Toulouse 10-12 October 2017

33rd INTERNATIONAL MEETING OF SEDIMENTOLOGY

16ème CONGRÈS FRANÇAIS DE SÉDIMENTOLOGIE

ABSTRACT BOOK

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EVIDENCE OF AN EARLY CRETACEOUS HYDROTHERMAL EVENT IN THE MIDDLE JURASSIC LIMESTONES OF THE PARIS BASIN

Benjamin BRIGAUD[(1,@)], Magali BONIFACIE[(2)], Maurice PAGEL[(1)], Damien CALMELS[(2)], Philippe LANDREIN[(3)]

[(1)] Géosciences Paris Sud, Université Paris Sud (France)
[(2)] Institut de Physique du Globe de Paris, Université Sorbonne (France)
[(3)] Agence nationale pour la gestion des déchets radioactifs (France)
[(@)] benjamin.brigaud@u-psud.fr

In sedimentary basins, the precise temperature in shallow buried rocks (< 60°C) are poorly recorded by classic geothermometers or low temperature thermochronometers. In the last ten years, thermal history and fluid flow periods in the shallow buried Paris Basin have been considerably improved. Different diagenetic studies, coupling petrographic observations and isotopic analyses ($\delta^{18}O_{carb}$) allowed to characterize a main episode of carbonate cementation during the Early Cretaceous, leading to the filling of intergranular space within the Middle Jurassic limestones. On the other hand, the scenarios of fluid flows within a reliable geological history are difficult to reconstruct because of the difficulty in finding calcites with two-phase aqueous fluid inclusions or apatite to obtain (U-Th)/He or fission track ages. These scenarios depend to a large extent on the $\delta^{18}O_{carb}$ interpretations, which are themselves dependent on the assumptions made about the temperature or about of the oxygen isotopes. Consequently, geological interpretations on the same calcite cements, filling-intergranular pore space or fissural porosity, can be diametrically opposed depending on the assumptions made on temperature. This demonstrates that temperature constitutes an important lock in diagenetic studies. The aim of this work is to couple (i) temperature and (ii) $\delta^{18}O$ fluid reconstruction from calcite crystals of the Paris Basin in order to remove the uncertainties on the diagenetic scenarios of this basin. In order to answer this question, a diagenetic study was carried out using (i) classical methods (paragenetic association, stable isotopes) and [(2)] a thermometric method developed recently, the clumped isotope or D47 thermometry. The D47 temperatures of the 2 main blocky calcites indicate temperatures of 60°C and 85°C on average respectively for both generations. The thermal history of the eastern Paris Basin, compiled from organic matter, clay minerals and apatite fission track data indicates that the D47 temperatures in calcite are about 20°C to 45°C higher than the temperature recorded in sediments during the Early Cretaceous. We suggest that D47 temperatures recorded in these carbonate cements reflect a short hydrothermal event, probably too short to be recorded by organic matter or clay minerals. The $\delta^{18}O$ fluids calculated by taking into account these D47 temperatures vary from + 2.5 ‰ to + 8 ‰ SMOW. This implies deep ascendant hydrothermal brine circulations. The high $\delta^{18}O$ fluids at the origin of calcite (up to + 8 ‰ SMOW) can be typical of (1) fluids interacting at high temperature with minerals of a crystalline basement or (2) a mixture between hydrothermal fluids and fluids having dissolved a large amount of carbonates.