Plate 8.1 Basic Maps on Geology, Hydrogeology and Pedology

Introduction

For studies on hydrological catchments, knowledge of geological, hydrogeological, and pedological conditions is of utmost importance. The atlas map shows the maps available for these topics. Large and medium scale maps of more important mapping projects as well as of map works are compiled on the map and in the tables 1, 4, 6, and 7, while further maps are shown in the tables 2, 3, 5, and 8. The map is completed with a selection of characteristic hydrogeological and pedological profiles.

Geological maps

From 1860 to 1985 the main function of the Swiss Geological Commission, a branch of the Swiss Academy of Sciences, was geological surveying and the production of geological maps. In 1986, this task was taken in charge by the Swiss National Hydrological and Geological Survey.

The geological maps provide information on the condition and position of the rock formations at surface. They provide information for education and research, but also contribute to the solution of practical problems in fields such as construction, water and energy engineering, mining, and waste disposal. Geological maps also provide the basis for groundwater and water protection maps as well as for maps of geological hazards or on soil foundation.

Geological Atlas of Switzerland

The maps compiled in the «Geological Atlas of Switzerland» have been published since 1930 (tab. 1). Contrary to the Special Geological Maps published mostly before 1930 (tab. 2), their limits were brought in line with the National Map at the scale 1:25 000. By 1990, 88 of 228 (nearly 40 %) of the planned maps were completed. As a basis for topographical maps, the Siegfried map was used first, superseded by the National Map at the scale 1:25 000 later, however.

Hydrogeological maps

The Swiss Geotechnical Commission has been publishing hydrogeological maps based on the National Map 1:100 000 since 1972 (tab. 4). These maps provide a general view on the types of groundwater circulation, the permeability of rocks close to surface, the spatial range of usable groundwater, the position and the form of the groundwater table, and finally, on the position of important sources and wells.

Further hydrogeological maps published after 1970, most of which at large scales, are compiled in table 5.

Geological and hydrogeological profiles

For the three selected hydrogeological profiles, the permeability of loose and compact rock are all identified by the same colour scale. This type of presentation actually sums up two different conditions: loose rocks show a porosity limited to the void spaces between grains and the water flow takes place in a fine-porous material. In compact rock, on the other hand, water ciculation occurs less through the pores than along large scale discontinuities (fractures, karst conduits, etc.).

Situations are presented in the three profiles as they may be encountered throughout Switzerland.

Profile A «Val de Ruz» [1] shows a cross-section through a karst system typical of the Jura. Similar systems also exist in the alpine region. They form productive springs which are of great importance to the water supply, but are very susceptible to pollution.

The Inn (Profile B, [2]), like the majority of Switzerland's larger rivers, flows over a great distance in a valley consisting largely of unconsolidated materials: moraines, lacustrine and fluvial deposits. Generally in these alluvial valleys, narrow interactions occur between rivers and groundwater.

As in the Inn valley, the upper sediments of the Aare valley (Profile C, [3]) are composed of gravel. The thickness of this aquifer reaches about ten meters, and the groundwater is used by means of numerous wells. In molasse sandstones, water flows along fractures, which allow the formation of local aquifers. For purposes of interpretation, it should be noticed that this profile is strongly exaggerated in the vertical direction.

Soil maps

The soils in Switzerland are very diverse. They are characterised by the topography, parent rock, and local climate. The soils vary from deep to shallow, rocky to fine-grained, wet to dry, and nutrient-rich to nutrient-poor. In the midland and the pre-alpine region, the soils are largely fertile and conducive to agricultural use. In the mountains, however, they are mainly undeveloped, rocky, and store little water. A first survey is given by the eight standard soil profiles selected. Their position is determined on the map 1:1 100 000.

Soils are often altered through clearing, forestation, agricultural uses, soil reclamation, watercourse regulation, and built-up areas. In this day and age, and in future, no anthropogenic interventions should be planned or carried out without previous soil investigations. Results of such investigations, covering both the field survey and the classification of chemical, physical and biological soil characteristics, are compiled in soil maps. Soil maps mainly reveal the position of the different kinds of soil. In Switzerland, soil classification is based on the system mentioned in [4]. Today, soil cartographers usually use [5], a further development based on [4], as well as documentation of the Swiss Pedological Society [6]. The usefulness of soil maps in practice depends heavily on the accuracy of data collection and presentation (scale) of the map.

Large scale soil maps

Large scale soil maps are recorded and presented at scales of 1:1000 to 1:10 000. Thus regional problems concerning agricultural and forestry use of soil are of primary importance. The maps include regions above all whose soil uses conflict with each other. Often the demands of agriculture directly clash with those of drinking water supply.

Soil maps at large scale provide information on the storage and purification potential of various soils, allowing the agricultural land-users to estimate the nutrient impact (nitrate in particular) on the groundwater. Based on these principles, use and fertilization can be optimised for local conditions. In this way, for example, crops for shallow coarse, sandy and gravelly soils should be chosen so that, from one crop to the next, the ground is continuously covered with plant growth. The controlled application of nitrogen-containing fertilizers (manure, sewage sludge) is also of great importance in these cases.

Large scale soil maps are an important basis for the determination of agricultural zones in areas with expanding building zones. Furthermore, they are indispensable in land redistribution and soil reclamation.

Soil maps 1:25000

In Switzerland, soil maps using the scale 1:25 000 have been part of the framework of a long-term mapping project since 1977 (tab. 7). Amongst other things, they are an important basis for local and regional planning (for example, maintenance of the most fertile soils), provide useful data to determine optimal use of land, and serve environmental scientific research.

Medium scale soil maps

The map on soil suitability 1:200 000 (tab. 8) is a useful tool for professionals in the fields of planning, agriculture and forestry. This map presents the significant differences in soil conditions in Switzerland, thus communicating the need for economical use of the limited available arable land.

The soil map of Switzerland 1:500 000 depicts the spread of the most important soil units found in our country. Twenty-three units, divided into seven main groups, are distinguished, with the dominating type of one unit determining the name. Further accompanying types are also named.

References

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