21. The Japanese Equivalents of the *Lepidopteris* and *Thaumatopteris* Zones of East Greenland.

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The Nariwa Series of the Nariwa district is a thick complex of terrestrial origin with abundant fossil plants in certain horizons indicating Rhaetic to Liassic periods, and brought into juxtaposition with a marine formation rich in a Noric species of *Pseudomonotis* by dislocations.¹⁾ The terrestrial formation being also traversed by many faults, it is a matter of difficulty to decide the relative stratigraphical sequence among plant beds exposed at numerous localities in Nariwa except for a few cases in which they are stratigraphically continuous. The present writer²⁾ once stated that the greater parts of the fossiliferous beds represent the Rhaetic, while it is probable from the occurrence of some Liassic elements in the fossil plants from certain localities that the upper part of this thick complex may be slightly younger, thus suggesting the probable existence of at least two main floral zones differing in age.

For the purpose to judge the tenability of this view, the floral lists of the *Lepidopteris* (Rhaetic) and *Thaumatopteris* (Basal Liassic) Zones of Scoresby Sound in East Greenland studied by T. M. Harris³⁾ have been compared with those of each locality in Nariwa, since the two districts are in the same geobotanical province and there are a good deal of important common genera and species in their floras. The result is outlined below.

The main fossil localities in Nariwa are about 30 in number, of which more than half contain certain genera and species characteristic to either the *Lepidopteris*- or the *Thaumatopteris* Zone.

The plant beds of the following localities⁴⁾ contain one or more species which occur from the *Lepidopteris* Zone only and never mixed with any species restricted to the *Thaumatopteris* Zone; the localities, the respective species and the association are as follows:

Loc. 1. *Neocalamites hoerensis*, *Pterophyllum Schenki*.

1) S. Ôishi: The Rhaetic Plants from the Nariwa District, Prov. Bitchû (Okayama Pref.) Japan. Jour. Fac. Sci. Hokkaidô Imp. Univ., Ser. IV, Vol. 1, Nos. 3-4, 1932.

2) S. Ôishi: *Yabeiella* sp. from the Japanese Triassic. Jap. Jour. Geol. Geogr., Vol. VIII, No. 4, 1931.

3) T. M. Harris: The Fossil Flora of Scoresby Sound, East Greenland. Pt. I, Med. om Grønland, Bd. LXXXV, No. 2 (1931); Pt. 2, Ibid., No. 3 (1932); Pt. 3, Ibid., No. 5 (1932); Pt. 4, Ibid., Bd. CXII, No. 1 (1935); Pt. 5, Ibid., No. 2 (1937).

4) As to the geographical position of each locality, see Pl. I in S. Ôishi and K. Huzioka: Fossil Plants From Nariwa. A Supplement. Jour. Fac. Sci., Hokkaidô Imp. Univ., Ser. IV, Vol. IV, Nos. 1-2, 1938 (in preparation).

Association: *Annulariopsis inopinata*?, *Cladophlebis nebbensis*, *Clathropteris meniscoides*, *C. meniscoides* var. *elegans*, *Thaumatopteris nipponica*, *T. pusilla*, *Hausmannia nariwaensis*, *H. crenata*,¹⁾ *H. dentata*, *Taeniopteris* cfr. *Carruthersi*, *Nilssonina simplex*, *Baiera Muensteriana*,²⁾ *Czekanowskia rigida*, *Pityophyllum longifolium*, *Elatocladus plana*, *E. tenerrima*, *Podozamites Schenki*, *P. lanceolatus*, *P. concinnus*,* *Nageiopsis rhaetica*, *Drepanozamites*? sp. indet.³⁾

Loc. 45. *Neocalamites hoerensis*.

Association: *Clathropteris obovata*, *Podozamites lanceolatus*.

Loc. 48. *Neocalamites hoerensis*.

Association: *Todites Roesserti* Zeill. (non Presl) = *Todites goepertianus*, *Cladophlebis haiburnensis*, *C. Raciborskii* forma *integra*, *Thaumatopteris elongata*, *Nilssonina Muensteri*, *Czekanowskia rigida*.

Loc. 55. *Pterophyllum Schenki*.

Association: *Cladophlebis nebbensis*, *Podozamites lanceolatus*.

Loc. 63. *Pterophyllum Schenki*.

Association: *Annulariopsis inopinata*?, *Cladophlebis denticulata*, *Clathropteris meniscoides*, *C. meniscoides* var. *elegans*, *Thaumatopteris Kochibei*, *T. pusilla*, *Dictyophyllum Muensteri*, *Hausmannia nariwaensis*, *Pterophyllum serratum*,* *Taeniopteris nabaensis*, *Stenorachis elegans*, *Podozamites Schenki*, *P. lanceolatus*, *P. concinnus*.*

Localities 16, 21, 50 and 62 do not yield species characteristic to either the *Lepidopteris*- or the *Thaumatopteris* Zone, but contain certain species closely allied to the elements of *Lepidopteris* flora, and none allied to those of *Thaumatopteris* flora, viz.:

Loc. 16. *Baiera Muensteriana*, closely allied to *Ginkgoites minuta*.

Association: *Annulariopsis inopinata*?, *Cladophlebis denticulata*, *Podozamites lanceolatus*.

Loc. 21. *Ctenis japonica*, closely allied to *C. nilssoni*.

Association: *Taeniopteris nabaensis*, Cfr. *T. minensis*, *T.* cfr. *Carruthersi*, *Nilssonina acuminata*, *Ginkgoites sibirica*, *Baiera filiformis*, *Czekanowskia rigida*, *Pityophyllum longifolium*, *Podozamites lanceolatus*.

Loc. 50. *Baiera Muensteriana*, closely allied to *Ginkgoites minuta*, and *Taeniopteris lanceolatus*, closely allied to *T. tenuinervis*.

Association: *Neocalamites Carrerei*, *Cladophlebis haiburnensis*, *C. denticulata*, *Clathropteris meniscoides* var. *elegans*, *Pterophyllum aequale*, *P. jaegeri*, *Ptilozamites tenuis*, *Ctenis Yabei*, *C. Takamiana**, *Baiera Muensteriana*, *B. elegans*, *Stenorachis Konianus*,* *Pityophyllum longifolium*, *Podozamites lanceolatus*.

Loc. 62. *Ptilozamites Nilssoni*?, closely allied to *P. nilssoni*.

Association: *Cladophlebis nebbensis*, *Clathropteris obovata*, Cfr. *Pterophyllum distans*, *Campylophyllum hoermanni*.⁴⁾

1) Harris regards *H. crenata* as an element of *Lepidopteris* flora.

2) Closely allied to *Ginkgoites minuta*, an element of *Lepidopteris* flora.

3) Allied to *D. nilssoni* (Nath.) Harris.

* The species with an asterisk denote new species, to be described in a forthcoming paper by Ôishi and Huzioka: Op. cit.

4) The identification of the Japanese specimen to *C. hoermanni* is now slightly doubtful. Harris states that the species is of the *Thaumatopteris* flora.

The following localities yield one or more species occurring in the *Thaumatopteris* Zone only and none restricted to the *Lepidopteris* Zone: the localities, the respective species and the association are as follows:

Loc. 44. *Marattiopsis Muensteri*, *Swedenborgia major*.

Association: *Todites Williamsoni*, *Cladophlebis haiburnensis*, *C. gigantea*, *C. bitchuensis*, *C. nebbensis*, *C. Raciborskii*, *C. Raciborskii* forma *integra*, *C. subplectrophora*,* *C. tenue*, *C. pseudodelicatula*, *Clathropteris obovata*, *Sphenopteris gracilis*, *Pterophyllum Jaegeri*, *Taeniopteris nabaensis*, *Nilssonina orientalis*, *Ctenis* sp., *Ginkgoites sibirica*, *Baiera paucipartita*, *Czekanowskia rigida*, *Phoenicopsis* sp., *Podozamites lanceolatus*, *Swedenborgia cryptomerioides*.

Loc. 49. *Marattiopsis Muensteri*, *Todites princeps*, *Dictyophyllum Muensteri*, *D. Nilssoni*.

Association: *Equisetites multidentatus*, *Neocalamites Carrerei*, *Cladophlebis Raciborskii* forma *integra*, *C. denticulata*, *Clathropteris obovata*, *Thaumatopteris elongata*, Cfr. *T. Brauniana*, *Nilssonina Muensteri*, *Ginkgoites sibirica*, *Phoenicopsis* sp., *Pityophyllum longifolium*, *Podozamites lanceolatus*.

Loc. 64. *Dictyophyllum Nilssoni*.

Association: *Taeniopteris* cfr. *Leclerei*.

Loc. 66. *Baiera taeniata*, closely allied to *Ginkgoites hermelini*.

Association: *Todites Williamsoni*, *Nilssonina acuminata*, *Ginkgoites digitata* var. *Huttoni*, *Baiera taeniata*.

Association: *Elatocladus* sp.

Loc. 87. *Dictyophyllum Nilssoni*.

Association: *Cladophlebis haiburnensis*.

Locality 91 yields Cfr. *Storgaardia spectabilis* which probably is specifically identical with *S. spectabilis*, an element of *Thaumatopteris* flora; the association is *Cladophlebidium? okayamaensis**

The plant beds from the following localities contain species occurring in the transition beds between *Lepidopteris*- and *Thaumatopteris* Zone only and are free from those restricted to either one of the two zones; the localities, the respective species and association are as follows:

Loc. 65. *Swedenborgia cryptomerioides*.

Association: *Taeniopteris?* sp. nov., *Podozamites lanceolatus*.

Loc. 68. Cfr. *Thaumatopteris Brauniana*.

No association.

Loc. 69. *Swedenborgia cryptomerioides*.

Association: *Phyllothea* sp. = ? *Swedenborgia cryptomerioides*, *Cladophlebis nebbensis*, *C. denticulata*, *Clathropteris obovata*, *Baiera* sp., *Czekanowskia rigida*, *Pityophyllum longifolium*, *Podozamites lanceolatus*.

The above comparison shows that the fossil species restricted to either the *Lepidopteris* or the *Thaumatopteris* Zone at Scoresby Sound are always found in separate localities of Nariwa, and never mixed with the species restricted to the other Zone. This analogy held be-

tween the fossil floras of Scoresby Sound and those of Nariwa is marked; may it be accidental?, or does it suggest the probable far eastern extension of these floral zones to the Nariwa district?

The conclusion to which the present writer has reached from solely the palaeobotanical point of view is that, among plant beds of many fossil localities in the Nariwa district, those of Locs. 1, 45, 48, 55, 63 certainly and of Locs. 16, 21, 50, 62 probably correspond to the *Lepidopteris* Zone, while those of Locs. 44, 49, 64, 66, 86, 87 certainly and of Loc. 91 probably correspond to the *Thaumatopteris* Zone.

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