

U-Pb dating of TSR calcite in the Lower Cambrian in the western Tarim Basin

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Although thermochemical sulfate reduction (TSR) has been extensively investigated from case studies and experimental simulation, no TSR has been dated so far except unprecise estimation from fluid inclusions and burial history. A case from the Lower Cambrian dolostones in Well Qiaotan 1, Buchu uplift, is investigated to time TSR. Many sulfur-bearing species including element sulphur, pyrite, pyrobitumen, gypsum and barite are found in the dolostones to co-grow with quartz and calcite. High H₂S content (8%) in fluid inclusions from quartz with homogenization temperatures from 140 to 180°C, and element sulfur with sulfur isotopic composition from 24‰ to 25‰ close to the gypsum from 32‰-35‰ and the coeval seawater, suggest that these reduced sulfur species may have a sulfur contribution from thermochemical sulfate reduction, although pyrite with $\delta^{34}\text{S}$ values from -26‰ to -30‰ may have an origin of bacterial sulfate reduction. Thus, the associated calcite with homogenization temperatures from 140 to 180°C must have a origin of TSR. The calcite was measured using U-Pb dating to give an age of 220±30Ma, indicating the TSR may have occurred during this period.