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INTERPRETATION OF AEROMAGNETIC INVESTIGATION IN THE EASTERN PART OF THE SLOVENSKÉ RUDOHORIE MTS.: THE KNOWLEDGE AND PROBLEMS

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Abstract: The completion of the aeromagnetic map of the Slovenské Rudohorie Mts. has yielded an integral and well-balanced view of the geomagnetic structures of this variegated region. Magnetically anomalous belts were detected which expressively indicate the NW and N margin of the Gemeric unit. Further, local anomalies were detected in the Gemeric lower Paleozoic sediments, and another ones belonging to Mesozoic basic and ultrabasic rocks of the Meliata Group. The regional anomalies belonging to the Veporic, Gemeric and Meliatic units were interpreted as well. The knowledge obtained was embodied in the submitted tectonic scheme.

Key words: aeromagnetometry, sources of anomalies in the Meliatic, Gemeric and Veporic units, deep structure of the Gemeric unit.

Introduction

The first stage of geophysical investigation of the Spiš-Gemer Ore Mts. including the Rimava Basin and the W part of the Košice Basin was realized in the late sixties (Filo 1966; Bárta et al. 1969). Plančár et al. (1977) interpreted the measured data. Ground geophysical survey and interpretations of the contact of the Veporic and Gemeric units are presented in Obernauer et al. (1980 a,b).

A comprehensive elaboration of detailed geophysical mapping of the Inner Western Carpathians (magnetometry, gamma ray spectrometry) was presented by Gnojek & Janák (1986). Exeptionally variegated geophysical fields have been mapped by aeromagnetometry in the area between Lučenec (SW) and Košice (E), from the upper course of the Hornád river up to the Czechoslovak-Hungarian state frontier (Fig. 1 a,b).

Definition of studied objects and the problems of magnetic sources localization

The area of interest - the Slovenské Rudohorie Mts. is formed by pre-Tertiary sequences of the south Veporic, Gemeric, Meliatic and Silicic tectonic units (Fig. 2). Tertiary sediments and subordinate volcanics are of more importance mainly in the southern part - in the Lučenec, Rimava, Rožňava and Turňa - Košice Basins.

The southern Veporic unit is formed by lower Paleozoic metamorphites and magmatites, and by envelope sequences - upper Paleozoic (upper Carboniferous and Permian sediments of the Revúca Group - the Slatvina, Rimava Formations) and Mesozoic (Triassic and Jurassic sediments of the Foederata Group and Tuhár facies development). Granites occurring in Alpine structures at the Gemeric-Veporic contact are also included to the southern Veporic unit. (cf. Bajaník et al. 1984; Vass et al. 1987; Vozárová & Vozár 1988).

The Alpine granites in the contiguous zone of the Gemeric and Veporic units in the Rochovce structure area show a significant magnetic anomaly. It is due to the higher concentration of minerals causing high susceptibility of intrusives both at the contact with the envelope and in conditions of open dome structure. In contrast with this area, Alpine granites are in a rather tight overthrust-slice structure in other part of the contiguous zone. Such a position determines also a differing petrophysical character of rocks without significant magnetic anomalies.

The lower Paleozoic groups (Gelnica, Rakovec, Klátov), the Carboniferous and Permian sediments of the northern part (Črmeľ, Dobšiná, Krompachy), the Permian sediments of the southern part (Gočaltovo Group) of the Gemeric unit, as well as the Mesozoic sediments in autochthonous position, are all included in the Gemeric unit (Fig. 2).

In the northern part of the Gemeric unit, particularly compared with the Gelnica Group, the Rakovec and Klátov Groups show distinguished magnetic properties. Significant magnetic anomalies are, as we suppose, connected with some sequences of the Dobšiná Group, mainly Ochtiná Formation. In this way we account for some anomalies in the northern part of the Gemeric unit, but also in the western part in the vicinity of the contact with the Veporic unit, where manifestations of Alpine granite intrusions can be supposed besides the effects of the Ochtiná Formation.

A separate problem appears to be the function of the Ochtiná Formation and Črmeľ Group in the eastern part of the Gemeric unit. It is not possible to distinguish unequivocally the sources of magnetic anomalies in these adjoining units.

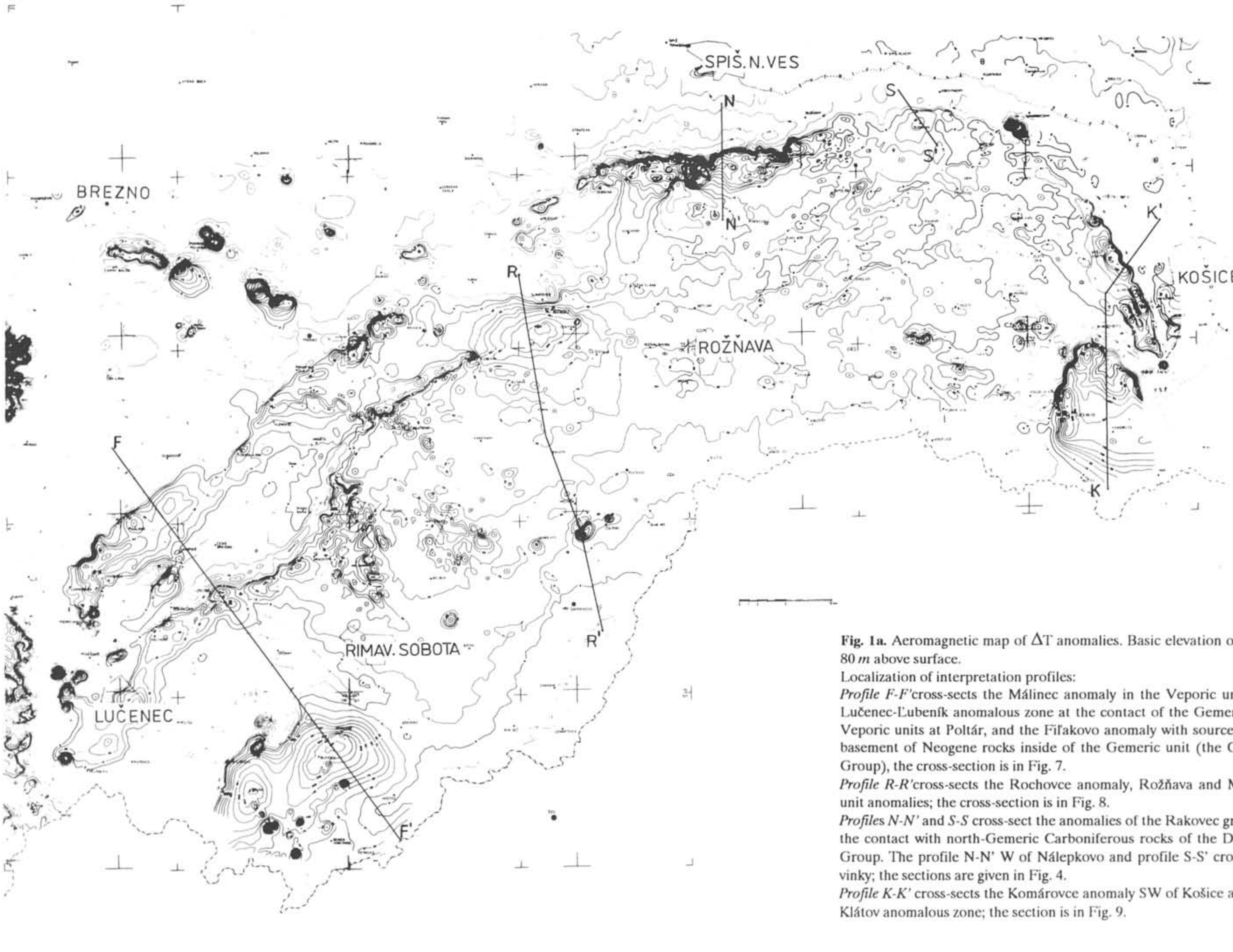


Fig. 1a. Aeromagnetic map of ΔT anomalies. Basic elevation of flight 80 *m* above surface.

Localization of interpretation profiles:

Profile F-F' cross-sects the Málinec anomaly in the Veporic unit, the Lučenec-Ľubeník anomalous zone at the contact of the Gemeric and Veporic units at Poltár, and the Fiľakovo anomaly with source in the basement of Neogene rocks inside of the Gemeric unit (the Gelnica Group), the cross-section is in Fig. 7.

Profile R-R' cross-sects the Rochovce anomaly, Rožňava and Meliata unit anomalies; the cross-section is in Fig. 8.

Profiles N-N' and *S-S* cross-sect the anomalies of the Rakovec group at the contact with north-Gemeric Carboniferous rocks of the Dobšiná Group. The profile N-N' W of Nálepkovo and profile S-S' cross Slovinky; the sections are given in Fig. 4.

Profile K-K' cross-sects the Komárovce anomaly SW of Košice and the Klátov anomalous zone; the section is in Fig. 9.

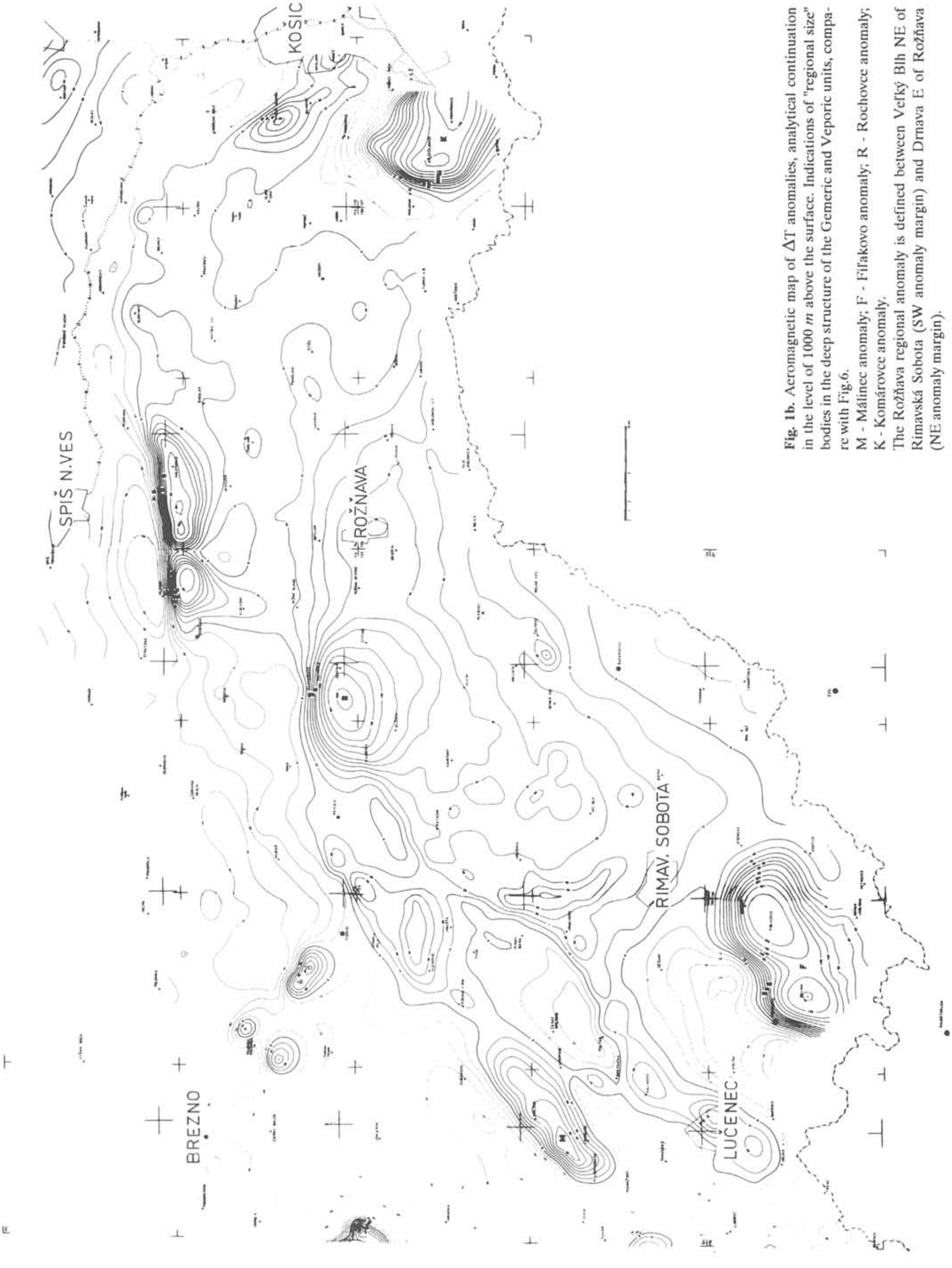


Fig. 1b. Aeromagnetic map of ΔT anomalies, analytical continuation in the level of 1000 *m* above the surface. Indications of "regional size" bodies in the deep structure of the Gemeric and Veporic units, compare with Fig.6.

M - Málinec anomaly; F - Fiľakovo anomaly; R - Rochovce anomaly; K - Komárovce anomaly.

The Rožňava regional anomaly is defined between Veľký Blh NE of Rimavská Sobota (SW anomaly margin) and Drnava E of Rožňava (NE anomaly margin).

The southern part of the Gemeric unit is rimmed by the strongly tectonically reduced Meliata unit (Bajaník et al. 1984; Mello et al. 1988). This tectonic unit is rich in basic volcanics and metamorphosed carbonates and represents a source of sig-

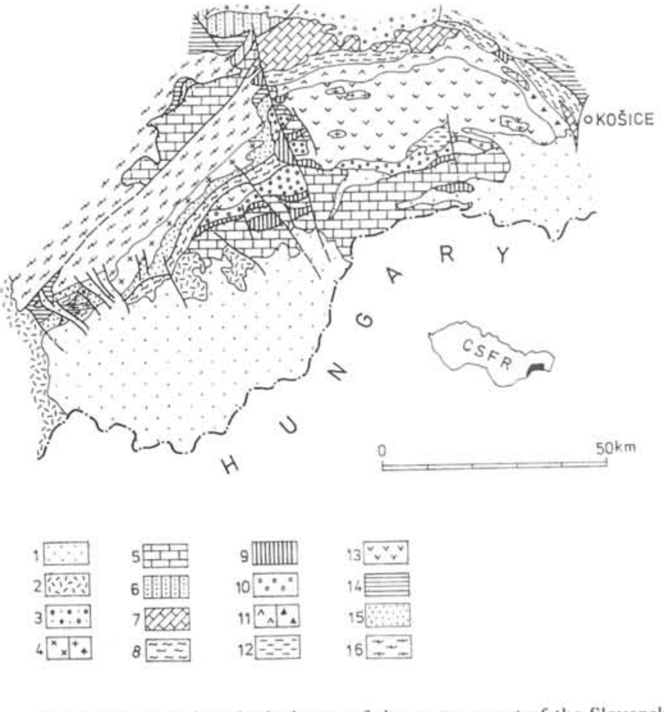


Fig. 2. Synoptical geological map of the eastern part of the Slovenské Rudohorie Mts..
Legend: 1-3 Alpine molasse: 1 - Neogene sediments, 2 - Neogene volcanics, 3 - Inner-Carpathian Paleogene sediments; 4 - Alpine granitoids: a-in the Veporic-Gemeric contiguous zone, b-in the Gemeric unit; 5 - Silicic unit: Upper Paleozoic (in the anticline at Brusník), predominantly Mesozoic; 6 - Hronic unit: Upper Paleozoic (Nižná Boca and Malužiná formations); 7-13 - Gemeric unit: 7 - Mesozoic rocks of the Stratená Goup and Galmus, 8 - Upper Paleozoic rocks of the Dobšiná and Krompachy Groups, 9 - Mesozoic rocks of the Meliata unit, 10 - Upper Paleozoic rocks of the Gočaltovo Group, 11 - Paleozoic sediments: a - Rakovec Group, b - Klátov Group, 12 - Paleozoic rocks - Štós formation, 13 - Lower Paleozoic rocks - the Gelnica Group; 14 - 16 Veporic unit: 14 - Mesozoic rocks of the Foederata, Struženík, Veľký Bok, Tuhár, 15 - Upper Paleozoic rocks - Slatvina, Rimava formations, 16 - crystalline complex - metamorphites and granites.

nificant magnetic anomalies. Carbonatic sequences of the Silicic unit are characteristic by zero magnetic activity. This nappe unit builds in substantial part the Slovak Karst (Mello et al. 1988). It has been preserved in the form of tectonic outliers to the NW of Rožňava (Bajaník et al. 1984) and it represents an immediate basement of the Rimava Basin Neogene sediments (Elečko et al. 1985).

An exception is the Brusník anticline area where, besides Mesozoic sediments, clastogene Permian (the Brusník Formation, Vozárová in Vass et al. 1986) and a Carboniferous olistostrome with limestones and acid volcanics (Szendrö phyllites formation, Vozár et al. 1989; Vozárová & Vozár 1990) also take part in the structure of the Silicic unit.

Significant magnetic anomalies bound to the Paleozoic sequences of the Gemeric and Meliatic units can be followed to the basement of the Tertiary - Quaternary infilling of southern Slovak basins.

In the eastern part of the Slovenské Rudohorie Mts., in the area with dominant occurrence of the Gemeric unit, we define the following types of magnetic anomalies:

a - magnetically anomalous belts in the northern part of the Gemeric Paleozoic rocks and in the contiguous zone of the Gemeric and Veporic units,

b - local anomalies in the Gelnica Group,

c - local anomalies in the Meliata tectonic unit,

d - extensive areal anomalies caused by deep-seated sources (magmatic bodies).

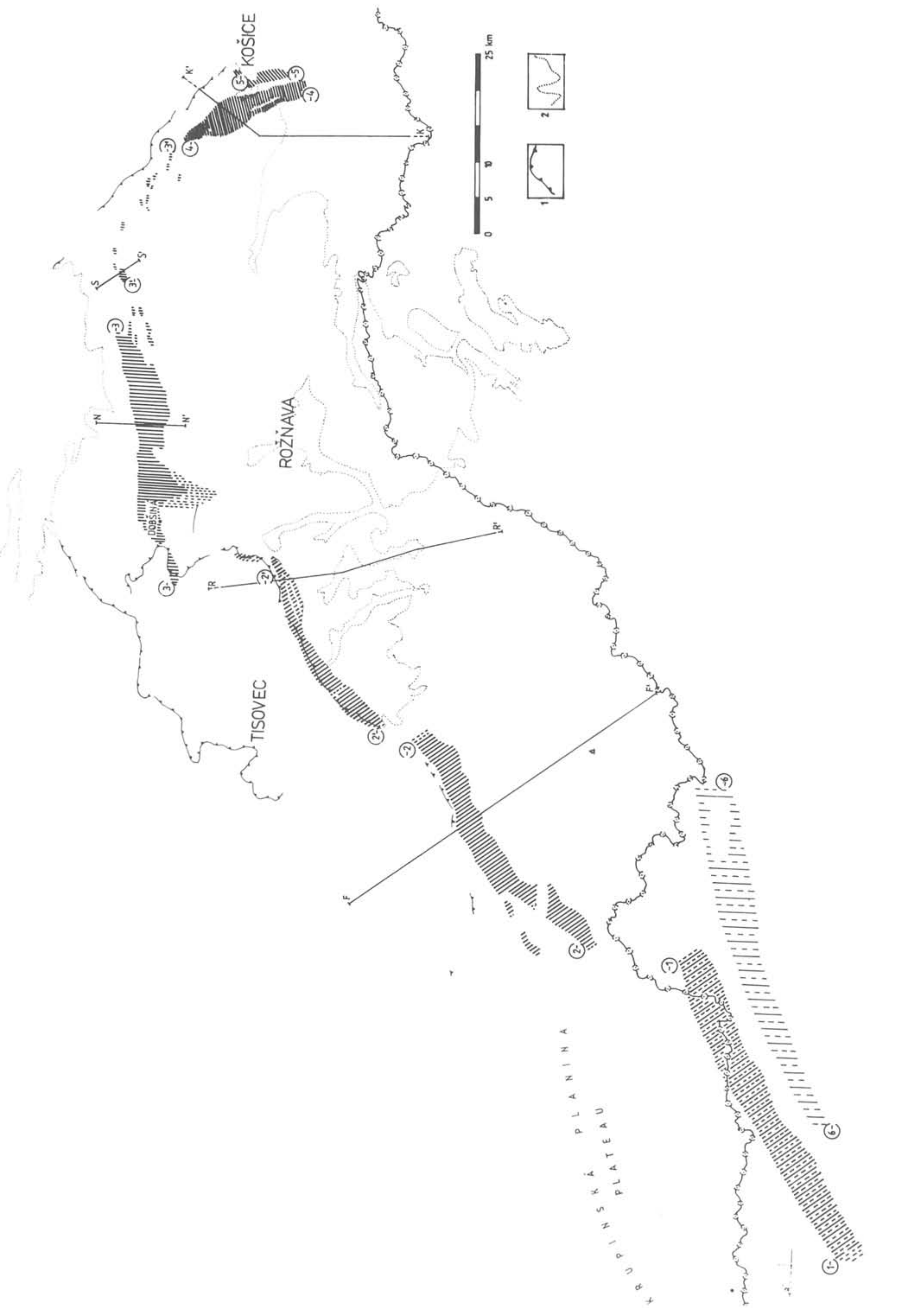
Belts of magnetic anomalies in the northern and northwestern part of the Gemeric Paleozoic rocks

The Rakovec Group

The most prominent belt reaching up to 6 *km* in width with amplitudes of individual anomalies in hundreds nT occurs in the northern part of the Gemeric unit and corresponds to the Rakovec Group. The total length is 35 *km*, thickness 2.5 - 3 *km* (belt 3-3 in Fig. 3). It is a volcanic-sedimentary formation of the Devonian - lower Carboniferous age. Sandy-clayey sediments are accompanied by abundant basic (and sporadic acid) subaqueous tholeiitic volcanics metamorphosed in the greenschist facies. The position of the Rakovec Group against the Gelnica Group is a tectonic one, in some places by sharp boundaries of both groups, in other places obliterated by post-Variscan events (cf. Grecula 1982; Reichwalder & Snopko in Bajaník et al. 1984; Vozárová & Vozár 1988).

The anomalous magnetic fields of the rocks suggests their steep descending mainly to the south in almost the whole section 3-3 (Dobšiná-Rudňany). The boundary of magnetic anomalies follows the contact of the Rakovec and Gelnica Groups, which we consider as Variscan but having been influenced by the Alpine tectonics. Such a position of sources was interpreted by Fillo & Kubeš (in Šefara et al. 1987) in surroundings of Nálepkovo. The magnetic field measured along the N-S profile N-N' (Fig. 4a), suggested by us, can be described by the effect of a model reaching from the surface to the depth of approximately 1.5 *km* in a nearly vertical position, or dipping steeply to the S, and becoming more gentle (30°) below the 1.5 *km* depth level. This model geometry cannot confirm the conception of Snopko & Reichwalder as expressed in explanations to the geological map 1 : 50000 (in Bajaník et al. 1984). We support by this an overfault-sliced structure of the northern Gemeric unit as presented by Grecula (1973, 1982) and Vozárová & Vozár (1980, 1988).

Fig. 3. Magnetically anomalous belts at the outer margin of the Gemeric unit.
Legend: 1 - margin of the Gemeric unit overfault; 2 - boundaries of pre-Tertiary formations on surface in the Slovenské rudohorie Mts. and adjacent part of Hungary.
Anomalous magnetic belts:
1-1 Diósjenö-Piliny belt (it includes the Kováčovce anomaly in the Ipeľ Basin. Confer. Magyar Állami Eötvös L. Geoph. Int. 1986).
2-2 Veľká nad Ipľom-Hrachovo belt (SW part of the Lučenec -Ľubeník magnetic zone - in sense of Gnojek 1988).
2'-2' Brádno-Ľubeník belt (Markuška) - (NE part of the Lučenec-Ľubeník magnetic zone, in sense of Gnojek 1988).
3'-3' Segment of discontinuous (local) anomalies Slovinky -Košické Hámre (Gnojek & Janák 1986).
4-4 Košická Belá-Šaca belt (Klátov magnetic zone, in sense of Gnojek 1987).
5-5 Črmeľ-Myslava belt (Gnojek & Janák 1986).
6-6 Rétség-Salgótarján (Confer. Magyar Állami Eötvös L. Geoph. Int. 1966).


KOŠICE
ROŽŇAVA
DOBŠINÁ
TISOVEC
KRUPINSKÁ PLANINA
PLATEAU
25 km

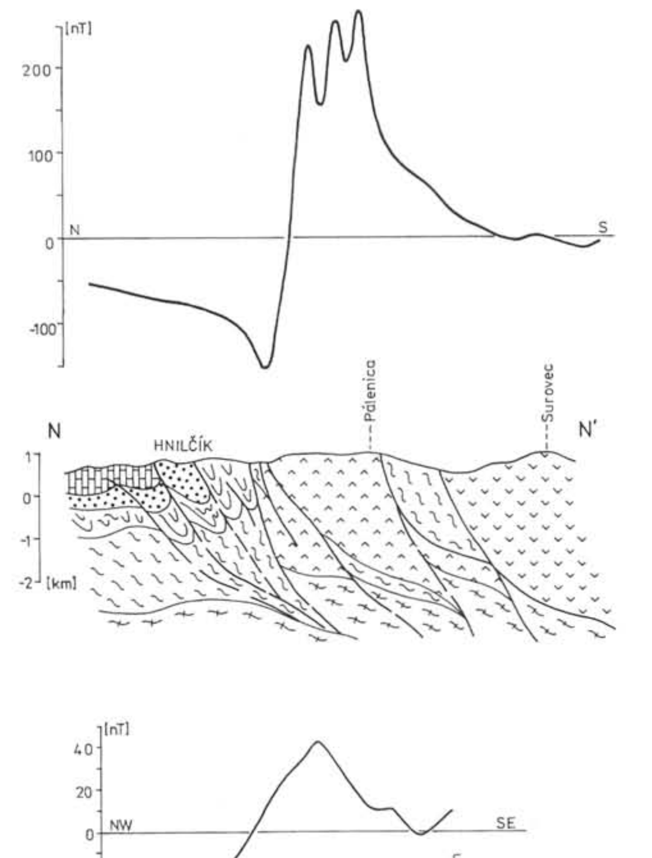


Fig. 4. Geological sections across the Rakovec Group.
1 - Neogene sediments; 2 - Alpine granitoids; 3 - Mesozoic rocks of the Silicic unit nappes; 4 - Mesozoic rocks of the Stratená Group and Galmus; 5 - Mesozoic rocks of the Meliata unit; 6 - Permian rocks of the northern Gemeric unit (Krompachy Group); 7 - Carboniferous rocks of the northern Gemeric unit (Dobšiná Group); 8 - ?Devonian-?Lower Carboniferous rocks of the Gemeric unit (Klátov and Rakovec Groups); 9 - Permian rocks of the southern part of the Gemeric unit; 10 - ?Cambrian to lower Devonian of the Gemeric unit (Gelnica Group); 11 - Upper Paleozoic rocks - Stephanian and Permian of the southern Veporic unit (Slatvina and Rimava formations); 12 - Lower Paleozoic rocks of the Veporic unit - metamorphosed volcanics and sediments; 13 - Lower Paleozoic rocks of the Veporic unit - granitoids and migmatites.

The Rakovec Group in the eastern section between Poráč and Košická Belá (interval 3'-3') shows a lower magnetic field intensity. The magnetic anomalies reach only one fifth (maximum 40 - 50 *nT*) when compared with the highly anomalous western section 3-3, and do not form a continuous anomalous belt. Some particular anomalies suggest that they have been caused by deeper sources (bodies of amphibole gneisses, gabbro-amphibolites, gabbros of the Rakovec Group).

A most prominent anomaly of this discontinuous section is the one developed in broader surroundings of Slovinky (Fig. 4b). The anomaly can be explained by a source occurring 700 to 1000 *m* below surface. The upper part is steeply raised but in the depth of about 2 *km* dipping decreases substantially down to 20°. The majority of small anomalies occurring in the section 3'-3' from Slovinky to the SE of Košická Belá suggest descending of their sources to the S or SSE. These directions indicate the tectonic position of the Rakovec Group. Its sliced structure represents a fan-like style in the near-surface part. Toward depth it changes to a monoclinical sliced-structure. The upper structure of the fan-like style is a reflection of the Alpine frontal contact of the Rakovec Group with upper Carboniferous, Permian amd Mesozoic piles. Tectonic contacts are assumed to be Alpine re-activated.

Substantially less developed discontinuous magnetic anomalies of the Rakovec group in the section 3'-3' between the area south of Poráč and Košická Belá are accounted for by two factors:

1 - an intensive tectonic failure of the area under consideration,

2 - the influence of alteration processes on the rocks of the area.

A numerous series of disjunctions of SW-NE, NW-SE and N-S directions intensively rupturing rock massif here is developed in this area at the intersection of NW-SE faults and the geophysically prominent trans - Gemeric fault zone of the SW-NE direction. Ore-bearing fluids penetrating these ruptured rocks caused degradation of the mineral content with originally high susceptibility to secondary products with lower susceptibility.

The Klátov Group

An entirely different anomalous field occurs in the section 4-4 between Košická Belá-Šaca (Fig. 3). This predominantly continuous anomalous field includes 2 - 3 *km* wide individual anomalies with the amplitude up to 200 *nT* in the overall length of 20 *km* and width of 2 - 3 *km*. The different rock composition of the complex, viz. amphibolites and gneisses (Dianiška & Grecula 1979) lead some authors , e.g. Spišiak et al. (1985) to distinguish an independent Klátov Group. Ivan (1989) considers this rock complex a representative of the ophiolite series in the Gemeric Paleozoic rocks. The development of the anomalous field of the Klátov Group suggests that the source amphibolite bodies in the northern half of the belt drop from near the surface steeply to the WSW. At the depth of 1500 *m* the dipping angle decreases to 40 - 30°. In the southern part of this belt the northern branches of the Darnó system begin to participate and split the unique belt into two parallel anomalous belts. The sources are inclined very steeply to the WSW or are even vertical. Reversed dipping to the ENE is also not excluded.

The Črmeľ Group

The smallest magnetically anomalous belt (Fig. 3, 5-5) occurs at the eastern margin of the Gemeric unit . Its sources belong most probably to the Črmeľ Group assigned on the basis of palynomorphs to the lower Carboniferous by Bajaník et al. (1987). In the paper by Vozárová & Vozár (1988) the Črmeľ Group is lithostratigraphically correlated with the lower part of the Ochtiná formation in the section Ochtiná - Podrečany and thus considered as the stratigraphic basement of the magnezite-bearing horizons. The magnetically anomalous belt reaches a length of 6 - 7 *km* and a width 2 - 2.5 *km* to the NW of Košice in the area of Črmeľ. The descent of sources (metabasalts, their tuffs, tuffites, metasediments) of the Črmeľ Group to the WSW can be presumed from the development of the anomalous field. To the north of the distinguished anomalous belt the Črmeľ Group occurs as phyllites without any significant magnetic anomalies.

The Dobšiná Group

The longest magnetically anomalous rim at the NW margin of the Gemeric unit is a pair of belts 2'-2' and 2-2 of the NE-SW direction (Fig. 3). The northern section is distinctly developed from Markuška, through Ochtiná and Ľubeník up to Bradno. It is, however, obliterated by a strong magnetic effect of the Rochovce granites between Ochtiná and Ľubeník. Except the areas of Neogene volcanics this anomaly can be traced up to Veľká nad Ipľom SSW of Lučenec (belt 2-2). Amplitudes attain 100 *nT*.

This anomalous paired belt (2'-2', 2-2) is brought about by rocks of the Dobšiná Group (in sense of Vozárová in Bajaník et al. 1981) particularly by the Ochtiná formation composed of basic volcanics, their tuffs and tuffites metamorphosed predominantly in greenschist facies. The thickness of the Ochtiná formation is up to 1200 *m* (l.c.).

The anomalous belt can be correlated with the ocurrences of the Dobšiná Group almost in the whole section 2-2 (Bradno - Ochtiná) and in the NW part of the section 2-2 (Hrachovo - Breznička). In view of its stable character we also interpret its covered part as a demonstration of altered basalts and volcanoclastics of the Ochtiná formation shallowly hidden under Neogene and Quaternary sediments at Kalinovo. The SW termination at Veľká nad Ipľom is in the depth up to 600 *m* (cf. Gnojek 1990b). The anomalous paired belt 2'-2' and 2-2, interpreted as a demonstration of the Dobšiná Group rocks, has accordingly been defined in the total length of almost 80 *km*.

A magnetically anomalous belt 1-1 sets in at the village of Piliny in northern Hungary about 12 *km* to the south of the southwestern termination of the anomalous belt 2-2 (Fig. 3). It is formed by a string of individual anomalies arranged almost in a straight-line with a width of 4 - 6 *km*. The belt reaches a length of about 5.3 *km* its demonstrations being lost in the intensive anomalous field of the Börzsöny volcanic mountains at the SW margin.

A part of this anomalous belt in Czechoslovak territory is so-called Kováčovce magnetic anomaly (interpreted by Fillo in Vass et al. 1979), verified by the drillhole MV-12 which reached basement at a depth of 560 *m* below the surface. After Klinec & Miko (fide Biela 1978) the basement is composed mainly of micaschists, mica quartzites and quartzite micaschists, and from 780 *m* down to the termination at 1100 *m* of amphibolites and amphibole gneisses. The mentioned rock sequences is considered as the Hron complex by quoted authors. This belt was reached by two drillings (Dj-1, Dj-2) in Hungarian territory at the village of Diósjenő near its WSW margin. Phyllites and amphibolites (Ivancsics & Kisházi in Balla 1989) were reached in the basement drilled at the depths of 600 and 740 *m*, respectively. Balla (l.c.) emphasises that, according to their revision of drill cores, only low degree metamorphosed rocks including basic metavolcanics were found. A necessity of revision of Klinec & Miko's results (fide Biela 1987) also follows from it in Slovak territory, particularly of the drillhole MV-12.

The anomaly type, the similarity of amplitudes, the very similar width of belts, the way individual anomalies are ordered, and particularly , the NE termination of the belt at the join Piliny-Veľká nad Ipľom, lead us to the assumption that the anomalous belt 1-1 occurring in Hungary is brought about by an analogous rock sequence as is known in Slovak territory from the Dobšiná Group of the Gemeric unit, *viz.* its Ochtiná formation. By this interpretation, the continuation of the Gemeric unit is moved from our westernmost occurrences at Lučenec by about 60 *km* to the SW in the basement underlying Neogene rocks, up to the Börzsöny Mts.

The southern belt 6-6, Fig. 3, found only in northern Hungarian territory to the W-SW of Salgótarján can be interpreted either as another belt of the Ochtiná formation, or by the presence of "Meliatic rocks" supposing their continuity with other Meliatic unit occurrences in northern Hungary (the Bükk Mts., Uppony, Rudabánya) and southern Slovakia (in the basement of both Neogene rocks and nappes of the Silicic unit).

Local magnetic anomalies

Local magnetic anomalies are found in the Paleozoic and Mesozoic complexes of the Gemeric unit. They are magnetic responses of small size sources, approximately in the length range $5x10^2$ to $5x10^3$ *m*. Based on performed calculations of the effects of such bodies at various depths, it follows that these "small" sources are able to demonstrate their presence only when occurring within depths of 2 *km*. Therefore, they indicate first of all the presence of surface and near-surface sources, only when reaching greater thickness they can indicate the sources in the depth level of 1-2 *km*. Also following from these facts is the knowledge that, if small isolated bodies with rather high magnetic susceptibility occur in depths greater than 2 *km*, we do not obtain any magnetometric indication at the Earth's surface.

Local anomalies in Paleozoic complexes

Except for local size anomalies belonging to the Rakovec Group (belt 3'-3', Fig. 3), all other local Paleozoic anomalies overlap areally with the Gelnica Group (Fig. 5a). Their greatest accumulation occurs in a 12 to 15 *km* wide belt, with the approximate axis being the join Rožňava - Margecany (along the trans-Gemeric fault). The majority of these anomalies is elongated in nearly SW-NE directions. We infer from it that sources of anomalies are conformable with the arrangement of the Gelnica Group. Only local anomalies occurring outside this belt suggest different elongations ("v" W of Volovec in the W-E direction, "k" W of Henclová and "z" in the surroundings of Kojšova Hoľa are isometric, the anomaly "r" SSE of Rejdová is in the N-S direction, "m" at Medzev and "p" S of Gemerská Poloma is in the direction WNW-ESE, the anomaly "y" in the surroundings of Hýľov is in the direction NW-SE). The course of all anomalies can be explained in a structural way in view of the Alpine tectonic arrangement.

Since the anomalies groups "a-h" are, according to the map of the Slovenské rudohorie Mts. (Bajaník et al. 1984) caused by metabasalts and metabasalt tuffs, we suppose also the majority of remaining anomalies to be caused by similar basic or intermediate paleo-volcanics not uncovered on the surface. The majority of detected sources we range in the depth interval of 0 to 1 *km*. The largest (in area) and at the same time the most intensive near-surface sources (up to 150 *nT*) occur to the E of Švedlár (s) and between Uhorná and Štós (u). The NE part of the latter source lies probably in the depth exceeding 1 *km*.

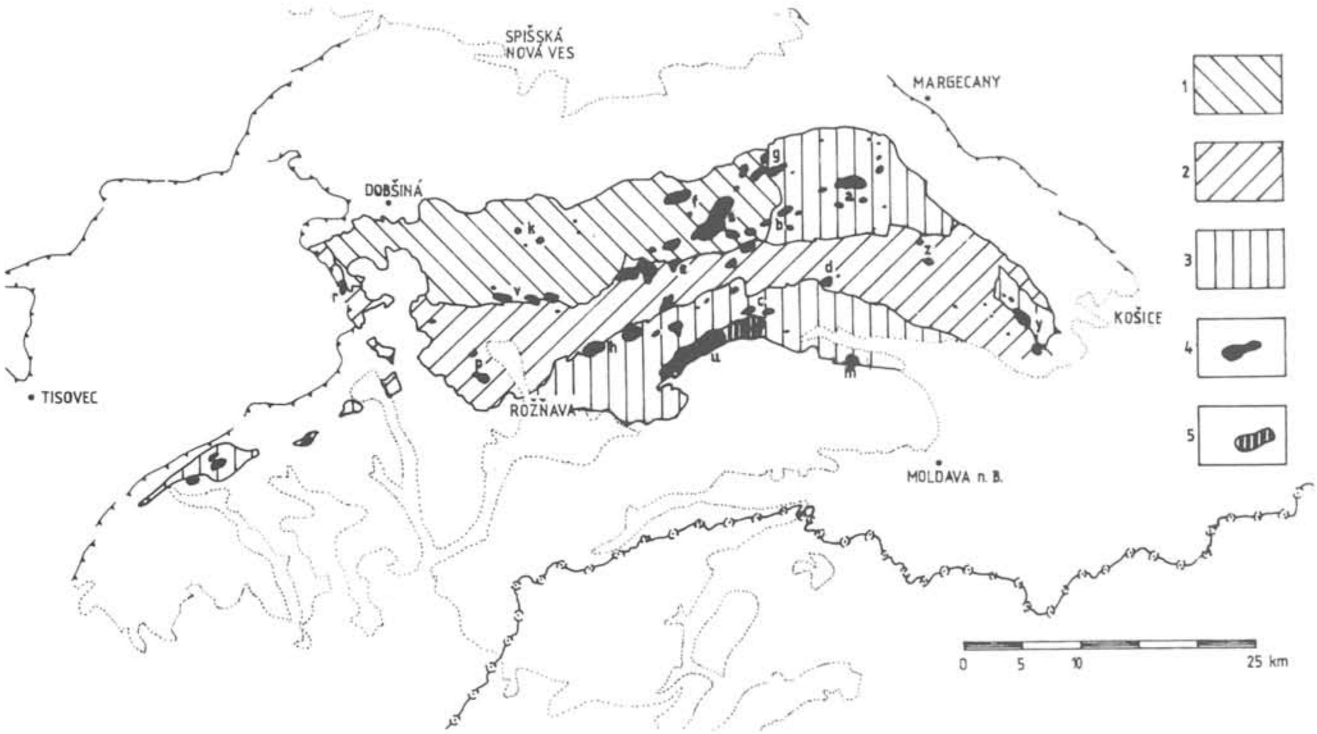

SPIŠSKÁ NOVÁ VES
MARGECANY
DOBŠINÁ
KOŠICE
TISOVEC
ROŽŇAVA
MOLDAVA n. B.
1
2
3
4
5
0 5 10 25 km

Fig. 5. a


SPIŠSKÁ NOVÁ VES
MARGECANY
DOBŠINÁ
KOŠICE
TISOVEC
ROŽŇAVA
MOLDAVA n. B.
RIMAV. SOBOTA
RUDABÁNYA
0 5 10 25 km

Fig. 5. b

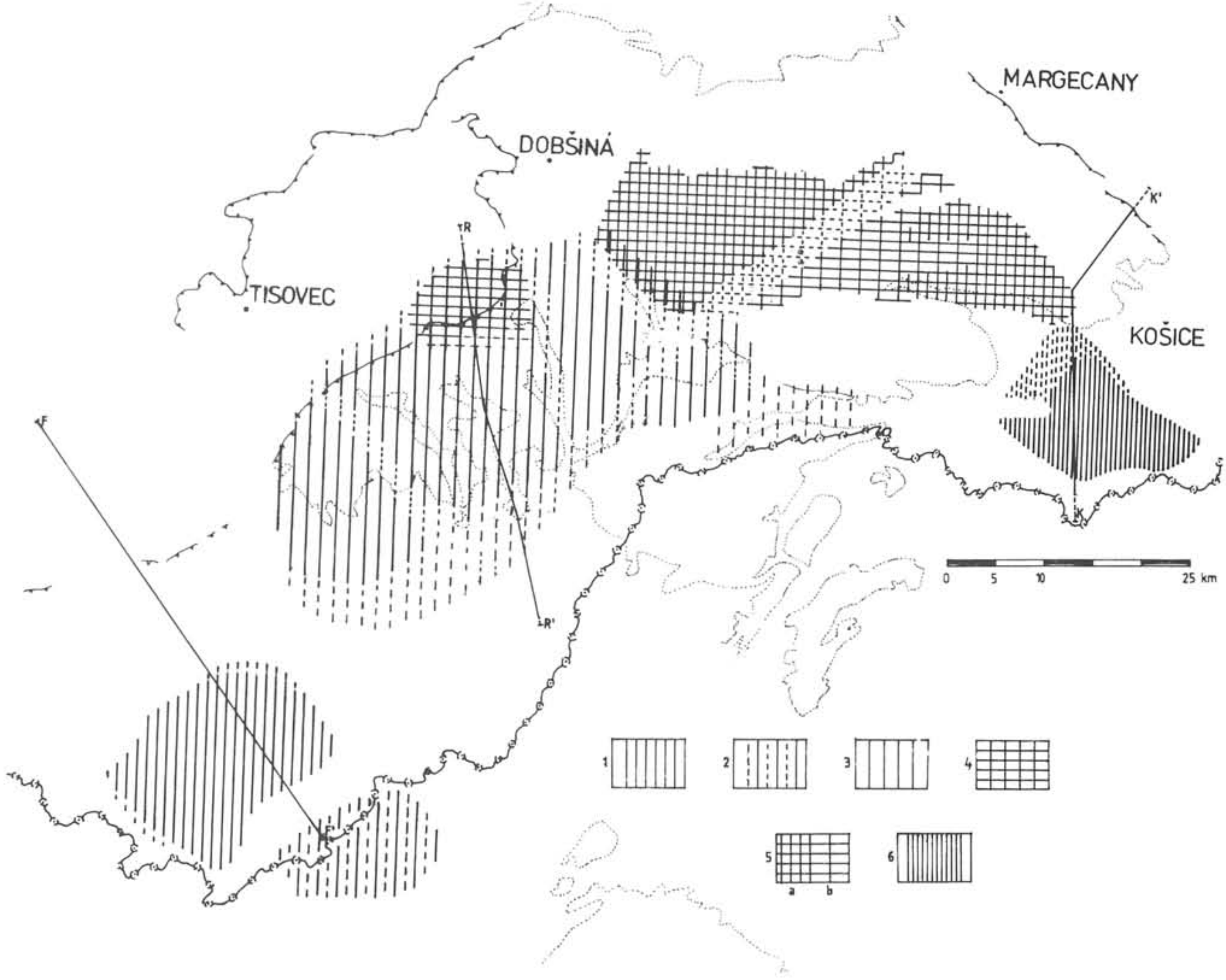


Fig. 6. Bodies of "regional size" in deep structure.
1 - Fiľakovo magnetically anomalous body (a source of the Fiľakovo magnetic anomaly), broken hachure indicates fading away of the body. 2 - source of the magnetic anomaly WSW of the town Ózd (in the vicinity of Domaháza and Zabar villages), NE termination of the magnetic anomalous belt Rétság-Salgótarján, 6-6. 3 - source of the extensive Rožňava magnetic anomaly (broken hachure indicates fading away of the body in small thickness margins, or tectonic failures crossing the bodies). 4 - magnetically anomalous Rochovce granite body superimposed on the NW margin of the Rožňava anomaly source. 5 - occurrence of magnetically non-anomalous Gemeric granites: a-at the depth of the upper margin 1 *km*; b-at the depth of the upper margin predominantly 1 *km*; defined after data of Mikuška (in Šefara et al. 1987). Broken hachure indicates the places of tectonic failure of the body. 6 - source of the Komárovce magnetic anomaly, broken hachure indicates tectonically disturbed parts of the body.

Fig. 5a. Sources of aeromagnetic anomalies in the lower Paleozoic of the Gelnica Group.
Legend: 1 - Vlachovo formation (upper Cambrian to middle Silurian, marked as S_{1-2}); 2 - Bystrý Potok formation (upper Silurian, marked as S_3); 3 - Drnava formation (lower Devonian, marked as D_1); 4 - sources of magnetic anomalies predominantly in depth interval 0-1 *km*; 5 - probable continuation of a near-surface source in greater depth.
Anomalous groups a-h represent the localities in the vicinity of which the geological map of Bajaník et al.(1984) shows (meta)basic volcanic rocks.
Anomalous groups k, m, p, r, s, u, v, y, z are discussed in more detail in text.

Fig. 5b. Sources of local aeromagnetic anomalies in the Meliata unit; predominantly basic and ultrabasic rocks in Triassic sequences.
Sources groups: 1 - Ratková-Červeňany-Rákoš; 2 - Jelšava Group; 3 - Štítnik Group; 4 - Markuška-Rochovce-Ochtiná; 5 - Kobeliarovo-Nižná Slaná; 6 - Honce Group; 7 - Rakovnica Group; 8 - Kunova Teplica Group; 9 - Rozložné Group; 10 - Gemerské Teplice-Mikolčany-Šivetice; 11 - Držkovce-Chvalová-(Višňové)-Strelnice; 12 - Licince-Meliata-Gemerská Hôrka; 13? - a problematic source Uzovská Panica; (the area is strongly disturbed by a transmitter); 14 - Bretka-Čoltovo; 15 - Krásnohorské Podhradie-Drnava-Lipovník; 16 - Lúčka-Bôrka-(Matesova skala); 17 - Hačava Group; 18 - Jablonov nad Turňou; 19 - Zádiel-Dvorníky-Turňa n. B.-Drieňovec; 20 - Jasov-Rudník-Debraď-Paňovce.
Ultrabasic rocks in the northern Gemeric unit - the Stratená Group (in sense of Bajaník et al. 1984): 21 - Dobšiná Ice Cave Group; 22 - SW surroundings of Spišská Nová Ves; 23 - Jaklovce-Folkmár Group.

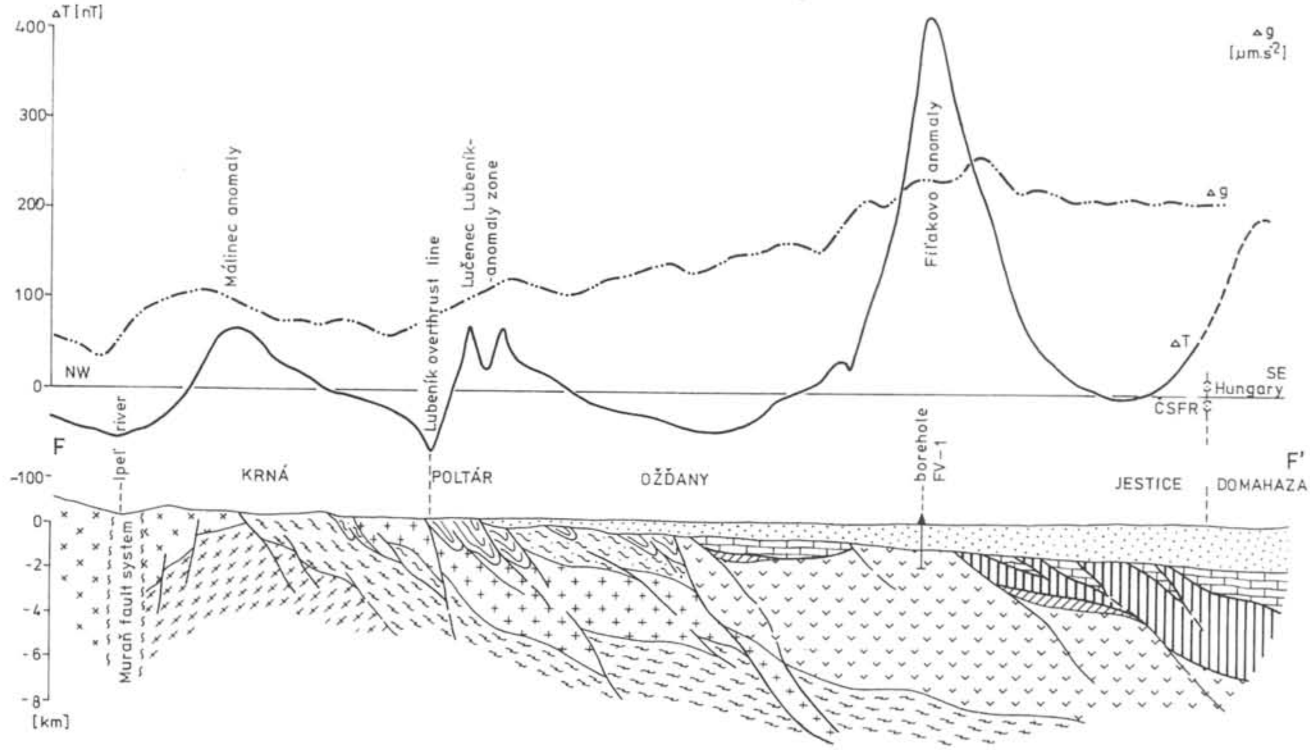


Fig. 7. Geological section across the Fiľakovo magnetic anomaly. Explanation see Fig. 4.

The aeromagnetic map shows the relatively lower frequency of magnetic anomalies in the older formations of Vlachovo and Bystrý Potok, and the relatively higher frequency in the Drnava formation. Anomalous sources are unevenly distributed at present erosion level in all three formations (in sense of Ivanička et al. 1984). A number of significant anomalies occur just at the contact of three mapped formations. Particularly, the relation of magnetic anomalies and the upper part of formations characterized by cryptoflysch and richer accumulations of bituminous components with dissipated Fe-sulphides mineralization can be mentioned.

It is not excluded that minute isometric anomalies W of Henclová (k) can be brought about by the contact effect of Alpine granites on the Vlachovo formation here. The findings of Vozárová & Krištín (1985) in contact aureoles of the Alpine granitoids in the SE part of the Veporic unit where a newly-formed magnetite was demonstrated in the amphibolite facies of the low pressure type, are comparable to the above-mentioned.

Local anomalies of the Meliata tectonic unit sources

The Meliata unit is characterized by Mello (in Bajaník & Vozárová et al. 1983) as a set of more or less metamorphosed rocks, mainly of Triassic and, possibly, of Jurassic age emerging at the surface from below the Silicic Nappe in tectonic windows, or forming tectonic slices on the Gemeric Paleozoic basement.

Magnetometry is able to reveal a number of basic volcanics in the Meliata unit metamorphosed in places to metabasalts, basic metamorphosed volcanoclastics, serpentinites and glaucophanites (cf. Hovorka et al. 1987). Results from Hungarian territory and from the BRU-1 drillhole (Brusník) indicate in the Meliata unit a Jurassic olistostrome with basic volcanics in the form of olistoliths (Vozárová & Vozár 1990) enlarging substantially our knowledge of this magnetic anomaly source.

Although after Gnojek (1990a), four known occurrences of basic volcanism at localities Radzim, Brdárka, Vlachovo, Medzev reported by Hovorka (1985) and Hovorka & Spišiak (1988) could not have been confirmed by aeromagnetometry, another 18 have been indicated by this method (Fig. 5b). Associated covered small bodies ocurring in addition to known outcropping bodies were detected at a number of localities. Many magnetically detected localities represent entirely new basaltoid bodies, e.g. in groups Rákoš - Červeňany (1), Mikolčany (10), Levkuška (13), Debraď (20).

More than 70 small bodies, e.g. in groups could have been detected and then distinguished by aeromagnetometry. They are grouped into 20 groups occuring in areas to the south of the Gemeric Paleozoic complex. Only three groups are found at the northern margin of the Gemeric unit, viz. at the Dobšiná Ice Cave (21), on the outskirts of Spišská Nová Ves (22), and at the villages of Jaklovce and Folkmár (23) as localities with problematic tectonic position. The Jaklovce occurrence we explain by a strike-slip fault at the trans-Gemeric fault Rožňava-Margecany (cf. Grecula et al. 1990), along which the southern phenomenon - the Meliata unit came to an anomalous position in the northern part of the Gemeric unit. The anomalous source at Spišská Nová Ves is covered, and its upper margin occurs at a depth of up to 200 *m* below Paleogene sediments. The occurrence at the Ice Cave can be interpreted in several ways. The Mock's (1988) concept seems to be a very attractive one, nevertheless, it should be proved. A single drillhole to 650 - 800 *m* would be sufficient.

Since the basaltoid bodies in the Meliata Group are typical small-size anomalous sources only bodies found at depths up to

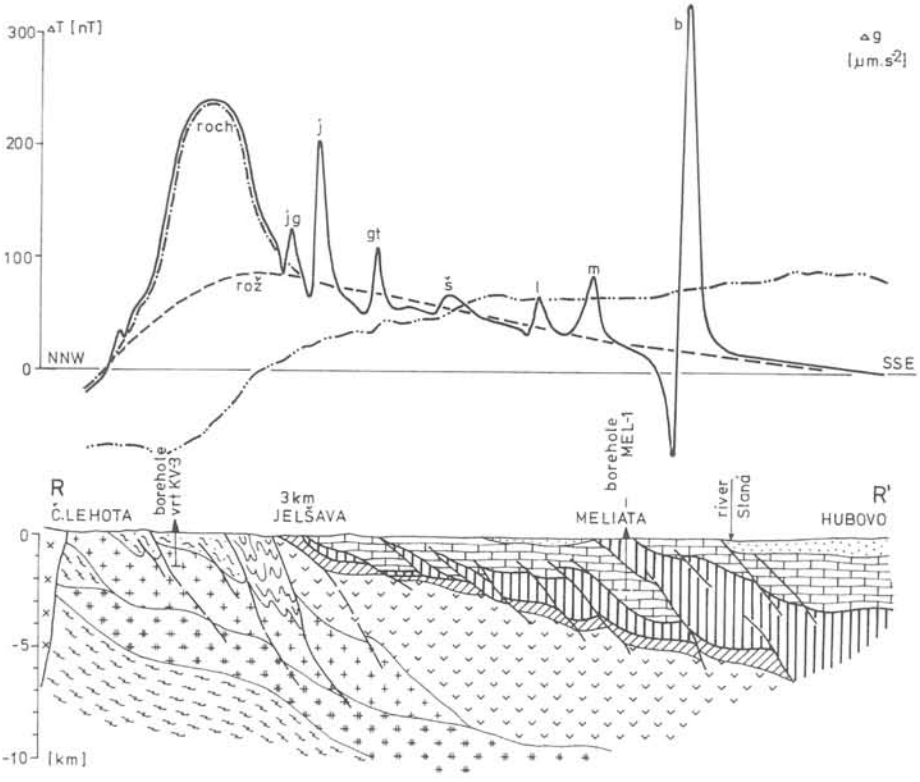


Fig. 8. Geological section across the Rožňava magnetic anomaly. Explanation see Fig. 4.

1 - 1.5 *km* have a chance to be detected due to their anomalous response. Deeper bodies may be detected only when reaching the thickness of several hundreds meters, or the length of descending over 1 *km*, a rather rare case in the given unit. The western bodies in the group of Bretka (14) and Hačava (17), and the northern body at Turňa n. B. (19) belong to the largest ones reaching in size the type of "large sources" of this unit.

Irregular, but more or less homogeneous distribution of sources in the whole area between Rimavská Sobota and Košice is distinctly interrupted in the Plešivec and Silica plains. Based on the above-mentioned facts we assume that possible occurrences of the Meliatic unit are covered by the Silica nappe thicker than 1-1.5 *km*.

Large bodies (of "regional size") in the deep structure

All the large bodies in the study area (Fig. 6) are distinctly magnetically anomalous (with the exception of the Gemeric granite). Regional profiles F-F', R-R', and K-K' show the vertical size of magnetic anomalous bodies.

The source of the Fil'akovo magnetic anomaly (profile F-F', Fig. 7)

The Fiľakovo magnetic anomaly occurring to the S of Rimavská Sobota (a distinct one in Fig. 1) consists of two anomalous elevations. At many places it is complicated by strong local superimposed effects of predominantly reversely magnetised Neogene basalts. The anomaly was first analysed by Kubeš (1979). After Filo & Kubeš (in Bodnár et al. 1988) the lower, problematic, termination of the body has not been solved yet.

The Fiľakovo magnetic anomaly source most probably attains a thickness of several kilometers. The high amplitude and steep gradient of the Anomaly suggest an increasing susceptibility towards its upper margin. It can be explained by the presence of a deep-seated source interpreted as a granite intrusion with contact metamorphic effects on metasediments, and a concentration effect on pyrrhotite and magnetite. The Gelnica group reached by the FV-1 drillhole contains over 300 *m* of metabasalts and their tuffs (Vass & Bajaník et al. 1988). In the wider area we cannot, however, exclude that a part of the Fiľakovo anomaly can be brought about by basic rocks of the Meliata unit.

Owing to the fact that according to the interpretation of deep-seismic profile the Gemeric unit is presented as a 5 - 6 *km* thick nappe the lower part of the Fiľakovo anomaly source still needs to be added to the southern Veporic unit (in the basement of Gemeric unit). A source, smaller both in size and in anomalous amplitude, situated predominantly in Hungary (to the WSW of town Ózd) can be joined either, analogically, partly to the Gemeric and partly to the Veporic units, or as supposed by Fusán et al. (1987) only to the latter one. The results of magnetometry interpretations, however, require a suposed contact of the Veporic-Gemeric unit to be shifted to the southeast in the basement of Neogene rocks.

The source of the Rožňava magnetic anomaly (profile R-R', Fig. 8)

The Rožňava magnetic anomaly (Fig. 1) in the northwest bound culminates in the Rochovce anomaly. The anomalies of the Meliata unit sources are superimposed at many places of its area on them. In the SW part there are also anomalies caused by Miocene volcanic rocks. A definition of the source causing these anomalies in the sense of Filo & Kubeš are presented in Šefara et al. (1987). The Rožňava anomaly represents the largest arc-shaped magnetic formation between Rimavská Sobota and Turňa nad Bodvou.

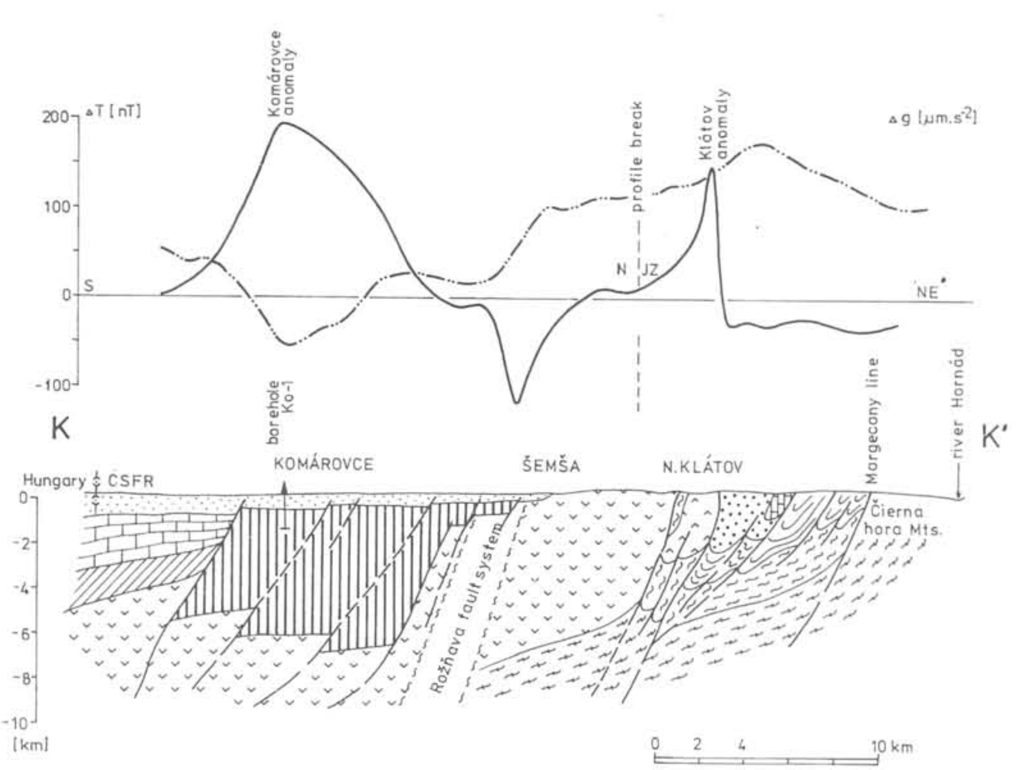


Fig. 9. Geological section across the Komárovce magnetic anomaly. Explanation see Fig. 4.

A model in the section along the profile R-R' presents the Rožňava anomaly source as a body setting in surroundings of Čierna Lehota-Slavošovce, dying out slowly towards SSE, and terminating at Šafárikovo. Its overall length reaches 30 *km* in the NNW-SSE direction. Moreover, the section shows that the Rochovce anomaly source may be placed directly on the Rožňava anomaly source and may be modeled as a body with a maximum thickness of about 3 *km*.

Both source bodies are situated in the sub-Gemeric environment (the complex of metamorphites and the NW part is identical with the granite boundary in the area of Rochovce-Čierna Lehota). The Rožňava anomaly reaches below an extensive body of Gemeric granites, by its NE marginal part. An idea seems to be attractive on the relationship of the Rožňava anomalous source with granite intrusion effects at the contact of the Gemeric and Veporic units, and with the effects of supposed Gemeric granites mainly in the southern part of the Gemeric Paleozoic complex to the SW of Rimavská Sobota.

The source of the Komárovce magnetic anomaly (profile K-K', Fig. 9)

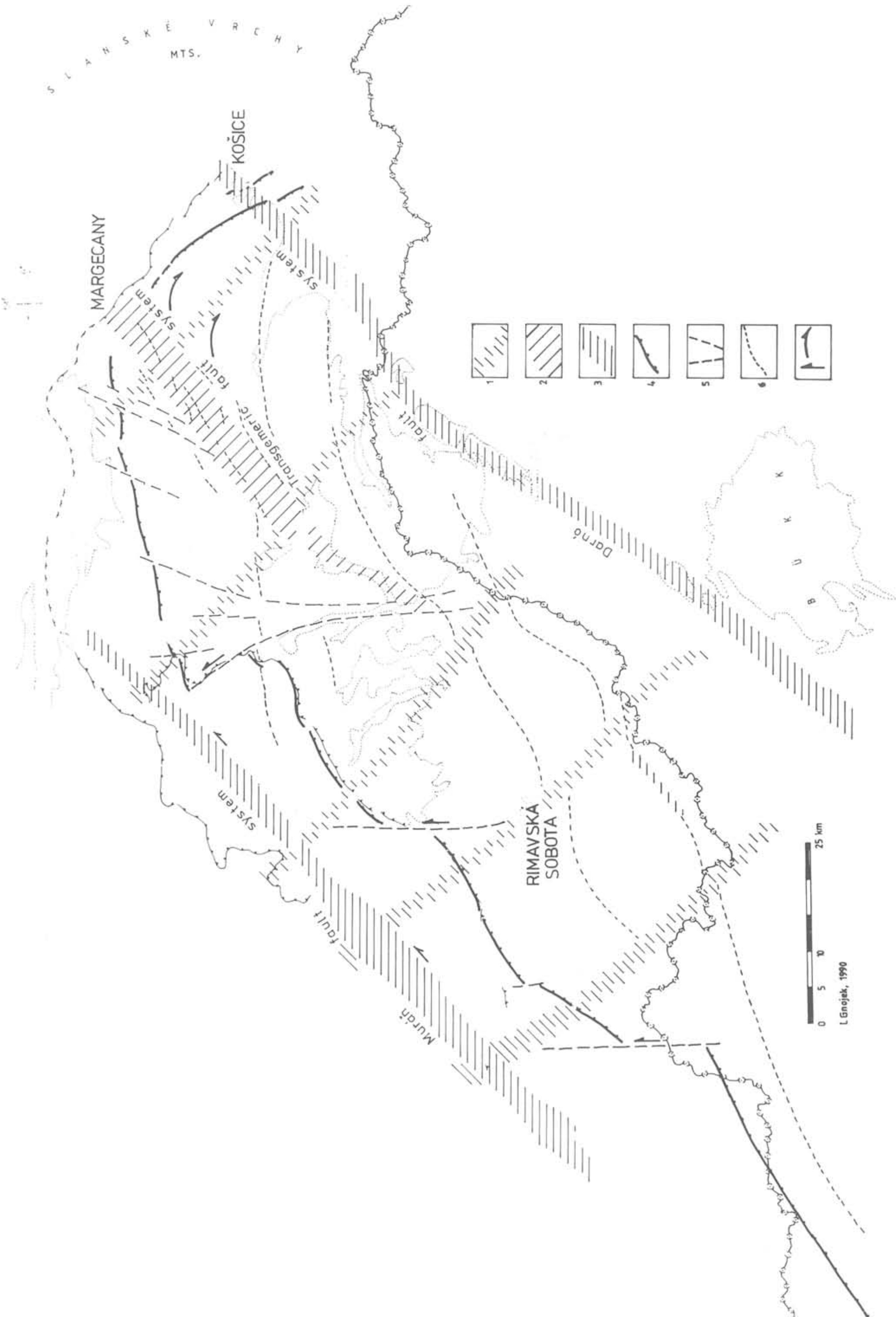
The Komárovce anomaly was first interpreted by Filo (in Plančár et al. 1977). He presented information on the upper part of its source. The latest quantitatively interpreted model of its source in the shape of a monolithic body was submitted by Kubeš (in Gnojek & Kubeš 1989). Our interpretation also based on the calculations of magnetically anomalous bodies modeled in the profile K-K' shows the Komárovce anomaly source as a body 4 - 6 *km* thick. On the basis of magnetotelluric sounding of Pawliszynová (in Grecula 1982) we present the Gemeric unit as a nappe body disrupted by the Rožňava fault system the subsided part of the body forming a basement of the Komárovce source . By the southward inclination of the model presented here we suggest a possibility of its original overfault to the north (NE) as well as the folowing subsidence to the south. The shallowly deposited, tectonically forced up outliers at the N margin of the Komárovce source correspond to the proved surface occurrences of ultra-basic rocks at Hodkovce and Paňovce (Hovorka 1985; Zlocha & Tomášiková 1989).

Gemeric granites (magnetically non-anomalous)

The latest definition of the Gemeric granites body based on a detailed gravimetric mapping and sophisticated data processing was given by Mikuška in collaboration with Maar (in Šefara et al. 1987).

The granitoid massif interpreted is found in a much shallower position in its NW part, than in the central or E part. It has been significantly influenced by the so-called trans-Gemeric fault system of the SW-NE direction. It attains the depth of 4 to 4.5 *km*.

Fig. 10. Structural scheme of the Gemeric area.
1 - NW - SE old fault systems of the in places rejuvenated; 2 - Central Gemeric fault system; 3 - fault systems with (young) horizontal displacement; 4 - determined and presumed overthrust lines (outer margins of magnetically anomalous metamorphosed volcanic-sedimentary formations); in the section Börzsöny Mts.-Dobšiná they are interpreted as the NW margin of the Gemeric unit; 5 - interpreted dislocation belts and faults (N-S and near directions) along which (older) horizontal displacements had occurred; 6 - prominent structural elements of the magnetic field; 7 - directions of horizontal displacements or rotations of blocks.


SLANSKÉ VRCHY
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MARGECANY
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fault
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fault
Darnó
BÜKK
RIMAVSKÁ
SOBOTA
system
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Murán
1
2
3
4
5
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0 5 10 25 km
L. Gnojek, 1990

Conclusions

The structural-tectonic knowledge achieved among others in present work, results from the analysis of the basic aeromagnetic map and the maps derived from it (Fig. 1) along with the map of total Bouguer anomalies and density boundaries indication maps (Šefara et al. 1987). The fault zones of three prevailing directions have been defined (Fig.10).

NW-SE fault zones

1 - The zone Lučenec-Salgótarján represents a SW boundary of the Málinec anomaly source, probably limits the SW margin of the Fiľakovo anomaly, makes possible the rise of Neogene basaltoid rocks of the Podrečany formation as well as the youngest Cerová formation, and influences the magnetically anomalous rock sequences of the Ochtiná formation.

2 - The zone Kokava nad Rimavicou-Rimavská Sobota-Ózd defines the Málinec anomaly from the NE, represents a boundary between the Rožňava anomaly source and the Fiľakovo anomaly; consequently following the boundaries of the Gemeric block in the basement of Neogene complex.

3 - The zone Tisovec-Šafárikovo-Rudabánya interrupts the Ostrá anomalous complex of the Veporic unit, it defines the arrangement of neo-volcanic islands, and influences the SE margin of the Rožňava anomaly. It probably represents a SE continuation of the Mýto-Tisovec fault zone,it follows a shift of the Gemeric unit in basement, or also the Meliatic unit, taking into account occurrences Brusník-Držkovce-Meliata.

4 - The zone Dobšiná-Rožňava-Turňa nad Bodvou defines the anomalous belt of the Rakovec Group to the W, represents an area where the Rožňava anomaly fades away towards the NE and of the SW boundary of the Gemeric granite bodies. It corresponds also with the equivalent and presumed distribution of the Meliatic unit on the surface and in the basement.

5 - The zone Krompachy-Košice-south defines the anomalous belt of the Rakovec Group in the NE and the SW continuation of the Klátov Group. It limits the NE margin of the Gemeric granites and the Komárovce anomaly source.

Due to the fact that the above zones put limits on a number of deep-seated sources (in depth of several kilometers) they need to be considered as the significant crustal disjunctions.

The fault systems of the N-S directions can be reliably distinguished in places of discontinuities and deflections of magnetic anomalies belonging to the volcano-sedimentary formations in the proximity of the outer margin of the Gemeric unit. Besides the Štítnik fault system we can evidence also "the Bradno fault and parallel faults up to the Poltár area" distinguished by Vozár & Vozárová (1988). This fault system also controls the distribution of neo-volcanics to the N of Rimavská Sobota.

In addition to a series of N-S and related faults with slight horizontal displacements we interpret a prominent N-S fault system to the SW of Lučenec approximately at the join Szécsény-Lovinobaňa. We ascribe it a function of horizontal displacement about 10 *km* long because it separates two conspicuously similar anomalous belts between Veľká nad Ipľom and the village of Piliny in Hungary. Owing to the fact that the defined magnetic anomalous belt Lučenec-Ľubeník represents the NW margin of the compact Gemeric unit (unless we consider the relics of the Gemeric unit to the NNW of Lučenec), we suppose here the possibility of a continuation of the Gemeric unit further to the SW in the belt running through northern Hungary to the Börzsony Mts.

The trans-Gemeric fault system, the most obvious between Rožňava and Margecany, represents a 5 to 7 *km* wide, tectonically disturbed belt. As shown by Mikuška (in Šefara et al. 1987) it reaches the depth of several kilometers. In magnetic field it also represents a pronounced boundary where the SW-NE and WSW-ENE directions typical of the block occurring NW of this fault system change to the NW-SE directions found in the block SE of the system. A wedge block with Plešivec, Dobšiná, Margecany forming the apices of a triangle can be interpreted as having been shifted to the N, the block occurring SE of the trans-Gemeric fault systems we consider to have been clockwise rotated. The trans-Gemeric fault system indications die out in the area of the Štítnik fault system. However, there are some indications of its SW continuation to Šafárikovo or up to Gemerský Jablonec where it could separate the Fiľakovo anomaly source from the source of the anomaly SW of town Ózd (similarly, as presented by Grecula & Varga 1979).

The area under consideration is practically defined by two young SW-NE oriented fault systems. To the NW it is the Muráň system, recently analysed by Pospíšil et al. (1989), and to the SE it is the Darnó system having been studied geophysically in detail in covered areas NE of Rudabánya in the Szendrö Mts. (Szalay et al. 1989).

Translated by D. Petríková

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