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Studies on the Cenozoic Plants of Hokkaidô and Karahuto

V. Tertiary *Acers* from Hokkaidô and Karahuto

By

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With 6 Plates

(Contribution from the Department of Geology and Mineralogy, Faculty of Science, Hokkaidô Imperial University, Sapporo. No. 312).

Acer, most species of which having peculiar morphological features in leaf form as well as in characteristic winged seeds, is one of the most familiar plants in the modern vegetation. It now mostly distributes in the temperate zone of the northern hemisphere, comprising possibly more than 150 species in the world, while sect. *Campestris* exceptionally extends southwards to N. L. 35° in Northern Africa, sect. *Negundo* to N. L. 13° in Central America, and sect. *Platanoidea* to S. L. 8° in the Sunda Isl. In the northern extension of this genus, sects. *Glabra* and *Palmata* extend to N. L. 60° in the western coast of North America, and sect. *Platanoidea* to N. L. 65° in Europe.

There can be enumerated more than 130 Asiatic species of this genus, of these 46 species and 22 varieties are living in the Japanese Islands, 13 species in Tyôsen, 9 species in Manchoukuo, and 65 species and 29 varieties in China. Among the Japanese *Acers* mentioned above, 15 species and 10 varieties grow in Hokkaidô, among which 3 grow also in Karahuto. *Acers* in Hokkaidô (H) and Karahuto (K) are as follows:

<i>Acer aizuense</i> NAKAI (Karakogi-kaédé)	H.
<i>A. aizuense</i> var. <i>yezoense</i> MAKINO et NEMOTO (Ezo-Karakogi-kaédé)	H.
<i>A. carpinifolium</i> S. et Z. (Tidorinoki)	H.
<i>A. cissifolium</i> C. KOCH (Mitude-kaédé)	H.
<i>A. diabolicum</i> BLUME (Oni-momizi)	H.

<i>A. horonaiense</i> NAKAI (Horonai-kaédé)	H.
<i>A. japonicum</i> THUNB. (Hautiwa-kaédé)	H.
<i>A. japonicum</i> var. <i>microphyllum</i> KOIDZ. (Ezo-meigetü-kaédé)	H.
<i>A. japonicum</i> var. <i>stenlobum</i> HARA (Momizi-hautiwa)	H.
<i>A. japonicum</i> var. <i>villosum</i> KOIDZ. (Ke-hautiwa-kaédé)	H.
<i>A. kobakoense</i> NAKAI (Kobako-hautiwa)	H.
<i>A. Mayri</i> KOIDZ. (Aka-itaya)	H.
<i>A. Miyabei</i> MAXIM. (Kurobi-itaya)	H.
<i>A. mono</i> MAXIM. var. <i>acutissimum</i> NAKAI (Ezo-momizi-itaya)	H.
<i>A. mono</i> var. <i>eupictum</i> NAKAI (Itaya-kaédé)	H. K.
<i>A. mono</i> var. <i>Savatieri</i> MURAI (Itomaki-itaya)	H.
<i>A. mono</i> var. <i>magnifica</i> HARA (Oh-yezo-itaya)	H.
<i>A. mono</i> var. <i>velutinum</i> NAKAI (Yezo-itaya)	H.
<i>A. monocarpon</i> NAKAI (Yezo-hautiwa-kaédé)	H.
<i>A. ornatum</i> CARR. var. <i>Matsumurae</i> KOIDZ. (Yama-momizi)	H.
<i>A. ornatum</i> var. <i>Matsumurae</i> subvar. <i>spontaneum</i> NEMOTO forma <i>angustilobum</i> NEMOTO	H.
<i>A. Sieboldianum</i> MIQ. var. <i>typicum</i> MAXIM. (Itaya-meigetü)	H.
<i>A. Sieboldianum</i> MIQ. var. <i>ezoense</i> MIYABE et TATEWAKI (Ezono-itaya-meigetü)	H.
<i>A. ukurunduense</i> TRAUTV. et MEY. (Ogarabana)	H. K.
<i>A. ukurunduense</i> TRAUTV. et MEY. var. <i>pisilosum</i> NAKAI Usuge-Ogarabana)	H. K.

Fossil Acers

More than 20 species (including varieties) of fossil *Acers* have been reported from the Tertiary rocks of the Japanese Islands. They were mostly only listed with neither figure nor description except those described by NATHORST¹⁾²⁾ and FLORIN.³⁾ While in the

- 1) A. G. NATHORST: Contributions à la flore fossile du Japon. Kgl. Sv. Vet. Akad. Handl., vol. XX, 1883.
- 2) A. G. NATHORST: Zur fossilen Flora Japans. Palaeont. Abh., vol. IV, 1888.
- 3) R. FLORIN: Zur Kenntnis der jungtertiären Pflanzenwelt Japans. Kgl. Sv. Vet. Akad. Handl., vol. LXI, 1920.

recent days several types of Tertiary *Acers* have been described successively by such authors as S. ENDÔ,¹⁾²⁾³⁾ E. KON'NO,⁴⁾ S. MIKI,⁵⁾⁶⁾ H. OKUTU,⁷⁾ T. SHIKAMA⁸⁾ and K. HUZIOKA⁹⁾, who all made very valuable contribution to our knowledge on the Tertiary vegetation of the Japanese Islands. E. KON'NO also figured certain *Acer* from Sinano, however, without description. As to the Tertiary *Acers* from Tyôsen, very little has been known to us until the junior writer¹⁰⁾ described several number of species from the Miocene deposits of the peninsula.

All of the Japanese Tertiary species of *Acer* heretofore reported, including those announced by name only, may be listed below:

1. *Acer arcticum* HEER (*Woodwardia* Sandstone of Hokkaidô, ENDÔ 1931).
2. *A. carpinifolium* S. et Z. ? (Omi, KON'NO 1931).
3. *A. diabolicum* BLUME (Omi, KON'NO 1931; Nenosiroidi, ENDÔ 1938, OKUTU 1940).
4. *A. Franchetii* PAX (Nenosiroidi, ENDÔ 1938, OKUTU 1940).
5. *A. Hilgendorfi* NATHORST (Locality unknown, NATHORST 1883).

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- 1) S. ENDÔ: Cenozoic Plants. IWANAMI's Geological and Palaeontological Series. 1931.
 - 2) S. ENDÔ: Cenozoic Plants from Tyôsen (Korea). Journ. Geol. Soc. Japan, vol. XLV, no. 532 and 533, 1938.
 - 3) S. ENDÔ: On Fossil Plants from the Environs of Sendai. Ibid., no. 538 and 539, 1938.
 - 4) E. KON'NO: Cenozoic flora of the Central Sinano, in HOMMA's: Geology of the Central Sinano. 1931.
 - 5) S. MIKI: Plant fossils from *Stegodon* Beds and the *Elephas* Beds near Akashi. Jap. Journ. Botany, vol. VIII, no. 4, 1937.
 - 6) S. MIKI: On the change of flora in Eastern Asia since Tertiary Period (I). The clay or lignite beds flora in Japan with special reference to the *Pinus trifolia* beds in Central Hondo. Ibid., vol. XI, 1941.
 - 7) H. OKUTU: Fossil Plants from the Nenosiroidi Plant Beds near Sendai, (I). Saitô Hô-on Kai Mus., Res. Bull. no. 19, 1940.
 - 8) T. SHIKAMA: Kôbe Group and Its flora. Journ. Geol. Soc. Japan, vol. XLV, no. 539, 1938.
 - 9) K. HUZIOKA: Notes on Some Neogene Plants from the Island of Heigun, Yamaguti Pref., with Description of Two New Species of the Genera *Carpinus* and *Sassafras*. This Journ., vol. IV, nos. 1-2, 1938.
 - 10) K. HUZIOKA: Notes on some Tertiary Plants from Tyôsen. I. This number of this Journal.

6. *A. Miyabei* MAXIM. (Nenosiroisi, OKUTU 1940).
7. *A. Nomurai* OKUTU (Nenosiroisi, OKUTU 1940).
8. *A. Nordenskiöldi* NATHORST (Mogi, NATHORST 1883; Amakusa, FLORIN 1920; Heigun, HUZIOKA 1938; Akasi, MIKI 1937; Kôbe, SHIKAMA 1938; Omi, KON'NO 1931; Tûsen ENDÔ 1938 and Geizitu Bay of Tyôsen, KANEHARA 1938).
9. *A. ornatum* CARR. (including all specimens reported under the names *A. palmatum*, *eupalmatum* and *euseptenlobatum*) (Amakusa, FLORIN 1920; Omi, KON'NO 1931; Aiti pref., MIKI 1941; Nenosiroisi, OKUTU 1940; Geizitu Bay of Tyôsen, KANEHARA 1938).
10. *A. Pavi* NATHORST (Prov. Bungo, NATHORST 1888).
11. *A. platanoides* L. (Kantindô of Tyôsen, ENDO 1938).
12. *A. rufinerve* S. et Z. (Omi, KON'NO 1931; Nenosiroisi, ENDO 1938, OKUTU 1940; Akasi, MIKI 1937).
13. *A. cfr. rubrum* L. (Omi, KON'NO 1931).
14. *A. rubrum* L. var. *lignitum* MIKI (Aiti pref., MIKI 1941).
15. *A. Sieboldianum* MIQ. (Nenosiroisi, ENDÔ 1938).
16. *A. subpictum* SAPORTA (including all the specimens reported under the names *A. pictum* and *eupictum* (Tûsen, Kissyû and Kantindô in Tyôsen, ENDO 1938; Kôbe, SHIKAMA 1938; Omi, KON'NO 1931; Nenosiroisi, ENDÔ 1938, OKUTU 1940; Mogi, NATHORST 1883; Amakusa, FLORIN 1920; Heigun, HUZIOKA 1938).
17. *A. sp. cfr. A. trifidum* H. et ARN. (Omi, KON'NO 1931).
18. *A. trilobatum* (STERNB.) (Tûsen, Kantindô and Kokangen in Tyôsen, ENDÔ 1938).
19. *A. aff. trilobatum* (STERNB.) (Kôbe, SHIKAMA 1938).
20. *A. truncatum* BUNGE (Kôbe, SHIKAMA 1938; Nenosiroisi, ENDÔ 1938).
21. *A. Ueharae* KON'NO (Omi, KON'NO 1931).

Besides the above, there are two more species described from Sachalien; they are as follows:

- A. ambiguum* HEER (Mgratch, HEER 1878).
- A. sachalinensis* HEER (Do.)
- A. trilobatum* (STERNB.) = *A. ezoanum* ÔISHI and HUZIOKA (Mgratch and Dui, HEER 1878).

From the Pleistocene deposits of Japan, ENDÔ¹⁾, KOIDZUMI²⁾ and MIKI³⁾ described the following species.

- A. eupalmatum* KOIDZUMI (Siobara, ENDÔ 1934; KOIDZUMI 1940).
- A. euseptenlobatum* KOIDZUMI (Siobara, ENDÔ 1934; KOIDZUMI 1940).
- A. japonicum* THUNB. (Siobara, ENDÔ 1934; KOIDZUMI 1940).
- A. Sieboldianum* MIQ. (Siobara, ENDÔ 1934; KOIDZUMI 1940).
- A. cfr. nikoense* MAXIM. (Siobara, ENDÔ 1934).
- A. crataegifolium* S. et Z. (Siobara, ENDÔ 1934; Katada, MIKI 1938)
- A. micranthum* S. et Z. (Siobara, ENDÔ 1934; KOIDZUMI 1940).
- A. rufinerve* S. et Z. (Siobara, ENDÔ 1934; KOIDZUMI 1940).
- A. Tschonoski* MAXIM. (Siobara, ENDÔ 1934, KOIDZUMI 1940).
- A. Miyabei* MAXIM. (Siobara, ENDÔ 1934; KOIDZUMI 1940; Nisino-miya, MIKI 1941).
- A. pictum* THUNB. (Siobara, ENDÔ 1934; KOIDZUMI 1940; Neolithic bed of Ekoda, MIKI 1940).
- A. pictum* THUNB. var. *eupictum* PAX ? (Siobara, ENDÔ 1934).
- A. diabolicum* BLUME (Siobara, ENDÔ 1934, KOIDZUMI 1940).
- A. Matsumurai* KOIDZ. (Siobara, KOIDZUMI 1940).
- A. latilobum* KOIDZUMI (Siobara, KOIDZUMI 1940).
- A. cfr. Nordenskiöldi* NATH. (Hanamaki, MIKI 1938).
- A. palmatum* THUNB. (Simokurada, MIKI 1938; Neolithic bed of Ekoda, MIKI 1940; Azuti, MIKI 1940).

None of the Tertiary *Acers* have been described from Hokkaidô and Karahuto, except those only listed by ENDÔ (vid. supra). In dealing with numerous specimens of fossil plants from the Tertiary deposit of Hokkaidô and Karahuto, the present writers found that there is a considerable number of leaves which belong in most probability to the genus *Acer*. As the determination has been made through a careful comparison of the fossil leaves with leaves of

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- 1) S. ENDÔ: Some Japanese Cenozoic Plants. I. On the Fossil *Acer* from the Siobara Pleistocene Plant Beds. Jap. Journ. Geol. Geogr., vol. XI, nos. 3-4, 1934.
 - 2) G. KOIDZUMI: Siobara Pleistocene Fossil-Flora. Acta Phytotax. et Geobot., vol. IX, no. 1, 1940.
 - 3) S. MIKI: On the change of flora of Japan since the Upper Pliocene and the Floral Composition at the Present. Ibid., vol. IX, no. 2, 1938.

modern *Acer*, it may be unquestionable that *Acer* has in reality existed in Hokkaidô and Karahuto in the Tertiary period represented by a number of different species. Occasional occurrence of samarae in close association with leaves proves this view.

Acers from Hokkaidô and Karahuto which the present writers discriminated may be tabulated below accompanied with the respective geological occurrences:

Species	Horizons					
	Isikarian		Urahoroian		Kawabataian	
	Low.	Up.	Low.	Up.		
1. <i>Acer arcticum</i> HEER	—	Wz	—	—	—	—
2. <i>A. ezoanum</i> sp. nov.	—	—	—	—	Es, Na, So, Sk, Kn	
3. <i>A. rotundatum</i> HUZIOKA	—	—	—	—	Es	
4. <i>A. subpictum</i> SAPORTA	—	—	—	—	Sk, Kn	
5. <i>A. trilobatum</i> (STERNB.)	—	—	—	—	Kn	
6. <i>A.</i> sp. nov. ?	—	As	—	—	—	
7. <i>A.</i> sp. indet.	—	—	Hr	—	—	
8. <i>A.</i> sp.	—	—	—	—	Sk	
9. <i>A.</i> sp. (Samarae)	—	—	—	—	Kn, Sk	

Wz *Woodwardia* Sandstone in the Isikari Series, Hokkaidô.

As Asibetu coal-bearing bed in the Isikari Series, Hokkaidô.

Hr Harutori bed in the Urahoro Series, Hokkaidô.

So Soya coal-bearing bed in the Kawabata Series, Hokkaidô.

Sk Sakipenbetu plant beds in the Kawabata Series, Hokkaidô.

Kn Kunnui Series, Hokkaidô.

Es Esutoru coal-bearing bed in the Honto Series, Karahuto.

Na Naihoro coal-bearing bed in the Honto Series, Karahuto.

Of these species listed above, *A. arcticum* HEER is almost indistinguishable from the specimens heretofore described under this name from the older Tertiary rocks of Spitzbergen, Alaska and some other parts of the world. *A. ezoanum* sp. nov. is a type similar to *A. Miyabei* MAXIM. and *A. diabolicum* BLUME, living in Japan, *A. saccharum* MARSH., *A. macrophyllum* PARSH and *A. dacycarpum* EHRB. in North America, and *A. italum* LAUTH and *A. platanoides* L. in the Mediterranean region; among the fossil species the comparable ones are *A. Merriami* KNOWLT., *Osmonti* KNOWLT., *Chaneyi* KNOWLT., *Bolanderi* LESQ., and *florissanti* KIRCHN. from the Miocene rocks of North America, *massiliense* SAP., *recognitum* SAP., *palaeosaccharinum* STUR, *sub-Miyabei* MAEDL., and *subcampestre* GOEPP. from the European Miocene rocks. *A. rotundatum* HUZIOKA is identical to *A. rotundatum* from the Ryûdô Formation and Enniti Series of Tyôsen, and belongs to *mono*-group which has wide geographical

distribution in eastern Asia and to *A. angustifolium* HU living in central China. *A. subpictum* SAPORTA is a form-species which includes all the fossil leaves of *A. pictum* = *A. mono* type, and has very wide geographical distribution contained in the rocks younger than Miocene. *A. trilobatum* (STERNB.) is a variable form distributing in the younger Tertiary deposits of Asia and Europe, and has similar morphological characters with the living *A. rubrum* L. in North America (*A. rubrum* L. var. *pyncanthum* MAKINO now grows in central Honsyû). *A. sp. nov. ?* is a specimen unfortunately somewhat imperfect, but is a form close to *A. Buergerianum* MIQ. living in Taiwan and southern China. *A. sp. indet.* may be comparable to *A. trilobatum* (STERNB.) var. *productum* AL. BR. from Alaska. *A. sp.* is *A. diabolicum* type. There occur also some samarae undoubtedly belonging to *Acer*, but they are hardly specifically determinable.

Seeing all over the fossil species of *Acer* derived from Hokkaidô and Karahuto, it is highly interesting that the species from the Kawabataian have their similarity to the modern *Acers* in Honsyû, north and central China, that is to say to the *Acers* in the temperate, especially, to those in its southern parts but have less similarity to those in the latitude where Hokkaidô and Karahuto now situated. Species from the Isikarian and Urahorioian are unfortunately represented by imperfect specimens but it may at least be mentioned that they have little similarity to the modern *Acers*. Therefore, it is suggested that the fossil *Acers* in Japan have, so far as the material from Hokkaidô and Karahuto is concerned, become to show very close similarity at least in leaf form with the living species since the Kawabataian which roughly correspond in age to the Miocene in the European standard. It must also be noted that most of the Kawabataian *Acers* have their affinity to the modern sect. *Platanoidea* which has also very wide geographical distribution in the world. Samarae which are also very close to those of modern species occurred from the Kawabataian deposits while none has been known from the Urahorioian and Isikarian rocks.

Description

Acer arcticum HEER

Pl. IX (I).

1877. *Acer arcticum* HEER: Flora Fossilis Arctica, Vol. IV, Abt. I, Beitrage zur fossilen Flora Spitzbergens, p. 86, pl. XXII, pl. XXIII, pl. XXIV, figs. 1, 2; pl. XXV, fig. 1 (? 2, 3).

1936. *Acer arcticum* HOLLICK: The Tertiary Floras of Alaska. U. S. G. S., Prof. Paper, 182, p. 133, pl. LXXVII, fig. 1; pl. LXXVIII, figs. 7, 8.

HEER¹⁾ in describing this species from the Cape Lyell and Cape HEER of Spitzbergen classified the leaf types into following five groups: 1) leaf broader than long, shortly lobed, and at the base deeply cordate, 2) leaf broader or slightly shorter than long, deeply cordate at the base, and short lobed at the lateral margin, 3) leaf longer than broad, base almost round, 4) leaf longer than broad, unlobed and roughly toothed, and 5) leaf with wavy margin.

As the Arctic specimens show, the leaf form named by HEER as *Acer arcticum* displays a considerable variation in respect to the size, form and marginal characters of the leaves, sometimes one type being connected to another by the series of intermediate forms. The Japanese specimens now at our disposal also display a considerable variation in several morphological characters of the leaves, but may perhaps be referable to this arctic species among the known fossil leaves of this type. Among the specimens shown in Pl. I, one in fig. 1 is broader than long with slightly cordate base and roughly dentate margin, that in fig. 2 is slightly longer than broad, with similar marginal and basal characters as the preceding, that in fig. 3 is also slightly broader than long, with a little developed marginal lobes, that in fig. 4 is incomplete in its distal portion, but the base is markedly cordate, while that in fig. 5 is longer than broad with lobed margin as that in fig. 3.

HEER compared *A. arcticum* with the fossil species such as *A. crenatifolium* ETT. from Bilin, *A. vitifolium* AL. BR., *A. ponzianum* GAUD., *A. Simondae* GAUD. and *A. otopterix* GOEPP., and *A. spicatum* LAM. living in North America. But the resemblance may be closer to *A. neopolitanum*, an American existing species. It is also deniable that certain leaf types of *A. arcticum* show a close resemblance to the leaves of Vitaceae, such as *Vitis* and *Ampelopsis*, but the balance of resemblance may rather be in favour to *Acer*. HEER figured undeniable winged samara of *Acer* from the type locality of his *A. arcticum*. Therefore, it is at least certain that true *Acer* is certainly contained in the leaf types grouped under the name *Acer arcticum* HEER, though neither reproductive organs nor any other reliable

1) O. HEER: Flora Fossilis Arctica, Bd. VII, Abth. 2, 1883, p. 126, pl. XCIV, fig. 2.

evidences which point the generic position are yet available in the Japanese specimens.

Besides listed above in the synonym table, *A. arcticum* has been reported also from the Upper Atane Formation of Greenland,¹⁾ the Miocene auriferous gravel beds of California²⁾, and the Fort Union Formation of North Dakota in U. S. A.,³⁾ but these are all represented by fragmentary leaf specimens and their identification to *A. arcticum* is doubtful. In Asia. ENDÔ also reported this species from Kunsyun,⁴⁾ Prov. Chientao, the Fushun coal-field,⁵⁾ Prov. Fengtien, both in Manchoukuo, and from the Ôwada coal mine,⁶⁾ Prov. Isikari, Hokkaidô, but they are all accompanied by neither figure nor description. A specimen from Koyamura, in Hukusima pref., which NATHORST⁷⁾ described is, according to KIRCHHEIMER,⁸⁾ a *Vitis*.

Occurrence: Near Bibai town (coll. Y. HATTORI and K. HUZIOKA); near Sunagawa town (coll. T. SIMOGAWARA and K. HUZIOKA); Yûbari coal mine (coll. K. ÔTATUME and K. HUZIOKA); all Prov. Isikari, Hokkaidô; *Woodwardia* Sandstone; Isikarian.

産地. 北海道石狩國美唄町附近, 砂川町附近及び夕張炭礦. 石狩統羊齒砂岩層.

Acer exoanum sp. nov.

Pl. X(II), Figs. 1, 2, 3; pl. XI(III), Figs. 1, 2, 3, 4; pl. XII(IV), Figs. 1, 2.
(Type-specimen: Pl. XI, figs. 1-4).

Description: Leaf petiolate; lamina variable in size, generally attaining about 10 cm. in height and breadth, deeply 3 lobed; median

- 1) O. HEER: Flora Fossilis Arctica, Bd. VII, Abth. 2, 1883, p. 126, pl. XCIV, fig. 2.
- 2) L. LESQUEREUX: Report on the Fossil Plants of the Auriferous Gravel Deposits of the Sierra Nevada. Mus. Comp. Zool., Mem., vol. VI, no. 9, 1878, p. 60.
- 3) L. LESQUEREUX: Contributions to the Fossil Flora of the Western Territories, III. The Cretaceous and Tertiary Floras, 1883, p. 233, pl. XLIX, figs. 8, 9.
- 4) S. ENDÔ: Some Cenozoic Plants from Tyôsen (Korea). Journ. Geol. Japan, vol. XLV, 1938, p. 86.
- 5) S. ENDÔ: Ibid., 1938, p. 86.
- 6) S. ENDÔ: Cenozoic Plants. IWANAMI's Geol. and Palaeont. Series, 1931.
- 7) A. G. NATHORST: Zur fossilen Flora Japans. Pal. Abhandl., Bd. IV, 1888, p. 11, pl. III, fig. 1.
- 8) F. KIRCHHEIMER: Ueber die fossilen Reste der Rebengewächse. Wine und Rebe, Jahrg. 21, 1938, p. 94.

lobe the largest, provided with a pair of prominent dents in the middle and sometimes less defined ones in the distal part; lateral lobes almost entire or with small dents in the upper margin, while with 2 or 3 prominent dents in the lower margin, the basal one usually most prominent; tip of each lobe acute; base nearly straight or slightly cordate; primary veins 3 in number, rigid and well-defined, entering into each lobe straight up to the tip, forming an angle of about 45° to each other; lateral ones less strong than the primaries, at an angle of 45° to the primaries, those entering into marginal dents nearly straight or slightly curved forward, while others curving gently forward at the margin.

The above description is based on the type-specimen figured in Pl. XI(III) figs. 1, 2, 3 and 4. Besides the type-specimen, there is a number of specimens which have been derived from different localities and have been regarded to represent the same specific type. These specimens are shown in Pl. X(II) figs. 1-3 and Pl. XII(IV), figs. 1, 2. Pl. X(II), Fig. 1 shows a basal portion of a lamina with strong three median veins running into the lobes; that this leaf is 3 lobed is obviously seen in that one of the primary veins enters in the left lobe facing the figure. The characteristic basal dent in each lateral lobe is clearly seen; on the right corner of the figure is seen a fragment of a distal portion of the median of the lamina, showing acute tip and characteristic two pairs of marginal dents of which the lower one is stronger. Pl. X(II), fig. 2 shows a distal portion of a lamina; prominent marginal dents in the margin of the median lobe and the acuminate lateral lobe is clearly seen in the figure; in this lateral lobe the upper margin is entire, while in the lower margin a dent is seen in the basal part. Pl. XII(IV) fig. 2 shows that the leaf of this species is somewhat variable in regard to the shape of the lateral lobes which are somewhat reduced, with roughly dentate upper margin; a prominent dent in the median lobe is seen in the figure; this leaf appears to be considerably longer than broad. There are some leaves considerably larger than the type-specimen, the breadth attaining about 20 cm.; these specimens are particularly interesting because the dents at the lower margin of the lateral lobes are extremely developed, and moreover the dents themselves are also finely denticulated at their margins; when the basal dent is thus particularly developed, we may be sometimes misled to the conclusion that the leaf is 5 veined or 5 lobed instead of being in reality 3 lobed, that is

3 veined. Though it has not been figured at this place, there is in the collection a very large leaf attaining at least 25 cm. in breadth; this specimen has been associated with the specimens figured in Pl. X (II) figs. 1, 2 and Pl. XII (IV), fig. 2. The specimen in Pl. X (II) fig. 3 and Pl. XII (IV), fig. 1 appear to be somewhat different from the specimens described above in having acutely pointed dents and rounded base, but have been included in the same specific type as such are regarded to be in the limit of variation of this species.

Remarks and comparison: This species may be characterised by the comparatively large size of the leaf, presence of a pair of prominent dents in the median lobe and also one or more dents at the lower basal margin of the lateral lobes. Fossils which are very closely allied to the present species have been described by various authors from various parts of Europe and North America under more than a dozen different specific names, namely, *A. Chaneyi* KNOWLT., *massiliense* SAP., *Merriami* KNOWLT., *Osmonti* KNOWLT., *Bolanderi* LESQ., *recognitum* SAP., *florissanti* KIRCHN., *palaeosaccharinum* STUR, *sub-Miyabei* MAEDLER, *subcampestre* GOEPP., and some others. However, it is somewhat doubtful whether all these types may in reality represent valid specific types, one species having tendency to merge in morphological characters to other.

Also in the site of our specimens, there exists certainly a considerable variation, as mentioned above, in respects to the size and shape of the leaves, and the manner of marginal dents, yet they are hardly separable to one another to recognize more than one specific type in the specimens. A certain type may be quite unseparable from *A. Merriami* KNOWLTON figured by MACGINITIE¹⁾ from the Trout Creek Flora of Oregon in U. S. A., while some others are also closely allied in their foliar characters to the specimens figured under the name *A. Osmonti* KNOWLT.,²⁾ *florissanti* KIRCHNER³⁾ *palaeosaccharinum* STUR,⁴⁾ etc. Under such circumstances, the best way is,

- 1) H. D. MACGINITIE: The Trout Creek Flora of Southeastern Oregon. Carnegie Inst. Washington, Pub. no. 416, pt. 2, 1933, p. 61, pl. X, fig. 1.
- 2) F. H. KNOWLTON: Fossil Flora of the John Day Basin, Oregon. U. S. G. S., Bull. 204, 1902, p. 72, pl. XIII, fig. 2.
- 3) W. C. G. KIRCHNER: Contribution to the Fossil Flora of Florissant, Colorado. St. Louis Acad. Sci. Trans., vol. VIII, 1898, p. 118, pl. XI, fig. 1.
- 4) W. PH. SCHIMPER and A. SCHENK: Palaeophytologie, in ZITTEL's Handbuch der Palaeontologie, Bd. V, 1890, p. 566, fig. 322.

the writers believe, to identify our specimens with neither of these exotic species mentioned above and to call the Japanese specimens now in consideration under a new name to which the present writers suggest a name *ezoanum*.

Specimens which HEER once described as *Acer* sp. from Sertuy¹⁾ (or Sarturnay) in western coast of Karahuto and as *A. trilobatum* (STERNBERG) from Dui coal-mine²⁾ in Sachalien may almost doubtlessly *A. ezoanum*. Specimens which HAHLOV³⁾ described from Western Siberia as *A. trilobatum* are a type similar to the present species.

It is of utmost interest that the fossil type described here as *A. ezoanum* has not less similarity with some of the living species such as *A. Miyabei* MAXIM. and *A. diabolicum* BLUME in Japan and *A. saccharum* MARSHAL, *A. macrophyllum* PURSH, *A. dacycarpum* EHRB. in North America, and *A. italum* LAUTH and *A. platanoides* L. in the Mediterranean district, while there is none of the similar type in the living *Acers* in China although more than 60 species are now growing in this country. At any rate, it is interesting to note that the fossil leaves of *A. Miyabei* type flourished chiefly in Eastern Asia and New World in the Miocene age, and later having been replaced by more dissected types such as *A. japonicum* and *A. Sieboldianum* downwards the Pliocene and later ages than this. Therefore if a supposition may be admitted, it may be said that the living species which have leaves of *A. Miyabei* or *A. diabolicum* type or others as mentioned above represent rather archaic type.

Localities:

Karahuto: Sarutu, Nayosi-mati, Nayosi-gun; Nayosi, Nayosi-mati, Nayosi-gun (coll. K. HUZIOKA); Tôro coal-mine, Tôro-mati, Nayosi-gun (coll. S. ÔISHI, K. HUZIOKA, T. INOUE); Taihei coal-mine, Esutoru-mati, Nayosi-gun (coll. S. ÔISHI); all the Esutoru coal-bearing Bed; Kawabataian. Siretori coal-mine, Siretori-mati,

- 1) O. HEER: Om nogle fossile Blade fra Oeen Sachalin. Vid. Meddel. Naturhist. Foren. Kjöbenhavn, no. 23-25, 1871, p. 2, pl. VIII, fig. 4.
- 2) O. HEER: Flora Fossilis Arctica, Bd. V, Abth. iii, 1878, p. 48, pl. XIII, fig. 10.
- 3) V. A. HAHLOV: The Tertiary Flora of Tomsk District. Bull. Geol. Prosp. West Siberia, vol. XI, 1931, p. 55, figs. 8, 13.

Siretori-gun (coll. S. ÔISHI); Naihoro coal-bearing Bed; Kawabataian.

Hokkaidô: Sakipenbetu, Kami-Asibetu, Asibetu-mura, Sorati-gun, Prev. Isikari; Sakipenbetu Plant Bed; Kawabataian (coll. K. HUZIOKA); Sôya coal-mine, Kami-Onisibetu, Onisibetu-mura, Sôya-gun, Prov. Kitami; Sôya coal-bearing Bed; Kawabataian (Coll. K. HUZIOKA); Abura, Setana-mati, Prov. Siribesi; Kunnui Series; Kawabataian (colls. S. ÔISHI and K. HUZIOKA).

産地. 樺太 名好郡名好町猿津及び名好, 塔路町塔路炭礦, 惠須取町太平炭礦 (惠須取夾炭層)
 知取郡知取町知取炭礦 (内幌夾炭層)
 北海道 北見國宗谷郡鬼志別村上鬼志別宗谷炭礦 (宗谷夾炭層)
 石狩國空知郡芦別村上芦別炭邊別 (川端統サキベンベツ植物化石層)
 後志國瀬棚郡瀬棚町虻羅 (訓縫統)

Acer rotundatum HUZIOKA

Pl. XII (IV), Fig. 3.

1943. *Acer rotundatum* HUZIOKA: Notes on Some Tertiary Plants from Tyôsen. I. This number of this Journal, p. 129, pl. XXIV (IV), figs. 1-3; XXV (V), fig. 2.

The specimen in Pl. XII (IV), fig. 3 was identified to *Acer rotundatum* which HUZIOKA recently named for specimens from the Neogene formation of Tyôsen. As HUZIOKA described, this species rather comparable to certain living species such as *A. mono* MAXIM. and *A. angustifolium* HU, but may be distinguishable from either of those in the shape of leaf.

As the figured specimen shows, the size and shape of the leaf, especially the characteristic rounded base agree essentially with the type-specimen of *A. rotundatum* from Tyôsen.

Locality: Nayosi, Nayosi-mati, Nayosi-gun, Karahuto, Esutoru coal-bearing Bed; Kawabataian. (Colls. K. HUZIOKA and R. HUKAYA).

産地. 樺太 名好郡名好町名好 (惠須取夾炭層)

Acer subpictum SAPORTA

Pl. XIII (IV), Figs. 1-4; Pl. XIV (VI), Figs. 3, 4.

1873. *Acer subpictum* SAPORTA: Sur les caractères propre à la végétation pliocène à propos de découvertes de M. J. Rames dans le Cantal. A. Meximieux, B. Pas de Mougudo, C. St. Vincent, D. Ceyssac. Bull. Soc. géol. France, Sér. 3, Tom. 1.

1856. *Acer trachyticum* KOVATS: Fossile Flora von Erdoebnye. Arb. geol. Gesell. f. Ungarn, Vol. I, p. 32, pl. VII, figs. 1, 2.
1861. *Acer acutilobatum* LUDWIG: Fossile Pflanzen aus dem tertiären Spatheisenstein von Montabauer. Palaeontogr. Bd. VIII, p. 177, pl. LXIX, figs. 1, 1a, 2.
1876. *Acer laetum pliocaenicum* SAPORTA et MARION: Recherches sur les végétaux fossiles de Meximieux. Arch. Muss. Hist. Nat. Lyon, Vol. I, p. 280, Pl. XXXIV, figs. 2, 3.
1883. *Acer pictum* THUNBERG *fossilis* NATHORST: Contributions à la flore fossile du Japon. Kgl. Svensk. Vet.-Akad. Handl., Bd. XX, No. 2, p. 60, pl. XII, figs. 2-8.
1887. *Acer labelii* TENN., SCHMALHAUSEN: Ueber tertäre Pflanzen aus dem Thale des Flusses Buchtorma am Fusse des Altaigebirges. Palaeontogr., Vol. XXXIII, p. 212, pl. XXII, figs. 5-7.
1888. *Acer pictum* THUNB. *fossilis* NATHORST: Zur fossilen Flora Japans. Pal. Abh., Bd. IV, p. 38, pl. XIII, figs. 1, 2.
1920. *Acer pictum* FLORIN: Zur Kenntnis der jungtertiären Pflanzenwelt Japans. Kgl. Svensk. Vet.-Akad. Handl., Vol. LXI, no. 1, p. 24, pl. IV, fig. 5.
1931. *Acer pictum* KON'NO: Cenozoic Flora of Central Sinano, in HOMMA's Geology of Central Sinano, pl. IV, fig. 7, pl. XIII, fig. 7.
1940. *Acer subpictum* HU and CHANEY: A Miocene Flora from Shantung Province, China. Carnegie Inst. Washington, Publ. no. 507, p. 61, pl. XXXIV, figs. 3, 4, 5, 7; pl. XXXV, fig. 1.

The name *Acer subpictum* SAPORTA is now applied to all the fossil leaves bearing very similar morphological characters to the living *Acer mono* MAXIM. In Asia, *A. mono* comprising many subspecies, varieties and subvarieties distributes widely in Sachalien, Karahuto, southern Tisima, Hokkaidô, Honsyû, Sikoku, Kyûsyû, Tyôsen, Manchoukuo, China and eastern Siberia, and contains many different types chiefly classified in characters of leaf form.

The fossil types bearing also similar leaf form to *A. mono* are indeed very common in the Tertiary deposits of Asia, and it is often very difficult to compare each of these fossil leaves with those of the living species. HU and CHANEY¹⁾ recently proposed to use the name *Acer subpictum* for leaves which bear very similar character in leaf form to *A. mono* but not strictly identical to the living species. This action by HU and CHANEY is certainly convenient in treating such leaves similar to *A. mono*, and it is desirable also to the present writers to use SAPORT's name in the same sense as HU and CHANEY

1) H. H. HU and R. H. CHANEYS: A Miocene Flora from Shantung Province, China, 1940, op. cit., p. 61.

used. Therefore, the *Acer subpictum* used in the present sense may contain also leaf types similar to such living species specifically distinct from *A. mono* but bearing very similar leaf form to those of *Acer mono*. This means that *subpictum* is a comprehensive form species having leaves closely allied to *A. mono*, but probably including also other species with similar leaf form as *A. mono*.

A. subpictum in the present sense appears to have had a wide geographical distribution in the Tertiary time. In Asia it has been known from the Neogene deposits in Hokkaidô, Honsyû, Kyûsyû, Tyôsen and northern China, and show also the variation in regard to the leaf form just as in the modern allied species, and has been called under such specific names as *subpictum*, *pictum*, *pictum fossilis*. In the American continent, there is no living *Acer* which bear leaves of *A. mono* type, while, it is noteworthy that fossils which are very close to this modern species have been known from Older and Younger Tertiary rocks under several names such as *A. gracilescens* LESQ.,¹⁾ *A. Lesquereuxi* KNOWLTON,²⁾ *A. Scottiae* MACGINITIE,³⁾ etc. In Europe, *A. subpictum* is very common in Neogene floras, and has been called under such several names as *subpictum*, *acutelobatum*, *trachyticum*, *laetum pliocaenicum*, *labelii*, etc.

Localities: Sakipenbetu, Kami-Asibetu, Asibetu-mura, Soratigun, Prov. Isikari; Sakipenbetu Plant-Beds; Kawabataian (coll. K. HUZIOKA); Abura, Setana-mati, Setana-gun, Prov. Siribesi; Kunnui Series; Kawabataian (colls. S. ÔISHI and K. HUZIOKA); Kayanuma coal-mine, Huruu-gun, Prov. Siribesi; Kunnui Series; Kawabataian (coll. K. HUZIOKA).

産地。北海道石狩國空知郡芦別村上芦別咲邊別 (川端統サキペンベツ植物化石層)
後志國古宇郡茅沼炭礦 (訓縫統茅沼夾炭層)
後志國瀬棚郡瀬棚町虻羅 (訓縫統)

- 1) L. LESQUEREUX: Contributions to the Tertiary Flora of the Western Territories. Pt. III. Cretaceous and Tertiary Flora, 1883, p. 237, pl. XLIX, fig. 7 (?).
- 2) F. H. KNOWLTON: Catalogue of the Cretaceous and Tertiary Plants of North America. U.S.G.S., Bull. 152, 1898, p. 26 (= *A. indivisum* LESQ., 1883).
- 3) H. D. MACGINITIE: The Trout Creek Flora of Southeastern Oregon. Carnegie Inst. Washington, Publ. no. 416, 1933, p. 62, pl. XI, figs. 4, 8; pl. XII, fig. 4.

Acer trilobatum (STERNBERG) AL. BR.

Pl. XII(IV), Fig. 4.

- 1825-1838. *Phyllites trilobatum* STERNBERG: Versuch einer geognostisch-botanischen Darstellung der Flora der Vorwelt. I., p. 42, pl. L, fig. 2.
1845. *Acer trilobatum* (STERNB.) ALEX BRAUN: Die Tertiär-Flora von Oeningen. Neues Jahrb. f. Min. Geol. Palaeont. u. Petr.-Kunde f. 1845, p. 172.

Although the figured specimen in Pl. XII(IV), fig. 4 is imperfect, it is highly probable that it represents a fossil form commonly known under the name *A. trilobatum*. The specimen represents lower half of a rather narrow lamina, the upper portion being broken; it is almost unquestionable that the lamina is 3 lobed, the lateral two which are rather narrow being preserved as is shown in the figure; the median one is entirely missing. The margin is finely serrate. The nervation is well shown in the figure.

Acer trilobatum distributes widely in Europe and northern part of Asia being recorded from the strata between Oligocene and Pliocene. The species is highly polymorphous and many types have been figured under this name.

Acer trilobatum is comparable to *A. rubrum* L. in North America, a variety of which now lives in Japan (*A. rubrum* var. *pyncanthum* MAKINO). A form allied to *A. trilobatum* was described under the name *A. trilobatum productum* by HOLLICK¹⁾ from the Tertiary of Alaska, but it may be distinct from the typical form of *A. trilobatum*.

In Japan, leaves of this type have recently been described by MIKI from Aiti pref as *A. rubrum* L. var. *lignitum* MIKI²⁾ which he distinguished from typical species in having long hairs on the under side of the lamina. ENDÔ³⁾ only listed *A. trilobatum* from Tusen and Kokangen of Tyôsen, and SHIKAMA⁴⁾ figured from the Kôbe group of Hyôgo pref.

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- 1) A. HOLLICK: The Tertiary Floras of Alaska. U.S.G.S. Prof. Paper 182, 1936, p. 135, pl. LXXVI, fig. 2.
 - 2) S. MIKI: On the change of flora in Eastern Asia since Tertiary Period (I). The clay or lignite beds flora in Japan with special reference to the *Pinus trifolia* beds in Central Hondo. Jap. Journ. Botany, vol. XI, 1941, p. 283, fig. 17A.
 - 3) S. ENDÔ: Some New and Interesting Miocene Plants from Tyôsen (Korea). Jub. Publ. Prof. YABE's 60th Birthday, 1939, p. 344.
 - 4) T. SHIKAMA: Kôbe Group and Its Flora. Op. cit., 1938, p. 628, pl. XVIII, fig. 8.

Locality: Kayanuma coal-mine, Huruu-gun, Prov. Siribesi, Hokkaidô; Kayanuma coal-bearing Beds of the Kunnui Series; Kawabataian. (Coll. S. IKEGAMI).

産地. 北海道後志國古宇郡茅沼炭礦 (訓縫統茅沼夾炭層)

Acer sp. nov.?

Pl. XIV(VI), Fig. 2.

Leaf petiolate, petiole being more than 1.7 cm. long; lamina about 5.5 cm. broad, rounded at the base, shallowly trilobate, lateral ones shortly trigonal, smaller than the median one, and acutely pointed at their apices; sinus broadly curved; margin appears to be almost entire; primary nerves three in number, palmately disposed, straight, forming about 45° to each other.

The present specimen is peculiar one, the lamina being 3 lobed very shallowly. The general feature recalls one *Acer Buergerianum* MIQ. (= *A. trifidum* HOOK. et ARN.) living in Taiwan and southern China, especially its variety *formosum* SASAKI in Taiwan. The fossil may represent a new species, but the material is somewhat imperfect to admit of more detailed morphological comparison between the fossil and the living types.

Locality: Rokusen-no-sawa, Mitubisi Asibetu coal-mine, Kami-Asibetu, Asibetu-mura, Prov. Isikari, Hokkaidô; Asibetu coal-bearing Beds of the Isikari Series; Upper Part of the Isikarian. (Coll. E. TAKAHASI).

産地. 北海道空知郡芦別村上芦別六線ノ澤三菱芦別炭礦 (石狩統芦別夾炭層)

Acer sp. indet.

Pl. XIV(VI), Fig. 1.

The specimen in Pl. XIV(VI), fig. 1 is here figured as it appears to belong to neither of the species described in the present note. It is obviously 3 lobed and only a part of the lamina is represented in the specimen. Some marginal serrations are clearly seen. The nervation is distinct, the primary nerves being straight, while the lateral ones somewhat curving upwards.

As it was suggested in p. 96 in this note, specimen figured by HOLLICK from Alaska as *A. trilobatum productum* is somewhat distinct from the typical one, but rather resembles the present specimen.

The present specimen is certainly a type very close to living *A. Miyabei* or *A. negundo*, but is too imperfect to admit of further precise comparison.

Locality: Harutori coal-mine, Kusiro city, Prov. Kusiro, Hokkaidô; Harutori Bed of the Urahoro Series; Lower Part of the Urahoroian. (Coll. K. HUZIOKA).

産地。北海道釧路國釧路市春採炭礦 (浦幌統春採層)。

Acer sp.

Pl. X(II), Fig. 4.

Pl. X(II), fig. 4 shows an imperfect lamina with shallow marginal sinus. Upper part of the leaf being broken, the number of lobed can hardly be made out. But it may be probable that it is at least 5 lobed. The margin of each lobe appears to be almost entire, but in some places it appears to be slightly wavy. The base is broadly cordate. Five primary nerves are disposed palmately from the center of the base; they are straight, the median one being especially stronger than the rest. The lateral ones disposed from the lower two of the primaries are particularly well-defined.

The present specimen is, though imperfect, closely akin to *A. Miyabei* MAXIM. now living in Hokkaidô and Honsyû, and *A. diabolium* BLUME in Hokkaidô, Honsyû, Sikoku and Kyûsyû, but appears to be slightly different from these living types in the shallow sinus and nearly straight base, though otherwise almost indistinguishable.

Locality: Sakipenbetu-gawa, a tributary of the Asibetu-gawa, Kami-Asibetu, Asibetu-mura, Sorati-gun, Prov. Isikari, Hokkaidô; Sakipenbetu Plant Beds of the Kawabata Series; Kawabataian. (Coll. K. HUZIOKA).

産地。北海道石狩國空知郡芦別村上芦別，芦別川支流咲邊別川 (川端統サキペンベツ植物化石層)。

Acer spp. (Samarae)

Pl. XI(III), Figs. 5, 6; Pl. XIII(V), Fig. 5; Pl. XIV(VI), Fig. 5.

At this place, are grouped several types of fossil samarae belonging to *Acer* but their specific name is hardly determinable. They are all derived from Abura except one in Pl. XIII(V), fig. 5 which has been yielded from Sakipenbetu plant beds.

1) Pl. XI(III), fig. 5 shows a large winged seed 4.3 cm. long and 1.25 cm. in the broadest distal portion, with upper margin straight and the lower broadly curved at the distal part. Seed is large, about 8 mm. in diameter. The two wings extends an angle of 90°. This samara is certainly a type of *A. mono* MAXIM.

2) Pl. XI(III), fig. 6 is similar in size and form to the preceding, but the two wings extends an angle of approximately 170°. Similar fossil samarae are those figured by LUDWIG¹⁾ from Germany as *Acer trilobatum tricuspdatum*, by KRYSHTOFOVICH²⁾ from Sarmatian flora as *A. subcampestre*, by MÄDLER³⁾ from Germany as *A. sub-Miyabei*. All these fossil samarae including the present fossil are very similar to the samarae of living *A. Miyabei* MAXIM.

3) Pl. XIV(VI), fig. 5 differs from the preceding specimens in somewhat smaller size. Although the distal end of the wing is missing, the whole length of the samara may be about 2.8 cm. As the base of the seed with which it attaches to another seed is imperfectly preserved, the angle between two wings is not clear, though the writer's subposition is that the angle is wide being comparable to *A. ornatum* CARR. (= *A. palmatum* THUNB.).

4) Pl. XIII(V), fig. 5 is also imperfect, the distal end of the wing being missing. The wing seems to be widened rapidly from the base. The seed is about 0.6 cm. in diameter. In this fruit the wings make an angle of about 45°. This is also the type of *A. mono* MAXIM., especially it is the type of *A. mono* var. *eupictum* NAKAI.

Localities: 1)–3), Abura, Setana-mati, Setana-gun, Prov. Sibirbesi, Hokkaidô; accompanied with leaves of *A. ezoanum* sp. nov. and *A. subpictum* SAPORTA*); Kunnui Series; Kawabataian. (Colls. S.

1) R. LUDWIG: Fossilen Pflanzen aus der ältesten Abtheilung der rheinische Wetterauer Tertiärformation. Palaeontogr., Bd. VIII, 1859-'60, p. 129, pl. LI, fig. 10; pl. LII, fig. 7.

2) A. KRYSHTOFOVICH: Les dernières decouvertes des restes flores Sarmatique et Meotique dans la Russie meridionale. Bull. l'Acad. Imp. Sci., St. Pétersburg, No. 6, 1914, p. 593–597, figs. 12, 13.

3) K. MÄDLER: Die pliocäne Flora von Frankfurt am Main. Senck. Naturwiss. Gess., Abhandl., 446, 1939, p. 117, pl. IX, figs. 15–17.

*) Besides these, leaves similar to the living *A. ornatum* are found in the collection from Abura, but they are neither figured nor described in this note because they are too imperfectly preserved to deserve description. There are also some other imperfect samarae derived from the same locality, except those described in this note.

ÔISHI and K. HUZIOKA). 4), Sakipenbetu-gawa, a tributary of Asibetu-gawa, Kami-Asibetu, Asibetu-mura, Sorati-gun, Prov. Isikari, Hokkaidô; accompanied with the leaves of *A. subpictum* SAP. and *A.* sp.; Sakipenbetu Plant Beds of the Kawabata Series; Kawabataian. (Coll. K. HUZIOKA).

産地. 1-3) 北海道後志國瀬棚郡瀬棚町虻羅 (訓縫統)

4) 北海道石狩國空知郡芦別村上芦別, 芦別川支流咲邊別川 (川端統サキペンベツ植物化石層)

EXPLANATION OF THE PLATES

(The figures are of natural size)

The specimens are in the Department of Geology and Mineralogy, Faculty of Science, Hokkaidô Imperial University, Sapporo.

Plate IX (I)

Acer arcticum HEER

- Fig. 1. Loc. Yûbari coal-mine, Yûbari-gun, Hokkaidô; *Woodwardia* Sandstone of the Isikari Series (Reg. No. 9355).
 Fig. 2. Loc. Simizuzawa, Yûbari-mati, Yûbari-gun, Hokkaidô; Geological horizon ditto. (Reg. No. 9356).
 Fig. 3. Loc. Environs of Sin-Bibai coal-mine, Bibai-mati, Sorati-gun, Hokkaidô; geological horizon ditto. (Reg. No. 9352).
 Fig. 4. Loc. River course of Bibai-gawa, near Bibai-town, Bibai-mati, Sorati-gun, Hokkaidô; geological horizon ditto. (Reg. No. 9354).
 Fig. 5. Takinosawa, Bannosawa near Sin-Bibai coal-mine, Bibai-mati, Sorati-gun, Hokkaidô; geological horizon ditto. (Reg. No. 9353).

Plate X (II)

- Figs. 1, 2. *Acer ezoanum* sp. nov. Loc. Taihei coal-mine, Esutoru-mati, Nayosi-gun, Karahuto; Esutoru coal-bearing Bed. (Reg. No. 9403, a and b).
 Fig. 3. *Acer ezoanum* sp. nov. Loc. Nayosi, Nayosi-mati, Nayosi-gun, Karahuto; Esutoru coal-bearing Bed. (Reg. No. 9404, a).
 Fig. 4. *Acer* sp. Loc. Sakipenbetu-gawa, a tributary of Asibetu-gawa, Asibetu-mura, Sorati-gun, Hokkaidô; Sakipenbetu Plant Beds of the Kawabata Series. (Reg. No. 9332).

Plate XI (III)

- Figs. 1, 2. *Acer ezoanum* sp. nov. Loc. Siretori coal-mine, Siretori-mati, Siretori-gun, Karahuto; Naihoro coal-bearing Bed. (Reg. No. 9360, a and b).
- Figs. 3, 4. *Acer ezoanum* sp. nov. Loc. Ditto. (Reg. No. 9359).
- Figs. 5, 6. *Acer* sp. (samara). Loc. Abura, Setana-mati, Setana-gun, Hokkaidô; Kunnui Series. (Reg. No. 9363).

Plate XII (IV)

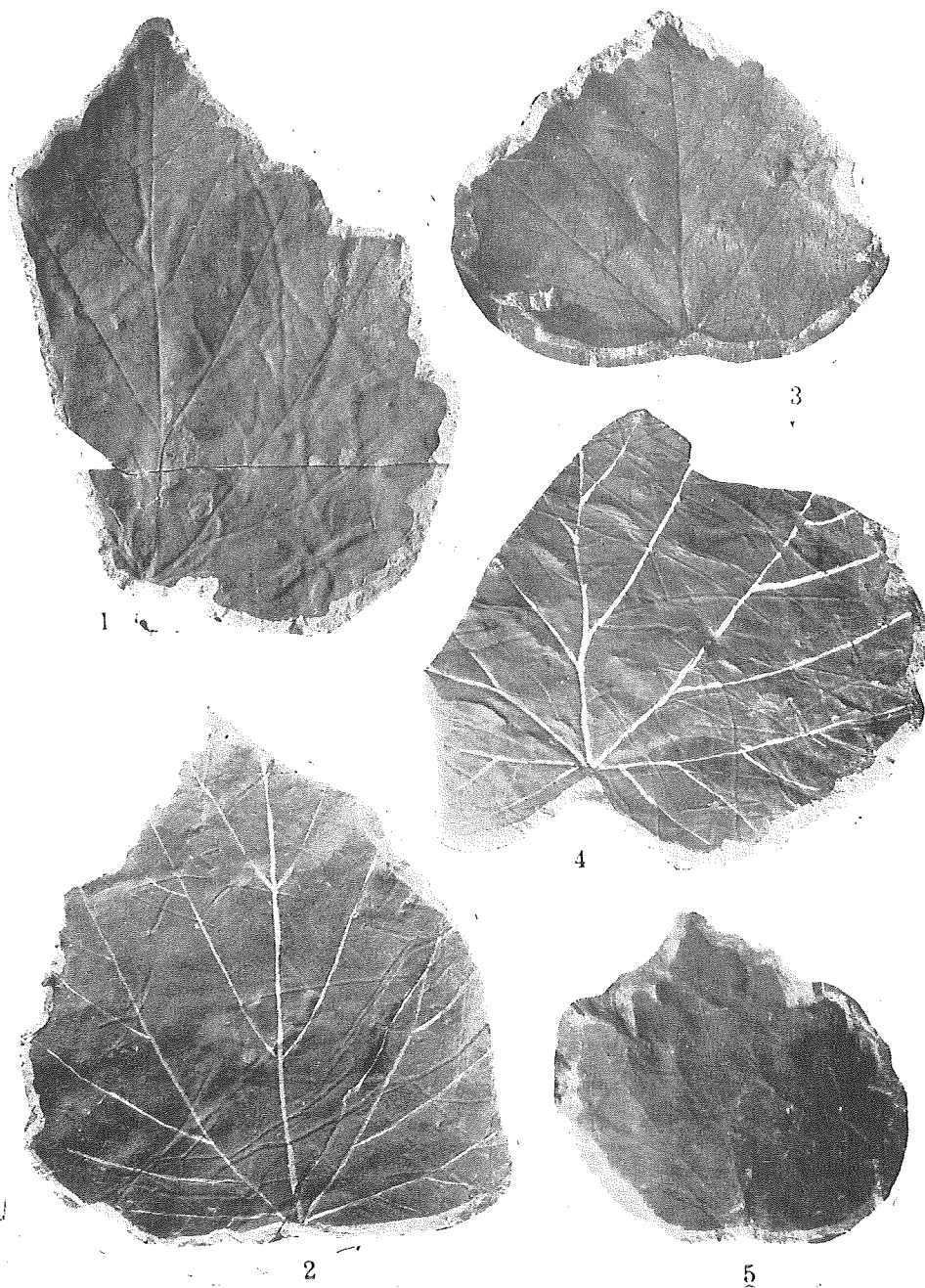
- Fig. 1. *Acer ezoanum* sp. nov. Loc. Sarutu, Nayosi-mati, Nayosi-gun, Karahuto; Esutoru coal-bearing Bed. (Reg. No. 9405).
- Fig. 2. *Acer ezoanum* sp. nov. Loc. Taihei coal-mine, Esutoru-mati, Nayosi-gun, Karahuto; Esutoru coal-bearing Bed. (Reg. No. 9403, c).
- Fig. 3. *Acer rotundatum* HUZIOKA. Loc. Nayosi, Nayosi-mati, Nayosi-gun, Karahuto; Esutoru coal-bearing Bed. (Reg. No. 9334).
- Fig. 4. *Acer trilobatum* (STERNBERG) AL. BR. Loc. Kayanuma coal-mine, Huruu-gun, Hokkaidô; Kayanuma coal-bearing Bed of the Kunnui Series. (Reg. No. 9362).

Plate XIII (V)

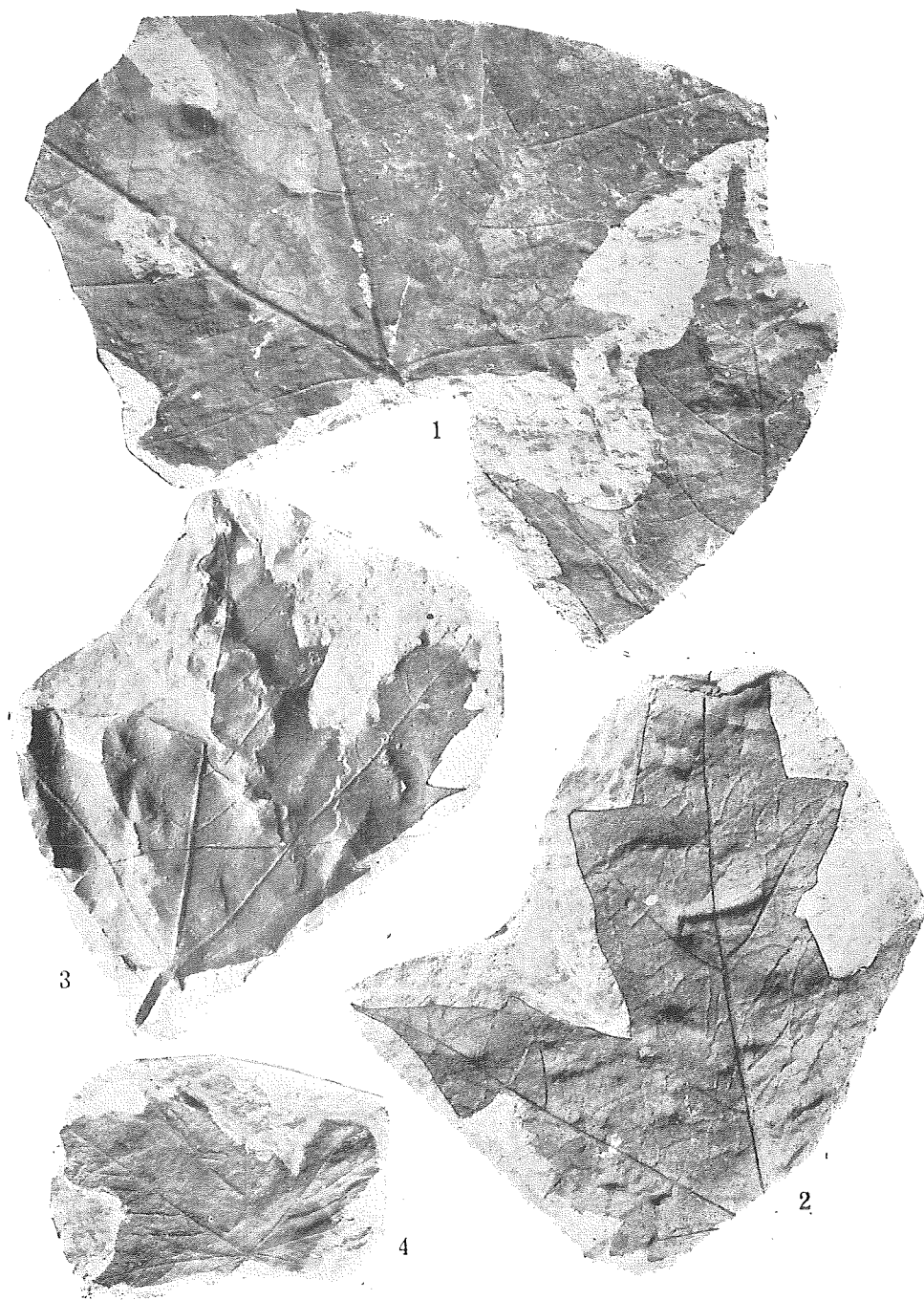
- Figs. 1-4. *Acer subpictum* SAPORTA. Loc. Sakipenbetu-gawa, a tributary of Asibetu-gawa, Kami-Asibetu, Asibetu-mura, Sorati-gun, Hokkaidô; Sakipenbetu Plant Beds of the Kawabata Series. (Reg. No. 9335, 9336, 9337, 9406).
- Fig. 5. *Acer* sp. (Samara). Loc. Ditto. (Reg. No. 9333).

Plate XIV (VI)

- Fig. 1. *Acer* sp. indet. Loc. Harutori coal-mine, Kusiro City, Hokkaidô; Harutori Bed of the Urahoro Series. (Reg. No. 9357).
- Fig. 2. *Acer* sp. nov.? Loc. Rokusen-no-sawa, Mitubisi Asibetu coal-mine, Kami-Asibetu, Asibetu-mura, Sorati-gun, Hokkaidô; Asibetu coal-bearing Bed of the Isikari Series. (Reg. No. 9358).
- Figs. 3, 4. *Acer subpictum* SAPORTA. Loc. Abura, Setana-mati, Setana-gun, Hokkaidô; Kunnui Series. (Reg. No. 9361, 9327).
- Fig. 5. *Acer* sp. (Samara). Loc. Ditto. (Reg. No. 9364).
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S. Ôishi and K. Huzioka: Tertiary Acers from Hokkaidô and Karahuto.



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S. Ôishi and K. Huzioka: Tertiary Acers from Hokkaidô and Karahuto.



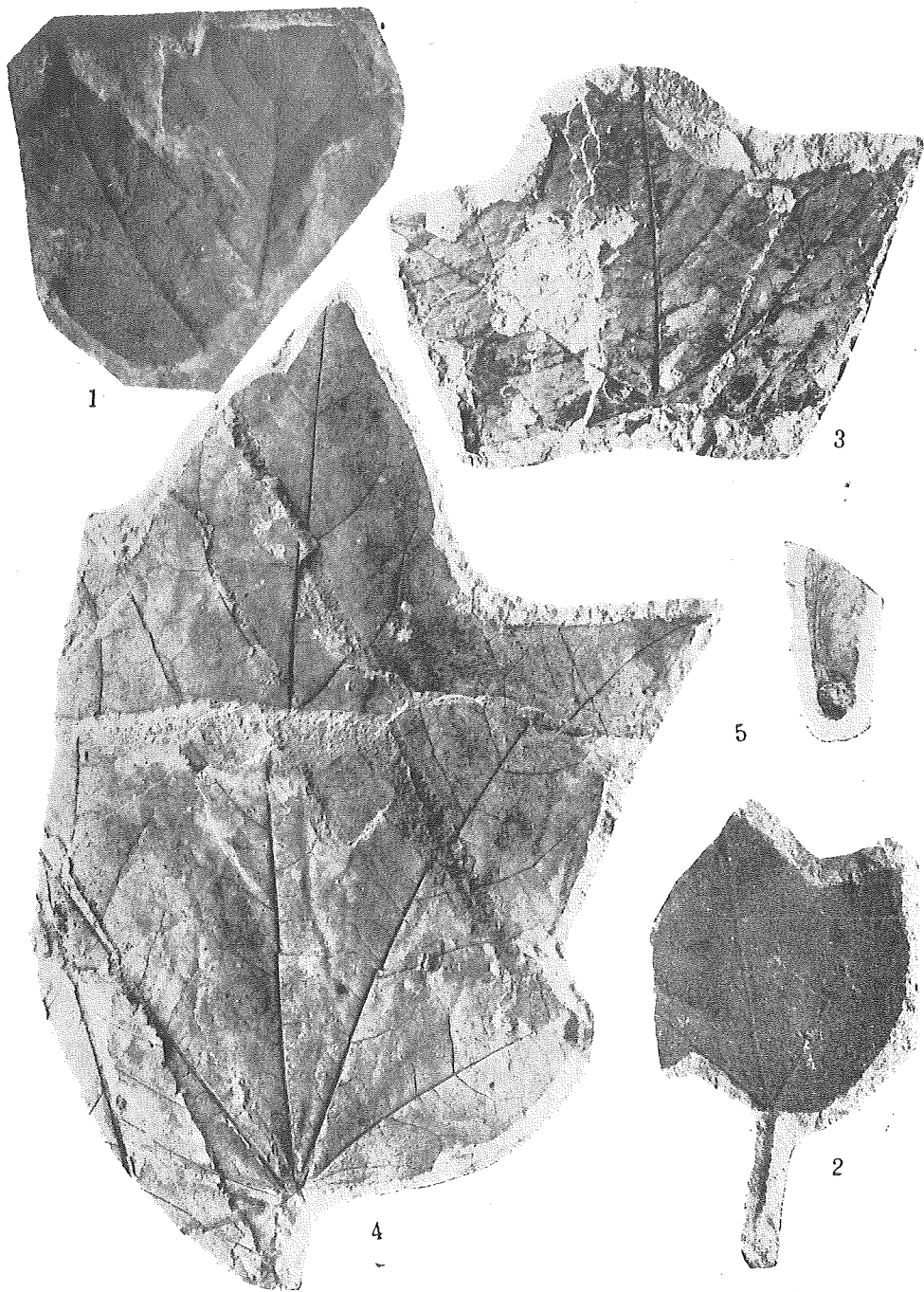
Kumano photo.

S. Ôishi and K. Huzioka: Tertiary Acers from Hokkaidô and Karahuto.



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S. Ôishi and K. Huzioka: Tertiary Acers from Hokkaidô and Karahuto.



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S. Ôishi and K. Huzioka: Tertiary Acers from Hokkaidô and Karahuto.