Evidence for a two-stage brittle tectonic evolution from fault analyses in the Horn Basin (SE Bohemian Massif)

10-13/09/2022
PANGEO AUSTRIA 2022
MONTANUNIVERSITÄT LEOBEN

Eva-Maria Ranftl [1)], Reinhard Roetzel [2)], Esther Hintersberger [1)] & Manfred Linner [1)]

Geologische Bundesanstalt

Abstract:

We provide an overview of faults and nappe boundaries mapped during the ongoing geological mapping project on sheet Horn in the southeastern Bohemian Massif. The tectonic boundary between the Moldanubian and the Moravian Superunit, the Moldanubian Thrust, roughly defines the northern and eastern margin of the Horn Basin structure. At this tectonic contact, Moldanubian mica schist overlies the Moravian granodioritic Bíteš Gneiss. However, younger brittle deformation produced the area's recent geomorphology.

The eastern marginal faults of the Horn Basin have been the focus of brittle tectonics assessment. Several fault segments and smaller-scale faults were mapped in detail to gain an insight into the tectonic evolution of the basin. Faulting activity of the approximately N-S trending structures on the eastern margin was initiated by left-lateral strike-slip displacement along the NE-SW trending Diendorf Fault System. This resulted in extensional duplexes with left-lateral strike-slip faulting and associated vertical displacement with top -> E (cf. Decker, 1999). Causing also steepening of mica schist and Bíteš Gneiss foliation, this deformation phase mainly formed the tectonic windows of Moravian Bíteš Gneiss in Moldanubian rocks. Additionally, dextral antithetic Riedel shearing relating to the Diendorf fault was observed at few locations. Reactivation of the N-S trending faults during at least one younger deformational phase afterwards shaped the recent geomorphology of the basin. A roughly E-W directed extensional regime was observed at the eastern margin in many outcrops by means of tension gashes, conjugate joint sets and normal faults. Furthermore, altitude correlation of Oligocene—Neogene sediments proposes post Egerian—Ottnangian normal faulting activity, mainly westwards, during this late extensional phase.

The evolution of the E-W orientated northern margin of the Horn Basin is less known; clearly, it shows intense brittle deformation close to the Moldanubian Thrust. Brittle normal faults are either running E-W or represent NW-SE to N-S trending conjugate fault sets. The NW-SE trending ones presumably are the result of displacement along original joints, since joints mostly trend NW-SE or NE-SW and synkinematic quartz recorded oblique-slip shear sense. The creeks and valleys often seem to follow the NW-SE orientated brittle structures. Additionally, steep dip of mica schist foliation may indicate strike-slip activity along the E-W trending northern margin of the basin. Remnants of Miocene sediments again suggest later southward subsidence in or after early Eggenburgian times and Pleistocene to Holocene debris flows from the northern as well as the eastern margin of the Horn Basin reflect landscape response to faulting and denudation of the fault scarp.

The investigations reveal a two-stage brittle tectonic evolution of the marginal faults of the Horn Basin. An early-stage brittle-ductile strike-slip activity, probably late Carboniferous to early Permian, could be shown for the N-S trending faults, which is probably triggered by the Diendorf Fault System. The late-stage subsidence and basin formation took place during an E-W directed extensional phase with displacement from Egerian—Ottnangian onward. The data on fault geometry, kinematics and, as far as possible, timing of tectonic activity were added to the fault database of the Geological Survey of Austria (GBA).

Tectonic overview:

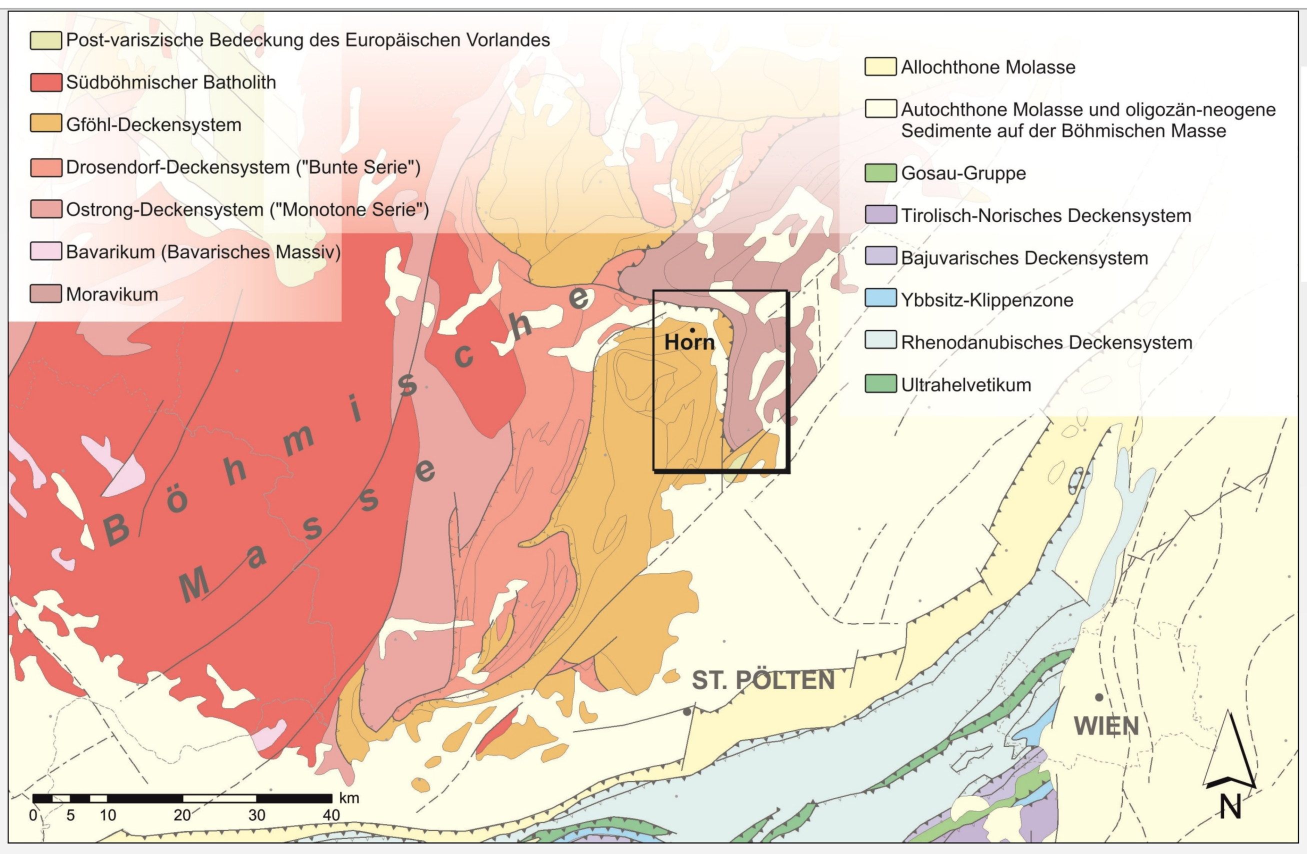


Fig.1: Geographic and tectonic overview of the investigated area close to the tectonic boundary of Moldanubian (Gföhl nappe system) and Moravian superunits. The black rectangle area around the town of Horn is also shown in figures 2 and 4.

Tectonic boundaries map sheet Horn, examples for deformation:

Fig. 2: All tectonic boundaries on map sheet Horn, including the investigated faults of the eastern and northern margin of the Horn Basin. The Breiteneich Fault, Maria Dreieichen Fault, Mörtersdorf Fault, Schönberg Fault and the Kriegenreith Fault to the east had been the focus of brittle tectonic assessment. Field mapping along the northern margin of the Horn Basin and the Mödring Fault gave more insights into the tectonic activity there.
The pictures show outcrop examples of weathered grey fault gouge, a quartz vein and synkinematic fibres.

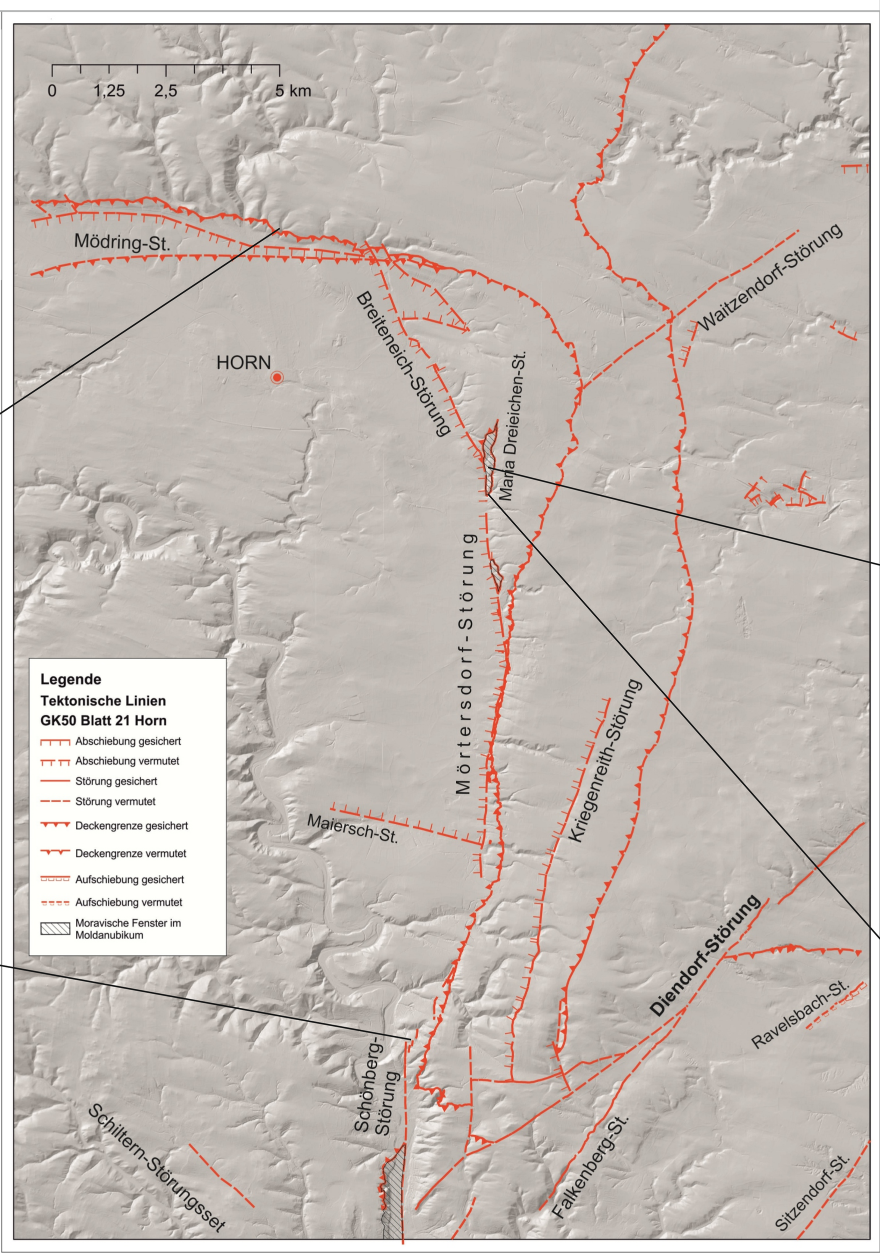


Fig. 2a: Synkinematic quartz fibres on a original joint, which was tectonically activated later (Bíteš Gneiss).

Fig. 2b: Weathered grey fault gouge (paragneiss).

Fig. 2c: Intensly deformed Bíteš Gneiss.

Fig. 2d: Vein with horizontally grown synkinematic quartz, parallel to steep schistosity of Bíteš Gneiss.

Outcrops of faults at the northern margin of the Horn Basin:

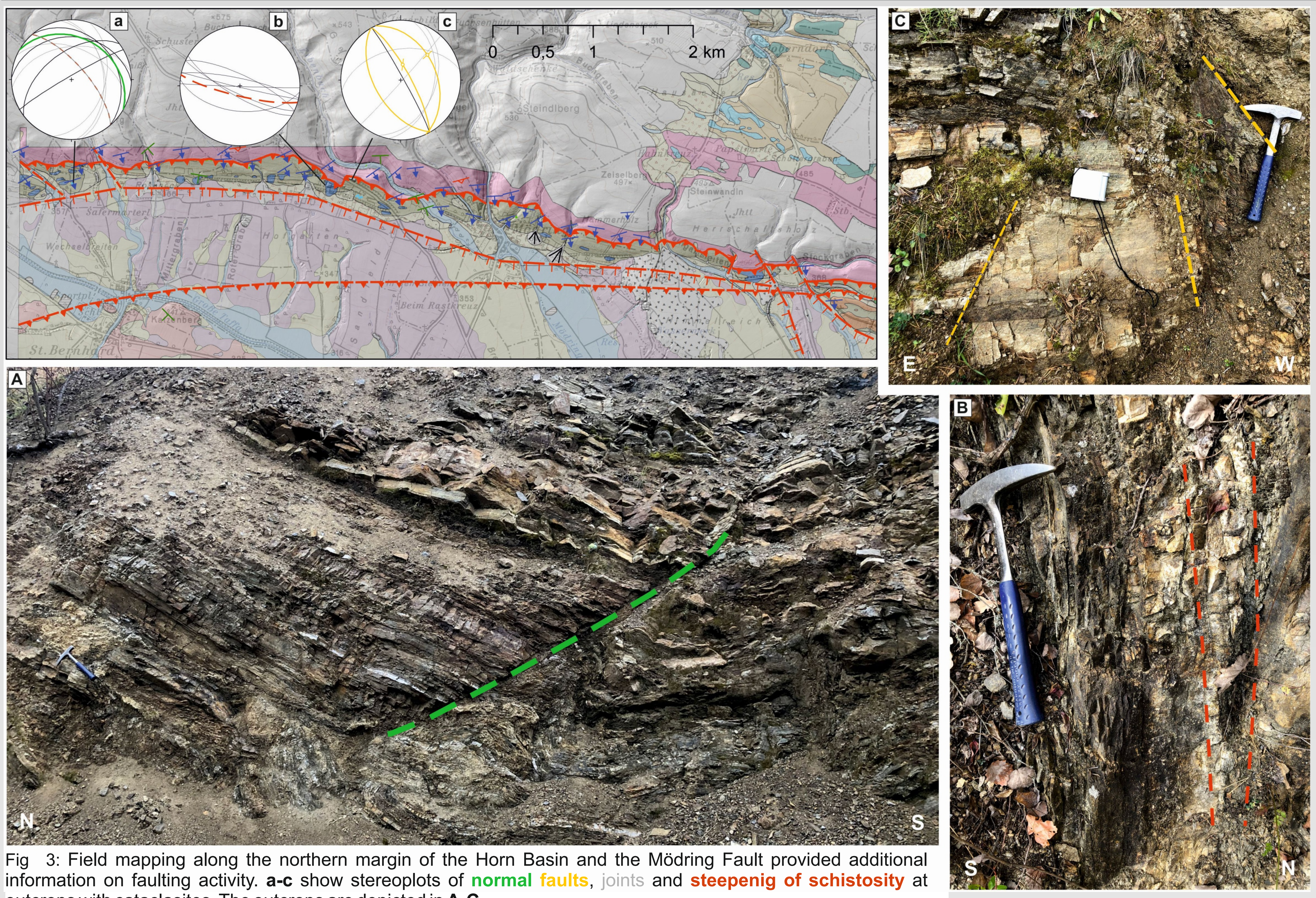
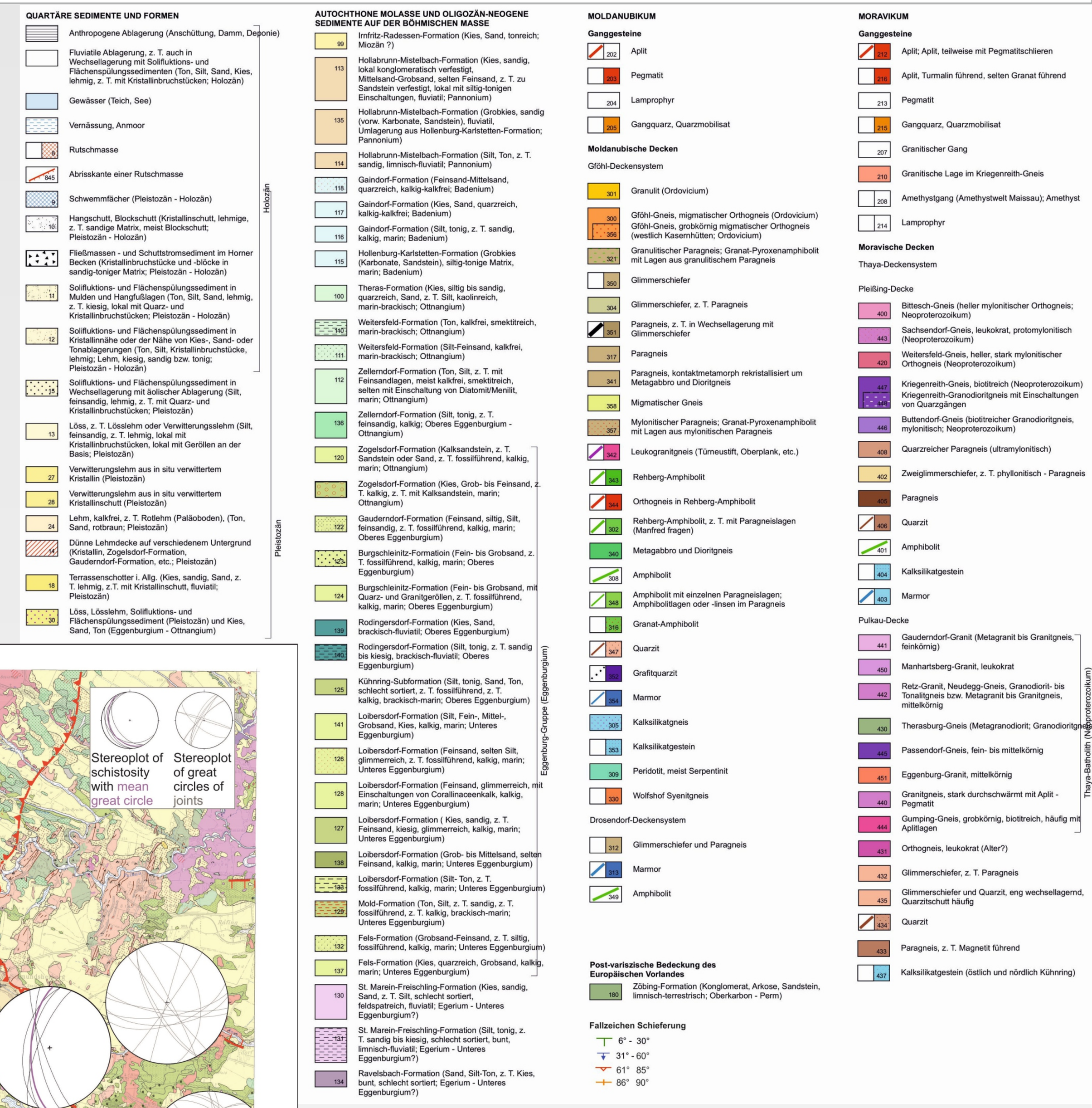


Fig 3: Field mapping along the northern margin of the Horn Basin and the Mödring Fault provided additional information on faulting activity. **a-c** show stereoplots of **normal faults**, joints and **steepenig of schistosity** at outcrops with cataclasites. The outcrops are depicted in **A-C**.

Manuscript map and overview plots of schistosity and joints:



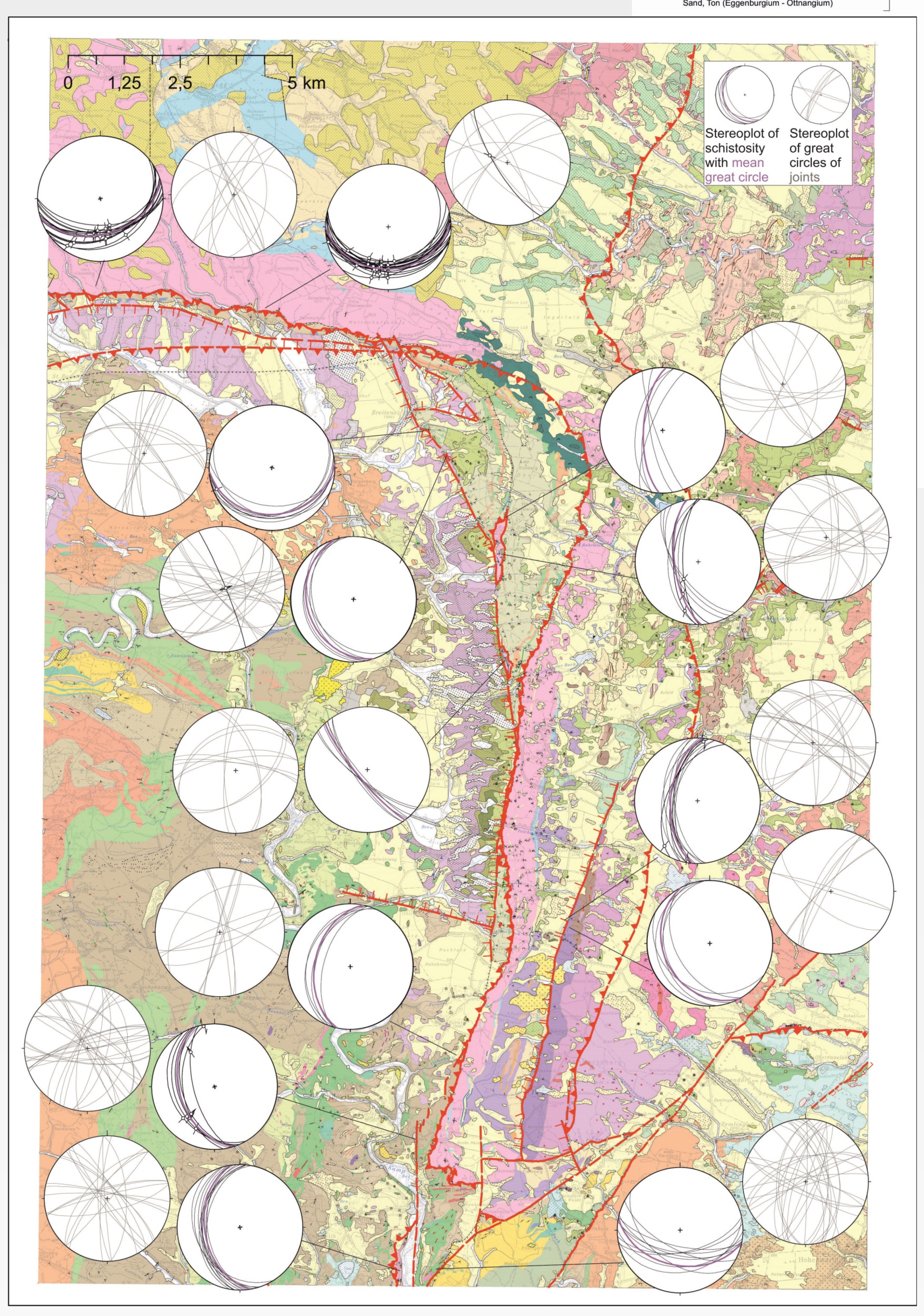


Fig. 4: Manuscript of geological map sheet Horn (GEOFAST compilation in process, August 2022). Stereoplots of great circles of measured schistosity and joints at various locations and legend of geological units to the right.

[1)] Department of Hard-Rock Geology, Geological Survey of Austria, Neulinggasse 38, 1030 Vienna, Austria.

[2)] Department of Sedimentary Geology, Geological Survey of Austria, Neulinggasse 38, 1030 Vienna, Austria

References

GEOFAST Project: Compilation of selected archive maps and map manuscripts. Map sheet number 21 Horn in proc. – Geological Survey of Austria, Neulinggasse 38, 1030 Vienna, Austria.
Decker, K. (1999): Tektonische Auswertung integrierter geologischer, geophysikalischer, morphologischer und strukturgeologischer Daten. – Geogenes Naturraumpotential Horn-Hollabrunn, Projektbericht. – GBA, Wien.