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Carmichael, Sarah K., and Von Damm, Karen L., 2008, Constraining reactions between MOR vent fluids and new oceanic crust: the hydrothermal upflow zone beneath M vent, 9°50'N EPR. **Geochimica et Cosmochimica Acta**, vol. 72, no. 12, Supplement 1, p. A137. July 2008. Abstracts of the 18th Annual V.M. Goldschmidt Conference Vancouver, Canada July, 2008. Published by Elsevier. (ISSN: 0016-7037)

Constraining Reactions between MOR Vent Fluids and New Oceanic Crust: The Hydrothermal Upflow Zone beneath M Vent, 9°50'N EPR

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M vent, located at 9°50.7'N on the East Pacific Rise, is part of the Ridge 2000 (R2K) Integrated Study Site (ISS). It sits on the upper lip of the east wall of the ~20m deep axial summit collapse trough (ASCT) that marks the axis of spreading. The walls of the ASCT have been slowly receding as a result of mass wasting in the ~15 years since the 1991-2 eruption at this site. Hydrothermal vent fluids were collected from M vent from 1992-2004 [1], and in 2004 two samples of hydrothermal stockwork, or alteration pipe, were collected from ~17m below M vent. To date, these are the only samples recovered from beneath a vent where there has been an ongoing sampling program, and they record the last reactions that occurred between the hydrothermal fluids and the ocean crust. Sample 3987-2 contains anhydrite, kaolinite, chlorite, sepiolite, atacamite, and disseminated sulfides (pyrite, chalcopyrite, sphalerite, pyrrhotite) and sample 3993-2 is primarily altered basalt and glass (from the 1991 eruption) and also contains chlorite, calcite, pyrrhotite, pyrite, kaolinite, and zeolites.

Cathodoluminescence imaging has shown that the anhydrite in 3987-2 is chemically zoned, with crystal growth zones recording the temporal variability of trace elements in the fluid. Major element analysis of the volcanic glass in 3993-2 shows that Ca has been progressively leached out of the rock via fractures. Selvages around fractures show a 6-10 wt% loss of CaO from the margins to the interior, while molal Ca in vent fluids increased from 1.2×10^{-2} to 4.2×10^{-2} during 1992-2004, indicating that at least some of the Ca in the fluid was due to alteration of volcanic glass in the stockwork.

[1] Von Damm, K.L. (2004) AGU Monograph 148, 285-304.