Geophysical Research Abstracts
Vol. 21, EGU2019-5252, 2019
EGU General Assembly 2019

Improved characterization of mineral fabrics using AMS and anisotropy of permittivity

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The anisotropy of magnetic susceptibility (AMS) measured in low magnetic fields often contains contributions from different mineral phases. If the AMS can be decomposed into magnetic sub-fabrics, the alignment of a certain mineral phase can be characterized. If the alignment of phyllosilicates is of interest, their paramagnetic sub-fabric can be determined individually, e.g. by using high-field torque magnetometers. For salt rock samples with very weak anisotropy, we had difficulties with the quantitative determination of the paramagnetic sub-fabric, which is supposedly generated by a minor amount of phyllosilicates. Therefore, we searched for an independent method to measure the alignment of phyllosilicates. We tested the measurement of anisotropy of electric permittivity, since it could in general also reflect the alignment of phyllosilicates due to their relatively large electrical conductivity. The existence of electrical conductive particles in a resistive matrix causes a change in the spectral properties of the permittivity due to the Maxwell-Wagner effect. This effect will be anisotropic, if the particles are elongated and aligned. Ferromagnetic minerals are supposed to influence the permittivity less, if their concentration is much lower than that of phyllosilicates. We measured the AMS and anisotropy of permittivity of several salt rocks and other samples. From mineralogical analysis and acquisition of isothermal remanence, the magneto-mineralogy of most samples is well known. Samples with a higher amount of phyllosilicates showed a pronounced anisotropy of permittivity, which agreed with the AMS in terms of the orientation. The anisotropy of permittivity could therefore give independent constraints for the degree of alignment of individual mineral fractions.