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Control of fault shearing on the fabric of a syn-tectonic granite : magnetic fabric and crystallographic preferred orientation (CPO) of quartz input

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The late-Miocene monzogranitic pluton of Porto Azzurro (PA) on Elba Island (Italy), was emplaced in the footwall of the N-S striking Zuccale Fault (ZF), a Low-Angle Normal Fault (LANF). In the Barbarossa outcrop, this poorly exposed pluton shows few NNE-SSW and WNW-ESE striking shear bands, respectively moderately dipping eastward and steeply dipping northward, which appear to be associated to the brittle fracturation, and no clear relationship between all these structures and the ZF is described. In order to get information about possible relationship between these shear bands, brittle structures and prior fabric of this igneous stock, and about the timing of formation of these ductile deformations relative to the pluton emplacement, rock fabrics were studied on samples taken both inside and outside of one of these shear bands. The magnetic fabric was analyzed with anisotropy of magnetic susceptibility measurements (AMS), and the crystallographic preferred orientations of dynamically recrystallized quartz were measured with the electron back-scattered diffraction (EBSD) method. Quartz CPOs are directly compared, after EBSD data processing, with the macroscopic ductile structures orientation, according to the geographical North. The pooling of data of these two methods reveals two distinct petrofabrics within the Barbarossa monzogranite. The first fabric, with a low dip angle, is identified only on samples taken outside of the influence of the shear bands. Orientation of paramagnetic minerals, with biotite as the main magnetic mineral carrier, and quartz CPOs are consistent, pervasive within the whole outcrop and are linked to the eastward extension produced by the LANF Zuccale Fault. This fabric suggests that the dynamic of the magmatic supplies during emplacement of the pluton of PA was controlled by the LANF's extension, and confirms this magmatic intrusion to be likely syn-tectonic. The second fabric is identified close or within the studied shear bands with a similar orientation to them. Our data show that these ductile structures impose a local new tectonic fabric overprinting the pre-existing one. The common re-orientation of the magnetic minerals, of the recrystallized quartz and of the brittle structures suggest a strain localization and a continuous strain process localized along stain bands from late-magmatic flowing, highlighted by biotite orientation, then during shear bands activation, at temperature around 350-400° C. Finally, these structures would have remained active through the ductile-brittle transition, leading to the localized intense fracturation of the Barbarossa outcrop.