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Estimation of lithium origin in salt lakes at Nevada by using lithium isotope ratio

ARAOKA, Daisuke[1*], NISHIO, Yoshiro[2], TAKAGI, Tetsuichi[3], WATANABE, Yasushi[3], KAWAHATA, hodaka[4]

[1]GSFS and AORI, The University of Tokyo, [2]Kochi Institute for Core Sample Research, JAMSTEC, [3]GREEN, AIST, [4]AORI, The University of Tokyo

Lithium is a useful element for industrially purposes. Lithium has unique characteristics such as lowest Oxidation-reduction potential and the third-lightest element among all elements. These properties are valuable for lithium-ion secondary battery that is high-power, lightweight and the highest energy density among batteries in practical use.

Salt lakes are the most major lithium resources on earth. Highly concentrated lithium resources have been formed in salt lakes by repetition of water evaporation and inspissation with an arid climate. As a result of rising consumption of lithium carbonate, lithium-rich brine in salt lakes have been developed all over the world. Therefore, it is essential for understanding the origin of highly concentrated lithium in salt lakes for future exploration.

Lithium has two stable isotopes and its ratio is known for newly useful tool understanding water-rock interaction. Amount of lithium leached from rock to fluid at high temperature, and once leached lithium is kept in fluid while decreasing temperature, because lithium is a fluid-mobile element. Therefore, lithium isotope ratio of samples collected from salt lakes has a potential for tracing lithium origin in salt lakes.

In this study, we report lithium isotope ratio, as well as major and trace element compositions and strontium isotope ratio, of samples collected from some salt lakes at Nevada, USA. These lithium isotopic values of samples have a large variation among each sample, however all the values are much lower than the values of river water reported previously, and are close to values of upper continental crusts. These results suggest that highly concentrated lithium in these salt lakes were not formed during surface weathering processes, but were supplied by the result of water-rock interaction below the surface of the earth at high temperature. In the future, further detailed studies must be required such as the initial values of host rocks.

Keywords: Lithium isotope ratio, Salt lakes, Lithium resources, Water-rock interaction, Nevada