

An Application of Dental Anthropological Analysis to the Human Dentition of Two Early Metal Age Sites, Palawan, Philippines

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INTRODUCTION

The Problem

THE PURPOSE of this brief paper is to apply the principles of modern anthropological dental analysis to a particular body of archaeological data, specifically the human teeth recovered from two Early Metal Age jar-burial sites located on the southwest coast of Palawan Island. The two caves were excavated by the staff of the National Museum, Manila, headed by Robert B. Fox (1970). Although many jars were recovered from the surface or subsurface levels of the Tabon Caves (according to Fox, a complete census of the jar-burial caves in the Tabon Cave complex has not been completed), including the two caves discussed in this report, not a single absolutely undisturbed jar burial was found. The jars generally had simply collapsed due to their age (the two burial caves reported herein are over 2000 years old) and the contents of the jars were scattered on the floor of the cave or found in the shallow subsurface levels. Human bones and artifacts were further scattered by animals entering or nesting in the caves, and there was evidence of ancient grave robbing (Fox 1970: 72). Thus whether single secondary or multiple secondary burial was practiced, the number of individuals interred in the jars, and other important data could not be determined during the excavation.

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An attempt to answer some of the key archaeological problems which faced the excavators is presented in this analysis of the human teeth screened with 1/8-inch wire mesh from the deposits of the two caves. Specifically, the aims of this paper are:

1. to determine the number of individuals represented in the burial population of the caves by a dental examination and determination of the teeth interred in the burial jars;
2. to determine the age of the individuals by a dental examination which will then provide the age groupings interred in the jars;
3. to perhaps be able to determine the race of the interred population by an examination of characteristic racial features of the teeth found in the site which are characteristic of specific populations of peoples;
4. to determine some cultural practices of the jar-burial population which are reflected in the dentition; and
5. to gain, by analysis of the teeth, some insight into the dietary behavior and the condition of the teeth of a Filipino population living in Palawan over 2000 years ago.

The methodology found in this paper has been developed largely by the writer, who has utilized extensively the publications of Dahlberg (1964), Suzuki (1964), and Hanihara (1969) for Mongoloid dentition. The methodology will be explained and enlarged upon in the sections of the paper dealing with the dental analysis.

Background Data

The teeth analyzed in this report were from two jar-burial caves, Duyong in Iwaig Municipality and Uyaw, Lipuun Point, Quezon Municipality, Palawan, which Fox has treated in *The Tabon Caves* (1970). A number of limestone caves, known as the Tabon Caves and located on the Palawan Island, were excavated by the staff of the National Museum headed by Fox. Twenty-nine caves were discovered on Lipuun Point. Of these sixteen were partially excavated and nine were completely excavated, including the two discussed here (Fig. 1).

The Island of Palawan was joined with Borneo during the glacial periods and Pleistocene men and animals moved by land into Palawan, leaving behind them their bones and teeth. Much later, when the sea had assumed more or less its present level, a developed jar-burial complex appeared, first during the Late Neolithic but continuing into the Metal Age.

Among the caves with jar burials completely excavated were Duyong Cave and Uyaw Cave. Duyong Cave is located on an isolated stretch of beach about 11 km north of Lipuun Point. Although it is not one of the Tabon Caves, it has the same assemblage of cultural material found in the Tabon Caves on Lipuun Point. Uyaw Cave is on Lipuun Point, Quezon, where the Tabon Caves are found.

Duyong Cave

Duyong Cave is in the center of a huge limestone outcrop about 30 m high and about 75 m thick, and faces the land. The entire floor of the cave was covered with

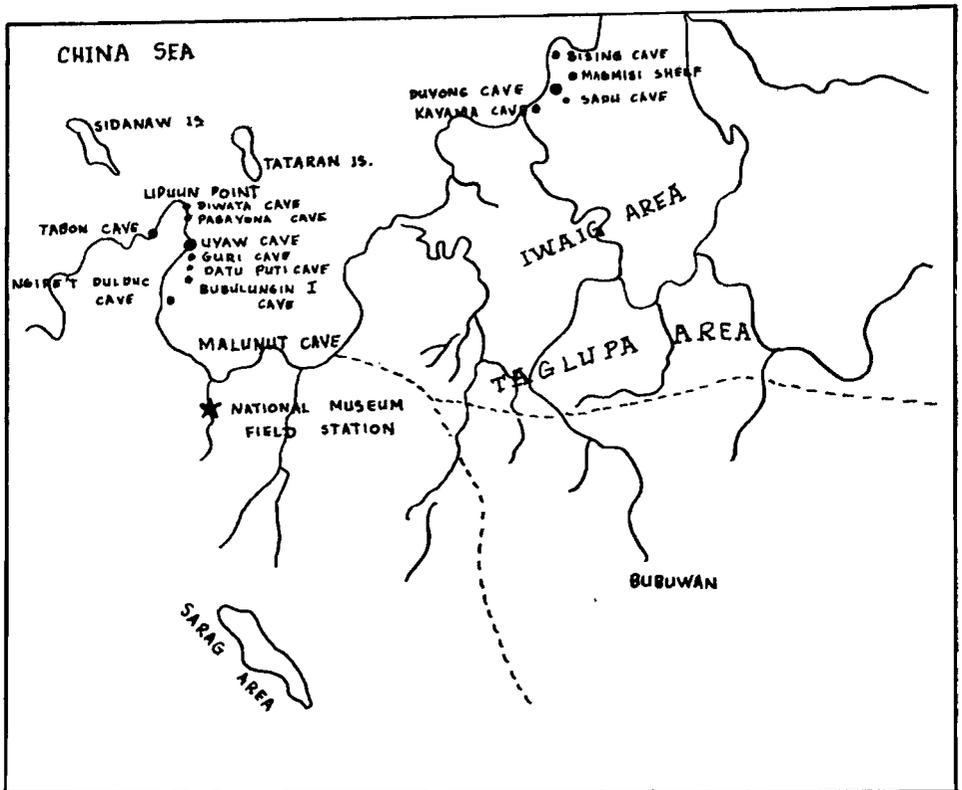


Fig. 1 Map of the Quezon area, west coast of Palawan Island, showing Lipuun Point and the Tabon Caves, and other caves excavated or described.

sherds and other artifacts of an Early Metal Age jar-burial assemblage. Over 5000 bones of the *Sirenia* or "sea cow" were found on the surface or recovered from subsurface levels. The cave itself is quite small—about 8 m by 7 m in width and length. The entire cave was excavated to bedrock. On the surface were 200 vessels of all types (Fox 1970), including 20 to 30 burial jars which are still being studied (Fox, personal communication).

The surface of the cave on which the jars were placed was badly disturbed. The jars were broken and their contents were scattered in the first layer of the cultural deposit. From this layer 501 human adult teeth and 17 deciduous teeth were recovered. All of these presumably came from the secondary burial jars.

Uyaw Cave

Uyaw Cave is located on the northern side of Lipuun Point (see Fig. 1). The cave measured about $5\frac{1}{2}$ m at its greatest width and length. The floor of the cave was covered with disturbed sherds and small earthenware vessels. Recovered from the surface and subsurface levels were 355 adult teeth and 19 deciduous teeth, mixed with the pottery of the jar-burial assemblage.

Both Uyaw and Duyong Caves yielded identical jade ornaments, bracelets, beads, small polished stone tools, and pottery of the Tabon Pottery Complex. The cultural

materials also included early metals—bronze, copper, gold, and possibly iron—all pointing to Early Metal Age burial sites. C-14 dates from the Tabon Caves show that the Metal Age is from 700 or 500 B.C. to about 200 B.C. (Fox 1970).

DENTAL ANALYSIS

Population

In Duyong Cave, the field team screened 518 teeth from the deposits which were associated with the jar burials. It was first necessary to separate this total corpus of teeth into types—incisors, cuspids, premolars, and molars which were subtyped into upper molars and lower molars. The separation was used for permanent teeth, the deciduous teeth being simply divided into incisors, cuspids, and upper and lower molars (there are no premolars in deciduous teeth). This analysis revealed the following quantities of each type of tooth:

	DECIDUOUS	PERMANENT
Incisors	4	111
Cuspids	4	66
Premolars		125
Upper molars	5	88
Lower molars	4	111
Total	17	501

In one individual with deciduous teeth there are 20 incisors, cuspids, and molars in all. That there were only 17 teeth of approximately the same development would suggest that there was one jar burial of an individual from 2 to 7 years old (by 7 years of age the incisors are normally lost). However, an examination of the molars reveals 5 upper and 4 lower, indicating that two individuals were present, as there are only 4 upper molars in preadults. The examination of the deciduous teeth thus discloses that there were two individuals in Duyong Cave between 2 and 12 years old (deciduous teeth are totally lost in the contemporary population by 11 years and 9 months).

All of the permanent teeth recovered in Duyong Cave were also divided by the number of the types of teeth found in one individual, yielding the number of individuals reflected by the different types of teeth found in one individual (Table 1).

TABLE 1. PERMANENT TEETH RECOVERED IN DU Yong CAVE

TYPE OF TOOTH	TOTAL TEETH EXCAVATED	NUMBER IN ONE INDIVIDUAL	NUMBER OF INDIVIDUALS
Incisors	111	8	14
Cuspids	66	4	14
Premolars	125	8	14
Upper molars	88	6	16
Lower molars	111	6	19

It may be seen from Table 1 that there is a possible maximum of 19 individual adults interred in Duyong Cave. However, as there might be some confusion in analysis of upper and lower molars due to destruction of roots, crowns, and so forth, it was decided to add the upper and lower molars together—199 molar teeth—and divide by 12. This gave us a secure total of 17 adults plus 2 preadults, or 19 individuals interred in the jars.

This method assumes, of course, that all teeth were recovered. Fox (personal communication) is certain that all teeth were recovered in Uyaw Cave. However, because Duyong Cave slopes toward the mouth, there may have been some artifactual and skeletal materials lost from it. It is therefore assumed that the population for Duyong Cave—17 adults and 2 preadults—is a minimum figure, but accurate to within a few individuals. It is noteworthy too that the separation and division by types of teeth gives a range of 14 to 19 individuals, but it would not be less than 17, and possibly 19.

Cultural Patterns

An examination of the teeth revealed no filing or chipping (see Plate II), practices which are characteristic of "Protohistoric" populations and minority groups who still live near the caves—Tagbanwa and Palawan—and who still file their teeth labially and incisally (Plate *If-g*). It is probable that these cultural practices appeared in the Philippines at a much later "Protohistoric" date, perhaps not until the protohistoric period or within the last 1000 years. (Fox in correspondence states that all gold pegged teeth from Museum excavations are the "Age of Contacts and Trade with the East" or after A.D. 1200 and later, and that pegging is characteristic of this period, particularly in the central Philippines; Plate *1h*).

Staining

In the Duyong and Uyaw teeth the crowns are stained reddish-brown to black. This is a characteristic betel-nut stain. Thirty-two of 37 central incisors and 44 of 54 lateral incisors were stained. Five teeth of young adults showed no evidence of staining, indicating that staining appears in the mature adults. Stained teeth and containers for lime were also found in Duyong Cave in the single Neolithic burial dating to ± 4600 years ago. This suggests that betel-nut chewing, using either wild or domesticated nuts, was known (Fox, personal communication). The contemporary people in Palawan also chew betel, and it is presently believed that the staining of the Duyong and Uyaw teeth resulted from betel chewing (Fox 1970: 355).

Pathology

Caries (decay in teeth)

Out of 518 teeth only 1 incisor, 3 upper molars, and 4 lower molars had caries, making a total of 8 carious teeth or .16 percent. The incidence of caries or the formation of cavities and decay in the continuity of a tooth is thus negligible in the Duyong population.

Calculus

The majority of teeth show light to heavy calcareous deposits. (It is recommended that the archaeologist wash the teeth found in sites but not brush them with a stiff brush, in order to preserve the deposits on the teeth as much as possible for future analysis.)

Abrasion

Principally using molars, I provided the National Museum established standards of wear—(1) light, (2) medium, and (3) marked. (See Plate Ia-c.) The results of a study of tooth abrasion are given in Table 2.

TABLE 2. TOOTH ABRASION

DEGREE OF WEAR	UPPER MOLARS (N=79)	LOWER MOLARS (N=113)
light	47*	64
medium	19	17
marked	13	32

*includes impacted third molars with no wear.

To arrive at a population count from the figures shown in Table 2:

47 upper molars + 64 lower molars = 111 molars ÷ 12 (total molars in human dentition), or 10 individuals

19 upper molars + 17 lower molars = 36 molars, or 3 individuals

13 upper molars + 32 lower molars = 45 molars, or 4 individuals

Therefore, in a total of 17 individuals interred, 10 individuals showed light wear, 3 individuals showed medium wear, and 4 individuals showed heavy wear.

It is evident that this population used wooden mortars and pestles to grind cereals, assuming they were used, during food preparation. In populations using stone mortars, fine abrasive particles from the action of the pestles in the mortars are incorporated in the diet, causing wear on the occlusal surfaces of the teeth.

Age

The analysis reveals that both adults and preadults (infants, children, teenagers) were interred in burial jars. An examination of root development and crown wear indicates that a range of adults was present—young, middle age, and aged. Wear, although a poor criterion, further indicates that a range of ages of adults was present in the population.

Race

It was assumed that the jar-burial population was Mongoloid, but it is necessary to verify this assumption, if possible through a dental study. Of 37 central incisors, there was a 100 percent shovel characteristic with fossa of varying depths with both mesial and distal rims (see Plate Id). The upper lateral incisors were also character-

istically shoveled. Since most Mongoloid teeth are distinctly shoveled, we may conclude that this was a (*Southern*) *Mongoloid* population (Fox 1970: 70).

Ten teeth examined were in good enough condition to permit the fissural pattern to be viewed. It was found that 5 had a "Y5" pattern (Plate 1e) and 5 a "+5" pattern. These findings also indicate that the population was typically Mongoloid.

A sample of 10 teeth—the lower first molars—ranged in size from 10.5 to 12 mm mesio-distal to 9.5 mm to 11 mm bucco-lingual, which compares with other Mongoloids such as the Chinese, whose molars are 10 × 11.2, and the Javanese, 10.8 mm (Brothwell 1957).

The teeth from Uyaw Cave showed similar characteristics. Only one case of caries was found in the 335 teeth that were examined. An analysis revealed the following types of teeth:

	DECIDUOUS	PERMANENT
Incisors	8	109
Cuspids		41
Premolars		93
Upper molars	7	58
Lower molars	4	34
Total	19	335

Applying to these numbers the deductive procedure used earlier (see *Population* and Table 1), we find that 14 adults and 2 preadults were interred in Uyaw cave. The sizes of the lower first molars are 10.5 to 12.5 mm mesio-distal and 10 to 11.3 mm bucco-lingual. The rest of the picture is the same as that of the teeth from Duyong Cave, showing a Mongoloid population.

CONCLUSION

Dental analysis can be of great value to archaeologists, as teeth are sometimes the only skeletal remains that may be left. Teeth can be worn down, or ulcerated, but they never grow or change once they have been formed. Inherited dental features are well preserved in fossil materials as in archaeological sites, so that living and dead populations can be compared in terms of phenotypic frequencies.

Various ethnic groups are characterized by different frequencies in the appearance of certain morphological traits which may be genetically determined. These traits are useful in determining the physical characteristics of a population. Dental samples from skeletal populations may be used for estimating the amount of mixture in hybridized descendant populations (Turner 1967). Since these characteristics do not vary in time, past and present populations may be compared, an extremely important study for prehistorians concerned with the origin of contemporary breeding populations as well as with past populations.

Dental analysis enables the archaeologist to determine from teeth found in a site how many adults and children lived in the area. Food habits and types of food



a



b



c



d



e



f



g



h

Plate I Standards of molar wear: *a* light, *b* medium, *c* marked; *d* shovel-shaped incisor; *e* lower M² with "Y5" fissural pattern; incisors filed; *f* labially, and *g* incisally; *h* gold-pegged cuspid.

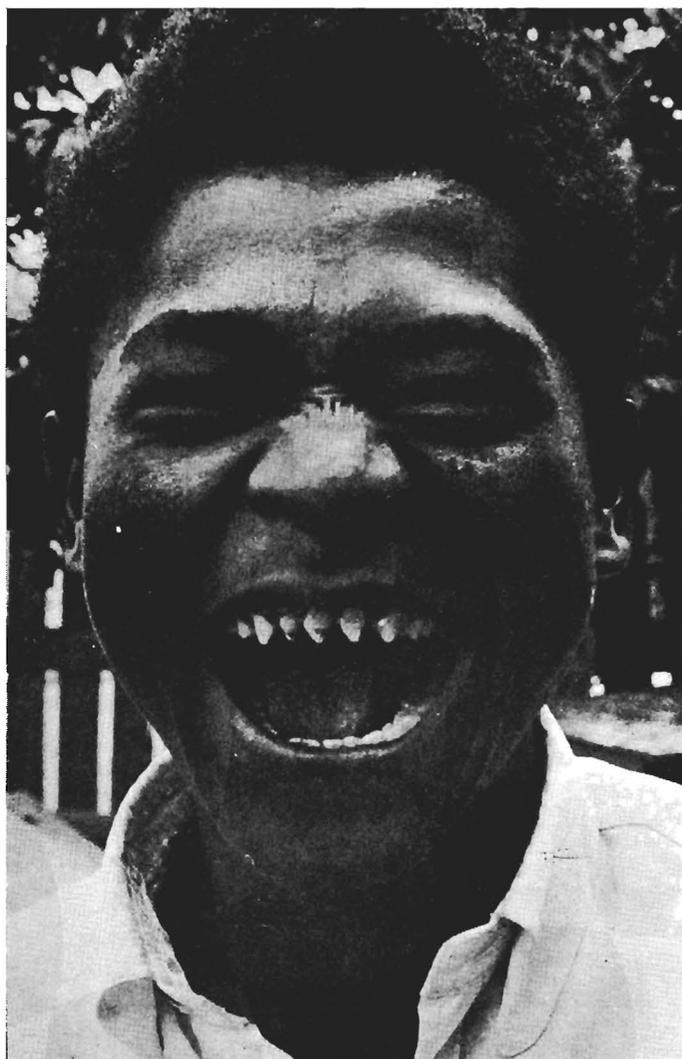


Plate II Teeth filed to a point.

can be determined by the amount of occlusal abrasion found. Caries or the absence of caries can be detected, as well as the extent of hybridization.

In this paper I have attempted to set up a standard of dental analysis for archaeologists of the National Museum and all researchers who utilize their facilities.

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