Paleosecular variation in the last 6 Ma recorded by lava flows from the East Carpathians (Romania)

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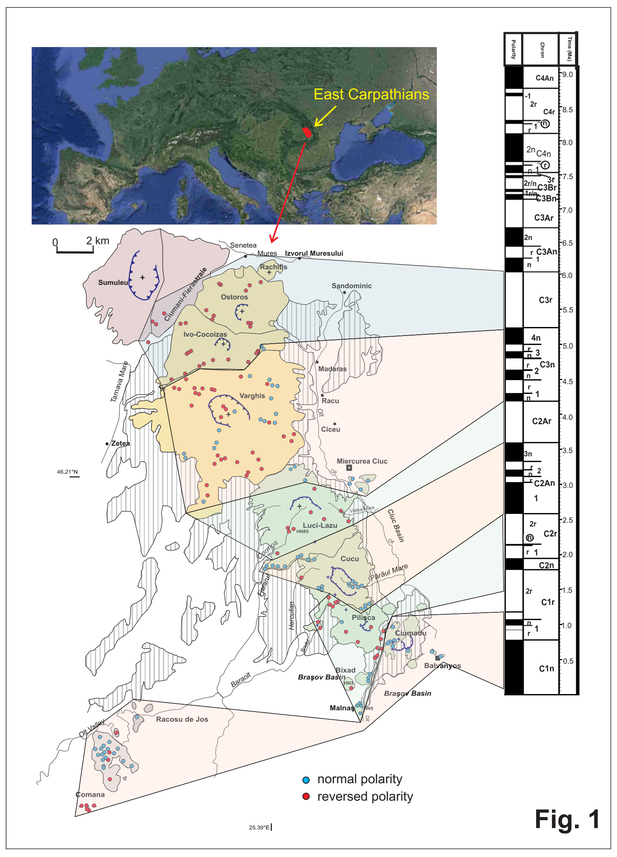


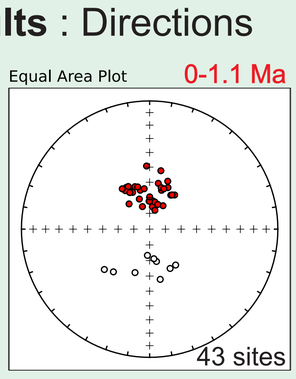
Fig. 1

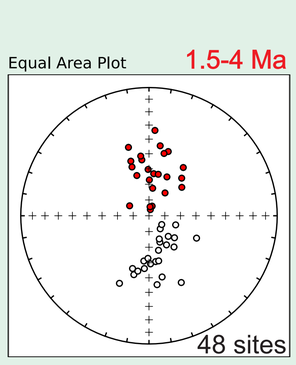
Introduction. In the last 10 Ma a post collisional volcanism took place in the East Carpathians forming a 160 km long chain. We present paleomagnetic results from the volcanic rocks erupted in the last 6 Ma covering around 70 km from the volcanic chain. The geographic distribution of magnetic polarity support the currently accepted model of a progressive migration of the volcanic activity from North to the South, in time steps of around 1 Ma or less according to the magnetic polarity data (Fig. 1). This research is part of larger study to obtain data about paleosecular variation (PSV) from lava flows in this part of Europe and its time variability in the last 10 Ma.

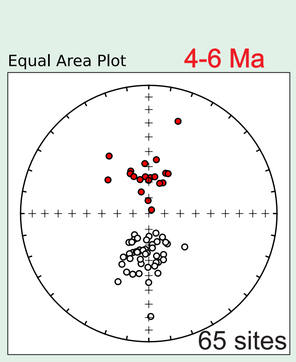
Methods. For the paleosecular variation study we have selected the sites following the criteria from Johnson et al. (2008): minimum 5 samples per site, dispersion parameter k > 50 and colatitude cutoff 45°, both AF and thermal demagnetization, full demagnetization of each specimen. We selected a total of 156 sites divided in 3 age intervals: 0-1.1Ma (43 sites), 1.5-4 Ma (48 sites) and 4-6 Ma (65 sites). For stastitical analysis we used PmagPy 2.171.

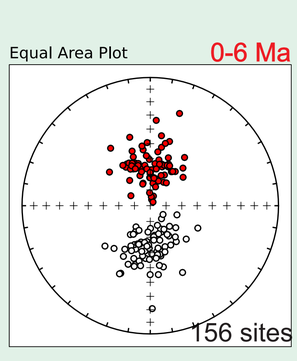
Fig. 1 Correlation of magnetic polarity zones with the Polarity Time Scale (Lourens et al., 2004) based on K-Ar ages (Peskay et al., 2006) and geographical distribution of magnetic data.

Results : Directions

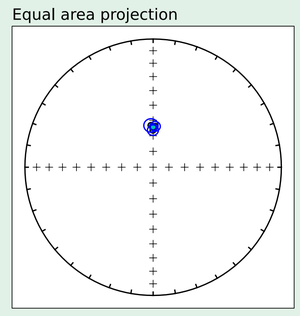






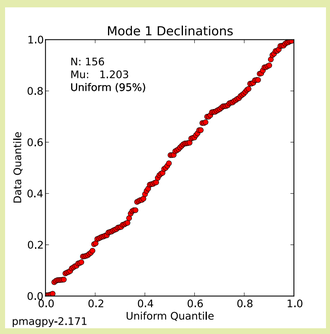


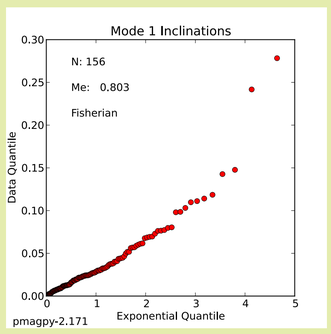
All groups have a positive reversal test, but the group 1.5-4 Ma has a marginal negative test.



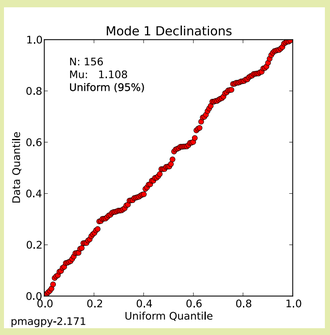
Group mean directions support the absence of significant tectonic rotations post-emplacement

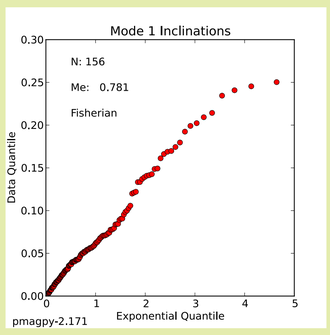
Results: Which data set is Fisherian: directions or VGPs? *Both are !*





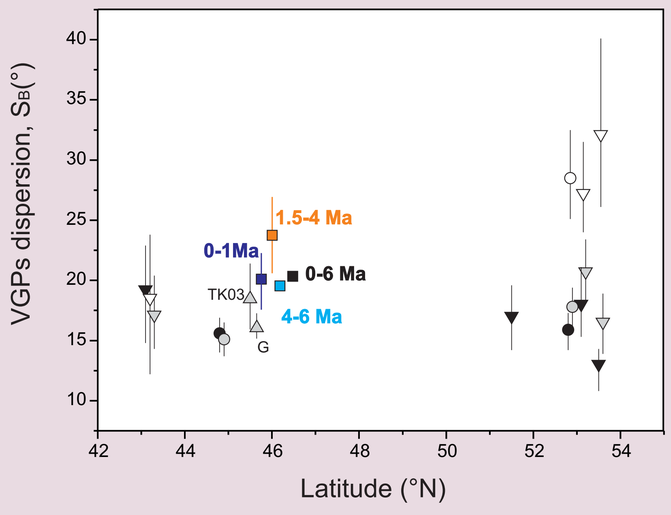
Directions (all combined 0-6 Ma)





VGPs (all combined 0-6 Ma)

Paleosecular variation



VGP dispersion from lavas and their 95% confidence intervals. Normal and reversed combined data from this study are represented with squares; Data from Johnson et al. (2008) are represented with full symbols for Brunhes-age normal polarity, open symbols for Matuyama-age reversed polarity data and grey symbols for 0-5 Ma combined data set: inverted triangles represent data only from TAFI studies, circles are latitudinally binned global data. Predicted dispersions for statistical model G and TK03: triangles.

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Conclusions

1. PSV was characterized both by dispersion of virtual geomagnetic poles (S_B) or precision parameter k of VGP or directions (Lhuillier & Gilder, 2013). The VGPs dispersion of the 1.5-4 Ma group is larger both than the global data base and the other two groups in this study. K parameter for this group is significant different than k parameter for others groups.
2. Numerical simulations from statistical paleosecular variation models and dynamo models indicate the need for several hundred paleomagnetic sites and more than 2 Ma to get an accurate determination of the VGPs dispersion (Tauxe et al, 2003; Tauxe et al., 2008; Lhuillier & Gilder, 2013). Only the total data set (0-6 Ma) is near this condition and its dispersion is close to the TAFI data and the predicted dispersions for Model Tk03.
3. The results from this study might imply an increase of VGP dispersion between 1.5-4 Ma starting at around 45°N, but more data are needed both at local and global level to determine if this reflects the behavior of the geomagnetic field, or an incomplete database.