An impact of water activity on microbial activity - A case study of IODP Expedition 337

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Water activity is one of the important factors that can limit and preserve the microbial growth in soils and foods as well as in deep sediments biosphere. However, water activity for the subseafloor sediments had not been measured so far, the correlation between water activity and microbial activity was not clear. In this study, water activity in relation to microbial activity for the deep sub-seafloor environments was studied by using core samples obtained from Integrated Ocean Drilling Program Expedition 337, the deep-water coal bed basin off Shimokita. The water activities of core samples were measured by using two commercial water activity sensors, Lab Touch-aw (Novasina, Switzerland) and WP4-T (Decagon Devices, Inc., USA) at 25 ºC of temperature.
Water activity at the depth from 0 to 2466 mbsf ranges from 0.96 to 0.98, which represents much greater habitable environment for most micro-organisms, though the correlation between water activity and microbial biomass is not clear. The water activity of sedimentary rocks is not affected by lithology, porosity, or relative change of water contents. Instead, water activity depends more on NaCl concentration. Moreover, the measured water activity is in good agreement with the prediction made from the Rault’s law in corporation with interstitial water chemistry measured on board. Apparent reduction of cell abundance associated with increase in water activity at four sites could be explained by the assumption that amount of nourishment for microorganism solved in pore water is proportional to solutes concentration. Strong correlation between cell abundance and porosity and free fluid content, which was evaluated from NMR logging, suggests that amount of energy sources and mobility of energy in the pores will account for the reduction in cell population with depth at basin off Shimokita.

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