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The Kocabaş hominin (Denizli Basin, Turkey) at the crossroads of Eurasia: New insights from morphometric and cladistic analyses

L'homininé de Kocabaş (bassin de Denizli, Turquie) au carrefour de l'Eurasie : nouvelles données obtenues à partir d'analyses morphométriques et cladistiques

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ABSTRACT

The Kocabaş skullcap (Denizli Basin), dated between 1.2 and 1.6 Ma, is the only ancient hominin fossil from Turkey and is part of discussions focusing on the first settlement outside the African continent. Our morphometric study tends to link this specimen with the African fossils, *Homo ergaster* and early *Homo erectus*, and to distinguish it from the specimens from Dmanisi and Asian *Homo erectus*. These results are confirmed by a cladistic analysis, which shows a separation of Kocabaş from the Eurasian clade comprising the Dmanisi hominins and grouping it with the African fossils dated to around 1 Ma (KNM-OL 45500, Daka-Bouri BouVP2/66, Buia UA31). As in the Kocabaş fossil, the divergence of the frontal bone is not very marked on these latter fossils and the temporal lines are separated on the parietal bone. The Kocabaş skull seems to point to a different evolutionary history than that of the Dmanisi fossils, and could reflect a later "out-of-Africa" expansion.

RÉSUMÉ

Seul fossile d'homininé ancien en Turquie, la calotte crânienne de Kocabaş (bassin de Denizli), datée entre 1,2 et 1,6 Ma, s'inscrit dans la discussion sur les premiers peuplements en dehors du continent africain. Notre étude morphométrique tend à le rapprocher des fossiles africains, *Homo ergaster* et *Homo erectus* récents, et à le distinguer des spécimens de Dmanissi et des *Homo erectus* asiatiques. Ces résultats sont confirmés par une analyse cladistique qui montre une séparation du fossile de Kocabaş du clade eurasiatique qui inclut les homininés de Dmanissi, et le regroupe avec les fossiles africains datés autour d'1 Ma (KNM-OL 45500, Daka-Bouri BouVP2/66, Buia UA31). Ces derniers partagent avec Kocabaş une divergence de l'os frontal peu marquée et une séparation des lignes temporales sur l'os pariétal. Le crâne de Kocabaş semble témoigner d'une histoire évolutive différente de celle des fossiles de Dmanissi, qui pourrait correspondre à une expansion hors d'Afrique plus tardive.

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1. Introduction

Several hominin fossils are known from Africa after 7 Ma, when the first early *Homo* is recorded at 2.8 Ma (Villmoare et al., 2015). There is a significant time lag of about 1 Ma between Africa and Eurasia, where the first human fossils are dated to 1.77 Ma at the site of Dmanisi in Georgia. This latter is the earliest known direct evidence of the "out-of-Africa" expansion. Based on lithic assemblages discovered in Asia, these first waves of settlement could be considerably older than 2 Ma (Prat, 2018, this issue). However, these discoveries remain scarce. In this context, the Kocabaş skull, from the Denizli Basin in Turkey, provides important evidence of early human presence in the Middle East, or an "out-of-Africa" expansion along the Levantine corridor, and possible dispersal toward Europe – via the Bosphorus Strait – and toward Asia – across mountainous territories such as the Taurus, Zagros, and the Caucasus. Although the Kocabaş skullcap is very fragmented, it fills a paleoanthropological gap between 1.6 and 1.2 Ma, not only in Africa but also in Eurasia. Indeed, there is no fossil between OH9 from Olduvai in Tanzania and the one-million-year-old *Homo erectus*-like hominins from East Africa (KNM-OL 45500, Daka-Bouri BouVP2/66, Buia UA 31). In Europe, apart from the deciduous tooth from the Orce Basin dated to 1.4 Ma (Toro-Moyano et al., 2013), the oldest human fossils are from the Atapuerca–Sima del Elefante site dated to 1.2 Ma (Carbonell et al., 2008).

The goal of this paper is, on one hand, to characterize morphometrically the Kocabaş fossil and, on the other hand, to test its link with other Pleistocene hominins from Africa and Asia using cladistic analysis. The main question is to establish whether the Turkish hominin, found at the crossroads of Africa and Asia between 1.6 and 1.2 Ma, is indeed closer to African or Asian specimens.

2. Background

The Kocabaş fossil was discovered in 2002 by one of us (M.C.A.) in one of the quarries in the Denizli Basin (Alçiçek and Alçiçek, 2014). The small skull was sliced by the blades used to cut blocks in this travertine quarry. Although the discovery of the skull was accidental, associated fauna is abundant in the find horizon (Alçiçek, 2014, Boulbes et al., 2014). This fossiliferous horizon from which the Kocabaş fossil comes from, is identified as the upper travertine (UT) (Lebatard et al., 2014a, 2014b), which was the only quarried travertine at the time of discovery in 2002, and the only unit to have yielded paleontological material up until now.

The stratigraphic and chronological context of the UT bearing the hominin skull and an abundant Upper Villafranchian fauna were comprehensively defined during the field missions in 2011 and 2012. This fieldwork has been focused on the deposits from the Faber Quarry where the succession reaches a depth of over 90 m and contains preserved levels comparable to those from which the fossils were extracted in 2002 within the UT. This UT unit is situated stratigraphically between two fluviatile levels. The results obtained from $^{26}Al/^{10}Be$ cosmogenic nuclides analysis on the overlying and underlying fluviatile conglomerate levels (Lebatard et al., 2014a, 2014b) indicate an age of 1.1 Ma and 1.6 Ma respectively, setting a chronological bracket between these two dates for the Kocabaş fauna and the human fossil. The magnetostratigraphy for the whole sequence of the deposits (Khatib et al., 2014) allows a correlation of the base of the upper fluvial unit (normal polarity) with the Cobb Mountain excursion, dated to 1.22 Ma. Moreover, the biochronology of the fauna *Archidiskodon merionalis meridionalis* (*Elephantidae*) and *Palaeotragus* (*Giraffidae*) associated with the skull (Boulbes et al., 2014) confirms this chronological framework between 1.2 and 1.6 Ma.

No lithic artefacts are strictly associated with the human and animal fossils from the UT of the Denizli Basin. Archaeological prospection in the surrounding terraces has just started recently (Maddy et al., 2015; Aytek *comm. pers.*), leading to the discovery of lithic artefacts, mostly on the surface. More generally, few Lower Palaeolithic sites are known in Turkey (Dinçer, 2016) and none are as old as the Kocabaş locality. We have no evidence for the moment to ascertain whether at 1.2/1.6 Ma, the technological mode could be related to Oldowan or Acheulean technocomplexes. However, the Dursunlu site (Güleç et al., 2009) and Yarimburgaz Cave (Howell et al., 1996) have yielded stone flakes. The open-air site of Kaletepe Deresi 3 attested to the presence of well-shaped handaxes made of obsidian (Slimak et al., 2004, 2008) dated to the middle Pleistocene (Tryon et al., 2009). Some handaxes were discovered in the lower levels of the Karain E Cave (Taşkıran, 2008, Taşkıran, 2018 this issue). At this site, the Mousterian industry is well represented in the upper levels in association with 20 fragmentary Neandertal-like human remains (Chevalier et al., 2015) older than 125 ka (Otte et al., 1998).

3. Anthropological settings

The Kocabaş skull was attributed to *Homo erectus* (Kappelman et al., 2008). It is composed of 3 fragments separated at the cranial sutures, which were not completely fused due to the young age of the specimen (Fig. 1). The three cranial fragments were scanned using the Philips helical scanner at the Pamukkale teaching hospital, in Denizli, on September 14th, 2009; slice thickness was 0.80 mm, the space between slices was 0.4 mm (field of view: 20 cm, matrix: 512 × 512, power: 175 mA, intensity: 120 kV).

A first virtual reconstruction was carried out based on the CT data (Vialet et al., 2011, 2012). This paper concerns the second virtual reconstruction with Geomagic Studio 12 software by A.V. and P.W. (technical platform ASIM, at the MNHN). In this reconstruction, called "Kocabaş 2", the right part of the frontal bone is more accurately situated. Indeed, there is a gap of a few millimeters between the parietal and frontal sutures which prevents the direct anatomical connection between the two bones, as was previously thought and consequently applied to the first reconstruction. This reconstruction proceeded as follows. First, the two parietal fragments (right and left) were rearticulated following the congruence of their sagittal suture. Such rearticulation could be done using different angles. To ensure that the rearticulated bones were not out of the initial volume, we confirmed that they are situated between the two reference

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