3D Geometries of hydrothermal fluid flow paths in a dextral strike-slip fault, Grimselpass

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Geological background

The study area is located in the Aar Massif in the southern part of Switzerland. The terrain is dominated by a host of granitoid rocks which are metamorphosed in the Greenschist facies. Two phases of deformation - the Handegg (early reverse faulting) and the Oberaar (strike slip) phase occurred. The last vestiges of Paleohydrothermal fluid flow have been dated at 3 Ma. The natural plumbing is suspected to exist until a depth of about 4 km below the surface.

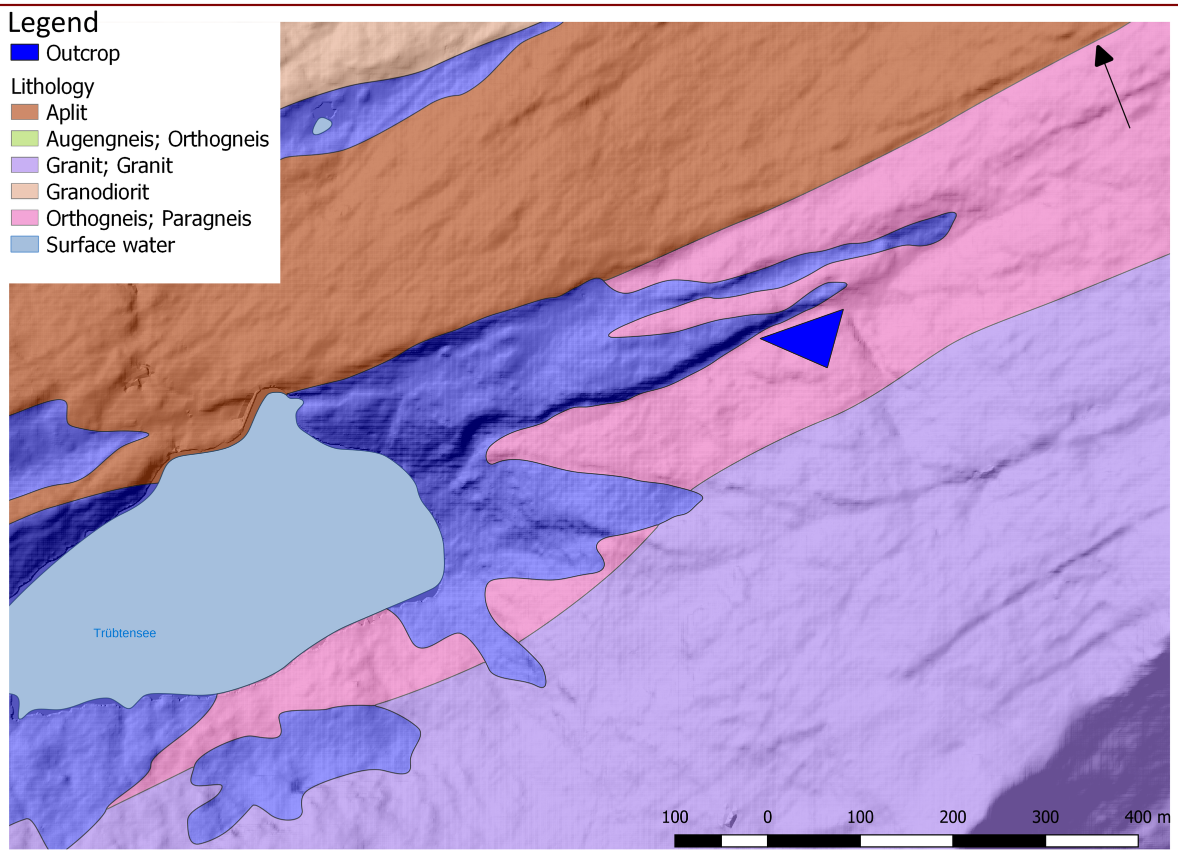
Aims and Objectives

-Identification of fluid proxies and hydrothermal markers in the Grimsel Breccia Fault

- Delineation of fault architecture to characterize flow geometries
- Generation of a 3D model
- The end goal being a total evaluation of fluid paths in a large scale strike-slip fault.

Methodology

The various methods employed for this study include fieldwork and mapping at a multitude of scales, quantifying hydrothermal activity within the study area and analysis of fracture network. The data can be documented and presented using QGIS. Next, generating a 3D model using this data. The software used for 3D modelling is MOVE^{TM} by Petex. In order to do so, structural data will be fed into the 3D model for precise geometric correlation. They include drone images, field photos along with satellite data (major focus on the first two).



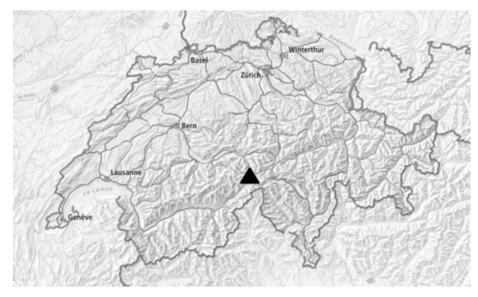


Fig 1 - a lithological map of the study area (left)

Fig. 2 (top) - a general map indicating the study area in the Grimselpass

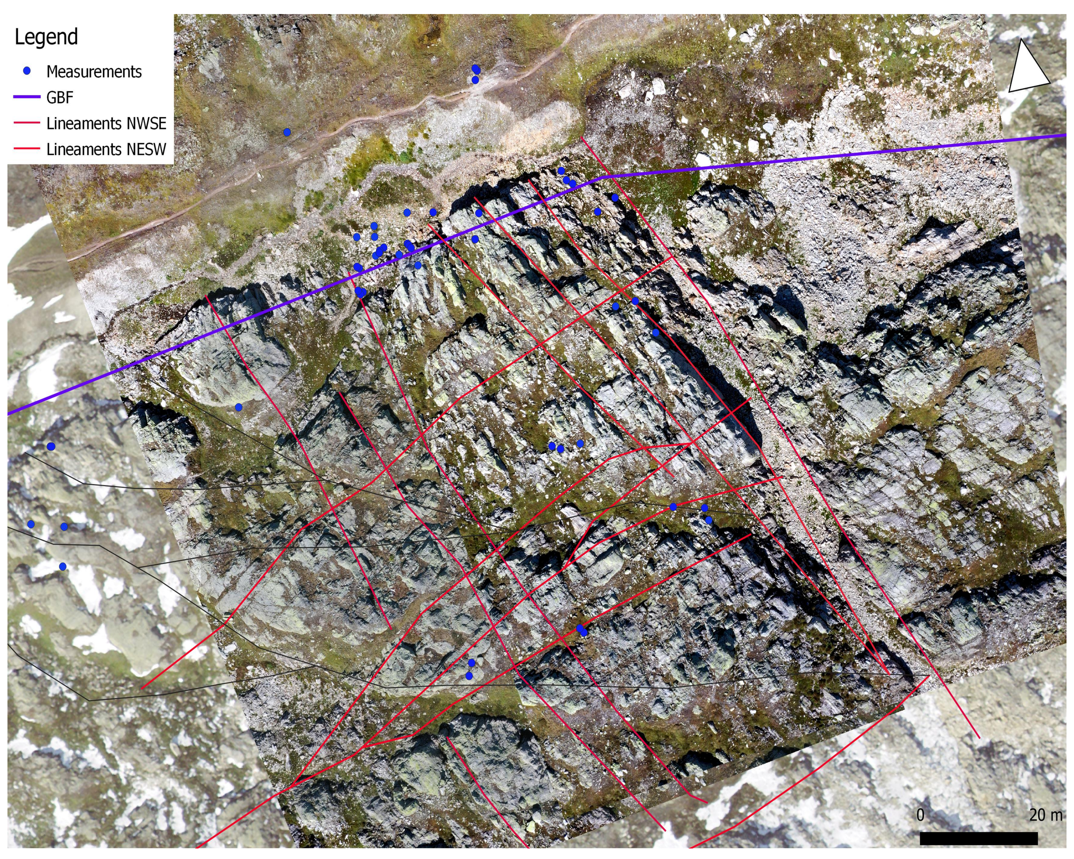
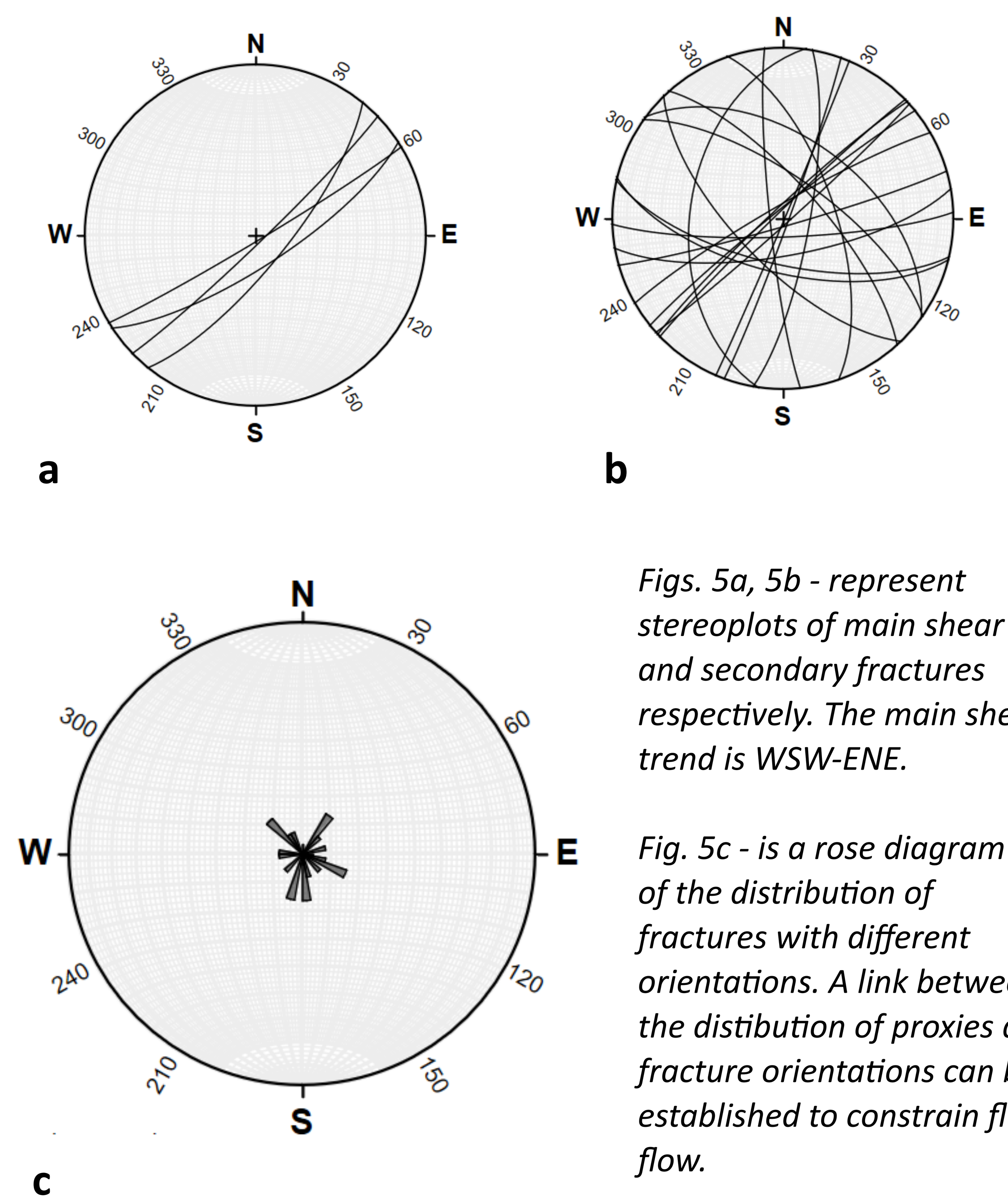


Fig 2 (top left)-*Hydrothermal breccia is (at m scale) fractured as a result of overwhelming fluid pressure.*

Fig. 3 *(top right) - Microcrysralline Quartz (cm to dm scale). A major proxy for fluid flow.*

Fig. 4 (left) - *The Grimsel Breccia fault (m to km scale) - a look at how mapping would work. At the smaller scales, more extensive mapping is needed. Hundreds of fractures are already in process. This map shows a scale of about 100 m in both directions. The red lines represent the major faults and the blue dots are measurement locations.*

Results - Stereoplot



Figs. 5a, 5b - represent stereoplots of main shear and secondary fractures respectively. The main shear trend is WSW-ENE.

Fig. 5c - is a rose diagram of the distribution of fractures with different orientations. A link between the distibution of proxies and fracture orientations can be established to constrain fluid flow.

Conclusion and Outlook

The preliminary results obtained include - the fracture orientation and distribution, and the distribution of proxies around the study area. A further study would be undertaken to measure the frequency of proxies at the smaller scale.

The 3D model is expected to provide many more insights into the flow geometry.

References

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