MULTIPLE METHANE SEEP EVENTS AND IMPLICATIONS FOR THE CLIMATE CHANGES IN NEOPROTEROZOIC CAP CARBONATE IN SOUTH CHINA

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Extreme negative stable carbon isotopic signals have been recently recognized from Neoproterozoic cap carbonates at the beginning of Ediacaran era after the Cryogenian Marinoan glacial deposition. The reported methane-related carbon isotopic signal within the cap carbonates are mainly from the three sections underlying the Nantuo glacial diamictite (Marinoan glacial deposition) widely distributed in South China, their δ¹³C values are -41‰ VPDB from the middle part of cap in Huajipo section, -44‰ VPDB from the low part of cap in Jiulongwan section and -48‰ VPDB from the upper part of cap in Wangzishi section, respectively. These extreme negative δ¹³C signals of carbonate are definitely related to the special biogeological processes of anaerobic oxidation of methane (AOM), and interpreted most likely as the results of the dissociation of methane hydrate during the Cryogenian glacial meltdown, associated with a suite of distinctive sedimentary structures including Tepee-like structures at the end of Snowball Earth. Recently, a new extreme negative δ¹³C value as low as -27‰ is found by high-resolution sampling at the middle part of cap in Xijiaao section near the reported Wangzishi section, indicative of the widespread methane seeps in the ca. 635 Ma Doushantou cap carbonate in south China. The reported triple oxygen isotope compositions of barites within the cap carbonate in South China revealed a distinct global climate scenario having an extreme high pCO₂ atmosphere at the end of Cryogenian glaciation and/or at the beginning of cap carbonate deposition. Our new data of the strontium isotopes show that ⁸⁷Sr/⁸⁶Sr values of cap carbonate are changed dramatically into a high level up to 0.718637 at and just after the extreme negative δ¹³C positions, suggest that an intensive weathering event would happen in the spreading Rodinia continents during and/or just after the methane seep events at the beginning of Ediacaran cap carbonate. Thus, we propose that an episodic and multiple methane seeps event developed during the cap carbonate deposition, resulting into a methane-derived greenhouse climate scenario and an intensive weathering geosystem at the end of Neoproterozoic Cryogenian and the beginning of Ediacaran era.

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