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Paleontology of the Lower Paleozoic of northern Victoria Land: Brachiopods with Australian and New Zealand affinities in the Spurs Formation

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During the austral summer of 1981–1982, we investigated the paleontology of the Bowers Supergroup of northern Victoria Land (figure 1) as event K20 of the New Zealand Antarctic Research Program. Although it was under New Zealand sponsorship and had two New Zealand members, the team had an international composition because it also included an Australian and an American. Much of the season we worked in close cooperation with members of event K19 (M.G. Laird, J. D. Bradshaw, C. J. D. Adams, and K. Sullivan) who were studying the sedimentology and physical stratigraphy of the same sequence of Lower Paleozoic rocks.

Transportation was primarily by motor toboggan-drawn sledge and during the period 17 November 1981 through 3 January 1982 we covered some 1,200 kilometers. Our fieldwork was aided substantially by the availability of helicopter support for establishing food and fuel depots and for geological reconnaissance of outlying areas.

Our principal objective was to make fossil collections that would better constrain the age of the Bowers Supergroup and its various formations. In this we were successful and short accounts are available (Cooper, Jago, and Rowell 1982b; in press). In outline, it is now apparent that the oldest beds of the supergroup are much younger than had previously been thought. The base of the Sledgers Group (figure 1) is unlikely to be older than Middle Cambrian. Earlier views regarded these basal beds of the "Bowers Trough" as Vendian (Cooper et al. 1982a; Laird 1981; Laird, Bradshaw, and Wodzicki 1982; Tessensohn et al. 1981), an age based upon acritarchs that are now known to range into post-Vendian rocks (Vidal in Cooper et al. in press). This revised date for the initiation of deposition in the trough has considerable paleogeographic implication. Furthermore, it alters our perception of the magnitude of the strati-

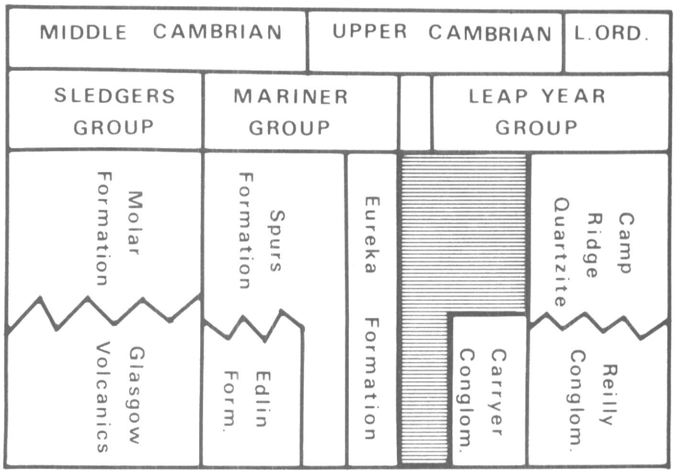

Figure 1. Stratigraphic subdivision and age of the Bowers Supergroup (after Cooper et al. in press).

graphic break between the Sledgers and Mariner groups (figure 1), (Cooper et al. in press; Laird and Bradshaw in press). There is no longer any reason to suspect a significant hiatus between them, and we presently consider that sedimentation was essentially continuous across their boundary, which is of late Middle Cambrian age.

Poorly preserved inarticulate brachiopods had previously been recorded from near this boundary (Cooper et al. 1982a) but although they provided some broad age constraints they yielded no information on provincial affinity. Our recent fieldwork, however, has produced collections that with acetic or formic acid treatment yield modest samples of phosphatic-shelled inarticulate brachiopods. The best preserved samples to date are from the thick limestone bed within the Spurs Formation on the northeast side of Reilly Ridge. (The outcrop is illustrated by Laird et al. 1982, fig. 66.4.) The brachiopod fauna is dominated by the acrotretid *Stilpnotreta* cf. *magna* Henderson and MacKinnon (figure 2) but includes specimens of *Treptotreta* sp. and fragmentary *Picnotreta* sp. together with unidentifiable pieces of lingulides. The *Stilpnotreta* is very similar to that recently described by Henderson and MacKinnon (1981). The ventral valves are virtually indistinguishable but grooves in the dorsal propareas of our material are much less conspicuous than those of *S. magna* itself. The known range of these taxa would date this part of the Spurs Formation as within the span of latest Middle Cambrian to middle early Late Cambrian (within the zones of *Leiopyge laevigata* through *Cyclagnostus quasivespa*). Furthermore, these taxa also show that the brachiopod fauna had strong affinities with that of Australia and New Zealand. All three genera are known from the Tasman Formation of New Zealand and occur in Queensland (Henderson and MacKinnon 1981). Other than this new antarctic record they have not been noted from elsewhere but their presence in China might be anticipated.

The only other brachiopods that have previously been recorded from the Spurs Formation are the middle Late Cambrian (Idamean) taxa *Schizambon reticulatus* MacKinnon, *Billingsella* sp., and a form referred to *Prototreta*(MacKinnon in Shergold et al. 1976). The latter species would today be better placed in *Treptotreta* and is the only endemic element with Australian affinities. *Billingsella* and *Schizambon* are both relatively cosmopolitan genera.

That some of the Idamean brachiopods show affinities with Australian taxa is hardly surprising for many of the trilobites from this level are forms that are known also in Australia, China, and Kazakhstan (Shergold et al. 1976). The strongly provincial older brachiopod fauna is less expected for although the late Middle and early Late Cambrian trilobites from the Spurs Formation include some provincial Australian forms [e.g., *Paleodotes* cf. *italops* Öpik and "*Amphoton*" sp. (Cooper et al. 1976, 1982a)], the fauna from this part of the sequence is dominated by more cosmopolitan taxa like the agnostoids and the polymeroid genera *Centropleura* and *Pianaspis*. The reason for this seeming change in the level of endemism from low to high in the Spurs Formation is not immediately apparent. It is conceivable that it reflects changing water depth and ease of communication with the open ocean. The Spurs Formation is known to be part of a shallowing-upward sequence (Andrews and Laird 1976) and the more cosmopolitan taxa are more abundant in its lower beds. It also is conceivable that the pattern is an artifact produced by small sample size. We hope our new collections will resolve the problem when they are fully prepared and evaluated.

Rowell is indebted to the National Science Foundation for transportation to New Zealand and Jago acknowledges a similar debt to the Australian National Antarctic Research Expedition. We are all grateful to the Antarctic Division of the New Zealand Department of Scientific and Industrial Research who supported the fieldwork on which this report is based.

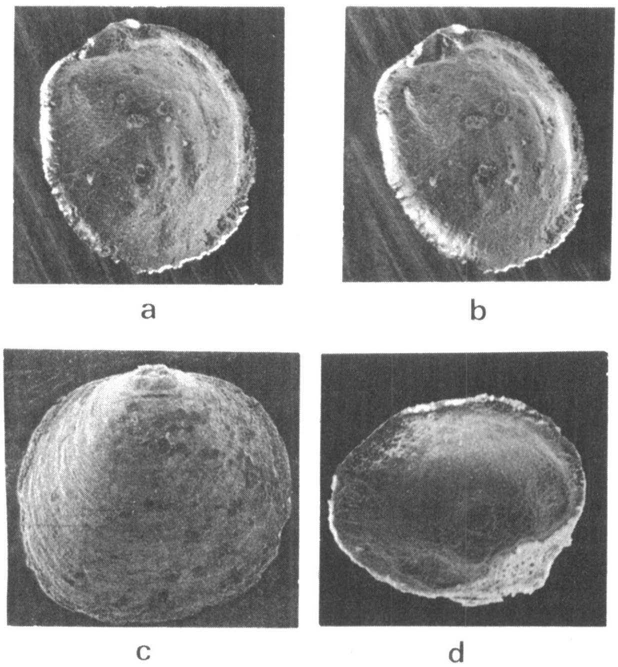

Figure 2. *Stilpnotreta* cf. *magna* Henderson and MacKinnon. Scanning electron microscope photographs of material from locality M116, Spurs Formation, Reilly Ridge. (a) and (b) Stereopair of oblique view of dorsal valve interior, × 50. (c) Dorsal valve exterior, × 50. (d) Oblique view of ventral valve interior with bifid dorsal surface of pseudointerarea, × 50.

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Sedimentary petrology of Permian-Triassic fluvial rocks in Allan Hills, central Victoria Land

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Sedimentologic studies of Permian-Triassic fluvial rocks in Allan Hills (76°42′S 159°50′E) were conducted to compare the sequence there with equivalent sequences elsewhere in Victoria Land. The Allan Hills sequence, first described and mapped by Ballance (1977), was found to be greatly similar to the stratigraphic section described by McElroy (1969), Barrett, Grindley, and Webb (1972), and McKelvey et al. (1972) in southern Victoria Land, but dissimilar to equivalent rocks in northern Victoria Land (Collinson and Kemp 1982). The stratigraphic sequence in Allan Hills is shown in figure 1.

A five-person field party, including Collinson and Kemp, B. L. Roberts (geologic field assistant), and W. H. Hammer and J. M. Zawiskie (vertebrate paleontologists), worked from 8–15 January 1982 from a tent camp emplaced by helicopter from McMurdo Station. Stratigraphic sections of each formation were measured, described, and sampled. More than 750 crossbedding directions were analyzed to determine paleocurrent dispersal. Figure 2 was compiled from modal analysis by Chapman of 29 thin sections.

The lowest stratigraphic unit exposed in the Allan Hills, the upper 73 meters of the Permian Weller Formation, is represented by meandering stream, floodplain, and floodbasin deposits. These consist of 5 to 10 meter-thick fining-upward cycles of feldspathic sandstone, carbonaceous shale and coal. Point-bar accretion beds dip 10–15° and extend from top to bottom of sandstone units (figure 3). Fifty or more measurements of trough crossbedding and of ripple mark directions within each sandstone unit at several localities indicate flow generally toward the west; dispersal varies as much as 180° from one cycle to another. Large coalified and silicified logs and *Glossopteris* leaves are locally abundant. Coal beds, up to 2 meters thick, are of high rank because of heating by the intrusion of Jurassic Ferrar Dolerite.

An abrupt change in lithology and one to three well-developed ferricrete horizons at the top of the Weller Formation suggest that a major disconformity separates the Weller and the overlying Feather Sandstone.

The lower Feather Sandstone (120 meters thick), which is a massive cliff-forming, medium-grained, quartzose sandstone, was deposited by sand-dominated braided streams. Vertical-tube (*Skolithos*) burrows, also noted by Ballance (1977), 0.5 centimeters in diameter and 20–30 centimeters long, are abundant.

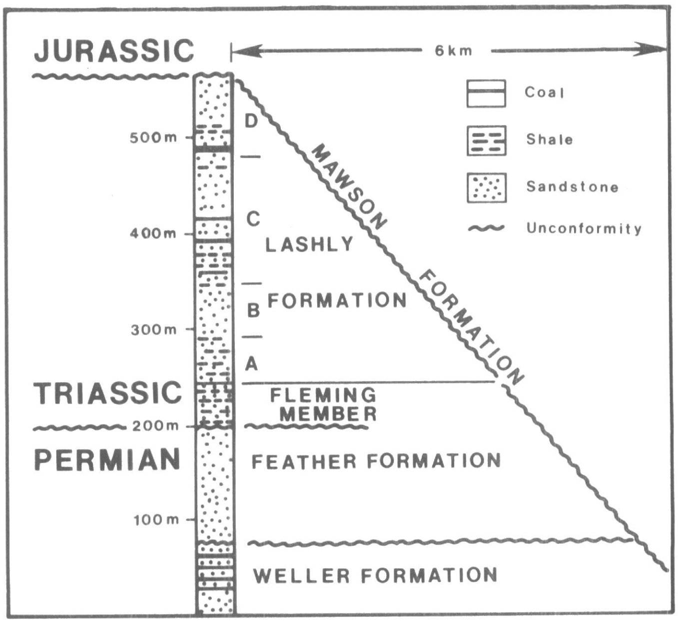

Figure 1. Stratigraphic sequence in Allan Hills.