Using Light Lithophile Elements to Evaluate Crustal Assimilation on Mars

V. S. Reynolds  
*University of Tennessee*

Jeffrey G. Ryan  
*University of South Florida, ryan@usf.edu*

W. F. McDonough  
*University of Maryland*

H. Y. McSween  
*University of Tennessee*

Follow this and additional works at: [https://scholarcommons.usf.edu/gly_facpub](https://scholarcommons.usf.edu/gly_facpub)

Part of the [Geochemistry Commons](https://scholarcommons.usf.edu/gly_facpub), [Geology Commons](https://scholarcommons.usf.edu/gly_facpub), and the [Geophysics and Seismology Commons](https://scholarcommons.usf.edu/gly_facpub)

Scholar Commons Citation  
Reynolds, V. S.; Ryan, Jeffrey G.; McDonough, W. F.; and McSween, H. Y., "Using Light Lithophile Elements to Evaluate Crustal Assimilation on Mars" (2005). Geology Faculty Publications. 20.  
[https://scholarcommons.usf.edu/gly_facpub/20](https://scholarcommons.usf.edu/gly_facpub/20)

This Article is brought to you for free and open access by the Geology at Scholar Commons. It has been accepted for inclusion in Geology Faculty Publications by an authorized administrator of Scholar Commons. For more information, please contact scholarcommons@usf.edu.
USING LIGHT LITHOPHILE ELEMENTS TO EVALUATE CRUSTAL ASSIMILATION ON MARS. V. S. Reynolds¹, J. G. Ryan², W. F. McDonough³, and H. Y. McSween, Jr.¹. ¹Department of Earth and Planetary Sciences, University of Tennessee, Knoxville, TN 37996-1410, USA. vsreynolds@hotmail.com ²Department of Geology, University of South Florida, Tampa, FL 33620, USA, ³Geochemistry Laboratory, Department of Geology, University of Maryland, College Park, MD 20742, USA

Introduction: Systematic variations in rare earth element partitioning, oxidation state, and Nd and Sr isotopic ratios suggest basaltic shergottites represent either various degrees of crustal assimilation or sample a heterogeneous mantle [1-5]. The apparently oxidized nature of the enriched (i.e. “crust-like”) component could indicate interaction with an ancient ocean or other long-lived water source on Mars. On Earth, low-temperature hydrothermal alteration of oceanic crust results in elevated concentrations of B and Li, and high δ²⁶Li and δ¹¹B while Be contents are unaffected [6, 7]. As altered crust is subducted, dewatering reactions transport fluid-mobile B and Li from the slab, but leave Be relatively unchanged. The different partitioning behaviors of these light lithophile elements provide a means to track the presence of altered oceanic crust or fluids derived from altered oceanic crust in the source regions of subduction-related lavas. Using a single detector inductively coupled plasma mass spectrometer (ICP-MS) at the University of Maryland, we analyzed whole-rock Li and Be concentrations in six Martian meteorites (Shergotty, Zagami, Los Angeles, EETA 79001, Dhofar 019, and Chassigny) to evaluate whether the “crust-like” component in the basaltic shergottites experienced low-temperature hydrothermal alteration.

Results: A positive correlation between Li and Be in most meteorites suggests these elements behave incompatibly and preserve igneous conditions. Dhofar 019 has an unusually high Li content, possibly due to terrestrial weathering. When compared to ε⁰⁹⁰Nd, Li and Be in Zagami, Shergotty, Los Angeles, and EETA 79001 display similar trends as ε⁰⁹⁰Nd vs. La/Yb, fO₂, and ⁸⁷Sr/⁸⁶Sr, suggesting the “crust-like” component is enriched in these elements. Li and Be values for Chassigny plot opposite the oxidized meteorites, apparently representing mantle Li and Be compositions. A strong correlation is not observed between Li or Be and δ¹⁸O [8], suggesting the “crust-like” component was not altered at low temperatures. Whole rock Li data contrast with in situ pyroxene data by [9, 10] who concluded lower Li and B contents in pyroxene rims vs. cores suggests Li and B were lost during magma degassing.