A LOWER PERMIAN FLORA FROM THE THERON MOUNTAINS, COATS LAND

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

ABSTRACT. Fifty hand specimens from seven localities in the Theron Mountains have been examined. The flora of 14 taxa contains abundant cycadopsids (species of *Glossopteris* leaves and of leaves resembling *Gangamopteris*); occasional *Vertebraria* axes, sphenopsid axes and seeds; and a single axis of uncertain affinity. A Sakmarian–Artinskian (Lower Permian) age is indicated.

THIS paper presents a brief report on new plant macro-fossils from East Antarctica, collected by D. Brook (British Antarctic Survey) in the Theron Mountains (Fig. 1) during the 1966–67 Antarctic field season. Samples of the better material from seven localities were selected by the authors in 1977 and taken to the University College of North Wales for study (Lucas, 1979).

A detailed description of the general geology and stratigraphy of the Theron Mountains has been given by Brook (1972). He described the Theron Mountains as consisting of approximately 700 m of late Palaeozoic terrestrial waterlain sedimentary rocks, intruded by thick Jurassic dolerite sills and occasional thin dykes. The sediments include arkosic to quartzitic fine-grained sandstones and siltstones with thin shales and mudstones, subordinate carbonaceous beds and coals. They represent a lateral correlative of part of the Beacon Supergroup of the Transantarctic Mountains and contain plant material at several levels in the sequence. A previous investigation of fossil plants collected by the Trans-Antarctic Expedition, 1955–58, from the south-western end of the Theron Mountains only (Coalseam Cliffs), suggested that floras of late Carboniferous–early Permian age were present (Plumstead, 1962).

MATERIAL AND METHODS

A total of 50 hand specimens has been examined. The material consists mainly of stem and leaf compressions and impressions. In general, it is rather ill-preserved, although some of the material has proved interesting and of possible stratigraphical value.

As the compressions did not yield cuticles, their examination has been confined to the study of surface features by reflected light. Some of the impression material was sufficiently well preserved to permit stereoscan study using the latex-cast technique (Lacey, in press).

SYSTEMATIC DESCRIPTION OF THE COLLECTIONS

An asterisk indicates a new record for the Theron Mountains (see Fig. 1 for station localities).

Collection from station Z.487: 38 specimens yielded the following taxa:
Glossopteris indica Schimper*
G. communis Feistmantel*
G. browniana Brongniart
G. angustifolia Brongniart*
G. cf. *conspicua* Feistmantel*
G. stricta Bunbury
Glossopteris sp.
Glossopteris sp. with possible fructification
cf. *Gangamopteris angustifolia* McCoy*
cf. *Gangamopteris* sp.*
Vertebraria indica Royle
cf. *Samaropsis* sp.*

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

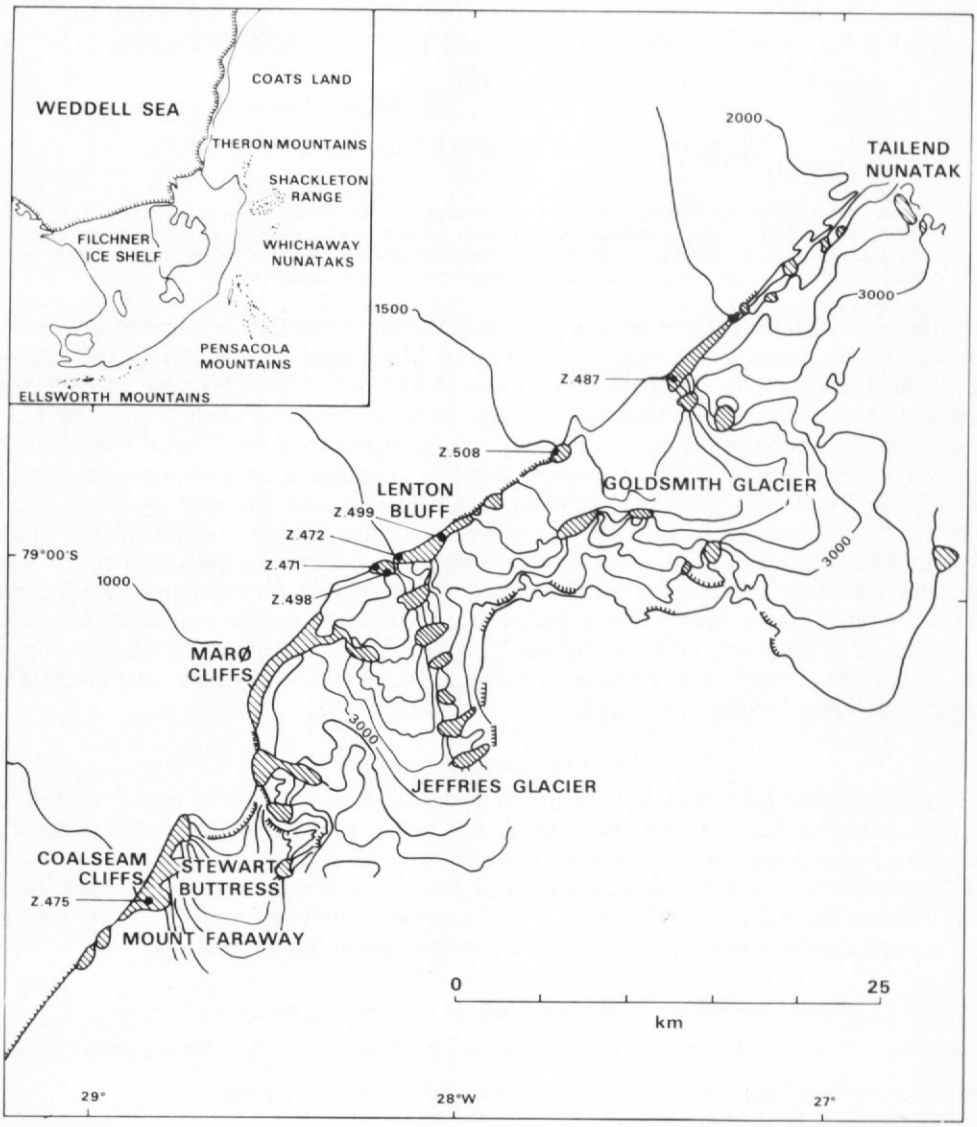

Fig. 1. Sketch map of the Theron Mountains, Coats Land, showing the locations of stations from which fossil plant material was collected (after Brook, 1972). Elevations are in feet above sea-level (approximately).

2. *Collection from station Z.508*: six specimens yielded the following taxa:
   Glossopteris indica Schimper*
   G. communis Feistmantel*
   G. browniana Brongniart
   G. angustifolia Brongniart*
   G. cf. *conspicua* Feistmantel*
   Glossopteris sp.
   cf. *Gangamopteris* sp.*
   Vertebraria indica Royle
   Scale leaf

Axis* (problematical; neither lycopsid nor reproductive in nature; may be a defoliated shoot of *Glossopteris*)

3. *Collection from station Z.499*: one specimen yielded the following taxon:
   Paracalamites australis Rigby*

4. *Collection from station Z.472*: one specimen yielded the following taxa:
   *Glossopteris indica** or *G. communis** (very small fragment)
   *G. indica** or *G. browniana* (very small fragment)
   G. cf. *conspicua* Feistmantel*

5. *Collection from station Z.471*: one specimen yielded the following taxon:
   Glossopteris browniana or *G.* cf. *conspicua** (very small fragment)

6. *Collection from station Z.498*: one specimen yielded the following taxa:
   Glossopteris angustifolia Brongniart*
   G. cf. *conspicua* Feistmantel*
   Glossopteris sp.
   Vertebraria indica Royle

7. *Collection from station Z.475*: two specimens yielded the following taxon:
   Vertebraria indica Royle

Discussion

The two larger sub-collections from stations Z.487 (38 specimens) and Z.508 (six specimens) make up the bulk of the material and include 12 of the 14 taxa represented. The other collections are small and contain too few taxa for effective comparisons to be made.

The complete flora is characterized by a domination of cycadopsid leaves. In particular, species such as *Glossopteris indica* and *Glossopteris communis* are very common; *Glossopteris browniana, Glossopteris angustifolia* and *Glossopteris* cf. *conspicua* are represented to a lesser extent, with *Glossopteris stricta* being extremely rare.

Scale leaves, cf. *Samaropsis* sp., cf. *Gangamopteris augustifolia* and cf. *Gangamopteris* sp. are uncommon and there is a complete absence of lycopsids, pteropsids, coniferopsids and "northern elements" of any kind.

Vertebraria indica, although found in three of the seven sub-collections, is not abundant.

The Gondwana formations most closely comparable with the present collection are as follows:

Antarctica: Theron Mountains and Whichaway Nunataks, Coats Land (Plumstead, 1962); Prince Charles Mountains, MacRobertson Land (White, 1970).

Africa: Mid-Ecca, South Africa (Le Roux and Anderson, 1977); Tete region, Mozambique (Oliveira, 1975).

Australia: Lower Bowen Series, Queensland (Walkom, 1922; Hill, 1952; Rigby, 1962); Perth and Collie Basins, Western Australia (Rigby, 1966).

South America: Bajo de la Leona, Santa Cruz, Argentina (Archangelsky, 1958, 1968; Rigby, 1972); Guata Formation, Brazil (Rigby, 1972; Rösler, 1978).

India: Karharbari Stage, Lower Gondwana (Surange, 1975; Lele, 1976; Maheshwari, 1976).

The collection is of undoubted Permian age. *Gangamopteris angustifolia* is confined to lower horizons in the Permo-Carboniferous era (Du Toit, 1954) and Plumstead (1962) has stated that the presence of *Gangamopteris* indicates that the rocks may safely be regarded as not younger than Lower Permian in age.

White (1970) has stated that, although the large *Gangamopteris* leaves of the *cyclopteroides* type were extinct by the Upper Permian, this is not true for the smaller leaves of the *angustifolia*

type and that *Gangamopteris angustifolia* has been found in the Upper Permian Bandanna Formation in Queensland, Australia.

Most of the species are of little stratigraphical value, although there is a marked absence of so-called advanced glossopterid leaves such as *Glossopteris elongata* Dan (syn. *Glossopteris retifera* Feistmantel) which appear to be restricted to upper horizons.

From all available comparisons, it is suggested that the flora is of probable Sakmarian to Artinskian (Lower Permian) age.

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

ARCHANGELSKY, S. 1958. Estudio geologica y paleontologica del Bajo de la Leona. *Acta geol. lilloana,* **11,** 5–133.

——. 1968. [Permian and Triassic floras of South America]. *Trudy geol. Inst., Leningr.,* **191,** 71–87.

BROOK, D. 1972. *Geology of the Theron Mountains, Antarctica.* Ph.D. thesis, University of Birmingham, 267 pp. [Unpublished.]

DU TOIT, A. L. 1954. *The geology of South Africa.* 3rd edition. Edinburgh and London, Oliver and Boyd.

HILL, D. 1952. The Gondwana System in Queensland. *Symposium sur les Séries de Gondwana, 19th Int. geol. Congr., Algiers,* 1952, 35–49.

LACEY, W. S. In press. Scanning electron microscopy in Gondwana palaeobotany. *Palaeobotanist.*

LELE, K. M. 1976. Late Palaeozoic and Triassic floras of India and their relation to the floras of the Northern and Southern Hemispheres. *Palaeobotanist,* **23,** No. 2, 89–115.

LE ROUX, S. F. *and* H. M. ANDERSON. 1977. A review of the localities and flora of the Lower Permian Karoo strata at Vereeniging, South Africa. *Palaeont, afr.,* **20,** 27–42.

LUCAS, R. C. 1979. *Studies in Antarctic palaeobotany.* Ph.D. thesis, University of Wales, 20+219 pp. [Unpublished.]

MAHESHWARI, H. K. 1976. Floristics of the Permian and Triassic Gondwanas of India. *Palaeobotanist,* **23,** No. 2, 145–60.

OLIVEIRA, M. E. C. B. DE. 1975. Taphloflora of Karroo in the Zambezi Basin (Tete region, Mozambique). *Bol. Inst. Geocienc. Univ. S. Paulo,* **6,** 33–53.

PLUMSTEAD, E. P. 1962. Geology. 2. Fossil floras of Antarctica (with an appendix on Antarctic fossil wood, by R. Kräusel). *Scient. Rep. transantarct. Exped.,* No. 9, 154 pp.

RIGBY, J. F. 1962. On a collection of plants of Permian age from Baralaba, Queensland. *Proc. Linn. Soc. N.S.W.,* **87,** No. 3, 341–51.

——. 1966. The Lower Gondwana floras of the Perth and Collie Basins, Western Australia. *Palaeontographica,* Abt. B, **118,** 113–351.

——. 1972. The distribution of Lower Gondwana plants in the Parana Basin of Brazil. *Proceedings and Papers of the 2nd Gondwana Symposium, South Africa, 1970,* **10,** 575–84.

RÖSLER, O. 1978. The Brazilian Eogondwanic floral succession. *Bol. Inst. Geocienc. Univ. S. Paulo,* **9,** 85–91.

SURANGE, K. R. 1975. Indian Lower Gondwana floras: a review. *Gondwana Geology; Papers of the 3rd Gondwana Symposium, Australia, 1973,* 135–47.

WALKOM, A. B. 1922. Palaeozoic floras of Queensland. Pt. 1. The flora of the Lower and Upper Bowen Series. *Publs geol. Surv. Qd,* No. 270, 45 pp.

WHITE, M. E. 1970. Permian flora from the Beaver Lake area, Prince Charles Mountains, Antarctica. 2. Plant fossils. (*In* Palaeontological papers, 1969. *Bull. Bur. Miner. Resour. Geol. Geophys. Aust.,* No. 126.)