New approach helps expand study of living fossils

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Intertidal mounds in back reef at Highborne Cay, Bahamas. Credit: University of Miami Rosenstiel School of Marine & Atmospheric Science

The origin of life lies in unique ocean reefs, and scientists from the University of Miami's Rosenstiel School of Marine & Atmospheric Science have developed an approach to help investigate them better.

A new article published in the November issue of *Geology* reveals how Dr. Miriam Andres' stromatolite investigation – the first of its kind – has begun to "fingerprint" ancient microbial pathways, increasing the

understanding of how these reef-like structures form and offering a new way to explore the origins of these living records, which are considered to be the core of most living organisms.

Modern marine stromatolites are living examples of one of the earth's oldest and most persistent widespread ecosystems. Although rare today, these layered deposits of calcium carbonate are found in shallow marine seas throughout 3.4 billion-year-old geologic records. Ancient stromatolites represent a mineral record of carbonate chemistry and the evolution of early life.

In the *Geology* paper, Dr. Andres and colleagues point out that incorrect assumptions have been made in interpreting stromatolite data: phototrophs, or oxygen-producers, were actually dominated by heterotrophs, or oxygen-consumers, in their contribution to stromatolite formation.

"The motivation for this study is that in ancient stromatolites, direct evidence of microbial activity is lacking," Dr. Andres explained. "Stable isotopes have provided a powerful tool to 'fingerprint' microbial pathways and better understand the sedimentary structures we see in the geologic record. Surprisingly, no study to date has documented this process for modern marine stromatolites."

Stromatolites are the oldest known macrofossils, dating back over three billion years. Dominating the fossil record for 80 percent of our planet's history, stromatolites formed massive reefs in this planet's primitive oceans. While stromatolites look much like coral reefs, they are actually formed from living microorganisms, both animal and plant-like. These microorganisms trap and bind sand grains together and/or produce calcium carbonate to form laminated limestone mounds.

"We knew that the stromatolite ecosystem was dominated by

photosynthetic cyanobacteria, and expected to see this reflected in a positive carbon isotopic value. However, we saw the exact opposite." Andres said.

"We still don't understand how stromatolites calicify," Dr. Andres said, referring to her research plans. "This information will be key to understanding how organisms form skeletons and when this process – leaving lasting impressions of historical biological data – first began."

Source: University of Miami Rosenstiel School of Marine & Atmospheric Science