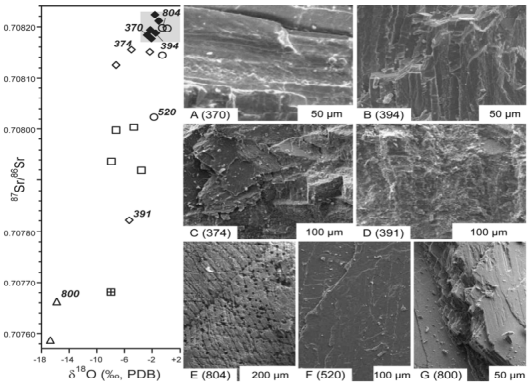
Hydrothermal diagenesis of Paleozoic seamount carbonates

U. BRAND[1], K. AZMY[2], J. TAZAWA[3], H. SANO[4] AND D. BUHL[5]

[1]Dept. Earth Sciences, Brock University, St. Catharines, ON L2S 3A1 Canada (uwe.brand@Brocku.ca)
[2]Dept. Earth Sciences, Memorial University, St. John's, NF A1B 3X5 Canada
[3]Department of Geology, Niigata University, Niigata 950-2181, Japan
[4]Department of Earth & Planetary Sciences, Kyushu University, Fukuoka 812-8581, Japan
[5]Institute für Geologie, Mineralogie und Geophysik, Ruhr-Universität, D-44801 Bochum, Germany

We present geochemical results of a new process of diagenesis that affected Paleozoic carbonate components (brachiopods- biogenic low-Mg calcite: bLMC, crinoids-biogenic high-Mg calcite: bHMC and whole rock-admixture of aragonite and/or calcite: wrAC) from Permo-Carboniferous seamounts of Japan situated in the tropical mid-Panthalassic Ocean. The diagenetic history of these carbonate allochems was determined by standard screening procedures and methods. The degree and trends of the diagenetic altered material were compared and reconciled with those of the established seawater Sr-isotope curve. The altered carbonate material from three of the four time slices support the novel concept of diagenesis in the presence of marine/hydrothermal fluids leading to less radiogenic Sr isotope values, which suggests that Sr-isotope diagenesis is much more complex and complicated than is espoused in the literature.



Consequently, the concept of less instead of more radiogenic Sr isotope values in diagenetic marine carbonates has profound implications for the voracity of the established seawater $^{87}Sr/^{86}Sr$ profile and curve, and marine carbonates need to be carefully evaluated in light of the findings.

The HSE budget in early mars and genesis of shergottites

A.D. BRANDON[1], I.S. PUCHTEL[2], J.M.D. DAY[2], R.J. WALKER[2]

[1]Dept. Earth & Atmos. Sci., Univ. Houston, Houston, TX 77204, USA (abrandon@uh.edu)
[2]Dept. of Geology, Univ. Maryland, College Park, MD, 20742 USA

Shergottites are a suite of broadly basaltic meteorites that were likely derived from martian mantle domains that formed and became isolated within the first 100 Ma of solar system history. We measured ^{187}Re-^{187}Os isotopes and highly siderophile element (HSE – Os, Ir, Ru, Pt, Pd, Re) concentrations in 23 shergottites in order to further characterize the shergottite source (s), and on a larger scale, to provide new insights to the processes that established HSE abundances in the mantles of the terrestrial planets.

Our new data are consistent with less comprehensive earlier studies. They show that initial $\gamma^{187}Os$ (% deviation from c-chondrites avg. at time of formation) generally correlates with radiogenic lithophile isotope ratios, such as initial $^{143}Nd/^{144}Nd$. For long-term melt depleted shergottites with $\varepsilon^{143}Nd$ of +37 to +40 and $\mu^{142}Nd$ of +60, $\gamma^{187}Os$ ranges from ~ -3 to +2. Lherzolitic shergottites with intermediate $\varepsilon^{143}Nd$ of ~ +7 have $\gamma^{187}Os$ from ~ 0 to +2. Shergottites from long-term enriched sources with $\varepsilon^{143}Nd$ of -7 to -8 and $\mu^{142}Nd$ of -20, are characterized by suprachondritic γOs values +5 to +15. Enriched shergottites RBT-04262, LAR-06319, and NWA-1068, with suprachondritic initial $\gamma^{187}Os$, have MgO contents from 15.8 to 21.6 wt.% and Re/Os_N (normalized to average chondrites) of 0.4 to 1.5. The depleted shergottites display a similar range of MgO but with higher Re/Os_N of 1.1 to 3.3. These characteristics are inconsistent with an increase of $\gamma^{187}Os$ in the enriched samples resulting from contamination with high Re/Os crust, as has previously been proposed to account for the enriched characteristics of these meteorites. Instead, the Os results, coupled with the other isotope systems, suggest that the compositional variations within the shergottite suite reflect their long-term mantle source characteristics. This favors a model for shergottite source generation via mixing between residual melts and cumulates formed in a magma ocean early in Martian history.

The HSE abundances for shergottites are broadly similar to terrestrial lavas with similar MgO contents and are, thus, most parsimoniously interpreted as being derived from mantle sources with similar HSE characteristics. If the HSE were supplied by late accretion, the late accretion for Mars must have occurred prior to differentiation of its magma ocean.