

# SAPHYR

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## Swiss Atlas of Physical Properties of Rock

### Progress Report

by

A. Zappone

# SAPHYR project

Compilation of all existing data on geophysical properties of rocks present in the Swiss Alps (not restricted to the borders of CH).

Digitization of the data using a geographical frame (GIS)

Measurements on rock samples where data are less abundant

Integration of the resultant maps in the Atlas of Switzerland

Physical properties

- 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

# Working Group 2011: a transition

Dr. Alba Zappone  
Scientific coordination

( & sample collection and preparation,  
lab measurements, ...etc)

*20% time*

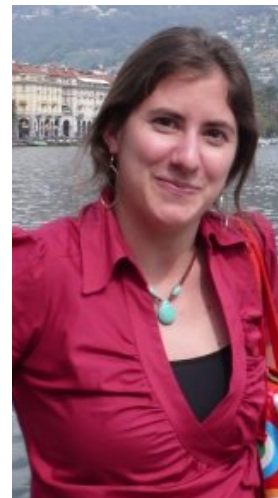


Andrea Biedermann  
(PhD student, ETH)  
Magnetic properties

*<5% time*



Nicola Tisato (PhD  
student, ETH)  
Mechanical and  
electronical systems  
designer  
*<5% time*



Michaela Erni  
(Master in Geology )  
Lab measurement & GIS  
*60% time  
since  
15 October 2011*

# Working strategy

- **Aim:**
  - representative and complete physical properties for all rock types
- **First step:**
  - compilation of literature values whenever possible
- **Second step:**
  - measure new /update literature values where necessary

# Plan for 2011

- Complete the measurement of  $V_p$  at High Pressure and room Temperature ✓
- Complete the measurement of  $V_s$  at High Pressure and room Temperature *In progress*
- Measurement of  $V_p$  and  $V_s$  at High Temperature and Pressure (600 °C, 500 MPa) on selected samples *In progress*
- Collecting existing data from boreholes (NAGRA) *In progress*
- Digitalization of Magnetic properties from literature ✓

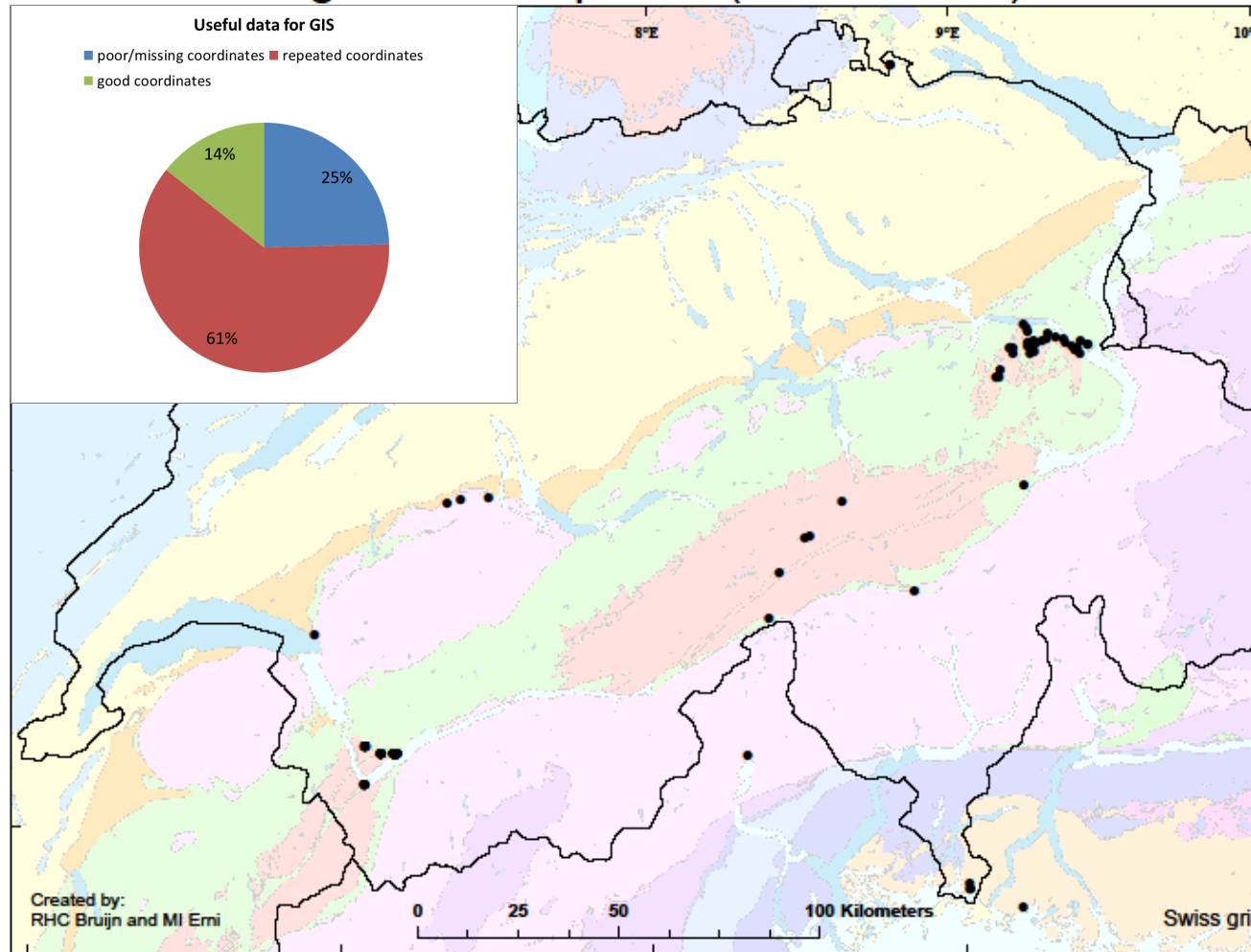




# Magnetic properties: literature data

## SAPHYR Magnetic data points (March 2011)

data points received: 342 (100%)



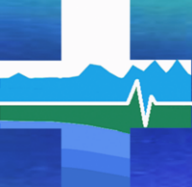
Magnetic property	Normalized count
kbulk /Km (SI)	85.4%
K1	90.4%
K2	90.0%
K3	90.0%
L	93.1%
F	93.1%
P	91.6%
P'	79.7%
T	79.7%
U	80.8%
dK1geo	93.1%
iK1geo	93.5%
dK2geo	91.6%
iK2geo	91.6%
dK3geo	93.5%
iK3geo	93.5%
del k	80.5%
NRM intensity (A/m)	10.7%
NRM declination	2.3%
NRM inclination	1.9%
alpha 95 NRM	1.9%
D secondary magnetization	3.1%
I secondary magnetization	3.1%
alpha 95 secondary magnetization	3.1%
D ChRM	5.4%
I ChRM	5.4%
alpha 95	5.4%
koenigsberger ratio	0.0%

# Magnetic properties: new measurements

Bulk susceptibility:  
261 samples  
measured

Good but not complete



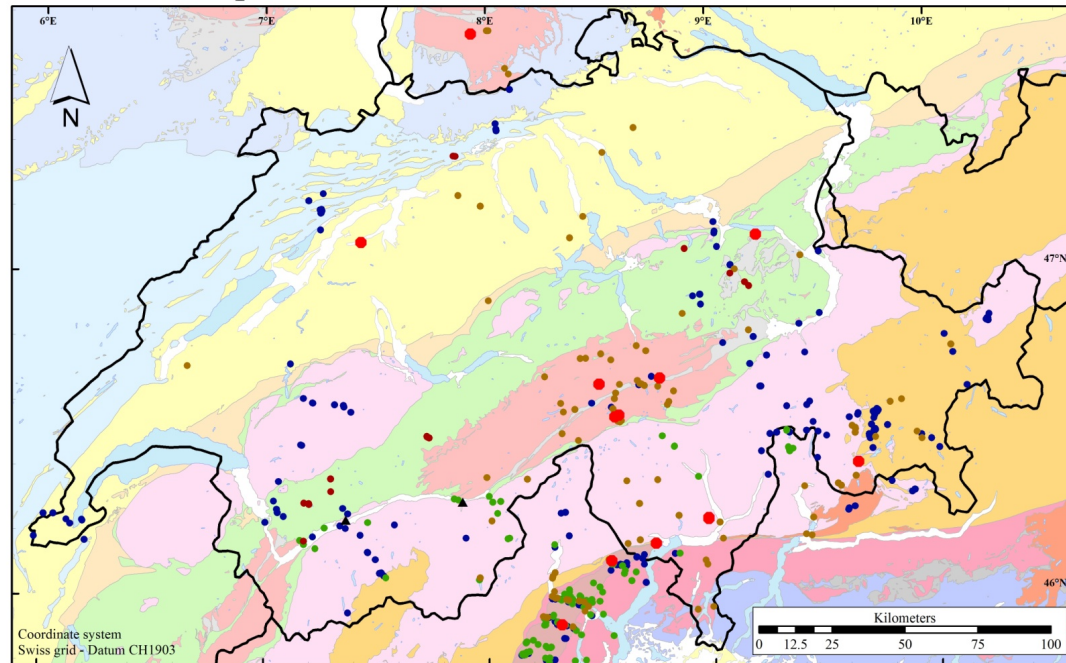


# Seismic properties: **new measurements**

**at high pressures and high temperature!**

Vp at high pressure	15	<b>+12</b>	Vp at room pressure	261
Vs at high pressure	15	<b>+12</b>	Vs at room pressure	261
Vp at high P and T	0	<b>+6</b>		
Vs at high P and T	0	<b>+6</b>		

SAPHYR sample locations



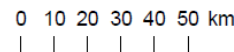
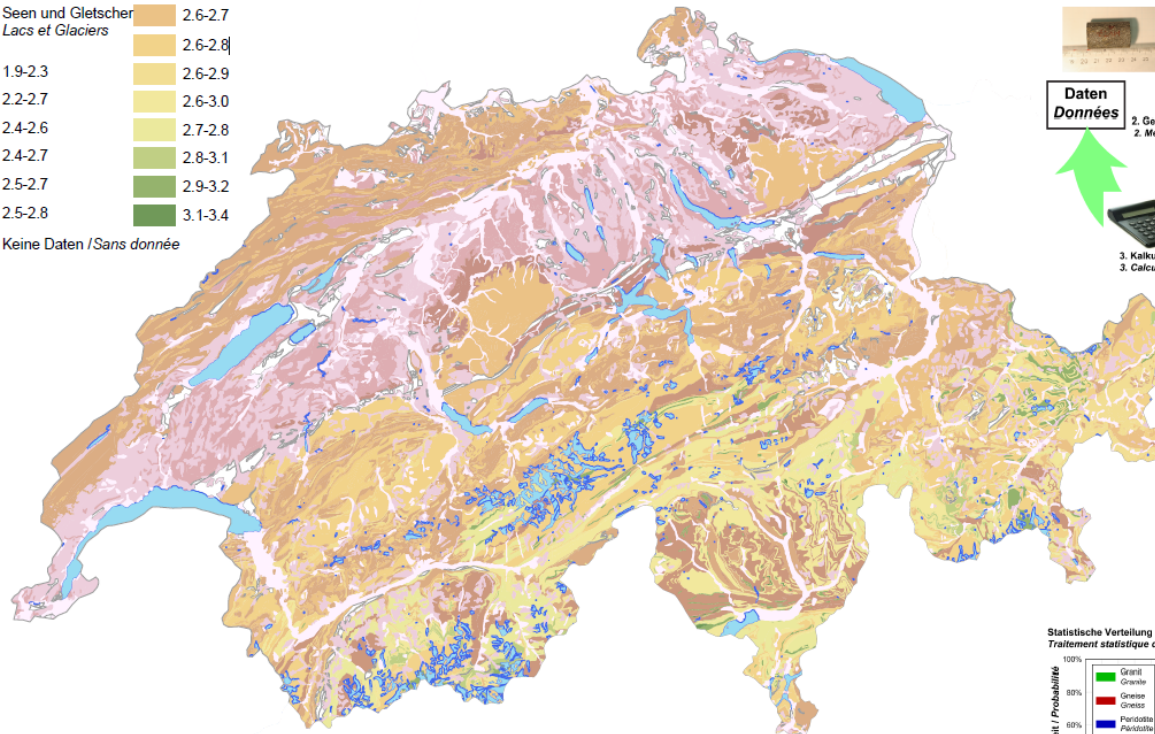
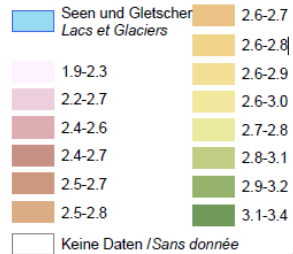
**Sample locations**

- <2008 data
- 2008 additions
- 2009 additions
- 2010 additions
- 2010 sampling
- 2010 lab measurements
- ▲ Seismic stations

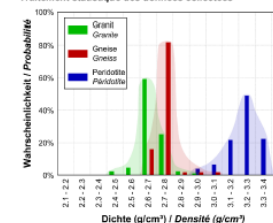


# Surface rock bulk density in Switzerland

Dichte des Gesteins [g/cm<sup>3</sup>]  
 Densité des Roches [g/cm<sup>3</sup>]

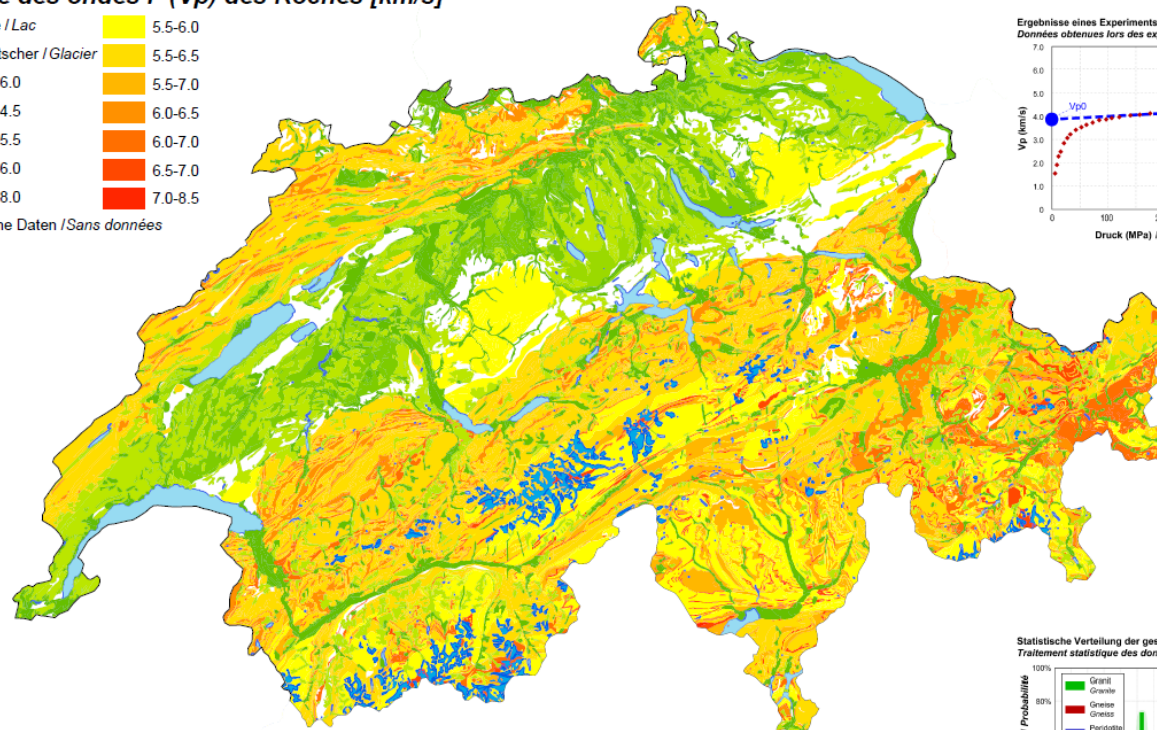
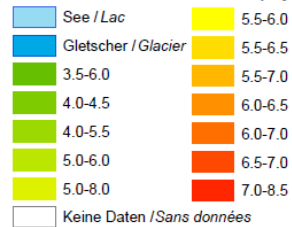


Statistische Verteilung der gesammelten Daten  
 Traitement statistique des données collectées

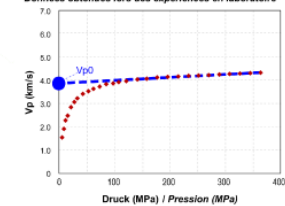


# Surface rock Vp at room pressure

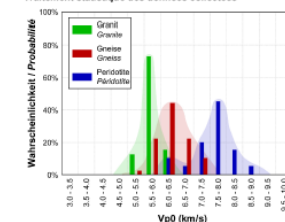
Geschwindigkeit der P-Welle (Vp) im Gestein [km/s]  
 Vitesse des ondes P (Vp) des Roches [km/s]



Ergebnisse eines Experiments im Laboratorium  
 Données obtenues lors des expériences en laboratoire



Statistische Verteilung der gesammelten Daten  
 Traitement statistique des données collectées



# Program for the year 2012

- Complete the measurement of  $V_s$  at High Pressure and room Temperature *continuation*
- Complete measurement of  $V_p$  and  $V_s$  at High Temperature and Pressure (600 °C, 500 MPa) on selected samples *continuation*
- Completing collection existing data from boreholes *continuation*
- Magnetic susceptibility measurements *continuation*
- **New task:** integrating thermal properties