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Vol. 9

AGIP-ENEL JOINT-VENTURE FOR GEOTHERMAL RESEARCH
AND PROGETTO FINALIZZATO GEODINAMICA - CNR

PHLEGREAN FIELDS

Edited by
MAURO ROSI & ALESSANDRO SBRANA

ROMA
CONSIGLIO NAZIONALE DELLE RICERCHE
1987

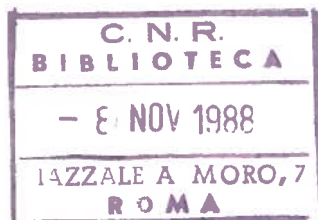
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P R E F A C E

The main objective of Subproject 3 of the Italian Geodynamic Project was that of promoting research in the field of active volcanology aimed at the mitigation of volcanic hazard. The actions undertaken included the improvement of the permanent monitoring networks on active volcanoes, and the sponsoring of research on eruptive mechanisms and in the field of volcanic hazard assessment.

Advancement in this last sector required, in turn, a deep revision of the previous basic knowledge on volcanic geology, stratigraphy and tectonics, as well as a careful reconstruction of the volcanic history. The obtainment of a new geological map at adequate scale of each active volcanic area of Italy was one of the main objective of this research plan. Considering that detailed geological maps had been recently published on Etna (1982) and on the Aeolian Islands volcanoes (1980), the main effort was concentrated on the active volcanic areas of the neapolitan region (Phlegrean Fields, Vesuvius, Island of Ischia).

In the case of Phlegrean Fields and Vesuvius, the achievement of this objective has been greatly facilitated by the existence of a parallel and important research effort made by the AGIP-ENEL Joint Venture and aimed at the geothermal exploration of the two areas. The AGIP-ENEL programme included detailed geological mapping, geophysical investigation (gravimetric, aeromagnetic and geoelectric surveys) and exploratory drilling. A cooperation programme was established between AGIP-ENEL and the Geodynamic Project, and many of the geological and petrological investigations were carried out through the collaboration of researchers from AGIP and from the Department of Earth Science of the University of Pisa (A. Sbrana did most of the work while he was an AGIP's staff member).

This monograph illustrates the results of this important joint research effort. It is accompanied by a new 1:15,000 geological and gravimetric map, that alone represents a marked improvement of the knowledge of the area (previous geological maps were those of A. Rittmann and coworkers, 1:25,000 - 1950, and of the geological survey of Italy, 1:100,000 - 1967).

The monograph summarizes all the results of the surface and subsurface geological, petrological and geophysical studies. A new volcanological and structural model, more complete with respect to previous ones, is presented for the Phlegrean Fields. It provides, a sound base for more detailed studies on the volcanic hazard assessment presently under progress. The results contained in this monograph have already served during the severe seismic-inflation crisis that affected the Phlegrean Fields in the 1982-1984, and which has been described in a Special Issue (vol. 47, n. 2, 1984) of Bulletin Volcanologique. That issue contains also the description of the Phlegrean Fields monitoring system, as well as the preliminary results obtained on volcanic hazard assessment.

This is the reason why these two arguments have been not treated in the present monograph, which has therefore a mostly volcanological and structural character.

FRANCO BARBERI
Professor of Volcanology at the University of Pisa
Director of the Italian Geodynamic Project

PHLEGREAN FIELDS

1 — Introduction (M. ROSI & A. SBRANA)

The Phlegrean Fields are one of the classical active volcanic areas of the Quaternary Potassic Roman Province, the volcanic Province of central-southern Italy. Since the beginning of their activity (not precisely known, but certainly earlier than 50,000 years B.P.) the Phlegrean Fields have been characterized by an impressive series of volcanic eruptions from many eruptive vents, the proximal products of which cover an area of about 200 km² west of Naples. The detailed stratigraphic study of more than 150 measured sections and the extensive use of radiometric age determinations, both original and taken from the literature, have allowed the reconstruction of the eruptive history of the volcanic complex. This reconstruction is obviously less detailed with increasing age, but is, as a whole, quite reliable and nearly complete for the last 4,500 years. Different eruptive behaviours, already recognized in a previous paper by the same authors [54], are more precisely defined and described; for recent major events the available data are sufficient to depict the areal distribution of the various products. A number of deep geothermal wells, recently drilled in the Phlegrean Fields have provided data which are useful for the reconstruction of the earlier periods of activity and indispensable for the knowledge of the present subsurface arrangement of the volcano.

The whole set of presented data is necessary to our understanding of the phenomena presently occurring and to the evaluation of the related volcanic hazard.

2 — Geological setting of the area (M. ROSI & A. SBRANA).

The Quaternary volcanic area of the Phlegrean Fields is located in a central position within the graben of the Campanian Plain. This structure was formed in the high Pliocene on the western margins of the Appennine chain, probably as a consequence of those phenomena that caused the opening up of the Tyrrhenian basin [36], [45]. A geological sketch map of the main stratigraphic and structural units of the Campanian area is presented in Fig. 1 while a Landsat image of the area is reported in Fig. 2.

The structure of the Appennine chain in this area consists of a pile of nappes formed in the Miocene, overthrusting towards the north and north-east. The subsequent plioquaternary tectonic is related to the sinking of the Tyrrhenian margin and to the rising up of the axis of the chain. Maximum subsidence took place during the Calabrian.

To the south, the graben is delimited by the Sorrento peninsula and, structurally, by the NE-orientated faults which lower the Mesozoic carbonate series towards the N-NW [36]. These faults are aligned between Torre del Greco and Vesuvius. To the N-NW

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