DISCOVERY OF A DESMOSTYLIAN TOOTH FROM KITAMI CITY, NORTHEASTERN HOKKAIDO, JAPAN

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ABSTRACT

A fragmentary tooth of Desmostylus sp. was found in the pebbly sandstone of the lower Toika Formation exposed near Tomisato, Kitami City, Hokkaido, which is the second record of the genus from Kitami area. It is identified as the unworn metaconid cusp (column) of a left lower third molar of the genus, and is probably one of the youngest fossil records of the genus in Japan (late Middle Miocene).

Key words: Desmostylus, tooth, late Middle Miocene, Hokkaido


北海道北見市富里付近に露出する登以加層下部の礫質砂岩から、Desmostylus sp. に同定される白歯の破片が発見された。本属の化石としては、北見地域では二番目の記録である。化石は Desmostylus 属の左下顎第三大臼歯のメタコニッド臼柱で、萌出前の未咬破状態である。種の同定はできないが、本属としては日本ではもっとも若い年代（中期中新世後期）を示す化石の一つと考えられる。

INTRODUCTION

A fragmentary tooth of the genus Desmostylus was newly found in Kitami City, Hokkaido in 1996. It was collected directly from the sediments and is the second discovery of the genus in Kitami area (see Uozumi et al., 1966 for the first discovery). Although over 20 localities of various fossils of the genus (including a nearly complete skeleton to a tooth fragment) have been known within Hokkaido (Inuzuka, 2000a), some of them were found float, and their stratigraphic positions may not be clear (Yahata and Kimura, 2000). Thus, it is worth to note this fragmentary tooth as a new addition to the fossil records of the genus in Hokkaido.

The fossil tooth was found by Mr. Yukio Sakakibara, a local amateur geologist, from an exposure along Kita-ainonai forest path (see below for detail) near Tomisato, Kitami City, while he was looking for fossils. The tooth was donated to Kitami Region Museum of Science, History and Art for study and custody.

LOCALITY AND GEOLOGIC SETTING

The tooth fragment was found directly in the sediments of an exposure at Shohan “I” of Rinpan 246 of Tomisato National Forest in Kitami City, Hokkaido, Japan (43° 52′ 03″ N, 143° 46′ 11″, based on GPS system after 2002), which is located on the left bank of Samakke-Nikoro River, a tributary of Nikoro River, and northwest of Tomisato of Kitami City (Figs. 1 and 2). Kita-ainonai forest path reaches to the upper stream along the Samakke-Nikoro River.

The fossil-bearing bed is the Miocene Toika Formation, which overlies the Late Jurassic to Late Cretaceous Nikoro Group (Ishida et al., 1968). The Toika Formation is subdivided into 4 "members" as sandstone, solid shale, mudstone, and tuffaceous sandstone in ascending order (Ishida et al., 1968; although they used "beds" for subdivisions of the formation, they meant members in current usage). The fossil tooth was yielded from a pebbly sandstone bed within the lowest sandstone "member" (Fig. 2). The pebbly sandstone bed includes small to medium-sized pebbles of tuff, green rock, chert, and limestone derived from the Nikoro Group, and sand grains consist also of the same...
Okoppezawa specimen of *Desmostylus* was a float, but Yahata and Kimura (2000) mentioned that it might have been from Atsunai Formation. Yahata and Kimura (2000) correlated Aionai Formation to the late Middle Miocene, while they correlated Atsunai Formation to the Late Miocene in their figure 2 but mentioned the Middle Miocene in the text (p. 42).

The first specimen of *Desmostylus* from Kitami area is from the tuffaceous sandstone “member” (basal subdivision) of Aionai Formation (Sawamura and Hata, 1965; Uozumi et al., 1966), and the sandstone “member” of Toika Formation is correlated with the former, based on the rock facies and invertebrate fossils (Ishida et al., 1968). Thus, according to geologic age of the Aionai Formation by Yahata and Kimura (2000), at least the lower part (sandstone “member”) of Toika Formation should be the late Middle Miocene, and the new specimen of *Desmostylus* reported here consists with this correlation. No specimen of the genus *Desmostylus* is known...
from the Late Miocene or younger sediments (younger than ca. 11 Ma) (Ogasawara, 2000; Yahata and Kimura, 2000).

**SYSTEMATIC DESCRIPTION**

Order **DESMOSTYLLIA** Reinhart, 1953  
Family **DESMOSTYLLIDAE** Osborn, 1905  
Genus **DESMOSTYLUS** Marsh, 1888  
*Desmostylus* sp.  
(Figs. 3 and 4)

**Referred specimen.**—Unworn metaconid cusp (column) of left lower third molar (left m3), cataloged as Kitami Region Museum of Science, History and Art (KRMSHA) 2–4–480.

**Locality and horizon.**—A small exposure at Shohan "I" of Rinpan 246 of Tomisato National Forest in Kitami City, Hokkaido, Japan (43° 52' 03" N, 143° 46' 11" W; Figs. 1 and 2). The sandstone "member" of Toika Formation, supposed to be the late Middle Miocene (Ishida et al., 1968; Yahata and Kimura, 2000).

**Description.**—Directions of the tooth fragment are actually defined after the identification of taxon and dental species (tooth position) of the fossil is completed, and identification would be made after description and comparisons are made. However, it is extremely difficult to describe without directional terms (mesial, buccal, etc.), and therefore, those terms will be used in the following description, as if the tooth position is already identified.

The specimen is an isolated single cusp (column) of a molar tooth typical of advanced desmostylians. It is unworn but is almost erupted as indicated by a shallow concavity of occlusal surface with a tiny convexity in the center and the size of the column (Fig. 3e). Because it is unworn, the thickness of enamel on the occlusal surface is unobservable, but it is rather thick on the cross section at the bottom of the column. In lingual view, the column becomes wider toward the bottom, mesio-distal diameter approximately 13.3 mm near the top to 26.3 mm near the bottom of the column. It curves gently as a whole, with the middle part convex mesially. The mesial edge is slightly concave at about 52 mm from the top of the column. The lingual surface is rugose in general but particularly so on the approximately lower one third. Maximum height of the preserved portion is 68.3 mm (Fig. 3a).

In distal view (Fig. 3b), the column is slightly curved lingually, and the buccal side is gently concave, while lingual side is more convex at about the middle of the height. Transverse width at the top and that of near the bottom of the column are about the same. The surface is rather rugose in general except for the bottom part, which is rather flat indicating a contact with another column. The buccal surface (Fig. 3c) is rather flat with a slight concavity as a whole, indicating the whole surface contacting to another column. Therefore, the distobuccal corner near the bottom of the column forms rather sharp edge, the angle
of which is about 90 degrees or slightly less. The mesio-distal diameter in buccal view increases from the top toward the bottom of the column as observed on the lingual view. There is a small step-like structure, an indication of extra cuspule, on the mesial side of the column, which is also visible from the buccal view (Fig. 3—c, d). The general morphology in the mesial view is similar to but mirror image of distal view, except for the extension of the bottom part with rugose surface.

Comparisons.—Based on the general morphology and the size, KRMSHA 2—4—480 is obviously one of the major cusps (columns) of molars of the genus *Desmostylus* or closely related genera (see Discussion section below). As described above, KRMSHA 2—4—480 has two flat surfaces (distal is only on the lower part) that form an angle about 90 degrees, indicating that it must be a cusp of a lower molar and is possibly one of the four corner cusps. However, the distal two cusps are smaller, lower, and more strongly curved than the two mesial cusps, and therefore, KRMSHA 2—4—480 must be one of two mesial cusps (protoconid and metaconid). Mesiolingual cusp (metaconid) of the lower molar tends to be located slightly more mesial than the mesiobuccal cusp (protoconid), and therefore, the angle between the two flat surfaces of metaconid tends to be sharper (less than 90 degrees) than that of protoconid. Also, mesiolingual cusp tends to expand laterally more than buccal cusps. Thus, we identified KRMSHA 2—4—480 as the metaconid of a lower molar, and also based on the size, as the third (left m3). KRMSHA 2—4—480 is in fact almost identical, not only in general morphology but also in size and growth stage, with the metaconid of the National Museum of Nature and Science (used be National Science Museum) NSM-PV 16632 (identified as left m3 based also on the characters mentioned above) among the numerous isolated teeth of *Desmostylus* sp. (generally referred to *D. hesperus*) from the Temblor Formation of Monocline Ridge, Fresno County, California, USA (Fig. 4).

**DISCUSSION**

Studies on the order Desmostyli have greatly advanced since 1980’s (see Inuzuka, 2000a), and particularly after the symposium entitled ‘Evolution of Desmostylia—commemorating 100th anniversary of the discovery of Togari specimen and opening of Ashoro Museum of Paleontology’—that held at Ashoro, Hokkaido, Japan in 1998 (Inuzuka et al., 2000, 2001; see the papers in those volumes). Among the named genera whose molars consist of thick columnar cusps with thick enamel, *Cormwallius* has obviously shorter cusps than KRMSHA 2—4—480 (Inuzuka et al., 1994). *Kronokotherium* (Promina, 1957) is poorly known genus but can be separated from *Desmostylus* by the arrangement of major cusps of molars (Inuzuka et al., 1994) and its small size. KRMSHA 2—4—480 is an isolated single cusp, and so, the cusp arrangement pattern cannot be used. *Kronokotherium* is, however, clearly smaller in general size (height is unclear) than KRMSHA 2—4—480. *Vanderhoofius* is now synonymized with *Desmostylus* (Kohno, 2000; Inuzuka, 2000b). Therefore, KRMSHA 2—4—480 can be identified as a species of the genus *Desmostylus*.

Within the genus, three species are currently recognized, namely *D. japonicus*, *D. hesperus*, and *D. coalingensis* (Inuzuka, 2000b). But, because they are characterized by the morphology of the skulls and mandibles and not by dental morphology, it is impossible to distinguish them by isolated tooth alone (Inuzuka et al., 1994; Inuzuka, 2000b). Thus, KRMSHA 2—4—480 cannot be identified at specific level. *D. japonicus* is known only from the Early Miocene, and *D. hesperus* is known only from Middle Miocene as far as specific identifications are certain, and *D. coalingensis* is known only from North America (Kohno, 2000). Geologic age of the sandstone “member” of Toika Formation, from which KRMSHA 2—4—480 was found, is correlated to the late Middle Miocene (see above), the possibility of KRMSHA 2—4—480 to be *D. hesperus* is quite high.

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*: in Japanese with English abstract
**: mostly in Japanese with English abstracts
***: partly in Japanese with English abstracts
****: in Russian

< 地名・地層名 >

Ainonai Formation ・・・・・・・・・・・・相内層 Samakke-Nikoro River ・・・・サマッケ仁頃川 Rinpan 246 ・・・・・・・・・・・・・・・・246林万
Ashoro ・・・・・・・・・・・・・・足寄 Nikoro Group ・・・・・・・・仁頃層群 Shohan ‘T’ ・・・・・・・・・・・・・・・い小万
Atsunai Formation ・・・・・・・・厚内層 Notoro Formation ・・・・・・能取層 Toika Formation ・・・・・・・・・・・・・笈以加層
Kita-ainonai ・・・・・・・・・・・・・北相内 Okoppezawa ・・・・・・・・・・オコッペ沢 Tomisato ・・・・・・・・・・・・・・・・・富里