

The CONRAD Observatory in Austria – A Design Challenge

Peter Melichar

The Austrian Seismological Service was established at the ZAMG in 1904, Victor Conrad was appointed as the first head. He became Professor of Cosmic Physics at the Franz Joseph University in Czernowitz, crown land Bukovina, in 1910. Conrad emigrated with his wife Ida to the USA in 1939. He taught inter alia at Harvard University in Cambridge, Mass. untiringly until the age of 80. Ida Conrad, who passed away in 1969, conferred in her will a legacy to the ZAMG, with the wish that „ ... from the estate a building will be erected, serving geophysical and meteorological research, and will be named after Victor Conrad.” The generous legacy of Ida Conrad and subsidies from the Province of Lower Austria made it possible to set up the CONRAD Observatory at an excellent location. This external financial support was the starting point for the implementation of this ambitious project by the Ministry of Science and Research.

In 1975, Peter Melichar was commissioned by the ZAMG (Central Institute for Meteorology and Geodynamics) to find a suitable site for a new geophysical observatory. The order included design and structuring of the observatory to meet the specific needs for a research center for seismology, gravimetry and geomagnetism. In 1978/79, a suitable site was found in Lower Austria on the Trafelberg at 1,100 meters above sea level. The essential criteria for the location are (i) that it is free from interference from natural and artificial sources, and (ii) that the location has a geological underground with spacious largely non-magnetic rocks. To be independent from seasonal fluctuations, an underground construction was chosen for the design, which makes the observatory operation independent of weather conditions. In the tunnel system, the temperature of + 7 ° Celsius remains constant. This is a real gift the mountain offers and it provides ideal conditions for highly sensitive sensors and electronics, leading to a significant reduction in thermal low noise.

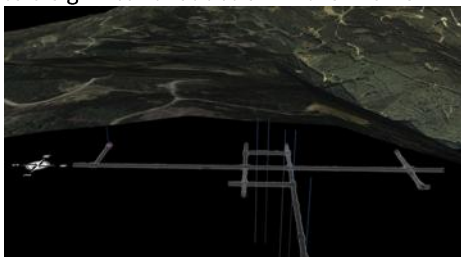


Figure 1: Tunnel System of the Geomagnetic Observatory

The GMO tunnel system was built by the Austrian company ÖSTU STETTIN using a special nonmagnetic construction technique. The CONRAD Observatory, with its two separated underground sections SGO and GMO, has a total tunnel length of 1,166 m with a total of eight boreholes reaching up to 200-meter depth accessible from the tunnel floor. The central heart of the GMO is the 3D gradiometer magnetometer system from GEM Systems, Canada. In its configuration, it is currently the

world's most sensitive measurement system of its kind. It includes two horizontal gradiometers in north-south and east-west directions as well as a vertical gradiometer. The maximum extension on the three axes x, y and z is 200 meters each. Measurements in the Femto-Tesla range are now carried out with the 9 potassium sensors that make up the gradiometer. Everyone knows that earthquakes cannot (yet) be reliably predicted, but it is known that due to the pressure build-up in the earth's crust just shortly before an earthquake happens very small electromagnetic signals are generated in the rock masses. This leads to induction and piezoelectric effects, which then cause extremely small changes in the current systems of the ionosphere. Due to the extreme resolution of the 3D gradiometer in the GMO, these magnetic precursor effects may be recorded and analysed for the first time.

The opening ceremony of the SGO took place on 23 May 2002. It is used for research and development in seismology and gravimetry, as well as for applied sciences. The opening ceremony of the GMO - a center for geomagnetic research and development - took place on 21 May 2014. From the beginning, the goal was to establish the CONRAD Observatory as an international research center and meeting place for the science community!



Figure 2: The GMO Building on Trafelberg in Lower Austria

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