Two bony enigmas: not everything is what it looks like

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TWO BONY ENIGMAS: NOT EVERYTHING IS WHAT IT LOOKS LIKE

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(in memory of dr William H. Waldren and dr Paul Y. Sondaar, who both passed away in 2003)

RESUMEN: La literatura paleontológica y arqueozoológica se enfrenta desde hace un tiempo a dos desconcertantes fenómenos que parecen ser muy persistentes. En un caso se trata del extraño estado que presenta una muestra del venado endémico del Pleistoceno *Candiacervus spp*., hallada en la localidad de Mavro Mouri (Creta, Grecia), y que se ha explicado como el efecto de una enfermedad, de la acción de insectos trepanadores o de la malnutrición. El otro es el supuesto recorte de los cuernos del *Myotragus balearicus,* bóvido endémico del Pleistoceno/Holoceno en Mallorca (Baleares/España), que se ha explicado como efecto de la acción humana.
Describimos aquí brevemente estos fenómenos y los atribuimos al trato postmortem de los huesos por parte de buitres barbados (*Gypaetus barbatus*) y del propio *Myotragus balearicus*, respectivamente.
PALABRAS CLAVE: Creta, *Candiacervus*, Mallorca, *Myotragus*, trato postmortem.
ABSTRACT: Paleontological and archeozoological literature has been haunted for quite some time by two phenomena that appear to be quite persistent. One is the bizarre condition of a sample of Pleistocene endemic deer Candiacervus spp. from the locality of Mavro Mouri (Crete, Greece) that has been explained as being the result of a disease, boring insects or malnutrition. The other one is the supposed trimmed horns of the Pleistocene/Holocene endemic bovid Myotragus balearicus from localities in Mallorca (The Balearic Islands, Spain), which has been explained as the result of human action.
This paper briefly describes these phenomena and attributes them to post-mortem treatment of the bones by, respectively, bearded vultures (Gypaetus barbatus) and Myotragus balearicus itself.
KEYWORDS: Crete, Candiacervus, Mallorca, Myotragus, post-mortem treatment.

INTRODUCTION

Paleontological and archeozoological literature has for quite some time been haunted by two phenomena that appear to be quite persistent. One is the bizarre condition of a sample of Pleistocene endemic deer *Candiacervus* spp. from the locality of Mavro

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Mouri (Crete, Greece) that has been explained as being the result of either a disease, of boring insects or of malnutrition. The other one is the supposed trimming of the horns of the Pleistocene/Holocene endemic bovid *Myotragus balearicus* from localities in Mallorca (Baleares, Spain) that has been explained as the result of human action.

Here we will briefly describe the phenomena and attribute them to post-mortem treatment of the bones by, respectively, bearded vultures (*Gypaetus barbatus*) and *Myotragus balearicus* itself.

The case of the Cretan bones

The Cretan locality of Mavro Mouri (de Vos 1984: fig. 1; also known as Mawro Muri, Mavro Muri or Rethymnon) has yielded a sample of bones of the endemic fossil deer *Candiacervus cretensis* and related taxa of the Cretan cervid species flock (e.g., Kuss 1975, Sondaar 1977, de Vos 1979). Many of these Mavro Mouri bones show an aberrant morphology that has led researchers to various explanations. The bones are generally thin, provided with enlarged foramina and often a rough surface, and with a thin to very thin cortex. Condyles seem changed by some sort of shrinkage. In general, these bones look extremely unhealthy at first sight. They led Kuss (1975) in the first publication about these bones to state: «Sie erwecken zunächst den Eindruck, als handele es sich hier um krankhafte Veränderungen» (at first sight they provide the impression of showing pathological changes). In subsequent publications, the following explanations were provided for the phenomena observed:

a. boreholes made by polychaete worms of the genus *Polydora* (Polychaeta, family Spionidae); this must have occurred at a time when high sealevel caused the bones in the cave to be in contact with seawater (Kuss 1975)
b. a severe osteoporosis as a result of failure in bone formation due to malnutrition (food shortage; Sondaar 1977)
c.malnutrition in the juvenile stage leading to thinner bones during life, in combination with post-mortem attack of the bone by boring insects, e.g. Lepidoptera (Braber 1981)
d. in addition, personal communications to the first author by staff members of the Erasmus Medical Center (Rotterdam University) suggested some anaemia (comparable to the human Thalassaemia Major syndrome) as a possible cause.

This leaves us with at least four possible causes, both pre-mortem and post-mortem, neither of which is, however, satisfactory.

Sondaar (1977) provided an illustration of an inflicted bone, so far this is the only published picture of the 'sick' Mavro Mouri deer bones. It is here reproduced as figure 1. The enigma remained unsolved until the present authors met at a conference in Weimar, April 2004. It appeared there that the seemingly pathological changes of the bones could have been caused by the bearded vulture *Gypaetus barbatus*.

The bearded vulture is a very large cave nesting bird. Its diet, unique in the animal world, is composed mainly of bones (70 to 90%) removed from large ungulates carcasses (Terrasse 2001). Some of them measure up to 25 cm long. Very acid gastric juices in its stomach extract organic substances from the bones, necessary for the bird's

metabolism. Occasionally it happens that some swallowed bones escape complete digestion and are regurgitated inside the nest. Figure 2 shows examples of this: a metatarsal (figure 2a) and a calcaneum (figure 2b). Regurgitation year after year creates an accumulation of bones within the nesting caves.

The bearded vulture is still breeding in Crete, Corsica and the Pyrenees and has been recently reintroduced in the Alps. One of us (IR) used the contents of Corsican bearded vulture nest sites in order to create a taphonomic model with the aim of recognising such macrofaunal accumulation in paleontological and archaeological sites (Robert & Vigne 2002).

The cervid bones from the Pleistocene cave site of Mavro Mouri were compared to this reference collection. On the total amount of Cretan *Candiacervus* bones recovered (Number of Identified Specimens = 1404), 55% showed semi-digestion marks (see figure 3), such as enlarged foramina and very thin cortical surfaces. This proportion is the same in the reference material (52.5%). The most severely attacked skeletal elements are phalanges (figure 3a), carpal and tarsal (figure 3b) and metapodials (figure 3c). When compared to modern ungulate bones regurgitated by the bearded vulture, damage locations and damage intensity were identical. Analysing the quantity of *Candiacervus* bones, we can conclude that successive pairs of bearded vulture probably nested in the Mavro Mouri cave during a few centuries, and in this period produced the remarkable faunal accumulation that has caused so much misinterpretation.

The aspect of the deer bones from Mavro Mouri is not due to any disease, neither to malnutrition leading to severe osteoporosis. All the deer present in this cave died naturally and the vultures carried their carcasses inside. As malnutrition is not the reason of the phenomena, it cannot be used as an explanation for endemic morphological developments or for final extinction of the endemic deer in the island of Crete.

The case of the trimmed horns

Waldren (1982) published the occurrence of *Myotragus balearicus* skulls possessing horncores that are highly damaged. Up to three quarters of the horns have disappeared, leaving a remnant with a typically forked appearance (Waldren 1982: Plates 26, 27/1, 29, 30, 31; our figure 4). Waldren –who consequently wrote about 'V-trimmed horns'– attributed this phenomenon to human interference, that is, prehistoric man cutting the horns of corralled *Myotragus* in order to reduce damage inflicted during fights. He corroborated this hypothesis with the known practise of Mallorcan shepherds to cut the horns of their goats for this purpose (Waldren, 1982: Plates 27/2, 28/2). The hypothesis came forth from his presumption that prehistoric man had lived alongside *Myotragus balearicus* for a considerable period of time, and that man had even attempted to domesticate or –at least– corral the animal. It sounds perfectly reasonable to poll corralled (male) *Myotragus* for the purpose of avoiding unnecessary wounds. Waldren –in his characteristic flamboyant way of lecturing– used to vividly demonstrate how pretalayotic Mallorcans must have cut the horns, due to the apparent lack of saws, with two well-directed blows of a sharp knife.

There is ample evidence against a long period of convival of *Myotragus* and *Homo*. The overlap in time between the first arrival of man and the demonstrated last occurrence of Myotragus is little (e.g., Alcover *et al*. 2001). Is seems plausible to assume that –like on many other islands– the endemic fauna collapsed in a short time-span after human arrival.

The rather immediate introduction of sheep and goat, two species that were already domesticated long before human arrival on Mallorca, made attempts to domesticate *Myotragus* obsolete. It is reasonable to envisage a quick extinction of *Myotragus* due to both overhunting (the 'dodo-effect') and probably competition for food with the introduced ruminants. We suppose that man did not try to domesticate the endemic ruminant because there was no need to do so, and hence there was no such thing as a horn-trimming practise.

The phenomenon of V-shaped bones and antlers was published in 1973 by Sutcliffe, who gave an overview of this practise among Artiodactyla: cattle, caribou and reindeer, red deer, muntjac, camel, giraffe, wildebeest, kudu, gemsbok, sable antilope all gnaw bones and atlers or horns. The reason for this practise is the lack of phosphorous in the vegetable diet, a result from either a phosphorous-poor subsoil or a calcium-rich subsoil, whereby calcium reduces the availablitiy of phosphorous in plants. Mallorca consists largely of Mesozoic limestones, a calcium-rich sediment. Any bone-gnawing habit in *Myotragus* will thus come as no surprise. The same reasoning applies to the island of Crete, where identical forked (V-shaped) bones and antlers of the endemic deer *Candiacervus cretensis* had been found and considered to be cultural relics by Kuss (1969). This author attributed the bone and antler forks to a Palaeolithic 'osteokeratic' culture, whatever that was supposed to be. One of us (IR) recently found an antler of *Cervus elaphus* in France showing the same forked pattern (figure 5). Similarly gnawed antlers were found in the Doñana reserve, as indicated by Pérez Ripoll & Nadal (2000), who also discussed this matter after describing V-shaped horns and bones of *Myotragus balearicus* from the Cova des Moro (near Manacor, Mallorca). Waldren (1982) was quite aware of Sutcliffe's paper, which he gave full credit. He even accepted Sutcliffe's explanation for Kuss' (1969) osteokeratic artifacts as in fact being gnawed bones. Yet he refused to accept this explanation for the forked appearance of the *Myotragus* horn stumps, «especially if we take into consideration that there are living examples of horn clipping in herd management (…)» (Waldren, 1982: p. 213). This applies to the habit of polling goats in Mallorca. These goat horns are sawed however, leaving a flat surface and never a V-shaped fork.

We consider the «V-trimmed» *Myotragus* horns to be the result of gnawing based on the following evidence:

1) the limestone subsoil of Mallorca providing phosphorous-poor nutrition to the herbivores, forcing them to search for other sources of phosphor;
2) the short period of human-*Myotragus* coexistence and the absence of any need to exploit *Myotragus* for purposes other than just hunting;
3) the fact that polling in modern ruminants leaves a flat surface, not a V-shaped one, which undermines the supposed similarity;
4) the high resemblance of the tip of the Mallorcan horns with the forked ends of undoubtedly gnawed bones and antlers such as published by Sutcliffe (1973);
5) the discovery of identically shaped horns in *Myotragus* of pre-human age (*Myotragus* aff. *bateae* from Avens Socarrat, Mallorca: Crespi *et al*. 2001; our figure 6), eliminating a human origin of the phenomenon.

Discussion

Both examples provided in this short note show that initial opinions about phenomena observed in an archeological or paleontological context are sometimes unjustified. Cretan Pleistocene deer antlers and Mallorcan Holocene *Myotragus* horns that are seemingly worked by humans are in fact the result of bone-gnawing activities by ruminants. They do so in search of phospor. Other Cretan deer bones show strange phenomena that were explained as either due to animal boring, malnutrition leading to osteoporosis, anaemia, or combinations of these causes. They are in fact the result of etching (solution) by the gastric juices of bearded vultures, *Gypaetus barbatus*.

It shows that scientists should always keep their minds open for the unexpected, even if this means that old paradigms need to be abandoned.

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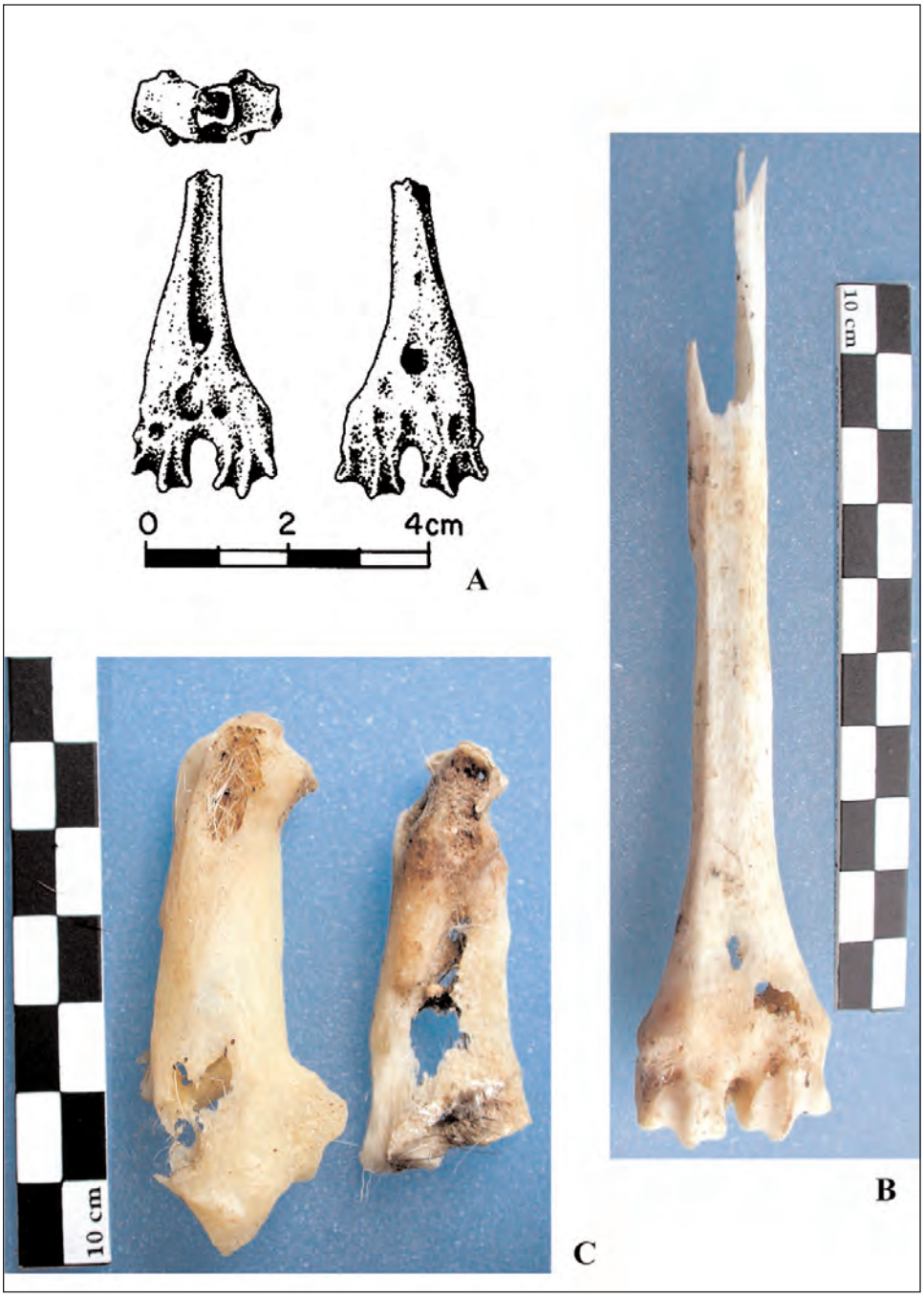

Fig. 1. (A) Distal fragment of a metatarsal of *Candiacervus cretensis*, Mavro Mouri, Crete, showing strong indication of solution due to gastric juices (from Sondaar 1977: figure 8). This is the first published illustration of the phenomenon, then attributed to «severe osteoporosis». Caprine bones regurgitated by a bearded vulture in its nest, inside a cave in the Spanish Pyrenees): (B) metatarsal; (C) two calcanea (photographs I. Robert).

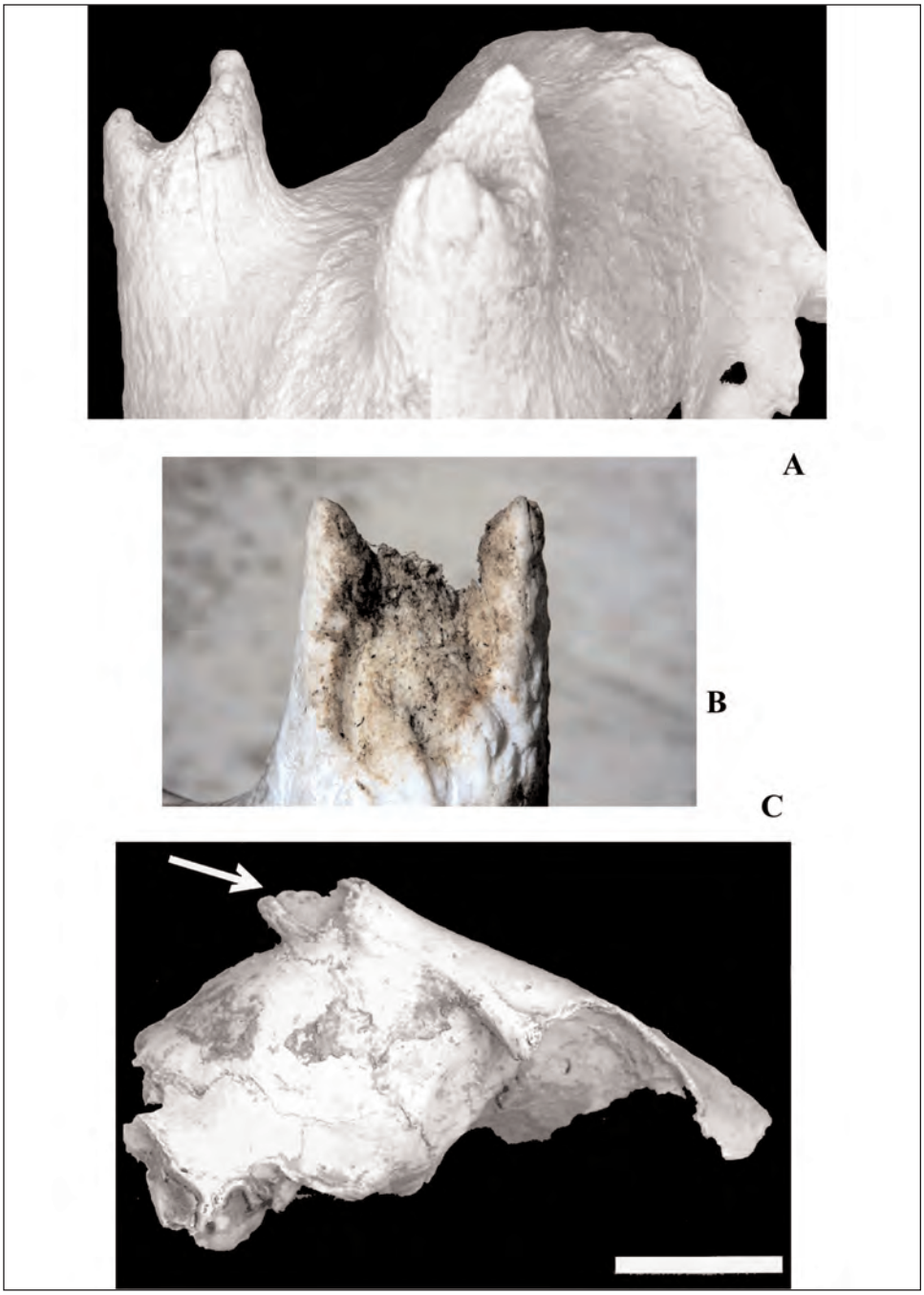

Fig. 2. (A) Cranium of *Myotragus balearicus*, Abrigo de Son Matge, Mallorca, showing the «V-trimmed» horns (from Waldren 1982: Part iii, Plate 29/2). (B) Antler of recent *Cervus elaphus*, found on the 10th of August, 2004 in a forest on Mont Lozère, (Lozère, France), showing the described V-shaped or forked pattern due to gnawing (photograph I. Robert). (C). Cranium of *Myotragus* aff. *bateae*, l'Avenc Socarrat, Mallorca, showing the same phenomenon (from Crespí *et al*. 2001: Photo 12).

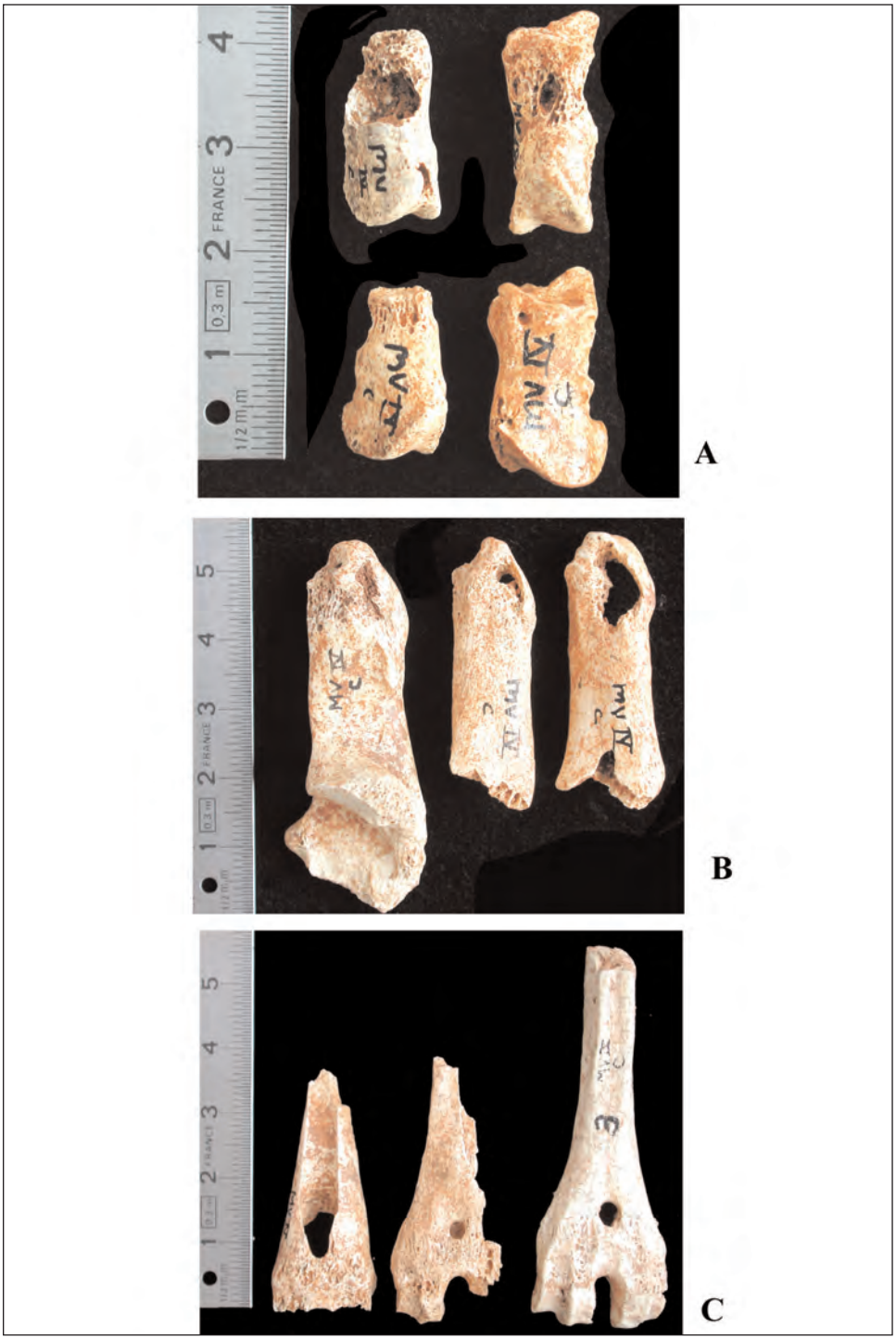

Fig. 3. Bones of *Candiacervus cretensis* showing severe stages of solution; (A) phalanges, (B) calcaneum, (C) metatarsals (photographs I. Robert).