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The Rhine Graben is a major site of development for the geothermal heating production in France. Targeted geothermal reservoirs are in deep Hercynian granitic basement which is fractured dominated system, and more recently at the cover/basement interface.In this framework of geothermal exploration, a better understanding of the hydraulic behaviour of the fracture network and fluid/rock interactions is needed.

For that fracture fillings inHercynian granitic basement and in the formations of the cover (Permian rhyolites, Permian and Triassic sediments) were studied for mineralogy, fluid inclusion microthermometry and (C, O, Sr) isotopes in order to trace paleocirculations at the cover/granite interface in the Rhine Graben. Data were acquired on fracture fillings in samples of the basement/cover interfaces from the EPS1 borehole at Soultz-sous-Forêtin the Rhine grabenat ~ 1417 meters depth, and from outcrops in quarries on the flanks of the graben (Waldhambach, Saint Pierre Bois, Windstein, Heidelberg...). Mineral sequences of polyphasedfillings were interpreted in relation with the geological contextincludinglate evolution of the Hercynian basement and major extensive tectonic events.

Quartz, carbonates, sulfates and illiteare major minerals identified in fractures crosscutting Hercynian granites, Permian rhyolite (Waldhambach) and Permian and Triassic sedimentary cover. Although quartz being considered as a major mineral filling fractures, petrological observations showed that carbonates are also an important and probably underestimated phase of filling, and of interest for two reasons. Firstly, from a geothermal point of view, they contribute to the clogging of fractures. Secondly, from a scientific point of view, they are informative on the variations of fluid chemistry through geological times. Among carbonates, dominant dolomite with minor ankerite, Mn-bearing carbonates and siderite was identified by CL, SEM and EPMA in fractures. A same generation of dolomite was identified in fractures crosscutting Hercynian granite and in Permian and Triassic sandstones of the Rhine Graben (EPS1 borehole) but also on the flank of the Rhine Graben in Hercynian granite of Waldhambach, Heidelberg and Windstein quarries, and in Permian rhyolite at Waldhambach. This dolomite is Fe and Mn poor, formed at ~120-130°C, and has a 87Sr/86Sr of ~0.708-0.709. Barite is the major sulphate observed in fracture filling, already formed later than dolomite. Rare microthermometric data combined with strontium isotopes provide evidence of several generations of barite with one generation formed at ~130°C.

Preliminary data on dolomite provide evidence of large fluid circulations at the cover/granite interface.This dolomite is observed at least at depth down to 1650 m of the granite in the EPS1 borehole, i.e. with a minimum penetration of 200 m into the granite. Alternating deposition of ankerite and dolomite in fracture corridors strongly suggest pulses of fluids. Such fracture fillings at 1641 meters depth were attributed to present-day fluid circulations. However similar generation of dolomite also observed in fracture corridorcrosscutting the Hercyniangranite and Permian rhyolite at Waldhambachon the flank of the Rhine graben demonstrate that the fluid circulations

associated to these fillings were already active at the cover/granite interface before the formation of the Rhine graben.

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