Separation of Magnetic Fabrics

Scientific note

The whole-rock AMS is in general controlled by all minerals present in a rock. As the individual magnetic minerals or their groups may behave in different ways in various geological situations, it is often desirable to resolve the rock AMS magnetic fabric into components corresponding to individual magnetic mineral sub-fabrics. This resolution is based on specific behaviour of susceptibility of individual minerals in variable magnetic fields or at variable temperatures.

Techniques were developed for separating the magnetic sub-fabrics of magnetite and paramagnetic minerals (mostly mafic silicates) as well as those for separating the magnetic sub-fabrics of minerals of pyrrhotite/hematite type from paramagnetic mineral sub-fabric. Unfortunately, these techniques require the high-field torque magnetometer, which, as far as I know, is manufactured commercially nowhere the world over.

Some researchers investigate the paramagnetic mineral sub-fabrics through the anisotropy of the temperature-dependent magnetic susceptibility (tdAMS), some of them using even Agico instruments. Our investigations of this problem have however shown that the accuracies of these techniques are insufficient. Agico, as renowned manufacturer of rock magnetism instruments, does not therefore recommend using these techniques, because we cannot guarantee sufficient reliability and reproducibility and do not support them neither in hardware nor in software.

What is possible using the Agico instruments is the measurement of the Anisotropy of Magnetic Remanence (AMR), which determines the ferromagnetic mineral sub-fabric uninfluenced by paramagnetic minerals. The Agico equipment for measurement of the AMR consists of spinner magnetometer, AF demagnetizer and isothermal/anhysteretic magnetizer + corresponding software.

In addition, techniques were developed for direct determination of the magnetic sub-fabrics of the minerals that exhibit low-field variation of susceptibility such as MD titanomagnetite, MD pyrrhotite, MD hematite. This measurement can be equally precisely made by both MFK1 and KLY5 Kappabridges. As these minerals show also non-zero out-of-phase susceptibility, the anisotropy of out-of-phase susceptibility (opAMS) can serve as a tool for the direct determination of the magnetic sub-fabrics of these minerals as well. This measurement, which is made automatically and simultaneously with the measurement of the whole-rock AMS, can be made only by the KLY5 Kappabride.

The sub-fabric of magnetically viscous ultrafine grains of magnetite or maghemite (on transition between SP to SSD) can be determined through anisotropy of frequency dependent susceptibility (fdAMS) and also through opAMS. The fdAMS can be measured only by MFK1 Kappabridge, while the opAMS only by the KLY5 Kappabridge.