4th International Geologica Belgica Meeting

September 11-14, 2012
Brussels, Belgium

ABSTRACT BOOK

MOVING PLATES AND MELTING ICECAPS Processes and Forcing Factors in Geology

Paramagnetic metamorphic mineral assemblages controlling AMS in low-grade deformed metasediments and the implications with respect to the use of AMS as a strain marker

Session 11 12

Haerinck T.¹, Adriaens R.¹, Debacker T.N.², Hirt A.M.³, Sintubin M.¹

→ tom.haerinck@ees.kuleuven.be

1 Department of Earth and Environmental Sciences, Katholieke Universiteit Leuven, Belgium

2 F.W.O.-Vlaanderen, Belgium

3 Institute of Geophysics, ETH Zürich, Switzerland

A regional, integrated analysis of the low-field and high-field anisotropy of magnetic susceptibility (AMS), of the (magnetic) mineralogy and of the geochemistry has been performed on low-grade metamorphic, deformed homogeneous siltstone beds (HSBs) of the Lower Palaeozoic Plougastel Formation in the Central Armorican Domain (CAD), Brittany, France. Despite the fact that we sampled a single bed type, different paramagnetic metamorphic mineral assemblages are controlling the AMS in the anchizonal metamorphic, Crozon peninsula sites (white mica and chlorite) and in the epizonal metamorphic, inland sites of the CAD (white mica, chloritoid and chlorite).

We show that the AMS of the HSBs reflects a composite magnetic fabric, resulting from the progressive superposition of a cleavage-parallel fabric on a pre-existing bedding-parallel compaction fabric. Both the Crozon peninsula and the inland datasets show a hockey-stick shaped pattern on a Jelinek graph, in which the shape parameter T is plotted against the corrected degree of anisotropy P_j , although the whole pattern is shifted to higher P_j values for the inland dataset (Fig. 1). We tentatively attribute this shift to the intrinsic AMS of chloritoid which we have proven to be significantly higher than the intrinsic AMS of white mica and chlorite. For both Crozon and inland datasets, the southern sites show relatively low P_j and T values compared to the northern sites. This suggests a northward-increasing strain gradient for the CAD, in line with the overall geodynamic model of the “Bretonian” convergence of the CAD with the Léon Domain, situated to the northwest of the CAD (cf. Sintubin *et al.* 2008, Ballèvre *et al.* 2009).

However, the different investigated sites also show an internal spread in P_j and T values that seems to be linked to the observed quartz/white mica ratio. We attribute this relationship to non-platy quartz that disrupts the petrofabric intensity. Also, high-field torque magnetometry indicates that the (low-field) P_j and T values in two inland sites (i.e. in site 3 and partly in site 5, see figure 1) are enhanced by a small ferromagnetic (*s.l.*) contribution.

Our findings show that the P_j and T values of the HSBs are strongly influenced by (small) compositional variations and do not merely indicate tectonic strain, even in very similar tectonostratigraphical settings. Therefore, the observed differences in AMS parameters cannot be compared quantitatively in terms of tectonic strain.

Ballèvre, M., Bosse, V., Ducassou, C., Pitra, P., 2009. Palaeozoic history of the Armorican Massif: models for the tectonic evolution of the suture zones. *Comptes Rendus Geosciences* 341, 174–201.

Sintubin, M., van Noorden, M., Berwouts, I., 2008. Late Devonian-early Carboniferous contraction-dominated deformation in Central Armorica (Monts d'Arrée, Brittany, France) and its relationship with the closure of the Rheic Ocean. *Tectonophysics* 461, 343–355.

Fig. 1: Plot of T versus P_j , showing a hockey-stick shaped pattern both for Crozon peninsula sites (anchizonal mineral assemblage) and for inland sites (epizonal mineral assemblage).