Compound-specific radiocarbon ages of biomarkers in the western North Pacific marginal sea sediments

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Compound-specific radiocarbon analysis (CSRA) of organic compounds, as well as compound - specific isotope analysis, provide valuable information on the origin and carbon cycling in the biogeosphere. Age of the bulk organic matter in the marine sediments is difficult to be perfectly accepted as realistic age of sediment due to the reworking "relict" problem of organic material such as humic detritus and age uncertainty of organic components from marine and terrestrial sources.

We present results of the CSRA of individual compounds (biomarkers) isolated from surface sediments in the southern Okhotsk Sea and the western North Pacific. The radiocarbon ages of biomarkers such as fatty acids, hydrocarbon, sterols and long-chain ketones (alkenones) have been analysed in order to obtain information of not only the dates but also origin and carbon cycles of organic compounds in marine systems. In the western North Pacific marginal sea, the radiocarbon diversity of individual compounds from the sediment have been first investigated to explore the compound-specific radiocarbon chronology as the alternative dating proxy to foraminifera-based chronology. The three multiple core samples were recovered from southern and northern flasks across the Kurile islands between southern Okhotsk Sea and western North Pacific. (MC-02: 46˚18'N, 152.32.E, water depth: 2796m, MC-03: 48˚14'N, 151˚59'E, 3245m, MC-04: 49˚22'N, 153˚00'E, 1822m) during the MR00-K01and MR00-K03 cruises of JAMSTEC R/V Mirai. We have found large age variability among individual compounds of assuredly different origins from both autochthonous (marine) and allochthonous (terrestrial) products in the same horizon of sediment core. The dating approach of CSRA had several problems in relation to difficulties of recovering target compounds with higher purities and realistic amount from sediment samples, and extremely small amount AMS ^{14}C analysis. However, to date we have achieved successfully these problems as the result of technical modifications of the PCGC system and graphitization of compounds for a microscale AMS analysis. Our results of CSRA using the bathyal sediments would provide the possibility as an chronology tool for estimating the age of sediment using organic matter for paleoceanographic study.

Age spectra of biotite as indicator of deformation rate: evidence from microchemical, structural, step-heating and laser $^{40}Ar/^{39}Ar$ analyses

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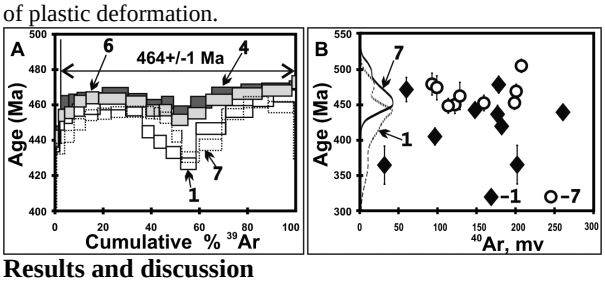
Introduction and geological background

Micas are most often used for $^{40}Ar/^{39}Ar$ dating of deformation events yet dependence of age spectra shape from rate of deformation is not clear totally. This study examines relation between rate of deformation and $^{40}Ar/^{39}Ar$ isotope record in biotite. Samples were selected from metapelitic layer of uniform composition passing through rigid lithon (0.5 km in size) inside Ak-Dagskaya shear zone of Sangilen massif (South-East Tuva, Russia). Ductile deformations are collected on borders of such lithons composed from metapelitic rocks. Microstructures are expressed by S/C fabrics, shear bands indicating sinistral sense of shear. Metamorphic conditions calculated using Bt-Grn geothermometers correspond to the late HTLP (M2) event dated to be of 468±6 Ma (Petrova, Kostitsyn, 1997) with higher temperature on the lithon borders relatively to internal parts.

Figure. 1. $^{40}Ar/^{39}Ar$ stepwise heating (A) and laser (B) data on biotite. Numbers 1 and 7 correspond to samples from opposite borders of lithon and are characterized by high deformation rate. Numbers 4 and 6 correspond to samples from internal part of the lithon and have not visible indications of plastic deformation.



Results and discussion

Step-heating of the bulk biotite separates (Fig. 1 A) yields spectra with staircase at low and depression at intermediate temperatures. The deformed samples (1, 7) yield much more expressed depression and noticeably younger ages all over the spectra. Dating on biotite grains of different size using pulsed ruby laser (size of the probe area – 50 micron) yield one mode age distribution for sample-7 (Fig. 1 A) with maximum at 455 Ma. At the same time sample-1 yields 3 mode age distribution with maximums at 475 Ma, 439 Ma and 366 Ma.

Digital modeling revealed that age spectra of all samples can be described well using model of superposition of at least two components of different age and grain size with lover age value corresponding to smaller grain size. The model is based on assumption that every component display plateau age spectra. Depression at intermediate temperatures is formed due to the fact that maximum of degassing of smaller grain size component is shifted towards lower temperatures.