Cretaceous Amur sedimentary complex in the Kiselevka area, Far East Russia: Cretaceous history of accretion and rearrangement

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Introduction

Jurassic to Cretaceous sedimentary complexes cut by the Central Sikhote-Alin Fault (CSF) widely occur in the Kiselevka area (around 51° 25′ N, 139° 00′ E), the northeastern part of the Khabarovsky Kray, Far East Russia. These sedimentary complexes, striking northeast and dipping to the west, comprise the Kiselevka–Manoma, Amur, and Badzhal complexes, in apparent ascending order.

The Jurassic to Early Cretaceous Badzhal Complex in this area is the northern extension of the Nadanhada accretionary complex (AC) in Northeast China and the Tamba-Mino-Ashio AC in the Inner Zone of Southwest Japan. The Cretaceous Amur Complex lies beneath the Badzhal Complex and consists of an AC and a graben-fill, coarse sedimentary sequence. The AC mainly comprises turbidite, with minor chert, siliceous mudstone, bivalve-bearing siltstone, HCS sandstone, and conglomerate. The complex occupies 100 km in width (E–W) and 650 km in length (N–E). The Cretaceous Kiselevka–Manoma Complex is a relatively thin AC consisting mainly of basalt, red chert, and red siliceous shale with minor amounts of limestone, mudstone, and sandstone. Jurassic to Middle Aptian radiolarians have been reported from the complex (Zyabrev et al., 2015; Bragin and Bragina, 2017), and Zyabrev et al. (2015) suggested that the age of accretion of the complex was Late Aptian–Middle Albian.

The AC of the Amur complex can be correlated with the northern part of the Cretaceous Shimanto AC in the Outer Zone of Southwest Japan, the Northern Shimanto Terrane of Yanai (1984). The two complexes commonly contain shallow-marine rocks and overlap in age. Such a thick Cretaceous AC is absent in the Inner Zone of Southwest Japan. We hence think that the Kiselevka area is one of the best fields to study the late Mesozoic history of accretion and rearrangement in the eastern margin of Asia.

Samples and Methods

The Amur Complex in the Kiselevka area consists of three formations: the Zhorma, Silusu, and Utitza formations from the oldest (e.g., Kirillova and Anoikin, 2011). The Zhorma (western) and Silusu (eastern) formations are AC, whereas the Utitza Formation is a graben-fill sedimentary sequence. The AC is assumed to have formed in the Late Aptian to Middle Albian on the basis of radiolarian fossils from pelagic siliceous rocks and mudstone (Zyabrev et al., 2015). We collected five sandstone samples from the Zhorma Formation, six from the Silusu Formation, one from the Utitza Formation, and one sandstone pebble from the conglomerate of the Utitza Formation. We extracted zircons from these samples and conducted U–Pb dating with the LA-ICPMS equipped in the Graduate School of Environmental Studies of Nagoya University.

Results

We calculated the weighted mean of the 206Pb/238U ages of the youngest age cluster for each rock sample and regarded it as the maximum depositional age (MDA). The MDA of the sandstone samples of the Zhorma, Silusu, and Utitza formations fall between 115–100 Ma (latest Aptian–earliest Cenomanian), 97–85 Ma (Cenomanian–Santonian), and 73–67 Ma (latest Campanian–Maastrichtian), respectively. The MDA of the sandstone pebble from the Utitza Formation is 98–87 Ma (Cenomanian–Coniacian).

Discussion

Our study revealed that the age of sedimentation of the Amur complex, at least partly, lasted until Late Cretaceous. The MDA of sandstone samples of the Silusu Formation (97–85 Ma: Cenomanian–Santonian) suggests that the formation accreted significantly later than the Kiselevka–Manoma Complex, indicating post-accretionary, Cenomanian or later rearrangement of ACs. The movement of the CSF, long supposed to be of Early Cretaceous in age (e.g., Khanchuk et al., 2016), must have lasted until Cenomanian or later.

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