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日本西部渐新世-中新世啮齿类及其地质古生物学意义

加藤高文
(日本，九州大学，地球与行星科学系，福冈 812-81)

大塚裕之
(日本，鹿儿岛大学，地学研究所，鹿儿岛 890)

摘要 日本九州渐新-中新世沉积物中新发现的啮齿类，有四种类型：1. 河狸科未定属种A; 2. 晚渐新世 Sasebo (佐世保) 群的*Steneofiber* sp.; 3. 河狸科未定属种 B; 4. 早-中中新世 Nojima (野岛) 群的山东硅藻鼠 (*Diatomys shantungensis*)。河狸科的两个未定属种的标本属于大型河狸，头骨大小接近于巨河狸 (*Trogontherium*)，门齿珐琅质具有明显的纵沟。个体大小和门齿珐琅质特征方面的相似性表明这些标本可能为同一个属。*Steneofiber* 是一个遍布北半球的属，以前还未曾在东亚的晚渐新世地层中发现过。山东硅藻鼠的出现使我们有理由推测，在早中新世晚期，位于东亚边缘的日本和中国东部的哺乳动物同属一个区系。

关键词 日本，九州，晚渐新世-早中新世，啮齿目

一、前 言

日本的第三纪啮齿类化石很少。富田幸光和濑户口烈司 (Tomida 和 Setoguchi) (1994) 曾报道过日本中部岐阜 (Gifu) 县，Mizunami (瑞浪) 和 Kani (可儿) 盆地早中新世的9块标本，并对日本岛第三纪啮齿类做了小结。根据他们的报道，这些盆地的啮齿类动物群包括有河狸科、始鼠科及一些不能确认的种类。河狸科中有一个典型的中国中新世的种，中国杨氏河狸 (*Youngofiber sinensis*)，该种的出现有力地说明在中新世早期日本列岛与中国南部有密切的古地理联系。

在本课题研究过程中，在九州长崎县 Sasebo 煤田新发现许多渐新-中新世的脊椎动物化石点 (图1)，在 Sasebo 和 Nojima 群的河湖相堆积物中发现有偶蹄类、奇蹄类、啮齿类及鳄类等脊椎动物。本文旨在初步描述采自这些层位的啮齿类化石。

所描述的标本中，有三块属于河狸科，包括 *Steneofiber* 和两块属种未定的不完整头骨和下颌；另有一块是 *Diatomys shantungensis*。这些在九州发现的新材料不仅对河狸科的系统发育，而且对东北亚的古地理研究具有重要意义。

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二、地质概况

Sasebo（佐世保）地处九州的西北部，组成日本主要煤田之一的 Sasebo 煤田的主体部分。地质上，这个地区主要由第三纪沉积、火山岩和部分第四纪沉积组成（图2）。第三纪沉积岩由下至上为 Sasebo 群，Nojima 群和 Hirado 组。这些岩层都被中新世中晚期的 Kitamasuura 玄武岩大面积覆盖。

Sasebo 群整合于 Ainoura 群之上，后者是煤田的主要含煤层。Sasebo 群厚 720 — 1220m，被分为五组。岩性为河湖、半咸水和浅海环境下沉积的砂岩、泥岩和煤层。至今，已从该群地层中发现丰富的植物化石、一些龟类和少量哺乳动物化石（Matsumoto，1929；Otsuka，1970；Shikama，1953，1964；Urata，1968；Tanai，1955；Takunaga，1925）。

Nojima 群的最大厚度约为 2300m，不整合地覆盖于 Sasebo 群之上。按岩性可分为三个组，由下至上为 Oya 组，Fakazuki 组和 Minamitabira 组。岩性为砂岩、泥岩、凝灰岩和凝灰角砾岩。在 Oya 组和 Fukazuki 组的很多层位中有淡水软体动物和植物化石。

根据对火山碎屑岩所作的裂变径迹年龄测定，Sasebo 群和 Nojima 群的时代都为晚渐新世至中中新世（图2）。

三、标本描述

啮齿目 Rodentia Bowdich，1821

河狸科 Castoridae Gray，1821

属 *Steneofiber* Geoffroy Saint-Hilaire，1833

未定种 *Steneofiber* sp.

（图版 I，图1）

归入标本 ESK，Reg. NO. F－6058；右 $M^{1@}$，Ohashi（大桥）标本。

地点 长崎县，Kita-Matsuura-gun，Yoshii-cho，Ohashi Kannon

层位 Sasebo 群，Fukui 组的底部。

时代 晚渐新世；Utagaura 凝灰角砾岩的裂变径迹年龄 25.7±2.3，25.6±3.0Ma（Miyachi 和 Sakai，1991）。

描述 一枚 M^1 或 M^2，齿冠高，中等磨蚀程度。舌侧珐琅质高于唇侧，前沟和中沟几乎伸及齿冠基部。咀嚼面上有三个凹和两个褶。次褶宽短，中褶长且向后弯。前凹和中褶之间还有一凹。

讨论 *Steneofiber* 属分布广泛，最早发现于欧洲的早渐新世地层。徐晓风（1994）指出，*S. hesperus* 产自亚洲的早－中中新世层位中，如中国内蒙古的通古尔组和河北省张北汉诺坝玄武岩中的粘土层，但尚未在这些地区的渐新世地层中发现过。由于仅有一枚牙齿，难以定种。

河狸科未定属种 A Castoridae gen. et sp. indet. A

(图版 I, 图 2a、2b)

归入标本　ESK. Reg. No. F－6057; 一具几乎完整的头骨吻部，带有两枚上门齿。Takashima (高岛) 标本。

地点　长崎县，Kita-Matsuura-gun，Takashima-cho，Miya

层位　Sasebo 群，Yunoki 组。

时代　晚渐新世; Hareki 凝灰角砾岩的裂变径迹年龄测定为 28.3±2.7，28.1±2.8Ma，(Miyachi 和 Sakai，1991)。

描述　大型河狸。门齿珐琅质表面凸，像 *Anchitheriomys* 那样具有纵沟。鼻骨长，额鼻缝后弯，咬肌嵴弱。颧颌缝性状及眶下孔位置与 *Trogontherium* 的相似。

讨论　Takashima 标本是渐新世河狸中最大的。头骨的尺寸及具平行纵沟的门齿是新第三纪河狸属 (*Anchitheriomys*、*Youngofiber* 和 *Trogontherium*) 区别于其他渐新世属 (*Steneofiber*、*Agnotocastor* 及 *Paleocastor*) 的明显特征。具纵沟的门齿以及巨河狸型 (*Trogontherium*-like) 的吻部表明，Takashima 标本属于包括 *Youngofiber*，*Anchitheriomys* 和 *Trogontherium* 在内的单系类群 (徐晓风，1994)。该标本是在东亚发现的最早的河狸化石，据此可以推测，特有的门齿和个体的增大是在适应辐射的早期才出现的。

河狸科未定属种 B Castoridae gen. et sp. indet. B

(图版 I, 图 3a — 3c)

归入标本　ESK，Reg. No. F－6056; 右下颌，带不完整的 P_4。Kosaza (小佐佐) 标本。

地点　长崎县，Kita-Matsuura-gun，Kosaza-cho，Mae-Shima。

层位　Nojima 群，Oya 组。

时代　早中新世晚期。Kojimazaki 凝灰角砾岩的裂变径迹年龄测定为 18.9±2.9，18.5±2.3Ma (Sakai et al.，1990)。

描述　松鼠型下颌骨。齿虚窄短。门齿的珐琅质表面凸，具纵沟。P_4 中等磨蚀，齿冠较低，齿根长。齿冠唇侧珐琅质较高。下内尖及后齿带缺损。具有下中沟和下次沟，下次沟伸至齿冠基部，下中沟深但不伸及齿冠基部。嚼面的珐琅质图式不及 *Anchitheriomys* 的复杂。在下前凹前方有一与其平行的凹，下前凹的近端位于该凹的前方，下前凹较下中沟及下次沟长。

讨论　未定属种 A 和 B 均为大型河狸，由于具有相似的门齿，应归同一个属。

徐晓风 (1994) 依据颊齿的珐琅质图式将河狸科分为三类: *Asiacastor* 型，*Castor* 型和 *Castoroides* 型。除 *Castoroides* 外，门齿珐琅质表面凸、并有纵沟的河狸类群的颊齿图式为 *Asiacastor* 齿型，这类颊齿在下前凹前部还有一小凹。Kosaza 的 P_4 有此特征。

Castoridae gen. et sp. indet. B 与具 *Asiacastor* 型颊齿的 *Youngofiber* 和 *Anchitheriomys* 的牙齿相似。*Youngofiber* 是欧亚大陆上最大的河狸，在中国江苏省早中新世晚期的下草湾组和日本中部早中新世的 Mizunami 群中均有发现。*Youngofiber* 的 P_4 与 *Anchitheriomys* 的一样，为椭圆形，珐琅质图式简单。在 Mizunami 群中发现的门齿的珐琅质沟脊较 Kosaza 标本的浅而弱。*Anchitheriomys* 是广布于北半球的属，在欧亚大陆更为多见。该属包括4个种：*A. wiedemanni*，*A. fluminis*，*A. tungurensis* 和 *A. caucasicus*。这些种的化石出现在早–中中新世，它们具有复杂的下齿凹；P_4 的下中沟弱而短，有时缺失；齿冠咀嚼面为椭圆形，不如其他河狸类的那样长。

与上述两个属不同，Kosaza 标本的嚼面珐琅质图式简单。P_4 的下中沟长，该沟在磨蚀的最后阶段才消失。与 *Anchitheriomys* 一样，下中沟在磨蚀的很早期就已封闭。因此，我们认为 Kosaza 的标本保留了较 *Youngofiber* 和 *Anchitheriomys* 更为原始的特征。

?囊鼠超科 ?Geomyoidea Weber，1904

科待定 Family indet.

硅藻鼠属 *Diatomys* Li，1974

山东硅藻鼠属 *Diatomys shantungensis* Li，1974

(图版 I，图4)

归入标本 ESK. Reg. No. F－6055，左 M^2，Doba 标本。

地点 长崎县，松浦市，Mikuriya-cho，Ura-men，Doba

层位 Nojima 群，Fukazuki 组。

时代 早中新世晚期；Kojimazaki 凝灰角砾岩的裂变径迹年龄测定为 18.9±2.9，18.5±2.3Ma (Sakai et al.，1990)。

描述 标本为左上第二臼齿，低冠，由两脊组成。原脊（即原尖和前尖）较后脊长。原脊在近原尖处稍收缩。原尖的舌侧有一弱齿带。

讨论 硅藻鼠属（*Diatomys*）属囊鼠超科（Li，1974），现有两个种：*D. Shantungensis* Li，1974 和 *D. liensis* Mein et Ginsburg，1985。迄今 *D. Shantungensis* 发现于山东省临朐县早中新世晚期山旺组和江苏省泗洪县早中新世晚期的下草湾组地层中。下草湾组中 共有23 枚单个牙齿，与其它阿拉冈期（Aragonian）的脊椎动物共生（Li et al.，1983）。从山旺组中则发现有两具近于完整的骨架，带有完整的颊齿列。依李传夔（1974），骨架特征如下：头骨轮廓似鼠类；尾长；地面疾走型骨架结构；松鼠型下颌；齿式 1，0，1，3/1，0，1，3。颊齿低冠，臼齿双脊型，在咀嚼面上具有两个相等的珐琅质圈。Doba 的标本在总的牙齿形态上与*D. Shantungensis* 的上臼齿一致，但其前后径和唇舌径稍大于正型标本。

D. liensis 发现于泰国北部 Li 盆地的早中新世地层中（Mein and Ginsburg，1985）。齿冠较高，但小于 *D. Shantungensis* 和 Doba 的标本。其时代相当于欧洲陆相哺乳动物分期 MN3b 带，因此早于中国和日本的 *Diatomys* 的时代。

四、结　论

富田幸光和濑户口烈司（1994）记述的日本第三纪的7种啮齿类都发现于早中新世晚期（距今 19—16.5Ma）的地层中。除 Sasebo 煤田的啮齿类化石外，其余的都来自日本中部岐阜县的中新世 Mizunami 群。

在 Sasebo 煤田中新发现的渐新世河狸表明，河狸科迁入东亚的事件发生在渐新世晚期，早于徐晓风（1994）的“第一次迁入事件”。晚渐新世时中国啮齿类有圆柱齿鼠科、梳趾鼠科、松鼠科、仓鼠科、林跳鼠科和竹鼠科（Li 和 Ting，1983）。仅有一篇报道内蒙古晚渐新世啮齿类的文章提到有一些不能鉴定至属的河狸科牙齿（Wang 等，1981）。河狸科的属和种的数量在晚渐新世至早中新世期间增加，并在北半球广泛分布，可被看作是河狸科的第一次适应性辐射。渐新世河狸在日本 Sasebo 煤田的出现很可能反映了这一事件。

所有在 Mizunami 和 Nojima 群中发现的中新世河狸的门齿都具有纵沟（Tomida 和 Setoguchi，1994），它们都与 *Asiacastor* 单系类群近缘。Takashima 标本的发现表明这一类群出现在河狸科适应辐射的早期阶段。东亚的河狸科的历史可能较徐晓风的推论（1994）更复杂些。

Youngofiber sinensis 和 *Diatomys shantungensis* 是中国（早中新世晚期的下草湾组和山旺组）和日本（早－中中新世 Mizunami 群和 Nojima 群）的土著啮齿类。已知这两个种在下草湾组共生（Li 等，1983；Qiu，1990），下草湾组的时代距今 19—18Ma。这些事实说明当时在东亚的边缘地区已形成了以 *Youngofiber* 和 *Diatomys* 为特征的哺乳动物群。正如富田幸光（Tomida，1990）指出的，当时的日本海不宽，因此日本岛与中国大陆间的动物群相互交流，致使海峡两侧拥有一些相同的动物群分子。

致谢　日本东京国立科学博物馆的富田幸光博士、中国科学院古脊椎动物与古人类研究所的李传夔和邱铸鼎博士提出宝贵意见和提供了中国中新世啮齿类对比标本；九州大学 Hakuyu Okada 教授自始至终地对我们的工作给予鼓励并阅读了本文初稿，我们在此表示深切的谢意。此外感谢九州大学给予本文第一作者松本多津郎（Tatsuro Matsumoto）教授奖学金。

（吴文裕译）

DISCOVERY OF THE OLIGO-MIOCENE RODENTS FROM WEST JAPAN AND THEIR GEOLOGICAL AND PALEONTOLOGICAL SIGNIFICANCE

TAKAFUMI KATO

(*Department of Earth and Planetary Sciences, Kyushu University, Fukuoka* 812－81, *Japan*)

HIROYUKI OTSUKA

(*Institute of Earth Sciences, Faculty of Science, Kagoshima University, Kagoshima* 890, *Japan*)

Abstract New rodent fossils found in the Oligo-Miocene sediments in Kyushu, West Japan, are identified to the following four taxa: 1) Castoridae gen. et sp. indet. A; 2) *Steneofiber* sp. from the Late Oligocene Sasebo Group; 3) Castoridae gen. et sp. indet. B; 4) *Diatomys shantungensis* from the Early to Middle Miocene Nojima Group. Studies of two specimens identified to the family Castoridae gen. et sp. indet. A and B indicate that they are large beavers with the skull of nearly same size as *Trogontherium* that holds enamel of longitudinally grooved incisors. Resemblance in size and features of the incisor enamel indicates that these specimens could be of the same genus. Furthermore, it is known that *Steneofiber* is a cosmopolitan genus, however, it has not been found in the Late Oligocene in East Asia. The occurrence of *Diatomys shantungensis*, on the other hand, strongly suggests that the late Early Miocene mammals from Japan and the East China belong to the same faunal province in East Asian margin.

Key words Kyushu, Japan, Late Oligocene-Early Miocene, Rodents

Introduction

Tertiary rodent fossils have been rarely found in Japan. Tomida and Setoguchi (1994) reported nine specimens from the Early Miocene sediments in the Mizunami and Kani basins, Gifu Prefecture, central Japan with a brief review of the Tertiary rodents from the Japanese Islands. According to their report, the rodent fauna in these basins is composed of the specimens referred to Castoridae, Eomyidae and unidentified rodents. Among them, Castoridae includes *Youngofiber sinensis*, a characteristic Chinese Miocene beaver. The occurrence of *Youngofiber sinensis* strongly implies a close paleogeographical connection between the Japanese Islands and southern China in the Early Miocene.

In the course of the present study, many localities of the Oligo-Miocene vertebrate fossil beds in the Sasebo Coal Field, Nagasaki Prefecture, Kyushu, have been newly added (Fig. 1), where such vertebrate fossils as Artiodactyla, Perissodactyla, Rodentia and Crocodilia are found in fluvio-lacustrine deposits of the Sasebo and the Nojima groups. This paper aims to describe preliminarily the fossil rodents collected from the above mentioned groups.

Among the described specimens, three belong to the family Castoridae, including the specimen of the genus *Steneofiber* and the two other undetermined new genera and species with incomplete jaw and skull. Another one is referred to *Diatomys shantungensis*, that was first reported from the Miocene deposits in Shantung Province, North China. These new rodents from Northwest Kyushu seem to be very important for considering not only the phylogeny of the Castoridae but also the paleogeography of northeastern Asia.

Geology

The Sasebo area is situated in northwest Kyushu, southwest Japan and occupies the main part of the Sasebo Coal Field, which is one of the major coal fields in Japan. The geology of this district consists mainly of Tertiary sedimentary and volcanic rocks and partly of Quaternary sediments (Fig. 2). The Tertiary sedimantary rocks

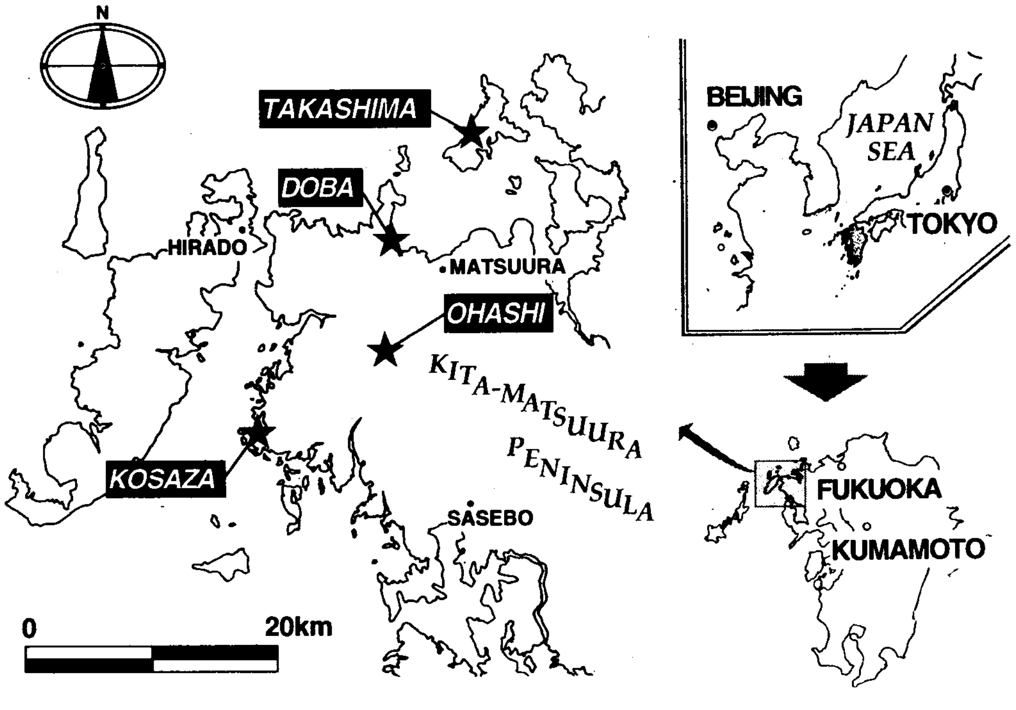

Fig. 1 Map showing the locality of Tertiary rodents in Kyushu, Japan. (solid star)
图1. 日本九州第三纪啮齿类地点分布图。

comprise three sequences, the Sasebo Group, the Nojima Group, and the Hirado Formation, in ascending order. These sediments are widely covered by the Middle to Late Miocene Kitamatsuura Basalts.

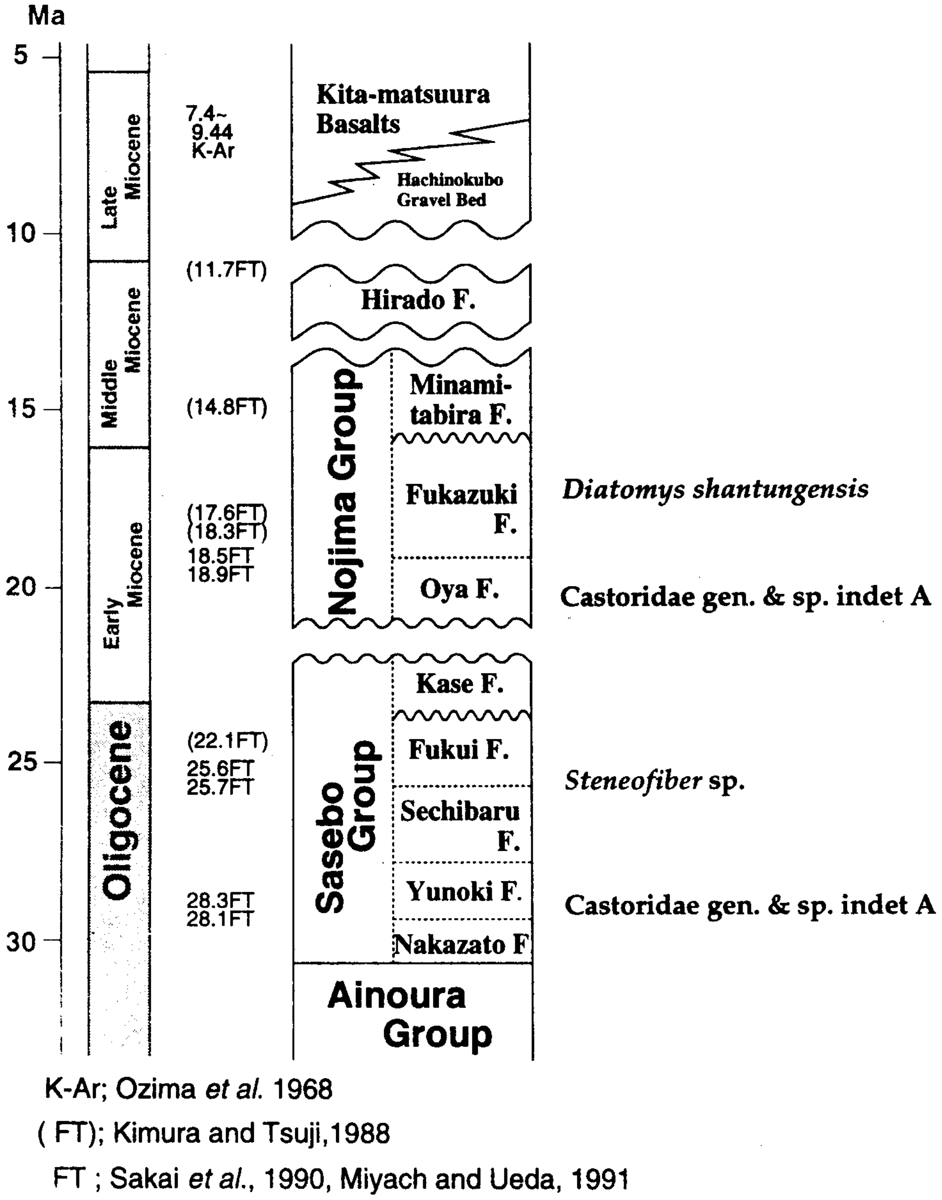

Fig. 2 Stratigraphy in Sasebo Coal Field with data of fission-track, and K-Ar ages.

图 2. Sasebo 煤田地层剖面图，附裂变径迹和钾氩法测年数据。

The Sasebo Group conformably lies on the Ainoura Group, which is considered as the main coal-bearing unit in the Sasebo Coal Field. The Sasebo Group ranges in thickness from 720 to 1220 meters and is divided into five formations. This group is composed of sandstone, mudstone and coal seams deposited under fluvio-lacustrine and brackish water to shallow marine environments. To date, abundant fossil plants, some fossil tortoises and a few mammals have been discovered from this group (Matsumoto, 1929; Otsuka, 1970; Shikama, 1953, 1964; Urata, 1968; Tanai, 1955; Tokunaga, 1925).

The Nojima Group, about 2300m in the maximum thickness, unconformably covers the Sasebo Group. It is divided lithologically into three formations, the Oya, the Fukazuki and Minamitabira, in ascending order. This Group consists of sandstone, mudstone, tuff and tuff breccia. Fresh-water molluscs and plant fossils are present in many horizons of the lower and middle formations.

Taking into account the fission-track ages of the pyroclastic layers in the Sasebo and Nojima groups, both the groups are regarded as the Late Oligocene to Middle Miocene (Fig. 2).

Systematics

Order Rodentia Bowdich, 1821

Family Castoridae Gray, 1821

Genus *Steneofiber* Geoffroy Saint-Hilaire, 1833

***Steneofiber* sp.**

(Pl. I, fig. 1)

Referred specimen ESK. Reg. No. F-6058; Right $M^{1 or 2}$, Ohashi specimen.

Locality Ohashi Kan'non, Yoshii-cho, Kita-Matsuura-gun, Nagasaki Prefecture.

Horizon Base of the Fukui Formation, the Sasebo Group.

Age Late Oligocene; $25.7^{+}_{-}2.3$, $25.6^{+}_{-}3.0$Ma according to the fission-track dating of the Utagaura Tuff Breccia (Miyachi and Sakai, 1991).

Description

An isolated upper first or second molar ($M^{1 or 2}$) has rather hypsodont-crown and under medium-stage of wearing. The enamel of the lingual side is higher than the labial side. The parastria and mesostria extend nearly to the base of the crown but do not reach there. There are three fossettes and two flexuses on the occlusal face. The hypoflexus is wide and short. The long mesoflexus curves posteriorly. There is an additional fossette between the parafossette and mesoflexus.

Discussion

Steneofiber is a cosmopolitan genus. The first appearance of this genus is in the Early Oligocene in Europe. According to Xu (1994), *S. hesperus* has been found from the Early to Middle Miocene fossil beds in Asia, such as the Tunggur Formation in Nei Mongol and a clay layer sandwiched by the Hannoba Basalts in Zhangbei, China. This genus, however, has not yet been found from the Oligocene fossil beds in those areas.

Based on the characteristics of the specimen, it is difficult to establish a specific level of identification especially when referring to the isolated tooth.

Castoridae gen. et sp. indet. A

(Pl. I, figs. 2a — 2b)

Referred specimen ESK. Reg. No. F-6057; An almost complete snout with incisors, Takashima specimen.

Locality Miyo, Takashima-cho, Kita-Matsuura-gun, Nagasaki Prefecture.

Horizon The Yunoki Formation, the Sasebo Group.

Age Late Oligocene; $28.3^{+}_{-}2.7$, $28.1^{+}_{-}2.8$Ma according to the fission-track dating of the Hareki Tuff Breccia (Miyachi and Sakai, 1991).

Description

Large beaver. The incisors have a convex enamel face and its surface is grooved longitudinally as in *Anchitheriomys*. The nasal bone is long. The frontonasal suture curves posteriorly. The masseter ridge is weak. The zygomaticomaxillary suture pattern and the position of the infraorbital foramen are similar to those of the genus *Trogontherium*.

Discussion

Takashima specimen is the largest of the Oligocene beavers. The skull size and also the parallel-grooved incisor represent the distinguishable characters of the Neogene genera (i. e. *Anchitheriomys*, *Youngofiber* and *Trogontherium*) distinct from the other Oligocene genera (i. e. *Steneofiber*, *Agnotocastor* and *Paleocastor*). This longitudinal grooved incisor and the *Trogontherium*-like snout suggest that the Takashima specimen belongs to the monophyletic group including *Youngofiber*, *Anchitheriomys* and *Trogontherium* (Xu, 1994). The Takashima specimen indicates the oldest record of the Castoridae in East Asia. These facts suggest that the peculiar incisor and the increasing in body size had not occurred until the early stage of the adaptive radiation of the Castoridae.

Castoridae gen. et sp. indet. B

(Pl. I, figs. 3a — 3c)

Referred specimen ESK. Reg. No. F-6056; Right lower jaw with incomplete P_4, Kosaza specimen.

Locality Mae-shima, Kosaza-cho, Kita-Matsuura-gun, Nagasaki Prefecture.

Horizon The Oya Formation, the Nojima Group.

Age Late Early Miocene; $18.9^{+}_{-}2.9$, $18.5^{+}_{-}2.3$Ma according to the fissiontrack dating of the Kojimazaki Tuff Breccia (Sakai et al., 1990).

Description

The mandible is sciurognathous. The diastema is short and narrow. The incisor has a convex enamel face, and its surface is grooved longitudinally as in *Anchitheriomys*. The P_4 under the medium-occlusion holds relatively low crown and long roots. The labial side enamel of the crown is higher. The entoconid and the posterior cingulum are crumbled away. There are also a mesostriid and a hypostriid. The hypostriid extends to the base of the crown. The mesostriid is deep but does not reach the base. Enamel pattern on the occulusal surface is not complicated as in *Anchitheriomys*. There is an anterior fossettid parallel to parafossettid. The proximal end of parafossettid lies anteriorly than the position of the fossettid. The parafossettid is longer than the meso- and the hypoflexids.

Discussion

The Castoridae gen. et sp. indet. A and B are large sized beavers. They belong to the same genus basdd on the similarity of their incisor features.

Xu (1994) divided the Castoridae into three groups on the basis of its enamel pattern of the cheek tooth: *Asiacastor* dental pattern, *Castor* dental pattern, *Castoroides* dental pattern. Except for the *Castoroides*, the group having the rounded and grooved enamel incisor possesses the *Asiacastor*-type dental pattern. The *Asiacastor*-type tooth has a small fossette that lies on the anterior part of the parafossettid. This dental character is seen in the P_4 of the Kosaza Specimen.

Youngofiber and *Anchitheriomys* having *Asiacastor*-type tooth are similar to the Castoridae gen. et sp. indet. B in dental characters. *Youngofiber* is the largest Castoridae in Eurasia that was recorded in the late Early Miocene Xiacaowan Formation in Jiangsu Province, China and the Early Miocene Mizunami Group in central Japan. The P_4 of *Youngofiber* is ovoid in shape as in *Anchitheriomys* and has a simple enamel pattern. The enamel ridges on the incisor found in the Mizunami Group are shallower and weaker than those of the Kosaza specimen. *Anchitheriomys* is widely distributed in the Northern Hemisphere, but appears to be more common in Eurasia. This genus consists of four species, *A. wiedemanni*, *A. fluminis*, *A. tungurensis*, and *A. caucasicus*. These species were reported from the Early to Middle Miocene deposits, which holds very complicated fossettid. Their mesostriid of P_4 is very weak and short or none in some cases; the outline of the occlusal surface shows ovoid shape, not elongate as seen in other Castoridae.

Being different from the above two genera, the enamel pattern of the occlusal surface of the Kosaza specimen is simple rather than complicated. P_4 has a long mesostriid. Its mesostriid gets extinct especially is in the latest stage of occlusion. As in the case of *Anchitheriomys*, mesostriid is closed in the very early stage of occlusion. Accordingly, it is believed that the Kosaza specimen preserves more primitive features than *Youngofiber* and *Anchitheriomys*.

Superfamily ? Geomyoidea Weber, 1904

Family indet.

Genus *Diatomys* Li, 1974

***Diatomys shantungensis* Li, 1974**

(Pl. I, fig. 4)

Referred specimen ESK. Reg. No. F−6055; Left M^2, Doba specimen.

Locality Doba, Ura-men, Mikuriya-cho, Matsuura City, Nagasaki Prefecture.

Horizon the Fukazuki Formation, Nojima Group

Age Late Early Miocene; $18.9^{+}_{-}2.9$, $18.5^{+}_{-}2.3$Ma according to the fission-track dating of the Kojimazaki Tuff Breccia (Sakai *et al.*, 1990).

Description

The present upper molar is brachyodont and bi-lophed. The protoloph (*i.e.* the proto- and paracones) is longer than the metaloph. The protoloph is slightly compressed near the protocone. There is a small cingulum on the lingual side of the protocone.

Discussion

The genus *Diatomys* was assigned to Geomyoidea (Li, 1974). The genus *Diatomys* includes two species: *D. shantungensis* Li, 1974 and *D. liensis* Mein and Ginsburg, 1985. *D. shantungensis* was found in the late Early Miocene Shanwang Formation of the Linqu District, Shandong Province, and in the late Early Miocene Xiacaowan Formation in Jiangsu Province, China. 23 isolated teeth of *D. shantungensis* were recorded from the Xiacaowan Formation together with the Aragonian vertebrates (Li *et al.*, 1983). Two nearly complete skeletons with complete cheek teeth were found from the Shanwang Formation. According to Li (1974), the skeleton is characterized as follows: skull shape is similar to murine; tail long; hopping type skeleton; sciurognathous; dental formula 1,0,1,3/1,0,1,3; cheek teeth brachyodont; molar bi-lophed, with two equal enamel rings on the grinding surface.

The tooth comparison with *D. shantungensis* indicates that the M^2 from Doba is identified with the upper molar of *D. shantungensis* in general dental characters but slightly larger than those of the type specimen in the antero-posterior and lingual-labial diameters.

D. liensis was recorded from the Early Miocene sediments of the Li Basin in Northern Thailand (Mein and Ginsburg, 1985). The crown of *D. liensis* is relatively hypsodont, and is smaller in size than *D. shantungensis* and the Doba specimen. The geologic age of *D. liensis* from Thailand was regarded as MN zone 3b, This age is older than those of *Diatomys* from China and Japan.

Conclusion

According to Tomida and Setoguchi (1994), Japanese Tertiary rodents are classified into seven taxa. All are known from the late Early Miocene deposits, approximately 19 to 16.5 Ma. Except for the fossil rodents from the Sasebo Coal Field, others were found from the Miocene Mizunami Group, Gifu Prefecture, central Japan.

The newly found Oligocene beavers from the Sasebo Coal Field suggest that the Castoridae immigration events took place in East Asia in the Late Oligocene. It is earlier than Xu (1994)′s "1st immigrant event". The Chinese Late Oligocene rodents consist of the Cylindrodontidae, the Ctenodactylidae, the Sciuridae, the Cricetidae, the Zapodidae and the Rhizomyidae (Li and Ting, 1983). Only one report describes the Late Oligocene rodents from Inner Mongolia that includes generically unidentified castorid teeth (Wang et al., 1981). The number of the genera and the species of the Castoridae increased during the Late Oligocene to Early Miocene and was widespread in the Northern Hemisphere. It could be assumed as the first adaptive radiation of the Castoridae. The occurrence of Japanese Oligocene beavers from the Sasebo Coal Field probably reflects this episode.

All the Miocene Castoridae found in the Mizunami and Nojima groups have longitudinally grooved incisors (Tomida and Setoguchi, 1994). These Castoridae are closely related to *Asiacastor* monophyletic group. The occurrence of the Takashima specimen suggests that this group appeared at the early stage of the adaptive radiation of the Castoridae. The history of the Castoridae in East Asia may have been more complicated than Xu (1994) considered.

As already mentioned, *Youngofiber sinensis* and *Diatomys shantungensis* are endemic rodents found in fossil beds of China (i. e. late Early Miocene Xiacaowan and Shanwang formations) and Japan (i. e. Early to Middle Miocene Mizunami and Nojima groups). Both of the species are known to occur together especially in the Xiacaowan Formation (Li et al., 1983; Qiu, 1990). The geologic age of these deposits is 19 to 18 Ma. These facts suggest that the mammalian fauna characterized by *Youngofiber* and *Diatomys* had been formed in the East Asian margin at that time. As pointed out by Tomida (1990), the Japan Sea area had not been widened enough during the Early Miocene to hinder migration of the living species. It is natural to find fossil rodents common in both the Chinese Continent and the Japanese Islands.

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Explanation of Plate I

1: *Steneofiber* sp. (ESK. Reg. No. F-6058). right $M^{1 \text{ or } 2}$.

2a－b: Castoridae gen. et sp. indet. A (ESK. Reg. No. F－6057). complete snout with incisors.
2a, left lateral view; 2b, anterior view.

3a－c: Castoridae gen. et sp. indet. B (ESK. Reg. No. F—6056). right mandible with P_4.
3a, lingual view; 3b, occlusal view; 3c, ventral view.

4: *Diatomys shantungensis* Li, 1974 (ESK. Reg. No. F—6055). left M^2.

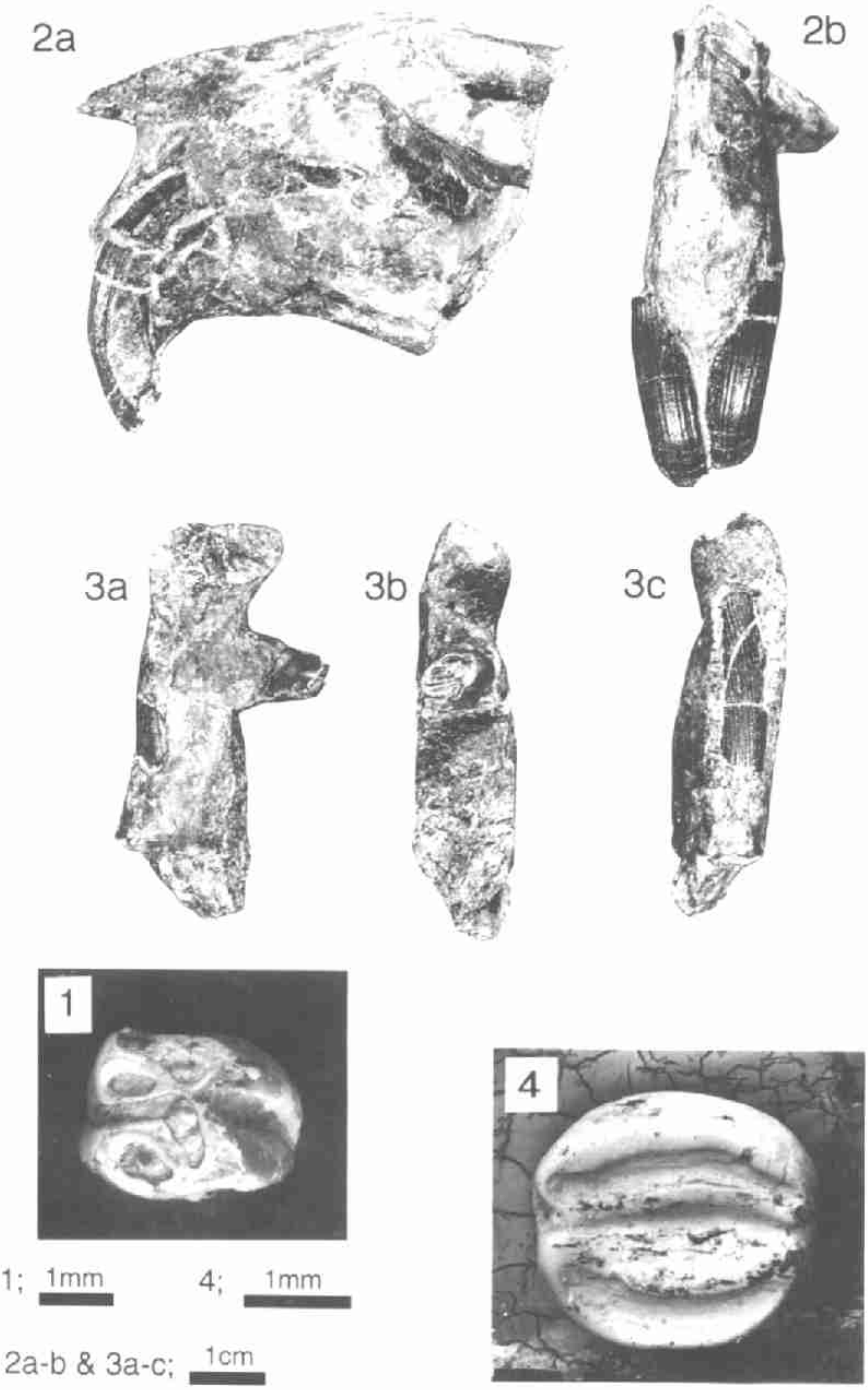
图 版 说 明

1. *Steneofiber* sp. 的右 $M^{1或2}$。

2a－b. 河狸科未定属种 A.
完整的头骨吻部，带门齿。2a. 左侧视；2b. 前视。

3a－c. 河狸科未定属种 B
右下颌，带 P_4。3a，舌侧视；3b. 嚼面视；3c. 腹面视。

4. 山旺硅藻鼠。左 M^2。


2a
2b
3a
3b
3c
1
4
1; 1mm
4; 1mm
2a-b & 3a-c; 1cm