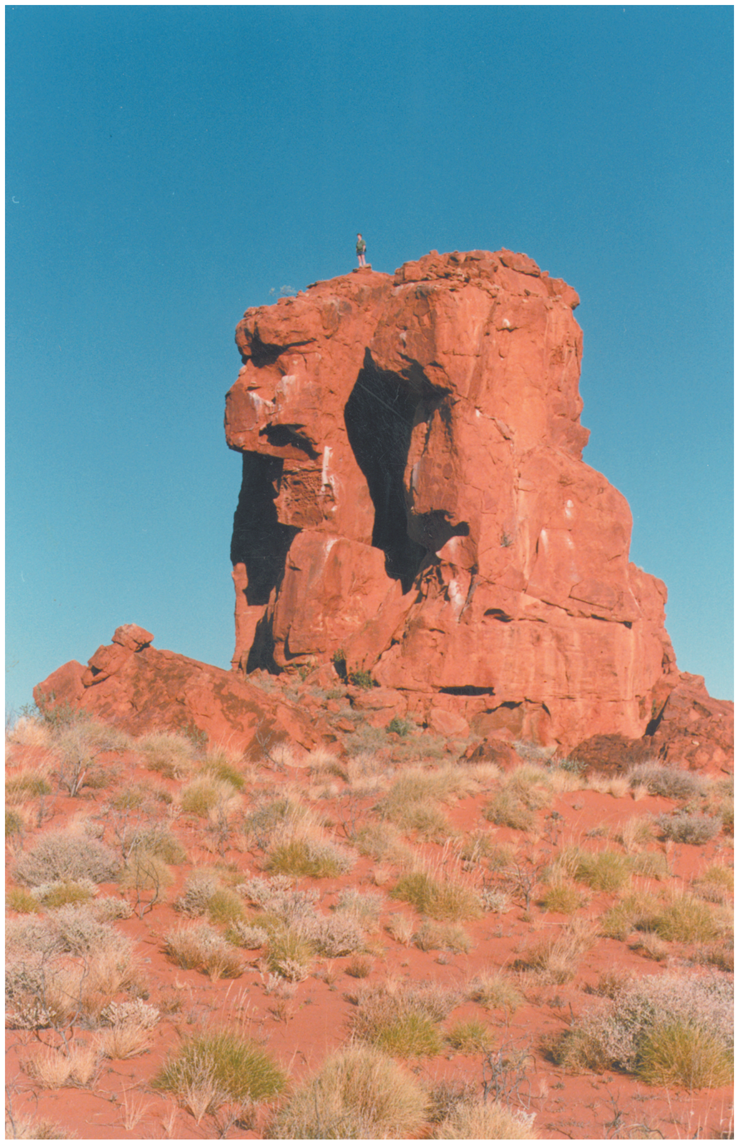
EXPLANATORY NOTES

GOVERNMENT OF WESTERN AUSTRALIA

GEOLOGY OF THE POISONBUSH 1:100 000 SHEET

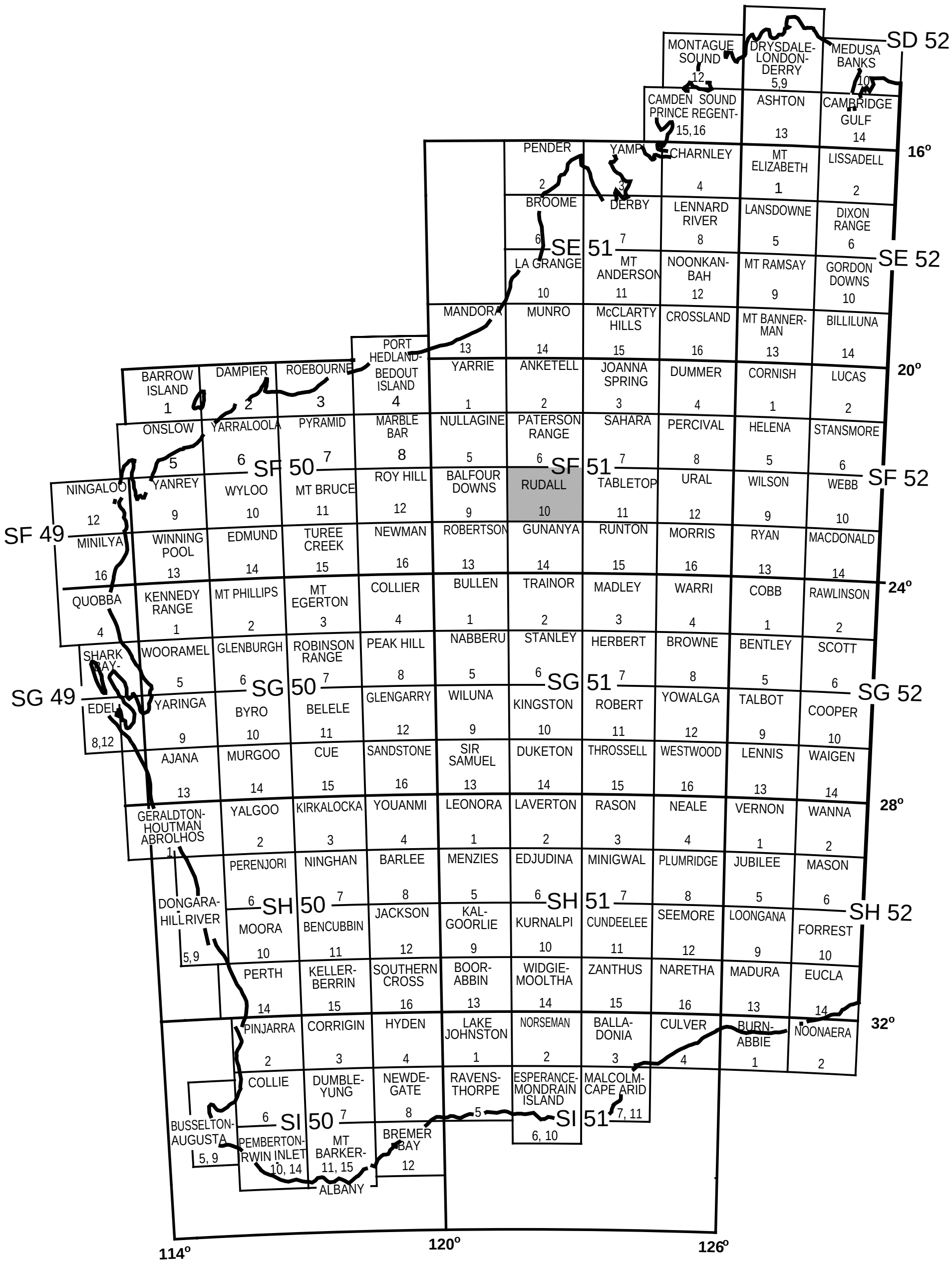
by I. R. Williams and L. Bagas

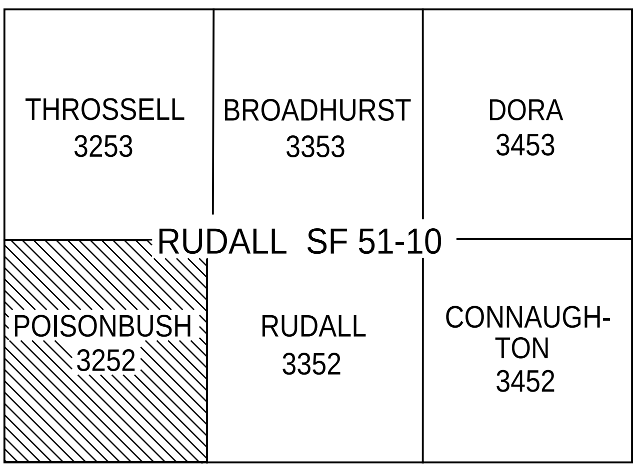
1:100 000 GEOLOGICAL SERIES



GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

DEPARTMENT OF MINERALS AND ENERGY





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GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

GEOLOGY OF THE POISONBUSH 1:100 000 SHEET

by
I. R. Williams and L. Bagas

Perth 2000

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Cover photograph:
Hanging Rock (AMG 627104), viewed from the northwest, is composed of sandstone of the Tchukardine Formation. Scale is shown by the human figure on top of the rock.

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Geology of the Poisonbush 1:100 000 sheet

by

I. R. Williams and L. Bagas

Abstract

The POISONBUSH 1:100 000 sheet straddles the boundary between the Paterson Orogen and the Officer Basin. On POISONBUSH, the orogen comprises Palaeoproterozoic metasedimentary and meta-igneous components of the Rudall Complex, the Mesoproterozoic to Neoproterozoic metasedimentary Throssell Group, and the Neoproterozoic sedimentary Tarcunyah Group. This latter group is also a component of the Officer Basin, with the Sunbeam Group, the Boondawari Formation, and the Disappointment Group.

The Rudall Complex is composed of metamorphosed siliciclastic rocks interlayered with orthogneiss belonging to the tectono-stratigraphic Talbot Terrane. The Rudall Complex was deformed and metamorphosed during the Yapungku Orogeny, which involved northeast–southwest compression between c. 2000 Ma and c. 1760 Ma.

The Throssell Group of the Yeneena Supergroup unconformably overlies the Rudall Complex and consists of the Coolbro Sandstone and the conformably overlying carbonaceous Broadhurst Formation. Both the Throssell Group and the underlying Rudall Complex were deformed and metamorphosed during the Miles Orogeny, a poorly constrained event between c. 1300 and c. 800 Ma. The Throssell Group is faulted against younger rocks of the Tarcunyah Group.

The Tarcunyah Group contains rock units that can be correlated with units of Supersequence 1 of the Centralian Superbasin, which now includes the Officer Basin. The Tarcunyah Group is represented on POISONBUSH by the basal Choorun Formation, the Brownrigg Sandstone, and the Wongarlong and Nooloo Formations.

Within the Officer Basin, the Mundadjini Formation of the Sunbeam Group is also correlated with Supersequence 1 of the Centralian Superbasin. Both the Tarcunyah and Sunbeam Groups were broadly folded by northwest–southeast compression during the Blake Movement (c. 700 Ma). The glacigenic Boondawari Formation is correlated with Supersequence 3 and is part of the Marinoan glacial event.

The Tarcunyah Group, together with the Throssell Group and Rudall Complex, underwent southwest-directed transpression during the Paterson Orogeny (c. 550 Ma).

The younger Disappointment Group, comprising the McFadden, Tchukardine, and Woora Woora Formations, unconformably overlies the Tarcunyah and Sunbeam Groups, and the Boondawari Formation. The Disappointment Group, correlated with Supersequence 4, occupies the Wells Sub-basin of the Officer Basin. The axis of the sub-basin roughly parallels the trend of the Paterson Orogen.

POISONBUSH has been prospected for copper, zinc, gold, uranium, and diamonds.

KEYWORDS: Paterson Orogen, Rudall Complex, Throssell Group, Officer Basin, Tarcunyah Group, Disappointment Group, deformation.

Introduction

The POISONBUSH* 1:100 000 sheet (SF 51-10, 3252), bounded by latitudes 22°00'S and 23°00'S and longitudes 121°30'E and 122°00'E, is situated close to the northwestern corner of the Little Sandy Desert and occupies the southwest corner of the RUDALL 1:250 000 sheet. The sheet derives its name from the northwesterly trending Poisonbush Range (AMG 610780)† that is briefly mentioned in F. H. Hann's 1897 diary of his exploratory expedition to the Rudall River area (Donaldson and Elliot, 1998).

* Capitalized names refer to standard 1:100 000 map sheets unless otherwise indicated.

† Localities are specified by the Australian Map Grid (AMG) standard six-figure reference system whereby the first group of three figures (eastings) and the second group (northings) together uniquely define position, on this sheet, to within 100 m. AMG coordinates of localities mentioned in the text are listed in Appendix 1.

In general, POISONBUSH is uninhabited, although, at various times in the past, there have been temporary mineral exploration and Aboriginal camps in the northeastern corner, along the western margin to the west of the Poisonbush Range, and east of the Wells and Horsetrack Ranges close to the Talawana Track. The southwestern corner of the Rudall River National Park, declared in 1977, covers the northeastern quarter of POISONBUSH.

The main access to POISONBUSH is gained from the graded Talawana Track crossing the sheet from west to east. This track connects Newman, 249 km to the west, and Balfour Downs Homestead, 70 km to the west, with Windy Corner, 321 km to the east. The Parnngurr (Cotton Creek) Aboriginal Community on CONNAUGHTON is also accessible from this track. The Talawana Track is linked to the Rudall River area, 39 km to the northeast, via a rough track running northeast from the Wells Range area (AMG 891712). The rough Christie Crossing (Oakover River) – Rudall River track, used by exploration companies in the 1970s, crosses the northern margin of POISONBUSH. This rough track passes through Meeting Gorge, which contains Tchukardine Pool (AMG 565066) where explorers W. F. Rudall and F. H. Hann met, by chance, in April 1897 (Donaldson and Elliot, 1998). North of Curran Curran Rockhole (AMG 908083), this track is joined by an old exploration track that provides access to the Three Sisters Hills and Moses Chair areas on THROSSELL to the north (Williams and Bagas, 1999).

Access by four-wheel drive vehicles on POISONBUSH is difficult apart from areas adjacent to the Talawana and Christie Crossing – Rudall River tracks, and in the dune-free sandplain country in the northeast corner and along the northwest margin. Many of the rocky hills, and dissected ridges and plateaus that extend across POISONBUSH from the northwest to southeast corners are difficult to access from four-wheel drive vehicles. These outcrops are surrounded by closely spaced longitudinal-, chain-, and net-dune complexes that make cross-country travelling slow and laborious.

Previous and current investigations

Brief descriptions of the area can be found in early exploration journals of W. F. Rudall (Rudall, 1898) and F. H. Hann (Donaldson and Elliot, 1998), who both traversed the area in 1897. Although Talbot (1920) briefly recorded some observations along the northern margin of POISONBUSH, and a Bureau of Mineral Resources (BMR) survey party recorded some observations whilst traversing the region in 1956 on their way to the Canning Basin (Veevers and Wells, 1961), it was not until 1975 that the first systematic geological mapping was carried out. This was undertaken by the Geological Survey of Western Australia (GSWA) as part of the RUDALL 1:250 000 geological sheet mapping project (Chin et al., 1980).

The BMR, now the Australian Geological Survey Organisation (AGSO), published preliminary Bouguer anomalies in 1970, radiometric contours – total count in 1987, and total magnetic intensity maps in 1988 for RUDALL (1:250 000), which includes the POISONBUSH area. Reports of mineral exploration in the area from the mid-1970s onward are available from the Department of Minerals and Energy Western Australian mineral exploration database (WAMEX) open-file system held in the departmental library (see Appendix 2).

The present study, part of the Geological Survey's 1:100 000-scale mapping program of the Paterson Orogen commenced in 1987, was undertaken during the 1994 field season using black and white 1:50 000-scale aerial photographs flown in 1988. The POISONBUSH 1:100 000-scale geological sheet was published in 1998 (Williams and Bagas, 1998). These data have been incorporated in the second edition of RUDALL (1:250 000; Bagas, 1999a).

Climate, vegetation, and physiography

The climate on POISONBUSH is arid (desert) with summer rainfall peaking in February. Most rain comes from summer thunderstorms associated with monsoonal troughs, or from decaying southerly to southeasterly moving tropical cyclones. Lighter winter rains may occur between May and July. The mean annual rainfall is around 200 mm. Apart from the cyclone season (December to April), the humidity is low, with high evaporation rates of up to 4000 mm per annum. Summers are very hot, with mean daily maximum temperatures over 40°C in Dec-ember and January. Winters are mild, having mean daily minimum temperatures around 11°C in July (Pink, 1992).

POISONBUSH falls entirely within the Keartland Botanical District (Beard and Webb, 1974) of the Eremaean Botanical Province (Beard, 1975; Fig. 1). The widespread sand dune country in this part of the Keartland Botanical District carries a mixed tree and shrub steppe of *Acacia, Hakea,* and *Grevillea* species with feather-top spinifex (*Plectrachne schinzii*). Sandplain country is minor and carries a shrub steppe of waterwood (*Acacia coriacea*), *Hakea* sp., and buck spinifex (*Triodia basedowii*). Sparsely scattered desert bloodwood (*Corymbia dichromophloia*; Hill and Johnson, 1995; previously described as *Eucalyptus dichromophloia*; Beard and Webb, 1974) is distributed throughout the region. Broad, sand-filled palaeovalleys carry extensive stands of desert oak (*Casuarina decaisneana*), and patches of tea-tree scrub (*Melaleuca* sp.) are scattered along calcreted palaeodrainages. Patches of samphire and saltbush fringe the large playa lakes east of the Horsetrack Range (AMG 667610).

Shrub steppe of kanji (*Acacia pyrifolia*) with mixed soft (*Triodia pungens*) and hard (*Triodia basedowii*) spinifex cover stony terrains in the headwaters of the Rudall River drainage and along the western margin in the Oakover Drainage Basin (Fig. 1). Low rocky hills and dissected ridges and plateaus are covered with a grass steppe of soft spinifex (*Triodia pungens*) with sparsely scattered snappy gum (*Eucalyptus brevifolia*), *Acacia,* and

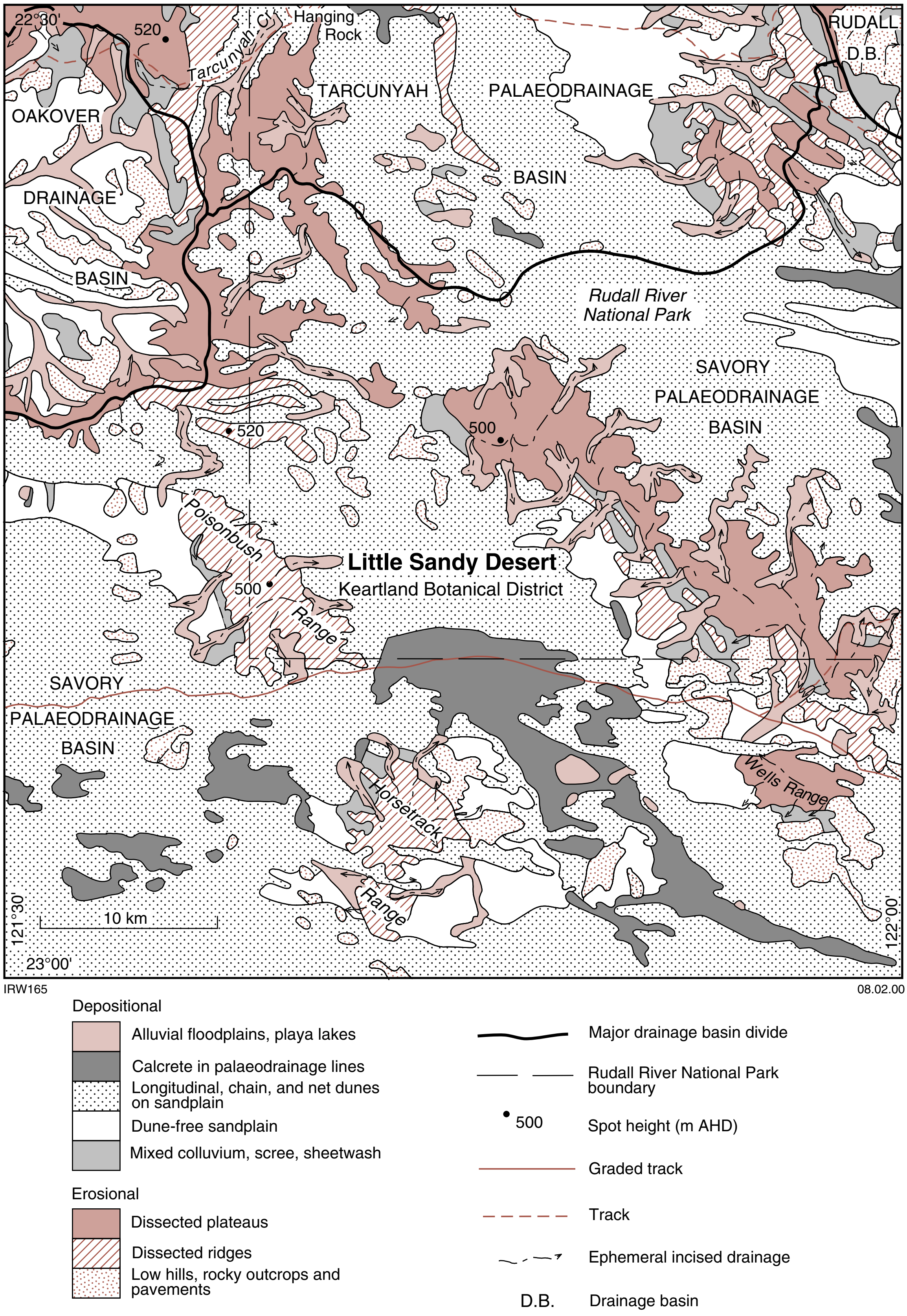

Figure 1. Natural regions, botanical districts, physiography, and drainage map of Poisonbush

Hakea species.

The physiographic divisions used on Poisonbush have been adopted from Throssell, where depositional regimes are distinguished from erosional regimes (Williams and Bagas, 1999; Fig. 1). Poisonbush lies entirely within the Little Sandy Desert (Beard, 1970).

Over 75% of the area is covered with longitudinal- (seif), chain-, and net-dune complexes. Individual dunes trend between 300°, on the eastern margin, and 260° in the southwestern corner. The Oakover Drainage Basin (Fig. 1), which lies in the northwest corner, is largely a dune-free, pebble-veneered sandplain. Elsewhere, longitudinal and chain dunes encroach upon and partly bury the scattered rocky hills and dissected ridges and plateaus on the windward (eastern) sides. The corresponding lee (western) sides of the outcrops are typically dune free, although this is partly dependent on the size of the outcrop. Surficial deposits in these areas comprise mixed scree, colluvium, and sheetwash deposits (Fig. 1). Net-dune complexes are restricted to valley floors and depressions.

Typically, Poisonbush is undulating with broad, dune-filled valleys separating dissected ridges, plateaus, and rocky hills. A maximum height of over 520 m AHD (Australian Height Datum) is reached in the headwater divide region of the Oakover Drainage Basin (Fig. 1). However, local relief is low with a maximum variation of about 60 m in the Hanging Rock (AMG 627104) and Choorun Waterhole (AMG 896018) areas.

Dissected plateaus, ridges, and low rocky hills occupy the northeast corner and a broad zone extending from the northwest to the southeast corners of Poisonbush (Fig. 1). The margins of the dissected plateau are commonly marked by lines of low cliffs or abrupt escarpments. Most outcrops are located along the major drainage divides that separate the Savory and Tarcunyah palaeodrainage basins from the Rudall and Oakover drainage basins (Fig. 1).

The Tarcunyah palaeodrainage originally flowed north to the Percival Palaeoriver (van de Graaff et al., 1977; Williams and Trendall, 1998a), whereas the Savory palaeodrainage is connected, via the ephemeral Savory Creek, to Lake Disappointment 70 km to the southeast (Williams, 1992). Extensive valley calcrete deposits have developed in both palaeodrainage basins.

All modern drainage on Poisonbush is ephemeral and, apart from the Tarcunyah Creek and unnamed tributaries of the Rudall River, consists of short sandy creeks emptying into the surrounding sand dunes. The broad, calcreted valley that separates the Horsetrack Range from the Wells and Poisonbush Ranges contains scattered playa lakes.

Regional geological setting

Poisonbush covers the boundary between the northwest part of the Paterson Orogen (Williams and Myers, 1990), previously referred to as the Paterson Province (Daniels and Horwitz, 1969; Blockley and de la Hunty, 1975), and the redefined and expanded Officer Basin (Bagas et al., 1999), which now includes the area previously called the ‘Savory Basin’ (Williams, 1992, 1994). The Mesoproterozoic sedimentary Manganese Subgroup of the Bangemall Basin lies to the west on Balfour Downs (1:250 000; Williams and Trendall, 1998b; Fig. 2).

The Paterson Orogen is an arcuate, northwest-trending belt, approximately 1200 km long, of deformed and metamorphosed sedimentary and igneous rocks that have a tectonic history ranging in age from Palaeoproterozoic to Neoproterozoic (Williams and Myers, 1990). Regional aspects of the orogen have been described and discussed in Williams and Bagas (1999).

Myers (1993), Myers et al. (1996), and Bagas and Smithies (1998) concluded that the Paterson Orogen was the result of collision and amalgamation of the West Australian Craton with continental crust from the east and northeast (North Australian Craton).

On Poisonbush, components of the Paterson Orogen are restricted to the northern half of the sheet, to the east of the Marloo Fault. The orogen consists of the Palaeoproterozoic Rudall Complex (Chin et al., 1980; Williams, 1990), the Mesoproterozoic to Neoproterozoic Yeneena Supergroup (Williams and Bagas, 1999), and the Neoproterozoic Tarcunyah Group (Williams and Bagas, 1999).

The Rudall Complex is confined to the far northeast corner of Poisonbush, where it is exposed in the headwaters of the Rudall River. These exposures lie at the western end of the complex, which extends 150 km to the east-southeast (Chin et al., 1980; Hickman and Clarke, 1994; Hickman and Bagas, 1998; Bagas and Smithies, 1998; Bagas, 1999b). The complex forms the core, and oldest component, of the Paterson Orogen. On Poisonbush, the complex comprises extensive felsic, and minor ultramafic intrusive and sedimentary rocks. All rocks were deformed and metamorphosed at least twice before deposition of the Yeneena Supergroup. Geochronology data indicate that deformation, metamorphism, and granitoid intrusion took place between c. 2000 Ma and 1760 Ma (Hickman et al., 1994; Bagas and Smithies, 1998). This event is called the Yapungku Orogeny and covers the D_{1-2} events (Bagas and Smithies, 1998). The orogeny is postulated to be contemporaneous with the Capricorn Orogeny of the West Australian Craton (Myers et al., 1996; Bagas and Smithies, 1997), and partly contemporaneous with the Strangways Orogeny in the Arunta Inlier of central Australia (Bagas and Smithies, 1997).

The Throssell Group of the Yeneena Supergroup (Williams and Bagas, 1999) unconformably overlies the Rudall Complex in the northeast corner of Poisonbush. In the west, the group is separated from the younger Tarcunyah Group by the major, dextral-transpressional Southwest Thrust. The Throssell Group has undergone lower greenschist facies metamorphism and tight to isoclinal folding with overturning directed toward the southwest. The folds are associated with brittle–ductile, dextral-transpressional, reverse, thrust, and lag faults and shear zones. This deformation is assigned to the Miles Orogeny (D_{3-4}; Bagas et al., 1995; Bagas and Smithies, 1998). Uncertainty remains as to the exact age of this

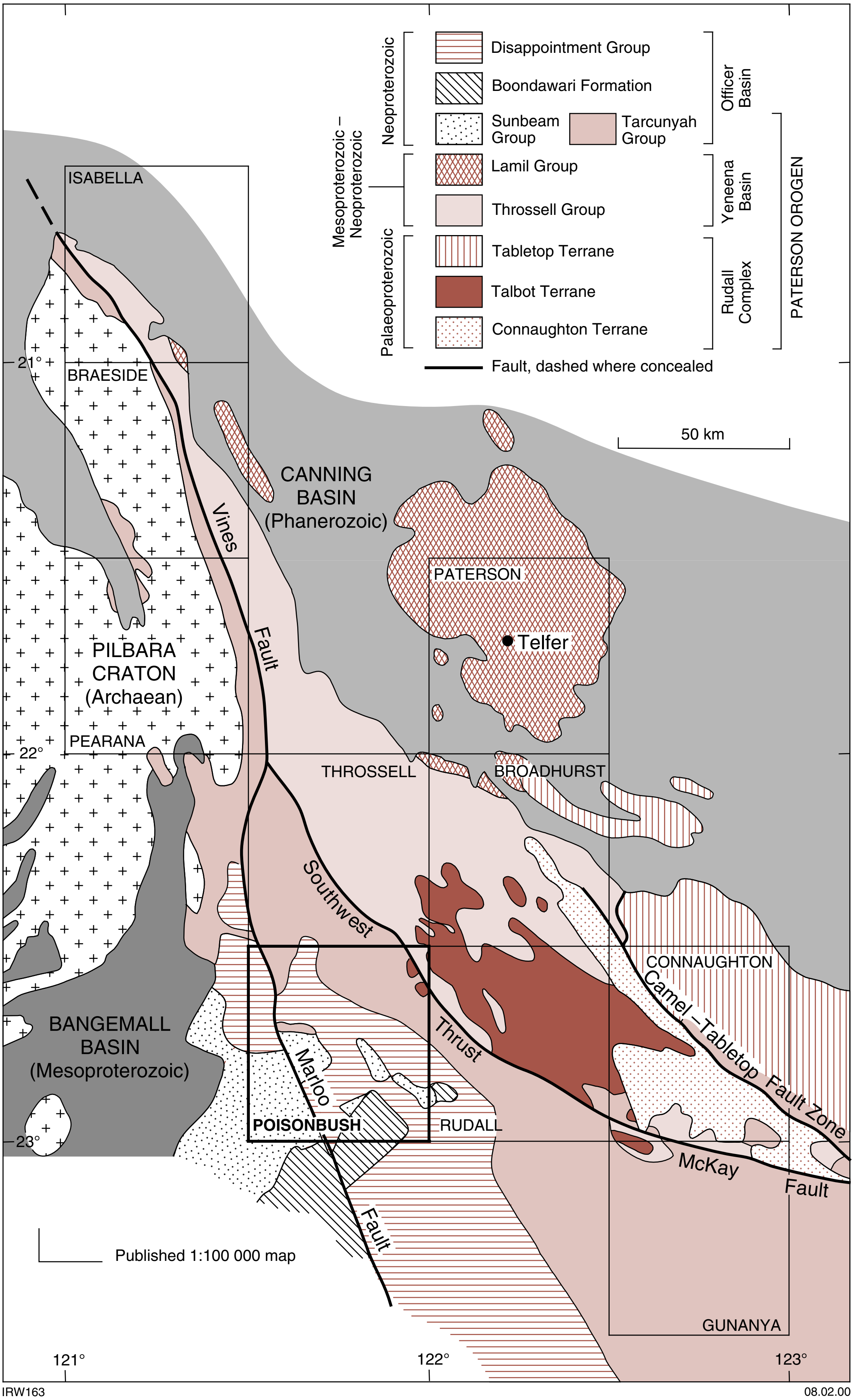

Figure 2. Regional geological setting of Poisonbush

orogeny. Available age data are poorly constrained and range between a maximum age of c. 1132 Ma and a minimum of c. 820 Ma (Bagas and Smithies, 1998). The implications of these age constraints are discussed in Myers et al. (1996), Bagas and Smithies (1998), and Williams and Bagas (1999).

The Neoproterozoic Tarcunyah Group (Williams and Bagas, 1999) is restricted to the northern half of POISONBUSH, east of the Marloo Fault (Fig. 2). To the south, it is unconformably overlain by the Disappointment Group*, or in faulted contact with the Mundadjini Formation of the Sunbeam Group* (Bagas et al., 1999). Although the Tarcunyah and Throssell Groups are in faulted contact on POISONBUSH, elsewhere the Tarcunyah Group unconformably overlies the Throssell Group; for example, southeast of the McKay Range (Bagas and Smithies, 1998). The Tarcunyah Group also unconformably overlies the Rudall Complex 4 km east-southeast (AMG 935008) of the Choorun Waterhole.

The absence of metamorphism and the different structural style is used to distinguish the Tarcunyah Group rocks from the adjoining Throssell Group. Preliminary work on stromatolites and acritarchs also suggests that the Tarcunyah and Throssell Groups have different geological histories (Bagas et al., 1995). These palaeontological data (Grey and Cotter, 1996; Grey and Stevens, 1997; Stevens and Grey, 1997) also support the contention that the Tarcunyah Group is a correlative of Supersequence 1 of the Centralian Superbasin (Bagas et al., 1995, 1999; Walter et al., 1995) and that the Tarcunyah Group is a northwesterly extension of the Officer Basin.

Recent reviews of new data on the status of the 'Savory Basin' (Bagas et al., 1995, 1999; Perincek, 1996) confirm earlier postulates that the 'Savory Basin' is part of the Officer Basin (Williams, 1992, 1994). Although some recent workers have referred to a Savory Sub-basin of the Officer Basin (Grey and Cotter, 1996; Grey and Stevens, 1997; Stevens and Grey, 1997), it is not strictly a sub-basin, but a northwestern extension of the Officer Basin without the previously included Phanerozoic cover rocks (Hocking et al., 1994; Bagas et al., 1999; Fig. 3). As a consequence, the 'Savory Group', which by definition occupied the 'Savory Basin', has now been subdivided into several major successions (Bagas et al., 1999; Fig. 3). All formations below the glacigenic Boondawari Formation are assigned to the Sunbeam Group, which is correlated, on stromatolite biostratigraphy, with Supersequence 1 of the Centralian Superbasin (Walter et al., 1995; Grey, 1996; Stevens and Grey, 1997). All formations above the Boondawari Formation, except for the Durba Sandstone (Williams, 1992), have been assigned to the Disappointment Group. The Boondawari Formation is part of Supersequence 3, whereas the unconformably overlying Disappointment Group belongs to the earliest Supersequence 4 (Walter and Gorter, 1994; Bagas et al., 1999).

A further consequence of the stratigraphic rearrangements in the northwest extension of the Officer Basin is that the Tarcunyah Group, previously correlated with Supersequence 1 (Bagas et al., 1995), can now also be correlated with components of the Sunbeam Group (Bagas et al., 1999). This relationship is not shown on POISONBUSH (Williams and Bagas, 1998).

* Mapped as 'Savory Group' on the accompanying POISONBUSH 1:100 000 map; see Figure 3.

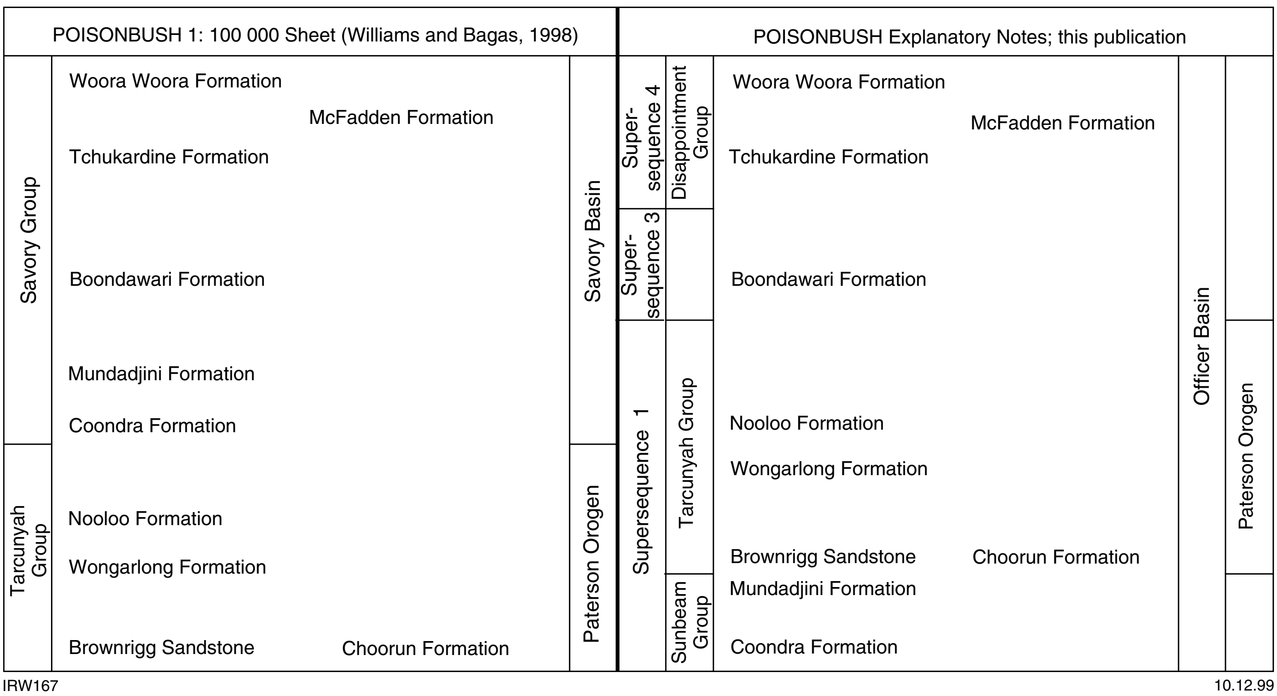

Figure 3. Revised stratigraphy for POISONBUSH

On POISONBUSH, the Sunbeam Group is represented by the Mundadjini Formation, which is exposed in the Poisonbush Range (AMG 610780), and in faulted, anticlinal cores north and northeast of the Wells Range (AMG 910670). The formation is unconformably overlain by the Tchukardine Formation of the Disappointment Group.

The glacigenic Boondawari Formation is poorly exposed east of the Horsetrack Range (AMG 670610) where it is faulted against the Mundadjini Formation. A hiatus of at least 150–200 m.y. separates the Mundadjini Formation from the overlying Boondawari Formation.

North- to northeast-trending folds in the Mundadjini Formation and Tarcunyah Group are attributed to the Blake Movement (D_5; Williams, 1992, 1994). These open to locally tight folds are the product of basin inversion that took place along the northwest margin of the Officer Basin (see 'Savory Basin'; Williams, 1992). This event is thought to have preceded the deposition of the Boondawari Formation.

The intracratonic Centralian Superbasin (850–540 Ma; Walter et al., 1994), to which the Tarcunyah Group is now assigned, was disrupted by the Paterson Orogeny (c. 550 Ma). The Paterson Orogeny, redefined by Bagas and Smithies (1998) as a D_6 event, is correlated with the Petermann Ranges Orogeny (560–525 Ma) of central Australia (Grey, 1990; Camacho and Fanning, 1995; Walter et al., 1995). On POISONBUSH, this event is marked by strong dextral transpressional reactivation of earlier faults, particularly the Southwest Thrust. Tight northwesterly trending folds in the Choorun Formation at the base of the Tarcunyah Group and adjacent to the Southwest Thrust, and more open, northerly trending folds in the Tarcunyah Creek area (AMG 516080) to the west, are assigned to D_6. These folds are obliquely truncated by steep reverse and lag faults, including the Marloo and Perentie Faults (Fig. 4).

This folding and thrusting, connected with the Paterson Orogeny, is thought to be related to the breakup of the Rodinia supercontinent (Myers et al., 1996).

Scattered outcrops of the Disappointment Group occupy a broad zone, extending from the northwest to the southeast corner, through the middle of POISONBUSH. The group includes the Woora Woora, McFadden, and the widespread Tchukardine Formations, The Disappointment Group rests unconformably on, or is faulted against, units of the Tarcunyah and Sunbeam Groups. The Disappointment Group was deposited in the Wells Sub-basin (Bagas et al., 1999; previously called Wells Foreland Basin, Williams, 1992), which is interpreted to have developed during tectonism related to the Paterson Orogeny (D_6).

The revised stratigraphy for the Officer Basin is given in Figure 3, and a summary of the geological history is given in Table 1.

Proterozoic rocks

Proterozoic rocks of the Paterson Orogen on POISONBUSH consist of the Palaeoproterozoic Rudall Complex (>1760 Ma), the Mesoproterozoic to Neoproterozoic Throssell Group (c. 1300–850 Ma), and the Neoproterozoic Tarcunyah Group. The Tarcunyah and Sunbeam Groups (c. 830–700 Ma) of Supersequence 1, the Boondawari Formation of Supersequence 3, and the Neoproterozoic Disappointment Group (<600 Ma) of Supersequence 4 of the Centralian Superbasin occupy the Officer Basin.

Rudall Complex

The Rudall Complex (Williams, 1990) is exposed in the extreme northeast corner of POISONBUSH, where it forms low hills in the headwaters of the Rudall River (Figs 1, 4). Here it is unconformably overlain by the Throssell Group, which forms cliff-lined scarps. Several rubble-strewn exposures of the complex also lie just west of the Southwest Thrust. They are unconformably overlain by the Choorun Formation of the Tarcunyah Group 5 km northeast (AMG 930050) and 4 km east (AMG 940001) of Choorun Waterhole. Metasedimentary rocks of the Rudall Complex have also been intersected in exploration drillholes near this latter locality.

Bagas and Smithies (1998) divided the Rudall Complex into the Talbot, Connaughton, and Tabletop tectono-stratigraphic terranes. The part of the complex exposed on POISONBUSH belongs to the Talbot Terrane (Fig. 4; Bagas et al., 1995; Bagas and Smithies, 1998).

Talbot Terrane

The Talbot Terrane on POISONBUSH consists principally of deformed and metamorphosed siliciclastic sedimentary rocks and granitoids, which are now a mixture of gneiss and schist. In general, the rocks have been metamorphosed to amphibolite facies. The deformation and metamorphism are assigned to the 2000–1760 Ma Yapungku Orogeny (Bagas and Smithies, 1998). From observations made on adjacent RUDALL (Hickman and Bagas, 1998), the complex on POISONBUSH belongs to the Clayton Domain of the Talbot Terrane (Fig. 4).

Unassigned metasedimentary rocks (ⱣRs, ⱣRmb, ⱣRp)

Psammitic paragneiss (*ⱣRs*) consists of fine-grained quartz–feldspar–muscovite gneiss, quartz–muscovite schist, and quartzite layers. The paragneiss probably represents a metamorphosed sandstone–shale succession. Areas of psammitic paragneiss lie 3 km and 6 km northeast of Curran Curran Rockhole (AMG 908083) where they are surrounded by orthogneiss (*ⱣRga*).

Quartz–muscovite–biotite schist (*ⱣRmb*) occupies a fault-bordered zone 4.5 km east (AMG 950100) of Curran Curran Rockhole. This schist is also located unconformably beneath the Choorun Formation 4 km east-southeast (AMG 936007) of Choorun Waterhole, and in exploration drillholes 1 and 1.5 km northeast of this locality. The schist comprises various amounts of quartz, muscovite, and

Figure 4. Structural sketch map of Poisonbush

biotite with minor feldspar, opaque minerals, and garnet. The unit is interpreted to be metamorphosed siltstone.

Quartz–biotite–plagioclase gneiss and schist containing layers of quartzite and pelitic schist (*ERp*) occupy a small area 3.5 km northeast (AMG 941100) of Curran Curran Rockhole. This unit is closely related to the quartz–muscovite–biotite schist (*ERmb*). The pelitic rocks contain quartz, biotite, muscovite or sericite, secondary chlorite, and minor plagioclase. The gneiss is fine to medium grained and contains quartz, feldspar, biotite, muscovite, and secondary sericite. The quartzites are fine to medium grained with quartz, minor biotite and sericite, and accessory tourmaline. Some pelitic schists consist

Table 1. Summary of the geological history of Poisonbush

Age range (Ma)	*Geological events*
pre-2000	Deposition of sedimentary and volcanic rocks, now included in the Rudall Complex
~2000–1760	Yapungku Orogeny (D_1–D_2 events)
pre-1790	D_1 partly synchronous with amphibolite facies conditions (M_1)
	D_2 southwesterly to westerly directed compression, partly synchronous with granitoid magmatism and amphibolite facies conditions (M_2)
post-D_2–pre-D_4	Deposition of Throssell Group
c. 1132–820	Miles Orogeny (D_3–D_4 events)
	D_3 not recorded on Poisonbush
	D_4 southwesterly directed compression associated with prograde greenschist facies conditions for Throssell Group and retrograde conditions for Rudall Complex
c. 800	Deposition in Officer Basin of Tarcunyah and Sunbeam Groups; Supersequence 1
c. 750	Blake Movement (D_5)
	D_5 northwest–southeast-directed compression in Officer Basin
c. 600	Marinoan glacial period, deposition of Boondawari Formation; Supersequence 3
<600	Deposition in Officer Basin of Disappointment Group; Supersequence 4
~550	Paterson Orogeny (D_6)
	D_6 southwest-directed compression; dextral strike-slip faulting

of iron oxides, quartz, minor sericite, and rare garnet. These are probably metamorphosed sulfidic shales. The gneiss and schist assemblage (*ᵽRp*) is interpreted to be a metamorphosed, finely interlayered succession of shale, sandstone, and feldspathic wacke.

The metasedimentary rocks are complexly folded and faulted, and are tectonically interleaved with K-feldspar augen orthogneiss (*ᵽRga*).

Ultramafic rocks (ᵽRu)

Several pods of ultramafic rock (*ᵽRu*) lie 5 km northeast (AMG 945113) of Curran Curran Rockhole. They are composed of serpentine-group minerals (after olivine and pyroxene), tremolite, chlorite, and opaque minerals. The ultramafic rocks are tectonically interleaved with the metasedimentary rocks (*ᵽRmb*) to form large boudins.

Orthogneiss (ᵽRga)

About 50% of the Rudall Complex on Poisonbush is composed of strongly foliated, megacrystic augen orthogneiss (*ᵽRga*). Sensitive high-resolution ion microprobe (SHRIMP) U–Pb zircon dates of between 1790 and 1765 Ma (Nelson, 1995) have been obtained from augen orthogneiss samples collected from four widely spaced localities on Rudall (Hickman and Bagas, 1998) and Connaughton (Bagas and Smithies, 1998).

The augen orthogneiss is commonly well exposed, and forms low rocky hills sparsely covered with vegetation. The rock ranges from a poorly foliated, metamorphosed, porphyritic granite or monzogranite to a quartz–feldspar–muscovite schist. The orthogneiss consists of a granoblastic mosaic of microcline, plagioclase, and quartz, with variable amounts of biotite and muscovite, and minor sphene, allanite, and epidote. Opaque minerals, apatite, and zircon are accessory. Plagioclase is sericitized or saussuritized, and microcline forms elongate to lenticular coarse-grained mosaics. Microcline augen commonly enclose small crystals of plagioclase and biotite.

The orthogneiss has a variable S_2 foliation, which is defined by the alignment of elongate grains of quartz, K-feldspar, and mica. In highly foliated samples, S_2 is defined by quartz, biotite, muscovite, and sericite enveloping feldspar and quartz phenocrysts. The foliation is commonly folded by F_4 folds or is crenulated by S_4. Some augen orthogneiss has been intruded by aplite veins that lack the D_2 schistosity. These are probably related to late-stage granitic intrusions on Rudall (Hickman and Bagas, 1998).

Yeneena Supergroup

The Palaeoproterozoic to Neoproterozoic Yeneena Supergroup (Williams et al., 1996; Hickman and Bagas, 1998; Williams and Bagas, 1999) is represented on Poisonbush solely by the Throssell Group.

Throssell Group

On Poisonbush the Throssell Group (*ᵽT*; Bagas et al., 1995; Williams and Bagas, 1999) is restricted to a narrow northwest-trending zone in the northeast corner of the sheet area, where it unconformably overlies the Rudall Complex. The western margin of the group is juxtaposed against the Choorun Formation of the Neoproterozoic Tarcunyah Group by the southwest-directed, transpressional Southwest Thrust. The Throssell

Group comprises the basal siliciclastic Coolbro Sandstone and the conformably overlying carbonaceous Broadhurst Formation.

Coolbro Sandstone (Ᵽtc, Ᵽtcp)

The Coolbro Sandstone (*Ᵽtc*; Williams et al., 1976) is a pale grey-brown to orange-brown, fine- to coarse-grained sandstone. On Poisonbush, it is restricted to a few rocky outcrops in the northeast corner, and to some isolated hills 7 km east-northeast (AMG 962042) of Choorun Waterhole.

Petrographically, the sandstones are metamorphosed arenites with flattened or recrystallized quartz grains and a sericitic (after intergranular clay) matrix. Tourmaline is a common accessory mineral. The rocks have been dynamically metamorphosed (S_4 foliation) under lower greenschist facies conditions.

Regionally, the Coolbro Sandstone thins rapidly to the southwest (Chin et al., 1980; Williams and Bagas, 1999), and 2.6 km east (AMG 935083) of Curran Curran Rockhole the formation is reduced to a thin (10 m) unit of coarse-grained sandstone, pebbly sandstone, and pebble to cobble conglomerate (*Ᵽtcp*). Clasts in the conglomerate are mainly vein quartz and quartzite. Trough and planar cross-beds are common throughout the sandstone units.

The lithology and sedimentary structures of the Coolbro Sandstone are consistent with a fluvial to deltaic depositional environment (Hickman and Clarke, 1994; Williams and Bagas, 1999).

Broadhurst Formation (Ᵽtb, Ᵽtbs, Ᵽtbq, Ᵽtba)

The conformably overlying Broadhurst Formation (*Ᵽtb*; Williams et al., 1976) is characterized by poorly outcropping, metamorphosed, grey, carbonaceous (graphitic) shale and siltstone (*Ᵽtbs*). This unit separates thick intertongues of strongly outcropping metamorphosed, brown to red-brown, fine- to medium-grained sandstone and siltstone (*Ᵽtbq*), and interbedded fine- to coarse-grained sandstone, siltstone, shale, and minor carbonate (*Ᵽtba*; Williams and Bagas, 1999). The carbonate is multicoloured and thin bedded. Many sandstone layers are cross-bedded but rarely show size grading. Upward-fining sequences are evident in repetitive sandstone, siltstone, and shale successions.

On Poisonbush, the Broadhurst Formation is restricted to the northeast corner of the sheet area, where it is tightly folded and faulted. Although thickness estimates are hampered by the complex structure, it does appear that the formation, as with the underlying Coolbro Sandstone, thins southward. The formation is separated from the Choorun Formation of the Tarcunyah Group by the Southwest Thrust.

The Broadhurst Formation is interpreted to have been deposited in a fault-controlled, starved basin under euxinic conditions (Hickman et al., 1994). The southwest parts of the basin, including the area on Poisonbush, have been periodically penetrated by coarser siliciclastic material deposited under higher energy conditions (Williams and Bagas, 1999).

Officer Basin*

The Officer Basin (Bureau of Mineral Resources, Geology and Geophysics, 1960; Iasky, 1990) has recently been extended (Bagas et al., 1999) to cover areas previously assigned to the 'Savory Basin' (Williams, 1992) and Tarcunyah Group (Bagas et al., 1999; Williams and Bagas, 1999). The content of the Officer Basin is restricted to Neoproterozoic rocks that are part of the Centralian Superbasin (Walter et al., 1995). The northeastern margin of the Officer Basin (Fig. 2) was affected by the Paterson Orogeny (Bagas and Smithies, 1998; Williams and Bagas, 1999). On Poisonbush, the enlarged and redefined Officer Basin now includes components of the Tarcunyah Group (Williams and Bagas, 1999), the newly named Sunbeam and Disappointment Groups (Bagas et al., 1999), and the Boondawari Formation (Williams and Tyler, 1991; Williams, 1992; Fig. 3).

Tarcunyah Group

The Tarcunyah Group (*Ᵽu;* Bagas et al., 1995; Williams and Bagas, 1999) is restricted to the northern half of Poisonbush east of the Marloo Fault (Fig. 4). In the northeast corner of Poisonbush, the group unconformably overlies the Rudall Complex 4.5 km northeast and 4 km east of Choorun Waterhole (AMG 896018). It is separated from the Throssell Group in this area by the Southwest Thrust. The Tarcunyah Group is unconformably overlain by the Tchukardine Formation of the Disappointment Group 6.5 km south (AMG 575003) of Tchukdarine Pool, and 12.5 km further south (around AMG 575878) an inlier of the Tarcunyah Group is faulted against the Mundadjini Formation of the Sunbeam Group. The Tarcunyah Group in both areas is delimited to the west by the Marloo Fault (Fig. 4).

The Tarcunyah Group is represented on Poisonbush by the basal Choorun Formation in the east and by the Brownrigg Sandstone and the Wongarlong Formation in the west. The Choorun and Wongarlong Formations are overlain by the carbonate-bearing Nooloo Formation.

Choorun Formation (Ᵽuh, Ᵽuhh)

The Choorun Formation (Chin et al., 1980; Williams and Bagas, 1999) is well exposed in an area of dissected ridges and plateaus in the northeast corner of Poisonbush. Five kilometres northeast and 4 km east of the Choorun Waterhole (AMG 896018), the formation can be seen to unconformably overlie, respectively, orthogneiss and mica schist of the Rudall Complex. The Throssell Group, which unconformably overlies the Rudall Complex 1 km east of the Southwest Thrust (AMG 936081), is absent from these localities. The Southwest Thrust separates the Choorun Formation from the Broadhurst Formation of the Throssell Group.

The Choorun Formation (*Ᵽuh*) is a siliciclastic, upward-fining, fluviatile succession of matrix-supported,

* This replaces the term 'Savory Basin' on the accompanying Poisonbush 1:100 000 map sheet.

cobble to pebble conglomerate and pebbly sandstone, overlain by a distinctive pink-red to red-brown, coarse- to medium-grained sandstone. The clasts in the conglomerate are primarily vein quartz, quartzite, and sandstone. Interbedded with the conglomerates are sandstones with a high detrital muscovite content. Siliceous nodules are also characteristic of many sandstone units in the formation.

Although the formation is tightly folded, it appears to be at least 1800 m thick. An axial planar cleavage is evident in fold closures but, unlike the Coolbro Sandstone of the Throssell Group east of the Southwest Thrust, the formation lacks the multiple deformation, penetrative foliation, and low-grade regional metamorphism of the older rocks.

Numerous cross-beds in the sandstone units indicate palaeocurrents directed toward the north and northeast. Some ripple-marked surfaces are also present.

A distinctive red-brown to purple siltstone (*Ꝑuhh*), exposed east of Curran Curran Rockhole (AMG 908083), contains thin, dark green to grey-green tuffaceous bands. Although petrographically described as an autolithic quartz–tourmaline mudstone, it has been interpreted to be a hydrothermally silicified and tourmalinized lapilli tuff (Nelson, 1999). A sample collected about 100 m northeast (AMG 909085) of Curran Curran Rockhole contained a zircon population with a SHRIMP U–Pb zircon age of 544 ± 10 Ma (Nelson, 1999). This has been interpreted as the maximum depositional age of the host sediment. Other large older populations of detrital zircons cluster around 574 ± 62 Ma and 1204 ± 35 Ma (Nelson, 1999).

This younger than expected age for the Choorun Formation may indicate the rock collected for dating is not part of the 800 Ma Tarcunyah Group. The age of the Tarcunyah Group is deduced from studies of stromatolite and acritarch data, which places the Tarcunyah Group in Supersequence 1 of the Centralian Superbasin (Grey and Stevens, 1997; Stevens and Grey, 1997).

Brownrigg Sandstone (Ꝑur)

A small, fault-bounded area of Brownrigg Sandstone (*Ꝑur*; Williams, 1989) is exposed on the eastern side of the Marloo Fault (Fig. 3), along the northern boundary of Poisonbush. The sandstone is faulted against the Wongarlong Formation to the east, and the Tchukardine and Woora Woora Formations of the newly defined (Bagas et al., 1999) Disappointment Group to the west.

The Brownrigg Sandstone is characterized by white, cream to light brown, fine- to coarse-grained sandstone or orthoquartzite. Some of the coarse-grained sandstones contain sparsely scattered small pebbles. The formation is well bedded, with flaggy and massive units. Cross-beds, ripple marks, and current striae have been recorded. Palaeocurrent directions are commonly toward the northeast and east. The formation is interpreted to be a shallow-marine shelf deposit (Williams and Bagas, 1999).

Wongarlong Formation (Ꝑuo, Ꝑuoh, Ꝑuov)

The Wongarlong Formation (*Ꝑuo*; Williams and Bagas, 1999) is largely confined to the northwest quadrant of Poisonbush. The largest exposure, which extends north and south of Tchukardine Pool (AMG 565065), is bordered to the west by the Marloo Fault. This fault has juxtaposed the formation against the underlying Brownrigg Formation in the north, and the younger Woora Woora Formation (Disappointment Group) to the west and southwest. To the east and south, the Wongarlong Formation is unconformably overlain by the Tchukardine Formation of the Disappointment Group. This unconformity is well exposed 6.5 km south (AMG 575003) of Tchukardine Pool. A narrow east-trending inlier of Wongarlong Formation is faulted against the Mundadjini Formation of the Sunbeam Group 19 km south (AMG 575878) of Tchukardine Pool. This inlier is also faulted to the west by the Marloo Fault and is unconformably overlain, along the northern margin, by the Tchukardine Formation. A narrow, steeply dipping, partly sand covered ridge of Wongarlong Formation extends 15 km south and southeast from the northern margin of the map sheet in the central-north part of Poisonbush (around AMG 710070). The structures in this region indicate a faulted anticline (Fig. 4).

The Wongarlong Formation characteristically forms strike ridges, reflecting the interbedded nature of the resistant sandstones and softer siltstone–shale units. Light to dark brown and red-brown, fine- to coarse-grained sandstones are interbedded with white to cream orthoquartzite. Bedding ranges from flaggy to massive. The orthoquartzite is commonly covered with orange-brown oxidation spots. Some beds also contain brown, bladed or needle-like pseudomorphs after gypsum. Both the sandstone and orthoquartzite are cross-bedded and ripple marked. Siltstone intraclasts are common in some sandstone beds. Both upward coarsening and fining successions have been recorded in the mixed sandstone, siltstone, and shale successions (Williams and Bagas, 1999). A thick unit of red, purple, and grey-green siltstone, micaceous siltstone, and shale (*Ꝑuoh*) has been mapped north (AMG 560100) and west (AMG 550065) of Tchukardine Pool.

A small structural basin on the northern margin of Poisonbush (AMG 529109) contains a small area, approximately 5 km^2, of deeply weathered basalt or fine-grained dolerite (*Ꝑuov*). The rock has weathered to a mottled, brown-grey to white clay containing patches of dark blue-green chlorite. Fractures within the clay material strongly resemble pillows with the interstices between the pillow-like structures infilled with dark blue-green chlorite (Williams and Bagas, 1999).

The Wongarlong Formation is interpreted to be a shallow-marine shelf deposit (Williams and Bagas, 1999).

Nooloo Formation (Ꝑun, Ꝑunh, Ꝑuns)

There are low outcrops of poorly exposed, multi-coloured dolomite and limestone (*Ꝑun*) in an area 14.5 km southeast (AMG 710010) of Tchukardine

Pool. Secondary calcrete partly covers many of these exposures. The formation occupies a broad valley to the west of a partly sand covered ridge that comprises steeply dipping sandstones and orthoquartzites of the Wongarlong Formation. As noted above, this ridge is probably a faulted anticline. However, the Nooloo Formation is not exposed immediately east of the ridge because of thick sand cover. Siliciclastic units of the formation are exposed 18 km further northeast (AMG 870070), where they conformably overlie the Choorun Formation. A broad, sand-filled valley to the southeast that lies between prominent outcrops of the Tchukardine Formation and dissected ridges of the Choorun Formation is probably underlain by the Nooloo Formation.

Scattered outcrops of distinctive purple- to red-weathering siltstone and shale (*Ꝑunh*) and overlying interbedded fine- to coarse-grained sandstone, pebbly sandstone, wacke, and grey-green siltstone (*Ꝑuns*) are present in the northeast corner of POISONBUSH. These units conformably overlie the Choorun Formation, and are mostly thinly bedded, and tightly folded, with a spaced, axial planar cleavage in the area west-southwest (AMG 880070) of Curran Curran Rockhole.

The Nooloo Formation may be correlated with the Waters Formation, which is exposed 80 km to the southeast on RUDALL (Hickman and Bagas, 1998).

The Nooloo Formation is interpreted to be a deep-water shelf deposit.

Sunbeam Group*

The newly named Sunbeam Group of the northwestern Officer Basin (Bagas et al., 1999) comprises the oldest formations of the superseded 'Savory Group' (Williams, 1992). The constituent formations on POISONBUSH are the Coondra and Mundadjini Formations, which have been equated with the c. 800 Ma Supersequence 1 of the Centralian Superbasin (Walter and Gorter, 1994; Walter et al., 1995). Only the Mundadjini Formation of the Sunbeam Group is exposed on POISONBUSH.

Coondra Formation (Ꝑsc)

The unexposed Coondra Formation (*Ꝑsc*; Williams and Tyler, 1991), a siliciclastic unit of coarse- to medium-grained sandstone, pebbly sandstone, and conglomerate, is interpreted to underlie the Mundadjini Formation in the southwest corner of POISONBUSH. The formation is shown in the diagrammatic section on POISONBUSH (Williams and Bagas, 1998).

Mundadjini Formation (Ꝑsm)

The main exposure of the Mundadjini Formation (*Ꝑsm*; Williams and Tyler, 1991) lies in the Poisonbush Range area (AMG 610780) where it is faulted against the Wongarlong Formation of the Tarcunyah Group. The formation also occupies cores of eroded anticlinal structures north of the Wells Range (AMG 910670) and west of Perentie Rockhole (AMG 851795), where it is unconformably overlain by the Tchukardine Formation of the Disappointment Group. Some widely scattered and partly sand covered outcrops lie west of the Poisonbush and Horsetrack Ranges in the southwestern corner of POISONBUSH. A small exposure of Mundadjini Formation also lies 7.5 km east-northeast (AMG 740650) of the Horsetrack Range, where it is disconformably overlain by the McFadden Formation of the Disappointment Group and faulted against the Boondawari Formation.

On POISONBUSH, the Mundadjini Formation consists mainly of grey-brown, brown, and red-brown, fine- to coarse-grained sandstone. It is thin to thick bedded and commonly flaggy. In the Poisonbush Range area, coarse-grained sandstones are interbedded with pebble conglomerate beds that appear to be channel fills. Some coarse-grained sandstones also contain irregular patches of small pebbles. The pebbles in the conglomerate consist of vein quartz, quartzite, blue-grey banded chert, and red jasper. The fine-grained sandstones are interbedded with siltstone in places and some sandstones contain siltstone intraclasts. Tabular and trough cross-bedding, symmetrical and asymmetrical ripple-bedding, and current striae are present in the sandstones. The palaeocurrent directions, recorded from cross-bedding, are toward the northeast and north (Williams, 1992).

The Mundadjini Formation on POISONBUSH is interpreted to be a fluvial deposit (Williams, 1992).

Boondawari Formation (*Ꝑsb*)

The formal inclusion of the 'Savory Basin' in the Officer Basin and the reassignment of formations from the superseded 'Savory Group' to the lower Sunbeam Group and upper Disappointment Group (Bagas et al., 1999), has resulted in the glacigenic Boondawari Formation being separated out from these two new groups (Fig. 3). The Boondawari Formation is now known to be separated from the underlying Sunbeam Group rocks by a hiatus of about 150 to 200 Ma (Bagas et al., 1995; Walter et al., 1995). Although not evident on POISONBUSH, the Boondawari Formation is unconformable on the Sunbeam Group and is equated with the Marinoan glaciation of the c. 600 Ma Supersequence 3 (Walter et al., 1994; Bagas et al., 1995; Grey, 1996).

Small areas of the Boondawari Formation (*Ꝑsb*; Williams and Tyler, 1991) are exposed 13 km east (AMG 805624) and 9 km east-northeast (AMG 755645) of the Horsetrack Range in the central-southern part of POISONBUSH. The formation is faulted against the Mundadjini Formation in this area. In general, the exposures are poor and commonly capped by silcrete (not shown on the map).

The formation comprises thick-bedded, red-brown to dark red, sandy diamictite interbedded with cross-bedded sandstone, siltstone, and silicified shale. The diamictite

* This is mapped as part of the 'Savory Group' on POISONBUSH; see Figure 3 for revision.

carries scattered pebbles, cobbles, and small boulders of chert and white quartzite. Some of the larger boulders show striations and faceting. Very rare dropstones are contained in the shale and siltstone.

The Boondawari Formation has been interpreted to be a shallow-marine deposit, strongly influenced by glacial conditions (Williams, 1987, 1992).

Disappointment Group*

The newly named Disappointment Group (Bagas et al., 1999) covers, with the exception of the Durba Sandstone, all formations younger than the Boondawari Formation. The McFadden, Tchukardine, and Woora Woora Formations constitute the Disappointment Group on POISONBUSH. The Disappointment Group has been assigned to Supersequence 4 of the Centralian Superbasin (Bagas et al., 1999). Formations of the Disappointment Group were previously assigned to the Wells Foreland Basin (Williams, 1992), which has now been renamed the Wells Sub-basin of the Officer Basin (Bagas et al., 1999).

McFadden Formation (Ᵽsf)

The McFadden Formation (*Ᵽsf*; Williams, 1992) is confined to the Horsetrack Range area (AMG 670610) on POISONBUSH. It disconformably overlies the Mundadjini Formation on the eastern side of the range.

The McFadden Formation mainly consists of fine- to coarse-grained lithic, feldspathic, and quartz sandstone, with minor pebbly sandstone, pebble conglomerate, and siltstone. The sandstones are characteristically poorly sorted and commonly form flaggy to thick-bedded, very large tabular and trough cross-beds up to 7 m thick. Many of the large cross-beds are asymptotic, which is indicative of high-energy conditions (Collinson and Thompson, 1982). In some cases, the upper surface of the cross-beds have been eroded. Stacked, large cross-bedded units are separated by flat-bedded, fine- to medium-grained sandstone, and siltstone. In places these sandstones show current striae and asymmetric ripple marks. Some sandstone beds contain siltstone intraclasts.

The prevailing palaeocurrent direction, derived from the cross-bedding, is toward the southwest. This contrasts strongly with measurements in the underlying Mundadjini Formation, where the palaeocurrents are directed toward the northeast and north (Williams, 1992).

Although not measurable on POISONBUSH, the McFadden Formation has been estimated to be at least 1500 m thick elsewhere (Williams, 1992).

The McFadden Formation is interpreted to be the product of migrating, sandy current-ridges or giant ripples in channels, probably related to a prograding, high-energy, transverse, sandy delta encroaching onto a sandy, shallow-marine shelf (Williams, 1992).

* This was mapped as part of the 'Savory Group' on POISONBUSH.

Tchukardine Formation (Ᵽst)

The Tchukardine Formation (*Ᵽst*; Williams, 1992) occupies a broad zone of scattered outcrops extending southeast from the Hanging Rock area (AMG 627104) in the north, to the Wells Range area in the southeast corner of POISONBUSH. A separate exposure, in the northwest corner, lies west of the Marloo Fault.

The Tchukardine Formation unconformably overlies the Wongarlong Formation 6.5 km south (AMG 575003) of Tchukardine Pool and the Mundadjini Formation north of the Wells Range. Although the Tchukardine Formation is separated from the Woora Woora Formation by the Marloo Fault on POISONBUSH, elsewhere this formation disconformably overlies the Tchukardine Formation (Williams, 1992).

The Tchukardine Formation consists mainly of mature red-brown, medium-grained quartz sandstone with a variable clay content, and minor fine- and coarse-grained sandstone. The basal units of the Tchukardine Formation consist of thin beds of pebble to cobble conglomerate and pebbly sandstone overlain by a chocolate-brown mudstone and siltstone containing sparse pebbles and cobbles. This unit is overlain by cross-bedded sandstones distinguished by large-scale cross-beds up to 10 m thick. Asymptotic foresets are common in both the tabular and trough cross-beds. The tabular cross-beds also have planar foresets. Current striae and ripple marks have been recorded from the flat-bedded, medium- to fine-grained sandstone units that are interbedded with the cross-bedded units. The formation is estimated at be at least 700 m thick (Williams, 1992).

The Tchukardine Formation is interpreted to be a sandy marine-shelf deposit. The large cross-beds are probably the product of migrating sand waves and tidal current ridges on a shallow-marine, sandy shelf (Williams, 1992).

Woora Woora Formation (Ᵽso)

Scattered outcrops of Woora Woora Formation (*Ᵽso*; Williams, 1992) are exposed along the northwest and western margins of POISONBUSH, west of the Marloo Fault. Although the formation is faulted against the Tchukardine Formation in this area, elsewhere it disconformably overlies it (Williams, 1992). The Woora Woora Formation is lithologically similar to the McFadden Formation in the southeast and, hence, may be a northwestern extension of the latter.

The Woora Woora Formation is a distinctive white-flecked, purple to purple-brown weathering, fine- to coarse-grained sandstone with minor lithic wacke and siltstone. Bedding is typically flaggy. Sandstones are commonly ferruginous and laterite (*Czl*) overlies some of the finer grained units.

Large tabular cross-beds up to 5–6 m thick are common, but trough cross-beds are absent. Some of the larger cross-beds show graded bedding within the individual flaggy foresets, a feature in common with the McFadden Formation (Williams, 1992). Palaeocurrent directions, derived from cross-bedding, are directed toward the west.

The position of the Woora Woora Formation above, and to the west of, the shallow marine basin occupied by the Tchukardine Formation suggests that this basin may have been encroached by prograding deltaic sediments (the Woora Woora Formation) from the east and northeast (Williams, 1992).

Silicified rock and fault breccia (*fb*)

An unusual silicified megabreccia (*fb*), 8 km northeast (AMG 650850) of the Poisonbush Range, is interpreted to occupy a shallow, east-dipping fault zone. The megabreccia lies at the southern end of a discontinuous narrow ridge of silicified grey-blue chert and breccia that lies between exposures of sandstone and conglomerate of the Tchukardine Formation to the east, and shale and sandstone of the Mundadjini Formation to the west.

The megabreccia comprises large, chaotically arranged blocks of mainly grey orthoquartzite in a silicified sandy matrix. Microfaults cut the matrix.

Mafic intrusive rocks *(d)*

Discontinuous, north- to northeast-trending airphoto lineaments that lie 4 km east (AMG 720964) of Carcoonya Waterhole, 13 km east (AMG 796620) of the Horsetrack Range, and between the Marloo Fault and the western margin of POISONBUSH, are interpreted to indicate the position of mafic dykes. The lineaments are distinguished on the aerial photographs by a distinct colour change, either dark lines against a light background or light lines against a dark background. These lines may also correspond to a change in vegetation (for example larger trees) and narrow gaps in sandstone outcrops. At the Horsetrack Range locality (AMG 796620), low mounds of laterite cap a narrow mottled clay zone, which appears to be weathered dolerite. The host rocks at this locality are sandstone and diamictite of the Boondawari Formation. Elsewhere in the northwest part of the Officer Basin, both fresh and weathered, thin dolerite dykes have been recorded (Williams, 1992).

The lineaments transect sandstones of the Tchukardine and Woora Woora Formations that are correlated with Supersequence 4 of the Centralian Superbasin (Stevens and Grey, 1997). This suggests that the maximum age for the intrusions is lower Cambrian, or very latest Neoproterozoic.

Structure

POISONBUSH straddles the northwest-trending boundary between the Paterson Orogen (Williams and Myers, 1990) and the northwest extension of the Officer Basin (Bagas et al., 1995; 1999). The Paterson Orogen is a northwest-trending belt of deformed sedimentary, metasedimentary, and meta-igneous rocks that, in the POISONBUSH area, encompasses components of the Palaeoproterozoic Rudall Complex, the unconformably overlying Mesoproterozoic to Neoproterozoic Throssell Group, and the unconformably overlying Neoproterozoic Tarcunyah Group.

Recent reappraisals of the tectono-stratigraphic status of the Tarcunyah Group (Bagas et al., 1995; Grey and Stevens, 1997; Stevens and Grey, 1997; Bagas et al., 1999) now recognize that the Tarcunyah Group is also a component of the northwesterly extension of the Officer Basin. The effects of the tectonic activity, generated from within the Paterson Orogen region, appear to extend south of the Tarcunyah Group to involve the unconformably overlying Disappointment Group, the youngest component of the Officer Basin in this region. The Disappointment Group was deposited in the Wells Sub-basin of the Officer Basin (Williams, 1992; Bagas et al., 1999). The development of the Wells Sub-basin appears to be coeval with the Paterson Orogeny (D_6). Although this sub-basin bears structural imprints of the Paterson Orogeny, in the form of broad asymmetric folds and micro-reverse faults directed toward the southwest, it is not included in the region designated as the Paterson Orogen tectonic unit.

Chin et al. (1980), Myers (1990a,b), Clarke (1991), Hickman and Clarke (1994), Hickman et al. (1994), Myers et al. (1996), Bagas and Smithies (1998), and Hickman and Bagas, (1998, 1999) have all discussed and elaborated on the structural history and evaluation of the Paterson Orogen. The tectonic history of the Paterson Orogen and adjacent areas can be broken down into four main events — the Yapungku Orogeny (D_{1-2}), the Miles Orogeny (D_{3-4}), the Blake Movement (D_5) and the Paterson Orogeny (D_6).

The major tectono-stratigraphic units and major structures on POISONBUSH are presented in Figure 4.

Yapungku Orogeny (D_{1-2})

The Rudall Complex was intensely deformed and metamorphosed to amphibolite facies during the Yapungku Orogeny, an event which comprises the D_1 and D_2 episodes of the Paterson Orogen (Bagas and Smithies, 1998). On present geochronological evidence, these events took place between c. 2000 and 1760 Ma (Bagas and Smithies, 1998; Hickman and Bagas, 1998). This deformation and metamorphism pre-dated the deposition of the overlying Throssell Group. Metasedimentary rocks, represented by paragneiss and schist (*ⱣRs, ⱣRp, ⱣRmb*) on POISONBUSH, were deformed in the D_1 event before 1790 Ma, and before the emplacement of the augen orthogneiss (*ⱣRga*) protolith (Bagas and Smithies, 1998). All rock units in the Rudall Complex on POISONBUSH were deformed during D_2 and metamorphosed during M_2, producing a pervasive micaceous schistosity (S_2) parallel to the axial planes of F_2 isoclinal folds. The D_2 deformation took place between 1790 and 1760 Ma (Bagas and Smithies, 1998).

The Yapungku Orogeny has been attributed to plate collision (Myers et al., 1996; Smithies and Bagas, 1997; Bagas and Smithies, 1998). This involved progressive stacking of thrust sheets and emplacement of granitoids, now represented by the augen gneiss (*ⱣRga*) on POISONBUSH (Bagas and Smithies, 1998).

Miles Orogeny (D_{3-4})

The Miles Orogeny affected rocks of both the Rudall Complex and the overlying Throssell Group (Bagas et al., 1995; Bagas and Smithies, 1998). Good geochronologic control is still sparse for this event, but on current data the orogeny falls within the c. 1132–820 Ma time span (Bagas and Smithies, 1998). Evidence of the recumbent F_3 folds (Hickman and Clarke, 1994) of the D_3 episode is absent on POISONBUSH. The unconformity between the Rudall Complex and Throssell Group was folded by D_4. A pervasive S_4 foliation is associated with the F_4 folds in the Broadhurst Formation of the Throssell Group.

The Southwest Thrust, postulated to be a sole thrust (Hickman and Bagas, 1998), separates strongly deformed and metamorphosed (greenschist facies) Throssell Group from deformed but unmetamorphosed Tarcunyah Group rocks. Spaced, mostly steep, reverse faults that have cut through the Throssell Group and Rudall Complex to the east of the thrust are interpreted to be part of the overlying imbricate zone.

The M_4 phase of metamorphism is a prograde greenschist facies event in the Throssell Group but a retrograde greenschist event in the Rudall Complex (Hickman and Bagas, 1998).

Blake Movement (D_5)

In the western half of POISONBUSH, gentle, north-northeasterly plunging open folds have been recorded in the Mundadjini Formation of the Sunbeam Group from the Poisonbush Range area (AMG 610780). On the northern margin, 6 km northwest (AMG 529109) of Tchukardine Pool, a small structural basin has resulted from the interference of earlier northeast and later northwest-trending folds (D_6) in the Wongarlong Formation of the Tarcunyah Group. Similar open to tight, northeast-trending folds, previously described from the adjacent THROSSELL sheet to the north, have been assigned to the Blake Movement (D_5; Williams and Bagas, 1999).

The Blake Movement was first applied to a broad, northeast-trending zone of open folds and parallel faults, the Blake Fault and Fold Belt, that lay in the northwestern half of the now superseded 'Savory Basin' (Williams, 1992, 1994). The Blake Movement culminated in basin inversion, which is characterized by steep reverse faults, with transport directed toward the northwest along the northwest margin of the Officer Basin (Bagas et al., 1999). This event was attributed to northwest–southeast compression that pre-dated the deposition of the glacigenic Boondawari Formation (Williams, 1992). This places the event in the period c. 610–750 Ma (Stevens and Grey, 1997). It is probable that all northeast-trending folds in the Tarcunyah and Sunbeam Groups on POISONBUSH are the result of the Blake Movement.

Paterson Orogeny (D_6)

Two fold groups are attributed to the c. 550 Ma Paterson Orogeny (D_6; as redefined by Bagas and Smithies, 1998). They are: tight to open folds in the Choorun and Wongarlong Formations of the Tarcunyah Group that trend from 300° in the south to 340° in the north, and widely spaced broad folds in the Tchukardine Formation of the Disappointment Group that trend between 285° and 315°. In all areas, penetrative foliation and metamorphism are absent, although tight folds in the Choorun Formation have a spaced axial planar cleavage in fold closures. The D_6 fold trends post-date the northeast-trending fold axes of the Blake Movement (D_5) as described above (see **Blake Movement**). D_6 folds also refold S_4 foliations in the Broadhurst Formation east (AMG 934090) of the Curran Curran Rockhole. Large D_4 faults that transect the Rudall Complex and Throssell Group have been reactivated during the Paterson Orogeny (D_6).

A large, northwesterly trending asymmetrical anticline with a steep northeast-dipping axial plane lies west (AMG 818795) of the Perentie Rockhole. This large structure, which is faulted along the southwest side (Perentie Fault; Fig. 4), has exposed Mundadjini Formation in the fold core. The formation is unconformably overlain by the Tchukardine Formation of the Disappointment Group. The Perentie Fault is offset by a later, east-northeasterly trending sinistral strike-slip fault.

The Southwest Thrust, reactivated during D_6, is a dextral transpressional fault that connects to the dextral transpressional Vines Fault to the north on THROSSELL (Williams and Trendall, 1998b; Williams and Bagas, 1999) and to the sinistral transpressional McKay Fault in the southeast on CONNAUGHTON (Bagas and Smithies, 1998).

The north-northwesterly trending, dextral transpressional Marloo Fault (Fig. 4) transects the western half of POISONBUSH. This fault also truncates earlier, south-directed reverse faults on THROSSELL (Williams and Bagas, 1999), and a similar fault 4 km north of the Poisonbush Range (AMG 610780; Fig. 4). It also cuts a northeast-trending sinistral strike-slip fault in the Horsetrack Range area (Fig. 4).

The Tchukardine, McFadden, and Woora Woora Formations were deposited in the Wells Sub-basin of the Officer Basin (Bagas et al., 1999; previously called the Wells Foreland Basin of the 'Savory Basin'; Williams, 1992). The following observations support the conclusion that the Wells Sub-basin is related to events taking place in the Paterson Orogen. Firstly, palaeocurrent data (Williams, 1992) suggest depositional material was eroded from highlands uplifted to the northeast. Secondly, the axes of broad folds and faults in the basin are parallel to the fold trends within the adjacent Paterson Orogen; and thirdly, numerous stepped microfaults with reverse movement, indicating transport to the southwest, cut the Tchukardine Formation. These structures reflect the similar southwest-directed compression of the D_6 event (Paterson Orogeny) in the Paterson Orogen. The microfaults are commonly intersected by anastomosing kink bands that have vertical displacements, in places some 10 mm, along the axial plane. These are oblique to the microfaults and appear to be conjugate sets (Williams, 1992). The Paterson Orogeny is younger than 610 Ma and has been correlated with the

Petermann Ranges Orogeny in central Australia (Myers, 1990b; Bagas et al., 1999).

Cainozoic deposits

Cainozoic deposits cover about 80% of POISONBUSH. Rock outcrops are confined to the northeast corner and to two broad zones of scattered rocky hills extending across the sheet, northwest from the Wells Range area and north-northwest from the Horsetrack Range area.

The superficial material is dominated by Quaternary eolian deposits, but also includes minor consolidated residual, colluvial, and lacustrine deposits, as well as unconsolidated Quaternary colluvial, alluvial, and lacustrine deposits.

Dissected, and partly silicified valley calcrete (*Czk*) is widespread in the Savory palaeodrainage basin (Fig. 1), particularly in the palaeodrainage that passes between the Poisonbush and Horsetrack ranges and extends to the southeast. Calcrete is also common 8 km southeast (AMG 950960) of Choorun Waterhole on the eastern margin of POISONBUSH. Other scattered outcrops lie 6 km east (AMG 690110) of Hanging Rock in the headwaters of the Tarcunyah palaeodrainage basin (Fig. 1). The calcrete is a massive or nodular, sometimes vuggy, grey-white limestone, typically with minor surface silicification consisting of chalcedonic and opaline silica.

A large playa lake, 13 km northeast (AMG 780680) of the Horsetrack Range, contains gypsum (kopi) dunes (*Czdy*) that are partly recrystallized and eroded.

Active erosion along creeks in the area 5 km southeast (AMG 930000) of Choorun Waterhole has exposed consolidated colluvium (*Czc*) beneath eolian sand (*Qs*). The colluvium comprises silica- and iron-cemented, weakly bedded sand, silt, and gravel.

Apart from a few low mounds of ironstone pebble-veneered laterite 15 km east (AMG 818622) of the Horsetrack Range, and the Tchukardine Formation 5 km north-northwest (AMG 895720) of the Wells Range, the only extensive areas of laterite (C*zl*) are confined to the Oakover Drainage Basin (Fig. 1). In this area, broad ridges of massive to pisolitic laterite overlie ferruginous Woora Woora Formation. Ironstone-pebble veneers (*Qp*) are widespread on the sandplain in this area.

Quaternary deposits

As on adjoining THROSSELL, the topography and prevailing southeasterly winds have broadly subdivided the Quaternary units into three domains. Dune-bearing eolian deposits favour the windward, or easterly and south-easterly, sides of rocky hills and dissected plateaus and ridges. An exception is the eastern side of the Horsetrack Range, where it is fringed by extensive calcrete outcrops. The lee or westerly and northwesterly sides of outcrops host a mixture of alluvial, colluvial, and minor sheetwash deposits. Lacustrine deposits and some minor, recent alluvium occupy the palaeodrainage lines.

Broad alluviated drainage lines (*Qa*) are prominent in the Oakover Drainage Basin (Fig. 1). Tarcunyah Creek, in the headwaters of the Tarcunyah palaeodrainage basin, is the largest incised modern drainage system. The remaining drainages are short (<8 km), sandy creeks that end abruptly in the surrounding sand-dune and sandplain country. The alluvial unit (*Qa*) consists of unconsolidated sand, silt, and gravel. All drainage lines on POISONBUSH are ephemeral.

Lacustrine deposits (*Ql*) occupy playa lakes (saline) and claypans (fresh). The deposits consist of clay, silt, and silty-clay deposits, some with fine pebble-veneered surfaces. They are scattered through the calcreted palaeodrainages of the Savory and Tarcunyah palaeo-drainage basins. The largest playa, 13 km northeast (AMG 780680) of the Horsetrack Range, is partly vegetated with samphire. Some of the short creeks emptying into the sand-dune country terminate in small claypans.

The mixed claypan and dune unit (*Qd*) is common in the headwaters of the Tarcunyah palaeodrainage basin, 10 km southeast (AMG 705040) of Hanging Rock. The unit consists of numerous small clay pans, sometimes with a pebble veneer, separated by low sand, silt, and sandy-silt dunes.

Red-brown, fine- to medium-grained eolian sand (*Qs*), comprising iron-stained quartz grains, is widespread on POISONBUSH. As well as being blown into longitudinal- (seif), chain-, and net-dune complexes it occupies dune-free sandplains. Very commonly on POISONBUSH, the sandplain is covered with a veneer of small ironstone and quartz pebbles (*Qp*). This unit (*Qp*) is particularly widespread in the Oakover Drainage Basin. It is also present on the lee sides (west) of prominent ranges such as the Poisonbush Range (AMG 610780), Wells Range (AMG 910670) and west of Curran Curran Rockhole (AMG 908083). Pebble veneer (*Qp*) also lies east of the Horsetrack Range (AMG 670610), where a calcreted drainage has restricted the dune progress on the windward (east) side of the range.

Recent colluvium (*Qc*), in the form of scree and talus, is located in narrow valleys and adjacent to rocky hills in the headwaters of the Tarcunyah Creek and Rudall River. Patches also lie along the western side of the discontinuous rocky hills and ridges that diagonally cross POISONBUSH from the northwest to the southeast corner. The colluvium consists of a mixture of sand, silt, and rock fragments, commonly with a thin veneer of rock-fragment or quartz-vein debris.

Sheetwash (*Qw*) is largely restricted to the Oakover Drainage Basin, where it is closely associated with the ironstone pebble-veneered sandplain (*Qp*). The sheetwash areas (*Qw*) have a distinctively banded vegetation pattern, sometimes referred to as a ‘tiger bush’ pattern (Wakelin-King, 1999).

A small area of swelling-clay, ‘crabhole’ or gilgai eluvium (*Qb*) lies 8 km west (AMG 490080) of Tchukardine Pool. This deposit appears to be a type of claypan surrounded by sheetwash (*Qw*).

Economic geology

POISONBUSH is located in the Marble Bar District of the Pilbara Mineral Field. There has been no mineral production from the area and, due to its remoteness, little interest was shown in the area before the mid-1970s. Such interest arose from gold and base metal discoveries in adjacent areas, for example, the Telfer gold deposit discovered in 1971 on PATERSON (Tyrwhitt, 1995).

The Rudall River National Park, declared in 1977, covers more than 48% of the north, northeastern, and eastern parts of POISONBUSH. Special attention to the effects of exploration methods used in this area is now required.

From the mid-1970s onward, mineral exploration has been directed toward the discovery of base metals (copper, lead, zinc), gold, uranium, and diamonds. Despite rock-chip, auger, soil, and lag geochemical sampling, and gravity and magnetic surveys by a number of exploration companies, only a few anomalies have been identified so far on POISONBUSH. Follow-up reverse circulation (RC) and rotary-air blast (RAB) drilling have failed to locate extensive mineralization in the Rudall Complex and the adjacent Choorun Formation. An unsuccessful search for kimberlite pipes and diamonds was carried out 11 km west (AMG 800673) of the Wells Range (Lawrence, 1985). Low-grade gypsum (kopi) forms dunes adjacent to the playa lake in this area.

Open-file company mineral exploration reports covering exploration on POISONBUSH, which have been submitted to the GSWA since 1975, are held in the Department of Minerals and Energy (DME) WAMEX database, now accessible online. Information from the WAMEX database as at November 1999 is summarized in Appendix 2.

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Appendix 1

Gazetteer of localities on POISONBUSH

	AMG coordinates	
Place name	*Easting*	*Northing*

Carcoonya Waterhole	368100	7497250
Choorun Waterhole	389600	7501900
Curran Curran Rockhole	390850	7508350
Hanging Rock	362650	7510400
Horsetrack Range	367000	7461000
Meeting Gorge	358000	7506700
Nooloo Soak	386900	7498500
Perentie Rockhole	385100	7479450
Poisonbush Range	361000	7479000
Tarcunyah Creek	359500	7507500
Tchukardine Pool	356550	7506550
Wells Range	391000	7467000

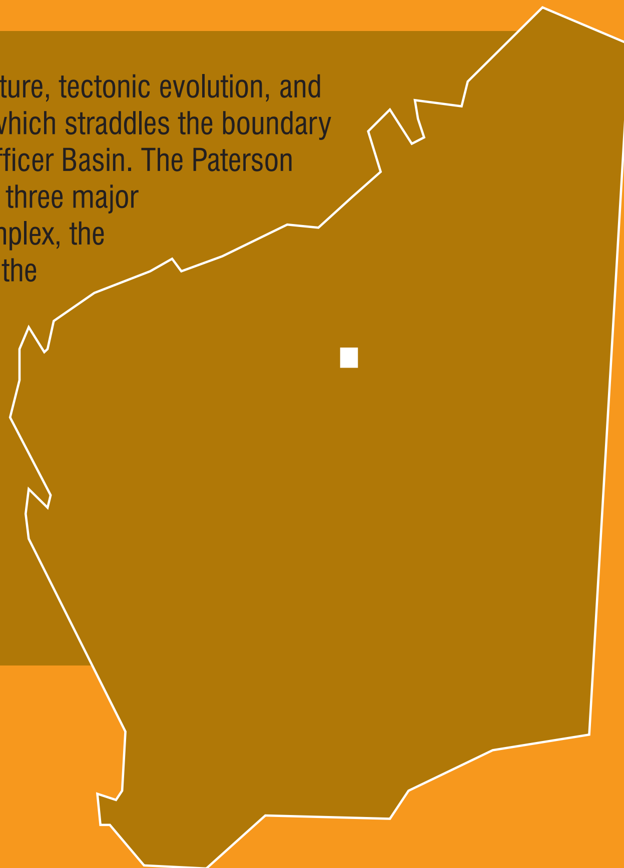
Appendix 2

Company data available from WAMEX open file for POISONBUSH as at November 1999

WAMEX[(a)] *Item number*	*Duration of exploration*	*Title of project*	*Company*
458	1975	Curran Curran gold exploration	Broken Hill Proprietary Company
1099	1976–1978	Rudall uranium–gold – basemetals exploration	Esso Australia
974	1977–1978	Three Sisters copper–lead–zinc exploration	CRA Exploration
1694	1978–1981	Paterson Province uranium–copper–lead–zinc exploration	Occidental Minerals Corporation
2046	1980–1981	Rudall River area uranium–nickel–copper exploration	Geopeko; Mobil Energy Minerals Australia
2610	1981–1983	Balfour Downs copper–uranium exploration	Oilmin; Petromin; Transoil
2779	1981–1983	Watrara – May Creek uranium exploration	Aquitaine Australia Minerals
3063	1983–1984	Gnamma Hole – Savory Creek gold – basemetals exploration	Esso Exploration Australia
2174	1984	West Wells Range diamond exploration	CRA Exploration
6091	1984–1992	Three Sisters gold – basemetals – uranium exploration	BHP Minerals
3494	1985–1986	Tchukardine Pool copper–lead–zinc exploration	BHP Minerals
6270	1986–1992	Rudall uranium – basemetals – gold exploration	CRA Exploration
6288	1986–1992	Rudall uranium – basemetals – gold exploration	CRA Exploration
7676	1988–1994	Yandagooge gold–uranium – basemetals exploration	Idemitsu Minerals Australia; Uranerz Australia; Poseidon Exploration
6701	1991–1992	Rudall gold exploration	Poseidon Exploration
8076	1993–1994	Stacey 2 and 4 diamond exploration	CRA Exploration
8194	1993–1995	White Gum 1–7 base metals – gold exploration	CRA Exploration
9650	1996–1997	Gregory Pool gold – basemetals exploration	BHP Minerals

NOTE: (a) WAMEX: Department of Minerals and Energy's Western Australian mineral exploration database

These Explanatory Notes describe the stratigraphy, structure, tectonic evolution, and economic geology of the POISONBUSH 1:100 000 sheet, which straddles the boundary between the Paterson Orogen and the newly redefined Officer Basin. The Paterson Orogen, in the northeastern part of the sheet, comprises three major lithostratigraphic units: the Palaeoproterozoic Rudall Complex, the Mesoproterozoic to NeoproterozoicThrossell Group, and the Neoproterozoic Tarcunyah Group. All were affected by southwest-directed transpression during the Paterson Orogeny. The Tarcunyah Group and its lateral equivalent, the Sunbeam Group of the Officer Basin, may be correlated with units of Supersequence 1 of the Centralian Superbasin. The younger Disappointment Group, correlated with Supersequence 4, occupies the Wells Sub-basin of the Officer Basin. The area has been explored for copper, zinc, gold, uranium, and diamonds.



Further details of geological publications and maps produced by the Geological Survey of Western Australia can be obtained by contacting:

Information Centre
Department of Minerals and Energy
100 Plain Street
East Perth WA 6004
Phone: (08) 9222 3459   Fax: (08) 9222 3444
www.dme.wa.gov.au

WILLIAMS, BAGAS

Geology of the Poisonbush 1:100 000 sheet

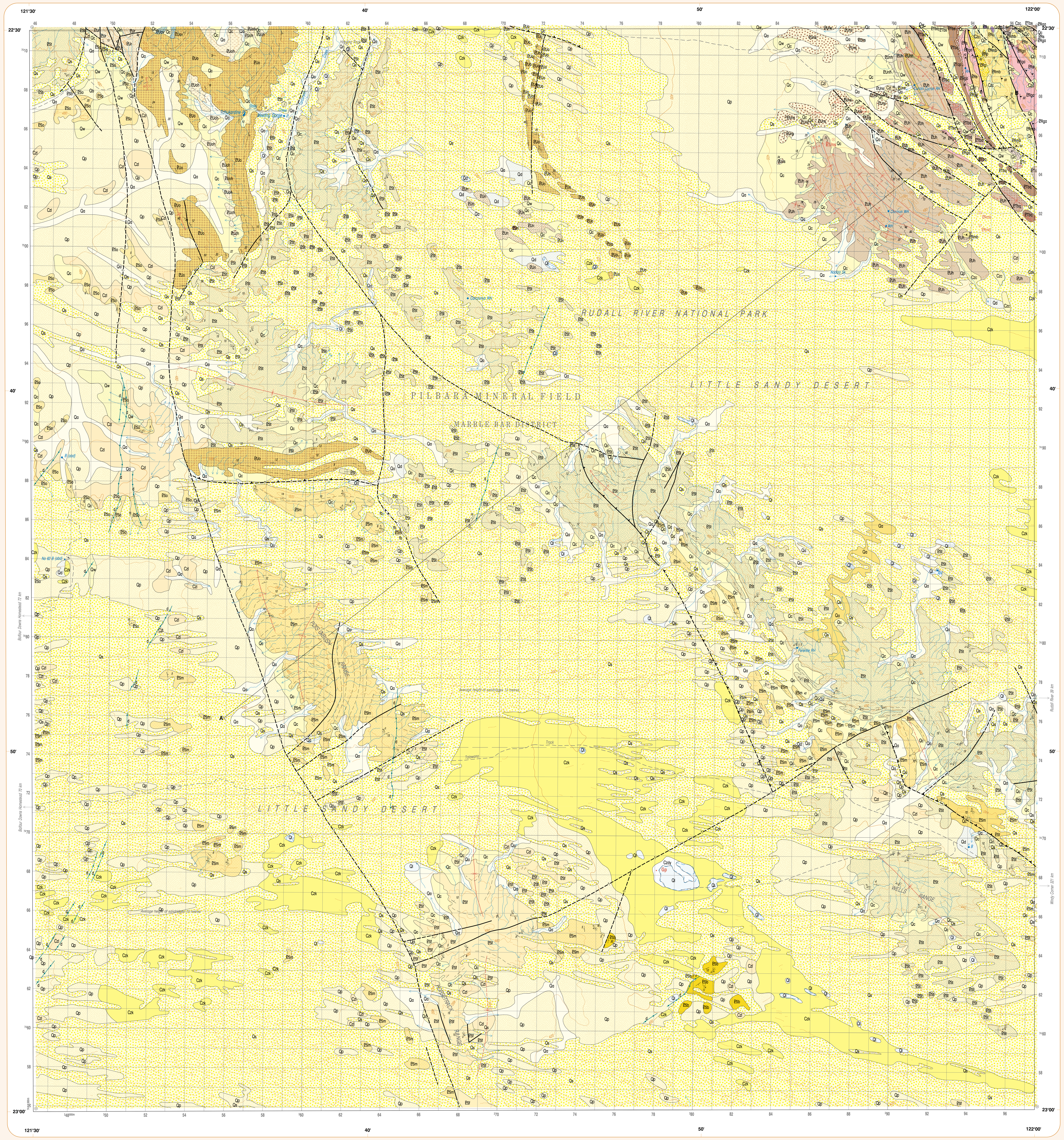
EXPLANATORY NOTES

POISONBUSH

AUSTRALIA 1:100 000 GEOLOGICAL SERIES

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

SHEET 3252



PHANEROZOIC — CAINOZOIC — QUATERNARY

Qa | Ql | Qd | Qs | Qp | Qc | Qw | Qb

- Qa — Alluvium — unconsolidated silt, sand, and gravel; in drainage channels and on adjacent floodplains
- Ql — Lacustrine deposits — clay, silt, and silty sand; playa (saline) and claypan (fresh) deposits
- Qd — Mixed lacustrine and eolian deposits — clay, silt, and sand; vegetated swamps, numerous small claypans with fringing lunette dunes
- Qs — Eolian deposits — sand, in sheets and simple longitudinal (seif), chain longitudinal, and net dunes
- Qp — Eolian sand with ironstone pebble, rock fragment, and quartz pebble veneer; in sheets and between dunes
- Qc — Colluvium — quartz pebble and rock fragment veneer on sand, silty sand; adjacent to, or over, shallow bedrock; scree and talus
- Qw — Colluvium and alluvium — silt, sand, and gravel on low slopes and sheetwash areas
- Qb — Eluvium — swelling-clay soil (gilgai); characterized by 'crabhole' surface

Czk | Czdy | Czc | Czl

- Czk — Calcrete — massive, nodular, and vuggy limestone; some surface silicification; in palaeodrainage lines
- Czdy — Gypsiferous material, kopi, in eroded dunes
- Czc — Colluvium — consolidated silt, sand, and gravel; dissected by active channels
- Czl — Massive and pisolitic laterite, and ferruginous duricrust

- d — Dolerite dyke
- fb — Silicified rock and fault breccia; tectonically controlled

PROTEROZOIC

SAVORY BASIN — Savory Group (< 610 Ma)

- ESo — **WOORA WOORA FORMATION:** medium-grained ferruginous sandstone, lithic sandstone, quartz wacke, and siltstone
- ESt — **TCHUKARDINE FORMATION:** medium- to coarse-grained sandstone, quartz wacke, siltstone, and shale; minor conglomerate
- ESb — **BOONDAWARI FORMATION:** glacigene diamictite, sandstone, siltstone, shale, and conglomerate
- ESm — **MUNDADJINI FORMATION:** fine- to coarse-grained sandstone, conglomerate, and siltstone; minor shale and mudstone
- ESc — **COONDRA FORMATION:** coarse- to medium-grained sandstone, poorly sorted conglomerate, and pebbly sandstone (section only)
- ESf — **McFADDEN FORMATION:** laminated fine- to coarse-grained quartz sandstone, feldspathic sandstone, and quartz wacke; minor conglomerate and siltstone

PATERSON OROGEN — Tarcunyah Group (c. 800 Ma)

EUn | EUns | EUnh

- EUn — **NOOLOO FORMATION:** thin-bedded to massive dolomite and limestone; minor thin-bedded, fine- to coarse-grained sandstone and siltstone
- EUns — Interbedded fine- to coarse-grained sandstone, pebbly sandstone, wacke, and siltstone
- EUnh — Red to purple weathering shale and siltstone
- EUov — Altered, pillowed mafic lava
- EUo — **WONGARLONG FORMATION:** fine- to coarse-grained sandstone and orthoquartzite; minor siltstone and shale
- EUoh — Siltstone, silty shale, and shale
- EUr — **BROWNRIGG SANDSTONE:** white to grey, fine- to medium-grained quartz sandstone and medium- to coarse-grained sandstone with scattered pebbles
- EUh — **CHOORUN FORMATION:** red-brown, medium- to coarse-grained sandstone, pebbly sandstone, quartz wacke, nodule-bearing sandstone, polymictic pebble to cobble conglomerate, and quartz pebble conglomerate
- EUhh — Siltstone with felsic tuff

Yeneena Supergroup — Throssell Group — Yeneena Basin (> 900 Ma)

ETb | ETbs | ETbq | ETba

- ETb — **BROADHURST FORMATION:** grey shale, carbonaceous shale, siltstone, dolomite, and fine-grained sandstone (not on map)
- ETbs — Grey carbonaceous shale and siltstone, sulfidic in part; graphitic schist, quartz–sericite schist, and phyllite
- ETbq — Interbedded fine- to medium-grained sandstone, siltstone, and minor shale; local scattered pyrite in places
- ETba — Interbedded fine- to coarse-grained sandstone, siltstone, silty shale, dolomite, and stromatolitic dolomite
- ETc — **COOLBRO SANDSTONE:** massive to thick-bedded sandstone; minor siltstone and shale
- ETcp — Basal polymictic conglomerate, pebble to boulder clasts, matrix-supported

Rudall Complex

- ERga (1765–1790 Ma) — Orthogneiss derived from porphyritic biotite granitoid; generally contains augen of K-feldspar
- ERu — Metamorphosed ultramafic rock; mainly serpentinite
- ERmb (c. 2000 Ma) — luartz–muscovite–biotite schist; metamorphosed siltstone
- ERp — luartz–biotite–plagioclase gneiss and schist, containing layers of quartzite and pelitic schist
- ERs — Psammitic paragneiss; includes fine-grained quartz–feldspar–muscovite gneiss, quartz–muscovite schist, and quartzite layers

Symbols

Geological boundary
- exposed

Fault
- exposed
- concealed
- concealed, position uncertain
- reverse or thrust

Fold, showing axial trace and generalized plunge direction
- anticline; exposed, concealed
- syncline; exposed, concealed
- overturned anticline; exposed
- overturned syncline; exposed

Minor fold, showing direction and plunge of axis
- anticline
- syncline
- Z-vergence

Bedding, showing strike and dip
- inclined
- vertical
- horizontal
- overturned
- strike and dip estimated from aerial photography
  - 0–15°
  - trend of bedding

Way-up indicator
- cross-bedding

Direction of movement of sediment-bearing current,
- from cross-bedding

Metamorphic foliation, showing strike and dip
- inclined

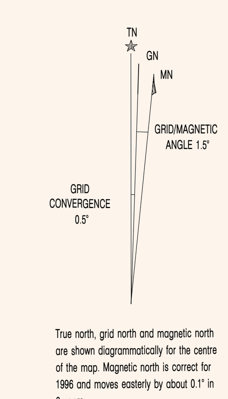
Cleavage, showing strike and dip
- inclined
- vertical

Lineation, showing direction and plunge axis of crenulation
- inclined

Major track, maintained
Track
Building
National park boundary
Breakaway
Sand dune
Contour line, 20 metre interval

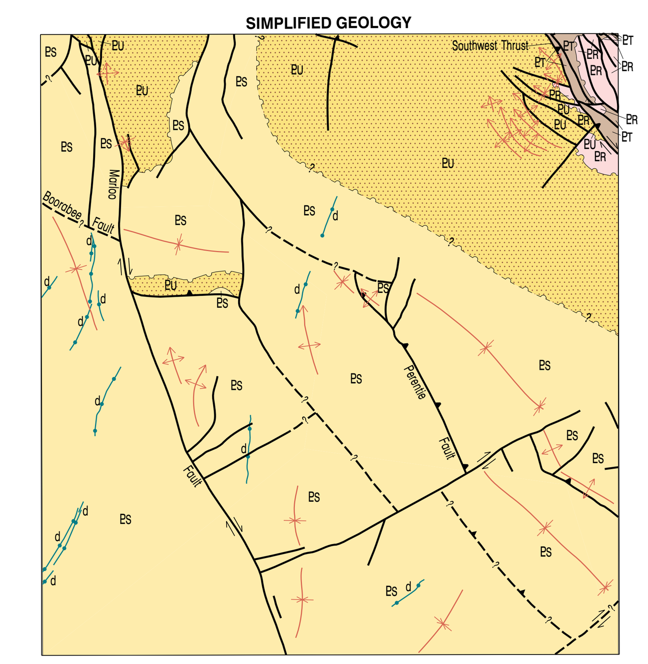
Watercourse, ephemeral; pool
Rockhole — RH
Waterhole — WH
Soak — Sk
Bore — B
Windpump
Abandoned — (abd)

Mineral exploration drillhole, showing subsurface data — ERmb
Mineral occurrence
- Gypsum — Gp

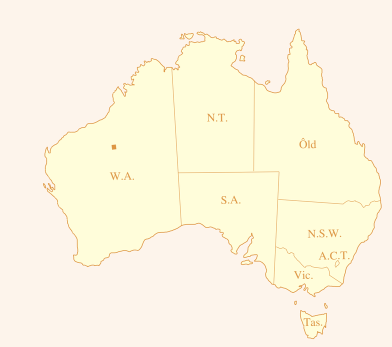


True north, grid north and magnetic north are shown diagrammatically for the centre of the map. Magnetic north is correct for 1996 and moves easterly by about 0.1° in 5 years.

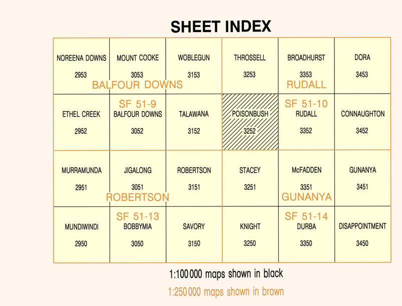
SIMPLIFIED GEOLOGY



- Dolerite dyke
- Savory Group — SAVORY BASIN
- Tarcunyah Group — PATERSON OROGEN
- Throssell Group — Yeneena Supergroup — Yeneena Basin
- Rudall Complex
- Unconformity
- Unconformity, concealed, position doubtful
- Strike-slip fault, showing relative horizontal displacement



SHEET INDEX



DEPARTMENT OF MINERALS AND ENERGY
L.C. RANFORD, DIRECTOR GENERAL

GOVERNMENT OF WESTERN AUSTRALIA
HON. NORMAN MOORE, M.L.C.
MINISTER FOR MINES

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA
DAVID BLIGHT, DIRECTOR

SCALE 1:100 000

Metres 1000 0 1 2 3 4 5 6 7 8 9 10 Kilometres

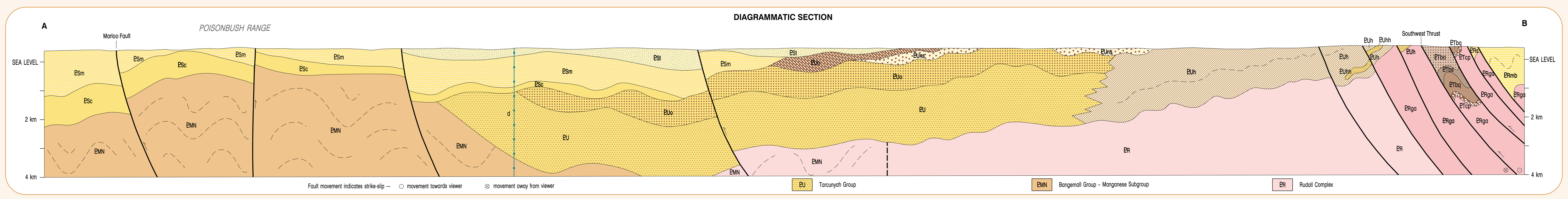
TRANSVERSE MERCATOR PROJECTION
HORIZONTAL DATUM: AUSTRALIAN GEODETIC DATUM 1984
VERTICAL DATUM: AUSTRALIAN HEIGHT DATUM

Grid lines indicate 1000 metre interval of the Australian Map Grid Zone 51

The Map Grid Australia (MGA) is based on the Geocentric Datum of Australia 1994 (GDA94)
GDA94 positions are compatible within one metre of the datum WGS84 positions

Reference points to align maps based on the previous datum, AGD84, have been placed near the map corners

DIAGRAMMATIC SECTION



Geology by I. R. Williams and L. Bagas 1994

Edited by F. Apidopoulos and G. Loan

Cartography by E. Green, K. Greenberg and M. Ward

Topography from the Department of Land Administration Sheet SF 51-10, 3252, with modifications from geological field survey

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This map is also available in digital form

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POISONBUSH

SHEET 3252 FIRST EDITION 1998

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