AGE AND STRATIGRAPHY OF A SEQUENCE OF METAVOLCANIC AND METASEDIMENTARY ROCKS IN THE PRAIRIE DOWNS-DEADMAN HILL AREA, SOUTHWESTERN MARGIN OF THE SYLVANIA DOME

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ABSTRACT

A sequence of metavolcanic and metasedimentary rocks at the southwestern margin of the Sylvania Dome clearly post-dates the granitoid-greenstone terrain of the dome and can be correlated with the Fortescue and Hamersley Groups of the southwestern Hamersley Basin.

INTRODUCTION

The Sylvania Dome is an inlier of granitoid-greenstone terrain outcropping at the southern margin of the Hamersley Basin (Fig. 1A). The northern margin of the dome is in tectonic contact with the Fortescue and Hamersley Groups, but to the south and east it is unconformably overlain by the Bangemall Group.

At the southwestern margin, in the general vicinity of Deadman Hill and the Prairie Downs Fault, Daniels and MacLeod (1965) identified an area of metabasaltic and metasedimentary rocks which they equated with greenstone sequences of the dome. Recent detailed mapping by the author has confirmed the suggestion made by Horwitz and Smith (1978) that a major part of these rocks belongs to the 2 700 Ma Fortescue Group, and that the metasedimentary rocks at Deadman Hill belong to the overlying Hamersley Group, (Horwitz, 1980, Fig. 1; Morris and Horwitz, 1983, Fig. 2a).

GEOLOGY OF THE PRAIRIE DOWNS-DEADMAN HILL AREA

Basement rocks of the Sylvania Dome

The western part of the Sylvania Dome consists mainly of foliated granitoid rock intruded by undeformed granitoid rock. Both rocks are medium grained and extensively recrystallized. Areas of greenstone belts occur and are intruded and extensively veined by the undeformed granitoid rock. They consist of mafic and ultramafic rocks together with metasedimentary rocks including banded chert and banded iron-formation. They are strongly deformed and show a well-developed metamorphic foliation. The cherts show a phase of isoclinal folding, and this is followed by a phase of tight folding which is widespread in the other rock types. Metamorphic mineral assemblages formed in conditions transitional from greenschist to amphibolite facies.

Both granitoid rocks and greenstones are intruded by numerous north-trending mafic dykes.

The cover succession

A succession of interbedded mafic volcanics, felsic volcanics, and metasedimentary rocks is well exposed along the track from Jillary Well to Prairie Downs Homestead (Fig. 1B). It has a southeasterly strike near Jillary Well, but strikes south to the north and west of Nirran Nirrie Bore. Dips are moderate or steep to the southwest and west. The succession has a minimum thickness of 6.5 km not 2 km as indicated by Horwitz (1980, Fig. 1) and Morris and Horwitz (1983, Fig. 2a). Contacts with adjacent granitoid rocks and greenstones are everywhere faulted.

Three main features distinguish this succession from the greenstones.

(a) The rocks are less deformed, and isoclinal folds are absent; but tight folds with a well-developed cleavage occur. Late, open folds show faults along their axial planes.

(b) The metamorphic grade is lower, and mineral assemblages indicate lower to middle greenschist facies conditions.

(c) The greenstones are extensively veined by granitoid rocks and are cut by north-trending mafic dykes, whereas these intrusions are absent from the cover sequence.

Northwest and west-northwest-trending mafic dykes cut both the granitoid-greenstone terrain and the overlying cover sequence.

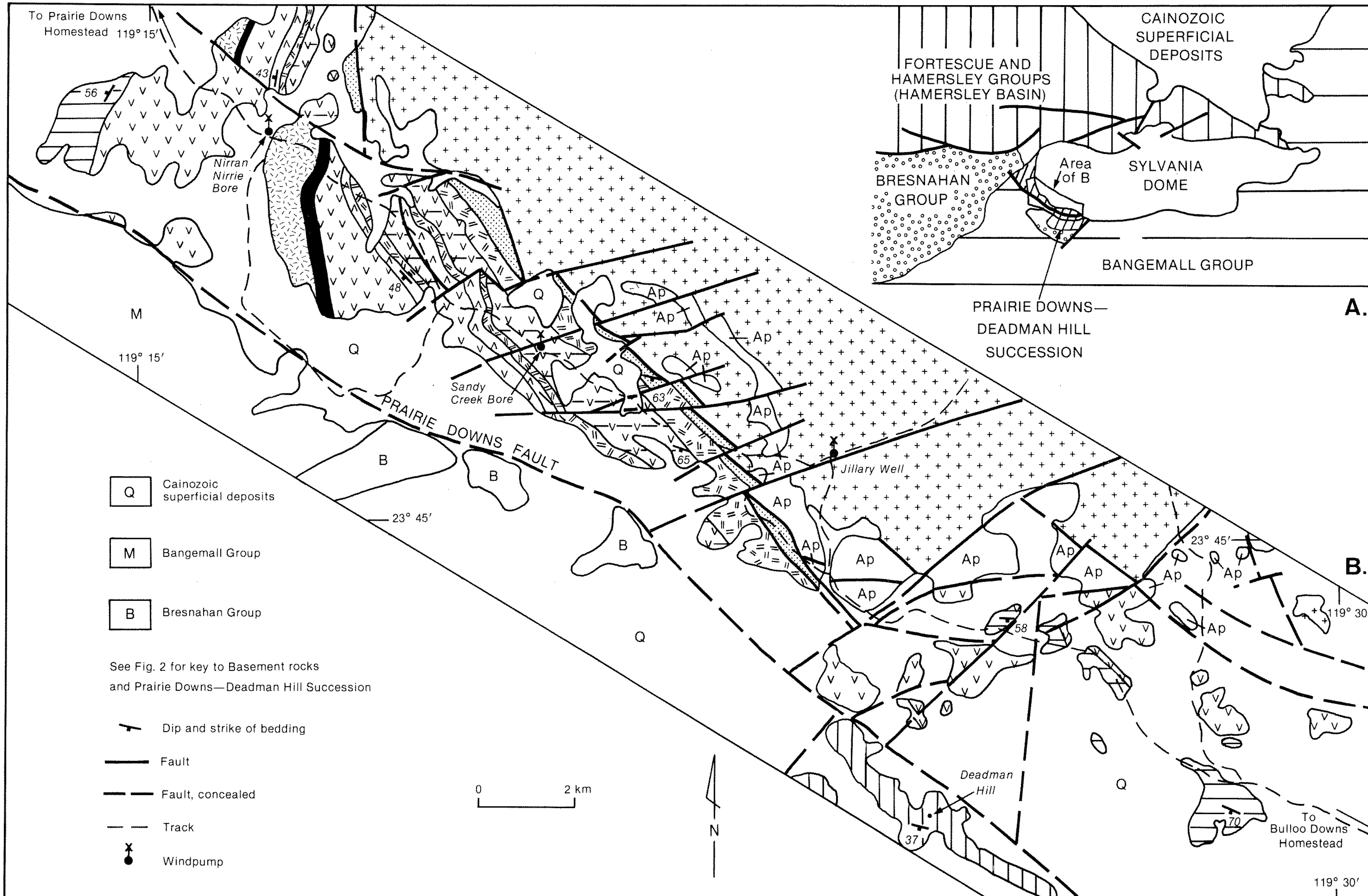

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Figure 1. A—Simplified map of regional geology. Location of Fig. 1B outlined. B—Geological map of the Prairie Downs-Deadman Hill area with mafic dykes omitted.

Six distinct units can be recognized within the succession (Fig. 2). A lower metasedimentary unit consists of interbedded phyllite, quartz-muscovite schist, metasandstone and peloidal carbonate. The metasandstone is generally coarse grained, shows poorly developed cross-bedding, and forms a good marker horizon up to 5 m thick. It is underlain by a purple-brown phyllite. Above the metasandstone, quartz-muscovite schist (possibly derived from felsic tuff) is interlayered with thin 10-15 cm thick, peloidal carbonate units.

This schist is overlain by a coarse metagabbroic sill (with a metapyroxenitic base) and a lower mafic volcanic unit, comprising interlayered mafic lava flows and tuffs which are locally bedded. Individual rock units are in the order of 2-3 m thick. These volcanic rocks are overlain by a second layered metagabbro sill below a felsic pyroclastic unit. This comprises felsic tuff which is locally laminated. A 5-10 m thick banded chert occurs above the tuff.

These rocks are overlain by an upper mafic unit, consisting of a monotonous sequence of metabasalts. However, it includes a komatiite flow with well-developed spinifex textures. An adjacent unit of serpentinite may represent a dunitic base to the flow.

An upper metasedimentary unit, comprising phyllite and silicified mudstone, occurs above the metabasalt.

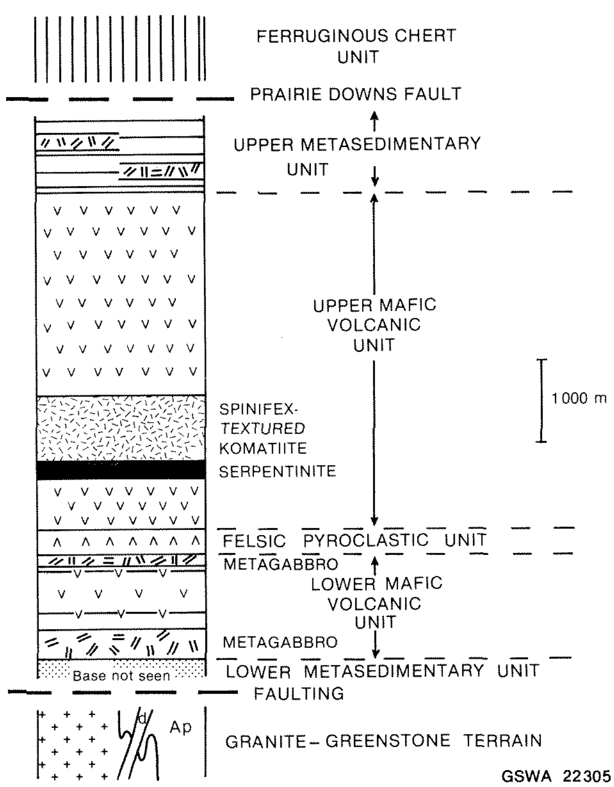

Figure 2. Stratigraphic column of the Prairie Downs-Deadman Hill succession.

To the south, the sequence is truncated by the Prairie Downs Fault, whereas to the west it is covered by Tertiary colluvial deposits.

The area to the south and east of Jillary Well is extensively disrupted by faulting, and a continuous sequence is not preserved. However, individual fault blocks may be correlated with the upper mafic volcanic unit and the overlying upper metasedimentary unit. Several mafic sills are evident within the uppermost unit.

At Deadman Hill, a ferruginous chert unit, characterized by internal podding, is exposed. This is separated from the sequence described above by the southeasterly extension of the Prairie Downs Fault (Fig. 1B).

STRATIGRAPHIC INTERPRETATION

The succession described above clearly post-dates the granitoids and greenstones of the dome. The predominantly mafic character and relatively high metamorphic grade of the succession distinguishes it from the adjacent Bangemall and Bresnahan Groups. As will be discussed below, the succession is similar to that of the Fortescue Group and lower part of the Hamersley Group of the Hamersley Basin, and this is the preferred correlation.

Fortescue Group—Hamersley Group stratigraphy

The stratigaphy of the Fortescue and Hamersley Groups has recently been reviewed and summarized by Hickman (1983) and Trendall (1983). Hickman (1983) produced a standardized nomenclature for rocks on, or adjacent to, the Pilbara Block north of the Fortescue River (Table 1).

In the southwestern part of the Hamersley Basin, the nomenclature of the succession described by de la Hunty (1965) on the Mount Bruce sheet—and extended by Daniels (1968, 1970) to the Turee Creek and Wyloo sheets—has been retained by Seymour and Thorne (in press) for the second edition of the Wyloo sheet. The Mount Roe Basalt, identified by Blight (1985), is included beneath the Hardey Sandstone. The succession is shown in Table 1.

On the Newman sheet, Daniels and MacLeod (1965) did not identify the Mount Jope Volcanics and believed the Jeerinah Formation to lie directly on the Hardey Sandstone. Horwitz (1976), in recording a section through the Fortescue Group adjacent to the northern contact of the Sylvania Dome identified a mafic volcanic unit between the Hardey Sandstone and the Jeerinah Formation which he ascribed to the 'Maddina Volcanics'.

Correlation with the Prairie Downs-Deadman Hill succession

The succession in the Prairie Downs-Deadman Hill area closely resembles that in the southwestern Hamersley Basin and a direct correlation is suggested (Table 1). The Mount Roe Basalt is absent. The lower metasedimentary unit represents the Hardey Sandstone; the lower mafic volcanic unit, the felsic pyroclastic unit, and the upper mafic volcanic unit, represent equivalents to the Boongal Pillow Lava Member, the Pyradie Pyroclastic Member, and the Bunjinah Pillow Lava Member of the Mount Jope Volcanics; and the upper metasedimentary unit represents the Jeerinah Formation. The ferruginous chert recognized at Deadman Hill, although separated from the main succession by the Prairie Downs Fault, is correlated with the Marra Mamba Iron Formation of the Hamersley Group.

The occurrence of a similar succession in the Prairie Downs-Deadman Hill area to that seen in the southwestern Hamersley Basin suggest that it may be possible to extend the stratigraphic nomenclature used by Seymour and Thorne (in press) on the Wyloo Sheet throughout the Fortescue Group of the southern Hamersley Basin. It seems unlikely, in view of the evidence presented in this paper, and of the observations of Horwitz (1976), that the Mount Jope Volcanics are absent from the rest of the Newman sheet.

TABLE 1. FORTESCUE GROUP—LOWER HAMERSLEY GROUP STRATIGRAPHY

Pilbara Block (a)			*Southwestern Hamersley Basin (b)*		*Prairie Downs-Deadman Hill*	
Formation	*Principal lithologies*		*Formation*	*Principal lithologies*	*Unit*	*Lithologies*
			HAMERSLEY GROUP			
Marra Mamba Iron Formation	Shale, chert and BIF		**Marra Mamba Iron Formation**	Chert and BIF	**Ferruginous Chert Unit**	Ferruginous chert
			FORTESCUE GROUP			
Jeerinah Formation	Siltstone, shale and chert, sandstone, local felsic lava, tuff and agglomerate, basalt; mafic sills locally abundant		**Jeerinah Formation**	Shale, chert, BIF, mudstone, quartzite, dolomite and dolerite	**Upper Metasedimentary Unit**	Phyllite, silicified mudstone; mafic sills locally developed
Maddina Basalt	Vesicular and amygdaloidal basalt and andesite	Mount Jope Volcanics	**Bunjinah Pillow Lava Member**	Pillow basalt, vesicular basalt, and volcanic breccia	**Upper Mafic Volcanic Unit**	Metabasalt and komatiite
Kuruna Siltstone	Sandstone and siltstone, local shale, ooidal sediments, pisolitic tuff and banded siliceous limestone					
Nymerin Basalt	Coarse textured basalt		**Pyradie Pyroclastic Member**	Tuff with agglomerate and volcanic bombs, local chert, shale, BIF and pillow lava	**Felsic Pyroclastic Unit**	Felsic tuff and banded chert
Tumbian Formation	Siliceous limestone (stromatolitic) and pisolitic tuff; subordinate tuff, basalt and sediments					
Kylena Basalt	Massive amygdaloidal and vesicular basalt and andesite; subordinate but widespread interbedded sediments		**Boongal Pillow Lava Member**	Pillow basalt, minor carbonate	**Lower Mafic Volcanic Unit**	Metabasalt and mafic tuff
Hardey Sandstone	Sandstone and conglomerate; local tuff, shale, mudstone and basalt		**Hardey Sandstone**	Sandstone, arkose, shale and conglomerate	**Lower Metasedimentary Unit**	Metasandstone, phyllite, quartz muscovite schist, peloidal carbonate
Mount Roe Basalt	Basalt and andesite with thin basal sedimentary rocks		**Mount Roe Basalt**	Basalt, intermediate to mafic tuffs and coarse clastic sediments; local felsic pyroclastics	**Absent**	

(a) is taken from Trendall (1983), Table 3-II

(b) is based on De la Hunty (1965) and Seymour and Thorne (in press)

Recent mapping by the author has confirmed the suggestion by Horwitz and Smith (1978) that volcanic and metsedimentary rocks in the Prairie Downs-Deadman Hill area of the Newman sheet, previously grouped with greenstones of the Sylvania Dome (Daniels and MacLeod, 1965) are part of the Fortescue and Hamersley Groups. A correlation with the succession recorded from the southwestern Hamersley Basin is preferred.

REFERENCES

Blight, D. F., 1985, Economic potential of the lower Fortescue Group and adjacent units in the southern Hamersley Basin: West. Australia Geol. Survey, Rept 13.

Daniels, J. L., 1968, Turee, Creek, W.A.: West Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.

Daniels, J. L., 1970, Wyloo, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.

Daniels, J. L., and McLeod, W. N., 1965, Newman, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.

de la Hunty, 1965, Mount Bruce, W.A.: West Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.

Hickman, A. H., 1983, Geology of the Pilbara Block and its environs: West Australia Geol. Survey Bull. 127.

Horwitz, R. C., 1976, Two unrecorded basal sections in older Proterozoic rocks of Western Australia: Australia CSIRO, Mineral Research Laboratories, Division of Mineralogy, Rept FP. 17.

Horwitz, R. C., 1980, Discussion *on* A progress review of the Hamersley Basin of Western Australia *by* A. F. Trendall: Finland, Geol. Soc. Bull. 53(1), p. 63-66.

Horwitz, R. C. and Smith, R. E., 1978, Bridging the Yilgarn and Pilbara Blocks, Western Australia: Precambrian Res. v. 6, p. 293-322.

Morris, R. C. and Horwitz, R. C, 1983, The origin of the iron-formation-rich Hamersley Group of Western Australia—Deposition on a platform: Precambrian Res. v. 21, p. 273-297.

Seymour, D. B. and Thorne, A. M., (in press), Wyloo, W.A. (2nd ed.): West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.

Trendall, A. F., 1983, The Hamersley Basin *in* Iron formations: facts and problems *edited by* A. F. Trendall and R. C. Morris: Elsevier, Developments in Precambrian Geology, 6.