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Converting geological maps to vector datasets – Completing the National Geological Information System

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Background

The Swiss Geological Survey (SGS) has been producing geological maps for more than 75 years. Their main products are the Geological Atlas of Switzerland at a scale of 1:25000 (GA25) and the Geological Special Maps (GSM) at different scales. About 50% of the 220 maps of the GA25 sheets are finished and available in printed and raster formats.

Only a limited number of these map sheets are available in vector format (cf. fig. 1). Because the demand for geological vector data has strongly increased in recent years, the SGS started to convert the existing geological maps into vector datasets.

Overview of actual vector datasets

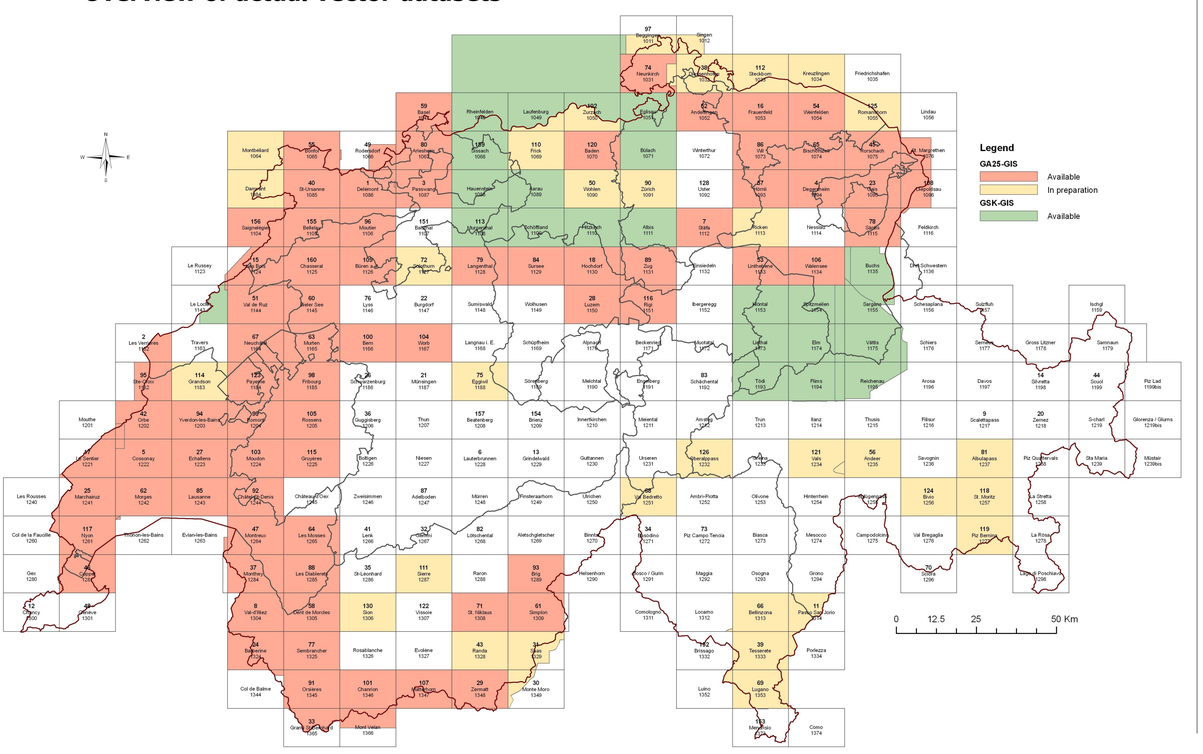


Fig. 1: Overview of actual available vector datesets

The data model which is used to structure geological vector data-sets is described by Strasky et al. 2009, this meeting.

Method of data transformation

Depending on the available source format, one of the following techniques is applied to convert map data into a GIS-format (cf. fig. 2):

Method Sion (GIS)

Maps available «only» in raster format are directly vectorised in a GIS environment. This method was developed in cooperation with the Research center on alpine environment (CREALP), and the actual transformation is performed at the Institute of Geomatics and Risk Analysis of the University of Lausanne (IGAR).

Method Vallorbe (Illustrator)

For recently printed maps, Adobe Illustrator vector data are available. Using these data as an input, «cartographic» data are converted with the aid of Avenza-MaPublisher to attributed GIS-data. This method is being developed in collaboration with the Swiss Geotechnical Commission (SGTK).

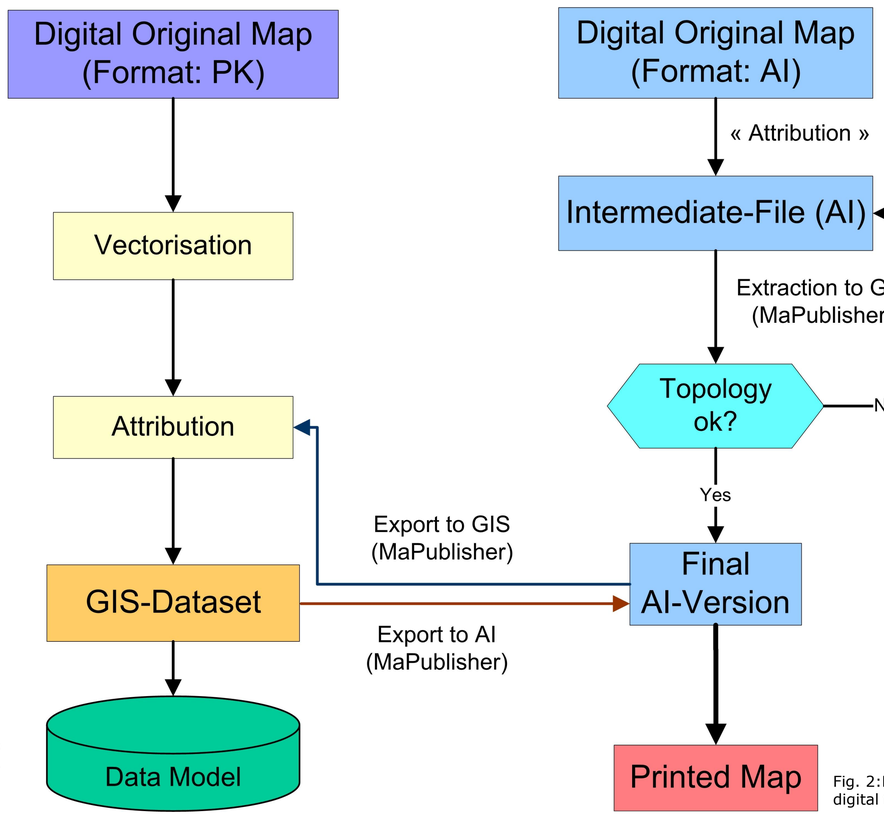


Fig. 2:Different workflows for the digital transformation

Method Sion [PK → GIS]

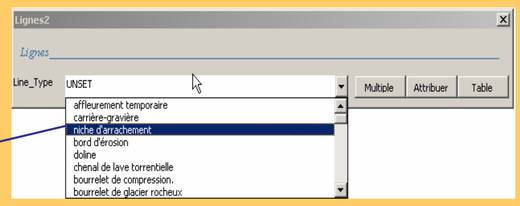
The method Sion is based on a tool developed in collaboration with CREALP (Toolmap 2).

At the SGS, the Method Sion is used to vectorise geological pixel data and to attribute vector-datasets.

The following steps are applied for the data conversion:

N°	Step
1	Integration of PK into GIS-Software
2	Vectorisation of line segments (e. g. geological contour, trace of fault,…) + label points (cf. fig. 3)
3	Single or multiple attribution of individual line segments
4	Creation of polygons (from lines + points)
5	Extraction of thematic layers based on the geological data model (cf. fig. 4)
6	Symbolisation of features

Fig. 3: Vectorisation of line segments and attribution



Tool for attribution of line segments

For detailed information on the method Sion, visit
http://www.crealp.ch/fr/cartographie/methode-sion/index.html

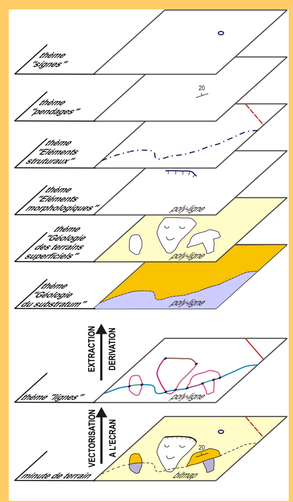


Fig. 4: Layer with vectorised line segments (second from bottom) and the derived thematic layers.

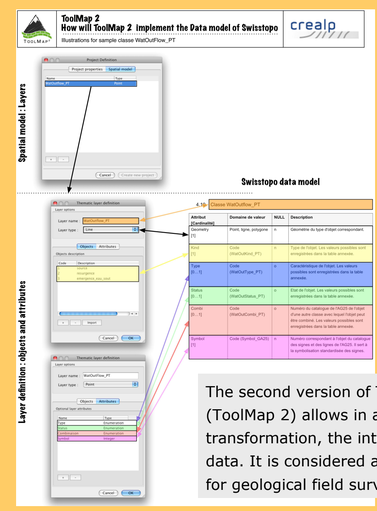


Fig. 5: ToolMap 2

The second version of ToolMap (ToolMap 2) allows in addition to data transformation, the integration of field data. It is considered as the future tool for geological field surveys.

Method Vallorbe [Vector → GIS]

In this method, Desktop Publishing Software (DP) (Adobe Illustrator) is applied for vectorising of geological features. In addition, Avenza MaPublisher is used for transforming «cartographic» data into attributed GIS-data.

Methode Vallorbe is currently used to convert the DP-files into attributed vector data.

For detailed information on the method Vallorbe, visit
http://www.sgtk.ch

The following steps are applied for the data conversion:

N°	Step
1	Integrate existing DP-data into Adobe Illustrator. If necessary, convert input data into appropriate format
2	Select required layers (contours, points,…) (cf. fig. 7)
3	Prepare data (i.e. cut contours at intersection) to produce individual segments
4	«Attribute» segments with «styles»
5	Vectorise and «attribute» label points → for polygon information (cf. fig. 6)
6	Export layers to GIS-Software, check topology and correct data in Adobe Illustrator (repeat until all errors are eliminated)
7	Create polygons with GIS-Software (cf. fig. 7)
8	Create final symbolisation and datasets

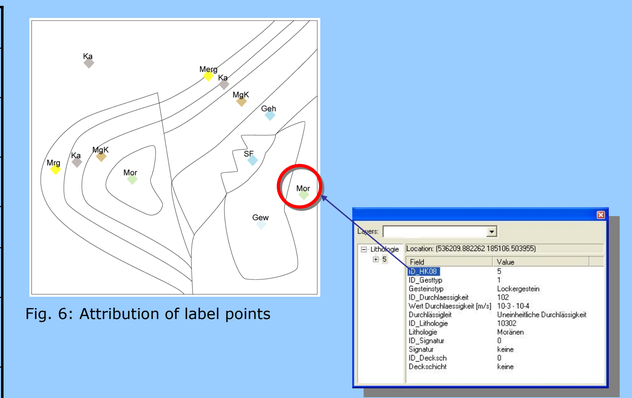


Fig. 6: Attribution of label points

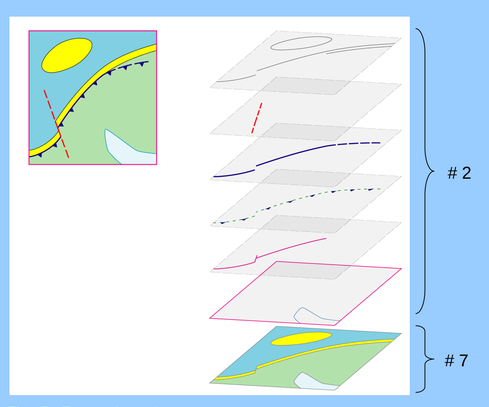


Fig. 7: Extraction of selected layers to create polygons

Further steps

- **Harmonisation of GA25 vector datasets**

  The overall objective of the SGS is to build a Geographic Information System, which provides seamless vector datasets of Switzerland. To reach this aim, one of the main tasks will be to geometrically and semantically harmonise the existing vector datasets. The difficulty of this task is increased by the various «qualities» of each map (cf. fig. 8). During the 75-year period of map production, the scientific knowledge has changed many times and therefore the geological interpretation of the maps as well.

- **GeoCover: a fast digitalisation of entire Switzerland**

  Although coverage of Switzerland with geological maps is not complete (cf. background) numerous geological maps (GA25 or GSM) at a scale of 1:25000 or 1:50000 already exist in digital format (TIFF). Additionally, the recent geological maps are available in Illustrator Format. Moreover, about 20 manuscript maps in paper format cover regions where no other geological data exist.
  All these data can be compiled and used to complete the coverage of Switzerland with geological data. For data capture and transformation the above described methods (Sion and Vallorbe) will be applied.

  GeoCover is a project of the SGS which aims to provide preliminary geological datasets in vector format. It is planned to compile the best from the above-mentioned sources and reach entire coverage by 2012 (cf. all coloured sheets in fig. 9). These data are the basis of the Geological Information System of Switzerland.
  GeoCover is inspired by the GeoF@st-project of the Austrian Geological Survey (http://www.geologie.ac.at/de/GEOMARKT/geofast.html)

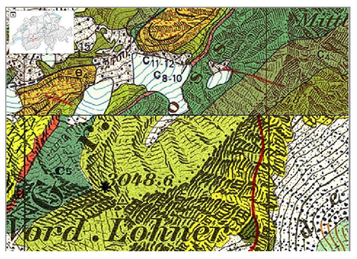


Fig. 8: The problem of harmonisation (two GA25 sheets, Adelboden und Gemmi)

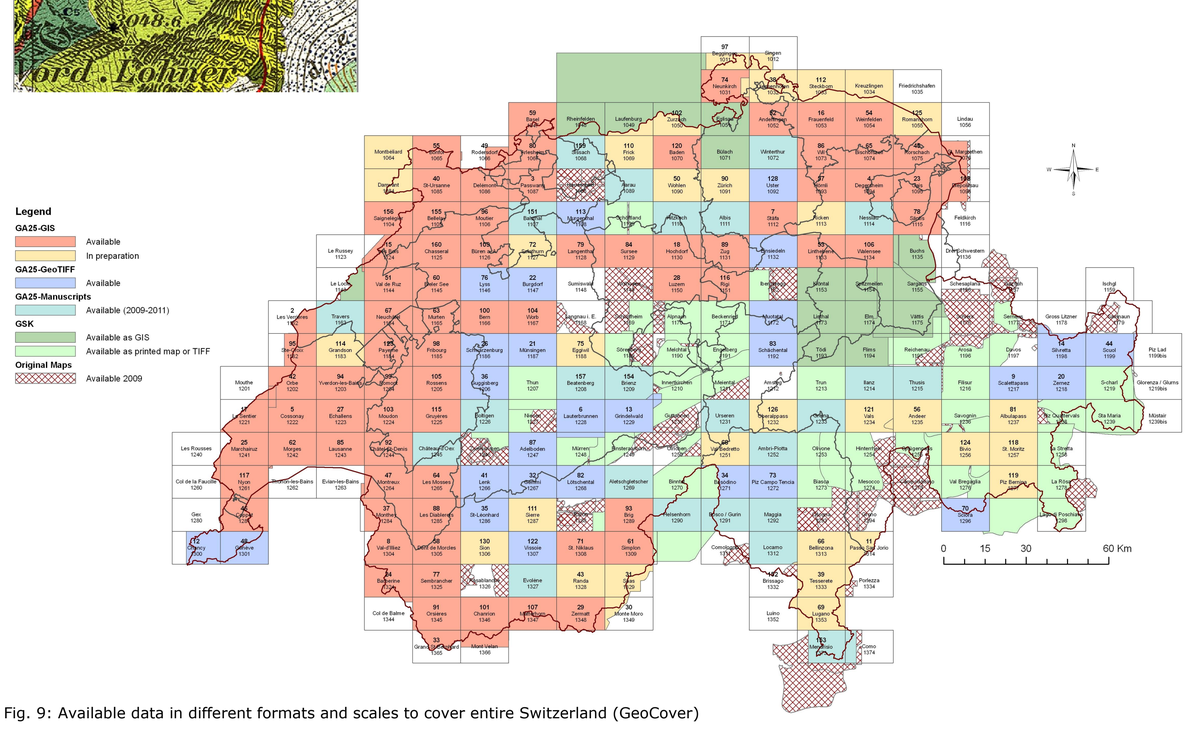


Fig. 9: Available data in different formats and scales to cover entire Switzerland (GeoCover)

Administrative aspect

The transformation of geological data into vector format is organised as a project. The different tasks are allocated as follows:

• Projectmanagement	SGS
• Vectorisation of raster maps (RM)	IGAR
• Transformation of AI-maps	SGTK
• Quality control	SGS

Since the SGS is not able to solely finance the entire vectorisation, collaborations with the following organisations are established or intended:

- Federal offices
- Cantonal offices
- Insurance companies

This model of financing works quite well, provided that the SGS is subject to the priorities and resources of the specific institutions.