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INDICATIONS FOR LARGE TERTIARY ROTATION IN THE CARPATHIAN-NORTHERN PANNONIAN REGION OUTSIDE THE NORTH HUNGARIAN PALEOGENE BASIN

IGOR TÚNYI[1] and EMÖ MÁRTON[2]

[1]Geophysical Institute, Slovak Academy of Sciences, Dúbravská 9, 842 28 Bratislava, Slovak Republic
[2]Eötvös Loránd Geophysical Institute, Columbus út 17-23, 1145 Budapest, Hungary

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Abstract: The first results of paleomagnetic directions from the Neogene sedimentary rocks of the western part of the Western Carpathians and the northern part of Pannonian Basin showed counter-clockwise rotation of the investigated areas. Further studies were extended to the Central Carpathian Paleogene basins (Levočské vrchy Mts. on the eastern and the northern part of the Bánovská kotlina Basin in Western Slovakia), the Šambrón-Kamenica Zone and the Lower Miocene sediments from the Northern Hungary. All the samples are sediments, mostly turbidites, with the exception of the fresh water limestones from the Northern Hungary. The results from the suitable localities (Lábatlan — Northern Hungary, Omastiná — Western Slovakia and Demjata — Eastern Slovakia) showed counter-clockwise rotation between 65-105°.

Key words: Central Carpathian Paleogene Basin, Levočské vrchy Mts., Bánovská kotlina Basin, Šambrón-Kamenica Zone, Paleogene deposits of the Northern Hungary, paleomagnetic directions.

Introduction

Paleomagnetic results from the Late Cretaceous-Tertiary sediments from the NW part of the Pannonian Basin (Márton et al. 1992) gave counter-clockwise (CCW) rotation of paleodirections. In an effort to extend the paleomagnetic study to the other Cenozoic basins in the Inner Carpathians region, we performed extensive sampling on the Paleogene sediments in western and north-eastern Slovakia.

The samples were collected from the Paleogene sediments of the Inner Western Carpathians. The Paleogene sedimentary sequences near the Klippen Belt in the Považie region (the Váh River valley) represents locality Horné Srnie situated in the western part of the orogene. In Eastern Slovakia similar rock samples (Paleogene sequences in the Pieniny Klippen Belt zone) were taken from the Šambrón-Kamenica Zone (localities Šambrón and Demjata). Sediments of the Central Carpathian Paleogene Basin were represented in the Levočské vrchy Mts. by the localities of Stará Ľubovňa, Dravce, Kežmarok and Slovenská Ves and in the northern part of the Bánovská kotlina Basin by the localities of Omastiná and Žitná Radiša. The samples from the localities of Čachtice and Sverepec situated in the Považie region were taken from the Lower Miocene deposits (Kováč et al. 1993). We also had samples from Southern Slovakia, from the Slovak part of the Buda Paleogene Basin (North Hungarian Paleogene Basin) and the results of these are present in this volume (Márton et al. 1996).

The localities in the western part of the Bánovská kotlina Basin were selected by M. Kováč from the Department of Geology and Paleontology, Faculty of Sciences, Comenius University, Bratislava, and by I. Baráth from the Geological Institute SAS, Bratislava, and they guided us in the field. Concerning the Central

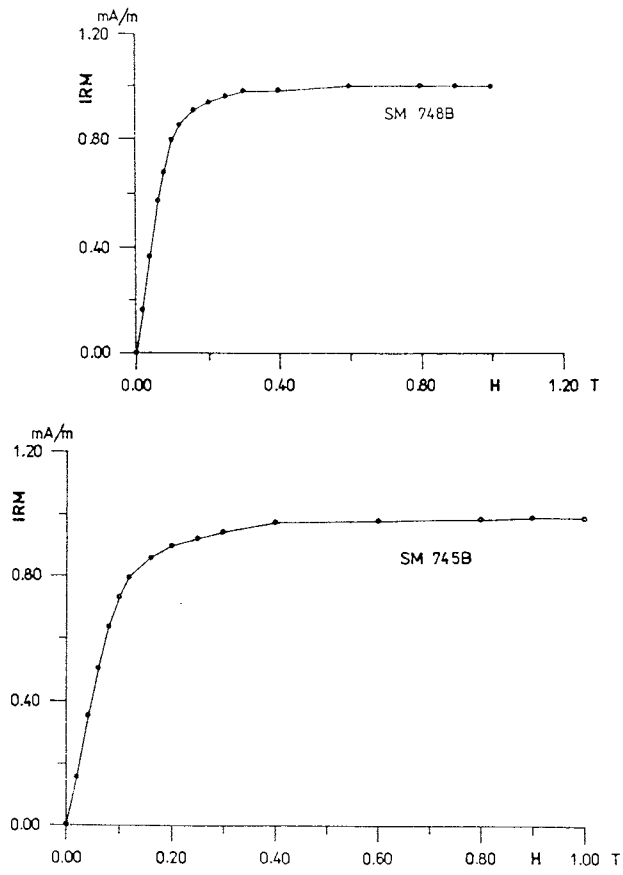

Fig. 1. IRM acquisition curves on the samples from loc. Omastiná (Eocene, flysch): top — in the natural stage, down — after heating to 600 °C.

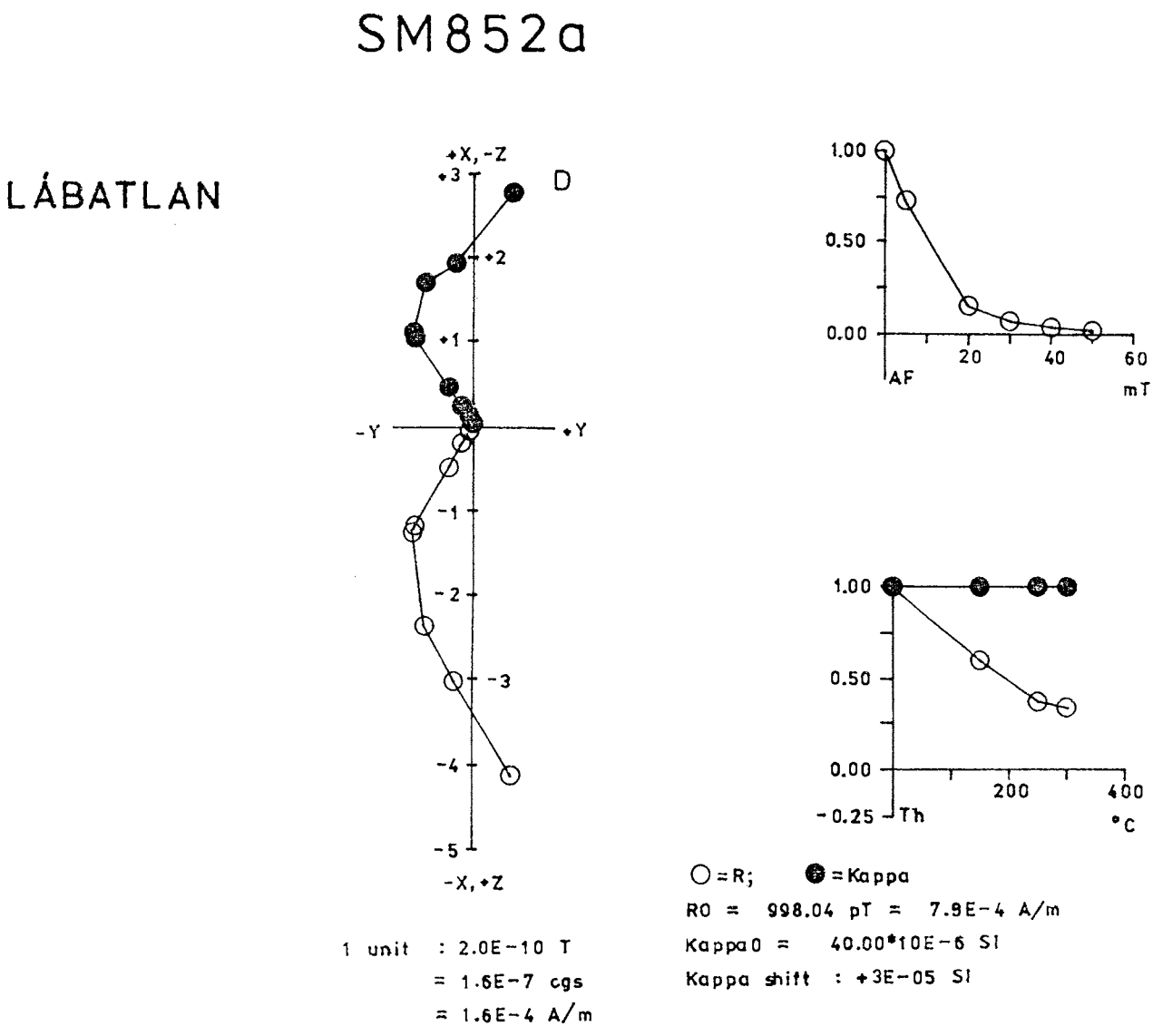

Fig. 2. Characteristic demagnetization curves from loc. Lábatlan (Eocene, fresh water limestone; Northern Hungary). R — remanent magnetic polarization; Kappa — magnetic volume susceptibility; R0 and Kappa 0 — initial values of R and Kappa.

Western Carpathians flysch basin, we first exploited some points with help of a geological map on which M. Nemčok from the Dionýz Štúr Institute of Geology, Bratislava, marked some points which he suggested for paleomagnetic sampling. Unfortunately those points turned out to represent heavily weathered flysch outcrops useless for paleomagnetism with the exception of one (Šambrón). Therefore we tried to find fresh outcrops mainly along the principal roads.

In addition to the sampling localities in the Inner Carpathians proper, we collected the Eocene samples at Lábatlan (Hungary) close to Esztergom, a place where we had previously obtained good results on the Oligocene sediments (Márton et al. 1992).

Sampling and method

The collection was divided into two parts. One set of the sister specimens was processed in the Paleomagnetic Laboratory ELGI in Budapest, the other half in the Paleomagnetic Laboratory of the Geophysical Institute SAS in Bratislava. The method of measurements and evaluation is the same as that mentioned in the article Márton et al. (1996) in this volume. All samples were sediments, mostly flysch and flysch like with the exception of Lábatlan, where variegated clay and fresh water limestones were sampled.

Results

We obtained reliable results from three localities. Samples from some others seemed to be paleomagnetically unstable and produced a large scatter of paleodirections. Such localities were rejected from statistical treatment.

We propose that the carrier of the characteristic remanence in the investigated rocks is magnetite, according to the IRM acquisition curve from locality Omastiná (Fig. 1). The typical demagnetization curves from suitable localities are given on Figs. 2–4. Fig. 2 presents the characteristic demagnetization

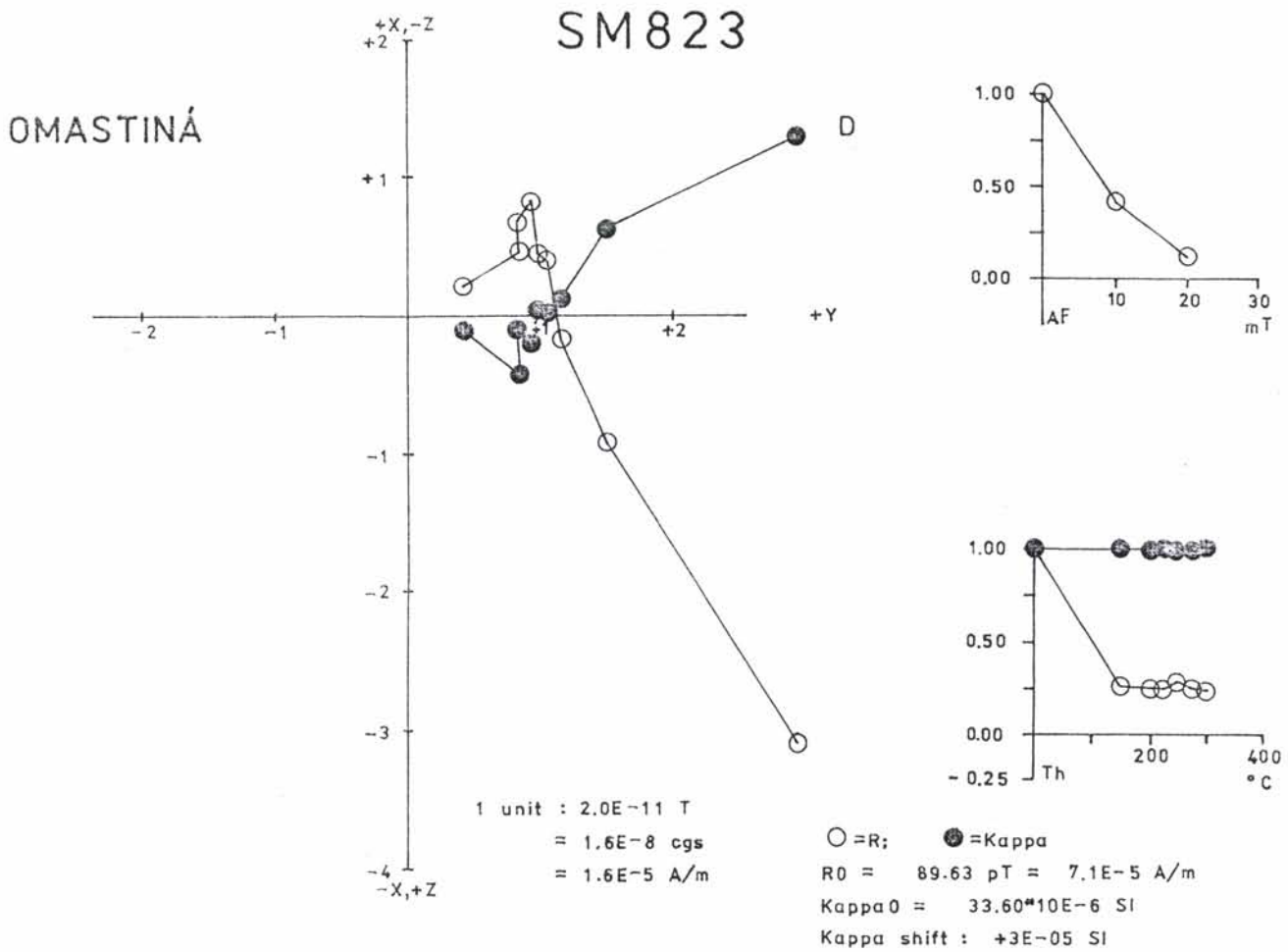

Fig. 3. Characteristic demagnetization curves from loc. Omastiná (Eocene, flysch; Western Slovakia) (key see Fig. 2).

curves from the Eocene fresh water limestones from locality Lábatlan in Northern Hungary. This locality gave the best paleomagnetic results of the whole collection. 23 samples from 30 measured were taken into statistical treatment. From Western Slovakia only samples from locality Omastiná gave the paleomagnetically suitable results (Fig. 3). 25 samples were measured, from which 10 samples were used for statistical treatment. They were flysch sediments of the Eocene age. From north-eastern Slovakia, the samples of the Eocene flysch sediments from locality Demjata gave reliable results (Fig. 4). There were measured 13 samples, from which 9 were taken into the statistical treatment.

Table 1: Paleomagnetic parameters for localities with counter-clockwise rotation.

Locality	N/N_o	Dec^o Dec^o_{corr}	Inc^o Inc^o_{corr}	k	α^o_{95}
Lábatlan	23/30	312	53	41	11
		295	48	75	9
Omastiná	10/25	85	-25	26	10
		83	-28	24	10
Demjata	9/13	115	-12	18	13
		75	-54	9	19

Key:
N/N_0 — number of used/collected samples
Dec^o, Inc^o — declination, inclination before bedding correction
Dec^o_{corr}, Inc^o_{corr} — declination, inclination after bedding correction
k, α^o_{95} — statistical parameters of the mean paleomagnetic directions

Table 2: Summary of tectonically significant paleomagnetic results according Márton et al. (1992) (key see Tab. 1).

Locality	N/N_o	Dec^o Dec^o_{corr}	Inc^o Inc^o_{corr}	k	α^o_{95}
Sološnica	11/15	343	-62	13	13
		106	-66		
Roh Motel	6/6	21	+6	29	13
*		250	+21		
Esztergom	9/25	99	-43	24	11
Castle Hill		113	-33		
Esztergom	10/10	303	38	44	7
Basa út		315	49		

* corrected for overturned position

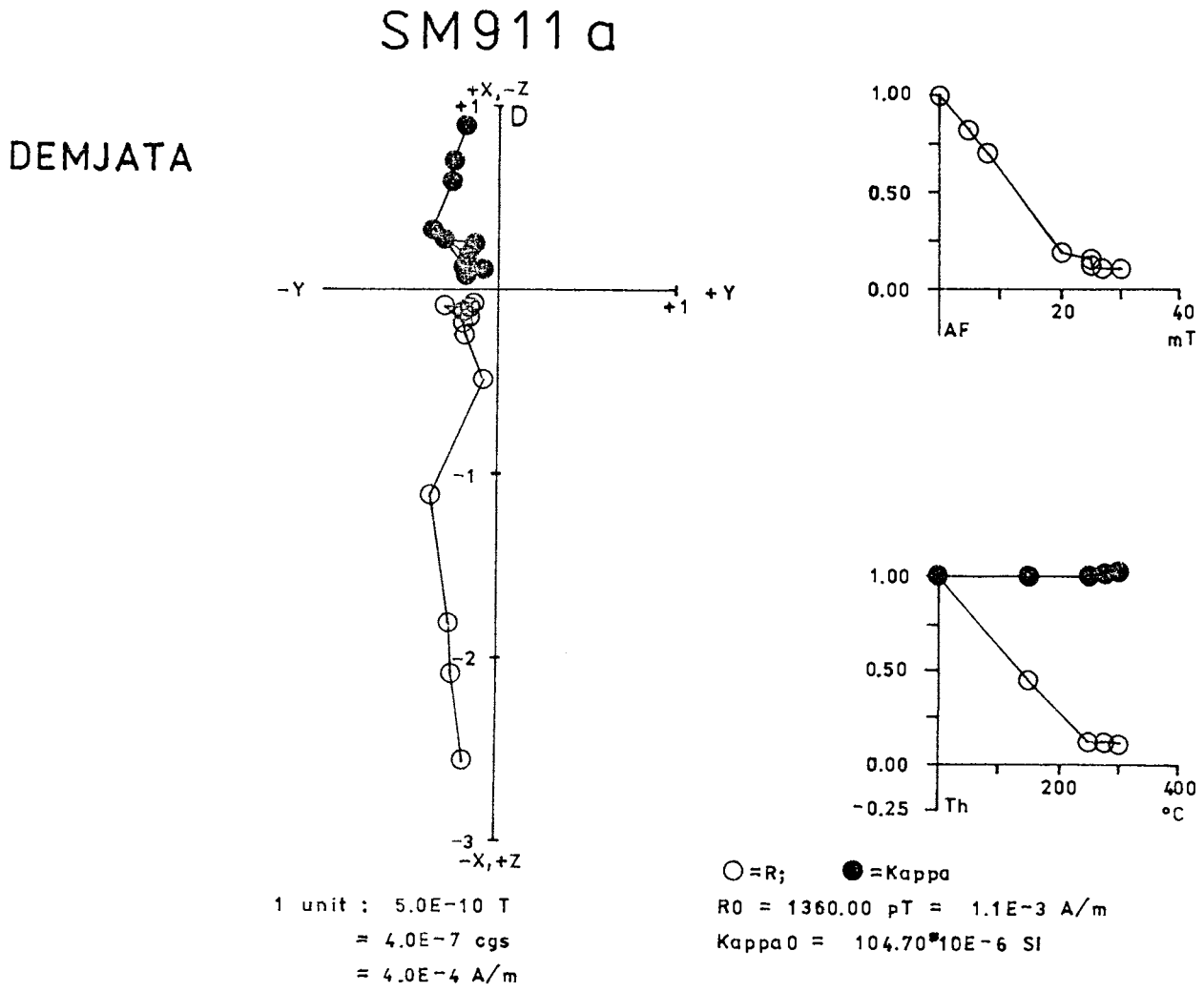

Fig. 4. Characteristic demagnetization curves from loc. Demjata (Eocene, flysch; Eastern Slovakia) (key see Fig. 2).

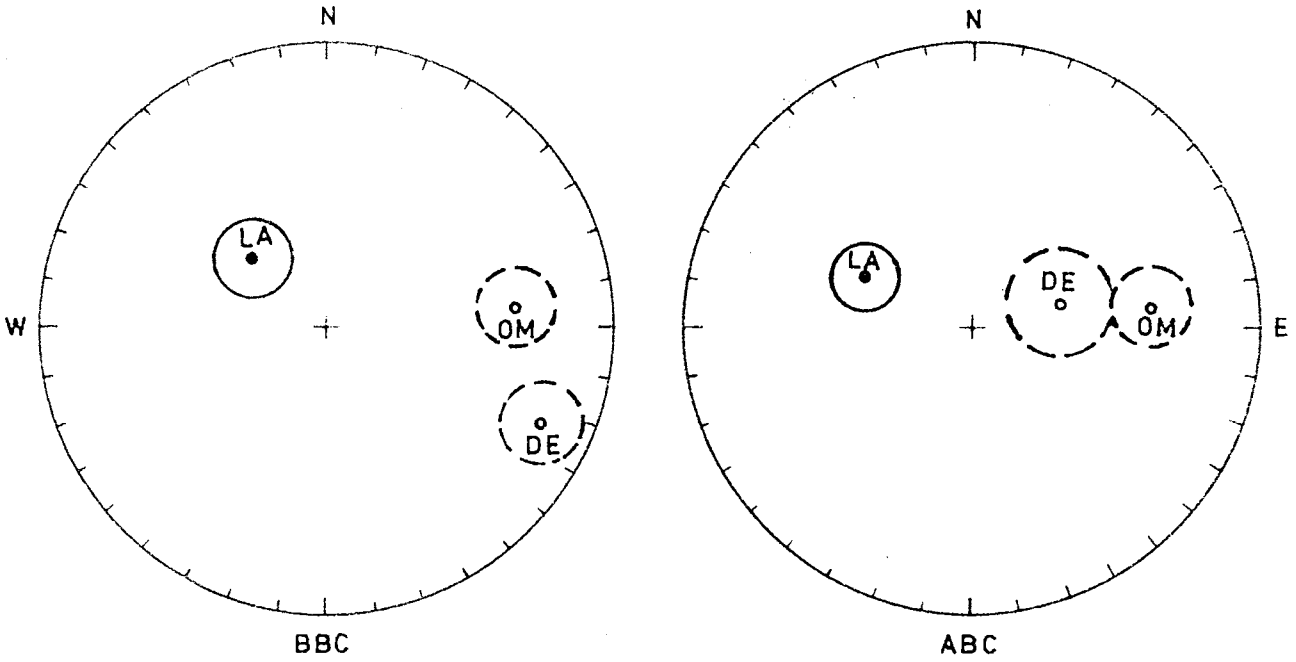

Fig. 5. Mean paleomagnetic directions before (BBC) and after (ABC) bedding correction: **LA** — Lábatlan (Eocene, fresh water limestone; Northern Hungary); **OM** — Omastiná (Eocene, flysch; Western Slovakia); **DE** — Demjata (Eocene, flysch; Eastern Slovakia).

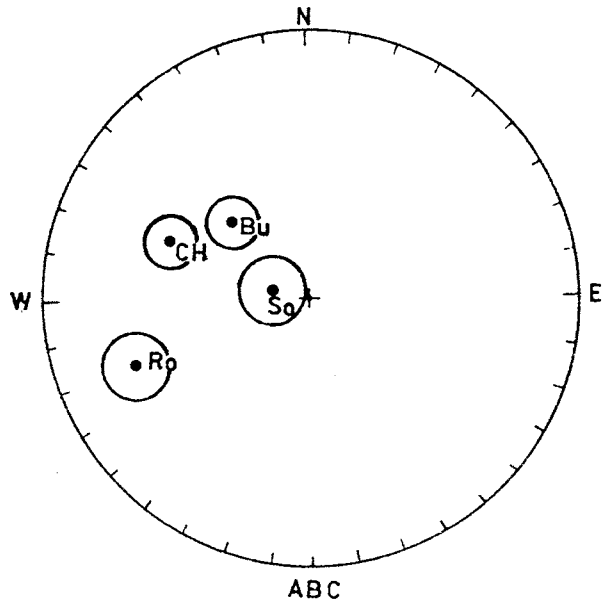

Fig. 6. Mean paleomagnetic directions, after cleaning and bedding correction: **CH** — Esztergom-Castle Hill (Oligocene, siltstone; Northern Hungary); **Bu** — Esztergom-Basa út (Oligocene, marl; Northern Hungary); **So** — Sološnica (Eocene, limestone; Western Slovakia); **Ro** — Roh Motel (Eocene, siltstone; Western Slovakia). Stereographic projection, inclinations are positive (Márton et al. 1992).

Discussion and conclusion

Fig. 5 presents paleodirections from localities Lábatlan, Omastiná and Demjata. Tab. 1 gives the paleomagnetic parameters before and after tilt correction. As we can see, all these localities give CCW-rotation in the interval 65–105°.

The comparison with the previous results (Márton et al. 1992) grants Fig. 6 on which we can see paleodirections from the localities of Roh and Sološnica in Western Slovakia and from the localities of Esztergom-Castle Hill and Esztergom-Basa út from the Northern Hungary. Tab. 2 gives the paleomagnetic parameters of these localities.

Besides these results we obtained two paleomagnetic directions which are in opposite of mentioned. One of them is from Western Slovakia from the locality of Horné Srnie (Eocene, flysch) and the second one from the north-eastern Slovakia from locality Šambrón (Eocene, flysch). Both gave quite good paleomagnetic demagnetization curves (Figs. 7, 8) but they produce clockwise rotation (CW) as shown on Fig. 9 and Tab. 3. One of the explanations for such behaviour may be that the rocks from these localities were partly remagnetized (their remanence is composite). It also suggests divergence and anomalously shallow inclination after tilt correction (Fig. 9). Because we are not sure if these results are tectonically meaningful, we refrain from interpreting them at this stage of the investigation in terms of tectonics.

Fig. 10 shows the final paleodirections together with those obtained previously (Márton et al. 1992). Paleodirections

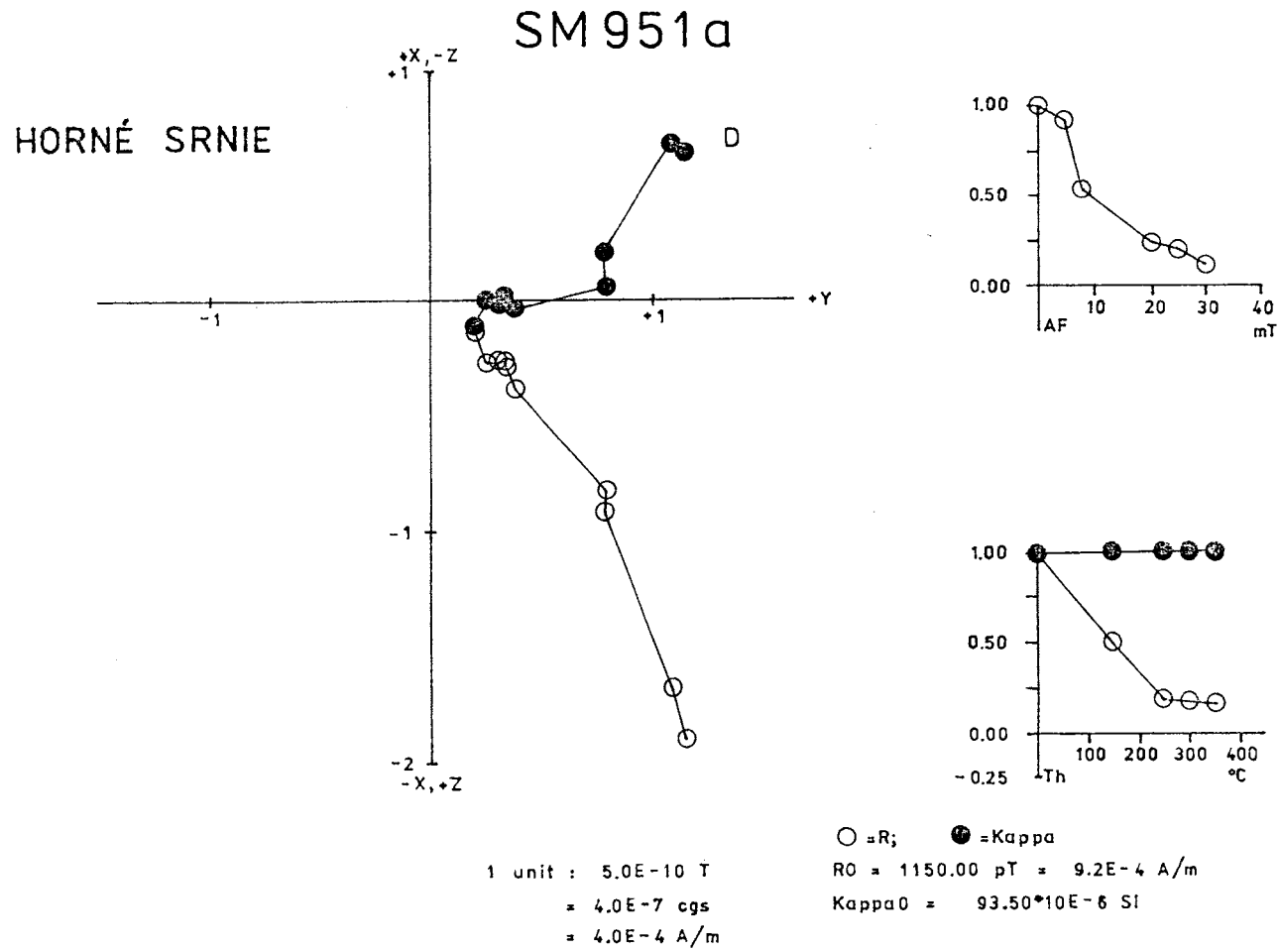

Fig. 7. Characteristic demagnetization curves from loc. Horné Srnie (Eocene, flysch; Western Slovakia) (key see Fig. 2).

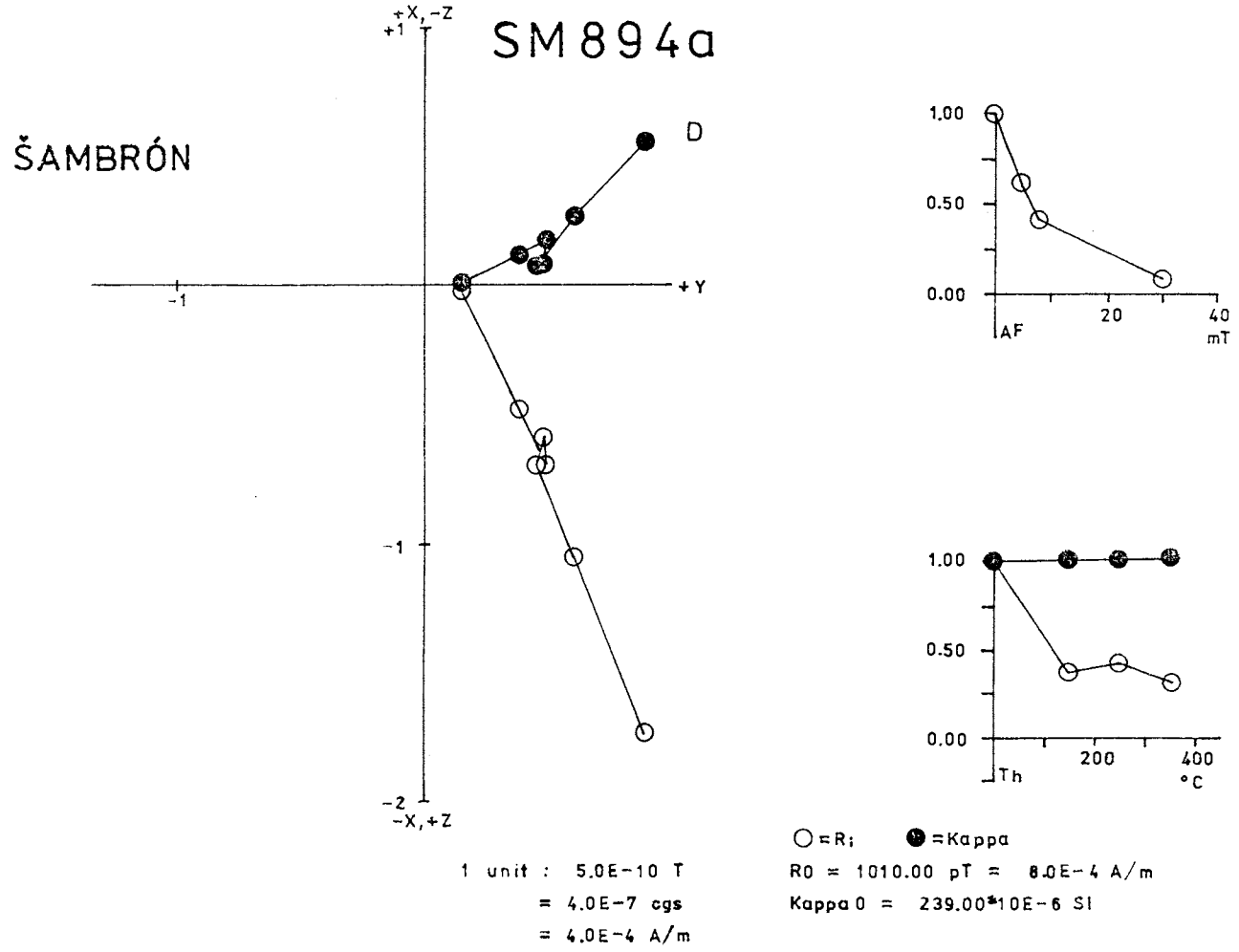

Fig. 8. Characteristic demagnetization curves from loc. Šambrón (Eocene, flysch; Eastern Slovakia) (key see Fig. 2).

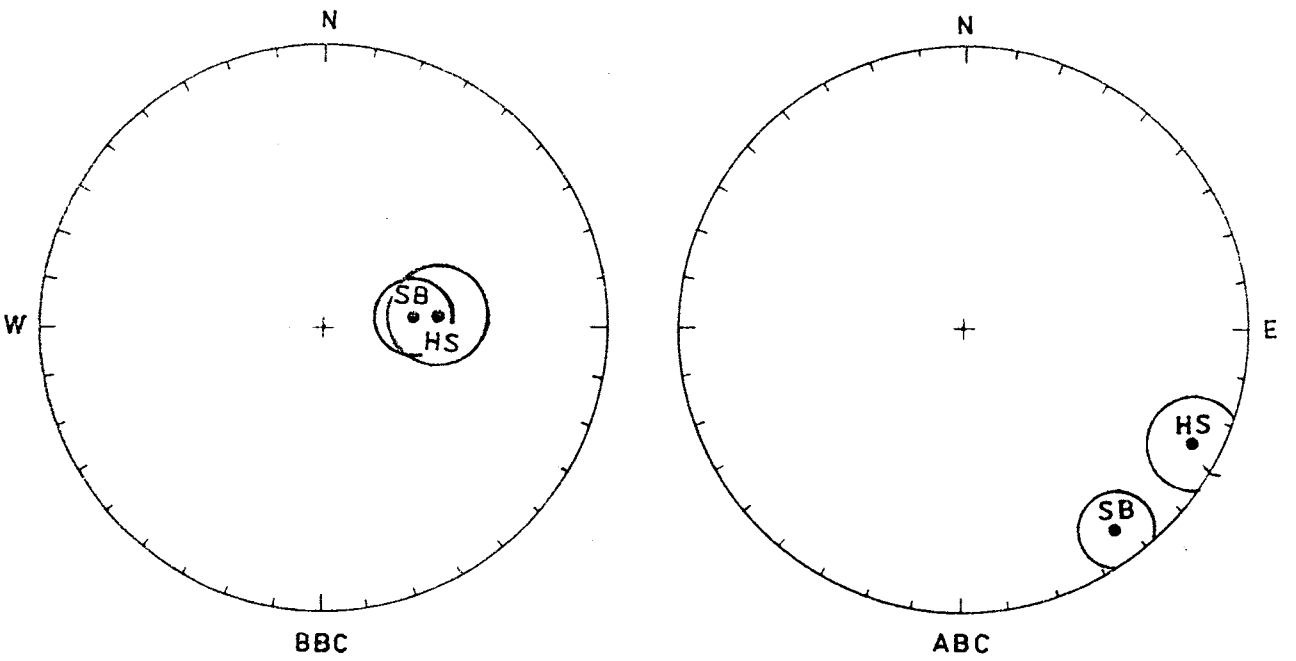

Fig. 9. Mean paleomagnetic directions before (BBC) and after (ABC) bedding correction: **HS** — Horné Srnie (Eocene, flysch; Western Slovakia); **SB** — Šambrón (Eocene, flysch; Eastern Slovakia).

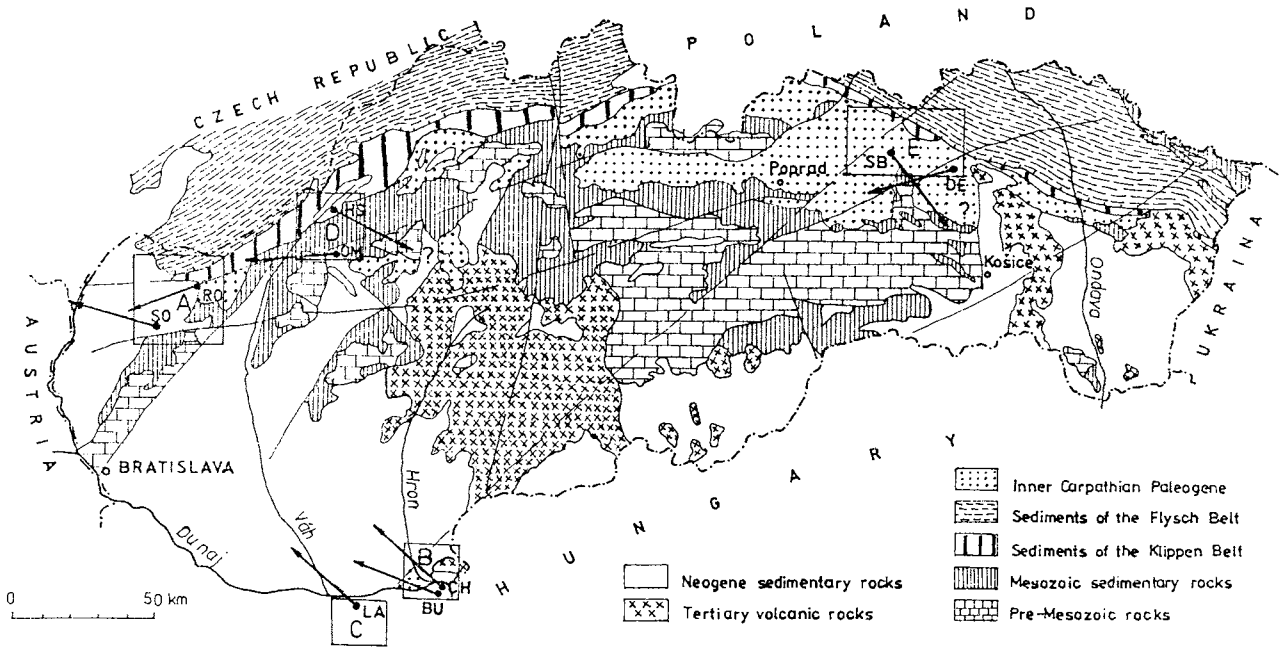

Fig. 10. Investigated areas with the mean paleomagnetic directions: Areas A (locs **Ro** — Roh Motel; Eocene, siltstone and **So** — Sološnica; Eocene, limestone) and B (locs **CH** — Esztergom-Castle Hill; Oligocene, siltstone, and **Bu** — Esztergom-Basa út; Oligocene, marl) are according E. Márton et al. (1992). Area C: loc. **LA** — Lábatlan (Eocene, fresh water limestone). Area D: locs **OM** — Omastiná and **HS** — Horné Srnie (both Eocene, flysch). Area E: locs **DE** — Demjata and **SB** — Šambrón (both Eocene, flysch).

Table 3: Paleomagnetic parameters for localities with CW-rotation (key see Tab. 1).

Locality	N/N_o	Dec^o Dec^o_{corr}	Inc^o Inc^o_{corr}	k	α^o_{95}
Horné Srnie	5/8	85	55	15	18
		119	8	15	18
Šambrón	7/8	93	55	21	14
		142	9	21	14

from localities of Horné Srnie and Šambrón are presented with question marks.

We would like to call attention to the fact that these rotations are similar to what we observed in Southern Slovakia on younger rocks (Márton et al. 1996). We have only sporadic results from the Inner Carpathians but they show an interesting consistency (with the exception of the localities of Horné Srnie and Šambrón) which stimulates us to continue our joint studies more intensively in the Inner Carpathians Cenozoic.

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