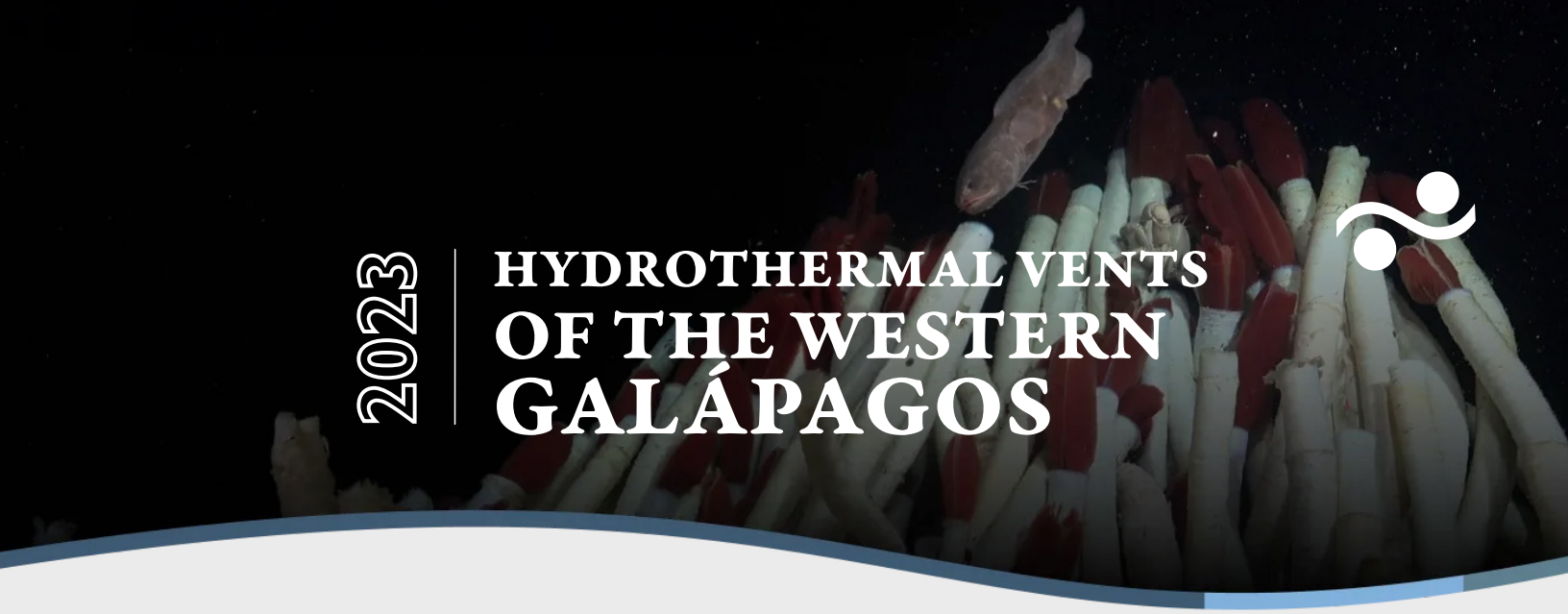

2023

HYDROTHERMAL VENTS OF THE WESTERN GALÁPAGOS

FKt230812 | GalápagosVents

- Galápagos Islands National Park, Ecuador
- 13 August - 10 September 2023
- Drs. Roxanne Beinart, University of Rhode Island and Jill McDermott, Lehigh University
- Ship Track

Fundación Charles Darwin Foundation GALAPAGOS

LAMONT-DOHERTY EARTH OBSERVATORY THE EARTH INSTITUTE AT COLUMBIA UNIVERSITY

Parque Nacional GALÁPAGOS Ecuador

VE RI TAS HARVARD

ARMADA DEL ECUADOR INSTITUTO OCEANOGRÁFICO Y ANTÁRTICO

USGS

THE UNIVERSITY of WISCONSIN MADISON

32 science days

32 terabytes of data collected

15 ROV dives

18,226 sq km mapped

6 CTD & rosette casts

457 ROV samples collected

Expedition objectives:

- Characterize vent fluid chemistry and assess the relationship between hotspot influence and vent fluid compositions at the Western Galápagos Spreading Center.
- Study animal and microbial communities at the Western Galápagos Spreading Center to understand how they relate to vent fluid composition and mineralogy while comparing them to nearby vent sites within this region and other regions in the tropical Eastern Pacific.
- Deploy a new fiber-optic distributed temperature sensor called a DTS to measure temperature changes that will deepen our understanding of seafloor hydrology and the role of temperature in animal distributions.

Hydrothermal vents have been located in all five ocean basins, yet they remain one of Earth's most mysterious and understudied ecosystems. The Western Galápagos Spreading Center, or WGSC, provides a natural laboratory for understanding geological, chemical, and biological interactions, which was the focus of this science team. The work revealed variations between nearby vents and across the Eastern Pacific.

Stunning chimneys and geologic structures formed by hydrothermal venting. Iguanas Vent Field, Galapagos Islands. The team explored four locations with hydrothermal vent activity, including Iguanas and Pingüinos, located within the Galápagos Marine Reserve. At the Navidad site, which a towed camera had previously detected, the ROV *SuBastian* dives were the first visits to the field by a deep-submergence vehicle. In the 2000s, scientists observed chemical signatures that indicated other vents were present in the region, but their existence and location had not been determined. On this expedition, the team successfully located vents and informally named the field Sendero del Cangrejo for the trail of crabs that drew their attention to the location.

The science team, led by Drs. Roxanne Beinart and Jill McDermott, explored with ROV *SuBastian* and an ROV-mounted sonar, conducted CTD and rosette casts, collected water samples for microbiology, successfully tested a new fiber-optic DTS device, and produced new high-resolution maps of the region. This expedition represents the most comprehensive sample collection taken at the Iguanas and Pingüinos vent sites and the first at the Navidad and Sendero del Cangrejo vent sites. Samples will help the scientists create a big-picture view of how life on hydrothermal vents functions across time and space, as they offer a comparison to the vents on the eastern portion of the Galápagos Spreading Center. Examining the differences between vents from the same region provides insight and data into their potential connectivity or lack thereof. This comparative data is valuable for ocean decision-makers in boosting protection and establishing regulation, especially as Ecuador, Panama, Columbia, and Costa Rica work together to establish the Eastern Tropical Pacific Marine Corridor, a marine protected area that would be managed jointly by these countries.

Resulting highlights include:

- The most comprehensive geological, chemical, and biological samples collected in the Western Galápagos Spreading Center for comparison to sites at the Eastern Galápagos Spreading Center.
- Demonstrated the successful use of the DTS device, which measured temperature every two minutes synoptically along the length of two fiber optic cables approximately 150 meters, providing a week's worth of time-series temperature data at a resolution of 0.01 degrees Celsius.

Permits to conduct research in Ecuador and Galapagos Islands National Park waters: INOCAR: 005-2023 / MAATE - DPNG/DGA-2023-0938-O / PC-51-23