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New Materials to the Knowledge of the Genus *Shikamainosorex* HASEGAWA 1957 (*Insectivora, Mammalia*)

[Pp. 341—358, with 2 text-figs.]

Nowe materiały do znajomości rodzaju *Shikamainosorex* HASEGAWA 1957 (*Insectivora, Mammalia*)

Новые материалы к изучению рода *Shikamainosorex* HASEGAWA 1957 (*Insectivora, Mammalia*)

Abstract. *Shikamainosorex densicingulata* HASEGAWA, 1957 (*Soricinae, Blarinini*), hitherto known from a single mandibular fragment, is described in detail and its systematic position discussed. New material, including a complete set of upper teeth, comes from three Japanese localities, the Ando Quarry, Okada Quarry and Yoshizawa Sekkai, all of them lying in Honshu Island and referred to the Middle or Late Pleistocene. A list of finds of fossil insectivores in Japan is also given.

INTRODUCTION

In Japan remains of insectivores are known only from Quaternary deposits, from which two extinct forms have been described: *Shikamainosorex densicingulata* HASEGAWA, 1957 and *Anourosorex japonicus* SHIKAMA and HASEGAWA, 1958. *Erinaceus* sp., whose fossil remains have been found in Japan, is absent from her modern fauna. Two further species of the *Insectivora*, *Sorex shinto* THOMAS, 1905 and *Sorex minutissimus* ZIMMERMANN, 1780, are known in the fossil state from the outside of the range of their present distribution in Japan.

Most of the Japanese localities of small mammals, including insectivores, cannot be dated precisely within the Quaternary. They represent the Middle and Late Pleistocene and also the Holocene. So far there are no fossil finds of insectivores from Hokkaido Island and the Ryukyu Islands.

Out of the family *Erinaceidae* the hedgehog *Erinaceus* sp. is known from the

Ikumo Quarry in the Akiyoshi region, Yamaguchi Prefecture at the southern end of Honshu (HASEGAWA, 1963, 1966). This is one of the geologically oldest localities of small Quaternary mammals in Japan, probably dating from the penultimate glaciation. Nowadays hedgehogs do not live in Japan.

The family *Talpidae* is represented by three fossil forms. *Dymecodon* sp. was found in the Ikumo Quarry, Yamaguchi Prefecture (HASEGAWA, 1963, 1966). A modern member of this genus, *D. pilirostris* TRUE, 1887 lives in the mountains of Honshu, Shikoku and Kyushu. It resembles *Urotrichus talpoides* and is regarded by ELLERMANN and MORRISON-SCOTT (1951) as belonging to this last genus. *Dymecodon pilirostris* is endemic to Japan. *Urotrichus talpoides* TEMMINCK, 1841 was found in the following localities: Ikumo Quarry, Yamaguchi Prefecture (HASEGAWA, 1963, 1966), Ando Quarry, Yamaguchi Prefecture (HASEGAWA, 1966, 1972), Tokuyama Soda Quarry, Yamaguchi Prefecture (HASEGAWA, 1966; SHIKAMA, HASEGAWA and OKAFUJI, 1958; SHIKAMA and OKAFUJI, 1958), Ushikawa Mine, Aichi Prefecture (HASEGAWA, 1966; SUZUKI and TAKAI, 1959), Shiraiwa Mine, Shizuoka Prefecture (HASEGAWA, 1966), Shiriya Quarry, Aomori Prefecture (HASEGAWA, 1966, 1972; NAKAJIMA, 1958), Nekata Quarry, Shizuoka Prefecture (TAKAI and HASEGAWA, 1966), Tadaki Limestone Quarry, Shizuoka Prefecture (HASEGAWA, 1972; TAKAI, 1962), Yoshizawa Sekkai Co. 10th Quarry, Totigi Prefecture (HASEGAWA, 1972), Yoshizawa Sekkai Co. 2nd Quarry, Totigi Prefecture (NAORA, 1954), Maegawara Cave, Totigi Prefecture (NAORA, 1954), Takanosu-zawa Cave, Totigi Prefecture (NAORA, 1954), Okado Cave in Izuruhara (NAORA, 1954), Shimizu Quarry, Totigi Prefecture (NAORA, 1954), Koziki-ana, Yamaguchi Prefecture (SHIKAMA and OKAFUJI, 1958), Makurazino-ana, Yamaguchi Prefecture (SHIKAMA and OKAFUJI, 1958). Outside Honshu this species is known only from Ojikado Cave in Northern Kyushu (HASEGAWA, YAMAUTI and OKAFUJI, 1968). At present *Urotrichus talpoides* lives in lowlands and mountains in Honshu, Shikoku and Kyushu and also in the Tsushima and other smaller islands. It is absent from Hokkaido and the Ryukyu Islands and does not occur out of Japan.

Mogera wogura (TEMMINCK, 1842) was found in numerous fossil localities: Ikumo Quarry, Yamaguchi Prefecture (HASEGAWA, 1966, 1968), Ando Quarry, Yamaguchi Prefecture (HASEGAWA, 1966, 1972), Tokuyama Soda Quarry, Yamaguchi Prefecture (HASEGAWA, 1966; SHIKAMA, HASEGAWA and OKAFUJI, 1958; SHIKAMA and OKAFUJI, 1958), Shiraiwa Mine, Aomori Prefecture (HASEGAWA, 1966, 1972; NAKAJIMA, 1958), Shikimizu Quarry, Ehime Prefecture (HASEGAWA, 1966; SHIKAMA and HASEGAWA, 1958), Same Cave, Siga Prefecture (HASEGAWA, 1966; SHIKAMA, SIMAOKA, CHINZEI and KAGAMI, 1952), Nekata Quarry, Shizuoka Prefecture (TAKAI and HASEGAWA, 1966), Tadaki Limestone Quarry, Shizuoka Prefecture (HASEGAWA, 1972; TAKAI, 1962), Yoshizawa Sekkai Co. 10th Quarry, Totigi Prefecture (HASEGAWA, 1972), Yoshizawa Sekkai 2nd Quarry, Totigi Prefecture (NAORA, 1954), Maegawara Cave, Totigi Prefecture, (NAORA, 1954), Takanosu-zawa Cave, Totigi Prefecture (NAORA, 1954), Okado Cave in Izuruhara, Totigi Prefecture (NAORA, 1954; SHIKAMA, 1949), Top Site

Cave of Kamagate Sekkai, Totigi Prefecture (NAORA, 1954). Miyata Caves I and II, Okubo, Tuidi and Kadosawa, all in the Totigi Prefecture (SHIKAMA, 1937, 1949), Koziki-ana, Yamaguchi Prefecture (SHIKAMA and OKAFUJI, 1958), Makurazino-ana, Yamaguchi Prefecture (SHIKAMA and OKAFUJI, 1958). All these localities lie in Honshu, outside which *Mogera wogura* is known from Ojikado Cave in northern Kyushu (HASEGAWA, YAMAUTI and OKAFUJI, 1968). *Mogera wogura* is a typical mole and, according to ELLERMANN and MORRISON-SCOTT (1951), a subspecies of *Talpa micrura* HODGSON, 1841. Today it occurs in Honshu, Shikoku, Kyushu and small neighbouring islands, some of its populations being regarded as separate subspecies or even species.

In the Japanese fossil fauna the family *Soricidae* is represented by two subfamilies: *Crocidurinae* and *Soricinae*. *Crocidura dsinezumi* (TEMMINCK, 1848) is a known fossil member of the first of them. It was found in the Ikumo Quarry, Yamaguchi Prefecture (HASEGAWA, 1963, 1966), Tokuyama Soda Quarry, Yamaguchi Prefecture (HASEGAWA, 1966; SHIKAMA, HASEGAWA and OKAFUJI, 1958) Shiraiwa Mine, Shizuoka Prefecture (HASEGAWA, 1966), Shiriya Mine, Aomori Prefecture (HASEGAWA, 1966; NAKAJIMA, 1958), Shikimizu, Ehime Prefecture (HASEGAWA, 1966; SHIKAMA and HASEGAWA, 1958), Ando Quarry, Yamaguchi Prefecture (HASEGAWA, 1972), Maegawara Cave, Totigi Prefecture (NAORA, 1954), Takanosu-zawa Cave, Totigi Prefecture (NAORA, 1954), Okado Cave, Izuruhara, Totigi Prefecture (NAORA, 1954; SHIKAMA, 1949), Miyata Caves I and II, Totigi Prefecture (SHIKAMA, 1949), Makurazino-ana, Yamaguchi Prefecture (SHIKAMA and OKAFUJI, 1958). In addition, *Crocidura* sp. was reported from the Tadaki Limestone Quarry, Shizuoka Prefecture (HASEGAWA, 1972; TAKAI, 1962). Now *Crocidura dsinezumi* lives in Honshu, Kyushu and Shikoku and in small islands in their vicinity. According to ELLERMANN and MORRISON-SCOTT (1951), it is a subspecies of *C. russula* HERMANN, 1780.

In Japan the *Soricinae* are represented by members of the tribes *Soricini*, *Neomyini* and *Blarinini*. Fossil specimens of *Sorex shinto* THOMAS, 1905 belonging to the first of them have been recorded from the Ikumo Quarry, Yamaguchi Prefecture (HASEGAWA, 1963, 1966), Tokuyama Soda Quarry, Yamaguchi Prefecture (SHIKAMA, HASEGAWA and OKAFUJI, 1958), Ando Quarry, Yamaguchi Prefecture (HASEGAWA, 1972), Shiraiwa Mine, Shizuoka Prefecture (HASEGAWA, 1966), Shikimizu Quarry, Ehime Prefecture (HASEGAWA, 1966; SHIKAMA and HASEGAWA, 1962), Maegawara Cave, Totigi Prefectu (NAORA, 1954), Takanosu-zawa Cave, Totigi Prefecture (NAORA, 1954), Shimizu Quarry, Totigi Prefecture (NAORA, 1954), Miyata Caves I and II, Totigi Prefecture (SHIKAMA, 1949) and Shiriya Mine, Aomori Prefecture (HASEGAWA, 1966, 1972; NAKAJIMA, 1958). Most of these fossil localities lie outside the present range of this species, which covers Hokkaido and the mountains of Honshu. *Sorex shinto* is probably a subspecies of *S. caecutiens* LAXMANN, 1788. *Sorex* sp. was mentioned from the top site of Kamagata-Sekkai, Totigi Prefecture (NAORA, 1954).

Sorex minutissimus ZIMMERMANN, 1780 was found in the Ando Quarry, Yamaguchi Prefecture (HASEGAWA, 1966). Mention of the occurrence of this

form in the fauna of the Ikumo Quarry, Yamaguchi Prefecture (HASEGAWA, 1966) is a mistake. Now this species lives in Japan only in Hokkaido, but even there it is rare.

In the fossil fauna of Japan the tribe *Neomyini* is represented by *Chimarrogale platycephala* (TEMMINCK, 1842) and *Anourosorex japonicus* SHIKAMA and HASEGAWA, 1958. The first of these species, now occurring in Honshu, Shikoku and Kyushu, is known only from the Holocene fauna of Same Cave, Siga Prefecture (HASEGAWA, 1966; SHIKAMA, SIMAOKA, CHINZEI and KAGAMI, 1952). *Anourosorex japonicus* is known from the Ikumo Quarry, Yamaguchi Prefecture (HASEGAWA, 1963, 1966), Ando Quarry, Yamaguchi Prefecture (HASEGAWA, 1966, 1972), Tokuyama Soda Quarry, Yamaguchi Prefecture (HASEGAWA, 1966; SHIKAMA, HASEGAWA and OKAFUJI, 1958; SHIKAMA and OKAFUJI, 1958), Ushikawa Mine, Aichi Prefecture (HASEGAWA, 1966, SUZUKI and TAKAI, 1959), Shiraiwa Mine, Shizuoka Prefecture (HASEGAWA, 1966; SHIKAMA and HASEGAWA, 1958), Yoshizawa Sekkai Co. 10th Quarry, Totigi Prefecture (HASEGAWA, 1972), Yoshizawa Sekkai Co. 2nd Quarry, Totigi Prefecture (NAORA, 1954), Maegawara Cave, Totigi Prefecture (NAORA, 1954), Takanosu-zawa Cave, Totigi Prefecture (NAORA, 1954), Okado Cave in Izuruhara (NAORA, 1954; SHIKAMA, 1949), Miyata Caves I and II and Tuidi, Totigi Prefecture (SHIKAMA, 1949) and Isa Limestone Quarry, Yamaguchi Prefecture (SHIKAMA and HASEGAWA, 1958). *A. japanicus* is an extinct species. *Anourosorex squamipes* MILNE-EDWARDS, 1872 is the only living member of this genus; its range covers the wooded mountains of the south-eastern part of the Asiatic mainland.

In the fossil fauna of Japan there is only one species belonging to the tribe *Blarinini*, i.e. *Shikamainosorex densicingulata* HASEGAWA, 1957. Its remains have been colleted in three fossil localities.

A mandibular fragment, used as the holotype of the species, was described by HASEGAWA (1957) from the Kuzuü formation at the Okada Quarry in Izuruhara, Totigi Prefecture. The presence of *Shikamainosorex densicingulata* in the Ando Quarry, Yamaguchi Prefecture, has also been mentioned by HASEGAWA (1966, 1972). In addition, the National Science Museum in Tokyo is in possession of a specimen belonging to this species, derived from Yoshizawa Sekkai in the Totigi Prefecture, where it was found, like the holotype, in the Kuzuü formation. It has not been published hitherto.

All the three localities lie in Honshu Island, the Ando Quarry in the southernmost part of this island and the other two localities in the Kuzuü region in its middle part, north of Tokyo.

The fauna of the Ando Quarry has not been described in detail, HASEGAWA (1966, 1972) published only its list. The geological situation refers it to the period of the penultimate glaciation (Riss), which would also be indicated by the occurrence of remains of *Palaeoloxodon naumanni* (MAKIYAMA, 1924), absent from the older deposits of Japan. The composition of the rodent fauna (KOWALSKI and HASEGAWA, 1976) indicates, on the other hand, that the Ando fauna cannot be ascribed to the last glaciation.

The other two localities of *Shikamainosorex* are in the Kuzuü region. A series of fossil faunae were found there in caves and fissures in limestone rocks and described by SHIKAMA (1937, 1949). SHIKAMA uses the name „Kuzuü formation" for the filling of these caves and fissures and he distinguishes its lower, middle and upper part. The occurrence of the genus *Stegodon* in the lower Kuzuü formation suggests an age corresponding with the Mindel glaciation in Europe. It is difficult to determine the age of particular localities in the Kuzuü region. Nevertheless, it may well be that the remains of small mammals come from an earlier period. In other localities of the Japanese fossil fauna containing mammals from the period of the last glaciation no *Shikamainosorex* has been found so far.

In SHIKAMA'S (1949) paper the remains of both *Anourosorex* and *Shikamainosorex* together were defined as *Chimarrogale crassidentata* KOSHIDA (nomen nudum). It was later that HASEGAWA (1957) and SHIKAMA and HASEGAWA (1958) found that they were concerned with two different forms. As has already been mentioned, only the mandibular fragment from the Okada Quarry was included in *Shikamainosorex* and used to describe this new genus and species.

The authors of the present paper were in a position to examine, in addition to the holotype, the remaining material belonging to this species, from the Ando Quarry and Yoshizawa Sekkai. A photograph of the skull from Ando is presented in OKAFUJI'S (1975) paper, no description is however given.

The whole of material examined is in the possession of the National Science Museum (Department of Vertebrate Palaeontology) in Tokyo.

SYSTEMATIC PART

Order *Insectivora* BOWDICH 1821
Family *Soricidae* GRAY 1821
Subfamily *Soricinae* FISCHER von WALDHEIM 1817
Tribe *Blarinini* STIRTON 1957
Genus *Shikamainosorex* HASEGAWA 1957
Shikamainosorex densicingulata HASEGAWA 1957
(text-fig. 1—2)

1949 — *Chimarrogale crassidentata* KISHIDA (nomen nudum) (partim); SHIKAMA, p. 45.
1957 — *Shikamainosorex densicingulata*, gen. nov., sp. nov.; HASEGAWA, p. 67—69, text-fig. 1, pl. XII.
1962 — *Shikamainosorex densicingulata* HASEGAWA; SULIMSKI, p. 472—473.
1966 — *Shikamainosorex densicingulata* HASEGAWA; HASEGAWA, p. 34.
1967 — *Shikamainosorex densicingulata* HASEGAWA; REPENNING, p. 42.
1971 — *Shikamainosorex densicingulata* HASEGAWA; OKAFUJI, p. 96—97.
1972 — *Shikamainosorex densicingulata* HASEGAWA; HASEGAWA, p. 560, 566.

Material. Okada Quarry, Izuruhara, Kuzuü region, Totigi Prefecture: mandibular fragment with P_4—M_3 and processes except angular process; this specimen is the holotype and at the same time the only material so far described

on which the knowledge of the morphology of the species has been based (HASEGAWA, 1957). Ando Quarry, Akiyochi region, Yamaguchi Prefecture. Rostral portion of a skull with nearly complete dentition except left A^1 and both A^4; maxillary fragment with A^2—M^2; 3 halves of mandibles, of which one nearly complete (lack of angular process), another broken behind M_2, with I_1—M_2 preserved, and the third broken at the height of M_2, with M_2—M_3 and the processes except the angular process preserved; detached teeth: 8 I^1, 1 A^1, 1 A^2, 1 A^3, 17 P^4, 12 M^1, 12 M^2, 21 I^1, 3 P^4, 13 M^1, 6 M^2 and 3 M^3. Yoshizawa Sekkai Quarry, Ogano, Kuzuü region, Totigi Prefecture. Maxillary fragment with P^4—M^2.

Description. Dental formula

$$\frac{1—5—3}{1—2—3} = 30$$

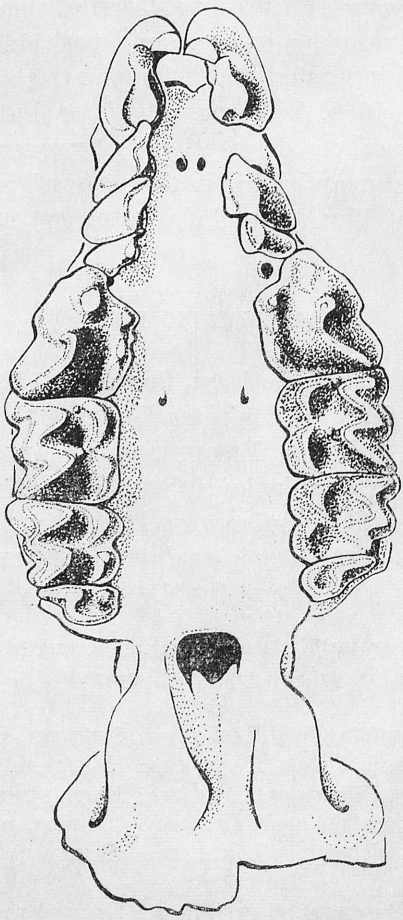

Fig. 1. *Shikamainosorex densicingulata* HASEGAWA from Ando quarry — rostral portion of the skull with nearly complete dentition except left A^1, and both A^4

The teeth of all specimens except the holotype are heavily pigmented. At the tops and ridges of the teeth the pigmentation shades from dark-red to nearly black. The rostrum is broad and the premaxillae are swollen in the region of the external nostrils. Their swollen appearance is enhanced by the fact that there are fairly marked depressions just behind them, over the space below A^1—P^4,

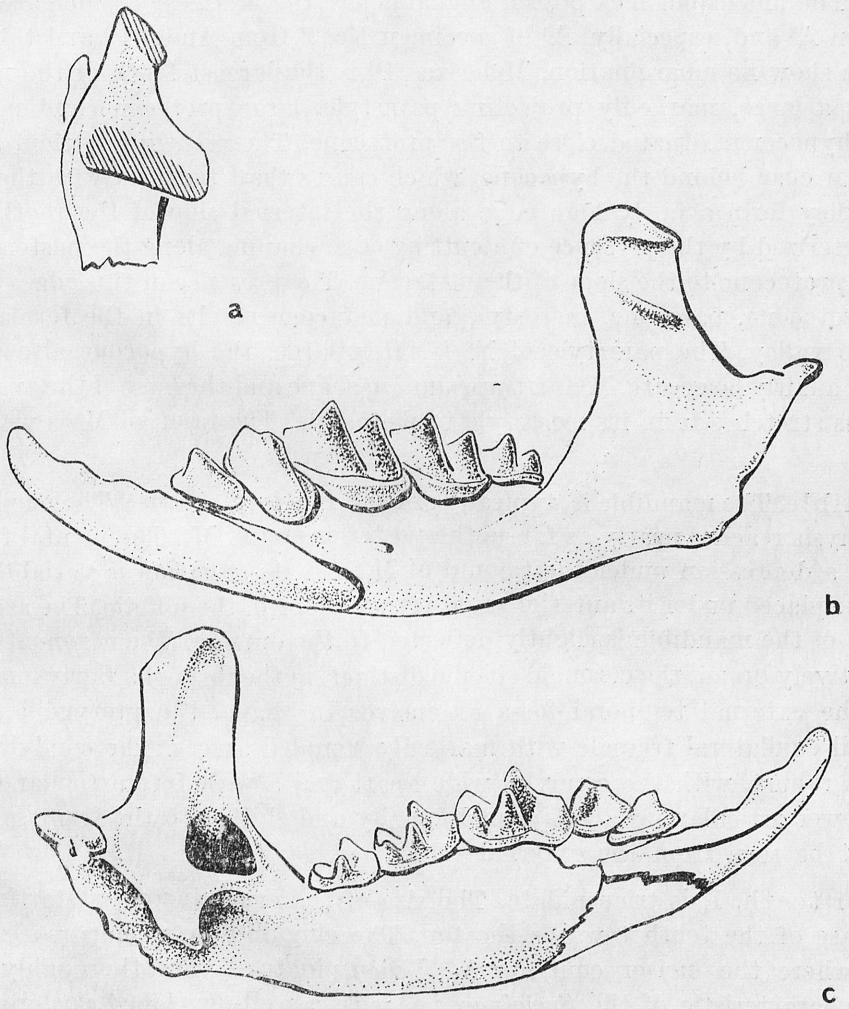

Fig. 2. *Shikamainosorex densicingulata* HASEGAWA from Ando quarry: a — processus condyloideus of the left half of mandible, b—c — left half of the mandible with I_1,—M_3

on the external side of the skull. The infraorbital foramina are fairly large. Their anterior edge lies under the anterior part of the metacone of P^4 and the posterior one between P^4 and M^1. The almost round small lacrimal foramen is situated under the anterior part of M^1, in the extension of the diameter of the infraorbital foramen drawn parallel to the long axis of the skull. The fairly

large anterior palatine foramina extend, more or less, to the place over the point at one-third of the length of A^2.

Upper teeth. Nonbifid I^1 is large, sturdy, with a rectangular talon and wide cingulum. I^1 is followed by four unicuspids, the largest of which is A^2. A^1 is not much smaller than A^2, A^3 about half the size of A^2, and A^4 tiny, almost round and invisible from the lateral side, being entirely intercepted by the parastyle of P^4. The unicuspids lack posterolingual cusps, the vestiges of which are visible only on A^2 and, especially, A^3 of specimen No. 2 from Ando. P^4 and the upper molars show no emargination. Molarized P^4 is the largest tooth of the maxilla. It has a large, markedly projecting parastyle, large protocone and not very large hypocone, situated close to the protocone. There is, in addition, a small cingular cusp behind the hypocone, which causes that, together with the cingulum, they form a fairly high edge along the internal side of the tooth. M^1 is characterized by the presence of a cutting edge running along the posterior part of the protocone to the slope of the metacone. The presence of this edge between the protocone, paracone, mesostyle and metacone results in the formation of a deep valley. The parastyle of M^1 is fairly large, the hypocone also distinct and of a fairly large size. M^2 is a trapezium in shape and the base of the zygomatic process stretches from its mesostyle to metastyle. The talon of M^3 is well developed.

Mandible. The mandible is, typically of most *Blarinini*, robust. The mandibular symphysis reaches nearly as far as the posterior end of M_1. The mental foramen lies in a depression under the talonid of M_1, but its situation is variable, for it may be placed under its anterior or posterior end or in the middle. The ascending ramus of the mandible is slightly deflected to the outside. The coronoid process is relatively broad, the coronoid spicule distinct, in the form of a fairly long ridge, and the external temporal fossa extensive. In shape, the pterygoid fossa is a small equilateral triangle with markedly rounded apices. The condyloid process is robust, with the condyles wide apart and a wide interarticular surface. The lower articular surface is bent lingually and shifted to the front so that it cannot be seen from the external side.

Lower teeth. I_1 is tricuspidate. The size of the cusps increases starting from the base of the tooth towards the top. The cingulum, very narrow, is visible only where the incisor contacts A_1. Unicuspidate A_1 lies thoroughly on I_1. P_4 is characteristic of the *Soricinae*, i.e. with a well-developed postero-lingual basin. The cingulum is hardly visible on both A_1 and P_4. M_1 is marked by its very distinct endoconid, but the endoconid crest is lacking. The hypoconid of the first molar is united with the trigonid in the depression between the protoconid and metaconid, whereas the protolophid is not joined with the endoconid. The very flat and wide cingulum, especially in the middle of the tooth, between the trigonid and talonid, narrows considerably towards the anterior and posteior ends of this molar. It is also visible on the internal side. M_2 is, as usual in the *Soricidae*, a diminished counterpart of M_3. M_1 has no endoconid developed

Shikamainosorex densicingulata HASEGAWA, dimensions of skull and upper dentition

Locality		ANDO														Yoshizawa Sekkai
		no of specimens		isolated teeth												
		1	2													
Width of rostrum before P_4		4.40	—	—	—	—	—	—	—	—	—	—	—	—	—	—
max. width of rostrum		8.60	—	—	—	—	—	—	—	—	—	—	—	—	—	—
I^1	L_1	3.50	—	3.10	3.60	3.20	3.70	—	—	—	—	—	—	—	—	—
	L_2	1.90	—	1.60	1.90	1.70	1.90	—	—	—	—	—	—	—	—	—
	W	2.70	—	2.50	2.50	2.30	2.50	—	—	—	—	—	—	—	—	—
A^1	L	1.80	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	W	1.30	—	—	—	—	—	—	—	—	—	—	—	—	—	—
A^2	L	1.40	1.40	—	—	—	—	—	—	—	—	—	—	—	—	—
	W	1.40	1.50	—	—	—	—	—	—	—	—	—	—	—	—	—
A^3	L	0.80	0.80	—	—	—	—	—	—	—	—	—	—	—	—	—
	W	1.10	1.10	—	—	—	—	—	—	—	—	—	—	—	—	—
A^4	L	—	0.70	—	—	—	—	—	—	—	—	—	—	—	—	—
	W	—	0.70	—	—	—	—	—	—	—	—	—	—	—	—	—
P^4	L_1	2.80	2.70	2.60	2.80	2.70	2.70	2.70	2.60	2.70	2.70	2.60	2.60	2.55	2.60	2.50
	L_2	1.70	1.80	1.90	1.90	1.90	1.80	1.80	1.70	1.90	1.80	1.80	1.80	1.90	1.80	1.60
	W	2.70	2.50	2.40	2.50	2.40	2.50	2.60	2.50	2.40	2.60	2.50	2.40	2.40	2.40	2.50
M^1	L_1	2.20	2.20	2.20	2.20	2.20	2.20	2.10	2.00	2.10	2.10	2.10	—	—	—	2.10
	L_2	2.10	2.10	2.10	2.10	2.10	2.10	2.00	1.95	2.00	2.00	2.00	—	—	—	2.00
	W_1	2.60	2.60	2.50	2.50	2.55	2.40	2.40	2.40	2.50	2.60	2.50	—	—	—	2.50
	W_2	2.40	2.50	2.30	2.40	2.50	2.40	2.30	2.30	2.30	2.45	2.35	—	—	—	2.40
M^2	L_1	1.90	1.80	1.90	1.80	1.80	1.80	1.80	1.80	1.80	1.70	1.70	—	—	—	1.70
	L_2	1.80	1.70	1.70	1.70	1.70	1.70	1.70	1.75	1.70	1.60	1.60	—	—	—	1.60
	W_1	2.60	2.60	2.40	2.70	2.60	2.50	2.40	2.50	2.60	2.40	2.40	—	—	—	2.60
	W_2	2.10	2.20	2.00	2.10	1.90	1.90	2.00	2.20	2.00	2.00	2.00	—	—	—	2.20
M^3	L	0.90	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	W	1.90	—	—	—	—	—	—	—	—	—	—	—	—	—	—
width of contriction between rostrum and brein-case		3.70	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table II

Shikamainosorex densicingulata HASEGAWA, dimensions of mandibles and lower dentition

Locality		OKADA	ANDO											
		holotype	numbers of specimens					isolated teeth						
			1	2	3	4	5							
I_1	L	—	broken	8.35	—	8.00	8.30	7.70	8.00	7.90	8.10	7.90	—	—	—
	L	—	1.60	1.55	—	—	—	—	—	—	—	—	—	—	—
A	W	—	0.90	1.10	—	—	—	1.10	—	—	—	—	—	—	—
P_4	L	1.85	1.75	1.90	—	—	—	—	—	—	—	—	—	—	—
	W	1.50	1.60	—	—	—	—	1.50	1.40	1.50	—	—	—	—	—
M_1	L	2.45	2.35	2.40	—	—	—	2.40	2.40	2.40	2.40	2.40	2.35	2.30	2.40
	W_2	2.00	1.95	1.85	—	—	—	1.90	1.80	1.80	1.90	1.75	1.90	1.85	2.00
M_2	L	1.85	1.85	1.90	1.90	—	—	1.80	1.90	1.85	1.90	1.90	1.90	—	—
	W_2	1.70	1.65	1.60	1.60	—	—	1.50	1.60	1.50	1.50	1.70	1.70	—	—
M_3	L	1.55	1.60	—	1.60	—	—	1.65	1.60	1.60	—	—	—	—	—
	W_2	1.00	1.00	—	0.95	—	—	0.95	0.85	0.90	—	—	—	—	—
M_1—M_3	L	5.75	5.80	—	—	—	—	—	—	—	—	—	—	—	—
Height of mandible between M_2—M_3		2.90	2.85	3.10	3.00	—	—	—	—	—	—	—	—	—	—
Height of ascending ramus		7.15	7.20	—	7.65	—	—	—	—	—	—	—	—	—	—
Length of mandible with I_1		—	16.90	—	—	—	—	—	—	—	—	—	—	—	—
Length of mandible without I_1		—	broken	—	—	—	—	—	—	—	—	—	—	—	—
Length of lower articular facet		broken	3.10	—	3.20	—	—	—	—	—	—	—	—	—	—
Height of proc. condyloideus		3.55	3.40	—	3.50	—	—	—	—	—	—	—	—	—	—

on the large talonid. The cingulum of the last molar is narrow and its width is nearly uniform all over the internal side of the tooth.

Dimensions: see Tables I and II.

Discussion. As has already been mentioned in the introduction the specimens described come from three different localities. The most abundant material was found in the Ando Quarry, only a madibular fragment (holotype) being known from the Okada Quarry and a maxillary fragment from Yoshizawa Sekkai. A close analysis of the material shows no essential differences in size and morphology between the specimens from these three localities. The only differences observed are the presence of tiny posterolingual cusps on A^2 and A^3 of specimen No. 2 from Ando, absent from the rest of the material, and complete lack of pigmentation in the teeth of the mandible, which is the holotype. The lack of pigmentation in the teeth of the specimen from the Okada Quarry is a striking fact, for the pigmentation of teeth in the *Soricidae* is very lasting and persists even in specimens from geologically older (Tertiary) strata. In our case the lack of pigmentation does not result from the wear of the teeth, because the remains belonged to a young specimen. Although the specimen under discussion is not quite white, but it is not so either that the coloration acquired during fossilization might mask the pigment. As the remaining specimens, except for tooth pigmentation, do not depart from the holotype in any morphological characters, it should be thought that the decoloration of the holotype was caused by some peculiar conditions of the substratum in which it lay. There seems to be no reason to assume that the other specimens belonged to another systematic unit and so we regard all of them as members of one species. It belongs to the subfamily *Soricinae*, which is indicated by the presence of pigmentation, the occurrence of the posterolingual basin, the marked overhanging of the cingulum over the root and the surface under the posterolabial corner of P_4, the situation of the mental foramen, which lies farther to the rear than in the other subfamilies (except the geologically older subfamily *Heterosoricinae*) and, finally, the structure of the condyloid process, whose articular surfaces unite on the labial side and the interarticular surface shows an emargination on the lingual side.

The membership of the species studied in the tribe *Blarinini* is suggested by the following characters: non-bifid I^1, trapezoid M^2, the deflection of the coronoid process to the outside from the long axis of the mandible, the smallness of the internal temporal fossa, the robustness of the endoconid and lack of the endoconid crest on M_1, the reduction of M_3, the distance between the roots of M_3, smaller than the transverse diameter of the alveolus of this tooth, and, lastly, the structure of the condyloid process. In this last structure the features characteristic of the *Blarinini* are the widely disposed articular surfaces and, as a result, the wide interarticular surface with a small lingual emargination, and the elongate lower articular surface, which is bent lingually, shifted to the front and turned to the ventral side.

Sulimski's (1962) suggestion as to the affinity between *Shikamainosorex*

densicingulata and the genus *Anourosorex* MILNE-EDWARDS, 1872 is unjustified, which has already been pointed out by REPENNING (1967).

According to REPENNING (1967), in addition to the genus *Shikamainosorex*, the tribe *Blarinini* comprises four American genera: *Adeloblarina* REPENNING, 1969 from the Late Miocene, *Cryptotis* POMEL, 1848, living since the Late Pliocene, *Paracryptotis* HIBBARD, 1956 from the Middle and Late Pliocene and *Blarina* GRAY, 1838, persisting since the Late Pliocene. Out of the Eurasian forms, in the *Blarinini* REPENNING includes the genus *Blarinoides* SULIMSKI, 1959 with its only species *B. mariae* SULIMSKI, 1959, occurring in Europe from the decline of the Miocene to the Middle Pleistocene, „*Sorex*" *dehneli* KOWALSKI, 1956 from the end of the Miocene in Poland, „*Sorex*" *kretzoi* SULIMSKI, 1962 from the Pliocene of Poland and *Peisorex pohaiensis* KOWALSKI and LI, 1963 from the Middle Pleistocene of China. In comparing *Shikamainosorex densicingulata* with the remaining members of the tribe, „*Sorex*" *dehneli*, „*Sorex*" *kretzoi* and *Peisorex pohaiensis* were omitted because of their still obscure systematic position. Out of the other five genera of this tribe, the American genus *Paracryptotis* most resembles *Shikamainosorex*, as has already been stated by HASEGAWA (1957).

The genus *Adeloblarina* REPENNING, 1969, though described only on the basis of a mandibular fragment, is no doubt different from the other known fossil remains of the *Soricidae* and, as has been shown by REPENNING, represents the characters of the tribe *Blarinini* despite the fact that it is considered to be its most primitive member. Judging from the description and drawings it differs from *Shikamainosorex* in its smaller size, finer structure of the mandible (similar to that in the genus *Sorex*), narrower coronoid process, which is not deflected buccally but positioned at an angle of 90° to the body of the mandible, narrower and differently shaped cingulum on M_1, details in the structure of the condyloid process (which, to be true, is damaged in the only specimen known), position of the mental foramen, shifted farther to the front between the roots of M_1 and the different shape of the internal temporal fossa, which in *Adeloblarina* more resembles an isosceles triangle than an equilateral one and has a well-developed limula.

Another primitive member of the tribe *Blarinini*, the genus *Cryptotis* POMEL, 1848, less specialized than the other genera except *Adeloblarina*, also differs much from *Shikamainosorex* in structure. It was found on the basis of the descriptions and comparison with the modern Mexican species *Cryptotis* cf. *griseoventris* JACKSON, 1933, to a specimen of which the authors had access, that in *Cryptotis* the rostrum is narrower than in *Shikamainosorex*, the infraorbital foramina are situated in a different manner, A^1 and A^2 have distinct posterolingual cusps and A^4 is perfectly well seen from the external side of the maxilla, because the parastyle of P^4 does not project to the front but is aligned with the protocone. Further features that differ *Cryptotis* from *Shikamainosorex* are as follows: the poorly developed hypocone of P^4, the presence of emargination (slight to moderate) on P^4 and upper molars, the short cutting edge running

from the posterior part of the protocone of M^1 but not reaching the metacone, which causes that, in contradistinction to *Shikamainosorex*, the valley between the protocone, paracone, metastyle and metacone is open, and, finally, the vestigial hypocone on M^1, more rectangular M^2 and more reduced talonid of M_3. In comparison with *Shikamainosorex*, the pigmentation of teeth in *Cryptotis* is lighter and its condyloid process is also different, more resembling that in the genus *Adeloblarina*.

The genus *Blarina* GRAY, 1838, above all, big modern *Blarina brevicauda* (SAY, 1823), which most resembles *Shikamainosorex densicingulata* in size, differs from this last in its somewhat smaller dimensions, the different dental formula (one antemolar more in the maxilla), the size and mutual proportions of the upper molars and the presence of distinct posterolingual cusps on them. The structure of P^4 of *Blarina* is different in details, its parastyle not projecting so much as it is in *Shikamainosorex* and, in consequence, the smallest of the antemolars, A^5, can be seen a little from the external side of the maxilla. I_1 in *Blarina brevicauda* is, in addition, almost smooth, the cingulum of the lower molars ill developed and the talonid of M_3 less reduced than in *Shikamainosorex*. Moreover, the structure of the coronoid process is different in either form under comparison: in *Blarina* the coronoid spicule has the shape of a process and not a furrow and lies very high, close to the posterior edge of the coronoid process, not in the middle of it as in *Shikamainosorex*. Some differences occur also in the shape of the condyloid process, e.g. in *Blarina* the apper articular surface is larger.

The only systematically certain member of this tribe from Europe, *Blarinoides mariae*, described by SULIMSKI in 1959, is also different from *Shikamainosorex densicingulata*. KRETZOI (1962), to be sure, includes *Blarinoides* in the genus *Shikamainosorex* as *S. mariae*, but his opinion has no corroboration. KOWALSKI and LI (1963), showing the unsoundness of this statement, mention that *Shikamainosorex densicingulata* has the cingulum on the lower molars wider and the reduction of M_3 more advanced than they are in *Blarinoides mariae*. A comparison of *Shikamainosorex densicingulata* with big series of *Blarinoides mariae* from several fossil localities in Poland made it possible to demonstrate further essential differences. Thus, *Blarinoides mariae* differs from *Shikamainosorex* in having more antemolars in the maxilla or, in other words, a different dental formula. The proportions between the unicuspids in *Blarinoides mariae* are different and cusps are visible at their posterolingual corners. In the European form P^4 and the upper molars are characterized by a slight emargination, the parastyle of P^4 is still more distinguished and M^2 more approaches a trapezium in shape. The structure of P_4 is characteristic of the *Crocidurinae* (without the posterolingual basin), the shape and the width of the cingulum on the lower molars are different from those in *Shimakainosorex* and so is, in details, the structure on the condyloid process, etc.

As has already been mentioned, *Shikamainosorex densicingulata* comes nearest in morphology to the American fossil genus *Paracryptotis* HIBBARD,

1956 and especially to its big species *P. rex* HIBBARD, 1956. The new material described in this paper supports this statement. Both *Shikamainosorex* and *Paracryptosis* have their rostrum broad and premaxillae swollen in the region of the external nostrils, pigmented teeth of the same colour, the same number of teeth and identical dental formula, more or less the same size and mutual proportions of the upper unicuspids, which lack posterolingual cusps, nonbifid I^1 with a robust cingulum and square talon, no emargination on P^4 and the upper molars, similar M^1 with the edge running from the posterior part of the protocone to the metacone well developed and forming a deep basin on the trigonid, trapezoid M^2 and well-developed talon on M^3. In addition, in both these genera P_4 has a *Soricinae*-type structure, i.e. it has a posterolingual basin, and M_1 has no endoconid crest, its endoconid being united with the trigonid in the depression between the protoconid and metaconid. The structure of the last lower molar is also similar in these genera, because its cingulum, unlike that on M_1 and M_2, is narrow and the talonid large but without a distinct endoconid. In both genera the sturdy mandible has the coronoid process broad, the coronoid spicule present, the position of the mental foramen similar, the superior pterygoid fossa, not very deep, without the pterygoid spicule, and the interarticular surface on the coronoid process wide.

The American forms and Japanese species differ in that in *Shikamainosorex* the large projecting parastyle of P^4 intercepts the last tiny unicuspidate tooth (A^4) so that it cannot be seen at all from the external side of the maxilla, whereas in *Paracryptotis rex* the parastyle of P^4 is smaller and less projecting and A^4 is partly visible from the lateral side. The two genera differ in the position of the anterior mental foramina and somewhat in the shape and position of the infraorbital foramen. In *Shikamainosorex densicingulata* the palatine foramina end at the height of one-third of the length of A^2 and in *Paracryptosis rex* at the line of the posterior edge of A^2. The infraorbital foramen of the former species begins at the line drawn between the parastyle and metastyle of P^4 and ends between P^4 and M^2, whereas in the latter its anterior edge is situated above the metacone of P^4 and the posterior one between the parastyle and mesostyle of M^1. Moreover, the mandible of *Shikamainosorex* is somewhat larger and its molars have a wider and flatter cingulum than have the molars in *Paracryptotis rex*. I_1 has besides more cusps in the Japanese species and both inferior articular process and the inferior articular surface are shifted to the front so that they cannot be seen from the labial side of the mandible, whereas in *Paracryptotis rex* they are visible, though to a slight degree.

On analysing the similarities and differences of the two genera discussed, REPENNING (1967) suggested that *Shikamainosorex densicingulata* should perhaps be included in the genus *Paracryptotis*. He did not however arrive at a final decision, for he had not seen the specimens from Japan. Comparing the specimens of *S. densicingulata* with the description and drawings of *Paracryptotis rex*, one may actually find many similarities, the differences being few in number and rather in the nature of specific and not generic differences. Since the authors

of the present paper had no opportunity to compare the Japanese material directly with the American specimens, the question of the generic distinctness of *Shikamainosorex densicingulata* is left open for the time being.

As has already been mentioned, the American species *Paracryptotis rex* has been found in the faunae dating from the Middle and Late Pliocene, whereas *Shikamainosorex densicingulata* comes from younger localities, referred to the Middle and Late Pleistocene. During the last glaciation this species probably did not occur in Japan.

Devjatkin and Zazhigin (1974) mentioned the presence od *Shikamainosorex* sp. in Pleistocene layers of the locality Buran-obo in Northern Mongolia without, however, any description of the material.

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STRESZCZENIE

Praca niniejsza jest uzupełnieniem pracy Hasegawy (1957), w której opisał on nowy rodzaj i gatunek kopalnego ssaka owadożernego z Japonii, *Shikamainosorex densicingulata*, na podstawie fragmentu żuchwy z P_4—M_3. Znalezienie

nowych materiałów pozwoliło na uzupełnienie opisu i przedyskutowanie na nowo pozycji systematycznej tej formy.

Holotyp *Shikamainosorex densicingulata* pochodził ze stanowiska Okada. Nowe materiały pochodzą z dwu innych stanowisk: Ando, datowanego najprawdopodobniej na okres przedostatniego zlodowacenia i Yoshizawa Sekkai, którego wiek geologiczny, podobnie jak Okada nie da się dokładnie określić, jest jednak niewątpliwie plejstoceński. Ando leży na południowym krańcu wyspy Honsiu, Okada i Yoshizawa Sekkai w jej środkowej części.

Szczegółowa analiza morfologiczna wykazuje, że wszystkie opisywane szczątki należą do jednego gatunku i nie różnią się między sobą. Jedyną istotną różnicą jest całkowity brak pigmentacji na zębach okazu z Okada, podczas gdy reszta okazów jest silnie pigmentowana. Należy sądzić, że przyczyną braku pigmentacji były szczególne warunki warstw, w których okaz z Okado spoczywał. Dzięki nowym materiałom *Shikamainosorex densicingulata* można ten gatunek zaszeregować do trybu *Blarinini* podrodziny *Soricinae*. Jest on, w obrębie tego trybu, najbardziej zbliżony do rodzaju *Paracryptotis* Hibbard 1956, na co wskazywali już Hasegawa (1957) i Repenning (1967). Różnice między *Shikamainosorex densicingulata* i *Paracryptotis rex* Hibbard 1956 mają raczej charakter gatunkowy niż rodzajowy. Ponieważ autorzy nie mieli możności porównania formy japońskiej z okazami amerykańskimi, sprawę odrębności rodzaju *Shikamainosorex* pozostawiają otwartą.

Na wstępie pracy podano zestawienie dotychczasowych danych o kopalnych przedstawicielach *Insectivora* z Japonii. Są one znane jedynie z czwartorzędu, przy czym dotąd stwierdzono obecność 10 gatunków kopalnych. Z rodziny *Erinaceidae* występuje tu *Erinaceus* sp., z rodziny *Talpidae Dymecodon* sp., *Urotrichus talpoides* Temminck 1841 i *Mogera wogura* Temminck 1842, z rodziny *Soricidae: Crocidura dsinezumi* Temminck 1848, *Sorex shinto* Thomas 1905, *Sorex minutissimus* Zimmermann 1870, *Chimarrogale platycephala* Temminck 1842, *Anourosorex japonicus* Shikama i Hasegawa 1958 i *Shikamainosorex densicingulata* Hasegawa 1957. Wsród tych 10 form są dwie wymarłe (*Anourosorex japonicus* i *Shikamainosorex densicingulata*), jedna nie żyjąca współcześnie w Japonii (*Erinaceus* sp.) i dwie występujące w stanie kopalnym poza dzisiejszym areałem w Japonii (*Sorex shinto*, *S. minutissimus*). Pozostałe znane są ze stanowisk plejstoceńskich i holoceńskich w obrębie obecnego zasięgu.

РЕЗЮМЕ

Настоящая работа является дополнением работы Гасегави (1957), в которой он описал новый род и вид ископаемого насекомоядного млекопитающего из Японии, *Shikamainosorex densicingulata*, на основании фрагмента нижней челюсти (P_4—

M_3.) Находка новых материалов позволила на дополнение описания и продискутирования заново систематики этой формы.

Голотип *Shikamainosorex densicingulata* происходил из стации Окада. Новые материалы происходят из двух других мест: Андо, вероятно из предпоследнего оледенения и Йошизава Секкаи, которого геологический возраст невозможно также точно определить, однако несомненно он происходит из плейстоцена. Андо лежит на юге острова Хонсю, а Окада и Йошизава Секкаи — в его центральной части.

Подробный морфологический анализ доказывает, что все описываемые фрагменты принадлежат одному виду и не отлидаются друг от друга. Одной существенной разницей является полное отсутствие пигментации на зубах у особи из Окада, тогда как у остальных экземпляров пигментация сильно отмечается. Следует считать, что причиной отсутствия пигментации были особенные условия слоёв, в которых находился экземпляр из Окадо. Благодаря новым материалам *Shikamainosorex densicingulata* этот вид можно отнести к трибе *Blarinini* подсемейства *Soricinae*. В пределах этой трибы он наиболее близок к роду *Paracryptotis* HIBBARD 1956, на что указывал уже Гасегава (1957) и Репеннинг (1967). Разницы между *Shikamainosorex densicingulata* и *Paracryptotis rex* HIBBARD 1956 имеют скорее видовой чем родовой характер. Так как авторы не имели возможности сравнения японской формы с американскими экземплярами своеобразие рода остаётся открытым.

Во вступлении работы дано сводку существующих до сих пор данных по ископаемым представителям *Insectivora* с Японии. Они известны лишь из четвертичного периода, причём до сих пор констатировано существование 10 ископаемых видов. Из семейства *Erinaceidae* здесь отмечен *Erinaceus* sp., из семейства *Talpidae Dymecodon* sp., *Urotrichus talpoides* TEMMINCK 1841, и *Mogera wogura* TEMMINCK 1842, из семейства *Soricidae Crocidura dsinezumi* TEMMINCK 1848, *Sorex shinto* THOMAS 1905, *Sorex minutissimus* ZIMMERMANN 1780, *Chimarrogale platycephala* TEMMINCK 1842, *Anourosorex japonicus* SHIKAMA и HASEGAWA 1958 и *Shikamainosorex densicingulata* HASEGAWA 1957. Среди этих 10 форм две вымершие, а именно: *Anourosorex japonicus* и *Shikamainosorex densicingulata*, одна не обитающая в настоящее время в Японии (*Erinaceus* sp.) и две отмеченные в ископаемом состоянии вне современного ареала Японии (*Sorex shinto*, *S. minutissimus*). Остальные известны из плейстоценовых и голоценовых стаций в пределе современного ареала.

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