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Organic matter from the rock clasts in the mud volcanoes of the Gulf of Cadiz

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During several international cruises of UNESCO-IOC Programme "Training-Trough-Research" the investigations in the Gulf of Cadiz were focused on hydrocarbon seep areas characterized by widespread underwater mud volcanism. The main products of mud volcanoes are water and gas saturated mud breccia. Mud breccia usually appears as subrounded to angular clasts embedded in dark to light grey silty clayey matrix. The organic matter (OM) of the rock clasts from mud breccia in the different mud volcanoes from water depth 300-4000 m were analysed with big set of organic geochemical methods such as fluorescent analysis, Rock-Eval pyrolysis, chemical extraction, gas-chromatography, gas-chromatography-mass-spectrometry and others.

Fragments of rocks from different mud volcanoes are represented by large variety of lithotypes: bioclastic or micritic limestones, marlstones, claystones and sandstones, fragments of magmatic and metamorphic rocks. The clasts from the mud volcanoes derived from different sedimentary rocks range in age from Cretaceous until Pliocene; Miocene rocks are being most important in volume.

About half of the studied clasts are virtually devoid of OM, with total organic carbon (TOC) contents lower than 0.05%. The remaining show TOC content ranging from 0.06 to 10%. Organic-rich samples ($>$ 1% TOC) correspond to claystones and micritic limestones, while sandstones and bioclastic limestones display lower OM contents.

According to wide range of hydrogen index (HI)-values (21 to 654 mg HC/g TOC), estimated by Rock-Eval instrument and result of elemental analysis (H/C), OM of the studied samples can be attributed to Types II, III. The maximum of hydrocarbon pro-

duction (Tmax) values of all studied samples are relatively low ($< 438°C$ with a mean value around $423°C$), indicating that organic matter has not experienced strong thermal maturation. Low maturity of OM is also confirmed by distribution of biomarkers.

Generally, OM of the rock clasts belongs to immature and low mature kerogen of the II and III types. Level of maturity and significant range (from poor to excellent) of oil/gas potential of the samples suggest, that OM of the study rocks can produce mostly gas from upper gas window zone, and quantity of this gas strongly depend on TOC and type of kerogen.