3 EARTH - PHYSICAL RESEARCH

The *geomagnetic* instrument stock of the Tihany observatory was renewed in 1978. The new instruments offer a better opportunity to record time variations of the geomagnetic field components (D, H, Z, F) and enable to improve the accuracy of absolute measurements as well as to render them simpler.

The classical (La Cour) variation systems recording time variations have been replaced by Bobrov-type quartz fibre instruments having temperature compensation. The new instruments have been set up and adjusted, their technical parameters having been checked and determined. One La Cour system continued to operate for comparison of data.

Sensitivities of the new variation instrument groups, continuously operated since the beginning of September, are as follows:

0.5 nT/mm (D, H, Z — Bobrov I.)

2.0 nT/mm (D, H, Z, F — Bobrov II.)

5.0 nT/mm (D, Z, H — Bobrov III.)

From September 1978 the Bobrov II. system has been used as a basic instrument group of geomagnetic data furnished by the Observatory.

By the end of the year a mobile variety of the Bobrov instrument family was temporarily set up at the Observatory (with 1 nT/mm sensitivity in D, H, Z–Bobrov M), for longer recordings at outpost stations.

In addition to the analogue recording systems as listed above the digital variation station of the Observatory continues to work in routine operation with punched tape output.

Accuracy of absolute measurements is enhanced by a proton precession magnetometer type ELSEC set up in the middle of the year. The apparatus measures the components F and H, Z – on compensation principle. The total field (F) can be recorded by one minute sampling interval; recording is realized by thermoprinter with numerical indication, compensograph and digital cassette type tape recorder. Comparative measurements at the Tihany Observatory with proton instruments of the Hurbanovo

Observatory and the IZMIRAN Institute, Moscow, have given the same results with an accuracy of ± 1 nT.

Work on the computer processing package of time variations of the geomagnetic field components has started. Recorded field values are entered in a data bank arranged on magnetic tape, from where they can be called by programs stored on discs with the purpose of analysing the required segments for routine tasks (e.g. compiling of annual reports) or special customers' requirements.

In *magnetosphere research* regular whistler recording with two minutes duration per hour, as well as simultaneous recording with the on-board measurements of the IK–18 satellite, static and analytical processing of measured data have continued. To increase efficiency of processing sonograms were sampled by a digitizer. By using a digitizer the electron density sections are plotted from a substantially greater quantity of data, than earlier. The statistical data are published in the Annual Report of the Tihany Observatory.

In 1978 *gravity tidal observations* were carried out at Tihany, Pécs and Sopron. Our recording gravimeter was set up in October 1978 at Potsdam in accordance with the schedule of the working group 3.3 of KAPG. Observations in the GDR are expected to go on till the second half of 1979.

Investigation of the Earth's deformations under the effect of external loadings that can be described by an array of load numbers has been continued. The effects of several natural phenomena influencing the Earth's surface and its gravity field have been studied. Thus the effect of long period variations of the sea level on the surface of our planet has been investigated. It has been determined that a variation in sea level with an amplitude of 10 cm extending over an area of 10^6 km^2 results in a level change of 1 mm on the shore and at a distance of 150 to 200 km from the shoreline the change still exceeds 0.7 mm. Gravity change under the effect of air pressure variations (if it appears e.g. on a spherical square of $5° \times 5°$) amounts to –0.27 microgal/mbar, while variations of the Earth's surface reach 0.05 mm/mbar. Fluctuations of the ground water table involve load changes, too. By harmonic analysis of data arrays obtained in observation wells it has been determined that their annual amplitude change is 70 cm on the average, meaning that the resulting load fluctuations lead to height variations of the surface with an amplitude of 0.1 to 0.5 mm, showing an annual period. Significant areal changes are observed in the water table level from one year to another amounting to 1 to 1.5 m, that may also lead to shifts on the surface. Finally, gravity and level fluctuations due to the upfilling of water reservoirs or to variations in their levels have also been investigated. Their effect depends on the extent of the area and the depth of water. The results of our calculations in case of the Kisköre reservoir show that the extent of vertical movements in the proximity of the shore (within several kilometers from it) is 1 to 2 mm, while at a distance of 15–20 km from the reservoir 0.2 to 0.3 mm. Variations of the gravity field are of the order of 0.01 mgal in a zone extending to 10 km from the shoreline. In summary it can be stated that gravity effects i.e. level changes due to the investigated phenomena do not affect our measurements in noticeable form at the present accuracy of our instruments.

In comission of the Central Office of Geology *paleomagnetic investigtion* of 150 samples of Paleozoic rocks from the Bükk, Szendrő and Uppony Mountains has been carried out. The mean direction of magnetization in the present tectonic situation (prior to dip correction) and after dip correction has been determined from stable magnetizations obtained by A.C. demagnetization. Mean declination and inclination, then paleomagnetic pole positions were calculated from the data for each region.

It can be seen in Fig. 64 that the pole positions obtained from the rocks of the Szendrő Mountains before and even after dip correction can be regarded as a continuation of the polar-wander path as known for Africa. The decisively negative polarity of magnetization corresponds to the polarity of magnetic field prevailing in the Devonian.

The pole obtained for the Bükk Mountains after dip correction has furnished a result similar to the upper Permian–lower Triassic section of the African polar drift curve.

The pole position of the Uppony Mountains can be interpreted neither before dip correction, nor after it in a stable European or African tectonic system. Pole positions of the Szendrő and Bükk Mountains suggest the participation of these mountains in movements similar to those of the Transdanubian Central Range.

For the area of the Mórágy block (Mecsek Mountains) detailed thermal demagnetization of petrographycally heterogenous granitoides of migmatitic origin, as well as aplite veins and bostonite samples from 6 sampling sites (Fig. 65) has been carried out. By analysing the lost magnetization of granitoides in various temperature ranges we have determined the direction of magnetization bound to titanomagnetite, which is uniform regardless of where the sample was taken from among the six sampling sites:

$$\bar{D}=188°; \qquad \bar{I}=18°; \qquad K=11; \qquad \alpha_{95}=8°;$$

where K and α are statistical characteristics of the mean direction.

The magnetic pole calculated from this direction approximates the 280 to 300 million and 1,450 million years sections of the stable European polar-wander path. Solely on the basis of paleomagnetic determination it is impossible to decide between the Carboniferous and Precambrian ages. Investigation of granite aplites and bostonites, and analysis of the magnetization of granitoides recorded at lower temperatures are in-progress.

In the course of geophysical investigation of the Dunazug Mountains the paleomagnetic study of tuffs and tuffites was carried out. In all instances when the A.C. demagnetization gave no results, detailed thermal demagnetization was applied. Combination of these two methods enabled the determination of characteristic magnetization of the rocks for more sample groups than in previous years. Since all handled tuffs and tuffites have negative magnetization it can be concluded that not only the subvolcanic formations, but the bulk of the pyroclastic sediments were created in an inverse magnetic field.

Within the scope of *geodetic gravimetry* the Carpathian polygon established in 1973 was re-measured in international cooperation of Hungary, Poland and Czechoslowakia. 8 Sharpe and 4 Worden gravimeters were involved in this work. Observed data are being processed.

In the course of the year the determination of the absolute g value with a mean square error of ± 14 μgal was realized on the Siklós absolute gravity base point. The measurement was carried out by a Soviet team using a Soviet made portable laser gravimeter working on the principle of free fall.

In the past years about two thirds of the 2nd order gravity base points, established in the period from 1951 to 1955, have been destroyed. In order to make up for losses, work has begun to create gravity base points in protected environment (in the proximity of churches, monuments), where they are marked by concrete pillars.

The Hungarian Geodetic Survey has established a levelling with a reliability exceeding even the first class accuracy requirements for investigating recent crustal movements. The purpose of these measurements is partly to determine the numerical values of vertical crustal movements in Hungary and partly to study the vertical movements of large continental blocks – in cooperation with Eastern European socialist countries.

When determining the height of the base points of the network for studying crustal movements gravity values were also measured. The measurements served a double purpose:

- to determine gravity values needed for calculating the normal height of the base points,
- to acquire data for investigating phenomena related to crustal movements and other geophysical processes.

The gravity measurements along the levelling network (Fig. 86) were carried out by two Sharpe gravimeters in the period from 1973 to 1978. Processing of measured data extends for 1979.

To realize computer processing of graphical informations, first of all photographic charts and maps, a *two-dimensional digitzer* has been constructed (Fig. 67). This apparatus furnishes the coordinates of a drawing lying on the working surface having an area of 480×480 mm in units of 0.1 mm. A tape perforator or digital tape recorder can be attached to the apparatus as a periphery. In this case the coordinates are recorded on the data carrier in addition to being numerically displayed.

Two modes of operation are possible: reading point by point or automatic continuous operation. In continuous operation it is possible to set the sampling rate.

The data output gives a format readable for Fortran programs and there is a possibility to choose from one of the two built-in codes.

External data not bearing the character of coordinates may be entered by a key-board. These data simplifying and accelerating the processing are also recorded on the data carrier.