LETTER

Reply to Dyke and Naish: European alvarezsauroids do not change the picture

Dyke and Naish (1) draw attention to three points that they consider to be "serious shortcomings" of our recent paper on a monodactyl nonavian dinosaur (2). Here, we respond to each point in turn.

Our paleobiogeographic hypothesis was based strictly on the phylogenetic tree we recovered (2), which did not include the European alvarezsauroid *Heptasteornis* because of the extremely fragmentary nature of the known material (3). However, we did include this taxon in a section of our paper (albeit in the SI Appendix) dealing with the biogeography of the Alvarezsauroidea, and even discussed its possible systematic position (2). Because it is probably a derived alvarezsauroid deeply nested within an Asian clade (2), it will not affect our biogeographic hypothesis (at best adding another dispersal event from Asia to Europe after the three dispersal events we proposed). Second, we acknowledge that a node-based definition of Parvicursorinae that would exclude *Linhenykus* has previously been proposed (4). However, *Linhenykus* and other recently reported parvicursorines, such as *Albertonykus* (5) and *Xixianykus* (6), are so morphologically similar to members of this node-based Parvicursorinae that we believe the most informative option is to treat Parvicursorinae as a stem-based taxon as proposed in our paper, allowing for the inclusion of this genus and other taxa. Finally, our previous study indicates that *Linhenykus* is clearly different from *Parvicursor* in a number of features (2, 3). Large pneumatic foramina are present in the middorsal vertebrae of *Linhenykus*, whereas the dorsal vertebrae lack pleurocoels in *Parvicursor*; *Linhenykus* possesses biconvex dorsal vertebrae, whereas all the preserved dorsal vertebrae are opisthocoelous in *Parvicursor*; the anterior caudal vertebrae are amphicoelous in *Linhenykus* but procoelous in *Parvicursor*; and the supracetabular crest is prominent anteriorly and convex in dorsal view in *Linhenykus* but appears to be concave in dorsal view in *Parvicursor*. The two taxa also show some proportional differences, such as a much longer metatarsal III in *Linhenykus* than in *Parvicursor*. Furthermore, *Parvicursor* has only been briefly described and a detailed comparison between the known specimens of the two taxa would be likely to reveal even more differences.

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The authors declare no conflict of interest.

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