New test adds to scientists' understanding of Earth's history, resources

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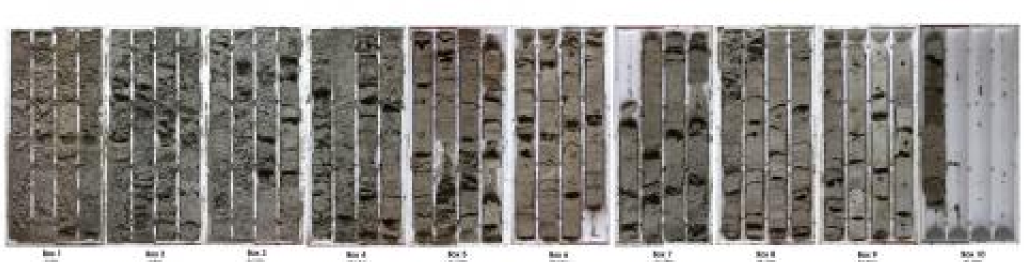
Shells and fragments found in sediments in the Po Plain, Italy, show the abundance and diversity of the area's fossils. In a study published online Nov. 29, 2012, in Geology, researchers dated mollusks extracted from the sediment to verify key predictions of the sequence stratigraphy model, a powerful tool for interpreting Earth's history and exploring for petroleum. Credit: Daniele Scarponi, University of Bologna

(Phys.org)—A new study co-authored by a University of Florida researcher provides the first direct chronological test of sequence stratigraphy, a powerful tool for exploring Earth's natural resources.

The model allows geologists to better understand how sedimentary rocks are related to one another in time and space and predict what types of rocks are located in different areas. The information may help scientists more reliably interpret various aspects of Earth's history such as long-term climate changes or extinction events, and also benefit companies searching for the best locations to drill for oil.

The study published online Friday in *Geology* uses extensive numerical dating of fossil shells to verify key predictions of the sequence stratigraphy model. Although used successfully for more than 30 years as a theoretical framework for interpreting and exploring rock bodies, the model had never been proven quantitatively by direct numerical dating.

"Paleontologists and geologists are well aware of the fact that you should not take the fossil record at face value because you will then see changes through time that may not be meaningful," said study co-author Michal Kowalewski, a curator of invertebrate paleontology at the Florida Museum of Natural History on the UF campus. "However, by using dating to quantify how the resolution changes through time, we can improve quality control on our data and develop better strategies for reconstructing the history of life more accurately."



This 125-foot core drilled in the Po Plain, Italy, was extracted from the subsurface and partitioned into 3-foot segments. The top of the first core segment, left, represents the present-day plain surface, and deeper depths are shown to the right. In a study published online Friday in Geology, researchers dated mollusk shells extracted from the sediment to conduct the first direct chronological test of sequence stratigraphy, a powerful tool for exploring Earth's natural resources. Credit: Daniele Scarponi, University of Bologna

In the study, researchers used racemization, a technique in which amino acid ratios are obtained to estimate the age of fossils from the most recent geological record. Relative age estimates were calibrated using radiocarbon to date about 250 mollusk shells extracted from cores drilled in the Po Plain in northern Italy. The technique, developed over the last 30 years, has made dating of large numbers of shells affordable and efficient, Kowalewski said.

Kowalewski is principal investigator on the National Science Foundation-funded project, a four-year study involving a team of scientists from the University of Bologna and Northern Arizona University.

"We were thrilled to learn that sedimentary rocks assemble through time exactly as predicted," said Kowalewski, who recently relocated from Virginia Tech and is the Jon L. and Beverly A. Thompson Chair of Invertebrate Paleontology at the Florida Museum. "The results are not only a direct validation of the sequence stratigraphic model, but also provide us with direct numerical estimates of changes in the resolution of the fossil record as a function of relative changes in sea level."

As the model predicted for the geological setting of the Po Plain, the sediments accumulated at an increasingly slower pace during initial phases of sea level rise, culminating with horizons that formed so slowly that shells from multiple millennia were mixed within the same sediment layers. Following the sea level rise, sediment was deposited at an increasingly faster pace.

"We are pretty confident that the primary driver of sea level changes in this time frame was climate, but that's not always the case in the geological record," Kowalewski said. 'We can now provide a more informed constraint on timing of the most recent sea level rise in the northern Adriatic."

Because the Po Plain contains young sediments dating to about the last 10,000 years, part of the cycle researchers tested includes changes occurring today, said Carlton Brett, a geology professor at the University of Cincinnati. As sea level rises quickly, sediment accumulates in bays and river mouths, leaving little sediment offshore, Brett said.

"I think what they're doing is groundbreaking in the sense that they're testing a model that is one of the most important models in sedimentary geology that has ever come down the pipe," Brett said. "As one who uses that model a lot and makes those assumptions about why we are getting shell beds offshore, the fact that they have put numbers on the tests gives us very good confidence that we're on the right track."

The team plans to continue working in the Po Plain, a well-understood system that records the most recent millennia of the region's geological history. The project can help researchers better understand human-induced changes because the Po Plain sediments document the fossil record of ecosystems that directly predate what many geologists refer to as the Anthropocene Epoch, the new geologic era of human modification of the natural world.

Provided by University of Florida