Constraints on lithospheric enrichment and crustal contamination in the central Rio Grande Rift (New Mexico, U.S.A.): Volatile and trace-element variability in basaltic melt inclusions

M.C. ROWE AND J. C. LASSITER

Department of Geological Sciences, University of Texas at Austin, Austin, TX 78712 (rowem@mail.utexas.edu)

Many basalts erupted during the early stages of rifting throughout the southwestern United States have a preferential enrichment in water-soluble elements relative to insoluble elements leading to high ratios of water-soluble to insoluble elements, e.g. Ba/Nb, K/Nb, and Sr/Nd. These high ratios are characteristic of "arc-like" or "subduction-related" basalts often found in volcanic arcs. Numerous studies have suggested that these basalts originate from melting of a mantle source that has undergone hydrous metasomatism as a result of shallow subduction of the Farallon Plate beneath western North America during the Laramide orogeny (80-40 Ma).

We have analyzed olivine- and orthopyroxene-hosed melt inclusions from Rio Grande Rift (New Mexico, U.S.A.) tholeiites and alkaline basalts for major-, trace-, and volatile-element concentrations in conjunction with whole rock geochemistry. If prior petrogenetic models requiring melting of hydrous metasomatized mantle are correct, then melt inclusions from lavas with an "arc-like" signature (e.g. elevated Ba/Nb or Sr/Nd) should be enriched in volatile species such as water and Cl.

In melt inclusions from Rio Grande Rift tholeiites and alkaline basalts Cl/K and Cl/Nb ratios broadly correlate with Ba/Nb and Sr/Nd. In melt inclusions with high Ba/Nb and Sr/Nd ratios (up to 32 and 31, respectively), Cl/Nb (~20-35) and Cl/K (0.04-0.08) ratios are also elevated. Similarly, tholeiitic basalts with lower Ba/Nb and Sr/Nd possess low Cl/Nb and Cl/K ratios (Cl/Nb 8-17; Cl/K 0.02-0.04), more consistent with ratios observed in fresh MORB (Cl/Nb 3-8; Cl/K 0.02-0.04). However, at a given Ba/Nb ratio, Cl/Nb ratios are generally low compared to melt inclusions from present day arc and backarc basalts from the Casacade range in western North America.

The observed correlation between Cl enrichment and "arc-like" trace element ratios is consistent with a model for generation of Rio Grande Rift basalts through melting of variabily metasomatized mantle. However, partial melting and assimilation of continental crust could potentially produce qualitatively similar trends. No overall systematic variation in Ba/Nb, Sr/Nd or Cl/K is evident relative to the host Mg#, although within an individual sample host phenocryst compositions are restricted. Future in situ water and Pb-isotope analyses of melt inclusions will further constrain the role of crustal contamination and mantle source enrichment in the generation of the Rio Grande Rift basalts.

Sulfate reduction across a salinity gradient in hypersaline coastal pans

ALAKENDRA N ROYCHOUDHURY[1] DONOVAN PORTER[1] AND DONALD COWAN[2]

[1]Department of Geological Sciences, University of Cape Town, Rondebosch, 7700 Cape Town, South Africa (alakendra.roychoudhury@uct.ac.za; dporter@geology.uct.ac.za)

[2]Department of Biotechnology, University of the Western Cape, Bellville, 7535 Cape Town, South Africa (dcowan@uwc.ac.za)

The impact of salinity on the metabolic activity of sulfate-reducing bacteria in five highly saline to hypersaline coastal pans was studied using a radioactive tracer ($^{35}SO_4^{2-}$) technique. We recorded sulfate reduction at the higher *in situ* porewater salinity (422) than previously reported. The depth-integrated sulphate reduction rates (integrated to 12 cm) varied from 6 to 241 mmol m^{-2} d^{-1} and were also among the highest ever reported rates. The reduction rates decreased down-core and, surprisingly, were highest in the winter season when the lowest sediment temperatures were encountered.

High salt concentrations did not inhibit sulfate reduction rates. Rather, higher rates were measured at pans with higher *in situ* salinities. In laboratory slurry incubation experiments, sediments from the saltpans were treated with increasing salt concentrations. Regression analysis suggested that the short term response of microbial consortia to up-shock was an increase in sulfate reduction activity up to salinities of 350 – 400 and 200 – 300, in hypersaline and highly saline pans, respectively. Beyond these salinities, the cells showed evidence of reduced activities.

Suprisingly, sulfate reduction rates also show an increase with increasing sulfate concentration of up to 600 mM. This is unusal, as for sulfate reduction, the highest reported half-saturation constant values in the literature lie below 10 mM. Does this suggest that there is a third sulfate transport mechanism that becomes active among sulfate reducers thriving in hypersaline environments?