

Volcanic records of the Laschamp geomagnetic excursion from Mt Ruapehu, New Zealand

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We present palaeodirectional records of the Laschamp excursion from the thermoremanent magnetization of lavas on Mt Ruapehu, New Zealand. Fourteen lava flows on the western and southern flanks of Mt Ruapehu, for which $^{40}\text{Ar}/^{39}\text{Ar}$ dating yields ages between 39.1 ± 1.4 and 45.4 ± 2.0 ka, were studied. The youngest and older flows have normal polarity magnetizations; however, six flows, dated between 41.8 ± 1.8 and 45.4 ± 2.0 ka, record excursions field directions. The palaeomagnetic directions of three flows have southerly declinations and inclinations of about -40° , in good agreement with a previously published Laschamp record from the Auckland Volcanic Field (AVF). Together, the AVF and Mt Ruapehu lavas represent the only current volcanic records of the Laschamp excursion outside the Chaîne des Puys region of France. They, thus, provide a vital contribution to the global studies of the Laschamp excursion. Comparison of virtual geomagnetic pole (VGP) positions determined from the New Zealand and French excursion records suggest the dominance of an equatorial dipole dominated field in the early phase of the Laschamp excursion. Meanwhile, differing VGPs for the younger excursions from France and New Zealand suggests that either the field lost its predominantly dipole-dominated morphology in the later phase of the excursion, or that the two records are not synchronous. Compatible features of volcanic and sedimentary records of the Laschamp excursion are explored, including the possibility of a precursory palaeodirectional anomaly before the main excursion phase. Overall, $^{40}\text{Ar}/^{39}\text{Ar}$ ages for the Mt Ruapehu excursion records are slightly older than recently published ages from the northern hemisphere. Although the difference is not significant at the 2s level, if real, it could result from such a precursory phase, or from non-synchronicity of anomalous field directions at near-antipodal locations, or it could indicate a longer overall excursion duration than the currently accepted 1500 years.

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