Paleointensities from Miocene lavas of St. Helena (South Atlantic)

Elisabeth Schnepp, Patrick Arneitz, Yael A. Engbers, Robert Scholger, Roman Leonhardt, Andrew J. Biggin

Paleointensities have been investigated on the island of St. Helena in two locations with successions of lava flows. One belonging to the SW Upper Shield recorded transitional field directions of a reversal from reversed to normal polarity, while the other located in the SW Main Shield exhibits a R-N-R-N polarity pattern. The lavas have ages of 8.0 Ma and will be supplied with further $^{39}Ar/^{40}Ar$ dating under work. The paleointensities are generally low and support a long-lasting existence of the South Atlantic Magnetic Anomaly.

The first paleodirections and paleointensities from St. Helena (South Atlantic at 16° S and 5.7° W) have been published by Engbers et al. (2022, https://doi.org/10.1029/2021JB023358, and references therein). The lavas on the island were mainly emplaced between 8 and 10 Ma and the obtained paleointensities give evidence for a low field intensity during this time. This suggests that the South Atlantic Anomaly, an area of geomagnetic weakness that represents the most significant anomaly in the present-day field, is not a single occurrence but rather the latest in a series of recurring weaknesses in the field in this region. Here, we present further paleointensities from a location which recorded intermediate directions of a reversed-to-normal polarity transition and another volcanic succession spanning four polarity intervals.

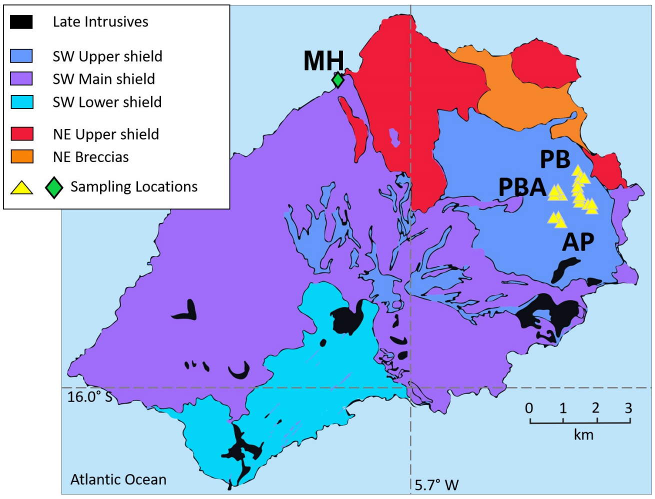

Figure 1: Geological map of Saint Helena adapted from Engbers et al. (2022).

The profile Munden Hill (MH, Fig. 1) spans 19 lava flows of the SW Main Shield. It recorded normal and reversed field directions of four polarity intervals with a dispersion showing only secular variation (Fig. 2). Two profiles sampled in the SW Upper Shield close to Prosperous Bay (AP-PBA and PB, Fig. 1) span at least three polarity intervals and recorded transitional field directions that can be attributed to the transition from subchron C4r.r1 to C4.2n about 8.2 Ma ago (Engbers et al., 2022; Fig. 2).

Paleointensity measurements were done using the MT4 and IZZI protocols, the latter with conventional and microwave heating. Success rates were low and only 15 of 30 lava flows gave at least one successful paleointensity determination. Some of them show a rather large dispersion (Fig. 2, right side). Most of the values are very low compared to the present-day field intensity of 29 µT. They support the findings of Engbers et al. (2022).

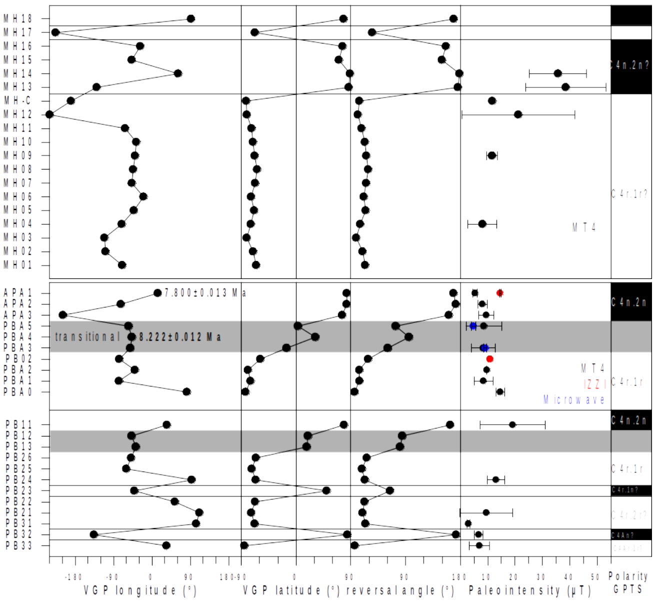

Figure 2: Virtual geomagnetic pole coordinates, reversal angle paleointensity of the three profiles and correlation with the geomagnetic polarity time scale (GPTS).

Correlation with the geomagnetic polarity time scale is unsure yet for the Munden Hill profile and the lower flows from Prosperous Bay (Fig. 2, right side with '?'). Further $^{39}Ar/^{40}Ar$ ages under work will clarify this issue.

Authors:
E. Schnepp[1], P. Arneitz[2], Y.A. Engbers[3], R. Scholger[1], R. Leonhardt[2], A.J. Biggin[3]
1) Montanuniversität Leoben, Leoben, Austria
2) GeoSphere Austria, Vienna, Austria
3) University of Liverpool, UK

Corresponding author:
Dr. Elisabeth Schnepp
Palaeomagnetic Laboratory Gams, Chair of Applied Geophysics, Montanuniversität Leoben
Gams 45, A8130 Frohnleiten, Austria
Tel.: +43 (3842) 402 2643
e-mail: elisabeth.schnepp@unileoben.ac.at