

# THE STRATIGRAPHIC IMPLICATIONS OF *MONOGRAPTUS EXIGUUS* FROM CAMP HILL, CANBERRA, ACT

D. L. Strusz & C. J. Jenkins<sup>1</sup>

The Camp Hill Sandstone of Öpik (1958) is unconformable not only on the Black Mountain Sandstone but also the State Circle Shale (whose age is established as Late Llandovery by the occurrence of *Monograptus exiguus*).

It is almost certain that the Black Mountain Sandstone overlies the State Circle Shale, and is thus of Late Llandovery age, not Early Ordovician.

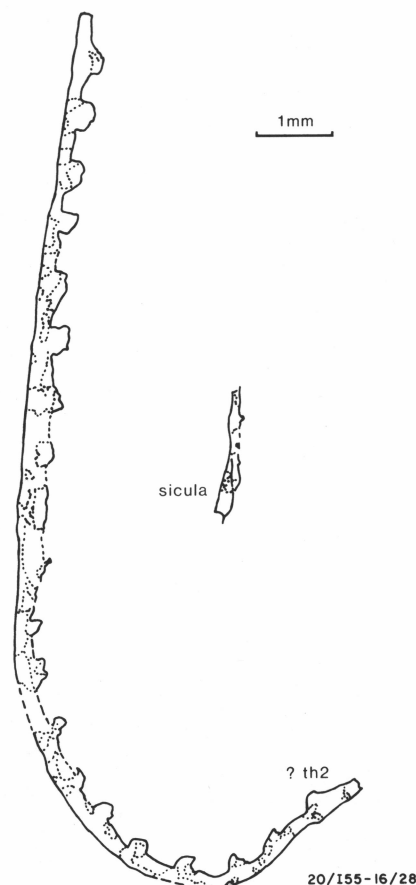
In the seventy years since Pittman (1911) reported on the geology of the Canberra area, the age assigned to the prominently outcropping Black Mountain Sandstone has changed from Silurian to earliest Ordovician and back. Yet still there is no direct evidence, all interpretations being deduced from its relation with the surrounding rocks (Öpik, 1958; Strusz & Henderson, 1971; Crook & others, 1973)—and those relations have themselves been subject to disagreement (Link, 1970, 1971; Öpik, 1971).

The stratigraphic units most involved, of those erected by Öpik, are the Camp Hill Sandstone and the State Circle Shale. The former contains a Silurian shelly fauna, including the brachiopod *Rhipidium*, which Öpik took to be of Llandovery age, but which is now known to be a Wenlock-Ludlow form (Strusz & Henderson, 1971). The State Circle Shale contains a graptolite fauna, of which the commonest species is *Monograptus exiguus*, restricted to two zones in the middle of the Late Llandovery. Öpik thought that the State Circle Shale was conformable on the Camp Hill Sandstone (the contact was not exposed) and passed upwards into his calcareous Turner Mudstone. However, excavations for Capital Circle and the widened State Circle in 1969-71 revealed a different and more complex situation (Henderson, 1973). At the summit of Capital Hill (now removed during excavation for the new Parliament House), the Camp Hill Sandstone lay unconformably on quartz sandstone identified by Öpik as the Black Mountain Sandstone. In a pedestrian underpass below Capital Circle about 400 metres west of the summit, and 300 metres south of the type locality of the State Circle Shale, the same quartz sandstone conformably overlay shale similar to the State Circle Shale. In cuttings on Capital Circle 350 metres north-northeast of the summit, a tectonically disturbed area showed the quartz sandstone definitely interbedded with State Circle Shale (containing *M. exiguus*). None of the excavations contained rock resembling the Turner Mudstone.

A major fault separates most of Capital Hill from Camp Hill to the northeast, type locality of the Camp Hill Sandstone, and the deepened road cutting on State Circle exposed the unconformity at the base of the Camp Hill Sandstone. The underlying slumped pinkish buff siltstone is quite unlike the Black Mountain Sandstone, and, though unfossiliferous, was identified as the State Circle Shale. A trunk sewer tunnel behind the present Parliament House, less than 300 metres northeast, but with no outcrop intervening, had yielded shale with a good *M. exiguus* fauna in

1958, but a fault separated it from rocks of Öpik's Canberra Group, so it could not be put in proper stratigraphic context. While examining test pits for the new Parliament House with Henderson in 1979, one of us (D.L.S.) collected a single specimen of *M. exiguus* from a pinkish buff siltstone exposed in a pit on Camp Hill behind the northern end of the Parliament House car park. The exposure clearly showed the same unconformity as in State Circle, and the graptolite came from below it, so the stratigraphic context is unequivocal. The identity of the specimen (Fig. 1) has been confirmed by the other author (C.J.J.).

It is thus now certain that the Camp Hill Sandstone is unconformable on both State Circle Shale and Black Mountain Sandstone. The interbedding of the State



**Figure 1.** *Monograptus exiguus* (Nicholson, 1868), CPC 21458.

The dimensions and shape of the specimens most closely match those of the *M. e. exiguus* described in Hutt (1975), and from the *Monograptus turriculatus* and *Monograptus crispus* Zones of the Upper Llandovery in Britain.

<sup>1</sup> James Cook University of North Queensland, Townsville, Queensland 4811.

Circle Shale with quartz sandstone assigned to the Black Mountain Sandstone on Capital Circle, while not conclusive, strongly supports the more recent thesis, based on reappraisal of the outcrops at the southern end of Black Mountain (Strusz & Henderson, 1971; Crook & others, 1973), that the Black Mountain Sandstone is conformable above the State Circle Shale. While definite proof of this thesis remains elusive, Öpik's alternative concept that the Black Mountain Sandstone is below everything, including the Pittman Formation (of known Ordovician age), is becoming increasingly difficult to support.

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