

How old maps are used to investigate modern environmental issues in the Czech Republic

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Cernajsek, T., Hauser, Ch. & Posmourny, K. How old maps are used to investigate modern environmental issues in the Czech Republic. In: Winkler Prins, C.F. & Donovan, S.K. (eds.), *VII International Symposium 'Cultural Heritage in Geosciences, Mining and Metallurgy: Libraries - Archives - Museums': 'Museums and their collections', Leiden (The Netherlands), 19-23 May 2003. Scripta Geologica Special Issue, 4: 78-82, 2 figs.*; Leiden, August 2004.

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Key words — Maps, land reclamation.

The Austrian Geological Survey and Czech geological organizations have in their archives source materials that can be used for the landscape restoration. At many places in the Czech Republic, considerable changes of the environment took place due to building and other industrial activities, especially the mining of mineral raw materials. Changes of relief, river networks and hydrogeological conditions are conspicuous. The largest changes and damages are due to open-cast mining in the North Bohemian and Sokolov brown-coal basins. Other damage was caused by underground black coal-mining, exploitation of uranium and building materials.

During huge floods in northern and central Moravia in July 1997, the morphology of the landscape underwent conspicuous changes. Maps and other historical materials are priceless for specialists to solve problems of landscape reclamation and rehabilitation. They document the original morphology, geography and geology of the areas. Not only topographical, but also geological, maps are important enabling estimation of the original situation.

In 1989 the Austrian and Czech Geological Surveys proposed a project to use the historical map resources of the Austrian Institute in Vienna and other organisations for rehabilitation and reclamation of the landscape, as part of the long-standing Czech-Austrian co-operation „The history of geology – common work on the condition of geological mapping of the Czech countries up till the years 1918“. Historical sources will be further analysed for reconstruction mapping in the area of the Beca and Morava rivers in central Moravia. On basis of the agreement for cooperation with Austrian Geological Survey, the Czech Geological survey has obtained colour copies of historical topographic map material from the so-called Joseph (1763-1768) and Francis (1810-1866) mapping periods from the area of the river beds of Morava and Beca, between Litovle and Uherske Hradiste, that have been most intensively damaged by huge floods. These will enable comparison of changes in the landscape after more than 200 years.

Contents

Environmental change	79
Austrian-Czech cooperation	79
Future research	81
References	82

Environmental change

Information technology enables the presentation of map layers for different useful objectives such as GIS analysis. A comparison of historical maps with modern ones (overlay, intersection) might be useful for the solution of environmental problems.

The Austrian Geological Survey in Vienna and the Czech Ministry of the Environment organizations have many precious source maps and other materials in their archives that can be used for the solution of complicated environmental problems and for a restoration of the original landscape. Many places of the Czech Republic have historically suffered considerable changes of environment due to building and other industrial activities, especially exploitation of minerals. Among the most pronounced impacts on the environment are changes of relief of the land surface and alterations of river networks and hydrological conditions. The largest changes and greatest damage to the environment occurred in areas of open pit exploitation of brown coal in the North Bohemian and Sokolov basins, where the largest displacement of material has taken place. Other damaged areas also fall into this category, especially underground pit coal mining areas (Ostrava and its surrounding, Karvina and surroundings), areas of uranium exploitation (Stráz pod Ralskem and Hamr na Jezerce, Příbram and its surroundings, the area of Rozinka and Jáchymov), large scale quarrying of building materials such as limestone (Bohemia Karst, Moravia Karst), and winning of gravel, sands (the area of Třebon, Litoměřice, Melník, Olomouc, Kroměříž) and agglomerate (České středohoří Mountains). The landscape also underwent conspicuous changes of morphology during large scale floods and related landslides that occurred in the area of northern and central Moravia in July 1997, and in southern, central and northern Bohemia in August 2002. Massive sedimentation on the flood plains occurred and sometimes river channels were displaced.

In these cases, old maps (Figs. 1-2) and other historical documents were of enormous value to the specialists who solved the problems of reclamation and rehabilitation of the landscape. Such maps provided documentary evidence of the original character of the morphological, geographical and geological features of the devastated areas. Thus, not only topographical, but also geological, bases become important because they enabled the estimation of the original situation, and are of basic importance in discovering the historical geodynamic, hydrological and hydrogeological situation.

Such materials commonly record the geological and geomorphological features of a disappeared landscape. They record the position of old quarries, mines and pits, the image of the area before large anthropogenous interferences into the landscape (such as building of towns, industrial enterprises, dams, changing the river courses), the situation of exposures, and, tectonic structures and sediments, together with much additional relevant information that completes the picture of old landforms.

Austrian-Czech cooperation

In the Austrian and Czech Geological Surveys in 1989, a project proposal for using unique historical map materials filed in the present Austrian Institute in Vienna and in the other organisation of the Austrian state, for example Austrian State Archives

(Österreichische Staatsarchiv) was formulated for rehabilitation and reclamation of the landforms. The planned cooperation was facilitated by the Czech and Austrian Geological Surveys, and many other European geological surveys, being partners united in the international organisation FOREGS. One of the important points of the Czech-Austrian co-operation is the theme 'The history of geology; joint work on the geological mapping of the Czech countries until 1918.' This project has been in operation since 1990.

Czech-Austrian cooperation continues, building on the results of previous stages (summarized in Cernajsek & Posmourny, 1993). The present stage is evaluating historical geological maps as a source of data and their use in contemporary practise, particularly an evaluation of geological, mining and thematic small scale maps and other historical archive materials from industrial areas of Northern Bohemia, the surroundings of Kladno, Pribram and Ostrava.

Applied studies based on historical maps guide, for example, reconstruction of areas with major human-induced changes of the geological environment. They directly contribute to landscape reclamation and solutions of topical problems of everyday life, such as the influence on the hydrogeological situation of and landslide hazards. Historical maps play an important role in urban studies and facilitate mitigation of damage caused by contamination from old dumping grounds.

Organisations cooperating with relevant sections of the Ministry of the Environment of the Czech Republic have expressed an interest in the results of the above mentioned research and related information. The Czech Geological Survey made their own studies in cooperation with the Austrian historical archives and Geological Survey. Good examples of results can be found in the studies of Benes *et al.* (1993) and Bruna *et al.* (2002, 2003).

Future research

Ongoing research focuses on reconstruction mapping, under the auspices of the Czech Geological Survey, for the area of the Beca and Morava rivers in central Moravia. Changes of the river network are being traced, as are the influence of hydrogeological condition, changes of geomorphology, the development of the relief and microclimate, the influence of melioration, the impacts of landslides, urbanism and impacts connected with old mining activity all being investigated for the longest possible time span. On basis of the agreement to cooperate with the Austrian Geological Survey, the Czech Geological Survey obtained colour copies of historical topographic map materials from the so-called Joseph (1763-1768) and Francis (1810-1866) mapping periods from the area of the river courses of Morava and Beca, between Litovel and Uherske Hradiste, that have been most intensively damaged by floods in July 1997. These maps will enable reconstruction of the landscape, based on what is known from the past 200 years.

- ◀ Fig. 2. An example of a geological field map at the scale of 1 : 28,800 from NE Bohemia, showing the eastern part of the Krkonose Mts. (Riesengebirge) (Johann Jokely, 1861). Much detailed information about historic outcrops, quarries and geological measurements can be obtained here.

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