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## Palaeopathology of the Pleistocene specimen D2600 from Dmanisi (Republic of Georgia)



## Paléopathologie du spécimen pléistocène D2600 de Dmanisi (république de Géorgie)

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## ARTICLE INFO

## Article history:

Received 15 May 2013

Accepted after revision 16 October 2013

Available online 18 January 2014

Handled by Yves Coppens

## Keywords:

Palaeopathology

*Homo georgicus*

Dmanisi site

Dental wear

Compensatory eruption

Periodontal disease

Cysts

## Mots clés :

Paléopathologie

*Homo georgicus*

Dmanisi (site de)

Usure dentaire

Éruption compensatoire

Maladie parodontale

Kystes

## ABSTRACT

Here we present a detailed palaeopathological study of the hominin mandible D2600 recovered at the Dmanisi site, Republic of Georgia. The Dmanisi assemblage represents the earliest evidence of hominins outside Africa with an age of 1.8 Ma. D2600 is the holotype of *Homo georgicus* species and its taxonomic assignment is still under debate. Our study reveals severe and unusual dental wear accompanied of extensive root exposure and dental axial migration, periapical abscesses and enamel fractures. In addition, there is evidence of post-eruptive tooth rotation and temporomandibular arthropathy. We propose that the wear pattern observed in this individual is related to a diet with a high intake of fibrous and abrasive foods such as fruits and plants, as it is usually recorded in chimpanzees and gorillas and unlike the wear pattern observed in other *Homo* specimens of our comparative sample. The rounded occlusal surfaces and highly polished labio-lingual surfaces of D2600 anterior teeth could be mainly the consequence of pre- and/or para-masticatory activities such as gripping and stripping. This type of food would be also the origin of the highly cupped occlusal morphology of the posterior dentition in combination with relatively slight approximal attrition. However, the lesions exhibited by D2600 have not significantly altered the morphology of the mandible and do not prevent a proper taxonomic assessment.

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## R É S U M É

Ici est présentée une étude paléopathologique détaillée de la mâchoire humaine D2600, recueillie au site de Dmanisi, en république de Géorgie. L'assemblage de Dmanisi représente la preuve la plus récente d'homininiens hors de l'Afrique ; il est daté de 1,8 Ma. D2600 est l'holotype de l'espèce *Homo georgicus*, et son attribution taxonomique est encore débattue. Notre étude révèle une usure sévère et inhabituelle, avec exposition extensive de la racine et déplacement axial de la dent, abcès péri-apicaux et fractures de l'émail. En outre, il y a rotation de la dent après l'éruption dentaire et arthropathie temporo-maxillaire. Les auteurs

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proposent de relier le patron d'usure observé chez cet individu à son alimentation, avec ingestion importante de nourriture fibreuse et abrasive, tels que fruits et plantes, comme on le rapporte couramment chez les chimpanzés et les gorilles, mais contrairement à ce qu'indique le patron d'usure observé chez d'autres spécimens d'*Homo* de notre échantillonnage de comparaison. Les surfaces occlusales arrondies et les surfaces labio-linguales fortement polies des dents antérieures de D2600 pourraient surtout être la conséquence d'activités pré- ou para-masticatrices de saisie et d'arrachage. Ce type de nourriture serait aussi à l'origine de la morphologie occlusale fortement évasée de la dentition postérieure, combinée à une attrition relativement légèrement approximale. Cependant, les lésions que présente D2600 n'ont pas significativement altéré la morphologie de la mâchoire et n'empêchent pas l'appréciation taxonomique propre.

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## 1. Introduction

The Dmanisi site is located in the South of the Republic of Georgia. The excavation has yielded a rich sample of lithics, hominins and faunal fossils dated to the Pleistocene period (1.81–1.77 Ma) (Gabunia et al., 2000, Gabunia et al., 2002). The hominin assemblage comprises cranial and post-cranial remains of at least five individuals (Lordkipanidze et al., 2007; Rightmire et al., 2006, 2008; Vekua et al., 2002). The Dmanisi remains have been attributed to *Homo erectus* (Gabunia and Vekua, 1995; Rightmire et al., 2006), late *H. erectus* (Bräuer and Schultz, 1996); *H. sp. indet.* (*aff. ergaster*; Rosas and Bermúdez de Castro, 1998), *H. ex gr. ergaster* (Gabunia et al., 2000). According to Gabunia et al. (2002), D2600 mandible presents distinctive morphological characteristics, compared to those of *Homo habilis* and *H. erectus*, leading to the naming of a new species, *Homo georgicus*, of which D2600 is the holotype. However, the taxonomic assignment of the complete fossil assemblage to only one species has raised controversy (e.g., Gabunia et al., 2002; Margvelashvili et al., 2013; Martínón-Torres et al., 2008; Rightmire et al., 2008; Skinner et al., 2006). Morphological and metrical differences between D2600 individual and the rest of Dmanisi mandibles have been attributed to a marked sexual dimorphism by some researchers (Gabunia et al., 2002; Rightmire et al., 2008). However, other scholars suggest that the metric and morphological analysis of the mandibular corpus and the teeth could evince the existence of two different species in the Dmanisi assemblage (Martínón-Torres et al., 2008; Skinner et al., 2006). Furthermore, in a recent study Margvelashvili et al. (2013) suggest that the dentognathic pathologies are key factors in causing the morphological variation within the Dmanisi hypodigm. Whether D2600 belongs to the same taxon as the rest of the hominins is still under revision (e.g., Martínón-Torres et al., 2008; Rightmire et al., 2008). The identification of several pathological processes in the D2600 mandible credits a more detailed palaeopathological study of the specimen in order to evaluate if the dentognathic lesions have significantly altered the morphology of the mandibles as stated by Margvelashvili et al. (2013). Additionally, this study could provide dietary, behavioural information about this early hominin population. We conducted an analysis of the alveolar bone morphology and height, root exposure, dental wear, enamel breakage and infectious processes.

## 2. Material

The study was carried out on the original fossil at the Georgian National Museum (Tbilisi). The D2600 specimen consists of a mandibular bone that presents fractures principally at the mandibular rami. The mandible preserves *in situ* all teeth except the right second premolar (RP4), left first molar (LM1) and second premolar (LP4) (Fig. 1).

### 2.1. State of preservation

The mandibular body is almost complete except for some fractures at the inferior border. Two fractures affect the right and left rami. The fractures of the rami are both oblique, follow an ascending direction and have caused the loss of the mandibular angle and the masseteric area. On the right side the fracture begins at the location of the M1 distal root and finishes 30 mm inferiorly to the condyle, and its total length is 90 mm. Moreover, the ramus exhibits crushing on the lateral side of the outer table and the breakage of the mandibular notch (Fig. 1d). On the left side the fracture has produced a greater bone loss than in the right side, and the total length of the area affected is of 85 mm. The breakage starts at the distal root of the M2 and finishes 35 mm inferiorly to the articular surface of the condyle; it also affects the mandibular notch and has produced the loss of the coronoid process (Fig. 1b). Finally, there is a minor third fracture that affects the left buccal aspect of the mandibular bone. The fracture at the LM2 and LM3 location, of approximately 30 mm, has caused the exposure of the M2 root – 17 mm – and the alveolar crest (AC) breakage at the M3 (Fig. 1).

The sharpness of the margins together with the lack of bone remodelling indicates that all three fractures are peri-postmortem and likely consequence of diagenetic processes.

Apart from these, the mandible presents a series of abnormalities of pathological origin; and therefore, they will be tackled in the following section.

## 3. Methods

The degree of wear (or *wear category*) was determined following the eight-score system proposed by Molnar (1971), based on the amount of dentine exposure. The plane

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