Intermediate Field of Cryptochron C2r.2r-1 Recorded in Styrian Basalts

Elisabeth Schnepp, Patrick Arneitz, Morgan Ganerød, Robert Scholger, Ingomar Fritz, Ramon Egli, Roman Leonhardt

Paleodirections and -intensities were investigated for Pliocene volcanic units from Styria (Austria). Only four virtual geomagnetic poles (VGP) lie close to the geographic pole, while all others are concentrated in a narrow longitude sector offshore South America at low VGP latitudes and relatively low paleointensities were obtained. $^{39}Ar/^{40}Ar$ ages of 2 sites with low latitude VGPs agree at 2.47 ± 0.11 Ma and allow for correlation of the Styrian transitional directions with cryptochron C2r.2r-1 of the geomagnetic polarity time scale.

The Styrian Basin is located at the south-eastern margin of the Alps and its formation started in the Late Oligocene to Miocene at the final collision stage of the Adriatic with the European plate. The major tectonic events were accompanied by volcanism producing volcaniclastics and high-K effusive rocks with Miocene and Pliocene ages. Paleomagnetic sampling was done at 27 sites of 8 Pliocene volcanic units.

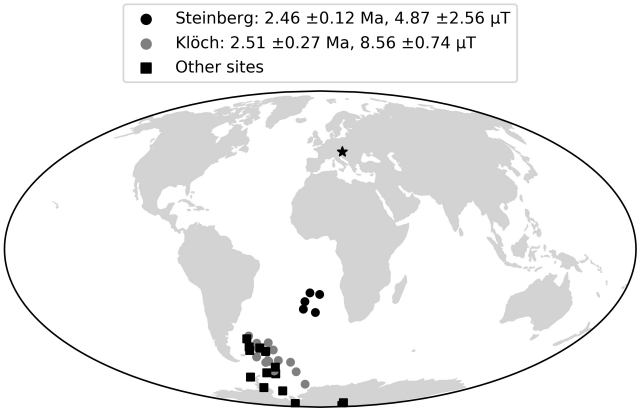

Figure 1: Virtual geomagnetic poles from Styrian volcanic units.

Rock magnetic investigations revealed that the magnetic carriers are Ti-rich or Ti-poor titanomagnetites with mainly pseudo-single-domain grain size. Many samples showed strong alteration of the magnetic particles during heating. This hampered determination of paleointensity. Characteristic remanent magnetization directions were obtained from alternating field as well as from thermal demagnetization. Four localities give reversed directions agreeing with the field direction expected for secular variation. Another four localities of the Klöch-Königsberg volcanic complex (3) and the Neuhaus volcano (1) have reversed directions with shallow inclinations and declinations of about 240°, while the locality Steinberg yields a positive inclination of about 30° at 200° declination. These aberrant directions cannot be explained by local or regional tectonic movements.
Corresponding virtual geomagnetic pole (VGP) positions are located on the southern hemisphere (Fig. 1). Only few VGPs lie close to the geographic pole, while the others are concentrated in a narrow longitude sector offshore South America (310° to 355°) with low VGP latitudes ranging from -15° to -70°.

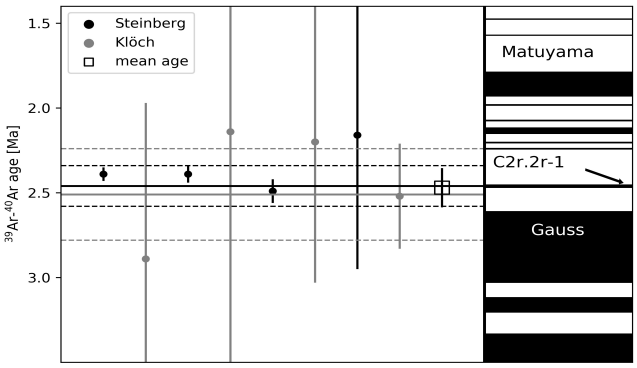

Figure 2: $^{39}Ar/^{40}Ar$-ages with 2 sigma error from individual samples shown together with the weighted mean and error band in comparison with the geomagnetic instability time scale (Singer, 2014, Quaternary Geochronology, 21).

The hypothesis, that the volcanic activity of these five volcanic units had a short duration and that a transitional geomagnetic field configuration was recorded is supported by nine paleointensity results and $^{39}Ar/^{40}Ar$ dating. Virtual geomagnetic dipole moments range from 1.1–2.9·10^{22} Am^2 for sites with low VGP latitudes under 60° and 3.0–9.3·10^{22} Am^2 for sites the higher VGP latitudes. The present value is about 8·10^{22} Am^2. $^{39}Ar/^{40}Ar$ ages obtained for two sites (Klöch, Steinberg) agree. Their mean age (2.47 ± 0.11 Ma) allows for correlation of the Styrian transitional directions with cryptochron C2r.2r-1 of the geomagnetic polarity time scale (Fig. 2).

Authors:
E. Schnepp[1] , P. Arneitz[2], M. Ganerød[3], R. Scholger[1], I. Fritz[4], R. Egli[2], R. Leonhardt[2]
1) Montanuniversität Leoben, Leoben, Austria
2) Central Institute for Meteorology and Geodynamics, Vienna, Austria
3) Geological Survey of Norway, Trondheim, Norway
4) Landemuseum Joanneum, Graz, Austria

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