Characterisation of the basement-sedimentary transition zone in the Saint Pierre Bois quarry (Vosges, France).

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The development of geothermal exploitation for heat and power generation requires detailed knowledge of the subsurface in order to mitigate associated geological risk and streamline exploitation techniques. In addition to temperature, the presence of a geothermal fluid and adequate reservoir permeability are required conditions for geothermal energy exploitation.

In the Upper Rhine Graben (France/Germany), the basement-sediment transition zone is located at depths where the temperature is sufficiently high (between 120 and 200°C) to be economically exploitable for industrial heat or electricity. Furthermore, several recent projects have targeted this zone because it acts as a permeable fluid reservoir. However, the complexity of this zone makes characterization of its heterogeneities a great challenge to the development of geothermal resources, a problem common to deep basins throughout Europe.

On the western border of the Upper Rhine Graben, the basement-sediment transition zone outcrops and is accessible at the Saint Pierre Bois quarry (France). At this location, the granitic crystalline basement is overlain by arkoses. Fracture orientation measurements and rock sampling were conducted on all accessible quarry benches, providing rich datasets for both the granite and the arkose.

The porosity of the granite matrix is ca. 2%, and essentially related to the feldspar alteration. In the cataclastic fracture zones, the porosity is slightly higher (ca. 4.6%) and these zones are partially cemented by 3.5% of barite. Arkose porosity is ca.12% and is a result of plagioclase and K-feldspar alteration.

Fractures observed on the wall have two main sets: N20°E and E-W. The first set is related to graben opening during Tertiary, but it is not the major fracture set. The E-W fracture set is more abundant, with large fractures distributed regularly along the wall. This dominant fracture set is related to the local Permian basin, which was active at the end of the Hercynian orogenesis.

This study shows that the fracture network could be largely influenced by local tectonic and the rock porosity is mainly secondary porosity in relation to the paleocirculation of fluids.