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VOLUME DEI RIASSUNTI

VOLUME II

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Conceptual model of shallow magma feeding system for Ischia Island (Italy)

GIUSEPPE LUONGO (*), STEFANO CARLINO (**), ELENA CUBELLIS (**) & FRANCESCO OBRIZZO (**)

Key words: *Ischia Island, laccolith, magma feeding, resurgence caldera*.

VOLCANIC HISTORY AND SEISMICITY

In this study we provide a general structural picture of Ischia island shallow crust to model the processes occurring at shallow depth, by using geological, geophysical, historical seismicity data and analytical structural models of the island (PENTA & CONFORTO, 1951; CUBELLIS & LUONGO, 1998; CUBELLIS *et alii*, 2004; CARLINO *et alii*, 2006; PAOLETTI *et alii*, 2009; VEZZOLI *et alii*., 2009; SBRANA *et alii,* 2009). These studies support the hypothesis of the presence of a shallow laccolith, which is responsible of the resurgence of Mt. Epomeo, following the Green Tuff eruption, volcanic activity and seismicity of northern sector of the island. The occurrence of magmatic intrusion and high geothermal gradients (180-200°C km^{-1}), have produced a shallow brittle-ductile transition (~ 2 km b.s.l.), deeper northward.

The island of Ischia was characterised by a long period of volcanic activity: the oldest outcroppings were erupted about 150 ka ago; the last eruption occurred in the 1301-1302 A.D. Historical records since 1228 A.D. testify the occurrence of numerous earthquakes in the island which produced heavy damage and fatalities (Fig. 1). The seismic events, except for one minor earthquake, were not correlated to eruptions, but they may be related to the episodic reactivation of the same tectonic structure. This observation, joined with geological and geophysical data, supports the hypothesis that the seismicity is linked to a local stress field, probably generated by volcanic processes. Since the active-quiescent periods of the island seem to be marked by Mt. Epomeo uplift and subsidence respectively, the monitoring of long term deformation of the resurgent block is fundamental to understand the state of Ischia volcanic system. Nowadays the island is undergoing to slow phase of subsidence. Before this phase uplift pulses were associated to earthquakes occurred between 1228 and 1883 years, generated by the stress field due to short-term magmatic impulses. On the other hand, an enduring inversion of the present Mt. Epomeo movement could represent an important long term precursor of volcanic activity reactivation.

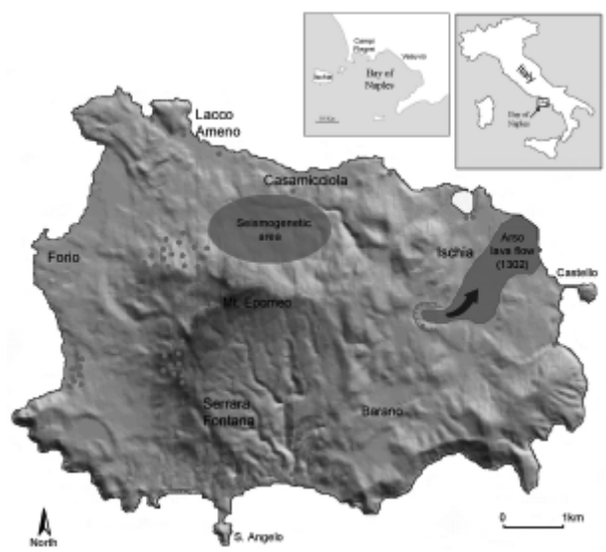

Fig. 1 - The island of Ischia and main features related to its recent dynamic; red dots represent the main hot springs and fumaroles fields.

DYNAMICS OF THE ISLAND AND MAGMA SYSTEM

The uplift/subsidence of the Mt. Epomeo is controlled by the increase/decrease of pressure in the shallow laccolith (CARLINO *et alii*, 2006) (Fig.2). During eruptions the uplift stopped, because the magma founded feeder dykes and no longer exerted pressure exceeding the overburden; on the contrary the earthquakes occurred during the resurgence of Mt. Epomeo.

The whole island is subject to subsidence for the stretching of the crust in Tyrrhenian Sea and along the near continental margin of Italian Peninsula since 10 millions years B.P.. In addition to this process large and rapid changes in sea level occurred in the area during the Late Quaternary. Some authors (RAMPINO *et alii*, 1979; NAKADA & YOKOSE, 1992) have considered a possible relationship of volcanic activity in the coastal and island volcanoes to large sea level changes during the Late Quaternary.

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If large and rapid changes of sea level at Ischia, during the uppermost Quaternary could induce eruptive activity, remains to be proved. Consequently the sea level data of the last 140 ka B.P. are compared with the volcanic activity of Ischia. The oldest outcrops in the island date back to about 150 ka B.P.; since that time five phases of activity have been distinguished, which were grouped in an older cycle and a younger cycle, separated by the 55 ka B.P. large eruption of Mt.Epomeo Green Tuff (MEGT).

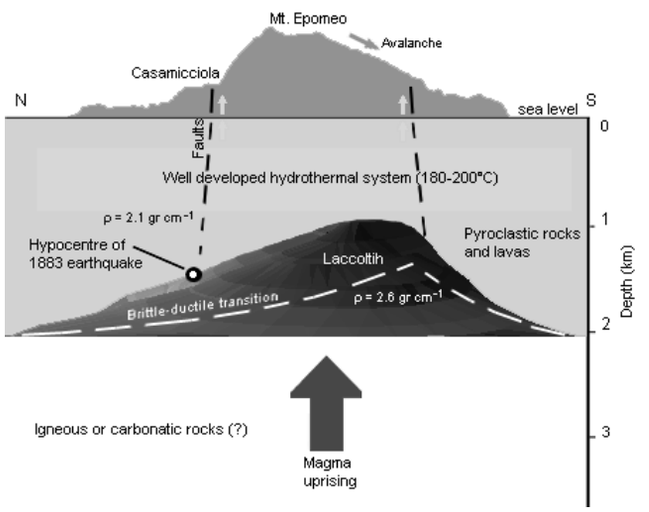

Fig.2 - Sketch of shallow crust of Ischia island inferred by geophysical data and historical seismicity.

At the same time of sea-level changes during the last 30 ka, ground uplifting occurs in the island, since the MEGT caldera resurgence, with permanent ground deformation produced by the increase of pressure in the shallow magma reservoir. This process overcomes largely the subsidence in the investigated period. In the short-term, i.e. as the last 2000 yrs, it is difficult to separate the share of the two opposite phenomena for lack of data. Today we observe Greeck and Roman ruins along the coast of the island submerged about 2 m b.s.l.. Geographers comparing historical and current maps of the island infer sinking of the coast since the sixteenth century at a rate of 2.5 mm/years (NIOLA BUCHNER, 1965). During the time lapse from 1892 to 1912 years, GRABLOVITZ (1920-21) measured at the tide gauge of Ischia harbour a subsidence with a velocity of 3 mm/y. Afterwards measurements of sea levels carried out in the island by FRIEDLAENDER (1938) confirmed the results obtained by GRABLOVITZ. Precise leveling data collected since the early twentieth century show the lowering of the southern part of the island which resembles a bowl-shaped sinking.

In the neighboring active caldera of Campi Flegrei the uplift in historical times was accompanied by seismicity at which sometimes explosions (Solfatara, 1198), or eruptions (Mt. Nuovo, 1538) follow it. If a similar process takes place at Ischia, we should expect that significant seismicity will occur only in case of new uplift phase of Mt. Epomeo block. Empirical data show that to predict incoming eruptions the occurrence of earthquakes is a necessary but not sufficient condition.

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