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Magnetic fabric study of rock deformation during alpine tectonic evolution on a cross section through the Eastern Alps (Austria)

K. Gruber, R. Scholger, and E. L. Pueyo

Department of Applied Geological Sciences and Geophysics, Chair of Geophysics. Univ. of Leoben. Paleomagnetic Laboratory. Leoben, Austria.

Measurements of anisotropy of magnetic susceptibility (AMS) were carried out on samples from more than seventy sites collected in the Eastern Alps. The sites were taken alongside a North-South transect (about 15°30‘ East Longitude) from Scheibbs in the North to Kapfenberg in the South, comprising most of the Northern Calcareous Alps (NCA) nappes, Helvetic and Penninic Flysh units as well as the greywacke zone. Samples were taken in detail mostly in Mesozoic rocks of the NCA, from North to South: Bajuvaric (Frankenfels, Lunz, Sulzbach and Reisalpen nappes), Tirolic (Ötscher, Göller, Rotwald-Gindelstein nappes) and Juvavic (Mürzalpen nappe) system. Two to six sites per thrust sheet or nappe were analysed for a structural investigation of the relationship between magnetic fabric and tectonic strain.

Standard paleomagnetic drill cores were taken. All measurements were performed in the Petrophysics and Paleomagnetic laboratories of the University of Leoben using AGICO MFK1-Kappabridge susceptibility system and a 2-G cryogenic magnetometer. Statistical evaluation of the AMS data was perfomed using the software package AGICO ANISOFT 4.2. (Chadima et al., 2009).

Throughout the Eastern Alps transect distinct changes of the magnetic fabric are observed. Primary sedimentary fabrics and very low susceptibility values are dominant in most cases in the northernmost and southernmost part of the transect. Some inverse fabrics were found in few sites of the nappes and the percentage increases towards the south which might be related to tectonic events. Contrastingly, isotropic fabrics dominate in the middle part.

The Helvetic and Penninic Flysh units yield in general weak oblate fabrics. A few sites show a tendency to inverse fabrics which indicate the presence of a certain amount of strain within this unit. The oblate fabrics of the Helvetic and Flysh units show either shallow NE dipping or slightly steeper SW dipping k1-axis orientation. Within the inverse fabrics, even steeper NE or SW dipping k1-axis are present. In a previous paleomagnetic study of the same samples (Pueyo et al., 2002) both, primary and secondary remanent magnetization vectors were observed. No significant rotations were detected in the Flysh units.

All samples from the Bajuvaric system show dominantly very low susceptibility values and isotropic fabrics and were therefore excluded from further investigations. Bajuvaric nappes hardly show any significant rotations based on paleomagnetic data (Pueyo et al., 2002).

The nappes of the Tirolic and Juvavic systems have very low susceptibility values but they increase slightly towards the south. The shape of the anisotropy ellipsoid remains oblate (group A) in most cases and the degree of anisotropy is very weak. Also more prolate fabrics (group B) are present. Group A and B show a trend to shallow N or S dipping k1-axis in the North. Further in the south the k1-axis of group A tend to dip steeply NE. Shallow NE or SW dipping and slightly steeper NE or SW dipping oriented prolate susceptibility ellipsoids are dominant in group B. Tirolic and Juvavic units display clockwise rotation ranging between 30 and more than 100° (Pueyo et al., 2002), which was assigned to block rotation.

Shallow E dipping and NNW dipping oblate susceptibility ellipsoids are dominant in the Basement. A gen-

eral increase of the degree of rotation (Pueyo et al., 2002) as well as better defined susceptibility ellipsoids with mainly oblate fabrics towards the south can be observed.
Six Tertiary deviatoric paleostress tensor groups are described by Peresson & Decker (1997). The new AMS data will be presented and correlated to the young tectonic history of the Eastern Alps. The study was funded by the Austrian Academy of Sciences (ÖAW) in the frame of the Geophysics of the Earths Crust Programme.

Peresson, H. and Decker, K., 1997. The Tertiary dynamics of the northern Eastern Alps (Austria): Changing palaeostresses in a collisional plate boundary, Tectonophysics, 272, 125 – 157.

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