Letter to the Editor

An Extended Pleistocene Range for Sand-Swimming Golden Moles like the Namib Mole

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We wish to draw your attention to a peer-reviewed article that we authored, recently published in Quaternary Research (Lockley et al., 2021), titled: *"Pleistocene golden mole and 'sand-swimming' trace fossils from the Cape coast of South Africa"*. It presented the fossil evidence that our research team has found for the tracks and burrows of golden moles, and in particular of the genus *Eremitalpa,* which is exemplified by the 'Namib mole' or Grant's golden mole, *Eremitalpa granti.* In this letter, we briefly review this evidence and discuss its implications for Namibia.

The Namib mole is one of the iconic Namibian desert-dwelling mammals, and has captured the world's attention (e.g., https://www.youtube.com/watch?v=8dP2LIUGekg). Eighteen of the world's 21 golden mole species occur in southern Africa. *Eremitalpa* is a monospecific genus, with two subspecies on the west coast, separated by the Orange River. *Eremitalpa granti namibensis* occurs in Namibia, south of the Kuiseb River, and *E. granti granti* occurs in South Africa, as far south as St. Helena Bay.

Although totally blind, the Namib mole has developed a search pattern that is effective in encountering patches of high prey availability. It is the smallest of the golden moles, and has limbs and claws that are adapted for burrowing in loose sand in search mainly of termites. It is acutely sensitive to vibrations as a means of locating its prey. It hunts at night, travelling through the sand at a much shallower depth than any other golden mole, in a form of locomotion known as 'sand-swimming'.

During this activity, the mole creates distinctive raised areas with well-preserved, anteriorly-convex margins. If the consistency of the sand is less cohesive, the midline portion of the trail may collapse behind the mole, leaving a linear sulcus. Laura Fielden, internationally renowned expert on the Namib mole from Truman State University, kindly provided us with excellent images of such trails. Alternatively, if the sand is more cohesive,

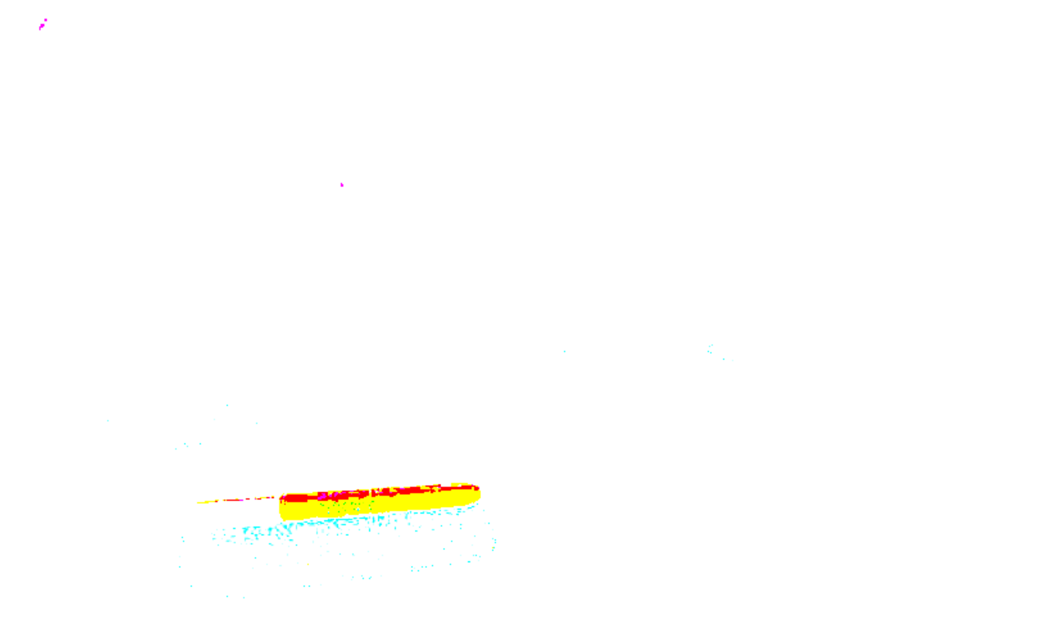

Figure 1: E. granti *sand-swimming trails with transition to a surface trackway; scale bar = ~14 cm (reproduced with permission from the Gobabeb Training and Research Centre)*

the trail does not collapse and remains raised above the dune surface. Eugene Marais, Gillian Maggs and the staff of the Gobabeb Training and Research Centre were extremely helpful in providing us with photographs of this variety of trail (Figure 1).

In 1988, in an article in *Sedimentary Geology,* John Ward described fossil golden mole traces from Early- to Middle Tertiary sediments from Namibia. It was noted that "back-filled, burrow-like traces cutting cross eolian stratification in the Tsondab Sandstone Formation resemble trackways left by the golden mole, *Eremitalpa* sp., that today is endemic to the Namib Desert". In Figure 2, we reproduce the photograph from Ward (1988).

Prior to our work, that was the only reported fossil description of golden mole traces. Since the inception of our fossil tracks project on the Cape south coast of South Africa, we have identified more than 300 vertebrate track sites over a 350km coastal stretch. Numerous fossil burrow traces are also present, and not surprisingly, given that golden moles occur commonly in the area today, some of these can be attributed to the golden mole family (Chrysochloridae). What we did not expect to find, however, were typical sand-swimming fossil traces, yet we have identified three definite sites (two on the south coast and one on the southeast coast) where these occur, as well as a number of possible sites. And remarkably, we identified cases where the roof was preserved and also where it had collapsed. Because *Eremitalpa granti* and its mode of locomotion are so unique,

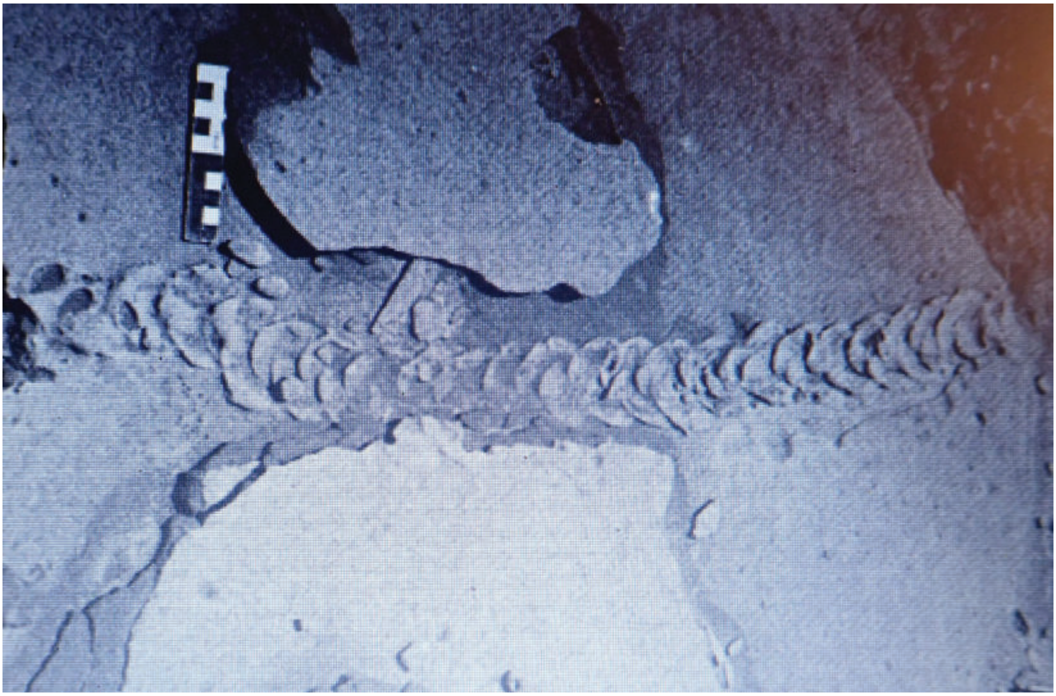

Figure 2: Trace fossil attributed to Eremitalpa *sp. by Ward (1988); reproduced with permission from John Ward*

it is no surprise that, apart from Ward's 1988 site, nothing like this has been described anywhere else in the fossil record. We therefore erected a new ichnogenus, *Natatorichnus,* meaning "swimmer trace", with two ichnospecies, *N. subarenosa* ichnosp. nov. for the trail type where the roof is preserved (Figure 3), and *N. sulcatus* ichnosp. nov. for the trail type where the roof has collapsed (Figure 4). Translated from Latin, these mean 'swimmer trace under the sand' and 'swimmer trace with a sulcus' respectively.

The holotype site for the *N. subarenosa* traces was remarkable: a huge block had tumbled down from coastal cliffs, and come to rest at the high tide mark, having split in two (Figure 5). Fortunately, the sand-swimming fossil traces occurred right at the level of the split, and could therefore be examined in both epirelief (the original surface) and hyporelief (the layer that filled in the original surface). The trail extended for more than 130cm in a curved fashion, and was 8-10cm in diameter.

These trails were probably made between 80,000 and 130,000 years ago; we have submitted samples for Optically Stimulated Luminescence dating, and anticipate receiving the results soon. While some of them exhibit a diameter of 5-7cm, similar to the *E. granti* trails and the fossil trail from Namibia described by Ward (1988), others are wider, with a diameter range of 8-12cm. It seems likely that these trails were made by a larger golden mole with a means of locomotion similar to that of *Eremitalpa granti.* However,

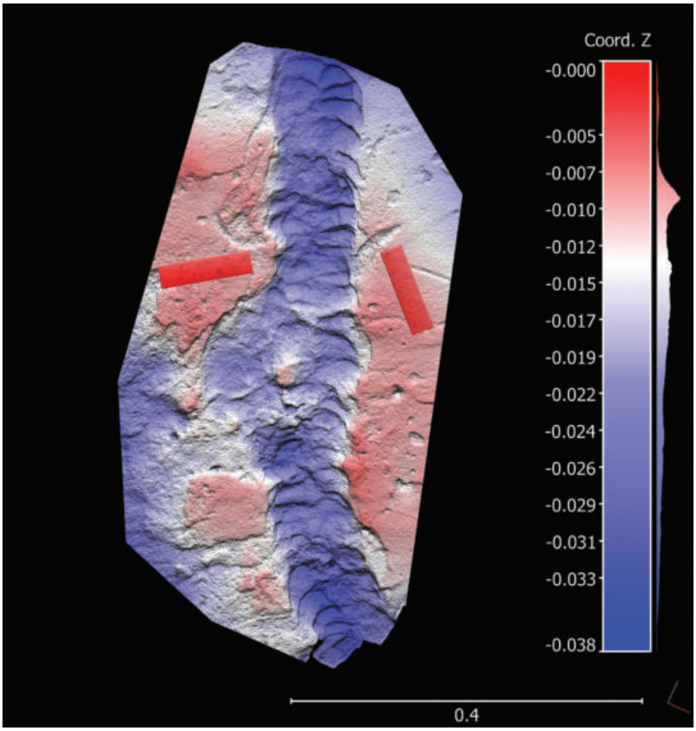

Figure 3 (right): Photogrammetry colour mesh of hyporelief surface showing the holotype of N. subarenosa; *vertical and horizontal scales are in metres*

Figure 4 (below): Part of holotype of N. sulcatus, *preserved in epirelief and showing the characteristic median sulcus; scale bar is in cm*

Figure 5: The holotype site for the N. subarenosa *traces*

convergent adaptation to similar dune conditions is possible, and sand-swimming locomotion by other fossorial groups cannot be completely excluded.

E. granti inhabits areas characterised by extensive dune fields, and this is apparently a requirement for the species. The presence of tracks of the extinct giant Cape zebra on one of the surfaces containing sand-swimming fossil traces is of potential significance, as this species is generally characteristic of more arid environments. While it is thus tempting to infer widespread arid paleoenvironmental conditions in the Pleistocene on the Cape south coast, based on the discovery of these fossil traces, extensive dune fields can also be the result of persistent strong winds. One of the sites lies close to the largest coastal dune field in South Africa (>15,000ha). *Eremitalpa granti* is a poor thermo-regulator, and if such a species existed at times on the Cape south coast during the Pleistocene, it is conceivable that a long period of cooling associated with a glacial phase ('Ice Age') may have led to its extirpation from a region situated so far south.

Through our published work on this topic, we have tried to shed light on the distant past of a fascinating and enigmatic species, which in many ways epitomizes the wonders of adaptation to the harsh desert world of Namibia. It appears, though, that the current distribution of the *Eremitalpa* genus is unexpectedly smaller than it was in the past.

References

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