

## Hydrothermal contributions to oceanic anoxic event 2? Evidence from trace metals

X.N. LI<sup>1\*</sup>, S. SEVERMANN<sup>1</sup>, J. OWENS<sup>2</sup> AND B.B. SAGEMAN<sup>3</sup>,

<sup>1</sup>Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ, 08901, USA

(\*correspondence: xiaonali@marine.rutgers.edu, silke@marine.rutgers.edu)

<sup>2</sup>Dept of Earth Sciences, University of California–Riverside, Riverside, CA 92521 (jeremy.owens@ucr.edu)

<sup>3</sup>Earth and Planetary Sciences, Northwestern University, Evanston, IL, 60208 (brad@earth.northwestern.edu)

Different mechanisms have been put forward to explain the observed increase in organic carbon burial during the Cretaceous ocean anoxic event 2 (Cenomanian-Turonian). Increased hydrothermal activity associated with large scale submarine magmatic events has been proposed to play an important role to deplete the deep water oxygen and supply trace metals such as Fe to the surface water to enhance primary productivity [1]. We will test this idea by examining several sites throughout the Western Interior Seaway (WIS). Here a gradient in trace metal enrichments has previously been ascribed to a hydrothermal source that likely originated from the Caribbean Large Igneous Province [2]. In this study, we will present a detailed geochemical dataset (including Fe redox proxies, trace metal and Rare Earth Element concentrations) from sediments deposited during the C/T transition in the WIS and the Proto North Atlantic Ocean to constrain potential hydrothermal contributions. Further, we will compare the trace metal abundances with Fe isotope compositions to test the suitability of this novel isotope system as a *direct* tracer for hydrothermally derived Fe.

[1] Kerr (1998) *Journal of the Geological Society* **155**, 619–626. [2] Orth *et al.* (1993) *Earth Planetary Science Letter* **117**, 189–204.

## Isotopic signatures in Cedar Butte lavas: An indication of thermal diffusion?

X-X. LI<sup>1</sup>, C.C. LUNDSTROM<sup>1</sup>, Z-F ZHANG<sup>1</sup>, M. MCCURRY<sup>2</sup> AND C. HOLMDEN<sup>3</sup>

<sup>1</sup>Dept. of Geology, Univ. of Illinois Urbana Champaign, Urbana, IL 61801 (li58@uiuc.edu)

<sup>2</sup>Dept. of Geology, Idaho State Univ. Twin Falls ID 83303

<sup>3</sup>Dept. of Geology, SIL, Saskatchewan, Canada

Cedar Butte, a volcanic complex which lies in the volcanically active Snake River Plain (SRP), erupted a compositional progression of lavas from initial high silica rhyolite to final basaltic trachyandesite in the late Pleistocene (~0.4 Ma). The curved array on a MgO vs SiO<sub>2</sub> diagram is consistent with fractional crystallization from a tholeiitic basaltic parent, ruling out a primary role for mixing in producing this compositional sequence (McCurry *et al.*, 2008).

To gain insight into how magma differentiation from basalt to rhyolite might occur, we analyzed Fe isotope ratios in a suite of Cedar Butte lavas (ranging from 56 wt% to 75 wt% SiO<sub>2</sub>) as well as a high silica rhyolite from nearby Big Southern Butte by high resolution MC-ICPMS. Results show a progressive increase in δ<sup>56</sup>Fe with SiO<sub>2</sub> with the most silicic samples having δ<sup>56</sup>Fe of ~0.40 ‰. This upwardly curving progression of δ<sup>56</sup>Fe<sub>IRMM-17</sub> with increasing SiO<sub>2</sub> is opposite to the predicted sense of δ<sup>56</sup>Fe occurring during magnetite removal. Given that the predicted magnitude of fractionation of iron isotopes at inferred magmatic temperatures is also smaller than observed, this trend is unlikely to simply reflect fractional crystallization. An alternative mechanism for producing the compositional zoning and isotopic signature is a top down crystallization-reaction process involving a downward moving temperature gradient zone (Lundstrom, GCA, 2009). Such a process differentiates the magma by a moving thermal migration zone while thermal diffusion isotopic fractionation leads to heavy isotope enrichment at the cold end of the gradient (in the most silicic material). Ultimately, basaltic magmas may melt the compositionally zoned mush formed by this process, leading to eruption.

The hypothesis is testable through analyses of other isotopic systems. Double spike <sup>238</sup>U/<sup>235</sup>U analysis of 3 samples (two compositional endmembers) found no significant fractionation; however, significant fractionation was unlikely to be found. Calcium isotopic analysis of Cedar Butte samples is in progress and we will report these results. Finally, piston cylinder T gradient experiments are in progress to gain further constraint on whether this alternative differentiation process could form Cedar Butte lavas.