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Influence of partial melting on magnetic fabrics of migmatites: evidence from Paleoproterozoic terrains of Pointe Géologie, Terre Adélie (East Antarctica)

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A magnetic structural mapping using Anisotropy of Magnetic Susceptibility (AMS) technique was carried out in Pointe Géologie archipelago (Terre Adélie, East Antarctica) that represents a deep crustal section affected by intensive anatectic processes during Paleoproterozoic times, 1.69 Ga ago. This generated different High Temperature rock types such as: migmatites including leucosomes and melanosomes, coarse-grained pink granites dyke and anatexites. Magnetic mineralogy study shows that oxide minerals are mainly large and solid state deformed grains of magnetite. In the leucosomes, oxides appear more scattered than in the melanosomes and their rounded isometric shape suggests rotations of the former elongated grain during melt segregation. This contrasted magnetite grains distribution will generate specific AMS signatures for melanocratic layers on the one hand and felsic leucosomes, dykes and anatexites on the other hand. The mean magnetic susceptibility (Km) and the anisotropy degree (P') are higher in the gneisses and much lower in granitic samples. Orientation of principal susceptibility axes also differs. In migmatitic gneisses, magnetic foliations are coherent with the local and regional structural pattern. Nevertheless AMS technique provides complementary information on the orientation of lineations when they are difficult to observe in the field. The magnetic lineations are dominantly sub-horizontal in the shear zone while they tend to be vertical in granitic dykes, anatexites and well-defined leucosomes. Such a changing of orientation is related to a rheological contrast between the solid-state deformation suffered by the oxide grains and their reorientation in a viscous flow during the aggregation of felsic melt. Increasing amounts of partial melting lead to a loss of the rock cohesion related to the migration of the melt trough a solid-state made of previously deformed minerals. Thus the former tectonic structures will be progressively erased. Melt segregation and transfer occur under a viscous flow regime, mainly driven by gravity forces. In such a regime, the well-defined leucosomes, dykes and anatexites will develop a magnetic fabric corresponding to the upward transport of magmas. There, AMS measurements can better map the mass transfers associated with intensive melting at peak temperatures and to characterize the general framework of a warm and buoyant lithosphere. Hence, rheological changes related to partial melting generate strain partitioning between gneisses and strongly melted rocks in a regional transpressional tectonics context such as suffered by the Pointe Géologie terrains.