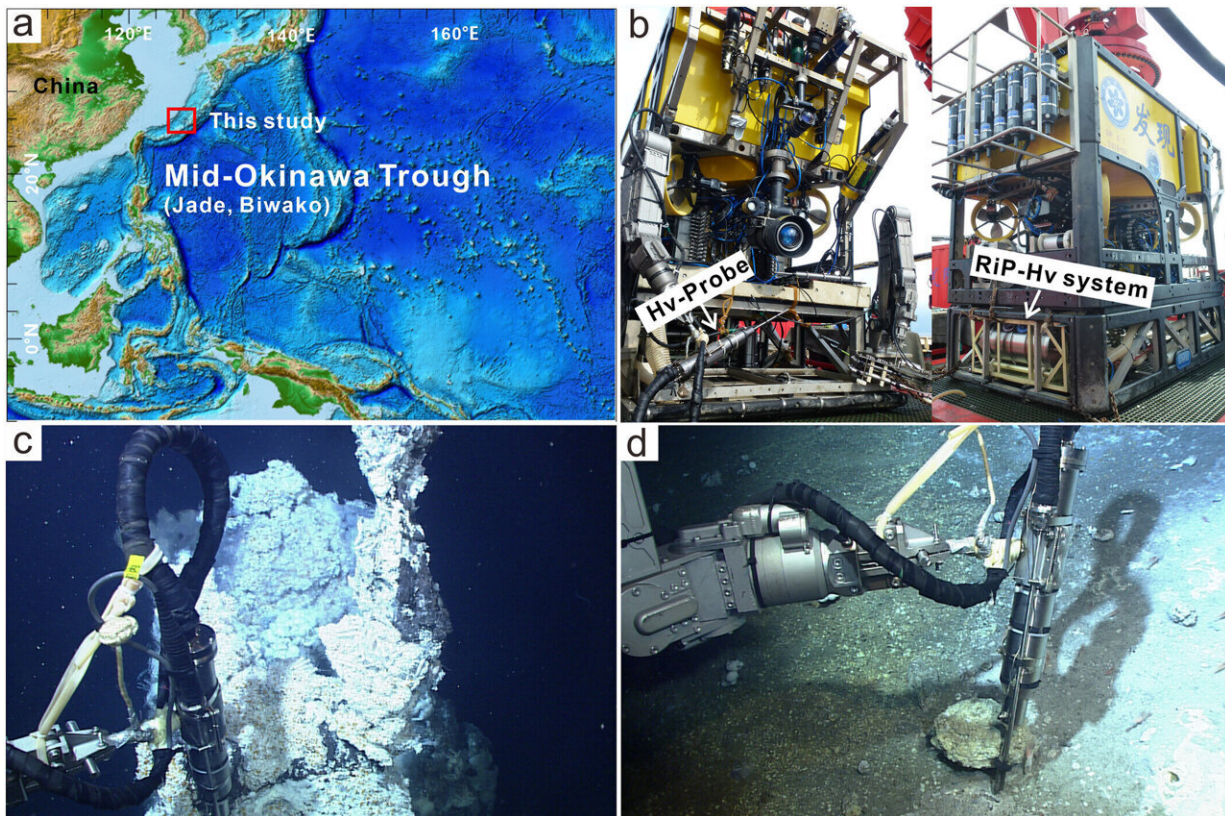


Novel in-situ pH measurement method for high-temperature hydrothermal systems

May 29 2023, by Li Yuan



Photographs of in situ Raman detection of hydrothermal fluids in the Okinawa Trough hydrothermal field. (a) Location of the Jade and Biwako sites in the mid-Okinawa Trough. (b) The high temperature resistant probe and in situ Raman spectrometer inside titanium pressure housing. The RiP-Hv was inserted into the Jade and Biwako hydrothermal vents to obtain Raman spectra respectively (c and d). Hydrothermal vent fluids for Jade and Biwako sites were collected using a gas-tight fluid sampler (e and f). Credit: *Geophysical Research Letters* (2023). DOI: 10.1029/2023GL103195

Alkaline hydrothermal systems are considered ideal environments for the origin of life because they can provide ideal ion gradient conditions for the formation of early life on Earth.

However, alkaline hydrothermal vents have only been found in the Lost City hydrothermal field in the Atlantic Ocean. Additionally, accurately obtaining the in-situ pH of high-temperature hydrothermal [vent](#) fluids is a challenge.

Recently, a research team led by Prof. Zhang Xin from the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS) and their collaborators from the University of Science and Technology Beijing constructed an in-situ pH measurement method for high-temperature [hydrothermal fluids](#) based on the self-developed Raman insertion Probe (RiP) system.

They applied it to the measurement of arc-back arc (ABA) hydrothermal systems and revealed that the in-situ pH of high-temperature fluids in the sediment-host hydrothermal systems is alkaline. The study was published in *Geophysical Research Letters* on May 10.

The researchers used a deep-sea extreme environment simulation platform to conduct [quantitative analysis](#) of the H_2S - HS^- ion equilibrium system. They established Raman quantitative analysis models for H_2S and HS^- under high-temperature and high-pressure conditions, as well as an in-situ pH calibration model for hydrothermal fluids.

They focused on a typical hydrothermal system in a back-arc setting and conducted in-situ detection using the ROV Faxian equipped with RiP. The observations revealed that the in-situ pH value of the high-temperature vent (6.3) exceeded the pH value of neutral fluids at the

same vent temperature and pressure (5.6), indicating weak alkalinity. The in-situ pH value was approximately 1.5 units higher than the measurements conducted at room temperature.

"This study confirmed that [alkaline hydrothermal vents](#) not only exist in hydrothermal areas like the Lost City, which are controlled by serpentinization reactions, but may also be widely distributed in hydrothermal areas near [continental margins](#) affected by significant sedimentation," said Li Lianfu, first author of the study.

More information: Lianfu Li et al, Direct H₂S, HS⁻ and pH Measurements of High-Temperature Hydrothermal Vent Fluids With In Situ Raman Spectroscopy, *Geophysical Research Letters* (2023). [DOI: 10.1029/2023GL103195](#)

Provided by Chinese Academy of Sciences

Citation: Novel in-situ pH measurement method for high-temperature hydrothermal systems (2023, May 29) retrieved 24 June 2024 from <https://phys.org/news/2023-05-in-situ-ph-method-high-temperature-hydrothermal.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--