Early dolomite recrystallization at low temperature and pressure evidenced by coupling clumped isotopes thermometry with x-ray diffraction analysis.

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Geochemical proxies are often use to infer the depositional environment of early dolomites. Yet, much debate exists concerning the extent to which they recrystallize and preserve the signature of their original environment (Land, 1992; Machel et al., 1993). Here, we combine three methods: clumped isotopes thermometry (Ghosh et al., 2006; Eiler, 2007), XRD analyses and Electron Backscatter Diffraction (EBSD) to study recrystallization under shallow burial (<1 km). We analyse 26 dolomite samples from two Miocene platforms (Marion Plateau, NE Australia). Results show that dolomites are very rich in calcium and their temperature of precipitation $T(\Delta_{47})$ ranges between 15 and 37°C. The computed fluid composition ($\delta^{18}O_w$) falls in the range of sea water composition. There is a correlation between $T(\Delta_{47})$ and $\delta^{18}O_w$: the higher $T(\Delta_{47})$, the higher $\delta^{18}O_w$ (Trend A). There is also a correlation between $T(\Delta_{47})$ and the oxygen isotopic composition of dolomite ($\delta^{18}O$): the higher $T(\Delta_{47})$, the lower $\delta^{18}O$. We interpret Trend A and B has the evidence of shallow burial recrystallization via dissolution/re-precipitation in a rock-buffered environment at very low water to rock ratio. In the deepest samples, this process is also associated with extensive cementation and dissolution. We then look at the crystal orientation of three dolomites with increasing degree of recrystallization with EBSD to assess the use of the method in the study of recrystallization under shallow burial.