Publications of the Institute of Geophysics, Polish Academy of Sciences
Geophysical Data Bases, Processing and Instrumentation
vol. 423 (C-112), 2018, pp. 7-7
DOI: 10.25171/InstGeoph_PAS_Publs-2018-005
16th Castle Meeting New Trends on Paleo, Rock and Environmental Magnetism, Chęciny, Poland, 2018

Per-component Thellier-Thellier

Annemarieke BÉGUIN[1,✉] and Lennart de GROOT[1]

[1]Paleomagnetic Laboratory Fort Hoofddijk, Utrecht University, the Netherlands

✉ a.beguin@uu.nl

A b s t r a c t

Obtaining reliable paleointensities from lavas is a notoriously difficult task. Methods to obtain absolute intensities, e.g., Thellier-Thellier or Multi-specimen-style techniques, rely on heating a specimen to demagnetize their thermally acquired Natural Remanent Magnetization (NRM) and replace it with a partial Thermoremanent Magnetization ((p)TRM) arising from an applied external lab field.

The most common Thellier-type protocols require heating a specimen to each temperature at least twice ('double heating') to assess the NRM left or the partial TRM gained individually for each temperature step. The double heating of the specimen is performed once for the demagnetization of the sample in a field free thermal demagnetizer, and once with an external field to acquire a partial TRM in the direction of the applied field. The heating temperature in both steps must be similar and the accuracy of the temperature control of the furnace used is crucial for the experiment to work. pTRM checks and pTRM-tail checks can be performed to see if the sample underwent alteration. Tails of the pTRM can, however, also show as an effect of the non-repeatability of the set temperatures in the lab, which will falsify the results.

Here we propose a new Thellier-style protocol to obtain reliable paleointensities from lavas that will reduce the number of heating steps and potentially eliminate the effects of pTRM tails. This protocol relies on interpreting the demagnetization of the NRM from the two orthogonal axes to the applied field axis, that can be isolated from the pTRM steps. The zero-field steps are therefore no longer necessary and can be removed from the measurement protocol since the magnetic vector is decomposed in three components along the three Cartesian axes, with the applied field direction along one of them. The main assumption underlying our per-component protocol is that the applied field only leads to an induced magnetization along the applied field-axis – but this is hardly an extension of the rules of additivity and independence that form the basis of all Thellier-type paleointensity protocols. Here we will discuss the mathematical derivation of the paleointensity information, the first results using this newly proposed measuring scheme, and a broader assessment based on reinterpreted literature data to shed light on, e.g., the limitations on the direction of the NRM with respect to the applied field and possible overprints on the NRM.

Keywords: paleointensity experiments, Thellier-Thellier, new protocol, per-component.