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World's oldest ocean crust dates back to ancient supercontinent

The oldest known bit of oceanic crust is sitting at the bottom of the Mediterranean
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By **Emily Benson**

The oldest patch of undisturbed oceanic crust on Earth may lie deep beneath the eastern Mediterranean Sea – and at about 340 million years old, it beats the previous record by more than 100 million years.

Earth's outermost shell can be billions of years old on land, but most oceanic crusts are younger than 200 million years. Understanding where they developed can help us figure out what Earth looked like as continents formed, broke apart, and shifted around the globe hundreds of millions of years ago.

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Earth's crust is well-studied, but there are geologically complex places where scientists don't agree on its nature – whether it's oceanic or continental, and its age – says Roi Granot at Ben-Gurion University of the Negev in Israel.

"The Mediterranean Sea is one of them," he says. "And now it seems that we know what it is."

Hidden stripes

Oceanic crust is formed when hot magma wells up at mid-ocean ridges, then slowly spreads out towards the edges of the ocean. When it collides with continents, it slides under the land, and its components are recycled within Earth's mantle, ready to rise again as new magma. That conveyor belt-like movement is why oceanic crust tends to be relatively young compared with continental crust.

When molten magma cools, magnetic minerals within it align themselves with Earth's geomagnetic field. Because the planet's north and south magnetic poles flip at irregular intervals, a distinctive, striped pattern in mineral orientation forms over millions of years.

Granot towed magnetic sensors behind a boat on four different cruises, criss-crossing the area between Turkey and Egypt. The magnetic signals revealed stripes indicating a previously unknown mid-ocean ridge.

“Here I am in the middle of the eastern Mediterranean and I see this beautiful feature that crosses the entire sea, from north to south,” Granot says. “That feature can only be created by oceanic crust.”

Granot estimated the age of the oceanic crust by comparing its magnetic signals with predictions based on the northward drift of the African continental plate over the past 400 million years. Because he knew where plate tectonics shifted Africa – and when – he could calculate the expected magnetic signals of the nearby oceanic crust over time. The best match between Granot’s observations and the model estimates suggest the oceanic crust formed about 340 million years ago.

Supercontinental structure

“This is a nice suggestion that certainly will promote more debate,” says Uri ten Brink at the US Geological Survey in Woods Hole, Massachusetts. “But it is by no means something that one can totally hang their hat on.”

The thick blanket of sediment that covers the crust in the eastern Mediterranean makes it difficult to interpret magnetic signals, ten Brink says. And the basin itself is so small that it’s hard to identify multiple stripes of the minerals that signify oceanic crust.

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This isn’t the first time that scientists have found evidence for extremely old sections of oceanic crust in the Mediterranean, ten Brink adds, although the newest age estimate is the oldest yet.

“This crust is by far the oldest crust that still lies at the sea floor,” says Douwe van Hinsbergen at Utrecht University in the Netherlands.

The runner up, located east of Japan, is only about 190 million years old, van Hinsbergen says. And although older chunks of oceanic crust – some of which are billions of years old – have been partially preserved in mountain ranges, the chemical properties of those fragments are likely to have been changed in the process.

The eastern Mediterranean basin was thought to have been created when a newly forming ocean split the supercontinent Pangaea apart, less than 300 million years ago. But the revised, older age of the oceanic crusts suggests that Pangaea might have started breaking up even before it was finished forming, or that this section of crust existed before the supercontinent arose.

“A piece of pre-Pangaea ocean may be preserved here,” van Hinsbergen adds. Studying that bit of oceanic crust could help us understand the conditions that led to Pangaea’s formation.

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