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PALYNOLOGICAL STUDY OF THE MIOCENE KAWABATA-KOTANBETSU-MASUPORO FORMATIONS IN CENTRAL HOKKAIDO

by

Seiji Sato

(with 8 text-figures)

Abstract

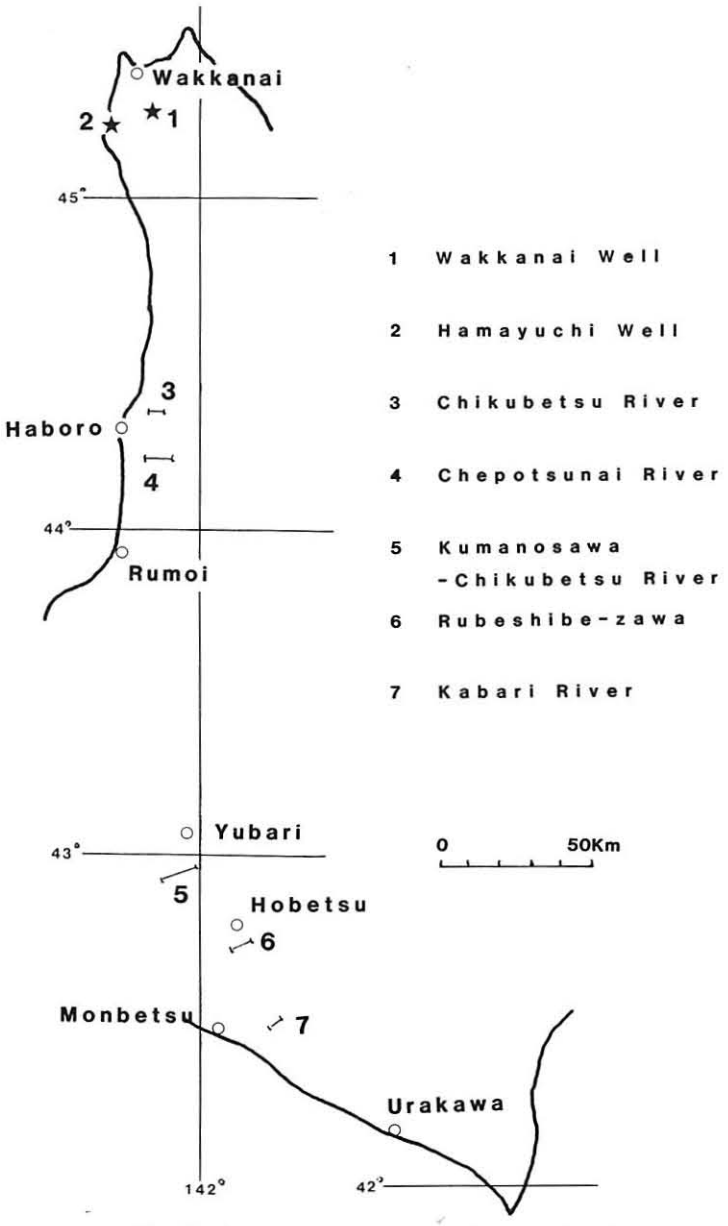
The Miocene Kawabata-Kotanbetsu-Masuporo Formations in Central Hokkaido are very poor in macrofossils, but they contain abundant and widely distributed fossil pollen and spores. By the study of these pollen floras, it is concluded that Central Hokkaido was under a cool temperate climatic condition during the time when the Kawabata-Kotanbetsu-Masuporo Formations were deposited.

Introduction

The characteristic sediments are found in the midst of the Miocene in Central Hokkaido; they are called the Masuporo Formation in the Tempoku region, the northernmost region of Hokkaido, the Kotanbetsu Formation in the Haboro region, the Kawabata Formation in the Ishikari region and the Fureoi Formation (=Kawabata Formation) in the Hidaka region, the southernmost region of Hokkaido. The sediments, which are said to be "mollasse" formed by the Hidaka orogeny, are peculiar in their facies: they are composed of rhythmic alternating layers of sandstone and mudstone, or sometimes composed of thick monotonous mudstone as seen in the Hamayuchi well described later in the present paper, and they reveal ill-sorted sediments including huge boulders in some parts. The sediments are extremely thick, some exceeding 5,000m.

Paleontological information of these thick sediments in the midst of the Neogene is of course important for the interpretation of the history and correlation of the Neogene. However, the sediments are poor in fossil evidence, except for benthonic foraminiferas, though they contain abundant and widely distributed fossil pollen and spores. The author previously reported a preliminary palynological study of the sediments (Sato, 1972); and the present study, which is based on a number of samples collected from all areas of Neogene distribution in Central Hokkaido, is a continuation of that report. The seven examples among them are reported in the present paper. The author briefly describes the nature of the pollen floras in the Kawabata-Kotanbetsu-Masuporo Formations in the present paper, and their significance from the view-point of the stratigraphy will be discussed in another paper.

Contribution from Department of Geology and Mineralogy, Faculty of Science, Hokkaido University, No. 1938



Text-fig. 1 Sampling Localities for the present study

Pollen flora in the Masuporo Formation

As observed from the surface of the earth, the Masuporo Formation is distributed in an undulating pattern by folding, and its upper boundary is scarcely exposed. Since it is difficult to collect samples from the complete section of the formation on the surface of the earth, the samples for the present study were taken from two wells, MITI

Wakkanai and MITI Hamayuchi Wells.

1) MITI Wakkanai Well — The Masuporo Formation in this well is composed of dark gray mudstone in its upper part and alternating layers of mudstone and sandstone in its lower part. The formation is about 1,000m in thickness (Japan National Oil Corporation, 1972b). The pollen flora of this formation is composed mainly of Pinaceae (bisaccate pollen), *Tsuga*, Taxodiaceae and *Alnus*, as shown in Fig. 2, in the following percents: Taxodiaceae about 50% in the upper part and 30% in the lower part, Pinaceae 20—30% in the upper part and 10—25% in the lower part, *Tsuga* 10—30% and *Alnus* 10—30%. Other pollens are found at frequencies less than 10%. Taxodiaceae and Pinaceae increase gradually upward from the base to the top of the formation in frequency. Conversely, *Tsuga* and *Alnus* decrease gradually upward. Compared with the contemporaneous formations of the other districts stated in the present paper, the abundant occurrence of Taxodiaceae is characteristic of this pollen flora. The flora suggests a rather cool temperate climatic condition.

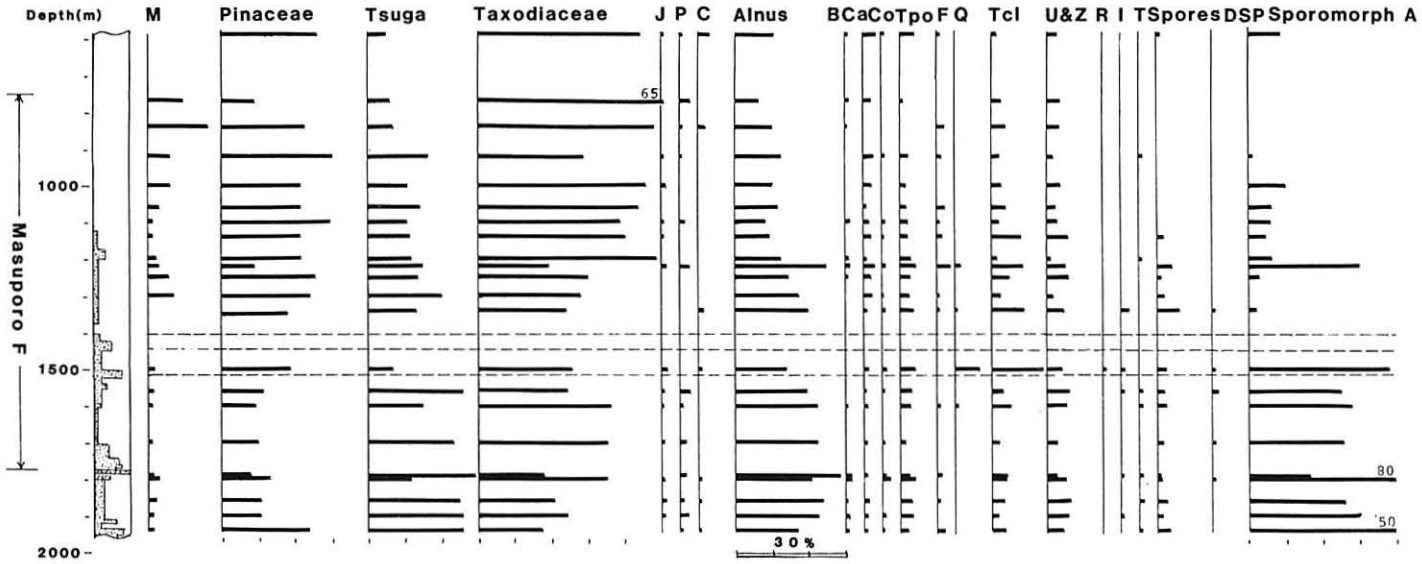
2) MITI Hamayuchi Well — The Masuporo Formation in this well is thick (about 2,500m) and is almost completely composed of argillaceous rock with thin tuff in some horizons and fine pebbles, which are sometimes scattered among the rocks (Japan National Oil Corporation, 1972a). The main elements of the pollen flora are Pinaceae (bisaccate pollen), *Tsuga*, Taxodiaceae and *Alnus*. Pinaceae is the most abundant, 30—60%, usually over 40%. The frequency of Taxodiaceae is 20—40% and that of *Tsuga* and *Alnus* is similar, 10—20%. The frequency of other pollens amounts to less than 5%. A similar composition of flora exists throughout the formation. The pollen flora obviously indicates a cool temperate climatic condition.

Pollen flora in the Kotanbetsu Formation

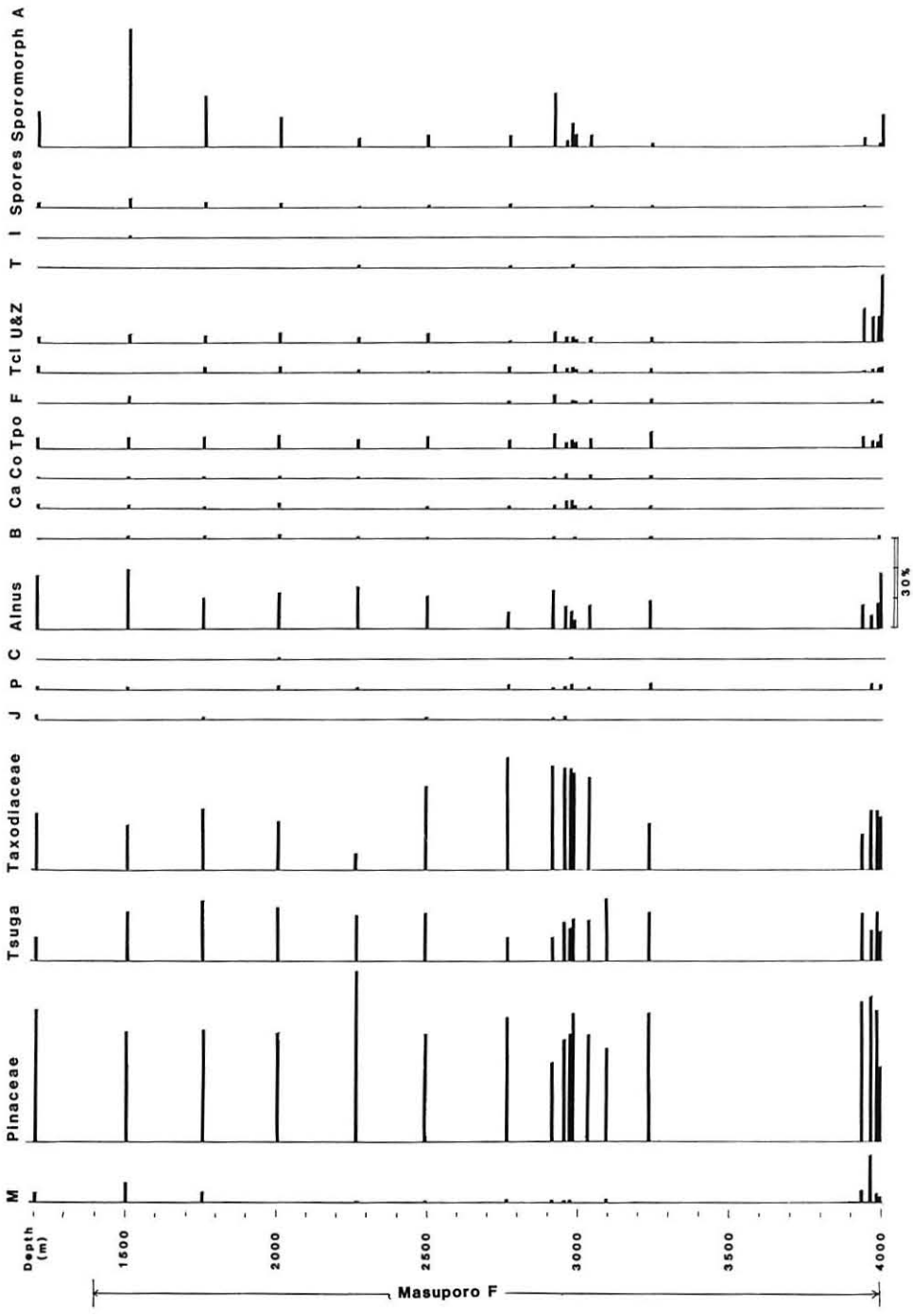
The formation is distributed in the Haboro-Uryu region. According to published reports, the formation in this region is the thickest of all contemporaneous formations in Central Hokkaido (sometimes it reaches 6,000m). The formation is composed mainly of rhythmic alternating layers of sandstone and mudstone with occasional thick amount of conglomerate and tuff. Samples for the present study were collected along the Chikubetsu and Chepotsunai rivers (Fig. 1).

The pollen floras in the Kotanbetsu Formation in the above-mentioned two localities are very similar to each other: the main components of the floras are Pinaceae, *Tsuga* and *Alnus*, as shown in Figs. 4 and 5. The frequencies are as follows: *Tsuga* and *Alnus*, the most abundant, 20—40%, usually more than 30%; Pinaceae 10—30%, sometimes over 40%; Taxodiaceae 5—20%, usually less than 10%; *Ulmus* and *Zelkova*, 5—15%; others less than 5%. The frequency of *Alnus* is considered to be influenced greatly by edaphic rather than climatic conditions. *Tsuga*, an element of cool temperate climatic conditions, seems to decrease upward in frequency. These floras indicate a cool temperate climate.

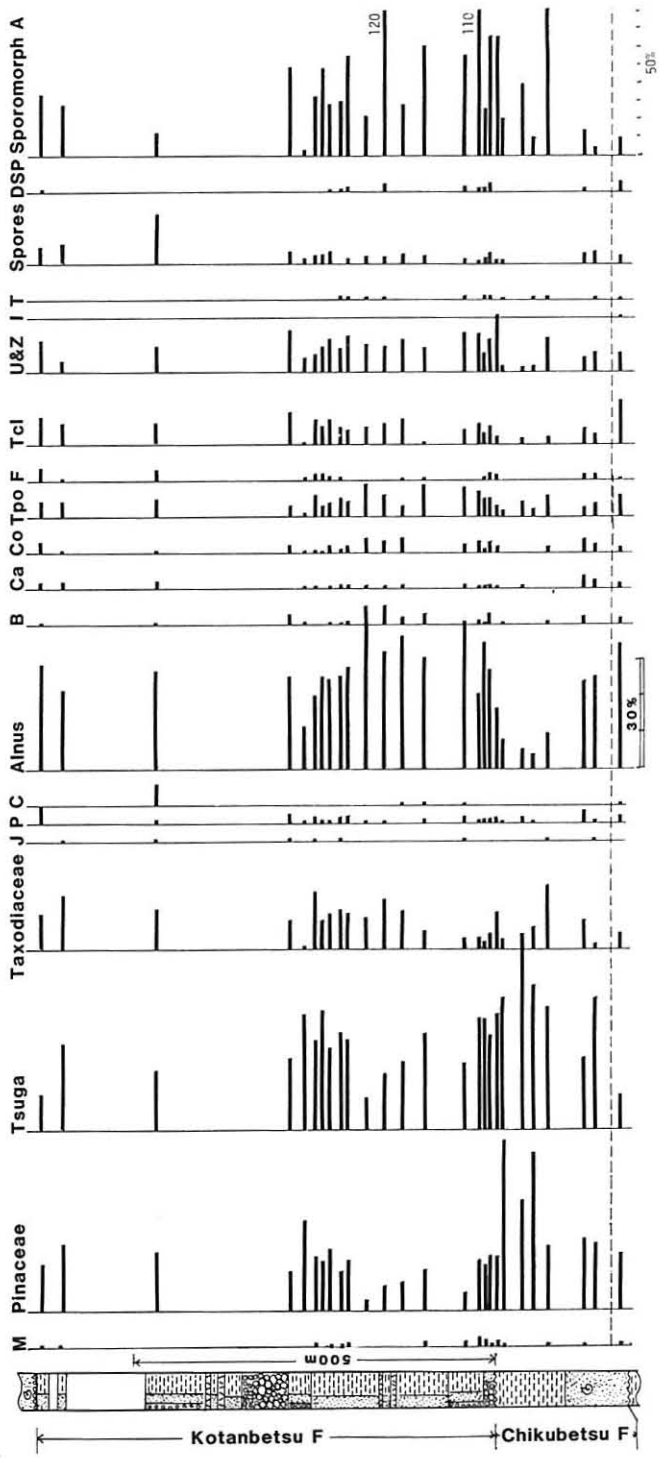
Text-fig. 2 Pollen Diagram of the Masuporo Formation of the Wakkanai Well, Wakkanai District



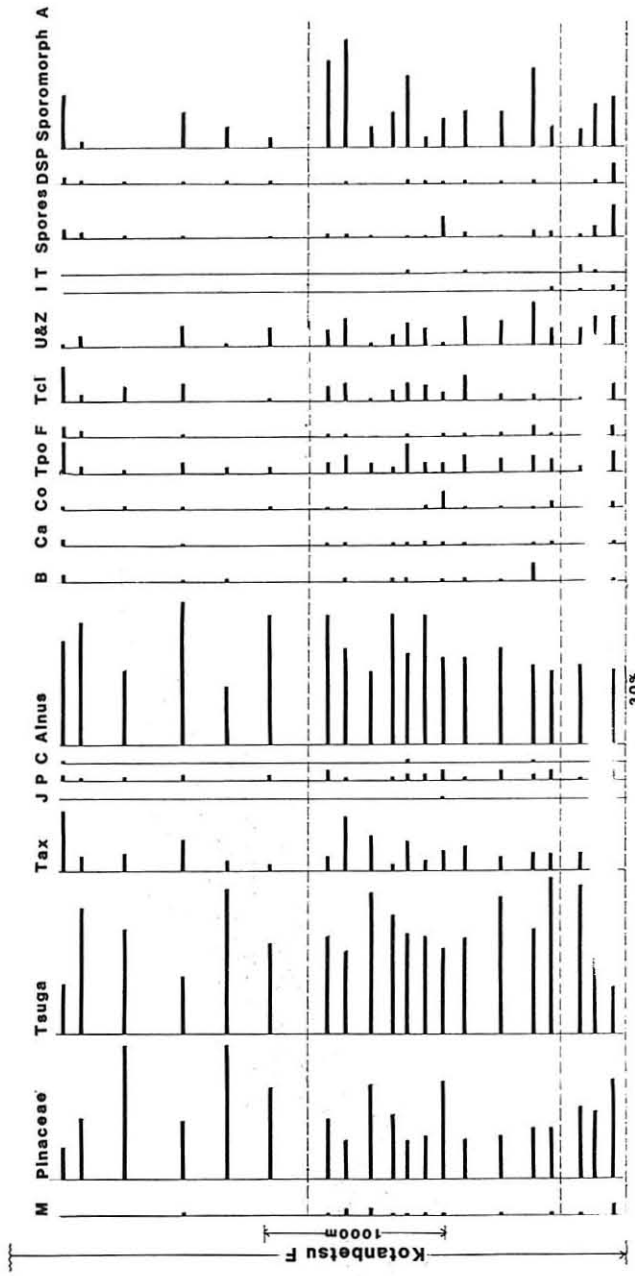
Legend for Figures: M:Microplanktons, J:Juglans, P:Pterocarya, C:Carya, B:Betula,,Ca:Carpinus, Co:Corylus, Tpo:Triporate pollen gen.indet., F:Fagus, Q:Quercus, Tcl:Tricolpate pollen gen.indet., U&Z:Ulmus and Zelkova, L:Liquidambar, R:Rhus, I:Ilex, T:Tilia, Sp:Spores, DSP:Spores and pollen clearly judged to be derived from Cretaceous rocks, based on their chracteristic shapes, ✕ Sporomorph A:Spherical, less than 10u in diameter, surface smooth, biological affinity unknown, not found in terrestrial sediments. ---- ------ Horizon containing very few or no pollen and spore.



Text-fig. 3 Pollen Diagram of the Masuporo Formation in the Hamayuchi well, Wakkanai District



Text-fig. 4 Pollen Diagram of the Kotanbetsu Formation along the Chikubetsu river, Haboro District



Text-fig. 5 Pollen Diagram of the Kotanbetsu Formation along the Chepotsunai river, Haboro District

Pollen flora in the Kawabata Formation

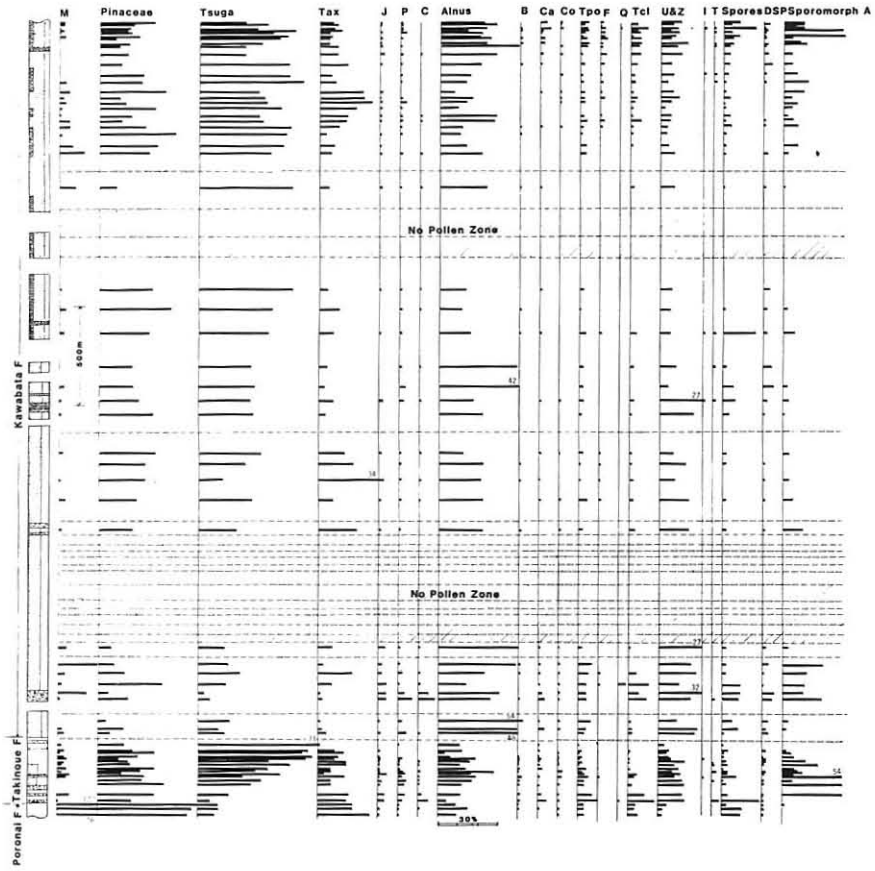
The formation in the Ishikari region consists mainly of rhythmic alternating layers of sandstone and mudstone with some layers of conglomerate and tuff. Some parts of the formation reveal zones with sedimentary features such as slumping, intraformational folding and poor sorting sediments with huge blocks of sedimentary rocks. The formation is well exposed on the banks of Kumano-sawa and the Chikubetsu river. The maximum thickness of the formation is about 3,000m. The Kawabata Formation in the Ishikari region is clearly distinguishable from the underlying Takinoue Formation and the overlying Iwamizawa Formation (so-called hard shale formation) by its lithology and fossils. However, as we move southward towards the Hidaka region, the difference in lithology between the Fureoi (or Ukegoi) Formation, correlated to the Kawabata Formation, and the overlying Karumai Formation, correlated to the Iwamizawa Formation, becomes obscure. In the present paper the Fureoi Formation is referred to as the Kawabata Formation.

1) Kumano-sawa — Chikubetsu river area, Yubari district. The Kawabata Formation in this area is also composed mainly of rhythmic alternating layers of sandstone and mudstone with thick conglomerate and tuff in some horizons. Interbeds of disordered deposits containing huge boulders and intraformational folding are also observed. Microfossils as foraminifera, diatoms and radiolaria are present in this formation, but no macrofossils are reported. The formation reaches about 3,000m in thickness. The argillaceous sediments contain abundant fossil pollen and spores, except in two horizons, which are designated as no pollen zones in the pollen diagram of Fig. 6. It is unknown why no pollen is contained in these horizons, because the sediments in these horizons cannot be discriminated from those in which pollen is abundantly found in the same locality. This finding may have some relation to the process of sedimentation of this formation. The composition of the pollen flora of this formation is shown in Fig. 6. The main components of the flora are Pinaceae, *Tsuga*, Taxodiaceae and *Alnus*. Cool elements such as Pinaceae and *Tsuga* increase upward from the basal part of the formation. The range of frequency of Pinaceae is about 5% in the basal part to 40% in the upper part, and that of *Tsuga* is from 10% to 60%. Taxodiaceae and *Alnus* occur at frequencies below 10% and 20—50% respectively. The presence of this pollen flora suggests a cool temperate climatic condition, except in the basal part. The pollen assemblage n the basal part, in which *Alnus*, *Ulmus* and *Zelkova* are found at a rather high frequency, and in which the cool elements such as *Tsuga* and Pinaceae are low in frequency (*Alnus* 30—50% and *Ulmus* & *Zelkova* 10—30%), is unusual in floral composition among the pollen floras of the Kawabata-Kotanbetsu-Masuporo Formations.

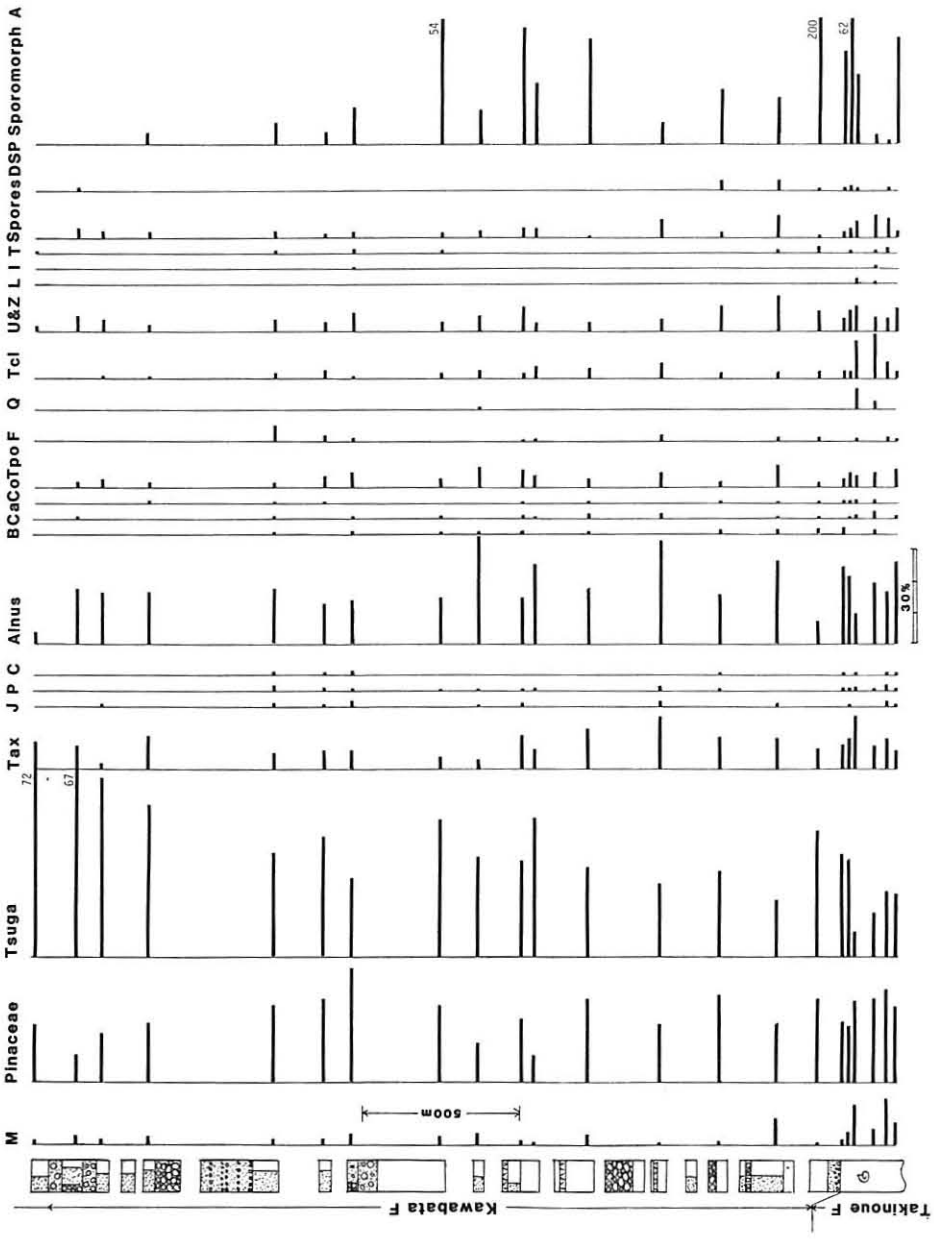
2) Rubeshibe-zawa area, Hobetsu district — The Kawabata Formation in this area is composed of much coarser sediments than those found in the Yubari district. The pollen floral composition of this formation is shown in Fig. 7. In frequency *Tsuga* is the most dominant, 30—45%, throughout most of the formation, showing 60—70% at the top. Pinaceae occurs next in frequency at 20—40%. *Alnus* is also frequently found: 20—35% in the lower part and about 20% in the upper part of the formation.

The above pollens are accompanied by Taxodiaceae and *Ulmus*: the frequencies of the former are 5—20% and the latter 5—10%. Other pollens occur with frequencies under 5%. Cool elements like Pinaceae and *Tsuga* are abundant in frequency. Though the frequency of *Tsuga* seems to become higher upward, the composition of the flora appears to be uniform throughout the formation, indicating a very cool climatic condition.

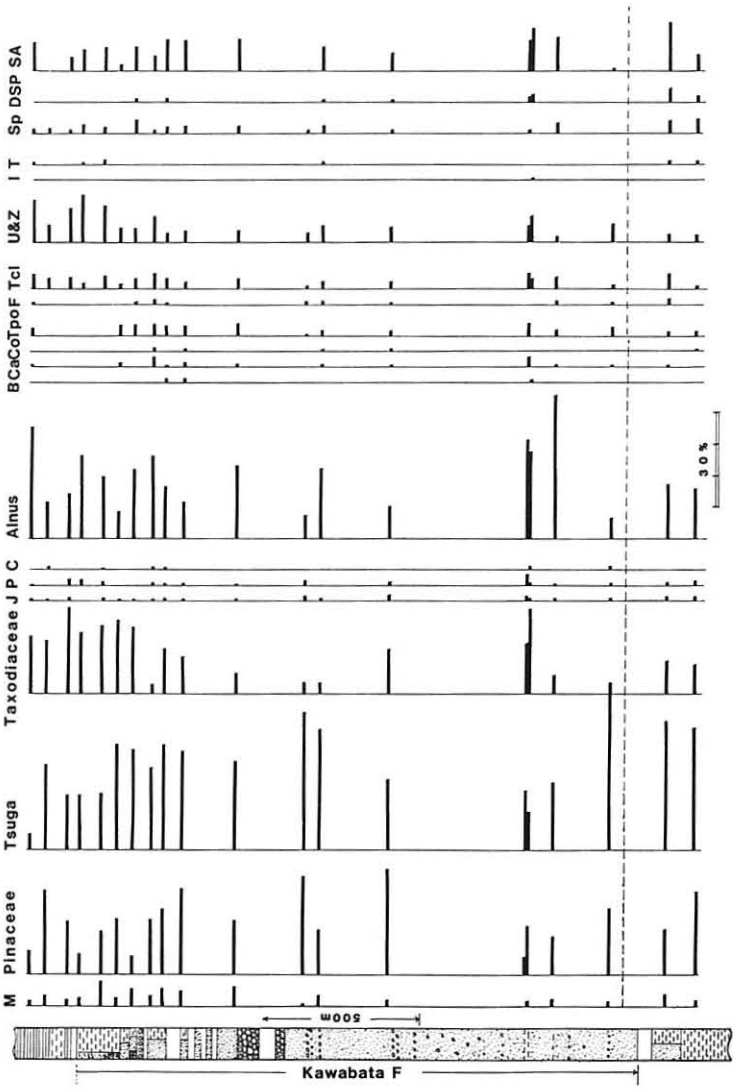
3) Kabari river area, Monbetsu district — The Kawabata Formation in this area is composed of coarser sediments than those distributed in the Rubeshibe-zawa area. The pollen floral composition is shown in Fig. 8. The pollen flora is similar in composition to that in the above-mentioned Rubeshibe-zawa area, except that Taxodiaceae and *Alnus* are higher and *Tsuga* is lower in frequency than the latter. That is, the pollen flora in this locality also indicates a cool temperate climatic condition.



Text-fig. 6 Pollen Diagram of the Kawabata Formation along the Chikubetsu River and Kumano-sawa, Yubari District



Text-fig. 7 Pollen Diagram of the Kawabata Formation along Rubeshibe-zawa, Hobetsu District



Text-fig. 8 Pollen Diagram of the Kawabata Formation along the Kabari River, Monbetsu District

Concluding Remarks

The present paper describes the pollen floras of the Masuporo-Kotanbetsu-Kawabata Formations. Results of the investigation reveal that the pollen floras in these formations in Central Hokkaido are composed mainly of *Tsuga*, Pinaceae, Taxodiaceae and *Alnus*, though their frequencies vary with the localities, indicating a cool temperate climatic condition. No assemblages composed of warm elements were observed. This is meaningful when we consider the correlations of the Neogene in Central Hokkaido (so-called non-green tuff region) and in Southwest Hokkaido (so-called green tuff region). That is, the pollen floras in the Middle Miocene sediments in Southwest Hokkaido, which may be synchronous with the Kawabata-Kotanbetsu-Masuporo Formations, are different in composition from these in the latter. This finding will be discussed further in another paper.

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References

Japan National Oil Corporation, 1972a: *Report on MITI Hamayuchi Well.* 36 pp. (MS). (in Japanese)

Japan National Oil Corporation, 1972b: *Report on MITI Wakkanai Well.* (MS). (in Japanese).

Sato, S., 1970: On the stratigraphy and correlation of Miocene sediments in Central Hokkaido — with special reference to palynology of marine sediments. *Jour. Geol. Soc. Jap.* 78, 6: 283-302. (in Japanese).

Sato, S., 1972: Palynological consideration of Tertiary marine sediments of Hokkaido, compared with animal faunas. *Jour. Fac. Sci. Hokkaido Univ.,* [4] 1-2: 217-272.

Yamaguchi, S. and Matsuno, K., 1963: *Explanatory Text of the Geological Map "Sankei"* (1:50,000). Geol. Surv.

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