

Intermediate field directions recorded in Pliocene basalts in Styria (Austria): Evidence for cryptochron C2r.2r-1

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Pliocene volcanic rocks from southeastern Austria were paleomagnetically investigated. For the study of paleodirection and paleointensity samples were taken from 28 sites which are distributed over 8 volcanoes (localities). Directional results from six sites have already been published by Pohl & Soffel (1982: *Geologisches Jahrbuch*, vol. 52, p. 137), they were resampled at the same place or nearby and their results were confirmed. Rock magnetic investigations revealed that magnetic carriers are Ti-rich or Ti-poor titanomagnetites with mainly pseudo-single domain grain size. Characteristic remanent magnetization directions were obtained from alternating field as well as from thermal demagnetization. Four localities give reversed directions agreeing with the expected direction from secular variation. Another four localities of the Klöch-Königsberg volcanic complex and the Neuhaus volcano have reversed directions with shallow inclinations and declinations of about 240° while the locality Steinberg yields a positive inclination of about 30° and 200° declination. These aberrant directions cannot be explained by local or regional tectonic movements. All virtual geomagnetic pole (VGP) positions are located on the southern hemisphere. Four VGPs lie close to the geographic pole, while all others are concentrated in a narrow longitude sector offshore South America (310° to 355°) with VGP latitudes ranging from -15° to -70°. The hypothesis that a transitional geomagnetic field configuration was recorded during the short volcanic activity at these five localities is supported by 9 paleointensity results and ³⁹Ar-⁴⁰Ar-dating. Paleointensities were obtained with the Thellier double heating method from nine sites. While mean paleointensity values of 56.6, 29.9 and 23.4 μT are associated with VGP latitudes above 70°, sites with intermediate poles give considerably lower values. The weighted mean obtained from four sites of the Klöch-Königsberg complex is 8.62 ± 0.06 μT, while the mean paleointensity from Steinberg is only 2.93 ± 0.07 μT. Corresponding virtual geomagnetic dipole moments range from 1.1 to 2.9·10²² Am² for sites with low VGP latitudes below about 60° and from 3.0 to 9.3·10²² Am² for sites with higher virtual geomagnetic pole latitudes. K-Ar data obtained from associated tuffs give an age frame from about 2 to 4 Ma. Two new ³⁹Ar-⁴⁰Ar ages were acquired for Klöch and Steinberg volcanoes for four and six specimens, respectively. These new ³⁹Ar-⁴⁰Ar ages of 2.51 ± 0.27 Ma for Klöch and 2.39 ± 0.03 Ma for Steinberg allow the correlation of the Styrian transitional directions with cryptochron C2r.2r-1 of the geomagnetic polarity time scale (e.g. Singer, B., 2014: *Quat. Geochronol.*, vol. 21, p. 29). A cryptochron is a short geomagnetic event in which the geomagnetic field flips to opposite polarity with a duration of less than 10 to 30 kyr. Accordingly, at least 3 of the 4 investigated Styrian volcanoes may have been formed in a short time interval corresponding to the duration of a geomagnetic cryptochron.