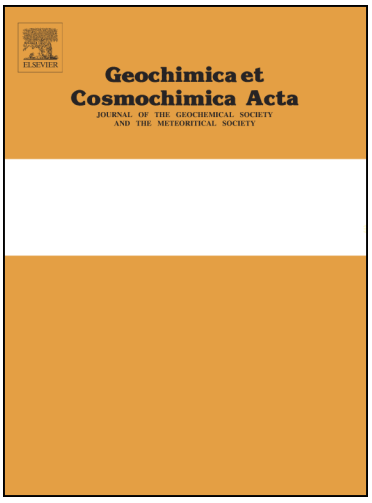

Hydrogen and oxygen stable isotope dynamics of hyper-saline and salt-saturated aqueous solutions

Erik J. Oerter, Michael Singleton, M. Lee Davisson

PII: S0016-7037(18)30385-5
DOI: https://doi.org/10.1016/j.gca.2018.07.009
Reference: GCA 10840

To appear in: *Geochimica et Cosmochimica Acta*

Received Date: 3 May 2018
Revised Date: 2 July 2018
Accepted Date: 4 July 2018

Please cite this article as: Oerter, E.J., Singleton, M., Lee Davisson, M., Hydrogen and oxygen stable isotope dynamics of hyper-saline and salt-saturated aqueous solutions, *Geochimica et Cosmochimica Acta* (2018), doi: https://doi.org/10.1016/j.gca.2018.07.009

Hydrogen and oxygen stable isotope dynamics of hyper-saline and salt-saturated aqueous solutions

Erik J. Oerter[1]*, Michael Singleton[1], M. Lee Davisson[1]

[1] Lawrence Livermore National Laboratory, 7000 East Avenue, Livermore, CA 94550, USA.

* Corresponding Author email: erikjoerter@gmail.com

Highlights

- We studied hydrogen and oxygen stable isotope salt effects in water-salt mixtures from dilute to well beyond salt saturated.

-Isotope effects for $BaCl_2$, K_2SO_4, and NaBr are quantified and are a new addition to previously studied salt compounds.

-Hydrogen and oxygen isotope effects in vapor do not behave as systematically above salt saturation as at less than saturated conditions.

-We make specific recommendations on the use of salts that exert hydrogen and oxygen isotope effects with the least magnitude and most predictability for various target humidity levels.

Keywords

salt effect, humidity control, aging studies, water-ion interactions, ionic hydration

Abstract

A potentially attractive tracer of water-surface interactions in humidity exposure experiments are the stable hydrogen and oxygen isotopes in water vapor, though the conventional method of using salt saturated aqueous solutions to control humidity is likely to exert strong effects on the H and O stable isotope composition of the vapor. The magnitude of these effects are virtually unknown for hyper-saline solutions near salt saturation and beyond. Here we explore the hydrogen and oxygen stable isotope effects of salt-water mixtures from dilute to the salt saturation point and beyond for $BaCl_2$, $CaCl_2$, KCl, K_2SO_4, $MgCl_2$, NaBr, NaCl, and NaI salts, of which the O isotope results on $BaCl_2$, K_2SO_4, and NaBr are the first to be reported, and the first for H with $BaCl_2$. We find that vapor humidity levels, and hydrogen and oxygen isotope effects in the vapor generated from dilute solutions to salt-saturated mixtures increase in magnitude by predictable linear trends. In the case of hydrogen isotope salt effects, the cation identity matters, as the effect becomes stronger with decreasing size and increasing charge (increasing ionic potential). in the