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Report on Plant Fossils from the Beaver Lake area, Prince Charles Mountains, Antarctica

by

Mary E. White

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RECORDS 1969/100

Contents

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Summary:

Plant fossils were collected at four localities from "Amery Group"* sediments. At one locality, Vertebraria occurs in abundance without associated fossils. At a second locality, from which most specimens came, an association of five species of Glossopteris with Vertebraria is found. At a third locality a number of well preserved pieces of silicified tree trunk were collected. At the fourth locality two species of Glossopteris and a Glossopteris fructification are associated with Gangamopteris and Palaeovittaria.

The plants are of Permian age. It is not possible to determine whether the plant horizons are Upper or Lower Permian on the floral evidence.

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* "Amery Group" - new name, see McLeod et al.

Introduction:

A collection of plant fossils was made from four localities in the Beaver Lake area, Prince Charles Mountains, Antarctica. All the samples are from "Amery Group" sediments.

The collection is of particular interest in view of the fact that there has been a detailed study in recent years of Antarctic Glossopteris floras by Dr. Plumstead (1962) who reported on the 1955-1958 Trans-Antarctic Expedition collections, and by Professor Cridland (1963) who examined the Ohio State University collections. The present collection can therefore be compared closely with these comprehensive studies.

There are very considerable problems in any study of Glossopteris leaves. A great volume of literature, much confusion in the determination of species, and the problems of making reliable identifications on leaf morphology contribute to an unsatisfactory state of affairs. This collection offers an opportunity to bring determinations into line with Dr. Plumstead's work, which in scope and volume is a good starting point for a reappraisal of Australian Glossopteris floras.

The specimens from the Beaver Lake area have been compared in the first instance with Dr. Plumstead's lavish illustrations and descriptions, then matched with Cridland's illustrations. They have then been compared with specimens illustrated in Bureau collections.

The study of some of the poorer material in the collection has been more detailed than would have been the case had it been collected in Australia in localities which might have been re-collected as required at a future date. The samples were split repeatedly to try to obtain all available evidence from them, and the collection has been illustrated with photographs of eighteen specimens to give a comprehensive picture of the flora. Further work will be undertaken to report on the microscopic structure of the silicified wood if satisfactory thin sections can be made.

The plant fossil localities are shown on the maps attached, supplied by A. Medvecky who submitted the specimens for examination.

DESCRIPTION OF THE COLLECTION

LOCALITY 1. (Field No. AM 56A, Point No. 418)

Specimens F23262, 23263, 23264 and 23265 illustrated in Figures 1-4. Remainder of specimens F 23266.

These grey siltstone specimens contain fine examples, in an excellent state of preservation, of *Vertebraria indica* Royle. Four examples are illustrated below. Many of the impressions are of branching axes. In some, very thin projections may be seen arising from the joints between wedges of xylem.

Dr. Plumstead, in reporting on the *Vertebraria* axes she studied, concluded that the axes were roots, that they bore fine rootlets, and that they were most probably the root systems of Glossopterids.

Vertebraria indica Royle.
Natural size.

Figure 1: Negative F/5581
specimen F 23262.

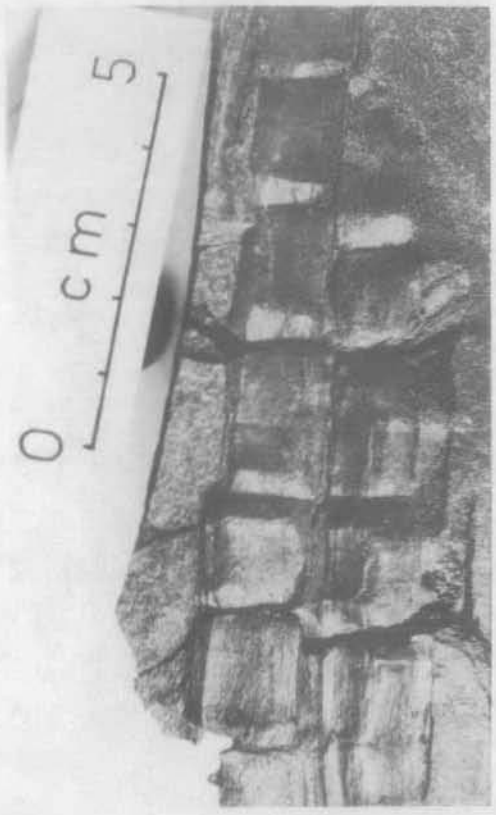
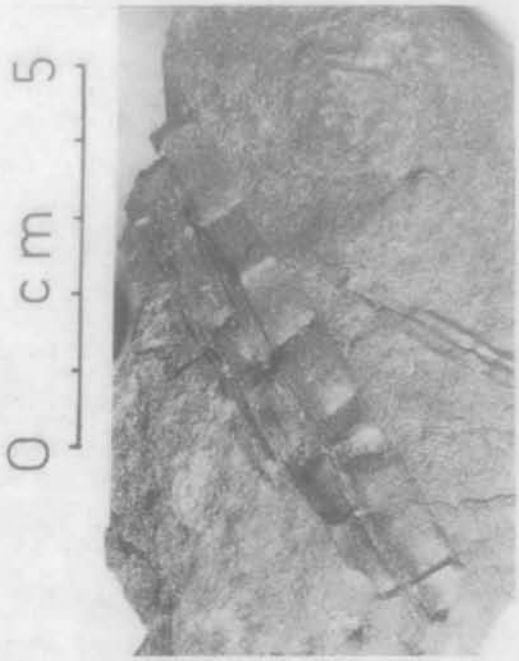


Figure 2: Negative F/5582
F 23263.

Figure 3: Negative F/5583
Specimen F 23264.

Figure 4: Negative F/5584
Specimen F 23265.



There has long been discussion on the nature of Vertebraria. Its highly evolved and unique structure has intrigued palaeobotanists. The original assumption was that the axes were rhizones and it was presumed that they bore Glossopteris leaves. As evidence from increasing study of the Glossopteridae suggests that they were arborescent the rhizome theory for Vertebraria lost ground, and there was also some suggestion that the internal organisation of Vertebraria, seen in poor petrifactions, showed affinity with true roots. The puzzle has now been solved. In the Ohio University collection of 1962, a satisfactory petrifaction of Vertebraria was found. This is reported on by J.M. Schopf (1965). Preservation of the tissues was sufficient for it to be shown without doubt that Vertebraria is a true root with a specialised Gymnospermous anatomy.

The assumption that Vertebraria is part of the Glossopterid plant is still valid. It is now necessary to prove that petrified stems which occur in the Permian floras were the organs which bore Glossopteris leaves and that they were in continuity with Vertebraria root structures. No doubt in time such a relationship will be proved.

LOCALITY 3. (Field No. AM 152, Point No. 447)

Specimens F23267, 23268 and 23269 illustrated
Remainder of specimens F23270

A number of pieces of silicified wood were collected at this locality. They are well preserved and are to be sectioned for microscopic examination. If sufficient cell structure has been replaced an account of their internal anatomy will be prepared at a later date.

Figures 5, 6 and 7 below illustrate three typical examples. In Figure 5 a somewhat flattened cylinder of wood is seen. It has a flattened core filled with coaly material. There are dark lenticular patches in the wood tissue.

Figure 6 shows a small piece of wood in which the annual rings are clearly seen. The dark lenticular patches are visible in transverse section on the annual rings, and in tangential section on the side of the specimen. They are probably resin canals.

Figure 5: Slightly flattened cylinder of wood.

Specimen F 23267. 2/3 Natural size. Negative F/5585

Figure 6: Negative F/5586
Specimen F 23268.
Natural size.

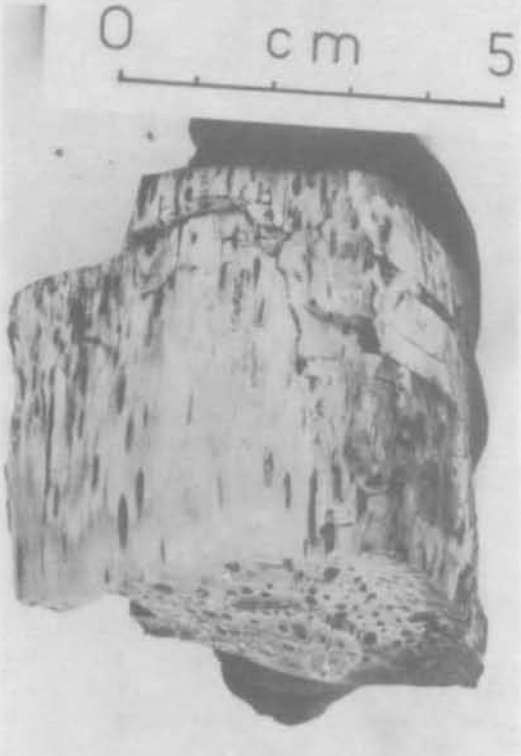


Figure 7: Negative F/5587 Natural size. Specimen F 23269.
Taeniopitys scotti Krausel

Figure 7 shows a piece of silicified tree trunk in which regular annual rings are present. The wood is uniformly fine-grained without marked seasonal changes in wood growth. There are no resin canals. There are about forty annual rings in the $3\frac{1}{2}$ inch radius of this trunk. Growth was very slow and regular. In outward appearance this wood corresponds with Taeniopitys scotti Krausel which is described and illustrated in the appendix by Krausel in Plumstead's Antarctica flora.

LOCALITY 4. (Field No. 140A, Point No. 443)

Specimens F 23271, 23272, 23273 and 23274 illustrated.
Remainder of specimens F 23275.

These specimens are brownish-grey siltstone containing carbonised leaf impressions.

In specimen F 23271, illustrated in Figure 8, an interesting plant assemblage is present. This comprises:-

(a). Apical parts of two leaves of Gangamopteris angustifolia McCoy, numbered 1 and 6on photograph.

(b). Basal part of Glossopteris leaf (2) narrowing to a petiole. Venation of indica type with striated midrib. Leaf margin is slightly undulating and the angle of tapering indicates that the leaf margins would probably not be parallel in the middle regions of the leaf. The leaf is referred to Glossopteris longicaulis, Feist and is the same as the leaf with the long petiole illustrated in Figure 9.

(c). A portion of lamina 1.5 cm long and .5 cm wide with a blunt apex, gangamopteroid venation and small circular spots on the surface is seen at (4) in Figure 8. This is a small example of Dictyopteridium sporiferum Feist., the male fertile frond of a species of Glossopteris.

(d). A Glossopteris scale leaf is seen (3) near the top corner of the specimen. It is of a shape commonly found in scale leaves.

(e). The leaf numbered (5) on Figure 8 has very steeply angled venation. In place of a midrib it appears to have a wide groove with vertical veins near the base, to be faintly grooved in the middle of the blade, and without groove near the apex. It is referred to Palaeovittaria sp.

Figure 8. Negative F/5588

Specimen F 23271. Magnification X2

1 and 6 : Gangamopteris angustifolis.

2 : Glossopteris longicaulis.

3 : Scale leaf.

4 : Dictyopteridium sporiferum

5 : Palaeovittaria sp.

Gangamopteris angustifolia McCoy was present in the collections from the Weddell and Ross Sea Areas described by Plumstead. Type material of the species was from Bacchus Marsh in Victoria. The species also occurs in Greta Coal Measures and Lower Bowen. Plumstead states that Gangamopteris is extinct by Upper Permian. However, in Australia, although this applies to the large Gangamopteris leaves of Cyclopteroides type, smaller leaves of angustifolia type persist into Upper Permian. In a collection from the Bandanna Formation, Queensland (Records 1961/9) an example of Gangamopteris angustifolia is illustrated in Figure 3. Bandanna Formation is Upper Permian. In Cridland's paper he illustrates as Gangamopteris sp. a similar leaf from a formation regarded as younger than Lower Permian.

In specimen F 23272, illustrated in Figure 9, are two leaves of Gangamopteris angustifolia McCoy, the basal part of Glossopteris longicaulis showing the petiole, and a poorly preserved leaf of Glossopteris communis Feist.

Specimen F 23273 illustrated in Figure 10 shows Glossopteris indica Sch. A small Glossopteris scale leaf is seen in Figure 11.

Figure 9: Negative F/5589
Specimen F 23272. natural size.
1 & 2 : Gangamopteris angustifolia
3 : Glossopteris communis
4 : G. longicaulis

Figure 10: F 23273.
Negative F/5590
Glossopteris indica.

Figure 11. F 23274.
Negative F/5591
Scale. Magn. X3.

LOCALITY 2. (Field No. 110, Point No. 433)

Illustrated specimens F 23276, 23277, 23278, 23279, 23281
F 23282 and F 23287.
Not illustrated F 23280, 23283, 23284, 23285 and 23286.

The fossils consist of impressions, mostly carbonised, in grey siltstone. Many of the specimens are deeply weathered and preservation of the plants is poor, but some are well preserved, Figures 12-18 illustrate a representative selection of the better specimens.

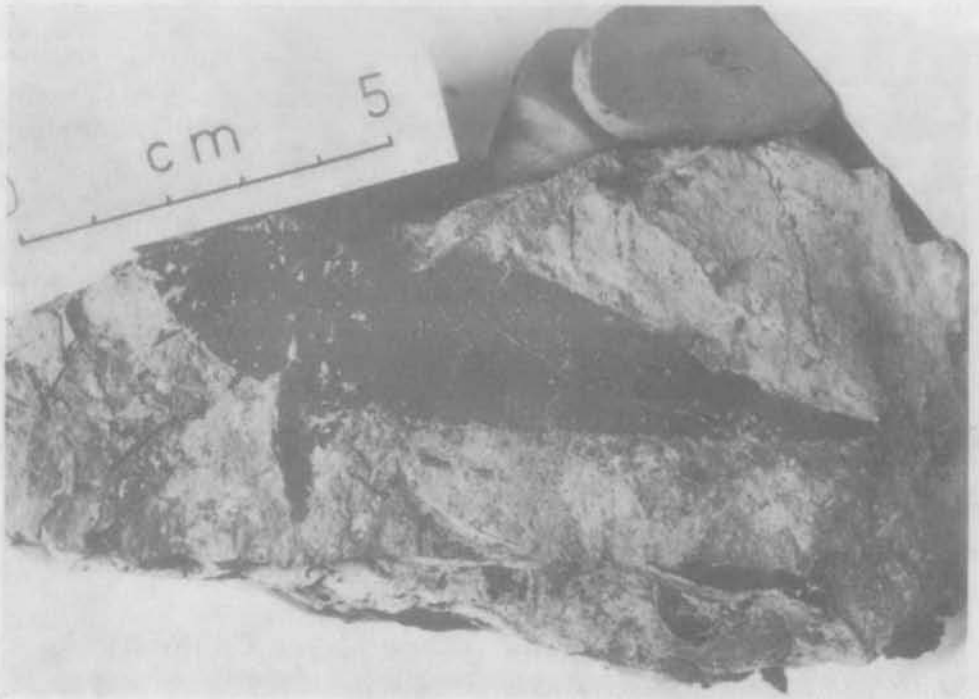
In Figure 12 of specimen F 23276 is a well preserved leaf of Glossopteris communis Feist. The separation of the species communis from indica follows Plumstead's lead. Venation is of indica type but whereas indica has a striated midrib and parallel margins over most of the length of the leaf, communis is characteristically the shape of the specimen illustrated in Figure 12 and has a smooth, hollow midrib.

Cridland does not separate communis from indica and in his paper he illustrates in Figure 1 a specimen very like F 23276 as "Glossopteris indica".

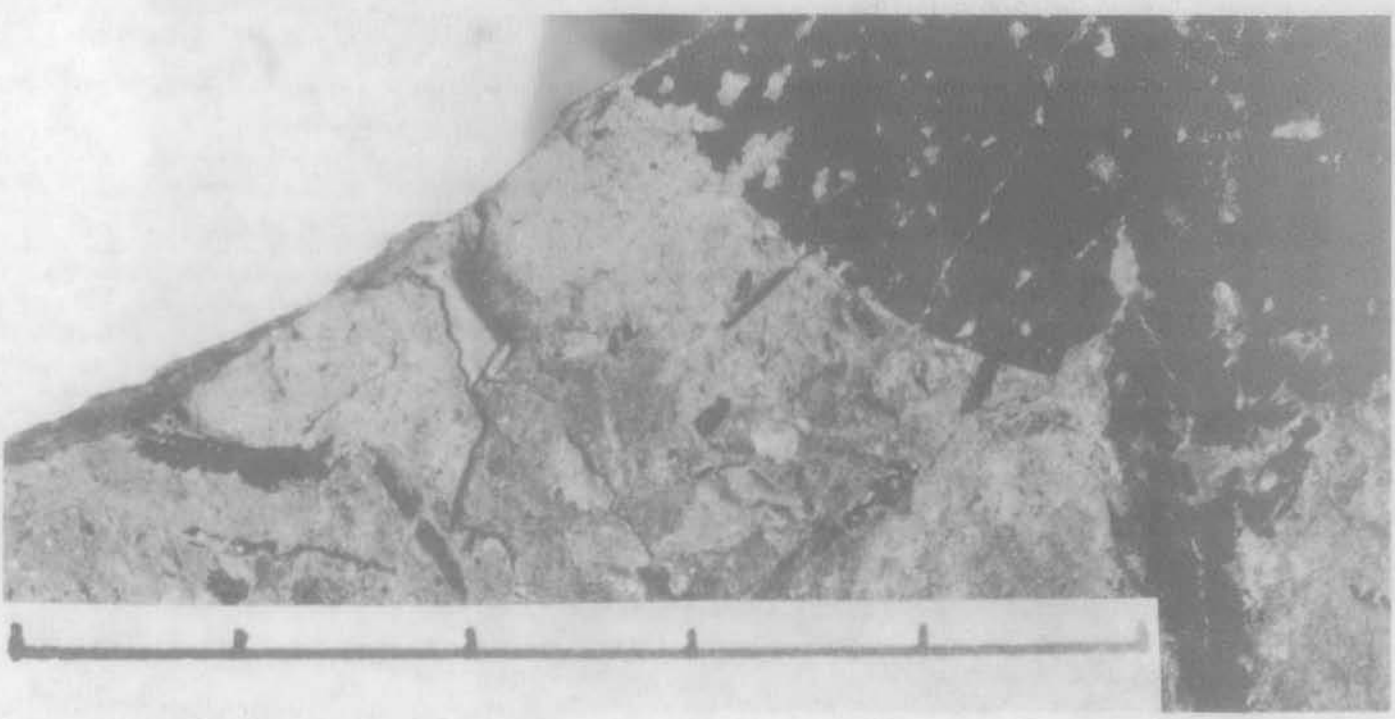
Figure 12. Neg. F./5592

Specimen F/23276. Natural size.

Glossopteris communis Feist.



Inset showing details of venation



There are many examples of Glossopteris communis in this collection, from locality 2. The species is common in Australia throughout the Permian. There as an example collected in Antarctica in 1961 by R. Ruker from a moraine at the foot of Mt. Rymill. (Records 1962/114). It was associated with Vertebraria indica Royle.

In Figure 13 of specimen F 23277 are four complete leaves and several fragments. The leaf form is clearly seen. Apices are bluntly rounded and there is a strong midrib which persists to the apex. The leaf margins taper abruptly to the apex over the last third of the length of the blade and curve smoothly to the leaf base.

Figure 13. Negative F/5593
Glossopteris fuchsii Plumstead
Specimen F 23277. Natural size.

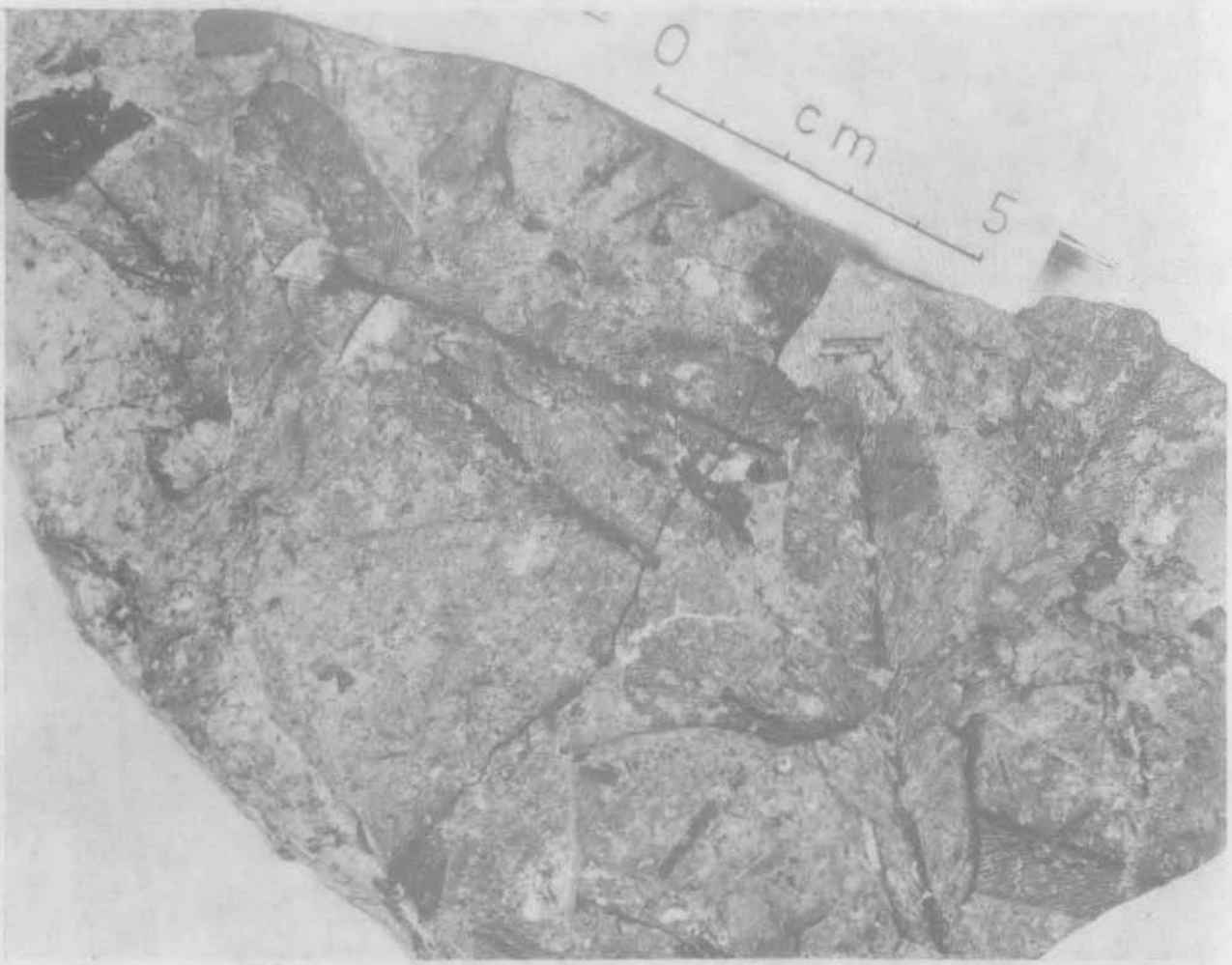


Figure 13a.

Detail of venation magnified X3

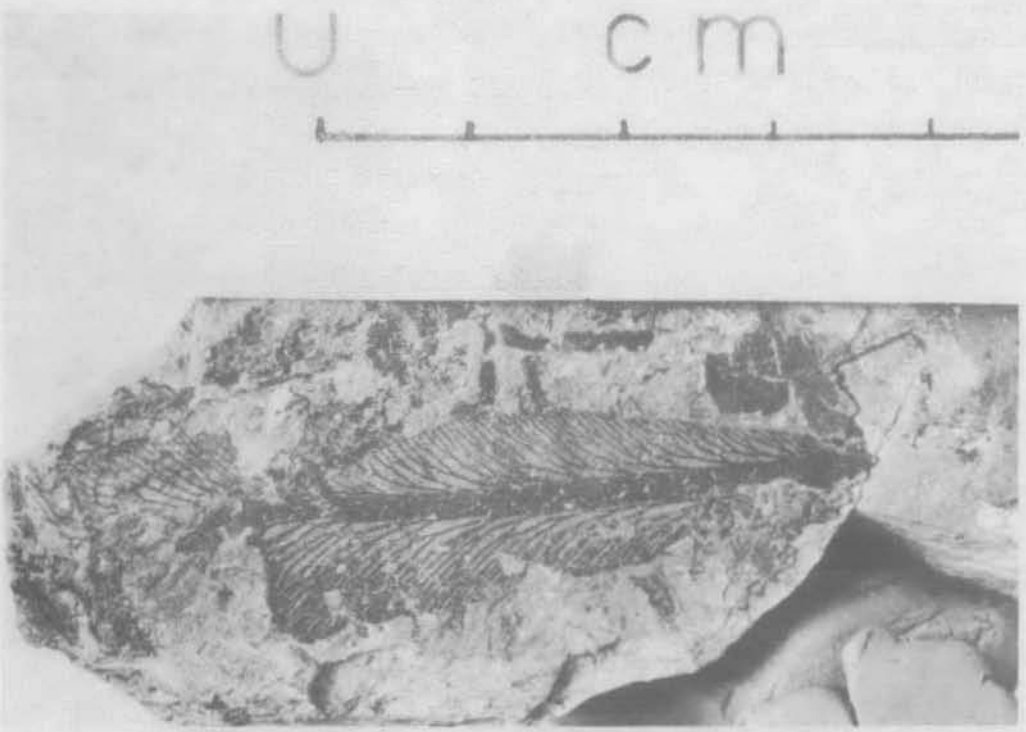
Venation in the middle of the leaf adjacent to the midrib shows meshing followed by dichotomy, and a second dichotomy half way across the blade results in fine, close venation at the margin. There are very few anastomoses between the secondary veins, which run a straight parallel course to the leaf margin. There is no regular and prominent meshing of the veins in the manner most commonly found in Glossopteris. Detailed of venationis shown in Figure 13 a, which is a magnification X3 of part of Figure 13. (Page 13).

The median strip of each leaf adjacent to the midrib is sparsely veined in comparison with the outer thirds which are closely veined in Taeniopteroid manner. This feature is seen clearly in the leaf in Figure 14 which illustrates another leaf of the species (F 23278).

Figure 14. Negative F/5594

Glossopteris fuchsii Plumstead.

Magnification X2 F 23278



The venation in these leaves resembles that illustrated in Walkon (1928) in "Glossopteris angustifolia var taeniopteroides". Plumstead states that species is unrelated to angustifolia and should be called sewardii. Leaf form does not correspond with the examples under discussion.

The leaves illustrated in Figure 13 and 14 are similar to G. stricta but the angle of the secondary veins is steeper. In stricta they meet the margin at right angles. This applies in damudica as well.

The only specimens which appear to match these leaves from locality 2 are some illustrated by Plumstead as Glossopteris fuchsii sp. nov. She found it necessary to create a new species for a few well preserved leaves showing the same form and venation and the illustrations and description appear to match up completely.

The leaves are therefore identified as Glossopteris fuchsii Plumstead.

Figure 15 of specimen F 23279 shows a further example of Glossopteris fuchsii in the centre of the specimen, a fragment of fuchsii venation, and parts of leaves of Glossopteris communis and indica.

Figure 15. Negative F/5595
Specimen F 23279. Natural size.
Glossopteris fuchsii 1 and 2.
Glossopteris communis 3.
Glossopteris indica 4.

Figure 16 of specimen F 23281 illustrates a small part of a Glossopterid fructification.

Figure 17, specimen F 23282, shows part of a leaf of Glossopteris indica Sch. showing the striated midrib and the fine secondary venation.

In Figure 18, specimen F 23287, is what appears to be an example of Dictyopteridium sporiferum Feist the male fertile frond of Glossopteris.

Figure 17. Negative F/5597
Glossopteris indica Sch.
F 23282. Natural size.

Figure 16. Negative F/5596
Fragment of fructification,
Magn. X3.

Figure 18. Negative F/5598
Specimen F 23287. ? Dictyopteridium

In specimen F 23280 is the only example in the collection of Glossopteris ampla Dana. It is a very poor specimen. The leaf was large. Part of half the lamina is preserved. The characteristic fine venation is just visible.

Specimens numbered F 23283 all contain poor specimens of Vertebraria indica Royle.

List of Plants identified:

Locality 1: Vertebraria indica Royle.

Locality 2: Glossopteris communis Feist.
Glossopteris fuchsii Plumstead.
Glossopteris indica Sch.
Glossopteris ampla Dana.
Vertebraria indica Royle.
Dictyopteridium sporiferum Feist.

Locality 3: Petrified wood.

Locality 4: Gangamopteris angustifolia McCoy.
Glossopteris longicaulis Feist.
Glossopteris indica Sch.
Dictyopteridium sporiferum Feist.
Glossopteris scale leaf.
Palaeovittaria. sp.

Conclusions.

The flora is a Permian one. It does not contain any species which are limited to Lower Permian, and it lacks the large, coarse type of Glossopteris and Gangamopteris which characterise the Lower Permian. On the other hand it does not contain species which are positively diagnostic of Upper Permian.

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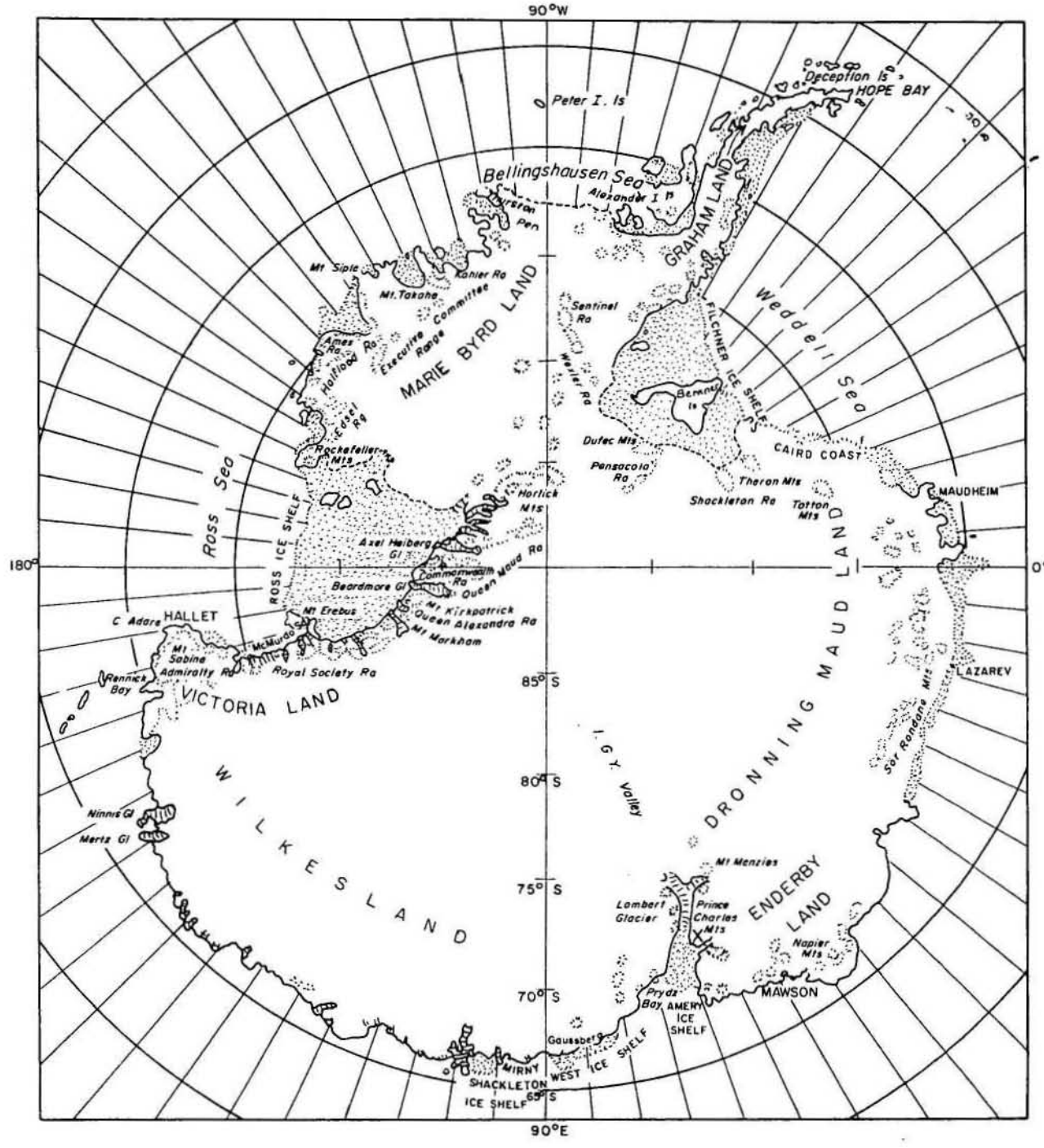
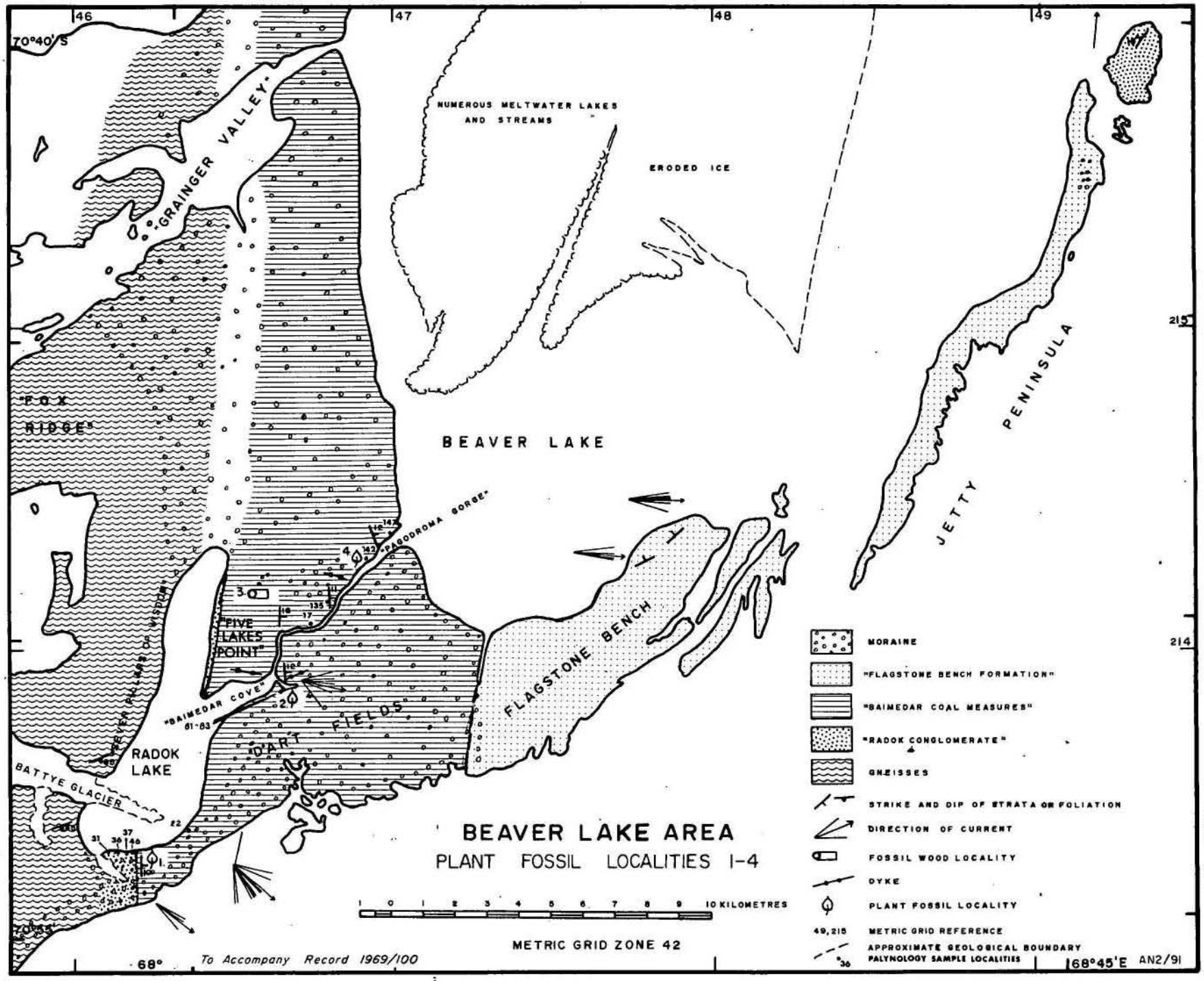
MAP I. SHOWING LOCATION OF BEACON GROUP AND "AMERY GROUP"



X *Beacon Group and "Amery Group" in the Beaux Lake area.*

To Accompany Record 1969/100

AN2/92 E.H.



BEAVER LAKE AREA

PLANT FOSSIL LOCALITIES 1-4

MAP 2.

To Accompany Record 1969/100