MUD VOLCANOES ON THE MEDITERRANEAN RIDGE : DISTRIBUTION AND POSSIBLE MECHANISM OF FORMATION

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About twenty new mud volcanoes and mud diapirs on the Mediterranean Ridge south of Crete were discovered during the TTR-3 Cruise of the R/V Gelendzhik (June-July 1993) with the aid of swath survey with two types of sidescan sonars. Nine of them were checked by bottom sampling and the mud breccia were found occurring at shallow depth (a few centimetres to a few metres) below the seafloor. The comparison of the coordinates of the newly-discovered mud volcanoes and the highly reflective patches in the GLORIA mosaic (KENYON *et al.*, 1982) shows that most of these patches (with the possible exception in the Hellenic Trench area) represent not the dissolution structures related to the Messinian evaporites but mud volcanoes and mud diapirs.

These structures are widespread on the Mediterranean Ridge, especially south and west of Crete and they concentrate mainly in the crestal and inner parts of the Ridge, decreasing in size towards the Ridge flanks. The structures are mostly elongated and are aligned according to the general trend of the Ridge. Many of them are related to the principal thrust(?) planes.

The mud volcanism and diapirism phenomenon is closely tied to the Mediterranean Ridge accretionary complex evolution. A strong lateral compression results in stacking of sedimentary slabs with different lithologies and densities, contacting along thrust planes. Less dense plastic rocks saturated with gas and fluid could be overlain by denser rocks. This would create the density inversion and overpressuring in the plastic units, giving rise to the diapiric growth or the breakthrough of the deep-seated material to the seafloor along fault and thrust planes. At the same time, tectonic compressional stress across the Ridge can squeeze plastic material upward to the seafloor. The role of the Messinian evaporites in this process seems to be insignificant. They hardly can form an impermeable layer enhancing the overpressuring effect in the underlying rocks. Recently obtained seismic data (HIRSCHLEBER *et al.*, 1994) confirmed by the data of the TTR-3 Cruise suggest that the Messinian is missing at many places on the Mediterranean Ridge crest. Moreover, we suppose that the mud volcanoes and diapirs are located just at the places where the Messinian is missing, otherwise the greatest manifestation of the mud volcanism should be expected on the southern Ridge flank covered by relatively thick Messinian layer.

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COBBLESTONE AREA ON THE WESTERN MEDITERRANEAN RIDGE : RE-VISITED AGAIN. A PRELIMINARY REPORT

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During the 4th Training-through-Research Cruise (1994), the underway 2-day investigations in the Cobblestone area on the western Mediterranean ridge were carried out with the OKEAN long-range sidescan sonar and the MAK-1 deep-tow acoustic system. This area was chosen by two reasons :

(i) the Prometheus mud diapir in this locality was the first one discovered on the Mediterranean Ridge, and its mud breccia contains the fragments of the oldest (Middle Cretaceous) rocks (CITA *et al.*, 1981; RYAN *et al.*, 1982);

(ii) on the Gloria mosaic, compiled by KENYON *et al.* (1982), some highly reflective patches arranged along a single lineament are seen in the Cobblestone area. The position of one ot them coincides with the known position of the Prometheus mud diapir, that is why other dark patches were supposed to be mud diapirs and mud volcanoes as well.

Two parallel tracks ran with the OKEAN sidescan sonar roughly in a N-S direction allowed us to make the mosaic for the area with a total swath range of about 25 km. Some features with intensive backscatter on that mosaic turned to be wide outcrops Hellenic Trench system. However, at least four dark patches looked very similar to mud volcano images obtained in the Olimpi mud diapir field in 1993 (LIMONOV *et al.*, 1994). On the basis of that mosaic, a MAK-1 line was run between the two OKEAN lines and continued further North, beyond the area covered by the OKEAN swath. The length of the line is about 40 km with the swath range of 2 km. Along this line, six circular structures have been recorded. All of them have a diameter of 2-2.2 km and a relative height of up to 130 m. These structures are closely spaced and sometimes have common borders. Three of them are typical mud volcanoes with craters 100-200 m in diameter and extensive mud flows on their slopes. The cores from them gave the mud breccia below a few tens of centimetres of oxidized Holocene sediments. The clasts from the mud breccia are very variable in composition, and, according to the preliminary shipboard microfossil definitions, may have the age from Cretaceous to Pliocene. The rest of the circular structures are probably inactive extinct mud volcaneos. They have well-defined rims and are covered by an approximately 30-m layer of acoustically stratified sediments pinching out toward the rim. The margin of one of them is protruded by a narrow cone-like feature which could be a clay diapir. The new discovered mud volcanoes are undoubtedly related to a system of thrust plains parallel to the general trend of the Mediterranean Ridge and they may reflect several stages of tectonic activity of the ridge.

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