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OSSA

This study focuses upon the main burial of a Mycenaean grave dated to the Bronze age, on the island of Psara in Greece. The skeletal material was evaluated for pathological manifestations. Isotopic analysis on bone sample suggested the dietary patterns of this individual.

Keywords: Mycenanean burial, Dental and General Pathology, Isotopic Analysis

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## Introduction

The island of Psara, known to have been one of the most Northeastern Mycenaean sites in the Aegean sea (J.F. Cherry, 1981) is located in the Northeastern Mediterranean of Greece. (Fig. 1).

A Mycenaean burial ground lies along the western seashores of the island at a site named Archnotiki, ca. 3 km northwest of the main village. It occupies an area of ca. 2000 sq.m., involving graves with primary and secondary burials. Many of the burials were disturbed by sea level changes and human factors.

The graves were constructed with crystalline schists, quartzite, and chrystalline limestone slabs, forming subrectangular ditches into the cliffs along the contemporary seashore. The slabs were either inserted vertically or laid into the ground, creating a ditch. Cover stones were still found with some of the graves. Ceramic beads, fragments of gold ornaments, fajentum and decorated vessels were among the burial goods found.

## Grave No. XI / Main Burial

The grave assigned No. XI involved seven burials, of which six were secondary and one was primary. (Fig. 2). The primary or main burial was represented by an almost complete cranial and postcranial skeleton. This individual was alligned nearly at the center of the grave on a north-

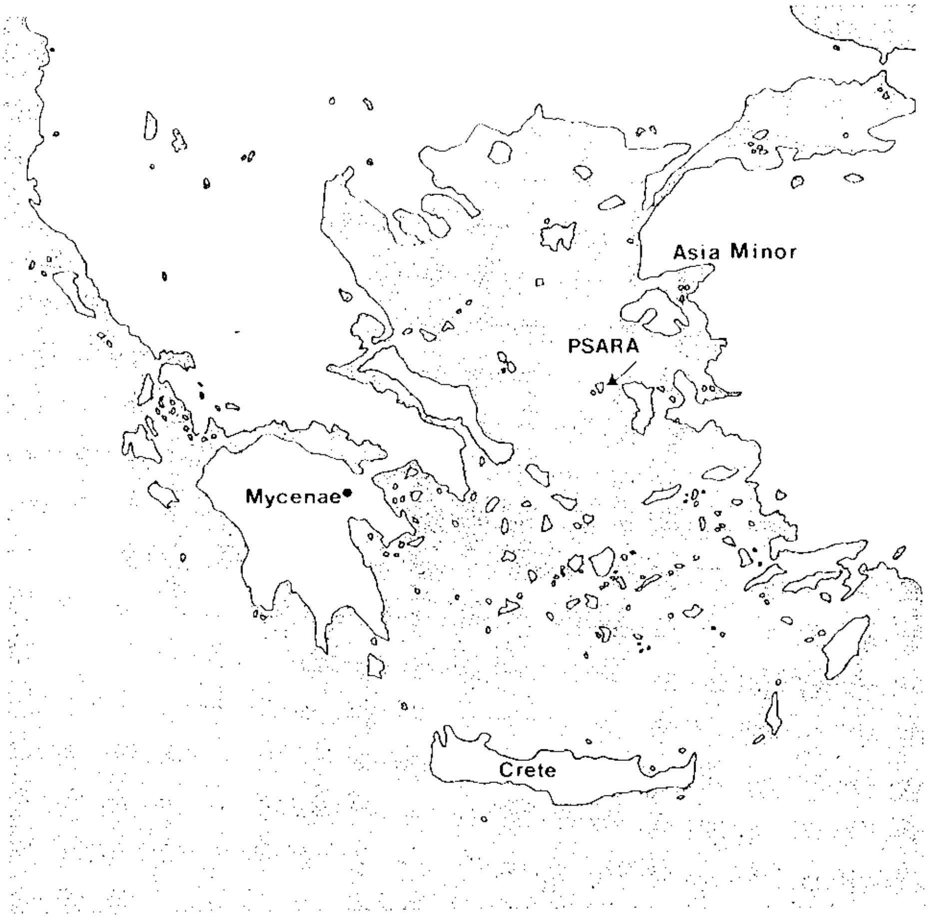


Fig. 1.

south axis, in a prone and crouched position.

The skull was in a fragmentary and distorted state, revealing forward displacement of the right parieto-temportal region of the skull. Apart from a few small fragments missing, the entire vault was reconstructed, except for the facial bones (Table 1; Table 2). The skull, which had an ovoid shape, was small and lightly built. The suporaorbitals, mastoids, occipital protuberance, and condyllii occiptiale, were also small and unaccented. The thicknesses taken at the eminences were: frontal, 6.93 mm; parietal, 5.84 mm; occipital, 6.20 mm. The cranial, as well as the dental and post cranial features, suggested the sex of this individual was female. All the sutures were open, a condition unlikely to persist after the age of approximately 25 years

## Stature

The average computed height in life of this individual was 150.07 cm. This estimate was based on the maximum length of the humerii, the right radius, femurs, and tibias (Trotter and Gleser,


Fig. 2.

1958; Martin, 1967). The preservation and condition of the remaining long bones did not suffice for other measurements to be taken.

**Dental pathology**

Seven out of the thirty.two teeth were lost ante mortem. Two out of the seven teeth, the right manidublar molars I and II, must have been lost long before the death of this individual, for both alveols were completely healed over with new bone. The alveols of the maxillary right central and lateral incisors, and the mandibular left molar I, were still in the process of healing. The open alveols representing the maxillary molars II and III, disclosed no interproximal interdental septum (Loe, 1964). Fragments of the mesio-distobuccal roots of the maxillary left molar II were still in situ. A fistulum connecting the alveolar cavities of the maxilary left molars II and III with the left sinus palatinus, may have been caused by abscess and pyogenic infection, before and/or after the loss of the teeth. The thin palatal sinus walls were penetrated by increasing pressure of pyosis in the alveolar cavities. This condition may also have been due to the presence of periodontal disease, which was also indicated through an overgrowth at the cortical layers of the alveolar processes (Ruben, Goldman, & Schulman, 1970).

The interproximal alveolar septae were either flat or concave as well as osteoporotic (Loe, 1964; Zuhrt, 1956). Slight buccolingual-buccopalatal calculus accumulation (Supra and infragingival) was also observed. The alveolar bone recession was greater at the molars and canines, roughly following the curve of Spee (buccolingual-palatal). These changes and malformations strongly suggested the presence of periodontal disease. The protruding counterparts of the teeth lost ante mortem were not computed for the alveolar bone loss.

Recurrent enamel hypoplastic defects (transverse linear depressions and pitting) were observed on all teeth. The earliest hypoplastic defect was estimated to have occurred at 3.3 years of age (marking the maxillary left canine). The last to occur was estimated at ca. 10.9 years of age (marking the maxillary right molar III) (Swärdstedt, 1966).

Two enamel pearls, at the roots of the maxilary right molar I buccal surface, and at the maxillary right molar III distal surface, may have been due to prenatal developmental anomalies (Pindborg, 1970). Enamel protrusions were not observed.

The dental enamel was defected ante mortem by cracks at the occlusal and incisal surfaces (Pindborg, 1970). This may have been due to the abrasive quality of the foods ingested (chewing raw or half roasted seeds, dry fish, shell fish, hard fruit nuts, or foods not well prepared or ground). This was also evident by the uneven degree of abrasion of individual teeth (Molnar, 1980), where secondary reparative dentin was revealed, mainly on the canines, premolars, and molars (where a stronger mechanical force was required for crushing such foods). Cracks on the maxillary left canine, (on the lingual surface), gradually made by a mechanical force, may have been caused by the use of the tooth as a tool for material harder than the dental enamel. Eight root carious cavities suggested that starch sweeteners were included in the diet of this individual.

The masticatory muscle imprints were uneven, indicating a moderate muscle development at the right lateral portions of the skull and mandible. This may have been due to stress enforced at the right side of the maxilla and mandible once the tooth loss at the left side occurred.

**General Pathology**

There was a slight depression at the bregma, which may have been caused by the prolonged pressure of a band of webbing across the head from which a weight was suspended, or by some type of head-dress which was worn from early Childhood (McGibbon, 1912; Dingwall, 1931; Steward, 1948). An asymmetry of the skull displayed a slight left occipitopetaly with no analogous frontopetaly. It could not be determined whether this asymmetry was due to illness, retarded growth, external irritation, or muscular activity. The artificial deformation at the bregma may be associated with the factors causing the asymmetry (Moss, 1958; Zivanovic, 1980).

The X-ray photographs of the calvarium displayed hyperporous atrophy and slight osteoporosis. The artifical deformation could have been a factor causing localized osteoporosis. Long lasting exterior pressure could have affected the cells in such a way that the drainage in this region, as well as the blood supply, were insufficient. As a result, the tissue calcium diminished and the bone became weaker and less resistant to pressure. In this case, though, the X-Ray photographs showed expansion of the diploic spaces over the skull vault.

Trace of injury (caused by a blunt object) was evident on the left ectocranial region by a concave elipsoid mark (17.66 mm x 14.97 mm). The traumatic trace was also observed in the X-ray photographs through the loss of ectocranial cortical bone. The individual survided the injury, for the trauma had been healed long before death.

In conjunction with the lambdoid suture, there were at least nine sutural bones (one os Incæ multipartium and nine Wormian bones).

From the axial skeleton, six thoracic vertebrae and eight fragments (processes) were preserved, although in poor condition. The vertebral bodies did not reveal signs of compression. The left os coxae was fragmentary, with layers of periosteal reactive bone at the corpus ilii (sign of severe infection). The rib fragments revealed advanced osteoporosis. The humeri, right radius, femurs, and tibiae were complete and their measurements were recorded (Table 3). Other distinguishable fragments were: the proximal and metaphysial fragments of the right fibula, and the proximal end of the left and right ulna. The radius was dolicheric; the femurs were hyperplatymeric, the tibiae were platycnemic (Table 4). The muscle insertions of the upper extremities were quite emphasized.

All lower extremities revealed primary periostitis. Osteoarthritis was observed at the right trochlea humeri, as well as at the most weight bearing portions of the femurotibial diarthroses (the femural latero-medial condyli and the central portions of the proximal tibial joint surfaces).

X-Ray photographs of the long bones indicated extensive osteoporosis at the distal portions of the humeri, where the enlarged trabeculae formed parallel striations to the vertical axis of the humerii. The lower extremities were not as osteoporotic. There were Harris Lines on the distal metaphysial portions of the bone shafts of the tibias. The first of these lines was estimated (Steward, 1968) to have been formed during late Infancy I, ca. 4 to 6 years. The last was formed during the middle of Infancy II, ca. 9 to 11 years. These estimates coincided with the enamel hypoplastic defects, suggesting the same time of onset of the pathological and/or nutritional stress factors.

**Non-Metric Variation**

Two cranial traits of non-metric variation were scored as present, the "highest nuchal line" and the "ossicle at asterion" (Berry & Berry, 1967).

Through observation of the post cranial skeleton, the right humerus revealed a "supracondyloid process" extending distally at a length of 10 mm. Both femurs revealed "plaque", "Poirier's facet", "Allan's fossa", and "third trochander" and "hypotrochanteric fossa". The occurance of these three traits ("plaque", "Poirier's facet", "Allen's fossa"), combined, at the femur heads is quite rare (Finnegan & Faust, 1974).

**Isotope Analysis**

Isotopic analysis on bone sample for dietary evaluation indicated that the condition of the mineral portion was altered, possibly due to sea water exposure (sea level changes resulted in partial inundation of the burial with sea water).

The 13C on gelatin gave a value of -18.7%, representing approximately 20% of 4C plant food in the diet. However, it should be noted that few if any 4C seafood plants are common in the Eastern Mediterranean area. A pure 3C plant food diet would produce a gelatin value of -21.5%. Marine food included in the diet would result to approximately -15%. These results may indicate as much as 50% of marine foods (fish and/or shellfish) in the diet.

The 15 N result on gelatin was +9.2%. Herbivorous gelatins are approximately +10%. This result is indicative of a high level of animal protein in the diet. It cannot be distinguished, though, whether the animal protein was terrestial or marine.

The 87Sr/86Sr resulted in a value which suggested a high seafood diet, although the 0.70880+/-0.00007 value may well have been due to alteration of bone by sea water. This value is fairly close to sea water Sr, but far from volcanic Sr.

The Sr/ca x 1000 index resulted in a value of 1.68, which is very high. This may have been due to a high seafood diet and/or to the alteration of the bone by sea water.

The results of the isotopic analysis pointed to a relatively high seafood diet, at least with respect to protein sources.

## Discussion

The general pathology of this individual disclosed degenerative and aquired pathological manifestations as a response to pathological and physiological stress factors.

There were indications of systemic growth disturbancs during the early Childhood period, as were suggested by the lines of arrested and improved growth. These stress indicators, enamel hypoplasias and Harris lines, were concurrent.

The high incidence of ante mortem tooth loss and root carious cavities, advanced periodontal disease, enamel cracks, and the uneven degree of incisal and occlusal abrasion suggested a low status of oral hygiene and a quality of coarse and poorly prepared foods consumed.

The incidence of early osteoporosis, the expansion of the diploe, the linear striations of the enlarged trabeculae of the distal humerii, and the advanced cortical thinning of the ribs suggested a condition of iron deficiency anemia (Angel, 1955, 1967 and personnal communication). Gastrointestinal parasitic infestation and probable excessive loss of iron from the body, metabolic disturbances in iron absorbtion, multiparous conditions and malnutrition could be involved in the multiple factors causing this deficiency (Steinbock, 1976; Ortner, 1981). In the later case (malnutrition), a protein deficiency would be most unlikely as this conditon would rather retard bone remodeling than stimulate diploe expansion. Ruling out protein deficiency, is in agreement with the isotopic analysis if one would like to compile the results.

Stress factors and disorders occuring from early Childhood operated synergetically with many pathological factors to increase the individuals susceptibility to disease and consequently shorten it's life expectancy.

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**TABLE 1.** Cranial Measurements

| | | |
|---|---|---|
| Glabela-Opisthocranium | 175 | mm. |
| Glabela-Inion | 158 | mm. |
| Glabela-Lambda | 172 | mm. |
| Auricular height | 122.12 | mm. |
| Euryo-Euryo | 137 | mm. |
| Frontotemporale-Frontotemporale | 93.40 | mm. |
| Cranial circumference | 50 | cm |
| Cranial capacity | 1267 | cc. |

**TABLE 2.** Cranial Indices

| | |
|---|---|
| Cranial Index | 77.84/Mesocranic |
| Length-Height Index | 69.31/Hypsicranic |
| Breadth Height Index | 89.05/Acrocranic |
| Fronto-Parietal Index | 68.17/Metriometopic |
| Cranial capacity | 1267 cc/Euencephalic |

**TABLE 3**. Measurements in mm

| | LEFT | RIGHT |
|---|---|---|
| MAXIMUM LENGTH | | |
| Humerus | 265 | |
| Radius | | 212 |
| Femur | 381 | 383 |
| Tibia | 308 | |
| CAPUT HUMERUS DIAM. | 38.24 | |
| CAPUT FEMURIS DIAM. | 40.11 | 39.97 |
| SUB TROCHLEA DIAM./ANT.-POST. | 23.12 | 22.40 |
| SUB TROCHLEA DIAM./LAT.-LAT. | 31.99 | 31.21 |
| TIBIAL NUTRIT. FORAMEN DIAM./ANT.-POST. | 30.24 | 28.71 |
| TIBIAL NUTR. FORAMEN DIAM./LAT.-LAT. | 17.68 | 17.69 |
| MID-DIAPHYSIAL DIAM./ANT.-POST. | | |
| Humeral | 19.34 | 19.43 |
| Femoral | 21.36 | 23.54 |
| MID-DIAPHYSIAL DIAM./LAT.-LAT. | | |
| Humeral | 17.32 | 16.45 |
| Femoral | 27.18 | 24.76 |
| LEAST CIRCUMFERENCE | | |
| Tibial | 65.0 | 65.0 |
| Fibular | 36.0 | |
| BICONDULAR LENGTH | | |
| Humeral | 57.50 | 57.52 |
| Femoral | | 69.70 |
| Tibial | 61.91 | |

**TABLE 4.** Post Cranial Indices

| | | |
|---|---|---|
| HUMERUS | | |
| Robusticity | Left- 13.83 | |
| Humero-Femoral | Left- 82.49 | Right- 82.52 |
| RADIAL | | |
| Humero-Radial | Brachial Index- 80 Dolichocercic | |
| FEMORAL | | |
| Meric: | Left- 72.27 Hyperplatymeric | |
| | Right- 71.77 Hyperplatymeric | |
| | Average- 72.02 Hyperplatymeric | |
| Pilastric | Left- 78.58 | |
| | Right- 95.07 | |
| | Average- 86.82 | |
| Robusticity | Left- 69.29 | |
| TIBIAL | | |
| Cnemic | Left- 58.46 Platycnemic | |
| | Right- 61.61 Platycnemic | |
| | Average- 60.03 Platycnemic | |
| Length-Thickness | Left- 21.10 | Right-21.10 |
| TIBIO-FEMORAL | | |
| Crural Index | 88.82 | |
| INTRAMEMBRAL | | |
| Radius-Humerus-Tibia-Femur | 362.43 | |