

FURéMAG: A very fast-heating furnace dedicated to absolute paleointensity with the MSP-DSC protocol.

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Abstract: Recent developments on the methodology (MSP-DSC protocol) for documenting the intensity of the ancient Earth magnetic field, as recorded in rocks or archaeological artifacts, allow to use samples which until now were not measured because their magnetic properties do not meet selection criteria required by conventional methods. However, these new experimental protocols require that samples be heated and cooled under a field parallel to its natural remanent magnetization (NRM). Currently, standard paleointensity furnaces do not match precisely this constraint. Yet, such new measurement protocols would possibly double the number of available data.

We are developing in Montpellier (France), a very fast-heating furnace with infrared dedicated to the MSP-DSC protocol (Fabian and Leonhardt, 2010). Two key points determine its characteristics. The first is to heat uniformly a rock sample of a 10-cc-standard volume as fast as possible. The second is to apply to the sample during the heating (and the cooling) a precise magnetic induction field, perfectly controlled in 3D. We tested and calibrate this oven along with the MSP-DSC protocol with 3 historical lava flows, 2 from Reunion Island (erupted in 2002 and 2007) and one from Etna (erupted in 1983). These lava flows were selected because they have different magnetic behaviors. Reunion 2002 is rather SD-PSD-like, while Reunion 2007 is PSD-MD-like, and Etna 1983 is MD-like. The paleointensity determinations obtained with the original protocol (Biggin and Poidras, 2006; Dekkers and Bohnel, 2006) are within $\pm 1 \mu\text{T}$ of the known field for the three flows. The same precision is obtained when we applied the fraction correction (MSP-FC protocol). However, as Muxworthy and Taylor (2011), we found that the Domain State Correction is difficult to be applied since $\alpha = 0$ is always found whatever we use an ordinary least square regression or a robust regression.

Keywords: Paleointensity; MSP-DSC protocol; Technical development;

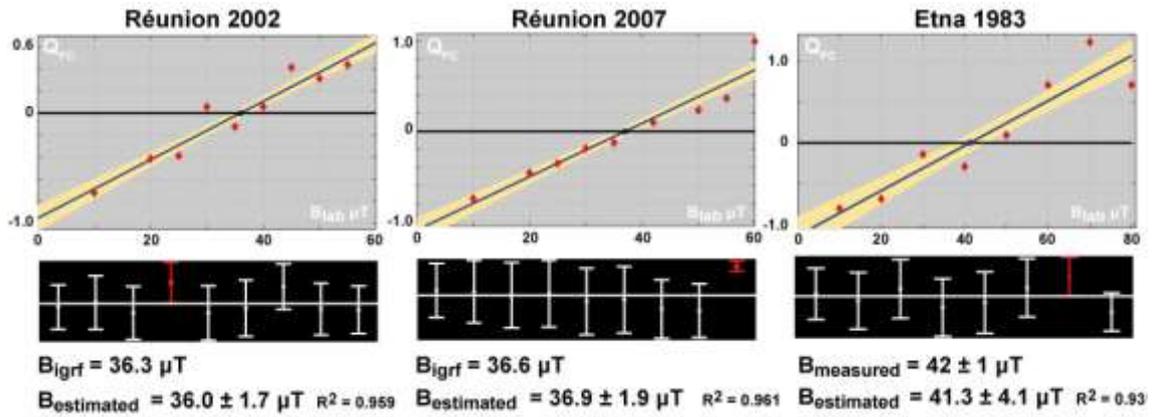


Figure 1: MSP-FC plots for recent lava flows and residual plots.

References :

Biggin and Poidras, 2006. EPSL, 438-453.

Dekkers and Bohnel, 2006. EPSL, 248, 508-517.

Fabian and Leonhardt, 2010, EPSL, 297, 84-94.

Muxworthy and Taylor, 2011. GJI, 187, 118-127