Effect of feeding on the carbon isotopic composition of the zooxanthellate coral Stylophora pistillata

DR STÉPHANIE REYNAUD-VAGANAY, CHRISTINE FERRIER, RAYMOND SAMBROTTO, ANNE JUILLET-LECLERC, JEAN-PIERRE GATTUSO

sreynaud@centrescientifique.mc
ferrier@centrescientifique.mc
sambrott@ldeo.columbia.edu
Anne.Juillet-Leclerc@lsce.cnrs-gif.fr
gattuso@obs-vlfr.fr

Abstract

The effect of feeding on the carbon isotopic composition of zooxanthellae, animal tissue and skeleton was investigated in the scleractinian coral *Stylophora pistillata*. Two sets of corals were grown with filtered seawater under controlled conditions. One group of colonies was fed with *Artemia* nauplii and compared to a control group that was starved. Fed corals exhibited higher concentrations of calcification rates than starved colonies. The average $\delta^{13}C$ value of *Artemia* nauplii used for feeding was -12‰. $\delta^{13}C$ was significantly heavier in zooxanthellae than in animal tissues, for both fed (-10.1 vs. -11.7‰) and starved colonies (-10.9 vs. -13.2‰). Isotopic data reflected the incorporation of *Artemia* carbon into the coral tissue in that the $\delta^{13}C$ was significantly heavier in fed than in starved colonies (-11.7 to -13.2‰ respectively), although there was no difference in the $\delta^{13}C$ of the zooxanthellae fraction. Skeletal $\delta^{13}C$ was similar in fed and starved colonies (mean = -4.6‰).

These data are used to establish a conceptual model of the carbon flow between the various compartments of a symbioticcoral.

Groundwater weathering rates from U- and Th- series nuclides

B.C. REYNOLDS [1,2] AND G.J. WASSERBURG [2]

[1] The Department of Earth Sciences, The Open University, Milton Keynes, MK7 6AA, UK
[2] The lunatic Asylum of the Charles Arms Laboratory, Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125 USA

The transport of U, Th, Ra and Rn nuclides of the ^{238}U- and ^{232}Th- decay series has been investigated in a large sandy confined aquifer in New Mexico. Groundwater data are compared with a model of weathering of aquifer grains and interaction with surface coatings, to constrain important physico-chemical parameters that occur within the aquifer, principally weathering rates, α-recoil effects, adsorption-desorption characteristics, and irreversible precipitation (Tricca *et al* 2001). The model can explain the observed nuclide activities measured in the groundwater. The relative importance of α-recoil effects compared to bulk weathering of mineral grains can be estimated from the $\delta^{234}U$ values in the groundwater.

Thorium concentrations are at their saturation limit throughout the aquifer. The total Th activity in the surface coating increases linearly with the age of the aquifer for ^{232}Th, but reaches a steady-state activity for ^{230}Th. In order to explain the Rn concentration, it appears that between 2 and 7 % of the host rock has been chemically weathered in the aquifer over the past 10 yr in an early stage of weathering, which has left behind a surface coating enriched in ^{232}Th and ^{230}Th. This provides the high Rn in the waters. Radium is strongly adsorbed onto the surface of the host aquifer rocks, roughly 1000 times more than is in solution. The $\delta^{234}U$ found in the aquifer is ~8000 It was found that water in the aquifer could not be derived from the present vadose zone waters which have high ^{238}U concentrations and $\delta^{234}U$ ~500.

From the U-decay series it is found that the average α-recoil fraction is ~0.007, and the average weathering rate in the aquifer is ~6 x 10^{-17} s^{-1}, that equates to a chemical exhumation rate of the aquifer rock of 0.1 mm/kyr, or 0.25 ton/km^2/yr. Simply from their relative $\delta^{234}U$ values, the weathering in the vadose zone must be over 20 times the weathering rate inside the aquifer, around 1x 10^{-15} s^{-1}, or 4.5 ton/km^2/yr for a 55 m thick vadose zone. Despite low weathering rates estimated for this region, the overall chemical exhumation rates are still relatively large. The results demonstrate that the U- and Th-decay series provide a powerful tool to investigate the long-term evolution of groundwater-systems and can constrain the physico-chemical reactions that affect the transport of actinides in groundwater systems.

Reference: Tricca A., Wasserburg G. J., Porcelli D. and Baskaran M. (2001) *Geochim.Cosmochim.Acta.* 65. 1187-1210. Caltech Contribution 8782(1093) Research supported by DOE DE-FG03-88ER13851.