ACTIVITIES COMPLETED TOWARD ESTABLISHING A GEOMAGNETIC OBSERVATORY IN THE REPUBLIC OF MACEDONIA

MARJAN DELIPETROV[23]
Faculty of Mining and Geology

Abstract. This paper presents the activities carried out in the territory of the Republic of Macedonia toward establishing a geomagnetic observatory. It gives the geographic location of the repeat station at Mount Plackovica, where construction of the geomagnetic observatory is planned. The paper also presents a proposal for the construction of the observatory.

Keywords: Geomagnetic Observatory, Republic of Macedonia, Geomagnetic field, Geomagnetic buildings

1. Activities completed so far toward establishing a geomagnetic observatory in the Republic of Macedonia

Since the declaration of independence in 1991, the Republic of Macedonia has lacked a geomagnetic observatory. Prior to 1991, during the existence of FR Yugoslavia, all geomagnetic measurements and permanent observations of the geomagnetic field were performed by Grocka observatory personnel in Serbia.

After independence, the Department of Geology and Geophysics of the Faculty of Mining and Geology in Štip purchased the first magnetometers for the investigation of some anomalies of the geomagnetic field. Of interest were ore deposits, archaeomagnetism, and the structural composition of some terrains.

The first steps in establishing the geomagnetic observatory started with the international project "Establishing a geomagnetic observatory in the Republic of Macedonia according to the standards of INTERMAGNET".

[23] Address for correspondence: Faculty of Mining and Geology, Department of Geology and Geophysics 2000 Štip, Macedonia. Email: marjan@rgf.ukim.edu.mk

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The project was undertaken in collaboration with the Royal Meteorological Institute - Geomagnetic observatory in Dourbes, Belgium under the leadership of Dr. Todor Delipetrov, Dr. Jean Rasson, and the Faculty of Natural Sciences and Mathematics, Seismological observatory in Skopje.

The first measurements of the geomagnetic field were completed at the beginning of the project in 2002 at a number of locations in the country in order to select the most suitable terrain for construction of the geomagnetic observatory.

After the initial field survey in 2002, a grid of 15 repeat stations was established. Laboratory processing of measured results was carried out. Since these investigations aimed to define the location for construction of a geomagnetic observatory in the country, detailed analyses were performed. Bearing in mind the INTERMAGNET standards and the local conditions, the aim was to define an area that would meet the following criteria:

- The horizontal and vertical gradients of the geomagnetic field surrounding the location should not exceed 5 nT/m. At the locations for the absolute and variometer huts, the gradients should be within 1 nT/m;
- The wider area and the observatory should be located on a tectonically inactive block, meaning not in the zone of active tectonic dislocations,
- No seismic activity should be detected,
- The ground should be physically stable (no landslides, dip, bulging or similar);
- Observation pillars should be anchored on an undisturbed rock mass;
- Risk of floods or sudden changes in ground water levels should be minimal or nonexistent;
- Only moderate risk of strong winds and thunderstorms should exist;
- The surrounding area should not be populated or occupied by industrial facilities or be in an area where growth is expected. Infrastructure that would have negative impacts on observatory activities should be avoided.
- The possibility of acquiring surrounding property (5 – 10 hectares) for the needs for the observatory should be considered;
- The site should have the necessary infrastructure: road access, electricity, etc;
- The land should not be arable;
- From an economic aspect, the value of the area should be minimal, possible state land of low agricultural value;

- The site should be accessible year-round.

The locations in Ponikva, Galicica, and Plackovica (Figure 150)[2] completely satisfy the magnetic standards. However, bearing in mind other parameters such as property prices, area infrastructure, possible future growth, state ownership, and a favorable location with regard to neighboring observatories, it was decided that the best location for the construction of the geomagnetic observatory in the Republic of Macedonia is Mount Plackovica.

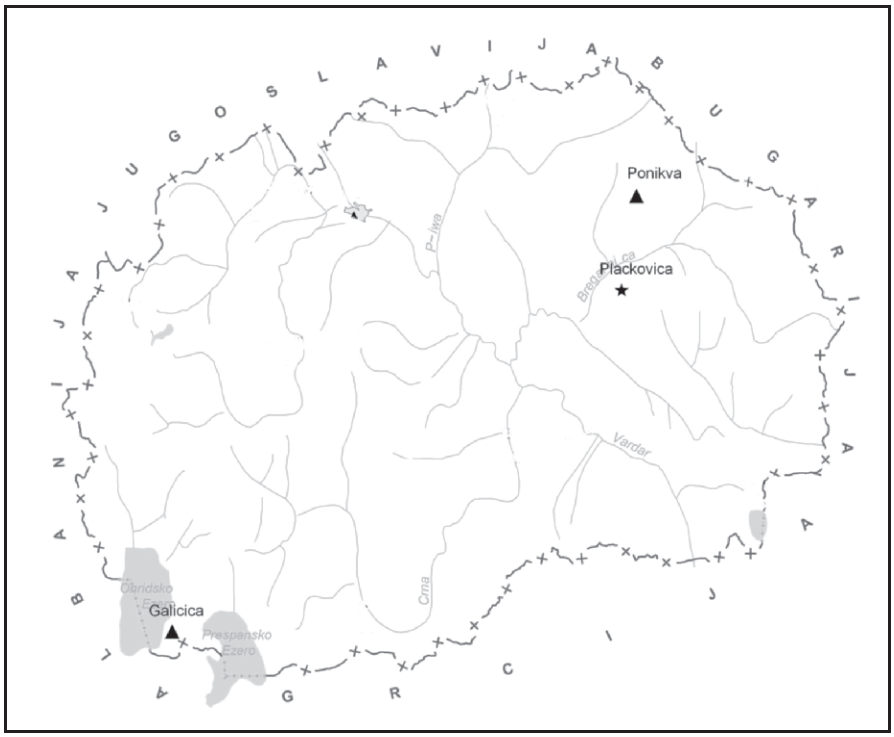

Figure 150. Map of the three most favorable locations for the observatory.

After deciding on the location of the geomagnetic observatory, the Department of Geology and Geophysics and the Seismological observatory in Skopje continued the work needed for starting construction. The National Government and the Ministries gave support for implementation of the idea because it was of scientific and state interest. Information about geomagnetic field changes should be announced in public media similar to weather forecasts in developed countries.

Changes in the geomagnetic field affect navigation and wireless communication. Airports in particular require accurate, up-to-date geomagnetic information. Those who use compasses for orientation also require this information.

Understanding the geomagnetic field was of interest to and was supported by the Ministry of Education and Science and also by the Ministries for Defense and Transport.

Figure 151. Topography of access road to the Plackovica repeat station.

The Department of Geology and Geophysics and the Seismological observatory completed a proposal for a geophysics activities law which is in the process of discussion and adoption.

A geomagnetic observatory needs adequate equipment, so contacts were established with several top institutions from countries in the European Union, within the Tempus Project "Geomagnetic Measurements and Quality standards". The European Training Foundation is financing the observatory project. The Tempus project provided significant funds for modern geomagnetic equipment. The equipment was tested at the observatory in Dourbes, Belgium and training was organized for a team of people for measuring the geomagnetic field.

2. Plackovica - location for construction of the geomagnetic observatory

The coordinates of the repeat station in Plackovica are: Longitude: 22°18'13"; Latitude: 41°47'41", Altitude: 677 m. This repeat station is situated on Mount Plackovica near the town of Štip and the village of Radanje (Figure 151). The local geology consists of micaschists and gneisses[1]. The plan is to install the magnetic observatory at the site of the repeat station.

During the past several months, architect Ljubica Velkovska[3] completed a proposal for the construction of the buildings for the geomagnetic observatory. The proposal was requested by the Department of Geology and Geophysics and the Seismological Observatory.

According to the requirements and consistent with the terrain conditions, a complex of structures for the observatory was designed.

This proposal gives schematics for the huts and structures for the actual buildings making up the geomagnetic observatory (see drawings in Annex 1).

References

1. Delipetrov, T., Report: "Establishing geomagnetic observatory in the Republic of Macedonia according to INTERMAGNET standards", Stip, R. Macedonia, 1991
2. Rasson, JL., Delipetrov, M., "Republic of Macedonia: Magnetic Repeat Station Network Description, Dourbes, Belgium", 2004
3. Velkovska, Lj., Proposal project for geomagnetic observatory in the Republic of Macedonia, Skopje, R. Macedonia, 2005

DISCUSSION

Question (Valery Korepanov): What is the minimal distance from the main road to the observatory buildings?

Answer (Marjan Delipetrov): The minimal distance from the main road to the observatory buildings is more than 500m. But from the office building to observatory buildings the distance is about 150m.

ANNEX 1: DRAWINGS FOR THE PROPOSED BUILDINGS OF THE MAGNETIC OBSERVATORY ACCORDING TO ARCHITECT LJUBICA VELKOVSKA

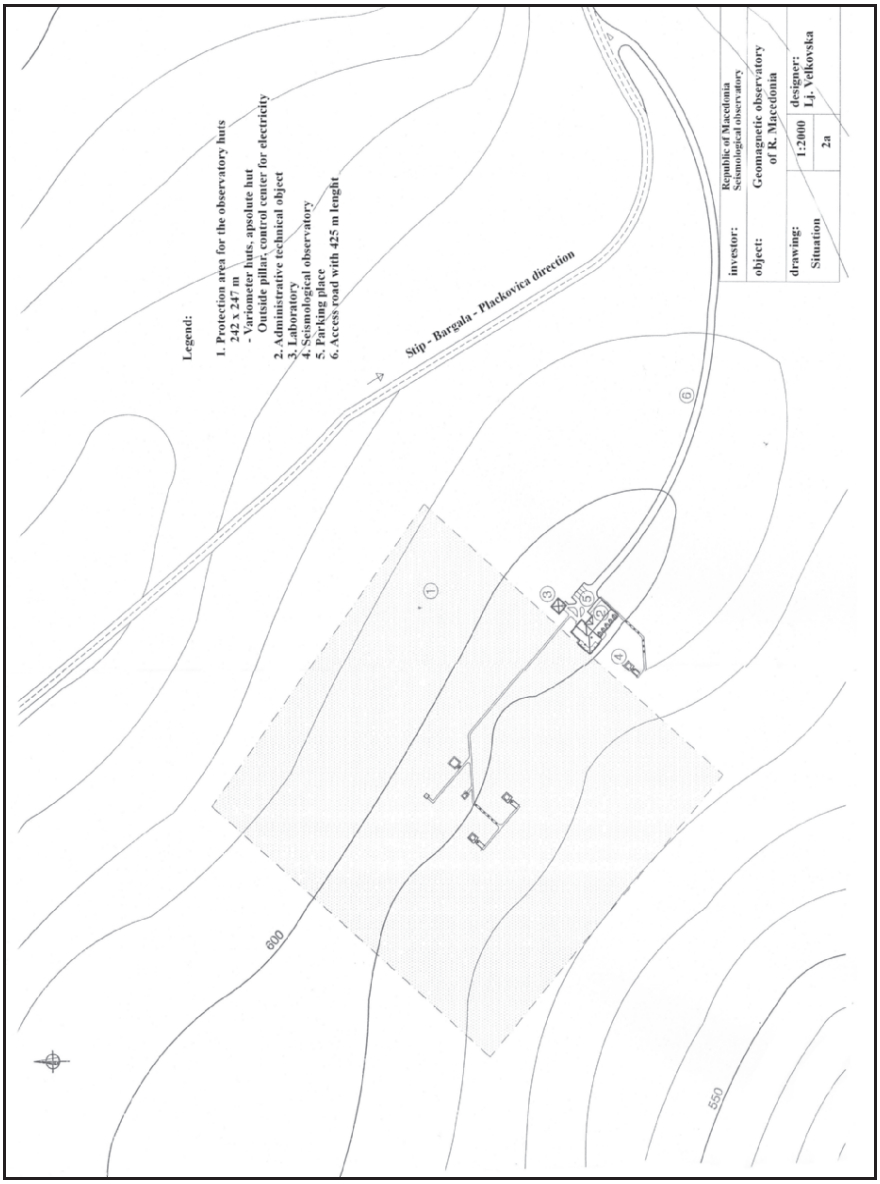

Figure 152. General view and disposition of the proposed geomagnetic observatory.

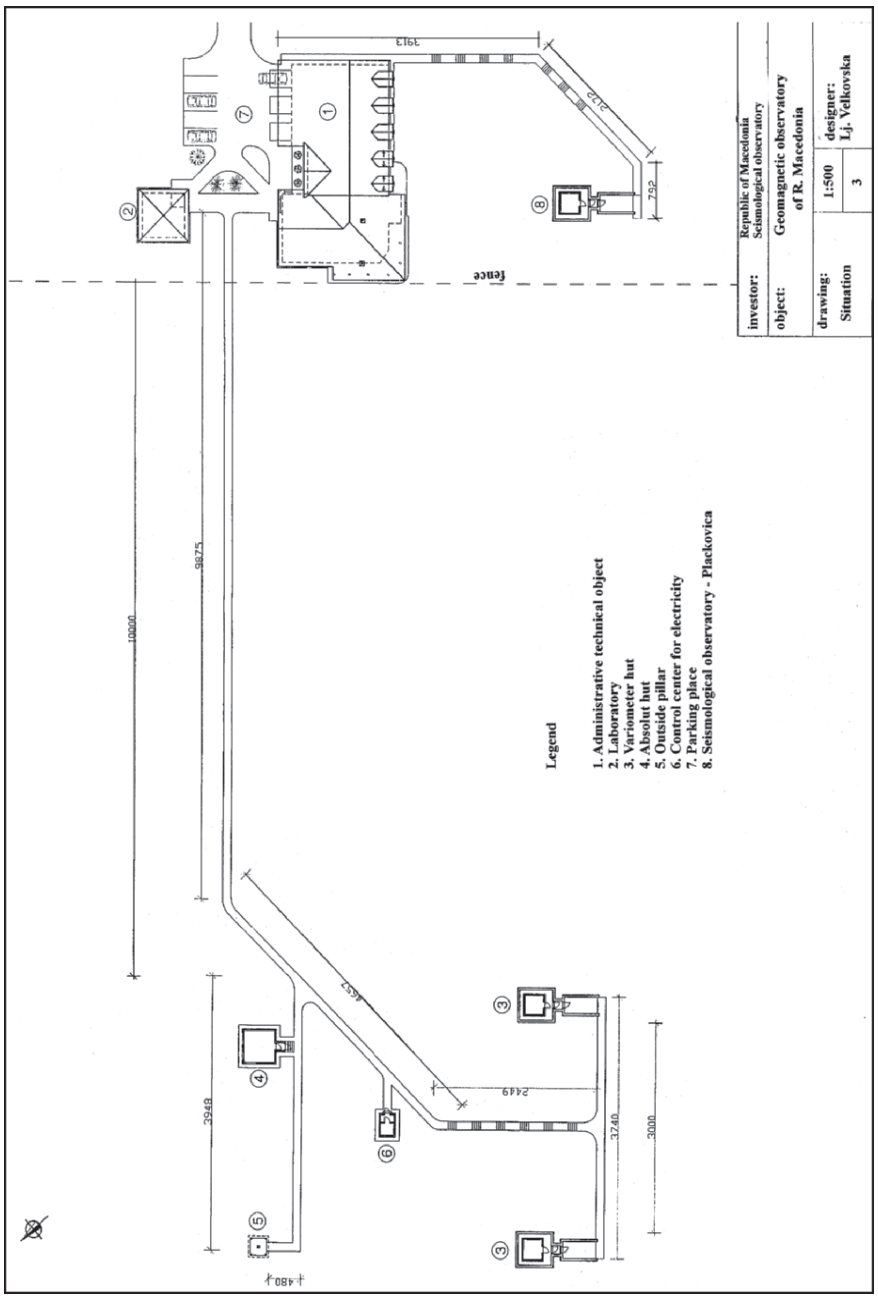

Figure 153. Close-up on the buildings for the proposed geomagnetic observatory.

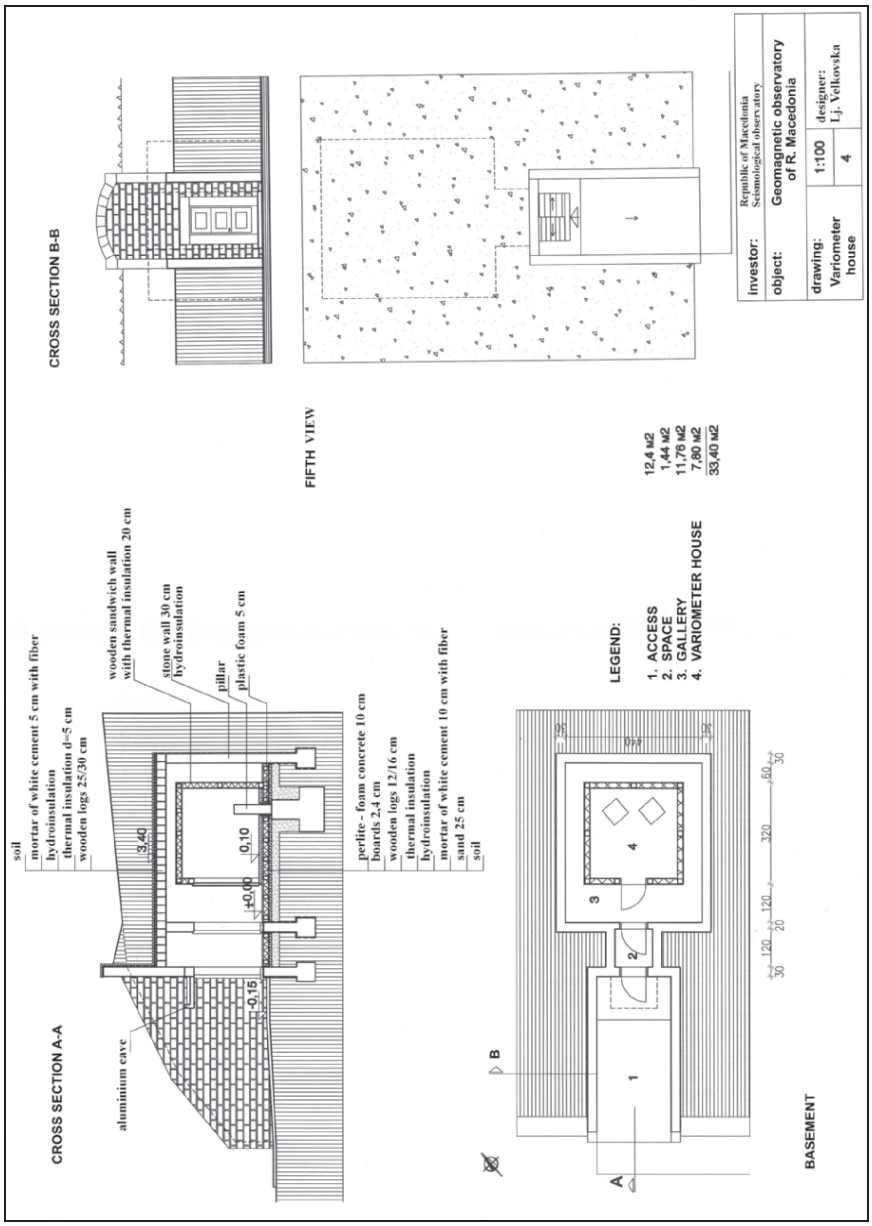

Figure 154. Variometer house.

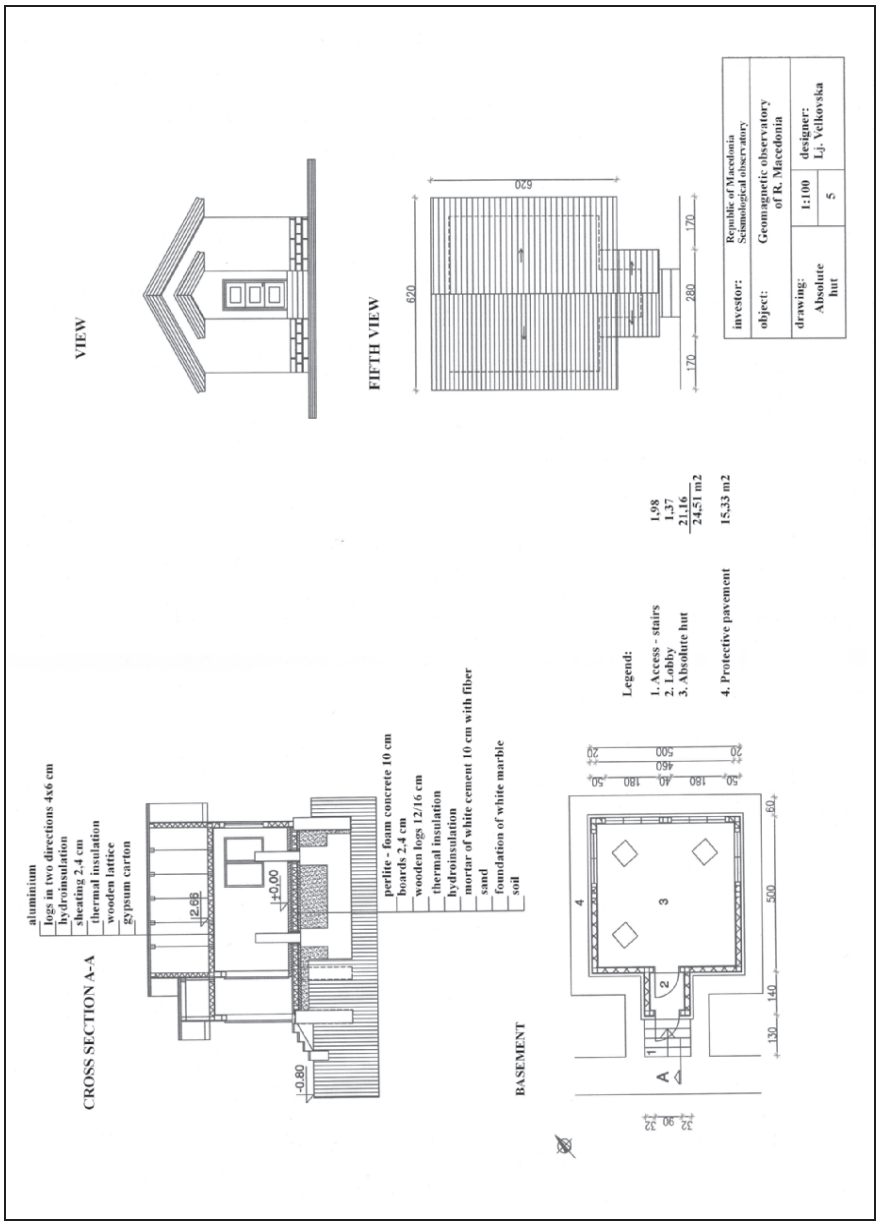

Figure 155. Absolute hut.

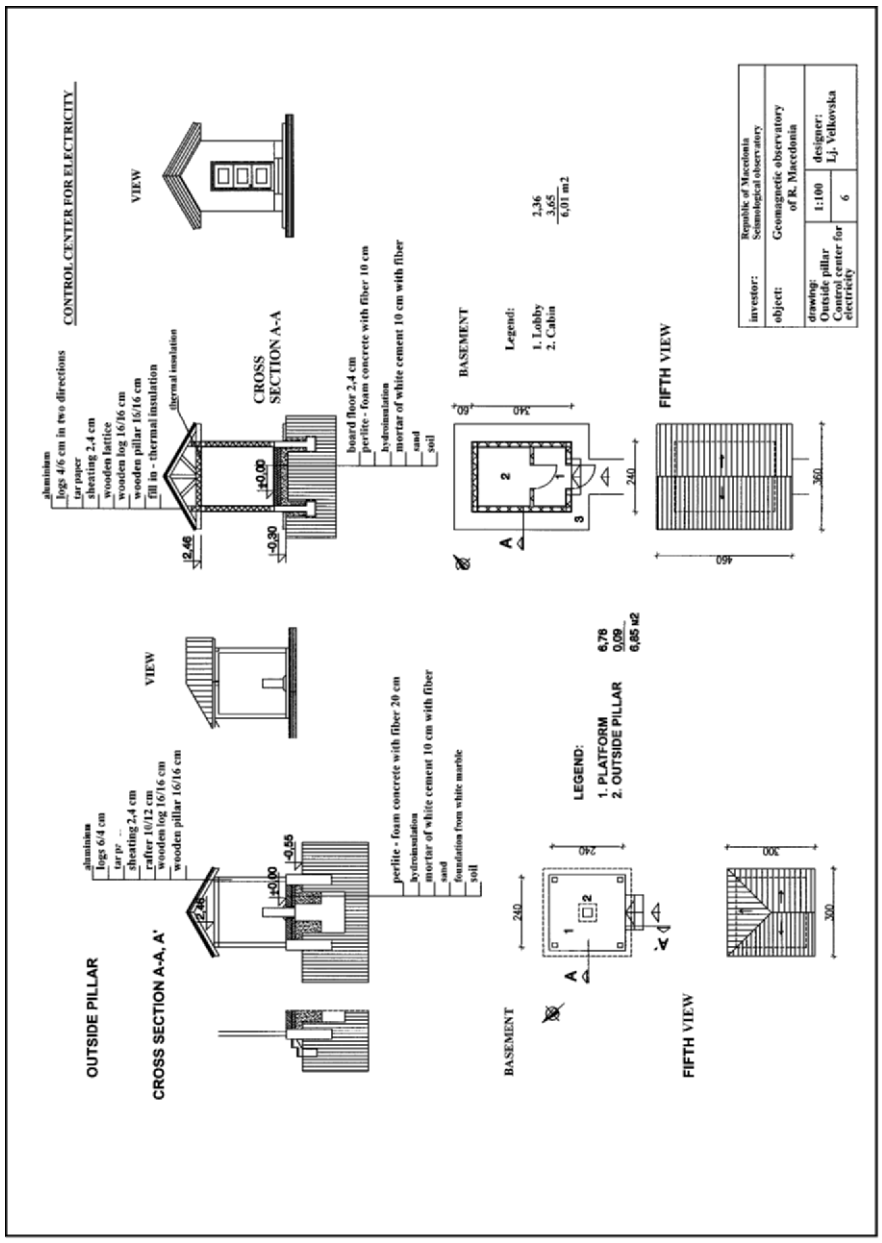

Figure 156. Outside pillar and control center for electricity.

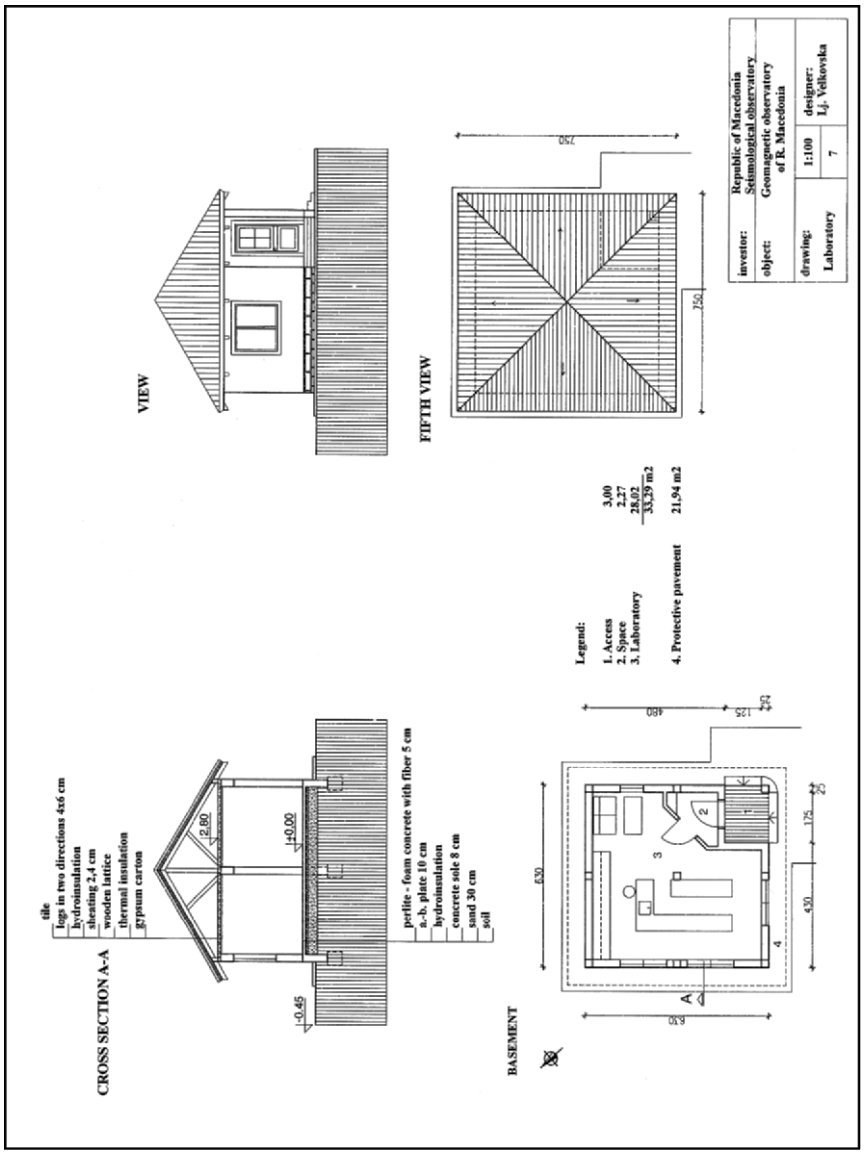

Figure 157. Laboratory.

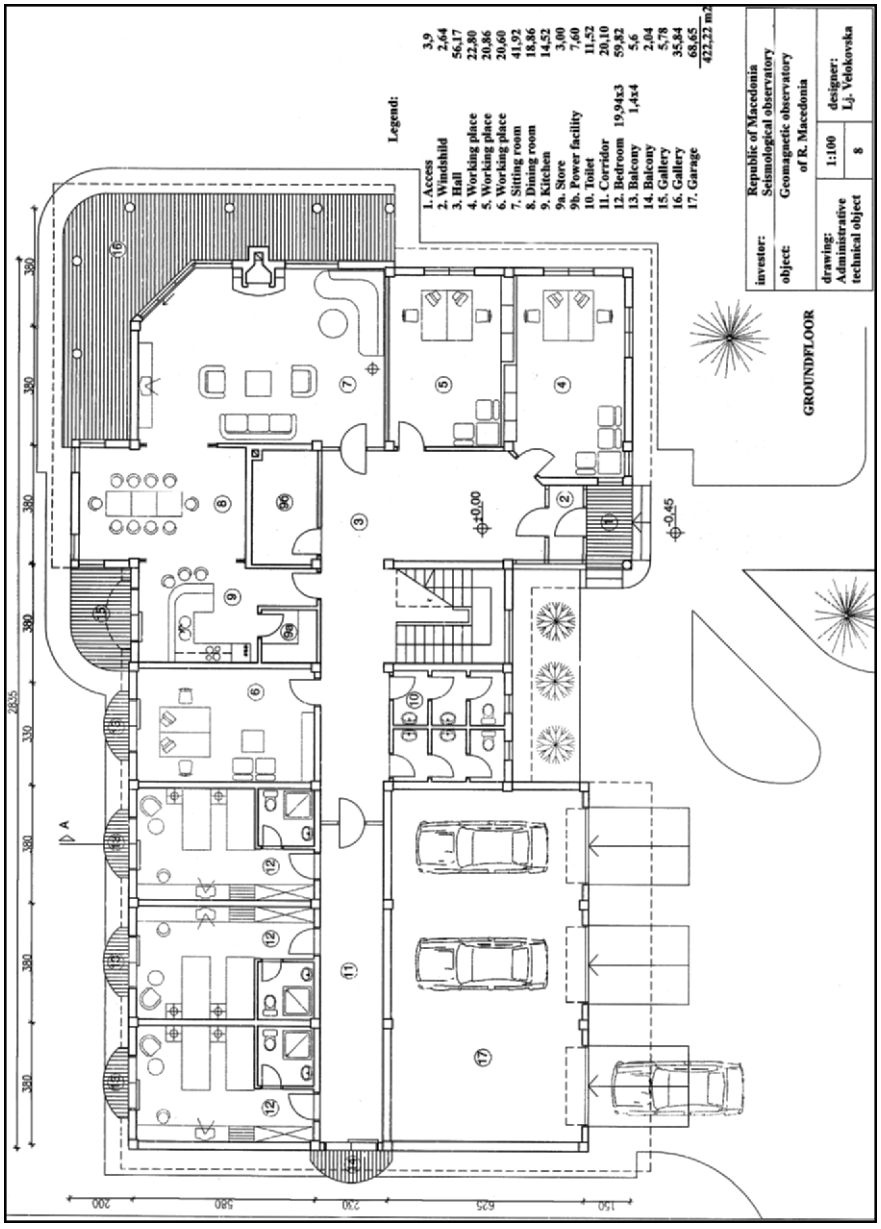

Figure 158. Administrative building (first floor).

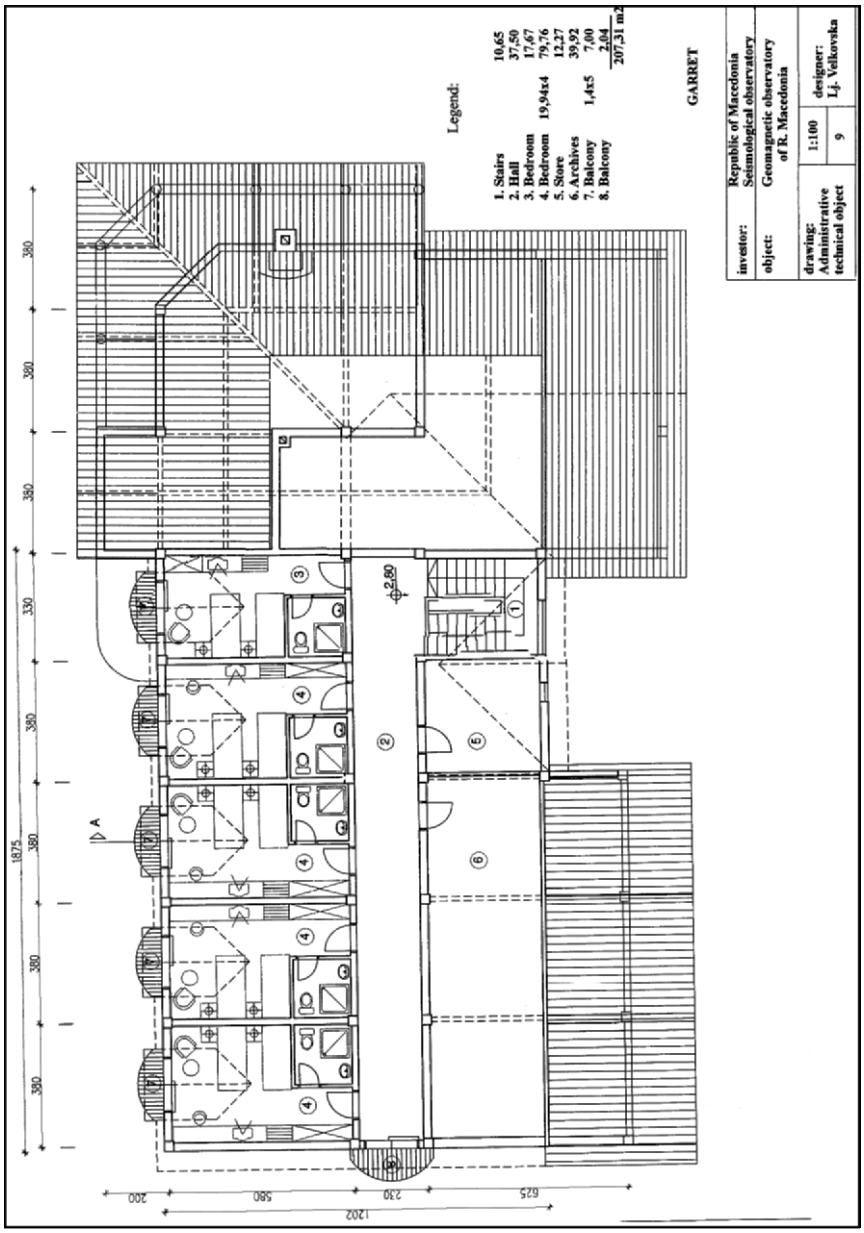

Figure 159. Administrative building (second floor).

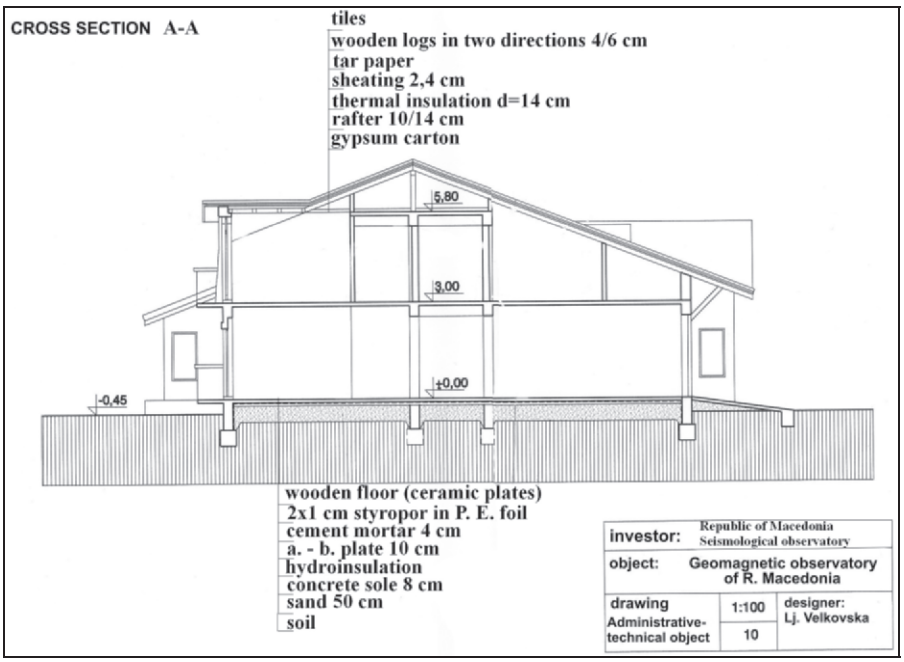

Figure 160. Cross section A – A of the administrative building.

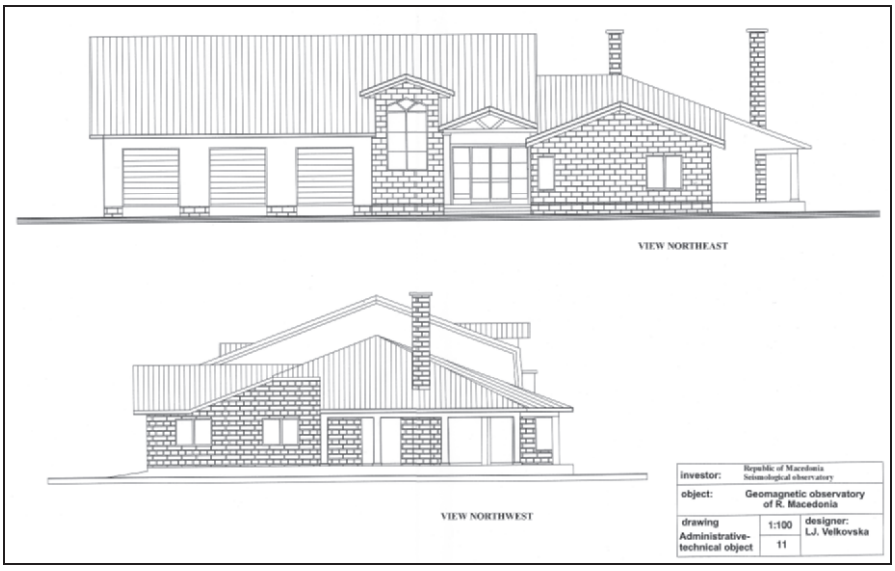

Figure 161. Northeast and northwest view of administrative building.

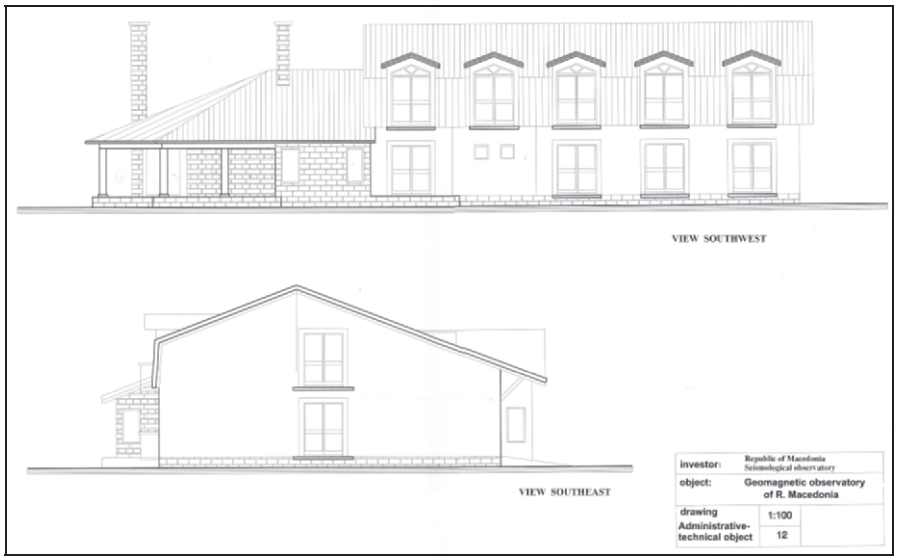

Figure 162. Southwest and southeast view of administrative building.