

**1999–2002 CZECH NATIONAL PROJECT DEVOTED TO CO–OPERATION
AMONG POLAND, THE SLOVAK REPUBLIC, THE CZECH REPUBLIC AND
UKRAINE IN THE CARPATHIANS**

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Abstract: In December 1999, a new Czech National Project was started, entitled "Strukturně-geologická stavba Západních Karpat a jejich podloží na základě geofyzikálních dat v příhraničních oblastech s Polskem a Slovenskem" (Structural-Geological Configuration of the West Carpathians and the Basement on the Basis of Geophysical Data from Border Areas with Poland and the Slovak Republic). The project is supported by the Ministry of Environment of the Czech Republic with a budget of 150.000,- EUR. Begun in December 1999, the three-year project will be completed in December 2002.

Key Words: Czech Republic, Outer Western Carpathians, geophysics, geology, basin research

Introduction

The main goals of the Czech National Project "Strukturně-geologická stavba Západních Karpat a jejich podloží na základě geofyzikálních dat v příhraničních s Polskem a Slovenskem" are:

- To collect new detailed ground magnetic data in the NE part of the Czech Republic
- To collect new detailed gravity data along the Brno-Hodonín and Šternberk-Lysá pod Makytou profiles
- To collect rock samples in selected anomalous areas and to study their petrophysical properties
- To re-process older seismic well-log data related to the profiles Brno-Hodonín and Šternberk-Lysá pod Makytou

- To draft models of geological-geophysical cross-sections along the two profiles mentioned above across the Outer Western Carpathians.
- To carry out modelling of burial- and thermal-history basins below and within the Outer West Carpathians in the Czech Republic
- To construct a structural-tectonic diagram of the eastern part of Czech Republic based on geological and geophysical data

The main results of the project will contribute to a newly planned, larger international project, CARTA, which will be aimed at close co-operation among the Czech Republic, Poland, the Slovak Republic, and Ukraine as to geological-geophysical investigations of the Carpathians.

Contemporary results

Magnetometry

A 3,500 kilometre square area in the NE part of the Czech Republic, near the borders of Poland and the Slovak Republic (Figure. 1), has been covered by ground proton magnetometric survey. No detailed total vector T magnetic measurements had been done there before this time. During the period 1999-2001, 15,000 new magnetic stations were measured, using an the average interval between the stations of about 430 m. Owing to extensive industrial disturbance, approximately 10 % of the area could not be covered by this magnetic survey.

A regular grid of 250 m x 250 m was calculated and a map of delta T anomalies was constructed from the measured data. Preliminary geologic interpretation of anomaly sources was performed.

During 2002, the new data will be merged with older magnetic measurements that cover a large area of the eastern part of the Czech Republic, and a complete magnetic map for the area of almost 30 000 km² will be constructed. Finally, a catalogue of geological sources of magnetic anomalies will be elaborated.

Gravimetry.

During 1999-2001, a new profile gravity survey was conducted at intervals of 100 m., along the lines Brno-Hodonín and Šternberk-Lysá pod Makytou (Figure. 1). Altogether, 1,500 new gravity points were measured. The data will be used for the preparation of starting models of geological-geophysical cross-sections, along these two profiles, across the Outer Western Carpathians.

Gravity maps of the complete eastern part of the Czech Republic were constructed at the same time from older gravity measurements. About 135,000 original gravity stations (partly from near-border areas of Poland and the Slovak Republic) were used to construct a Bouguer gravity map, a map of horizontal gravity gradients, and a map of density contrasts of the area of interest. During 2002, a map of the main anomalous structures of the gravity field and a catalogue of geological sources of the anomalies will be constructed. These results will be utilised to construct a structural-tectonic scheme of the eastern part of Czech Republic.

Physical properties of rocks

During 2001-2002, a set of 70 rock samples from selected anomalous areas will be collected in order to study their density and magnetic susceptibility. The new data will be added to the petrophysical database that contains several thousand samples from the Czech part of the Carpathians. The database will be utilised for geological interpretation of geophysical maps.

Seismics

Several older seismic lines parallel with the profiles Brno-Hodonín and Šternberk-Lysá pod Makytou (Fig. 1) have been newly reprocessed (lines 3/73, 240/79, 240A/80, 3/81, 1P/83, 5/83, 3AP/83, 3BP/83, 4P/83, 5/84, 7A/84F1, 7B/84, 8HR/85, 8AHR/86, 8DHR/86). The lines were reprocessed using new parameters and procedures and some of them were even assembled anew (for instance 3BP+3P+3AP). The final outputs were produced both in black-and-white and coloured versions. This enables easy use of seismic data for geological interpretation. The results will help in constructing a map of the top of the basement below younger structures of the Carpathians as well as in preparing preliminary geological-geophysical models of the two profiles across the Outer Western Carpathians.

Digital Terrain Elevation Model

Shaded relief of the digital terrain elevation model has been constructed for the entire area of interest. The goal is to depict the main structural-tectonic features of the Carpathians that are reflected in the terrain morphology. This will help our team in constructing the final structural-tectonic scheme of the entire eastern part of the Czech Republic at the contact zone of the Carpathians and the Bohemian Massif.

Well Logging

Ten selected existing analogue well-logging diagrams near the lines Brno-Hodonín and Šternberk-Lysá pod Makytou were digitised and geologically reinterpreted during the period 2000-2001. The names of the boreholes are Těšany 1, Kobyly 1, Němčičky 1, Němčičky 2, Karlín 1, Cho-9 Vysoká, SV-1 Kozlovice, Potštát 1, Jablůnka 1 and Bystřice pod Hostýnem 1. Special attention was paid to logging records of spontaneous potential, electric resistivity, and gamma-ray.

The main targets of reinterpretation were updating the lithological columns in the boreholes and the determining vertical sections with equal well-log characteristics. Integral criteria based on well-log measurements were established to identify homogeneous sections of well logs as particular facies. These facies made geological correlation among the boreholes possible.

Model of the Burial and Thermal History of Sedimentary Basins

Subsidence, sedimentation, uplift, erosion and heat flow are simulated in key borehole and regional profiles using the thickness and stratigraphic ages of sedimentary bodies. Modelled erosion and paleo-heat flow are calibrated by the degree of diagenesis and thermal maturity of organic matter. In the eastern part of the Bohemian Massif below the West Carpathians, a deposition and erosion of a 1.5-5 km thick Upper Paleozoic Sequence is documented. The calculated heat-flow in the Late Paleozoic was higher by 20 mW.m⁻² than the heat-flow during the final phase of the West Carpathian overthrusting.

Conclusions

The Czech National Project "Strukturně-geologická stavba Západních Karpat a jejich podloží na základě geofyzikálních dat v příhraničních s Polskem a Slovenskem" is in the final stage and it will result in a final report in December 2002. The results of the project should be utilised in the follow-up international project CARTA that is aimed at geologic-geophysical co-operation among Poland, the Slovak Republic, Ukraine, and the Czech Republic in the Carpathian region.

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References

- Sedlák J. et al. (2000): Strukturně-geologická stavba Západních karpát a jejich podloží na základě geofyzikálních dat v příhraničních oblastech s Polskem a Slovenskem. I. etapa prací 1999-2000. – MS Geofond Praha
- Sedlák J. et al. (2001): Strukturně-geologická stavba Západních karpát a jejich podloží na základě geofyzikálních dat v příhraničních oblastech s Polskem a Slovenskem. Zpráva za roční výšeč prací 2001. – MS Geofond Praha
- Krejčí O., Franců J., Hubatka F., Mrlina J., Sedlák J. (2001): Geodynamic Model of the Contact Area of the Bohemian Massif and West Carpathians. – Slovak Geol.Mag., 7, 2, 163-164. Bratislava 2001.
- Gnojek I., Sedlák J., Dědáček K. (2001): Preliminary Results of the New Magnetic Survey Carried Out in the NE of the Czech Republic. – Slovak Geol. Mag., 7, 2, 149. Bratislava 2001.
- Pepel A., Sedlák J., Szalaiová V. and Sczypa St. (2001): New Gravity Map of Carpathians.– Slovak Geol. Mag., 7, 2, 177-182. Bratislava 2001.

Fig. 1 - The area of interest

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