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Relative chronology of deep circulations within the fractured basement of the Upper Rhine Graben

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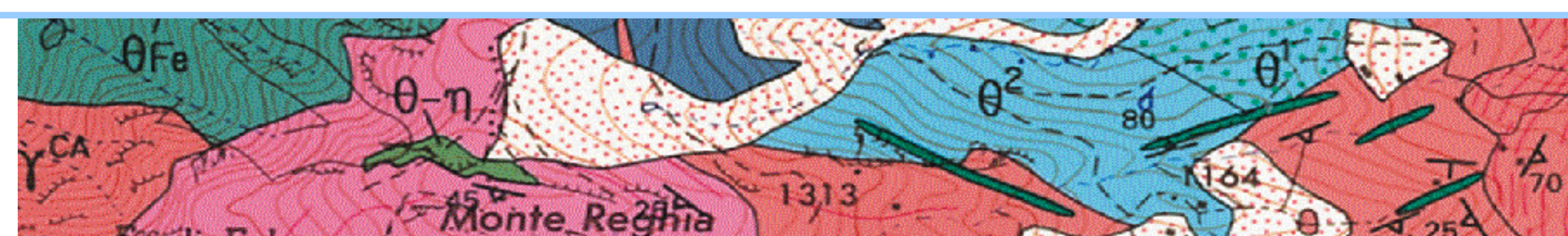
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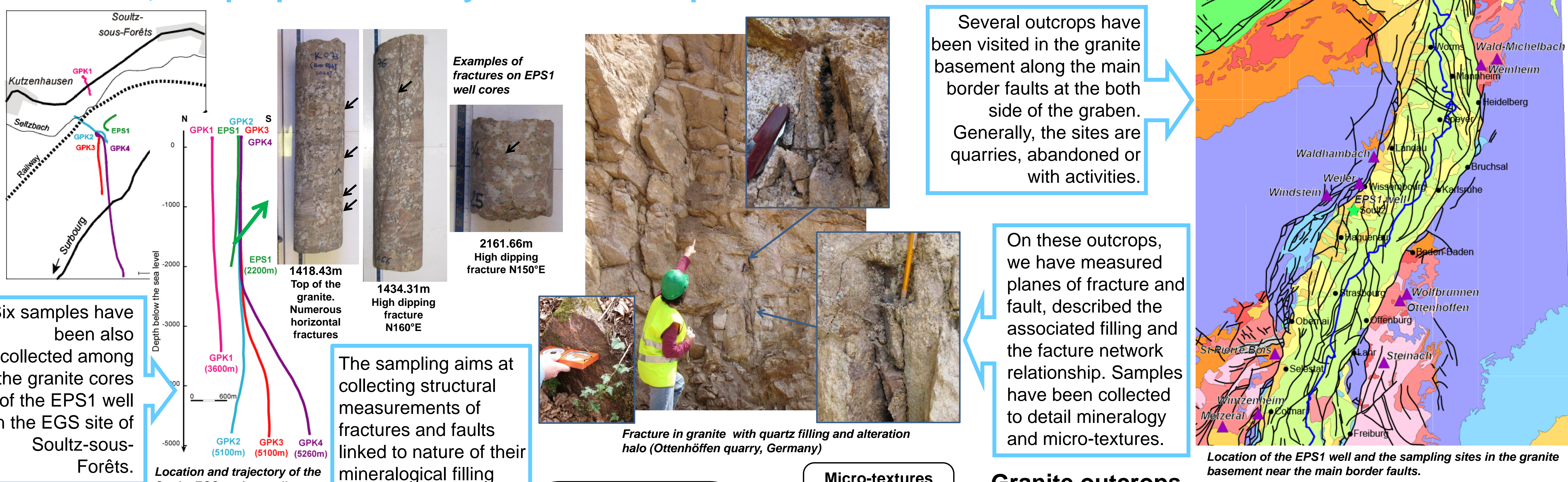
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Relative chronology of deep circulations within the fractured basement of the Upper Rhine Graben

In the Upper Rhine Graben, geothermal projects are strongly under development, especially for the exploitation of fluid within the top of the basement. In order to better understand the hydraulic behaviour of the fractured crystalline basement for the development of geothermal reservoir, we propose to study the nature of palæo-circulations.



Six samples have been also collected among the granite cores of the EPS1 well on the EGS site of Soultz-sous-Forêts.

The sampling aims at collecting structural measurements of fractures and faults linked to nature of their mineralogical filling

Fracture in granite with quartz filling and alteration halo (Ottenhöffen quarry, Germany)

Micro-textures observed under microscope

Granite outcrops

The global orientation of the fracture measured on the field in the granite basement on the shoulders shows different sets :

- NW-SE associated to N20°E and E-W in the southern part and at Windstein and Waldhambach
- E-W at Saint-Pierre-Bois and Wolfbrunnen
- N-S associated with E-W direction set in the Odenwald

Waldhambach NW-SE fractures:

- 1) shear/cataclasis with sericite mass/granite clasts, 2) quartz filling, 3) Fe-bearing carbonates, 4) dolomite/ankerite, 5) barite

Windstein NW-SE fractures :

- 1) quartz vein, 2) cataclasis

Windstein N-S fractures :

- 1) ill + μ Qtz

Saint Pierre Bois E-W fractures :

- 1) cataclasis

Wintzenheim NE-SW fractures :

- 1) Qtz infilling, 2) cataclasis

Metzeral N170°E fractures :

- 1) radial illite

Wolfbrunnen E-W fractures :

- 1) cataclasis, 2) quartz filling

N-S fractures :

- 1) cataclasis, 2) quartz/silica coating

Ottenhöffen NW-SE, E-W fractures :

- 1) cataclasis, 2) microquartz filling

N-S fractures :

- 1) cataclasis, 2) quartz/silica coating

Direction of fractures measured on the granite outcrops and in the granite cores of EPS1 well. Rose diagram of strike direction with 10° classes. Contour-density diagrams in Schmidt's projection, lower hemisphere: 10%, 30%, 50%, 70%, and 90% of the maximum frequency.

The analyses of the palæocirculation in the granite basement show several stages of fracturing following by several pulses of fluid circulation.

On the cores of the Soultz well EPS1, numerous fractures have been observed (almost 3000 on 800m of borehole cores). Because of the long geological history of the granite, most of fractures are reactivated at different tectonic phases.

The determination of fracture infillings shows that some types of filling may be linked to the main identified fracture set directions

cataclasis including microquartz and illite in N45°E direction

Fe-rich dolomite in N-S direction

Synthesis of micro-texture observations

Synthesis of main fracture directions in the granite with associated filling

Diagenetic sequence of fracture infillings in relation with the main tectonic phases

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Tension radial Illite

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Dolomite

Cataclasis Illite+Quartz; Dolomite

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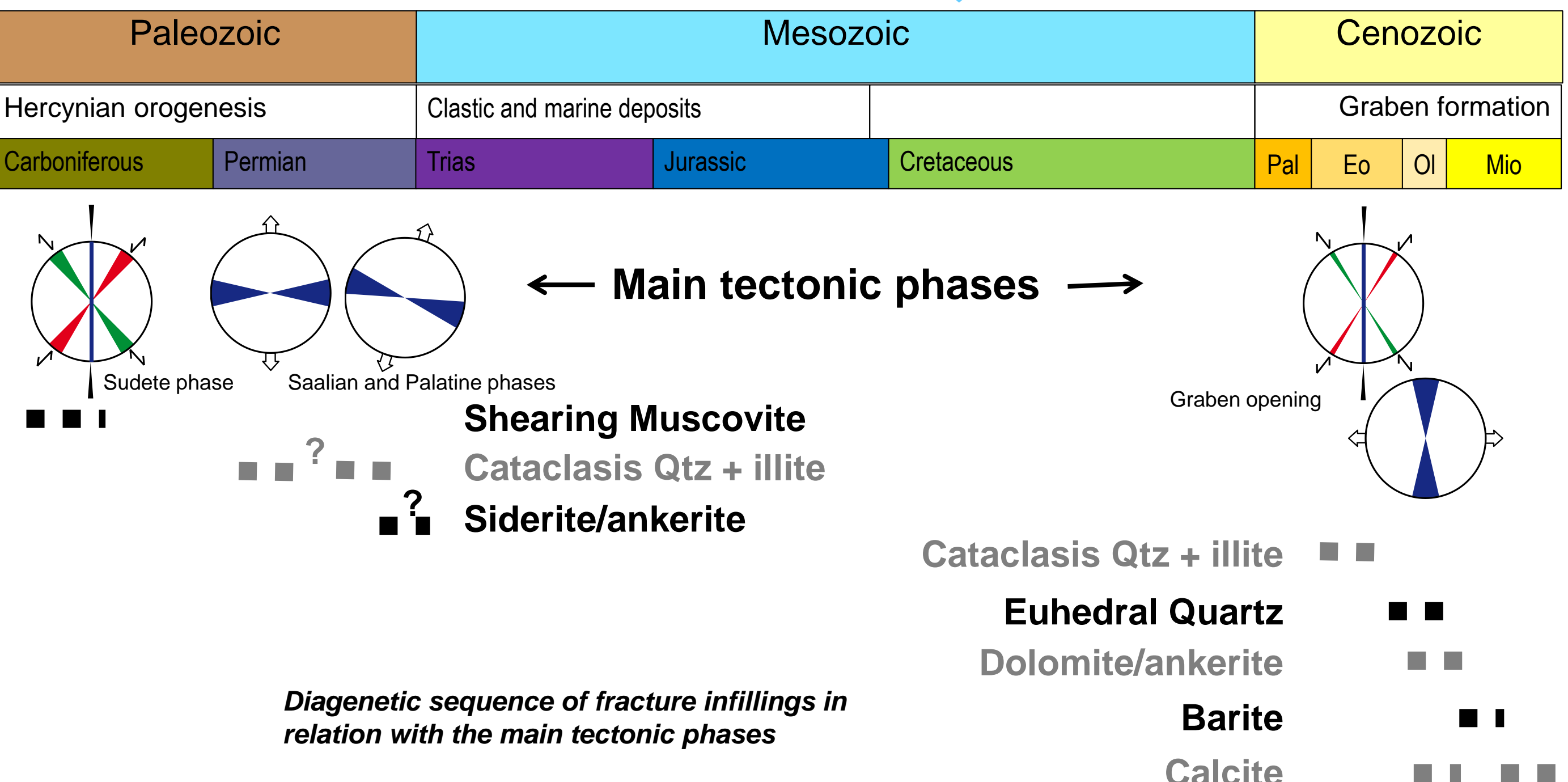
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Cataclasis Illite+Quartz; Dolomite



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