Surface charge and potential at carbonate mineral surfaces

M. WOLTHERS[1], P. VAN CAPPELLEN[1] AND L. CHARLET[2]

[1]Department of Earth Sciences – Geochemistry, Faculty of Geosciences, Utrecht University, PO Box 80.021, 3508 TA Utrecht, The Netherlands, (wolthers@geo.uu.nl; pvc@geo.uu.nl)

[2]Environmental Geochemistry Group, LGIT-OSUG, University of Grenoble, F-38041 Grenoble, Cedex 9, France, (laurent.charlet@obs.ujf-grenoble.fr)

The surface chemistry of divalent metal carbonate minerals has received ample attention. The macroscopic properties of carbonate mineral surfaces were initially studied using electrokinetic measurements and potentiometric titrations Since the 1990's, the application of sophisticated surface imaging and spectroscopic methods plus the development of molecular models for (hydrated) carbonate mineral surfaces have significantly advanced our comprehension of the microscopic structure and reactivity of carbonate–aqueous solution interfaces. Surface complexation models for carbonate mineral–solution interfaces reproduce the macro-scale surface charging behaviour taking into account surface coordination sited derived from spectroscopic information [1,2]. Charge Distribution MUltiSite Ion Complexation (CD–MUSIC, [3]) modelling allows one to also include micro- and nano-scale information such as the presence of crystallographically distinct surface coordination sites, structural information of surface complexes, and possibly surface morphology. The CD–MUSIC model for carbonate mineral surfaces will be presented and tested against independent surface titration and potential measurements.

References

[1] Van Cappellen P., Charlet L., Stumm W., Wersin P. (1993), *Geochim. Cosmochim. Acta* **57,** 3505–3518.

[2] Pokrovsky O.S. and Schott J. (2000), *Envir. Sci. Technol.* 36, 426-432.

[3] Hiemstra T. and Van Riemsdijk W.H. (1996), *J. Coll. Interf. Sci.* **179**, 488–508.

Barium isotope compositions of chondrites revisited

F. WOMBACHER AND H. BECKER

Institut für Geologische Wissenschaften, Freie Universität Berlin, Malteserstr. 74-100, 12249 Berlin, Germany (fwo@zedat.fu-berlin.de; hbecker@zedat.fu-berlin.de)

The decay of the short-lived nuclide ^{135}Cs to ^{135}Ba with a half-life of 2 Ma offers potential for the study of volatile loss. However, the application of Cs-Ba cosmochronometry is only feasible if sufficient live ^{135}Cs was present in the early solar system and if nucleosynthetic isotope anomalies are absent to allow for the unambiguous identification of radiogenic effects. The initial ^{135}Cs/^{133}Cs = 4.8 x 10^{-4} reported in [1] should result in well resolvable ^{135}Ba variations in chondrites. However, two studies reported nucleosynthetic Ba isotope anomalies [2, 3] in bulk chondrites. For example, Ranan and Jacobson [3] observed enrichments of ^{137}Ba/^{136}Ba and ^{138}Ba/^{136}Ba up to 25 and 60 ppm, respectively for carbonaceous and ordinary chondrites.

Here, we readdress the issue of nucleosynthetic and radiogenic Ba isotope anomalies in bulk chondrite samples. To this end, four chondrites (Murchison CM2, Allende CV3, Saint-Séverin LL6, Pillistfer EL6) and one terrestrial sample were analyzed using a ThermoFinnigan Triton thermal ionization mass spectrometer.

After normalization to ^{134}Ba/^{136}Ba, the ^{135}Ba/^{136}Ba isotope ratios for all samples agreed to within 20 ppm with the terrestrial Ba standard, and no radiogenic ^{135}Ba isotope anomaly was resolvable within uncertainty (2 se). Also, the ^{137}Ba/^{136}Ba and ^{138}Ba/^{136}Ba ratios deviated by no more than 17 ppm which is within the measurement uncertainty (13 to 37 ppm, 2 se) and were not resolvable, except for Pillistfer which differed from the Ba standard value by 47±22 ppm and 53±33 ppm (2 se) for ^{137}Ba/^{136}Ba and ^{138}Ba/^{136}Ba, respectively.

Our first results suggest that i) live ^{135}Cs was not abundant enough to provide a useful cosmochronometer in bulk chondrite samples and ii) nucleosynthetic anomalies in chondrite samples [2, 3] may be nonexistent and thus, the solar nebula was probably very homogeneous. In that regard, however, we need to further evaluate whether the ^{137}Ba/^{136}Ba and ^{138}Ba/^{136}Ba anomalies observed in Pillistfer are real.

References

[1] Hidaka H., Ohta Y., Yoneda S., and DeLaeter J. R. (2001) Isotopic search for live 135Cs in the early solar system and possibility of 135Cs-135Ba chronometer. *Earth Planet. Sci. Lett.* **193**, 459-466.

[2] Hidaka H., Ohta Y., and Yoneda S. (2003) Nucleosynthetic components in the early solar system inferred from Ba isotopic compositions in carbonaceous chondrites. *Earth Planet. Sci. Lett.* **214**, 455-466.

[3] Ranen M. C. and Jacobson S. B. (2006) Barium isotopes in chondritic meteorites: implications for planetary reservoir models. *Science* **314**, 809-812.