METHANE IN HYDROTHERMAL PLUMES

ALONG THE EAST PACIFIC RISE, 28-32°S

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ABSTRACT

Samples were collected from hydrothermal plumes along the East Pacific Rise (EPR) from 28-32°S during the RAPANUI cruise (5 March - 12 April 1998). 45 vertical hydrocasts and tow-yos were conducted: 3 off-axis and 42 over the axes of two overlapping propagating ridges, the West and East Ridges. These ridges are subdivided into 8 non-transform offset segments, 6 of which were studied: W3, W4, E1, E2, E3, E4. Spreading rates ranging from 149 mm/yr, considered the world's fastest, to 0 mm/yr at the propagating tips produced a wide variety of hydrothermal environments. Methane concentrations were determined chromatographically while at sea; selected duplicate samples were stored for shore-based stable carbon isotopic analysis.

Methane concentrations on the West Ridge were nearly double that of the East Ridge. Plume maxima averaged 5.4 nM on segment W3 and 7.2 nM on segment W4. The four eastern segments, E1, E2, E3, and E4, averaged 3.2, 1.7, 3.9, and 3.7 nM, respectively. Background concentrations at the same depth as the plume maxima were less than 1 nM. The highest methane concentration measured was 50 nM in a buoyant plume on the West ridge. There was evidence for multiple plume maxima and for bottom plumes in several locations. Westwardly advecting hydrothermal methane persisted to nearly 480 km west of the EPR. Molar ratios of methane/manganese in plumes over segment W3 indicated methane did not covary with manganese, nor did methane covary with any other hydrothermal tracer such as nephelometry or heat anomaly on this segment. Methane/manganese ratios on the other segments ranged from 0.077 to 0.091. Methane $\delta^{13}C$ values for plume maxima ranged from –27 to –33‰ vs. PDB; background values at the same depths were around –40‰.

Anomalous methane/manganese molar ratios on segment W3 may be a result of the hydrothermal system's recovery from a phase separation event, possibly related to recent volcanics. The high spreading rates of this area imply geologically frequent magmatic heat injections, but the only evidence for this from the methane geochemistry is on segment W3.