Geochemical constraints on the chert in the Ediacaran Doushantuo Formation at the Xiaofenghe section in the Three Gorges area, Yangtze platform: Implications for the diagenetic conditions

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Silicification is widespread in the carbonate rocks overlying the cap carbonate of the Ediacaran Doushantuo Formation at the Xiaofenghe section in the Three Gorges area, Yangtze platform, South China. The cherts can be subdivided into five types (S1 to S5) based on the petrographic features: S1 is the microquartz in the chert nodules/bands; S2 is the microquartz disseminated in the matrix carbonates; S3 is the megaquartz in the matrix carbonates; S4 is quartz replacing the calcite cements; and S5 is fibrous silica replacing calcite cement. The sedimentary structures suggest that the silica deposition occurred during early burial diagenesis and recorded diagenetic processes of the carbonates. The $\delta^{18}O$ values show that most cherts and coexisting carbonates are out of oxygen isotopic equilibrium. The $\delta^{18}O$ values of carbonate and cherts are controlled by the isotope composition of precipitating waters and temperatures. It is suffest that the surface seawater temperatures of the Ediacaran Period at Xiaofenghe sections might vary from 28 to 39ºC with the oceanic $\delta^{18}O$ values buffering at values of -5 to 0‰. The formation temperatures of cherts, from 47 to 75ºC, are higher than those of the matrix carbonate but consistent with those of the carbonate nodules (C1) and the carbonates associated with cherts (C2 and C3) if they equilibrated with the same fluids. The REE+Y patterns of cherts characterized as minor light REE depletions, positive La, Eu and Gd anomalies, negative Ce anomalies and slightly super-chondritic Y/Ho ratios implying that the silica may have originated from the seawater. The formation temperatures of quartz probably represent the diagenetic temperatures of the matrix carbonates. Under such low temperatures, the primary geochemical signatures of carbonates, such as $\delta^{13}C$, $\delta^{34}S$ and REE+Y patterns could be preserved.