your source for geophysical instruments

Qmeter

magnetisation meter

The Qmeter offers both university lecturers and mineral explorers the ability to demonstrate/measure and differentiate remanent magnetisation from induced magnetisation. The measurement of remanence (Jr) in the field and the ratio of remanence to the induced magnetisation (Jr/Ji = Q) has in the past been problematical. The induced magnetisation can be estimated using the susceptibility (k, where Ji = kH and typically H = 40 – 50 Am^{-1}) which can be measured using a handheld meter, but magnetic remanence is more difficult.

A recent development in field instrumentation uses a miniature fluxgate magnetometer and a pendulum arrangement in which a magnetic rock may be swung generating a transient signal at the fluxgate which is converted to a magnetic moment and magnetisation. The pendulum is setup to swing in the plane of the magnetic meridian. The periodic signal is processed using an algorithm designed to determine the vertical and horizontal components of magnetisation in the magnetic meridian. In the most straightforward procedure, the operator is required to find the orientation of the sample where the signal is a maximum (S1), at which point the induced and remanent magnetisations are additive (S1 = Ji + Jr). By repeating the procedure with the rock reversed in position the signal is a minimum (S2) and the induced magnetisation and remanence can be separated using simple algera and the Königsberger ratio determined (see below). If the strength of the local magnetic field is known then the magnetic susceptibility may be calculated, otherwise it is not a necessary parameter to determine the Königsberger ratio.

The simple relationships are:

$Ji + Jr = S1$

$Ji – Jr = S2$

$Ji = (S1 + S2) / 2$

$Jr = (S1 – S2) / 2$

$Q = (S1 – S2) / (S1 + S2)$ and $k = Ji / H$, or $\sim Ji / 40$

It is nevertheless best to also have a susceptibility meter to confirm the Q-meter susceptibility value.

Unless a sample has a large remanent magnetisation it may be difficult to find the point where the remanent and induced magnetisations are aligned. In general a more reliable approach is to make four measurements, two in the X-Z plane of the sample and two in the Y-Z plane by rotating the sample through 90° about the Z axis and repeating the two measurements. This procedure yields all X, Y and Z components of the (total) magnetization in the upright and inverted position. Applying the simple algebra operations shown above allows the remanence and induced magnetisation to be separated. The ratio of the remanent intensity to the induced intensity yields the Königsberger ratio, Q.

The structure of the instrument is shown in the photo. The only moving part is the pendulum making maintenance easy. The fluxgate and DAQ device are powered directly from a PC/laptop through a normal USB port. The framework is collapsible so the whole meter fits into a rugged carry case for transporting.

Dimensions (W x H x D): 62cm x 34cm x 12cm (packed in aluminum carry case)
Weight: 7 kg

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