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An example of a natural laboratory for studying the microstructural and petrophysical properties in mylonitic leucogneiss

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In the southern border of the Calabrian Peloritani Orogen (southern Italy) near to the mount Montalto, a thick alpine shear zone crops out interposed between two units: the Aspromonte Unit at the top and the Madonna di Polsi Unit at the bottom, respectively. The crustal-scale shear zone involves different rock types of these two units and can be considered as a natural laboratory for studying the changes in microstructural features and elastic properties of progressively deformed mylonitic rocks.
In order to evaluate the relationship between rock fabric and seismic anisotropy, we collected a suite of myonitic leucogneiss belonging to the Aspromonte Unit. They are mostly made up of Qtz+Ab+Wm+Kfs together with subordinate amounts of Bt+Ep+Chl+Tur. The texture of these leucocratic gneisses ranges from weakly deformed mylonite to ultramylonite; the progressive mylonitization is demonstrated by decreasing in grain-size of the pre-kinematic porphyroclasts associated with increase in SPO and syn-mylonitic growth of high phengite white mica and plagioclase albitization.
We present here the results of an integrated microstructural study which combines both modern and classical techniques (e.g. C.I.P. method and U-stage approach) and petrophysical investigation consisting of laboratory seismic measurements at various pressure conditions (up to 600MPa) as well as calculations of elastic properties of the mylonitc rock considered as a poly-mineral and poly-crystalline aggregate.
Our data suggest that a close relationship exists between bulk seismic anisotropy and petrofabric features. The most important consideration that we can set out is that the mineralogical changes, together with the strain partitioning, are the main factors responsible for the changes in elastic properties observed in the studied mylonitic leucogneiss during the progressive deformation.