



**HAL**  
open science

## Fluid paleocirculations at the cover/granite interface in the Rhine graben

C Lerouge, Chrystel Dezayes

► **To cite this version:**

C Lerouge, Chrystel Dezayes. Fluid paleocirculations at the cover/granite interface in the Rhine graben. EGU, Apr 2017, Vienne, Austria. hal-01493247

**HAL Id: hal-01493247**

**<https://hal-brgm.archives-ouvertes.fr/hal-01493247>**

Submitted on 21 Mar 2017

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## Fluid paleocirculations at the cover/granite interface in the Rhine graben

C. Lerouge<sup>a\*</sup>, C. Dezayes<sup>a</sup>

<sup>a</sup> BRGM av. Claude Guillemin BP6009 45060 Orléans cedex 2, France (\*, c.lerouge@brgm.fr)

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 in Hercynian 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-Forêt in the Rhine graben at ~ 1417 meters depth, and from outcrops in quarries on the flanks of the graben (Waldhambach, Saint Pierre Bois, Windstein, Heidelberg...). Mineral sequences of polyphased fillings were interpreted in relation with the geological context including late evolution of the Hercynian basement and major extensive tectonic events.

Quartz, carbonates, sulfates and illite are 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  $^{87}\text{Sr}/^{86}\text{Sr}$  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 corridors crosscutting the Hercynian granite and Permian rhyolite at Waldhambach on 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.

Thank you very much for your interest in the EGU General Assembly 2017. Please follow the guidelines for the submission of your abstract. Please note that an abstract processing charge (APC) of €40 gross per abstract is levied (deadline: 11 January 2017). As of this year, the APC is also charged for abstracts submitted to the programme group Educational and Outreach Symposia (EOS). Abstracts submitted to the GIFT workshop are exempted from this rule. Late abstracts (submitted by conveners until 20 January 2017) require a final approval by the programme committee and will be invoiced with €80 gross.

- Use a text editor of your choice to compile your abstract: title, author(s), affiliation(s) of author(s), and abstract text. Your abstract text should have 100–500 words;
- Browse through the session programme and select the session of your interest;
- Use the Abstract Submission link at the respective session. Please keep in mind that submission of the same abstract to more than one sessions is not allowed. Duplicates will be rejected;
- You will be asked to log in to the Copernicus Office Meeting Organizer. Use your account data or create a new account;
- Fill in the submittal information about title, author(s), and affiliation(s) of author(s);
- Choose between plain text, LaTeX, or Word content with regard to the abstract text;
- Please remember that a LaTeX submission only refers to general LaTeX commands directly inserted in the form (e.g. formatting commands like superscripts and subscripts, and special characters). Style packages and environment commands cannot be considered and must not be included in the form;
- Copy-and-paste your information into the form or download and use the WORD template;
- Select your preference for poster presentation or for oral presentation (see the first author rule below). However, there is no guarantee that an oral preference can be realized. If a session is identified as a PICO session, the oral/poster preference cannot be selected;
- Accept the licence& copyright agreement and proceed to the abstract preview;
- Check the generated PDF file of your edited and formatted abstract. Please note that this PDF is only a preview file (indication "PREVIEW" is highlighted in the abstract header) in order to enable you to check the input. Close the PDF preview and click on "Payment" to proceed;
- In case of a successful submission, a confirmation message including your abstract number will be displayed and you will receive an abstract submission confirmation email;
- If the conversion of your abstract fails, please specify your problems and we will then take care of them;
- In any case, please indicate your invoice details for the APC (see below) as well as your payment method (credit card or PayPal);
- Submit your abstract. You will receive a confirmation email providing your abstract number.

In case any questions arise, please do not hesitate to contact us at: [egu2017@copernicus.org](mailto:egu2017@copernicus.org)