Mg isotope geochemistry for the characterisation of late-diagenetic dolomites

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Coarse crystalline and zebra dolomites (CCZ) form an intriguing lithology. They often are porous and thus form potential hydrocarbon reservoirs worldwide. They are also associated with base metal ore or magnesite deposits. Based on extensive research efforts, combining field evidence, petrography, elemental composition, isotope geochemistry (C, O and Sr) and microthermometry of fluid inclusions, several dolomitisation models have been proposed. The source of the magnesium, however, remains poorly constrained. CCZ dolomites testify of the circulation, early or late during diagenesis, of high temperature (often hydrothermal) Mg-rich fluids (based on fluid inclusion and stable oxygen isotopic analyses). The working hypothesis in this study is that some of the dolomitising fluids can be derived from fluids that interacted with (ultra)mafic rocks or their metamorphic equivalents.

The "classical" approach does not allow unequivocal discrimination between different fluid sources, but recent developments in high-precision isotopic analysis based on Multi-Collector-ICP-MS provide promising tools for unravelling source-sink relationships. Sr isotopic analysis has already proven its use in dolomite research, but the use of Mg isotope ratios to pinpoint the source of Mg in dolomites is relatively new. The prime question is whether the combined isotopic signatures of dolomites differ, when different Mg sources are involved in the dolomitisation process. Several dolomite types, sampled from dolomite occurrences with well known dolomitisation mechanisms, are being studied. An analytical protocol for the isolation of the pure Mg fraction from different rock types using ion exchange chromatography was developed during this study and Mg and Sr isotope ratios were measured using a Neptune MC-ICP-MS unit with the purpose of discrimination between different dolomitisation mechanisms.