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Ancient dune morphologies preserved by partial burial

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Aeolian activity dominates the surface of modern Mars and has been a major contributor to landscape change throughout the planet's history. Dune fields are common on modern Mars, but, as on Earth, the preservation of ancient duneforms is rare. In this work we present evidence that pits in Noctis Labyrinthus and Hellas Basin represent the outlines of partially buried ancient dunes. The pits, with a mean depth of 6 m, exhibit morphologies characteristic of barchan dunes, including crescent shapes, apparent dune-dune interactions, and asymmetric terminations. The pits are interpreted to have formed after the dune fields were flooded by basalt to a depth of between 6-8 m, roughly one third the typical dune height. After partial burial, the still loose aeolian sands eroded away, eventually leaving barchan-shaped pits in the basalt. Similar scenarios of partial burial and resulting dune-shaped pits have been documented on Earth at locations in Namibia and the United States, but the Martian examples presented here represent the first identifications of this phenomenon on Mars.