Hydrocarbon Generation Potential of the Diatomites, Western Crete, Greece

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ABSTRACT

Diatomites are lightweight, soft, fine-grained, medium-consolidated sedimentary rocks that are rich in biogenic silica. They primarily consist of microalgae siliceous frustules from diatoms, including silicoflagellates, sponge spicules, and/or radiolarian [1]. These organisms thrive in both terrestrial and aquatic environments, and diatomites are found across most regions of the world, with a notable presence in the Mediterranean. Although their geographical and biostratigraphical distribution in Greece is not well-documented, they have been predominantly identified in Neogene age formations both on the mainland and on the islands. Diatomites are utilized in multiple industries, with their two main applications being commercial extraction and processing into diverse products [2]. Such products are used in building construction, the food industry, and other sectors such as chemical manufacturing and agriculture as well as advanced nanomaterials. They can be used as proxies for both paleoenvironmental analysis and in hydrocarbon exploration. Despite their global importance and potential as source rocks (SRs) for hydrocarbons, relevant research in Greece has been indeed limited.

This study concentrates on the Diatomites as SRs and provides a detailed geological and geochemical analysis of a Neogene outcrop (KV#) in Chania Prefecture, Crete. The findings corroborate our previous research ([1], [3]) and contribute to the growing understanding of the region's hydrocarbon prospectivity. The outcrop is divided into four sections: KV# (basal part), KVB# (mid part), KVC# (lateral extension), and KVTOP# (upper levels). A total of 92 samples were selected and analyzed, including 50 diatomitic samples and 42 other lithologies such as silty mudstones (SM) and laminites. Rock-Eval 6 (RE VI) pyrolysis was applied to determine key parameters, including Total Organic Carbon (TOC), S2 [hydrocarbons released by the organic matter (kerogen)], and Hydrogen Index (HI, the ratio of hydrogen to organic carbon), all of which indicate the rock's hydrocarbon potential (HP). Additionally, a samples subset underwent Gas Chromatography-Mass Spectrometry (GC-MS) for biomarkers identification. Scanning Electron Microscope (SEM) imaging and X-ray Fluorescence (XRF) analysis were employed to get the geochemistry and better resolution of preservation/alteration.

The results are highly promising, since several samples proved with very good HP. The findings significantly enhance our understanding of the energy/hydrocarbon sector by identifying these samples as new potential SRs, particularly in Greece, leading to the country's independence. They may have also served as such for the new offshore discoveries of natural gas accumulations in the Eastern Mediterranean (e.g. Zohr field).

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