

## Influence of microbiology and photochemistry on iodine cycling

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Investigation of microalgae, bacteria and photochemistry influence on the cycling of iodine in seawater was carried out. Axenic cultures of *Tetraselmis sp.* and natural bacteria found in seawater were prepared and samples were collected over 54h at 3 and 6h interval, respectively. Determinations included I<sup>-</sup>, IO<sub>3</sub><sup>-</sup>, O<sub>dis</sub>, NO<sub>3</sub><sup>-</sup>, NO<sub>2</sub><sup>-</sup>, NH<sub>4</sub><sup>+</sup>, DOC, pH, I in biomass, biomass growth and chorophylls.

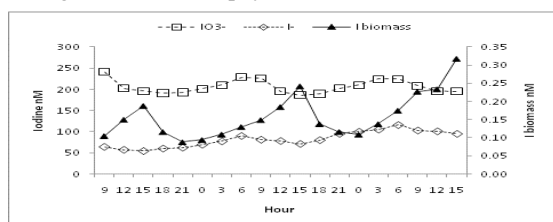


Figure 1: I<sup>-</sup>, IO<sub>3</sub><sup>-</sup> and I in biomass (*Tetraselmis sp.*)

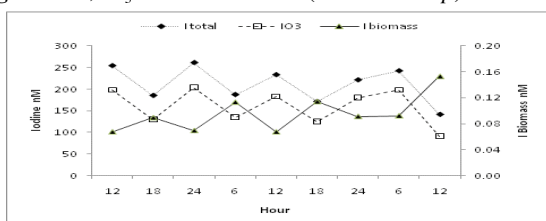


Figure 2: IO<sub>3</sub><sup>-</sup>, I total and I biomass (bacteria culture)

### Discussion and results

Dissolved iodine was absorbed during photosynthesis of *Tetraselmis* and released in respiration. A net production of 52 nM of I<sup>-</sup> occurred while  $\Delta$ IO<sub>3</sub><sup>-</sup> was < 4 nM. The shift by 3h in oscillations of IO<sub>3</sub><sup>-</sup> and O<sub>dis</sub> indicates participation of the former in enzymatic reactions as suggested by [1]. Significant correlations between I<sup>-</sup> concentration and primary production were found. Sorption of iodine seems to involve I<sup>-</sup> and organic I and may involve compounds that act storing energy. This would explain the liberation of I<sup>-</sup> at night. Iodate showed cyclic variation in the bacteria culture with 12 hours amplitude. A significant activity of nitrifying and denitrifying bacteria was observed.

[1] Wait & Truesdale (2003), *Mar Chem* **81**, 137-148

## Reactive transport analysis on chemical weathering of a porous rhyolite

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Reaction and transport in chemical weathering of a porous rhyolite from Kozushima, a volcanic island in Japan, were studied. The mass balance in the rhyolite can be described by the following reaction-transport equation:

$$\frac{\partial c}{\partial t} = R_d(1 - c/c_{eq})A/\Phi + D\frac{\partial^2 c}{\partial x^2} - v\frac{\partial c}{\partial x} \quad (1)$$

where  $c$  is the concentration (dissolved Si),  $t$  time,  $x$  depth from the surface of the rock,  $R_d$  dissolution rate (far from equilibrium),  $c_{eq}$  equilibrium concentration,  $A$  reactive surface area,  $\Phi$  porosity,  $D$  apparent diffusion coefficient, and  $v$  fluid flow rate. Each of the parameters in eq. (1) has been determined by the laboratory experiments designed to simulate natural condition. The dissolution rate of Si and hydraulic conductivity of the rhyolite were measured by flowing pure water into a rock column under a constant water head. The apparent diffusion coefficient of dissolved Si was determined by a through diffusion experiment [1]. Reactive surface area was measured by BET method. The depth profiles of the concentration of dissolved Si and dissolution rate calculated by eq. (1) (Fig. 1) reveal that an average dissolution rate for a depth of 1 m is  $\sim 2E-18$  mol Si cm<sup>-2</sup> sec<sup>-1</sup>. The dissolution rate of the rhyolite during 52,000 years of weathering has been estimated by the field based study to be  $\sim 6E-19$  mol Si cm<sup>-2</sup> sec<sup>-1</sup> [2]. The calculated dissolution rate is within one order of magnitude of the field rate.

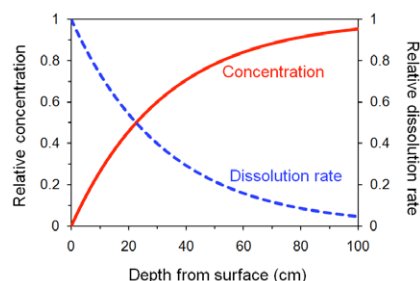


Figure 1: Depth profiles of the concentration of dissolved Si and dissolution rate.

[1] Yokoyama & Nakashima (2005) *Eng. Geol.* **80**, 328-335.

[2] Yokoyama & Banfield (2002) *Geochim Cosmochim Acta* **66**, 2665-2681.