

**PHYSICAL PROPERTIES OF “EXOTIC” SANDSTONES FROM MUD VOLCANIC DEPOSITS IN THE MOROCCAN MUD VOLCANIC PROVINCE (MOROCCAN CONTINENTAL MARGINE, THE GULF OF CADIZ)**

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During the TTR12 cruise (2002) large amount of sandstones’ fragments were observed on TV-lines AT34 and AT39 across the Al Idrissi and Mercator mud volcanoes. Three dredging stations were done. Collected sandstones (from 0.1x0.05x0.05 m to 0.3x0.2x0.1 m in size) were not typical for mud volcanic deposits, so were called “exotic”. In the MSU laboratories dating and thin section description of the sandstones were performed. They were described as Late Miocene-Pleistocene coarse- to fine-grained sandstones and siltstones with admixture of foraminifera and bioclasts cemented by poikilitic calcite. Collected rocks were determined as similar to the Late Miocene-Pleistocene sandstones of the Rharb basin of Morocco (Akhmanov et al., 2003) (Fig. 1).

During the TTR14 cruise fragments and slabs of similar medium- to fine-grained sandstones with foraminifera were observed and retrieved from the Kidd and Fiuza mud volcanoes. Collected rocks have size about 0.2x0.1x0.05 for fragments and 0.5x0.5x0.2 m for slabs. Dating and thin section description of the sandstones was performed. These sandstones are analogous with “exotic” sandstones from the Al Idrissi and Mercator mud volcanoes.

Several sandstone samples from the Kidd (AT-528Gr), Fiuza (AT-566D), Al Idrissi (AT-412D) and Mercator (AT-409D) mud volcanoes were selected for laboratory studies of their physical properties by a set of methods:- granulometric composition
- total carbonate content
- porosity measurement
- density measurement
- determination of permeability.

According to the laboratory results sandstones from the Kidd and Fiusa mud volcanoes have the sorting coefficient from 1.5 to 1.8 (well-sorted) by the Trask scale. An average grading is 0.4 mm.
The sorting coefficient of sandstones from the Al Idrissi and Mercator mud volcanoes are changing in rage between 1.3-1.5 (well-sorted) by the Trask scale. An average grading is 0.41 mm. Carbonate content analysis shows that samples from the Kidd and Fuisa mud volcanoes contain about 45-48% of calcite, and some of them more then 50%, that could be explained by development of calcite veins. Rocks from the Al Idrissi and Mercator mud volcanoes content 20-25% of carbonates. Samples from stations AT-528Gr and AT-566D have bulk density about 2.45 g/cm³; samples from AT-412D and AT-409D stations have density 2.48 g/cm³. Such differences in densities can be explained by the density difference between calcite and quartz: 2.5 g/cm³ and 2.65 g/cm³ accordingly. Porosity of all samples is from 4.8 to 19.8%. An average value of permeability for these samples is about 3 mD. The permeability of these rocks is related to their fracturing. Not fractured plugs have the permeability less then 1 mD, while the fractured plugs have permeability up to 13 mD. In spite of the fact that the studied samples have some differences in their physical properties, we can conclude about their similar nature.

Late Miocene–Pleistocene sandstones were described as reservoirs for gas in the Rharb basin, Morocco (Pratsch, 1995). The studied rocks have low reservoir properties for hydrocarbons accumulation. Due to the low porosity and permeability these rocks can form good capping for hydrocarbon traps at the Moroccan continental margin in the Gulf of Cadiz.

References


Pratsch J.-C., 1995. Prelif-Rharb area of Morocco may be new hydrocarbon province. Oil & Gas Journal, 93, 49: 72-76

SEA FLOOR EXPRESSION OF SEDIMENT EXTRUSION AND INTRUSION AT THE EL ARRAICHE MUD VOLCANO FIELD, GULF OF CADIZ

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The El Arraiche mud volcano field was discovered during the CADIPOR survey by the RV Belgica in May 2002 in the Moroccan Atlantic margin in the Gulf of Cadiz. It consists of 8 mud volcanoes of varying size and shape just below the shelf edge. The largest mud volcano in the field (Al Idrissi mud volcano) is 255 m high and 5.4 km wide, the smallest we observed is only 500 m wide and 25 m high. The morphology of the mud volcanoes consist of, from base to top: a moat around part of the base of the mud volcano cone, an irregular slope characterized by radial outward sediment flows, terraces and/or depositional sediment flow escarpments (lobe fronts), a crater depression or a flat top, and a central dome.

The 2002 surveys by the RV Belgica and the RV Professor Logachev yielded detailed swath bathymetry over the entire area, dense grids of high-resolution seismic data, very high-resolution deep-tow sub bottom profiles, side scan sonar mosaics over the major structures, selected video lines, TV-grabs, dredge samples and gravity cores. The large amount of sea floor data and the clear shape of the larger mud volcanoes prompted us to focus on the morphology of the mud volcano cones. Although mud volcanoes are prominent features in the submarine sea-scape little attention has yet been given to their small-scale morphology. Mud volcanoes in their broadest sense refer to any extrusion of mobilized sediment. Mud volcanoes sensu