NOTE ON THE FIRST FOSSIL RECORD OF GENUS *DACRYDIUM* FROM THE JAPANESE TERTIARY

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The genus *Dacrydium*, a rainforest conifer, occurs in the Philippines, Southeast Asia, New Caledonia, New Zealand and Chile. The fossil record of this genus is well known in New Zealand and Australia. While in Japan, a complete fossil of *Dacrydium* had not been recorded, but I recently obtained abundant pollen grains of *Dacrydium* from the Japanese Tertiary. This discovery will add a genus of tropical conifer to the Middle Miocene flora of Japan.

The sampling site is in the Namiishi Valley, Kurokawa Village, Niigata Prefecture (Fig. 1). Here, as shown in Fig. 2, the Tertiary basal conglomerate unconformably overlies Paleozoic rocks. The sample was taken from tuffaceous sandy siltstones, which contain much carbonaceous matter and many cones of Pinaceae, 60 cm above the basal conglomerate. These sediments, according to NISHIDA and TSUDA (1961), constitute the lowermost part of the Kamagui Formation which has been correlated with the Middle Miocene

Tsugawa Formation of the standard succession of the Neogene sediments in the Niigata oil field.

The sample was treated with KOH (10%), HF (47%), HCl+HNO₃ (1:1) and acetolysis method, and then with a solution of ZnCl₂ (sp. gr. 1.9).

Pollen grains of *Dacrydium* from the Kamagui Formation show considerable variations in morphological feature, and the typical forms are shown in Plate I. The pollen grains are 2-saccate (exceptionally 3-saccate), occasionally synsaccate or nearly so. Corpus about 42×48×40 μ; sacchi about 29×52×33 μ. According to the type classifications of this genus by UENO (1960) and ERDTMAN (1965), these pollen grains fall severally under 3:5 type and A₃ type, (such as *D. elatum* or *D. cupressinum*).

The analytical results are shown in Fig. 3. The greater part of pollen assemblage consists of coniferous members. Pollen grains, identified as *Dacrydium*, constitute 19% of the spectra. Although the spectra do not completely reflect the character of the vegetation of the adjacent coastal areas, there is no doubt that the pollen grains of *Dacrydium* were not transported from distant places. The sedimentary environment of the area investigated is lagoonal or littoral.

In Japan, *Dacrydium?* *transiens* was described by SATO (1961), from the Upper Cretaceous sediments of Hokkaido. This pollen is the same type as *Phyllocladites* which was reported by TAKAHASHI (1964) and MIKI (1973) from the Upper Cretaceous of Hokkaido. Those sporotypes of *Phyllocladites*, according to COUPER (1960), may be classified under the genus *Dacrydiumites* for

Fig. 1. Location of the sampling site.

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Fig. 2. Columnar section of the sampling site.

Fig. 3. Composition of pollen spectra.

fossil pollen grains of the atypical *Dacrydium*. They are comparable with the pollen of *Phyllocladus* or *Dacrydium franklinii*, and are clearly distinguished from typical pollen grains of *Dacrydium*.

The Middle Miocene vegetation, based on mega-plant fossil record, has the composition of mixed stand forest of deciduous and evergreen hardwoods, accompanied by deciduous and southern conifers such as *Metasequoia*, *Glyptostrobus*, *Cunninghamia*, *Taiwania*, *Fookienia* and *Libocedrus* (TANAI and HUZIOKA, 1966).

Many leaf impressions and seeds of *Libocedrus* were found in the Middle Miocene (Noroshi flora) of the Noto Peninsula, Central Japan (ISHIDA, 1970). The living *Libocedrus* occurs in similar regions as the genus *Dacrydium*. Thus, it is expected that mega-plant fossils of *Dacrydium* will be eventually found and then the yield range of this pollen in Japan will be clarified.

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Fig. 1に掲載した地図は、建設省国土地理院長の承認を得て、同院発行の5万分の1地形図を複製したものである。(承認番号) 昭 49 総復第 414 号

Explanation of Plate I

Dacrydium sp. from the Kamagui Formation (Middle Miocene). ×900.

- 1A: Polar view, proximal face.
 1B: Polar view, optical section.
 1C: Polar view, distal face.
 2A—2C: Lateral longitudinal view at three different foci.
 3A—3C: Lateral transverse view at three different foci.