Fault-related dolomite fronts in the Aptian-Albian platform limestone (NW Spain): Implications on conceptual dolomite models

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Field characteristics, petrographic and geochemical signatures, as well as some petrophysical aspects of fault-related dolomite bodies in the Ranero area (Karrantza Valley, NW Spain) are studied. These dolomite bodies are hosted by Albian slope to platform carbonates, which were deposited in the Basque-Cantabrian Basin (Fig. 1). Replacive and void-filling dolomite phases – postdating palaeo- and hypogene-karstification are interpreted to have originated from hydrothermal fluid pulses, and are spatially related with faults and fractures. Hydrothermal calcite cements pre- and postdate dolomitization. Mineralogical and geochemical investigations (XRD, ICP-MS/AES, XRF, stable and Sr isotopes) helped in distinguishing various dolomite and calcite phases. Dolomite phases can be grouped into ferroan (early) and non-ferroan (late). Dolomites are generally stoichiometric and exhibit a broad range of depleted $\delta^{18}O$ values (-18.7 to -10.5‰ V-PDB), which advocate for multiphase dolomitization and/or recrystallization at relatively high temperatures (150-200°C). The observation that bed-parallel stylolites pre- and post-date dolomites suggests that dolomitization occurred during the Late Albian regional tectonic activity and related fluid expulsions. Based on carbonate chemistry, authigenic silicate chemistry and replacement relationships, two contrasting types of dolomitizing fluids are inferred. Both arguably may have initiated as sulphate-dominated brines and/or basin compactional fluids, but they seemingly undergo sulphate reduction in contact with host rocks of contrasting compositions (Fe-rich silicate vs Fe-poor carbonate) thus, evolving either to acidic and ferroan (limestone replacive) or to neutral, Fe-poor and sulfidic (Fe-dolomite replacive). Fluid drives are not well constrained by our data, but both fluid types are focused along major faults that cross cut the platform edge and are associated with diapir tectonics.

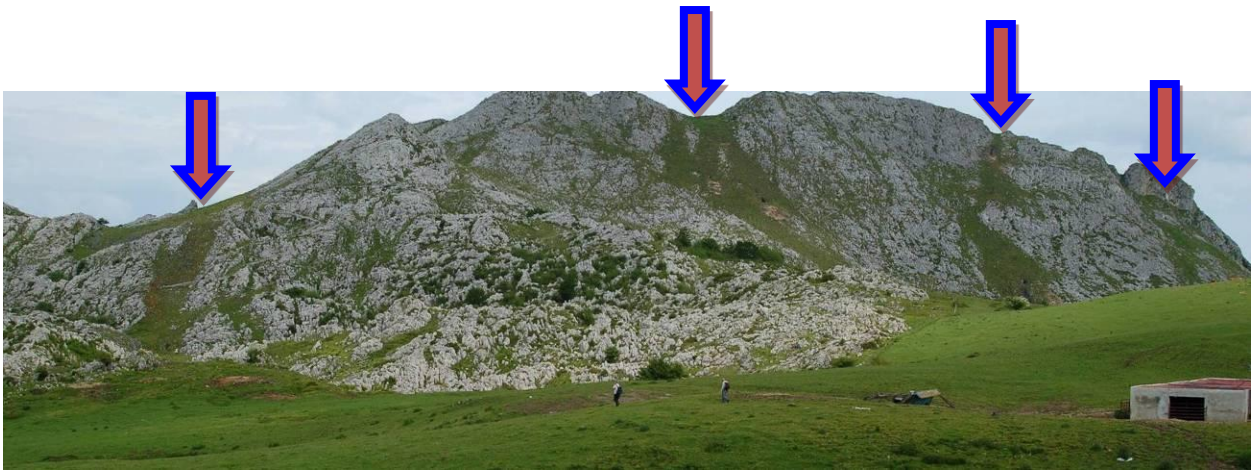

Fig. 1. Fault-related dark-grey colored dolomite bodies (indicated by arrows) in the light grey colored limestone.