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Distribution and evolution of organic matters in deep seafloor sediments collected during IODP Exp.338 and 348

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Seafloor sediments are important as a significant reservoir of organic matter, especially organic carbon and nitrogen. Sedimentary organic matters are mainly supplied through a photosynthetic process of phytoplankton biomass and other metabolisms of zooplankton and maturated during diagenesis (Lee *et al*., 1988). Proteins, peptides, and amino acid monomers are the main components and account for 30 – 40% of the total nitrogen and 10 – 15% of the total organic carbon content of seafloor sediments (Burdige and Martens, 1988). Some studies revealed the distribution and concentration of organic matters including hydrolyzable amino acids in shallow seafloor area (e.g., Cowie and Hedges, 1992; Kawahata and Ishizuka, 1993). The recent Integrated Ocean Drilling Program (IODP) Nankai Trough Seismogenic Zone Experiment (NanTro SEIZE) Expedition 338 and 348 at Site C0002 drilled and cored successfully up to 3059 mbsf. In this study, concentrations of hydrolyzable amino acids and maturation stage of organic matters in the sediments collected during the expeditions were determined in order to evaluate the distribution and evolution of sedimentary organic matters during diagenesis in deep seafloor.

Sediment core samples collected at Site C0002 (202.1 – 2216.9 mbsf), C0021 (3.7 – 186.4 mbsf), and C0022 (1.2 – 411.4 mbsf) were dried and powdered manually with an agate mortar on shore. The type and maturity of sedimentary organic matters were determined using Rock – Eval pyrolysis method at Japan Petroleum Exploration CO., LTD.

A part of the sediments were hydrolyzed to extract the amino acids from the hydrolyzable peptides and proteins. 1.0 g of the dried sediment was reacted with 6 N HCl at 110 ℃ for 22 h. The amount of total hydrolyzable amino acids (THAA) in the treated sample solutions were measured by high performance liquid chromatograph using postcolumn ortho-phthalaldehyde derivation.

The concentrations of THAA in the core collected at Site C0002 vary between 819.9 – 177.1 nmol/g, and Gly was the most abundant amino acid followed by Asp, Ser, Ala, Val, and Phe. At Site C0021 and C0022, the concentrations of THAA were 4679.2 and 6729.7 nmol/g at surface, respectively, and decreased drastically with depth. The THAA carbons account for $<$1% of total organic carbon and nitrogen, indicating that most of the biogenic organic matters would be changed into kerogens.

The amounts of hydrocarbons generated through thermal cracking of non-volatile sedimentary organic matter (S_2) were 1.2 – 0.15 mg/g. The low S_2 values and TOC (1.2 – 0.3 %) indicate that most of kerogen in the cores is categorized as type III. The temperatures at which the maximum release of hydrocarbons from thermal cracking of kerogen occurs during pyrolysis (T_{max}) were 379 – 416 ℃ at the shallow area (1.2 – 91.7 mbsf), increased gradually with depth, and reached to 439 ℃ at 2216.9 mbsf. Rock – Eval data indicate that the maturation of kerogens could be progressed with depth in seafloor sediment.

Keywords: Rock Eval, Kerogen, Amino Acids