

# HYDROCARBONS AND BIOMARKERS IN MUD-BRECCIA SEDIMENTS FROM NEW MUD VOLCANOES DISCOVERED IN THE GULF OF CADIZ: PRELIMINARY RESULTS

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This work presents the preliminary results on hydrocarbons and other biomarkers analyzed in mud-breccia sediments from three new mud volcanoes discovered in the Gulf of Cadiz during the MVSEIS\_08 cruise on-board *R/V Hespérides* (ESF EuroCORE-EuroMARGINS programme). Two mud volcanoes are located in the Moroccan Margin and named as *Madrid*, aligned along a main strike-slip fault; and *MVSEIS* mud volcano, found at the front of one thrust ridge. The third mud volcano is located in the Spanish Margin and it was named as *Gazul*, sited at only 380 m water depth, and also related to active faults.

A total of 35 sediment samples were taken along the gravity cores TG-10, TG-11 (*Madrid* mv), TG-14 (*MVSEIS* mv) and TG-29 (*Gazul* mv). About 4-8 g of freeze-dried sediment per sample was crushed-powdered and biomarkers were extracted with an ASE 200 system and analyzed by GC-MS following the Laboratory of Biomolecular Stratigraphy protocol. Components were identified with the Data Analysis program and the Wiley Library.

We can observe two different compositions in the samples from the Iberian and the Moroccan margins respectively.

## Moroccan Margin:

The sediments from the *Madrid* and *MVSEIS* mud volcanoes are characterized by the high abundance of sugar derivative compounds (Fig. 1A). Twenty five different substances have been identified, essentially glucosides, galactosides, glycosides and levoglucosan. All these compounds could be related to the metabolic action of aerobic and anaerobic bacteria and fungi.

The n-alkanes are in lower abundance in these samples (Fig. 1B). N-alkanes comprise a unimodal distribution with an odd-over-even carbon number predominance, ranging between 15 and 34 carbon atoms, maximizing at the n-C<sub>31</sub> homologue with an important presence of n-C<sub>29</sub> and n-C<sub>27</sub> isomers. The distribution and the predominance of high molecular weight n-alkanes indicate the presence of immature organic matter from terrestrial origin. The carbon preference indexes (CPI) range from 1.6 to 3.2, which are characteristic of samples with different degree of maturity. Pristane and phytane and/or crocetane were detected in all the samples studied

The distribution range of carbon numbers of *n*-ketones is C<sub>21</sub> to C<sub>31</sub> and they exhibit odd over even carbon number predominance, maximizing at the C<sub>23</sub> or C<sub>27</sub> homologue, which is coherent with the n-alkanes results and interpretation.

Fatty acids were detected in all the samples showing a distribution ranging from the C<sub>10</sub> isomer to the C<sub>32</sub> homologue with maxima at C<sub>18</sub> and C<sub>16</sub> which indicates a bacterial origin.

High contents of elemental organic sulphur have been detected in different sections of mud-breccia flows in the cores TG-10 and TG-11, indicating sulphate-reducing bacterial activity.

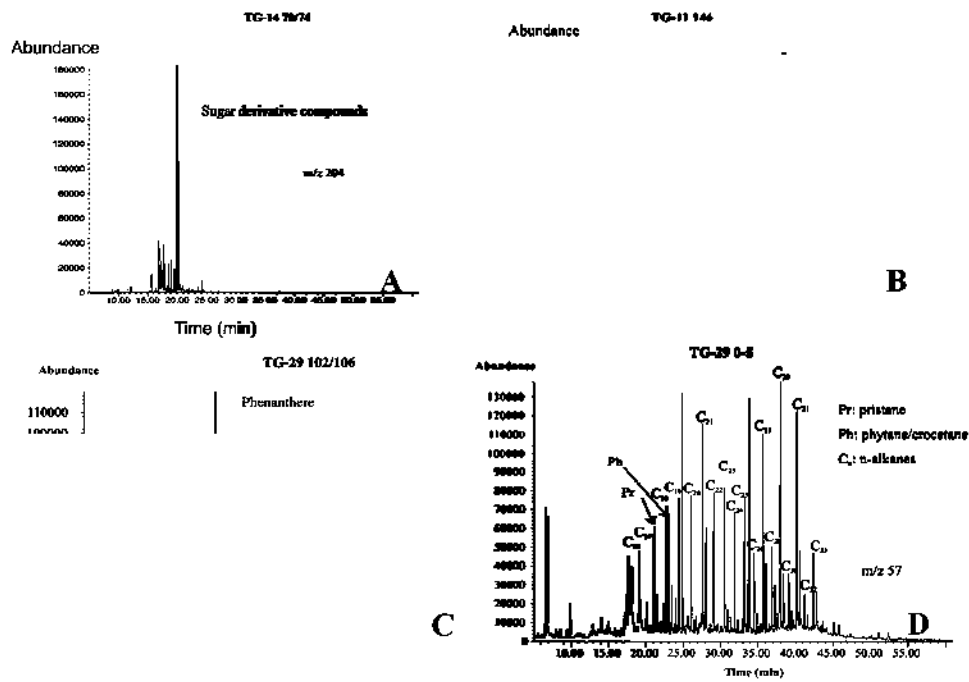
Squalene is present in the samples; it is a lipid present in methanogenic, halophilic and thermoacidophilic archaea and precursor of squalane which appears in petroleum.

#### Iberian Margin:

The sediments from the *Gazul* mud volcano are characterized by the high abundance of n-alkanes and the absence of sugar derivative compounds (Fig. 1C and D). N-alkanes comprise a bimodal distribution with an odd-over-even carbon number predominance, ranging between 10 and 34 carbon atoms, maximizing at both n-C<sub>19</sub> and n-C<sub>29</sub> homologue. This indicates the participation of mixing sources of organic matter: bacterial/algae and terrestrial. The similar abundance of the odd and even chains is indicative of the maturity of the organic matter. In fact, the carbon preference index (CPI) ranges from 1.3 to 1.9, which is characteristic of samples with an important degree of maturity. In addition, phenanthrene was detected in the samples analysed (Fig. 1C), and pristane and phytane and/or crocetane were also detected (Fig. 1D).

The distribution range of carbon numbers of *n*-ketones is C<sub>23</sub> to C<sub>29</sub>, confirming the presence of organic matter from terrestrial origin.

Fatty acids were detected in all the samples showing a distribution ranging from the C<sub>16</sub> isomer to the C<sub>26</sub> homologue with maxima at either C<sub>16</sub>, which indicates a bacterial origin, or C<sub>24</sub>, suggesting a terrestrial origin. High contents of elemental organic sulphur have been detected in different sections of mud-breccia flows, indicating sulphate-reducing bacterial activity.



**Fig. 1.** Examples of organic geochemistry of bitumen's extracted from the mud-breccia sediments and analyzed by GC-MS. A) *MVSEIS* mud volcano. B) *Madrid* mud volcano. C and D) *Gazul* mud volcano

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