A PERMINERALIZED WOOD FLORA OF PROBABLE EARLY TERTIARY AGE FROM KING GEORGE ISLAND, SOUTH SHETLAND ISLANDS

By ROGER C. LUCAS* *and* WILLIAM S. LACEY*

ABSTRACT. Eleven specimens of gymnospermous fossil wood from two localities in Keller Peninsula, King George Island, have been examined. Five taxa appear to be represented and three of these are reasonably well preserved (*Dadoxylon pseudoparenchymatosum* Gothan, *Dadoxylon kellerense* sp. nov. and *Dadoxylon* sp.). The woods are probably of early Tertiary age.

THIS paper presents a brief report on new plant macro-fossils from the South Shetland Islands. It is based on a study of two collections of fossil wood made by C. M. Barton during geological surveys for the British Antarctic Survey on Keller Peninsula, Admiralty Bay, King George Island (Fig. 1), in 1959–61 and sent to the senior author for investigation in 1977. The geology of Keller Peninsula has been described in detail by Barton (1965).

Keller Peninsula consists of a north-north-westerly dipping sequence of altered andesitic lavas and pyroclastic rocks. From early days in the geological exploration of King George Island, its volcanic rocks were divided stratigraphically into Jurassic, Tertiary and late Cenozoic assemblages. Because of their highly altered state, the rocks of Keller Peninsula were considered to be Jurassic in age (Hawkes, 1961; Barton, 1965). However, rocks previously mapped as Jurassic elsewhere on the island have been critically re-examined and the criterion that Jurassic rocks can be recognized by their state of alteration has been questioned (Grikurov and Polyakov, 1968; Davies, in press *a, b*). The latter authors cited evidence that these rocks are more likely to be early Tertiary in age and the presence of any Jurassic rocks at all on King George Island is arguable.

MATERIALS AND METHODS

The material consists of permineralized gymnospermous secondary wood only, there being no primary tissues present. Although much of it is poorly preserved, seven specimens, indicated by an asterisk in the list below, revealed sufficient anatomical detail for some taxonomic determination to be attempted:

G.536A, G.536B, G536.2*, G.536.3, G.536.4*, G.536.6*, G.536.7*, G.536.8*, G.536.9, G.536.13*, and G.536.14.

The specimens were studied using the cellulose acetate peel technique (Joy and others, 1956) and by SEM examination of the surface of split fragments (Alvin and Muir, 1969); the latter did not yield additional information.

SYSTEMATIC DESCRIPTION OF THE SPECIMENS

All of the woods studied constitute new records for the localities.

In this account the generic name *Dadoxylon* Endlicher is used for material in which only secondary wood with araucarian pitting is preserved. It is felt that the use of the name *Araucarioxylon* Kraus should be restricted to fossil wood in which a direct affinity with the living genus *Araucaria* can be shown. Erasmus (1976) has pointed out that the use of *Araucarioxylon* in place of *Dadoxylon* for gymnospermous secondary wood also disregards the priority rule.

Dadoxylon pseudoparenchymatosum Gothan

Specimen G.536B, from a surface moraine. Wood with distinct growth rings, tracheid pitting 1 or 2 (commonly 2) seriate, with uniseriate rays 2–11 (commonly 4–6) cells high. 2–8 pits occur

* School of Plant Biology, University College of North Wales, Bangor LL57 2UW.

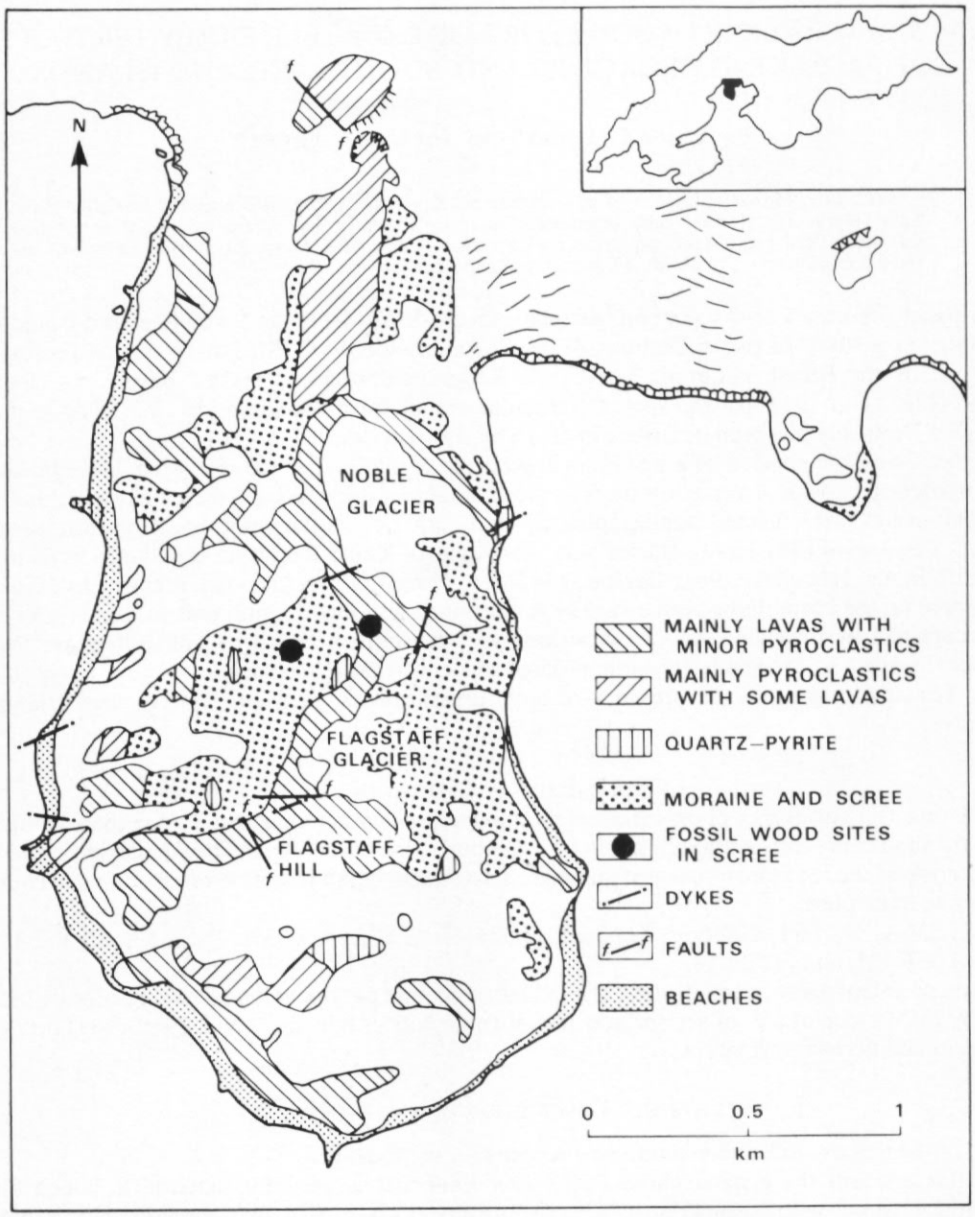

Fig. 1. Sketch map of Keller Peninsula, Admiralty Bay, King George Island, showing the geology and the locations from which fossil wood material was recovered. (From map by R. E. S. Davies.)

in each cross field and resin tracheids are present. No xylem parenchyma or bars of Sanio were observed.

These characters are identical with those of *Dadoxylon pseudoparenchymatosum* Gothan, which is synonymous with *Dadoxylon kerguelense* Seward, *Dadoxylon kaiparaense* Edwards and *Dadoxylon novae-zeelandii* Stopes according to Kräusel (1924) and Florin (1940).

Dadoxylon kellerense sp. nov.

Fig. 2a–d

Specimen G.536.2, from a surface moraine. This wood is regarded as a new species of *Dadoxylon* and named for the locality as, after an extensive study of the relevant literature covering over 100 taxa from Palaeozoic to Tertiary age, it appears distinct from previously described species of the *Dadoxylon* type.

Diagnosis: Secondary wood with distinct growth rings, late wood zone 2–3 cells wide with tracheids measuring 6.0–11.5 μm radially by 7.5–11.6 μm tangentially; early wood zone 20–29 cells wide with tracheids measuring 30–38 μm radially by 22–45 μm tangentially. Radial tracheid pitting bordered, 1–3 seriate (commonly 3 seriate), alternate, contiguous and flattened or hexagonal. Pit pore central, round to oval in shape measuring 7.0 μm by 7.5 μm to 8.3 μm by 10.5 μm in pits 9.5 μm by 11.0 μm to 12 μm by 15 μm in diameter. Xylem rays homogeneous, uniseriate, 1–11 cells high (commonly 4–5 cells) with cells barrel-shaped. Pits in the cross field 1–4, sometimes arranged in pairs, bordered, with pores measuring 5.2 μm by 5.2 μm to 5.6 μm by 7.5 μm in pits 6.6 μm by 6.6 μm to 7.5 μm by 10.0 μm.
Holotype: specimen G.536.2.
Locality: Keller Peninsula, King George Island, South Shetland Islands. *Dadoxylon kellerense* differs from *Dadoxylon pseudoparenchymatosum* Gothan in having fewer pits per cross field (1–4 instead of 2–8) and triseriate pitting on the radial walls of the tracheids.

Dadoxylon sp.

Specimens G.536.4, G.536.6 and G.536.8, from a surface moraine. Woods with distinct growth rings, tracheid pitting 1 or 2 (commonly 1) seriate with uniseriate rays 2–13 (commonly 3–5) cells high. Pits in the cross field are not preserved.
Resin tracheids appear to be present but xylem parenchyma and bars of Sanio absent.

Two of the remaining specimens cannot be identified further than as gymnospermous wood, but they appear to fall into two groups.

Gymnospermous wood A (indet.)

Specimen G.536.7, from a surface moraine. Wood with indistinct growth rings with uniseriate rays up to 18 (commonly 5–7) cells high. No other details were observed.

Gymnospermous wood B (indet.)

Specimen G.536.13, *in situ*. Wood with distinct growth rings with tracheid pitting 2–3 seriate. No other details were observed.

Discussion

Comparison with some other wood floras
Since new taxa from a single locality and undetermined taxa cannot be used for meaningful comparisons, these are necessarily limited to the consideration of the occurrence of *Dadoxylon pseudoparenchymatosum* Gothan. This species has been described from the type locality Seymour Island, Antarctica (Gothan, 1908; Seward, 1919); Archipel Kerguelen, South Indian Ocean (Seward, 1919; Edwards, 1921); Argentina (Kräusel, 1924) and New Zealand (Stopes, 1914; Seward, 1919; Edwards, 1926).
Dadoxylon pseudoparenchymatosum from Seymour Island, Archipel Kerguelen and Argentina has been found in Tertiary (probably early Tertiary) deposits. Specimens from New Zealand are slightly older, probably of Upper Cretaceous age.

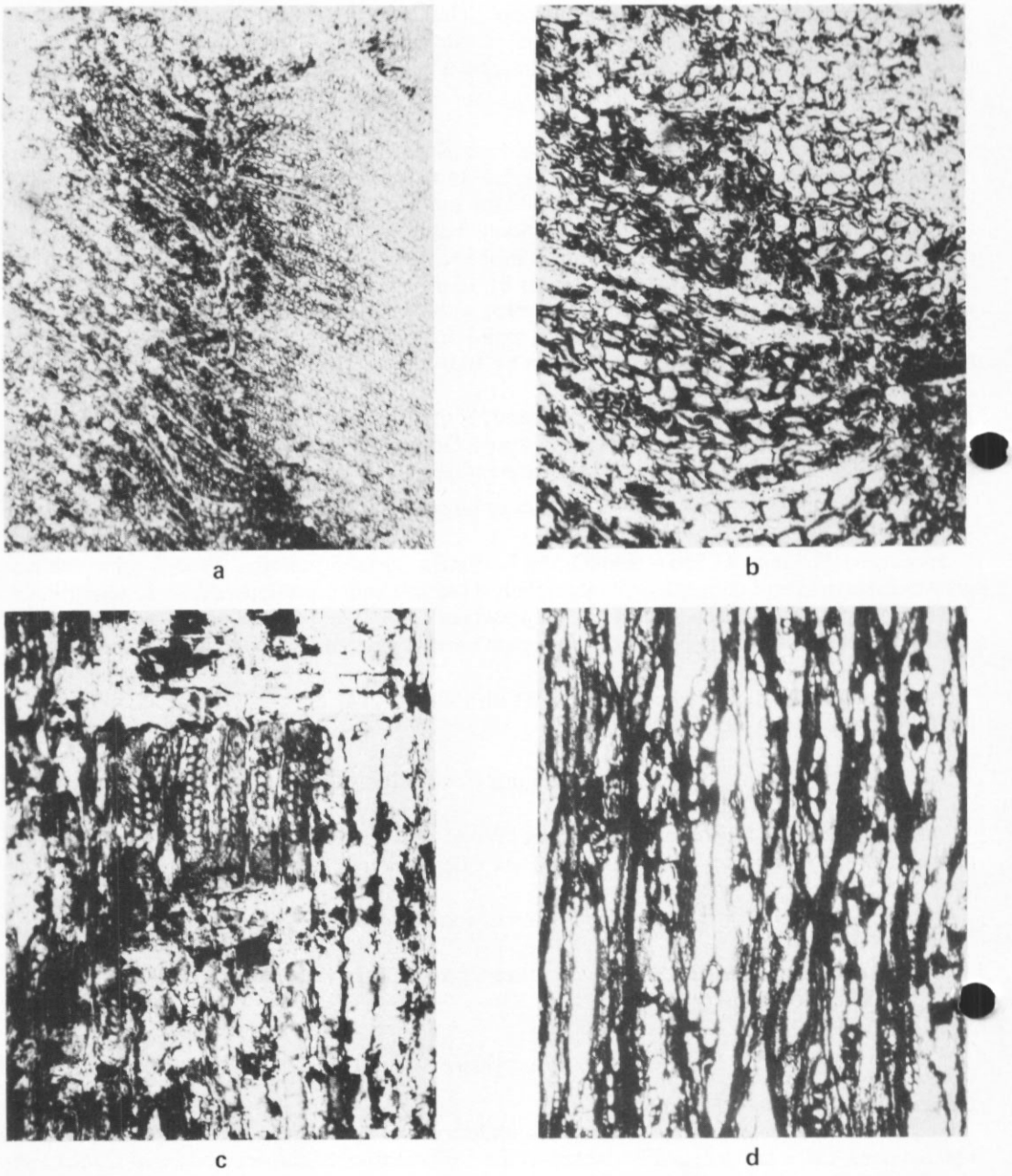

Fig. 2. *Dadoxylon kellerense* sp. nov.

a. Transverse section showing growth ring (G.536.2; slide No. 5; × 25).
b. Transverse section showing distorted tracheids in radial rows (G.536.2; slide No. 5; × 105).
c. Radial longitudinal section; note pitting up to three seriate on the walls of the tracheids (G.536.2; slide No. 6; × 105).
d. Tangential longitudinal section; note the short uniseriate rays (G.536.2; slide No. 7; × 105).

Conclusions

It seems probable that the woods from King George Island are more likely to be contemporary with the Tertiary material from Seymour Island, Archipel Kerguelen and Argentina than with the Upper Cretaceous specimens from New Zealand.

Consequently, a probable early Tertiary age is suggested for the King George Island material.

Acknowledgements

The work reported is part of a continuing project on the study of Gondwana fossil plants. It has been supported by an award to one of us (W.S.L.) of a research grant by the Natural Environment Research Council, to whom our thanks are expressed.

We are indebted to the Director of the British Antarctic Survey for permission to study the material, and to Dr M. R. A. Thomson for information on the field relations of the various collections.

MS received 4 December 1979

REFERENCES

Alvin, K. L. *and* M. D. Muir. 1969. Scanning electron microscopy—a new method of studying lignite. *Rev. palaeobot. & Palynol.*, **9,** 115–18.

Barton, C. M. 1965. The geology of the South Shetland Islands: III. The stratigraphy of King George Island. *British Antarctic Survey Scientific Reports*, No. 44, 33 pp.

Davies, R. E. S. In press *a*. The geology of the Marian Cove area, King George Island, and a Tertiary age for its supposed Jurassic volcanic rocks. *British Antarctic Survey Bulletin.*

————. In press *b*. New geological interpretation of Admiralen Peak, King George Island, South Shetland Islands. *British Antarctic Survey Bulletin.*

Edwards, W. N. 1921. Fossil coniferous woods from Kerguelen Island. *Ann. Bot.*, **35,** No. 140, 609–17.

————. 1926. Cretaceous plants from Kaipara, New Zealand. *Trans. N. Z. Inst.*, **56,** 121–28.

Erasmus, T. 1976. On the anatomy of *Dadoxylon arberi* Seward, with some remarks on the phylogenetical tendencies of its tracheid pits. *Palaeont. afr.*, **19,** 127–33.

Florin, R. 1940. The Tertiary fossil conifers of south Chile and their phytogeographical significance; with a review of the fossil conifers of southern lands. *K. svenska VetenskAkad. Handl.*, **19,** No. 2, 107 pp.

Gothan, W. 1908. Die fossilen Hölzer von der Seymour und Snow Hill-insel. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. 3, Lief. 8, 1–33.

Grikurov, G. E. *and* M. M. Polyakov. 1968. Geologicheskoye stroenie p-ova Failds, yugo-zapadnaya okonechnost, o. King-Dzhordzh (Vaterloo) [The geological structure of Fildes Peninsula, at the south-western extremity of King George Island (Waterloo Island)]. *Inf. Byull. sov. antarkt. Eksped.*, No. 71 17–24.

Hawkes, D. D. 1961. The geology of the South Shetland Islands: I. The petrology of King George Island. *Falkland Islands Dependencies Survey Scientific Reports*, No. 26, 28 pp.

Joy, K., Willis, A. *and* W. S. Lacey. 1956. A rapid cellulose peel technique in palaeobotany. *Ann. Bot.*, N. S., **20,** No. 80, 635–37.

Kräusel, R. 1924. Fossile Hölzer aus Patagonien und Benachbarten Gebiete. *Ark. Bot.*, **14,** Lief. 9, 1–36.

Seward, A. C. 1919. *Fossil plants Vol. IV*. Cambridge, Cambridge University Press.

Stopes, M. C. 1914. A new *Araucarioxylon* from New Zealand. *Ann. Bot.*, **28,** No. 110, 341-50.