



The activities of CNR-IGG, Italy, in the field of geothermal

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The *Istituto di Geoscienze e Georisorse* (IGG, i.e., Institute of Geosciences and Earth Resources) of CNR began its activity in January 2002, with its headquarters in Pisa, and six Sections based in Florence, Padua, Pavia, Rome, Turin and Pisa. . The staff of the Institute consists of 69 researchers of CNR, 77 university researchers assigned temporarily to the IGG, 34 technical/administrative personnel and 40 contractual scientific collaborators (doctorates, scholarship holders, etc.).



The mandate of the IGG is to carry out research and evaluation, exchange of technological expertise, and training and dissemination of information in relation to the following topics:

investigation of the geological phenomena affecting the Earth by means of geodynamic, geochemical, and geophysical studies;

analysis and definition of geological materials;

studies directed at the mitigation of geological risks, at predicting and reducing the effects of global changes and at identifying natural resources with a view to a sustainable development of the latter.

The IGG has expertise in the following sectors

- Geochemistry of stable isotopes
- Waste disposal gases
- Boron, strontium and neodymium geochemistry
- Absolute age determinations
- GIS and basic geological mapping
- Trace element analysis in minerals using ICP-mass and ionic microprobes
- Magnetotelluric, gravity and heat flow surveys
- Fluid geochemistry
- Crystallochemistry and definition of crystalline structures
- Experimental petrology
- Analogic modeling

Main research topics of IGG

- investigation of the geological processes regarding the earth system
- characterization of geological materials
- investigation of natural resources for a sustainable development (earth resources)
 - Geothermal resources and thermal waters
 - Mineral resources
 - Exploration and maintenance of water resources
- geological and environmental risks
 - environmental impact
 - geological risks (volcanoes, landslides, hydrogeologic)
 - Cartography and GIS
 - environmental monitoring (for seismic and eruptive forecast)
- forecast and mitigation of the effects of global changes
 - CO₂ capture

One of the main target of IGG is the exploration of natural resources for a sustainable development.

The research is focused on the investigation of the deep structures in geothermal areas and the fluids circulating therein. This knowledge will help to define the role of the heat extracted from deep, unexplored sectors of the crust in the country's future energy balance. Fluid-rock interaction models are studied in order to reduce the emissions of CO_2 into the atmosphere. The attention is focused on the granitic intrusions and volcanoes along the Tyrrhenian margin of the high-enthalpy geothermal and ore-deposit areas.

Since water resources are limited and at high risk, a part of this research is dedicated to studying the shallow and deep dynamic behaviour of these resources, as well as pollution phenomena, utilizing geochemical, geophysical and hydrogeological methods.

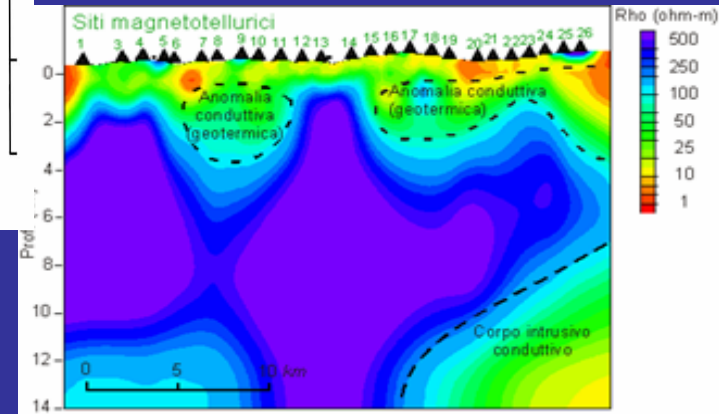
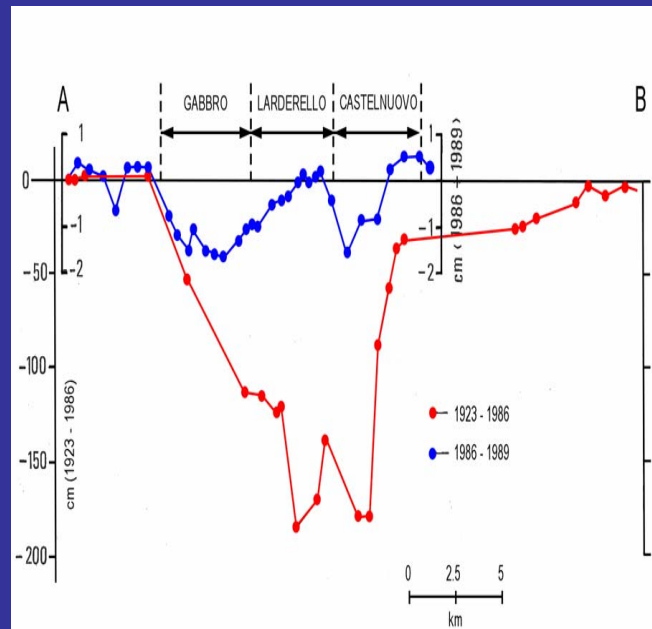
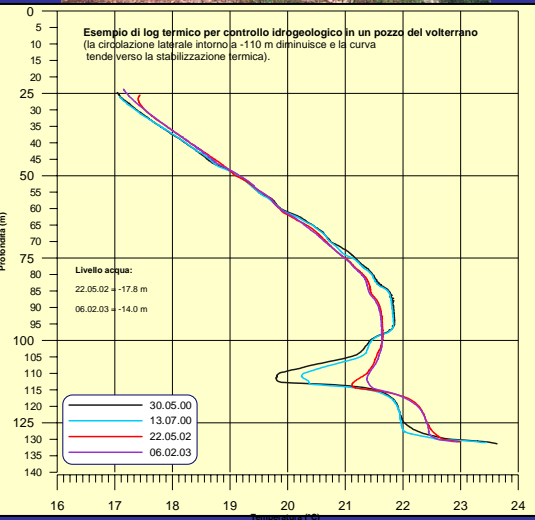
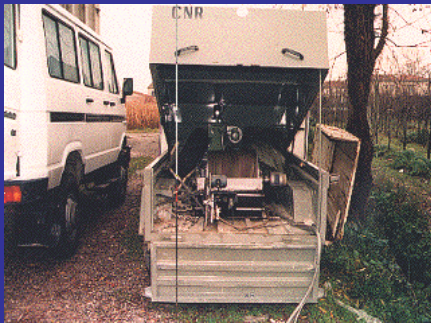
Geothermal expertise at IGG

Geophysics

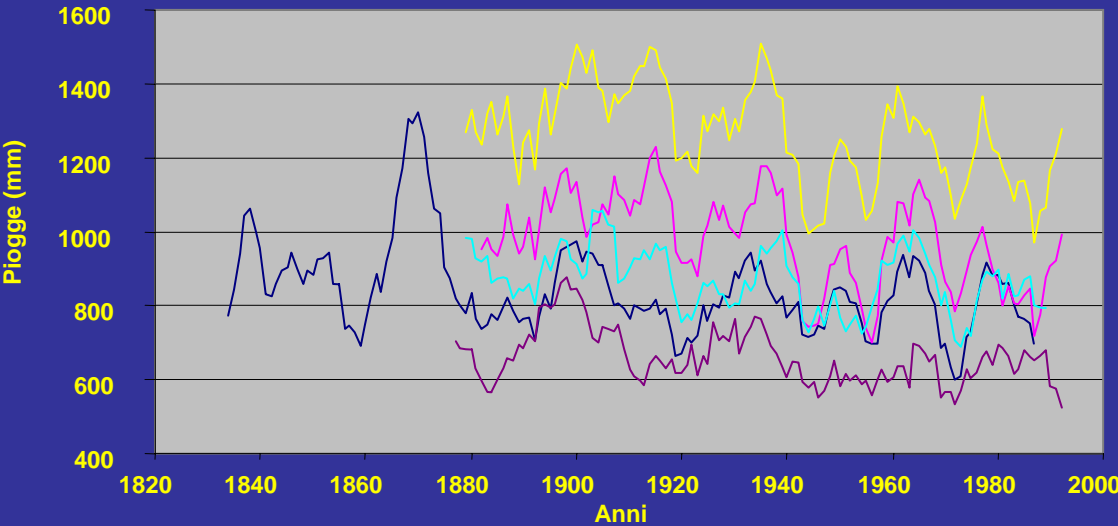
Subsidence monitoring

Magnetotellurics

Heat flow



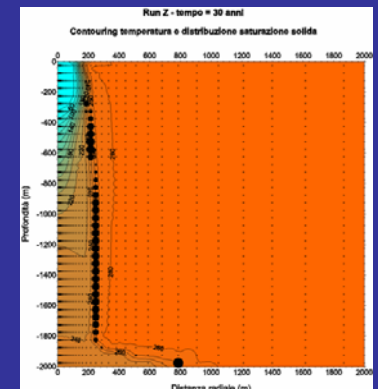
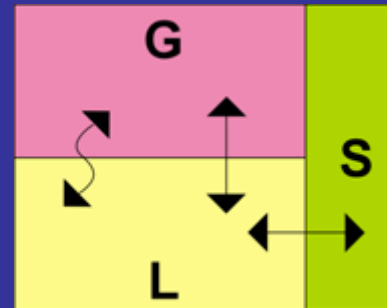
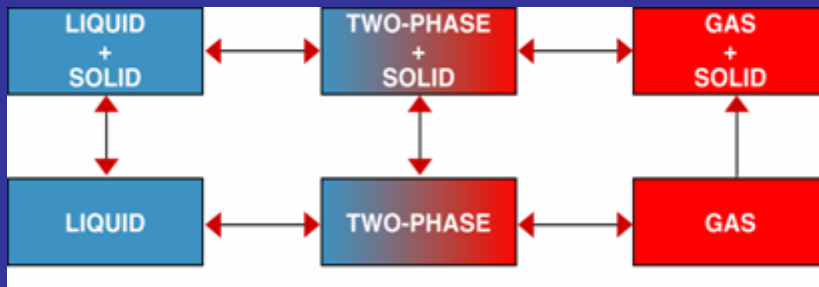
Geothermal expertise at IGG



Hydrogeology

Reservoir engineering

3-D reservoir simulators, which are used to model underground non-isothermal, multi-phase flow of fluid mixtures and transport of solutes, coupled with chemical reactions (fluid-rock interactions) or geomechanics



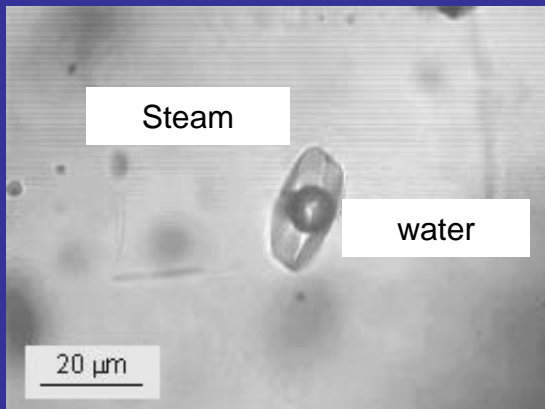
Geothermal expertise at IGG

Petrology and petrography

Rock-fluid interaction



Mineralogical geothermometry



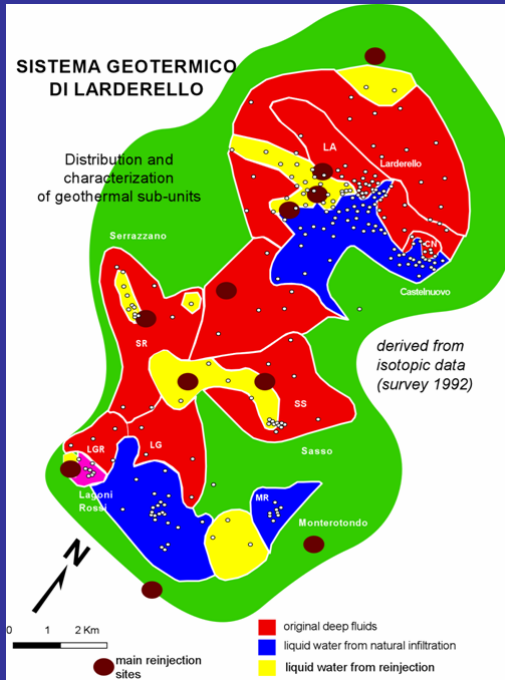
Fluid inclusions in minerals

Geothermal expertise at IGG

Geochemistry

Fluid geochemistry

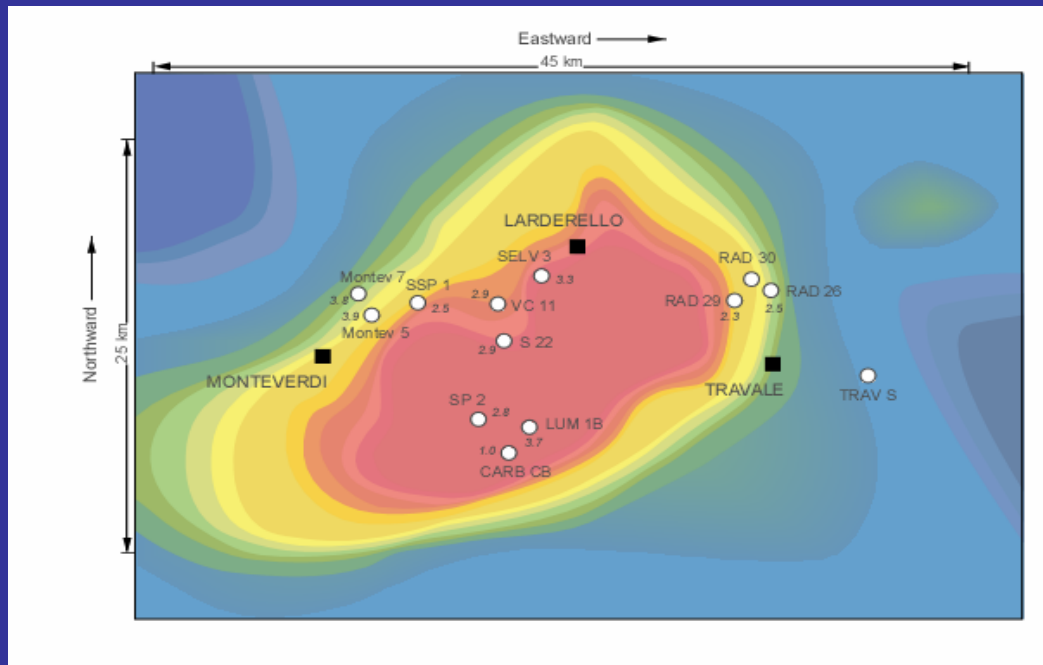
Gas geochemistry



Isotope geochemistry

Geothermal expertise at IGG

Geochronology





The geothermal international activity of the IGG takes the form of collaboration with institutes and organizations abroad in scientific research programmes, participation in exploration projects and in projects promoted by international organizations such as the Commission of the European Communities and the United Nations (IAEA, UNDP, UNESCO), as well as the activity of its

International School of Geothermics. During more than 30 years of activity, the School has trained over 800 experts from all over the world in its courses held in Italy and abroad. The School has also a wide experience in organizing international congresses, and in the preparation of teaching materials and handbooks.

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IGG, and in particular its former International Institute for Geothermal Research, had also being one of the founder of the International Geothermal Association (IGA) in which it played an important role since its establishment.

The management of IGA Information Committee of the IGA BoD was held by IGG for two recent terms (1998-2001 and 2001-2004). IGG participated to IGA Information Committee for tens of years and is still doing it.

The activities of IGG will contribute mainly to WP3 (exploration/investigation of geothermal systems), but also to WP4 (reservoir assessment), WP5 (environmental impact) and the related Expertise WPs.

The experience achieved with dissemination (International School of Geothermics, Geothermics, IGA Information Committee management) can also contribute to the CA.