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Anatomy of a dolomitization front

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Mineralogical replacement is a complex phenomenon that affects rocks at various temperature and pressure conditions. Mineral replacement changes physical properties of a rock such as porosity, density, grain size and solid volume. A relevant example of replacement occurring in the diagenetic pressure-temperature conditions is the dolomitization of calcite, a process around which debates have been going on for decades. In this contribution we report results of an analytical study of a reactional interface, observed in the Cretaceous limestones of the Bearnese Chains (Pyrenees, France).

Volume fraction, microporosity and oxide distribution, along with general morphology of the original calcite, the transforming rock and the produced dolomite, were quantified using 3D X-ray computed micro-tomography. These results are coupled with SEM-EBSD analysis that qualified the mineralogy, the oxide origin, and the evolution of crystallographic orientation in order to define strain variation, specific porosity and geometry of fluid-mediated replacement interfaces. To complement this approach, we studied the morphology of the dolomite-calcite contact itself, to decipher what governs the replacement reaction. Beyond regional implication on fluid-rock interactions, this study presents the first steps of a methodology that can lead to a better understanding of interface coupled dissolution-precipitation mechanisms.