THE HATCHASHINAI GRAVEL FORMATION

by

M. MINATO, Y. FUJIWARA,
S. KUMANO and Y. IGARASHI

(With 1 Table, 3 Text-figures and 2 plates)

(Contribution from the Department of Geology and Mineralogy
Faculty of Science, Hokkaido University, No. 1241)

The Hatchashinai gravel formation is typically developed at Hatchashinai in the outskirt of the Nayoro city (44° 20′ N, 142° 30′ E), the northern part of the island Hokkaido, Japan. This is chiefly composed of unconsolidated sand, gravel, and less amount of clay and peat, some 100 m in total thickness, locally unconformably covered by gravel deposit of the lower terrace along the Teshio river.

The base of this formation is observed in a few localities around the Nayoro city which is unconformably resting on the lignite bearing Kawanishi formation, presumably lower Pliocene in age. The Kawanishi formation is consisting of siltstone and conglomerate in alternation. Following plant fossils are found from the siltstone intercalted by lignites; they will be listed below:

Alnus cf. *pendula* MATSUMOTO
Acer cf. *palaeoplatanoides* ENDO
Fagus cf. *protojaponica* SUZUKI
Populus cf. *balsamoides* GOEPPERT
Pterocarya sp.
Salix sp.
Juglans sp.
Betula sp.

These fossils were kindly identified by Dr. K. SUZUKI, Fukushima University in Fukushima, for which the authors are grateful. It may be worth while noted, that conifers are not included among the authors' collection, but such warmer element like *Fagus* is found; it present northern limit of distribution lies far south in Hokkaido.

The boundary between the Hatchashinai gravel formation and the Neogene Tertiary formation has been further traced by drillings below the surface of flood plain fairly widely extending in and around the Nayoro city. As a result it became evident that the top surface of the Tertiary below the Hatchashinai gravel formation is considerably uneven by erosion prevailed prior to the deposition of the gravel beds now in concern. Possibly, the Hatchashinai gravel formation might be deposits brought in the alluvial plain of the older age, extending in wide inter-montanic basins, in which swamp or marsh may have been also present from place to place.

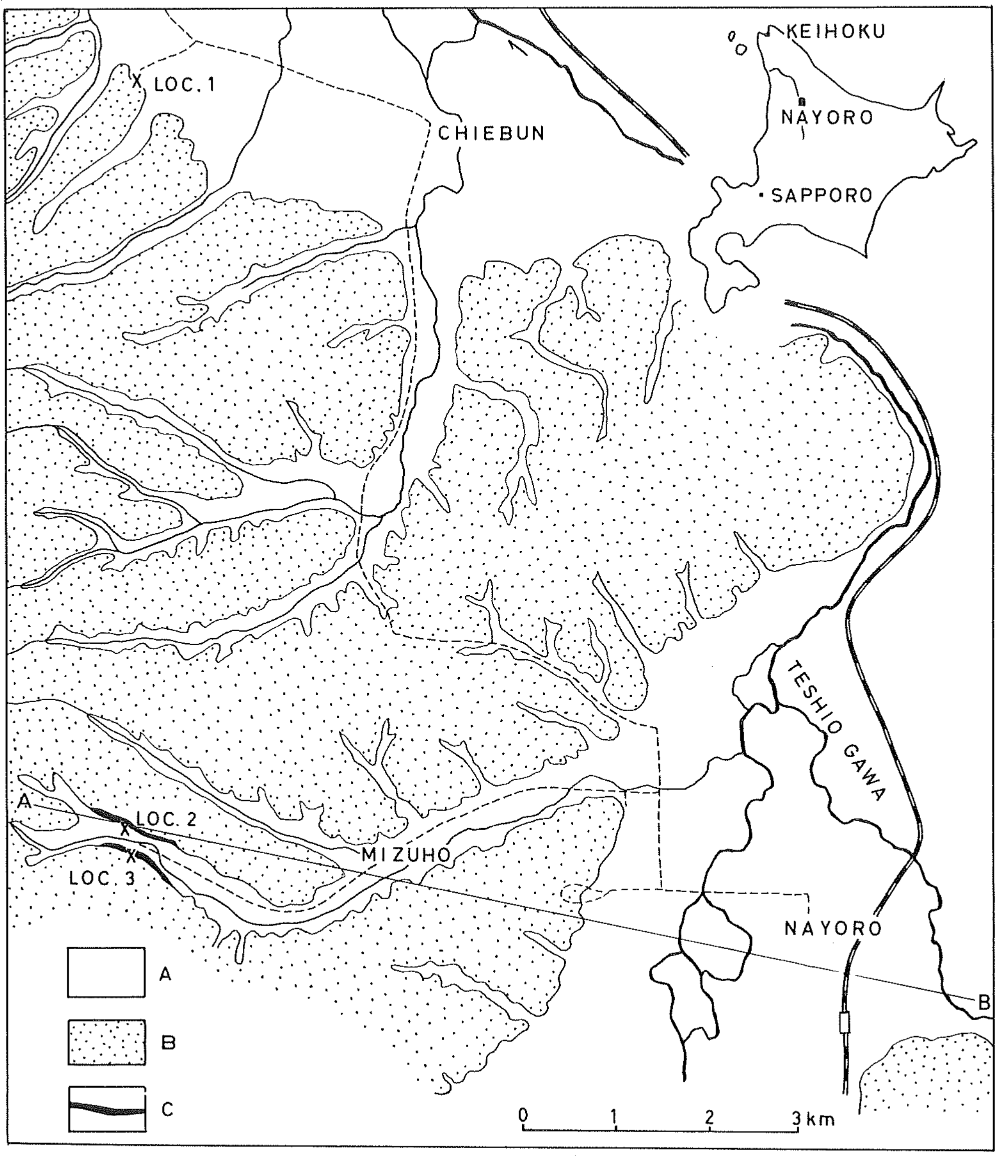


Fig. 1. Geological map around the Nayoro city.
A: Alluvial deposit, B: Hatchashinai gravel formation, C: Neogene Tertiary deposit.

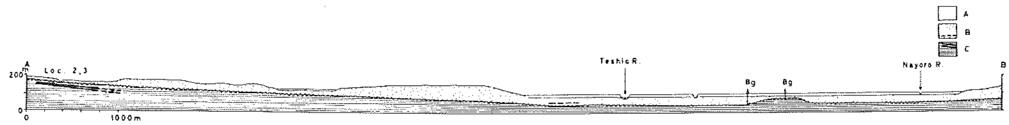


Fig. 2. Stratigraphical relation between the Hatchashinai gravel formation and the Neogene Tertiary.
Profile is shown along the A B line in the geologic map (fig. 1).
A: Alluvial deposit, B: Hatchashinai gravel formation, C: Neogene Tertiary deposit, black thick lines indicate plant bearing beds. Bg: Boring site.

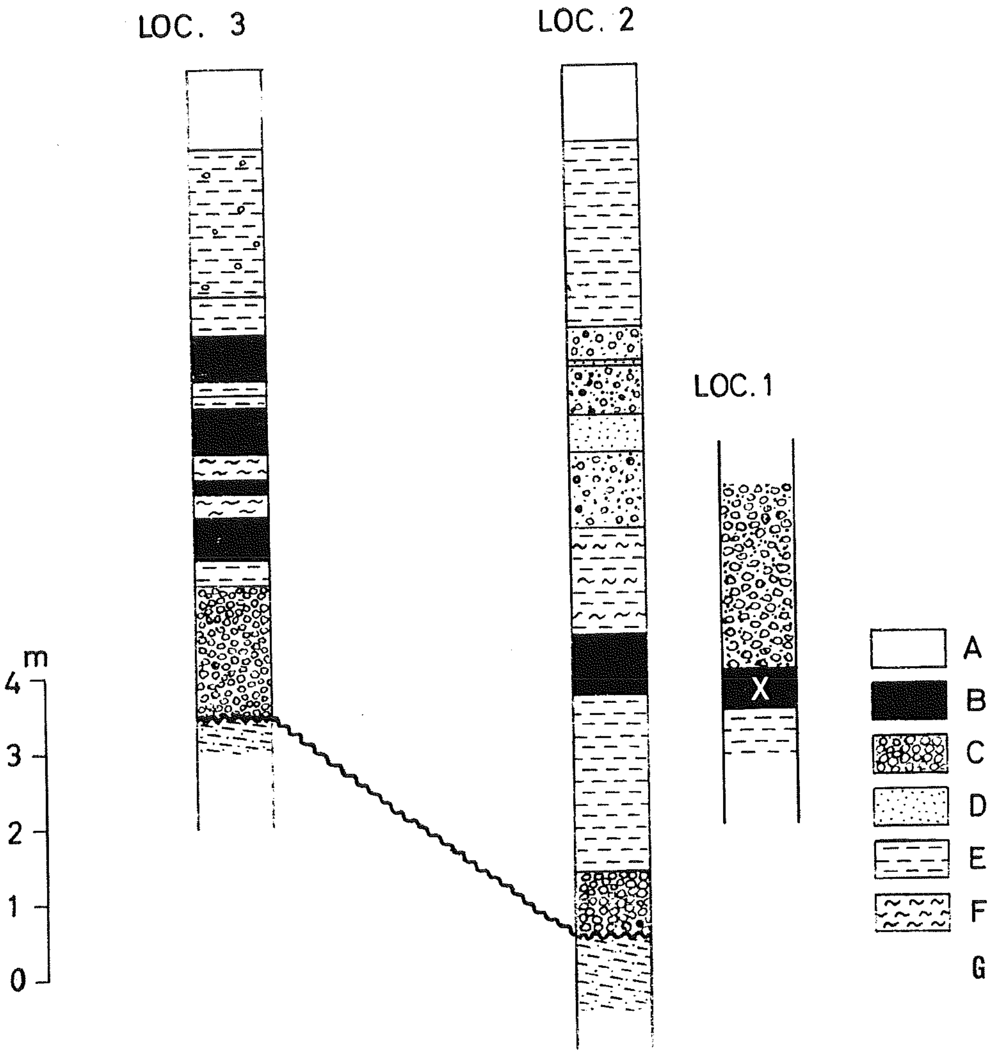


Fig. 3. Columnar sections of the lower part of the Hatchashinai gravel formation.
A: surface soil B: peat C: gravel D: sand E: silt F: clay G: specimen taken for pollen analysis

As a matter of fact, peat or peat-clay, in various thickness are found in the lowermost horizon of this formation. Cones of spruce *Picea Glehnii* MASTERS, *Picea jezoensis* CARRIÉRE, remains of branches of larch, *Larix Gmelinii* GORDON are richly found out in such a horizon either in peat or gravel immediately above the peat, insect remains belonging to *Mimela splendens* GYLLENHAL, *Plateumaris nipponensis* NAKANE, and seed of *Menyanthes trifoliata* LINNAEUS are also not seldom discovered in the peat layer.

The result of pollen analysis of the peat sampled from the basal part of this formation is shown in the table 1, in which *Abies* is most abundant, *Pinus, Picea* and *Larix* follow it in quantity. Of them, *Picea* may be belonging to *Picea Glehnii* or/and *jezoensis,* at least in its major part, and *Larix* may be *Larix Gmelinii,* as is evidently proved by the presence of fossil branches and cones of such species respectively. Further, *Abies* may be highly probable to belong to *Abies sachalinensis* SCHMIDT, while *Pinus* may be largely belonging to dwarf pine tree, *Pinus pumila* REGEL. Association of other pollen or spores further shows an old environment to have been slightly moist, and cold. Accordingly, the forest of the early stage of the Hatchashinai age, reconstructed by fossil evidences may suggest more or less cooler climate than the present one of the Nayoro city. From the ratio of number of pollen between *Abies* and *Picea,* the forest of this age may be considered as a type, represented by *Picea* < *Abies* with *Larix Gmelinii,* which is now typically distributed in South Saghalien, around the northern coast of the Aniva bay (46° 39′N, 142° 46′E).

The climate represented by the Hatchashinai gravel formation might be accordingly eventually as similar as the coastal plain of the Aniva bay of the present day. In comparison with the South Saghalien and the Nayoro basin of the present day, the temperature of the age of the Hatchashinai gravel formation may be concluded to have been about 3.0°C lower in summer than the present, 3.5°~5.0°C lower in winter, and the mean annual temperature might be 2.1°~3.6°C lower than the present. In bringing the fact into consideration that the altitude of the sampled locality for the Hatchashinai gravel formation around the Nayoro city, which is more than 100 m high above sea level, Paleo-temperature estimated by comparison of temperature between Nayoro and Aniva bay must be however certainly revised. Namely, the summer temperature might be only 2.0°C lower; winter temperature 4.4°~4.0°C lower and the anual mean, 2.0°C lower than the present day, although annual precipitation might be considerably less than the present day.

Finally the age of the Hatchashinai gravel formation will be discussed. From similarity in lithologic facies and paleoclimatic condition, the Hatchashinai gravel formation may be stratigraphically equivalent with the Keihoku formation, developed around Wakkanai and Sarobetsu in the

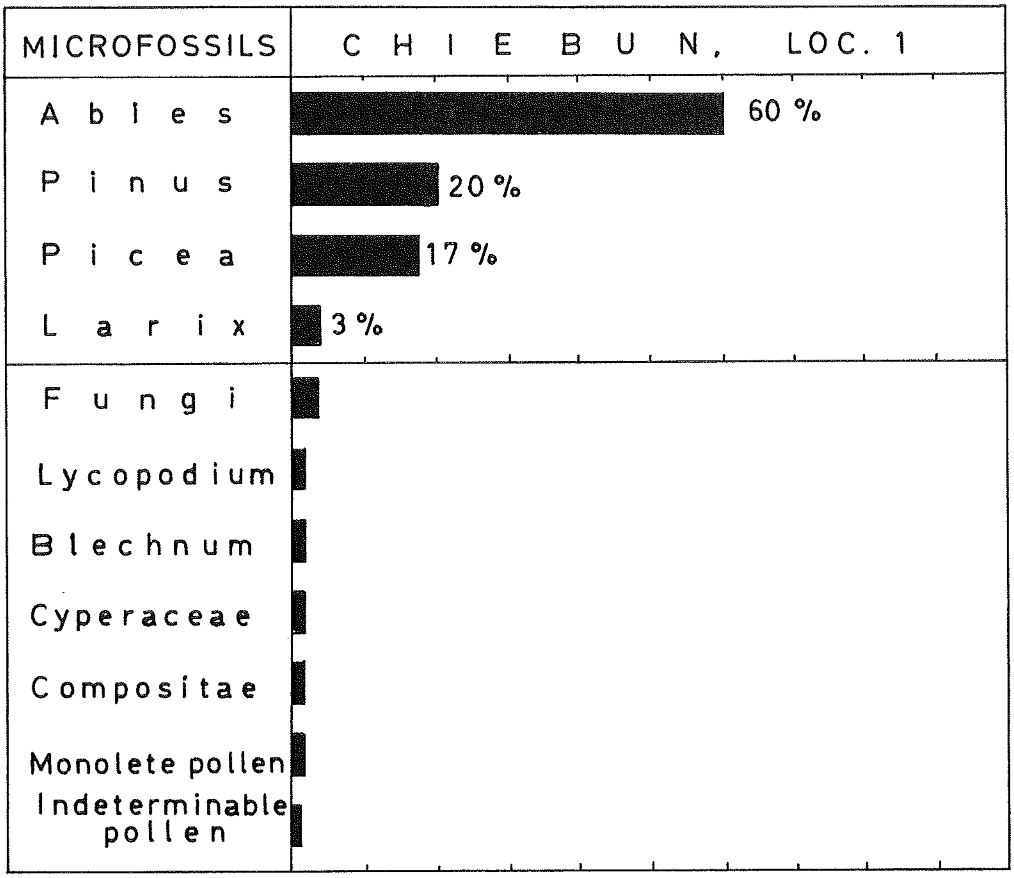


Table 1. Result of pollen analysis based on samples of peat at locality 1, Chiebun, see fig. 1. Percentage indicates only on the forest trees.

northernmost part of Hokkaido, as was once reported (1966). The Keihoku formation is evidently older than the middle terrace. Further, the Hatchashinai gravel formation is thought to be correlatable with the Asahikawa formation, to be reported in near future which is also composed of gravel, sand, clay and peat, and had been brought forth in the inter-montanic basin like the case of the Hatchashinai gravel formation. The rhyolitic flow overlying the Asahikawa formation shows normal polarity of geomagnetism. While, this rhyolitic flow unconformably rests on the dacite flow at places, the latter of which shows reversed polarity. As will be reported in datail in near future, various stratigraphic informations besides paleomagnetic data, the boundary between Matuyama/Brunhes epoch is now concluded to be just below the rhyolitic flow covering the Asahikawa formation and above the dacitic flow above mentioned.

Under such circumstances, the Hatchashinai gravel formation is now believed as being correlatable to the horizon, a little older than the boundary

Matuyama/Brunhes epoch but may be older than the Jaramillo event.

In closing this short note, thanks of the authors are due to Dr. S. ASAHINA for an identification of insect fossils collected from the Hatchashinai gravel formation and to Dr. K. SUZUKI for specific determination of plant fossils of the Kawanishi formation. Messrs. S. OKADA and T. MUNETA assisted the authors in field work. Mapping in field was done chiefly by M. MINATO and Y. FUJIWARA, pollen analysis was made by S. KUMANO in cooperation with Y. IGARASHI, identification of the plant remains of the Hatchashinai gravel formation was done by M. MINATO and S. KUMANO, while palaeomagnetic study was carried out by Y. FUJIWARA.

References

IMANISHI, S. (1956): Explanatory Text of the Geological Map of Japan "Nayoro" Scale 1:50,000, Geological Survey of Hokkaido.

Sarobetsu Research Group (1966): Quaternary Deposits in the Wakkanai-Sarobetsu Basin, Northern Hokkaido, Quaternary Research, Vol. 5, No. 1.

MINATO, M. et al (1971): Volcanic activities of the Pliocene and Pleistocene in Hokkaido, Quaternary Research (in Press).

YAMAZAKI, T. (1951): Studies on the Changes of the Forests and the Climate in Southern Saghalien and Hokkaido, based on Pollen Analysis, Bulletin of the Kyoto University Forests, No. 21.

(Manuscript received May 20, 1971)

Explanation of Plate I

Fig. 1 Cone, conescales and seeds of living *Picea jezoensis* CARRIÉRE, from a Locality near the Kogen hotspring, on the foot of Daisetsu Mountain, Hokkaido.

Fig. 2 Cone, conescales and seeds of fossil *Picea jezoensis* CARRIÉRE, Locality 1.

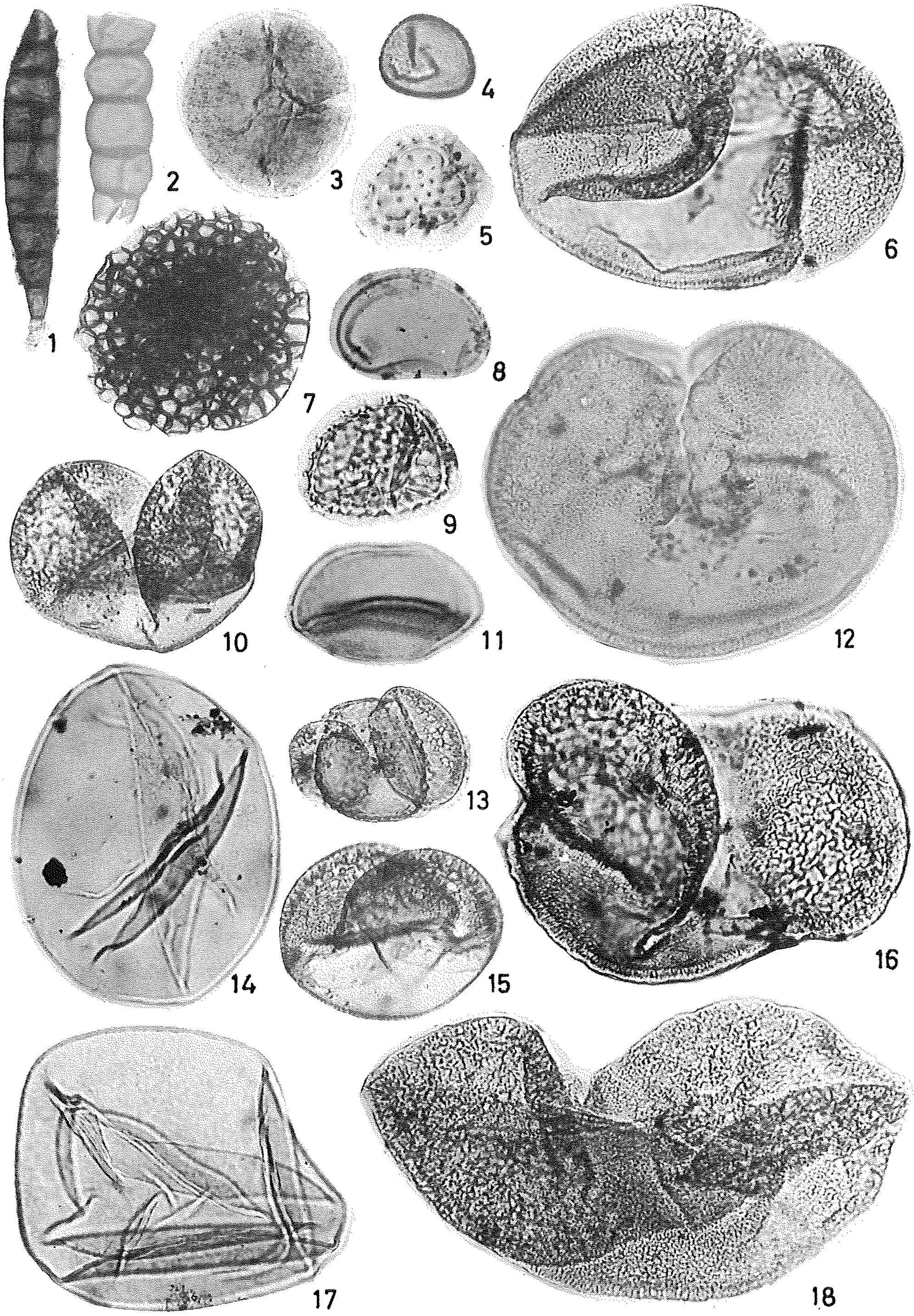
Fig. 3 Cone, conescales and seeds of living *Picea Glehnii* MASTERS, from a Locality near the Kogen hotspring, on the foot of Daisetsu Mountain, Hokkaido.

Fig. 4 Cone, conescales and seeds of fossil *Picea Glehnii* MASTERS, Locality 3.

Figs. 5 6 7. Branched stems of *Larix Gmelinii* GORDON (fossil); Locality 2, Figs.5 & 6x1 : Fig. 7 slightly magnified.

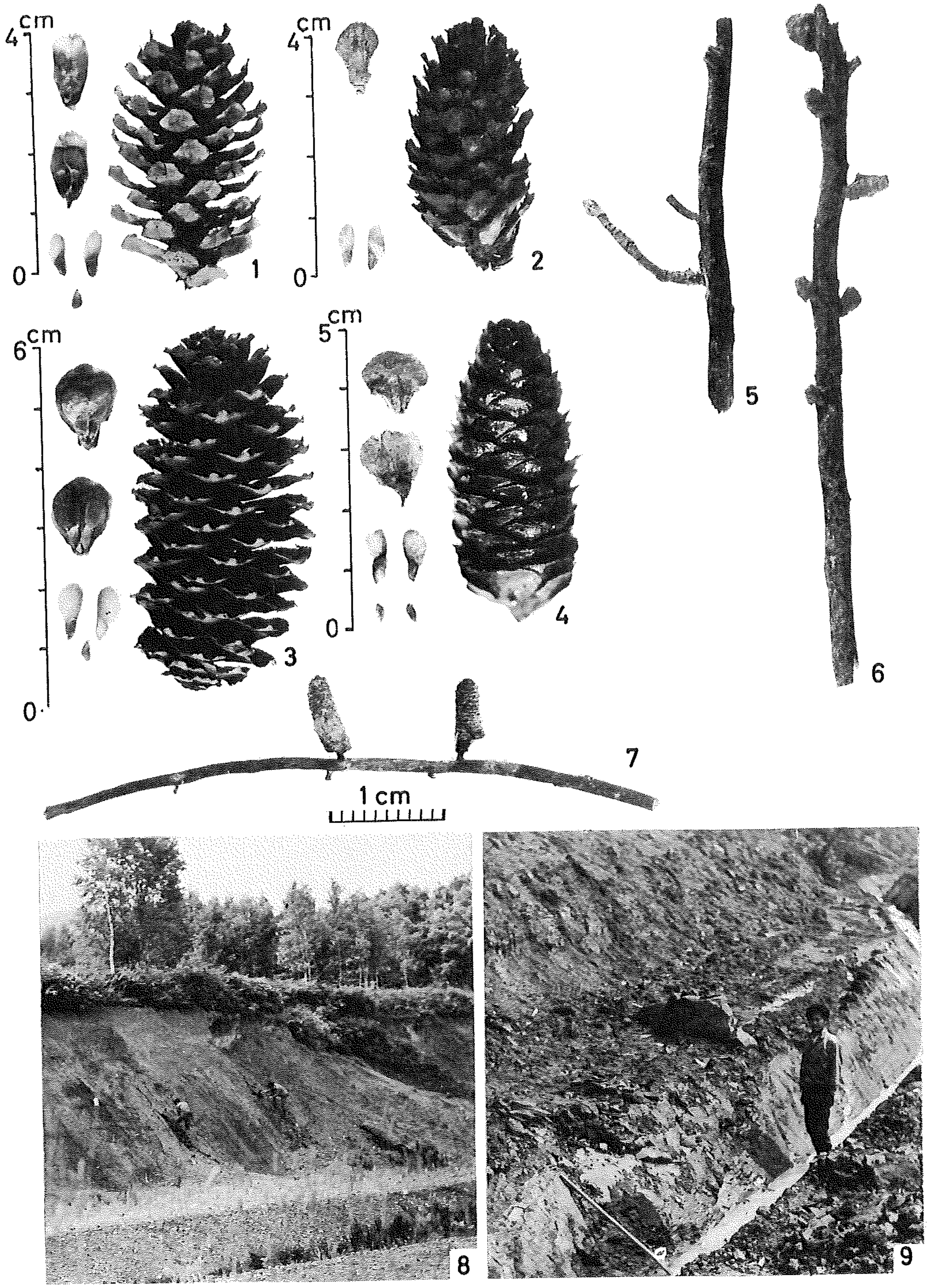
Fig. 8 Outcrop of the lower part of the Hatchashinai gravel formation at Locality 3.

Fig. 9 Unconformable relation between the Tertiary and the Hatchashinai gravel formation.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

Explanation of Plate II

Fig. 1.	Fungi gen. Indet.	135x20μ	lateral view
Fig. 2.	Fungi gen. Indet.	68x22μ	lateral view
Fig. 3.	Gen. et sp. indet.	59x52μ	polar view
Fig. 4.	Gen. et sp. indet.	30μx	oblique polar view
Fig. 5.	Compositae	32μx	polar view
Fig. 6.	*Picea*	116x78μ(body)	oblique polar view
Fig. 7.	Fungi gen. Indet.	74μx	polar view
Fig. 8.	Monolete type spore	50x29μ	lateral view
Fig. 9.	*Lycopodium*	44x39μ	oblique view
Fig. 10.	*Picea*	64x38μ(body)	polar view
Fig. 11.	Blechnaceae	62x34μ	lateral view
Fig. 12.	*Picea*	118x66μ(body)	lateral view
Fig. 13.	*Pinus*	42x37μ(body)	polar view
Fig. 14.	*Larix*	106x81μ	lateral view
Fig. 15.	*Picea*	69x30μ(body)	oblique lateral view
Fig. 16.	*Abies*	98x79μ(body)	oblique lateral view
Fig. 17.	*Larix*	114x94μ	lateral view
Fig. 18.	*Abies*	135x57μ(body)	lateral view


4 cm
0
1
4 cm
0
2
5
6
6 cm
0
3
5 cm
0
4
7
1 cm
8
9