Biomarker evidence for intense aerobic methane oxidation during sapropel conditions

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Here we report for the first time the observation of bacteriohopanepolyol (BHP) biomarkers including highly diagnostic structures indicative of aerobic methane oxidising bacteria in sapropel units S1 and S2 from the Eastern Mediteranean (Core MS66PC; location 33N1.9'; 31E47.9'; waterdepth 1630 m) off the River Nile. The most specific marker 35-aminobacteriohopanepentol, known only from Type I methanotrophs [1], was the most abundant aminoBHP in both units investigated. This compound, together with related structures, has previously been reported from the oxic/anoxic transition zone of the Black Sea water column [2, 3] as well a a range of lacustrine sediments [4, 5, 6], terrestrial environments and sediments from the Congo and Amazon deep sea fans up to an age of 1.2 Ma [7].

By analogy with their occurrence in the Black Sea water column we hypothesise that the target biomarkers are focused to periods of increasing or decreasing deoxygenation in the run-up or recovery from sapropel conditions, however, more detailed knowledge of the exact timing of these first biomarker observations is vital. Comparison with other geochemical evidence on productivity (e.g. Ba) and redox (trace elements) is ongoing and will support the biomarker interpretation. Work on S1 and S2 sections in other deep basin cores will complement the interpretation.

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Origin of the Lower Triassic Feixianguan Formation oolitic shoal reservoir, Sichuan Basin, Southwest China

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Oolitic shoal reservoir of the Lower Triassic Feixianguan Formation in the Sichuan Basin (southwest China) has big success in hydrocarbon (especially gas) exploration recently, as some giant, large and middle gas fields have been discovered, such as in the Luojiazhai, Dukouhe, Tieshanpo, Puguang and Longgang areas. Hence, origin of the shoal petroleum reservoir receives large research attention in recent years. In general, it is commonly accepted that the reservoir is subject to multiple geological processes, predominantly including dolomitization, and burial dissolution; otherwise, the reservoir has also been reported to be facies-controlled. However, of the three main geological processes, which is the most fundamental and how the reservoir evolve remains in dispute. This paper represents a try to improve the understanding on this issue, i.e. origin of the reservoir.

The reservoir has five basic features, including the reservoir being facies-controlled, reservoir space consisting mainly of residual intergranular or solution-enlarged residual intergranular pores, grains mainly in line- to concave convex-contact, only submarine cement developing in grain contact zone, and some cements without solution. This indicates that the reservoir is developed fundamentally on the basis of primary intergranular pores. Burial dissolution is not the main factor controlling reservoir development, as it only alters and adjusts the reservoir to certain degrees, whereas does not change reservoir distribution and not improve reservoir quality in a general sense due to mass balance.

In summary, the formation of the Feixianguan shoal reservoir is a complex process. Depositional environment is the primary factor controlling reservoir initial formation, while early compaction and shallow burial cementation is the key to reservoir formation. Then, multi-stage burial dissolution has alteration on reservoir. As to the last stage charge of gaseous hydrocarbons, they have little diagenetic effect, and the reservoir is finally formed.