

Inventory of Human Remains from the Central Tomb Chamber at Nan Douwas, Pohnpei, Micronesia

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Human remains from the Central Tomb Chamber at Nan Douwas, a stone-wall enclosed burial island at the Nan Madol site, Pohnpei, Eastern Caroline Islands, Federated States of Micronesia (site number PoC3-1), are comprised of more than six hundred small bone fragments and nearly two hundred teeth. No intact cranial or post-cranial remains were recovered. The bones are highly fragmented and incomplete as a result of taphonomic processes involving extensive disturbance, mixing, and old postmortem breakage of the interred remains. The objective of this survey was to determine the number of individuals represented by this assemblage, and to note skeletal and dental pathology observations. The teeth are in excellent condition and proved to be the most informative portion of the remains. Identifiable teeth were separated as to maxillary or mandibular and then tabulated as to specific type and side. Because of differences in tooth sizes and developmental statuses, four, and maybe up to seven, children are represented by deciduous and unerupted permanent teeth. At least 11 individuals are represented by permanent teeth found at this site.

Cranial Bone Inventory

Crania are represented by numerous small fragments, including 20 medium sized pieces (with three representative examples measuring 4.5 cm x 3.9 cm, 5 cm x 4.2 cm, and 4.5 cm x 4.4 cm) and 163 smaller bone pieces (e.g., 3.6 cm x 2.9 cm, 3.5 cm x 2.9 cm, and 4.1 cm x 2.7 cm).

Identifiable adult fragments include the mastoid portions of two right and two left temporals, six partial petrous temporals, one partial left and two partial right malars, three maxilla fragments, three frontal bone fragments, and five partial mandibles.

Two of the frontal bone fragments fit together. These two fragments are from the forehead region and show the superior portions of the frontal sinuses. Lack of supraorbital ridge development identifies this individual as a female. The endocranial surface shows increased thickening with a nodular appearance, changes characteristic of an early stage of *hyperostosis frontalis interna* (HFI). The third identifiable fragment of frontal bone is from the right lateral supraorbital region. Due to its lack of supraorbital ridge development, lack of temporal line development, and a fairly sharp supraorbital border, this piece also represents a female.

Fragments of two left and one right maxilla are present. One left maxillary fragment likely represents a female. The other two fragments are of indeterminate sex.

Five partial mandibles are present, three of which seem to be male and two female. There is a fragment representing a left mandibular condyle. The joint surface shows marked antemortem erosion and porosity.

Dentition

The teeth are well preserved, suggesting deposition during the past few centuries. The diet does not appear to have been especially abrasive, as most teeth show only slight wear. A few incisors show evidence of enamel chipping, but no well-defined task-induced incisor notches are present. Carious lesions are present. Minor calculus deposits are present on some, but not all, teeth. A few teeth show faint hypoplastic lines. Hypoplasia represent growth disruptions, such as caused by illness or malnutrition, that disturbed enamel formation during childhood. The

absence of well-defined lines suggests a relatively healthy population. The central and lateral maxillary incisors have slight to moderate shovel-shaping. A few maxillary molars have Carabelli's cusps.

Ten deciduous teeth are present. Maxillary deciduous teeth include a left central incisor, canine, and second molar, and a right central incisor, canine, and two second molars. Mandibular deciduous teeth include one left and one right second incisor, and a left canine. Five deciduous teeth show complete development. Three teeth show postmortem breakage and their development cannot be evaluated. The deciduous left maxillary canine has *Apex 1/2* development (Moorrees et al., 1963a). The deciduous left mandibular canine has *Root complete* development, indicating an age of about two years. Based upon the deciduous tooth count, the minimum number of children represented within this tomb is two. However, size differences in the deciduous teeth indicate that several more children are actually represented.

Six unerupted, permanent teeth are present. Based upon assessment of the unerupted mandibular teeth, three ages are represented. A left first premolar shows *Crown complete* development, indicating an age of 2.3 years; a left canine is at *Root 1/2* development, suggesting approximately 7.5 years of age; and a right first premolar at the same developmental stage suggests 8.4 years (possibly reflecting the same age range and individual as the preceding left canine); while a right second molar of *Root 1/2* development indicates an age of about 10 years (Moorrees et al., 1963b). Therefore, at least three children, aged around 2.3, 7.5 to 8.4, and 10 years, had unerupted permanent teeth. One of these, the 2.3 year old, could be the same individual as the two-year-old that had the deciduous left mandibular canine with *Root complete* development.

A total of 197 permanent teeth are present. All teeth are loose with the exception of a mandibular left canine, which remains in its socket. The minimum number of individuals with permanent, erupted teeth is eleven, as determined from the mandibular right first incisor count.

TABLE 1. *Erupted Permanent Teeth (MNI)*

TOOTH	MAXILLARY LEFT	MAXILLARY RIGHT	MANDIBULAR LEFT	MANDIBULAR RIGHT
1 ST INCISOR	8	6	5	11
2 ND INCISOR	6	1	4	10
CANINE	9	6	7	7
1 ST PREMOLAR			2	7
2 ND PREMOLAR			7	8
NON-CLASSIFIED PREMOLAR	28 ¹		2	
MOLARS	13	18	16	10
TOTAL	95		96	

¹Maxillary premolars non-differentiated

Maxillary

Of nine left first incisors, one is *Crown complete* and another has pulp exposure due to wear. There are six right first incisors. Of six left second incisors, one has a medium-sized lingual cavity. Only one right second incisor is present. Nine left canines are present. Six have large crowns and roots, consistent with a male classification. Of the six right canines, four are large and consistent with males; one has a distal cemento-enamel junction (CEJ) cavity.

Twenty-eight maxillary premolars are present. Eight are identified as first premolars, thirteen are second premolars, and seven are non-classifiable. Two premolars have circumferential CEJ caries and show moderately heavy (stage 6) lingual slope wear. This pair likely represents the same adult male. One second premolar has a moderate-sized, antemortem, enamel crown fracture.

Of fourteen left molars, two teeth have small occlusal surface cavities, one has a possible CEJ cavity, and one second molar has a shallow, mesial, CEJ interproximal groove. (Figure 1, photography taken.) Of eighteen right molars, three have occlusal pit cavities, one has a mesial interproximal CEJ root cavity, and one molar shows incomplete development; its stage of formation is *Cleft initial*.

Mandibular

There are five mandibular left first incisors, eleven right first incisors, four left second incisors, and ten right second incisors. Of seven left canines, one has incomplete root formation (*Root 1/2*). The crown of this tooth has hypoplastic pitting. Additionally, one of the left canines was in the mandibular socket (the only tooth of the series remaining in its socket). Seven right

canine teeth are present.

Two mandibular premolars are incomplete and could not be classified as to specific location. One of these two has advanced crown destruction from caries with open pulp exposure. There are three left first premolars. Of eight right first premolars, one has *Root 1/2* development and one has a distal surface CEJ cavity. Of seven left second premolars, one has a beginning fissure cavity. Eight right second premolars are present.

Nine of the seventeen left molars are carious. The following tooth surfaces are affected: buccal pit (3 times), occlusal (6 times), and root (1 time). One molar has both a buccal pit cavity and extensive CEJ root cavities. One molar has a large occlusal cavity including loss of the buccal surface enamel and pulp exposure. One molar shows *Crown complete* formation. There are eleven right molars: two have small occlusal surface cavities; two have small buccal pit cavities; and one molar, likely a second, has *Root 1/2* development.

A total of 28 of 191 erupted permanent teeth are carious (14.7%) (Table 2). The mandibular and maxillary bone fragments present show high antemortem tooth loss within this series, which increased with advancing age. As tooth wear among these individuals is slight, it is likely that this pattern of extensive tooth loss was caused by caries. Although the sample size is very small, 44.2% of the observed sockets show partial to complete resorption, and another 9.6% were abscessing (Table 2).

TABLE 2. Pathology in the Permanent, Erupted Dentition

TEETH AND ARCADE	NUMBER OF TEETH	NUMBER OF CARIOUS TEETH	% CARIES	NUMBER OF SOCKETS	ANTEMORTEM LOSS	% ANTEMORTEM LOSS	ALVEOLAR ABSCESSSES	% ALVEOLAR ABSCESSSES
INCISORS								
Maxillae	21	1	4.5	4	2	50	0	0
Mandible	30	0	0	13	5	38.5	1	7.7
CANINES								
Maxillae	14	1	7.1	3	1	33.3	0	0
Mandible	14	0	0	5	1	20	1	20
PREMOLARS								
Maxillae	28	2	14.3	6	2	33.3	0	0
Mandible	27	3	11.1	8	5	62.5	1	12.5
MOLARS								
Maxillae	31	7	22.6	6	2	33.3	1	16.7
Mandible	26	14	53.8	7	5	71.4	1	14.3
TOTAL	191	28	14.7	52	23	44.2	5	9.6

Postcranial Bone Inventory

Postcranial bones represented include seven vertebral fragments, a few rib fragments, long bone diaphyses, a patella, two partial calcanei, and hand and foot phalanges. Numerous other small unidentifiable fragments complete the series.

Approximately 548 small long bone diaphysis fragments are present. Representative measurements for two specimens are 2.6 cm in length by 0.7 cm thick by 1.5 cm in width and 8.4 cm by 1.0 cm by 1.4 cm. The largest long bone fragments are three pieces of femora; two are proximal left femur sections. The largest has a length of 12.1 cm. The gluteal muscle attachment site on its posterior surface is roughened, which may indicate a male sex. The subtrochanteric measurements are: A-P 2.5 cm, M-L 3.4 cm. The next largest piece, also a section of proximal femur, has a maximum length of 5.9 cm. The other large femur fragment measures 7 cm in length.

One right patella is present and has moderately severe joint surface degeneration and marginal lipping.

Fifteen small fragments of burned bone are present. Of these, one is nonhuman and one is a human right metacarpal. The other thirteen seem consistent with human bone, but due to their small size, complete confirmation is not possible. The biggest of these pieces is 3.3 cm by 1.6 cm. The incomplete metacarpal measures 3.9 cm by 1.3 cm.

The burned fragments vary in color from black to brown to white. Most of these pieces show blackening, with only two showing whitish or off-white coloration indicative of more extensive burning. In some cases, these pieces show evidence of burns on the medullary cavity surfaces, but not the external surfaces. This indicates burning of incomplete pieces, and probable postmortem, incidental, exposure to fire. These fragments are incidental to the site and do not provide firm evidence for intentional burning of human remains.

Conclusion

Most observations about the human remains from the Central Tomb Chamber at Nan Douwas in Pohnpei, came from the dentition, as other skeletal remains are fragmentary. The dental assemblage represents fifteen or more individuals, at least four of whom were children. Tooth decay was a serious problem, and contributed to abscessing and a high frequency of antemortem tooth loss. Two bone fragments indicate frontal bone hyperostosis, a mandibular condyle has arthritic changes, and a patella has arthritic lipping. Individuals were interred without cremation at time of death.

Bibliography

- Moorrees, Coenraad F.A., Elizabeth A. Fanning and Edward E. Hunt, Jr. 1963a. Formation and Resorption of Three Deciduous Teeth in Children. *American Journal of Physical Anthropology*, Volume 21, pp. 205-213.
- Moorrees, Coenraad F.A., Elizabeth A. Fanning and Edward E. Hunt, Jr. 1963b. Age Variation of Formation Stages for Ten Permanent Teeth. *Journal of Dental Research*, Volume 42, Number 6, pp. 1490-1502.