Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37871

Spatial patterns of methane-derived lipid biomarkers across the Hikurangi Subduction Zone, New Zealand

AROLA MORERAS MARTI[1], CHARLOTTE SLAYMARK[2], MATTHEW B STOTT[3], DAVID J BYRNE[4], ERY C. HUGHES[5], JULIANN PANEHAL[6], DEBORAH BASTONI[7], MICHAEL W. BROADLEY[8], CYNTHIA A. WERNER[9], MURRY CAVE[10], GERDHARD JESSEN[11], DONATO GIOVANNELLI[12], KAREN G. LLOYD[13] AND PETER H BARRY[14]

[1]Auckland University of Technology
[2]University of Glasgow
[3]University of Canterbury
[4]New Zealand Institute of Earth Sciences
[5]UCL
[6]USC
[7]University of Naples Federico II
[8]University of Manchester
[9]Research Geologist (contractor)
[10]Gisborne District Council
[11]Austral University of Chile
[12]CNR-IRBIM, National Research Council
[13]University of Southern California
[14]Woods Hole Oceanographic Institution

The Hikurangi Subduction Zone (HSZ) extends along the east coast of New Zealand's North Island, where the Pacific Plate subducts westward beneath the Australian Plate[1–3]. The Hikurangi Forearc (HF) is composed of turbidites, hemipelagic sediments, and greywacke basement[4], whereas back-arc extension linked to subduction drives volcanism at the Taupō Volcanic Zone (TVZ)[5]. Fluids are discharged along the shallow HF margin through surface thermal springs and mud volcanoes, whereas hydrothermal spring features are widespread across the TVZ[6]. These surface expressions represent conduits transporting fluid and gas reservoirs from the deep subsurface, which create unique and extremely localised physiochemical environments with strong redox gradients[7]. Such fluid transport processes provide a direct way to extract deep microbial communities fuelled by these deeply produced fluids and gases[8].

A key knowledge gap in geothermal and mud volcano systems is understanding how tectonically driven fluid flow controls the spatial distribution of lipid biomarkers signatures across forearc and volcanic arc settings[9]. In particular, the extent to which surface geochemical and lipid biomarker patterns reflect subsurface microbial processes remains unresolved. New Zealand provides a natural laboratory to address this question, as the close spatial coupling of subduction forearc and volcanic arc allows direct comparison of these systems.

Here, we will present the biogeochemical spatial distribution of organic lipid biomarkers across the TVZ and HF, with particular emphasis on methane cycling. We combine lipid biomarker assemblages, compound specific carbon isotopes (CSIA), with total organic carbon (TOC), total nitrogen (TN), and stable carbon isotope analyses of sediment.

1.Williams *et al.*, **Seismol. Res. Lett.** (2013). **2.** Henrys *et al.*, **Annu. Rev. Earth Planet. Sci.** (2025). **3.** Crutchley *et al.*, **Mar. Pet. Geol.** (2011). **4.** Bailleul *et al.*, **J. Sediment. Res.** (2007). **5.** Acocella *et al.*, **Tectonics** (2003). **6.** Epstein *et al.*, **Geochem. Geophys. Geosyst.** (2021). **7.** Tu *et al.*, **Biogeosciences** (2022). **8.** Giovannelli *et al.*, **Front. Microbiol.** (2022). **9.** Kumawat *et al.*, **Commun. Earth Environ.** (2025).