a prelude to clearing the land for new construction at the Church. Most of the records had been lost. For most individuals the age at death was estimated by students in the Anthropology Department of McMaster University. The estimated age is entered in my tables in Field 11 (AgeY). For the few individuals with documented age at death this is indicated by a "d" after the age. Under the direction of the late Shelley Rae Saunders of McMaster University extensive analyses were performed on these skeletons prior to their reburial in 1994, and provided the subject for several published reports.

GP3	GP4	Sample Size
Canada (CAN)	Ontario (ONT)	280

AFRICA (AF) (GP1)

- **Africa**

GP2	GP3	Sample Size
-	-	12
West Africa (W)	Cameroon (CAM)	2
West Africa (W)	Gabon (GAB)	7
West Africa (W)	Ghana (GHA)	33
West Africa (W)	Liberia (LIB)	2
West Africa (W)	Nigeria (NIG)	29
East Africa (E)	Kenya (KEN)	27
East Africa (E)	Tanzania (TAN)	47
Southern Africa (S)	Southern Africa (S)	65
North Africa (N)*	Sudan (SUD)	86
African Americans (AM)**	United States of America (USA)	64
	Total	374

*North Africa
The University of Geneva excavations at Kerma yielded remains dating from three Periods: Ancient, Middle and Classic (Bonnet, C., L. Chaix, M. Honegger and C. Simon. 1995. **Kerma: 1993-1994, 1994-1995, Soudan**. La Revue Genava. Nouvelle Serie, Tome XLIII). Estimated death of individuals made by Christian Simon and his graduate students at the Anthropology Department, University of Geneva, is entered in my Table in Field 11 (AgeY).

* *African Americans
In this series are included 25 anatomy dissecting-room subjects from the Terry Collection. For these crania the recorded age at death is entered in my Table in Field 11 (AgeY).

SOUTH PACIFIC (SP) (GP1)

- **South Pacific**

GP3	GP4	Sample Size
Australia (AU)	Aboriginal (AB)	55
Marquesas (MQ)	Marquesans (MRQ)	78
Chatham Island (CH)	Moriori (MOR)	22
New Zealand (NZ)	Maori (MAO)	48
	Total	**203**

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CITATION

The publishing of analysis and results from research using this data is permitted in research communications such as scholarly papers, journals and the like. The authors of these communications are required to cite the author as the source of these data, and to indicate that the results or views expressed are those of the author/authorized user.

This survey data should be referenced as follows:

Ossenberg, Nancy S. 2013. **Cranial Nonmetric Trait Database**. Kingston, Ontario, Canada: Nancy S. Ossenberg [producer]. Queen's University Library, Data and Government Information Centre [distributor].

DATA PROCESSING

The original 27 files received from Dr. Ossenberg were 'stacked' one on top of the other to create a single Excel spreadsheet. A new column was added at the beginning of the spreadsheet, containing the name of the original file (of the 27) from which that 'record' was obtained. Two additional columns of data were added (representing 'deformity' and 'side of deformity') based on a combined deformity/side of deformity variable in the original data. The original variable was retained on the final dataset.

Ambiguities, inconsistencies, and obvious errors in these data and/or coding were verified/clarified/corrected in close consultation with Dr. Ossenberg.

The resulting 'omnibus' file was imported into SPSS. Variable labels and value labels were added using an SPSS Syntax file (included in the metadata for this data).

Any questions about the dataset or its use should be directed to:
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