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The Palynological Study of Cenozoic Strata, Hokuriku Region, Central Japan

First Report : On Alluvial Peat from Ishikawa and Fukui Prefectures of the Hokuriku Region

By

Norio FUJI*

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* Institute of Geology, Faculty of Science, Kanazawa University

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Abstract——This paper is the first report of the "The Palynological Study of Cenozoic Strata, Hokuriku Region, Central Japan", and is concerned with the Quaternary problems of the Hokuriku Region.

This paper consists of three parts; firstly, the summary of the stratigraphic study of the Quaternary strata with the main emphasis on Alluvial peat. In the area along the Japan Sea coast of the Ishikawa and Fukui Prefectures, Alluvial peat develops widely. The most part of this area is occupied by the Late Yayoian sand dune called under New Sand Dune, which is constracted on the Alluvial fan deposits and this peat. The Early Alluvial marine deposits, the Alluvial deltaic deposits and the Alluvial fan deposits are the basal deposit of this peat. The stratigraphic relation of these deposits and correlation among them are shown on Table 1.

Secondly, the pollen analysis of this peat is stated in detil. The original material of the peat appears to be grass which had grown up on the Alluvial deposits. Alluvial peat, which is exposed along the coast and covered by the New Sand Dune, includes the Late Yayoian pottery of about 1,900 years before the present in the Hokuriku Region. The fact suggests that this peat was made from grass by the migration of the New Sand Dune in the Late Yayoi Age. According to the writer's pollen analysis, the following pollen and spore grains were determined ;

POLLEN GRAINS *Pinus* type, *Larix* type, *Abies* type, *Tsuga* type, *Picea* type, *Podocarpus* type, *Cryptomeria* type, *Juniperus* type, Compositae type, *Bidens* type, *Menyanthes* type, *Rhododendron* type, *Myriophyllum* type, *Oenothera* type, *Tilia* type, *Ilex* type, *Sapium* type, *Rubus* type, *Nuphar* type, *Persicaria* type, *Zelkowa* type, *Ulmus* type, *Quercus* type, *Fagus* type, *Alnus* type, *Betula* type, *Carpinus* type, *Juglans* type, *Platycarya* type, *Salix* type, *Gagea* type, *Carex* type, Gramineae type, Lenticulapollenites type

SPORE GRAINS *Selaginella* type, Bacillus type, Deltoidsporites type, Reniformsporites type, Subtriangularsporites type

The Paleoclimate of this period, from the Late Jômon to Late Yayoi Age, was perhaps equal the recent climate. The cause of the becoming of peat which are analysed for the present study, is distinctly the migration of Old Sand Dune in the end of Late Yayoi Age.

Finally, the writer describes fossil pollen and spore grains of these districts.

Introduction

Our knowledge of the palynological study of the Japanese Islands has been much increased during the last thirty years, and many important and valuable facts have been brought to us.

However, many important peats for the purpose of geology have still been left undescribed, although the distribution of them have already been reported in many regions.

This paper is the first report of the "Palynological Study of Cenozoic Strata, Hokuriku Region, Central Japan" and it is concerned principally with the movement of the strand line in the Hokuriku Region during the Alluvial Epock.

The Alluvial peat exposed along the coast of the Japan Sea in Ishikawa and Fukui Prefectures of Central Japan was already reported as "Recent shifting of the coast line in the Hokuriku Region" by S. Komaki (1925) about thirty years ago. As many students reported on Alluvial peat from the viewpoint of topography, the distribution of this peat was clear from long years ago. From the viewpoint of the geological and palynological studies this peat has been undescribed, although many various opinions have been expressed concerning the topographical study of the sand dunes developed widely along this coast. Among others, the studies of the following students gave me many important facts; G. Saito (1932, 1949), I. Ishii (1934, 1940-1941), and S. Fukai (1952, 1956, 1958, 1959). Above all, the late Dr. I. Ishii (1940–1941) summarized the recent movement of the Strand line of the Hokuriku Region. However, there are not the stratigraphic and palynological studies on the above mentioned peat. The research of this peat will help the research of the recent movement of the strand line in this region. The research of this peat must be studied from the viewpoint of geology, paleontology, archaeology and topography, that is to say, it is a "*boundary problem*", and is difficult to do.

Since the writer began the biostratigraphic and paleontological studies of the pollen and spore grains from this peat, the writer himself collected numerous specimens and many geologists, topographers and archaeologists sent various peats belonging to the Quaternary from the Hokuriku Region to him.

This paper is the result of the micropaleontological study of the writer's collection which will be kept in the Institute of Geology, Kanazawa University.

Although the relation between the movement of the strand line and the archaeological data during the Alluvial Epock in the Hokuriku Region is known up to the present, the problem was omitted from this paper and will be published in the future as a separate study.

Acknowledgment

The writer wishes to express his thanks to Dr. Professor Wataru ICHIKAWA of the Institute of Geology, Faculty of Science, Kanazawa University, for his much help and the determination of many diatoms from this area, and for his kind advice and much help to this study, the former Professor Kin-emon OZAKI of the same Institute, for his kind advice and much help to this study, Assistant Professor Yoshio KASENO of the writer's Labolatory, for his suggestions and informations on the stratigraphy of this area, Lecturer Hidekuni MATSUO of the same Labolatory, for his much help. The writer's thanks are also due to Professor Zenzo TSUKANA and Mr. Shizuka MIURA of Fukui University, and Mr. Kazuo KOJIMA of the Kanazawa higher commercial school, who kindly permitted the writer to use the unpublished data, and the discussion and the informations on the boring data from this area, Professor Genkei MASAMUNE and Lecturer Nobuo SATOMI of the Institute of Biology, Kanazawa University, for their kind advice ont he palynology and paleoecology, Professor Misaburo SHIMAKURA of the Department of Earth Science, Nara University of Education, for the kindly advice on the method of preparation of the fossil pollen or spore-bearing materials, and Professor Takamaro MAKU and Professor Tsuneo KISHIMA of the Wood Research Institute, Kyô o University, for their kindly advice and the determination of the Late Yayoian subfossil woods from this area, and Mr. Keitaro NUMATA of the member of the Archaeological Society of Ishikawa, for his help to the writer's archaeological study of the pottery from this area. The writer wishes to express his thanks to Miss Masako SHIBATA of TÔKA Girls High School, for the sampling of peats from this area and the stratigraphic survey with the writer in this field. Thanks are also due to some members of the Quaternary Research Group of Hokuriku. The writer wishes to express his thanks to Miss V. DETER of the Hokuriku-gakuin girls High School that she reads the paper in manuscripts. The present study was enabled by the Grant in Aid for Scientific Researches from the Ministry of Education in Japan.

CHAPTER I

TOPOGRAPHICAL SUMMARY

This area lies along the coast of the Japan Sea in the Kaga District of Ishikawa Prefecture, and the northeastern part of Fukui Prefecture in the Hokuriku Region of Central Japan.

This extends about 80 km from northeast to southwest and 2 km from northwest to southeast, about 160 sq. km. This area varies from 0 m to 20 m above sea-level. The most part of this area is occupied by the sand dunes, which are constructed on Tetori River Fan deposits in the Kaga Plain, and on the Pliocene formations.

The sand dune which is named Uchinada-sakyû in this district is the highest and greatest sand dune, reaching about 50 m above sea-level. At the mouth of Tetori River and its neighbourhood, these sand dunes are on a smaller scale than at the district detached from this mouth.

The lakes, Lake Kahoku, Lake Kitagata and three lakes which are named under Enuma-sankô at Enuma-gun, lie on the inner side of the sand dunes along the coast of the Japan Sea.

In this area, there are Tsubata River, Asano River, Sai River, Tetori River and Daishôji River etc.. The longest river of these is Tetori River, which produces the Tetori Fan on which is the town of Tsurugi.

The Old Sand Dune was produced in front of the Neolithic Beach in the regressional period of Middle Jômon Age, and the New Sand Dune was produced by the migration of Old Sand Dune which exposed widely along the beach, where was 300 to 500 m offshore from the present beach, over all the other districts in the region. The migration of Old Sand Dune is because of the transgression in the end of Late Yayoi Age. The transgression, however, is indistinct which of the increase of sea-water or the rising of land. The Old Sand Dune had distributed widely in front of the swamp in the Komatsu Stage of Late Yayoi Age, and the ancient had secured a sure means of living in the swampy area in rear of the dune. The most of Tetori Fan was produced in the regressional period from the Middle Jômon to Late Yayoi Age.

Chapter II

STRATIGRAPHIC SUMMARY

(Fig. 1, Table 1, Plates VII & VIII, and Chart 1)

The following stratigraphic notes describe, each stratum and the general stratigraphic succession, giving brief outlines of the stratigraphy of this area and of the correlation adopted in the present study.

The Quaternary stratigraphy of this region has not been studied until the present writer began his investigations.

The stratigraphic description of this region reported in the present study is divided into the following four districts as shown in Chart 1 :

1. Kanazawa District in Ishikawa Prefecture
2. Neagari District in Ishikawa Prefecture
3. Hashidate District in Ishikawa Prefecture
4. Kitagata District in Fukui Prefecture.

Table 1 Review of the Stratigraphic Classification of Quaternary Deposits of Kaga and North Echizen Districts in the Hokuriku Region.

TABLE 1

G.A.			CULTURES	KANAZAWA DISTRICT: Uchinada*	KANAZAWA DISTRICT: Kurabe	KANAZAWA DISTRICT: Lake Kahoku*	KANAZAWA DISTRICT: Shimeno*	NEAGARI	HASHI DATE	KENTOZAN	CHANGE OF SEA LEVEL
HOLOCENE			Historical Age	New Sand Dune	New Sand Dune	lake deposit	Saikawa Fan Deposit	New Sand Dune	New Sand Dune	New Sand Dune	regression
HOLOCENE			Old tomb Age	New Sand Dune	New Sand Dune	lake deposit	Saikawa Fan Deposit	New Sand Dune	New Sand Dune	New Sand Dune	regression
HOLOCENE			Yayoi Age	Black soil	Peat	lake deposit	Saikawa Fan Deposit	Peat	Peat	Peat	regression
HOLOCENE	NEW STONE AGE	Jomon Age	Kamiyamada Stage	lacking	lacking; Tetori Fan Deposit	lake deposit	Saikawa Fan Deposit	unknown	lacking	lacking	regression
HOLOCENE	NEW STONE AGE	Jomon Age	Moroiso Stage	Old Sand Dune; sand with fossil marine shell	unknown	fine sand and cclay	sand; clay and sand	unknown	Old Sand Dune; s a n d	clay; medium sanb	transgression
HOLOCENE	NEW STONE AGE	Jomon Age	Hanawadai Stage Tadokaso Stage	s a n d	u n k n o w n	fine sand and cclay	sand with thin clay lamina	u n k n o w n	sand with thin clay lamina	medium sanb	transgression
PLEISTOCENE	NEW STONE AGE	Jomon Age		gravel and sand	unknown	gravel and sand	gravel and sand	unknown	gravel; coarse sand; sand with shell	sand with thin clay lamina ?	?
PLEISTOCENE	OLD STONE			gravel and sand	unknown	gravel and sand	gravel and sand	unknown	gravel; ? lacking	gravel; lacking	level of recent in m 8(?) 0－3

＊ : boring data —— : conformity ▬▬ : unconformity G. A. : geological age

1. Kanazawa District in Ishikawa Prefecture

(Fig. 1, Table 1, Plate VII and Chart 1)

The stratigraphic units of this region under consideration are the Pliocene Omma formation, the Plio-Pleistocene or Pleistocene Utatsuyama formation, the Pleistocene deposits and Holocene deposits in which are found Alluvial peat.

The general stratigraphic succession in this district is generallized as shown in Table 1. The most of the data as shown in Table 1 have been obtained by the boring data and the present writer's survey in this district. The Pliocene Omma formation is distributed over an area of about 300 m under sea-level at the Japan Sea coast of this district. The distribution of this formation is known from the rock character appearing as dark bluish green coarse sandstone, and fossil shells.

Although the Plio-Pleistocene or Pleistocene Utatsuyama formation is distributed above the Omma formation, the relation between the Omma formation and the Utatsuyama formation is unknown in this area.

The Pleistocene deposits which are composed of the gravel, the sand and thin clay laminae, is distributed over an area of about 40 m to about 100 m under sea-level as discovered by the boring data. Some thin peat laminae develop in the above mentioned deposit. In the Pleistocene deposits, the gravel lamina is found to be thicker than the other laminae.

The Holocene deposits which are composed of clay, thin sand and gravel laminae, cover an area from about 40 m under sea-level to about 40 m above sea-level. The boundary between the Holocene and the Pleistocene deposits is the boundary between the clay or sandy clay of Holocene and the gravel of Pleistocene. The clay or sandy clay which developed on the Pleistocene gravel lamina, suggests the Neolithic transgression in the Holocene Epock. In this district, the succession of Holocene deposits is generallized as shown in the general stratigraphic succession table (Table 1), that is to say, in Uchinada field the Neolithic transgrassion is shown by the clay or sandy clay lamina at about 40 m under sea-level, and these lowermost laminae suggest the Hanawadai Stage of Jômon Age. The medium sand which develops on the above mentioned laminae contains marine shells, which suggest perhaps the Moroiso Stage of Jômon Age. This medium sand indicates the maximum of the Neolithic transgression, and the lower part of the Old Sand Dune on the medium sand suggests the regression in the Middle Jômon Age. The Old Sand Dune was developed in front of the Neolithic beach, and it suggests the Katsusaka Stage of Middle Jômon Age. The sea which will be called under the name of "*Lake Ancient Kahoku*" was made as an inlet by the deposition of the Old Sand Dune over the northern area of the Kaga Plain from Tsubata to Kanazawa, and the marine shells are found in the Kamiyamada Shell Mound belonging to the Middle Jômon Age, were living in Lake Ancient Kahoku. The Kamiyamada Shell Mound which contains some marine shells and fishes was made by the ancient people of Jômon Age. The sand of the Old Sand Dune is similar to the sand of the New Sand Dune. From the Late Jômon to the Late Yayoi Age, the shore line spread in front of the present shore line, and it was 300 to 500 m offshore from the present beach. In Uchinada field, the black sand soil lamina is found on the Old Sand Dune, and it contains some potteries which belong somewhere between the Middle Jômon to Late Yayoi Age.

The Tetori Fan deposits which contains the gravel lamina (10 to 20 m in thickness) and the light bluish gray clay lamina (50 to 60 cm in thickness) is located in the Kaga Plain, in where the Old Sand Dune is not found.

The peat laminae are deposited themselves on the Tetori Fan, and contain some Late Yayoian potteries. The black sandy soil lamina in Uchinada is correlated with the peat lamina on the Tetori Fan, and while the sand of the Old Sand Dune was being deposited in Uchinada, at the same time in the southern area of the Kaga Plain the Tetori Fan deposits were also been deposited. Although the peat lamina is generally one lamina of about 30 cm in thickness, it is divided into three or four thin laminae in Kurabe, Hamasôgo, and Tokumitsu. The deposits between these peats are the sand of the New Sand Dune. The New Sand Dune which was mainly made in the end of Late Yayoi Age, is distributed over this district.

This dune is made from a medium or fine sand, which is derived mainly from a black shell and sandstone belonging to the Tetori Group, the Miocene Andesite, the welded tuff and the terrace. Alluvial peat, which is exposed along the Japan Sea coast and covered by the New Sand Dune, includes some Late Yayoian potteries of about 1,900 years before the present in the Hokuriku Region. The fact suggests that this was made from grass for the migration of the New Sand Dune in the end of Late Yayoi Age. The New Sand Dune is the highest dune of about 50 m high in Uchinada, and is about 20 m high in Kurabe. The above mentioned stratigraphic and paleogeographical notes are described as shown in Table 1.

According to the investigation of Professor ICHIKAWA of the present writer's Institute, the following diatoms are found in the peat from locality no. 67 of Tokumitsu.

Pinnularia sp.
Stauroneis phoenicenteron EHR.

In this district, many fossil erect stumps had been grown on the Tetori Fan in the regression period. The erect stumps had been covered by the sand for the migration of the New Sand Dune in the end of Late Yayoi Age. According to the determination of Professor KISHIMA of Kyôto University and the presentwriter, these many fossil erect stumps are found as follows :

Cinnamomum japonicum	(locality no. 12, Hamayasuhara)
Zelkowa serrata	(locality no. 12, Hamayasuhara)
Alnus japonica	(locality no. 12, Hamayasuhara)
Viburnum sp.	(locality no. 12, Hamayasuhara)
Zelkowa serrata	(locality no. 14, Hamayasuhara)
Zelkowa serrata	(locality no. 18, Kurabe)
Zelkowa serrata	(locality no. 19, Kurabe)
Alnus hirsta TUNCZ. var. *sibirica*	(locality no. 25, Kurabe)
Viburnum sp.	(locality no. 41, Sôgoshin)

Carpinus sp. (locality no. 60, Tokumitsu)
Alnus hirsta TUNCZ. var. *sibirica* (locality no. 67, Tokumitsu)
Zelkowa serrata (locality no. 71, Tokumitsu)

The peat includes the root or stem of *Phragmites communis* TRIN. and it does also the seeds of *Juglans mandschurica* MAXIM. var. *Sieboldiana* MAKINO and *Menyanthes trifoliata* LINNE.

2. Neagari District in Ishikawa Prefecture

(Fig. 1, Table 1 and Chart II)

The stratigraphic classification of this district is shown on the correlation table (Table 1). In this district, the New Sand Dune is observed only at some sea cliffs which develope along the shore line. The peat lamina is developed themselves under the New Sand Dune, and it is distributed over an area of about 1 to 2 m under sea-level. In winter season some specimens of peat are carried to the shore line by wave and wind. The New Sand Dune is composed of medium or coarse sand, and the Dune includs thin gravel laminae in here and there, and it is distributed over an area of about 5 m at the highest conter from sea-level. According to Professor ICHIKAWA, the peat (locality no. 85, Yoshiharakamaya) which is distributed over an area of 1 m under sea-level, includes many fossil diatoms as follows :

Cymbella cymbiformis (AGARDH & KUTZ.) v. HEURCK
Eunotia pectinalis (KUTZ.) RABENHORST
Eunotia praerumta EHR.
Eunotia sp.
Melosira granulata (EHR.) RALTS
Navicula sp.
Pinnularia sp.
Stauroneis phoenicenteron EHR.

The peat includes also many seeds of *Menyanthes trifoliata* LINNE.

3. Hashidate District in Ishikawa Prefecture

(Fig. 1, Table 1, Chart III and Plate VII)

The stratigraphic units of this district under consideration are the Miocene Kasanomisaki tuffaceous sandstone formation, the Uppermost Miocene or Lowermost Pliocene Amagozen formation, the Pleistocene deposits and the Holocene deposits.

The general stratigraphic succession in this district is generallized as shown in Table 1. According to KASENO & SAKAMOTO (1959) and the present writer, the Kasanomisaki tuffaceous sandstone formation is distributed widely at Hashidate, Cape Kasa, Kurosaki and Katano in Kaga City, and it is composed of tuffaceous sandstone and mudstone, which include some following fossil shells :

Acila sp.

Anadara sp.
Dosinia sp.
Macoma sp.
Mactra sp.
Pecten sp.
Venericardia sp.
Volsella sp.

The Amagozen formation is distributed at the eastern sea cliff of Cape Amagozen, and it is composed of pumice-tuff, tuffaceous sandstone and mudstone, which includes some thin lignite beds. The stratigraphic relation between the Kasanomisaki tuffaceous sandstone formation and the Amagozen formation is indistinct in this field. The Amagozen formation will belongs perhaps to Plio-Miocene. The above mentioned formations are covered by Quaternary deposits, which is composed of gravel (30–55 cm thick), sand in which is found shell and foraminifera (1 m thick), gravely sand (50 cm thick), gravel (20 cm thick), thin peat (0–30cm thick), the Old Sand Dune (3.2 m thick) and the New Sand Dune (1–3 m thick) in ascending order.

The stratigraphic relation between Tertiary and Quaternary deposits is a clear unconformity, and the lowermost gravel in Quaternary deposits is clearly base of Quaternary deposits, which are distributed over an area of 2 to 10 m above sea-level. The marine fossiliferous deposit of mudy sand produced a small sea cliff, and it is known under the name of "*Hashidate shell bed*". The deposit contains a rich foraminifera, mollusca, bryozoa, sponge-spicules and diatoms. According to MIURA (1956) and the present writer, the fossil shells are shown as follow :

Brachiopoda.	*Coptothyris grayi*
Pelecypoda.	*Arca boucardi*
	Cardium californiense
	Chama nipponensis
	Macoma incongrua
	Septifer virgatus
	Venerupis variegata
Gastropoda.	*Cantharidella callichroa*
	Homalopoma amussitata
	Mitrella burchardi
	Natica janthostomoides
	Tectura pallida

These fossil shells are now common in warmer sea than this beach, and they are perhaps similar shells, which are living in the shallow water of northwest of Fukui Prefecture. The deposit, in which include these fossil shells suggests the warm water and the shallow water condition. The present writer can not described by the present data that geological age of the sand lamina included fossil shells, belonged to which age of Pleistocene and Holocene. The geological age of the gravel coarse sand, coarse sand and yellowish brown sand piled on the above mentioned sand lamina, therefore, is indistinct in now. Lower sand and upper sand are perhaps correlated with the Old Sand Dune and the New Sand Dune at Uchinada field. The peat laminae are not correlated with some peats in the other fields. These peats are found to be older than the other peats, and will perhaps belonged to the Late Jômon Age. In Cape Amagozen, the Quaternary deposits are piled on the Plio-Miocene Amagozen formation.

The stratigraphic succession of this locality is as shown in Table 1. The Alluvial peat is covered by the sand of the New Sand Dune (about 30 cm thick), which is found at 10 m above sea-level, and this peat is correlated with the other peats. In the Neolithic transgression, the most of the Enuma Plain, 0 to 8 m above sea-level, was flooded by a marine water, and the flood-marine water was shut by the Old Sand Dune in the Middle Jômon Age and the New Sand Dune in the Late Yayoi Age. The water shut by a beach sand dune produced three lakes in Enuma-gun, that is tosay, these lakes are Lake Shibayama, Lake Imae and Lake Kiba. The peat which is distributed at locality no. 97 of Hashidate, includes the seed of *Juglans mandschurica* Maxim. var. *Sieboldiana* Makino.

4. Kitagata District in Fukui Prefecture

(Fig. 1, Table 1, Chart IV, Figs. 1 & 2)

The stratigraphic units of this district in Fukui Prefecture are the Pliocene (?) Bentenjima tuffaceous mudstone formation, the Pleistocene deposits and the Holocene deposits in which are found Alluvial peat. The general stratigraphic succession in this district is generallized as shown in Table 1. The Pliocene (?) Bentenjima formation composed of tuffaceous mudstone in which is found fine sandstone, is distributed at Bentenjima, a northern cliff of Kentô Hill of Kitagata Village in Fukui Prefecture. This formation is covered by the Quaternary basal gravel, that is to say, the relation between two strata is distinctly the unconformity.

The Pleistocene deposits on the Bentenjima formation are divided into the following laminae

Holocene deposits
·······························unconformity·······························
coarse sand lamina with thin gravel or clay lamina
———————————— conformity ————————————
gravel lamina or coarse sand lamina
···················unconformity···················
Pliocene (?) formation

The lowermost gravel lamina of the Pleistocene deposits are composed of andesite pebble derived from the Lower Miocene Andesite, which is widely found in the Hokuriku Region, and it is about 1 m in thickness. The coarse sand lamina with thin gravel and clay laminae cover this gravel lamina, and these Pleistocene laminae show the monoclinal structure.

The upper limit of the coarse sand and clay lamina is covered by the Alluvial peat and the sand of the New Sand Dune in the relation of unconformity.

The Holocene deposits are divided into two lamonae of the peat lamina and sand of the New Sand Dune. The peat lamina which covers the Pleistocene clay lamina is thicker than the other laminae, it is 30 to 50 cm in thickness. This lamina is covered by the sand which belongs to the New Sand Dune, which is correlated with the New Sand Dune distributed in the other fields. This sand is medium sand, and it is is 1 to 5 m in thickness at Matsunami and its neighbourhood, and is especially thick

The peat which distributes on the medium sand or clay, includes following fossil diatoms:

Pinnularia alpina W. Smith.

Pinnularia sp.

The fossil erect stumps which had grown on the medium sand or clay, had been covered by the present peat, and according to Professor Kishima and the present writer, these erect stumps are found as follows :

Zelkowa serrata (locality no. 102, Kentôzan)

Carpinus sp. (locality no. 102, Kentôzan)

Alnus japonica (locality no. 102, Kentôzan)

The fossil leaf of *Quercus glauca* Thunb. is found from locality no. 101 at Kentôzan (Kentô Hill), and it is such as fig. 3 of Plate VIII.

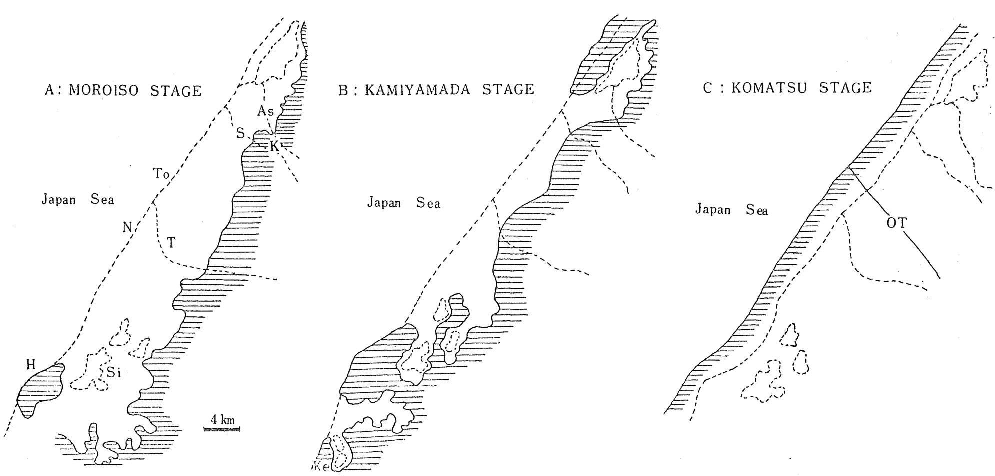


Fig. 1 Paleogeographical Maps of this Region in some Stages

A : The paleogeographical map in the Moroiso Stage of Early Jômon Age.

B : The paleogeographical map in the Kamiyamada Stage (Katsusaka Stage in the Kwantô Region) of Middle Jômon Age.

C : The paleogeographical map in the Komatsu Stage of the end of the Late Yayoi Age.

K : Kanazawa City, As : Asano River, S : Sai River, T : Tetori River, OT : old Tetori River, Si : Lake Shibayama, H : Hashidate, Ke : Kentô Hill, N : Neagari, To : Tokumitsu

………… : topography in recent

▤ : land area in each stage

5. Correlation

(Table 1)

The stratigraphic correlation in this region is shown in Table 1. In this correlation, the Quaternary stratigraphic correlation is especially noted such as the following description.

The relation of boundary between the foundation and Quaternary strata is found distinctly with a unconformity in all the area of this region. The Pleistocene deposits distributed on the border between Fukui and Ishikawa Prefectures. The Pleistocene deposits which distribute at Hashidate and Kitagata fields, will perhaps belong to the Last Interglacial Stage of Pleistocene from the view point of a distributive height of above sealevel, a rock character and a fossil shells. It is left for the study in the near future that the yellowish blue sand, sandy gravel, and basal gravel laminae belong to which age of Pleistocene and Holocene. The basal gravel lamina which distributes widely in Hashidate District, is correlated with the basal gravel lamina in Kitagata District. The Old Sand Dune was prodused in front of Neolithic beach in the regressional period of Middle Jômon Age. The Alluvial peat lamina which distributes over all the districts belongs to the end of Late Yayoi Age.

The New Sand Dune was produced the migration of the Old Sand Dune which exposed widely along the beach where was 300 to 500 m offshore from the present beach, over all the districts in this region. The migration of the Old Sand Dune is because of the transgression in the end of Late Yayoi Age.

Chapter III

POLLEN ANALYSIS

1. Localities of the Samples

(Charts 1, 2, 3 and 4)

Fossil pollen and spore grains described and illustrated in this paper have been collected from more than 110 localities over a period of two years from the summer of 1957 to the spring of 1959. These localities cover almost the whole coast of the Kaga and Echizen Districts in the Hokuriku Region, in where Alluvial peat is distributed.

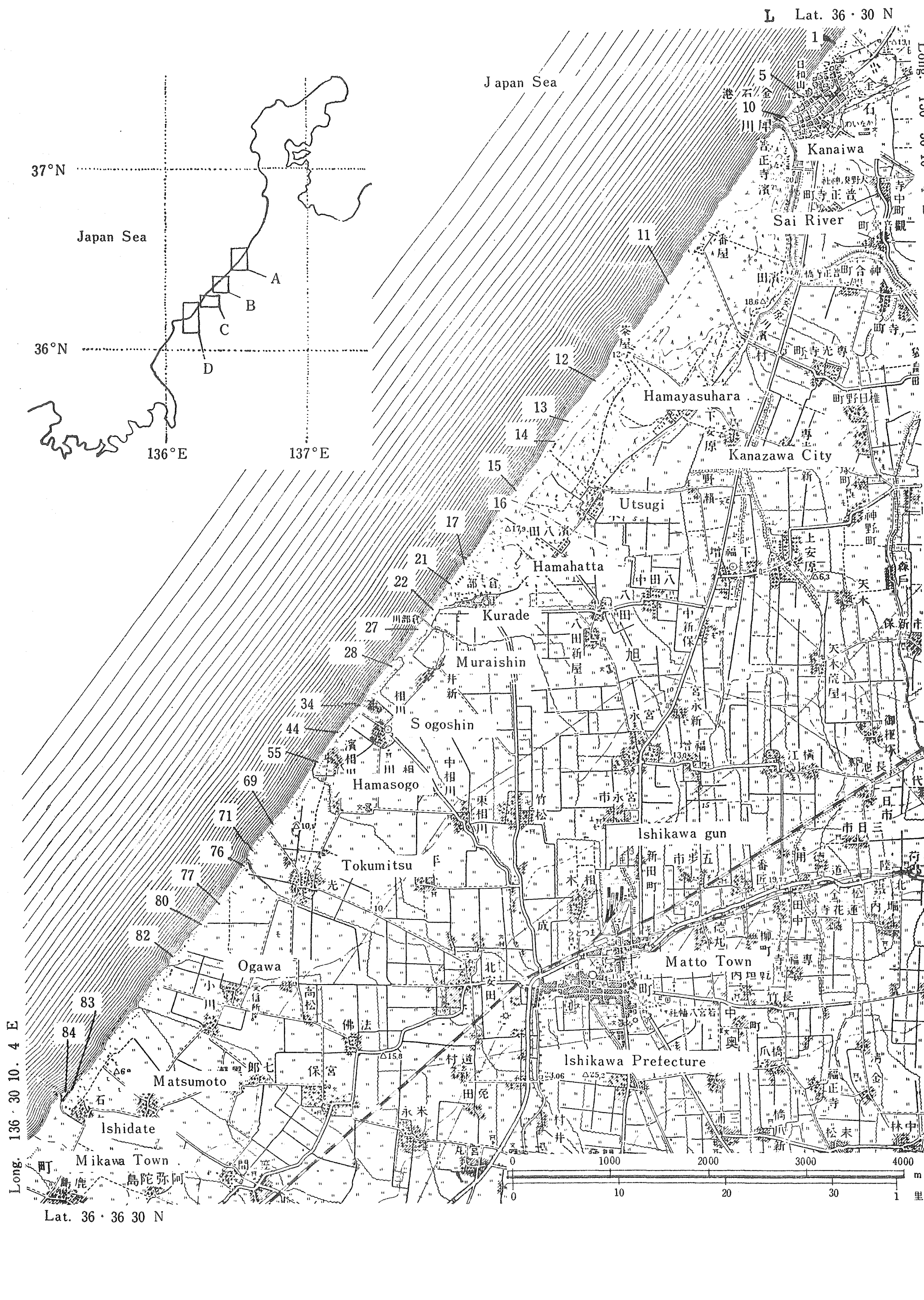
In the following description of the various localities, the first numbers indicate the locations themselves and they are numbered the same way on the diagrams and the tables of pollen and spore analyses. The Arabic figures in parentheses, immediately following the collection number, indicate the height above sea-level. For example, 97. (13m) indicates that 97 is the number of the locality on the map and this point is 13 m above sea-level.

As all the localities are found along the coast of the Japan Sea, the word "coast" is omitted from the following description.

1. (−1.8 m), The northeastern end of Kanaiwa, Kanazawa City, Ishikawa Prefecture; boring datum.

Chart 1 Index map showing location of the samples studied in Kanazawa District (This map is published by Geographical Survey of Japan)

A district············Chart 1. Kanazawa District
B district············Chart 2. Neagari District
C district············Chart 3. Hashidate District
D district············Chart 4. Kitagata District

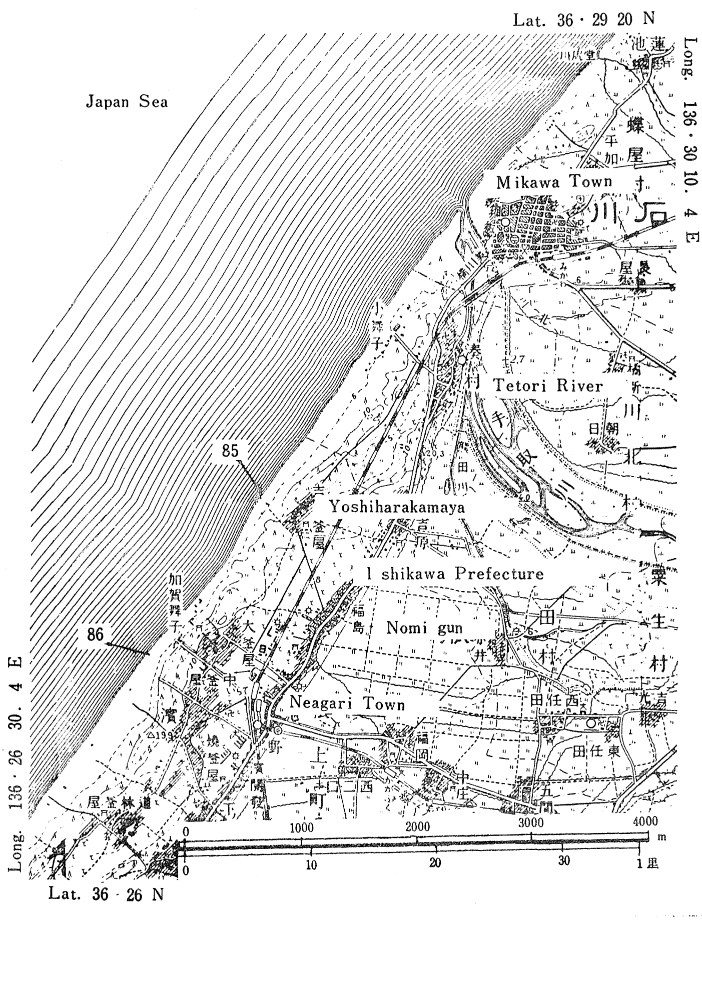


2. (−1.85 m), Nearly northeastern end of Kanaiwa, Kanazawa City, Ishikawa Prefecture.
3. (−1.85 m), Nearly northeastern end of Kanaiwa, Kanazawa City, Ishikawa Prefecture.
4. (−3.1 m), About 80 m southwestward from the northeastern end of Kanaiwa, Kanazawa City, Ishikawa Prefecture.
5. (−3.05 m), The center of Kanaiwa, Kanazawa City, Ishikawa Prefecture.
6. (−3.3 m), The center of Kanaiwa, Kanazawa City, Ishikawa Prefecture.
7. (−3.5 m), About 70 m northeastward from the southwestern end of Kanaiwa, Kanazawa City, Ishikawa Prefecture.
9. (−3.7 m), Nearly southwestern end of Kanaiwa, Kanazawa City, Ishikawa Prefecture.
10. (−3.8 m), The southwestern end of Kanaiwa, Kanazawa City, Ishikawa Prefecture.
12. (0.3 m), About 1,000 m westward from Hamayasuhara, Kanazawa City, Ishikawa Prefecture.
13. (0.18 m), About 350 m southwestward along the coast from 12, Utsugi, Kanazawa City, Ishikawa Prefecture.
14. (0.3 m), About 750 m northwestward of Utsugi, about 150 m southwestward of 13, Utsugi, Kanazawa City, Ishikawa Prefecture.
15. (0.1 m), About 800 m just westward of Utsugi, Kanazawa City, Ishikawa Prefecture.
16. (1 m), 200 m southwestward from 15, about 200 m northward of the bench of triangulation (17.9 m above sea-level), about 500 m westward from Hamahatta, Matto, Ishikawa Prefecture.
17. (0.5 m), Nearly the northern end of Kurabe, about 500 m northwestward of Kurabe, Matto, Ishikawa Prefecture.
18. (0.6 m), About 100 m southwestward of Kurabe, 100 m southwestern cliff from 17, Kurabe, Matto, Ishikawa Prefecture.
19. (1.55 m), About 100 m southwestern outcrop from 18, Kurabe, Matto, Ishikawa Prefecture.
20. (0.2, 0.4 m), About 100 m southwestern outcrop from 19, there are two peat laminae, Kurabe, Matto, Ishikawa Prefecture.
21. (0.35 m), About 100 m southwestern outcrop from 20, the cone of *Menyanthes trifoliata* is found from this locality; Kurabe, Matto, Ishikawa Prefecture.
22. (0.65, 0.80, 0.95, 1.10 m), About 2,800 m southwestern outcrop from 21, just westward of Kurabe, Matto, Ishikawa Prefecture.
23. (0.5, 0.65, 0.80, 1.05 m), About 600 m southwestward of 22, four peat laminae are covered by the New Sand Dune, which is 1.5 m in thickness, Kurabe, Matto, Ishikawa Prefecture.
24. (0.5, 0.60, 0.70, 0.80 m), About 300 m southwestward of 23, four peat laminae, Kurabe, Matto, Ishikawa Prefecture.
25. (0.55, 0.95, 1.45 m), About 270 m southwestward of 24, there are three peat laminae, Kurabe, Matto, Ishikawa Prefecture.
26. (0.4 m), About 100 m northward of 25, Muraishin, Matto, Ishikawa Prefecture.
27. (1.75 m), About 500 m southwestward of 26, Matto, Ishikawa Prefecture.
28. (1.28 m), About 500 m westward of Muraishin, Muraishin, Matto, Ishikawa Prefecture.

29. (1.75 m), 20 m southwestward of 28, Sôgoshin, Matto, Ishikawa Prefecture.
30. (1.4, 1.52, 1.65 m), southwestward of 29, Matto, Ishikawa Prefecture.
31. (1.8, 2.2 m), 20 m southwestward of 30, Matto, Ishikawa Prefecture.
32. (1.2 m), 20 m southwestward of 31, Matto, Ishikawa Prefecture.
33. (1.3 m), 20 m southwestward of 32, Matto, Ishikawa Prefecture.
34. (1.9, 2.1 m), 20 m southwestward of 33, Matto, Ishikawa Prefecture.
35. (2.1 m), 20 m southwestward of 34, Matto, Ishikawa Prefecture.
36. (2.3 m), 20 m southwestward of 35, Matto, Ishikawa Prefecture.
37. (2.0 m), 20 m southwestward of 36, Matto, Ishikawa Prefecture.
38. (1.6 m), 20 m southwestward of 37, Matto, Ishikawa Prefecture.
39. (1.6 m), 20 m southwestward of 38, Matto, Ishikawa Prefecture.
40. (1.6 m), 20 m southwestward of 39, Matto, Ishikawa Prefecture.
41. (1.1 m), 20 m southwestward of 40, Matto, Ishikawa Prefecture.
42. (1.6 m), 20 m southwestward of 41, Matto, Ishikawa Prefecture.
43. (0.6 m), About 500 m westward of Hamasôgo, Matto, Ishikawa Prefecture.
44. (0.6 m), 20 m southwestward of 43, Hamasôgo, Matto, Ishikawa Prefecture.
45. (0.3, 0.5, 0.75 m), 20 m southwestward of 44, Hamasôgo, Matto, Ishikawa Prefecture.
46. (0.51, 1.0 m), 20 m southwestward of 45, Hamasôgo, Matto, Ishikawa Prefecture.
47. (0.5 m), 20 m southwestward of 46, Hamasôgo, Matto, Ishikawa Prefecture.
48. (1.4m), 20 m southwestward of 47, Hamasôgo, Matto, Ishikawa Prefecture.
49. (1.0, 1.1 m), 20 m southwestward of 48, Hamasôgo, Matto, Ishikawa Prefecture.
50. (1.25 m), 20 m southwestward of 49, Hamasôgo, Matto, Ishikawa Prefecture.
51. (1.25 m), 20 m southwestward of 50, Hamasôgo, Matto, Ishikawa Prefecture.
52. (0.8 m), 20 m southwestward of 51, Hamasôgo, Matto, Ishikawa Prefecture.
53. (1.25 m), 20 m southwestward of 52, Hamasôgo, Matto, Ishikawa Prefecture.
54. (1.25 m), 20 m southwestward of 53, Hamasôgo, Matto, Ishikawa Prefecture.
55. (1.50 m), 20 m southwestward of 54, Hamasôgo, Matto, Ishikawa Prefecture.
56. (1.70 m), 20 m southwestward of 55, about 250m westward of the bench of triangulation (10.1 m above sea-level), northeastern margin of Tokumitsu, Matto, Ishikawa Prefecture.
57. (1.8 m), About 95 m southwestward of 56, Tokumitsu, Ishikawa Prefecture.
58. (1.7 m), About 5 m southwestward of 57, Tokumitsu, Ishikawa Prefecture.
59. (2.0 m), 20 m southwestward of 58, Tokumitsu, Matto, Ishikawa Prefecture.
60. (1.6 m), 20 m southwestward of 59, Tokumitsu, Matto, Ishikawa Prefecture.
61. (1.6 m), 20 m southwestward of 60, Tokumitsu, Matto, Ishikawa Prefecture.
62. (1.9 m), 20 m southwestward of 61, Tokumitsu, Matto, Ishikawa Prefecture.
63. (2.4 m), 20 m southwestward of 62, Tokumitsu, Matto, Ishikawa Prefecture.
64. (1.4 m), 20 m southwestward of 63, Tokumitsu, Matto, Ishikawa Prefecture.
65. (2.0 m), 20 m southwestward of 64, Tokumitsu, Matto, Ishikawa Prefecture.
66. (1.7 m), 20 m southwestward of 65, Tokumitsu, Matto, Ishikawa Prefecture.
67. (2.4, 2.9 m), 10 m southwestward of 66, Tokumitsu, Matto, Ishikawa Prefecture.
68. (1.7, 2.2 m), 10 m southwestward of 67, Tokumitsu, Ishikawa Prefecture.

69. (2.9 m), 10 m southwestward of 68, Tokumitsu, Matto, Ishikawa Prefecture.
70. (2.4 m), 10 m southwestward of 69, Tokumitsu, Matto, Ishikawa Prefecture.
71. (2.3 m), 20 m southwestward of 70, Tokumitsu, Matto, Ishikawa Prefecture.
72. (1.8 m), 20 m southwestward of 71, Tokumitsu, Matto, Ishikawa Prefecture.
73. (2.2 m), 20 m southwestward of 72, Tokumitsu, Matto, Ishikawa Prefecture.
74. (2.5 m), 20 m southwestward of 73, Tokumitsu, Matto, Ishikawa Prefecture.
75. (2.5 m), About 50 m southwestward of the mouth of Tokumitsu River, Tokumitsu, Matto, Ishikawa Prefecture.
76. (3.8 m), 10 m southwestward of 75, Tokumitsu, Matto, Ishikawa Prefecture.
77. (5.0 m), About 450 m southwestward of 76, Tokumitsu, Matto, Ishikawa Prefecture.
78. (3.5 m), About 30 m southwestward of 77, Tokumitsu, Matto, Ishikawa Prefecture.
79. (3.8 m), About 100 m southwestward of 78, Tokumitsu, Matto, Ishikawa Prefecture.
80. (4.0 m), About 120 m southwestward of 79, Ogawa, Matto, Ishikawa Prefecture.
81. (2.5 m), About 200 m southwestward of 80, Ogawa, Matto, Ishikawa Prefecture.

Chart 2 Index map showing location of the samples studied in Neagari District (This map is published by G. S. J.)



82. (5.0 m), About 300 m southwestward of 81, Ogawa, Matto, Ishikawa Prefecture.

83. (2.0 m), About 1,750 m southwestward of 82, the mouth of Ishidate River, Ishidate, Mikawa, Ishikawa Prefecture.

84. (3.2 m), About 35 m southwestward of 83, the mouth of Ishidate River, Ishidate, Mikawa, Ishikawa Prefecture.

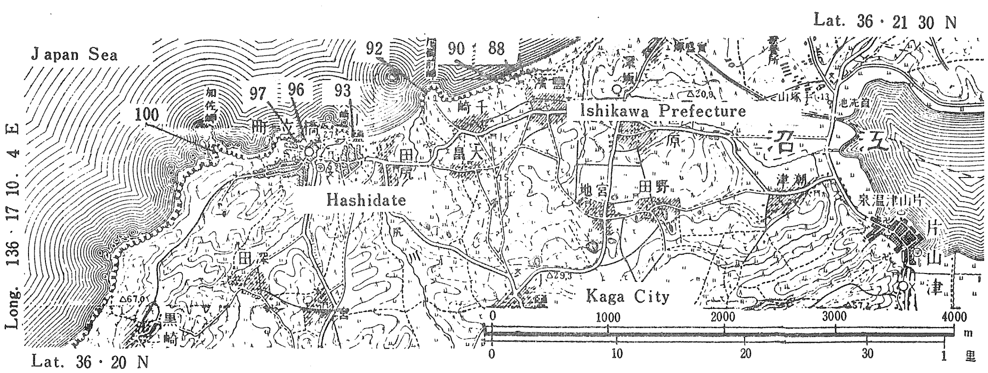
85. (−1.0 m), Sea bottom, about 30 m offshore from the coast of Yoshiharakamaya, Neagari, Nomi-gun, Ishikawa Prefecture.

88. (6.0 m), About 300 m northern margin of Shihohama, Kaga City, Ishikawa Prefecture.

93. (7.0 m), The western cliff at the port of Hashidate, Kaga City, Ishikawa Prefecture.

96. (4.2, 6.6 m), Cliff at the coast, where is 100 m northwestward from the Hashidate Branch of Public Office of Kaga City, Hashidate, Kaga City, Ishikawa Prefecture.

Chart 3 Index map showing location of the samples studied in Hashidate District (This map is published by G. S. J.)



97. (10.3, 13.5 m), About 50 m southwestward along the coast from 96, Hashidate, Kaga City, Ishikawa Prefecture.

101. (21.0 m), About 200 m southwestward from the mouth of Daishoji River, northwestern slope of Kentô Hill (bench mark 61 m above sea-level), Kitagata Village, Sakai-gun, Fukui Prefecture.

102. (13.0, 13.5 m), The sea cliff, about 25 m southwestward of 101, northwestern slope of Kentô Hill, Hamasaka, Kitagata Village, Sakai-gun, Fukui Prefecture.

103. (18.0 m), The sea cliff, about 40 m southwestward of 102, Hamasaka, Kitagata Village, Sakai-gun, Fukui Prefecture.

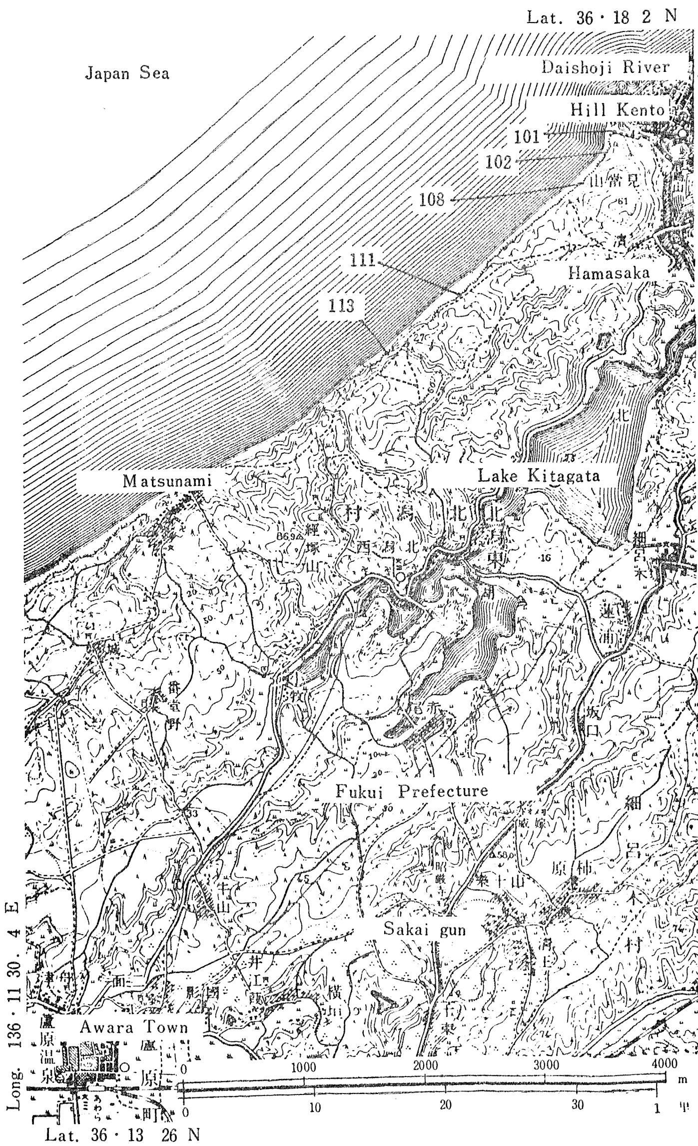
104. (11.0 m), The sea cliff, about 10 m southwestward of 103, Hamasaka, Kitagata Village, Sakai-gun, Ishikawa Prefecture.

105. (10.3 m), The sea cliff, about 20 m southwestward of 104, Hamasaka, Kitagata Village, Sakai-gun, Fukui Prefecture.

108. (22.0 m), The sea cliff, about 40 m southwestward of 105, Hamasaka, Kitagata Village, Sakai-gun, Fukui Prefecture.

111. (10.5 m), The sea cliff, about 1,500 m westward of Hamasaka, 1.100 m southwestward of 108, Hamasaka, Kitagata Village, Sakai-gun, Fukui Prefecture.

Chart 4 Index map showing location of the samples studied in Kitagata District (This map is published by G. S. J.)



113. (5.5 m), The small sea cliff, about 600 m southwestward of 111, Hamasaka, Kitagata Village, Sakai-gun, Fukui Prefecture.

2. Preparation of Materials and Method of Study

(Table 2)

Materials which were used for pollen and spore grains analyses of this present study, were collected from more than 110 localities. The interval between these localities is 20 m at the continuous outcrops, and many samples was collected from the peat laminae at discontinuous small outcrops. A composite sample obtained by mixing three to four pieces of pollen-bearing peat pieces of same weight represents a locality. The peat pieces were collected at the locality along the bedding plane within a thickness of 10 cm. When a change in the peat was observed at an exposure, the samples were collected from each of the units of the different facies in the peat lamina.

For samples thus obtained the analytical procedure* once reported by the present writer (OZAKI & FUJI 1958, pp. 567–574) was followed.

Mechanical Procedure

(1). The sample is crushed about 3 mm in diameter by an earthenware morter without grinding by the mortar.

(2). The sample is sifted by a 32 meshes sieve.

(3). About 5 grams of sample are removed to a 300 cc beaker.

Chemical Procedure

(4). About 50 cc of 10 per cent caustic soda are added, and the sample is set for 24 to 48 hours.

(5). The upper part of distilled water in the beaker is put away every 24 hours. This procedure is kept up for about a week.

(6). The sample with about 100 cc of distilled water is separated to some 200 cc tea-cups and is allowed to set quietly for about 3 minutes.

(7). The floating materials on the water are removed to the glass tube of centrifuge, and the water is excepted by the centrifuge.

(8). A small quantity of mixed liquid of hydrochloric acid and nitric acid is added to the sample.

(9). The sample is immersed in steam for about 10 seconds.

(10). This mixed liquid is separated from the sample by the centrifuge.

(11). The sample is removed to tea-cups, and the sample is allowed to set quietly for about 3 minutes.

(12). The floating materials on the water are removed to the glass tube of centrifuge again to remove the water.

(13). A small quantity of glacial acid is added to the sample. After about 30 seconds, this acid is separated from the sample.

(14). A small quantity of mixed liquid of acetic acid anhydride and sulfric acid (9 : 1 in volume) is added to the sample. After about 2 minutes, this liquid is separated from the sample.

(15). A small quantity of glacial acetic acid is added to the sample. After about 30 seconds, this acid is separated from the sample.

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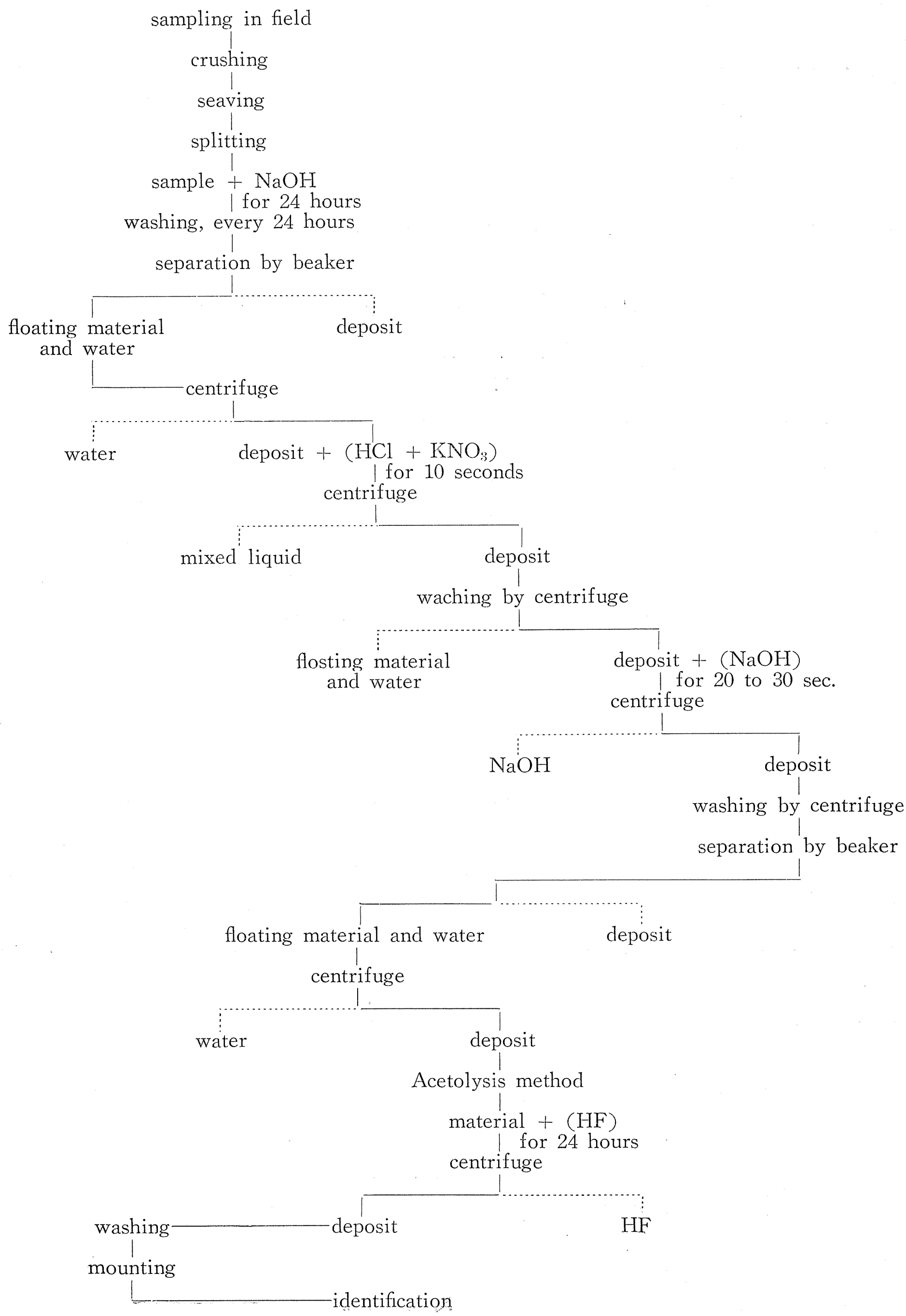
* : The present writer was suggested this analytical procedure by Professor M. SHIMAKURA of the Nara University of Education.

(16). A small quantity of hydrogen fluoride is added to the sample and kept for 24 houres. The hydrogen fluoride is removed

(17). The sample is removed to the glass tube of centrifuge, and is washed by the water.

TABLE 2. Systematic figure of analytical proceding



Mounting

(18). The small quantity of sample is mounted on the slide glass, and it is slowly dried by an electric heater or gas burner.

(19). Before the sample is perfectly dried up, a small quantity of glycerine jelly is dropped on the sample, and the slide is dried, until the cover glass is firmly fixed on the slide.

Microscopic Observation

The frequency and relative abundance of the species on each slide are obtained by counting 200* pollen and spore grains. The magnification of microscope is about 600 times.

The slides containing the registered specimens will be deposited in the collection of the Institute of Geology, Faculty of Science, Kanazawa University, Kanazawa, Japan.

3. Description of Assemblages in these Districts

Distribution Chart

(Tables 3 and 4)

The data in the present analysis of pollen and spore grains assemblages are described in the distribution tables as shown in Tables 3 and 4.

The frequency of same types obtained by a random specimen of 200 pollen and spore grains in the each sample, are shown in Table 3 and Table 4. The tables include the distribution of pollen and spore grains in 714 slides of 119 samples for this study, that is to say, Table 3 includes the distribution of pollen and spore grains in 348 slides of 58 samples from the Kanazawa District. Table 4 includes the distribution of pollen and spore grains in 366 slides of 61 samples from the Kanazawa, Neagari, Hashidate and Kitagata Districts. The stratigraphic notes about the strata of this area are given in Chapter II.

In the tables, the sample localities in each district, which are shown by corresponding numbers to those numbering the Charts 1, 2, 3 and 4. The reader is referred to the above mentioned notes of this chapter for detailed description of the stratigraphic relations of the samples. The type names of pollen and spore grains are arrenged in the order of natural classification. The alphabetical order of peat laminae is arranged from "a" to "d" in ascending order of laminae, that is to say, "a" lamina is shown lower lamina, and "d" lamina is shown uppermost lamina.

In the tables, the type names are divided into two groups. The first group is pollen grain and the second is spore grain.

Distribution of the Assemblages in the Kanazawa District

(Chart 1; Tables 1, 3, and 4; Figs. 2, 3, 4, 5 and 7)

As it was mentioned previously in the other paper, the present study of Alluvial pollen

* : BARKLEY's theory.

TABLE 3 **THE CHART OF POLLEN ANALYSIS**

AREA	KANAZAWA DISTRICT													
LOCALITY NAME	Kanaiwa									Hy.	Utsugi			Hh.
LOCALITY NO.	1	2	3	4	5	6	7	9	10	12	13	14	15	16
PEAT LAMINA														
POLLEN GRAIN														
Pinus	12.5	9.0	11.0	19.0	10.0	18.5	9.5	13.0	9.2	4.0	3.0	4.5	10.0	16.0
Larix	5.0	2.0	1.0	2.0	1.0	0.5	3.0	0	2.0	1.0	4.5	0.5	0	4.0
Abies	1.5	1.5	1.5	1.0	0.5	1.0	1.0	2.0	2.0	0.5	12.5	1.5	24.0	0
Tsuga	0.5	1.0	0.5	0	1.0	1.0	2.0	1.5	1.0	0	0.5	3.0	2.5	0
Picea	1.5	9.5	10.5	8.0	4.5	2.0	10.5	3.0	2.0	0	3.0	6.0	0.5	0.5
Podocarpus	0.5	0.5	1.0	1.0	0.5	0.5	11.0	0.5	1.3	2.0	0	1.0	0.5	0
Cryptomeria	18.5	24.0	32.0	39.5	50.0	31.0	14.5	24.5	23.0	16.0	21.0	30.0	30.5	18.0
Juniperus	1.0	2.0	1.0	2.0	1.0	0	1.0	0	0	0	0	0	0	0.5
Compositae	1.5	2.5	2.0	1.5	0.5	0.5	2.5	10.5	1.0	1.0	1.0	2.5	4.0	1.0
Bidens	0.5	0.5	1.0	0.5	0	0	0.5	0	0	0	0.5	0	0	0
Menyanthes	0.5	1.5	3.5	1.5	0	3.5	1.0	2.5	1.0	0	0	0	1.0	1.0
Rhododendron	1.5	0.5	0	0	0	0.5	0.5	0	0	1.0	2.0	0	1.0	0
Myriophyllum	0.5	1.0	0	0	4.0	0	0.5	3.5	3.0	0	1.0	1.0	1.5	0
Oenothera	0.5	0.5	1.5	1.0	0.5	0	0.5	0	0	0	0	0.5	0	0.5
Tilia	0.5	0.5	1.0	1.5	1.0	0.5	0.5	0.5	1.0	0	0	1.0	1.0	2.0
Ilex	0.5	1.5	0.5	1.0	0	1.0	0.5	0	0	0.5	1.0	0.5	0.5	0
Sapium	0	0.5	0.5	0.5	0	1.0	0.5	1.0	1.0	0	0	0.5	0.5	0
Rubus	0.5	0.5	0	0.5	0	0	1.5	0	0	0	0	0.5	0	0
Nuphar	0.5	0.5	0	1.5	0	0.5	0.5	0	0	1.0	0.5	0	0.5	0
Persicaria	2.0	5.0	6.0	2.0	15.0	4.0	2.0	1.5	6.0	0.5	1.5	4.5	0	3.0
Zelkowa	0.5	0.5	1.5	1.5	0.5	0.5	0.5	0.8	0	0	0	1.5	0.5	0
Ulmus	1.5	1.0	2.0	2.0	2.0	1.0	3.0	0	0	1.0	1.5	0	1.0	0
Quercus	14.5	10.0	11.0	0.5	5.5	9.0	7.5	6.5	5.0	15.5	8.0	5.0	4.0	18.0
Fagus	1.0	1.0	0	2.5	0	1.0	2.0	1.0	1.0	9.0	0	0.5	0.5	0
Alnus	2.5	0.5	0.5	1.0	1.5	1.5	0.5	3.5	13.0	1.0	10.5	2.4	0.5	0
Betula	1.0	0	0.5	1.0	0	1.0	1.5	2.0	2.4	0	0	4.0	0.5	0
Carpinus	5.5	0.5	0.5	2.0	0	0	0.5	1.0	1.5	0.5	0	0	0	6.0
Juglans	13.0	7.5	1.0	1.0	1.0	0.5	0.5	3.0	10.4	40.5	27.5	9.5	9.0	20.5
Platycarya	2.0	0.5	0	0	0	0	0.5	0	5.0	0	0	3.0	0	0
Salix	0.5	3.0	0.5	0.5	0	5.0	2.0	5.5	4.0	0.5	0.5	3.5	2.0	2.0
Gagea	0.5	0.5	0	0	0.5	0	0	1.0	0.5	0	0	0.5	1.0	1.0
Carex	0	0	0	0	0	0	0.5	1.0	1.2	0	0	2.0	0	0
Gramineae	4.5	5.5	4.5	1.0	3.0	6.5	9.0	3.5	0.5	5.5	1.5	6.5	0.5	0
Lenticularpollenites	0	1.0	0	1.0	0	0.5	0	1.0	0	0	0	1.0	0	0
SPORE GRAIN														
Selaginella	0.5	1.0	0	1.0	0	0	0.5	0.5	0	0	0	0.5	0	0
Bacillus spore	0.5	1.0	2.5	1.0	3.0	4.5	3.5	1.0	1.0	0	0.5	0	0.5	0
Deltoidsporites	1.0	0.5	0	0	0	0	0	0	0	0	0	0	0	0.5
Reniformsporites	0.5	1.5	1.0	0.5	0.5	3.0	3.5	3.7	1.0	4.0	7.0	2.5	2.0	6.0
Subtriangularsporites	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0

AREA	KANAZAWA DISTRICT																				
LOCALITY NAME	Kurabe																				
LOCALITY NO.	17	18	19	20		21	22				23				24				25		
PEAT LAMINA				a	b		a	b	c	d	a	b	c	d	a	b	c	d	a	b	c
POLLEN GRAIN																					
Pinus	10.5	13.0	26.0	16.5	3.5	16.5	19.0	11.5	9.5	12.0	11.5	5.0	10.0	13.5	19.0	13.5	5.5	26.5	11.5	11.0	8.5
Larix	1.5	0	0	1.0	1.0	1.5	3.5	1.0	1.0	0.5	2.0	0.5	1.0	0.5	0.5	0.5	4.0	1.0	3.0	0.5	1.0
Abies	2.0	2.5	1.5	2.5	1.5	2.0	1.0	3.0	3.0	0.5	1.0	1.5	2.0	1.0	3.3	1.5	2.0	1.0	2.5	2.0	1.0
Tsuga	1.0	0.5	0	0	2.5	0	3.0	0.5	1.5	1.0	0.5	1.0	0.5	2.0	1.5	0.5	0	0.5	0	1.5	2.5
Picea	0.5	0.5	0	10.5	3.5	0	0.5	0.5	3.0	6.5	5.0	1.0	1.5	1.0	7.0	4.5	2.0	0.5	3.5	4.0	3.5
Podocarpus	0	5.0	0	0	0	0	1.0	1.5	0	0	0.5	0.5	0	0	1.0	0	0	2.0	0.5	0	0.5
Cryptomeria	42.5	38.5	33.5	44.0	37.0	51.5	50.5	48.5	36.0	28.0	57.0	48.5	36.0	31.5	42.0	44.5	24.0	39.0	51.0	49.0	33.0
Juniperus	0	0.5	0.5	0	0	0	0.5	1.0	0	0.5	0	0	0	0	0	0	0	0	0.5	0	0.5
Compositae	1.2	0.5	1.0	1.0	0.5	1.5	1.5	2.0	0.5	0.5	0.5	1.5	0.5	1.5	1.0	2.5	0.5	0.5	1.5	0.5	1.5
Bidens	0	0.5	0.5	0	0	1.5	0	0.5	0	1.0	1.5	0	0	0	0	0	0	1.0	0	0	0
Menyanthes	0	3.0	1.5	1.0	5.0	0	3.0	0	4.0	1.5	2.5	1.5	4.0	0.5	2.0	0	0.5	0	1.5	1.0	1.0
Rhododendron	0	0.5	2.5	1.0	0	0	2.5	1.5	2.0	0.5	0.5	0	0	1.5	0	0	0	0.5	0	0	0
Myriophyllum	3.0	0	0	0	0	0	0	0	1.5	0	0	0	0	0	0	0	0	0	0	0	0
Oenothera	0	0.5	0.5	0	0	0	2.0	1.0	0.5	0	0	0	0	0	0	0	0	0	0	0	0
Tilia	0.5	0.5	1.0	0.5	0	0	1.0	0	0	0.5	0.5	0.5	0.5	1.0	0	2.5	0.5	0	0	1.5	0.5
Ilex	0.5	1.5	2.5	0	0.5	0	0.5	0	0	0	0.5	1.5	2.0	2.0	0.5	0.5	0	0.5	1.0	0	0
Sapium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0
Rubus	0	0	0	0	0	0	0	2.0	0	1.0	0	0	0	0	0	1.5	0	0	0.5	0	0
Nuphar	0	0.5	0	0	0	0	0	0	0.5	2.0	0	0	0	0	0	0	0	0	0	0	0
Persicaria	13.0	12.0	1.0	9.0	15.0	11.0	3.5	7.0	11.5	14.0	4.0	0.5	9.5	11.0	10.5	15.0	4.0	6.5	2.5	9.0	11.5
Zelkowa	0	0.5	0	0	1.0	0.5	1.0	2.0	0	0.5	0	0.8	0	1.5	0.5	1.0	3.0	0.5	0	3.0	1.0
Ulmus	1.0	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0	1.5	0	1.0	0.5	0.5	1.5	0	4.5	0.5	0.5	0	0
Quercus	19.0	7.5	4.5	5.5	8.3	5.0	1.0	4.5	8.5	5.5	4.0	4.5	5.0	6.0	5.0	8.5	21.0	4.0	4.0	4.0	5.0
Fagus	0	2.5	4.0	0	0	0	0	3.0	0	0	2.0	4.0	0	0	0	0	0	0	0	0	0
Alnus	0.8	0.5	0	1.5	1.5	2.0	1.0	1.5	3.5	3.0	1.0	0.5	1.5	1.0	1.0	1.0	1.5	1.0	0.5	2.5	2.0
Betula	0	0	0	0	0	0	1.0	0.5	0	0	0	0	0	0	0	1.0	0	0	0	1.0	0
Carpinus	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	1.0	0	0	0	0.5	0
Juglans	5.0	1.0	11.0	2.0	11.5	2.5	0.5	0.5	2.5	12.5	0	0.5	27.0	20.5	1.0	1.0	20.0	10.0	4.0	2.0	21.0
Platycarya	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	1.0	0	0
Salix	1.0	0	3.5	0.5	6.0	0.5	1.5	2.5	4.5	0	0.5	1.5	1.0	2.0	1.0	1.0	0.5	3.0	0.5	0.5	3.5
Gagea	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0
Carex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0
Gramineae	2.5	2.5	0	0	0	0	0	0	2.5	1.5	1.0	1.0	0	0.5	0.5	0	0	0	3.5	2.0	1.5
Lenticularpollenites	0	0	0	0	0	0	0	0	0	1.0	0.5	0	0	0	0	0	0	0	0	0.5	0
SPORE GRAIN																					
Selaginella	0	0	0	0	0	0	0	0	1.0	1.0	0	0	0	0.5	0	0	0.5	0	0	0	0
Bacillus spore	0	0	1.0	0.5	0	0	0	0.5	0	0	0.5	0	0	0	0	0.5	1.0	1.0	0.5	1.5	0
Deltoidsporites	0	0	0.5	0	0	0	0	0	0.5	0.5	1.0	0	0	0	0	0	1.0	0	0	0	0
Reniformsporites	1.5	4.0	2.0	2.0	1.0	3.5	0.5	0	2.0	2.5	1.5	1.2	2.5	0.5	1.2	0.5	3.5	0.5	1.0	2.0	1.0
Subtriangularsporites	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0	0

AREA	KANAZAWA DISTRICT																						
LOCALITY NAME	Hamasôgo																						
LOCALITY NO.	26	27	28	29	30			31		32	33	34		35	36	37	38	39	40	41	42	43	44
PEAT LAMINA					a	b	c	a	b			a	b										
POLLEN GRAIN																							
Pinus	10.0	11.5	13.0	15.0	17.5	15.0	18.0	12.0	7.5	12.5	9.0	3.5	11.5	11.0	8.0	20.0	9.0	19.0	11.0	10.5	17.0	16.5	19.0
Larix	2.5	0.5	0.5	0	1.3	2.5	0.5	3.5	0.5	0.5	2.5	0.5	0.5	0.5	3.0	1.0	1.0	1.0	0.5	0.5	0	1.0	2.0
Abies	0.5	1.5	3.0	2.0	1.5	5.0	1.0	0.5	1.5	3.0	0.5	2.0	1.0	1.5	1.5	2.0	1.5	1.0	1.5	1.0	0.5	1.0	2.0
Tsuga	0	1.0	0	0.5	0	1.0	0.5	2.0	2.0	0	0.5	1.0	2.0	0	2.0	0.5	3.0	0	1.0	1.0	0.5	0.5	1.0
Picea	3.0	5.5	1.0	0.5	10.0	10.5	1.5	0.5	3.5	12.0	2.0	21.0	3.0	15.0	12.0	0.5	2.0	1.5	4.5	1.5	1.0	0.5	7.0
Podocarpus	0	0.5	0	0	0	0.5	0	0	0.5	0	0.5	0	0	0	0	0	0.5	0	0	0	0	0	0.5
Cryptomeria	53.0	36.5	46.5	50.0	55.5	51.0	38.0	54.0	42.5	47.0	51.0	56.0	26.0	49.0	51.0	48.0	31.0	43.0	49.0	32.0	31.0	47.5	32.5
Juniperus	0	0	0	0	0.5	0	0	0	0.5	0	1.0	0	0.5	0	0	0.5	0	0	5.0	0	1.0	1.0	1.0
Compositae	0.5	0.5	1.0	2.0	0.5	0.5	0.5	2.5	0.5	1.0	0.3	0	1.5	1.0	0	2.5	1.0	0.5	1.0	2.0	1.5	1.5	2.5
Bidens	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	1.5	0.5	0	0	0.5	0.5
Menyanthes	2.0	0.5	2.0	3.0	1.5	2.0	1.5	0	0	0	1.5	0.5	2.5	0	0	2.0	3.5	3.5	1.5	0	2.0	0.5	2.0
Rhododendron	0	1.0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0.5
Myriophyllum	1.0	0	0	0	0	0.5	0	0	0	0	0	0	1.0	0.5	0	0	0.5	0	0.5	0	0	0	1.0
Oenothera	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tilia	0.5	0.5	0.5	0.5	0	0.5	0.5	2.0	0	0.5	1.0	0.5	1.5	1.0	1.5	1.5	2.0	0	0.5	1.5	2.5	1.0	0.5
Ilex	0.5	0.5	1.0	0.5	0.5	1.0	0	0	0.5	2.0	1.5	1.0	1.0	1.5	3.0	0	1.0	1.0	1.0	1.5	0.5	2.0	0.5
Sapium	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	2.5	1.5
Rubus	0	0	0	0	0	0	0	0	1.0	0	0.5	0	1.5	0	0	0	0	0	0	0	1.0	0	0.5
Nuphar	0	0	0.5	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0.5	1.0	0
Persicaria	3.0	13.0	14.5	11.0	4.0	1.5	3.5	10.0	16.0	10.5	8.0	7.0	12.5	6.5	2.0	4.0	10.5	8.5	17.0	11.0	5.5	8.0	2.0
Zelkowa	0	0.5	0	0	0	0.5	0	0.5	0	0	0	0	0.5	0	1.5	0.5	0	0	0.5	0.5	0	0	4.0
Ulmus	1.0	2.0	0.5	0.5	0.5	0.5	0	0.5	1.0	0	0.5	0	0.5	0.5	0.5	0.5	0.5	0.5	1.5	1.5	0	0	1.5
Quercus	5.0	6.5	4.0	8.0	0.5	0.5	14.5	7.0	11.0	1.5	5.0	1.0	5.0	0.5	1.5	14.0	6.0	5.0	5.0	4.0	19.0	1.0	3.0
Fagus	0	0	1.0	0	1.0	0	4.5	0	0	0.5	0	0	0	0	0	0	2.5	0	0	0	1.5	1.0	0.5
Alnus	0.5	1.0	1.0	2.5	0.5	1.0	1.0	0.5	5.5	0	0.5	1.0	1.0	0.5	0.5	0.5	0.5	0.5	1.0	0.5	1.0	3.0	2.0
Betula	1.0	0	0	0	0	0	0	0	0	0	2.0	0	0	0	0	0	0	0	0	0	0	0.5	1.5
Carpinus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0
Juglans	11.0	10.5	5.5	0	0.5	0.5	10.5	1.0	1.5	1.0	10.0	3.5	16.5	1.5	0.5	0.5	15.0	11.0	1.3	19.5	9.0	1.5	1.0
Platycarya	0.5	0	0	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0	0	0	0	0	0	1.0
Salix	0.5	0	0	1.0	1.5	3.5	3.5	1.5	1.0	1.0	0	0.5	2.0	7.5	0.5	1.0	3.5	0.5	0.5	3.5	2.0	0.5	1.0
Gagea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0	6.5
Carex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0
Gramineae	2.5	1.5	3.5	0	0	1.0	0.5	0	1.0	3.5	0.5	0	3.5	1.0	0.5	0	0.5	0	0.5	1.5	0	4.0	3.0
Lenticularpollenites	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0.5	0	0	0	0	0	0	0	0	0.5
SPORE GRAIN																							
Selaginella	0	0	0	0	0	0	0	0	0.5	0	0	0	0.5	0	0	0	0	0	0	1.5	0.5	0	1.0
Bacillus spore	0.5	1.5	0	0	0	0	0	0.5	0	0	0.5	0	1.5	0	0	0.5	0	1.0	0.5	1.0	0.5	1.0	0.5
Deltoidsporites	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0.5	0	0.5	0.5
Reniformsporites	0.5	2.5	0.5	2.0	2.0	2.0	0	1.5	1.5	2.5	0.5	0	3.0	0.5	0.5	0	1.5	0.5	1.5	1.5	2.0	2.0	1.0
Subtriangularsporites	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0

Hy.……Hamayasuhara, Hh.……Hamahatta

and spore grain assemblages was started in 1957 with the analyses of samples from Kurabe fo Kanazawa District, Ishikawa Prefecture. At that time the stratigraphic position and the relation between peats in the other areas was not precisely known.

In this district, the following samples were examined.

9 boring samples from 9 localities at Kanaiwa
1 sample from 1 locality at Hamayasuhara
3 samples from 3 localities at Utsugi
1 sample from 1 locality at Hamahatta
21 samples from 9 localities at Kurabe
38 samples from 30 localities at Hamasôgo
20 samples from 19 localities at Tokumitsu
10 samples from 10 localities at Mikawa

These localities and stratigraphic positions are given in Chart 1 and Table 1. As was explained before this chapter, the distribution of pollen and spore grains found in the analytical samples are shown in the distribution chart in per centage of the observed frequencies by a single random count of 200 specimens for each sample (see Tables 3 & 4). The relative frequencies of app appearance in each locality, each peat lamina and the relative frequencies between different localities can be read from the pollen d diagrams in Figs. 2, 3, 4, 5, and 7.

The grains which are observed in the present study from the above mentioned samples are the following types.

* *Pinus* type
= *Larix* type
\+ *Abies* type
= *Tsuga* type
\+ *Picea* type
Podocarpus type
* *Cryptomeria* type
Juniperus type
= Compositae type
Bidens type
= *Menyanthes* type
Rhododendron type
Myriophyllum type
Oenothera type
Tilia type
= *Ilex* type
Sapium type
Rubus type
Nuphar type

△ *Persicaria* type
Zelkowa type
= *Ulmus* type
△ *Quercus* type
+ *Fagus* type
+ *Alnus* type
Betula type
Carpinus type
* *Juglans* type
Platycarya type
+ *Salix* type
Gagea type
Carex type
+ Gramineae type
Lenticulapollenites type
Selaginella type
Bacillus type
Deltoidsporites type
Reniformsporites type
Subtriangularsporites type

The satrisked types are very abundant in comparison with the other generathe number of pollen and spore grains being more than 15 %. The types which are marked by △, are abundant, ranging from 8 to 14 %. The types which are marked by +, are common 4 to 7 % in per centage. The types which are marked by =, are rare, being less than 1 %, and the other types are very rare.

At Kanaiwa, as shown in the distribution chart and pollen diagram. (1) (see Fig. 2), the *Pinus* type, the *Cryptomeria* type, the *Quercus* type, and the *Juglans* type belong to abundant group. Although the *Cryptomeria* type appeared 50 % in locality no. 5 at Kanaiwa, this type is generally less than in the other localities. The Quaternary type and the *Juglans* type, instead of the *Cryptomeria* type, are more aboundance than in the other localities, for example, in locality no. 1, the *Quercus* type 14.5 %. This frequency belongs to the very abundant group. In locality no. 23 at Kurabe, the *Quercus* type belongs to the common group, 4 to 6 %. This phenomenon is found also in the *Juglans* type. In Kanaiwa, broad-leaved trees, including the *Ulmus, Quercus, Fagus, Alnus, Betula, Carpinus, Juglans* and *Platycarya* types, are found more than needle-leaf trees such as the *Pinus* type. In Hamayasuhara, Utsugi and Hamahatta, the most characteristic phenomenon is the frequency to which the *Cryptomeria* type pollen grain falls, being about 20 %. For example, in locality no. 16 as is shown in Fig. 1 pollen diagram (1), it falls to 18.0 %. The broad-leaved trees instead of in needle-leaf trees such as the *Cryptomeria* type increases to about 70 %. The Reniformsporites type which is imagined to be the same as Pteridophyta, is

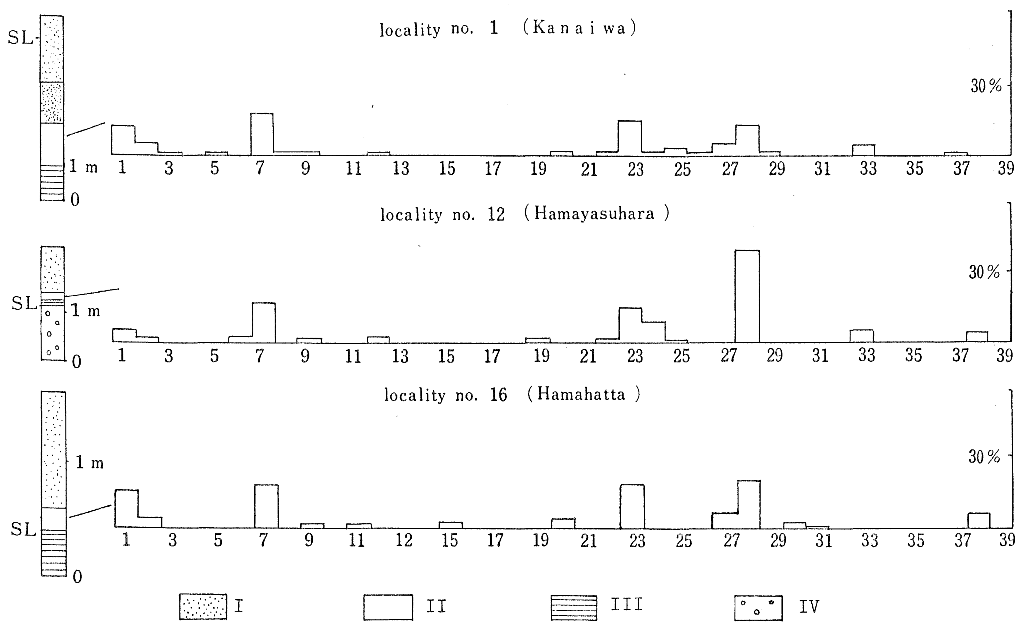


Fig. 2 POLLEN DIAGRAM (1)

The pollen diagram from locality nos. 1, 12, 16; and peat, other laminae and sampling level are shown along the left margin.
1 : *Pinus* type, 2 : *Larix* type, 3 : *Abies* type, 4 : *Tsuga* type, 5 : *Picea* type, 6 : *Podocarpus* type, 7 : *Cryptomeria* type, 8 : *Juniperus* type, 9 : Compositae type, 10 : *Bidens* type, 11 : *Menyantes* type, 12 : *Rhododendron* type, 13 : *Myriophyllum* type, 14 : *Oenothera* type, 15 : *Tilia* type, 16 : *Ilex* type, 17 : *Sapium* type, 18 : *Rubus* type, 19 : *Nuphar* type, 20 : *Persicaria* type, 21 : *Zelkowa* type, 22 : *Ulmus* type, 23 : *Quercus* type, 24 : *Fagus* type, 25 : *Alnus* type, 26 : *Betula* type, 27 : *Carpinus* type, 28 : *Juglans* type, 29 : *Platycarya* type, 30 : *Salix* type, 31 : *Gagea* type, 32 : *Carex* type, 33 : Gramineae type, 34 : Lenticulapollenites, 35 : *Selaginella* type, 36 : Bacillus type, 37 : Deltoidsporites type, 38 : Reniformsporites type, 39 : Subtriangularsporites type, I : sand lamina, II : peat lamina, III : clay lamina, IV : gravel lamina, SL : sea-level.

found more often in locality no. 5 at Kanaiwa than in the other localities, for example, it is 6.0 %.

At Kurabe in Kanazawa City, the *Cryptomeria* type pollen grain appears more frequently than in all the other observed localities, for example 57.0 % being the most frequent. When the broad-leaved trees, grass and spore grains are totaled together, they show the least per centage results.

At Kurabe, the most interesting and characteristic phenomenon is that the peat is divided into some laminae (about 3 or 4 laminae), and the material between the peats is composed of sand of the New Sand Dune. Because of the migration of sand of the Old Sand Dune in the Late Yayoi Age, as was mentioned in Stratigraphic Summary of Chapter II, the grass was baried and thus Alluvial peat began to form. The peat of locality no. 23 is divided into four lamonae as are shown in Fig. 3 pollen diagram (2). Although the

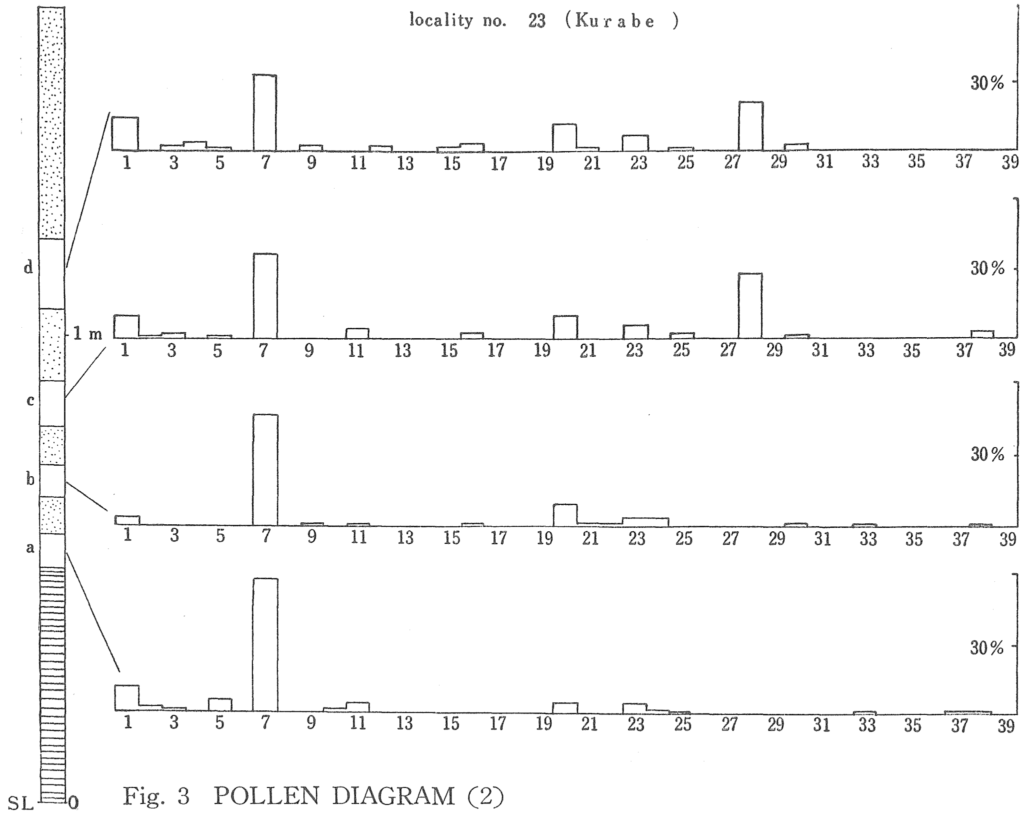


Fig. 3 POLLEN DIAGRAM (2)

The pollen diagram from locality no. 23; peat, other laminae and sampling level are shown along the left margin.

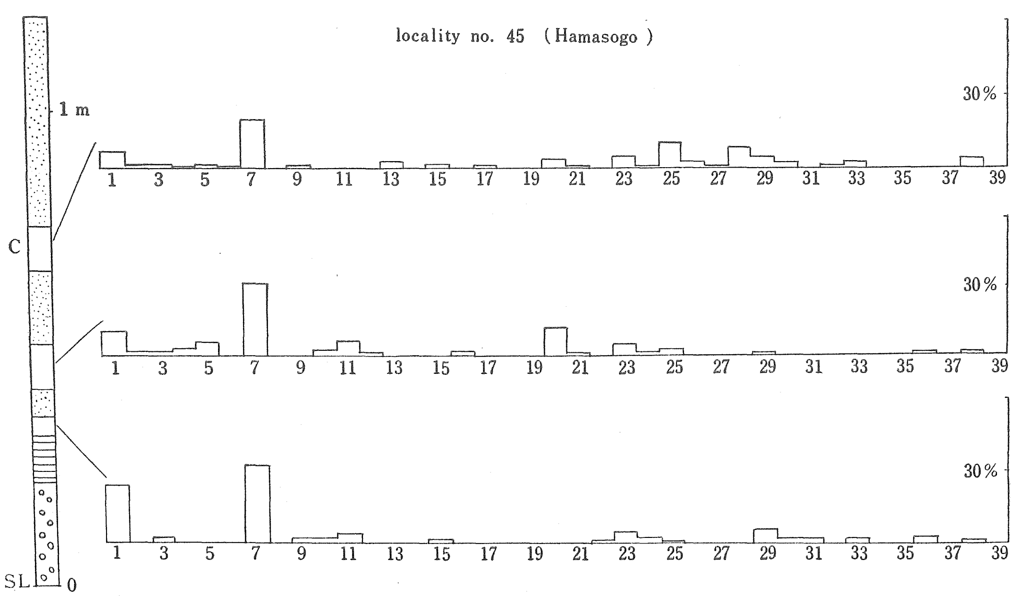


Fig. 4 POLLEN DIAGRAM (3)

The pollen diagram from locality no. 45; peat, other laminae and sampling level are shown along the left margin.

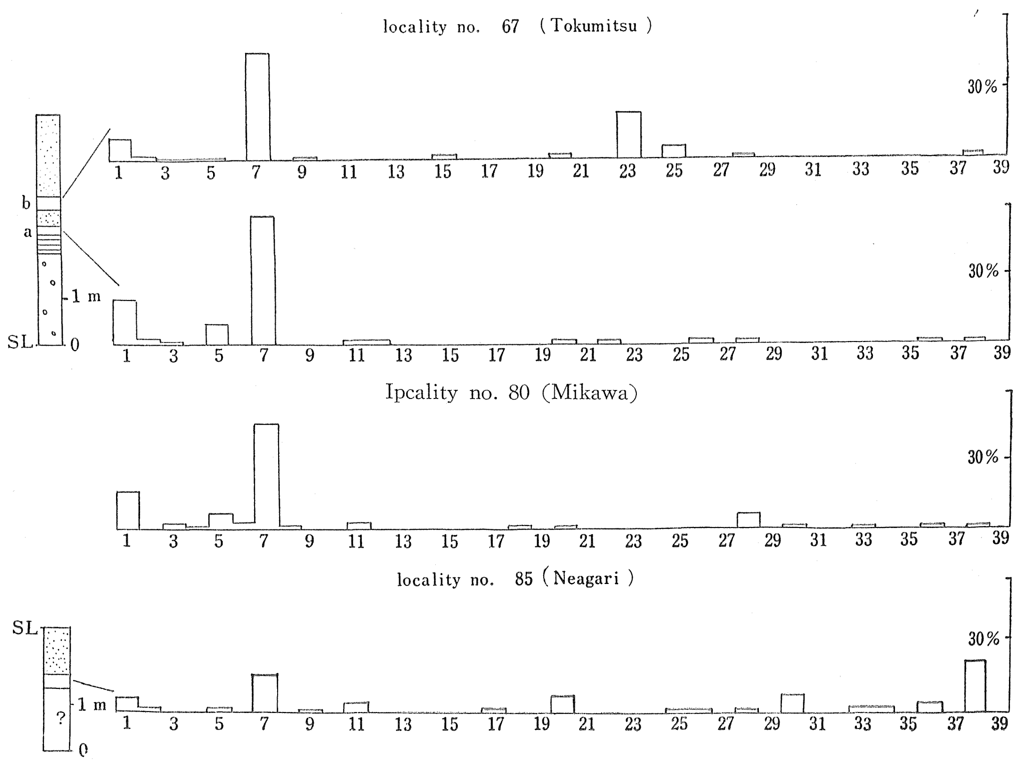


Fig. 5 POLLEN DIAGRAM (4)

The pollen diagram from locality nos. 67, 80, 85; peat, other laminae and sampling level are shown along the left margin.

lowermost lamina ("a" lamina in Fig. 3) includes 50.5 % of the *Cryptomeria* type, "b", "c" and "d" laminae include only 48.5 %, 36.0 % and 28.0 % respectively of this type. That is to say, the more the peat lamina moves up, the less the pollen and spore grains become. But at the same time the *Juglans, Quercus, Salix, Menyanthes,* Compositae and *Rhododendron* types increase. This fact is important when the fossil pollen and spore flora of the district is studied. As is given in Table 1, the Neolithic transgression had arisen from the Hanawadai Stage of Early Jômon Age, and it reached its highest sea-level in the Moroiso Stage. The fan deposits developed all over the Kanazawa District in the period of regression from the end of the Late Jômon Age to the Yayoi Age.

In the early period of regression, the strand line was 300 to 500 m offshore from the present strand line, and the Old Sand Dune developed behind this strand line. Here and there in the Old Sand Dune swampy places developed, and these correspond perhaps with the present shore line. In this early period, a plant-colony was only grass or moss, and the pollen grains of needle-leaf trees such as the *Pinus, Larix, Abies, Tsuga, Picea* and *Cryptomeria* types become abundant in lower peat lamina. In the Kanazawa District, the plant-colony changed slow or fast, from simple to complicated, and from lower plants to higher plants. This is based on the above mentioned reason that the upper peat laminae which are shown as "c" or "d" in the stratigraphic succession include more frequency of pollen grain of the broad-leaved trees than the lower peat laminae such as "a" or "b".

The peat of locality no. 45 at Hamasôgo is also divided into three laminae as are shown in Fig. 4 pollen diagram (3). The succession of plant-colony shows the same phenomenon as was described in the succession of locality no. 23. In the lowermost peat lamina of locality no. 67 of Tokumitsu is divided into two laminae. In the lower peat named under "a", the *Cryptomeria* type is 55.0 %, and the needle-leaf tree pollen grains are more frequent than it is in the other localities, appeare about 85.0 %.

Distribution of the Assemblages in the Neagari District

(Chart 2; Tables 1 and 4; and Figs. 5 and 7)

In this district, only one sample from one locality of Yoshiharakamaya is examined for the present study. This locality and stratigraphic position are respectively described in Chart 2 and Table 1, the distribution of pollen and spore grains found in the analytical samples are shown in the distribution chart (see Table 4).

The relative frequencies of appearance in each locality, each lamina and the relative frequencies of appearance between localities can be read from the pollen diagrams in Figs. 5 and 7.

The grains which are observed in the present study from the above mentioned samples are the following types.

+ *Pinus* type
Larix type
Abies type
Tsuga type
Picea type
Podocarpus type
* *Cryptomeria* type
Juniperus type
= Compositae type
Bidens type
+ *Menyanthes* type
Rhododendron type
Myriophyllum type
Oenothera type
Tilia type
Ilex type
Sapium type
Rubus type
Nuphar type

TABLE 4 **THE CHART OF POLLEN ANALYSIS**

AREA	KANAZAWA DISTRICT																																													ND	HASHIDATE DISTRICT						KITAGATA DISTRICT								
LOCALITY NAME	Hamasôgo															Tokumitsu																				Mikawa										N.	Hashidate						Kentôzan								
LOCALITY NO.	45			46		47	48	49		50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67		68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	88	93	96		97		101	102		103	104	105	108	111	113
PEAT LAMINA	a	b	c	a	b			a	b																		a	b																					a	b	a	b		a	b						
POLLEN GRAIN																																																													
Pinus	24.0	10.0	8.2	21.0	18.0	14.0	11.0	16.5	11.0	17.0	29.0	17.5	9.5	11.0	6.0	25.5	8.5	15.5	13.0	14.0	8.0	21.0	2.0	17.0	9.5	10.0	19.0	10.0	15.0	16.0	9.0	10.5	9.5	9.0	27.5	10.0	10.0	8.0	16.5	17.5	17.0	3.0	13.0	18.0	14.5	6.0	11.0	10.5	13.5	25.0	15.0	3.0	8.5	21.0	1.0	7.5	10.0	16.5	10.0	10.0	11.5
Larix	0.5	1.5	2.0	2.0	0.5	3.0	2.0	1.0	0.5	0.5	0	0.5	3.0	2.0	0.5	0	0.5	0.5	4.5	3.5	1.0	1.0	1.7	1.5	0.5	2.0	2.0	2.5	0	1.0	1.0	2.0	3.0	2.0	3.0	1.0	0	1.0	4.0	0	0	1.0	1.5	0	0	1.0	1.0	1.0	3.5	0	1.0	4.5	8.0	4.0	47.0	13.0	0.5	1.5	4.0	3.0	0.5
Abies	1.0	1.5	2.0	1.0	1.0	1.5	1.0	3.0	0.5	3.0	1.0	1.0	1.5	1.0	1.3	1.0	3.0	1.5	1.5	1.0	2.0	3.0	1.5	2.0	1.0	0.5	1.0	1.0	1.0	2.0	2.5	1.0	0.5	2.0	1.5	1.0	5.0	2.0	1.0	12.0	3.5	2.0	2.0	4.0	0	0	1.5	0.5	1.0	1.0	0.5	0.5	0.5	0	0	0	1.5	2.0	3.0	1.5	1.5
Tsuga	0	2.4	1.0	0	1.0	2.0	0.5	1.5	1.0	1.8	0	1.0	1.5	2.0	1.0	0	0.5	0.5	0.5	0.5	1.0	0.5	1.5	0.5	1.0	1.0	0	1.0	2.0	0.5	0	0	1.0	0	4.0	0.5	2.5	2.0	0.5	2.9	1.0	1.0	2.0	1.0	4.5	0	3.5	0.5	2.0	0	0	0	0	0	0	0	1.0	0	2.0	1.5	3.0
Picea	0.5	4.5	2.0	5.0	2.0	1.0	4.0	3.0	6.5	7.0	0	2.0	9.0	7.0	1.0	0	2.5	2.5	6.5	10.5	1.0	0.5	4.5	0.5	2.5	12.0	8.0	1.5	0.5	0.5	10.5	5.0	2.5	0.5	2.5	5.0	0.5	3.0	1.0	0	7.0	1.0	2.0	4.0	2.5	1.0	4.5	4.0	1.5	2.0	0	3.0	2.5	0	0	0.5	1.0	0	0.5	10.0	6.0
Podocarpus	0	0.5	1.0	2.0	0.5	0.5	1.5	0	0	0	3.5	0.5	1.5	0	0.5	0	2.0	0	0	1.0	0	0	0.5	0	0	0	0	0	0.5	0	0	0	0	0	0.5	0	2.5	0.5	0.5	0.1	3.5	2.4	1.5	3.0	0.5	0	0	1.55	0	0	0	0	1.0	0	0	0	0.5	0	24.5	0.5	1.0
Cryptomeria	32.0	30.5	21.3	32.0	31.0	45.0	56.0	46.0	25.0	43.0	28.0	29.0	25.0	39.5	45.5	33.5	54.0	34.5	37.0	36.0	38.5	48.5	51.5	52.0	30.0	41.0	55.0	47.0	26.0	49.5	57.5	55.5	48.0	41.0	30.0	50.5	38.0	30.0	20.0	50.5	46.0	25.1	48.5	30.0	42.5	26.0	27.5	0.5	45.5	29.5	26.5	16.0	26.0	15.5	4.0	3.0	50.5	53.0	0.5	25.0	30.0
Juniperus	0.5	0.5	0	2.0	0	0.5	1.0	0	0.5	0	0.5	0	2.0	1.0	0.5	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0.5	0.5	0	0	0	0.5	1.5	0	0.5	1.0	0.5	0	1.0	0	0.5	0	0.5	0	0	0	0.5	1.0	1.0	1.0	0	0	0.5	0.5	1.5	0	1.0	2.0	0
Compositae	1.0	0.5	1.0	1.5	0.5	1.5	0	0.5	1.0	1.0	0.5	0.5	2.5	1.5	1.0	1.5	1.0	0.5	0	0.5	1.2	7.0	1.0	2.0	1.0	1.0	0.5	1.0	13.5	0.5	0.5	0.5	2.0	0	0.5	0.5	5.0	14.5	2.0	0.5	0	5.1	0.5	2.0	0	2.0	4.0	0	1.5	1.5	0	1.0	1.5	0	0	0	0	0.5	0	2.5	2.5
Bidens	1.5	2.0	0	0.5	0	0	2.0	0	0	0	0	0	0.5	1.5	0.5	1.0	1.0	0.5	0	0.5	0.5	0	0.5	0	0	0.5	0	0	0	1.0	0	0	0	0	0	0.5	0	0.5	0.5	0.5	0.5	0	0	0.5	0	1.0	0	0	0	4.5	0	0.5	0	0	0	0	1.0	0	0	0.5	0
Menyanthes	3.0	6.0	0.5	2.5	3.5	1.0	2.0	1.0	2.0	0	3.5	3.5	1.5	2.0	2.0	1.0	3.0	1.0	0	0	1.0	0	0	2.0	0.5	2.5	1.0	0.5	0.5	3.5	1.5	0	4.0	3.0	1.5	4.0	7.0	1.5	0.5	0	3.0	0.5	4.0	1.5	5.5	4.5	2.5	0	3.0	0.5	0	0	0	0	1.0	0	0	0	0	1.5	0
Rhododendron	0	1.0	0	0	0.5	3.0	1.0	1.0	0	0	2.5	0.5	0.5	0	0.5	2.0	1.0	0.5	0	2.0	0	0	0	0	0.5	1.0	1.0	0	1.0	0	0	0	0	0	0.5	2.0	0	0	1.0	0	0	0	0	0.5	1.5	0	0	0	2.5	3.0	1.0	1.0	8.0	3.0	4.0	4.0	0	0	1.0	0.5	0
Myriophyllum	0	0.5	3.0	0	0	1.5	0	2.5	0	0.5	0	0	1.0	1.5	0	0.5	0	0	0	0	0	0	0	0	0	0.5	0	0	4.5	1.0	3.0	0.5	0	0	0	0	1.5	1.0	0	2.0	0.5	0.5	0	0	0	0	1.5	4.0	0	0	0	0.5	6.0	1.0	0	0	0	0	1.0	1.0	1.0
Oenothera	0.5	0.5	0	1.0	0.5	2.0	0.5	0.5	0	0	0.5	0	0.5	0	0	0.5	0.5	0	0	0.5	0	0	0	0	0	1.0	0	0	0	0.5	0	0	0	0	0	0	0	0	0.5	0	0	0.5	0	0.5	0	0.5	0	0	2.0	0.5	0.5	0.5	0	0	0.5	0.5	0.5	0	2.0	0.5	0.5
Tilia	1.0	0	1.0	1.5	0	1.0	0	0	0	0	1.0	0.5	0.5	0	0.5	1.0	0	0.5	0.5	1.0	2.5	0.5	0	0.5	1.5	1.0	0	2.0	0.5	0	0.5	1.0	2.0	0	3.5	0.5	0	0.5	0	0.5	0	1.0	0	3.0	0	0	0	1.5	1.0	1.0	0	0	0	0	0	0	1.5	0	0	0.5	1.0
Ilex	0.5	1.5	0	1.0	1.5	0.5	0	0	0.5	0.5	0.5	1.0	1.0	1.0	0.5	0	0	1.0	1.0	1.5	0.5	0.5	0.5	1.0	0.5	1.0	0.5	0.5	0	0.5	0.5	1.0	0	5.0	2.0	1.0	1.0	0.5	0.5	0.5	0.5	3.0	1.0	0.5	0	0	1.5	0	0.5	0	0	1.0	0.5	0	0.5	1.0	0	0	0.5	1.5	0.5
Sapium	0	0	1.0	0.5	0	0	0.5	0	1.0	0	0	0	1.0	0.5	1.0	0.5	0	0	0	0.5	0	0	0	0	0	0	0	0	1.0	0	0	0.5	0.5	0	0	0	0	0	0.5	0	0	0	0	0	0	1.0	0	0	0	0.5	0.5	0	6.5	0	5.0	1.5	0	0	0.5	0.5	0.5
Rubus	0.5	0	0	0	0.5	0	0	0	1.5	0	0	0	0.5	1.5	0	0	0.5	0.5	0	1.5	1.0	0	0	0	0	0	0	0	0	1.0	0	1.0	0	0.5	0.5	0	0	1.0	0.5	0	1.5	0.5	0	0	0.5	0	0	0	0	0	0	0.5	0	0	0.5	0	0	0	0	0.5	0.5
Nuphar	0	0	0	1.0	0	0	1.0	0.5	14.0	0	0	0	0	0	0	0	0.5	0	0	0	0.5	0	0	0	0	0	0	0	0	0.5	0	0	0	0.5	1.0	0	0	0	0.5	0.5	0	0	0	0	0.5	0	0	0	0	1.0	0	0	0	0	1.0	0.5	16.5	0.5	3.0	7.0	0
Persicaria	0.5	11.0	4.0	4.0	4.5	8.0	3.0	7.5	0.5	9.5	1.0	3.0	7.0	1.0	15.0	0	3.5	4.5	12.0	2.5	13.5	6.5	16.5	5.0	11.0	11.0	1.5	2.0	1.5	9.0	2.0	6.5	3.0	22.0	11.5	12.0	0.5	1.5	1.5	1.0	1.0	5.4	1.0	5.0	1.0	6.5	4.5	11.0	8.0	0.5	0.5	1.5	2.0	2.0	1.0	14.0	0.8	7.5	2.5	0.5	4.5
Zelkowa	0	1.3	1.0	1.5	0	2.0	0	0	1.5	1.0	0.5	1.5	0.5	5.0	2.3	0.5	0	0	0.5	1.0	1.0	0.5	0.8	0.5	0	0.5	0.5	0.5	0.8	0.5	1.5	1.0	0.5	0.5	0	0.5	1.0	0.5	0.5	1.0	0	1.0	0	0.8	1.0	0	0.5	0	0.5	1.5	0.5	0	0.5	0	1.0	0.5	1.0	0	0.5	1.0	1.5
Ulmus	1.0	0.5	0	9.0	1.0	0.5	0	0	5.0	2.0	0.5	1.0	1.0	0.5	1.0	0.5	2.0	1.0	0.5	0	3.0	0.5	1.0	0	1.5	3.0	1.5	0.5	0	0.5	0	2.0	1.5	0.5	0.5	2.0	0	0	0	0	0	0	0	3.0	0	0	0	2.5	1.5	0	0.5	1.5	0	3.0	0	5.0	4.5	0	4.0	10.0	0
Quercus	4.5	5.3	5.0	0.5	8.5	6.0	3.0	5.0	0.5	5.5	4.0	5.5	9.5	3.0	4.5	0.5	1.0	17.0	6.5	6.0	10.0	5.0	4.0	9.0	7.0	1.0	0.5	20.0	6.5	4.0	0.5	5.0	10.0	0.5	0.5	3.0	6.0	7.5	13.5	2.4	0	6.0	5.1	5.0	5.0	0.5	5.5	5.0	5.5	0	5.5	19.0	6.0	36.0	4.0	10.0	4.0	5.5	2.0	0	5.0
Fagus	2.0	1.0	1.0	2.5	0	0.5	3.0	0.5	4.0	0	4.0	6.0	1.5	0.5	2.0	5.0	1.0	0	0	3.0	0	0	2.5	0	0	0	0	0	0.5	1.0	4.0	2.5	4.0	0	5.0	0	0	1.0	1.0	1.5	0	4.0	0.5	1.5	0	0	0	0.5	1.5	4.0	11.0	1.5	2.5	1.5	8.0	13.0	0.5	0	10.0	1.5	0.5
Alnus	1.0	2.5	12.0	1.0	2.5	1.0	0.5	0.5	0	1.0	0	1.5	0.5	1.0	8.5	4.5	0.5	0.5	1.0	1.0	0.8	1.5	0.5	0.5	1.5	0.5	0.5	5.5	3.0	0.5	0.5	1.0	0.5	0.5	0.5	1.5	1.0	2.5	0	1.0	0.5	8.0	0	1.0	0	2.0	2.5	1.5	0.5	4.0	1.0	10.5	2.0	1.0	1.0	10.5	0	0.5	3.4	0	2.5
Betula	0.5	0.5	3.4	0	1.5	0	0.5	0	0	3.0	0	1.0	0	2.0	1.0	0.5	1.5	0	0	0	0	0	0	0	0	0	2.5	0	1.0	0.5	0	0	0	1.0	0	0	1.0	2.5	1.0	0	0.5	3.0	1.5	0.5	3.5	2.0	4.5	0	0.5	0	0	0	2.0	0	0	0	0	0	2.5	0.5	4.0
Carpinus	0.5	0	1.5	2.0	0	0	0	0	0	0	0.5	0	0.5	0.5	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0	2.0	0	0	0	0	0	0	0	0	1.5	4.5	0	0.5	4.5	0	0.5	0.5	0	0.5	0	0	0	0.5	0	0	0	2.0	1.5	0.5	0	10.4	8.0	0
Juglans	0	0	9.4	1.0	4.5	0.5	0	2.5	12.0	1.0	0.5	2.0	8.0	1.0	0.5	0	4.0	8.0	13.0	6.0	5.5	0.5	0.5	0.5	20.5	2.0	1.0	1.5	0.5	1.0	0.5	1.0	1.0	5.0	0	1.0	9.0	1.0	12.0	1.5	6.5	1.0	0.2	0	1.0	2.0	9.5	1.0	0	0	40.0	29.5	0	4.0	6.0	0	0	2.0	6.5	0	7.0
Platycarya	9.0	1.5	6.5	0	0	0	0	0	0.5	0	0	0	0.5	0	0	10.0	0	0.5	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	2.0	1.0	1.0	1.0	0.5	5.0	12.5	3.0	8.5	0	4.0	0	0.5	10.5	0	0	0	0	0.5	0	1.0	5.5	4.0	3.0	3.5
Salix	3.0	0	4.0	0.5	5.0	2.0	0.5	0.5	0	1.0	10.0	5.0	3.0	2.0	1.0	1.0	0	5.5	0.5	3.0	3.0	1.5	2.0	3.0	3.5	0.5	0.5	0.5	5.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	5.0	1.0	0.5	1.0	3.5	2.0	0.5	0.5	9.0	0	0	1.0	1.5	0	0.5	12.0	0	0	10.0	0.5	0.5	0.5	0.5	0.5
Gagea	3.0	0	0.5	0	0	0	0	0	0	0	0	0	0.5	0.5	0.5	2.5	0.5	0	0	0	0	0.5	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0.5	0.5	0	0.5	0	0	1.0	0	0.5	0	0	0	0.5	0	3.5	0.5	0	0	0	0.5	0	0	0	1.0	0	0.5
Carex	0.5	0	1.2	0	0	0	0.5	0	0.5	0	0.5	1.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	0	0	0	0	1.5	0	0	1.0	0	0	0	0	0.5	1.0	0	0.1	0	0	0	0	0.5	0	0.5	0	0.5	0	0	0	0	0	0	0	0	0	0.7	1.5	2.0
Gramineae	2.5	0.5	1.6	1.5	3.0	0	2.0	0.5	3.0	0.5	0.5	6.5	1.0	2.5	0	0.5	1.5	2.0	0	1.0	0.5	0.5	0	0	4.0	2.5	0	0.5	3.0	0.5	0	0	0	2.0	0	1.0	2.5	5.0	0	0.5	1.5	3.0	0	2.5	2.5	3.0	7.0	0	1.5	0	0	0.5	0.5	0	5.5	0	0	0.5	0	1.0	6.5
Lenticularpollenites	0	0	0	1.0	1.0	0	0.5	0	0	0	0.5	0.5	1.5	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	3.0	0	0	0	0	0	1.0	0	0	0	0	0	0	0	0	1.0
SPORE GRAIN																																																													
Selaginella	0.5	0	0	1.0	0	0	0	0.5	1.0	0	0	0	1.0	1.0	0	0	0.5	1.0	0	0	2.0	0	0	0	0	0.5	0.5	0	0.5	0	0	0	0	0	0	0	0	0	0.5	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	1.0	0	1.0	0.5
Bacillus spore	3.0	1.5	0.5	1.0	4.5	0	0.5	2.5	3.0	0	0.5	0.5	0	0.5	0	1.5	0.5	0	0	0.5	0	0	0.5	0	0	1.5	1.5	0	7.5	0.5	0	0.5	1.0	1.5	0	0.5	1.0	1.0	0	1.0	1.5	1.0	0	0.5	0	4.5	1.0	2.0	0	1.0	0	0.5	0	2.5	1.0	0.5	0	0	1.0	1.0	0
Deltoidsporites	0	0	0.5	0	1.0	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0.5	0	0	0	0	0.5	0	0	0	0	0	0.5	0	1.0	1.0	0	0.5	0	0	0	0	0	0.5	1.5	0	0.5	0	0.2	1.0	0	1.0	0	0	0	0	0	0	0	0	0.5	1.0	0	0.5	1.0	0	0
Reniformsporites	2.0	1.0	4.5	1.0	3.0	1.5	2.0	2.5	2.5	1.2	7.0	7.0	1.0	3.0	1.2	2.5	3.5	0.5	1.5	0.5	1.0	0.5	1.0	2.5	2.5	1.0	1.0	2.0	3.7	2.0	3.0	0	0.5	1.0	1.5	1.0	0.5	1.0	0.5	1.0	1.0	6.0	0.5	0.2	1.0	23.0	1.5	1.0	0.5	2.5	4.0	1.0	4.0	5.0	4.0	2.0	1.2	2.0	0.5	0.5	0.5
Subtriangularsporites	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0

N.……Neagari, ND……NEAGARI DISTRICT

+ *Persicaria* type
Zelkowa type
Ulmus type
Quercus type
Fagus type
= *Alnus* type
= *Betula* type
Carpinus type
= *Juglans* type
Platycarya type
△ *Salix* type
Gagea type
Carex type
= Gramineae type
= Lenticulapollenites type
Selaginella type
+ Bacillus type
Deltoidsporites type
* Reniformsporites type
Subtriangularsporites type

The peat of this locality distributes at about 1–1.5 m under sea-level. At this locality the most interesting and characteristic phenomenon is that the Reniformsporites type spore grain is included rich in the peat. The phenomenon suggests that a moss or fern had grown around the swamps and their neighbourhood, and some trees had distributed less than it is the other localities. Although the *Menyanthes,* the *Persicaria,* and the *Salix* type pollen grains are more than in the other localities. The *Pinus*, the *Larix*, the *Abies* and the other needle-leaf trees are rare frequent.

Distribution of the Assemblages in the Hashidate District

(Chart 3; Tables 1 and 4; Figs. 6 and 7)

In this district, 6 samples from 4 localities of Hashidate field, Kaga City is examined for the present study. The localities and stratigraphic positions are described in Chart 3 and Table 1. The distribution of pollen and spore grains found in the analytical samples are shown in the distribution chart (see Table 4). The relative frequencies of appearance in each locality, each peat lamina and the relative frequencies of appearance between localities can be read from the pollen diagrams in Figs. 6 and 7.

The grains which are experienced in the present study from the above mentioned samples are following types.

△ *Pinus* type

= *Larix* type
Abies type
= *Tsuga* type
= *Picea* type
Podocarpus type
* *Cryptomeria* type
Juniperus type
= Compositae type
Bidens type
= *Menyanthes* type
= *Rhododendron* type
Myriophyllum type
Oenothera type
Tilia type
Ilex type
Sapium type
Rubus type
Nuphar type
△ *Persicaria* type
Zelkowa type
Ulmus type
+ *Quercus* type
= *Fagus* type
= *Alnus* type
Betula type
Carpinus type
Juglans type
= *Platycarya* type
Salix type
Gagea type
Carex type
= Gramineae type
Lenticulapollenites type
Selaginella type
Bacillus type
Deltoidsporites type
= Reniformsporites type
Subtriangularsporites type

The pollen analytical type in this district is equal to it of Kurabe in Kanazawa District. The *Juglans* type of locality no. 67 shows higher frequent than it in the other localities.

The seed of the *Juglans mandschurica* Maxim. var. *Sieboldiana* Makino is found from this district. The fact shows that the tree of genus *Juglans* distributed here and there of this localities.

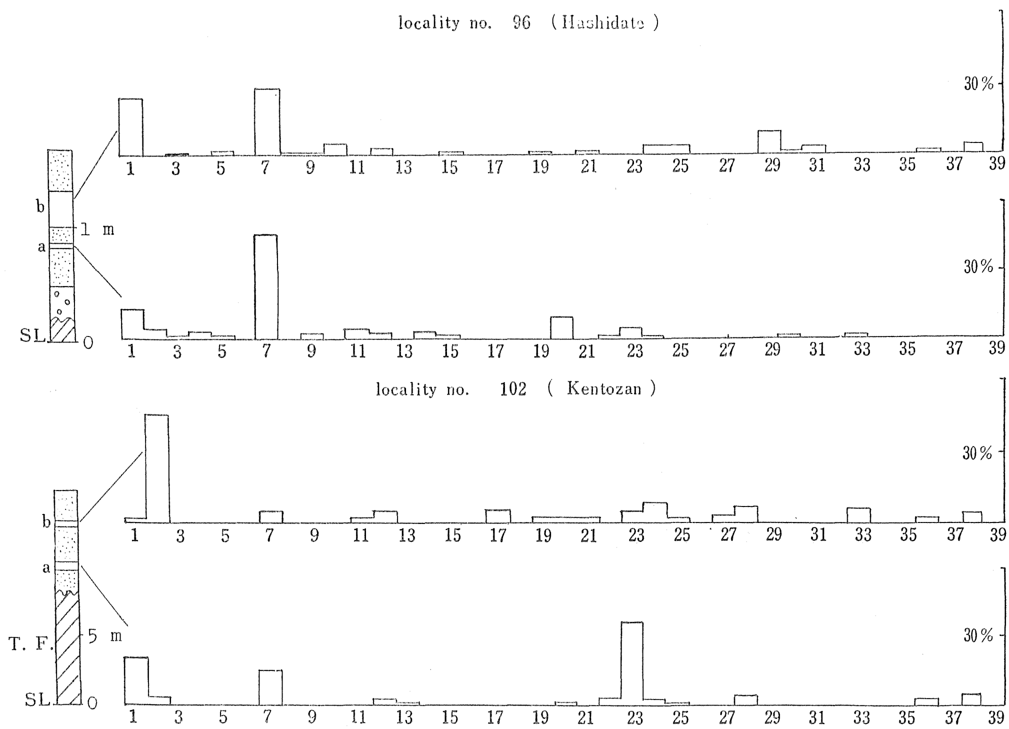


Fig. 6 POLLEN DIAGRAM (5)

The pollen diagram from locality nos. 96, 102; peat, other lamonae and sampling level are shown along the left margin.

T. F. ...... Tertiary formations

Distribution of the Assemblages in the Kitagata District

(Chart 4; Tables 1 and 4; Figs. 6 and 7)

In this district, 9 samples from 8 localities of Kentôzan (Kentô Hill), are examined for the present study. These localities and stratigraphic positions are given in Chart 4 and Table 1, the distribution of pollen and spore grains found in the analytical samples are shown in the distribution chart (see Table 4). The relative frequencies of appearance in each locality, each peat lamina and the relative frequencies of appearance between localities can be read from the pollen diagrams in Figs. 6 and 7.

The grains which are experienced in the present study from the above mentioned samples are the following types.

△ *Pinus* type

+ *Larix* type

= *Abies* type
Tsuga type
= *Picea* type
Podocarpus type
* *Cryptomeria* type
Juniperus type
Compositae type
Bidens type
Menyanthes type
= *Rhododendron* type
= *Myriophyllum* type
Oenothera type
Tilia type
Ilex type
+ *Sapium* type
Rubus type
= *Nuphar* type
+ *Persicaria* type
Zelkowa type
+ *Ulmus* type
+ *Quercus* type
+ *Fagus* type
= *Alnus* type
Betula type
Carpinus type
+ *Juglans* type
= *Platycarya* type
+ *Salix* type
Gagea type
Carex type
Gramineae type
Lenticulapollenites type
Selaginella type
Bacillus type
Deltoidsporites type
+ Reniformsporites type
Subtriangularsporites type

At Kentô Hill, as shown in the distribution chart and figures, the *Pinus*, the *Larix*, the *Cryptomeria* and the *Quercus* types belong to the abundant group. Although the *Cryptomeria* type appeared more frequent than the other types, it, however, shows less frequent than it is in the other localities. The *Larix* and the *Quercus* types are abundant instead of the *Cryptomeria* type.

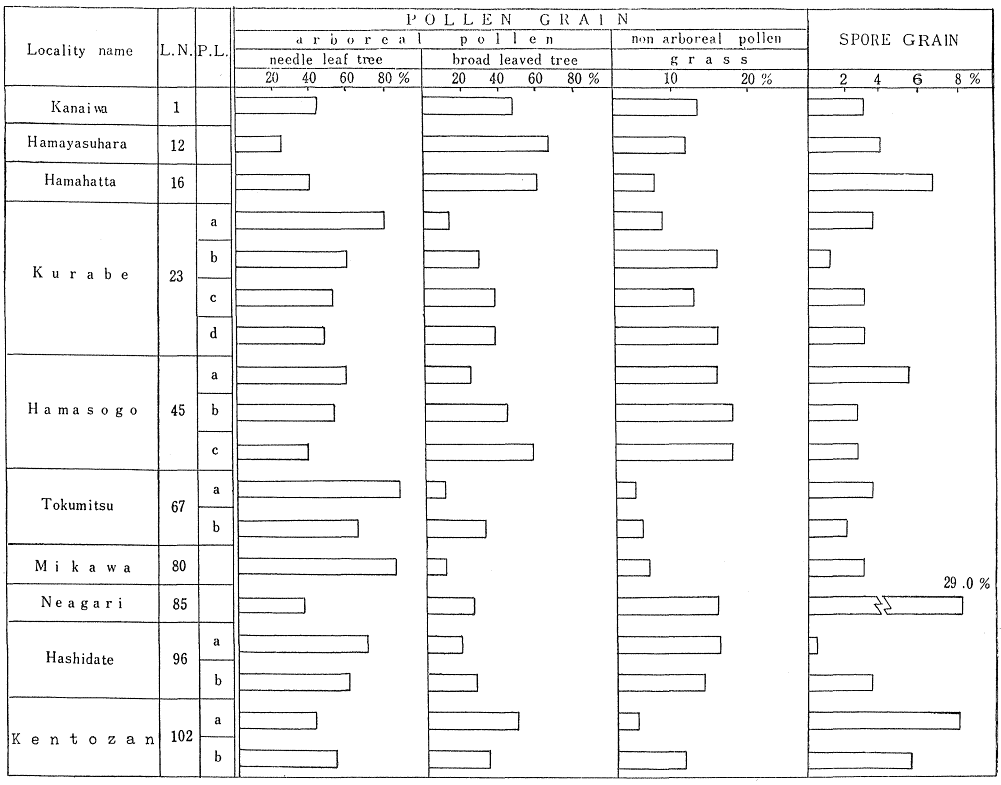


Fig. 7 POLLEN DIAGRAM (6)

The synthetic pollen diagram from locality nos. 1, 12, 16, 23, 45, 67, 80, 85, 96 and 102.

L. N. ······ locality no., P. L. ······ peat lamina

Concluding Remarks

According to FAEGRI and IVERSEN (1950), the pollen grains observed in a peat include generally very abundant the pollen grain which had been supplied from the nearest forest of a sampling locality. From the result of the present pollen analysis, it is imagined that the trees of the abundant pollens had grown on the sampling localities or their neighbourhood. The pollen and spore grains which are observed in the pollen analysis are divided into two groups, that is to say, the one group is the pollen grains which had been mainly derived from the other localities by a wind or water, and the other group is the pollen and spore grains which had primary grown on the sampling localities or their neighbourhood. The Compositae, *Menyanthes*, *Myriophyllum*, *Oenothera*, *Persicaria*, *Salix*, *Juglans*, *Platycarya* and Bacillus types belong to the latter group, and the *Pinus*, *Larix*, *Abies*, *Tsuga*, *Picea*, and *Podocarpus* types which have generally air sacks, belong to the former group. The

Menyanthes, Myriophyllum, Salix, Juglans, and Bacillus types grow around the swamps and their neighbourhood.

In the early stage of regression (Middle to Late Jômon Age), Phragmites communis grows only around the swamp. As shown above mentioned pollen diagrams, the lowermost peat lamina of some localities includes many pollen grains with air sacks and it is found less the pollen grains of the broad-leaved trees than them in the other locality or the upper peats. In the relative relation of fossil grains in the lowermost peat lamina, therefore, the pollen grains with air sacks are found more often than the pollen grains of the broad-leaved trees. In the former group, however, the absolute frequency of the lower and upper peats will be perhaps equal. In the Yayoi Age, as shown in some pollen diagrams and Plate VII, *Cryptomeria, Alnus japonica, Juglans, Quercus, Zelkowa serrata, Viburnum, Alnus hirsta* TURCZ. var. *sibirica,* and *Cinnamomum japonicum* had grown around the swamps and their neighbourhood.

The Old Sand Dune had distributed widely in front of the swamps in the Komatsu Stage of the Late Yayoi Age, and the ancient people had secured a sure mean of living in the swampy areas in rear of the dunes.

The paleoclimate in this period (from the Late Jômon to the Late Yayoi Age) was perhaps equal the present climate, as it was suggested by the pollen and spore grains derived from the primary plants, fossil leaves, seeds and erect stump. The lower laminate sands of the Old Sand Dune deposited in front of the Neolithic beach and their materials were mainly derived from Tetori, Asano, and Sai Rivers in the Middle Jômon Age. The eorian such as the sand of the sand dune of the regressional period had produced the Old Sand Dune, which exposed widely along the Japan Sea beach, where was 300 to 500 m offshore from the present beach. The New Sand Dune, which has been produced by the migration of the Old Sand Dune, is because of the transgression in the end of the Late Yayoi Age. The most of present peat had been made from the plants, which had grown on the swamps and their neighbourhood or the slopes in rear of the Old Sand Dune. The migration of the Old Sand Dune in the end of the Late Yayoi Age is distinctly the cause of the formation of the New Sand Dune.

CHAPTER IV
SYSTEMATIC DESCRIPTIONS OF POLLEN AND SPORE GRAINS

In this chapter the writer describes the pollen and spore grains from the Kanazawa, Neagari and Hashidate Districts of Ishikawa Prefecture, and Kitagata District of Fukui Prefecture.

The pollen and spore grains which are described here are as following grains :

Pinus type, *Larix* type, *Abies* type, *Tsuga* type, *Podocarpus* type, *Cryptomeria* type, *Juniperus* type, Compositae type, *Bidens* type, *Menyanthes* type, *Rhododendron* type, *Myriophyllum* type, *Oenothera* type, *Tilia* type, *Ilex* type, *Rubus* type, *Nuphar* type, *Persicaria* type, *Zelkowa* type, *Quercus* type, *Fagus* type, *Alnus* type, *Betula* type, *Carpinus* type, *Juglans* type, *Salix* type, *Gagea* type, *Carex* type, Gramineae type, Lenticularpollenites type, *Selaginella* type, Bacillus type, Deltoidsporites, Reniformsporites type, Subtriangularsporites type.

The standard of classification is based on bladder, reticulate, aperture, membrane, aperturoid, spine, brochi, colpi, colpoid, spinoid, spinules and shape etc.. The classification of pollen and spore grains which are classed by the natural and form type classifications must be put under a order in the near future.

Pinus sp.

Pl. 1, figs. 1–18

1954. *Pinus banksiana* ERDTMAN : p. 137, fig. 421
1954. *Pinus brutia* ERDTMAN : p. 137
1954. *Pinus cembra* ERDTMAN : p. 137, fig. 425
1954. *Pinus contorta* var. *murrayana* ERDTMAN : p. 138, fig. 427
1954. *Pinus excelsa* ERDTMAN : p. 138
1954. *Pinus halepensis* ERDTMAN : p. 138
1954. *Pinus laucodermis* ERDTMAN : p. 138, fig. 423
1954. *Pinus montana* ERDTMAN : p. 138, fig. 426
1954. *Pinus nigra* ERDTMAN : p. 138
1954. *Pinus peuce* ERDTMAN : p. 138
1954. *Pinus pinaster* ERDTMAN : p. 138
1954. *Pinus pinea* EDTMAN: p. 141
1954. *Pinus rigida* ERDTMAN : p. 140
1954. *Pinus silvestris* ERDTMAN : p. 140, fig. 428
1954. *Pinus thunbergii* ERDTMAN : p. 140
1956. *Pinus maritima* IKUSE : p. 35
1956. *Pinus koraiensis* IKUSE : p. 35
1956. *Pinus Bungeana* IKUSE : p. 35
1956. *Pinus pumila* IKUSE : p. 35
1956. *Pinus Thunbergii* IKUSE : p. 35
1956. *Pinus densiflora* IKUSE : p. 35
1956. *Pinus Banksiana* IKUSE : p. 35
1958. *Pinus* sp. 1 TOKUNAGA : Pl. IV, figs. 1, 3, 5, 7, 8
1958. *Pinus* sp. 2 TOKUNAGA : Pl. IV, fig. 2
1958. *Pinus* sp. OZAKI & FUJI : p. 574, Pl. I, figs. 1, 4, 5

Size range of measured specimens :

long length of body : 43–85 μ, short length of body : 37–49 μ, breadth of body : 37–59 μ, air-sack diameter : 31-48 μ

Description of specimens : Grains with two air-sacks; body round or slightly elliptical in distal or proximal side, cap of a well defined granular texture and generally with a conspi-

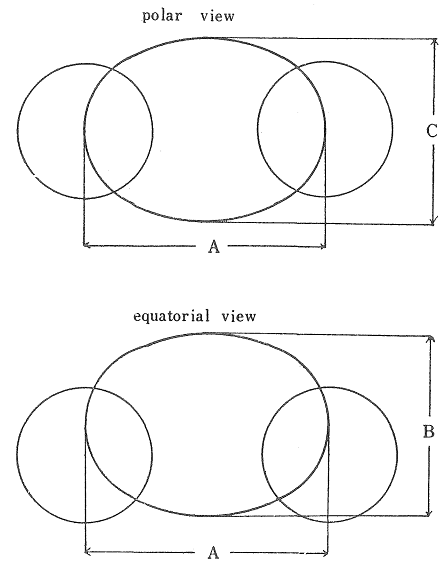


Fig. 8 Method to calibrate grains accompanying air sacks
A : long length
B : short length
C : breadth

cuous rim at point of transition to the distal part of the pollen grain; the specimen shown in Pl. I, fig. 1 is equatorial view, short length of body 47 μ, and long length of body 53 μ, magnae, the length of the base of the bladders, measured in lateral view of the grain is 46 μ, this specimen belonged to the *silvestris*—type described by Rudolph (1935), the bladders of this specimen are more or less contracted at their basal part and represent more than half of the sphere, marginal crests occur on the surface of the body and are well developed, the body is occupied by reticulum and the air-sacks by subreticulum or fine reticulum; the specimen shown in Pl. I, fig. 2 is oblique equatorial view, short length 45 μ and long length 60 μ, marginal crests unknown, the length of the bladder 34 μ, the specimen shown in Pl. I, fig. 3 is oblique equatorial view, short length 43 μ, long length 59 μ; the pollen grain shown in Pl. I, fig. 4 is equatorial view, short length 37 μ, long length 43; the specimen shown in Pl. I, fig. 5 is equatorial view, short length 45 μ and long length 53 μ; the pollen grain shown in Pl. I, fig. 6 is oblique equatorial view, short length 37 μ, long length unknown; the pollen grain shown in Pl. I, fig. 7 is oblique polar view, breadth 43 μ, long length 61 μ, the specimen shown in Pl. I, fig. 8 is oblique equatorial view, short length 47 μ, length 63 μ; the grain shown in Pl. I, fig. 9 is polar view, breadth 37 μ and long length 43 μ, the bladders length about 30 μ; the specimen shown in Pl. I, fig. 10 is oblique equatorial view, short length 41 μ and long length 52 μ; the pollen grain shown in Pl. I, fig. 11 is equatorial view, short length 49 μ and long length 63 μ, this bladder belonged to the *haploxylon*-type described by Rudolph (1935), they are semicircular, broadly attached to the body; the specimen shown in Pl. I, fig. 12 is oblique polar view, breadth 46 μ; the specimen shown in Pl. I ,fig. 13 is polar view, breadth 45 μ and long length 48 μ; the specimen shown in Pl. I, fig. 14 is oblique polar view, breadth 50 μ, long length 61 μ; the pollen grain shown in Pl. I, fig. 15 is polar view, breadth 39 μ, long length 43 μ; the specimen shown in Pl. I, fig. 16 is polar view, breadth 49 μ, long length 53 μ; the specimen shown in Pl. I, fig. 17 is polar view, breadth 51 μ, long length 53 μ; and the specimen shown in Pl. I, fig. 18 is oblique polar view, breadth 44 μ, long length 47 μ.

Remarks : As pointed out by Gerasimov (1930) and as described by Rudolph (1935), there are two general types of bladders. These types were the *silvestris*-type and the *haploxylon*-type respectively.

In the *silvestris*-type, the bladders are more or less contracted at their base and represent more than half of the grain. According to G. ERDTMAN (1954), "in polar view, parts of three intersecting circles from the contour of the grain; *Pinus banksiana*, *Pinus montana*, and *Pinus silvestris* may be used as examples of this type". Although the present samples are divided into two types of the *silvestris*-type and *haploxylon*-type, but they are not divided into species by two types of bladder. The pattern on the surface of pollen grain, reticulum on the bladder and subreticulum or fine reticulum on the body grain, is altogether same in genus, therefore, the pattern on the surface of pollen grain does not become the indicator of classification.

Occurrences in the present material (Tables 3 & 4) : The type is abundant in this region.

Localities : all localities.

Larix sp.

Pl. V, figs. 18 & 19

1954. *Larix decidua* ERDTMAN : p. 132, fig. 396
1954. *Larix occidentalis* ERDTMAN : p. 134, fig. 147
1956. *Larix kaempberi* IKUSE : p. 36
1957. *Larix occidentalis* ERDTMAN : p. 28, fig. 44
1957. *Larix gmelini* var. *japonica* ERDTMAN : p. 28, fig. 454
1957. *Larix decidua f. polonica* ERDTMAN : p. 28, fig. 45 B
1957. *Larix occidentalis* ERDTMAN : p. 28, fig. 45 C

Size range of measured specimens : 64-65 μ in lateral view.

Description of specimens : Grains acolpate, without air-sacks, spheroidal, 64-65 μ in lateral view, magnae grain, exine smooth, exceedingly fine reticulum; the specimen shown in Pl. V, fig. 19 is lateral view, 65 μ in diameter, magnae grain, exine smooth.

Remarks : This type is acolpate and about 60–70 μ in diameter, as example, *Larix decidua* usually 70 to 80 μ (ERDTMAN 1957), about 70 μ (VASTERAS 1936), 60 to 92 μ (GERASIMOV 1930); *Larix occidentalis* approximately 79 by 89 μ in diameter (ERDTMAN 1954). This type belongs to $3B^a$ type (the Letter Nomination by M. IKUSE 1956). The type belonging to $3B^a$ type and 60–70 μ in diameter, is only genus *Larix* in present plant pollen grain.

Occurrences of the measured material (Tables 3 & 4) : This type is found very rare in the most of the samples of this area.

Localities : 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 16, 17, 20a, 20b, 21, 22a–d, 23a–d, 24a–d, 25a–c, 26, 27, 28, 30a–c, 31a, 31b, 32, 33, 34a, 34b, 35, 36, 37, 38, 39, 40, 41, 43, 44, 45a–b, 47, 48, 49a–b, 50, 52, 53, 54, 55, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67a–b, 69, 70, 71, 72, 73, 74, 75, 77, 78, 81, 82, 85, 88, 93, 97a–b, 101, 102a–b, 103, 104, 105, 108, 111, 113.

Abies sp.

Pl. II, figs. 1 & 2

1954. *Abies sibirica* ERDTMAN : p. 130, fig. 390

1956. *Abies Mariesii* Ikuse : p. 35

1958. *Abies* sp. Tokunaga : p. 30, Pl. IV, fig. 2

1958. *Abies* sp. Ozaki & Fuji : p. 574, Pl. I, fig. 1

Size range of measured specimens : long length of body : 92–110 μ, short length of body : 82–98 μ, air-sack diameter : 68–75 μ

Description of specimens : Grains large, mostly over 90 μ in diameter, exine very thick, marginal crest unknown, boundary between the body and the bladders usually defined, bladders generally small in relation to the size of the grain, about 68–75 μ in diameter; the specimen shown in Pl. II, fig. 1 is equatorial view, short length 98 μ, long length 110 μ, permagnae grain, bladders 75 μ in diameter, marginal crest unknown, boundary between the body and the bladders shaply defined, patterns on the body grain subreticulum defined, reticulum on the bladders defined; the pollen grain shown in Pl. II, fig. 2 is equatorial view, short length 82 μ, long length 92 μ, magnae, bladder 68 μ in diameter, boundary between the body and the bladders shaply defined.

Remarks : This genus has especialy following characters which are divided from other Gymnosperm pollen grain with bladder, that is to say, firstly, in size this type body is large, mostly over 90 μ in diameter, as example M. Ikuse (1956) described the value shown the relation among many pollen grains with bladder.

genus name	long length in μ	diameter of bladder in μ
Podocarpus Nagi	31– 33	33–35
Pinus Banksiana	40– 59	43
Pinus densiflora	45– 53	39
Abies Mariesii	107–120	63
Keteleeria	84	58–65

(after M. Ikuse, 1956, p. 18)

In the present plant, the pollen grain over 100 μ in diameter with bladders is only genus *Abies.*

Secondary, the size of bladder is generally smaller than other pollen grain with air-sacks in relation to the size of the body grain.

In genera *Podocarpus* and *Pinus,* the size of bladder is almost same the size of body grain, in genus *Keteleeria,* the bladder is about 5/8 of the long length of body grain.

Finally, marginal crest is absent and the boundary between the body grain and air-sacks is shaply defined. The present writer determines that these specimens belong to genus *Abies* by above mentioned characters.

Occurrences in the present material (Tables 3 & 4) : This genus is found common in this area.

Localities : 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 17, 18, 19, 20a–b, 21, 22a–d, 23a–d, 24a–d, 25a–c, 26, 27, 28, 29, 30a–c, 31a–b, 32, 33, 34a–b, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45a–b, 46a–b, 47, 48, 49a–b, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67a–b, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 88, 93, 96a–b, 97a–b, 101, 104, 105, 108, 111, 113.

***Tsuga* sp.**

Pl. VI, fig. 10

1954. *Tsuga canadensis* ERDTMAN : p. 143, fig. 441

1954. *Tsuga diversifolia* ERDTMAN : p. 143, fig. 442

1954. *Tsuga pattoniana* ERDTMAN : p. 143

1956. *Tsuga diversifolia* IKUSE : p. 36

Size range of measured specimens : 82 μ in diameter.

Description of specimens : Pollen grains circular in polar view, according to ERDTMAN flat or cup-shaped in lateral view; the specimen shown in Pl. VI, fig. 10 polar view, 82 μ, spinules unknown.

Remarks : This specimen belongs to 1–aperturate $3B^a$ type described by IKUSE.

Occurrences in the present material (Tables 3 & 4) : This type is found rare in this area.

Localities : 1, 2, 3, 5, 6, 7, 9, 10, 13, 14, 15, 16, 17, 20a–b, 22a–d, 24a, 24b, 24d, 25b, 25c, 27, 29, 30b, 30c, 31a, 31b, 33, 34a–b, 36, 37, 38, 40, 41, 42, 43, 44, 45b, 45c, 46b, 47, 48, 49a–b, 50, 52, 53, 54, 55, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67b, 69, 72, 74, 75, 76, 77, 78, 79, 81, 82, 83, 84, 88, 93, 96a, 104, 108, 111, 113

***Podocarpus* sp.**

Pl. III, fig. 1

1954. *Podocarpus dacrydioides* ERDTMAN : p. 140, fig. 430

1954. *Podocarpus spicatus* ERDTMAN : p. 140, fig. 430

1954. *Podocarpus spinulosus* ERDTMAN : p. 142, fig. 431

1956. *Podocarpus macrophylla* var. *Maki* IKUSE : p. 18, and p. 35

1956. *Podocarpus Nagi* IKUSE : p. 18, and p. 35

1957. *Podocarpus angustifolius* var. *wrightii* ERDTMAN : p. 37, fig. 59 A

1957. *Podocarpus coriaceus* ERDTMAN : p. 37, fig. 59 B

1957. *Podocarpus alpinus* ERDTMAN : p. 37, fig. 59 C

1957. *Podocarpus dacrydioides* ERDTMAN : p. 37, fig. 60 A

1957. *Podocarpus blumei* ERDTMAN : p. 37, fig. 60 B

1957. *Podocarpus wallichianus* ERDTMAN : p. 38, fig. 61 B

1957. *Podocarpus minor* ERDTMAN : p. 38, fig. 61 C

1957. *Podocarpus Nagi* ERDTMAN : p. 38, fig. 61 D

1958. *Podocarpus* sp. OZAKI & FUJI : p. 574, Pl. I, fig. 3

Size range of measured specimens : Short length : 35 μ, long length : 42 μ, diameter of bladder : 22 μ

Description of specimens : Grains spheroidal, with two well-defined air-sacks, in size 40 μ in long length, furrow usually long, bladder usually large; the specimen shown in Pl. III, fig. 1 is equatorial view, short length 35 μ, long length of the body grain 42 μ, mediae grain, bladder 22 μ in diameter.

Remarks : In lateral view, the bladder of this genus *Podocarpus* has longer than the bladder of other genera pollen grain with bladders.

Occurrences in the present material (Tables 3 and 4) : This type is found very rare in the most of the samples of this area.

Locality : 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 14, 15, 18, 22a, 22b, 23a–b, 24a, 24d, 25a, 25c, 27, 30b, 31b, 33, 38, 44, 45b–c, 46a–b, 47, 48, 51, 52, 53, 55, 57, 60, 63, 68, 74, 76, 77, 78, 79, 80, 81, 82, 83, 84, 93, 101, 104, 108, 111, 113.

Cryptomeria **sp.**

(Pl. II, figs. 4, 5, 6, 7 and 8)

1954. *Taxodium distichum* Erdtman : p. 142, figs. 435, 436
1956. *Taxodium distichum* Ikuse: p. 36
1957. *Taxodium mucronatum* Erdtman : p. 42, fig. 69
1958. *Taxodium* sp. Tokunaga : Pl. IV, figs. 9 and 10
1958. *Cryptomeria* sp. Ozaki and Fuji : p. 574, Pl. I, figs. 6, 7, 8, 9 and 10.
1959. *Taxodiaceae* type Shimakura : p. 75, Pl. II, fig. 47

Size range of measured specimens : 28–32 μ in diameter

Description of specimens : Grain similar to *Sequoia*, spheroidal, monoporatae, 28–32 μ in diameter; the specimen shown in Pl.II, fig. 4 is equatorial view, 28 μ in diameter, mediae grain; the specimen shown in Pl. II, fig. 5 is equatorial view, 29 μ mediae grain; consisting of a conical projection which rises abruptly from the surface of grain; the pollen grain shown in Pl. II, fig. 6 is equatorial view, 32 μ in diameter, mediae grain; the grain shown in Pl. II, fig. 7 is equatorial view, 28 μ mediae grain, provided with a single germ pore, consisting of a conical papilla which rises abruptly from the surfacc of grain; the specimen shown in Pl. II, fig. 8 is equatorial view, 28 μ mediae grain, monoporatae, consisting of a conical papilla.

Remarks : These specimens belong to $3B^a$ type (the Letter Nomination described by Ikuse 1956). From the view point of the type and the grain size of these specimens, they are similar to Cephalotaxaceae, Cryptomeriaceae, Cupressaceae, Juniperaceae and Taxaceae. Although there is a conical papilla all them, it is only *Cryptomeria* that the tip of conical papilla bend. In the specimens shown in Pl. II. fig. 7 and 8 of the present writer's specimens, the tip of papilla bend, but other specimens are unknown. If the tip is not bend. from the view point of the grain size and the type, these specimens belong to Cephalotaxaceae, Cryptomeraceae except *Cryptomeria*, Cupressaceae, Juniperaceae and Taxaceae. These specimens, however, belong to *Cryptomeria.*

Occurrances in the present material (Tables 3 and 4) : This type is found very abundant in all the districts.

Localities : all localities.

Juniperus **sp.**

(Pl. VI, fig. 1)

1954. *Juniperus virginiana* ERDTMAN : p. 132, fig. 393
1956. *Juniperus chinensis* IKUSE : p. 37
1956. *Juniperus procumbens* IKUSE : p. 37
1956. *Juniperus rigida* IKUSE : p. 37, Pl. 2, fig. 8

Size ranges of measured specimen : 31.5 μ in polar view.

Description of specimens : Germ pore situated near the upper end; the specimen shown in Pl. VI, fig. 1 is polar view, one aperturate, 31.5 μ in polar view.

Remarks : This specimen is 1–aperturate $3B^a$ type in the Letter Nomination of IKUSE's description.

Occurrences in the present material (Tables 3 and 4) : This type is found very rare in all this district.

Locality : 1, 2, 3, 4, 5, 7, 16, 18, 19, 22a–b, 22d, 25a, 25c, 30a, 31b, 33, 34b, 37, 40, 42, 43, 44, 45a–b, 46a, 47, 48, 49b, 51, 53, 54, 55, 61, 68, 69, 73, 74, 76, 77, 78, 80, 82, 84, 96a–b, 97a–b, 102b, 103, 104, 108, 111.

Compositae type

Pl. III, figs. 6, 7, and 8

1952. *Mutisia speciosa* ERDTMAN : p. 119, fig. 62 A
1952. *Centaurea scabiosa* ERDTMAN : p. 119, fig. 62 B
1952. *Tarchonanthus camphoratus* ERDTMAN : p. 119, fig. 62 C
1952. *Adenostyles petasites* ERDTMAN : p. 120, fig. 63 A
1952. *Stenachaenium adenanthum* ERDTMAN : p. 120, fig. 63 B
1952. *Chrysanthemum leucanthemum* ERDTMAN : p. 120, fig. 63 C
1952. *Helianthusa nnuus* ERDTMAN : p. 120, fig. 63 D
1952. *Artemisia rupestris* ERDTMAN : p. 123, fig. 65 B
1952. *Gorteria diffusa* ERDTMAN : p. 123, fig. 65 C
1952. *Ambrosia maritima* ERDTMAN : p. 125, fig. 66 C
1954. *Achillea millefolium* ERDTMAN : p. 83, figs. 121 and 122
1954. *Artemisia borealis* var. *bottnica* ERDTMAN ; p. 83, figs. 125—126
1954. *Artemisia f. tilesii* ERDTMAN : p. 83, fig. 128
1954. *Bidens tripartita* ERDTMAN : p. 85, fig. 135
1954. *Crepis paludosa* ERDTMAN : p. 85, fig. 139
1954. *Mulgedium lapinum* ERDTMAN : p. 85, fig. 140
1956. *Dahlis variabilis* IKUSE : p. 144
1956. *Gnaphalium affine* IKUSE : p. 144
1956. *Gnaphalium japonicum* IKUSE : p. 144
1956. *Gnaphalium indicum* IKUSE : p. 144

1956. *Leontopodium japonicum* IKUSE : p. 144
1956. *Leontopodium japonicum* var. *shiroumense* IKUSE : p. 144
1956. *Anaphalis alpicola* IKUSE : p. 144
1956. *Anaphalis margaritacea* var. *angustior* IKUSE: p. 144
1956. *Inula ciliaris* IKUSE : p. 144
1956. *Inula salicina* var. *asiatica* IKUSE : p. 144
1956. *Inula britannica* subsp. *japonica* IKUSE : p. 144
1956. *Inula Helenium* IKUSE : p. 144
1956. *Carpesium abrotanoides* IKUSE : p. 144
1956. *Carpesium rosulatum* IKUSE : p. 144
1956. *Carpesium divaricatum* IKUSE : p. 144
1956. *Carpesium Matsuei* IKUSE : p. 145
1956. *Carpesium cernuum* IKUSE : p. 145
1956. *Carpesium triste* IKUSE : p. 145
1956. *Leibnitzia Anandria* IKUSE : p. 145
1956. *Pertya scandens* IKUSE : p. 145
1956. *Macroclinidium robustum* IKUSE : p. 145
1956. *Macroclinidium trilobum* IKUSE : p. 145
1956. *Ainsliaea apiculata* IKUSE : p. 145
1956. *Ainsliaea acerifolia* IKUSE : p. 145
1956. *Ainsliaea linearis* IKUSE : p. 145
1956. *Ambrosia trifida* IKUSE : p. 145
1956. *Xanthium strumarium* IKUSE : p. 145
1956. *Eupatorium Lindleyanum* IKUSE : p. 145
1956. *Adenostemma Lavenia* IKUSE : p. 145
1956. *Solidago japonica* IKUSE : p. 145
1958. Compositae type OZAKI and FUJI : p. 574, Pl. II, fig. 19
1959. Compositae SHIMAKURA : p. 75, Pl. I, fig. 40; Pl. II, fig. 84

Size range of measured specimens : 33.5–41.5 μ in diameter

Description of specimens : Grains usually oblate spheroidal, 33.5–41.5 μ, mediae grain, grains with composite apertures usually 3-colporate, spines 6-8 μ, spinules 2.5 μ; the specimen shown in Pl. III, fig. 7 is polar view, 33.5 μ mediae grain, spines 6-8 μ, spinules 2.5 μ; the grain shown in Pl. III, fig. 6 is polar view, 34 μ, mediae grain, there are spines and spinules, the ridges are provided high righes, the ridges are provided with prominent sharp spines, while the floors of the lacunae, enclosed by the ridges, the pattern of the grain as well as in Sventenia, according to ERDTMAN (1952) "Sventenia bupleoroides, grains 3-colpoidorate, ±speroidal, about 26×26 μ (sexine not included), 40×42 μ (sexine included). Colpoids short, fainly delimited. Ora distinct lalongate. Tectum exhibiting 17 smooth lacunae and depression, separated by spinuliferous ridges (on the ridges surrounding each aperture there are about 4-16 spinules in all). Besides the two polar areas there are 3 poral lacunae and 6 abporal and 6 paraporal depressions. The abporal depressions are situated on the same meridians as the poral lacunae and usually communicate with the latter by means of small gaps. Three equatorial ridges separate the paraporal depressions of one hemisphere from those of the other. The polar areas are often provided with detached or rudimentary ridge fragments"; the specimen shown in Pl. III, fig. 8 is polar view, 34 μ in diameter, mediae grain, ridges definite.

Remarks : These specimens described in this paper may belong to Sventenia. These grains belong to $6B^b$ type described by IKUSE (1956).

Occurrances in the present material (Table 3 and 4) : These specimens are found common in the most of samples from these districts.

Localities : 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20a–b, 21, 22a–d, 23a–d, 24a–d, 25a–c, 26, 27, 28, 29, 30a–c, 31a, 31b, 32, 33, 34b, 35, 37, 38, 39, 40, 41, 42, 43, 44, 45a–c, 46a–b, 47, 49a–b, 50, 51, 52, 53, 54, 55, 56, 57, 58, 60, 91, 92, 63, 64, 65, 66, 67a–b, 68, 69, 70, 71, 72, 74, 75, 76, 77, 78, 79, 81, 82, 83, 85, 88, 93, 96a–b, 97b, 101, 105, 111, 113.

Bidens **sp.**

Pl. VI, fig. 20

1933. *Bidens tripartita* YAMASAKI : p. 22 and p. 59, Pl. 59, fig. 172
1954. *Bidens tripartita* ERDTMAN : p. 86, fig. 135
1956. *Bidens frondosa* IKUSE : p. 148
1956. *Bidens tripartita* IKUSE : p. 148
1956. *Bidens pilosa* var. *minor* IKUSE : p. 148
1956. *Bidens biternata* IKUSE : p. 149

Size range of measured specimens : 24 μ in polar view.

Description of specimen : Grain shown in Pl. VI, fig. 20 is polar view, 24 μ in diameter in polar view, pollen apertures indistinct and abundant.

Remarks : This specimen is 3–colporate $6B^b$ type described by IKUSE.

Occurrences in the present material (Tables 3and 4) : This specimen is found very rare in the most of samples from these districts.

Localities : 1, 2, 3, 4, 7, 13, 18, 19, 21, 22b–d, 23a, 24d, 30a, 39, 40, 43, 44, 45a–b, 46a, 48, 53, 54, 55, 56, 57, 58, 60, 61, 63, 66, 69, 75, 77, 78, 79, 80, 83, 85, 96b, 97b, 104, 111.

Menyanthes **sp.**

Pl. VI, figs. 3, 4 and 5

1933. *Menyanthes trifoliata* YAMASAKI : p. 17 and p. 46, Pl. fig. 132
1952. *Menyanthes trifoliata* ERDTMAN : p. 185
1954. *Menyanthes trifoliata* ERDTMAN : p. 101, figs. 198, 199 and 200
1956. *Menyanthes trifoliata* IKUSE : p. 123

Size range of measured specimens : 34 μ in polar view, 36–38 μ in equatorial view

Description of specimens : According to ERDTMAN (1954), "General plan of the grain similar to that of Gentiana pneumonanthe. The exine has a well defined striated appearance which is due to a great number of low and densely, though somewhat irregularly, spaced ridges"; grain shown in Pl. VI, figs. 3, 4, and 5 are tricolpate type grain, fig. 3 is polar view; fig. 4 is equatorial view, germ pores distinct.

Remarks : These types are 3-colporate 6B^b type described by Ikuse.

Occurrences in the present material (Tables 3 and 4) : These specimens are found rare in the most of samples from these districts.

Localities : 1, 2, 3, 4, 6, 9, 10, 15, 16, 18, 19, 20a–b, 22a, 22c–d, 23a–d, 24a, 24c, 25a–c, 26, 27, 28, 29, 30a–c, 33, 34a, 34b, 37, 38, 39, 40, 42, 43, 44, 45a–c, 46a–b, 47, 48, 49a–b, 51, 52, 53, 54, 55, 56, 57, 58, 61, 64, 65, 66, 67a–b, 68, 69, 70, 72, 73, 74, 75, 76, 77, 78, 80, 81, 82, 83, 84. 85, 88, 96a–b, 102b, 111.

Rhododendron **sp.**

Pl. V, fig. 1

1933. *Ledum palustre* Linne var. *minus* Yamasaki : Pl. 42, figs. 120 & 121
1933. *Chamaedaphne calyculata* Yamasaki : Pl. 42, fig. 122
1952. *Rhododendron subsessilis* Erdtman : p. 161
1952. *Rhododendron cayawbiense* Erdtman : p. 162, fig. 93 A
1956. *Rhododendron Keiskei* Ikuse : p. 116
1956. *Rhododendron Fauriae* Ikuse : p. 116
1956. *Rhododendron Degronianum* Ikuse : p. 116
1956. *Rhododendron aureum* Ikuse : p. 116
1956. *Rhododendron aureum f. senanense* Ikuse : p. 116
1956. *Rhododendron niponicum* Ikuse : p. 116
1956. *Rhododendron Tanakae* Ikuse : p. 116
1956. *Rhododendron Tschonoskii* Ikuse : p. 116
1956. *Rhododendron trinerve* Ikuse : p. 116
1956. *Rhododendron serpyllifolium* Ikuse : p. 116
1956. *Rhododendron indicum* Ikuse : p. 116
1956. *Rhododendron Kaempferi* Ikuse : p. 116
1956. *Rhododendron obtusum* Ikuse : p. 116
1956. *Rhododendron macrosepalum* Ikuse : p. 116
1956. *Rhododendron dilatatum* Ikuse : p. 116
1956. *Rhododendron Weyrichii* Ikuse : p. 117
1956. *Rhododendron Wadanum* Ikuse : p. 117
1956. *Rhododendron reticulatum* Ikuse : p. 117
1956. *Rhododendron kiusianum* Ikuse : p. 117
1956. *Rhododendron mucronulatum* var. *ciliatum* Ikuse : p. 117
1956. *Rhododendron Komiyamai* Ikuse : p. 117
1956. *Rhododendron eriocarpus* Ikuse : p. 117

1956. *Rhododendron Tashiroi* IKUSE : p. 117

1956. *Rhododendron Albrechti* IKUSE : p. 117

1956. *Rhododendron pentaphyllum* IKUSE : p. 117

1956. *Rhododendron japonicum* IKUSE : p. 117

1956. *Rhododendron camtschaticum* IKUSE : p. 117

1956. *Rhododendron Schlippenbachii* IKUSE : p. 117

Size range of measured specimen : tetrad size 63 μ, single grain size 21 μ

Description of specimen : According to ERDTMAN (1954), "Grains similar to those in the Ericaceae, united in tetrahedral tetrads, tricolpate, furrows short, narrow, tapering. Each is flattened against its three neighbours in the tetrad, the flattening extending very near to the equator of the grains. The furrows of each cell contiguous and continuous with those of its three neighbours driectly across the edges of their faces of contact. Each furrow encloses a single germinal aperture near its point of contact with the furrow of the neighbouring grain. A narrow, ektexinous furrow is seen crossing the contact surfaces of two grains. Its tapering ends are surrounded by what seems to be endexinous thickenings. These formations taper slightly towards the ends of the furrow and are abruptly cut at the equators. The germinal apertures, therefore, appear as narrow channels between the endexinous contact walls on one side and the endexinous thickenings on the other. Comparison may be made with Ericaceae pollen, where the germinal appertures sometimes look like equatorial transverse furrows. The ektexine appears to be confined to the general surface of the tetrad, forming a thin, smooth coat, cut by the twelve colpae, whichunite to form six composite furrows with 12 general apertures in all". The specimen shown in Pl. V, fig. 1 is tetrad size and 21 μ in single tricolpate grain size.

Remarks : This specimen belongs to $7C^c$ type described by IKUSE.

Occurrences in the present material (Tables 3 and 4) : This specimen is found very rare in the most of samples from these districts.

Localities : 1, 2, 6, 7, 12, 13, 15, 18, 19, 20a, 22a–b–c–d, 23a, 23d, 24d, 27, 31, 39, 44, 45b, 46b, 47, 48, 49a, 51, 52, 53, 55, 56, 57, 58, 60, 65, 66, 67a, 68, 74, 75, 78, 83, 84, 96a–b, 97, 101, 102a–b, 103, 108, 111.

***Myriophyllum* sp.**

(Pl. IV, figs. 14, 15 and 16)

1952. *Myriophyllum spicatum* ERDTMAN : p. 201, fig. 118A

1954. *Myriophyllum alterniflorum* ERDTMAN : p. 101, figs. 205–207

1954. *Myriophyllum heterophyllum* ERDTMAN : p. 102, fig. 208

1954. *Myriophyllum spicatum* ERDTMAN : p. 102, figs. 209–212

1954. *Myriophyllum verticillatum* ERDTMAN : p. 102, figs. 213–215

1956. *Myriophyllum spicatum* IKUSE : p. 111

1958. *Myriophyllum* sp. OZAKI and FUJI : p. 574, Pl. I, figs. 14–15

Size range of measured specimens : 25–27 μ in polar view

Description of specimens : Grains aspidate suboblate, angular in outline, with four pores at the angles of square, pores provided with elongate apertures, equally spaced around the equator; the specimen shown in Pl. IV, fig. 14 is polar view, suboblate to square, 25.5 μ mediae grain, pores situated at four angles of square; the grain shown in Pl. IV, fig. 15 is polar view, square, 27 μ mediae grain, pores indistinct; the specimen shown in Pl. IV, fig. 16 is polar view, square, 25 μ mediae grain.

Remarks : These specimens are $6A^{b-c}$ type described by IKUSE (1956). According to some botanists, *Myriophyllum alterniflorum* 25–35 μ in diameter, *M. heterophyllum* 27–32 μ, *M. spicatum* 23–35 μ, and *M. verticillatum* 24–35 μ. From the grain size and the grain shape, the present writer's specimens belong to Betulaceae (*Alnus*), Haloragaceae (*Haloragis*, *Myriophyllum*) and Coriariaceae. According to some palynologists, there may be a slight similarity between *Myriophyllum* pollen grain and the pollen grain of *Alnus* or *Betula*. *Myriophyllum* pollen grain, however, lacks arci, nor is its pore pattern the same as in *Alnus* and *Betula*.

Occurrences in the present material (Tables 3 and 4) : These specimens are found very rare in the most of samples from these districts.

Localities : 1, 2, 5, 7, 10, 13, 14, 15, 17, 22c, 26, 30b, 34b, 35, 38, 40, 44, 45a–c, 46a–b, 47, 48, 49a–b, 51, 52, 53, 54, 55, 56, 57, 58, 61, 64, 65, 66, 67a–b, 68, 69, 70, 72, 73, 74, 75, 76, 77, 78, 80, 81, 82, 83, 84, 85, 88, 96a–b, 102b, 111.

Oenothera **sp.**

(Pl. V, figs. 5 and 6)

1952. *Oenothera biennis* ERDTMAN : p. 293, fig. 171 D
1954. Oenotheraceae ERDTMAN : p. 112, figs. 282–284
1956. *Oenothera Lamarchiana* IKUSE : p. 110
1956. *Oenothera odorata* IKUSE : p. 110
1956. *Oenothera parviflora* IKUSE : p. 110

Size range of measured specimens : 84 μ in polar view

Description of specimens : The specimens shown in Pl. V, fig. 5 is equal to Pl. V, fig. 6. These specimens are polar view, in polar view triangular in outline with one pore at each angle, 84 μ in polar view, magnae grain.

Remarks : This specimen is 3-porate 5B type by IKUSE. In the grain shape and the grain size, this specimen may belong to *Oenothera* of Family Oenotheraceae.

Occurrences in the present material (Tables 3 and 4) : This specimen is found very rare in the samples from these districts.

Localities : 1, 2, 3, 4, 5, 7, 14, 16, 18, 19, 22a–c, 26, 45a–b, 46a–b, 47, 48, 49, 51, 53, 56, 57, 60, 66, 69, 78, 81, 83, 85, 96a–b, 97a–b, 102b, 103, 104, 108, 111, 113.

Tilia **sp.**

(Pl. III, figs. 13 and 14)

1952. *Tilia americana* ERDTMAN : p. 435
1952. *Tilia cordata* ERDTMAN : p. 435
1952. *Tilia tomentosa* ERDTMAN : p. 435
1954. *Tilia americana* ERDTMAN : p. 124, fig. 359
1954. *Tilia cordata* ERDTMAN : p. 124, figs, 361, 362 and 363
1954. *Tilia platyphyllosa* ERDTMAN : p. 124, fig. 364
1954. *Tilia tomentosa* ERDTMAN : p. 124, fig. 365
1956. *Tilia japonica* IKUSE : p. 103
1956. *Tilia Miqueliana* IKUSE : p. 104
1956. *Tilia kiusiana* IKUSE : p. 104
1956. *Tilia* sp. SHIMAKURA : p. 75, Pl. II, fig. 74

Size range of measured specimens : 24–31.5 μ in diameter

Description of specimens : Grain suboblate to oblate, tricolpate ("less frequently 3–4—porate, 4–colporate, 4–ruporate, 6–rugorate, or oligoforate" by ERDTMAN 1952), furrows short, pitlike depressions enclose circular germ pores, time reticulum on the grain unknown in fossil; the specimen shown in Pl. II, fig. 13 is polar view, 24 μ in diameter, minutae grain, tricolpate, depressions enclosed germ pores indistinct, furrow indistinct; the grain shown in Pl. III, fig. 14 is polar view, 31.5 μ in diameter, mediae grain, tricolpate, furrow indistinct, depressions enclose distinctly circular germ pore.

Remarks : These grains are $6A^a$ type described by IKUSE (1956). According to her, *Tilia japonica* 31–32×35–37.5 μ; *Tilia Miqueliana* 21–23.5×24–26 μ; *Tilia Kiusiana* 21–22×28–31.5 μ; and these specimens belong to $6A^a$ type. In Japanese plant, the genus belonging to this type is only one genus *Tilia*. From the view point of size and type of the specimens, the grains shown in Pl. III, fig. 13 and fig. 14 are similar to *Tilia kiusiana*.

Occurrences in the present material (Tables 3 and 4) : This type is found very rare from these districts.

Localities : 1, 2, 3, 4, 5, 6, 7, 9, 10, 14, 15, 16, 17, 18, 19, 20a, 22a, 22d, 23a–d, 24b, 24c, 25b, 25c, 26, 27, 28, 29, 30b, 31a, 32, 33, 34a–b, 35, 36, 37, 38, 40, 41, 42, 43, 44, 45a, 45c, 46a, 47, 51, 52, 53, 55, 56, 58, 59, 60, 61, 62, 64, 65, 66, 67b, 68, 70, 71, 72, 74, 75, 77, 79, 81, 83, 93, 96a–b, 104, 111, 113.

Ilex **sp.**

(Pl. III, figs. 10 and 11)

1952. *Ilex canariensis* ERDTMAN : p. 54, fig. 18c
1954. *Ilex verticillata* ERDTMAN : p. 68, fig. 46
1956. *Ilex serrata* IKUSE : p. 100
1956. *Ilex crenata* IKUSE : p. 100
1956. *Ilex Sugeroki* IKUSE : p. 100
1956. *Ilex Sugeroki* var. *longipedunculata* IKUSE : p. 100
1956. *Ilex rotunda* IKUSE : p. 100
1956. *Ilex chinensis* IKUSE : p. 100

1956. *Ilex rugosa* Ikuse : p. 100
1956. *Ilex leucoclada* Ikuse : p. 100
1956. *Ilex latifolia* Ikuse : p. 100
1956. *Ilex integra* Ikuse : p. 100
1956. *Ilex* sp. 1 Tokunaga : Pl. V, fig. 24
1958. *Ilex* sp. 2 Tokunaga : Pl. V, fig. 23

Size in the measured specimens : 23.5–24 μ in diameter.

Description of specimens : Grains subprolate or suboblate, tricolpate, furrows broad and long, germ pores represented below the center of each furrow; the specimen shown in Pl. III, fig. 10 is polar view, 24.5 μ in diameter, minutae, tricolpate, piloid rodlets unknown, germ pores 2 μ in length of polar view; the specimen shown in Pl. III, fig. 11 is polar view, 23.5 μ minutae, tricolpate, piloid rodlets unknown, three germ pore 3.5 μ in length of polar view.

Remarks : These specimens are $6B^b$ type descripted by Ikuse (1956). According to Ikuse, in Japanese resent plant, the $6B^b$ type pollen grain with about 1–2×1–3.5 μ pilotid is only Family Aquifoliaceae.

As the piloid rodlets of the present writer's specimen, however, are unknown, the detail position of classification is regretfully unknown.

Occurrences in the present material (Tables 3 and 4) : This type is found rare in these districts.

Localities : 1, 2, 3, 4, 5, 6, 7, 12, 13, 14, 15, 17, 18, 19, 20b, 22a, 23a–d, 24a, 24b, 24d, 25a, 26, 27, 28, 29, 30a, 30b, 31b, 32, 33, 34a–b, 35, 36, 37, 38, 40, 45a–b, 46a–b, 47, 49b, 50, 51, 52, 53, 54, 55, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67a–b, 69, 71, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 88, 96a, 97b, 101, 102b, 103.

Rubus sp.

Pl. VI, figs. 23 and 24

1933. *Rubus arcticus* Ikuse : p. 12 and p. 30, Pl. 30, fig. 88
1933. *Rubus Chamaemorus* Yamasaki : p. 12 and p. 30, Pl. 30, fig. 89
1954. *Rubus Chamaemorus* Erdtman : p. 120, figs. 331 and 332
1956. *Rubus Sieboldi* Ikuse : p. 90
1956. *Rubus microphyllus* Ikuse : p. 90
1956. *Rubus crataegifolius* Ikuse : p. 90
1956. *Rubus pseudo-Acer* Ikuse : p. 90
1956. *Rubus trifidus* Ikuse : p. 90
1956. *Rubus palmatus* var. *coptophyllus* Ikuse : p. 90
1956. *Rubus minusculus* Ikuse : p. 90
1956. *Rubus Yabei* Ikuse : p. 90
1956. *Rubus pedatus* Ikuse : p. 90

Size range of measured specimens : 24.5–25 μ in polar view

Description of specimens : According to ERDTMAN (1954), "Exine provided with blunt spines of somewhat varying length, often irregularly placed over the surface"; the specimen shown in Pl. VI, fig. 23 is polar view, 24.5 μ in diameter in polar view, spines are spinules 2–3 μ in length, reticulum and striae indistinct; the pollen grain shown in Pl. VI, fig. 24 is polar view, 25 μ in diameter, spinules and striae indistinct.

Remarks : These specimens belog to 3-colporate $6B^b$ type of the Letter Nomination described by IKUSE (1956).

Occurrences in the present materlal (Tables 3 and 4) : This type is very rare.

Localities : 1, 2, 4, 7, 14, 22b, 22d, 24b, 25a, 31b, 33, 34b, 42, 44, 45a, 46b, 49b, 53, 54, 57, 58, 60, 61, 69, 71, 73, 74, 77, 78, 80, 81, 84, 97b, 102b, 111, 113.

Nuphar **sp.**

Pl. VI, fig. 14

1954. *Nuphar advena* ERDTMAN : p. 110, fig. 256
1954. *Nuphar luteum* ERDTMAN : p. 110, fig. 257
1954. *Nuphar pumilum* ERDTMAN : p. 110, fig. 258
1956. *Nuphar japonicum* var. *rubrotinctum* IKUSE : p. 71
1956. *Nuphar japonicum* IKUSE : p. 71
1956. *Nuphar pumilum* var. *ozzense* IKUSE : p. 71

Size range of measured specimens : 47 μ in lateral view.

Description of specimen : Grains more or less boat shape, the spine of the grain surface short; the specimen shown in Pl. VI, fig. 14 is lateral view, 47 μ, spines clear.

Remarks : This specimen belonged to $2A^a$ type of the Letter Nomination described by IKUSE (1956).

Occurrences in the present material (Tables 3 and 4) : This type is found very rare in the samples from these districts.

Localities : 1, 2, 4, 6, 7, 12, 13, 15, 18, 22c–d, 28, 33, 42, 43, 46a, 48, 49a–b, 57, 61, 69, 73, 74, 78, 79, 84, 96b, 102b, 103, 104, 105, 108, 111.

Persicaria **sp.**

Pl. II, figs. 24, 25, 26 and 27; Pl. VI, fig. 17.

1956. *Persicaria umbellata* IKUSE : p. 66
1956. *Persicaria nepalensis* IKUSE : p. 66, Pl. 12, fig. 5
1956. *Persicaria perfoliata* IKUSE : p. 66
1956. *Persicaria Maackiana* IKUSE : p. 66
1956. *Persicaria sentcosa* IKUSE : p. 67
1956. *Persicaria triangularis* IKUSE : p. 67
1956. *Persicaria hastato-triloba* IKUSE : p. 67
1956. *Persicaria Thunbergii* IKUSE : p. 67
1956. *Persicaria longiseta* IKUSE : p. 67

1956. *Persicaria Roettleri* IKUSE : p. 67
1956. *Persicaria lanuiflora* IKUSE : p. 67
1956. *Persicaria japonica* IKUSE : p. 67
1956. *Persicaria Makinoi* IKUSE : p. 67
1956. *Persicaria cochinchinensis* IKUSE : p. 67
1958. *Polygonum* sp. OZAKI and FUJI : p. 574, Pl. II, fig. 20
1959. *Persicaria* sp. SHIMAKURA : p. 75, Pl. I, fig. 12

Size range of measured specimens : 27–37.5 μ in diameter

Description of specimens : Grains oblate spheroidal in equatorial view, polyforate grain in polar view, mediae, pentagonal or hexagonal subreticulum; the specimen shown in Pl. II, fig. 24 is polar view, 37.5 μ polyforate; the grain shown in Pl. II, fig. 25 polar view, 30.5 μ in diameter polyforate, the specimen shown in Pl. II, fig. 26 polar view, 27 μ polyforate, pentagonal and hexagonal subreticulums; the grain shown in Pl. II, fig. 27 polar view, 27 μ in diameter polyforate; the grain shown in Pl. VI, fig. 17 polar view, 31 μ in diameter.

Remarks : The present writer's specimens belong to poly (ca. 10–30)-forate $4C^a$ type.

Occurrences in the present material (Tables 3 and 4) : The type is found abundant in the most of the samples from these districts.

Localities : 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20a–b, 21, 22a–d, 23a–d, 24a–d, 25a–d, 26, 27, 28, 29, 30a–c, 31a–b, 32, 33, 34a–b, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45a–c, 46a–b, 47, 48, 49a–b, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67a, 67b, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 88, 93, 96a–b, 97a–b, 101, 102a–b, 103, 104, 105, 108, 111, 113.

Zelkowa sp.

Pl. III, figs. 3 and 4

1952. *Zelkowa crenata* ERDTMAN : p. 442
1952. *Zelkowa serrata* ERDTMAN : p. 442
1952. *Hemiptelea (Zelkowa) davidii* ERDTMAN : p. 442
1956. *Zelkowa serrata* IKUSE : p. 62

Size range of measured specimens : 33-34 μ in polar view

Description of specimens : Grains suboblate, 30–35 μ in diameter, germ pores generally five, their aperture 4–6 μ in length, equatorially arranged, the fine reticulum appearance more or less to the surface of the pollen grain; the specimen shown in Pl. III ,fig. 3 is polar view, 32 μ in diameter, mediae grain, suboblate grain, germ pore situated in five angles, pentagonal grain in polar view, pore 4 μ in length in polar view, patterns on the grain unknown; the pollen grain in Pl. III, fig. 4 is polar view, 34 μ in diameter, mediae grain, suboblate grain, germ pores situated in five angles, pentagonal grain in polar view, pores about 6 μ in length in polar view, patterns defined at the equatorial zone of this grain.

Remarks : These specimens belong to $5A^c$ type in the Letter Nomination described by IKUSE in 1956. In the grain size and the type, these specimens belong to Family Ulmaceae, which includes *Aphananthe aspera, Celtis sinensis, Zelkowa serrata* and *Ulmus parvifolia* etc.. In other genera except *Zelkowa*, the grain size is smaller than *Zelkowa*. These specimens are genus *Zelkowa* as above mentioned description.

Occurrences in the present material (Tables 3 and 4) : The type is found rare in the most of these districts.

Localities : 1, 2, 3, 4, 5, 6, 7, 9, 14, 15, 18, 20b, 22a, 22b, 22d, 23b, 23d, 24a–d, 25b, 25c, 27, 30b, 31a, 34b, 36, 37, 40, 41, 44, 45b–c, 46a, 47, 49b, 50, 51, 52, 53, 54, 55, 56, 59, 60, 61, 62, 63, 64, 66, 67a–b, 68, 69, 70, 71, 72, 73, 75, 76, 77, 78, 79, 81, 82, 83, 84, 85, 88, 96a–b, 97a, 101, 102b, 103, 104, 108, 111, 113.

***Quercus* sp.**

Pl. V, figs. 8, 9, 10, and 11

1952. *Quercus oleoides* ERDTMAN : p. 177
1952. *Quercus cerris* ERDTMAN : p. 177
1954. *Quercus borealis* ERDTMAN : p. 100, fig. 188
1954. *Quercus ilex* ERDTMAN : p. 100, figs. 189, 190, 191
1954. *Quercus robur* ERDTMAN : p. 100, figs. 192, 193
1954. *Quercus sessiliflora* ERDTMAN : p. 100, figs. 194, 195
1956. *Quercus acuta* IKUSE : p. 62
1956. *Quercus acutissima* IKUSE : p. 62, Pl. 10, fig. 2
1956. *Quercus dentata* IKUSE : p. 62
1956. *Quercus glauca* IKUSE : p. 62
1956. *Quercus mongolica* var. *grosseserrata* IKUSE : p. 62
1956. *Quercus phillyraeoides* IKUSE : p. 62
1956. *Quercus serrata* IKUSE : p. 62
1956. *Quercus variabilis* IKUSE : p. 62
1958. *Quercus* sp. OZAKI and FUJI : p. 574, Pl. I, figs. 11, 12, 13.

Size range of measured specimens : 24–37.5 μ in diameter

Description of specimens : Grains subprolate to spheroidal, tricolpate; the specimen shown in Pl. V, fig. 8 is oblique equatorial view, 32 μ mediae grain, pore situated in the angles, furrows narrow, spinules lacking; the specimen shown, 28 μ, mediae grain, furrows narrow, of medium length, spinules lacking; the specimen shown in Pl. V, fig. 10 is oblique polar view, 24 μ in polar view, minutae grain, pores situated in the angles, furrows narrow, spinules unknown.

Remarks : According to IKUSE (1956), this type belongs to $6B^{b-c}$ type. As the sculpture is lack, if this pollen grain is determined by the grain size and shape, this pollen grain must be one genus among *Helianthus*, *Quercus*, *Castanopsis*, *Tetragonia*, *Citrus*, *Euonymus*, *Pleuropteropyrum* etc.. The difference between *Helianthus*, *Quercus*, *Castanopsis*, *Tetragonia* and the three others is as next character. The former has many spinules on the perine, but the latter has not spinule and it has reticulum. As the sculptures are lack in fossil pollen grains, this difference is entirely indistinguishable.

Occurrences in the present material (Tables 3 and 4) : The type is common in these area.

Localities : 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20a–b, 21, 22a–d, 23a–d, 24a-d, 25a–c, 26, 27, 28, 29, 30a–c, 31a–b, 32, 33, 34a-b, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45a–c, 46a–b, 47, 48, 49a–b, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67a, 67b, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 81, 82, 83, 84, 85, 88, 93, 96a, 97a–b, 101, 102a–b, 103, 104, 105, 108, 111, 113.

***Fagus* sp.**

Pl. VI, figs, 12 and 13

1952. *Fagus silvatica* Erdtman : p. 177
1954. *Fagus silvatica* Erdtman : p. 98, figs. 181, 182, 183
1956. *Fagus crenata* Ikuse : p. 61
1956. *Fagus japonica* Ikuse : p. 62
1958. *Fagus* sp. Tokunaga : Pl. V, fig. 42

Size range of measured specimens : 31 μ in oblique equatorial view. 33 μ in polar view

Description of specimens : Grains spheroidal, tricolpate, diameter (25–)30–34(–38) μ (after Rudolph and Firbas 1924), 26–46 μ (after Cernjavski 1935), aproximately 44 μ (after Zander 1935), furrows proportinately shorter than in *Castanea* and *Auercus*, each furrow has a distinct, equatorial germ pore; the specimen shown in Pl. VI, fig. 12 is oblique equatorial view, 31 μ in diameter; the pollen grain in Pl. VI, fig. 13 is polar view, 33 μ in diameter in polar view.

Remarks : These specimens are 3–colporate $6B^{b-c}$ typedescribed by Ikuse (1956)

Occurences in the present material (Tables 3 and 4) : This type is found abundant in the samples from these districts.

Localities : 1, 2, 4, 6, 7, 10, 12, 14, 15, 18, 19, 22b, 23b, 28, 30a, 30c, 32, 38, 42, 43, 44, 45a–c, 46a, 47, 48, 49a–b, 51, 52, 53, 54, 55, 56, 57, 60, 63, 68, 69, 70, 71, 72, 74, 77, 78, 79, 81, 82, 83, 93, 96a–b, 97a–b, 101, 102a–b, 103, 104, 108, 111, 113,

***Alnus* sp.**

Pl. IV, figs. 1, 2, and 3

1933. *Alnus alnobetula* Yamasaki : p. 16, fig. 39
1933. *Alnus tinctoria* Yamasaki : p. 16, fig. 40
1954. *Alnus glutinosa* Erdtman : p. 71, figs. 50–53
1954. *Alnus incana* Erdtman : p. 71, figs. 54–58
1954. *Alnus rugosa* Erdtman : p. 71, fig. 59
1954. *Alnus viridis* Erdtman : p. 71, figs. 60–61
1956. *Alnus firma* Ikuse : Pl. 9, fig. 11
1956. *Alnus hirsta* Ikuse : p. 61
1956. *Alnus japonica* Ikuse : Pl. 52, figs. 64, 65; p.61

1956. *Alnus serrulatoides* IKUSE : p. 61

1956. *Alnus Maximowiczii* IKUSE : p. 61

1956. *Alnus pendula* IKUSE : p. 61

1956. *Alnus Sieboldiana* IKUSE : p. 61

1958. *Alnus* sp. 1 TOKUNAGA : p. 37, Pl. VII, figs. 4, 5, 10

1958. *Alnus* sp. 2 TOKUNAGA : p. 37, Pl. VII, fig. 3

1958. *Alnus* sp. OZAKI and FUJI : p. 574, Pl. II, fig. 28

Size range of the measured specimens : 20.5–25.5 μ in diameter

Description of specimens : Grains oblate spheroidal to suboblate; the specimen shown in Pl. IV, fig. 1 is polar view, pentagonal according to the number of pores, 25 μ in polar view, minutae grain, pores situated in the angles, elliptical shaped, five pores 4.5 μ in long length, fine reticulum lacking; the specimen shown in Pl. IV, fig. 2 is polar view, pentagonal, 20.5 μ in polar view, minutae grain, pores situated in the angles, pore length indistinct, fine reticulum unknown; the specimen shown in Pl. IV, fig. 3 is polar view, pentagonal, 25.5 μ in polar view, pores situated in the angles, elliptical or slit shaped, five pores 3 μ in long length, fine reticulum lacking.

Remarks : This type belongs to $6A^c$ type. The genera belonged to this type are divided into three sub-types from the size. This species may belong to Alnus.

Occurrences in the present material (Tables 3 and 4) : The type is found rare in the most of the samples of these localities.

Localities : 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 17, 18, 20a–b, 21, 22a–d, 23a–d, 24a–d, 25a–c, 26, 27, 28, 29, 30a–c, 31a–b, 33, 34a–b, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45a–c, 46a–b, 47, 48, 49a, 50, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67a–b, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 79, 80, 81, 83, 85, 88, 93, 96a–b, 97a–b, 101, 102a–b, 103, 105, 108, 113.

***Betula* sp.**

Pl. VI, fig. 18 and 19

1952. *Betula nana* ERDTMAN : p. 72, fig. 30A

1952. *Betula tortuosa* ERDTMAN : p. 72, fig. 30B

1952. *Betula pubescens* ERDTMAN : p. 72, fig. 30C

1954. *Betula glandulosa* ERDTMAN : p. 73, fig. 71

1954. *Betula humilis* ERDTMAN : p. 73, fig. 62

1954. *Betula lenta* ERDTMAN : p. 74, figs. 72 and 73

1954. *Betula nana* ERDTMAN : p. 74, figs. 63, 64, and 65

1954. *Betula nigra* ERDTMAN : p. 74, fig. 66

1954. *Betula tortuosa* ERDTMAN : p. 74, figs. 67 and 68

1954. *Betula verrucosa* ERDTMAN : p. 74, figs. 69, and 70

1956. *Betula platyphylla* IKUSE : p. 61

1956. *Betula davurica* IKUSE : p. 61

1956. *Betula geobispica* IKUSE : p. 61
1956. *Betula grossa* IKUSE : p. 61
1958. *Betula* sp. OZAKI and FUJI : p. 574, Pl. II, fig. 27

Size range of measured specimens : 24 μ in polar view, 24 μ in equatorial view

Description of specimens : According to ERDTMAN (1954), "Grains suboblate to spheroidal, less flattened than in the grains of Alnus; in polar view, more or less angular owing to the aspidate pores; equatorial diameter about 16–30 μ"; the specimen shown in Pl. VI, fig. 18 is polar view, 24 μ in diameter; the specimen shown in Pl. VI, fig. 19 is equatorial view, 24 μ in diameter in equatorial view.

Remarks : These specimens belong to 3–poroidate $5A^{b-c}$ type described in IKUSE's Letter Nomination.

Occurrences in the present material (Tables 3 and 4) : The type is found common in the most of the samples of this area.

Localities : 1, 3, 4, 6, 7, 9, 10, 14, 15, 22a–b, 25b, 26, 33, 43, 44, 45a–c, 46b, 48, 50, 52, 54, 55, 56, 57, 67a, 68, 69' 73, 76, 77, 78, 80, 81, 82, 83, 84, 85, 88, 96a, 101, 108, 111, 113.

Carpinus sp.

Pl. IV, figs. 18 and 19; Pl. VI, fig. 6

1954. *Carpinus americana* var. *tropicalis* ERDTMAN : p. 76
1954. *Carpinus betulus* ERDTMAN : p. 76, figs. 76–78
1954. *Carpinus caroliniana* ERDTMAN : p. 76, fig. 79
1954. *Carpinus duinensis* ERDTMAN : p. 76, fig. 80
1956. *Carpinus Tschonoskii* IKUSE : p. 61
1956. *Carpinus laxiflora* IKUSE : p. 61
1956. *Carpinus cordata* IKUSE : p. 61
1956. *Carpinus japonica* IKUSE : p. 61
1958. *Carpinus* sp. TOKUNAGA : Pl. VI, fig. 26
1958. *Carpinus* sp. OZAKI and FUJI : p. 574, Pl. II, figs. 34 and 35

Size range of measured specimens : 24–26 μ in polar view

Description of specimens : Pollen grains same morphorogical type as those of Betula, Carpinus grains more rounded. In some species, according to ERDTMAN (1954), arci are fairly well developed, e. g. in *Carpinus americana* var. *tropicalis* and *Carpinus duinensis*, and in other species, type are sometimes hardly discernible. According to ERDTMAN's discription, "The grains are psilate, provided with a faint reticulate texture and generally have three or four, rarely five or six, aspidate pores. The pore pattern is somewhat similar to that in *Betula*, but the ektexine surrounding the apertures is not thickened and rises more distinctly from the general surface of the grain. The pores are circular, eventually broadly elliptical and, according to WODEHOUSE, usually operculate". The specimen shown in Pl. IV, fig. 18 is polar view, 25 μ in polar view, mediae grain, three-pore grain, fine reticulum unknown; the pollen grain shown in the Pl. IV, fig. 19 is polar view of three-pored grain, 26 μ in polar view of mediae grain; the specimen shown in Pl. VI, fig. 6 is polar view of three-pored grain, fine reticulume unknown.

Remarks : These specimens are 3–poroidate $5A^b$ type in the Letter Nomination described by IKUSE in 1956. In the grain shape and grain size, these specimens belong to Family Betulaceae, the difference between some genera in this family is difficult to find, especially between *Carpinus* and *Betula.* As ERDTMAN's description, *Carpinus* grain is more rounded than in *Betula* grain. The present writer thinks that these species belong to genus *Carpinus.*

Occurrences in the present material (Tables 3 and 4) : These specimens are found common in the samples from these districts.

Localities : 1, 2, 3, 4, 7, 10, 12, 16, 22b, 25b, 43, 45a, 45c, 46a, 51, 53, 54, 57, 68, 77, 78, 80, 81, 83, 84, 88, 97a, 102b, 103, 104, 108, 111, 113.

Juglans sp.

Pl. IV, figs. 10, 11 and 12

1952. *Juglans* ERDTMAN : p. 215
1954. *Juglans australis* ERDTMAN : p. 106, fig. 228
1954. *Juglans nigra* ERDTMAN : p. 106, fig. 229
1954. *Juglans regia* ERDTMAN : p. 106
1956. *Juglans ailanthifolia* IKUSE : p. 61, Pl. 9, fig. 10; Pl. 46, figs. 40 and 41
1958. *Juglans* sp. TOKUNAGA : Pl. VII, figs. 7 and 8
1958. *Juglans* sp. OZAKI and FUJI : p. 574, Pl. I, fig. 17; Pl. II, fig. 32

Size range of measured specimens : 37 μ in polar view

Description of specimens : Grains aspidate, oblate-spheroidal, 37 μ in diameter, eight pores situated in the eight angles, octagonal shape; the specimen shown in Pl. IV, fig. 10 is polar view, 37 μ in polar view, octagonal shape; the pollen grain shown in Pl. IV, fig. 11 is polar view, 37 μ in polar view; the pollen grain shown in Pl. IV, fig. 12 is polar view, 34 μ in polar view. eight pores situated in the each angle of octagonal shape.

Remarks : These specimens belong to $4A^a$ type in the Letter Nomination described by IKUSE in 1956. In the present plant from Japan, this type is included in *Juglans* and *Pterocarya* of Family Juglandaceae, according to IKUSE. Although *Pterocarya* has six or seven foraminorate. From the viewpoint of size, the difference, that is to say, according to IKUSE (1956), *Pterocarya rhoifolia* is 29–32$\times$35–38 μ, *Ptenocarya stenoptena* is 26–29.5$\times$31–35 μ, and *Juglans ailanthifolia* is 30–31 X 34–37 μ.

These specimens belong to *Juglans.*

Occurrences in the present material (Tables 3 and 4) : This type is found abundant in the most of the samples of this area.

Localities : 1, 2, 3, 4, 7, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20a–b, 21, 22a–d, 23b–d, 24a–d, 25a–c, 26, 27, 28, 30a–c, 31a–b, 32, 33, 34a–b, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45c, 46a–b, 47, 49a–b, 50, 51, 52, 53, 54, 55, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67a–b, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 88, 93, 97a–b, 102a–b, 105, 108, 113.

Salix sp.

Pl. V, figs. 14 and 15

1952. *Salix myrtilloides* Erdtman : p. 391, fig. 227 C
1954. *Salix caprea* Erdtman : p. 121, fig. 340
1954. *Salix cinerea* Erdtman : p. 121, fig. 341
1954. *Salix nigricans* Erdtman : p. 121, fig. 342
1954. *Salix polaris* Erdtman : p. 121, figs. 343 and 345
1954. *Salix triandra* Erdtman : p. 121, fig. 348
1956. *Salix japonica* Ikuse : p. 60. Pls. 5 and 60
1956. *Salix gracilistyla* Ikuse : p. 60. Pls. 5 and 60
1956. *Salix Koriyanagi* Ikuse : p. 60, Pls. 5 and 60
1956. *Salix Shiraii* Ikuse : p. 60, Pls. 5 and 60
1956. *Salix leucopithecia* Ikuse : p. 60, Pls. 5 and 60
1958. *Salix* sp. Ozaki and Fuji : p. 574, Pl. II. figs. 29, 30 and 31

Size range of measured specimens : 16.5–18 μ in diameter

Description of specimens : Grains usually prolate, frequently subprolate, tricolpate; the specimen shown in Pl. V, fig. 14 is polar view, 16.5 μ, minutae grain, without germ pores, exine reticulate unknown; the specimen shown in Pl. V, fig. 15 is equatorial view, 18 μ in polar axis length, minutae grain, tapering furrows without germ pores, exine reticulate unknown, furrows gradually disappearing towards the neighbourhood of two poles.

Remarks : Genus *Salix* based in pollen grain characteristics, such as size, shape, and aculpuring, is still many problems. The present writer, however, is determinable to be *Salix* type from the following points. Firstly, in size, according to Erdtman (1956), *Salix* is subprolate or prolate, 20—30 μ, and small grain is 20–30 μ in polar axis, and according to Ferrari (1927), 16.4 to 25.7 μ. Secondaly, in shape, *Salix* is almost tricolpate, sometimes 2–colporoidate. This shape, according to Ikuse (1956), belongs to 6B^b type.

The most genera of the present pollen grains belong to this type, and according to Erdtman, sculpture is only reticulation, which disappear towards the margins of the furrows, in present pollen grain. As reticulation, however, is lack in fossil pollen grain, sculpture is no an object of determination. Three furrows are taper from equator to pole in equatorial view, and they hollow remarkable at equator in polar view. In the other genera of this type except *Salix*, the hollow is not remarkable. The pollen grain as above mentioned is repressented by *Salix*.

Occurrences in the present material (Tables 3 and 4) : This type is found common in these districts.

Localities : 1, 2, 3, 4, 6, 7, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20a–b, 21, 22a–c, 23a–d, 24a–d, 25a-c, 26, 29, 30a–c, 31a–b, 32, 34a–b, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45a, 46a–b, 47, 48, 49a, 50, 51, 52, 53, 54, 55, 56, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67a–b, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 96a–b, 97a–b, 101, 103, 104, 105, 108, 111, 113.

***Gagea* sp.**

Pl. VI, fig. 21

1956. *Gagea lutea* IKUSE : p. 51

1956. *Gagea japonica* IKUSE : p. 51

Size range of measured specimens : 53 μ in lateral view.

Description of specimens : Pollen grain sulcate type, according to IKUSE (1956), *Gagea lutea* 46–49.5×55–58.5 μ, and *Gagea japonica* 35–42×46–52 μ; this specimen shown in Pl. VI, fig. 21, lateral view, 53 μ magnae grain, pattern on the grain surface indistinct.

Remarks : This specimen is l-sulcate 2A[a] type of the Letter Nomination of IKUSE (1956).

Occurrences in the present material (Tables 3 and 4) : This type is found very rare in the samples from these districts.

Localities : 1, 2, 5, 9, 10, 14, 15, 16, 22b, 43, 44, 45a, 45c, 53, 54, 55, 56, 57, 62, 68, 75, 76, 78, 81, 83, 93, 96b, 97a, 102b, 108, 113.

***Carex* sp.**

Pl. IV, fig. 5

1954. *Carex digitata* ERDTMAN : p. 56, fig. 6

1956. *Carex Kobomugi* IKUSE : p. 43

1956. *Carex Reinii* IKUSE : p. 43

1956. *Carex podogyna* IKUSE : p. 43

1956. *Carex Middendorffii* IKUSE : p. 43

1956. *Carex curvicollis* IKUSE : p. 43

1956. *Carex oshimensis* IKUSE : p. 43

1956. *Carex japonica* IKUSE : p. 43

1956. *Carex Doniana* IKUSE : p. 43

1958. *Carex* sp. TOKUNAGA : Pl. VII, fig. 27

1958. *Carex* sp. OZAKI and FUJI : p. 574, Pl. II, fig. 18

Size range of measured specimens : 30 μ in lateral view.

Description of specimens : Grains tetrahedral, more or less rounded type, pores fore (three lateral and one basal), 41–32 μ (after VASTERRAS 1938); the specimen shown in Pl. IV, fig. 5 is lateral view, 30 μ in lateral view, mediae grain, lateral three pores defined and basal one pore pooaly defined, aperture membrane and granula unknown.

Remarks : This type belongs to 3A[b] type by IKUSE. The Family belonging to this 3A[b] type, is only cyperaceae, From the view point of the grain shape and grain size, this specimen may perhaps belong to *Carex*.

Occurrences in the present material (Tables 3 and 4) : This type is found very rare in the samples from these districts.

Localities : 7, 9, 10, 14, 25b, 43, 45a, 45c, 48, 49b, 51, 52, 56, 57, 68, 71, 76, 77, 79, 84, 88, 96a, 108, 111, 113.

Gramineae type

Pl. IV, figs. 8 and 9

1952. Gramineae ERDTMAN : p. 193, fig. 114
1954. Gramineae ERDTMAN : p. 56, Pl. I, figs. 12–17
1956. Gramineae IKUSE : pp. 39–43
1958. Cf. Gramineae OZAKI and FUJI : p. 574, Pl. I, fig. 16

Size range of measured specimens : 30–38 μ in diameter

Description of specimens : Grains spheroidal or more or less ovoidal; the specimen shown in Pl. IV, fig. 8 is lateral view, 38 μ mediae grain, reticulum unknown, pore diameter about 3 μ; the specimen shown in Pl. IV, fig. 9 is lateral view, 30 μ mediae grain, pore diameter 4 μ, reticulum unknown.

Remarks : According to the present writer's specimen, the size range of the measured specimen is 30–38 μ. IKUSE reported the grain size of Family Gramineae in her papers. According to the size and form of pollen grain (IKUSE 1956), many genera as her description are found from the present Gramineae. Although the present Gramineae is occupied by fine reticulum on the pollen grain surface, Gramineae is not divided genera by fine reticulum. The whiter describes as Family Gramineae.

Occurrences in the present material (Tables 3 and 4) : This type is found very rare in the most of the samples from these districts.

Localities : 1, 2, 3, 4, 6, 7, 9, 10, 12, 13, 14, 15, 17, 18, 22c, 22d, 23a–b, 23d, 24a, 25a–c, 26, 27, 28, 30b–c, 31b, 32, 33, 34b, 35, 36, 38, 40, 41, 43, 44, 45a–c, 46a–b, 48, 49a–b, 50, 51, 52, 53, 54, 56, 57, 58, 60, 62, 65, 66, 67b, 68, 69, 73, 75, 76, 77, 79, 80, 81, 83, 84, 85, 88, 93, 96a, 97b, 101, 102b, 105, 111, 113.

Lenticularpollenites type

Pl. VI, fig. 25

Size range of measured specimens : 37 μ in lateral view

Description of specimens : This specimen shown in Pl. VI, fig. 25 is long lens shaped, 37 μ in lateral view, germ pore unknown.

Occurrences in the present material (Tables 3 and 4) : This type is found very rare in the samples from these districts.

Localities : 2, 4, 6, 9, 14, 22d, 23a, 25b, 34a, 35, 44, 46a–b, 48, 51, 52, 53, 54, 68, 81, 85, 97b, 113.

Selaginella sp.

Pl. VI, fig. 22

1954. *Selaginella selaginoides* ERDTMAN : p. 150, figs. 487 and 488
1956. *Selaginella firmula* ERDTMAN : p. 90, fig. 171
1956. *Selaginella rupestris* ERDTMAN : p. 91, fig. 172
1956. *Selaginella apus* ERDTMAN : p. 91, fig. 174

1956. *Selaginella atrovirides* ERDTMAN : p. 92, fig. 175

1956. *Selaginella biformis* ERDTMAN : p. 92, fig. 176

1956. *Selaginella eggersii* ERDTMAN : p. 92, fig. 177

1956. *Selaginella flagellata* ERDTMAN : p. 93, fig. 178

1956. *Selaginella kraussiana* ERDTMAN : p. 93, fig. 179

1956. *Selaginella radiata* ERDTMAN : p. 93, fig. 180

1956. *Selaginella selaginoides* ERDTMAN : p. 94, fig. 181

1965. *Selaginella uncinata* ERDTMAN : p. 94, fig. 182

Size range measured specimens : 62 μ in diameter of tetrad

Description of specimens : Tetrahedoral tetrad, microapore trilete, rounded shape, sometimes slightly bent spines, their number 25-32, according to REEVE (1935), grain surface smooth; the specimen shown in Pl. VI, fig. 22 is tetrad, 62 μ in tetrad size, grain spines distinct.

Occurrences in the present material : This type is found very rare in the samples from these districts.

Localities : 1, 2, 4, 7, 9, 14, 22c, 22d, 23d, 24c, 31b, 34b, 41, 42, 44, 45a, 46a, 49a–b, 53, 54, 57, 58, 61, 66, 67a, 68, 78, 81, 102a, 105, 111, 113.

Deltoidsporites type

Pl. VI, fig. 26

Size range of measured specimens : 27 μ in polar view

Description of specimens : This specimen shown in Pl. VI, fig. 26 equilateral triangle with more or less straight sides and sharp apices, 27 μ in polar view, mediae grain, colpoid unknown.

Occurrences in the present material (Tables 3 and 4) : This type is found very rare in the samples.

Localities : 1, 2, 16, 19, 22c, 22d, 23a, 24c, 31b, 41, 43, 44, 45c, 46b, 49a–b, 51, 53, 54, 56, 61, 67a, 68, 69, 71, 77, 78, 80, 82, 83, 85, 102b, 103, 105, 108.

Reniformsporites type

Pl. II, figs. 19, 20, 21, 22 and 23

Size range of measured specimens :

Reniformsporites α : 38 μ in lateral view

Reniformsporites β : 42–54 μ in lateral view

Reniformsporites γ : 42 μ in lateral view

Description of specimens : These specimens shown in Pl. II, figs. 19, 20. 21, 22 and 23 are lateral view, kidney or bean shape, these specimens are divided into three groups in grain shape, that is to say α, β and γ. Reniformsporites α 38 μ in lateral view, Reniformsporites β 42–54 μ, and Reniformsporites γ 42 μ.

Remarks : Although these specimens are similar to *Asplenium septentrionale, Athyrium filix-fermina, Anarthropterisdictyopteris, Cystopterisfragilis, Nephrolepiscordifolia, Platycerium* *madagascariense, Danaea elliptica* and *Histiopteris incisa,* in them the patterns on grain indistinct or lack or unknown. The separation of these specimens is difficult.

Occurrenses in the present material (Tables 3 and 4) : This type is common.

Localities : 1, 2, 3, 4, 6, 7, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20a–b, 21, 22a, 22c, 22d, 23a, 23b, 23c, 23d, 24a–d, 25a–c, 26, 27, 28, 29, 30a–b, 31a–b, 32, 33, 34b, 35, 36, 38, 39, 40, 41, 42, 43, 44, 45a–c, 46a–b, 47, 48, 49a–b, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67a–b, 68, 69, 70, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 88, 93, 96a–b, 97a–b, 101, 102a–b, 103, 104, 105, 108, 111, 113.

Subtriangularsporites type

Pl. II, fig. 10

Size range measured specimens : 27 μ in polar view

Description of specimens : The specimen shown in Pl. II, fig. 10 is equilateral triangle with more or less straight or convex sides and rounded apices, 27 μ in diameter in polar view, mediae grain, colpoid 8–10 μ length.

Occurrences in the present material (Tables 3 and 4) : This type is found very rare in the samples from these districts.

Localities : 1, 22c, 22d, 23a, 32, 49b, 56, 68, 77, 78, 85, 105.

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Plate I

EXPLANATION OF PLATE I

Fig. 1 : *Pinus* sp. equatorial view, short length 47 μ, long length 53 μ; locality no. 4.
Fig. 2 : *Pinus* sp. oblique equatorial view, short length 45 μ, long length 60 μ; locality no. 20.
Fig. 3 : *Pinus* sp. oblique equatorial view, short length 43 μ, long length 59 μ; locality no. 17.
Fig. 4 : *Pinus* sp. equatorial view, short length 37 μ, long length 43 μ; locality no. 85.
Fig. 5 : *Pinus* sp. equatorial view, short length 45 μ, long length 53 μ; locality no. 21.
Fig. 6 : *Pinus* sp. oblique equatorial view, short length 37 μ; locality no. 80.
Fig. 7 : *Pinus* sp. obliqe polar view, breadth 43 μ, long length 61 μ; locality no. 31, lower peat.
Fig. 8 : *Pinus* sp. obliqe equatorial view, short length 47 μ, long length 63 μ; locality no. 43.
Fig. 9 : *Pinus* sp. polar view, breadth 37 μ, long length 43 μ; locality no. 20, upper peat.
Fig. 10 : *Pinus* sp. oblique equatorial view, short length 41 μ, long length 52 μ; locality no. 76.
Fig. 11 : *Pinus* sp. equatorial view, short length 49 μ, long length 63 μ; locality no. 113.
Fig. 12 : *Pinus* sp. oblique polar view, breadth 46 μ, locality no. 113.
Fig. 13 : *Pinus* sp. polar view, breadth 45 μ, long length 48 μ; locality no. 101.
Fig. 14 : *Pinus* sp. oblique polar view, breadth 50 μ, long length 61 μ; locality no. 12.
Fig. 15 : *Pinus* sp. polar view, breadth 39 μ, long length 43 μ; locality no. 9.
Fig. 16 : *Pinus* sp. polar view, breadth 49 μ, long length 53 μ; locality no. 9.
Fig. 17 : *Pinus* sp. polar view, breadth 51 μ, long length 53 μ; locality no. 93.
Fig. 18 : *Pinus* sp. oblique polar view, breadth 44 μ, long length 47 μ; locality no. 97.
Fig. 19 : *Pinus peuce* (recent), upper fig. polar view, and lower fig. equatorial view; breadth 63 μ, short length 63 μ, long length 70 μ (Cernjavski 1935).
Fig. 20 : *Pinus canariensis* (recent), upper fig. polar view and lower fig. equatorial view, breadth 76 μ, short length 31 μ, long length 78 μ.
Fig. 21 : *Pinus pinea* (recent), upper fig. polar view and lower fig. equatorial view; breadth 36 μ, short length 36 μ, long length 51 μ (Deevey).

Pl. I

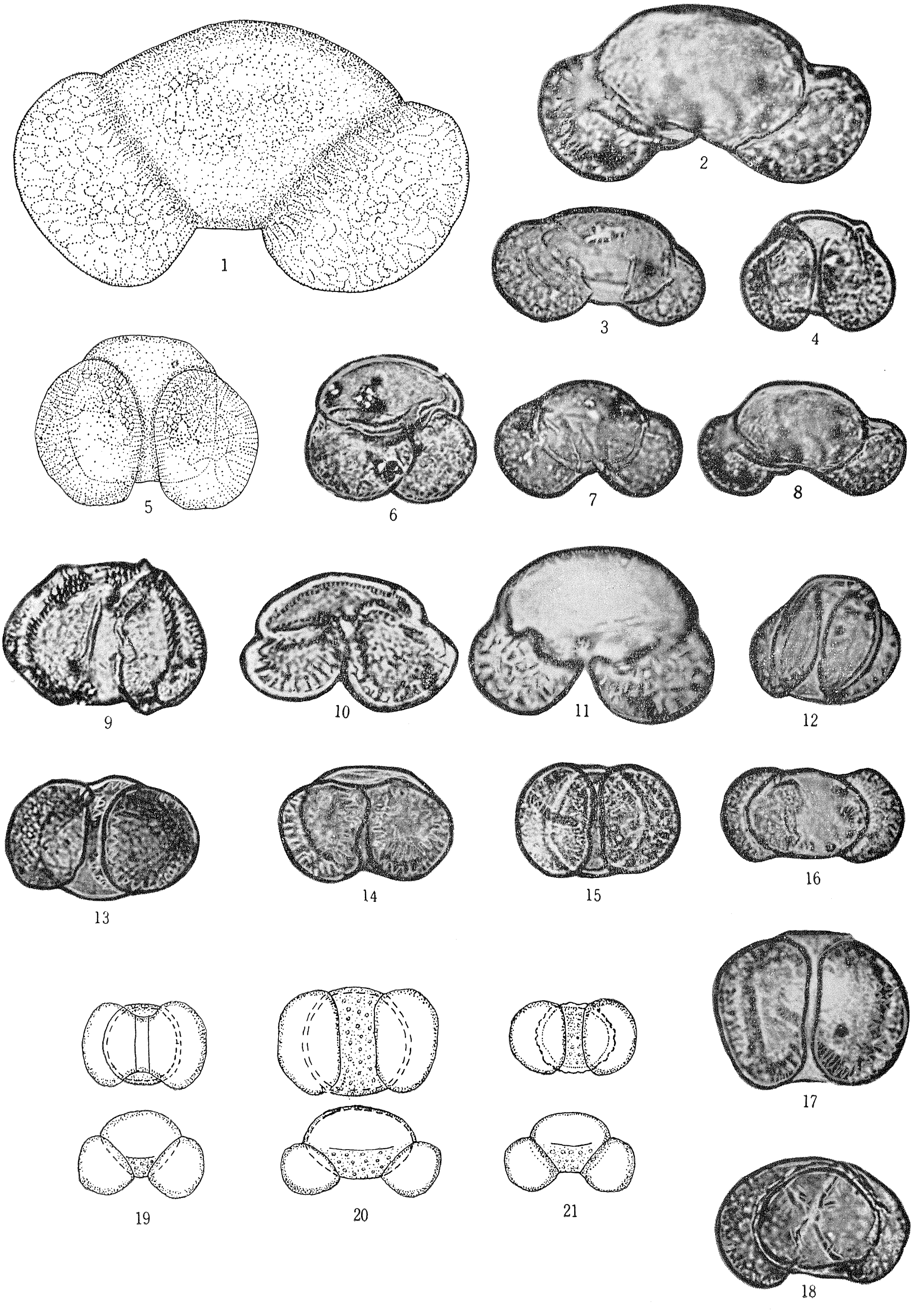

Plate II

EXPLANATION OF PLATE II

Fig. 1 : *Abies* sp. equatorial view, short length 98 μ, long length 110 μ, bladder 75 μ; locality no. 74.
Fig. 2 : *Abies* sp. equatorial view, short length 82 μ, long length 92 μ; locality no. 74.
Fig. 3 : *Abies* firma (recent), equatorial view, short length 108 μ, long length 117 μ.
Fig. 4 : *Cryptomeria* sp. equatorial view, 28 μ in diameter. locality no. 42.
Fig. 5 : *Cryptomeria* sp. equatorial view, 29 μ, locality no. 97, upper peat.
Fig. 6 : *Cryptomeria* sp. equatorial view, 32 μ, locality no. 1.
Fig. 7 : *Cryptomeria* sp. equatoeial view, 28 μ, locality no. 1.
Fig. 8 : *Cryptomeria* sp. equatorial view, 28 μ, locality no. 28.
Fig. 9 : *Cryptomeria japonica* (recent), equatorial view, 30-33×34-39 μ (IKUSE 1956).
Fig. 10 : Subtriangularsporites, polar view, 27 μ in diameter, locality no. 77.
Fig. 11 : *Asplenium septentrionale* (recent), lateral view, × 500 (ERDTMAN 1957).
Fig. 12 : *Athyrium fili-fermina* (recent), lateral view, × 500 (ERDTMAN 1957).
Fig. 13 : *Anarthropteris dictyopteris* (recent), lateral view, × 500 (ERDTMAN 1957).
Fig. 14 : *Cystopteris fragilis* (recent), lateral view, × 500 (ERDTMAN 1957).
Fig. 15 : *Nephrolepis cordifolia* (recent), lateral view, longitudinal view (optical cross-section and surface), × 500 (ERDTMAN 1957).
Fig. 16 : *Platycerium madagascariense* (recent), lateral view (ERDTMAN 1957).
Fig. 17 : *Danaea elliptica* (recent), lateral, longitudinal view (optical cross-section and surface), × 500 (ERDTMAN 1957).
Fig. 18 : *Histiopteris incisa* (recent), lateral, longitudinal view, × 500 (ERDTMAN 1957).
Fig. 19 : Reniformsporites α sp. lateral view, 38 μ, locality no. 82.
Fig. 20 : Reniformsporites β sp. lateral view, 42 μ, locality no. 96, lower peat.
Fig. 21 : Reniformsporites β sp. lateral view, 45 μ, locality no. 96, lower peat.
Fig. 22 : Reniformsporites β sp. lateral view, 54 μ, locality no. 96, lower peat.
Fig. 23 : Reniformsporites γ sp. lateral view, 42 μ, locality no. 93
Fig. 24 : *Persicaria* sp. polar view, 37.5 μ, locality no. 22, lowermost peat.
Fig. 25 : *Persicaria* sp. polar view, 30.5 μ, locality no. 18.
Fig. 26 : *Persicaria* sp. polar view, 27 μ, locality no. 82.
Fig. 27 : *Persicaria* sp. polar view, 27 μ, locality no. 59.

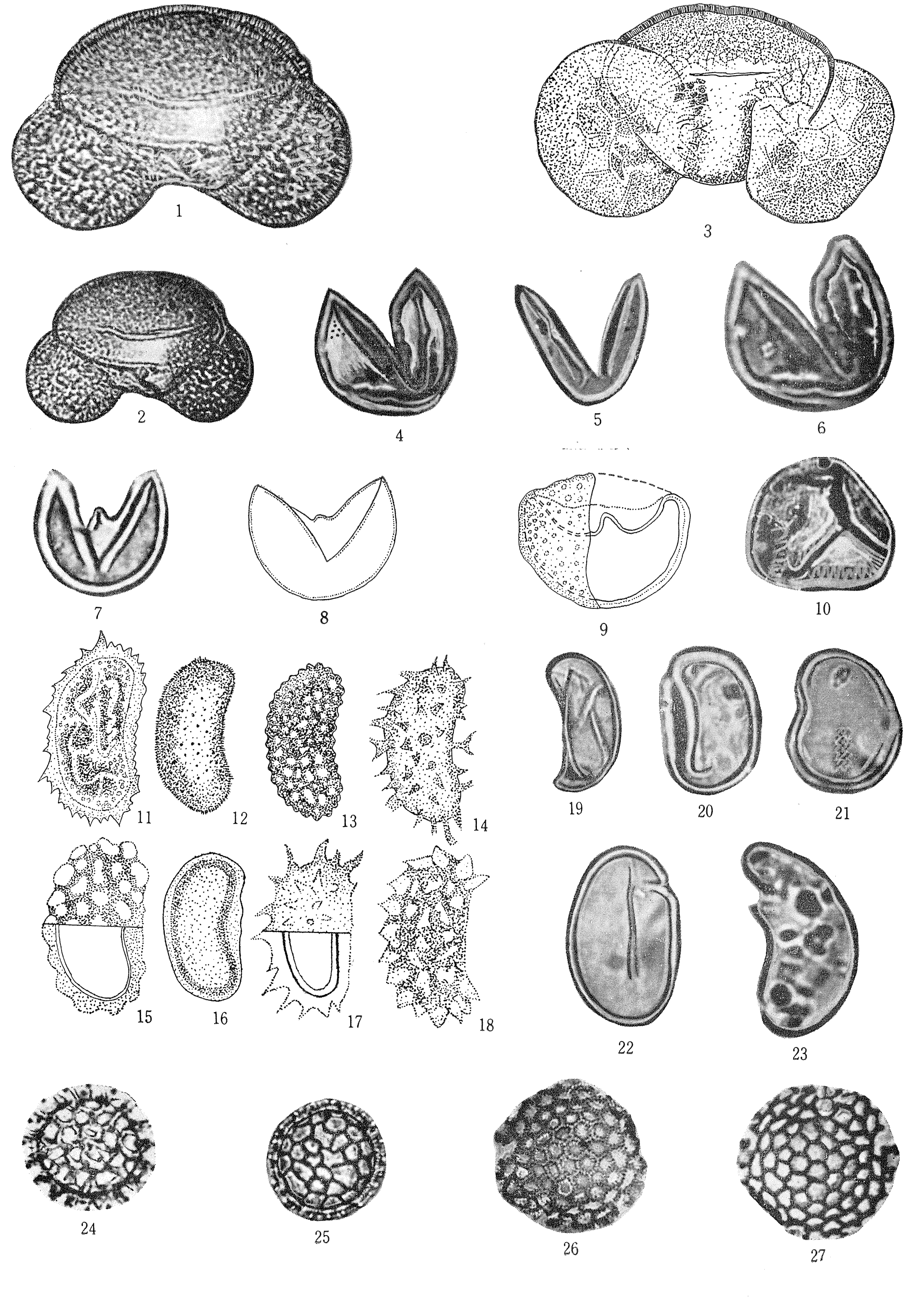
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PLATE III

EXPLANATION OF PLATE III

Fig. 1 : *Podocarpus* sp. equatorial view, short length 35 μ, long length 42 μ; locality no. 113.

Fig. 2 : *Podocarpus nagi* (recent), equatorial view, short length 31-32.5 μ, long length 31-32.5 μ (IKUSE 1956).

Fig. 3 : *Zelkowa* sp. polar view, 33 μ, locality no. 59.

Fig. 4 : *Zelkowa* sp. polar view, 34 μ, locality no. 69.

Fig. 5 : *Zelkowa serrata* (recent), polar view, 38 μ.

Fig. 6 : Compositae, polar view, 33.5 μ, locality no. 93.

Fig. 7 : Compositae, polar view, 41.5 μ, locality no. 28.

Fig. 8 : Compositae, polar view, 34 μ, locality no. 12.

Fig. 9 : *Sventenia bupleoroides* (recent), about 26×27 μ (ERDTMAN 1952).

Fig. 10 : *Ilex* sp. polar view, 24.5 μ, locality no. 82.

Fig. 11 : *Ilex* sp. polar view, 23.5 μ, locality no. 30, middle peat.

Fig. 12 : *Ilex integra* (recent), polar view, 25.5-30×30-32.5 μ (IKUSE 1956).

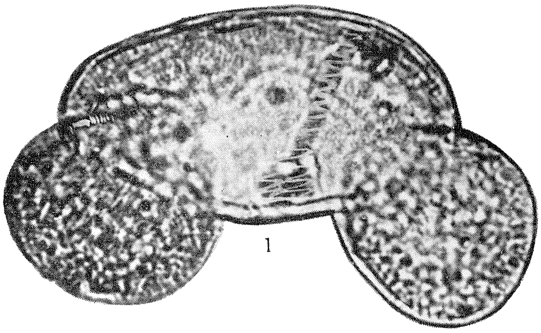
Fig. 13 : *Tilia* sp. polar view, 24 μ, locality no. 77.

Fig. 14 : *Tilia* sp. polar view, 31.5 μ, locality no. 15.

Fig. 15 : *Tilia cordata* (recent), equatorial view, 32 μ (ERDTMAN 1954).

Fig. 16 : *Tilia cordata* (recent), polar view, 32 μ (ERDTMAN 1954).

Pl. III



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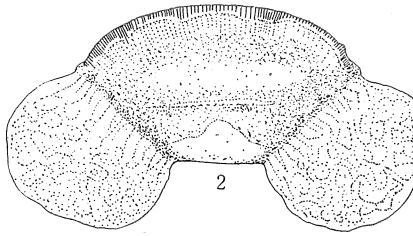

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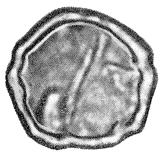

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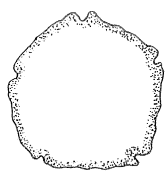

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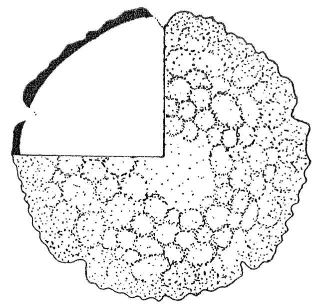

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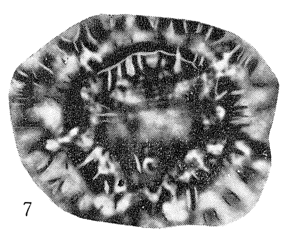

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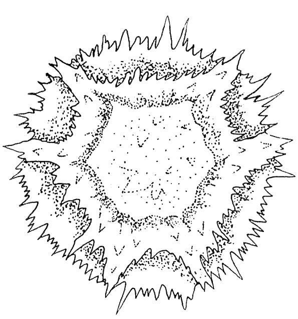

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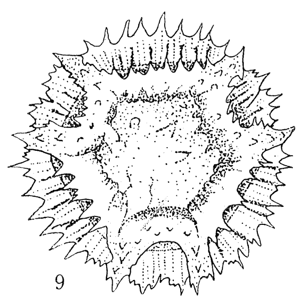

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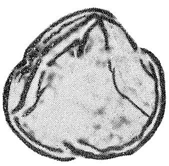

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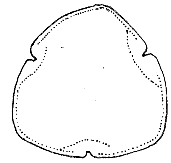

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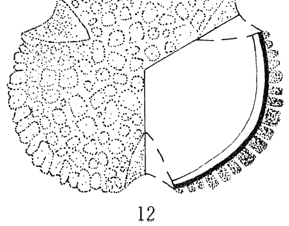

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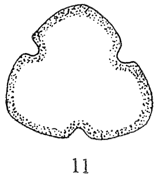

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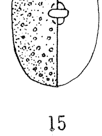

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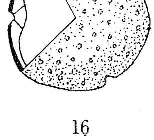

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Plate IV

EXPLANATION OF PLATE IV

Fig. 1 : *Alnus* sp. polar view, 23 μ, locality no. 24, third peat.
Fig. 2 : *Alnus* sp. polar view, 20.5 μ, locality no. 20, upper peat.
Fig. 3 : *Alnus* sp. polar view, 25.5 μ, locality no. 85.
Fig. 4 : *Alnus japonica* (recent), polar view, 22-23×25-28.5 μ (IKUSE 1956).
Fig. 5 : *Carex* sp. lateral view, 30 μ, locality no. 88.
Fig. 6 : Carex oshimensis (recent), polar view, 29-32 μ (IKUSE 1956).
Fig. 7 : *Carex oshimensis* (recent), equatorial view. 40-45 μ (IKUSE 1956).
Fig. 8 : Gramineae, equatorial view, 38 μ, locality no. 101.
Fig. 9 : Gramineae, equatorial view, 30 μ, locality no. 101.
Fig. 10 : *Juglans* sp. polar view, 37 μ, locality no. 34, lower peat.
Fig. 11 : *Juglans* sp. polar view, 37 μ, locality no. 20.
Fig. 12 : *Juglans* sp. polar view, 34 μ, locality no. 71.
Fig. 13 : *Juglans nigra*, polar view, 40 μ (ERDTMAN 1954), 34.2 to 30.8 μ in diameter (WODEHOUSE 1933).
Fig. 14 : *Myriophyllum* sp. polar view, 25.5 μ, locality no. 69.
Fig. 15 : *Myriophyllum* sp. polar view, 27 μ, locality no. 69.
Fig. 16 : *Myriophyllum* sp. polar view, 25 μ, locality no. 17.
Fig. 17 : *Myriophyllum* spicatum (recent), left fig. : equatorial view, right fig. : polar view; 24×28 μ (ERDTMAN 1952), 23-25.5×24-27 μ (IKUSE 1956).
Fig. 18 : *Carpinus* sp. polar view, 25 μ, locality no. 3.
Fig. 19 : *Carpinus* sp. polar view, 25 μ, locality no. 108.
Fig. 20 : *Carpinus caroliniana* (recent), polar view, 27 μ (ERDTMAN 1954), 22-30 μ (POTONIE 1934), 21-31 μ (WODEHOUSE 1933).
Fig. 21 : *Carpinus betulus* (recent), polar view, 37 μ (ERDTMAN 1954).
Fig. 22 : *Carpinus duinensis* (recent), polar view, 21-28 μ (ERDTMAN 1954).
Fig. 23 : *Carpinus cordata* (recent), polar view, 22×23 μ.

Pl. IV

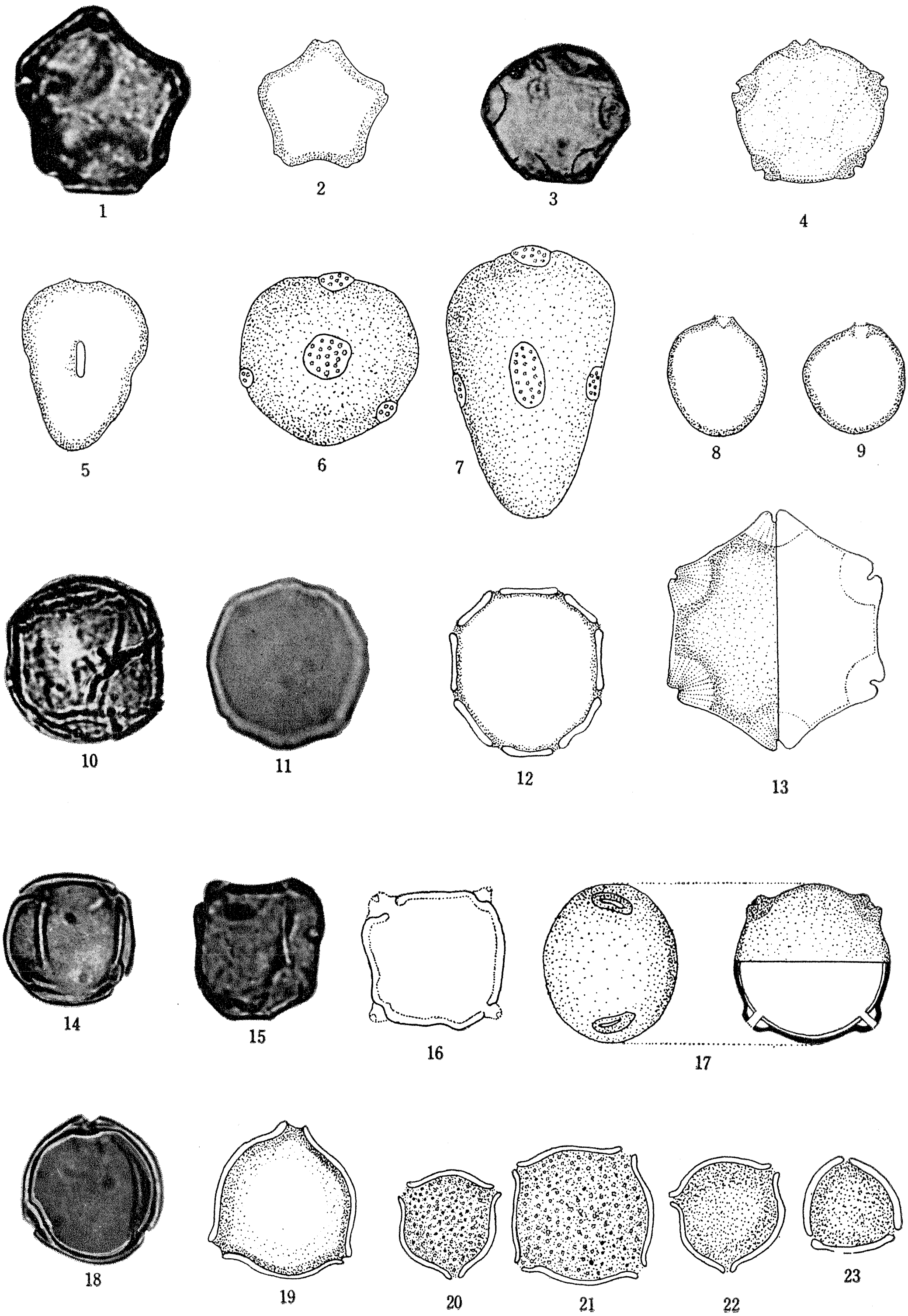


PLATE V

EXPLANATION OF PLATE V

Fig. 1 : *Rhododendron* sp. tetrad size 63 μ, single grain size 21 μ, locality no. 101.

Fig. 2 : *Rhododendron aureum* (recent), tetrad size 55-56 μ, single grain size 28-34 μ.

Fig. 3 : *Ledum palustre* LINNE var. *minus*, single grain size 30 μ (YAMASAKI 1933).

Fig. 4 : *Ledum palustre* LINNE var. *nipponicum*, tetrad, single grain size 37-43 μ (YAMASAKI 1933).

Fig. 5 : *Oenothera* sp. polar view, 84 μ, locality no. 97, lower peat.

Fig. 6 : *Oenothera* sp. polar view, 84 μ, locality no. 97, lower peal.

Fig. 7 : *Oenothera Lamarchiana* (recent), polar view, 88-90×115-132 μ (IKUSE 1956).

Fig. 8 : *Quercus* sp. oblique equatorial view, 32 μ, locality no. 102, upper peat.

Fig. 9 : *Quercus* sp. oblique equatorial view, 28 μ, locality no. 85.

Fig. 10 : *Quercus* sp. oblique polar view, 24 μ, locality no. 17.

Fig. 11 : *Quercus* sp. polar view, 37.5 μ, locality no. 81.

Fig. 12 : *Quercus sessiliflora* (recent), polar view, 39 μ (ERDTMAN 1954).

Fig. 13 : *Quercus sessiliflora* (recent), equatorial view, 29-39 μ (ERDTMAN 1954).

Fig. 14 : *Salix* sp. polar view, 16.5 μ, locality no. 32.

Fig. 15 : *Salix* sp. equatorial view, 18 μ, locality no. 108.

Fig. 16 : *Salix polaris* (recent), polar view, 19 μ, (ERDTMAN 1954).

Fig. 17 : *Salix polaris* (recent), equatorial view, 19-31 μ, (ERDTMAN 1954).

Fig. 18 : *Larix* sp. lateral view, 65 μ, locality no. 113.

Fig. 19 : *Larix* sp. lateral view, 65 μ, locality no. 67, uppe rpeat.

Pl. V

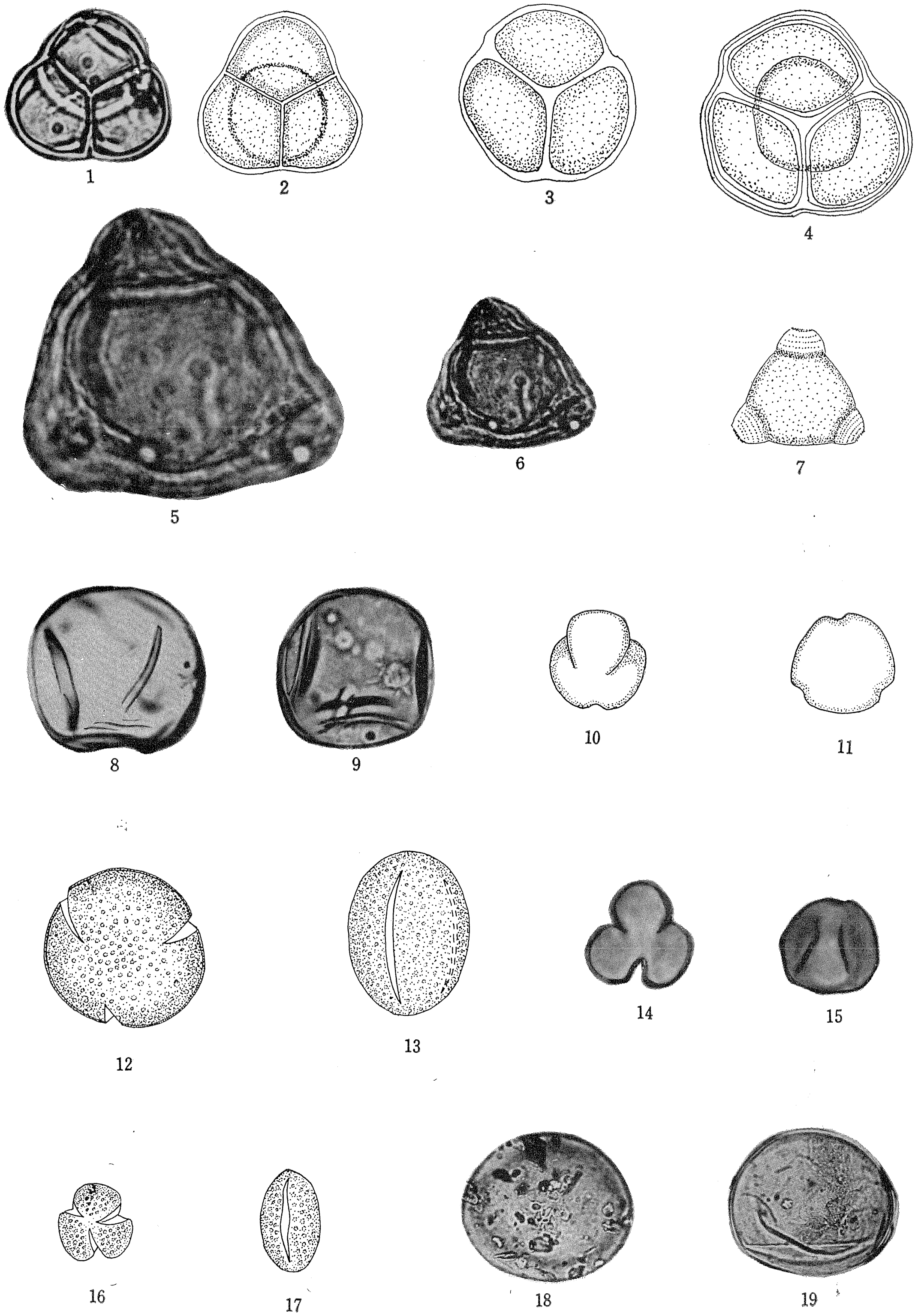


Plate VI

EXPLANATION OF PLATE IV

Fig. 1 : *Juniperus* sp. polar view, 31.5 μ, locality no. 33.
Fig. 2 : *Juniperus nana*, polar view, 23-30 μ (YAMASAKI 1933).
Fig. 3 : *Menyanthes* sp. polar view, 34 μ, locality no. 84.
Fig. 4 : *Menyanthes* sp. equatorial view, 38 μ, locality no. 25, middle peat.
Fig. 5 : *Menyantes* sp. oblique equatorial view, 36 μ, locality no. 25, middle peat.
Fig. 6 : *Carpinus* sp. polar view, 24 μ, locality no. 81.
Fig. 7 : *Carpinus japonica* (recent), polar view, 22.5-23.5 × 24-27 μ (IKUSE 1956).
Fig. 8 : *Menyantes trifoliata* (recent), polar view, 30-32.5 × 37-39 μ in long stamen, 30-32 × 33-35 μ in short stamen (IKUSE 1956).
Fig. 9 : *Menyantes trifoliata* (recent), equatorial view, 48-52 μ.
Fig. 10 : *Tsuga* sp. polar view, 82 μ, locality no. 93.
Fig. 11 : *Carpinus japonica* (recent), polar view, × 2,000.
Fig. 12 : *Fagus* sp. oblique equatorial view, 31 μ, locality no. 30, uppermost peat.
Fig. 13 : *Fagus* sp. polar view, 33 μ, locality no. 30, upper peat.
Fig. 14 : *Nuphar* sp. lateral view, 47 μ, locality no. 15.
Fig. 15 : *Fagus silvatica* (recent), equatorial view, 42 μ (ERDTMAN 1954).
Fig. 16 : *Fagus silvatica* (recent), polar view, 41 μ (ERDTMAN 1954).
Fig. 17 : *Percicaria* sp. lateral view, 31 μ, locality no. 18.
Fig. 18 : *Betula* sp. polar view, 24 μ, locality no. 22, lowermost peat.
Fig. 19 : *Betula* sp. equatorial view, 24 μ, locality no. 22, lowermost peat.
Fig. 20 : *Bidens* sp. polar view, 24 μ, locality no. 21.
Fig. 21 : *Gagea* sp. lateral view, 53 μ, locality no. 83.
Fig. 22 : *Selaginella* sp. tetrahedral tetrad, tetrad size 62 μ, locality no. 102, lower peat.
Fig. 23 : *Rubus* sp. polar view, 24.5 μ, locality no. 1.
Fig. 24 : *Rubus* sp. polar view, 25 μ, locality no. 31, upper peat.
Fig. 25 : Lenticularpollenites, lateral view, 37 μ, locality no. 113.
Fig. 26 : Deltoidsporites, polar view, 27 μ, locality no. 71.

Pl. VI

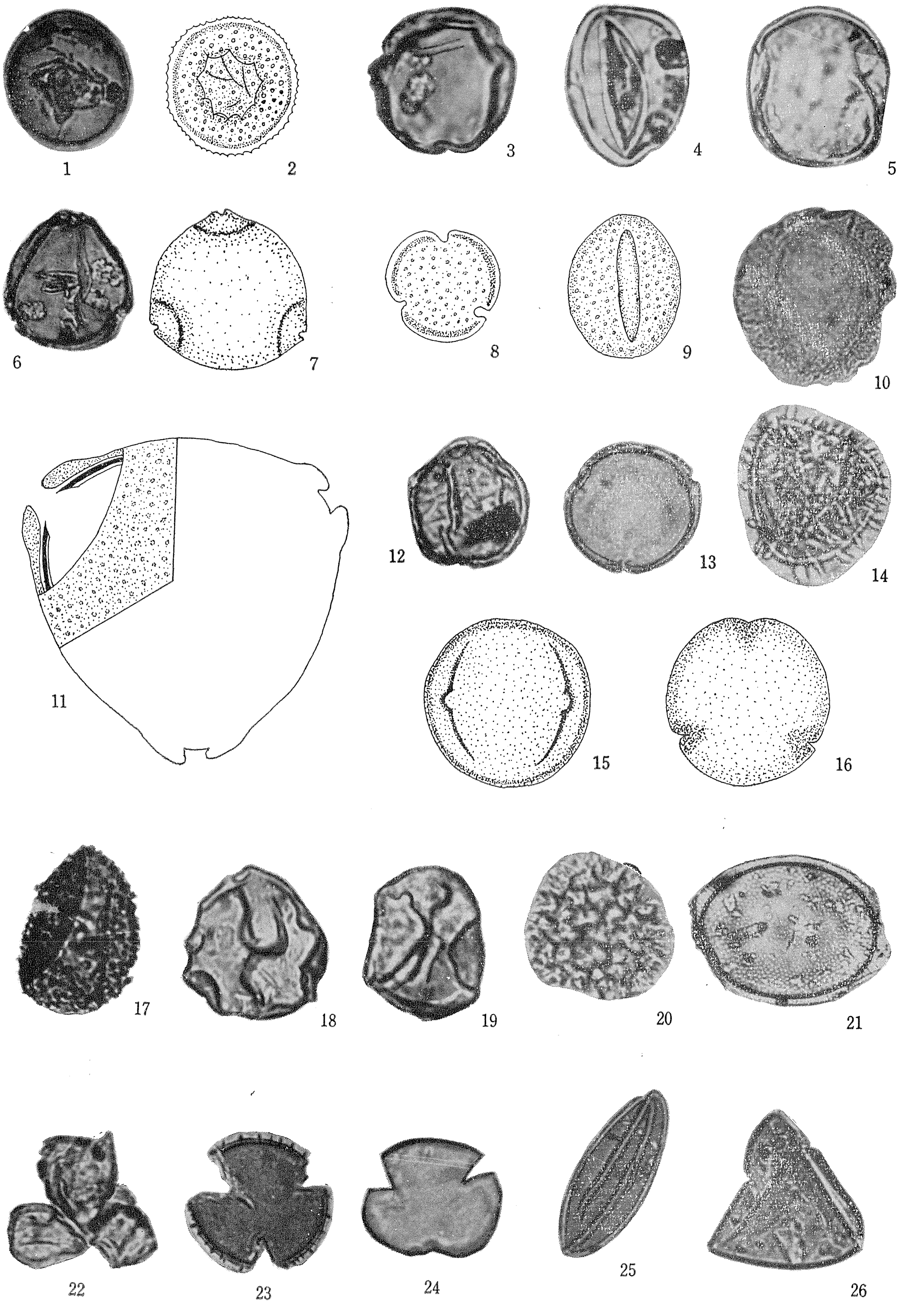


Plate VII

EXPLANATION OF PLATE VII

Fig. 1 : The erect stumps in the Late Yayoi Age, locality no. 12, Hamasôgo, Kanazawa City.
a : Post-"Late Yayoi" New Sand Dune
b : the Late Yayoian peat lamina with Late Yayoian potteries
c, d, e, f : erect stumps
c : *Cinnamomum japonicum* SIEB.
d : *Veburnum* sp. indet
e : *Zerkowa serrata* MAKINO
f : *Alnus japonica* SIEB. et ZUCC.
g : beach sand

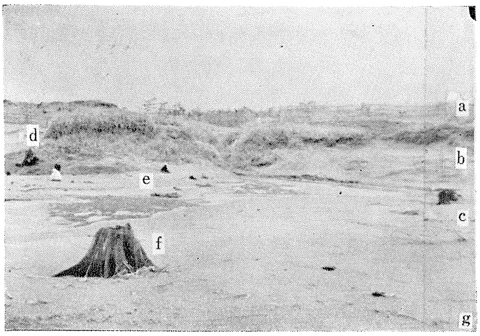
Fig. 2 : The Late Yayoian peat lamina with the Late Yayoian potteries, locality no. 28, Sôgoshin, Matto, Ishikawa Prefecture.
a : Post-"Late Yayoi" New Sand Dune
b : the Late Yayoian peat lamina (58 cm in thickness)

Fig. 3 : The Late Yayoian peat lamina develops along the strand line of the Japan Sea, locality no. 14, Utsugi, Kanazawa City.
a : New Sand Dune
b : beach sand
c : peat lamina (25 cm in thickness)
d : the clay of the Tetori Fan Deposit (45 cm in thickness)
e : Japan Sea

Fig. 4 : The Late Yayoian peat lmina, the clay and the gravel of the Tetori Fan Deposit, locality no. 29, sea cliff along Japan Sea at Sôgoshin, Matto, Ishikawa Prefeoture.
a : New Sand Dune
b : the Late Yayoian peat lamina (35 cm in thickness)
c : the clay lamina of the Tetori Fan Deposit (45 cm in cthickness)
d : the gravel lamina of the Tetori Fan Deposit (80 cm in thickness)
e : Japan Sea

Fig. 5 : Alluvial deposits at the sea cliff (locality no. 97) along the Japan Sea, Hashidate, Kaga City, Ishikawa Prefecture.
a : the sand of New Sand Dune
b : laminate coarse sand (5 cm in thickness)
c : thin peat lamina (30-35 cm in thickness)
d : sand lamina (3.5 cm in thickness)
e : thin peat lamina (30 cm in thickness)
f : light yellowish blue sand (6 m in thickness)
g : coarse sandy gravel (1.4 m in thickness)
h : basal gravel
k : Kurosaki sandstone formation
l : hammer (35 cm in length)

Fig. 6 : Alluvial deposits at the sea cliff (locality no. 97) along the Japan Sea, about 30 m southwestward from the outcrop described in fig. 5, Hashidate, Kaga City, Ishikawa Prefecture
a : thin shell bed (3 cm in thickness)
b : thin shell bed (5 cm in thickness)
c : dark bluish green sand lamina (37 cm in thickness)
d : basal gravel
e : Kurosaki sandstone formation



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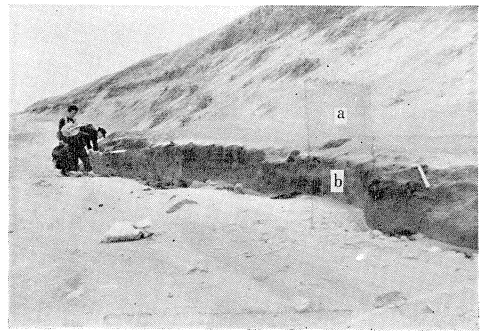

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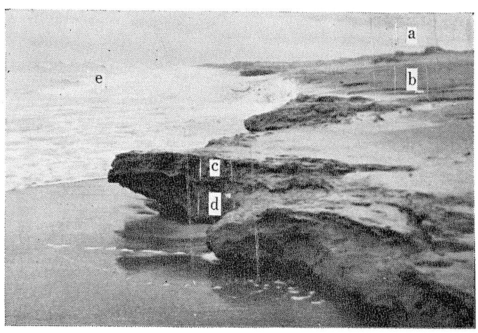

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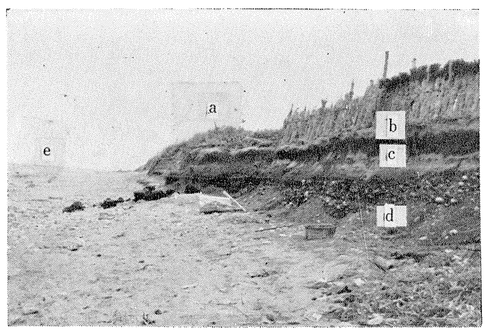

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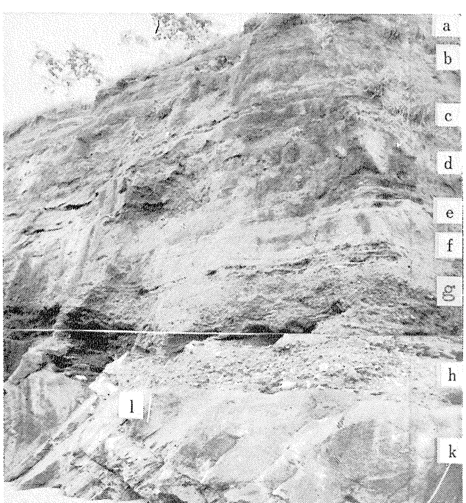

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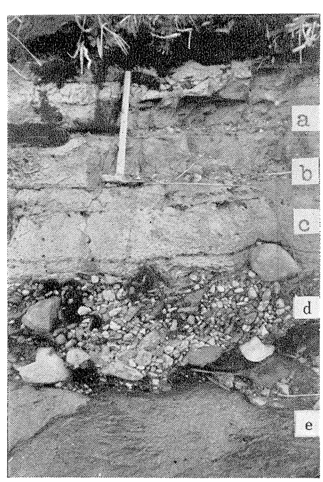

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PLATE VIII

EXPLANATION OF PLATE VIII

Fig. 1 : The stomata of *Quercus glauca* THUNB.,
Locality no. 101, Alluvial peat (35 cm in thickness), sea cliff of northern slope at Hill Kento, Hamasaka, Kitagata Village, Sakai-gun, Fukui Prefecture. ×600

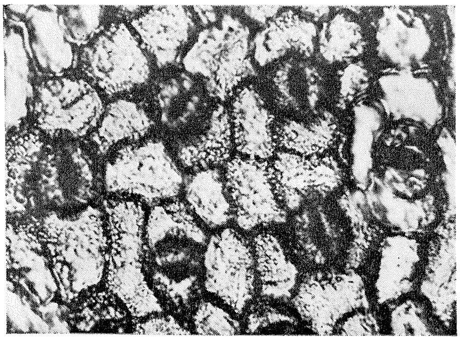
Fig. 2 : The stomata of *Quercus glauca* THUNB.,
Locality no. 101, Alluvial peat (35 cm in thickness), sea cliff of northern slope at Hill Kento, Hamasaka, Kitagata Village, Sakai-gun, Fukui Prefecture.
a : stomata, b : guard cell, c : dermal cell. ×1.200

Fig. 3 : *Quercus glauca* THUNB.,
Locality no. 101, Alluvial peat (35 cm in thickness), sea cliff of northern slope at Hill Kento, Hamasaka, Kitagata Village, Sakai-gun, Fukui Prefecture. ×1

Figs. 4 & 5 : A stone-knife of the Middle Jômon — the Late Yayoi Age (about 4.500 to 2.000 years before the present in the Hokuriku Region) from the Old Sand Dune, field, about 250 m southwestward from western margin of Hashidate, Kaga City, Ishikawa Prefecture. ×1.0 and ×1.5

Fig. 6 : The Late Yayoian big high plate ("*Takatsuki*" in Japanese name),
Locality no. 12, Alluvial peat (35 cm in thickness), Hamayasuhara, Kanazawa City, Ishikawa Prefecture. ×1/4

Fig. 7 : The Late Yayoian big high plate ("Takatsuki" in Japanese name),
Locality no. 80, Alluvial peaty clay (20 cm in thickness), Ogawa, Matto Town, Ishikawa-gun, Ishikawa Prefecture. ×1/4



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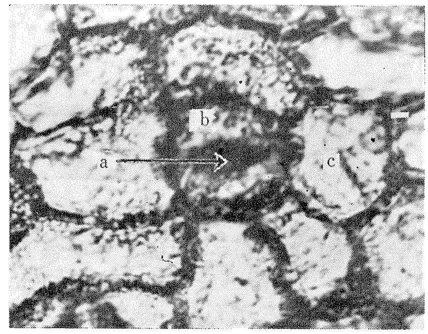

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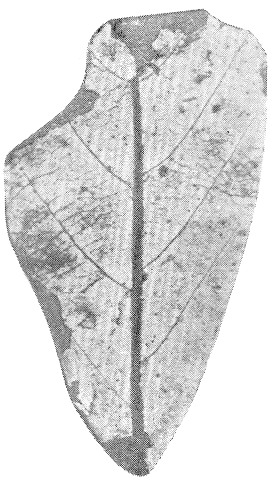

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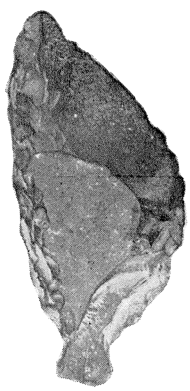

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