



BIODIVERSE BORDERLANDS

MINERAL-RICH HABITATS OF SOUTHERN CALIFORNIA



#BiodiverseSCB

July 26, 2021 – August 6, 2021

San Diego, CA, USA

Chief Scientist: Lisa Levin

Co-Chief Scientist: Paul Jenson, Greg Rouse, Kira Mizel

Scripps Institution of

Oceanography,

UC San Diego;

US Geological Service (USGS)

Researchers from Scripps Institution of Oceanography and the United States Geological Survey (USGS) set out to conduct work in the Southern California Borderland (SCB). The rugged, steep topography and low-oxygen conditions of the SCB are suitable for precipitation and formation of Iron-Manganese (Fe-Mn) crusts and phosphorite marine mineral deposits, which were the primary target for research during the expedition. Phosphorite on the seafloor has the potential to be a source of phosphorus for agricultural fertilizer, and both Fe-Mn crusts and phosphorites are enriched in rare metals that are used in electronics, green energy, and other technologies. As nations prepare to develop and allow extractive practices of deep-sea minerals, baseline biological data and a better understanding of life in these regions are needed, to further assess life in such mineral-rich environments.

In addition to characterizing biodiversity in the SCB, the team also explored and sampled a historic DDT waste production barrel dumping site. The site is located off the coast of Los Angeles in the San Pedro Basin. The team collected samples around the barrels to begin to better understand how the DDT and DDT derivatives may be affecting the marine environment.

Specific goals of the expedition included sampling water, rocks, fauna, and sediments, recovery of colonization experiments, conducting biodiversity video transects, and

3D imaging. The exploration of biodiversity in the SCB should inform spatial planning by state and federal agencies and potentially reveal conservation and blue economy resource trade offs within deep waters. The study of the DDT dump sites may inform regional and federal decision-making regarding contaminant hazard and reveal whether there is a need for further deep-sea remediation.

Expedition Objectives



Generate baseline descriptions of mineral, animal and microbial community structure across mineral-rich ecosystems in the Southern California Borderland.



Explore and map areas not previously visited within the California Borderland region.



Establish mineral baselines in the sites where marine minerals are known or expected to occur.



Examine biopharmaceutical potential of the animal microbiomes.



A sponge and the rock substrate it's attached to is examined by the ROV Subastian. Taking whole rocks from the sea bed along with any sediment and organisms helps the science team study whether some organisms prefer certain substrates.



12

days at sea



13

ROV dives



350

ROV samples collected



5

CTD casts

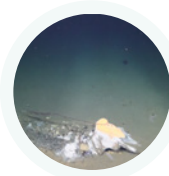
Over the 10 day expedition, 13 dives at 9 locations took place, collecting a total of 350 samples of water, rock, sediment, and fauna. Seventy video transects were recorded for biodiversity assessment and select flyovers were executed to collect 3D imagery. Samples of Fe-Mn crusts were collected at offshore sites and phosphorites were collected at more inshore sites, which will allow for the characterization of associated fauna and microbes. The rocks collected will be analyzed for mineral and biogeochemical composition by the USGS. Biological samples will be assessed by researchers at Scripps Institution of Oceanography for faunal and microbial biodiversity and microbes will be assayed for biopharmaceutical potential.

Additionally, some substrate colonization experiments that had been deployed in 2020 at San Juan Seamount and 40-mile Bank were recovered to determine if microbes and other organisms prefer to colonize different substrates when given the choice, and new experiments were deployed in the region.

Visits to DDT barrel dumpsites revealed a solid sedimentary feature surrounding some barrels (precipitated or lithified), with a microbial mat halo at the edge. Sponges were one of the few abundant animals in the nearly anoxic DDT barrel setting.



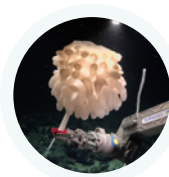
Discovery of a new, actively precipitating (non-bubbling) methane seep site at Lasuen Bank.



Discovery of a new small whale fall in San Pedro Basin.



Observation of high concentration of pyrosomes in the water column and in some cases the seafloor.



Observation of high diversity of sponges with evidence of strong tolerance to hypoxia.