

## Exploration of deep-seafloor communities along the Researcher Ridge seamounts

### Contact Information

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### Willing to Attend Workshop?

Yes

### Target Name(s)

Research Ridge including, but not limited to, the following named seamounts: Gramberg Seamount, Molodezhnaya Seamount, Keldysh Seamount, Brekhovskih Seamount, Vayda Seamount

### Geographic Area(s) of Interest within the North Atlantic Ocean (Indicate all that apply)

South West, South Central

### Relevant Subject Area(s) (Indicate all that apply)

Biology  
Geology  
Oceanography

### Description of Topic or Region Recommended for Exploration

#### Brief Overview of Feature

Researcher Ridge is the only high-profile seamount chain in the southern North Atlantic west of the Mid-Atlantic Ridge (MAR) (Fig. 1). The ridge consists of five named seamounts targeted as priorities for exploration along with many other lower profile features and knolls. Named features of Researcher Ridge are >3000m above surrounding seafloor and whose summits range in depth from 500m to 1200m water depth. The length of the ridge is approximately 180nmi from the westernmost (Gramberg Seamount) to easternmost feature (Vayda Seamount). Vayda seamount, is located approximately 75km due South of the Fifteen-Twenty Fracture Zone.

The potential for topographic diversity among these features is extremely high. These seamounts include cone-shaped peaks in addition to others that are composed of a more complex arrangement of ridge-crest topography along the entire breadth of Research Ridge. Brekhovskih Seamount, based on preliminary multibeam bathymetry, can be defined as a large guyot.

The existence of these seamounts is somewhat of a mystery as few published records on their formation exist. No records on the geologic age of this feature is available, however, there is an indication that these seamounts may have been formed by a tectonic hotspot (Epp & Smoot 1989) following a change in plate North and South American plate movement ~7Ma BP (Roest & Collette 1986). The location of these high-seas seamounts makes them an ideal target for geological, biological, and oceanographic exploration.

#### Brief Summary of Current State of Knowledge

This area was partially mapped in 2014 by the R/V Knorr resulting in a base map for the ridge at a sufficient resolution for dive planning purposes (Fig. 2). Nevertheless, many gaps exist, particularly over several seamount summits, that would benefit from additional

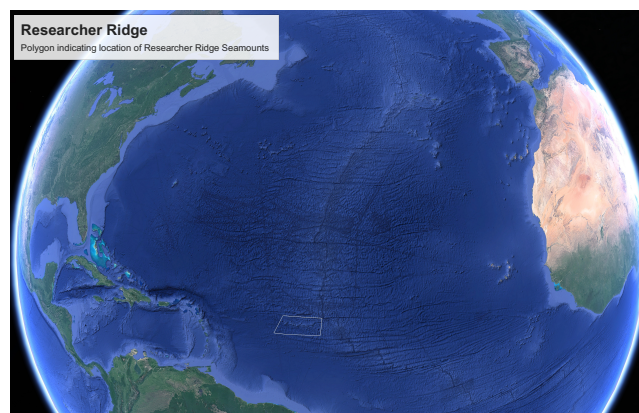


Figure 1: Map of the North Atlantic indicating the location of Researcher Ridge. Ridge center coordinates: 14.95° N, 49.36° W

mapping effort. The background on the geologic formation of these seamounts help to resolve changes to North and South American plate movement prior to 7 Ma BP (Pichot *et al.*, 2012 *Mar. Geo.*). There have been no remotely operated vehicle or human occupied vehicle surveys done on Researcher Ridge but DSV *Alvin* and the *Nautilo* have operated immediately east on the MAR axis examining and collecting vent-associated faunas from bathyal and abyssal depths (Calder & Vervoort 1998).

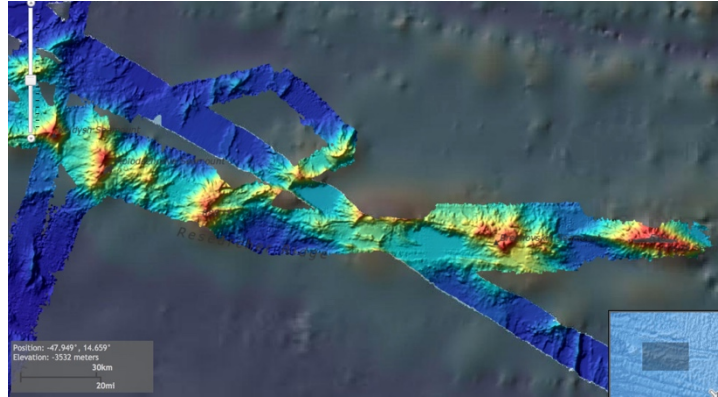


Figure 2: Existing multibeam bathymetry for seamounts of Researcher Ridge from a 2014 cruise on the R/V Knorr. Coverage is sparse from the central portion of the ridge and above several seamount summits.

### Rationale for Future Exploration

Benthic structure-forming taxa, including deep-sea corals and sponges, dominate the megafauna of seamounts and generate habitat for associated seafloor organisms. Biogeographically, the oceanographic setting of these seamounts allows us to look more closely at the communities of benthic organisms inhabiting Antarctic Intermediate Water (700-1200m) as it moves northward into the north Atlantic Basin, as well as species inhabiting the North Atlantic Deep Water (>1200m) as it exits to the south. Water mass boundaries have been observed to be oceanographic transition zones where species turnover occurs (Victorero *et al* 2018 *Sci. Rep.*) and local and regional biodiversity is enhanced.

A comparison could be made of deep-water benthic communities at this latitude to similar features in the north Atlantic (Corner Rise and New England Seamounts) to explore patterns of species diversity among deep-sea corals and sponges and examine environmental filtering associated with changes in water mass structure over latitude in the North Atlantic Basin. An interesting oceanographic feature of this area specifically is a zone of low oxygen coincident with Atlantic central and intermediate water masses (Fig. 3). More intense low oxygen zones in the east of RR may harbor distinct species assemblages capable of tolerating oxygen-limitation.

Additionally, the location and depth range of the Researcher Ridge seamounts sets up an opportunity to examine the species relationships and connectivity between MAR hard-bottom non-vent faunas and those of adjacent seamounts at bathyal depths. Clarifying these relationships are exceptionally timely as parts of the MAR directly east of the Researcher Ridge complex are being considered for seafloor massive sulfide (SMS) exploration. In this case, off-axis seamounts in the area may act as population refugia for hard-bottom non-vent species in the event of SMS mining impacts. Finally, as Researcher Ridge is located entirely outside national jurisdictions, it is a potential target destructive activities including mineral crust mining and bottom-contact fishing which can result in permanent biodiversity

loss and habitat destruction (Williams *et al.*, 2010 *Mar. Ecol.*; Van Dover *et al.*, 2017 *Nat. Geosci.*).

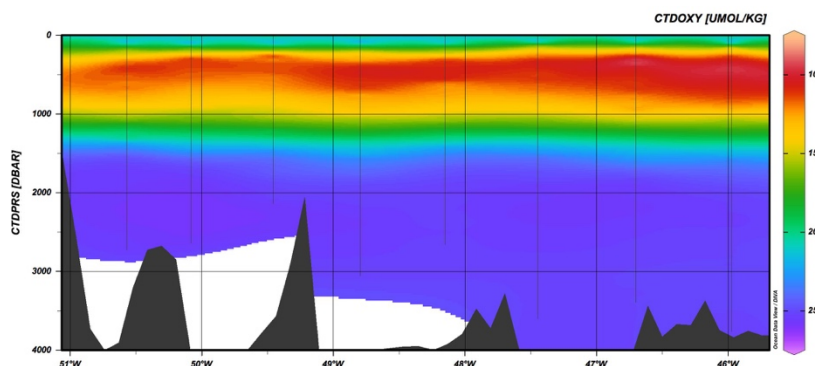


Figure 3: Longitudinal section of oxygen concentrations over 4000m depth along Researcher Ridge. The lowest oxygen concentrations of the water column are coincident with the summits of the Researcher Seamounts (500-1200m). Data obtained from CTD records via the CLIVAR & Carbon Hydrographic Data Office Database.