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Burrows Dug by Large Vertebrates into Rain-Moistened Middle Jurassic Sand Dunes: A Reply

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Odier (2007) is concerned with two issues: (1) I did not cite his work on burrows in the Navajo Sandstones of southeastern Utah in my article (Loope 2006), and (2) he believes I am wrong in interpreting the structures preserved in the Entrada Sandstone as burrows. On the first issue, I failed to cite both his 2004 abstract and the newly published book that he sent me in October 2006. My article was accepted on June 12, 2006; I returned the proofs on August 23; and the issue was published online on October 4, 2006. The timing of these events makes it clear why I did not cite the book. I did not cite the abstract because that would have necessitated airing my reservations about his interpretations. Since the middle 1970s, I have been aware of abundant cylindrical structures of likely biogenic origin in the Navajo Sandstone, and at the 2004 Geological Society of America meeting, I learned that Odier was interpreting these structures as mammal burrows. In my view, his interpretation could be correct, but, because the preferentially cemented (concretionary) features weather out of structureless sandstone, very little detail is available for study. For instance, in any one cylinder, the diameter commonly varies widely. What was the original diameter of the burrow (or the plant root)? Because bedding planes are absent, this simple question cannot be answered. In the "Conclusions" section of my article on burrows within the Entrada Sandstone, I emphasize the importance of thin-laminated sandstone to the preservation and recognition of biogenic structures; disruptions of this lamination by either physical or biogenic processes provide abundant clues that are simply unavailable in structureless sandstones.

On the second issue, Odier (2007) states that the structures in the Entrada Sandstone that I interpret as burrows cannot be burrows because of the crossbedding that is present inside several of them. Instead, he interprets them as "wells" formed by heavy rain falling on dune sand. Many sedimentologists have been interested in the effects of heavy rain on subaerially exposed sand. Clifton (1977) described rain-impact ripples with wavelengths of about 1 cm that form transverse to the wind direction. Rain-wetted blocks of cohesive sand sometimes move down steep lee faces of dunes (Bigarella et al. 1969; Hunter et al. 1983; Loope et al. 2001). I am not aware, however, of reports of rain events that excavate 3-m-long, 50-cm-wide cylindrical voids that are inclined 15°–20° to the horizontal and cut dune crossbeds at a high angle. Figure 8 in my article shows the origin of the internal crossbeds: wind-blown sand drifted into the open burrow throats. For high-resolution, color images of these structures, please see http://www.geosciences.unl.edu/~dloope/.

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