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Geothermal prospection in the Greater Geneva Basin (Switzerland and France). Impact of diagenesis on reservoir properties of the Upper Jurassic carbonate sediments

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Diagenesis of carbonate rocks is known to affect the petrophysical properties (porosity, permeability) of the host rock. Assessing the diagenetic history of the rock is thus essential when evaluating any reservoir exploitation project.
The Canton of Geneva (Switzerland) is currently exploring the opportunities for geothermal energy exploitation in the Great Geneva Basin (GGB) sub-surface. In this context, a structural analysis of the basin (Clerc et al., 2016) associated with reservoir appraisal (Brentini et al., 2017) and rock-typing of reservoir bodies of potential interest were conducted (Rusillon et al., 2017). Other geothermal exploitation projects elsewhere (e.g. Bavaria, south Germany, Paris Basin, France) showed that dolomitized carbonate rocks have good reservoir properties and are suitable for geothermal energy production.
The objectives of this work are to (1) describe and characterize the dolomitized bodies in the GGB and especially their diagenetic history and (2) quantify the reservoir properties of those bodies (porosity, permeability). Currently, our study focuses on the Upper Jurassic sedimentary bodies of the GGB.
Field and well data show that the dolomitization is not ubiquitous in the GGB. Results from the petrographical analyses of the Kimmeridgian cores (Humilly-2) and of field analogues (Jura, Saleve and Vuache mountains) display complex diagenetic histories, dependent of the study sites. The paragenesis exhibits several stages of interparticular calcite cementation as well as different stages of dolomitization and/or dedolomitization. Those processes seem to follow constrained path of fluid migrations through burial, faulting or exhumation during the basin's history.
These complex diagenetic histories affected the petrophysical and microstructural properties via porogenesis (conservation of initial porosity, moldic porosity) and/or poronecrosis events. The best reservoir properties appear to be recorded in patch reef and peri-reefal depositional environments in association with porous dolomitized intervals (Rusilloon et al., 2017).
The work presented here will help to constrain and quantify reservoir heterogeneities in a complex reservoir and to provide insights into porosity and permeability distribution that will ultimately help in reservoir modeling, a crucial step for further possible exploitation.

Brentini et al. 2017: Geothermal prospection in the Greater Geneva Basin: integration of geological data in the new Information System. Abstract, EGU General Assembly 2017, Vienna, Austria.
Clerc et al. 2016: Structural Modeling of the Geneva Basin for Geothermal Ressource Assessment. Abstract, 14th Swiss Geoscience Meeting, Geneva, Switzerland.
Rusillon et al., 2017: Geothermal prospection in the Greater Geneva Basin (Switzerland and France): structural and reservoir quality assessment. Abstract, EGU General Assembly 2017, Vienna, Austria.