2 FEASIBILITY AND DATA ACQUISITION FOR THE SWISS ATLAS OF PHYSICAL PROPERTIES OF ROCKS.

Feasibility for the multi-years program **SAPHYR** (E. Kissling and J.-P. Burg).

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ABSTRACT

This is a **feasibility project** for the multi year program **SAPHYR** where we propose to upgrade and extend the existing data-bases on different type of physical properties of rocks in a more dynamic platform that can serve to industry, society and scientific world.

In this report we define the aims of the SAPHYR multiyear program, the preliminary advancement of the inventory of existing data, the type of physical properties that will be collected, and the preliminary description of the results of the SAPHYR program, of the costs and of the user interface.

2.1 THE SAPHYR MULTIYEAR PROGRAM

Physical properties of rocks are key parameters for several disciplines spanning from oil industry to engineering to geophysics, petrology, structural geology and water resources. They are therefore useful to several scientific disciplines as well as to industry and society.

The long term aim is to digitize all existing data and to link them using a geographical frame (GIS), so that data can be ready accessible. Moreover, where data are less abundant we will promote campaigns of measurements on rocks samples collected during previous or this project. The resultant maps can be integrated in the Atlas of Switzerland. The future evolution of the SAPHYR program could be an extension to 3-D, using the structure of the exposed geology, the data from boreholes and from geophysical investigation.

The physical properties we will focus primarily are:

1) density and porosity
2) seismic properties
3) Magnetic properties and their anisotropy
4) Thermal properties
5) Gamma radiation, heat production
6) Permeability
7) Electrical properties

Potential user of our products will be:

Industry: oil companies, construction and engineering, geothermal investigation and geothermal extraction, etc.

Society: planning of land use (e.g. Kantons, etc), water resource, waste disposal natural hazard etc.

Academy: integrated geophysical, geological and petrological research, research in petrophysics etc.

2.2 TIMETABLE OF THE FEASIBILITY PROJECT

		Oct-Dec06	Jan-Mar07	Apr-Jun07	Jul-Spt07
Organization of a Team					
Preparation of the support					
Inventory of existing data	Papers, Monographs, Diploma and Phds				
Literature	Thesis, SGPK reports				
Contact specialists	(Seismic, magnetic, electric etc)				
Unpublished	Bundes Offices, Kantonal Offices				
	Private companies, Laboratories				
Type of the data	Geology/litology				
	density and porosity seismic properties (Vp,Vs, including anisotropy)				
	Magnetic properties and their anisotropy Thermal properties and thermal conductivity and their anisotropy				
	Gamma radiation, heat production				
	Permeability				
	Electrical properties				
Guidelines	Process of data				
	Quality definition				
	Representation of data				
Definition of product	Maps and their legend				
	Figures and tables				
	explanations				
	notes				
	table of content				
Digital (software etc)	to process data				
Check what is available	to store data (database)				
and select the best	GIS (3D)				
	to represent data				
Store existing data	from maps, papers, monographs, thesis				
	from reports, unpublished data				
	from labs, specialists and other sources				

Table. 1. Illustration of the feasibility of the SAPHYR program

2.3 RESULTS ACHIEVED

2.3.1 Inventory of all existing laboratory data and of their availability.

□*90% done* ■*50% done* □*not done*

Seismic properties:

We collected so far 30 documents (papers from literature, monographs and PhD thesis), for a total **656** samples. We expect to reach about 1000 samples at the end of the project.

Thermal conductivity, electrical and mechanical properties:

We collected so far 4 documents (papers from literature), for a total of less than 100 samples. We expect to reach about 200 samples at the end of the project.

Magnetic susceptibility:

We collected so far 5 documents (papers from literature), for a total of more than **100** samples. We expect to reach about 300 samples at the end of the project.

2.3.2 Definition of guidelines on the way to collect process and represent data.

□*90% done* □*50% done* ■*not done*

This will allow the definition of a quality factor of the data. We will also define the form of the final products (maps, figures, explanations, both on paper and digital) and define the content and structure of the Swiss Atlas.

Results achieved : Quality of data will be defined by experts in each field.

Product will be a dbase of public use (CD, internet Dbase and SGPK publication)

the atlas and final product should include also data from field surface geophysics (seismic reflection/refraction, geoelectric, magnetic, gravimetric etc)

2.3.3 Definition of structure and contents of the Atlas.

□*90% done* □*50% done* ■*not done*

The aim is to digitize all existing (and future) data, or acquire existing digitized data and store them in a format that can allow their elaboration and representation on a 2-D maps. The most suitable form will be a GIS program (maybe ArcView or similar). Eventually specific maps (e.g. sample location, map of Vp distribution of exposed rocks etc) can be printed out as demo for the database. As an example, from the map of the distribution of Vp and Vs of the exposed rocks one can elaborate a map of the dynamic bulk modulus (K), shear modulus (G) or young modulus (E), under the assumption of elastic isotropy.

Results achieved: First draft of a flow chart for the construction of the 2d and 3D atlas.

2.3.4 Research of the available software and user interfaces.

□*90% done* ■*50% done* □*not done*

After searching from different sources, as a working hypotesys, we suggest using the following software and user interfaces:

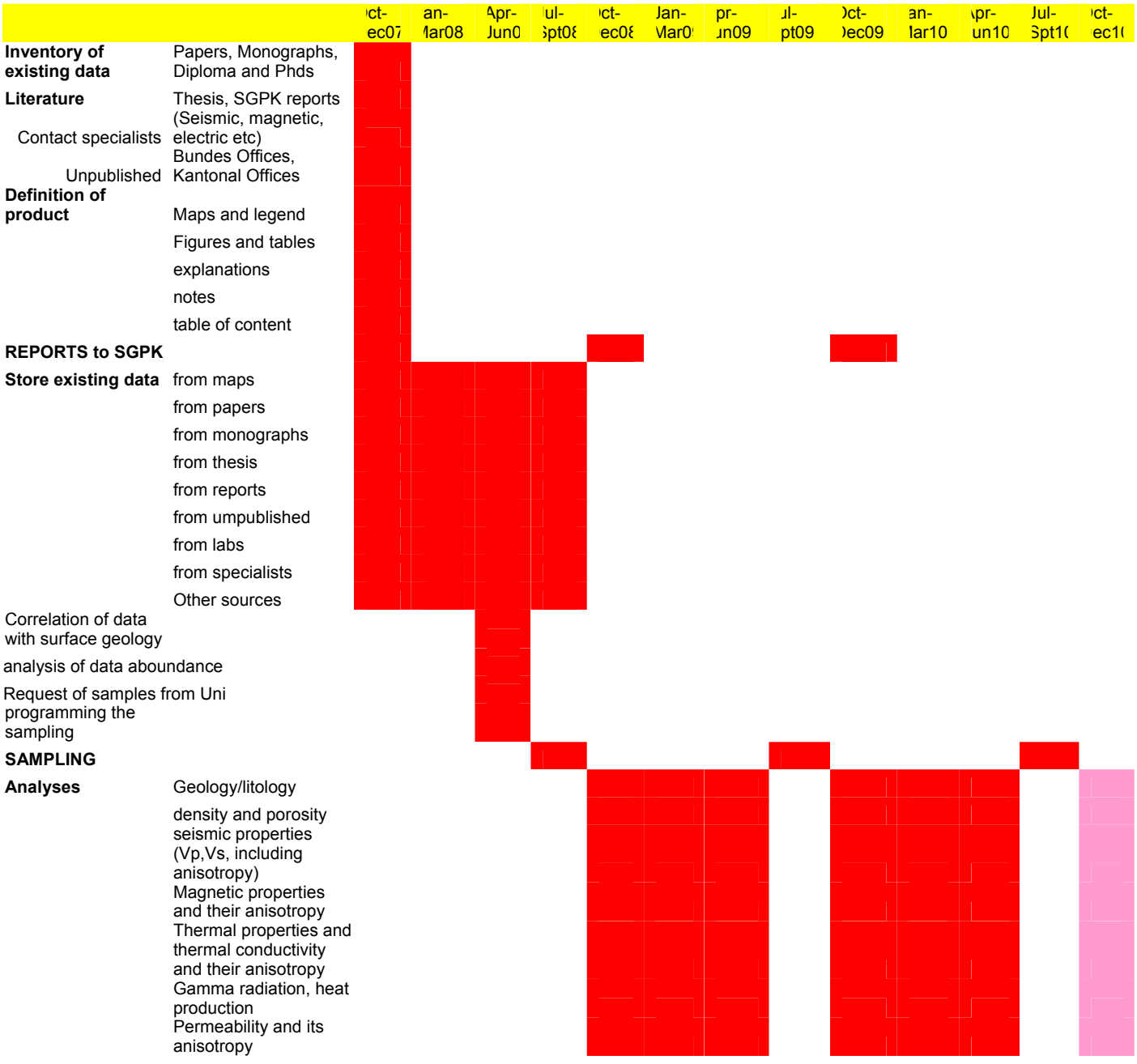
2D – Atlas of Switzerland. (Insitute of Cartography of ETH)

3D: GOCAD

Visualization software GOCAD (Geological Object Computer Aided Design) is a product of the GOCAD consortium (Nancy, France). GOCAD is an integrated and geologically oriented CAD software that provides various tools to construct a wide range of earth models, for application in geology, geophysics and reservoir engineering. GOCAD has been developed for many operating systems (see T-Surf). Packages FORMS and MODEL are equipped with the programs for conversion of points, lines, triangulated surfaces and 3-D grid of points into GOCAD. For the discussion how to display 3-D seismic models through the VRML and GOCAD refer to Bucha (2001).

2.4 PRELIMINARY TIMETABLE OF THE SAPHYR PROGRAM

Here is reported the preliminary timetable for the multiyear program SAPHYR. The final version will be prepared for the report at the end of October.



Electrical properties
and their anisotropy

Data manipulation

Data processing

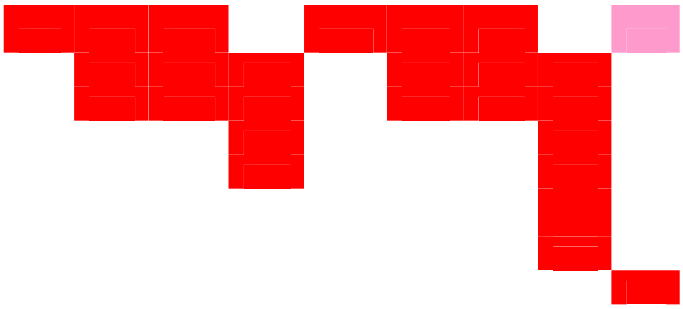
Data representation

User interface
Writing of the
explanation

Writing of the notes

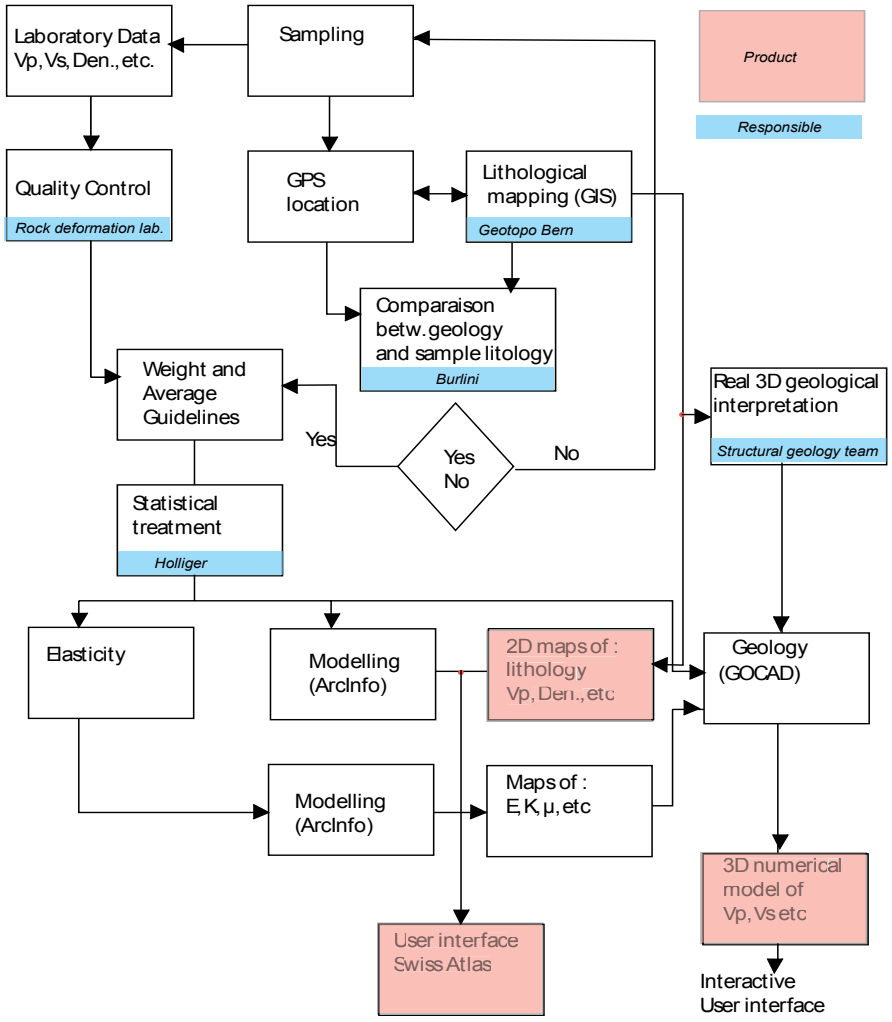
Final report

**D Geological
nterpretation**



2.5 PRELIMINARY FLOWCHART OF THE SAPHYR PROGRAM

Here is reported the preliminary flowchart for the multiyear program SAPHYR. The final version will be prepared for the report at the end of October. Here are shown the most relevant part of the program and are indicated the key points.



(By A. Zappone, 2007)