

50 Years of History of the Tihany Geophysical Observatory

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A b s t r a c t

The magnetic observation at Tihany Geophysical Observatory was started more than fifty years ago, in 1955. On the occasion of achieving this historical age, the brief history of the geomagnetic measurements in Hungary and the activities at Tihany Geophysical Observatory is presented. The article gives a retrospective review at the development of the instrumentation, survey campaigns and international connections of the observatory.

1. Historical Review of Hungarian Geomagnetic Observations

The history of systematic geomagnetic recording in Hungary started in 1768 at Nagyszombat University (now Trnava, Slovakia). In 1777, the university moved to Buda, where declination measurements continued with three-times-a-day periodicity until the siege of Buda in 1849, during Hungary's war of independence. Between 1781 and 1792 the observatory was part of the "Societas Meteorologica Palatina" European network.

Organized research of the Earth's magnetic field began with the foundation of the meteorological service in 1851 with the establishment of the Central Institute of Meteorology and Geomagnetism in Vienna, under Karl Kreil (1798-1862), former director of the Prague Observatory. From this date onward, organized investigation of the Earth's magnetic field began under the Habsburg Royalty, in the Austrian Empire. After the Austrian-Hungarian Compromise, however, an independent Hungarian institute was founded in 1870. The founder and first director of the Central Royal Hungarian Meteorological and Geomagnetic Institute was the Austrian Benedictine monk Guido Schenzl (1823-1890), who had already been observing the geomagnetic field in Buda for several years.

The first countrywide geomagnetic surveys in Hungary was carried out by the team of Empire's meteorological institute 1847-1857 (K. Kreil) and later by the independent Hungarian institute 1864-1879 (G. Schenzl), and 1892-1894 (I. Kurländer). Declination was measured using portable magnetic theodolites, inclination was observed with needle inclinometers. Schenzl used a variation needle and strong deflecting magnets to measure the horizontal intensity of the magnetic field. From 1873, the more precise earth inductors were introduced. Figure 1 is a reproduction of one of the maps of this survey.

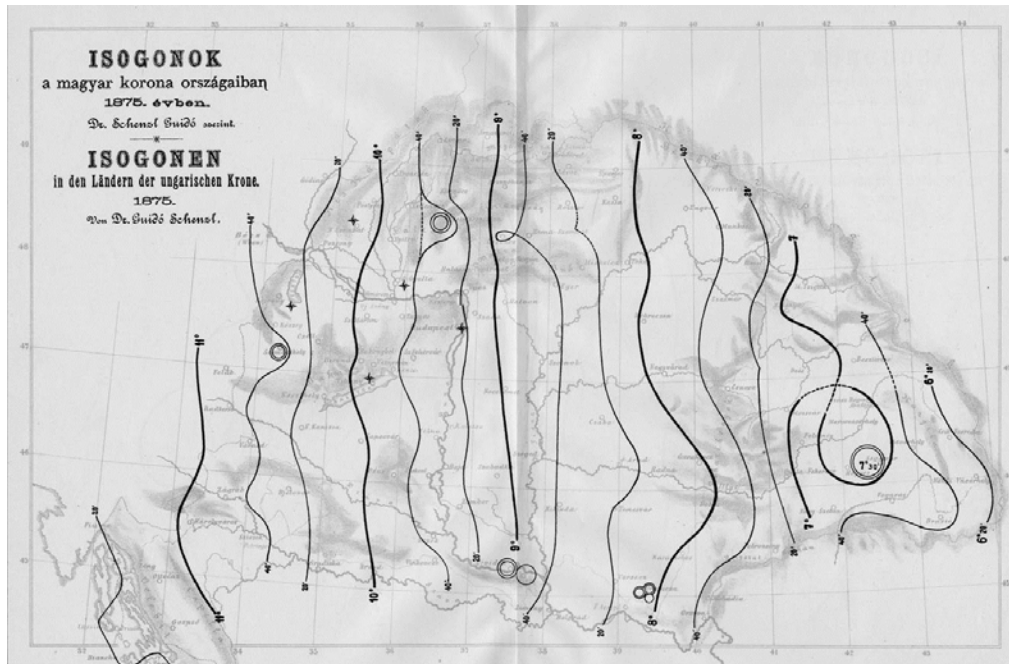


Fig. 1. Guido Schenzl's isogon map of Hungary for the epoch of 1875.0. Locations of historical and present geomagnetic observatories are marked by asterix (from north to south): Nagyszombat (now Trnava), Ógyalla (now Hurbanovo), Nagycenk, Buda (Budapest), Tihany.

Between 1890 and 1910, the independent Hungarian meteorological institute was headed by Miklós Konkoly Thege (1842-1916). In 1893, in order to avoid the industrial noise of the growing capital, he moved the geomagnetic observations to his personal observatory at Ógyalla (now Hurbanovo, Slovakia), where observations continued. After the First World War the region became part of Czechoslovakia and the observatory's name was changed to Stara Dala. In the period 1938-1945 the territory and the observatory returned to Hungary. After the Second World War the observatory continued its activity under the name Hurbanovo Observatory (Slovakia).

In Hungary, to replace the loss of Ógyalla, a temporary station was built at Budakeszi (near to Budapest) in 1949. In 1950, geomagnetic observations were transferred from the Meteorological Institute to the Eötvös Loránd Geophysical Institute (ELGI). The need for a permanent observatory was strongly felt during the 1949-50 geomagnetic base network measurements. The search for a location free of actual and

possible future industrial disturbance led to the selection of Tihany national park on the peninsula of Lake Balaton (see Fig. 2). The construction work of the observatory started in 1952 and was completed in 1954. The scientific preparation and the project itself, was headed by György Barta (1915-1992), who became later the first leader of the observatory. The observatory has been recording geomagnetic data since 1955. (ELGI Geomagnetism Group, 2006)



Fig. 2. Tihany village on the peninsula in the year 1955. On the left and right sides of the picture, the Abbey, and the office of the observatory can be seen, respectively. From the beginning of the observations in Tihany, the cross of the southern tower of the Abbey is used as a reference mark for the absolute measurements of geomagnetic declination. It can be seen at an angle of precisely $3^{\circ} 59' 10''$ from the observatory's absolute pillar.

In 1961 continuous geomagnetic observation started also in Nagycenk (NCK) Geophysical Observatory, maintained by the Geodetic and Geophysical Research Institute of the Hungarian Academy of Sciences.

2. Instrumentation of Tihany Geophysical Observatory

2.1 *From the analogue instruments to digital techniques*

Tihany Observatory started the continuous recording with analogue photo recorders. The variometer house was constructed in accordance with the needs of classical instruments. To reduce the effect of daily and seasonal temperature variation the rooms are underground and the roof is covered by a thick layer of reeds. The difference between the yearly temperature maximum and minimum is eight degrees centigrade. Between 1954 and 1991, the recording of geomagnetic elements was based on

LaCour instruments (Fig. 3.). In the early '70ies the LaCour variometers were equipped with photoelectric converters and their data recorded digitally. The data were recorded on punched tape. To increase the baseline stability, parallel to LaCour variometers, Bobrov type quartz variometers were installed. The first microprocessor-based recorder, DIMARS (Digital Magnetic Recording System) was developed by ELGI in 1982, for the registration of Bobrov data. The system performed 5 second sampling and the data were recorded on floppy disc in a PC readable format. DIMARS was in use until 1999; it was also employed in several other observatories around the world. Bobrov variometers were changed to LEMI fluxgate magnetometer in 1993. For LEMI a new low power recording system (DIMARK) was developed and built based on PC standard technology between 1999-2000. Data were recorded on a flash memory card from which data download was enabled by remote control via a telephone line. (Annual reports of Tihany Geophysical Observatory 1955-1987).

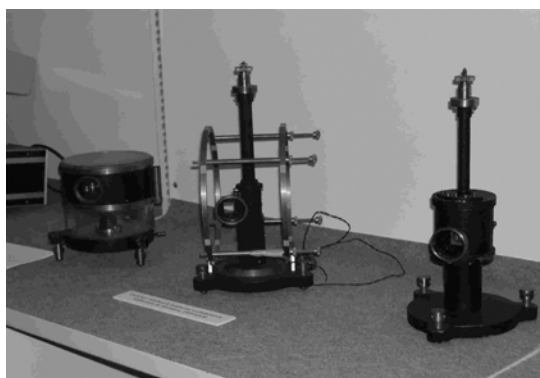


Fig. 3. LaCour instruments.

A new era in the history of Tihany Observatory started when the US-Hungarian Joint Fund (UHJF) accepted a project proposal submitted by ELGI and the US Geological Survey (USGS) to raise the level of the observatory instrumentation to international standards in order to get INTERMAGNET membership. A Meteosat transmitter was installed and regular one-minute data transmission to Geomagnetic Information Node in Edinburgh started. Since 1991 Tihany Observatory's data are annually published on INTERMAGNET's CD-ROM.

Recently, Tihany Observatory's three-component magnetic recording system is based on the FGE magnetometer with suspended sensor, produced by the Danish Meteorological Institute. At our request the magnetometer came equipped with an ADAM 4017 type, 16-bit A/D converter. The system is able to work with a 1-second sampling rate using the DIMARK data acquisition system. In addition, it records the calculated 1-minute mean values required by INTERMAGNET. This data acquisition system is developed by ELGI, and currently used in several observatories of the world.

Parallel to the above, there is a DIDD system working with Overhauser magnetometers of GEM Systems, Canada. DIDD was developed in the framework of an ELGI-USGS-GEM Systems cooperation in the early 1990s with the financial support of UHJF. DIDD system records inclination and declination, as well as total field data

in every 5 seconds. When these data are used as input to a task-oriented DIMARK, it produces real-time XYZF 1-minute means. Thus, DIDD can serve as back-up for our base FGE magnetic recording system. DIDD system is used in about 30 observatories throughout the world.

In 1995, within the framework of a US-Hungarian Joint Fund project, synchronized geomagnetic pulsation observations were started in two pairs of observatories [Boulder–South Park (Colorado, US) and Tihany (Hungary)–Hurbanovo (Slovakia)] to study the near-earth environment processes. Owing to this cooperation a further three-component fluxgate magnetometer (the Canadian NAROD) was installed in the observatory. Currently, it works at a 16 Hz sampling rate to record pulsations in the DC-5Hz frequency range. The resolution of LAWSON LABS' A/D converter is 20 bits and it is synchronized to a GPS unit with ± 0.001 sec accuracy.

2.2 Absolute measurements

The absolute measurements were carried out by QHM and BMZ instruments starting from the foundation of Tihany Observatory. Total field observations were introduced using a home-made proton magnetometer, in 1967. To replace QHM and BMZ instruments an ELSEC-type proton precession magnetometer—complemented by a Helmholtz coil system—was set up in 1979. The first D/I theodolite was purchased and installed in 1983. The first Overhauser magnetometer arrived to Tihany in 1991, thanks to UHJF.

3. Additional Activities of the Observatory

From 1950 onwards, the geomagnetic base network of Hungary has been reobserved every 15 years; this was carried out by György Barta (1949-1950); Etelka Aczél and Róbert Stomfai (1964-1965, see Fig. 4); Tibor Lomniczi and Péter Tóth (1979-1982); Alpár Körmendi and Péter Kovács (1994-95). Since 1965, the institute has also

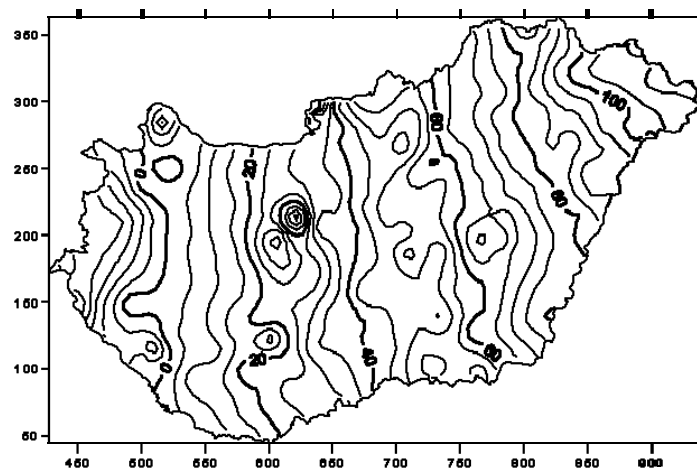


Fig. 4. Isogon lines of declination in Hungary, for the epoch of 1965.0.

maintained a secular network to record secular variations of the magnetic field on 12 to 15 stations of the base network.

In addition to geomagnetic observations the activity of the Observatory included meteorological, earth tide, micro-seismological and geothermal registrations as well as paleomagnetic- and rock-physical parameter measurements from time to time. In co-operation with Eötvös Loránd University (ELTE, Budapest) atmospheric radio noise registrations were carried out for about 20 years and, from 1970 on, whistlers has been observed and recorded in the observatory. Beside the magnetic observations, space research is one of the most important basic activities of the observatory up to this day.

In 1990 the third IAGA Workshop was organized by Tihany Observatory. The personnel of the Observatory is regularly taking part in ELGI's geomagnetic projects. (Körmendi *et al.* 1991)

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