Remaded stripped gravity map on Tibreg territory: Slovakia and Hungary

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Abstract. The object of this paper is an additional possible model of density distribution of the stripped sedimentary cover. The main distribution remains dependant of density with depth and the stratigraphic characteristics of the sediments and the dependence of density on the time its compaction stay to be complementary one.

Key words: Transcarpathian basin , Bouguer anomaly map, density analyses Stripped gravity map

Introduction

The area is situated between Western and Easter Carpathian (Fig. 1) as is shown by the interpretation of the tectonic units in its basement. In the western and northern part, its basement belongs to Central Western Carpathian units - Tatricum, Veporicum in parts, Gemericum (Kováč et al. 1995, Soták & Spišiak 1991, 1992) In the central part is formed by the known Iňačovce - Krichevo unit of the Eastern Carpathian. The southernmost Zemplin unit belongs to the inner Western Carpathian. The questionable area is just the space of Iňačovce - Krichevo unit in the central part which belongs to a variety of units, for example to the Flysch of the Szolnok trough or to the Penninicum. The mentioned structure and its extension into Hungary and Ukraine make international cooperation necessary in order to solve geological and raw material questions in this area (Rudinec 1989).

Previous results

The most recent Pre - Tertiary Basement Contour Map has been compiled in 1989 based on drilling, seismic, geoelectric and magnetotelluric results (Kilényi and Šefara, 1989). The spacing and distribution of this information is very different on Slovakian and Hungarian territory.

This fact explains the differing plausibility of interpretation. By comparing the unified map of Bouguer anomaly of this area with the relief basement differences between these maps can be seen. These features were analysed by the method of stripping. The results of 3D modelling led to a stripping of the gravimetric map which was followed by a correction of the basement contour map. For this procedure currently only the change of den sity with the depth of the sediments can be used. The mean error of stripped map was estimated at ± 1.8 mgal. Another atempt for stripping had been made by Bielik (1998 a, b) and on the Hungarian side by Szabó (1999). A significant gravity high was found here which continues onto the territories of Ukraine and Hungary. The depth of its sources was estimated to be 13 - 15 km by Pospíšil (in Šefara et al. 1987).

Methodology of stripping

Density distributions of the sedimentary filling from the resulting from 21 density borehole profiles have been studied (Ondra and Hanák 1986).The patern of the boreholes is favourable for analyses of stratigraphic units of the sedimentary filling of the basin. We observe typical dependence of density from depth with a change of value for different stratigraphic horizons (Fig. 2). It is possible to separate this relation into a function of the lithostatic pressure (d) and of the time of its duration (t). It is given by:

$$\sigma(x; y; z) = \sigma(d) + \sigma(t)$$

For the main density distribution σ (d) for the Badenian has been chosen. Density for the Pannonian until Pliocene and the Sarmatian (negative correction) as well as for the Karpatian (positive correction), are complementary to the density distribution. In this model the neovolcanic complex was not included. For the interpretation of buried neovolcanic rocks - apart of the stripped field together with magnetic anomalies has been used.

For the calculation of differential densities, the mean value of 2.67 g . cm^{-3} for the deeper basin seems to be less conclusive. Gradually increasing the density of the basement from - 2.67 to approximately 2.75 - 2.77 $g.cm^{-3}$ can be considered as a quite realistic continuation

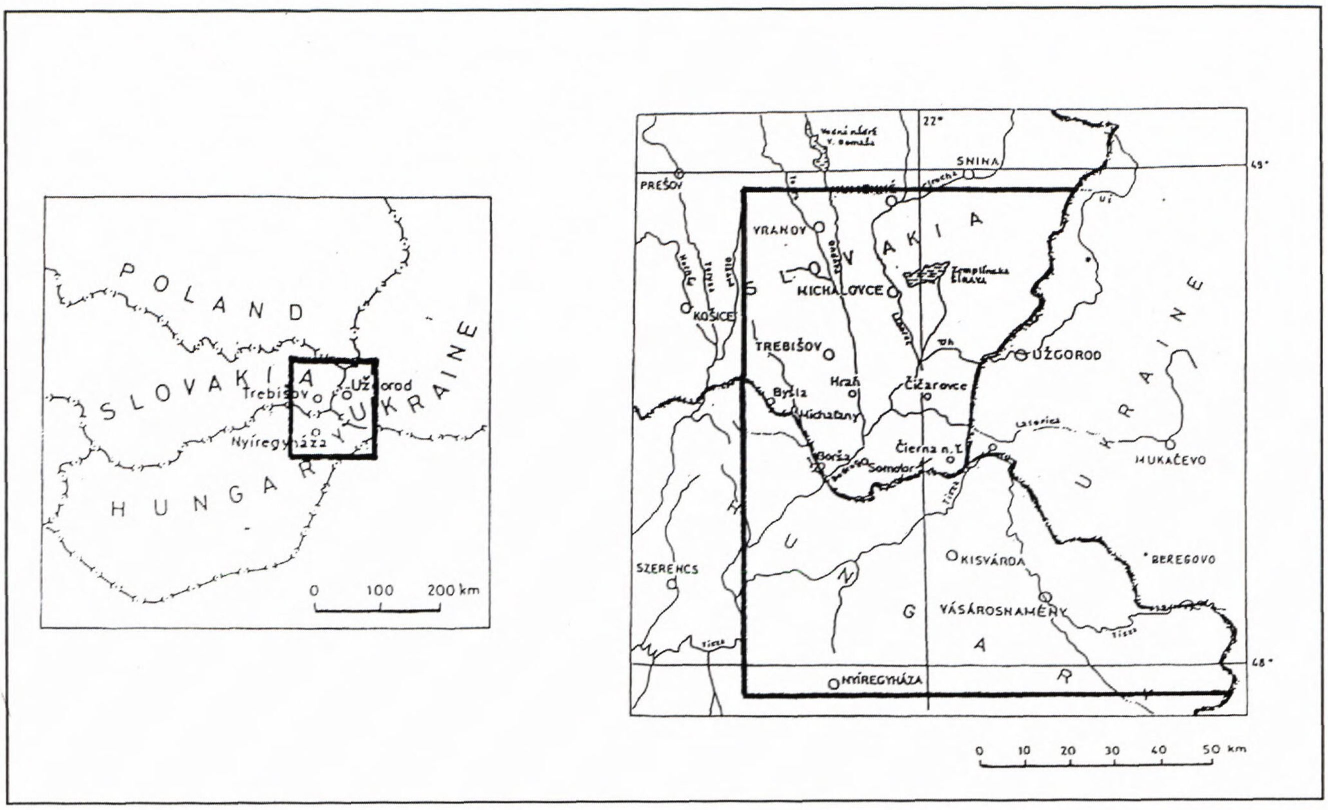

Fig. 1 Area of interest

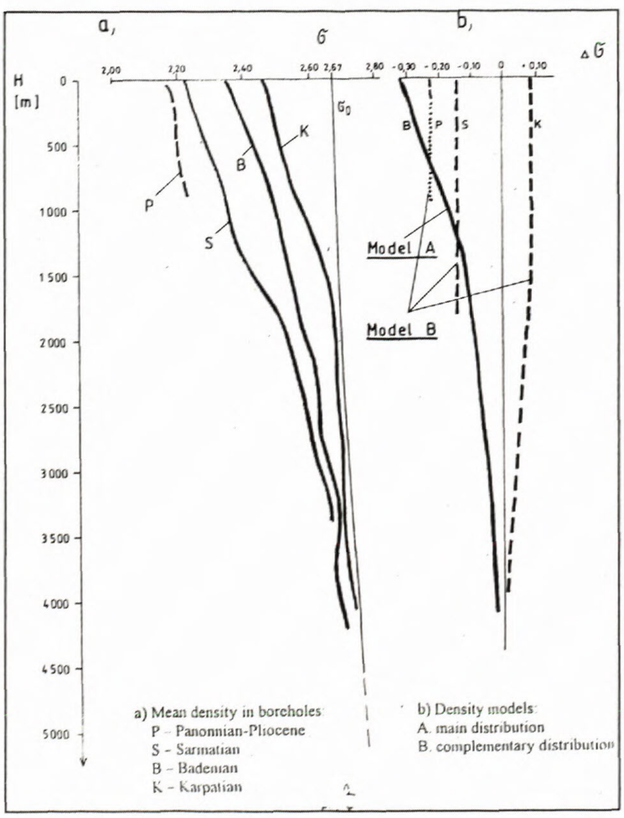

Fig. 2 Density analyses $\sigma = f$ (d, t)
(Šefara, J., 2000)

of the density model of the Earth determined by the normal field of the geoid (for example Dziewonski et al. 1995).

For the determination of the gravity effect of the models (Fig. 3) have been used:

a. Relief of the Pre-Tertiary basement, redone in areas with new measurements (model A)
b. Results of seismic sections and spatial distribution of the stratigraphic horizonts (model B).

In the curve after stripping (Fig. 3) the effects of deep structures and neovolcanic bodies have been included. We distinguish the neovolcanic bodies by magnetic anomaly (ΔT).

We classify them into three varieties:

a. Effusions with very high magnetic properties and lower density (2. 45 gcm^{-3})
b. Extrusive complex bodies with very high magnetic properties and an increase in density (2. 55 - 2. 65 gcm^{-3})
c. Intrusions with very high density (above 2. 65 gcm^{-3}) which have lost their magnetic properties by alteration distinguishing them from their surroundings. The magnetic anomalies are centered around local positive gravity anomalies.

Considering a data precision $m_\sigma = \pm 0.02 - 0.03$ $g.cm^{-3}$ (mean error of density values) and $m_{\Sigma\Delta z} = \pm 400 - 600$ m (mean error of interface depth) a mean error of stripping of about ± 0.5 mgal is expected, which is considerable improvement over previous precision. Lower precision we must declare on the Hungarian side, where useful profiles led resultes are more less. Result of the analysis of

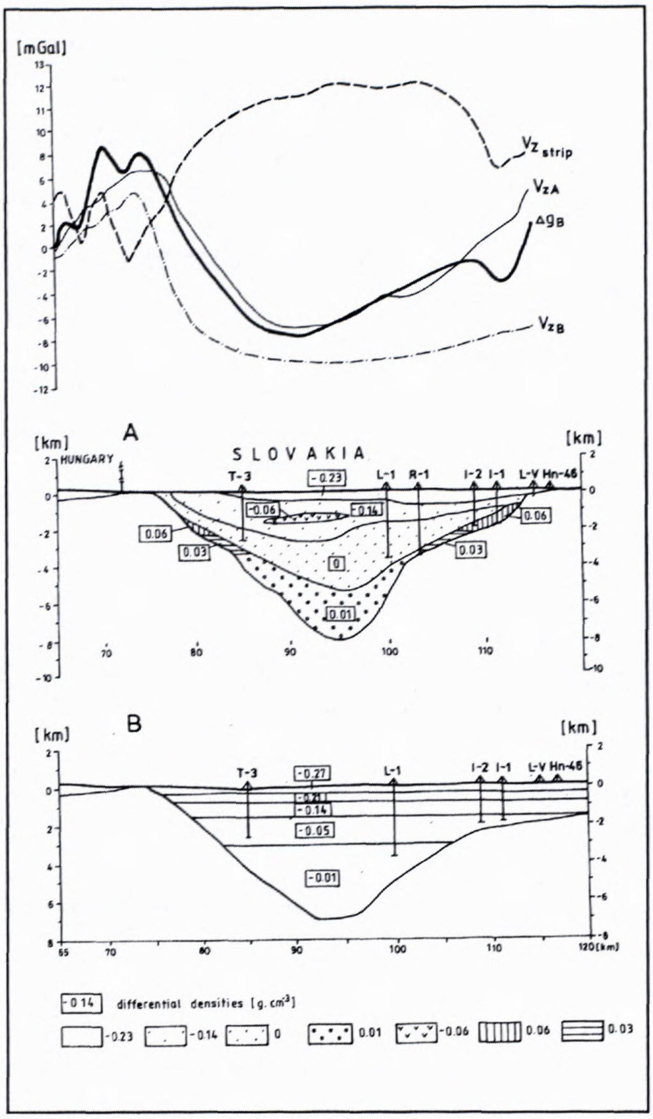

Fig. 3 Density – magnetic model
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the density models on the four profiles led to new stripped map with interesting structures with conection to deep structure of the area (Fig. 4)

Stripped gravity map and its structures

Besides expressive gravity maximum (Fig. 5), it was possible to complete gravity picture on deep structures about several anomalities of local importance. Their relation with basement units can be estimated as follows:

Positive zones:

1. Zone of central part with the most expressive positive values, with affinity to the extent of Iňačovce – Kričevo zone in the basement.

2. Zone of southern – Zemplín part with probably relation to Zemplicum core. The zone is very anomalously differenced, namely at Byšta surroundings, in its w. part.

3. Zone with relationship to Humenné Mesozoic.

4. Nonexpressive zone without direct connection with basement in se. part.

5. Zone of NE – SW direction with probable relation to the continuation of central Middle Hungarian zone.

Negative zones:

1. Zone with relation to alternative mantle of Kričevo zone or Central Carpathian Paleogene.

2. Zone with probable source in mantle units of Zemplin unit or Ptrukšany unit.

3. Zone with unknown source of lighter masses, while the presence of mainly Older Miocene is not excluded. The boreholes and other data signalized here the Post – Badenian complexes only.

All zones has generally NW - SE course, with the highest unregularities of perpendicular orientation in wider surroundings of Trebišov and Michalovce towns. Second disturbed course is on the Streda n/Bodrogom - Stropkov line.

From correlation of basin depocentres with stripped gravity map it can be judged that maximum extension (or even transtension) is accompanied by expressive gravity elevations. After identifying namely central depocentre with original overfault zone (between Iňačovce - Kričevo zone and its tectonic top wall), it can be expected direct cause of extension with deeper and deep structures of elevation character.

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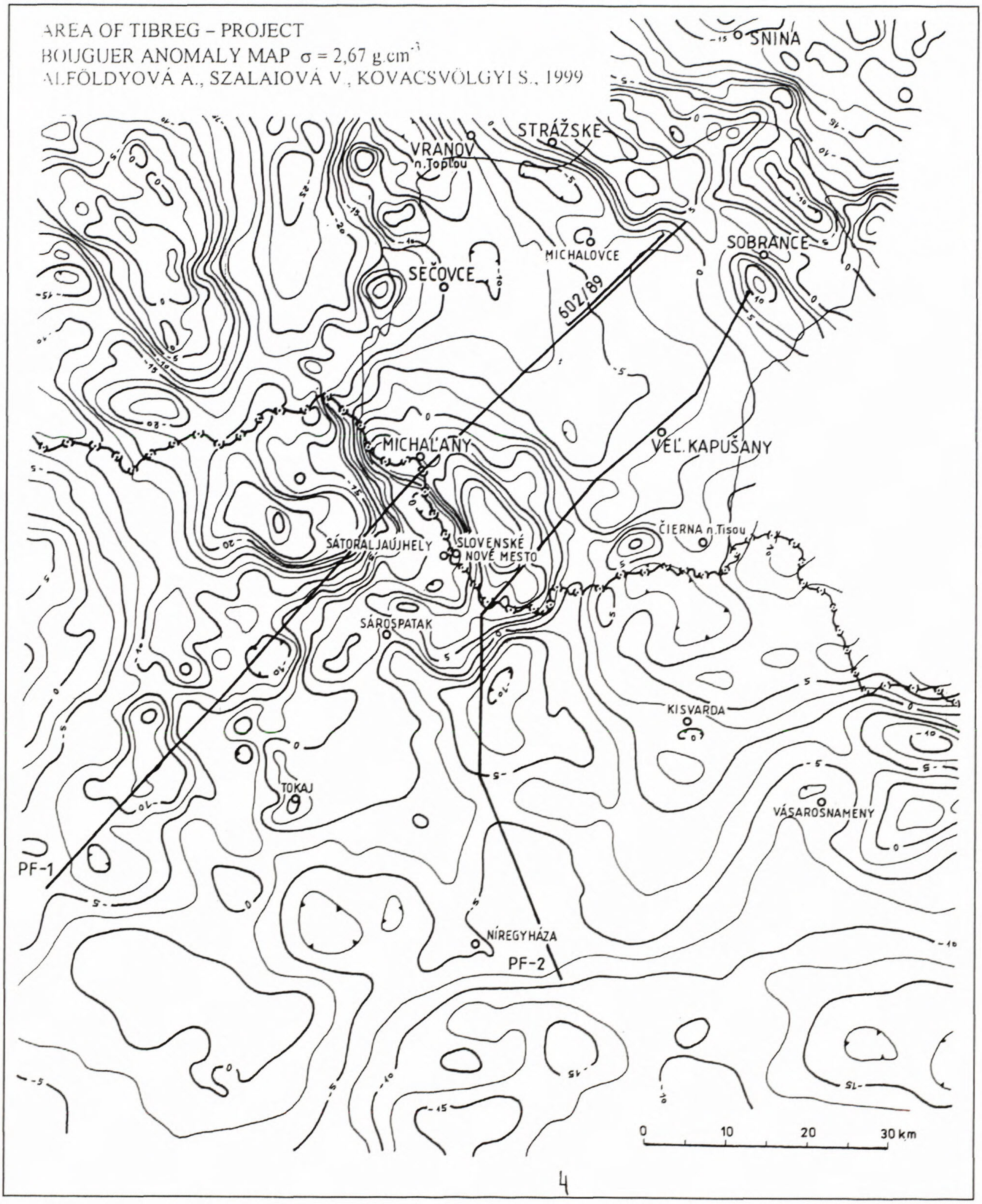

Fig. 4 Area of Tibreg – project
Bouguer anomaly map $\sigma = 2,67$ g.cm^{-3}
Alföldyová, A., Szalaiová, V. and Kovácsvölgyi, S., 1999

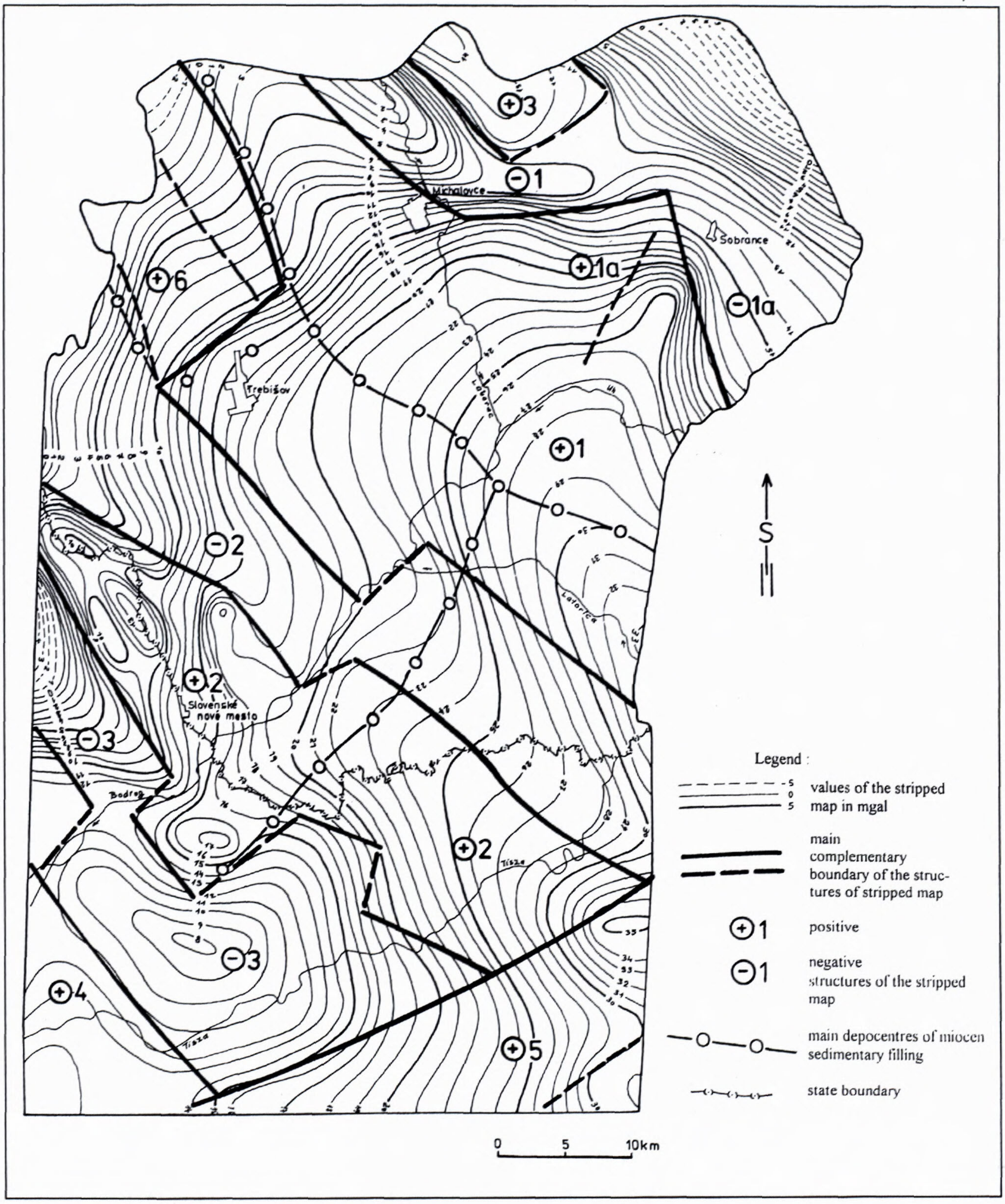

Fig. 5 Stripped gravity map of the Tibreg Area