The igneous floor of the Marsili Deep Plain : how did the "Oceanization" propagate in time and with which products ?

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The numerous example of back-arc, arc volcanic systems which are located in different structural settings are frontally bordered either by oceanic crust or by orogenes; this second case being particulary widespread in and around the Mediterranean Sea. The new igneous crust of the interarc-arc complexes of the Tyrrhenian shows a wide composition spectrum due to the highly different nature of magma sources, as are, on one side, the MORB producing mantle diapir of the Vavilov basin (ODP Site 373 and 655) and, on the other side, the supra-subduction wedge of the Marsili basin (Site 650) and the northern part of Vavilov basin (Site 651).

In the Southernest Tyrrhenian Sea a sequence of volcanic islands and seamounts form the concave arc of the Eolie. The Marsili deep basin borders the internal side of this arc. The basin central area is occupied by a big volcano, (from 3400 to 485 m bsl). The rilief divides the basin area roughly in two parts, western and eastern with maximum depths of respectively 3500 and 3400 m.

Figure 1 shows that the magnetic field related to the deep basin, according to the aeromagnetic survey commissioned by AGIP, is made up by a series of positive and negative anomalies which do not have the linear, correlatable patterns of the mid-oceanic ridges. The physiographic high of the seamount is associated with an elongated positive magnetic anomaly of high intensity which likely belongs to the Brunhes because of the state of freshness of the magmatic products distributed over a wide depth range and the young K/Ar age (not greater than 0.2 Ma) of some eruptions from the summit. The negative magnetic anomalies which flank the positive axial zone can be roughly correlated with the two small side-reliefs situated to the northeast (from 3400 to 2550 m waterdepth) and to the southwest (from 3350 to 3000 m) of the seamount, respectively.

In the west margin of the bathyal plain at a distance of 40-45 Km from the Marsili physiographic axis, an overall round-shaped high of the magnetic field with maximum intensity of about 170 nT is present. To the east-southeast, at an approximate distance of 35 Km from the seamount axis another round-shaped positive anomaly occurs which has an intensity up to about 60 nT. ODP Site, 650, located in the western margin of the Marsili basin, bordering the positive widespread anomaly (170 nT) mentioned above, succeeded in its aim of ascertaining nature and age of the deep-seated igneous floor: volcanic manifestations having (altered) basaltic andesite composition took place around 1.9-1.7 Ma ago.

Chronological data now available clearly indicate a diachronous activity, that is the interarc volcanism of the Vavilov and Marsili abyssal plains developed after the magmatic activity ceased in the adjacent remnant arc to the west and before it started in the new one to the east. Also in the Mariana arc-backarc sequences, during the early stages of interarc basin opening, arc-related volcanism is absent both on the remnant arc and the migrating forearc plate. Despite the significant differences concerning the crustal basement and the rispective geological frameworks, the Tyrrhenian basin and the above-mentioned region share fundan1elltal analogies, in terms of timing of tectono-magnetic events.

Specific questions to address in the Marsili region include: - Where did the early stages of the oceanization occur?

- Which were the composition, serial affinity, distribution and evolution of the rocks as the back-arc basin widened and foundered?
- Which were they as the basin ridge grew in height?
- To what extent was the composition of late-stage magmas which erupted at greater depth of the axial zone arc-like? Was the arc signature less pronounced than at shallower depth?

In the Marsili basin a first objective of drilling would be in the site of a positive roundsh.lped magnetic anomaly located in the eastern margin of the plain. It is expected that this site should provide valuable information on the age, petrochemical character and distribution of the early stage of the igneous crust formation, and hence on the decoupling mechanism of the subducted segment of the Adria-African plate apart from the overriding Tyrrhenian lithosphere.

A second objective of drilling would be in the site of negative magnetic anomaly located in intermediate position between the positive anomalies of the Olduvai and Brunhes. As mentioned above, the products associated to the positive magnetic anomalies of Brunhes and Olduvai occur, respectively, in the axial zone and the western margin of the Marsili basin. This site could be located in the area of the lateral relief to the WNW of Marsili volcano. It is expected that the site should ascertain whether the magmatic products related to this anomaly are intermediate in age (late Matuyama) or not, with respect to the adjacent igneous bodies.

A third objective of drilling would be in the site of the intense positive magnetic anomaly. Its location could be at the southern axial edge of Marsili volcano where deepseated basement of the late stage is expected to be present. One of the major objectives of this site is to study the nature of the volcanites with respect to the greater depth of the axial zone. Products from greater axial depth should have composition with less pronounced volcanic arc sigllature and maybe MORB-like characteristics.

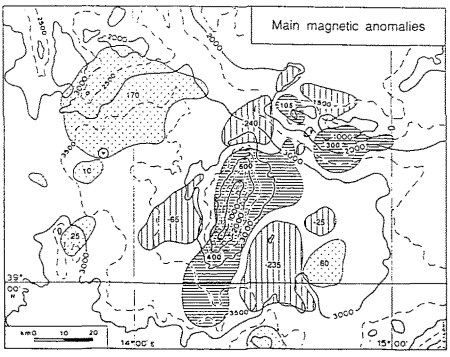

Fig. 1 - Main magnetic anomalies and bathymetry of the bathyal plain of Marsili (SE Tyrrhenian Sea). Bathymetry intervals of 1000 and 500 m (dashed lines). Marsili smt. is located about 45 nm to the NW of the islands of Salina and Lipari (Aeolian arc).
Stippled = positive anomalies of the Olduvai event, or presumed to belong to the Olduvai; circle and triangle = ODP Site 650; north-south stripes = negative anomalies presumed to belong to the late Matuyama (post-Olduvai); east-west stripes = positive anomalies of the Brunhes.

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