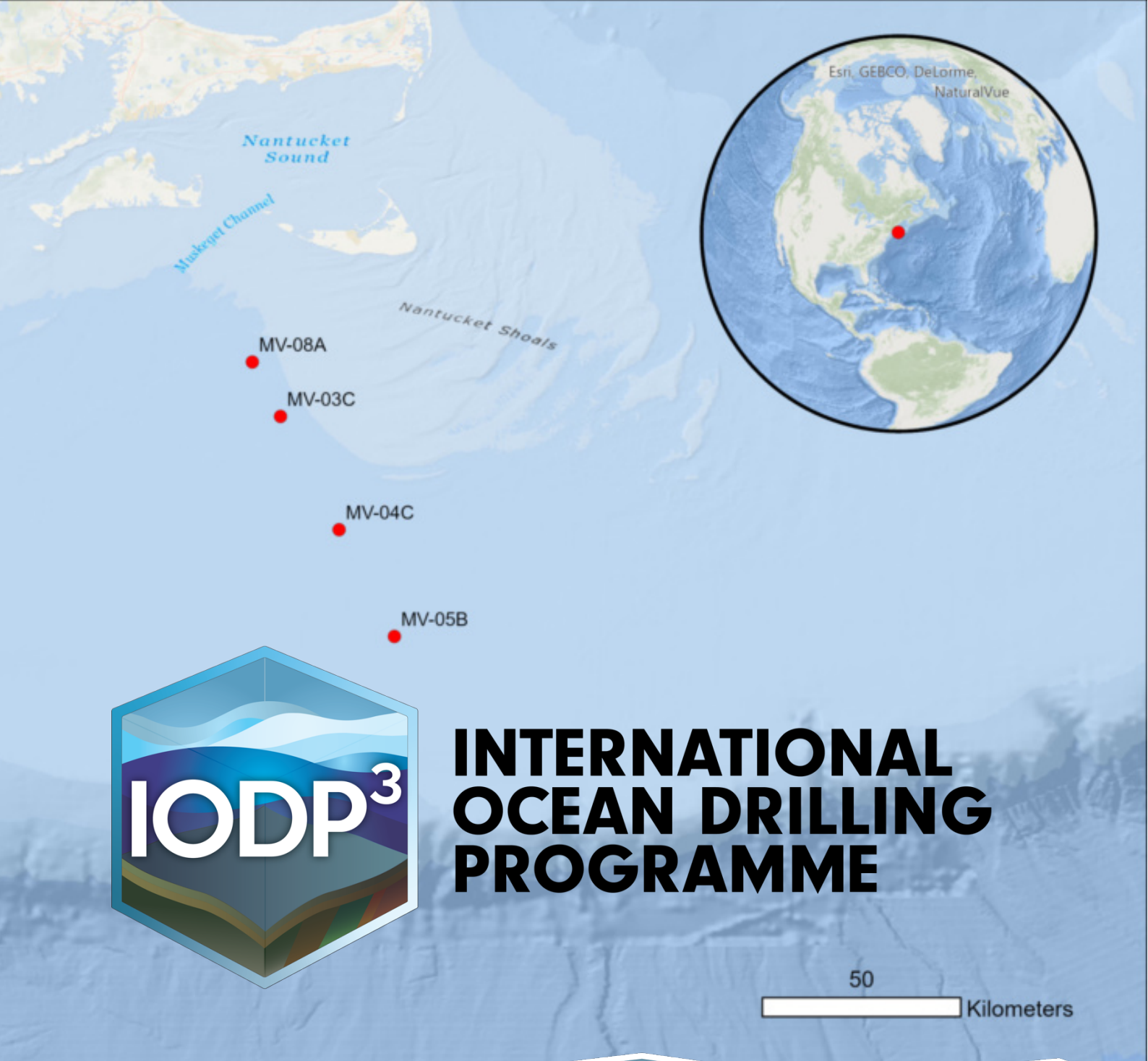


INTERNATIONAL OCEAN DRILLING PROGRAMME

CALL FOR PARTICIPATION

IODP^3/NSF Expedition 501: New England Shelf Hydrogeology

Deadline: 31 January 2025

19 December 2024

Call for Participation in IODP^3/NSF Expedition 501: **New England Shelf Hydrogeology**

Co-Chief Scientists: Brandon Dugan & Karen Johannesson
Expedition Project Manager: Jeremy Everest

Introduction

IODP^3 and the U.S. National Science Foundation (NSF) are collaborating in implementing Expedition 501: New England Shelf Hydrogeology. This call invites scientists in IODP^3 Core and Associate Member nations and the US to apply to join the Expedition Science Team. Successful scientists for IODP^3/NSF Expedition 501 will expand the current Expedition Science Team, which has largely been assembled through a previous Call for Scientists.

Opportunities exist for researchers in all specialties, but we are specifically seeking applications from scientists with expertise in aqueous geochemistry, hydrogeology, and physical properties. At a minimum, successful scientists will be granted access to expedition samples and data during the moratorium period, which starts during Offshore Operations (summer 2025), and ends 1-year after the conclusion of Onshore Operations (late 2026 or early 2027). Additionally, successful scientists can also be considered for participation in the Expedition's Offshore and/or Onshore Operations. Applicants should identify the level of participation they seek.

Research proposals attached to applications will be considered if they strengthen the research plans and anticipated science output of the current Expedition Science Team. Therefore, proposals that address new objectives or use novel techniques and/or analytical methods are especially encouraged. Interested scientists should review the **Expedition's background and objectives** below and are strongly advised to contact the Co-Chief Scientists with an outline of their proposed research before submitting a full application.

The Co-Chief Scientists for this Expedition are **Prof. Brandon Dugan** (Colorado School of Mines, USA) and **Prof. Karen Johannesson** (University of Massachusetts Boston, USA).

The proposal upon which this expedition is based was submitted as IODP Proposal #637 'New England Shelf Hydrogeology'. The proposal describing the primary drill sites, as well as up-to-date expedition information, can be found on the **Expedition 501 webpage**. You may also find it useful to consult **Gustafson *et al.* (2019)** and **Siegel *et al.* (2014)**.

Background and Objectives

In many coastal settings worldwide, the distribution of freshwater within continental shelf sediments is far out of equilibrium with modern sea level. One of the most remarkable examples is found on the Atlantic continental shelf off New England where groundwater within shallow Pliocene-Pleistocene sand aquifers over 100 km offshore has low salinity (3000 mg/l or less). On Nantucket Island, a 514 m deep borehole penetrating the entire Cretaceous-Tertiary sedimentary package shows considerable variations in salinity with extremely fresh (<1000 mg/l) water in sand aquifers, higher salinity (30-70% of seawater) in thick clay/silt layers, and intermediate-to-low salinity in thin confining units.

IODP Expeditions 313 and 317 also showed abrupt freshwater-saltwater boundaries linked to lithology. This demonstrates the disequilibrium nature of such systems; diffusion tends to eliminate such patterns. Pore fluid within Pleistocene to upper Cretaceous sands beneath Nantucket Island is also found to be modestly overpressured, ~4 m relative to the local water table.

We hypothesize that the rapid incursion of freshwater on the continental shelf in New England could have been caused by one or more of the following mechanisms:

1) meteoric recharge during Pleistocene sea-level lowstands including vertical infiltration of freshwater associated with local flow cells on the shelf;
2) sub-ice-sheet recharge during the last glacial maximum;
3) recharge from pro-glacial lakes.

We further hypothesize that the overpressures could be due to:

1) Pleistocene sediment loading;
2) fluid density differences associated with emplacement of a thick freshwater lens over saltwater (analogous to excess pressures in the gas legs of petroleum reservoirs).

We argue these different recharge mechanisms and overpressure models can be distinguished through drilling, coring, logging, and fluid sampling. Noble gas and environmental isotope data will be necessary to completely evaluate recharge models.

This work will extend our understanding of the current and past states of fluid composition, pressure, and temperature in continental shelf environments. It will help better constrain rates, directions, and mechanisms of groundwater flow and chemical fluxes in continental shelf systems. It will contribute to the development of new tools for measuring freshwater resources in marine environments. The apparent transient nature of continental shelf salinity patterns could have

important implications for microbial processes and long-term fluxes of carbon, nitrogen, and other nutrients to the ocean. Successful drilling will test process-based models for shelf freshwater off New England. These models can then be applied to other shelf freshwater systems around the world.

Timing

The offshore phase of the expedition is scheduled from 1 May to a latest end date of 14 August 2025, with a total of 105 days available for the drilling, coring, and downhole measurements. Offshore activities will focus on core recovery, curation, sampling for ephemeral properties, groundwater extraction, microbiology, biostratigraphy, physical properties, preliminary lithostratigraphy (whole core observed at core ends and through plastic liners), and downhole logging. The cores will not be split at sea.

Subsequently, an Onshore Operation will be held at the MARUM - Center for Marine Environmental Sciences, University of Bremen, Germany, in late 2025 or early 2026 (exact dates to be confirmed), where the cores will be split. The Onshore Operation will be a maximum of 4 weeks long, the exact length dependent on core recovery.

Expertise sought

Opportunities exist for researchers in all specialties. While other expertise may be considered, specialists in the following fields are required: downhole logging, geophysics, hydrogeology, inorganic geochemistry, microbiology, organic geochemistry, paleomagnetics, paleontology, palynology, physical properties, sedimentology, stratigraphic correlation, and structural geology.

How to Apply

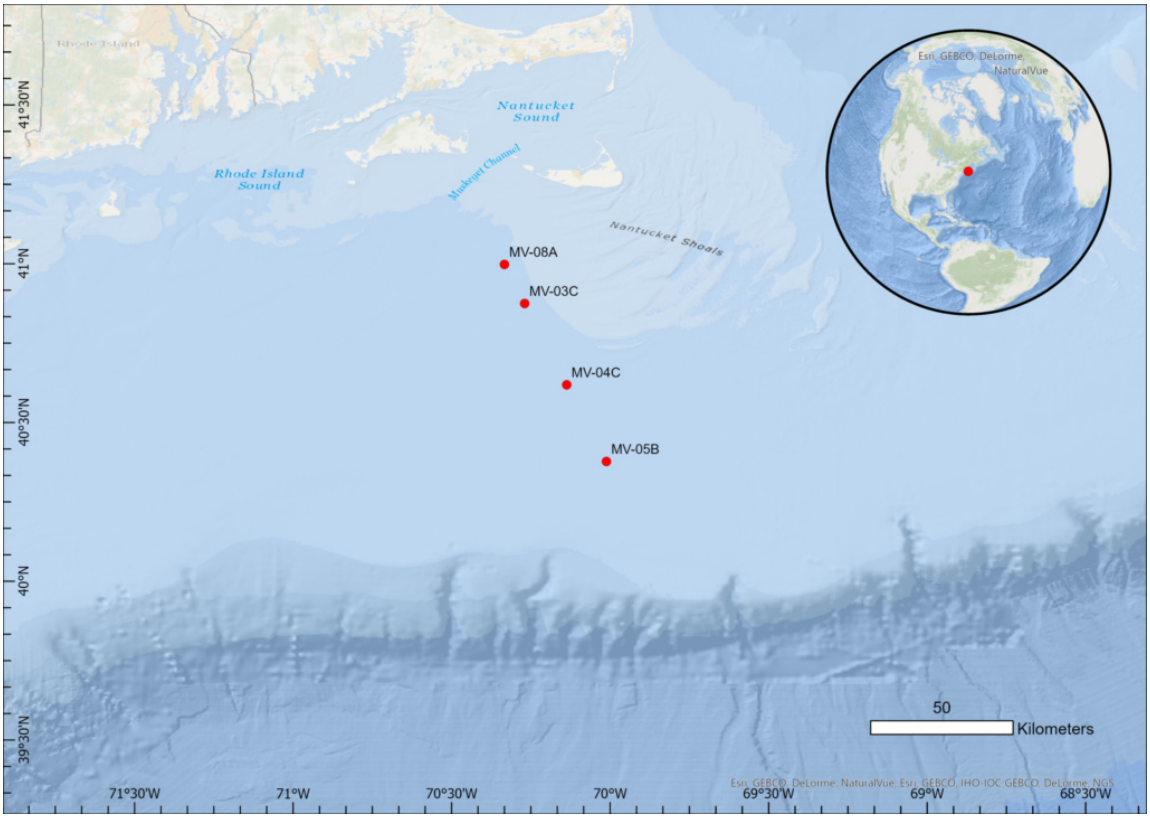
Applications must be submitted by the deadline of **Friday 31 January 2025.** Scientists from the U.S. should apply through the **U.S. Science Support Program**. Scientists from IODP^3 Core and Associate Member nations should use the **IODP^3 Gateway** system, accessed via the **Apply to Participate** link on the **IODP^3 website**.

At the time of release of this call, the IODP^3 Gateway is in the final stages of development and is not currently active – it will be ready in late December 2024 and its opening will be announced on the **IODP^3 website** homepage.

Information on the content required in applications to this call, however, is available in the IODP^3 **Guide for Applicants** (Note that the applicant roles for this call are **Offshore and Onshore**, **Onshore only**, and **Research plan** when applying through the IODP^3 Gateway system; see Section 3.1 in the guide).

Application materials may therefore be prepared before the opening of the Gateway using this guide, in readiness for submission once the system becomes active.

Applications received by the deadline will be evaluated by the appropriate Programme Member Offices and shortlisted candidates will be considered for selection by ESO and the Co-Chief Scientists in February 2025.



- For further expedition details from ESO, please contact:
  Jeremy Everest, Expedition Project Manager, **jdev@bgs.ac.uk**
- For further scientific details, please contact:
  Brandon Dugan, Expedition 501 Co-Chief Scientist, **dugan@mines.edu**
- For enquiries about the application process and IODP^3 Gateway, please contact:
  Jodie Fisher, IODP^3 Science Office, **applications@iodp3.org**