Rend. Online Soc.Geol. It., Vol.21(2012), pp.823-825, 8 figs.

The VIGOR Project – Evaluating the geothermal potential in the regions of "convergence". Activities and first results in Calabria

G. IOVINE (1), F. GUZZETTI (1), L. ACETO (1), L. ANTRONICO (1), C. BRUNO (1), D. CALOIERO (1), D. D'ONOFRIO (1), F. FRUSTACI (1), S. GABRIELE (1), S. GIORDANO (1), R. GRECO (1), G. GULLÀ (1), P. IAQUINTA (1), O. PETRUCCI (1), F. SANTALOIA (1), S. SOLERI (1), O. TERRANOVA (1), E. VALENTE (1), S. CHIESA (2), A. GALGARO (3), G. LOMBARDO (4), F. MUTO (5), E. RIZZO (6), A. MANZELLA (7)

Key words: *VIGOR, geothermal potential, Calabria*.

INTRODUCTION

In the last decades, the progressive exhausting of the conventional power resources (like coal oil and natural gas) have given a new impulse to renewable energy exploitation. Main renewable resources can be summarized in the follow types: hydroelectric; biomass, photovoltaic, solar thermal, aeolic onshore, aeolic offshore, geothermal. Among these sources, the geothermal is poorly exploited.

Geothermal energy can be considered the renewable type that best represents Italy. In fact, the small village of Larderello, in the "Valle del Diavolo" (Devil's Valley) in Tuscany, was named after François Jacques de Larderel, a French manufacturer who first extracted boric acid from volcanic mud by using volcanic steam in early 19th Century. In 1904, the Italian contractor and politician Piero Ginori Conti tested the first geothermal power generator in the world at the Larderello dry steam field; seven years later, the world's first geothermal power plant was built in the Devil's Valley.

Today, the Italian electric production from renewable sources is about 7% of the national production; its 10% is derived from geothermal energy. Mapping the geothermal potential of a given territory and exemplifying its peculiar types of exploitation are the first steps for increasing the awareness among the population and for stimulating the exploitation of this renewable source.

Below, the main goals of the VIGOR Project plus a short explanation of the activities carried out in Calabria and of preliminary results are summarized.

(1) CNR-IRPI (U.O.S. di Cosenza, U.O.S. di Bari e Sede di Perugia).

(2) CNR-IDPA, Milano.

(3) University of Padova, Department of Geosciences.

(4) CNR-IPFC, Rende.

(5) University of Calabria, Department of Earth Sciences.

(6) CNR-IMAA, Potenza.

(7) CNR-IGG, Pisa.

THE PROJECT

The Project VIGOR is aimed at evaluating of the geothermal potential in the Italian regions of "convergence" – i.e. Campania, Calabria, Puglia and Sicilia (Fig. 1). The project is funded by the Italian Economic Development Ministry (MISE) by means of FESR (European Funds for Regional Development) resources. It derives from an agreement between MISE (General Direction for the Nuclear Energy, the Renewable Energies and the Energetic Efficiency - DG ENRE) and the Italian National Research Council (CNR), within the frame of the Inter-Regional Operational Programme (POI) "Renewable Energies and Energy Saving 2007-2013", line of activity 1.4.

Fig. 1 – The regions of convergence analysed in the VIGOR Project.

For the considered regions, the main aims of the project are:

a) to examine the state of knowledge and standardize, where possible, the database;
b) to identify potential sources of geothermal energy utilization, and make an assessment of their geological, structural and hydrodynamics features;
c) to provide guidance and recommendations for expanding the use of geothermal resources, within the context of the EU commitment for sustainable energy, while ensuring the utmost respect for the environment;
d) to convey information and expertise, and intervention models

derived from the implementation of the Project.

In addition to analysing the geothermal potential at regional scale, 8 study areas (2 per region) have been selected - in agreement with the interested Regions - for detailed evaluations, aimed at exemplifying types of possible utilization of the geothermal energy.

ACTIVITIES IN CALABRIA

In a first phase, performed activities mainly consisted of collection and analysis of data to properly evaluate the regional geothermal potential, and to define reliable geo-structural and hydrogeological models of the two study areas of Arcavacata and Terme Caronte (Fig. 2). Later on, two projects have been developed to exemplify the types of utilization of the geothermal

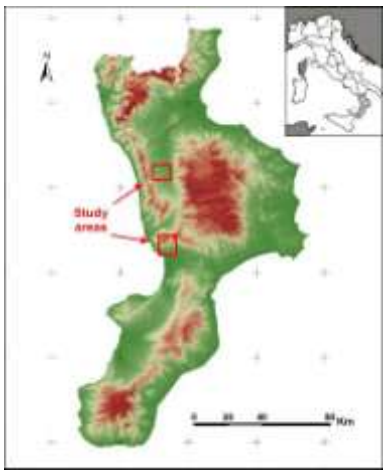

Fig. 2 – Location of the Arcavacata and Terme Caronte study areas.

energy in the study areas.

Literature (scientific and technical reports, papers, maps, etc.) and stratigraphic/hydrogeologic data related to drillings and wells have been collected (mainly thanks to the willingness of many colleagues and enterprises), and included into a bibliographic (VIGOR-Bib) and into a cartographic database (Geo-Network), both accessible via internet. Altogether, ca.400 bibliographic references and ca.300 cartographic data have been stored. From these, derived maps have been obtained. In Fig.3, two examples of derived maps are shown, related to: A) the main lithological groups, as obtained from the Geological Map of Calabria (at 1:25,000 scale, BURTON, 1971) by merging the 365 basic formations, according to lithological analogies; B) the distribution of ca.3.500 wells, whose related stratigraphic and hydrogeological information have been organized in a WebGIS at CNR-IRPI U.O.S. of Cosenza (accessible via internet).

The Arcavacata study area

The Arcavacata study area includes the campus of the University of Calabria, that is supposed to harbour the planned scientific pole of CNR, and the industrial area of Rende (Fig. 4).

During the first phase of activity, available scientific and technical papers and thematic maps, plus information on drillings and wells (including groundwater chemical and physical features), have been collected. Accordingly, the stratigraphic and hydrogeologic characteristics of the area have been hypothesised, and a pre-feasibility report has been prepared. In such report, both direct and indirect investigations have been suggested for a better understanding of the geological characteristics and of geothermal potential of the area.

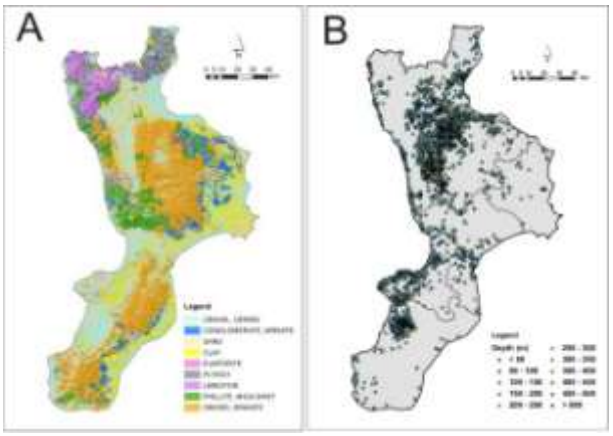

Fig. 3 – Lithological groups (A) and wells distribution (B).

Fig. 4 – The Arcavacata study area (base-map after Sorriso-Valvo & Tansi, 1996).

Aiming at better defining the geo-structural, geomorphologic and hydrogeologic features of the area, field surveys and aerial photographs interpretation have then been carried out. Successively, n.4 superficial geo-electric tomographies (940 m in length, investigating down to a depth of 170 m), and n.1 deeper geo-electric tomography (6,5 km in length, 900 m depth) have been performed (Fig.5).

Evidence collected during field investigations combined to literature information and new geophysical results (e.g. Fig.6) allowed to refine the initial geological/hydrogeological scheme of the area. Based on such information, a project for the air conditioning of the new CNR buildings based geothermal energy

Fig. 5 – The Arcavacata study area: profiles of the geo-electric high-resolution tomographies (T1, T2 T3 e T4, in red) and of the deep tomography (DERT, in blue) performed by CNR-IMAA.

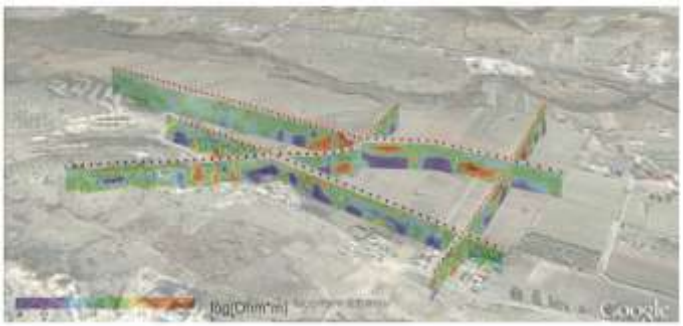

Fig. 6 – Preliminary results of superficial geo-electrical tomography (view from the South).

has been proposed, and the feasibility report prepared.

The Terme Caronte study area

In the second phase of activity, the Terme Caronte study area has been investigated, including Sambiase, Lamezia and its industrial area, and Terme Caronte thermal station (Fig.7). Again, literature and data collection have been performed, and a pre-feasibility report prepared.

Due to the high geo-structural complexity of the site, extensive field surveys have been carried out, in addition to interpretation of aerial photographs and literature data (Fig.8). Furthermore, a number of geophysical prospections (geo-electric tomography, electro-magnetic surveys) and deep drillings have been planned, both in the mountain and in the plain sectors.

Results have been finally interpreted, by using a specific 3D-modelling software, by also taking advantage of deep seismic profiles (courtesy of ENI). By considering such results, the geological scheme of the area could be refined. Accordingly, a project for the sludge treatment based geothermal energy has been proposed, and the feasibility report prepared.

Fig. 7 – The Terme Caronte study area (base-map after Sorriso-Valvo & Tansi, 1996).

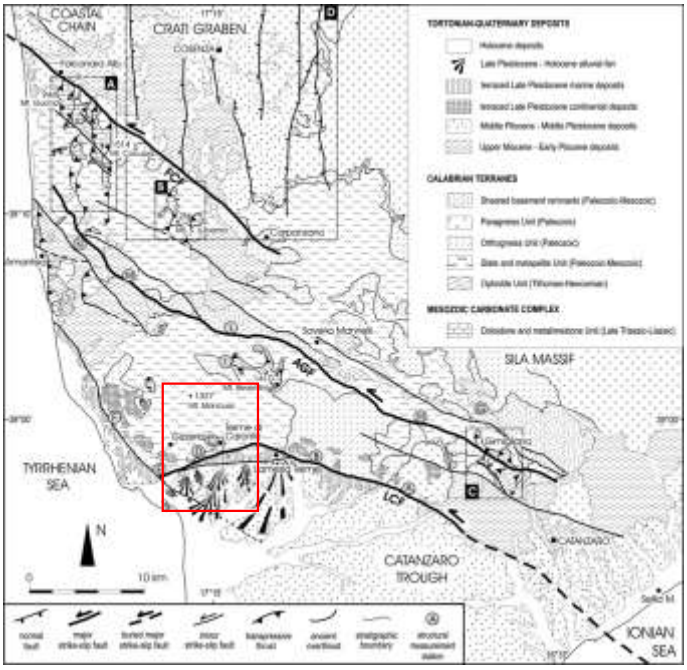

Fig. 8 – Terme Caronte: geo-structural setting of the study area (after TANSI *et al.*, 2007).

REFERENCES

BURTON A.N. (1971) - Carta Geologica della Calabria (1:25,000) – Relazione Generale. Cassa per Opere Straordinarie di Pubblico Interesse nell'Italia Meridionale (Cassa per il Mezzogiorno), 120 pp.

SORRISO-VALVO M. & TANSI C. (1996) - *Grandi frane e deformazioni gravitative profonde di versante della Calabria. Note illustrative per la carta al 250000.* Geogr. Fis. Din. Quat., **19**, 395-408.

TANSI C., MUTO F., CRITELLI S., IOVINE G. (2007) - *Neogene-Quaternary strike-slip tectonics in the central Calabrian arc (Southern Italy)*. Journal of Geodinamics, **43**, 393-414.