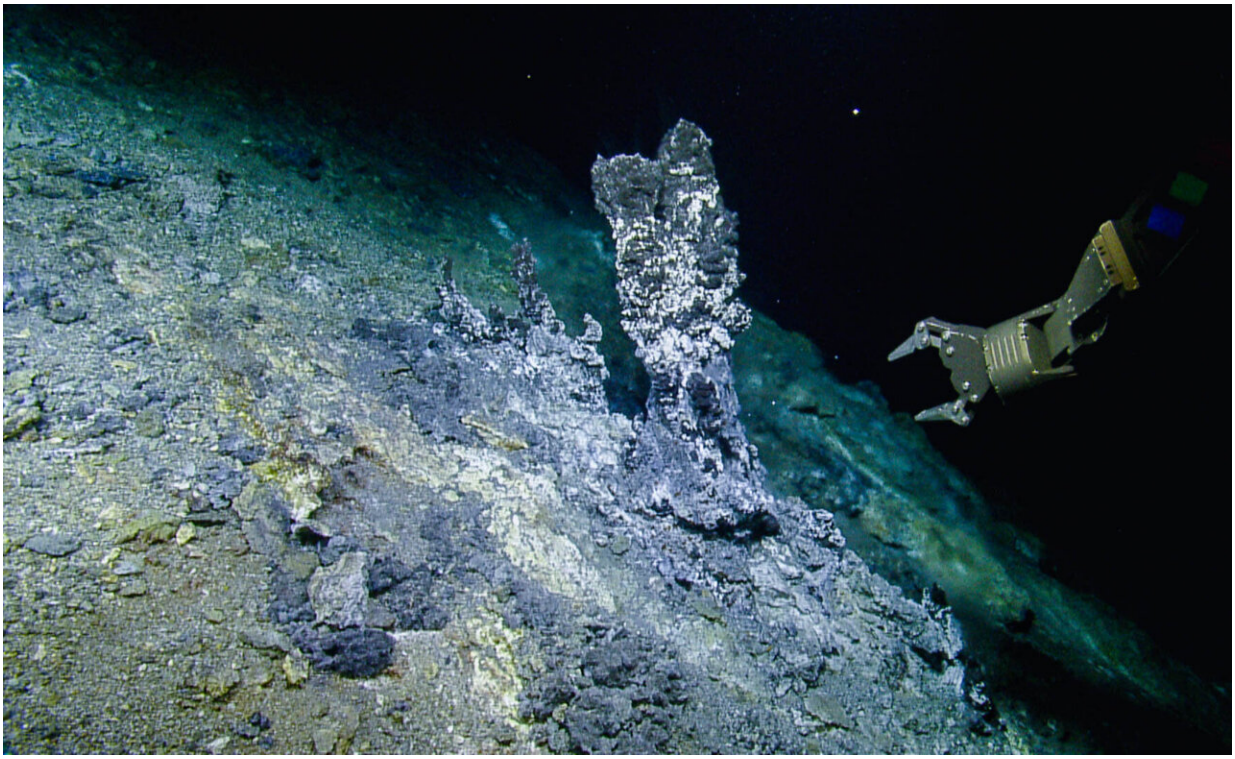
Study examines the role of deep-sea microbial predators at hydrothermal vents

July 16 2021



A view of the Apollo Vent Field at the northern Gorda Ridge, where samples were collected by the ROV Hercules for studying microbial predators. Credit: OET/Nautilus Live

The hydrothermal vent fluids from the Gorda Ridge spreading center in the northeast Pacific Ocean create a biological hub of activity in the deep sea. There, in the dark ocean, a unique food web thrives not on

photosynthesis but rather on chemical energy from the venting fluids. Among the creatures having a field day feasting at the Gorda Ridge vents is a diverse assortment of microbial eukaryotes, or protists, that graze on chemosynthetic bacteria and archaea.

This protistan grazing, which is a key mechanism for carbon transport and recycling in microbial food webs, exerts a higher predation pressure at hydrothermal vent sites than in the surrounding deep-sea environment, a new paper finds.

"Our findings provide a first estimate of protistan grazing pressure within hydrothermal vent food webs, highlighting the important role that diverse deep-sea protistan communities play in deep-sea carbon cycling," according to the paper, Protistan grazing impacts microbial communities and carbon cycling ad deep-sea hydrothermal vents published in the *Proceedings of the National Academy of Sciences* (*PNAS*).

Protists serve as a link between primary producers and higher trophic levels, and their grazing is a key mechanism for carbon transport and recycling in microbial food webs, the paper states.

The research found that protists consume 28-62% of the daily stock of bacteria and archaea biomass within discharging hydrothermal vent fluids from the Gorda Ridge, which is located about 200 kilometers off the coast of southern Oregon. In addition, researchers estimate that protistan grazing could account for consuming or transferring up to 22% or carbon that is fixed by the chemosynthetic population in the discharging vent fluids. Though the fate of all of that carbon is unclear, "protistan grazing will release a portion of the organic carbon into the microbial loop as a result of excretion, egestion, and sloppy feeding," and some of the carbon will be taken up by larger organisms that consume protistan cells, the paper states.

After collecting vent fluid samples from the Sea Cliff and Apollo hydrothermal vent fields in the Gorda Ridge, researchers conducted grazing experiments, which presented some technical challenges that needed to be overcome. For instance, "prepping a quality meal for these protists is very difficult," said lead author Sarah Hu, a postdoctoral investigator in the Marine Chemistry and Geochemistry Department at the Woods Hole Oceanographic Institution (WHOI).

"Being able to do this research at a deep-sea vent site was really exciting because the food web there is so fascinating, and it's powered by what's happening at this discharging vent fluid," said Hu, who was onboard the E/V Nautilus during the May-June 2019 cruise. "There is this whole microbial system and community that's operating there below the euphotic zone outside of the reach of sunlight. I was excited to expand what we know about the microbial communities at these vents."

Hu and co-author Julie Huber said that quantitative measurements are important to understand how food webs operate at pristine and undisturbed vent sites.

"The ocean provides us with a number of ecosystem services that many people are familiar with, such as seafood and carbon sinks. Yet, when we think about microbial ecosystem services, especially in the deep sea, we just don't have that much data about how those food webs work," said Huber, associate scientist in WHOI's Marine Chemistry and Geochemistry Department.

Obtaining baseline measurements "is increasingly important as these habitats are being looked at for deep-sea mining or carbon sequestration. How might that impact how much carbon is produced, exported, or recycled?" she said.

"We need to understand these habitats and the ecosystems they support,"

Huber said. "This research is connecting some new dots that we weren't able to connect before."

More information: Sarah K. Hu et al, Protistan grazing impacts microbial communities and carbon cycling at deep-sea hydrothermal vents, *Proceedings of the National Academy of Sciences* (2021). DOI: 10.1073/pnas.2102674118

Provided by Woods Hole Oceanographic Institution