Geology and Petrochemistry of the Centraltyrrhenian Volcanoes

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Summary - A geological, petrochemical and radiometric study of samples dredged from the three great central-tyrrhenian volcanoes (Seamounts Magnaghi, Vavilov and Marsili) has brought to light two volcanic associations, one from transitional to tholeitic (Sm.s Magnaghi and Vavilov) and the other calc-alkalic (Sm. Marsili), demonstrating that the latter has a notable resemblance to the Aeolian volcanism.

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Magnaghi, Vavilov and Marsili seamounts, the three volcanoes which rise from the tyrrhenian bathyal plain, were studied geologically, petrochemically and radiometrically. The resulting data led to conclusions which relate not only to the nature of the constituent rocks of these structures, but also to the geological evolution of the central-southern tyrrhenian area.

Geodinamically, these are three volcanoes consisting of large lavic crests, with elliptical base, set on large vertical or normal crustal faults, which are N15°E oriented and generated by the same tectonic stresses.

In spite of the parallelism of the three structures, the volcanoes are inserted in two different regional tectonic environments. Infact Magnaghi and Vavilov Sm.s were originated by faults with the same orientation, which characterize the surrounding Sardo-Corso-Tyrrhenian microplate. Marsili Sm.,instead,is isolated and surrounded by a network of variously oriented faults,which generated the Aeolian volcanic ring.

On the basis of both the absolute datings and the fossil faunas, it can be concluded that, from genetic point of view, the volcanoes are related to the general extension of the tyrrhenian area, which began about 3.5 million years ago. Furthermore, taking into account late NE-SW morphological lineations seen on Vavilov and Marsili Sm.s, it can be assumed

that the central-southern tyrrhenian expansion up to ca. 800.000 years ago was characterized by an almost E-W orientation and later assumed a NW-SE direction.

The petrographic study enabled the examined samples to be subdivided into two groups, one consisting of plagioclase, olivine and clinopyroxene, and the other of plagioclase, clinopyroxene and amphibole.

The petrochemical data allowed a sharper division, defining two volcanic associations, one from transitional to tholeitic, and the other calc-alkalic. The former is the only one present (based on the few samples at our disposal) in the Magnaghi and Vavilov volcanoes. The second was encountered in almost all of the Sm. Marsili samples.

When the samples described in the literature (Maccarone 1970, Del Monte 1972, Barberi et al. 1974, Keller and Leiber 1974), as well the ones we studied, were projected onto the diagrams of Pierce and Cann (1973), the lavas of Magnaghi and Vavilov volcanoes prove to belong to within plate basalts; whereas those of Marsili Sm. are calc-alkalic basalts, closely resembling the Aeolian volcanic rocks. This resemblance is even greater applying the K_2O-SiO_2 diagram.

These two magmatic associations are in perfect agreement with the two different tectonic environments, in which Magnaghi and Vavilov Sm.s on one hand, and Marsili Sm. on the other are placed, as shown above.

Available radiometric dating established 2.7-3.0 million years for Magnaghi volcano and 0.2 million years or less for the last eruption of Marsili Sm. These data agree very well with the age deduced by micropaleontological investigations, i.e.: upper Pliocene for the beginning of Sm. Magnaghi's activity and upper Pleistocene or Olocene for the last eruption of Marsili volcano.

Thus Marsili volcano and the Aeolian ring's volcanoes, in addition to a close magmatic similarity, also have in common a relatively recent date of the volcanic activity.

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