

Chronology of marine sediments by amino acid racemization reaction

tomomi kondoh[1], Naomi Harada[2], Masao Iwai[3]

[1] geology, Sci, Kochi Univ., [2] JAMSTEC, [3] Kochi Univ.

Accurate age determination of geological sample is an absolute prerequisite for explaining the paleoenvironment. The purpose of this study is to establish amino acid chronology for age determination of siliceous sediments which have the time scale of several hundreds thousand years.

In this study, racemization reaction rate constant of aspartic acid (k_{Asp}) was estimated to be $0.90 \times 10^{-6} \text{yr}^{-1}$ for a purified siliceous sediment. This value might be useful to determine the age of sediments through the past 35 hundreds thousand years.

One of the most important paleoceanographic studies is to understand the marine environmental changes and its mechanisms related to glacial - interglacial cycles over the past 103 -106 yrBP. Accurate age determination of geological sample is an absolute prerequisite for explaining the paleoenvironment. Yet, there are no reliable direct dating methods that can be applied to marine sediments in the age range from 105 to 106 yrBP. Therefore we applied amino acid racemization reaction as a chronology to determine the geological age corresponded time scale of 105 -106 yrBP.

The purpose of this study is to establish the amino acid chronology for age determination of siliceous sediments which have the time scale of several hundreds thousand years by using aspartic acid. In this study, racemization reaction rate constants of aspartic acid (k_{Asp}) were estimated for siliceous and calcareous sediments in the northwestern North Pacific during the Cruise MR98-05. This is the first study for determination of k_{Asp} value in the siliceous sediment. Then, the k_{Asp} values of siliceous sediment were compared with the calcareous sediment, and also with the previous studies. The obtained results are as follows:

The k_{Asp} value of each subsurface sediment was $1.75 \times 10^{-5} \text{yr}^{-1}$ for a bulk siliceous sediment and $0.70 \times 10^{-5} \text{yr}^{-1}$ for a bulk calcareous sediment. The difference of the k_{Asp} value might be caused by the difference of features between the biogenic tests. On the other hand, the k_{Asp} value was $0.90 \times 10^{-6} \text{yr}^{-1}$ for a purified siliceous sediment. As a result, this k_{Asp} value ($0.90 \times 10^{-6} \text{yr}^{-1}$) corresponded to the previous k_{Asp} value ($0.99 \times 10^{-6} \text{yr}^{-1}$) determined by using calcareous samples, and this result suggests that there is no difference of k values between siliceous and calcareous sediments. Furthermore, the relationship between D/L ratio and age obtained by this study implies that the k_{Asp} value of $0.90 \times 10^{-6} \text{yr}^{-1}$ might be useful to age determination of sediments through the past 35 hundreds thousand years.