

## Anisotropy of out-of-phase magnetic susceptibility as an alternative proxy for lattice preferred orientation of graphite

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Single crystals of graphite are known to exhibit high electrical conductivity and extremely strong conductivity anisotropy. Their AC magnetic susceptibility can be decomposed into a weak negative (diamagnetic) in-phase component and relatively strong out-of-phase component which is due to electrical eddy currents. Anisotropy of magnetic susceptibility (AMS) of graphite is known to be very strong and it is thus expected to be a good proxy for the lattice preferred orientation (LPO) of graphite in a graphite ore.

Here, we present the AMS results of natural graphite ores from the Moldanubian Unit (Bohemian Massif, Czech Republic), which were mined for the pencil industry in the past. The ores are metamorphic in origin and a strong graphite LPO is thus expected.

In-phase susceptibility is very low, in the order of  $10^{-6}$  [SI units], being positive in some specimens and negative in the others. This indicates simultaneous control by graphite and paramagnetic and/or ferromagnetic minerals. On the other hand, the out-of-phase susceptibility is much higher, in the order of  $10^{-4}$ , and no doubt indicates its graphite control. The degree of opAMS is truly high,  $P = 2$  to  $3$ , and the opAMS foliation is closely related to the metamorphic foliation created during the Variscan regional metamorphism and associated ductile deformation.

Our results show that the standard AMS, which is in fact the anisotropy of the in-phase component of susceptibility (ipAMS), reflects not only the LPO of graphite, but also the preferred orientation of paramagnetic and ferromagnetic admixtures. On the other hand, the anisotropy of out-of-phase susceptibility (opAMS) indicates LPO of graphite, free of the effects of non-conductive paramagnetic and ferromagnetic minerals and can be used as an alternative proxy for the lattice preferred orientation of graphite in a graphite ore.

Keywords: anisotropy of magnetic susceptibility, graphite, lattice preferred orientation