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A whale of a time: Scientists illuminate details of buried Miocene whale skeleton with ground penetrating radar

This is the first time that GPR was used to detect fossils in the Pisco Formation; results prove it can be used not only to detect buried fossils but also reveal details of the skeleton structure

MUNICH – The Ica Desert in southern Peru is among the worlds' most important Lagerstätten — sedimentary rocks that exceptionally preserve fossils assemblages. In this case, the Pisco Formation — a sub-horizontal layer of diatomaceous sediments — exquisitely entombs Cenozoic marine vertebrate fossils like whales, sharks and dolphins. Here, "it is possible to observe the transition of whales from terrestrial mammals to marine animals," says **Annalisa Ghezzi, a geophysicist collaborating with researchers at the University of Camerino, Italy**. In fact, the first quadrupedal whale record from the Pacific Ocean and Southern Hemisphere came from this region, she said.

More fossils are likely buried, but targeting the best locations for excavation proves tricky. However, most skeletons of these large oceanic creatures tend to be either full or partially enclosed in dolomitic nodules, which may have formed via microbially mediated processes shortly after the soft tissue decayed, explained Ghezzi. Buried dolomitic nodules may be a useful target for geophysical methods. **Antonio Schettino, a geophysicist at the University of Camerino**, will present the team's ground penetrating radar results next week during the European Geosciences Union (EGU) General Assembly 2023.

Ground penetrating radar lets scientists image the subsurface without digging. This non-intrusive method involves sending a radar pulse into the ground, and measuring the signals that bounce off subsurface structures — like dolomite nodules enclosing fossilized skeletons. The waves can be reflected, refracted or scattered back to the surface, and the variations in return signal can be analyzed to illuminate what's going on underground.

To the untrained eye, survey results may appear as unintelligible wiggles. But Ghezzi and colleagues' analysis of radar profiles and traces allowed them to characterize components of skeletons encapsulated in dolomitic nodules. They surveyed a 200 meter by 104 meter area in Cerro Los Quesos, one of the most fossil-rich localities in the Ica Desert, with their ground penetrating radar system. In one location, they found a whale skeleton that was almost completely buried. By surveying in detail this 5 by 12 meter rectangle, they were able to locate the full extent of the skeleton. Their analysis of the radar profiles and traces revealed skeleton components like the sternum, mandible, cranium and vertebrae inside concretions or nodules.

This is the first time that ground penetrating radar has been used to detect fossils in the Pisco Formation, Ghezzi said. “The importance of this research is that it proves that radar can be used not only to detect the presence of buried fossils but also to reveal details of the skeleton structure.”

To learn more about this work, check out the oral presentation during GI5.4 at EGU23 on **Monday, 24 April at 09:05 CEST** in Room 0.51.

Note to the media:

When reporting on this story, please mention the EGU General Assembly 2023, which is taking place from 23-28 April 2023. This paper will be presented in session GI5.4 on Monday, 24 April, 09:05-09:15 CEST. If reporting online, please include a link to the abstract: https://meetingorganizer.copernicus.org/EGU23/EGU23-10974.html

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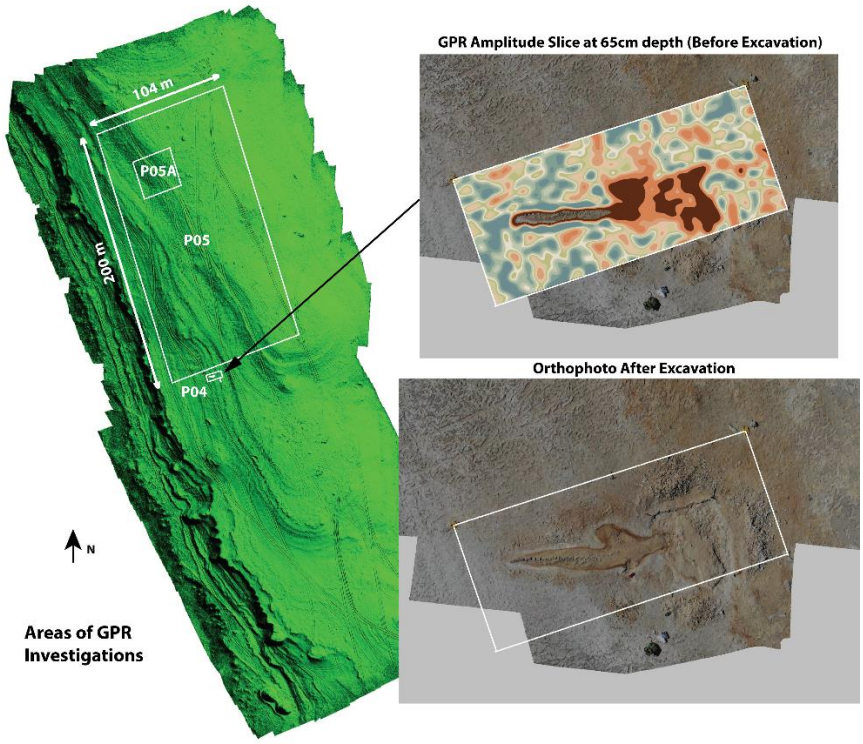

Description: The green image on the left shows the areas of ground penetrating radar investigation conducted by Ghezzi et al. The top right panel shows a slice through processed ground penetration radar data at a depth of 65 centimeters, overlaid atop an orthophoto. This image shows an almost completely buried fossilized whale. Brown regions correspond to strong amplitude reflections. The bottom right image shows the whale skeleton after excavation. Credit: Courtesy of Annalisa Ghezzi