

## IODP Proposal Cover Sheet

☒ New☐ Revised☐ Addendum**677-Full**

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|                          |   |       |                      |
|--------------------------|---|-------|----------------------|
| Title:                   | Microbiology of a Sediment Pond and the Underlying Young, Cold, Hydrologically Active Ridge Flank   |       |                      |
| Proponent(s):            | Katrina Edwards, Wolfgang Bach, Geoff Wheat, Andreas Teske, Axel Schippers, Julie Huber, Steve D'hondt, Heiner Villinger, Tom McCollom, Virginia Edgcomb, Joan Bernhard, Olivier Rouxel |       |                      |
| Keywords:<br>(5 or less) | sub-surface ocean, deep biosphere, weathering   | Area: | North Atlantic Ocean |

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 Permission to post abstract on IODP-MI Sapporo Web site: ☒ Yes ☐ No

## Abstract: (400 words or less)

We propose a Drilling Leg aimed at elucidating the microbiological communities associated with (1) an isolated sediment pond located on a slow spreading ridge, and (2) the underlying basement community harbored within a young ridge flank with low heat flow. The location we propose is North Pond, at 22°N on the western flank of the Mid-Atlantic Ridge (MAR). This region has been previously drilled (DSDP Site 395) and Hole 395A was last logged during ODP Leg 174B. The sediment pond (~300 m maximum) overlies 7 Ma crust. We propose several cores to sample sediments, and one core into basement (500 m basement). We propose to CORK the basement Hole drilled here and re-CORK Hole 395A.

Three characteristics unique to North Pond make it ideal for our objectives: (1) the geochemistry, hydrology, and geologic setting of North Pond have been previously studied, providing the contextual information for the studies proposed herein; (2) access to young ridge flank crust and the establishment of subseafloor "observatories" will allow us to determine the nature of microbial communities in young ridge flanks, and the role, if any, they play in ocean crust weathering; and (3) the isolation of the sediment pond enables major outstanding questions about deep-seated sedimentary communities to be addressed – do the inoculum microbes derive from the sediments themselves as they are laid, or do deep communities propagate laterally within sediments from deeper sources following redox gradients?

Combined molecular microbiological, geochemical, mineralogical, isotopic, and microscopic methods will be used to study North Pond. Results of the drilling and CORK operations will provide new insights and long-term opportunities to study biogeochemical subseafloor processes in a section of young ridge flank that may be representative of globally "average" ridge flank processes.

## Scientific Objectives: (250 words or less)

NP-1: Our first priority is to drill the NW edge of North Pond (near Hole 1074A). This Site is in vicinity of hydrological discharge, and high local heat flow. Piston-core (PC) drilling of sediment will be followed by 500 m basement drilling (rotary core). Major objectives at NP-1 are paired microbiological/chemical studies of recovered sediment and basement and the installation of packers and basement microbiology "observatories" for long-term studies. Hole will be CORKed.

NP-3: Our second priority is to drill sediment (only; PC) at the SE edge of NP (near Hole 395A). This Site is in vicinity of hydrological recharge and low local heat flow. Major objectives at NP-3 are paired microbiological/chemical studies of recovered sediment, and returning to Hole 395A for installation of basement microbiology "observatories" with packers and re-CORKing.

NP-2/NP-4: Our third priority is to drill sediment (only; PC) at 1-2 deeper locale(s) at midpoint along the flow path between the two Sites we propose to drill above. Two Sites are selected, a primary (NP-2) and alternate (NP-4). NP-2 is directly in line with above drilling Sites; alternate is 2100 m SE of NP-2. Major objectives are paired microbiological/chemical studies on recovered sediment.

Please describe below any non-standard measurements technology needed to achieve the proposed scientific objectives.

At NP-1 and NP-3, line observatories, packers, and CORKing will be installed following methods used for IODP Leg 301.

## Proposed Sites:

| Site Name | Position              | Water Depth (m) | Penetration (m) |     |       | Brief Site-specific Objectives  |
|-----------|-----------------------|-----------------|-----------------|-----|-------|---|
|           |                       |                 | Sed             | Bsm | Total |   |
| NP-1      | 22°46.63'N 46°06.47'W | 4450            | 100             | 500 | 600   | Recover sediments and basement for chemical and biological analysis. Log, set triple packers, observatories, and CORK Hole. |
| NP-2      | 22°46.10'N 46°05.78'W | 4450            | 200             |     | 200   | Recover sediments for chemical and biological analysis.   |
| NP-3      | 22°45.57'N 46°05.13'W | 4450            | 120             |     | 120   | Recover sediment for chemical and biological analysis. Set triple packer, observatories, and reCORK Hole 395A.              |
| NP-4      | 22°46.23'N 46°06.76'W | 4450            | 220             |     | 220   | Recover sediments for chemical and biological analysis.   |