
Fluid circulation and paleothermicity associated with the fracturing of Mesozoic carbonates in the Southern Alps: Implications for the thickness of internal nappes

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Résumé

Structural context and associated fracturing are key parameters impacting fluid circulation and porosity variations in sedimentary basins. The Mesozoic limestones of the southern Alps and the Eocene foreland deposits were covered by the Embrunais-Ubaye thrust sheets from the Oligocene onwards, as in the Colmars-les-Alpes area. Thermochronological data on Eocene turbidites (Labaume et al., 2008) indicate decreasing burial towards the south-west of the Alpine arc, and these nappes did not reach the western part of the Alpine flexural trench (Ford and Lickorish, 2004).

The aim here is to assess the burial of Mesozoic series beneath internal nappes in the Alpine foreland using paleo-temperature data on fluid inclusions in fracture calcites. Coupled with petrographic, isotopic, U/Pb dating and gas/fluid chemistry data, these results have enabled us to propose a scenario for thermal evolution and fluid circulation in the Colmars-les-Alpes area. The first generations of calcite in fractures hosted by Cenomanian carbonates show homogenization temperatures around 250°C with low salinities (1.5% NaCl) and methane; the age of fracturing and filling is currently being determined. On the other hand, calcites showing a gradual decrease in temperature (200°C then 145°C) with a significant increase in salinity for the last generation (8.8% NaCl) have provided Miocene ages.

Temperatures of 250°C can be explained neither by the thickness of burial during the Cretaceous prior to ante-Eocene erosion, nor by burial beneath the internal nappes, whose thickness has been estimated at 4-5 km (Labaume et al. 2008) following ante-Eocene erosion of part of the Cretaceous. Considering a normal thermal gradient and the reduced thickness of the Eocene series, the thickness of the inner nappes should have been around 8 km. Decreasing temperatures and increasing salinity in more recent fractures could indicate progressive erosion of the Embrunais-Ubaye nappes, changes in circulation paths and interaction with Triassic evaporites.

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