International Journal of Paleopathology 22 (2018) 92–96

Contents lists available at ScienceDirect

International Journal of Paleopathology

journal homepage: www.elsevier.com/locate/ijpp

Identifying small pelvic inclusions through SEM technology

Emilio González-Reimers[a,*], Emilio González-Arnay[b], María Castañeyra-Ruiz[b], Matilde Arnay-de-la-Rosa[c]

[a] Dpt. de Medicina Interna, Hospital Universitario de Canarias, 38320, Universidad de La Laguna, La Laguna, Tenerife, Canary Islands, Spain
[b] Dpt. de Anatomía, Universidad de La Laguna, La Laguna, Tenerife, Canary Islands, Spain
[c] Dpt. de Geografía e Historia, Universidad de La Laguna, Tenerife, Canary Islands, Spain

ARTICLE INFO

Keywords:
Sesamoid bone
Gallstones
Kidney stones
SEM analysis
Archaeological excavation
Paleopathology

ABSTRACT

Tiny calcified structures may be occasionally recovered during excavation of human skeletal remains. Since taphonomic processes may displace these structures from their topographical relation with neighbouring organs or bones, differential diagnoses may pose a major challenge to the archeologist and/or anthropologist. Enteroliths, kidney stones or gallstones, phleboliths, calcified ganglia, or sesamoid bones account for most of such calcified tiny structures. In addition to their pure medical/paleopathological interest, some remains may be related to diet, to chronic haemolytic conditions, and/or to infections or chronic intestinal diseases. We here describe the technical procedures carried out to confirm or refute the identification of a sesamoid bone. The object in question was a small (5 × 3 × 2 mm) calcified structure that appeared over the right coxal bone of an 18th century individual buried in the church Nuestra Señora de La Concepción, in Santa Cruz de Tenerife (Canary Islands). For comparative purposes we also analyzed kidney stones and gallstones from modern individuals. As shown in this study, scanning electron microscope (SEM) analysis is the preferred method to establish a precise differential diagnosis in these cases.

1. Introduction

Recovery of tiny calcified structures during excavation of human skeletal remains poses a major challenge to the archeologist and/or anthropologist. Although these structures may represent pure mineral formations, for instance calcite spherulites or zeolites (Verrecchia et al., 1995), they may also correspond to calcified organic remains or bony structures. Besides their pure medical/paleopathological interest, some remains, such as enteroliths, kidney stones or gallstones, or phleboliths, may be related to diet, to chronic haemolytic conditions, and/or to infections or chronic intestinal diseases. Therefore, the assessment of precise nature of such small calcified structures, which may require complementary techniques, also contribute to reconstruct past history.

In this manuscript we describe the recovery of a small mineralized structure during the excavation of the skeletal remains of an adult woman of the 18th century in the cemetery beneath the floor of the church Nuestra Señora de La Concepción (La Concepción). This was the main –and during centuries, the only- church of the emergent village Santa Cruz de Tenerife, future capital of the island and the entire Archipelago.

2. Sample description

The sample was recovered during the excavation of the floor of La Concepción, in which more than 200 tombs were excavated (Arnay de la Rosa, 2009). Tombs were frequently reused, especially during epidemics and famines, so skeletons recovered during the excavation correspond to the last individuals buried under the church´s floor, before the new laws formally prohibited burial in the churches. In La Concepción, a catholic church, the dead were buried in supine position, with the arms folded across the upper central portion of the chest. A small ovoid calcified structure, measuring 5 × 3 × 2 mm was recovered over the right hip bone of an adult female. A computed tomography (CT) scan showed trabecular bone inside of it, although the small size precluded a sharp image definition. A scanning electron microscope (SEM) analysis revealed a bony structure with coarse trabeculae (Fig. 1). For comparative purposes we analysed a cholesterol gallstone and a calcium oxalate kidney stone of similar shape and size from modern individuals. Spectroscopic analysis revealed a crystalline structure in both cases (Figs. 2–5).

* Corresponding author.
E-mail address: egonrey@ull.es (E. González-Reimers).

https://doi.org/10.1016/j.ijpp.2018.06.003
Received 7 July 2016; Received in revised form 18 June 2018; Accepted 18 June 2018

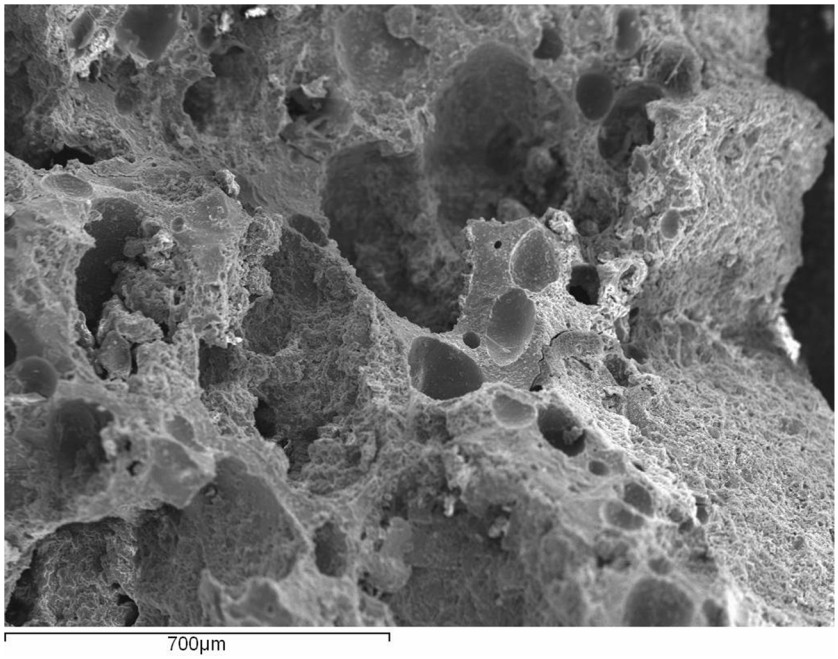

Fig. 1. A scanning electron microscope (SEM) image of the piece, showing coarse bone trabeculae.

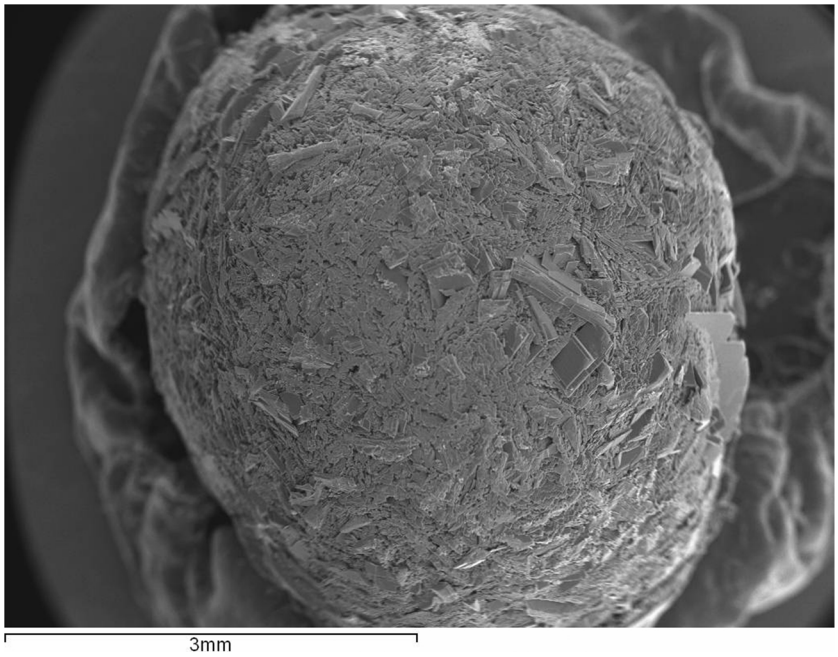

Fig. 2. SEM image of the biliary calculus, showing its crystalline structure.

3. Differential diagnosis

Calcified remains include many conditions, thoroughly reviewed elsewhere (Steinbock, 1989a). Some of them have characteristic shapes and sizes, such as porcelain gallbladder, lithopedion, or calcification of an aortic aneurysm wall, a hematoma, a cyst wall, a large abscess, pleural plaques, the entire kidney, as seen in tuberculosis, or kidney papillae, as a result of ischaemia (diabetes, sickle cell disease, or emboli), or calcification of vas deferens, hepatic artery or pelvic vessels, that show a clear tubular shape. Inflammatory pseudotumor (Kutluk et al., 2002), ovary tumors, uterine myomas, renal cancer, pancreatic cystadenoma, or liver tumors may also calcify (Salahi et al., 2015; Stoupis et al., 1998), but their size and shape is usually characteristic. The true challenge does exist when archaeologists recover minute (< 1 cm) calcified, more or less rounded remains, especially from tombs containing non-mummified corpses. The list of such findings is enormous (Steinbock, 1989a), and distinguishing between these different structures macroscopically may be difficult. Although the location of the finding may help sometimes taphonomic changes distort the position. However, size and shape narrow the differential diagnosis.

3.1. Calculi in the urinary tract

Calculi may be located in the pyelocaliceal area, ureters or bladder. Composition is variable. The most frequently observed include calcium oxalate monohydrate (whewellite), or dihydrate (weddellite), struvite