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Extraction methane from sedimentary carbonates and measurement stable carbon isotope

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To escape from snowball glaciations, a great amount of greenhouse gas was required. In particular, methane has been considered to contribute for escaping from entirely frozen earth because of its strong greenhouse effect (e.g. Kennedy et al., 2008). But amount and origin of methane in this period are still controversial.

We try to extract methane from sedimentary carbonates which deposited soon after snowball glaciations (cap carbonate). We then try to estimate of its CH4 flux into the atmosphere at that time.

We used the Doushantuo cap carbonate which formed after the Marinoan glaciation (ca. 635 Ma) for the analysis. Because evidences of methane were observed in the Doushantuo cap carbonate (Jiang et al., 2003; Wang et al., 2008), the sample is appropriate to test the utility of this method.

A vacuum crushing method has generally been adopted for extraction of gas from minerals, though we efficiently extracted gas to digest carbonate grains by phosphoric acid. Methane was concentrated by a purification line, and then its amount and carbon isotope ratio were measured using a GC-C-IRMS. In order to evaluate the blank methane production during experiment, we also analyzed powdered samples in which fluid inclusions and adsorbed gas were removed.

Amount of extracted methane from grain samples tend to be higher than those of powdered samples. The difference between powdered samples and grains is probably attributable to fluid inclusions and adsorbed gas. Amount of extracted methane from carbonate grain was up to 10257 nmol/g-rock. In terms of carbon isotope value, both grains and powder samples range from -38.7 permil to -43.1 permil (VPDB) and are consistent with thermogenic methane. Despite powderization, methane could be extracted from powder samples. This may indicate organic matters included in carbonates might react with hot acid to release methane.

Keywords: carbonate, methane, carbon isotope