GEOELEC Prospective for Geothermal Electricity in Europe

3rd Regional Workshop Italy, France, Slovenia and the Balkans

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Milano, 05/12/2011





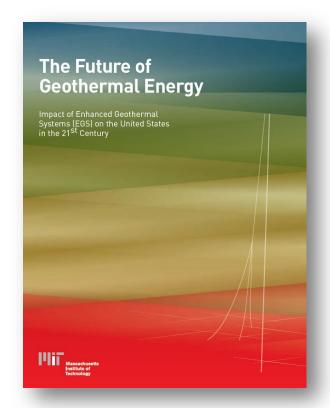
GEOELEC - Towards an assessment of the resource and the potential of geothermal power

Expected results:

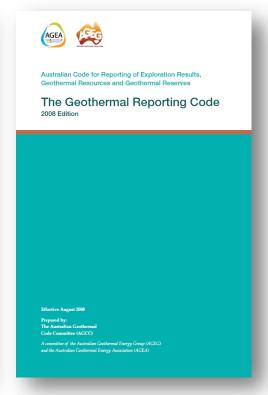
- Prospective study to forecast geothermal ressource for producing electricity to attract potential investors
- European Geothermal Reporting Code (discussion already started within TP Geoelec)



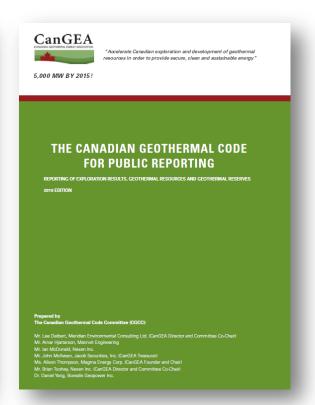
Outside Europe



USA MIT, 2006



Australia AGEA-AGEG, 2008



Canada Cangea, 2010



Contents

- Early geothermal data compilations
- Regional compilation of prospective areas and resource assessment
- Focus on a Typology of continental hot fractured systems in Europe
- GEOELEC data compilation



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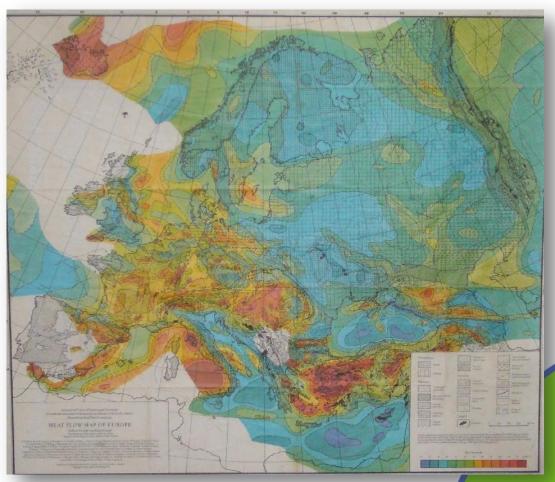
Early geothermal data compilations

CERMAK, V. & RYBACH, L. (eds.) (1979): Terrestrial Heat Flow in Europe

Book with different papers from a Workshop

A map of heat flow density was included in that book

Similar book: CERMAK, V. & HÄNEL, R. (eds.) (1980): Geothermics and Geothermal Energy, Symposium EGS/ESC Budapest





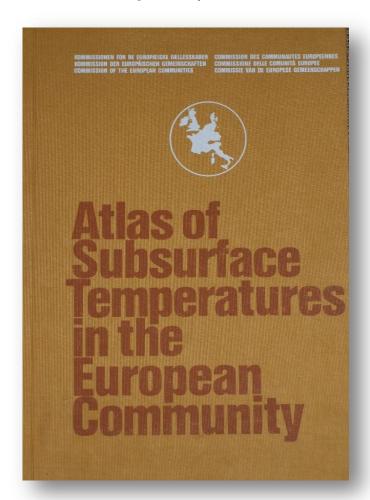
(Map by Cermak & Hurtig, 1979)

Early geothermal data compilations

EC 'Atlas of Subsurface Temperatures in the EC' (1980)

Coordinated by BGR, Hannover (Ralph Hänel)

Only heat flow and temperatures at depths between 500 and 5000, for countries and regions (e.g. Soultz-Landau)



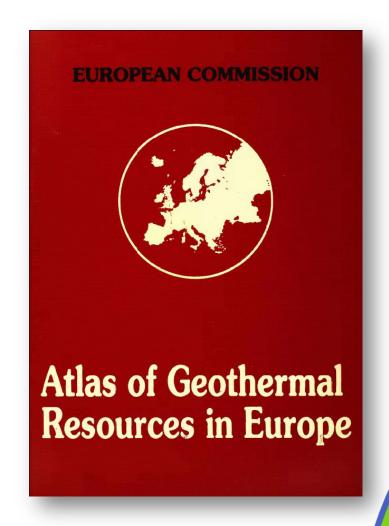


Regional compilation of prospective areas and resource assessment

EC 'Atlas of geothermal resources in Europe' (2002)

Coordinated by BGR, Hannover (Suzanne Hurter)

Overview:
Heat Flow
Temperature at 1 Km and 2 Km depth
European Geothermal resources

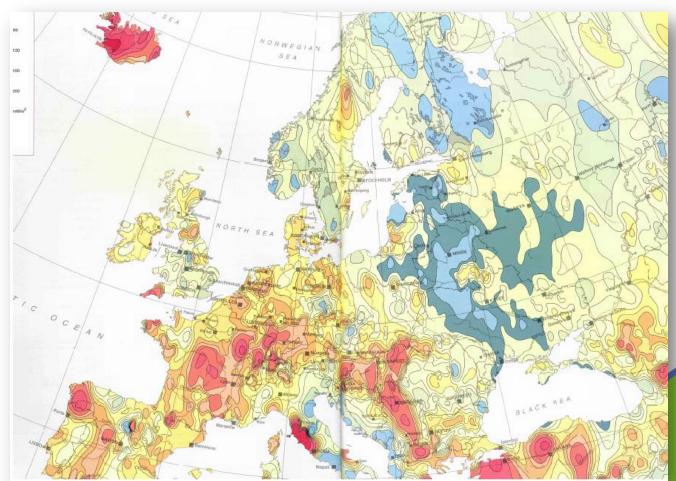




Regional compilation of prospective areas and resource assessment

EC 'Atlas of geothermal resources in Europe' (2002)

Heat flow density

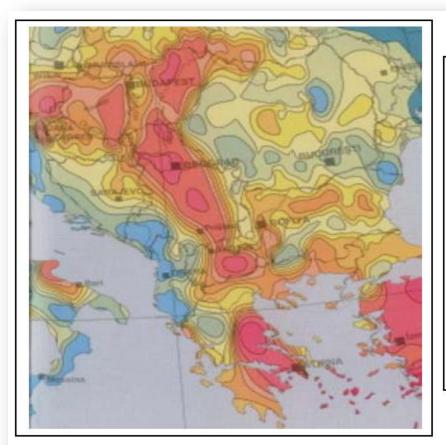




Regional compilation of prospective areas and resource assessment

EC 'Atlas of geothermal resources in Europe' (2002)

Heat flow density



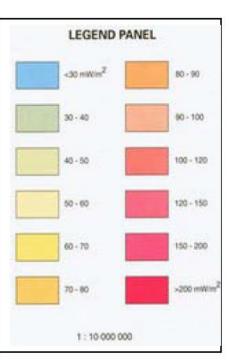


FIGURE 4: Heat flow map of the Balkan Peninsula (Hurter and Haenel, 1992)



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Typology of continental hot fractured systems in Europe

(WP10 of the European Hot Dry Rock Energy Project, 2001-2004)

Genter A. et al. (2003) – Typology of potential Hot Fractured Rock resources in Europe. Geothermics 23, p. 701-710.

Genter A. et al. (2004) - Typologie des systèmes géothermiques HDR/HFR en Europe. Rapport final. BRGM/RP-53452-FR, 165 p., 75 fig., 10 tabl.







Objective and results

Objective

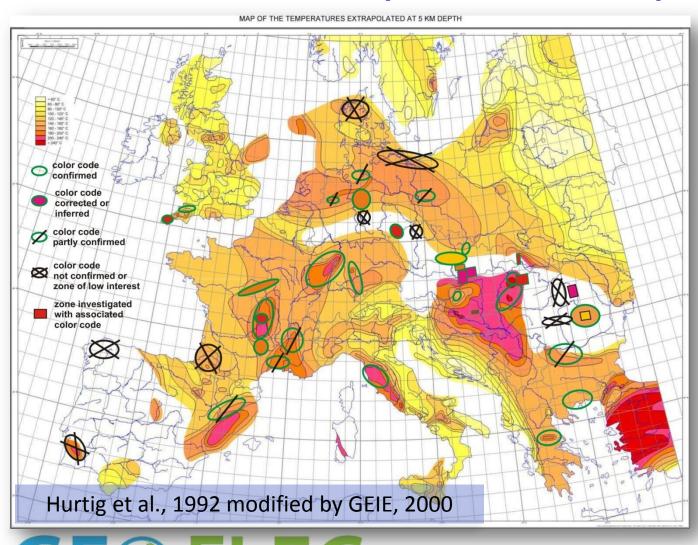
 Demonstrate the reproducibility of the Soultz concept to other deep fractured areas in Europe

Results

- Analysis of extrapolated temperature at 5000 m depth
- Location of interesting area
- Focus on promising zones for producing electricity from deep geothermal energy
- Computation of geothermal deep potential in Europe



Analysis of the map of the temperature extropalted at 5 km depth

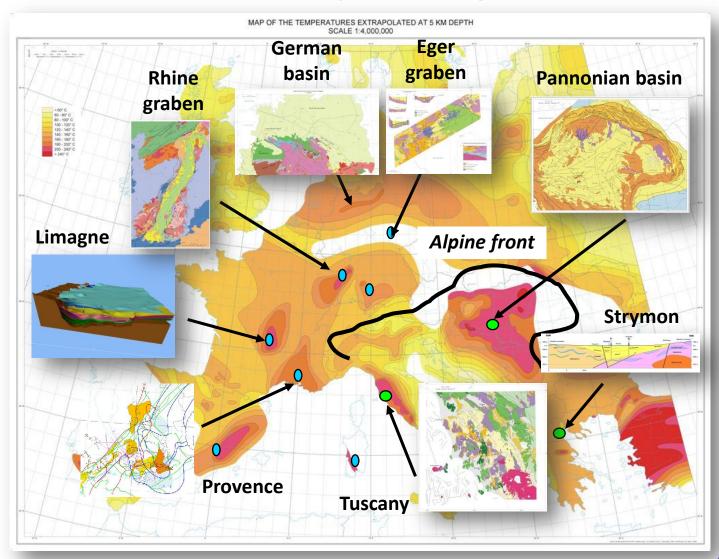


Comparison with data in literature, database....

-> only 5% of measured sites reach a depth > 3500m



Focus on promising zones





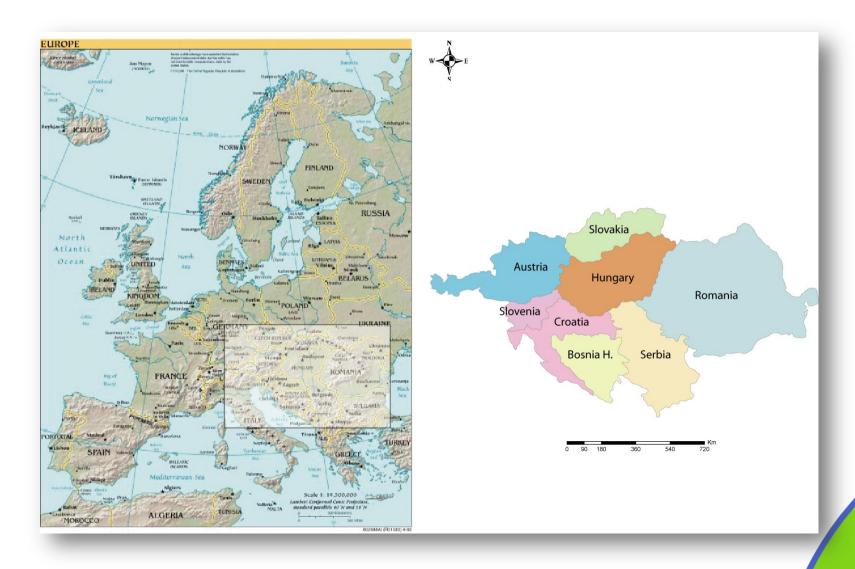
- Outer Alpine Front
- Inner Alpine Front

Promising areas studies

- Geographical and geological setting
- Origin of the geological structure
- Serie of maps:
 - Depth of basement
 - Thickness of sediments
 - Volcanism
 - Structures (faults, fractures...)
 - Stress field and seismic events
 - Hot spring
 - Temperature and heat flux
 - Potential

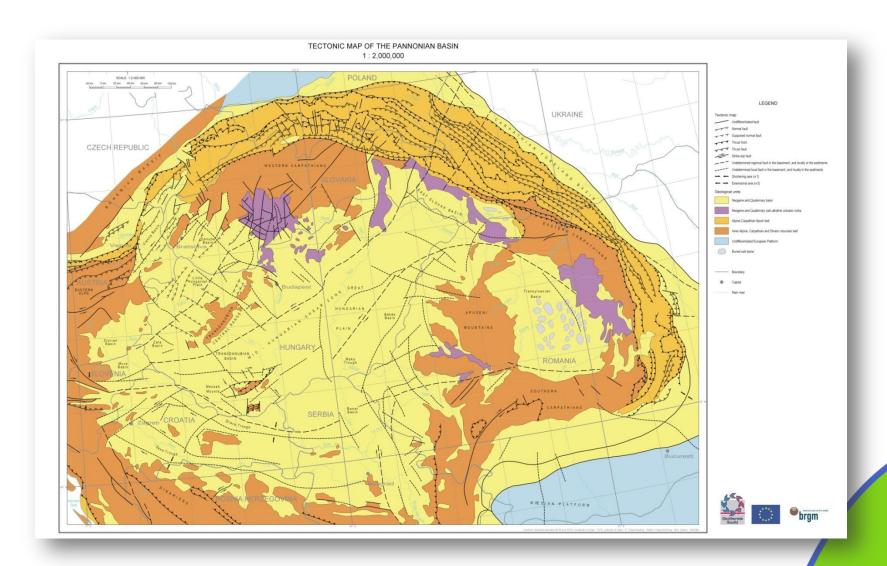


Panonnian bassin



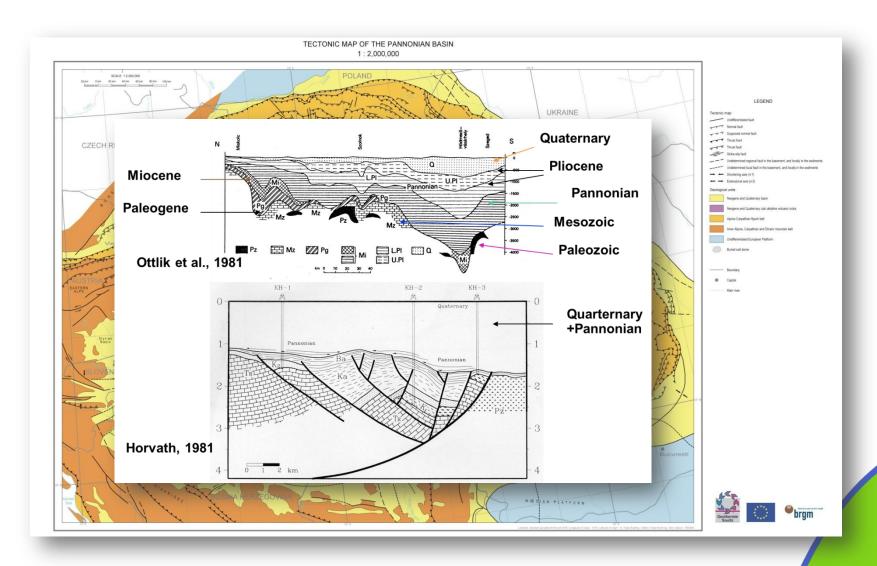


Tectonic map



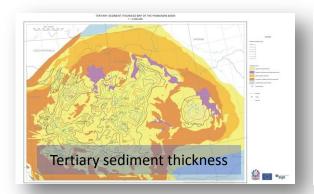


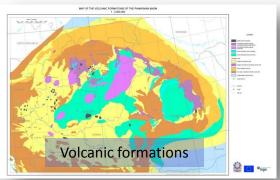
Tectonic map

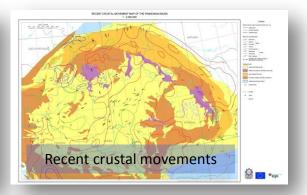


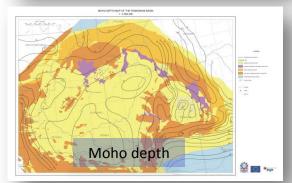


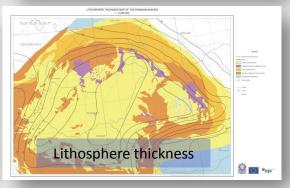
Other maps

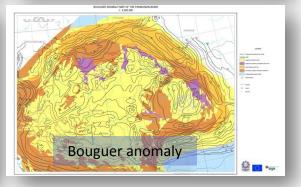


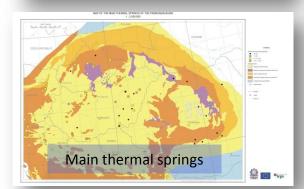


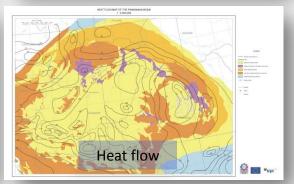






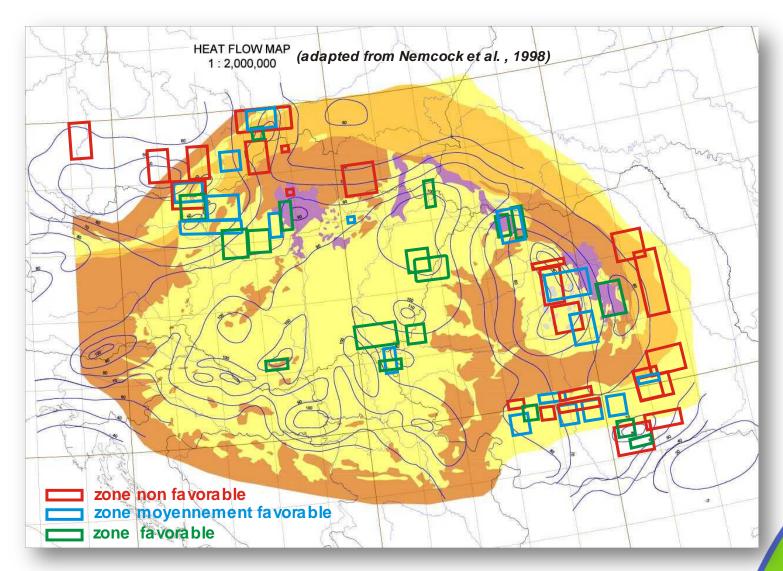






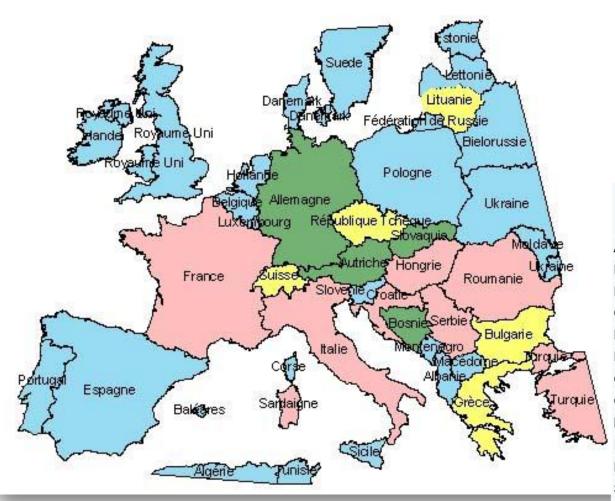


Crossing all maps for promising areas





Geothermal potential for the European countries



- High HFR potential

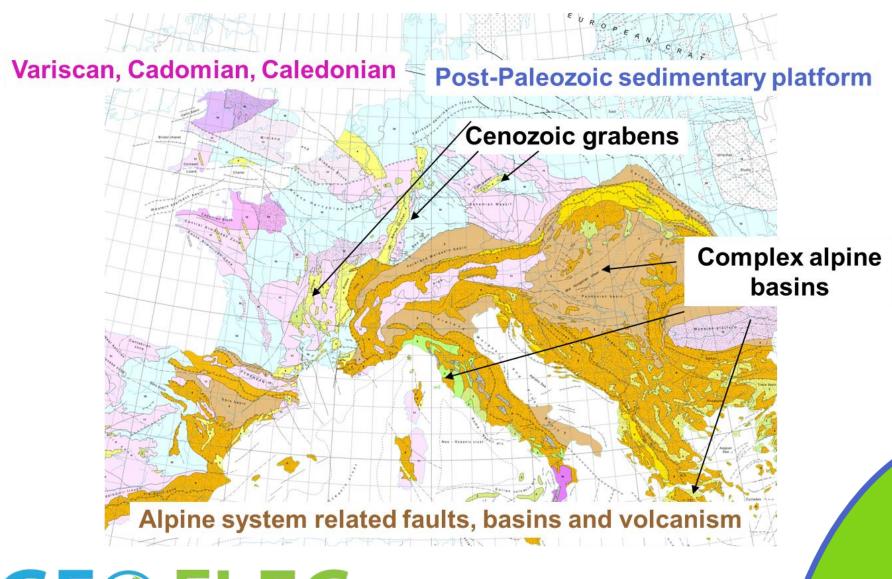
 Moderate HFR potential

 Low HFR potential
- No calculations but promising HFR potential

	Pays	Potentiel estimé (GW/an)	% de surface T > 180 °C @ 5000 m
	Austria	660	9,90
	Bosnia	230	5,90
	Bulgaria	30	0,40
	Croatia	1 300	29,00
	England	60	0,35
	France	4 700	12,00
	Germany	670	2,60
	Greece	100	1,25
	Hungary	6 270	76,00
	Italy	1 900	8,20
	Romania	1 220	6,70
	Serbia	3 960	52,00
	Slovakia	300	6,80
	Slovenia	70	4,50
	Spain	60	0,50
	Turkey	11 560	80,00

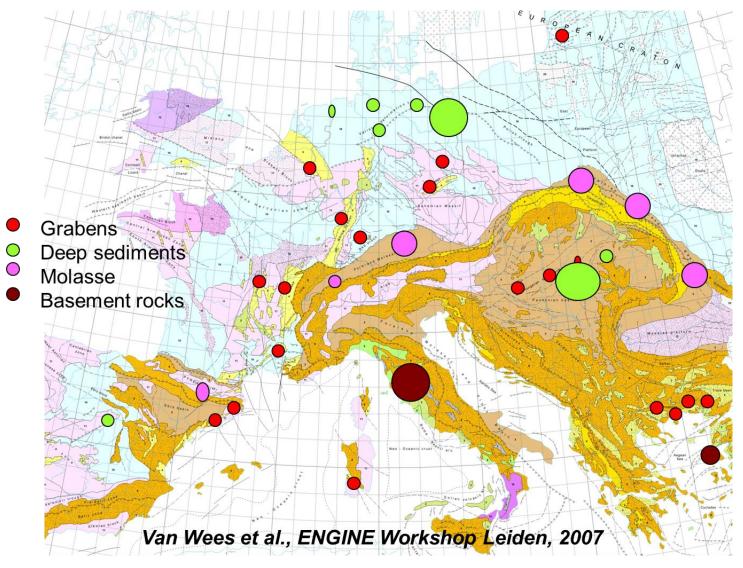


Litho-Tectonic map of Europe





Some EGS possible European sites





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Available data

- World Geothermal Congress: Country Updates
- European geothermal atlas
- European scale studies
- National geological databases from Geological Surveys
- Oil & Gas company public reports & data
- Data from underground geothermal developers



GEOELEC data compilation

- 7 regional workshops to carry out data compilation
- Geological surveys
- Underground 'explorators'

The GEOELEC Geothermal resource assessment protocol...



Thank You!

Visit www.geoelec.eu





