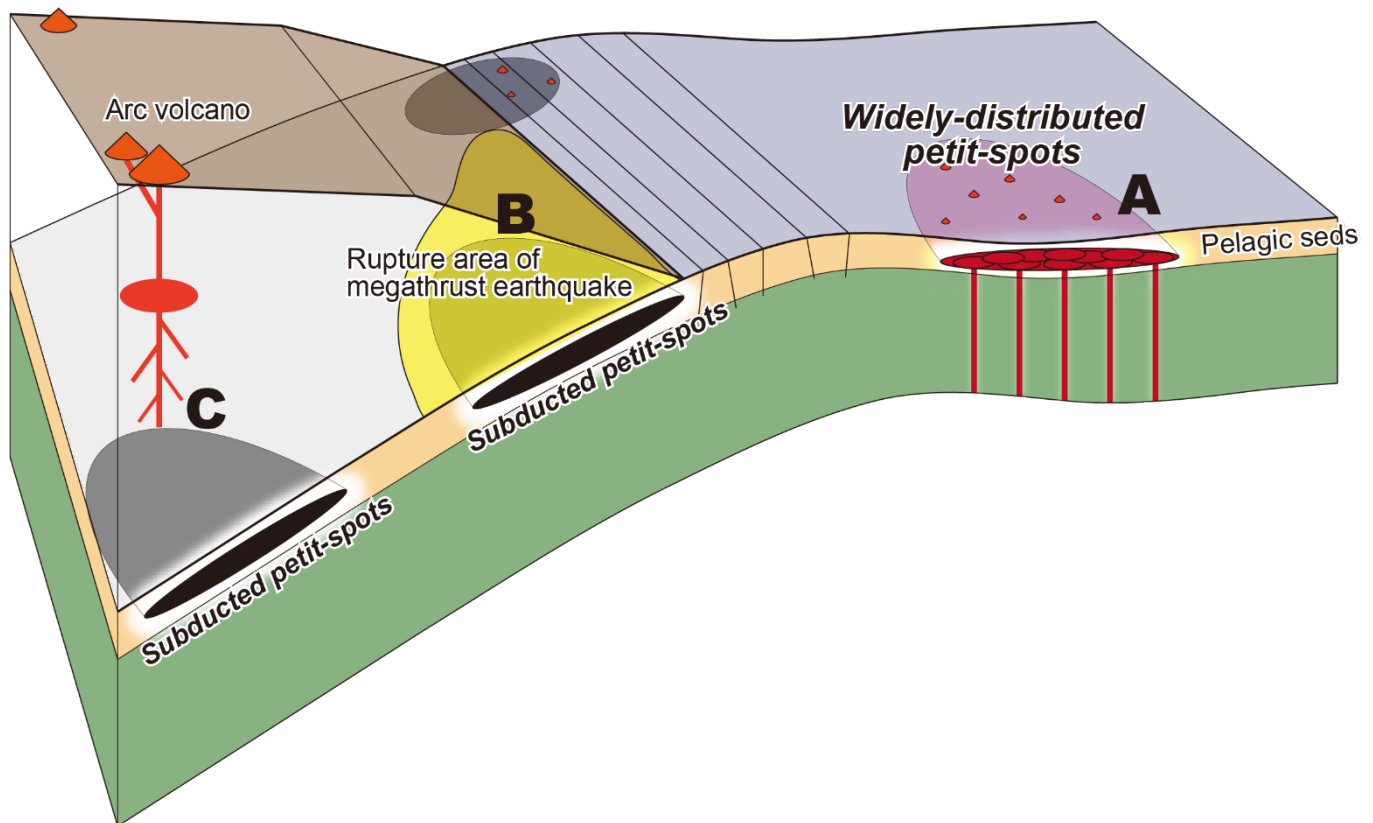




INTERNATIONAL OCEAN DRILLING PROGRAMME



SECOND CALL FOR PARTICIPATION

IODP³ Expedition 502:

Impact of Petit-Spot Magmatism on Subduction Zone
Seismicity and Global Geochemical Cycles

Deadline: 2 November 2026

Second Call for Participation in IODP³ Expedition 502: Impact of Petit-Spot Magmatism on Subduction Zone Seismicity and Global Geochemical Cycles



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Expedition Project Manager: Sean Toczko

Introduction

Petit-spots are a recently discovered volcanic system characterised by highly alkalic and CO₂-rich basalt generated by a low degree of partial melting of the asthenosphere. These deep mantle melts have been proposed to form and upwell due to the flexure of the oceanic Pacific Plate prior to subduction (Hirano et al., 2006; Yamamoto et al., 2014; Machida et al., 2015, 2017). IODP³ Expedition 502 aimed to explore the nature of the acoustic basement in the outer rise of the off-Tohoku Japan Trench and test the hypothesis that this acoustic basement is related to petit-spot magmatism (Yamaguchi et al., 2026). If this hypothesis is correct, petit-spot magmatism at the outer rise may be more widely distributed than previously thought. More extensive petit-spot volcanism could strongly impact our understanding of subduction systems, including rupture nucleation and slip propagation of plate boundary megathrust earthquakes.

Nature and extent of core materials recovered

IODP³ Expedition 502 successfully conducted logging and coring operations at Site C0027. Logging data were acquired while tripping the bit out of the drillhole from ~86 meters below sea floor (mbsf) to 23.5 mbsf, and cores were recovered from 0–106.5 mbsf. The boundary between the sediment layer and the acoustic basement is observed at ~60 mbsf, marked by a sharp increase in the electrical resistivity logs and a change in lithology. Recovered siliceous muds extend in age back to the late Pliocene. Core recovery in sediment units was nearly 100%, whereas core recovery from the underlying basaltic unit was limited, with an average of ~18%. The basement is composed mainly of fresh glassy and cryptocrystalline basalts. The basalt clearly differs from typical oceanic crust basalts of the Pacific plate in chemical composition, degree of alteration, and physical properties. Although no significant thermal alteration, decomposition, or deformation associated with the petit-spot magmatism was observed in the sediment, changes in sediment colour and pore fluid geochemistry in an interval of ~9 m above the sediment-basement boundary suggest that some fluid-rock reactions occurred between sediments and petit-spot basalt.

Analyses already being conducted by the Science Team

The Expedition 502 Science Team has planned to conduct broad and multidisciplinary analytical approaches using the collected cores and logging/drilling data:

- Petrological/geochemical analysis: petrographic analysis and halogen distributions (Cl, F, Br) using SEM/EDS/EPMA, X-ray mapping, high-resolution infrared imaging spectroscopy; whole rock major, trace, and trace element composition using XRF, ICP-MS, and Q-ICP-MS; Nd-Sm, Rb-Sr, Pb, Hf, B isotope analysis and stable isotope geochemistry (Zn, Ca, Mg, and K isotopes) using TIMS and MC-ICPMS; Combustion analysis for carbon and sulphur; H, He, O, C, and S isotope analysis; Fe²⁺ abundance using wet chemical titration; Highly siderophile (Ir, Ru, Pt, Pd, Re, Au, Rh) and chalcophile (S, Se, Te, Sn, Sb, Ge) element compositions using isotope dilution-ICP-MS; in-situ geochemical analyses of volatile elements (H₂O, CO₂, F, Cl, S, P) and H and S isotopes using SIMS; lithophile and volatile element analyses of phenocryst-hosted melt inclusions and quenched glass using laser-abrasion LA-ICP-MS, SIMS, and FTIR; Ba stable isotope ratios in water and sediments
- Sedimentological analysis: grain size analysis, microscopic observations, powder- and micro-XRD, powder- and micro-XRF.
- Geochronological analysis: tephrochronology, radiolarian biostratigraphy, paleomagnetic stratigraphy, basalt age determination (⁴⁰Ar/³⁹Ar dating, U-Pb dating, ⁸⁷Rb/⁸⁶Sr dating, Re-Os isochron dating)
- Paleontological studies: radiolarian and diatom biostratigraphy; calcareous nannofossil; TEX and alkenone paleothermometry, sterol biomarker analysis
- Paleomagnetic and rock magnetic analyses (NRM, AMS, ARM, IRM)
- Structural analysis: mesoscale and microscopic observations of microscale-pore structures and deformation features using SEM/EDS, synchrotron micro X-ray CT scanning, and NMR
- Geomechanical and petrophysical analyses: friction and deformation core testing, physical properties measurements (e.g., porosity, permeability, P- and S-wave velocities, thermal properties) at ambient pressure and elevated pressure and temperatures.
- Microbiological: microbial visualisation and DNA extraction
- Logging and drilling data analysis and core-log-seismic integration:
- Numerical modelling: geodynamics modelling of petit-spot magmatism and heat/fluid flow

Potential new approaches identified by the Science Team

To further understand the nature of petit-spot volcanism and associated hydrothermal alteration/reaction processes, potential new approaches that could further complement the original research portfolio and enhance the scientific value of Expedition 502 materials include,

but are not limited to:

- Non-destructive core analysis, including XRF core scanning
- Stratigraphic correlation of sediments with previous DSDP/ODP/IODP sites in the northwestern Pacific
- Geochemical/biological analysis of gas, interstitial water, sediment, and basalt.
- Experimental petrology (melting and quenching) with viscosity measurements
- Hydrological study of sediment and fractured basalt in relation to hydrothermal alteration

Please note that only a limited quantity of basalt samples remains available in the working halves. Consequently, proposals requiring large amounts of basalt may not be accommodated.

Applications are welcomed from scientists proposing to either: (a) adopt these or any other approaches to address the original objectives of the expedition without duplicating the plans of the original Science Team; or (b) use core samples recovered during the expedition to address new objectives and deliver new science not envisaged by the original expedition proposal.

How to Apply

Applications from scientists based in **IODP³ Core and Associate Member nations** must be submitted to the IODP³ Science Office by the deadline of **23:59 GMT on Monday 2 November 2026** using the **IODP³ Gateway** system, accessed via “Apply to Participate” on the **IODP³ website**.

Information on the content required in applications to this call is available in the IODP³ **Guide for Applicants** (Note that the applicant role for this call is **Sample Request**; see Section 4.1 in the guide)

Applications received by the deadline will be evaluated by the IODP³ Programme Member Offices and shortlisted candidates will be considered for selection by MarE3 and the Co-Chief Scientists.

- For further expedition details from MarE3, please contact:
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- For further scientific details, please contact:
Asuka Yamaguchi, Expedition 502 Co-Chief Scientist, asuka@aori.u-tokyo.ac.jp
Hiroko Kitajima, Expedition 502 Co-Chief Scientist, kitaji@tamu.edu
- For enquiries about the application process and IODP³ Gateway, please contact:
Jodie Fisher, IODP³ Science Office, applications@iodp3.org