On the misidentification and unreliable context of the new "human teeth" from Fuyan Cave (China)

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Sun et al. (1) question the Late Pleistocene chronologies of five hominin sites from southern China, including Fuyan Cave with 47 *Homo sapiens* teeth (2), and suggest they belong to the Holocene. Here we question the validity of their study, based on the uncertain origin and taxonomical identification of the two "human" specimens from Fuyan (FY-HT-1 and FY-HT-2) and the quality standards of their ancient DNA (aDNA) and ^{14}C analysis.

1) FY-HT-1 and FY-HT-2 were collected by Sun and colleagues in 2019 without supervision of the key team members leading the Fuyan excavations. They allege that both specimens belong to the same sample we studied (2), because they are "clearly AMH [anatomically modern human] and fit metrically and morphologically within the range of earlier finds from the site" (1). However, they do not provide any morphometric data to sustain this claim, nor precise information about the purportedly in situ position of the teeth. Critically, we confirm that FY-HT-2 is not human but belongs to an herbivore (Fig. 1): Wear is predominantly lingual instead of incisal; there are not visible interproximal wear facets despite the degree of incisal/lingual wear; the crown is high and narrow; and the inclination of the root with regard to the crown is typical of some herbivores (e.g., deer). Grievously, despite its nonhuman nature, they claim to have obtained human aDNA that "falls within the variation of present-day Eurasian lineages." Obviously, these results question the rigor and quality of their study.
2) For the accelerator mass spectrometry (AMS) ^{14}C dating, it is unclear whether there is any preprocess for the total organic carbon (TOC) measurement before adapting the procedures described in ref. 3, since the postdeposited carbonate is hard to eliminate with the normal acid–alkali–acid approach. It is also not clear what types of components, beside the collagen, are included in the TOC, since their C/N ratio is much higher [e.g., 46.2 in FY-HT-2 (1) vs. 2.9 to 3.6 (4) and 3.1 to 3.5 (5)] than that of collagen suitable for ^{14}C dating (6). Furthermore, the percent of C in FY-HT-1 is about 2.3, much higher than in contemporary enamel (0.1 to 0.8%) (6). Overall, it seems that these samples have undergone postdepositional alteration and/or contamination, and their ^{14}C dates are questionable. In addition, the authors do not discuss the Late Pleistocene fauna nor the >43 ka cal B.P. AMS ^{14}C dating we obtained for it.
3) Regarding FY-HT-1, we highlight the extremely good preservation of the root edges in contrast to the severe root alteration of the specimens in ref. 2. The possibility of two different taphonomic stories questions the association of all teeth to the same sample.

Except for the dubious aDNA and ^{14}C analyses of noncontextualized and likely contaminated samples, the U-Th dating of the speleothems and the optically stimulated luminescence of the sediments encasing the fossils confirm the Late Pleistocene ages of the Fuyan sample. Obtaining human aDNA from a nonhuman tooth brings into serious question the credibility of the study by Sun et al. (1). Our proposal of an early presence of *H. sapiens* in China (2) remains unchallenged.

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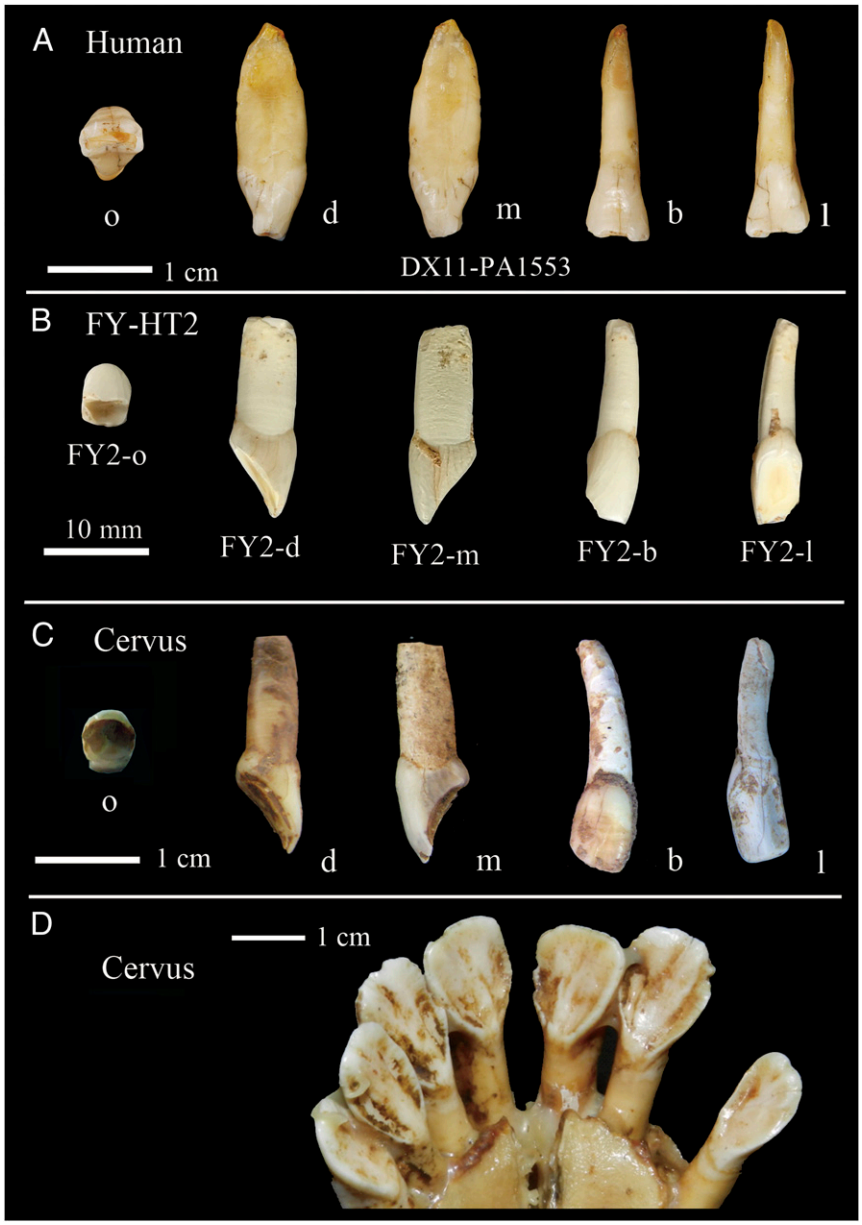

Fig. 1. Morphological comparison of human and deer lower incisors. (*A*) *H. sapiens* lower incisor recovered at Fuyan Cave in 2012 and published in Liu et al. (2); o, occlusal; d, distal; m, mesial; b, buccal; and l, lingual. (*B*) FY-HT-2 tooth recovered by Sun et al. (1) at Fuyan in 2019 and alleged to be human (reprinted with permission from ref. 1); (*C*) o, d, m, b, and l views of *Cervus* lower incisors recovered at Fuyan Cave in 2012; and (*D*) lingual view of lower dentition from a recent *Cervus* (reprinted with permission from ref. 7). Note the intense lingual rather than incisal wear present in *Cervus* specimens as well as in FY-HT-2. Note also the shape similarities in root and crown shape and orientation in *B*–*D*.

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