

## Abstract

This thesis focuses on topographic mapping of rock formations with the use of new technologies in a comprehensive manner, from airborne laser scanning (ALS) data acquisition and processing in rocky terrains, followed by their processing to the content of topographic databases and their cartographic processing in maps. The introduction discusses issues of importance for practice, and the relation between topographic mapping of rocks and other fields of human activity.

The ALS section describes products for topographic mapping of rocks derived from ALS data, and discusses the specifics of ALS data acquisition and processing in wooded rugged terrain. Existing solutions of this problem are explained and their limitations are identified. Author's own approaches to solving this task are presented as case studies, including three made a further three designed experiments with ALS data processing and evaluation of their results. Recommendation regarding mapping of sandstone landscapes in Czechia have been also addressed.

The topographic section describes the current representation of rocks and related objects in the ZABAGED database (Czech national digital topographic database), explains the historical context, analyzes this data and identifies their shortcomings in relation to the ALS. Research summarizes existing approaches for representation of rocks in foreign topographic databases, both on national and international level. The key part of this section is formed by the design of methodology for representation of rock formations in the topographic database, including the description of the individual objects types, examples of their use for typical rocky landforms and discussion of acquisition of these objects, partly automatically from ALS data, as well as from other sources relevant for the Czech territory. An experiment aimed at the automatic classification of the segments on perimeter of rocky terrain is included. The methodology has been practically tested on multiple model sites; the most important results of the evaluation are summarized. A chapter on geographic names of rocks, comprising an analysis of the current state of the Geonames database (Czech national geographic names database) and discussion regarding the possibility of adding new geographic names from climbing databases, is also included. An experiment focusing on the existing correspondence between these names has been performed.

The cartographic section describes the traditional analogue cartography methods for rock drawing, with an emphasis on detailed analytical processing, especially the ladder manner and the contour method, serving as the basis for the design of their automation. Description of existing methods used for representation of rocks in digital cartography including technical details regarding their implementation and their mutual comparison, with particular emphasis on the method used by the Czech Land Survey Office (LSO) on their base maps, form the following part of the section. The role of rock hachures in contemporary digital cartography is discussed. Research part includes thorough inspection of the existing algorithms for digital cliff and hachures drawing. The main part consists of the detailed explanation, testing and discussion of practical usage of three newly designed algorithms for digital rock drawing (based on the method used by LSO for base maps, the ladder manner and the contour method), using the proposed representation of rocky terrain from the previous topographic section.

The conclusion focuses on a general vision of a possible future treatment of rock formations in the Czech state map series including a plan for its practical realization. The work has been carried out in the cooperation with the experts from LSO.

**keywords:** rock formations, airborne laser scanning, data filtering, full waveform analysis, digital topographic database, ZABAGED, geographic names, topographic map, visualization of hypsography, cliff drawing, rock hachures, digital cartography, state map series

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