Late Cretaceous radiolarian assemblages and U-Pb zircon ages of the Yezo Group in the Niikappu area, Hokkaido, Japan

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The Yezo Group, distributed in the central part of Hokkaido, Japan, is composed of thick Cretaceous forearc-basin sediments. The macrofaunas, the foraminiferal biostratigraphy, and the carbon isotope stratigraphy have been studied (e.g., Hasegawa, 1997; Takashima, 2011). The detailed radiolarian biostratigraphy in the Urakawa area has been documented by Taketani (1982).

Cretaceous sediments in the Niikappu area are subdivided into the Shunbetsugawa and Niikappugawa formations. The Shunbetsugawa Formation consists of a basal conglomerate, sandstones, and alternating sandstones and mudstones along with several tuff beds in the lower part and hemipelagic mudstones in the upper part. The Niikappugawa Formation is composed mainly of mudstone along with turbidites in its lower part. The mudstones contain abundant radiolarians, and often inoceramids.

U–Pb ages were measured for zircons from four horizons of tuff (895, 931-02, 916-27, and 906) in the Shunbetsugawa and Niikappugawa formations. The cluster of the youngest peak was analyzed using the Unmix Ages routine of Isoplot/Ex 4.15 to obtain the depositional age. As a result, the ages of samples 895 and 931-02 collected from the lower part of the Shunbetsugawa Formation are ca. 100 Ma, corresponding more-or-less to the boundary between the Albian and Cenomanian. The age of the tuff in the lower part of the Niikappugawa Formation (sample 916-27) is ca. 91 Ma, and in the upper part (sample 906) it is ca. 87 Ma. The former age corresponds to the Turonian and the latter to the Coniacian.

We obtained moderately to well-preserved radiolarians, and recognized four assemblages (assemblages 1 to 4). Our age assignments are based on the works of Pessagno (1976) and O'Dogherty (1994). Assemblage 1 is characterized by *Crolanium triangulare* and *Hiscocapsa asseni* of late Albian to early Cenomanian age. Assemblage 2 consists of typical Cenomanian species such as *Dactyliosphaera silviae*, *Holocryptocanium barbui*, and *Pseudodictyomitra tiara*. Assemblage 3 is characterized by the dominance of *Stichomitra* species along with *Diacanthocapsa* sp. Assemblage 4 contains *Alievium superbum*, *Archaeospongoprunum bipartitum*, *Dictyomitra formosa*, and *Pseudotheocampe urna*, and this assemblage is considered to be late Turonian-Coniacian in age. The biostratigraphic ages are consistent with the numerical ages of the tuffs. In particular, assemblage 3 can be assigned to the Turonian based on the age of the tuff (sample 916-27: ca. 91 Ma) in the lower part of the Niikappugawa Formation.

The species in our assemblages of Albian to Cenomanian and Coniacian age (assemblages 1, 2, and 4) are similar to those in assemblages reported from the Tethys and North America (e.g., Pessagno, 1976; O'Dogherty, 1994; Hara & Kurihara, 2017). In contrast, the Turonian assemblage of the Yezo Group (assemblage 3) has a very low diversity of species and does not contain typical Turonian species. This implies that the faunal connection between the western Pacific and Tethys was limited during the Turonian.

