A more comprehensive view of the Denisovan 3-rooted lower second molar from Xiahe

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Bailey et al. (1) describe a lower second molar with 3 roots in a Denisovan hemimandible dated 160,000 ka. The presence of a third root is stated to occur in <3.5% of non-Asians and in up to 40% of Asians and some New World populations. From this, they conclude the feature "provides morphological evidence of a strong link between archaic and recent Asian *H*[*omo*] *sapiens* populations. This link provides compelling evidence that modern Asian lineages acquired the 3-rooted lower molar via introgression from Denisovans" (ref. 1, p. 14806). However, there are 2 problems regarding this statement:

1) While the expression of 3-rooted lower first molars (LM1) is more common in Asian and Asian-derived populations (2), frequencies of this trait in lower second molars (LM2) are rare in modern groups. For example, in an An Yang Chinese sample from C. G. Turner's database, the frequency is 38.4% (66/172) for LM1 and 1.4% (2/144) for LM2. For Aleuts, with the highest world frequencies of 3-rooted lower molars, the numbers are 40.7% (111/273) and 1.9% (4/210), respectively. The frequencies of this feature reported by Bailey et al. (1) are based on the "wrong" tooth.
2) More importantly, the 3-rooted molar identified in Xiahe is not equivalent to the archetypal 3-rooted lower molar (3RLM) (3, 4). Rather, as also referenced by Bailey et al. (1), a 3RM is defined by a "third (supernumerary) root . . . on the distolingual aspect . . . [that] may be very small but is usually about one-third the size of the normal distal root" (ref. 3, p. 25, among others). In Xiahe, the "accessory" root is far larger than one-third the size of the normal distal root and is on the mesiolingual aspect, not the distolingual. Similarly, the LM2 of the hominin fossil from Penghu (Taiwan) (5) shows a robust extra root between the lingual sides of plate-like mesial and distal roots. However, as Chang et al. (5) acknowledge, the Penghu supernumerary root "is different from the 'three-rooted' lower molar occasionally found in modern humans (often on M1) where the extra root appears immediately lingual to the distal root" (ref. 5, SI p. 23).

We have observed bifurcated mesial roots on lower molars in modern populations. It may be an as-yet-undefined nonmetric trait that, like the archetypal form, yields 3 roots (Fig. 1). However, the evidence is not enough to suggest a bifurcated mesial root like that in Xiahe (1) is homologous to the 3RLM in modern populations (2–4). Thus, interpretation of this feature as a sign of introgression from Denisovans (1) into modern populations is not sustained. Furthermore, the phenotypic signature of hybridization is still unclear. It is often assumed human hybrids should display intermediate morphologies or a "mosaic" of features inherited from each parental population (e.g., ref. 6). However, recent studies reveal that genetic admixture frequently leads to evolutionary innovation (e.g., ref. 7). Thus, the higher expression of a potentially primitive feature may not necessarily indicate introgression, but simply the retention of an archaic trait. We urge caution about overinterpreting isolated dental features.

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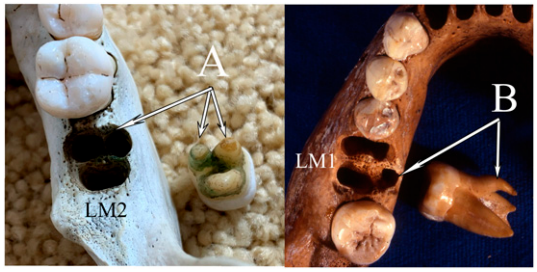

Fig. 1. (*A*) Three-rooted second lower molar in recent American white with bifurcated mesial root (potentially like that in ref. 1). (*B*) Three-rooted lower first molar with distolingual supernumerary root about one-third the size of adjacent distal root.

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