SOURCE ROCK CHARACTERIZATION OF THE MAJOR CYPRUS MARGINS: GEOCHEMICAL AND GEOLOGICAL IMPLICATIONS.

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During the last decade, the Eastern Mediterranean Sea has become an important exploration target, since large gas fields have been discovered by petroleum companies. Whereas Egypt, Israel, and Lebanon are studied quite well in terms of their petroleum systems, there is almost no geochemical data available yet dealing with petroleum source rocks in the area of Cyprus. In this work, potential source rock intervals of Cretaceous to Pliocene age were analyzed from both, onshore Cyprus as well as from two wells drilled by the International Ocean Discovery Program (IODP) at the northern slope of the Eratosthenes Seamount, using a combination of classical organic geochemical methods (e.g. Rock-Eval pyrolysis, organic petrography, bulk kinetics, biomarkers) in order to investigate the evolution of the source rock properties in complex tectono-stratigraphic sedimentary basins.

Here 67 potential source rocks from onshore Cyprus were sampled. The obtained results indicate the presence of organic matter-rich intervals within at least two different geological formations. The first one corresponds to the Upper Pachna Formation. It is mainly composed of Tortonian coral reef carbonates, and spans a wide range of different, proximal to distal facies (Eaton & Robertson, 1992). Locally dark mudstones with high total organic carbon (TOC) content of around 5 wt.% are interbedded between beige grainstones. The organic matter is mainly composed of a highly oxidized type II kerogen. Both Rock-Eval and biomarker data as well as organic petrographic observations also illustrate that the organic matter in this formation is immature. The second promising interval can be found within the Middle Triassic Vlambouros Formation. Shaly layers rich in plant remains are interlayered between calcarenites and show low-moderate TOC values of around 1 wt.%. For this formation, organic geochemical data reveal that organic matter is early mature with respect to petroleum generation.

In addition, 44 samples from offshore Cyprus were retrieved from the IODP Leg 160, wells 966 and 967 and comprise samples from Upper Cretaceous to Messinian age. The samples represent kerogen type II-bearing, organic rich (0.5 to 9 wt.% TOC) marine marls and shales, which have been deposited during high primary productivity phases. All investigated samples are thermally immature with average T_{max} values of 414°C. However, bitumen staining indicates hydrocarbon generation in underlying source rock intervals. Furthermore, S2 values of 11.40 mg HC/g rock and up to 49.70 mg HC/g rock in Bartonian to Pribonian intervals propose a generally high hydrocarbon generation potential in areas of deeper burial. However, source rock thicknesses could not be determined accurately due to very low recovery rates (< 15 %).

Since it is known from already discovered fields such as the Aphrodite and Leviathan that gas is mainly of biogenic origin in the Eastern Mediterranean (Needham, 2013, Wygrala et al.,

2014) also source rocks with low TOC values and even low burial depths might play an important role in terms of hydrocarbon generation.

All raised data will be used to build a large-scale numerical model, which will not only focus on the area of Cyprus, but also include previous studies such as Bou Daher et al. (2014-2016) which focused on the eastern margin of the Levant Basin and the area of Lebanon. The first step will be the simulation of the initial distribution of organic matter using the DionisosFlow software. Subsequently, these simulated source rocks will be implemented into one large 3D petroleum basin model (TemisFlow) to simulate the tectonic and geological evolution of the Eastern Mediterranean Sea, provide assumptions on hydrocarbon generation and migration and predict possible accumulations.

References

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