AMS variation across a small-scale shear zone in granite -influence of the composite planar fabric

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In order to compare strain variation and the fabric of mylonitized granite with anisotropy of magnetic susceptibility (AMS), we measured AMS of a large slab subparallel to the XZ plane from one half of a typical small-scale ductile shear zone on Teshima Island, Seto Inland Sea. The analyzed slab is composed partly of S-C(-C') mylonite derived from magnetite-free Ryoke-type foliated biotite granodiorite. The width of the slab is 35 cm from its weakly deformed margin to the fine-grained planer high-strain zone at the opposite margin which shows a sigmoidal arrangement of the S foliation giving a dextral shear sense. Based on the AMS measurements from 25 cylinder- samples taken from the slab, we obtained the geometrical relationship of Kmax (the maximum magnetic susceptibility) and Kmean with respect to the distance from the shear-zone center and to the occurrence of the S-C fabric. The modal amount and fabric of paramagnetic phyllosilicate having lattice-dependent magnetic properties in magnetite-free granitic rocks can control AMS. In the whole sample, the direction of Kmax is almost parallel to S, suggesting the orientation of Kmax is concordant with biotite arrangement. However, division of three domains (A,B and C from the shear-zone core to the margin) can be done on the basis of characteristics of planar fabrics and of the AMS. In the C zone (14-32cm) where only the S foliation is developed (angle between Kmax and C =26-45 degree, Kmean is largest (122-178 in 10-6 SI) and Pj (anisotropy degree) is 1.06-1.09 larger than those in the B zone (8-14 cm, Kmean=99-116; Pj=1.06-1.07) where both S and C' (major scale shear band) is developed. This must be explained by the coarser-grained biotite fabric parallel to S is strong in the C zone compared to the B zone where the composite planar fabric is developed in a relatively random fabric. In the A zone (0-8cm) where both C and C' (minor scale extensional crenulations), and fine-grained biotite-feldspar aggregate layers are developed, Kmean is smaller (101-123) than that in the C zone, however Pj is larger (1.10-1.12) than that in the C zone. This is presumably because fine-grained biotite flakes tend to arrange parallel to the C plane and results in the largest magnetic anisotropy in the ductile shear zone center. Our results strongly suggest that the variation of AMS across a ductile shear zone reveal not only the trace of S foliation but also the influence of composite planar fabrics.