BURIED VOLCANIC STRUCTURES IN THE GULF OF NAPLES (SOUTHERN TYRRHENIAN SEA, ITALY) RESULTING FROM HIGH RESOLUTION MAGNETIC SURVEY AND SEISMIC PROFILING

The integrated analysis of high resolution seismic and magnetic profiles, recently collected in the Gulf of Naples by CNR-IAMC Institute onboard of the R/V Urania (CNR, Italy) allowed to study buried volcanic structures in the subsurface of the Gulf in their regional geological framework. The Gulf of Naples was involved during the Late Quaternary and since historical times, to active volcanism, due to the occurrence of volcanic centers of Somma-Vesuvius, Phlegrean Fields and Ischia and Procida islands. The investigated area, into which magnetic and seismic coverage here presented is located, is bounded towards the Tyrrhenian sea by the – 50 m isobath and seawards by the Sorrento Peninsula-Capri island structural elongment.

Several geological and geophysical surveys of the Gulf of Naples have been already carried out (Latmiral et al., 1971; Finetti and Morelli, 1974; Pescatore et al., 1984; Fusi et al., 1991; Milia, 1998a, 2000; Milia et al., 1998b; Aiello et al., 2001). Nonetheless this, different types of marine geophysical data (seismic and magnetic profiles) have been never correlated by previous authors in this area.

Geologic interpretation of the high resolution magnetic anomaly map of the Gulf (Siniscalchi et al., 2002; Aiello et al., 2004) has shown complex magnetic anomaly fields, associated to buried volcanic structures, as evidenced by the interpretation of seismic reflection profiles and/or to volcanic morphological and structural highs, identified on Multibeam bathymetric survey (Aiello et al., 2001). Selected examples of interpreted seismic and magnetic profiles are discussed in order to improve the correlation of some volcanic features with corresponding magnetic anomalies.

Offshore the Somma-Vesuvius volcanic complex, where a shallow continental shelf occurs, structural trends related to NNW-SSE trending normal fault systems are here suggested based on alignment of magnetic anomalies and related seismic structures. Such a structural trends has been never previously suggested by previous authors, suggesting systems of NE-SW normal faults (Bernabini et al., 1973; Finetti and Morelli, 1974; Cassano and La Torre, 1987). Three intense and dipolar magnetic anomalies appear to be related to wide, dome-shaped, volcanic structures, located in the outer shelf off the volcano, at water depths ranging from –80 m and –110 m. These structures represent the prolongation of the Mt. Somma-Vesuvius volcano into Tyrrhenian sea. Weak anomalies, located southwards of the three ones, are probably related to lava flows entering the sea during recent eruptive activity of the volcano.

A strong interest is pointed out by our seismic and magnetic survey offshore the Phlegrean Fields, a volcanic district surrounding the western part of the Gulf of Naples, where volcanism has been active since at least 50 ky. They correspond to a resurgent caldera resulting from the volcanic-tectonic collapse induced from the eruption of the “Campanian Ignimbrite” pyroclastic flow deposits. Coastal sediments ranging in age from 10.000 and 5300 years crop out at 50 m of altitude on the sea level in correspondence to the marine terrace of “La Starza” (Gulf of Pozzuoli), indicating a volcano-tectonic uplift of the calderic centre (Rosi and Sbrana, 1987;
Dvorak and Mastrolorenzo, 1991). The seaward boundary of the Phlegrean caldera has been inferred as correspondent to a submarine belt of volcanic highs (Banco di Pentapalumbo, Banco di Nisida e Banco di Miseno). The Phlegrean offshore represents a relatively complex magnetic anomaly area, characterized by several magnetic anomaly fields with different intensity. Two dipolar anomalies, characterized by a couple maximum-minimum have been identified. The first anomaly, E-W oriented and located in the northernmost part of the area shows a minimum of -200 nT, associated to a maximum of + 185 nT. Such a values, relatively not so high, could be probably associated to volcanic bodies not cropping out at the sea bottom, but buried by sediments. The second anomaly, NW-SE oriented and located in the easternmost part of the area shows a maximum-minimum couple with a relative intensity similar to that of the previously discussed field. Besides of these two magnetic anomaly field, corresponding to magnetic bodies and/or volcanic edifices, other anomalies, not dipolar and of lower intensity, ranging between 40 and 135 nT are due to the occurrence of small volcanic edifices.

It is worth noting that it does not exist a precise correlation between the topography of the “Banco di Pentapalumbo” (Fig. 1) and the shape of related magnetic anomalies (Fig. 2). After the formation of the bank the intrusion of minor volcanic bodies probably occurred; as these structures are elevated with respect to the top of the bank, which has been terraced after the last glacio-eustatic sea-level low. Several anomalies of this area could correspond to minor volcanic bodies, which, at the moment of their emplacement and consolidation have previously recorded a magnetization of different intensity and direction with respect to that one of the volcanic deposits forming the bank.

Fig. 1 - High resolution seismic reflection profile GRNA45 (Gulf of Naples) and corresponding interpretation.
Fig. 2 - Magnetic anomaly map offshore the Phlegrean Fields volcanic complex (scale 1:50,000; contour interval 25 nT).

REFERENCES


Rosi A. and Sbrana M.; 1987: Phlegrean Fields. CNR, Quaderni De La Ricerca Scientifica, Roma, Italy.