Putting age into the equation: A new look at microbial distribution in subseafloor sediments

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At any given depth cell abundance in subseafloor sediments varies by up to six orders of magnitude between sites. To a large extend this variability correlates with mean sedimentation rate and distance from land. This relationship can therefore be used to predict subseafloor cell abundance.

Usually, decrease in subseafloor microbial abundance at each site can be described by a logarithmic function. However, at some sites, e.g. IODP Exp. 320, Site U1334 from the equatorial Pacific Ocean, cell distribution strongly deviates from this trend and cannot be described by a simple equation.

In order to better understand why cell distribution at some sites exhibits such unusual patterns it is necessary to take a closer look at sedimentation rates and therefore sediment ages as well. The sites that were drilled by IODP Exp. 320 and 321 recovered a continuous Cenozoic record of the paleoequatorial Pacific by coring above the paleoposition of the highly productive equatorial upwelling zone at successive crustal ages on the Pacific plate. Although some of the unusual cell distribution is caused by strong geochemical gradients and diagenetic alteration fronts, the significant differences in sedimentation rates between within and outside the upwelling zone appear to be a major cause for the strong deviations in cell abundance from the expected logarithmic decline with depth.

Subseafloor microbial communities have to subsist without fresh supply of organic matter, which becomes increasingly recalcitrant with increasing age. When assigning ages to cell count data from different oceanic regions, these cells vs. age correlation show less variability between sites than correlations vs. depth.

These observations suggest that subseafloor microbial abundance is controlled by organic matter reactivity, which is largely controlled by sediment age. Using age instead of depth models might provide important clues about the finer details of subseafloor cell abundance, especially in areas that have not fitted into previous models.

Biogenic or abiogenic hydrocarbon source of Melekes Depression

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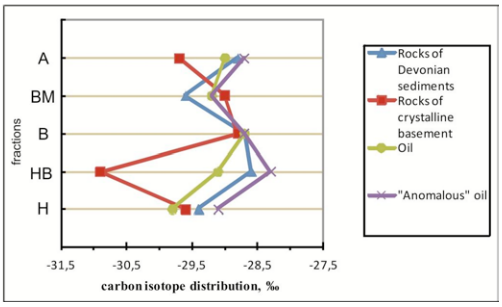
The question of hydrocarbon origin is an important problem in Tatarstan, where some of the geologists suggest the existence of abiogenic hydrocarbon "inflow" to sedimentary oil fields. Core samples for the study of the organic matter were taken from Devonian sediments (DS), as well as from the rocks of the crystalline basement (CB). The oil was taken from the main productive complexes of seven fields within the studied areas and from the so-called "anomalous" boreholes of the Romashkinskoye supergiant field, where the inflow of deep hydrocarbons is possible. The distribution of the isotope ratios of carbon between different fractions was studied in oil and extracted bitumoids of rocks by the method [1].

In the studied oil the sufficiently common type of carbon isotope distribution by fractions was found (Figure). This type of oil consists of the sapropelic type of organic matter and mixed type, which is formed by a certain percent of humus and aquahumus materials. The "anomalous" oil completely coincides with other samples of oil. So there is no reason to assume for them any other source of hydrocarbons. Bitumoids extracted from the organic matter of DS, with a few exceptions, are of the same genetic type as the studied oil.



Bitumoids extracted from the rocks of CB carry traces of thermal and hydrothermal effects missing in the oil of sedimentary strata [2]. Therefore, they may be the product of thermal alteration of sedimentary naphtides but cannot be primary with regard to the last one. Thus, the biogenic hydrocarbon source of Melekes Depression is proved.

[1] Galimov (2006) *Organc Geochem*. **10**, 1200-1262. [2] Kamaleeva *et al*. (2013) *Geochemistry Int*. **1**, 13-22.

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