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The Laschamp geomagnetic field excursion recorded in Icelandic lavas

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We sampled 28 lava flows and a tephra layer, dated at about 40 kyr, at the Reykjanes Peninsula, Iceland. 10 flows and the tephra recorded what has been originally referred to as the Skalamælifell geomagnetic field excursion. The age of this excursion (42.9±7.8 ka) is statistically indistinguishable from the Laschamp excursion (40.4±2.0 ka). Rock magnetic investigations show that the main remanence carriers are (titano-) magnetites with different degrees of oxidation. One excursional flow exhibits partial self-reversal behavior; however, it could be shown by continuous thermal demagnetization that its paleodirection is unaffected. We subjected 52 samples from 16 flows to Thellier-type paleointensity determinations. Reliable paleointensity data were obtained for 10 of the 29 sites. In the beginning of the excursion virtual geomagnetic poles (VGPs) in the Southeast Pacific are recorded. These sites are characterized by paleointensities of 4 to 5 μT, about 1/10 of the intensity of the normal polarity flows, which ranges from 27.4 μT to 59.3 μT. Towards the end of the excursion, VGPs are found in North Africa. At these sites paleointensity has already regained about half of its original value (19.9±2.4 μT). A comparison of the paleointensity data with the results of previous studies gives a very consistent picture, as all records show almost identical intensity values during the Skalamælifell excursion. A tentative stratigraphic relationship between 25 sites prior to, during and after the Skalamælifell excursion was established by comparing them with virtual geomagnetic poles (VGPs) from different marine sedimentary records. Only VGPs from four flows could not be matched unambiguously to those of the marine records. Our results support the theory that the geomagnetic field during the Laschamp excursion likely had a simple transitional field geometry at least during the onset of the excursion. The data are best explained by a decrease of the axial dipole field and a substantial transitional equatorial dipole field that was accompanied by a considerably reduced non-dipole field.