

## Evidence from Archean granitoids for microbial sulfate reduction before 4.0 Ga

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The oldest evidence for microbial sulfate reduction (MSR) dates back to *ca.* 3.5 Ga [1,2], however, scarcity of older sedimentary rocks prevents further study. Sulfur isotopes of granitoids sometimes reflect seawater sulfate probably through sulfate reduction in the oceanic crust and subsequent subduction process [3], thus in addition to sedimentary rocks, granitoids could possibly be useful to study MSR activity in global scale. Here, we report quadruple sulfur isotopes analysis of Archean granitoids including 4.0 Ga sample from Acasta Gneiss Complex.

The results show that most Archean granitoids from 4.0 to 2.5 Ga exhibit slightly negative  $\Delta^{33}\text{S}$  values likely derived from seawater sulfate, whereas some others show positive  $\Delta^{33}\text{S}$  values, possibly reflect assimilation of older sediment. The former granitoid samples also show a negative correlation between  $\Delta^{36}\text{S}$  and  $\Delta^{33}\text{S}$  values with a  $\Delta^{36}\text{S}/\Delta^{33}\text{S}$  slope of  $-10$ , that is typical for MSR. Both the negative  $\Delta^{33}\text{S}$  and steep  $\Delta^{36}\text{S}/\Delta^{33}\text{S}$  trend are observed also in the 4.0 Ga granitoid. Therefore, our study indicates the presence of ocean, seawater sulfate and MSR activity as early as 4.0 Ga.

[1] Shen, Y.A., Buick, R., Canfield, D.E., 2001. Isotopic evidence for microbial sulphate reduction in the early Archaean era. *Nature* 410, 77-81. [2] Ueno, Y., Ono, S., Rumble, D., Maruyama, S., 2008. Quadruple sulfur isotope analysis of *ca.* 3.5Ga Dresser Formation: New evidence for microbial sulfate reduction in the early Archaean. *Geochimica et Cosmochimica Acta* 72, 5675-5691. [3] Sasaki, A., Ishihara, S., 1979. Sulfur isotopic composition of the magnetite-series and ilmenite-series granitoids in Japan. *Contrib Mineral Petr* 68, 107-115.