

**Plant Fossils of the Izumi Group (Upper Cretaceous)  
in the Izumi Mountain Range, Kinki District, Japan.\***

by

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**I: Introduction**

Twelve years ago, the writer reported on a cone of the *Cunninghamia* sp. from the western part of the Izumi Mountain Range (1954; 362, text-fig. 1), which has long been known to be formed of the upper Cretaceous deposits in the Japanese Islands. A cone of *Cunninghamiostrobus yubariensis* was described by Drs. M. STORER and K. FUJII (1910; 45-52, text-fig. 15) from the upper Cretaceous of Hokkaido. The writer assumes it to closely resemble in shape the small globular cone of the Izumi specimen.

On the aquatic plant fossils, the works on *Archaeozostera lineata* and other three species were published by Drs. K. KÔRIBA and S. MIKI (1931; 165-204, IV, V: 1958; 107-110, I,II).

However, this is the first note but one to report on the land plant fossils from the Izumi Group.\*\*\* In the writer's collection there are some more materials, but are mostly very unsatisfactory in the mode of preservation to allow diagnosing.

In this report, the writer tries a description on two Gymnosperm species and a leaf of a Dicotyledon species, that have been yielded in the Kin'yûji Bed of the Izumi Group. The former are *Zamites* sp. and *Cunninghamia izumiensis* n. sp. discovered at the road side of Inukai village, Misaki-chô, Osaka-Fu; while the other, "*Ficus*" sp., was found along the shore zone of Kada-chô, Wakayama City.

The writer wishes to express his sincere thanks to Dr. I. HAYASAKA for his kind criticism, and reading the manuscripts.

**II: Geological Notes**

These land plants were collected by the writer from the Kin'yûji conglomerate and sandstone Bed of the Izumi Group in the western part of the Izumi

\* Read January, 21st, 1956 in the meeting of Palaeontological Society of Japan, at Sendai.

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\*\*\*K. HIRAYAMA (1933;22) noted a fern species of *Cladophlebis actipenis* Oishi from the Hikota Bed of Tokushima Prefecture.

Mountain Range; this bed conformably overlies the Takinoike shale Bed,\* which contains many molluscan shells (*Baculites*, *Bostrichoceras*, *Gaudryceras*, *Parapachidiscus*, *Turrilites*, etc. among ammonites; *Astarte*, *Grammatodon*, *Inoceramus*, *Pecten*, *Trigonia*, etc. among pelecypods:\*\* *Natica*, *Tyrostoma*, etc. among gastropods). This Takinoike Bed conformably overlies the Kasayama basal conglomerate Bed, which has been believed to be the basal part of the Izumi Group; by the evidence of all marine fossils, this group is considered to correspond to the Urakawa-Hetonai Series in the Japanese Cretaceous (See Table-1).

Table-1 : Stratigraphical Succession of the Izumi Group at the Western Part of the Izumi Mountain Range.

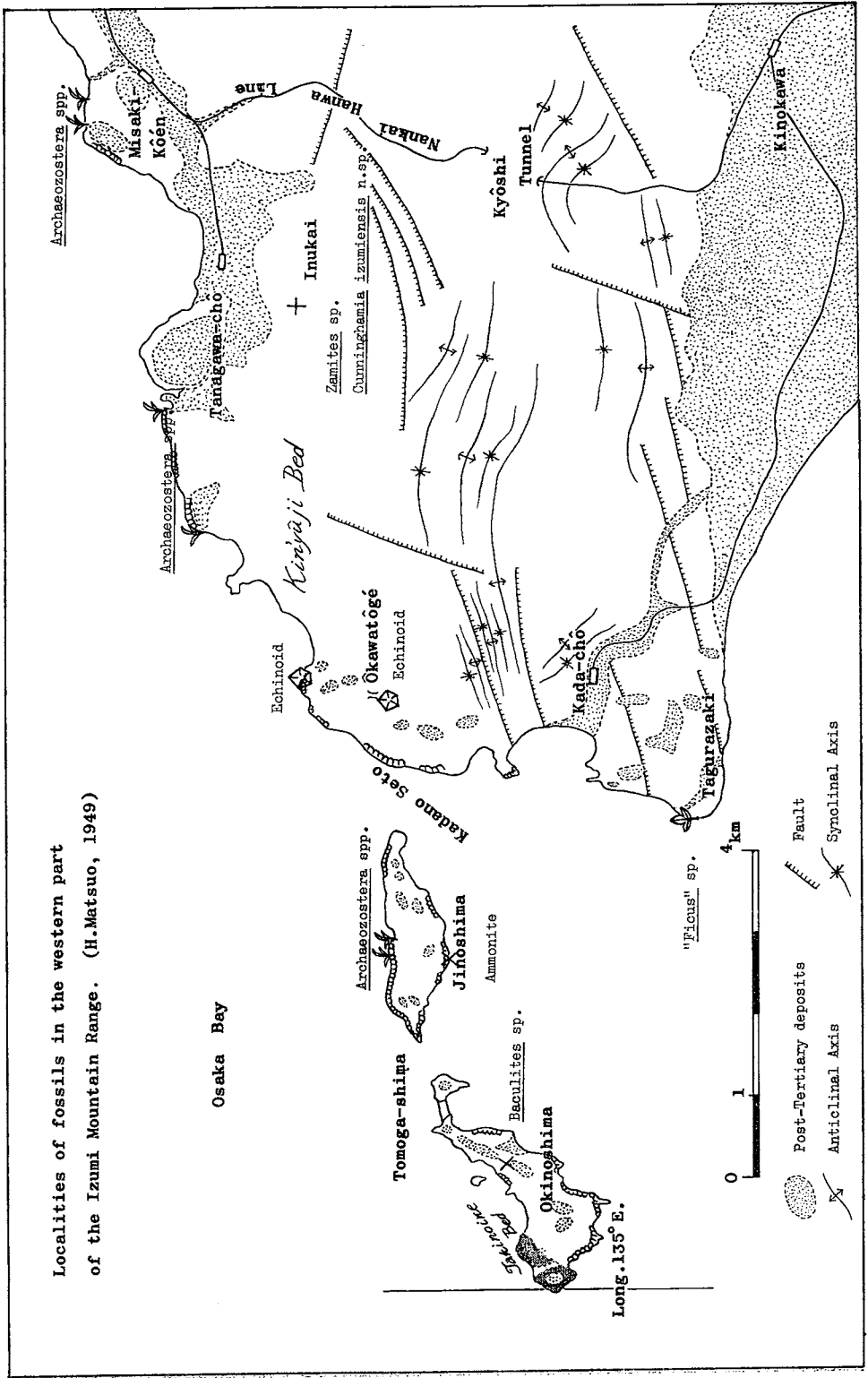
Age	T.KOBAYASHI(1936)	H.MATSUO(1949:MS)	T.MATSUMOTO(1953)	
Upper Cretaceous	Hetonai Series	Negoro Sandstone and Shale Bed	Nate Conglomerate and Sandstone Bed	
			Negoro Shale and Sandstone Bed; 500m in thickness	
	Urakawa Series	Tsuzurahata Bed	Kazafukitogé Sandstone and Conglomerate Bed	Tsuzurahata Sandstone and Shale Bed; 2,000m in thickness
			Warazuhata Sandstone and Shale Bed	Warazuhata Shale and Sandstone Bed; 1,500m in thickness
		Kin'yūji Bed	Kin'yūji Conglomerate and Sandstone Bed	Kin'yūji Sandstone and Conglomerate Bed; 1,000m in thickness
Azenotani Bed		Takinoike Shale Bed	Azenotani Shale Bed; 400-500m in thickness	
	Kasayama Basal Conglomerate Bed	Kasayama Basal Conglomerate Bed	Kasayama Conglomerate Bed; 10-150m in thickness	
?	Granite	Pre-Izumi Sandstone Bed and Quartzporphyry or Gneissose Granite, etc.		

The Kin'yūji Bed is considered to have been deposited under a brackish embaymental condition, because it yielded *Archaeozostera* spp. A few echinoid

\* This bed had been reported by T.KOBAYASHI under the name of the Azenotani shale Bed (1931;632). Azenotani is the local name at the northern side of the Mt. Kasayama.

\*\*Most recently, K.ICHIKAWA and Y.MAEDA reported on the Cucullaeidae from the Izumi Group (1958; 61-78, I, II).

Localities of fossils in the western part of the Izumi Mountain Range. (H. Matsuo, 1949)



*Archaeozostera* spp.

*Archaeozostera* spp.

Osaka Bay

*Kinyūji Bed*

Echinoid

*Archaeozostera* spp.

Tomoga-shima

Okinoshima

*Baculites* sp.

Jinoshima

Ammonite

*Okawatōgē*

Echinoid

Inukai

*Zemites* sp.

*Cunninghamia izumiensis* n.sp.

Nankai

Haikwa Lane

Kyōshi Tunnel

Kada-cho

"*Ficus*" sp.

4 km

1

0

Post-Tertiary deposits

Fault

Anticlinal Axis

Synclinal Axis

Kinokawa

Long. 135° E.

tests have been discovered by the writer in the black shale and the coarse sandy mudstone layers at the basal part of this bed. Its sedimentation might have taken place during the condition of regression which corresponds to the regression facies of the Urakawan age: the alternation of small pebbly conglomerate layers and coarse sandy layers are the evidence.

The layer yielding *Zamites* sp. and *Cunninghamia izumiensis* is found in the middle part of the Kin'yūji Bed; there is an alternation of the pale brown grey sandy shale layer and coarse sandstone layer at Inukai locality.

The layer yielding "*Ficus*" sp. is found in the same horizon, it occurred in one of the bluish compact medium sandstone layers which are in alternation with bluish grey, massive medium sandstone layers, at Kada-chō locality.

### III: Description of the three species from the Kin'yūji Bed.

The materials at the writer's disposal are incomplete leaves and a cone, but a fragment of *Zamites* sp. shows that it is a pinnate Cycadacean leaf: a Cunninghamian cone shows an imbricate scale-bearing, to prove it belongs to Recent genus of Taxodiacean (especially, Taiwaniaceae, Cunninghamiaceae) and Pinacean (especially Abitaceae) of the Northern Hemisphere. The *Ficus*-like leaf impression to be mentioned last, suggests itself to be a trinerved and palmated one.

## GYMNOSPERMAE

### *Zamites* sp.\*

Plate I, fig. 1.

The preservation of only one specimen is too poor to make out of the details, which was discovered by the writer in December, 1952, in association with Cunninghamian cone. It has nine pinnules in alternation on the axis.

*Description:* Frond pinnate; pinnule alternate and lanceolate, 6 to 7 mm broad and 30 mm long; base restricted; apex narrowly rounded, vein obscure, simple, about six or seven in number, slightly diverging from base.

*Discussion:* This material seems to be very close to the Kamogata specimen (Pl. I, fig. 2), which was collected by the writer, together with some Sequoian twigs in winter, 1961 (1964;52). This single specimen occurred at a road cutting at Sugitani, Kamogata-machi, Okayama Prefecture, discovered by K.SŌDA in 1955: the flora containing it was named by T. ŌYAMA the Kamogata flora in 1962.

According to the text-books by W. SCHIMPER (1890), A. C. SEWARD (1898-1919), W. GOTHAN and WEYLAND (1954 & 1964), among others, these cycadean

\*This species had been reported by the writer as *Zamites izumiensis* n. sp. (MS) (1964; 52).

leaves of *Zamites* and *Ptilophyllum* closely resemble each other. If this Izumi specimen had been found in the lower Cretaceous formation, it might possibly have been referred to *Ptilophyllum pecten* PHILLIPS, which seems to be somewhat smaller in size than the former. Of the smaller size, *Zamites arcticus* HEER in the Cretaceous age in the North Greenland (SCHIMPER, 1890; 218-219, figs. 158-3) very closely resemble the Izumi form. The larger one, *Zamites gigas*, is possibly to be identified with GOTHAN and WEYLAND'S figures (1954; 293, 272-e and 1964; 321, 212-e).

The writer considers that there is no doubt that the Izumi specimen belongs to *Zamites*: had the specimen been a well preserved one, it might have represent a new species.

Locality: Road-side of 300 m N in Inukai Village, Tanagawa-chô, Misaki-Machi, Osaka-Fu (Prefecture).

Holotype: Reg. No. DGLAKZ-12540.

*Cunninghamia izumiensis* new species

Plate I, figs. 3-5 & 8.

All the specimens, cone and some twigs had been collected by the writer together with the above mentioned *Zamites* sp.

*Description*: Leaves needly lanceolate, spirally disposed, 20 mm long and 2.5 mm wide, falcate-cave rather thick, midrib being marked on lower surface by some weekly rounded fine keel, indistinguishable fine serration at margin. Leaf scars on axis, pronounced, rhomboidal to obovate. Cone: globular, 27 mm by 28 mm in size, seemingly shaped much like living *Cunninghamia konishii*. Cone-scales: 5 mm broad, chest-nut like form, imbricated like in the living *Cunninghamia*.

*Discussion*: This is the only specimen of cone the writer has hitherto obtained and found unattached cone. It is incomplete, although it looks complete (a cone-bearing twig) on the sandy shale at Inukai locality.

In general shape it looks more like *Cunninghamia konishii* than the other recent species *C. sinensis*. Furhter, it more closely resembles in shape the recent species than *Cunninghamiostrobus yubariensis* STORÉS & FUJII from the upper Cretaceous of Hokkaido. Describing the Hokkaido species, they remarked as follows: "-- cone intermediate in size between *Cunninghamia sinensis* and *C. konishii*. Scales less pointed than in the former. In general shape more like *C. sinensis* than *C. konishii*." The cone of new species *C. izumiensis* is larger than the upper Cretaceous species of Hokkaido. This fact seems to involve an interesting problem for the study of palaeogeography in the late Cretaceous age in Japan. If the late Cretaceous climate of the region concerned is to be considered to have been temperate-subtropical, Hokkaido Island would naturally have been cooler even without

reference to the influence of the climate of the Siberian continent, than the Izumi Mountaineous land. What is now, the Izumi Mountaineous land might have an isolated high island like the Island of Formosa now is.

It may be appropriate to refer to the other upper Cretaceous *Cunninghamia*-like specimen, described by W. BELL in 1949, as *Torreyites torrelli* (DAWSON) from the Edmonton formation of Canada (1949; 47, VII, figs. 1 and 2): the author doubted wheather it is not *Cunninghamites elegans* HEBER from the Pattoot beds of Greenland. In his description of the species, BELL remarked as follows: "-- At first the writer was inclined to consider DAWSON's species (*Abietites torrellii* DAWSON) on account of associated ovoid-globular cones described elsewhere in this report as *Pityostrobus* sp. (47, *Cunninghamiostrobus* ?) but no proof was found of any organic connection between cones and foliage." The writer is uncertain if the Canadian species does belong to the upper Cretaceous *Cunninghamia*, however. The Izumi specimen on the other hand, is the undoubtly a species of *Cunninghamia* of the upper Cretaceous age in the Northern Hemisphere, so that, the writer proposes a new specific name for it after the Izumi Mountain Range where it was yielded.

Locality: Op. cit.

Holotype: Reg. No. DGLAKZ-12536; Syntype: Reg. No. DGLAKZ-12541.

Paratype: Reg. No. DGLAKZ-12542.

#### DICOTYLEDONEAE

"*Ficus*" sp.\*

Plate I, figs. 6 & 7.

Only one specimen was obtained by the writer in 1948, when he was engaged in the field in the Western part of the Izumi Mountain Range, for the graduation thesis from the Tohoku University, Sendai.

*Description*: Leaf small; apex lacking, 38 mm in length and 45 mm in width, trilobed; margin entire; three primary veins distinct, divided near the base; roundly obtuse.

*Discussion*: There are leaves of different kinds of plants that have similar, trilobed and entire-margined shape belonging to genera of Moraceae, Lauraceae, Aceraceae, Sterculiaceae, Convolvulaceae, etc., which are common in the temperate region.

The present specimen lacked a half part of the leaf, so that the writer can not identify the genus. Nevertheless, he ventures to regard it possibly to belong to certain Moracean genus, because of the characteristic stalk trinerved vein.

\*This species had been reported by the writer as *Ficus kadensis* n. sp. (MS) (1964; 52).

Locality: Tagurazaki, Kada-chô, Wakayama City, Wakayama Prefecture.  
Holotype: Reg. No. DGLAKZ-12537.

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#### V: Glossary of Men's, Local and Stratigraphical Names.

Asuwa Flora.....	足羽植物群
Azenotani shale Bed .....	汗ノ谷頁岩層
FUJII, K. (FUJII Kenjirô) .....	藤井健次郎
HAYASAKA, I. (HAYASAKA Ichirô) .....	早坂一郎
Hikita bed .....	疋田層
HIRAYAMA, K. (HIRAYAMA Ken) .....	平山健
ICHIKAWA, K. (ICHIKAWA Kôichirô) .....	市川浩一郎

Inukai .....	大阪府泉南郡岬町多奈川町字犬飼
Izumi Group .....	和泉層群
Izumi Mountain Range .....	和泉山脈
Kada .....	和歌山県和歌山市加太町 (旧海草郡加太)
Kamogata Flora .....	鴨方植物群
Kasayama .....	大阪府泉南郡熊取町笠山
Kasayama basal conglomerate Bed .....	笠山基底礫岩層
Kazafukitôgê sandstone and conglomerate Bed .....	風吹峠砂岩礫岩層
Kinki District .....	近畿地方
Kin'yûji conglomerate and sandstone Bed .....	金熊寺礫岩砂岩層
KOBAYASHI, T. (KOBAYASHI Teiichi) .....	小林貞一
KÔRIBA, K. (KÔRIBA Kan) .....	郡場寛
MAEDA, Y. (MAEDA Yasuo) .....	前田保夫
MATSUMOTO, T. (MATSUMOTO Tatsurô) .....	松本達郎
MIKI, S. (MIKI Shigeru) .....	三木茂
Nate conglomerate and sandstone Bed .....	名手礫岩砂岩層
Negoro sandstone and shale Bed .....	根来砂岩頁岩層
ÔYAMA, T. (ÔYAMA Toshiji) .....	大山年次
SÔDA, K. (SÔDA Katsumi) .....	宗田克巳
Sugitani, Kamogata-machi, Okayama Prefecture .....	岡山県浅口郡鴨方町杉谷
Tagurazaki .....	和歌山市加太町田倉崎
Takinoike shale Bed .....	滝ノ池頁岩層
Tsuzurahata sandstone and shale Bed .....	葛畑砂岩頁岩層
Urakawan Transgression .....	浦河統海侵
Warazuhata shale and sandstone Bed .....	童子畑頁岩砂岩層

Plate I (Nat. Size)

Fig. 1. *Zamites* sp.

Loc. : Inukai, Tanagawa-chô, Misaki-Machi, Sennan-Gun, Ôsaka-Fu  
(Prefecture).

Holotype : Reg. No. GDLAKZ-12540

Fig. 2. *Zamites* sp.

Loc. : Sugitani, Kamogata-Machi, Asaguchi-Gun, Okayama Prefecture.

Holotype : Reg. No. GDLAKZ-14014-b.

Figs. 3-5, & 8. *Cunninghamia izumiensis* n. sp.

Loc. : Inukai.

Holotype : fig. 3. Reg. No. GDLAKZ-12536.

Syntype : fig. 4. Reg. No. GDLAKZ-12541.

Paratype : fig. 5. Reg. No. GDLAKZ-12542.

Figs. 6 & 7. "*Ficus*" sp.

Loc. : Tagurazaki, Kada-chô, Wakayama City, Wakayama Prefecture.

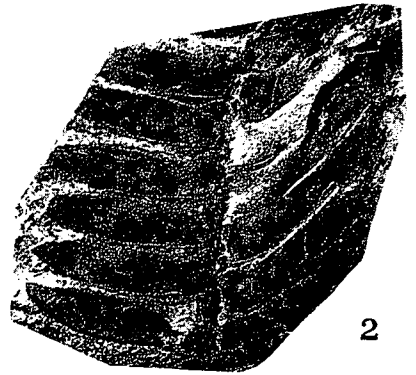
Holotype : fig. 6. Reg. No. GDLAKZ-12537.

fig. 7 is an opposite side of fig. 6.





1



2



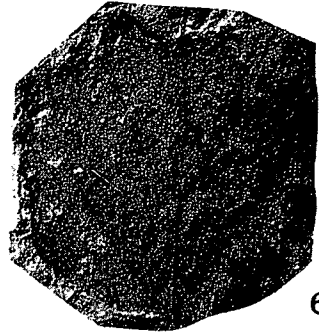
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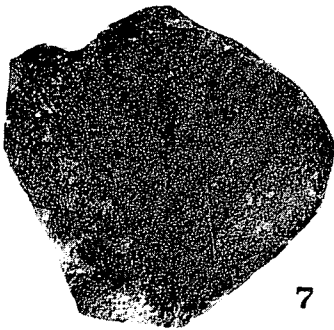
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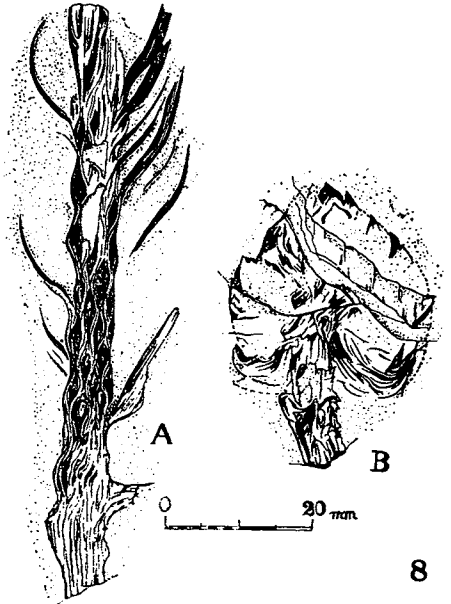
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6



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8