Hydrothermal origin of cap carbonate cement from Lesser Himalayan Proterozoic strata

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Drastic release of methane into atmosphere might be happened in the history during the terminal period of Marinoan "snowball Earth" ice at ~635 M.y. ago. To prove this idea highly depleted $\delta^{13}C$ in post-glacial cap dolostones was interpreted as a product of methane oxidation at the time of precipitation and coincide with the signature for rising temperature. Application of carbonate clumped isotope thermometry to these carbonates provides new constraints on their origin and diagenetic history. The extent of clumping, expressed as Δ_{47} in units of ‰, shows a systematic dependence on temperature [1]. This thermometer can be used to estimate the temperature of carbonate precipitation and the $\delta^{18}O$ of the fluids ($\delta^{18}O_{SMOW}$) from which carbonates grew. In our work by application of clumped isotope thermometry we analyzed different sets of carbonate sampes (cap dolomites, diamictites and stromatolite) from Mussoorie syncline, Lesser Himalaya of India which belongs to Blaini formation and corresponds to ~635 M.y. ago. The cap samples examined in this study have Δ_{47} values ranging from 0.512‰ to 0.36‰, corresponding to temperatures of 115 to 320°C. In contrast to earlier studies, $\delta^{18}O$ of fluid responsible for the carbonate precipitation estimated from using clumped-isotope technique, show variability from –16 to –30‰ and interpreted as later diagenetic imprints of glacial or meteoric water. The $\delta^{13}C$ signature recorded ranges –1.4 to –2.4‰ and is in agreement with data from previous work [2]. We compared our Δ_{47}, temperature and $\delta^{13}C$ signatures from Blaini formation and Doushantuo formation cap dolostone from south China [3]. Our data provide sufficient indication of rapid consolidation process in low depleted $\delta^{18}O$ environment during the time of Himalyan orogeny. Presentation will cover more results on some of the relative unaltered samples.

[1] Ghosh, P. et al., *Geochim. Cosmochim. Acta* **70**, 1439–1456 (2006). [2] Kaufman et al., *Precambrian Research* **147** (2006) 156–185 [3] Bristow et al., 2011; *Nature* 10096