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The role of substrate attributes as a driver for benthic epifaunal communities investigated applying OBIA techniques and image analysis on the Norskebanken cold seep site (Arctic Ocean)

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Cold seeps are hotspots of biodiversity and can deeply impact the local sediment geochemistry in marine environments (e.g., promoting the formation of authigenic carbonate crusts) throughout all the oceans. Natural gas seepage can lead to changes in sediment properties and nutrient cycling supporting unique benthic fauna living in or near the substrate, eventually promoting the establishment of chemosynthetic biological communities. In this study, a relatively shallow water area offshore northern Svalbard (located at roughly 150m of water depth), where evidence of gas seepage has been observed, is investigated using optical, high-resolution seafloor imagery, and OBIA (Object-Based Image Analysis) techniques. Visual data consists of two photomosaics assembled from frames extracted from videos acquired by means of a work-class Remotely Operated Vehicle (i.e. the ROV ÆGIR 6000), and processed by applying underwater Structure from Motion (SfM) photogrammetry technique. The study aims to detect, classify, and count each single specimen representing benthic epifaunal communities at the seafloor and describe changes in seafloor substrates (i.e. sediment grain size and morphometric attributes) across all the photo-referenced datasets. ArcMap software and direct ROV-based video analysis were used to annotate all visible epibenthic fauna (more than 20,000 individuals), identified to the lowest possible taxonomic level based on discernible external morphological characteristics. In a further step, OBIA techniques (using Trimble eCognition® software) were applied on seafloor geomorphological characteristics, to provide quantitative and repeatable classification of the substrate into four distinct classes. Finally, annotated benthic epifauna and seafloor substrate classes' data were combined to quantify patterns of community diversity, abundance, and structure in relation to seafloor morphometric parameters. Cluster analysis revealed substrate class similarities, as well as colonization preferences exhibited by the fauna, especially where methane-derived authigenic carbonates (MDAC) occur at the seafloor. All the fauna and substrate classification outcomes are reported in a catalogue which can be used as a bionomic guide for future studies. This work comprises data collected during the CAGE 20-7 cruise conducted in November 2020 as part of the Centre of Excellence for Arctic Gas Hydrate, Environment and Climate (CAGE) at UiT – The Arctic University of Norway and within the framework of the INTPART-AKMA "Advancing Knowledge on

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