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XX, 1—2.

SUPPLEMENT 1
1. PÓTFÜZET
ДОПОЛНЕНИЕ 1

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CONTENTS

TARTALOM

СОДЕРЖАНИЕ

Magyar Állami Eötvös Loránd Geofizikai Intézet
GEOFIZIKAI KÖZLEMÉNYEK
XX. kötet, 1-2. szám.

ELŐSZÓ AZ 1. PÓTFÜZETHEZ

A Geofizikai Közlemények évekre el van látva kéziratokkal. Nagy érdeklődésre számot tartó és teljes számokat kitöltő monográfiák várnak kiadásra. Ilyenek például: a közép- és kelet-európai országok szeizmikus földkéregkutatásainak részletes jelentése, Mongólia geofizikai monográfiája, és még jónéhány, értékes adatokkal szolgáló *case history*.

Hogy azonban nemzetközi érdeklődésre számot tartó *rövid* közlemények szerzőit ne kényszerítsük várakozásra, Pótfüzet, vagy — az igényeknek megfelelően — Pótfüzetek, idegen nyelvű — főleg angol nyelvű — kiadását határoztuk el. Kérjük olvasóinkat, fogadják szívesen ezt az első Pótfüzetet.

A SZERKESZTŐSÉG

FOREWORD TO SUPPLEMENT 1

Our paper, the Geofizikai Közlemények (Geophysical Transactions) is sold out for years ahead. Manuscripts of special interest: reports, monographs, e.g. a detailed report about the Central and Eastern-European seismic crustal investigations, a geophysical study of Mongolia, and other valuable *case histories* await for publication.

On the other hand, authors of *short notes* of international interest are continuously knocking on our door. In order to help them to an as early as possible publicity, we have decided to issue a Supplement, or, depending on the demand, a series of Supplements, in foreign, possibly English, language. This is the first one.

THE EDITORIAL BOARD

ПРЕДИСЛОВИЕ К ДОПОЛНЕНИЮ I

Журнал Geofizikai Közlemények (Геофизический Бюллетень) обеспечен публикуемыми материалами на годы. Рукописи монографий, представляющих особый интерес и заполняющих объем полных номеров журнала, ждут публикации. Такими являются напр. подробный отчет о работах по глубинному сейсмическому зондированию земной коры, проведенных в странах Средней и Восточной Европы; монография по геофизике Монголии и ряд других работ, содержащих интересные данные.

Но кроме этого, все чаще появляются рукописи *коротких сообщений* международного интереса. Чтобы не задержать их публикацию, было решено издавать Дополнения или, в случае необходимости, серию Дополнений к указанному журналу на иностранных, — по возможности английском — языках. Настоящий выпуск представляет собой первое из них.

Редакция

Magyar Állami Eötvös Loránd Geofizikai Intézet
GEOFIZIKAI KÖZLEMÉNYEK
XX. kötet, 1-2. szám.

SOME CONTRIBUTIONS TO HUNGARIAN MAGNETIC DECLINATION DATA IN HISTORICAL TIMES

A. TÁRCZY-HORNOCH*

Collecting values of magnetic elements from various places and epochs is more than of national, it is, in fact, of international interest, for the laws of magnetic variations can be established this way only. BOCK and SCHUMANN (1948) deserve appreciation for having collected annual averages of magnetic observatories. Sorrily enough their work goes back to the forties of the last century only, thus it cannot contain e.g. the D measurements of the University of *Buda* in the last two decades of the eighteenth century.

BARTA (1970) called the attention to the ancient Hungarian endeavours in a historical review from 1696 to our days. Fig. 1 (from Barta, *op. cit.*) shows, after Cristopher HANSTEEN (1819), who gives no reference to his source*, that the D in *Buda* in 1696 was $-10°00'$ (western). Hansteen, for the same year, gave $-9°30'$ for *Eger*, $-10°00'$ for *Szeged*, and $-10°19'$ for *Baja*. According to the 3, 7, 1765 number of the newspaper *Pressburger Zeitung*, the value of D then in *Vukovár* was $-12°15'$.

The latter report does not confirm the 1696 *Buda* value, for a linear interpolation in Fig. 1 gives for *Buda* in 1765 $-14°15'$, and being *Vukovár* almost on the same

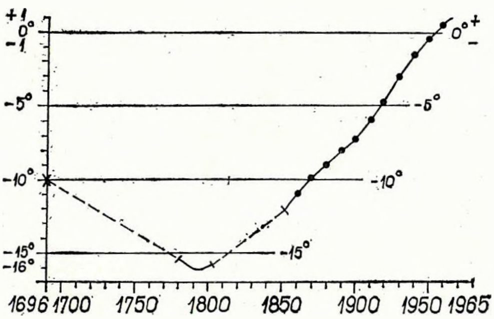

Fig 1
1. ábra
Рис. 1.

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* The Editor's note: Hansteen, obviously, must have collected these data from the Vienna Military Archives. The localities and year suggest that the original data-collecting was a project in the general military geodetical reambulance of Hungary just after the reconquest from the Moslem Empire.

longitude as *Buda,* its value could not differ by 2°. One of the data should be assumed as erroneous.

The decision is, however, easy enough, as soon as one takes a review of the famous *Epistola* of MIKOVINY (1732), the great Hungarian engineer of the eighteenth century. The cited work, namely, gives a value for 1732 for *Pozsony (Pressburg, Bratislava)*: —12°30′.

Interpolating in Fig. 1 for 1732 one obtains abt. —12°10′ for *Buda*, well correlating with the *Pozsony* data. (Better correlation cannot be expected anyway.)

Considering that MIKOVINY made meridian-determinations of *secundum* order, the mentioned value must be accepted as reliable. If so, the value —10°00′ for 1696 for *Buda* must be accepted as correct, and the 1765 *Vukovár* data most be rejected, as erroneous. All the more so, for longitude-difference between *Pozsony* and *Vukovár* is abt. 2 degrees altogether, and it is rather out of probability to assume that *D* became levelled between *Pozsony* and *Vukovár* 30 years later only.

It is worth mentioning that *D* values previously published in the Hungarian periodical *Bányászati és Kohászati Lapok (Mining and Metallurgical Transactions)* should be regarded sometimes with doubt, as referred to earlier (TÁRCZY—HORNOCH, 1952). Sometimes, however, LIZNAR and KURLÄNDER deserve some dubitation as compared to the periodical cited.

An example: according to the *Bányászati és Kohászati Lapok (Mining and Metallurgical Transactions)*, Vol. 1890 (p. 48), the *D* value at *Selmecbánya* ventilation-shaft, on 1 January, 1890, 8^h p.m. was — 7°57′. LIZNAR (1895), on the other hand, referring to KURLÄNDER, stated it to have been —8°17,3′. *D* value for Selmecbánya had been published by CSÉTI (1888) too, in 1888, as 8°16′, assumed to decrease by 0,16° in an annual average. It must, consequently, be impossible for *D* in 1890 to exceed the 1888 value. CSÉTI was not only an excellent surveyor, but a famous instrument-constructor, too. Consequently, his report, confirmed, by the way, by the *Bányászati és Kohászati Lapok (MMT)*, Vol. 1890 (8°16′ – 2.0,16,60′ = 7°56,8′) is reliable.

The data at disposal are, sorrily enough, insufficient as yet for an exact determination of the periods of magnetic secular variations in Hungary. *D* values could, in principle, be completed by archaeomagnetic data, but the latters' accuracy is less by orders.

There is, however, a better way to determine *D* values as far back as the sixteenth century. In Hungary, namely, mine-maps have been prepared since the second half of the sixteenth century, far ahead of those times (TÁRCZY-HORNOCH, 1963). The measurements having been made with magnetic compasses, with the aid of *D* values of old mine-maps, relatively reliable *D* values may duly be expected even from before 1785. This data is namely, the oldest among those of SCHENZL (LIZNAR, 1895).

A search for such old maps and the analysis of their data is suggested to check up old reports and to trace the magnetic secular variations in historical times.

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Magyar Állami Eötvös Loránd Geofizikai Intézet
GEOFIZIKAI KÖZLEMÉNYEK
XX. kötet, 1-2. szám

CRUSTAL LAYER THICKNESS DETERMINATION FROM CODA WAVES

E. BISZTRICSÁNY*

In an earlier paper (BISZTRICSÁNY, 1970), crustal layer thickness determination from coda waves was discussed, according to HARDTWIG's theory (1962).

To extend the validity of results arrived at in the cited work, one has to compare the values obtained with those of other stations. The conclusions of this work are briefly described hereafter.

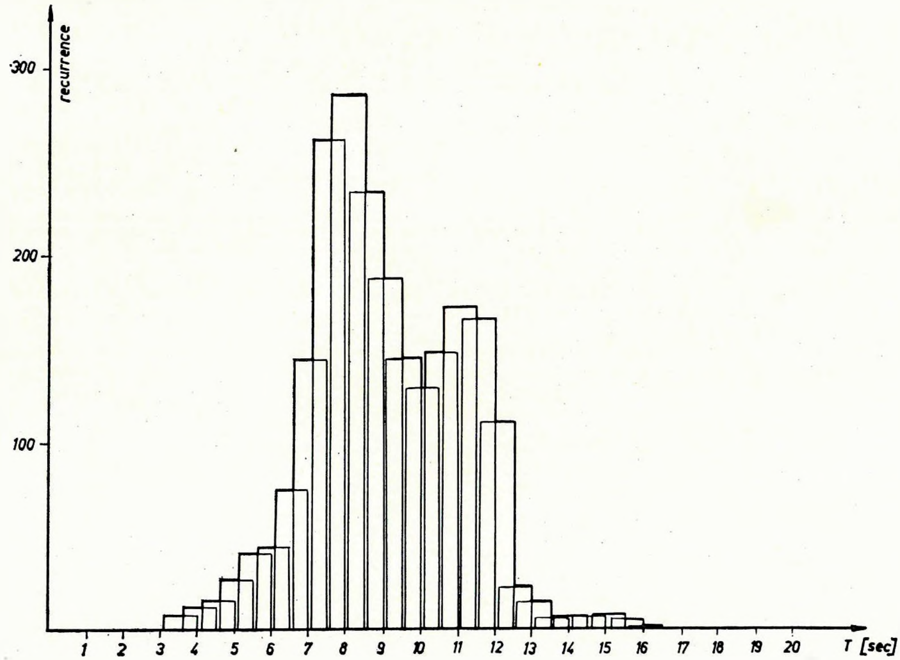

Fig. 1. Period-recurrences from Sopron compared to those of Budapest
1. ábra: A soproni állomás periódusgyakorisága a budapestiével összehasonlítva
Рис. 1. Повторяемость периодов для Шопронской станции в сопоставлении с Будапештской

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The method of calculation was the same as reported, but it was based on 1100 data of shallow focus earthquakes observed by the vertical seismometer Kirnos, in Budapest. The epicentral distance was the same as before: $5 < \Delta^\circ < 50^\circ$. The frequency maximum or recurrence peak of periods, here too, was found around 8 and 11 sec (Fig. 1). The function $Z = f(T)$, obtained from these 1100 data, is as follows (Fig. 2):

$$Z = 0{,}054\ T^2.$$

With this formula the following thickness values have been obtained:

at $T = 8$ sec: $z_0 = 20{,}35$ km,

at $T = 11$ sec: $z_0 = 27{,}58$ km.

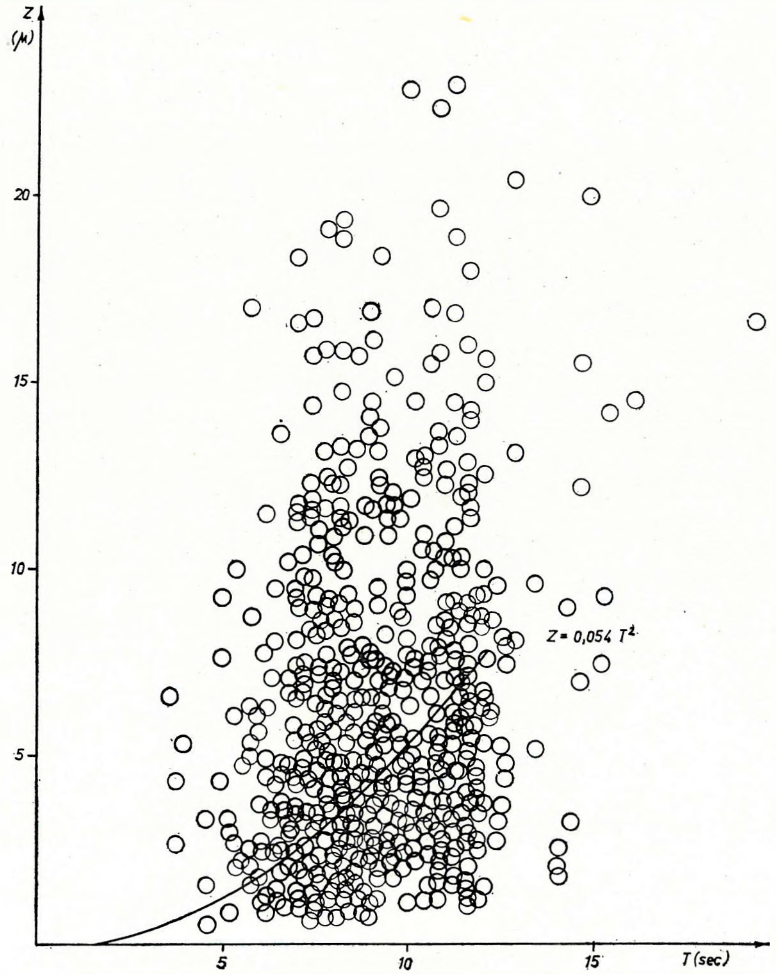

Fig. 2. Coda amplitudes vs. periods

2. ábra. Kóda hullámok amplitúdó-periódus összefüggése

Рис. 2. Зависимость амплитуд кодовых волн от периодов

Fig. 2 indicates that $Z=f(T)$ data are rather scattered. For actual calculation such records were selected which showed comparatively slight scattering, practically not half of the records were suitable for the work.

The integrated results can be seen in Fig. 3. The following curve of second order was computed with the method of least squares:

$$Z=0{,}035\ T^2.$$

The difference between the two equations is so slight that the thickness values must also closely agree, as shown below:

at $T=$ 8 sec $z_0=22{,}2$ km,

at $T=$ 11 sec $z_0=27{,}8$ km.

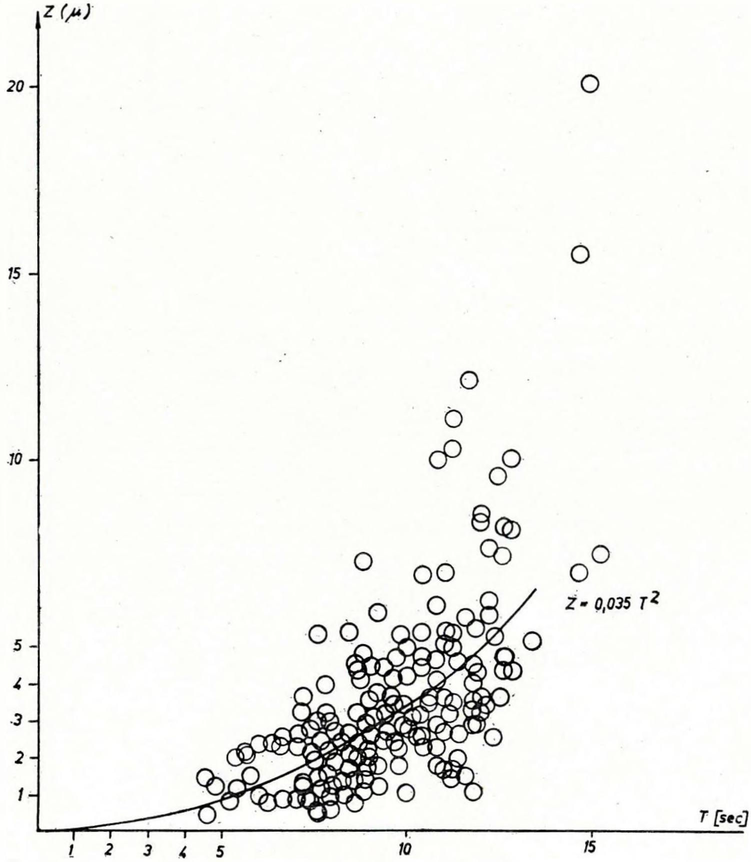

Fig. 3
3. ábra
Рис. 3.

The values for the Conrad and Mohorovičić discontinuity obtained this way from the Budapest station agree well with those calculated for the Hungarian basin from deep seismic soundings. The recurrence peak around 6 sec did not show up, neither did, consequently, the corresponding discontinuity at around 13—15 km.

An interesting, and hardly random, coincidence is that according to MTS reports from the Sopron (Nagycenk) observatory, a low resistivity layer in the same depth is known in the vicinity of Sopron only.

It is interesting to note that a pattern of long period noise, as computed by Walzer (1969) shows great similarity to our results.

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Magyar Állami Eötvös Loránd Geofizikai Intézet
GEOFIZIKAI KÖZLEMÉNYEK
XX. kötet, 1-2. szám.

LATITUDE-DEPENDENCE OF MICROPULSATION-PERIODS

M. TÁTRALLYAY*

The micropulsations of the Earth's magnetic field are quasi-sinusoidal variations with maximal amplitudes of a few gammas (in the magnetic field) or a few tens of mV/km (in the electric field) and with periods of 0,2 to 600 sec. No explanation has hitherto been offered about their origin.

For solving the problem the analysis of the geographical distribution of the pulsations seems to allow a possible approach. It has been observed that similar pulsations have been recorded at very distant stations, although the frequency of their occurrence is mainly a function of the local time.

Every researcher in this field agrees in an amplitude-increase from the equator to the poles. The opinions about the period of these pulsations are, however, rather different. Some of the recent results are contained in Table I. The authors cited deal, mainly, with *pc3* and *pi2* pulsations.

The present author extended her investigations to more stations and pulsation-events. Records of 28 stations (Fig. 1) were at disposal, but only 21 of them yielded records suitable enough for a qualitative determination of the coherences of synchronous pulsations (by correlation of the phases).

On the selected 13 days (between 1958—61) about 75 *pi*2-s were worldwide events.

In about 50 per cent of the cases, the pulsations had the same period and an amplitude decreasing at a similar rate in almost all the stations (Fig. 2).

In about 43 per cent of the events some records differed from the others: on the others: on the day-hemisphere a *pc*-modulation, in the auroral zone a bay could be observed in the moment of the *pi* 2-s.

In about 7 per cent of the events, however, a period-increase revealed itself toward the higher latitudes ($\Delta T \leq 15-20$ sec at $\Delta|\Phi| > 60°$). It is possible that these are merely local phenomena, for longer periods occurred in altogether a few stations of higher latitude.

No poleward period-increase occurred in the analyzed 14 *pc3* time-intervals, either. In the auroral zone a pulsation of 3—4 min did, however, occur synchronously with the *pc* of $T=30$ sec in several cases.

There was an interesting event: the period of the *pc* day-pulsation of about 75 sec was equal in the range $3° < |\Phi| < 60°$. At the two stations in the auroral zone, however, there occurred a pulsation of longer (together with some shorter!) period (Fig. 3) at *the same* time.

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Author	Origin of data	Character of periods
Obayashi, Jacobs, 1957.	9 stations (mainly in the Pacific region) ($40,4° < \|\Phi\| < 67,1°$)	for $T \approx 60$ sec (at $\Phi \approx 50°$) $T \sim \cos^{-2} \Phi$
Jacobs, Sinno, 1960.	17 stations (Pacific region)	*pi2* and $T > 30$ sec *pc*-s equal
Ellis, 1961.	3 stations (Australia) ($28° < \|\Phi\| < 51°$)	neither day- nor night-pulsations depend on latitude
Duncan, 1961.	the data of Ellis, completed with other ones ($28° < \|\Phi\| < 51°$)	for midday-*pc* $\Delta T = 8$ sec at $\Delta\Phi = 23°$
Voelker et al., 1961.	3 German stations ($48,9° < \|\Phi\| < 54,6°$)	for horizontal components of day-*pse* and *pc* $\Delta T \leq 12$ sec; *pi2*-s and declination of day-pulsations equal
Lock, Stevens, 1961.	2 stations (Pacific region) ($\Phi_1 = 51°$ $\Phi_2 = -8°$)	*pi2*-s equal; *pc*-s' range equal, but apparently incoherent
Bolshakova, Zubin, 1964.	4 Soviet stations ($36° < \Phi < 63°$)	the most persistent *pc* latitude-dependent
Komack, Orange, 1964.	3 Caribbean stations ($20° < \Phi < 40°$)	$T \approx 20$—30 sec *pc* independent of latitude
Herron, Heirtzler, 1966.	8 American stations ($36° < \Phi < 63°$) compared to the base at $\Phi = 50°$	neither *pc*, nor *pi2* latitude-dependent
Usher, Stuart, 1966.	3 stations in England ($54,6° < \Phi < 62,5°$)	no regularity
Fanselau, 1966.	Wingst ($\Phi = 54,6°$) and Niemegk ($\Phi = 52,2°$)	for $T = 20$ sec *pc*-s $\Delta T \approx 0$, for $T = 50$ sec *pc*-s $\Delta T \approx 8$ sec
Tátrallyay, 1967.	21 observatories, 6 different days' (synchronous recordings from 8—14 stations)	from 33 *pi2* tests 23 not varied, 5 varied ($\Delta T/\Delta\|\Phi\| \leq 0,5$ sec/grad) 5 irregular
Verő, 1969.	Niemegk ($\Phi = 52,5°$) Nagycenk ($\Phi = 47,2°$) Tamanrasset ($\Phi = 25,4°$)	for the most frequent *pc3* shorter on lower latitudes

Table I.

Change of micropulsation-periods with the latitude, investigated by different authors.

I. Táblázat

Különböző szerzők által talált változások a különböző szélességű állomásokon észlelt pulzációk periódusában

Таблица I.

Изменение периодов микропульсаций с широтой, изученное различными авторами

Fig. 1
1. ábra
Рис. 1.

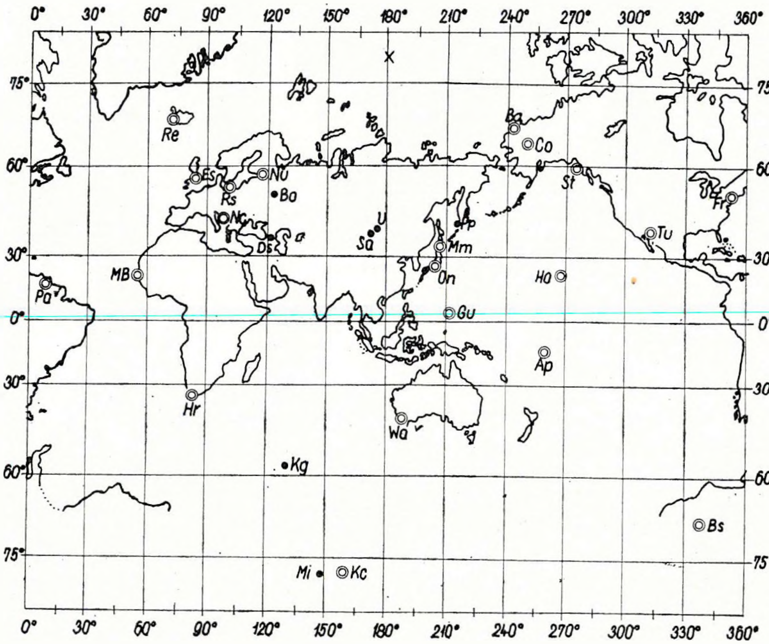


Fig. 2
2. ábra
Рис. 2.

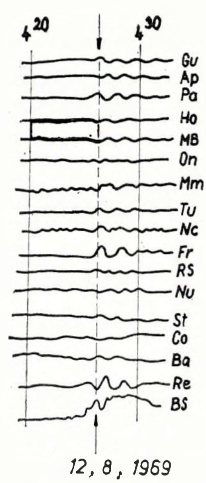
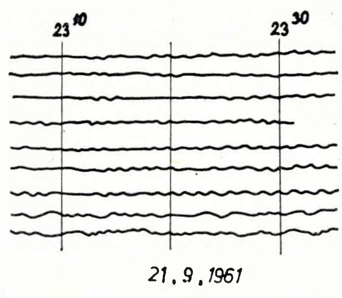
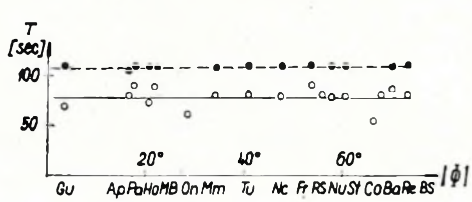
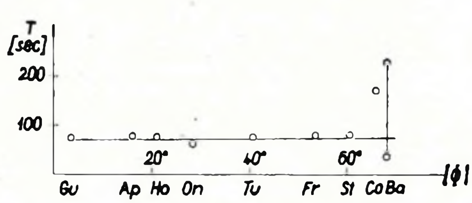


Fig. 3
3. ábra
Рис. 3.







A comparison between *pc5* of distantly situated stations is rather questionable: there is no guarantee for the coherence of the variations involved. The phases of the *pi2*-s, however, can be identified without correlation-calculations, basing exclusively on characteristic amplitude-maxima.

The phenomenon itself is a statistical one. Besides, the quality of records, the difference of the recording equipments contribute to hindering the interpretation.

The *pc* period-agreement dealt with in the present paper is, therefore, insufficient to support or object any of the results of Table I.

To attain a final decision, the following requirements should be met: a chain of not too distantly located stations in a N-S alignment, in geologically well-known environment, equipped with equal instruments.

A reliable result, however, is that *pi2*-s, at least outside the auroral zone, vary insignificantly only.

Magyar Állami Eötvös Loránd Geofizikai Intézet
GEOFIZIKAI KÖZLEMÉNYEK
XX. kötet, 1-2. szám.

ANALYSIS OF THE TER-DIURNIAL TIDAL GRAVITY VARIATIONS IN TIHANY

P. VARGA*

The gravity potential of the Earth's tide is described by the formula

$$W = \sum_{n=2}^{\infty} W_n = \sum_{n=2}^{\infty} \frac{f \cdot a^n \cdot m}{R^{n+1}} P_n(\Theta), \tag{1}$$

where W_n is the potential of a tide of n-th order, a is the radius of the Earth. R is the distance between the centres of the Earth, resp. of the tide-generating mass, f is the gravitational constant, m is the tide-generating mass. Term $n=2$ of this formula and of its derivates give useful information about the Earth's interior. It will be shown that term $n=3$, i.e. the ter-diurnal wave, also renders good services in searching our planet. From these waves the one, called M_3 by DARWIN, shows the greatest amplitude, though it does not exceed, on medium latitudes, 0,3 – 0,4 microgals.

The eight-hour wave was first proved by BARSENKOV (1967), based on long recordings of the Talgar observatory. MELCHIOR and VENEDIKOV (1968) established amplitude-quotients similar to those of theoretical Earth models, for several stations and long recordings.

Wave M_3 is in connection with term $n=3$. Its amplitude-quotient is a function of another combination of Love-numbers h_n and k_n than in the case of term $n=2$, usually examined.

Taking an arbitrary term n, differentiating (1), the gravity effect on the surface of an absolutely rigid Earth (PARIYSKIY, 1963) is

$$-\Delta g_0 = \sum_{n=2}^{\infty} \frac{n \cdot W_n}{a} \tag{2}$$

Considering an elastic Earth, the tidal gravity effect is

$$-\Delta g = \frac{\partial \sum_{n=2}^{\infty} W_n}{\partial r} + \frac{\partial \sum_{n=2}^{\infty} k_n(r) W_n}{\partial r} + \sum_{n=2}^{\infty} \frac{n \cdot g \cdot \zeta}{a}, \tag{3}$$

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where r is the distance of the Earth's centre from the point studied. The first term on the right side is the gravity difference caused by the tidal force. The second term is a secondary Δg change originating from the deformation of the elastic Earth. The third term is brought about because of change ξ in the level of the site of recording.

It is known that

$$\frac{\partial W_n}{\partial r} = \frac{n \cdot W_n}{r}$$

and

$$\frac{\partial k_n(r)}{\partial r} = \frac{\partial k_n \frac{a^{2n+1}}{r^{2n+1}}}{\partial r} = -k_n \cdot (2n+1) \cdot \frac{a^{2n+1}}{r^{2n+2}} \cdot$$

Thus, if $a = r$, then

$$\frac{\partial k_n(r)}{\partial r} = -(2n+1) \cdot \frac{k_n}{r}$$

and the height of the statical tide is

$$\zeta_n = h_n \frac{W_n}{g} \cdot$$

Hence, (3) can be transformed to the following form:

$$-\Delta g = \left(1 - \frac{n+1}{n} \cdot k_n + \frac{2}{n} \cdot h_n\right) \cdot \sum_{n=2}^{\infty} \frac{n \cdot W_n}{a}, \tag{4}$$

and for δ_n one obtains:

$$\delta_n = \frac{\Delta g}{\Delta g_0} = 1 - k_n \frac{n+1}{n} + \frac{2}{n} \cdot h_n$$

In case $n = 2$ it means:

$$\delta_2 = 1 - 3/2 k_2 + h_2,$$

while in case $n = 3$ it means:

$$\delta_3 = 1 - 4/3 k_3 + 2/3 h_3.$$

Further, values h and k and their ratio obviously change, for the density distribution of the Earth's interior will get different weights in each of the cases. Namely, in case of ter-diurnal waves, surface-nearer shells get greater weight, as noticed earlier by Melchior (1950), too, who stated at the same time, that density in the Earth's interior (ϱ) is a function of r.

Table I shows, for some Earth-models, the parameters characteristic for tides of second and third order. It seems that examination of third order tide offers information about the whole Earth, somewhat independent from those obtained from second order tides. As a matter of fact, the second order tide gives more accurate values, still the third order one should not be neglected either, for it helps in studying function $\varrho(h)$.

I

	Mo'odenskiy—Kramer (1961)	Takeuchi (1962)	Longman (1963)
n = 2			
h_2	0.617	0.592	0.612
k_2	0.302	0.280	0.302
δ_2	1.164	1.172	1.159
k_2/h_2	0.489	0.473	0.493
n = 3			
h_3	0.294	0.274	0.290
k_3	0.096	0.083	0.093
δ_3	1.068	1.072	1.069
k_3/h_3	0.327	0.303	0.321

Based on the aforementioned considerations, the amplitude-quotient and phase-difference of wave M_3 were determined through a 23 monthly recording in Tihany (22, 2, 1968 — 25, 1, 1970). First the hourly recorded data were treated with interpolated sensitivity-values. Then, without any filtering whatever, the suppression of other than ter-diurnal waves followed, with Fourier transforms (VARGA, 1970) on the frequency of wave M_3. Thereafter δ_{M3} has been determined with regard to eventual effects from nearby waves. Theoretical values were taken from DOODSON (1922) and PARIYSKIY (1961).

Consideration was given to the possible error of the value determined (Table II), the actual value of the error has been established from an examination of the noise level. It became obvious that δ_3 is as slighter than δ_2 as theoretically predicted, namely, the δ average of the greatest waves belonging to $n = 2$ (K_1 excluded) is 1,1579.

II

Wave	°/h	Ampl. observed	Ampl. calc.*	$\delta \pm \Delta\delta$
M_3	43.47616	0.5467 μgal	0.4940 μgal	1,107 ± 0,078

* Nearby waves considered.

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