Trace elements as indicators of mineral-fluid interaction in the dedolomitization of carbonate rocks

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Middle Jurassic sedimentary carbonate rocks from the Lusitanian Basin (LB), West-Central Portugal, show macroscopic transitional features of dolomitization. Most of LB sediments are Jurassic, but Late Triassic to Late Cretaceous is recorded, including evaporites at the base [1]. Studied samples include limestones, dolomites and late-calcite substituted dolomites resulting from late diagenetic dissolution/reprecipitation processes. Distinction between calcite generations is often difficult adding to their complex evolution, but based on their texture and trace-element composition is possible to distinguish primary (sedimentary) calcites, from recrystallized, vein and late deposited calcites. The widespread occurrence of dedolomitization processes was most likely enhanced by karstification in some areas of the LB [1] along fault and fracture controlled domains.

SEM-EDS shows that Fe (hydr)oxides explain the ferrous and non-ferrous character of carbonates. Trace element contents from LA-ICP-MS analysis show that carbonate rocks display a heterogeneous composition, suggesting different pulses of fluids controlling the precipitation processes able to produce the wide-ranged textural variations observed at macroscopic scale. Using trace elements (Fe, Mn, Mg, Sr, Ba, P, U, Th, and REE) to compare primary and secondary calcites revealed enrichments in Fe, Mn, Sr, and Ba in the latter. On the contrary, Mg content is significantly lower in late calcites as compared to primary ones. This suggests a Ca-enriched calcite-saturated fluid flow in the system with loss of Mg. Dolomite also shows depletion in Sr content as compared to the calcite. Absence of magnesite in the system leaves the fate of Mg in the LB as an open question that has yet to be discussed.

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[1] Azeredo, A. (1998), Geological Society, London, Special publications; v. 149; p. 281-314