Microbes have adapted to live on food that is hundreds of years old

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Microbial communities living in deep aquatic sediments have adapted to survive on degraded organic matter, according to a study published in *Applied and Environmental Microbiology* and coauthored by professors at the University of Tennessee, Knoxville.

"There are microbes living in deep ocean sediments eating carbon, like proteins and carbohydrates, that is hundreds of years old," said Andrew Steen, lead author of the study and assistant professor of environmental geology at UT. "However, we don't know much about how those microbes eat that old, poor-quality food."

Understanding how these microorganisms function on low-quality foods at a very slow pace could have future uses in biomedical applications such as a technology that could slow down cell metabolism in human organs so they can survive longer during a transplant process.

"It could also aid in preserving underground microbes that play a role in carbon sequestration, a key process in the fight against climate change," said Steen.

To better understand how these microorganisms access this food, researchers tested different types of peptidases—digestive enzymes that work to degrade proteins—in sediment cores from the White Oak River estuary in North Carolina.

"These microbes live incredibly slow lives, with cells multiplying somewhere between every 10 years and every 10,000 years, but we aren't sure how," said Steen. "Our work shows that those microbes are living the same way any other microbe does, just way more slowly and with

some improved ability to eat the low-quality food in their environment."

The data collected by the researchers represented about 275 years of sediment deposition from the White Oak River estuary. Using DNA analysis of the microbes in these sediments, and by measuring peptidases, researchers evaluated how these microorganisms metabolize with little access to fresh organic matter.

Organic carbon buried in aquatic sediments is a long-term sink for atmospheric carbon dioxide, and about 40 percent of organic carbon burial occurs in estuaries and deltaic systems. Steen's study gives insight into how these subsurface microbial communities begin the process of degrading organic carbon in such environments.

"Our study shows that, in some sense, subsurface microbes are happy to be where they are—or at least they're well adapted to a terrible environment," said Steen.

More information: Andrew D. Steen et al, Kinetics and identities of extracellular peptidases in subsurface sediments of the White Oak River Estuary, NC, *Applied and Environmental Microbiology* (2019). DOI: 10.1128/AEM.00102-19

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