553.96 : 56=581.081.3(521.11)

Palynological Study on the Kamikita Lignite, Aomori Prefecture in Japan (Part 1)*

by

Shigemoto Tokunaga**

Preface

The palynological study*** on lignite and coal in Japan has been sharply watched with keen interest in these several years.

The author performed a pollen analysis of lignite as well as field surveying, and examined the relation between depositional facies and distribution of the microplants in the lignite beds.

The lignite beds are distributed around Ogawara-numa in the east part of Aomori Prefecture.

Whether the microplants in lignite and coal beds in Japan, especially fossil pollen grains and spores, are effective or not for stratigraphical study is a question which is cleared in the future.

This report is one of the data for clarifying the question.

Geological Notes

At the neck part of the Shimokita Peninsula located in the east part of Aomori Prefecture, hills, marshes and lakes are scattered. The Pleistocene deposits making up hills are composed of sand, gravel, clay and so on.

Two lignite seams are interbedded in the Pleistocene deposits which stratify almost horizontally. To the west of Shichinohe-machi, the Miocene deposits are distributed in wide area which are composed of green tuff, tuff-breccia and agglomerate.

The Pleistocene deposits rest unconformably on them. On the other hand, the Pleistocene deposits are broadly covered by pumiceous sand and gravel beds. Since the *Paleoloxodon aomoriensis* TOKUNAGA et TAKAI was found in Tenjindo, Shichinohe-machi, the present Pleistocene deposits was considered to be of early Pleistocene age.

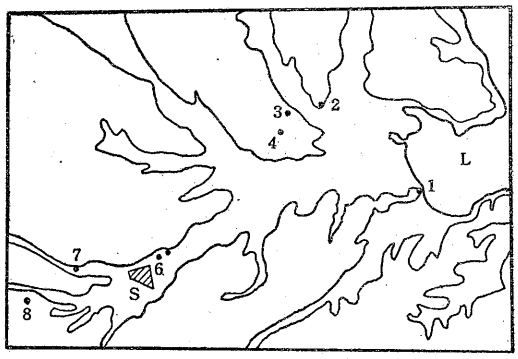


Fig. 1. Outcrops of lignite seams

1. Numazaki 沼崎 2. Sumomo-zawa 李澤 3. Kaizuka 貝塚 4. Enokibayashi 榎林 5. Shinchi 新地 6. Shichinohe-machi 七戸町郊外 7. Sakuta 作田 8. Yamaya 山屋 L. Ogawara-numa 小川原沼 S. Shichinohe-machi 七戸町

After that, however, another opinion which the deposit may be middle Pleistocene in age by its rock facies and the presence of *Juglans Sieboldiana hosenjiana* KRYSH., *Menyanthes* beds in lignite, was introduced. The lignite seams interbedded in the alternation of clay and gravel-bearing sand crop out at 8 points of the hilly land. The upper lignite seam, 0.30 to 1.00 meters in thickness, observed around Shichinohe-machi, Shinchi and Yamaya, is humid. And it is composed mainly of stems, roots and leaves of herbs associated with clay.

The lower lignite seam is intercalated in the alternation of clay, ligneous part, sand and the like. The carbonaceous part is about 0.6 meters in thickness. The lower lignite seam, thicker toward east, had been worked several times at Numazaki, Sumomo-zawa and Enokibayashi.

The remnants of *Carex* and the seeds of *Menyanthes* in the two lignite seams are visible even to the naked eye.

* Palynological and stratigraphical studies on the Pleistocene lignite and peat deposit in Japan. 1.

** Staff of Div. Fuel in Geol. Surv. Japan.

*** Palynology means pollen and spore science.

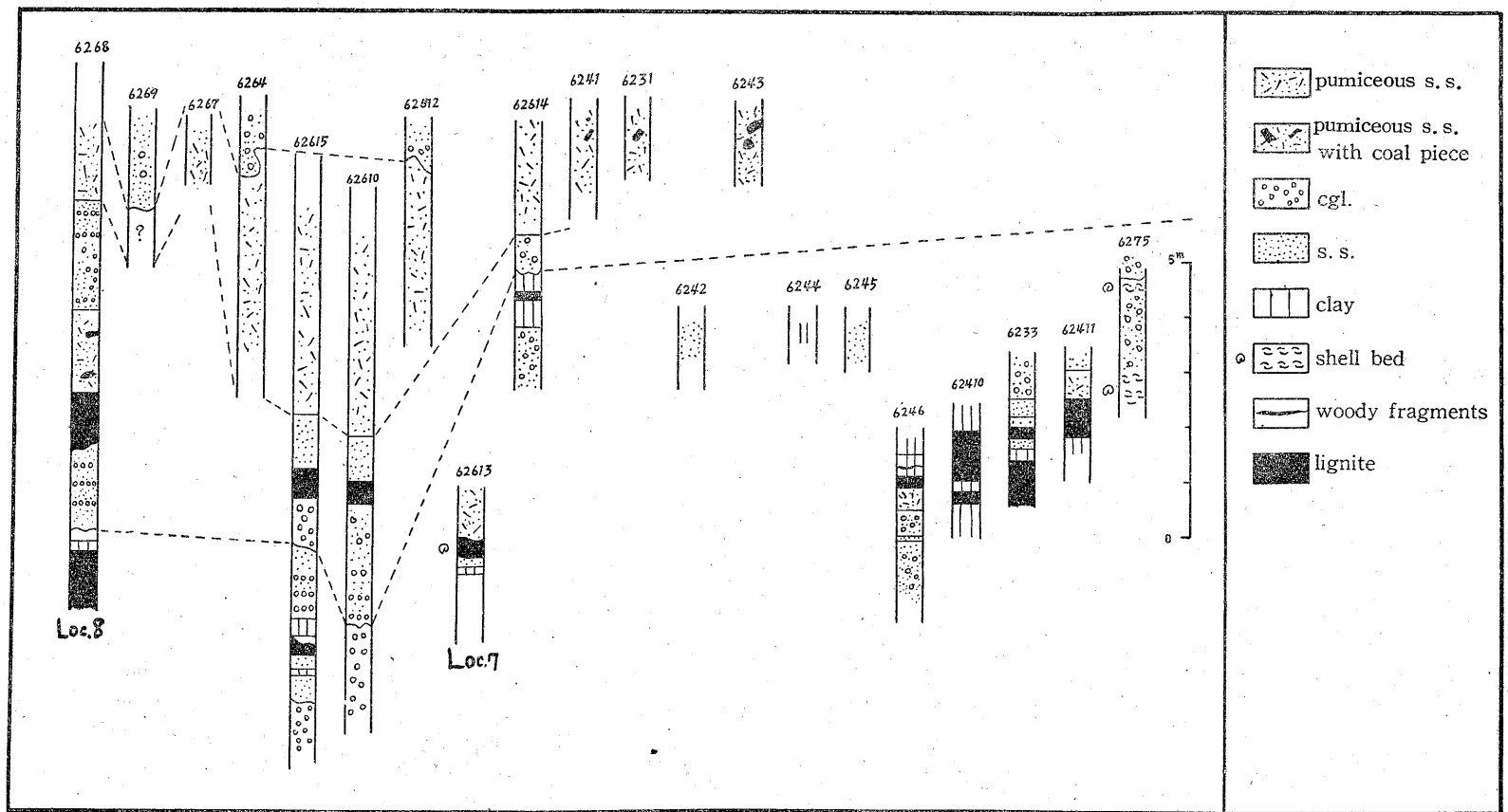


Fig. 2. Geologic columnar section in the Kamikita district

Technique

The samples for pollen analysis are collected at 8 points, Yamaya, Shinchi, Sakuta, Mukai-machi, Kaizuka, Sumomo-zawa, Enokibayashi, and Numazaki. These localities are shown in fig. 1.

Several grams of the testing materials are disentangled and put under the KOH treatment which is very simple in process. The materials are soaking in the 10 % KOH. After about half a day as it is, they are

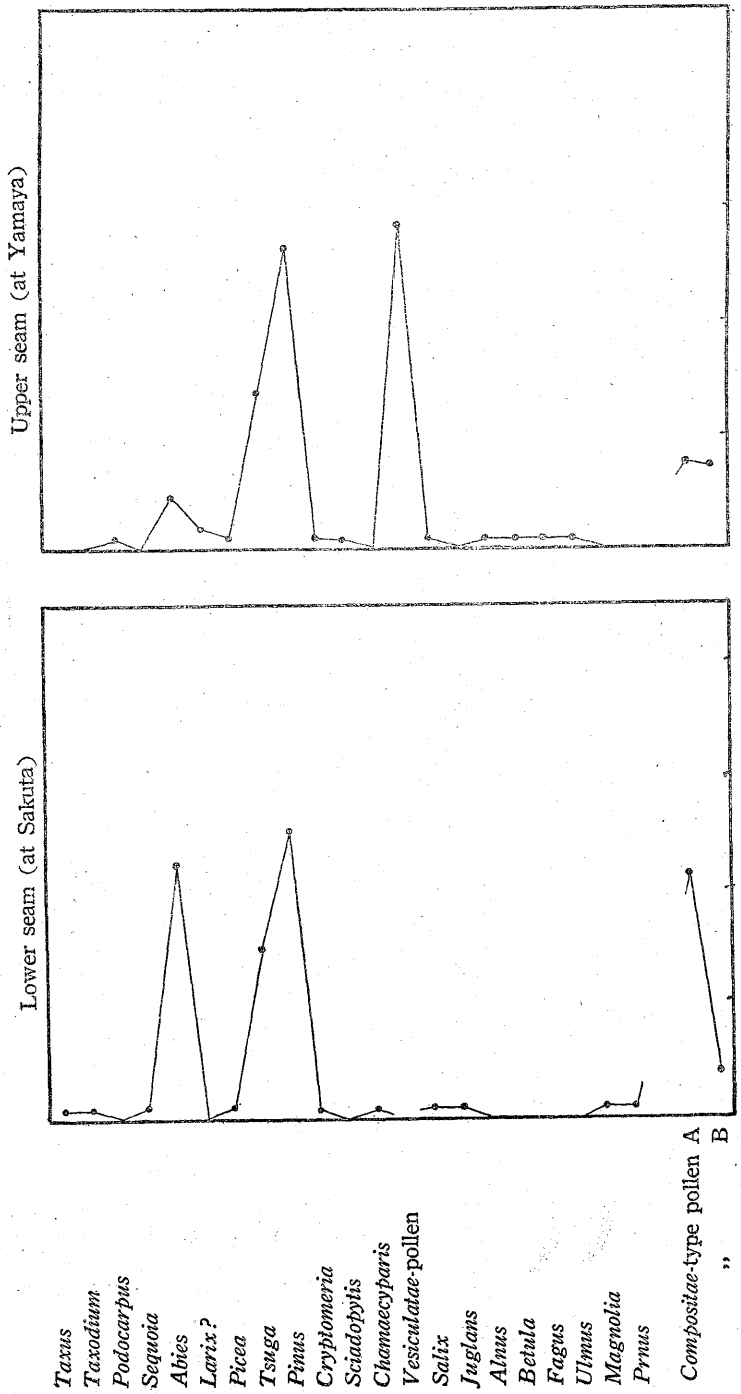


Fig. 3. Pollen diagrams of the two lignite seams

washed repeatedly and separated in a centrifuge. Being washed several times again, they are mounted in gum-chloral.

The results of the analysis at Yamaya and Sakuta are described in this paper.

Discussion

The pollen analysis was carried out as regards the materials from the Loc. 8 (maceration KM. 8. No. 6268, the upper lignite beds, Yamaya) and the Loc. 7 (maceration KM. 7, No. 62613, the lower lignite beds, Sakuta), and the following result was obtained.

From the Loc. 8: *Podocarpus*, *Abies*, *Tsuga*, *Pinus*, *Cryptomeria*, *Sciadopitys*, Vesiculatae-type* (Faegri & Iversen 1950), *Salix*, *Alnus*, etc.

From the Loc. 7: *Taxus*, *Taxodium*, *Abies*, *Picea*, *Tsuga*, *Pinus*, *Cryptomeria*, *Sequoia?*, *Chamaecyparis*, *Salix*, *Juglans?*, *Magnolia?*, *Alnus*, *Prunus*, Compositae-type, etc.

Besides these pollen, many spore and monocotyledoneae pollen were found. The Compositae-type pollen are classified into two types: A and B by size of grain. The type A is larger than 40 μ, and type B is smaller than 30 μ.

The pollen diagram of two lignite seams are shown in fig. 3. Though it is difficult to identify because of destruction and other reasons, there are seemingly pollen grains of Gramineae. The Vesiculatae-type pollen such as *Pinus* and *Abies* are specially abundant in the two lignite seams in quantity, being quite different from the present condition of forest sequence where the lignite seams were deposited.

In the lower seam, the total figure of the aculeate pollen is estimated to 25 % in total, but in the upper seam only 14 %.

The characteristic *Tsuga* pollen is contained in two lignite seams.

Description of the Characteristic Types

Podocarpus type

Grains provided with two bladders. Bladders are much larger than the body of grain in size. Grains about 40 μ in length. The largeness of grain is smaller in comparison with that of the *Abies*-type and others.

Germinal furrows is sharp. According to the above reasons, it has been identified as *Podocarpus*.

Abies type (Pl. 1, fig. 1.)

Grains 84 to 120 μ in diameter. Generally grains distinguished from other winged pollen (Vesiculatae-type) by their size.

Many fossil pollen of this type have been found in sediments. The common types are as follows:

1933. *Abies sachalinensis* Fr. Schm.: Rept. Forest. Exp. Stat., Kyoto Univ. Vol. 1, No. 5.
1942. *Abies balsamana* (L.) Mill.: Trans. Wis. Acad. Sci., Vol. 34.
1951. *Abies* type: Geol. Jahrb. Bd. 65, Taf. A, fig. 11.
1951. *Abietineae-poll. labdacus maximus* R. Pot.: Paleont. Bd. 91, Taf. 20, fig. 20–23.

Larix type (Pl. 1, fig. 2)

Grains spheroidal, ranging from 80 to 96 μ in diameter. Exine thin, with no flecks. The fossil and recent *Larix*-type pollen are as follows:

1933. *Larix dahurica* Turcz. var. *japonica* Maxim.: Rept. Forest. Exp. Stat. Kyoto Univ. Vol. 1, No. 5.
1933. *L. Kaempferi* Sargent: Sci. Rep. Tōhoku Imp. Univ., Vol. 4, No. 8.
1951. *Laricoidites magnus* R. Pot.: Geol. Jahrb. Bd. 65, Taf. C, fig. 9, 10.
1950. *Larix*: Paleont. Bd. 90, B, H. 4–6, Taf. 18, fig. 34.
1950. *L. poll.*: ibid. Taf. 13, fig. 8.
1951. *Laricoipollenites magnus* R. Pot.: Paleont. Bd. 91, B, Taf. 20, fig. 26.
1952. *Inap. Poll. magnus* R. Pot. /cf. *Larix*: Notizbl. hess. L.-Amt. Bodenforsch. Bd. 6, H. 3, Taf. 12.

Tsuga Type (Pl. 1, fig. 3)

Grains approximately spheroidal, found from the lignite bed are 60 to 78 μ in diameter rather globe in form. Exine is corugated. Bladder absent. but around the grain surface occurs the vestige of wings, namely of the belt of air sac. This *Tsuga*

* The "Vesiculatae" type pollen has two wing bladders.

type pollen grain resembles most the *Tsuga diversifolia* MASTERS.

The fossil and recent *Tsuga* type pollen, having so far been found, are as follows:

1933. *Tsuga diversifolia* MASTERS: Sci. Rep. Tohoku Imp. Univ., Vol. 4, No. 8.
1939. *T.* sp.: Jubilee Pub. Prof. Yabe, Vol. 1, Pl. 16, fig. 7.
1942. *T. canadensis* (L.): Trans. Wis. Acad. Sci. Vol. 34, fig. 14.
1950. *T. canadensoider (major) Typ.* RUDOLPH: Geol. Jahrb., Bd. 65, A, fig. 19.
1950. *T. diversifolioider (minor) Typ.* RUDOLPH: ibid. Taf. C, fig. 7.
1951. *Tsuga diversifolioider (major) Typ.* RUDOLPH: ibid. Taf. A, fig. 18.
1951. *T. diversifolia* type: Research Rep. Kochi Univ., Vol. 1, No. 2, Pl. 1, fig. 8.
1951. *T. canadensis* type: ibid. Pl. 1, fig. 9.
1951. *T. -poll. macroserratus major* WOLFF: Paleont. Bd. 91, B, Taf. 20, fig. 24.
1951. *T. -poll. igniculus major* R. POT.: ibid. Taf. 20, fig. 25.

Pinus type (Pl. 1, fig. 4, 5, 6)

Grains with two large bladders, mostly 40–55 μ (excluding bladders) in length of Grain (GL). *Pinus* type pollen grain is contained mostly in the Kamikita lignite. *Pinus* type pollen has been generally found in Quaternary and Tertiary sediments. The common types are as follows:

1933. *Pinus pumila* REGEL: Rept. Forest. Exp. Stat. Kyoto Univ. Vol. 1.
1933. *P. densifolia* SIEB. et ZUCC.: Sci. Rep. Tōhoku Imp. Univ., Vol. 4, No. 8, fig. 2, a, b.
1942. *P. Bankshire*: Trans. Wis. Acad. Sci., Vol. 34.
1950. *P. silvestroider (minor) Typ.* RUDOLPH: Geol. Jahrb. Bd. 65, Taf. A, fig. 15, Taf. C, fig. 4.
1951. *P. silvestroider (major) Typ.* RUDOLPH: ibid. Taf. A, fig. 14, Taf. C, fig. 3.
1951. *P.* sp.: Research Rep. Kōchi Univ., Vol., 1, No. 2, Pl. 1, fig. 6.
1952. *P. haploxylon-Typus*: Notizbl. hess. L. -Amt. Bodenforsch. Bd. 6, H. 2, Taf. B. fig. 52.
1952. *P. silvestris-Gruppe* RUDOLPH: ibid. H. 3, Taf. 11, fig. 21.
1952. *P. haploxylon-Gruppe* RUDOLPH: ibid. Taf. 12, fig. 22.

Cryptomeria type (Sequoia?) (Pl. 1, fig. 7)

Grains spheroidal, 30 μ in diameter, provided with single germ pore, consisting of a finger-like projection, somewhat bent to one side, but no sharp. Many species of *Cryptomeria* and *Sequoia (Metasequoia)* type pollen have been found in Quaternary and Tertiary sediments in Japan. The following fossils are known.

1939. *Cryptomeria japonica* D. DON: Jubilee Pub. Prof. Yabe, Pl. 17, fig. 6.
1946. *Sequoia lapillipites* WILSON & WEBSTER: Amer. Jour. Bot. Vol. 32, No. 4.
1951. *Sequoioidites polybormosus* THIERGART: Geol. Jahrb. Bd. 65, Taf. A, fig. 20, 21, Taf. C. fig. 8.
1951. *Sequoia* sp.: Research Rep. Kochi Univ. Vol. 1, No. 2, Pl. 1, fig. 10, 11.
1951. *Sequoioidites polyformosus* THIERGART: Paleont. Bd. 91, B. Taf. 20, fig. 16, 16 a.

Salix type (Pl. 1, fig. 8)

Grains spheroidal, flattened, 20–23 μ in diameter, tricolpate form. The following fossils are known.

1950. *cf. Salix*: Paleont. Bd. 90, B. H. 4–6. Taf. 18, fig. 68, a, b.
1950. *Salicoidites-poll.*: Geol. Jahrb. Bd. 65, Taf. B, fig. 3.
1952. *Tricolp.-poll. retiformis* THOMS. & PELUG/*cf. Salix*: Notizbl. hess. L. -Amt. Bodenforsch. Bd. 6, H. 3, Taf. 12, fig. 50.

Alnus type

Grains flattened, 35–40 μ in diameter, with five germinal aperture, found in the lignite bed. Pentagonal form in polar view.

The common types of Alnus pollen are as follows:

1933. *Alnus japonica* STEUDEL: Sci. Rep. Tōhoku Imp. Univ. Vol. 4, No. 8.
1933. *A. tinctoria* SARG.: Rept. Forest.

Exp. Stat. Kyoto Univ. Vol. 1, No. 5.

1933. *A. alnobetula* HARTIG var. *fruticosa* WINKL: ibid.

1942. *A.* sp.: Trans. Wis. Acad. Sci., Vol. 34.

1946. *A. specipites* WODEHOUSE: Amer. Jour. Bot., Vol. 33, No.4.

1950. *A.* cf. *glutinosa* GAERTN: Geol. Jahrb. Bd. 65, Taf. C, fig. 19, 20.

1950. cf. *Alnus*: Paleont. Bd. 90, B. H. 4-6, Taf. 18, fig. 69.

1951. *A. -poll. metaplasmus* R. POT.: Geol. Jahrb. Bd. 65, Taf. B, fig. 17, 18.

1951. *A. -poll. metaplasmus* R. POT.: Paleont. Bd. 91, B. Taf. 20, fig. 55, 56.

1951. *A.* sp.: Research Rep. Kochi Univ. Vol. 1, No. 2, Pl. 1, fig. 17.

1952. *Stephanopor-poll. versus* R. POT./ cf. *Alnus*: Notizbl. hess. L. -Amt. Bodenforsch. Bd. 5, H. 3, Taf. 12, fig. 77-81.

Ulmus type (Pl. 1, fig. 9)

Grains oblate, 22 μ in diameter, germinal pore four, elliptical in shape, texture of the exine marked undulation.

The common types of *Ulmus* pollen are as follows:

1942. *Ulmus americana*: Trans. Wis. Acad. Sci., Vol. 34, fig. 37, 38.

1951. *Ulmoidites undulosus* WOLFF: Geol. Jahrb. Bd. 65, Taf. B, fig. 36, 37. Taf. C, fig. 23.

1951. *Ulmus* sp.: Research Rep. Kōchi Univ., Vol. 1, No. 2, Pl. 1, fig. 16.

Summary

The subject of this report is the palynological study on the Kamikita lignite beds. The stratigraphy of the Kamikita lignite field has been described at the beginning.

About 20 types of pollen grains chiefly of the trees were picked out from the lignite beds. The picking technique and the results of pollen analysis has been briefly explained in the subsequent article.

The main types among the fossil pollen grains are represented through microscopic photographs. The author's work on pollen analysis has been undertaken so as to be a key for interpreting the stratigraphy of coal-bearing formation and the correlation of coal seams.

Refrence

Faegri, K. & Iversen, J.: Text Book of Modern Pollen Analysis (Ejinar Munksgaard), 1950.

Jinbo, T.: The diagnosis of the Pollen of Forest Trees, Sci. Rep. Tohoku Imp. Univ., Ser. 4, No. 8, 1933.

Minato, M. & Fukada, T.: On the Horizon of *Paleoloxodon aomoriensis*, Earth Science, No. 2, Kyoto Imp. Univ., 1950.

Nakamura, J.: Fossil Pollen in the Nahari Lignite, Rept. Kochi, Univ. Nat. Sci. No. 2, 1951.

Shimada, M.: Pollen Grains in Lignite from the Environment of the City of Sendai, Jour. Bot. Vol. 63, 1950.

Shimada, M. & Takahashi, N.: Pollenanalysis of Lignite II., Sci. Rept. Tohoku Univ. Vol. 19, No. 1, 1952.

Wodehouse, R. P.: Pollen Grains, Mc. Graw Hill Bk. Co. N. Y., 1935.

青森縣上北亞炭の花粉分析的研究

(その1)

徳 永 重 元

要 旨

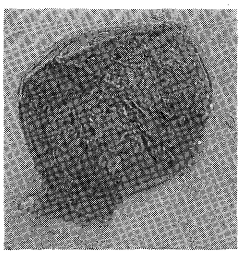
青森県東部の上北亜炭田において，地質調査を行うとともに，亜炭の花粉分析を行つた。亜炭中には毬果類 (Conifer)，特に *Abies* (モミ)，*Pinus* (マツ)，*Tsuga* (ツガ)等の花粉が多く含まれ，また Compositae (キク科) 植物の花粉と推定されるものも特に多産した。これらの含有微植物体によつて上・下2炭層を比較し，多少の差異を見出しえた。

この報告には，そのなかのおもな花粉型について略述し，顕微鏡写真によつて化石花粉の形態を示し，今後行う予定の亜炭の花粉分析の基礎資料とした。

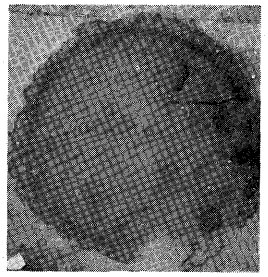
第2報においては，亜炭田各所における分析結果の綜合と，さらに詳細な化石花粉の記載を行い，化石花粉および胞子を炭層対比に応用する基礎としての資料を提示する予定である。

なお，この報告は "花粉分析による石炭原植物の研究" の一部をなすものである(第1報)。

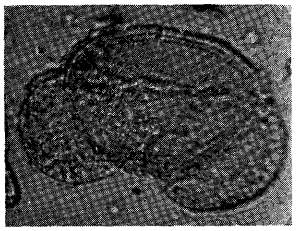
1



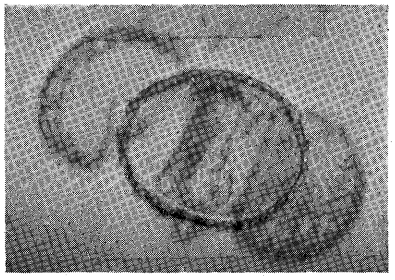
2



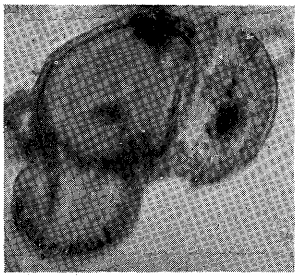
3



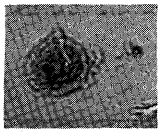
4



5



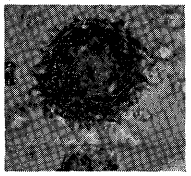
6



7

8

9



10

11

Explanation of Plate 1.

Plate. 1. *Abies* type: (Upper Seam) ×400 2. *Larix* type: (Lower Seam) ×400 3. *Tsuga* type: (Lower Seam) ×400 4, 5, 6. *Pinus* type: (Upper Seam) ×400, 400, 500 7. *Cryptomeria* type: (Upper Seam) ×400 8. *Salix* type: (Upper Seam) ×500 9. *Ulmus* type: (Upper Seam) ×500 10. Compositae type: (Upper Seam ×400 11. Monocotyledoneae type pollen: (Upper Seam) ×500

All the figures are untouched negatives.

Photo. by S. Tokunaga