application and analysis of water-rock-carbon dioxide reaction using basalt

Tomohiro Katayama1*, Naotatsu Shikazono1, Yutaro Takaya2, Yasuhiro Kato2

1Graduate School, Keio University, 2Graduate School, University of Tokyo

Water-rock-CO₂ reaction is important in many parts of science. Main reactions are as follows.

\[ \text{CO}_2 + \text{H}_2\text{O} = \text{H}_2\text{CO}_3 = \text{H}^+ + \text{HCO}_3^- \quad (1) \]

\[ \text{MSiO}_3 + 2\text{CO}_2 + \text{H}_2\text{O} = \text{M}^{2+} + \text{H}_4\text{SiO}_4 + 2\text{HCO}_3^- \quad (2) \]

\[ \text{M}^{2+} + 2\text{HCO}_3^- = \text{MCO}_3 + \text{CO}_2 + \text{H}_2\text{O} \quad (3) \]

M is divalent metal ion.

There are two steps. First, CO₂ dissolves into water at (1) and mineral(MSiO₃) and water react with CO₂ at (2). Next, divalent metal ion and HCO₃⁻ react and precipitation occurs at (3).

We will apply it to the CO₂ underground sequestration and the estimate of Archean atmospheric CO₂ concentration and global carbon cycle and materials of subsystem.

Keywords: basalt, water-rock reaction, CCS, the dissolution rate constant, simulation