Methane release at underwater mounds in the Barents Sea (76° N) and its impact on Arctic macro-benthic faunal communities

Emmelie Astrom[1], Arunima Sen[1], Michael L. Carroll[2], William G. Ambrose Jr[3], JoLynn Carroll[2]

[1]CAGE - Centre for Arctic Gas hydrate, Environment and Climate, Department of Geosciences, UiT - The Arctic University of Norway, Tromsø, Norway; emmelie.k.astrom@uit.no
[2]Akvaplan-niva, FRAM - High North Research Centre for Climate and the Environment, 9296 Tromsø, Norway
[3]Office of Polar Programs, National Science Foundation, Arlington, Virginia, USA

Arctic cold seeps are poorly investigated with respect to ecology and faunal community structure. Here, we present results from one of the few macrofaunal community studies in a high-Arctic cold seep system. Seafloor methane seepage has been localized in association to gas hydrate bearing mounds (~ 380 m water depth), on the western Barents Sea shelf (76° N), south of Svalbard. During the summers of 2015 and 2016, we used an underwater camera system (TOW-cam) and a remotely operated vehicle (ROV) for imaging and to collect benthic samples for macrofaunal community analysis and to study functional guilds and trophic interactions in fauna present around seep. Additionally, sediment and water measurements for environmental characteristics were analyzed. Samples were compared with control locations away from the active area of seepage. Soft sediments mixed with methane-derived carbonate reefs, patches of microbial mats and, dense aggregations of obligate chemosymbiotic siboglinid worms characterized the sea floor where methane emissions occurred. The density of siboglinids was on average 8000 ind. m-2 in areas of active seepage but occasionally densities over 30 000 ind. m-2 were recorded. In addition to the high densities of siboglinid worms, aggregations of heterotrophic species, (anemones), and commercially important fishes and crustaceans were seen associated with seep features such as microbial mats, carbonates as well as the worms themselves. The highly localized seepage drives strong macrofaunal community-level effects over small spatial scales (meters and centimeters) at these methane seeping mounds. Gas seepage creates a heterogeneous habitat resulting in chemosymbiotic organisms co-occurring with conventional fauna at the scale of the overall region.