HUNGARY

REPORT

ON
THE ACTIVITIES
OF
THE BARON ROLAND EÖTVÖS GEOPHYSICAL INSTITUTE
DURING THE PERIOD 1933—1935
SUBMITTED

TO THE CONGRESS GENERAL OF THE INTERNATIONAL GEODETICAL AND GEOPHYSICAL UNION IN EDINBURGH, SEPTEMBER 1936.

BY

EUGENE FEKETE
CHIEF GEOPHYSICIST
IN CHARGE OF THE BARON ROLAND EÖTVÖS GEOPHYSICAL INSTITUTE.
BUDAPEST.

BUDAPEST, 1936.

HUNGARY

REPORT

ON
THE ACTIVITIES
OF
THE BARON ROLAND EÖTVÖS GEOPHYSICAL INSTITUTE
DURING THE PERIOD 1933—1935
SUBMITTED

TO THE CONGRESS GENERAL OF THE INTERNATIONAL GEODETICAL AND GEOPHYSICAL UNION IN EDINBURGH, SEPTEMBER 1936.

BY

EUGENE FEKETE

CHIEF GEOPHYSICIST
IN CHARGE OF THE BARON ROLAND EÖTVÖS GEOPHYSICAL INSTITUTE.
BUDAPEST.

BUDAPEST, 1936.

„Élet“ Irod. és Nyomda Rt. XI., Horthy M.-út 15. — Igazgató: Laiszky Jenő.

Contents:

Enclosures:

I. Introduction.

Two Reports on the activities of the *Baron Roland Eötvös Geophysical Institute* were previously submitted to the *International Geodetical and Geophysical Union.* The first was published in 1930 on the occasion of the Congress General held by the Union in *Stockholm* and the second in 1933 for the Congress General held in *Lisbon.* The first Report described all the geophysical work made in Hungary by *Baron Roland Eötvös,* the inventor of the torsion balance, during the period 1901—1919 and summarized also the further activities of the *Baron Roland Eötvös Geophysical Institute* founded after the death of Eötvös. The maps enclosed with the first Report showed the results of all torsion balance surveys made by Eötvös and later by the Geophysical Institute which surveys can be regarded as the *pioneer work in geophysical prospecting.*

In the second Report submitted to the Congress General held in *Lisbon* in 1933 the field work made by the Geophysical Institute during the period 1930—1932 in Hungary, as well as the research work done in the laboratory of the Institute, was discussed.

This third Report, similar to the previous Reports, also gives a general description of the activies of the *Geophysical Institute* during the past three years (1933—1935) but more weight than before will be given to the results of the field work by deriving from them practical conclusions as to the distribution of subsurface masses.

II. Alterations in the administration and staff of the Geophysical Institute.

The Baron Roland Eötvös Geophysical Institute was subordinated to *Department XV of the Royal Hungarian Ministry of Finance* under the supervision of which all prospecting work for minerals, salt, oil and gas, etc., was concentrated. On July 1, 1935, the Geophysical Institute was transferred to *Department X of the newly formed Royal Hungarian Ministry of Industry,* which department took over all affairs in connection with mining prospecting already done and to be done in the country.

At the end of 1934 the first director of the Geophysical Institute, *Dr. D. Pekár,* ministerial councillor, retired from his position and *E. Fekete* was given charge of the leadership of the Institute.

E. Fekete was a collaborator of Baron Eötvös from 1904 to 1919 and was later on the staff of the Geophysical Institute as chief Geophysicist until 1923.

III. Experiments and research work made in the laboratory of the Geophysical Institute.

The experimental work continued during the period 1933—1935 in the laboratory of the Institute was especially concentrated on the torsion balance of the so called *„Original Eötvös made in Hungary"* type by determining the constants of such instruments. Also fine torsion wires were prepared and their torsion coefficient determined.

Many experiments were carried out by *Dr. D. Pekár* with the cooperation of *M. Szecsődy* and *J. Renner* to reduce the observation time of the torsion balance. The result of these researches was the construction of a damping device by the aid of which a considerable shortening of the time interval of the reading could be attained. This is a very important improvement in the practical application of the torsion balance because the time interval between readings i. e. the time necessary for the swinging balance beam to come to rest, could be *reduced from 60 minutes to 40 minutes,* the practical and economical advantage of which reduction is obvious.

By applying such damping devices in the torsion balances used first in the field work in 1934, it was possible to make observations with one torsion balance on three stations during the day instead of making only one or two stations daily as was usual previously. Making three stations in a day rendered it necessary to cut the number of the readings on a station from nine to six and later to five which is doubtless somewhat disadvantageous as far as the accuracy of the survey is concerned, but the results of surveys obtained by making five readings only are still satisfactory for practical purposes.

Investigations made in order to further reduce the time of 40 minutes were also carried out in the laboratory with the successful result that readings could be made at interval of *30 minutes.* Testing the 30 minute reading intervals in the field is now going on.

The aim of the research work made *by J. Renner* in the laboratory of the *Geophysical Institute* was to increase the accuracy of determining the proportion between the gravity and inertia or, in other words, to show *the independence of the attraction from the material substances.* These experiments and measurements were the continuation of those made by *Eötvös* in 1890, and later in 1908 with the cooperation or *Dr. Pekár and Fekete.* Eötvös's observations made with the torsion balance were based on the assumption that: should the attraction not be independent from the material substances, an alteration in the direction of gravity would occur. This alteration could be determined by the torsion balance if different kinds of material are put on the same end of the balance beam. Several kinds of material were compared by Eötvös in his torsion balance and from a great number of observations he arrived at the conclusion that if a difference exists in the attraction of different materials this is certainly *smaller than* 5.10^{-9}, which means that the difference in the gravity constant of different kinds of material is smaller than 5.10^{-9}.

The observations made by *J. Renner* were carried out with the greatest care and several improvements were used by him to increase the accuracy given above. He succeeded to reduce the value of 5.10^{-9}, determined by Eötvös and his collaborators, to $0.5.10^{-9}$ for several kinds of material. The materials used and the differences found *by J. Renner* were the following:

platinum-brass	$+ 0.45.10^{-9}$
glass drop-brass	$- 0.01.10^{-9}$
splinter of glass-brass ...	$+ 0.21.10^{-9}$
paraffin-brass	$+ 0.41.10^{-9}$

ammonium-fluorin-brass..	$+ 0.13.10^{-9}$
manganic alloy-brass ...	$+ 0.10.10^{-9}$
bismuth-brass	$— 0.14.10^{-9}$

Dr. D. Pekár carried out experiments in order to decide whether or not effects other than attraction exist between masses of the same material substance. He determined by a great number of observations the effect of attraction between plumb, copper and platinum and then the attraction between plumb-plumb copper-copper and found that no effect other than the attraction could be ascertained.

IV. Geophisical prospecting made by the Geophysical Institute in Hungary during the period 1933–1935.

The most important work done by the *Geophysical Institute* in 1933, 1934 and 1935 was geophysical prospecting for oil and gas and other minerals by *torsion balance* and *terrestrial magnetic surveys. Applied geophysical methods* for oil, gas and mineral prospecting became very common in the last fifteen years in spite of the fact that all of the geophysical methods used in prospecting for oil and gas *are indirect methods.* This means that the actual presence of oil and gas in the subsurface can never be shown by any of the geophysical methods, but by their aid oil and gas bearing geological structures can be detected without any surface indication.

The field work made by the *Baron Roland Eötvös Geophysical Institute* in 1933—1935 can be divided in two groups:

a) *torsion balance surveys,*
b) *terrestrial magnetic surveys.*

A) **Geophysical prospecting with the torsion balance.**

Two areas were surveyed in detail during the three above mentioned years.

1. The area of *Mezőkövesd*, Borsod County, Hungary in 1933 and 1934.
2. The area north and east of *Budapest* in 1935.

1. The results of the torsion balance survey in the area of Mezőkövesd.

Most of the torsion balance surveys in Hungary were made on the great plain of the *Nagy-Alföld* where many artesian wells drilled to a depth of a few hundred meters showed the presence of gas while the eight deep wells drilled to 1000—2000 meters did not yield oil or gas in commercial quantities. In order to reach the oilbearing horizon at a depth less than in the Nagy-Alföld, it was decided to locate wells close to the mountains bordering the Nagy-Alföld on the North. The purpose of the torsion balance survey in the area of *Mezőkövesd* was to find favourable geological structures on which wells could be located. In the first part of the survey in 1933 the whole area under examination was covered by torsion balance stations locating them at distance of two kilometers in triangle form. Although a big structure, probably *a dome,* was indicated by the results of the torsion balance survey made in 1933 south-west of *Mezőkövesd,* not much detail was obtained on account of the large station interval. Therefore the same area was surveyed in 1934, this time locating the torsion balance stations along section lines at intervals of a few hundred meters. The direction of the S—N and SE—NW traverses were chosen normal to the main trend of known geological structures in this area which is E—W or NE—SW.

The *torsion balance survey* in 1934 was made in a quite *different manner* than the previous surveys. Important *improvements* were applied in the surveying which are as follow:

1. The *observations* were carried out exclusively in *daytime* instead of making them during the night, which could be done on account of the improvement in the torsion balance concerning the invariability of the position of equilibrium against sudden changes in the temperatures.

2. On each station *one instrument* was used only. Previously double stations were generally made.

3. On each station *five or six readings* were taken only, instead of nine as before.

4. The time interval between two readings was reduced to *40 minutes* while formerly it was 60 minutes.

5. All equipment was kept on the same location for a long period and was not moved daily to each station as before.

The effect of these changes was that, while in 1933 observations were made on 167 double stations in 57 days, in 1934 the number of single stations finished *in 104 days was increased to 902.*

The results of the torsion balance surveys made in 1933 and 1934 are partly shown on *Table I.* The gravity anomalies determined by the torsion balance, i. e., the *gradients* and the *curvature values* were corrected by subtracting from them the gravity effect of the *surface irregularities* (terrain, cartographical and normal gravity effects).

From the corrected gradients $\triangle g$ *values* can be calculated for each interval between two neighbouring stations and, if the absolute value of the gravity anomaly is known on one station, the same can be easily calculated for everyone of the stations. The $\triangle g$ values should then be corrected by the least square method. The curves connecting the points of equal gravity anomalies are *the isogams.* The geological interpretation of the isogams is that they represent the contour lines of subsurface structure provided that there are two geological formations only and a homogenous structure is overlaid by one homogeneous sediment of less specific gravity than that of the underlying structure.

In such special cases the *gravity maximum* in the isogams mostly indicates the presence of an upleft and the gravity minimum the presence of *a depression.* However it is possible that the gravity maximum is caused by the *concentration of heavy minerals* in the underlying formation without being uplifted at all.

The geological conditions in the area of *Mezőkövesd* are not favourable for such simple interpretation of isogams as described above, therefore the calculation of $\triangle g$ values and consequently the construction of an isogam map was ommitted.

According to the geological data obtained from the *well Tard No. I.* the tuff of less specific gravity is overlaid by the Pannonian strata of higher specific gravity and underlaid by the oligocene mudstone of Kiscell, which is also heavier than the tuff. On account of such complicated geological conditions the isogams would not represent the contour lines of any of the formations, but would give the resultant gravity effect of all formations present.

It seemed more profitable for determining the subsurface conditions to calculate the gravity effect of assumed geological sections and to compare it with the observed gravity effect. Such calculations in the area of *Mezőkövesd* were facilitated by the fact that the gravity observations were made along S—N or SE—NW section lines, which directions are also normal to the general trend of the structures.

In the *section calculation* a certain set of assumptions is made as to the distribution of subsurface masses, and their theoretical gravity effect is calculated. A comparison between the calculated and observed gravity anomalies is then made to determine whether or not the assumed subsurface formation is a possible one. When discrepancies occur between the calculated and observed anomalies the assumed geological section must be altered repeatedly until a close correspondence is obtained.

The *shortcoming of this method* is that there are always *more than one set of assumptions* on the subsurface condition, the gravity effect of which will correspond to the observed gravity anomalies. Mathematically speaking there are always more unknowns than equations for their determination. On the other hand it is evident that all assumptions must be made in accordance with the known data obtained from well logs, geological data or from other kinds of geological data or from other kinds of geophysical work. This greatly limits the number of possible and probale combinations. The *more data* are available regarding the *form, depth and density* of different sediments, the *closer* will be the limitations of *the possible solutions.*

The section calculations were made with the following suppositions:

1. *the trend* of the assumed geological structure is *a straight line* and extends on both sides to the infinite;

2. the *different geological formations* of different specific gravities are in themselves perfectly *homogeneous;*

3. the *contact surfaces* between the formations are *plains.*

In the area of *Mezőkövesd* section calculations were made along *four sections,* the positions of which are shown on *Table I.* The results of the section calculations are shown on *Tables II and III.* The available geological data were taken from the well log *of Tard No. I,* according to which the sequence and the thickness of the formations, as well as their specific gravity, were known.

In the calculation the following specific gravities were used:

spec. grav.	of the Pannonian strata ...	2.2
„ „	of the tuff	1.4
„ „	of the Oligocene	2.2
„ „	of the Eocene limestone...	2.4

In *Section I* two suppositions are submitted showing two different, assumed distributions of the subsurface masses.

In the interpretation of the gravity results obtained in the area of *Mezőkövesd* it must be considered that there are three contact surfaces, the resultant gravity effect of which is reflected in the observed gravity anomalies. These contact surfaces are

1. between *Pannonian and tuff* with a difference of —0.8 in fhe specific gravity,

2. between *tuff and Oligocene mudstone of Kiscell* with a difference of + 0.8 in the specific gravity,

3. between *Oligocene strata and Eocene limestone* with a difference of + 0.2 in the specific gravity.

The gravity effect of the contact surface 3. is evidently much smaller than that of the contact surfaces 1. and 2. partly on account of the great depth and partly because of the small difference in the specific gravity. The gravity effects caused by the contact surfaces 1. and 2. are opposite to each other and the effect of 1. being nearer to the surface than 2. is larger but appears on a shorter distance than that of 2.

The general direction of the gradients on the whole area under examination is S. SE—N. NW or opposite; this direction changes in the vicinity of Bogács and Tard to S—N. The general trend of the geologicalformations is consequently E. NE—W. SW, near *Bogács and Tard* E—W.

The *sudden changes* in the gradient values along the sections indicate that in this area *the formations* are rather *faulted* with steep flanks than *folded* with gentle slopes.

From the gradients obtained southwest of *Mezőkövesd* it can be concluded that there is a *faultline* running north of and parallel with the railroad line. The most remarkable feature in the results of the torsion balance survey is the large *gravity maximum* southwest of the town *Mezőkövesd.* This gravity maximum is probably caused in most part by contact surface 2. altered — however — by the opposite gravity effect of contact surface 1. According to this assumptionthe gravity maximum of *Mezőkövesd* indicates *a large uplift* in the subsurface formations with *faulted flanks.* This supposition is shown on *Table II in Section I A,* the calculated gravity effect of which is in close correspondence with the observed values.

A second supposition is also given on *Table II* in *Section I B,* according to which the regular gradients of southeastern direction observed west of *Mezőkövesd* are in most part caused by contact surface 1. existing between the Pannonian strata and tuff, while the gradients of northwestern tendency observed on the southern part of the surveyed area are due to the gravity effect of contact surface 2. between the tuff and Oligocene strata. In this case the formations would not be uplifted at all but would be faulted step by step with downthrow to the south.

The calculated gravity effects of both *Suppositions I A and I B* are in close correspondence with the observed gradients and therefore *both interpretations are possible.* From the results of the torsion balance survey alone it is *impossible to decide* which one of the two possible assumption has a greater probability, or which one shows the actual subsurface conditions. In such dubious cases the *reflexion seismic method* has been applied in the last years by shooting along several profiles through the area to be examined.

If there is a good reflecting surface in the subsurface formations where the velocity of the seismic waves increases considerably then the seismic profile will show exactly whether an uplift exists southwest of *Mezőkövesd,* or the formations are faulted to the south.

In *Section II* running through the location of well *Tard No I* in S—N direction as well as *in Section III* lying east of the line *Tard—Nagymajor* and running in S 30° E—N 30° W direction the geological subsurface conditions are assumed in correspondence with the well results. The large gradient values are due to *faults with steep flanks* the downthrown side being to the south. The angle of fault cannot be determined from the torsion balance results because there is morethan one fault the resultant gravity effect of which cannot be divided into components.

In *Section IV* the subsurface conditions are assumed to be different from those shown in other Sections. This was done because the gradient values obtained in *Section IV* are entirely different from those observed in the other Sections. Here the gradient values are considerably smaller than in the western part of the surveyed area and, considering the southwestern direction of the gradients in connection with the faulted condition of the subsurface masses, one must conclude that the southwestern gradients are mostly due to the contact surface 1. between the Pannonian strata and tuff. On the southern end of *Section IV* the gradients of northwestern direction probably indicate a depression in the subsurface formations. In this part of the area the faults are of smaller throw than in the other Sections and have also a general direction of E. NE—W. SW. Furthermore the faults are of short extent and are interrupted by several crossfaultings. The results of the torsion balance survey made along *Section IV* do not indicate the presence of subsurface structures which would have any importance from a practical point of view.

2. The results of the torsion balance survey made in the area north and east of Budapest in 1935.

In some artesian wells of *Rákospalota* salt water and gas of small quantity were found and gas was shown also in the artesian well drilled near *Őrszentmiklós,* about 30 kilometers northeast of Budapest. A new well located close to this artesian well yielded about 20.000 cubic meters gas from a depth of abouth 280 meters, but this amount declined rapidly when the hole was deepened to a total depth of 948 meters. At 880 meters eocene limestone was struck.

In previous years in the whole area north and east of *Budapest geological investigations* were carried out which ascertained from the surface indications the presence of several uplifts seemingly favourable for gas accumulation. — The *geological investigations* could be reliably made on areas where the older *geological formations* were *outcropping* or were found *near the surface* while in other parts of the area under examination where thick pleistocene strata cover the older formations only a few very uncertain geological data could be obtained.

In order to compare the *geological data* with *geophysical results,* it was decided to survey the vicinity of *Budapest* with the *torsion balance.*

The field work made in 1935 was carried out generally in a manner similar to that used in 1934. The stations were located netlike at intervals not more than 1 kilometer. In places — however — where the gradients obtained on the regularly located stations indicated the possible presence of some kind of subsurface structure, a close net of stations were laid down for facilitating the interpretation of the gravity results.

Table IV shows the *gradients* obtained in this area as well as the *isogams* calculated from the gradients and adjusted with the least square method. The gradients are corrected by the gravity effect of the entire surface masses. The curvature values are omitted from this map because they would greatly disturb the clearness of the map.

The reason for calculating isogams this time was partly the netlike locations of stations, which are especially favourable for isogam calculations and partly to compare the Δg values obtained from the torsion balance results with those of pendulum measurements made on the area under examination by *Prof. Ch. Oltay.*

In the following table the Δg values obtained by the two different methods are given:

	Δg values from the pendulum measurements of Prof. OLTAY		Δg values from the results of torsion balance survey	
Budapest, Techn. Univ.	+41.10^{-3}	C. G. S.	—	
„ Geophys. Inst.	+36	„	—	
„ Geolog. Inst.	+37	„	—	
Rákospalota	+35	„	+35.10^{-3}	C. G. S.
Mátyásföld	+47	„	+45	„
Cinkota	+44	„	+43	„
Nagytarcsa	+39	„	+38	„
Pécel	+24	„	—	
Vác	+32	„	—	
Fót	+32	„	+37	„
Gödöllő	+35	„	+32	„

The correspondence between the Δ*g values* obtained by the *two surveys* can be considered as *satisfactory* in view of the fact the Δg values of the torsion balance survey are determined under such assumptions which are never completely fulfilled.

In the interpretation of the gravity results those contradictions which appear at first sigth between the geological and geophysical investigations, must be pointed out. Such contradictions can be explained by the entirely different nature of the two kind of investigation. The *gravity effect* is always a *resultant* effect composed not only by the gravity effect of formations lying just below the instruments but of those located at considerable distances from the instrument. On the other hand the geological investigations always show the geological conditions of one limited place. Therefore it is entirely not necessary that the dip and its direction found, for instance by pitwork, in one formation should correspond with the direction and magnitude of the gradient observed on the same place.

Furthermore the gravity effects of the formations are totally independent from their geological age and are influenced by the differencies in the specific gravities and the form of the sediments and rocks only.

According to the *geological survey* there is a very pronounced *dome* southwest of *Csömör* in the vicinity of *Kisszentmihály-puszta* which dome — however — is not reflected at all in the torsion balance results. On the other hand the *gravity maximum found* in the vicinity of *Mátyásföld* where the pendulum measurements also showed a gravity maximum, do not correspond with the results of the geological investigations which do not reflect any kind of uplift in this area.

In the western part of the surveyed area is a great depression with centers in the vicinity of *Vác,* in the western part of *Dunakeszi* and in *Zugló*. The structural trend from *Vác* and *Dunakeszi* is NW—SE, while from *Zugló* to the NE it is more SW—NE. On the flanks of this depression several gravity maxima were found, which will be later discussed in detail.

There are *two gravity maximum* areas which are seperated by a *depression* trending from Dunakeszi in a SE direction. One of these is the gravity maximum in the vicinity of *Mátyásföld* mentioned above and the other one lies between *Veresegyház* and *Kisnémedi,* with center somewhere in the triangle *Kisnémedi—Vácbottyán—Őrszentmiklós.*

The large western gradients on the eastern part of the surveyed area indicate that both uplifts indicated by these gravity maxima are faulted on the eastern side and rapidly plunging to the east. The direction of the fault line is NS between *Veresegyház and Nagytarcsa,* while farther to the north the fault turns to the NE.

The gravity maxima which appear on the flank of the depression, and also on the area of high gravity values, are indicated by the closeness of isogams. Although the innermost isogam line corresponds to the highest gravity value, it is absolutely not necessary that this point of highest gravity value be the apex of the subsurface structure. The difference between the gravity and actual apex of the structure can be great or small according to the inhomogenity and assymetry of the subsurface formations. The exact determination of such a discrepency is uncertain from the torsion balance results rather than from the results of reflexion seismic shooting.

On the *flanks* from south to the north the following gravity maximum areas were indicated by the isogams:

1. in the vicinity of the railroad station of *Ujpest—Rákospalota.*
2. westnorthwest of *Sikátor puszta*
3. east of *Sikátor puszta*
4. south of *Csomád* in the *Magas hegy*
5. SW of *Veresegyház* determined by isogam 46
6. W—NW of *Csomád* determined by isogam 43
7. on the SE side of *Fesőgöd*
8. between *Felsőgöd* and *Sződ*

On the *two gravity maximum* areas mentioned above the following *local gravity maxima* appear:

9. in *Mátyásföld*
10. W of *Kistarcsa* and SE of *Csömör*
11. NW of *Veresegyház* and S of *Őrszentmiklós*
12. N of *Őrszentmiklós*
13. S of *Váchartyán*
14. S of *Kisnémedi.*

The *gravity maxima* enumerated under *3. and 4.* exactly correspond to *uplifts determined by geological investigations.*

The gravity maxima 1. and 2. also are not in contradiction with the geological data.

No geological work was yet done on the areas of gravity maxima 7. and 8.

The gravity maxima 9—14. do not correspond to geological uplifts.

From the perfect correspondence which appears between the site of the *geological uplifts* and *the gravity maxima* under 3. and 4. it can be concluded that in this area the *gravity maxima may be interpreted as the indication of structural uplifts.* This conclusion is very important because there is a great probability that most of the gravity maxima found in this area can be interpreted as the indication of subsurface uplifts and they are not caused by alteration in the specific gravities of the formations without being uplifted.

The general interpretation of the torsion balance results based on the gradients and isogams do not give much detail to the structural conditions of the subsurface masses except that the large gradient values obtained near *Sikátor puszta,* then near *Sződ* and in some other places indicate the faulted conditions of the formations in which case the *gravity maxima* are *uplifts of faulted flanks* rather than *domes with gently folded flanks.*

In order to give a detailed interpretation *section calculations* were made similar to those described above in the discussion of the *Mezőkövesd* torsion balance survey. These section calculations were carried out in four sections, the location of which can be seen on *Table IV* and their results on *Table V.*

For the specific gravities of the formations the following values are used, determined on samples taken from the *well Őrszentmiklós No. III.*

specific gravity	of Pleistocene	... ...	2.0
„ „	of Pannonian and Mediterranean		2.2
„ „	of Oligocene mudstone of Kiscell		2.3
„ „	of Eocene limestone	... ...	2.6

In *Section I* the formations found by the geological investigations are also given, while in the other sections the ideal contact surfaces are given only, the gravity effects of which were calculated. On the western part of *Section I* the geological conditions are well known and the structural conditions are assumed in perfect correspondence to these known data. The most interesting part of the section is between *Rákospalota and Mátyásföld,* where an uplift appears in the assumed formations without having any closures in the isogams in the same place. This can be explained by the fact that the small gravity effect of the eastern flank cannot compensate the large gravity effect of western flank, accordingly the gradients are of eastern direction on the whole area and consequently the isogams do not show any closure here. On the eastern extremity of the section the large gradient values closely correspond with the gravity effect of an assumed fault with down thrown side to the east.

In *Section II* the gravity maximum of *Rákospalota—Ujpest* indicates *a flat dome* and the maximum found W—NW of *Sikátorpuszta* another dome which — however — must have a very steep faulted flank on the NE side as indicated by the large gradient values.

The *gravity maximum* on the *Magas hegy* with great probability indicates also *an uplift* with *steep faulting* on each side. Farther to the NE older geological formations come near to the surface or are outcropping in many places. The gravity maximum found N of *Őrszentmiklós* and S of *Kisnémedi* can be considered as the gravity indication of the same *uplift* on the top of which a *large graben* must be assumed according to the torsion balance results.

Section III runs through the gravity maximum E of Sikátor puszta where both the torsion balance results and the geological investigations indicate the presence of *an uplift also with faulted flanks.*

Section IV shows that the assumption of *two uplifts,* one SE of *Felsőgöd* an the other one between *Felsőgöd* and *Sződ* results in a close correspondence between the observed and calculated gradient values.

B) **Terestrial magnetic surveys.**

In connection with the gravity surveys *magnetic surveys* were also made by the *Baron Roland Eötvös Geophysical Institute. Eötvös* determined on each gravity station the *three elements* of the terrestrial magnetism i. e. *the horizontal intensity, the declination and inclination* of the magnetic force. Furthermore on areas where magnetic anomalies were found detailed magnetic surveys were carried out measuring the *variation* in the *horizontal intensity* and *declination* with magnetic variometers.

Later the absolute determination of the three elements was restricted to measuring them on a few stations only, while the relative observations of the magnetic anomalies were changed inasmuch as *the variations in horizontal and vertical anomalies* were determined with the *Kohlrausch* variometer and the *Schmidt* vertical variometer respectively.

The terrestrial magnetic observations were much handicapped since 1919 by the lack of a magnetic observatory in *Hungary*. This made it impossible to register the daily and secular variations in the terrestrial magnetism and correct with them the values obtained in the field. Having two *Kohlrausch* variometers for the relative determination of the horizontal intensity one instrument was used for registering the daily variations while the other instrument served in the field observations. For corrections of the vertical anomalies the data of magnetic observatory *in Vienna* were lately used.

During the period 1933—1935 three areas were surveyed by the *Baron Roland Eötvös Geophysical Institute* with relative magnetic instruments:

1. The area of *Recsk,* County Heves.
2. The area of *Mezőkövesd.*
3. The vicinity of *Budapest.*

1. The terrestrial magnetic survey in the area of *Recsk,* County Heves, was made in 1934 in order to detect *magnetic anomalies in the vertical intensity* (with the aid of the *Schmidt* variometer), from which conclusions can be drawn as to the *location of minerals.*

The results of a preliminary survey have shown that *above blocks of minerals* anomalies in the vertical intensity of $30\gamma - 40\gamma$ magnitude should appear which could be determined with the vertical variometer.

The whole area of about 150.000 m^2 was covered by 480 stations at small interval. The vertical magnetic anomalies obtained clearly indicated a *magnetic maximum.* Farther to the north of the area surveyed in detail several profiles were also laid down with 99 stations along which large magnetic anomalies were obtained. These anomalies — however — are due to outcropping *amphybol andezite* of high magnetic susceptibility.

2. In the area of *Mezőkövesd* a magnetic survey was made in 1935 for the purpose of traversing with magnetic profiles the gravity maximum found SW of the town of *Mezőkövesd* by the torsion balance survey and to find out whether or not the *subsurface masses* supposed to be uplifted have also a *magnetic effect.*

The *magnetic susceptibility* of rocks and sediments were also determined on samples gathered from this area, with the following results:

	10^6 $\varkappa$	
dacit tuff	3109	C. G. S.
dacit	584	,,
riolit-tuff	742	,,
mudstone of Kiscel	123	,,
trias limestone	102	,,

Theoretical calculations have shown that a block of riolit-tuff which is 10 km long, 0.6 km wide and lying at a depth of 0.6 km below the surface, will cause magnetic anomalies both in the horizontal and in the vertical intensities of about 130γ.

The magnetic anomalies observed in the area of the gravity maximum show but a *small magnetic maximum* from which it may be concluded that the riolit-tuff with dacit-tuff strata is uplifted in this area. However it is also possible that the rioli-tuff is not uplifted and the magnetic anomalies are due to the dacit-tuff of high magnetic susceptibility only.

Besides the profiles through the gravity maximum of *Mezőkövesd* a long profile of S—N direction was also made through *Füzesabony.* The magnetic anomalies obtained on this traverse line are shown on *Table VI.*

Computing the magnetic effect of an assumed subsurface mass as given on the map and comparing the observed anomalies with the calculated anomalies, a *remarkable correspondence* appears *in both the horizontal and vertical intensity.* No gravity survey was made as yet in this area to decide on the real nature of these characteristical magnetic anomalies.

3. A long profile of S—N direction was surveyed in the vicinity of *Budapest* with magnetic variometers from *Cinkota to Vácduka.* No noticeable magnetic anomalies were obtained along this traverse line.

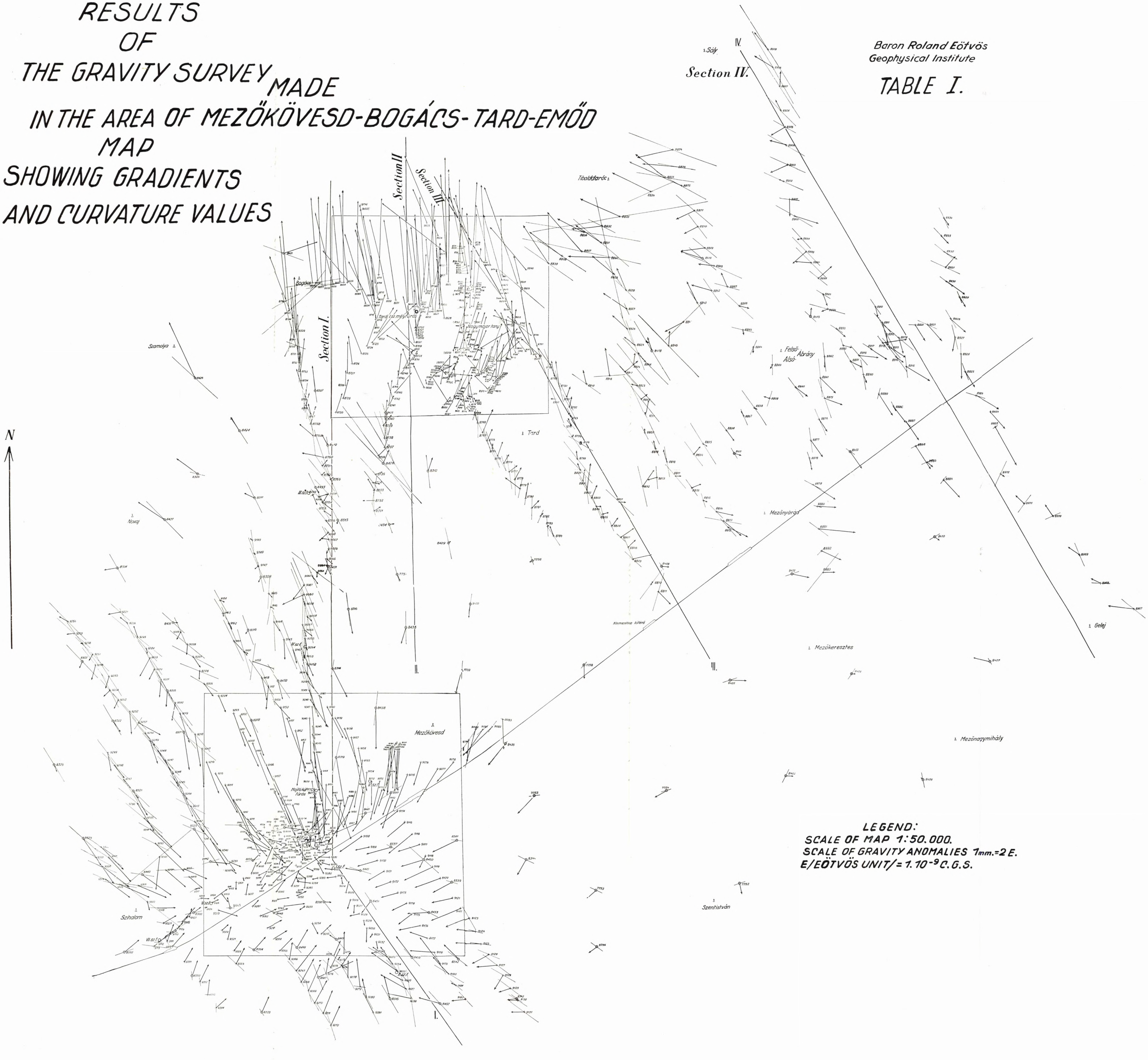
The submission of this Report is made possible through the kindness of the Royal Hungarian Ministry of Industry in permitting the publication of the results of the geophysical survey and by granting an allowance for the press expenses.

The writer wishes to acknowledge his indebtedness to *N. Szecsődy, J. Szilárd* and *A. St. Haáz,* all on staff of the *Baron Roland Eötvös Geophysical Institute,* who participated in both the field work and calculations of the results.

RESULTS OF THE GRAVITY SURVEY MADE IN THE AREA OF MEZŐKÖVESD-BOGÁCS-TARD-EMŐD MAP SHOWING GRADIENTS AND CURVATURE VALUES

Baron Roland Eötvös Geophysical Institute

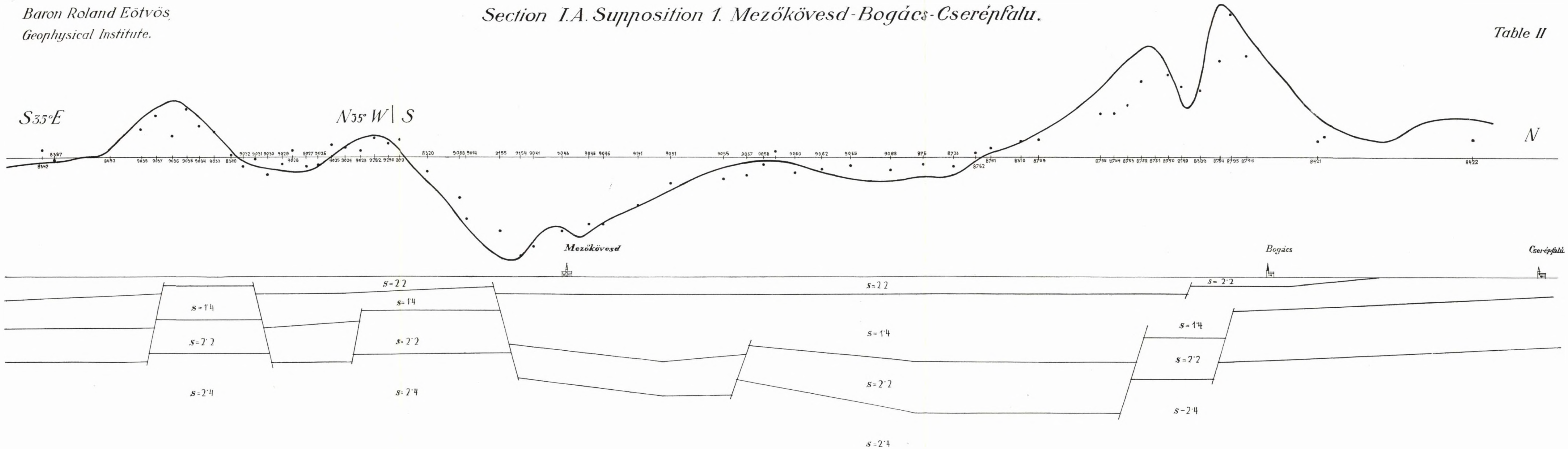
TABLE I.



Baron Roland Eötvös
Geophysical Institute.

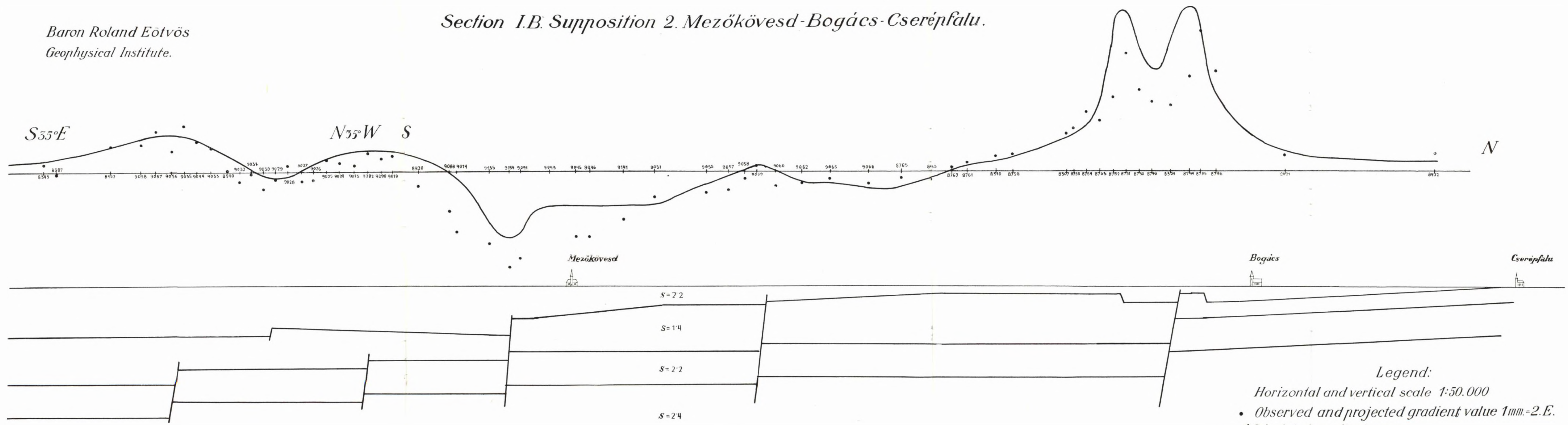
Section I.A. Supposition 1. Mezőkövesd-Bogács-Cserépfalu.

Table II



Baron Roland Eötvös
Geophysical Institute.

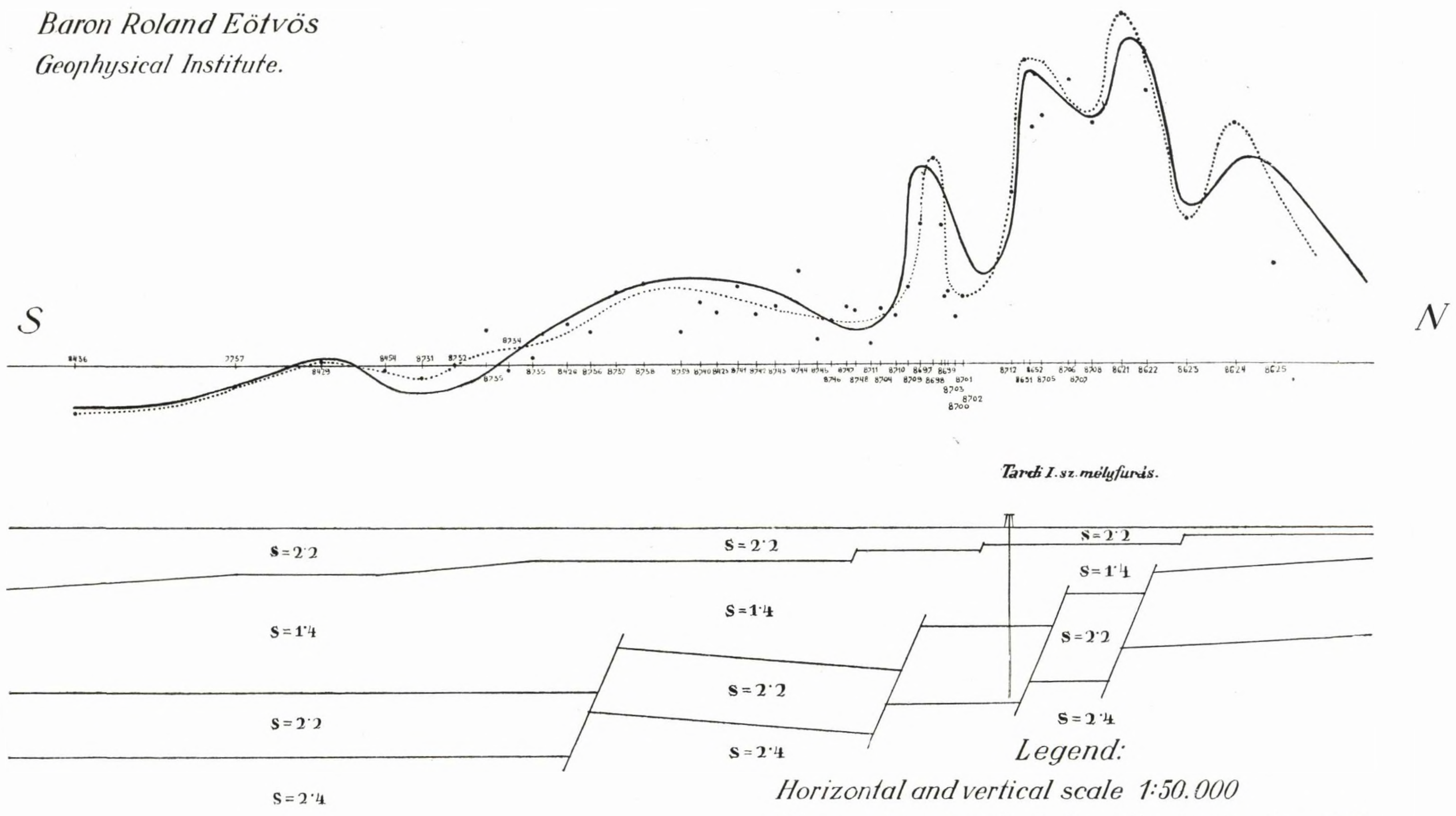
Section I.B. Supposition 2. Mezőkövesd-Bogács-Cserépfalu.



Legend:
Horizontal and vertical scale 1:50.000
• Observed and projected gradient value 1mm.=2.E.
⁄ Calculated gradient curve
E/Eötvös unit/= 1.10⁻⁹ C.G.S.

Baron Roland Eötvös
Geophysical Institute.

Section II. Through the location of well Tard № I



Legend:

Horizontal and vertical scale 1:50.000

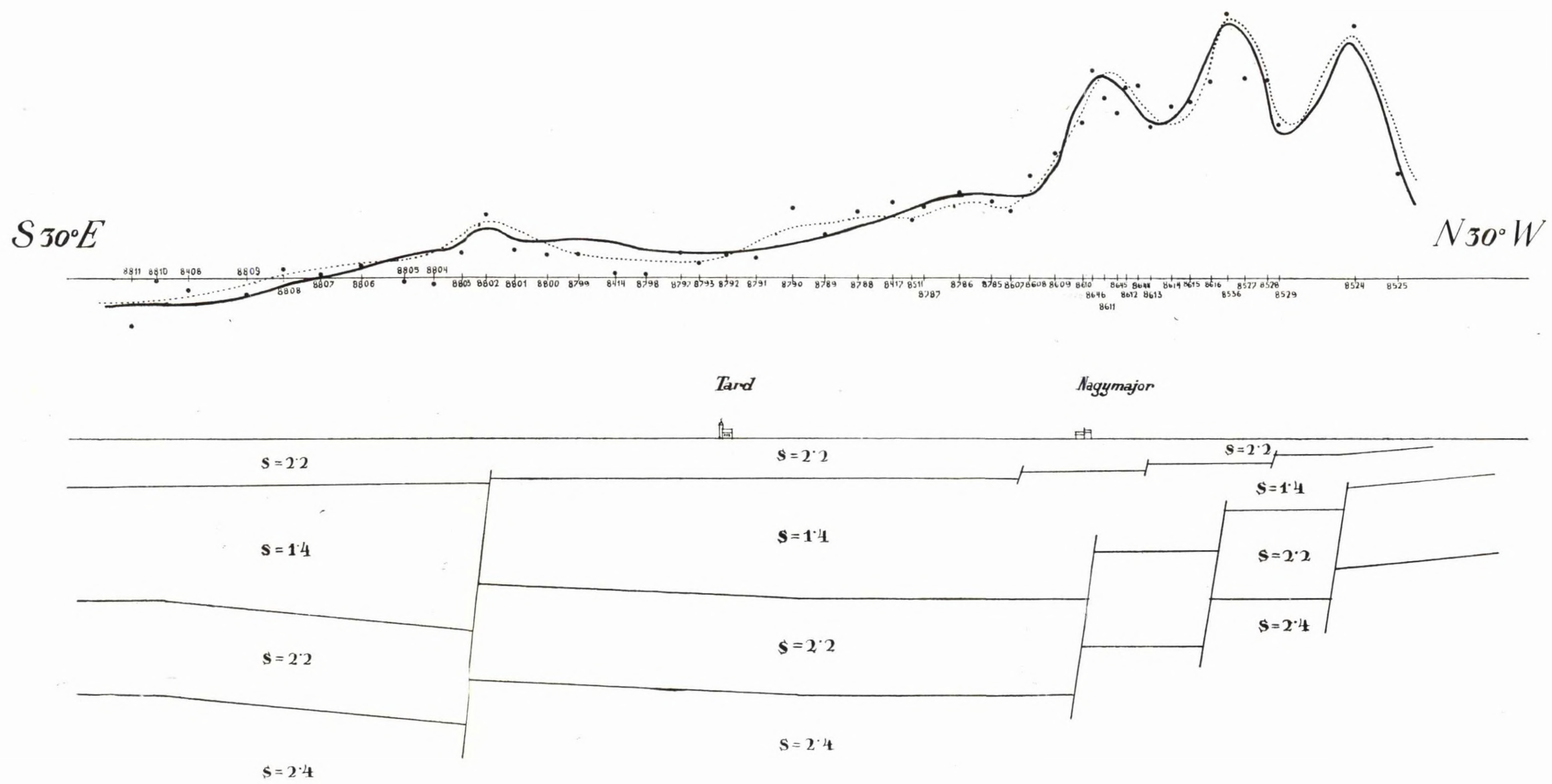
• Observed and projected gradient value 1mm.=2.E.

Mean observed gradient curve

Calculated gradient curve

E / Eötvös unit / = 1.10⁻⁹ C.G.S.

Section III. East of the line Tard-Nagymajor.



IV. Section. Gelej-Sály

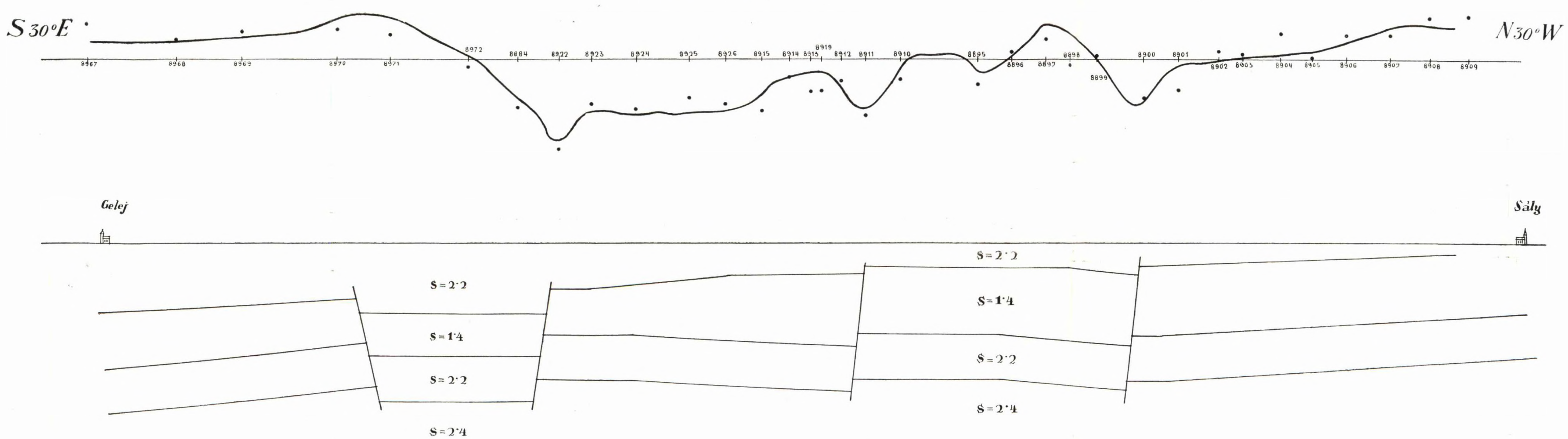
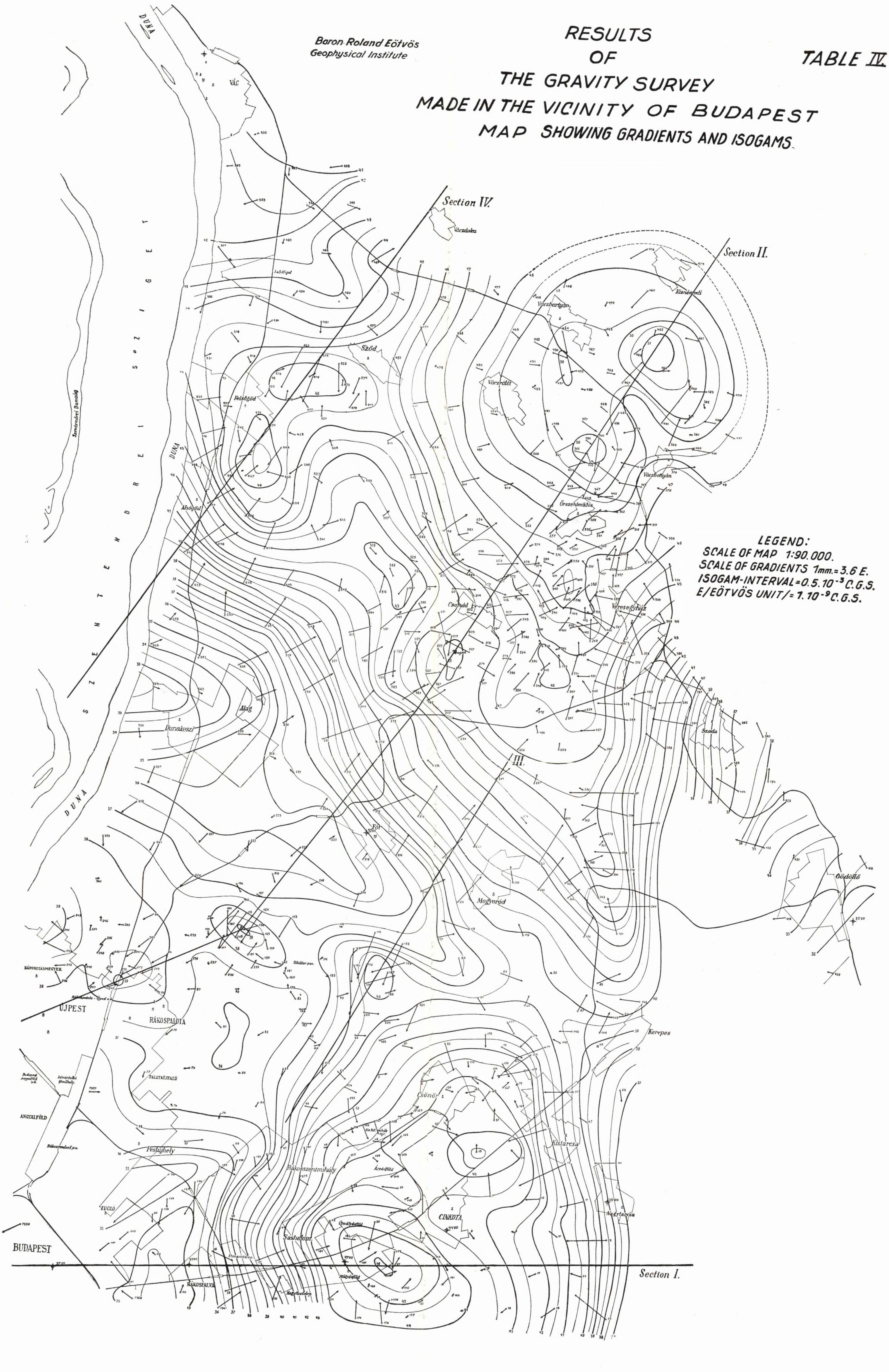


TABLE IV.

RESULTS OF THE GRAVITY SURVEY MADE IN THE VICINITY OF BUDAPEST

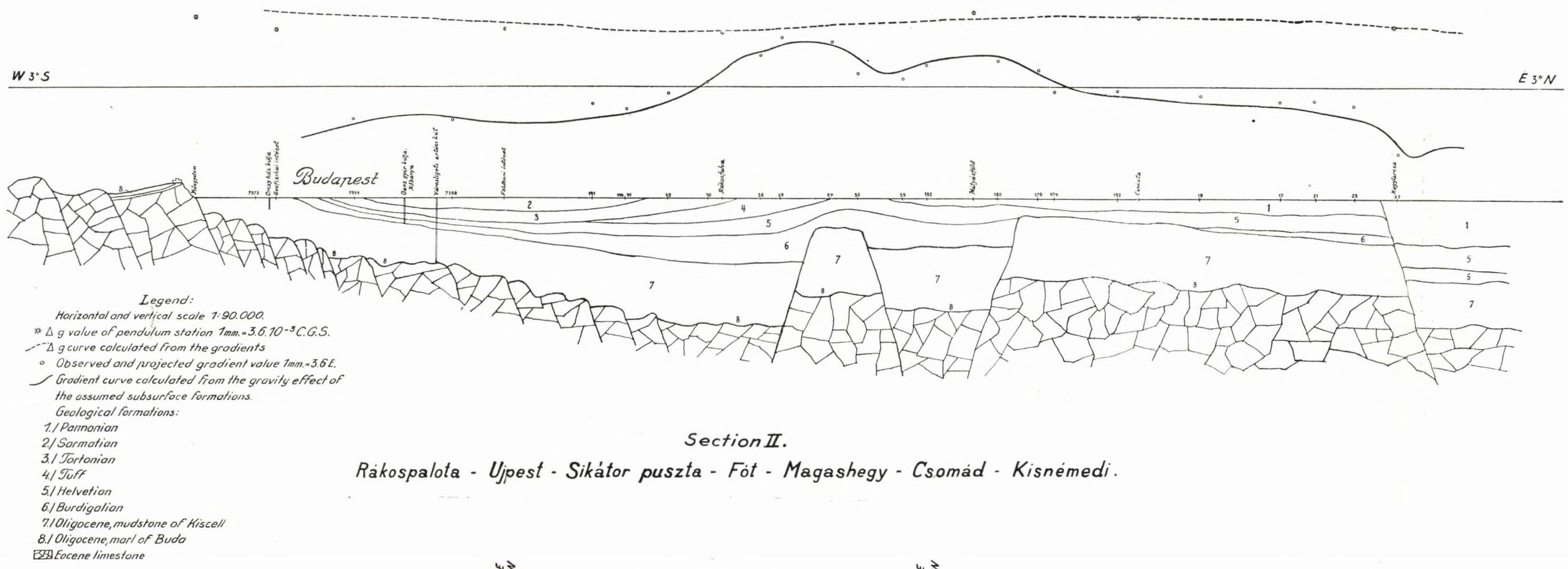
MAP SHOWING GRADIENTS AND ISOGAMS.



Baron Roland Eötvös
Geophysical Institute

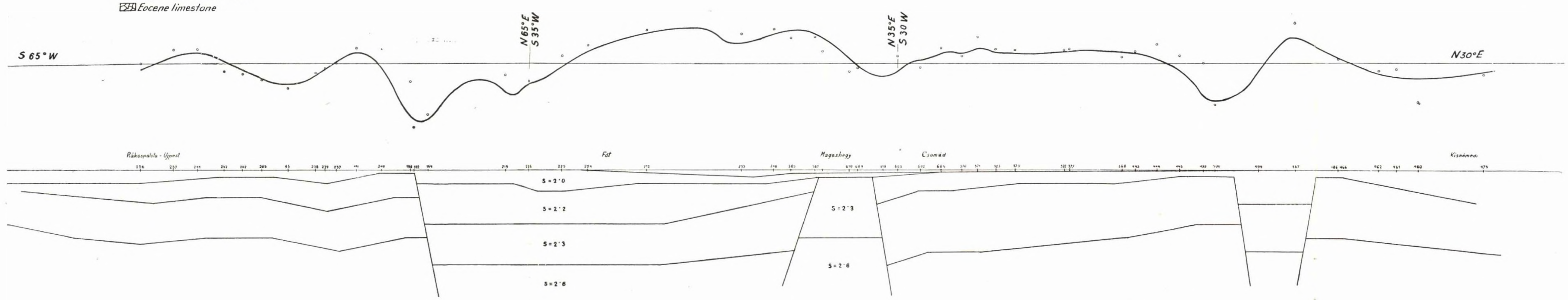
Section I.

Budapest (Gellérthegy) - Rákosfalva - Mátyásföld - Nagytarcsa.



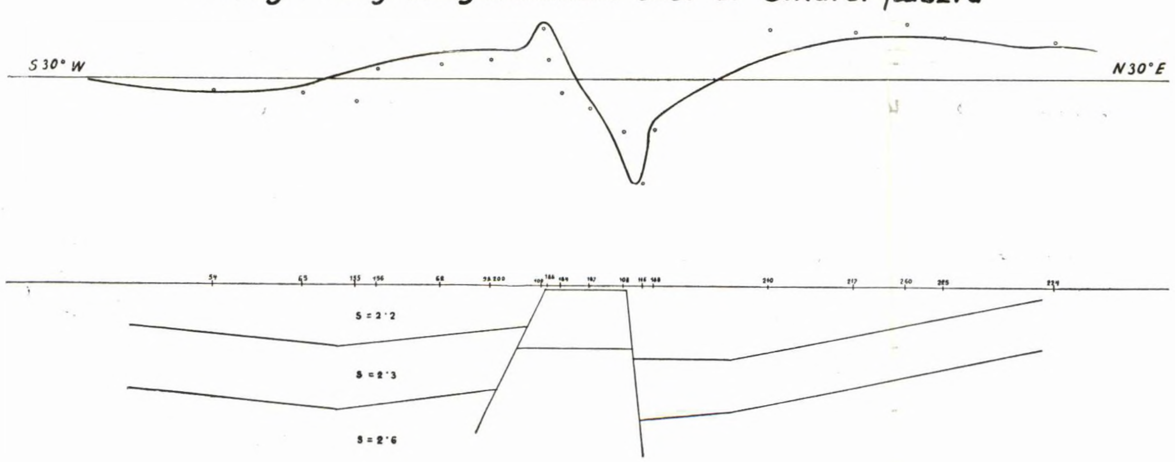
Section II.

Rákospalota - Ujpest - Sikátor puszta - Föt - Magashegy - Csomád - Kisnémedi.



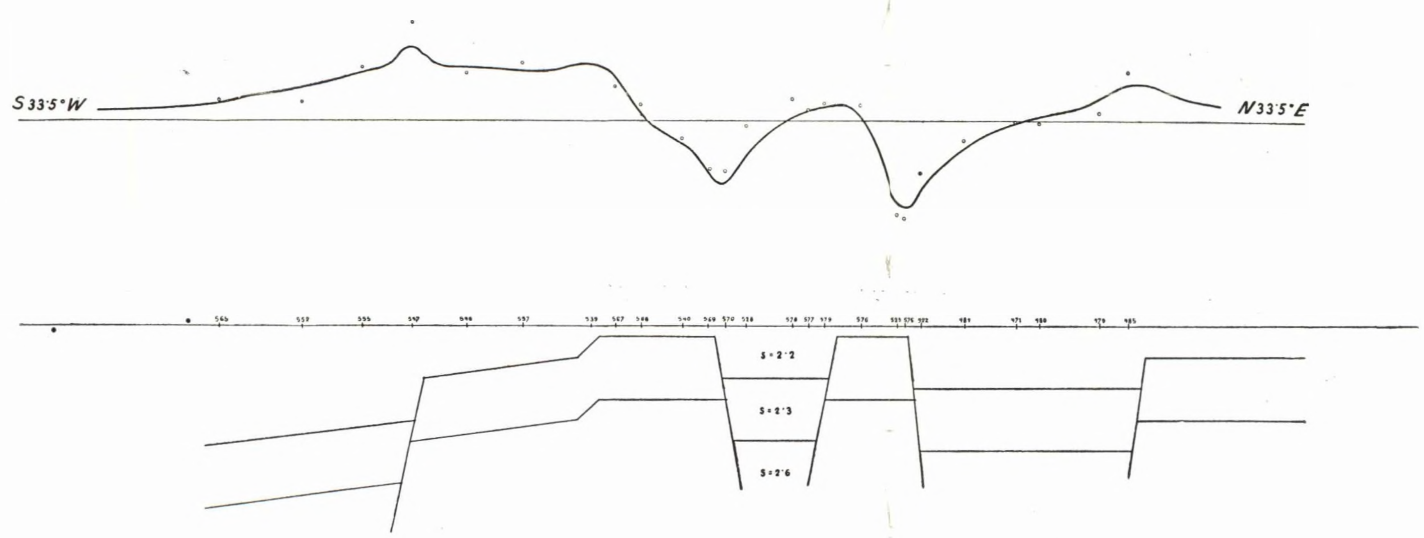
Section III.

Through the gravity maximum east of Sikátor puszta



Section IV.

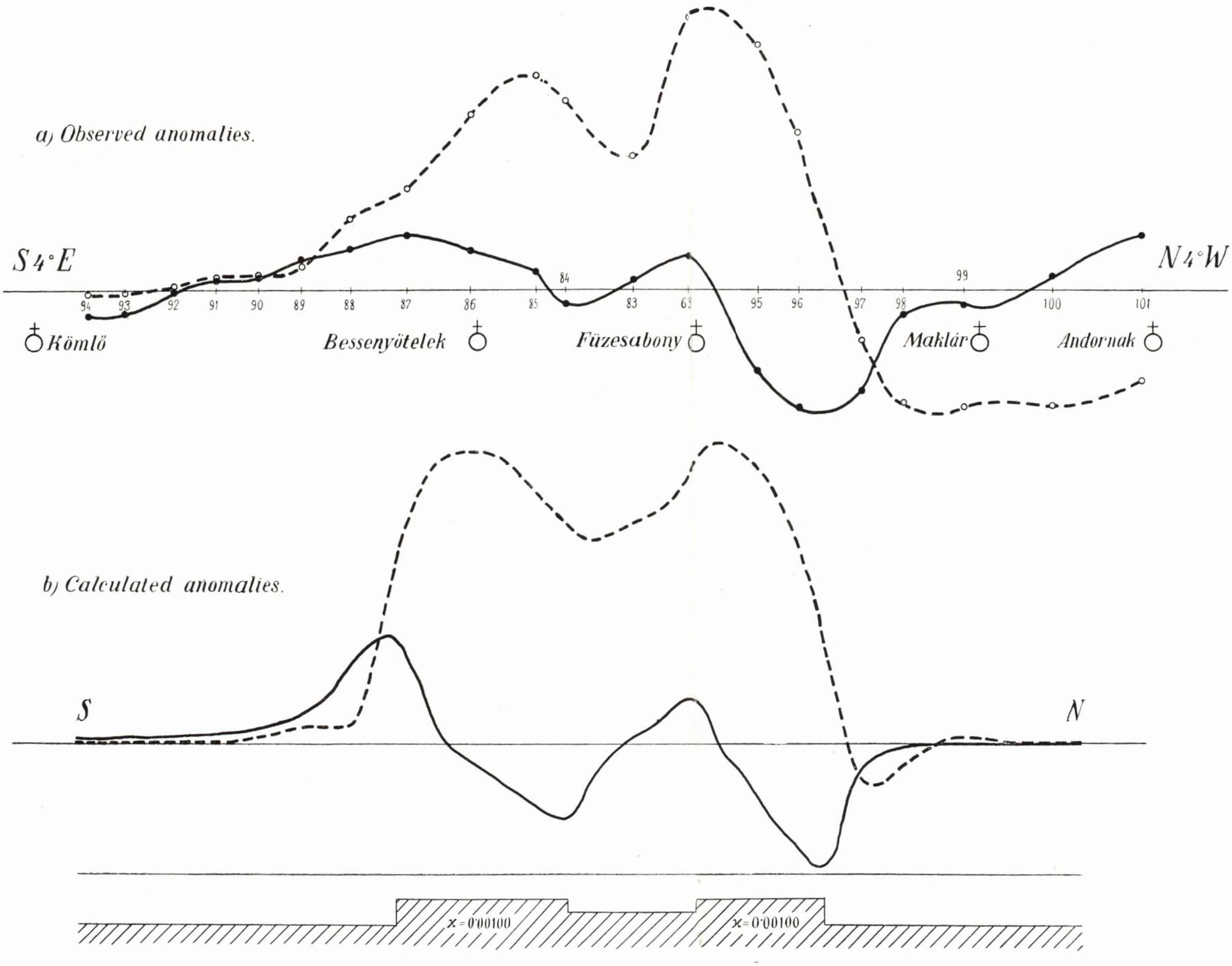
Duna - Felsögöd - Szöd - Vácduka.



Anomalies

in horizontal and vertical intensities of the terrestrial magnetism

in section through Füzesabony, Hungary.



Legend

Horizontal and vertical scale 1 : 150.000

Scale of anomalies 1 mm = 3 γ

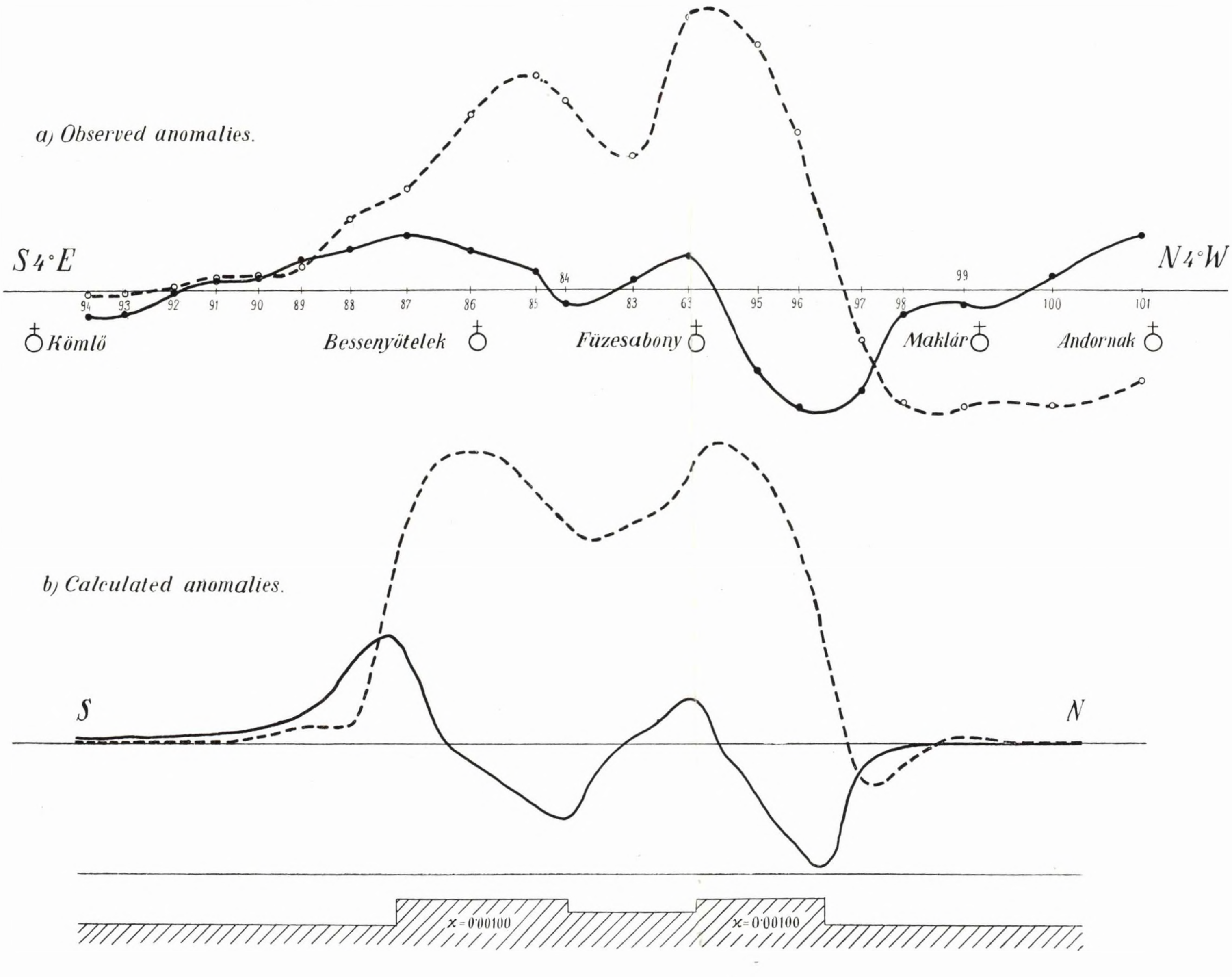
Curve of horizontal anomalies

Curve of vertical anomalies.

Anomalies

in horizontal and vertical intensities of the terrestrial magnetism

in section through Füzesabony, Hungary.



Legend

Horizontal and vertical scale 1 : 150.000

Scale of anomalies 1 mm = 3 γ

Curve of horizontal anomalies

Curve of vertical anomalies.