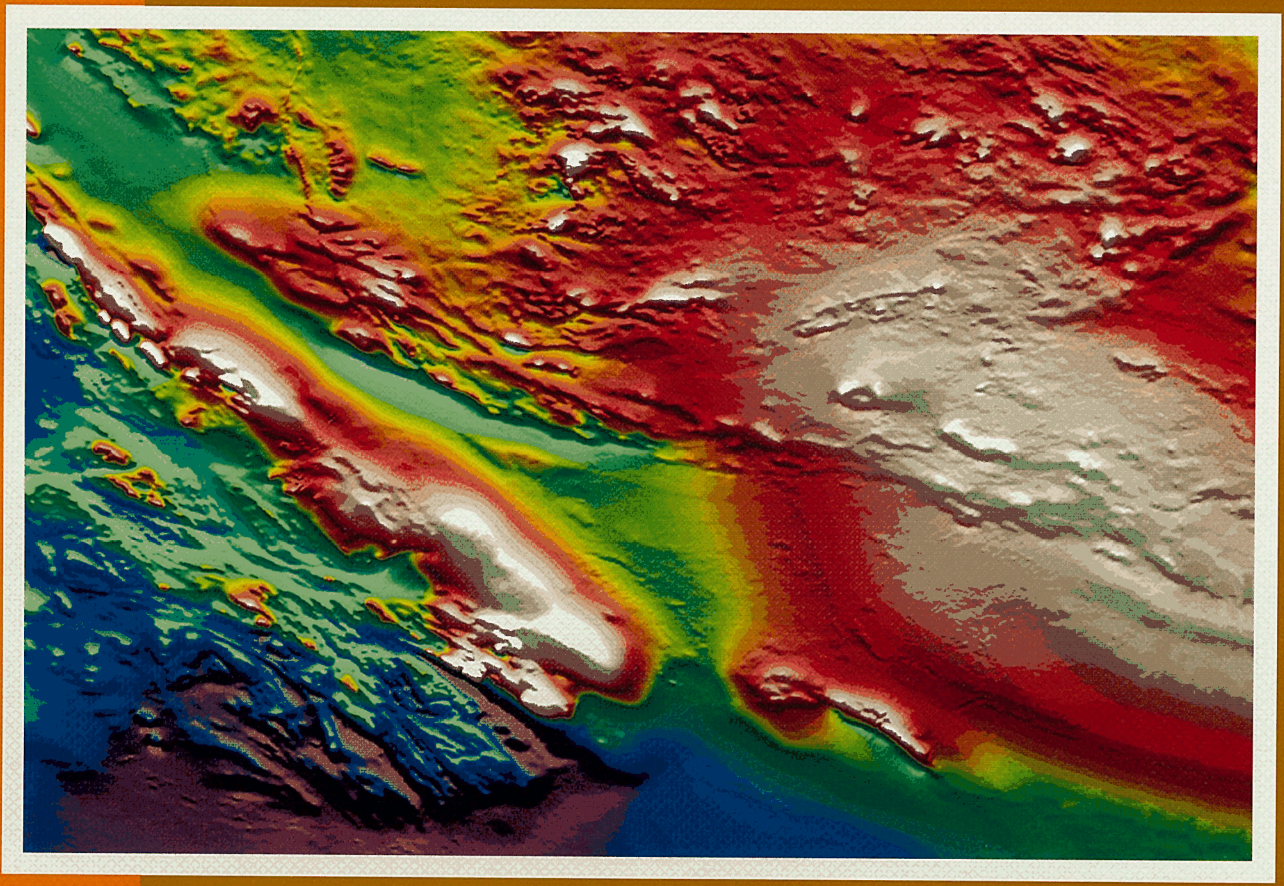
EXPLANATORY NOTES

GOVERNMENT OF WESTERN AUSTRALIA

GEOLOGY OF THE BLANCHE–CRONIN 1:100 000 SHEET

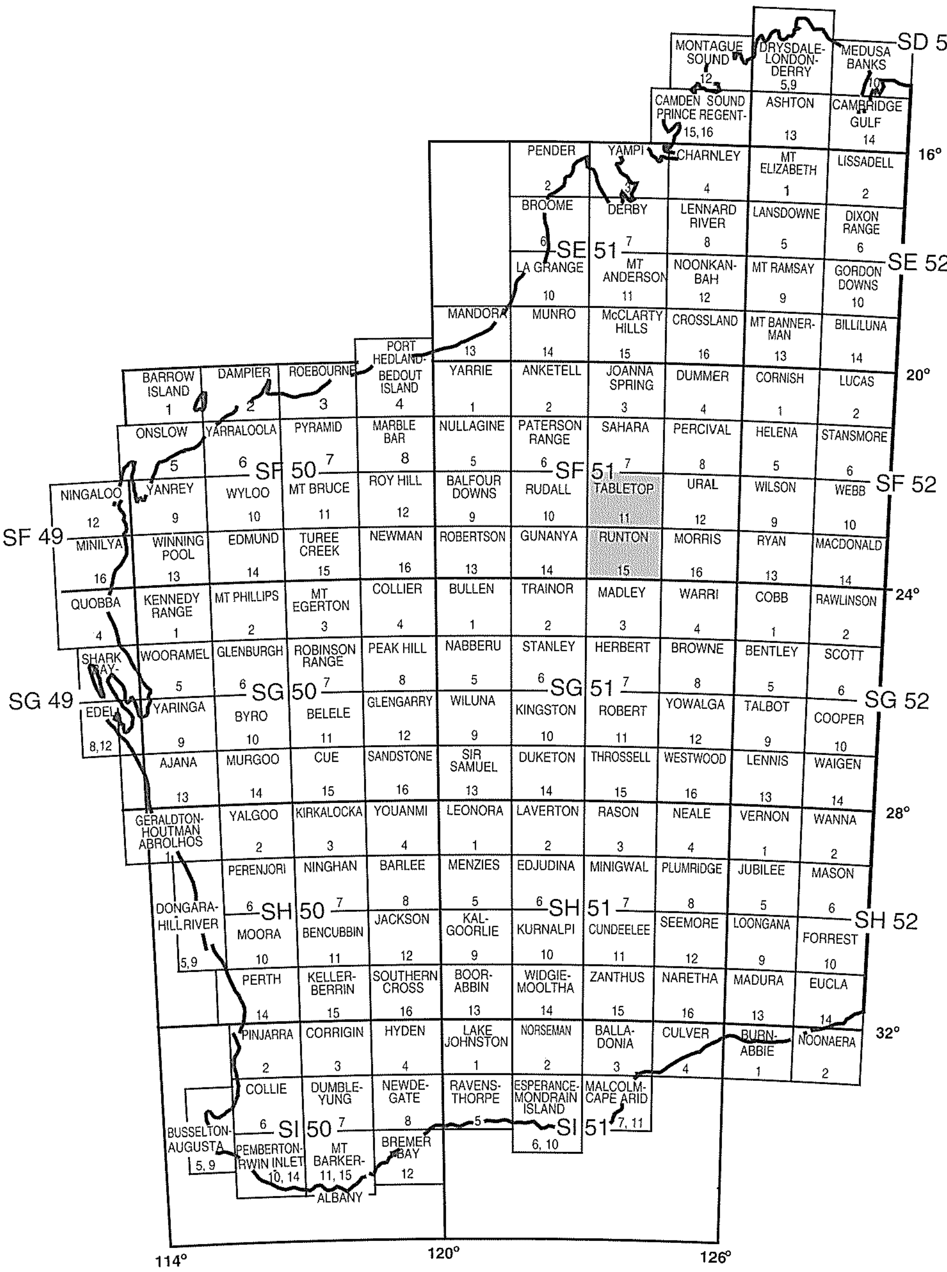
by L. Bagas

1:100 000 GEOLOGICAL SERIES



GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

DEPARTMENT OF MINERALS AND ENERGY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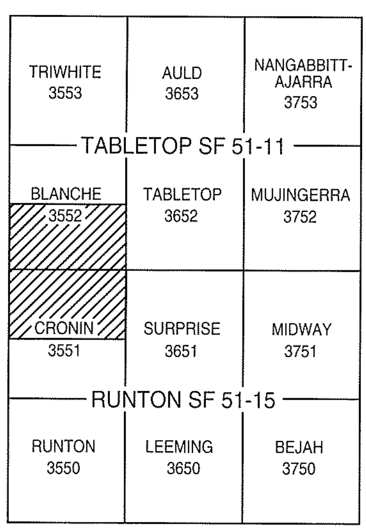
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GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

GEOLOGY OF THE BLANCHE–CRONIN 1:100 000 SHEET (part sheets 3551 and 3552)

by
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Perth 1999

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Colour-draped Total Magnetic Intensity image covering the central part of the BLANCHE–CRONIN 1:100 000 sheet. Image courtesy of Australian Platinum Mines NL. Approximate scale 1:250 000.

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Abstract

The BLANCHE–CRONIN 1:100 000 sheet occupies the eastern part of the northwestern component of the Paterson Orogen, and includes the Palaeoproterozoic Rudall Complex, Mesoproterozoic to Neoproterozoic Yeneena Supergroup, and Neoproterozoic Tarcunyah Group of the Officer Basin. Scattered outliers of Permian and Cretaceous sedimentary rocks of the Canning Basin unconformably overlie the orogen.

The Rudall Complex is divided into three distinct tectono-stratigraphic terranes separated by major faults. These are the Talbot and Connaughton Terranes to the west, and the Tabletop Terrane to the east (on BLANCHE–CRONIN). A Palaeoproterozoic collisional orogeny and high-pressure metamorphism deformed the western two terranes. The Palaeoproterozoic history of the Tabletop Terrane did not involve high-pressure and high-temperature metamorphism. However, Mesoproterozoic (c. 1310 Ma) leucocratic igneous rocks that are not found in the other two terranes intruded this terrane.

The Yeneena Supergroup is composed of the Throssell and Lamil Groups, but the latter is absent on BLANCHE–CRONIN. The Throssell Group on BLANCHE–CRONIN is a sandstone–shale succession unconformably overlying the Tabletop Terrane. The group was deformed by the Miles Orogeny at about 900–800 Ma, and unconformably overlain by the Tarcunyah Group at c. 800 Ma. The last deformation event affecting all Proterozoic rocks took place during the late Neoproterozoic (c. 550 Ma) Paterson Orogeny.

KEYWORDS: Rudall Complex, Yeneena Supergroup, Officer Basin, Tabletop Terrane, greenschist facies, metamorphism

Introduction

The BLANCHE–CRONIN* 1:100 000 map sheet is a combined map that covers the northern half of the CRONIN 1:100 000 and the southern half of the BLANCHE 1:100 000 sheets, between latitudes 22°45' and 23°15'S and longitudes 123°00' and 123°30'E (Fig. 1). This area is within the eastern part of the northwestern component of the Paterson Orogen (Williams and Myers, 1990), and lies along the western part of the Great Sandy Desert (Beard, 1970).

Only parts of the two sheets were mapped because the Rudall Complex is restricted to these areas. The remainder of the two sheets is underlain by Neoproterozoic or younger sedimentary rocks or sediments.

BLANCHE–CRONIN is situated in the Eastern Land Division and forms part of the Marble Bar District of the Pilbara Mineral Field. The map sheets are named after Lake Blanche in the northern part of BLANCHE, and the Cronin Hills on central CRONIN.

There is no permanent habitation on BLANCHE–CRONIN. The nearest habitation is Telfer, about 150 km northwest of the study area. The Talawana Track is a good-quality, four-wheel drive track that connects the western part of BLANCHE–CRONIN to Newman, through the Balfour Downs Homestead and the Ethel Creek – Jigalong road. A well-used four-wheel drive track follows the disused Canning Stock Route through the centre of the sheet area.

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

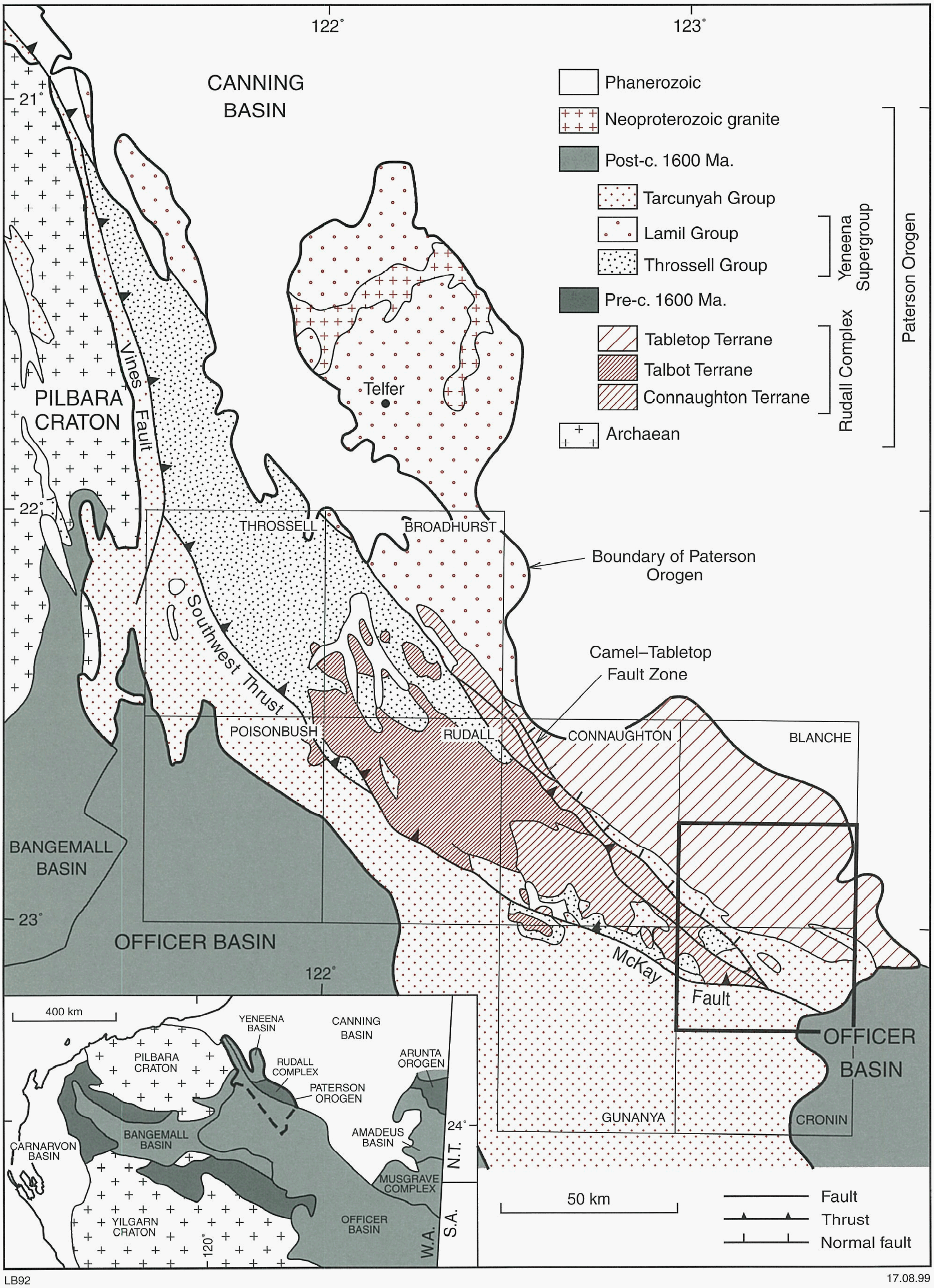

Figure 1. Regional setting of Blanche–Cronin

Previous investigations

Brief descriptions of the area can be found in the early exploration journals by Rudall (1897), who searched unsuccessfully for lost members of the Calvert scientific and exploring expedition in 1896. F. H. Hann, searching for grazing land and prospecting for gold, discovered the northwestern corner of Lake Disappointment, southwest of BLANCHE–CRONIN, in 1898 (Donaldson and Elliot, 1998).

H. W. B. Talbot, who accompanied A. W. Canning's well-sinking party along the Canning Stock Route (Talbot, 1910, 1920), made the first geological observations of the region in 1908–09. The history of scientific investigations in the area is summarized by Yeates and Chin (1979), and Crowe and Chin (1979).

The Geological Survey of Western Australia (GSWA) mapped the area in 1975, as part of the systematic 1:250 000-scale geological mapping of Western Australia (Crowe and Chin, 1979; Yeates and Chin, 1979; Williams and Williams, 1980; Chin et al., 1980).

The Geological Survey of Western Australia began a program of detailed 1:100 000-scale geological mapping of the Rudall Complex in 1989. By 1997, BROADHURST (Clarke, 1991; Hickman and Clarke, 1994), RUDALL (Hickman et al., 1994; Hickman and Bagas, 1998), CONNAUGHTON (Bagas and Smithies, 1998a), GUNANYA (Bagas, 1998), THROSSELL (Williams and Bagas, in prep.a), POISONBUSH (Williams and Bagas, in prep.b), and BLANCHE–CRONIN had been completed.

These Explanatory Notes and the accompanying 1:100 000-scale geological map are the result of detailed regional mapping during 1994 and 1997. Geophysical data supplied by Australian Platinum Mines NL were used to interpret structures and lithologies hidden by Cainozoic cover.

The southern portion of BLANCHE–CRONIN is a reinterpretation of field data reported by Crowe and Chin (1979).

Climate and vegetation

The climate on BLANCHE–CRONIN is arid, with evaporation far in excess of precipitation, and average annual evaporation of about 4400 mm. The average rainfall is about 200 mm per year, mainly derived from storm and cyclone activity between November and March. Average summer temperatures range from a daily minimum of about 25°C to a maximum of about 40°C, whereas daily winter temperatures vary between 5° and 25°C. Prevailing winds blow from the east and southeast, parallel with sand dunes in the area.

The area forms part of the Great Sandy Desert Natural Regions of Beard (1970). Spinifex (*Triodia*) is present across the entire area, whereas other forms of vegetation are associated with different types of terrain. For example, sandplain areas also contain wattles, *Grevillea*, eucalypts, tea tree, and soft shrubs (*Crotalaria*); areas of rock outcrop include grasses, small scrub, mulga, and small eucalypts; and playa lakes are commonly devoid of vegetation.

Physiography

The physiography of BLANCHE–CRONIN (Fig. 2) is the product of several distinct erosional and depositional events, the most important of which have been Tertiary peneplanation of the Mesoproterozoic to Neoproterozoic rocks, and the recent erosion and deposition.

Physiographic divisions used on BLANCHE–CRONIN (Bagas and Smithies, 1998b) have been adapted from CONNAUGHTON, where depositional regimes are distinguished from erosional regimes (Bagas and Smithies, 1998a).

Permian–Cretaceous land surface

Remnants of the Permian–Cretaceous land surface (Fig. 2) are present in the western, southern, and eastern parts of BLANCHE–CRONIN. These include Permian fluvial–glacial sedimentary rocks (benches), and hills and mesas of Cretaceous near-shore marine and fluvial sedimentary rocks.

Tertiary land surface

Variably dissected plateaus developed over the Neoproterozoic Tarcunyah Group essentially represent remnants of a Tertiary peneplain (Hickman and Bagas, 1998). The plateaus and ridges are commonly bevelled to a height of about 460 m above sea level.

Calcrete deposits (*Czk*) throughout northern BLANCHE–CRONIN pre-date the sandplains, and may relate to channels and lakes that were active during Tertiary times. These deposits form low mounds in low-lying areas, and are composed of massive, nodular, and vuggy limestone, locally replaced by chalcedony (*Czz*).

Recent land surface

The recent land surface can be subdivided into erosional- and depositional-dominated surfaces. The erosional surface comprises low hills, and rock pavement and low-lying outcrop. The depositional surface comprises seif dune and dune-free sandplains, and sheetwash fan and playa lake deposits.

The low hills area is subject to active erosion by headwater systems, and constitutes a dissected, low-lying pediplain. The underlying rock types influence the morphology of the hills: granitoid rocks characteristically form rounded hills, whereas quartzite forms more-rugged country.

Rock pavements, low outcrops, and colluvium are present in sandplain areas. Erosion results mainly from wind action and water movement in small streams or floods between dunes, and represents the last stage in the formation of a new pediplain.

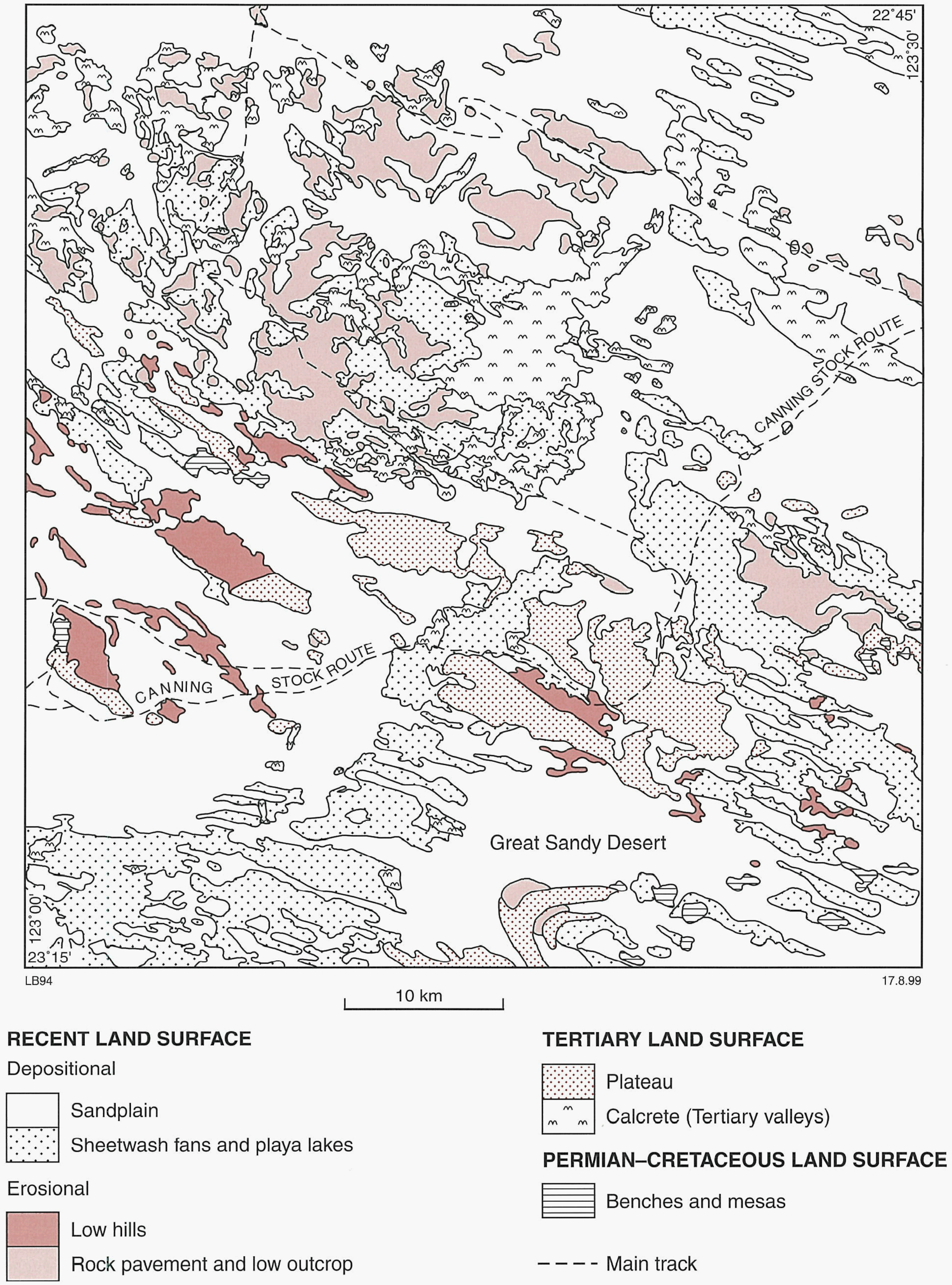

Figure 2. Physiography and main access on Blanche–Cronin

The seif-dune sandplain consists of seif (longitudinal) dunes that reach up to 30 m in height. The dunes are many kilometres long and spaced up to 3 km apart. In longitudinal profile, their steep southern slopes and tuning-fork shapes are consistent with prevailing winds from the east-southeast (Crowe, 1975).

The playa lake subdivision includes salt and playa lakes, lunette dunes, gypsum deposits (*Ql*), and a hybrid mix of playa lakes and eolian sand (*Qd*).

Precambrian geology

The Paterson Orogen is a northwesterly trending belt of folded and metamorphosed sedimentary and igneous rocks that extends about 1200 km across the central part of Western Australia (Fig. 1). The orogen is exposed in the northwest along the eastern margin of the Pilbara Craton, and in the Musgrave Complex of central Australia (Williams and Myers, 1990).

The northwestern exposure of the Paterson Orogen, originally referred to as the Paterson Province (Daniels and Horwitz, 1969; Blockley and de la Hunty, 1975), is flanked to the west and southwest by Archaean rocks of the Pilbara and Yilgarn Cratons respectively, which together form the West Australian Craton (Myers, 1990). The orogen is unconformably overlain by late Neoproterozoic to Phanerozoic rocks of the Officer Basin (Disappointment Group; Bagas et al., in prep.) and Phanerozoic rocks of the Canning Basin, to the east and north respectively (Williams and Myers, 1990).

The northwestern Paterson Orogen includes the Palaeoproterozoic Rudall Complex, Mesoproterozoic to Neoproterozoic Yeneena Supergroup (which consists of the Throssell and Lamil Groups; Williams and Bagas, 1999), and Neoproterozoic Tarcunyah Group of the early Officer Basin (Bagas et al., 1995; Bagas et al., in prep.).

The Rudall Complex is in the centre of the northwestern part of the Paterson Orogen between the Archaean West Australian and Precambrian North Australian Cratons (Bagas and Smithies, 1997). Sedimentary rocks of the Earaheedy Group, Bangemall Group, Yeneena Supergroup, Officer Basin, and Canning Basin obscure the basement rocks between the Rudall Complex and these cratons (Fig. 1).

Proterozoic rocks on BLANCHE–CRONIN comprise the Tabletop Terrane of the Rudall Complex, Yeneena Supergroup (Throssell Group), and Tarcunyah Group. A simplified map of the pre-Cainozoic geology is included on the map (Bagas and Smithies, 1998b).

Rudall Complex

The term 'Rudall Complex' is applied to Proterozoic rocks on BLANCHE–CRONIN that were deformed and metamorphosed before deposition of the unconformably overlying Throssell and Tarcunyah Groups. Weakly foliated or non-foliated igneous rocks that intruded the Rudall Complex are not assigned to a group. These igneous rocks are about 1300 m.y. old (Nelson, 1995; Smithies and Bagas, 1997a).

Rocks of the Rudall Complex outcrop in the central and northern parts of BLANCHE–CRONIN. The complex is here divided into two tectonically juxtaposed and lithologically distinct packages of rocks: the Connaughton and Tabletop Terranes (Fig. 3; Bagas and Smithies, 1998b).

The Connaughton Terrane comprises metamorphosed mafic volcanic rocks and intrusive rocks, banded iron-formation, pelite, chert, felsic gneiss (including augen orthogneiss), and quartzite. These rocks are metamorphosed to high-pressure amphibolite–granulite transitional facies (Smithies and Bagas, 1997b). The Tabletop Terrane comprises a succession of mafic schist, amphibolite, and metasedimentary rocks that resemble the succession found in the Connaughton Terrane; however, augen gneiss is not present in the Tabletop Terrane. Furthermore, there is no evidence that the peak metamorphic grade exceeded lower amphibolite facies or that it was accompanied by high pressure. Instead, weakly foliated tonalite and leucogranite characterize the terrane. The intensity of the foliation of these granitic rocks increases with proximity to the Camel–Tabletop Fault Zone, which marks the boundary with the Connaughton Terrane (Bagas and Smithies, 1997).

Connaughton Terrane

The Connaughton Terrane is present southwest of the Camel–Tabletop Fault Zone in the western part of BLANCHE–CRONIN.

Quartzite (ⱣRq)

Quartzite (*ⱣRq*) outcrops as thin and dismembered ridges that are parallel to the Camel–Tabletop Fault Zone. Quartzite is either massive or compositionally layered, with a pervasive foliation defined by recrystallized quartz grains. The unit consists of fine- to medium-grained recrystallized quartz, and various proportions of sericite, muscovite, opaque minerals, and rutile. This unit includes very thin intercalations of quartz–muscovite schist (*ⱣRm*) interleaved with sheared biotite orthogneiss (*ⱣRnb*) and amphibolite (*ⱣRna*). The protolith of the quartzite is either a chert or a quartz arenite.

Quartz–mica schist (ⱣRm)

Fine- to medium-grained quartz–biotite–muscovite(–iron-oxide–tourmaline–garnet–K-feldspar) schist (*ⱣRm*) is interlayered with thin quartzite (*ⱣRq*) east of Georgia Bore (AMG 016497)* in the western part of BLANCHE–CRONIN. The protolith is interpreted to be an argillaceous sedimentary rock.

* 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.

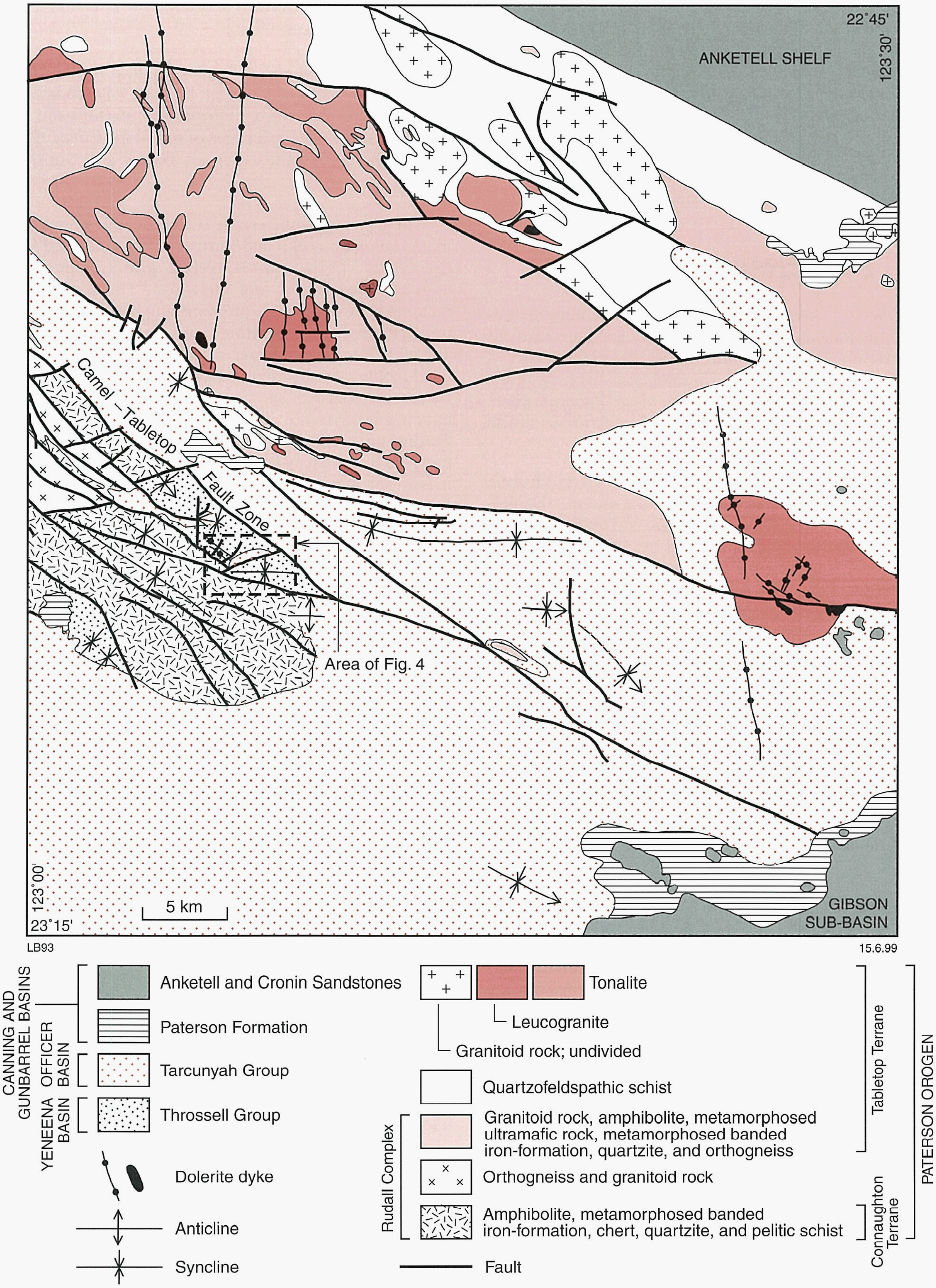

Figure 3. Simplified geological map of Blanche–Cronin, showing major structures

K-feldspar augen orthogneiss (ꝐRga)

The K-feldspar augen orthogneiss (*ꝐRga*) outcrops only in the Connaughton Terrane on western BLANCHE–CRONIN. The unit is a microcline–quartz–plagioclase–biotite gneiss containing numerous augen (deformed megacrysts) of K-feldspar. Minor and accessory minerals include zircon, garnet, titanite, allanite, apatite, and opaque minerals. The gneiss commonly shows a strong foliation parallel with the Camel–Tabletop Fault Zone. The foliation is defined by alignment of mica and microcline augens.

The protoliths to the augen orthogneiss are interpreted as porphyritic biotite monzogranite and biotite granite.

Amphibolite – mafic schist (ꝐRna)

Medium-grained, amphibolite – mafic schist (*ꝐRna*) outcrops 11 km southeast of Georgia Bore (AMG 115455) on western BLANCHE–CRONIN. The schist is composed of plagioclase, hornblende retrograded to tremolite–actinolite, minor quartz, and accessory epidote. Accessory minerals include titanite, apatite, magnetite (or leucoxene), rutile, biotite, and zircon. The mafic schist is interlayered with thin sheared quartzite (*ꝐRq*) and orthogneiss (*ꝐRnb*), and is interpreted as a sheared gabbro.

Medium-grained biotite gneiss (ꝐRnb)

Medium-grained, quartz–feldspar–biotite(–muscovite) gneiss (*ꝐRnb*) in western BLANCHE–CRONIN is wedged between quartzite (*ꝐRq*) and augen orthogneiss (*ꝐRnb*). The proportion of quartz roughly correlates with the degree of shearing, and decreases from 60% to about 30% near the augen orthogneiss. Furthermore, the more highly sheared rocks are muscovite rich, but biotite becomes the dominant mica in less sheared rocks. The rock is interpreted as a sheared orthogneiss.

Mylonite (ꝐRns)

Mylonitic quartz–sericite(–K-feldspar–plagioclase–muscovite–biotite) schist (*ꝐRns*) outcrops in the Camel–Tabletop Fault Zone. Early fabrics of the rock are completely destroyed by intense cataclasis, which has granulated the quartz and sericitized feldspar and biotite.

Tabletop Terrane

The Tabletop Terrane is present northeast of the Camel–Tabletop Fault Zone on BLANCHE–CRONIN.

Coarse-grained leucocratic amphibolite (ꝐRan)

Leucocratic, coarse- to very coarse grained amphibolite (*ꝐRan*) outcrops in the western part of BLANCHE–CRONIN and just north of the Camel–Tabletop Fault Zone. The rock is derived from protoliths ranging from leucogabbro to anorthosite. Coarse leucocratic amphibolite is commonly massive, but in places has a well-developed foliation. Commonly, igneous textures consisting of interstitial clinopyroxene (now altered to actinolite and rarely to hornblende) are preserved in a framework of euhedral plagioclase (anorthite to bytownite). Plagioclase forms between 60% (leucogabbro) and 90% (anorthosite) of the rock. Accessory minerals include titanite, apatite, and magnetite (leucoxene).

Fine-grained amphibolite (ꝐRab)

Fine-grained amphibolite (*ꝐRab*) outcrops on western BLANCHE–CRONIN in the Camel–Tabletop Fault Zone. The unit is interlayered with minor banded iron-formation and chert (*ꝐRi*). The rock is a metabasalt consisting of fine-grained hornblende (altered to actinolite) in a very fine grained matrix of quartz and plagioclase (altered to epidote and carbonate), with accessory magnetite, epidote, carbonate, and rare relict garnet.

Medium-grained, non-garnetiferous amphibolite (ꝐRam)

Medium-grained, weakly to well foliated amphibolite (*ꝐRam*) outcrops throughout the Tabletop Terrane. Plagioclase (andesine) and hornblende are the main constituents. Quartz comprises less than 20% of the rock and may be partly the product of retrogressive alteration of plagioclase to epidote. Accessory minerals include titanite, apatite, magnetite (or leucoxene), rutile, biotite, and zircon.

Amphibolite with plagioclase glomerocrysts (ꝐRap)

Fine-grained, weakly to non-foliated amphibolite (*ꝐRap*) with glomerocrystic plagioclase is common in the northern part of BLANCHE–CRONIN, and is probably a correlative of the dolerite in the central part of the sheet area. The amphibolite is fine to medium grained, and contains a matrix of interlocking plagioclase with ragged to bladed actinolite, which is a probable replacement of original clinopyroxene. The matrix also contains accessory fine-grained apatite that probably represents part of the alteration assemblage. The plagioclase (albite) has been pervasively replaced by fine, anhedral to tabular epidote and minor sericite, and the amphibole is altered to chlorite and minor biotite. Fine- to medium-grained, anhedral magnetite probably represents a primary interstitial phase and has been rimmed by titanite. The rock has been metamorphosed to lower greenschist facies (actinolite–albite), and is metasomatically retrogressed (epidote–sericite–chlorite–biotite). The protolith is interpreted to be a fine- to medium-grained dolerite intrusive.

Metamorphosed banded iron-formation (ꝐRi)

Banded iron-formation (*ꝐRi*) is fine to medium grained and finely laminated. The unit consists of an anhedral quartz-mosaic matrix with aligned magnetite, accessory amounts of muscovite and apatite, rare light-green amphibole (grunerite), and relict garnet and epidote. The laminations commonly define a pervasive early foliation and primary surfaces have not survived recrystallization.

Metamorphosed chert and banded iron-formation (*Ꝑ*Ric)

Metamorphosed chert with lesser amounts of banded iron-formation (*ꝐRic*) outcrops 9 km southwest of the PM prospect (AMG 150590). The unit ranges from pure chert to quartz–magnetite rock, although the dominant rock type is a ferruginous chert. The chert consists of quartz, magnetite, garnet, diopside, grunerite, and apatite.

Tremolite marble (ꝐRk)

Calc-silicate rocks (*ꝐRk*) include tremolite marble, chondrodite marble, and calcite–quartz–muscovite rock. These rocks are restricted to small pods in the central part of BLANCHE–CRONIN around the PM prospect (AMG 226648).

Relict textures in the calc-silicate rocks have been largely obliterated and replaced by a secondary assemblage that comprises sparry carbonate crystals with locally replaced bladed tremolite. The carbonate is locally enveloped by anhedral carbonate closely associated with interstitial fibrous chlorite. Chlorite also pseudomorphs pyroxene or forms small veins with tourmaline (Yeates and Chin, 1979). Altered zones in the rock are rich in chalcedony and contain accessory amounts of subhedral apatite.

One kilometre southwest of the PM prospect (AMG 219639), calc-silicate rock contains medium-grained polyhedral textures that have been replaced by carbonate associated with fibrous tremolite. The cumulate textures suggest an ultramafic precursor. The matrix has been replaced by medium-grained anhedral carbonate associated with fibrous tremolite, chlorite, and fine accessory subhedral apatite. The rock is interpreted as a pervasively metasomatized ultramafic rock.

Undivided mafic and felsic gneiss and leucogranite (ꝐRna)

The undivided unit labelled as *ꝐRna* in the Tabletop Terrane on central BLANCHE–CRONIN is a complex mixture of mafic gneiss, paragneiss, and quartzite, which are pervasively intruded by felsic (trondhjemite) dykes. The area is believed to form the roof zone of an intrusion, where deeper leucogranitic (*Ꝑgl*) levels of the intrusion (e.g. 6 km west of the PM prospect, AMG 165645) have been brought closer to the surface. The country rocks include mafic gneiss, ultramafic schist (sheared ultramafic rock), quartz–magnetite–grunerite gneiss (metamorphosed banded iron-formation), marble, and quartzite. The mafic gneiss is composed of plagioclase partially retrograded to epidote, hornblende partially retrograded to tremolite–actinolite, and garnet.

The trondhjemite contains medium- to coarse-grained, xenomorphic plagioclase, which forms most of the rock. The plagioclase is typically hematite dusted and locally altered to sericite. Secondary phases include relict, coarse-grained (up to 10 mm) K-feldspar phenocrysts, and anhedral epidote aggregates. Metasomatized samples contain interlocking bladed plagioclase aggregates, anhedral to bladed epidote, and clumps of interstitial chlorite. This same association is seen in metasomatic veins in other samples.

The felsic dykes in the undivided unit (*ꝐRna*) in central BLANCHE–CRONIN may also have a volcanic or subvolcanic origin.

Quartz–mica schist (ꝐRnp)

Quartz–mica schist interlayered with felsic schist, fine- to medium-grained leucogranite, and very fine grained quartzite (*ꝐRnp*) outcrops about 10 km north-northwest of No. 23 Well in the Camel–Tabletop Fault Zone (AMG 185563). The unit consists of a variably sheared leucogranite (*Ꝑgl*) that is tectonically interlayered with quartzite.

Ultramafic rock (ꝐRu)

Medium-grained serpentine–tremolite–magnetite rock (*ꝐRu*) is locally foliated, but commonly preserves olivine cumulate textures that identify its protolith as peridotite. Ultramafic rock is most abundant around the PM prospect and in western BLANCHE–CRONIN, where it outcrops as non-foliated and discontinuous layers and pods, up to 2 km long, within amphibolite (*ꝐRna* and *ꝐRam*), leucogranite (*Ꝑgl*), or complexly mixed rocks (*ꝐRna*). The ultramafic rocks near the PM prospect appear to be defining a refolded fold structure that has been disrupted by intrusion of late granitoid rocks (included in *ꝐRna* and *Ꝑgl*).

Ultramafic rocks have preserved medium- to coarse-grained, cumulate polyhedral forms after original olivine that has been replaced by serpentine and overprinted or replaced by chlorite aggregates and talc. Anhedral magnetite is also present within the olivine pseudomorphs. Diopside has been replaced by tremolite containing finely dispersed magnetite. More strongly altered portions of the rock comprise chlorite and anhedral to bladed tremolite aggregates. In some samples, hypersthene oikocrysts (up to 10 mm across) are interstitial. The hypersthene has been progressively altered to actinolite and chlorite in aggregates containing fine subhedral magnetite inclusions. The rock is interpreted as a progressively serpentinized and locally retrogressed (chlorite–talc) peridotite.

Quartzofeldspathic schist (Ꝑfs)

Extensive outcrops of quartzofeldspathic schist (*Ꝑfs*) are found in the northern part of BLANCHE–CRONIN. Some schist may be derived from tonalite and leucogranite within zones of deformation that parallel the Camel–Tabletop Fault Zone (such as in northwestern BLANCHE–CRONIN; AMG 025815). In other areas, however, such as in north-central BLANCHE–CRONIN (AMG 223750), leucogranite crosscuts schist with associated hornfelsing; this shows that at least some of the schist predates the intrusion of late granitoid rocks. The origin of the schist is unknown, but a volcanic or subvolcanic origin cannot be ruled out for some of the schist (Smithies and Bagas, 1997a).

Late granitoid rocks (Ᵽg, Ᵽgef, Ᵽgf, Ᵽgl, Ᵽgm, Ᵽgt, Ᵽgtp)

Late intrusive rocks (*Ᵽg*) are present throughout the Tabletop Terrane on BLANCHE–CRONIN. Massive to weakly foliated leucocratic granitoids comprise fine-grained equigranular (*Ᵽgef*), porphyritic (*Ᵽgf*), medium-grained equigranular (*Ᵽgl*), or megacrystic (*Ᵽgm*) rocks. Also present in the region are massive to weakly foliated, medium-grained biotite tonalite (*Ᵽgt*) and plagioclase-phyric tonalite (*Ᵽgtp*). The porphyritic granitoid (*Ᵽgf*) is confined to the Camel–Tabletop Fault Zone of western BLANCHE–CRONIN, the plagioclase-phyric tonalite (*Ᵽgtp*) appears to be confined to eastern and northern BLANCHE–CRONIN, whereas the other granitoid rocks are found throughout the Tabletop Terrane. These late granitoid rocks show some signs of recrystallization, particularly of quartz; however, igneous textures are commonly preserved and they have not been metamorphosed higher than greenschist facies.

Equigranular leucogranite (*Ᵽgl* and *Ᵽgef*) crosscut early (D_2) tectonic fabrics in foliated amphibolite about 8 km west and 10 km southwest of the PM prospect (AMG 142643 and 140585 respectively). The K-feldspar is more abundant than plagioclase and, in some rocks, forms phenocrysts up to 10 mm in size. Biotite comprises less than 10% of the rock and is commonly the sole mafic silicate. Accessory phases include apatite, opaque minerals, allanite, titanite, and zircon. The granitoid rock is partly recrystallized at lower greenschist facies (M_4), and is massive to weakly foliated (S_4). A sample of the rock collected east of the Camel–Tabletop Fault Zone, in the Tabletop Terrane, on CONNAUGHTON has a sensitive high-resolution ion microprobe (SHRIMP) U–Pb zircon crystallization age of 1310 ± 4 Ma (Nelson, 1996). The relationship between the granite and Throssell Group has not been determined.

The biotite tonalite (*Ᵽgt*) is medium grained and equigranular to slightly porphyritic. Microcline constitutes less than 5% of the rock, and biotite is the main mafic mineral comprising up to 10% of the rock. Hornblende is a common accessory mineral and usually rimmed by biotite. Other accessory phases include titanite, apatite, opaque minerals, and zircon. The plagioclase-phyric tonalite (*Ᵽgtp*) is commonly composed of abundant euhedral to subhedral phenocrysts of plagioclase in a medium-grained groundmass of quartz, plagioclase, biotite (up to 15%), and hornblende (less than 8%) that is commonly rimmed and partially replaced by biotite. Accessory phases include titanite, apatite, opaque minerals, and zircon (Smithies and Bagas, 1997a).

Yeneena Supergroup

The Yeneena Supergroup consists of the Throssell and Lamil Groups (Williams and Bagas, in prep.a). Only the Throssell Group outcrops on BLANCHE–CRONIN.

In the absence of continuous outcrop of the Throssell Group on RUDALL, the unassigned unit (labelled as *ᵽTa*) is tentatively included in the Throssell Group. This correlation is based on similar rock types, lithological successions, and interpreted environments of deposition and deformation history when compared with the Throssell Group on CONNAUGHTON (Bagas and Smithies, 1998a) and RUDALL (Hickman and Bagas, 1998).

Throssell Group

Unassigned unit (ᵽTa)

The unassigned unit (*ᵽTa*) of the Throssell Group in the southern part of BLANCHE–CRONIN consists of cross-bedded to laminated, medium- to coarse-grained sandstone interbedded with minor siltstone and shale. Rare matrix-supported granule and pebble conglomerate outcrop near the base of the unit. The unit unconformably overlies banded iron-formation in the Rudall Complex, 6 km west of Curara Soaks, and is unconformably overlain by the Karara Formation (*ᵽUk*). It is possible that the unassigned unit is a correlative of the Coolbro Sandstone (Hickman and Clarke, 1994).

Tarcunyah Group

The Tarcunyah Group unconformably overlies the Throssell Group on BLANCHE–CRONIN. The group is part of Supersequence 1 of the Centralian Superbasin, and a correlative of the Sunbeam Group in the basal part of the former Savory Basin (Bagas et al., in prep.).

The Tarcunyah Group includes the Karara Formation in central BLANCHE–CRONIN, and the unassigned units of shale, siltstone, sandstone, and dolomite in the south. These rocks lack the penetrative foliation (S_4) and greenschist-facies metamorphism observed in rocks of the underlying Throssell Group.

Karara Formation (ᵽUk, ᵽUkp, ᵽUkk, ᵽUks)

The Karara Formation (*ᵽUk*) consists of medium- to coarse-grained, characteristically light pink to purple, arkosic sandstone, interbedded with thin beds of feldspathic granule to pebble conglomerate (*ᵽUkp*) at the base, and overlain by thinly bedded dolomite (*ᵽUkk*).

Conglomerate (*ᵽUkp*) at the base of the formation is matrix supported, crudely bedded, and cross-bedded, and contains well-sorted, rounded pebbles of vein quartz, sandstone from the Throssell Group, and various rock types from the Rudall Complex. The conglomerate is about 350 m thick, and grades upward into sandstone (*ᵽUk*). The basal part of the conglomerate is interbedded with siltstone and shale (*ᵽUks*), and contains rare, sheared basalt or fine-grained doleritic sills (e.g. 7.5 km north-northwest of No. 23 Well; AMG 206547). The matrix of the mafic rock is pervasively and hydrothermally altered to a fibrous sericite–chlorite assemblage containing fine leucoxene that parallels a weak penetrative schistosity (similar alteration assemblages are seen in the dolerite dykes west of the PM prospect, see **Metamorphism**). The matrix has fine, interlocking plagioclase microphenocrysts and glomerocrysts that comprise recrystallized quartz aggregates.

The sandstone (*ꞒUk*) is overlain by finely laminated grey, light-pink, and buff dolomite interbedded with minor shale (*ꞒUkk*). The dolomite resembles the carbonate in the upper levels of the Waters Formation on RUDALL (Hickman and Bagas, 1998), and is probably a correlative of it.

Unassigned units (*ꞒUss, ꞒUd*)

The unassigned units of the Tarcunyah Group in southern BLANCHE–CRONIN are composed of cyclic successions of fine- to medium-grained sandstone with minor siltstone and shale (*ꞒUss*), interbedded with dolomite and dolomitic sandstone (*ꞒUd*; Crowe and Chin, 1979). Sandstone (*ꞒUss*) is cross-bedded, ripple marked, and commonly contains clay balls and intraformational mudstone clasts. Mudstone laminae define bedding planes with asymmetrical and symmetrical shallow-water ripples. Laminated dolomite (*ꞒUd*) consists of brown dolomitic sandstone interbedded with light-grey and light-pink, stromatolitic, fine-grained dolomite (Crowe and Chin, 1979; Grey, K., 1994, pers. comm.).

Dolerite dykes and sills (*d*), and quartz veins (*q*)

A distinctive feature of the Throssell Group on BLANCHE–CRONIN is the presence of dolerite (*d*) sills. The sills are folded (F_4) concordantly with the host rocks and were therefore intruded before folding of the Throssell Group and are older than the northerly and easterly trending dolerite dykes (described below). The dolerite sills are fine to medium grained and consist of altered plagioclase and clinopyroxene, orthoclase granophyrically intergrown with quartz, and opaque minerals. Clinopyroxene is altered to chlorite, and plagioclase to epidote and sericite.

Northerly and easterly trending dolerite (*d*) dykes on BLANCHE–CRONIN intruded the Rudall Complex and probably the Tarcunyah Group. Aeromagnetic maps of the region show that the dolerite dykes post-date structures that affected the Tarcunyah Group, although no intrusive contact by the dykes with this group has been observed in the field.

Northerly trending and vertical dolerite dykes outcropping 6 km west of the PM prospect (e.g. AMG 172632) contain platy actinolite aggregates, which have replaced medium-grained clinopyroxene associated with microphenocrysts of plagioclase. Epidote and minor sericite have pervasively replaced fine- to medium-grained plagioclase, and amphibole has been altered to chlorite and biotite. The matrix contains accessory amounts of fine anhedral and secondary apatite, and is cut by thin veins of plagioclase. Other accessory phases are opaque minerals (possibly magnetite) rimmed by titanite.

The relationship between the dolerite and the leucogranite (*Ꞓgl*) west of the PM prospect is complex. The leucogranite appears to be intruded by the dolerite in some places, and intruded the dolerite in others (e.g. both relationships are seen in the region 6 km west of the PM prospect; AMG 151635). Furthermore, the dolerite is present almost everywhere that the leucogranite outcrops. These relationships indicate that the rock types are probably co-magmatic.

Quartz (*q*) veins and breccia are widespread, and commonly located in faults and shear zones (e.g. 5 km northwest of the PM prospect AMG 183670). A few of the veins are limonitic, particularly along their margins, and others contain limonite and goethite in late fractures.

Permian and Cretaceous geology

The distribution of Permian and Cretaceous rocks are shown in the simplified geology sketch on the map (Bagas and Smithies, 1998b) and on Figure 3. The Cretaceous sedimentary rocks are included in the late Cambrian and younger Gibson Sub-basin of the Officer Basin and Anketell Shelf (Fig. 3; Hocking et al., 1994).

Paterson Formation (*Pa*)

Remnants of the Paterson Formation (*Pa*; Traves et al., 1956) are found in the western, southern, and eastern parts of BLANCHE–CRONIN. The formation consists of fluvio-glacial sedimentary rocks and tillite, and outcrops as isolated mesas (e.g. about 15 km northwest of No. 23 Well; AMG 095575), or partially dissected benches flanking larger hills (e.g. 20 km west of No. 23 Well; 020480). The basal unit is a tillite that passes upward into cross-bedded, medium- to coarse-grained sandstone, siltstone, and mudstone. The tillite deposits contain well-rounded boulders, which locally exceed 5 m in diameter, and include quartzite, orthogneiss, and paragneiss from a widely spread source region. Distinctive pebbles and cobbles of pink feldspathic sandstone are common in the tillite, and are probably sourced from the Karara Formation.

Cronin Sandstone (*Kr*)

The Cronin Sandstone (*Kr*; Veevers and Wells, 1961) outcrops in the southeastern part of BLANCHE–CRONIN. The formation disconformably overlies the Paterson Formation and consists of interbedded fine- to coarse-grained sandstone, conglomerate, and shale (Veevers and Wells, 1961). Well-preserved plant fossils in a sandstone unit towards the base of the formation have been identified as late Triassic or Jurassic in age (Veevers and Wells, 1961).

Anketell Sandstone (*Ka*)

The Anketell Sandstone (*Ka*; Traves et al., 1956) outcrops in eastern BLANCHE–CRONIN. The formation unconformably overlies the Karara Formation and disconformably overlies the Paterson Formation. The Anketell Sandstone consists of interbedded sandstone, shale, siltstone, and mudstone, with small beds and lenses of granule conglomerate (Veevers and Wells, 1961). The formation is believed to be Cretaceous in age based on foraminifers, worm burrows, *Rhizocorallium*, and other trace fossils (Veevers and Wells, 1961).

Cainozoic deposits

Dissected and variably cemented sediments mantling Mesozoic to Palaeoproterozoic rocks on BLANCHE–CRONIN are mapped as Cainozoic (*Cz*) deposits. Areas of active sedimentation are mapped as Quaternary deposits (*Q*). Individual Cainozoic and Quaternary units have been mapped using aerial photograph interpretation and limited field observations.

Dissected and variably cemented colluvium, sheetwash, fan deposits, and talus (*Czc*) are composed of locally derived gravel, sand, and silt.

Calcrete (*Czk*), consisting of massive, vuggy or nodular limestone, is found in palaeodrainage channels on BLANCHE–CRONIN. An example of such a channel is the northeasterly trending calcrete 5 km east of the PM prospect (AMG 265647), which has subsequently been transgressed and overlain by seif dunes. Secondary silicification locally results in incomplete replacement by a vuggy, opaline silica caprock (*Czz*), such as at No. 23 Well (AMG 230475). The calcrete outcropping 4 km northwest of the PM prospect (AMG 192682) is probably residual and developed over mafic and ultramafic rocks.

Ferricrete or ironstone deposits (*Czl*) are rare in the area. The ferricrete is present as a 5 to 10 m pisolitic crust that grades downward into leached and kaolinized deeply weathered rock. These sediments are probably Tertiary in age and may be part of the Tertiary continent-wide weathering event (Idnurm and Senior, 1978).

The present-day drainage courses and associated floodplains contain alluvium (*Qa*), consisting of unconsolidated clay, silt, sand, and gravel. The floodplain deposits also contain sand and clay mixed with eolian sands.

Locally derived colluvial silt, sand, and gravel (*Qc*) form scree and outwash fans. Watercourses weakly incise the colluvium.

Lacustrine deposits (*Ql*) consist of clay, silt, and evaporite minerals. They occupy low-lying areas that extend northeastward from Lake Disappointment on GUNANYA. A mixture of black to brown mud, evaporite minerals, and sand underlie the dry lake surface, which is not vegetated except by seasonal grasses. Gypsum deposits (*Qle*) are present as kopi dunes along the western side of dry lakes. Mixed lacustrine (*Ql*) and eolian (*Qs*) deposits that cannot be subdivided on the map are labelled as *Qd*.

Sand containing ferruginous granules and ironstone pebbles (*Qp*) in northwestern BLANCHE–CRONIN is a mixture of partly residual lag and partly transported ferricrete debris and eolian sand.

The sandplain unit (*Qs*), with northwesterly and easterly trending seif dunes, covers most of BLANCHE–CRONIN. The unit consists of dark-red eolian sand and clayey sand (Crowe, 1975), which is composed of iron-stained quartz grains up to 0.5 mm in diameter. The dunes are up to 30 m in height, many kilometres long, and up to 3 km apart. Sand movement is confined to the dune crests, and a cover of spinifex and small bushy eucalypts stabilizes their sides. The depth of the sand between dunes is commonly less than 3 m.

Poorly developed red, silty clay (*Qw*) is present in the northwestern part of the area. This unit is vegetated with mulga that has grown in a distinctive striped pattern. The soils have formed over mature, deeply weathered plains or after mature alluvium, and contain varying amounts of ferricrete granules.

Structure

The structural evolution of the Paterson Orogen on BLANCHE–CRONIN is discussed within the general framework outlined by Bagas and Smithies (1998a), who basically defined the Yapungku Orogeny, an early orogenic event affecting the Rudall Complex; the Miles Orogeny, an orogenic event affecting the Rudall Complex and Yeneena Supergroup; and redefined the Paterson Orogeny as affecting the Tarcunyah Group (Table 1). However, when assigning events of deformation observed on BLANCHE–CRONIN to these orogenies, it is assumed that:

- earlier structures in the Tabletop Terrane can be correlated with the Yapungku Orogeny;
- the rocks assigned to the Throssell Group on BLANCHE–CRONIN have experienced the same orogenic event assigned to the Miles Orogeny in the Connaughton and Talbot Terranes.

Neither of these assumptions should be taken for granted, as the structures seen in the rocks assigned to the Rudall Complex and Throssell Group in the Tabletop Terrane may be exotic and not related to those seen in the Connaughton and Talbot Terranes. These considerations will become clearer once the timing of events in the Connaughton, Talbot, and Tabletop Terranes is better understood.

The D_1, D_3, and D_5 deformation events recognized on BROADHURST (Hickman and Clarke, 1994) have not been recognized on BLANCHE–CRONIN.

Yapungku Orogeny

The Rudall Complex in the Connaughton and Talbot Terranes was intensely deformed and metamorphosed during two deformation events (D_1 and D_2) on RUDALL (Hickman and Bagas, 1998) and CONNAUGHTON (Bagas and Smithies, 1998a). These two events are collectively referred to as the Yapungku Orogeny (Bagas and Smithies, 1998a). Only one pre-Miles Orogeny deformation event has been observed on BLANCHE–CRONIN and, considering the scarcity of D_1 structures in the Connaughton and Talbot Terranes, it is assumed that this event is D_2.

The ultramafic and mafic rocks southwest of the PM prospect define a northerly trending F_2 syncline that has

Table 1. Summary of geochronological data relevant to the evolution of the Paterson Orogen

Age range (Ma)	*Geological event*
~2000–1760	Yapungku Orogeny (includes the D_1 and D_2 events)
~2000–1802	D_1 partly synchronous with M_1
1790–1760	D_2 partly synchronous with M_2
1476–1286	Crystallization of post-D_2 and pre-D_4 intrusive rocks in the Tabletop Terrane
post-D_2, pre-D_4	Deposition of the Throssell Group
1290	Maximum age for the Miles Orogeny (D_{3-4}) affecting the Throssell Group
820	Minimum age for D_4 and M_4
800	Probable age for the Sunbeam (former 'lower Savory Group') and Tarcunyah Groups in the lower part of the Officer Basin
~630	Emplacement of post-D_4 granitoid rocks in the Lamil Group before the Paterson Orogeny (D_6)
≤610	D_6 related to deposition of Supersequence 3 and 4 of the Disappointment Group (former 'upper Savory Group') in the Officer Basin
~550	Approximate age for the Paterson Orogeny

NOTE: After Bagas and Smithies (1998a)

been refolded (F_4) in a northwesterly direction. These rocks are extensively intruded and contact-metamorphosed by late leucocratic and felsic igneous rocks, therefore making detailed structural analysis of the area impossible.

Miles Orogeny

The Miles Orogeny covers the D_3 and D_4 deformation events. D_3 structures have been recognized in restricted areas on BROADHURST (Hickman and Clarke, 1994) but not on BLANCHE–CRONIN. The age of the orogeny is poorly constrained between 1300 and 800 Ma (Bagas et al., 1995). The later minimum age is based on the observation that the younger Tarcunyah Group (c. 800 Ma) is not affected by deformation and metamorphic events assigned to the Miles Orogeny (Bagas and Smithies, 1998a; Williams and Bagas, in prep.a).

The dominant structures within the Throssell Group on BLANCHE–CRONIN are tight, southeasterly plunging F_4 folds with a well-developed axial-planar S_4 cleavage containing sericite growth. The axial-planar cleavage dips steeply to the northeast.

Paterson Orogeny

The Paterson Orogeny was the last major tectonic event to affect the Paterson Orogen, and is probably related to the Petermann Orogeny of central Australia. The Paterson Orogeny occurred at about 550 Ma (Bagas et al., 1995).

Major structures attributed to the Paterson Orogeny on BLANCHE–CRONIN are those affecting the Tarcunyah Group. These include open F_6 folds with an associated spaced S_6 cleavage, and faults.

The F_6 folds clearly post-date D_4 folds, as seen southwest of No. 23 Well (AMG 125504), where southeasterly trending F_4 folded rocks in the Throssell Group are unconformably overlain by rocks of the Tarcunyah Group (Fig. 4). At this point, the Tarcunyah Group is folded by open, easterly trending folds accompanied by D_6 thrust and normal faults. The F_6 fold axes swing towards the southeast away from the Camel–Tabletop Fault Zone. This swing could relate to sinistral drag along the shear zone, which is consistent with movement observed along the D_6 McKay Fault on GUNANYA (Bagas, 1998). This similarity is not surprising as both faults may form the same structure, marking the boundary between the Connaughton and Talbot Terranes.

The late, northerly trending dolerite dykes (*d*) fill fracture zones that may relate to extensional structures associated with the D_6 event.

Metamorphism

The Rudall Complex was metamorphosed to amphibolite–granulite facies in the Connaughton Terrane and to amphibolite facies in the Talbot Terrane during M_2/D_2, before deposition of the Yeneena Supergroup and Tarcunyah Group (Table 1; Bagas and Smithies, 1998a). However, the Rudall Complex in the Tabletop Terrane was regionally metamorphosed to greenschist facies, and later hornfelsed and metasomatized during the intrusion of late (c. 1300 Ma) granitoid rocks.

Greenschist-facies metamorphism (M_4), associated with D_4, is known to affect both the Rudall Complex and Throssell Group in the Connaughton and Talbot Terranes (Hickman and Bagas, 1998; Bagas and Smithies, 1998a). However, the lower grade of regional metamorphism to greenschist facies in the Tabletop Terrane makes it impossible to distinguish between M_2 (associated with the D_2 event of the Yapungku Orogeny) and M_4 (associated with the D_4 event of the Miles Orogeny).

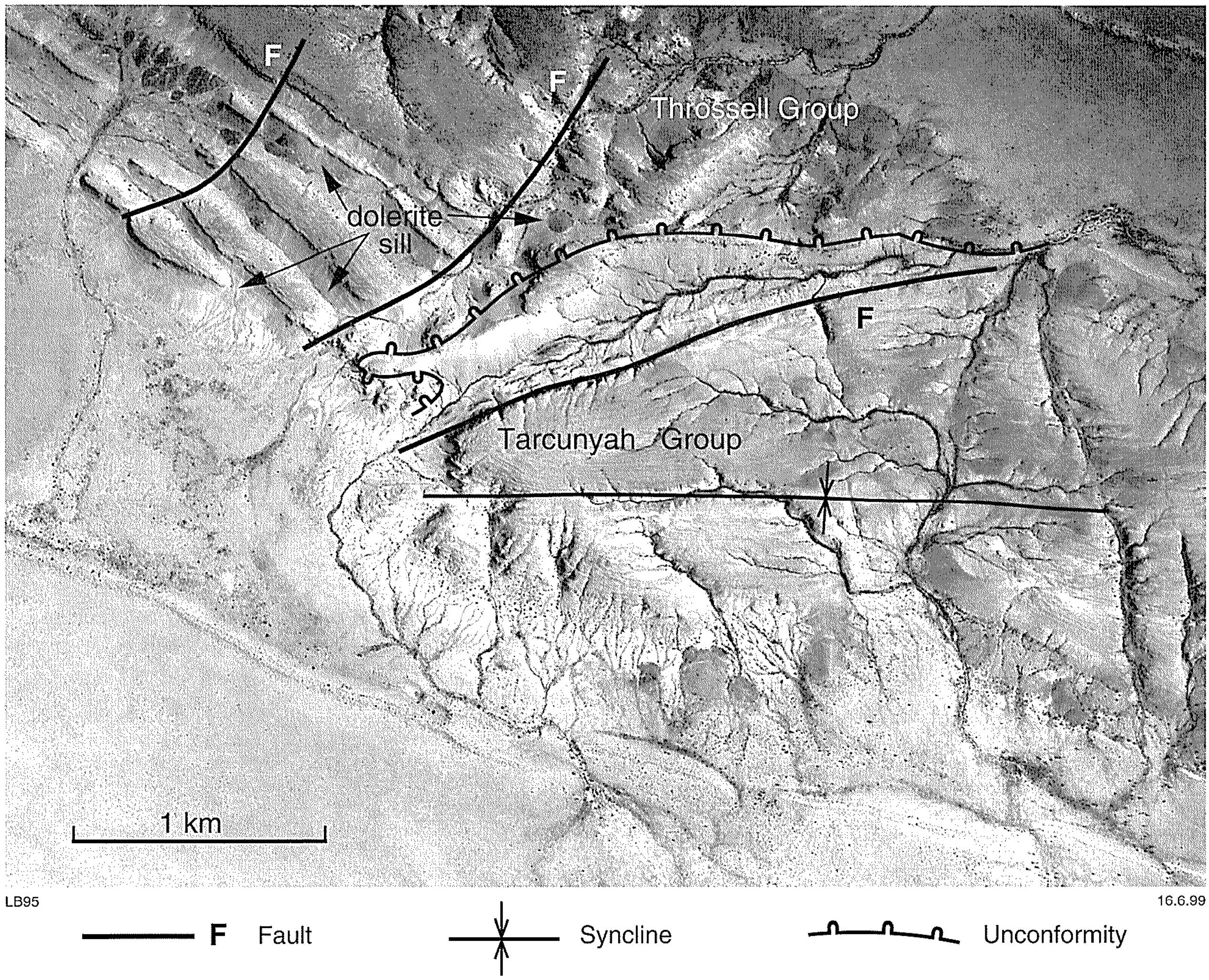

Figure 4. Aerial photograph showing the relationship between the Throssell Group and the unconformably overlying Tarcunyah Group (about 11 km west-northwest of No. 23 Well; AMG 120505). The open fold in the Tarcunyah Group trends in an easterly direction at an angle to northwesterly trending, tightly folded sandstone in the Throssell Group, which is intruded by dolerite sills. Location is shown on Figure 3

Amphibolite (*ꝐRam*) south of the PM prospect (AMG 237577) contains actinolite replaced by clinopyroxene, and plagioclase replaced by sericite and epidote. Further north (AMG 220655), fine-grained amphibolite in the mixed gneiss unit (*ꝐRna*) contains amphibole replaced by chlorite and quartz, and plagioclase altered to sericite and epidote (clinozoisite). Garnetiferous amphibolite that was sampled near a fault zone in the same mixed gneiss unit (AMG 203653) contains relict garnet xenoblasts in an altered foliated matrix. The matrix contains lenses of granoblastic quartz that are parallel to the foliation. The quartz is associated with chlorite, biotite, sericite, and epidote (zoisite). These associations indicate greenschist-facies (actinolite–tremolite–biotite) metamorphism (M_2 or M_4) and hydrothermal (chlorite–sericite–epidote) alteration.

Further evidence for hydrothermal alteration is found in calc-silicate rock (*ꝐRk*) from the PM prospect (AMG 223649). Carbonate and chlorite obliterate the primary textures of the rock. The carbonate matrix has locally replaced tremolite, chalcedony has replaced part of the matrix, and the matrix contains apatite. The hydrothermal alteration is indicated by the assemblage tremolite–carbonate–chlorite–apatite. A felsic dyke from the same area contains primary microphenocrystic plagioclase with a matrix composed of interstitial quartz and hornblende. The plagioclase is altered to sericite–epidote–chlorite. Similar alteration has been observed in felsic rocks 5 km west of the PM prospect (AMG 180642). This is interpreted to be the result of alteration by hydrothermal fluids derived from the intrusion of highly fractionated leucogranitoid (syenite, trondhjemite, and leucogranite) rocks.

Metamorphism associated with M_4 in the Throssell Group is characterized by sericite growth parallel to S_4 planar cleavage, and silica overgrowth of rounded to subrounded quartz grains in the siltstone and shale.

Northerly trending, fine-grained dolerite 6 km west of the PM prospect (AMG 165647) contains plagioclase that is pervasively altered to sericite–epidote (hydrothermal alteration) or microcline with granophyric textures (K-metasomatism). Minor amounts of biotite in the matrix may also represent part of the alteration assemblage. At least some of these dykes are probably younger than the Karara Formation in the Tarcunyah Group (as discussed earlier). The Karara Formation is hydrothermally altered and mineralized in gold and base metals near fine-grained, sheared mafic rocks east of No. 23 Well (e.g. AMG 207547 and 287491). These may be sheared, late, dolerite dykes.

Economic geology

There has been no mineral production from BLANCHE–CRONIN, and due to the remoteness, exploration companies showed little interest in the area until the 1970s. Since the 1970s, after the discovery of gold at Telfer on PATERSON, and the mid-1980s, after the discovery of uranium on BROADHURST, the area has been explored for diamonds, uranium, copper, nickel, gold, and platinum-group elements (PGE).

This exploration has been restricted to or near the Rudall Complex, where the subeconomic PM (PGE–Cu–Au–Ag; AMG 226648), BIF (Ag–Au–Mo; AMG 015620), Whale (Cu–Au; AMG 020690), and Gazza (Cu; AMG 170626) prospects and the Echo (Cu(–Au); AMG 276458 and 295455) occurrences were discovered.

The copper occurrences in the Tarcunyah Group (AMG 206547 and AMG 290491), discovered during recent mapping by GSWA, have further enhanced the prospectivity of the Tarcunyah Group for stratiform and structurally controlled copper mineralization. A shear zone near the base of the Tarcunyah Group, which is hydrothermally altered, hosts the occurrence 7.5 km north-northwest of No. 23 Well (AMG 206547). A grab sample from the area assayed 15% Cu and 5.2 g/t Au. The copper occurrence 7 km east-northeast of No. 23 Well (AMG 290491) is also found near the base of the Tarcunyah Group and contains fine disseminations of malachite in siltstone with grades of 0.2% Cu.

Water resources

Areas of calcrete may contain large, although possibly saline, groundwater supplies. Groundwater in the Rudall Complex is likely to be restricted to shear and fault zones. Significant groundwater supplies may be found in fractured and sheared Karara Formation.

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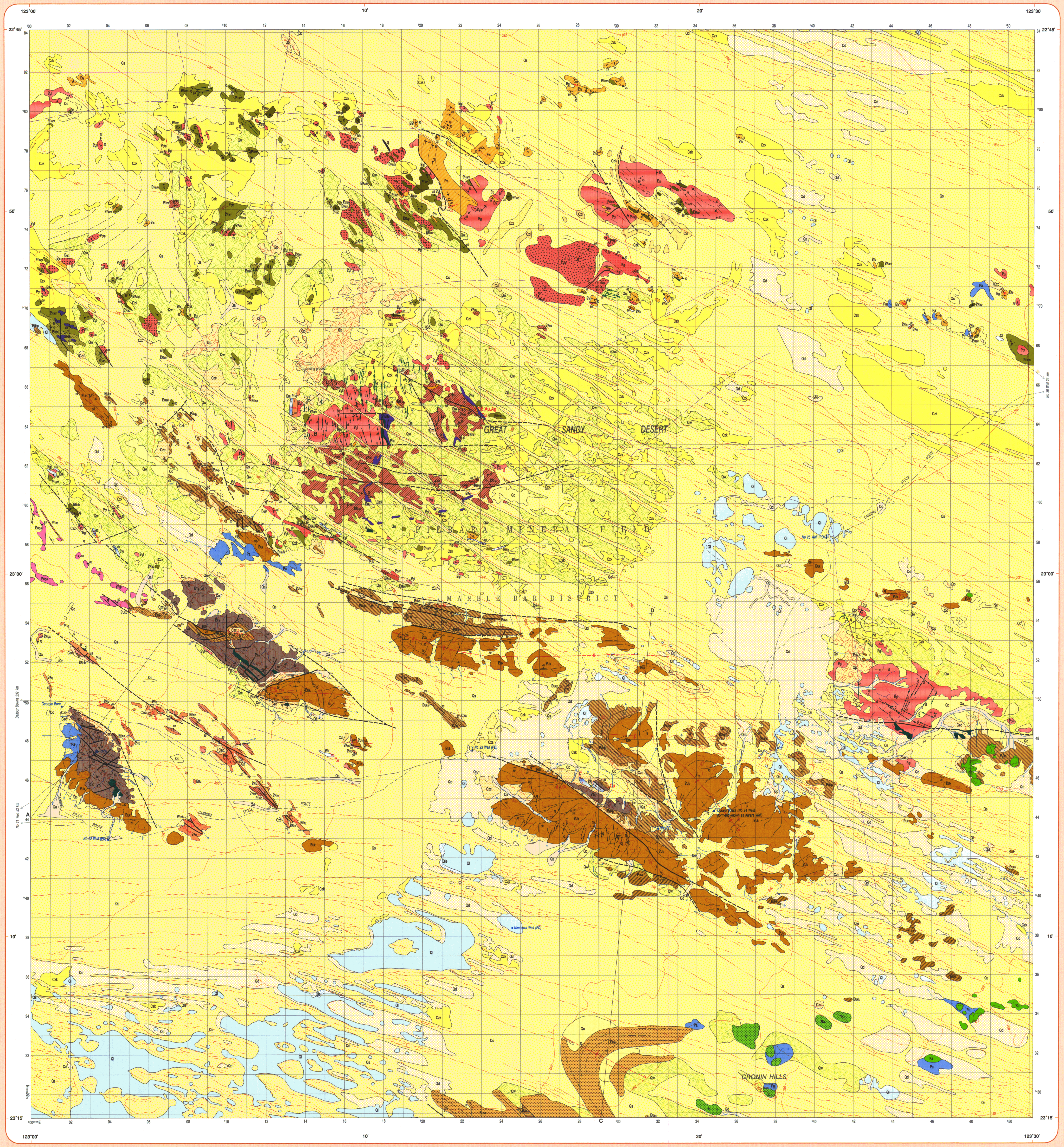
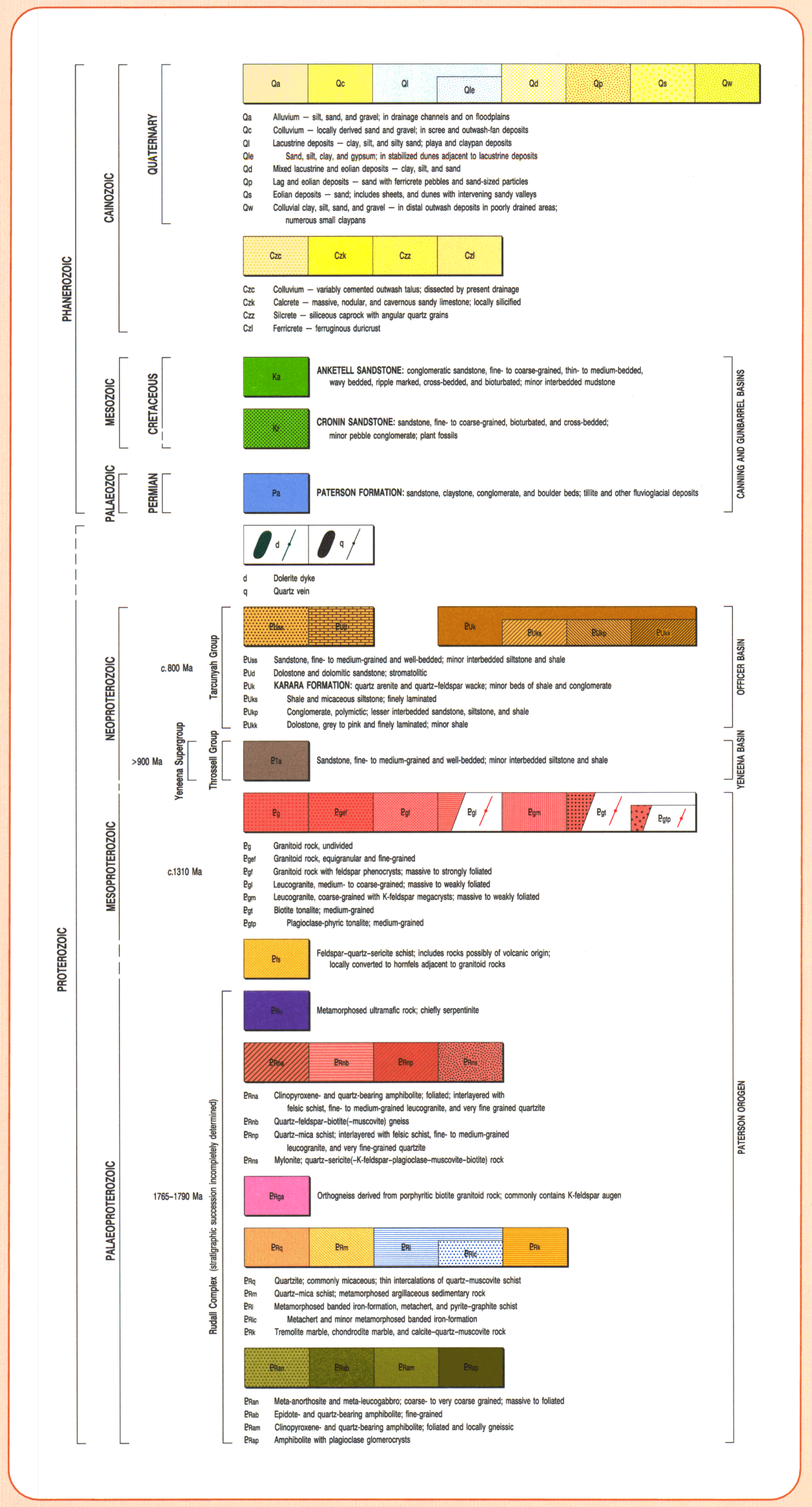
AUSTRALIA 1:100 000 GEOLOGICAL SERIES SPECIAL

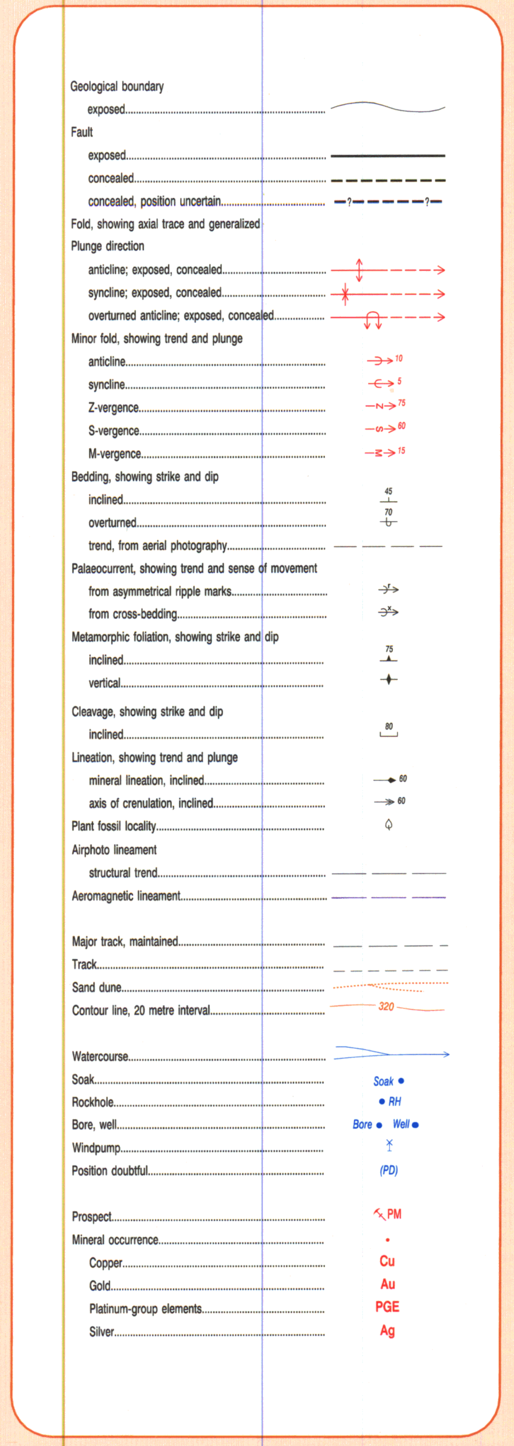
BLANCHE–CRONIN

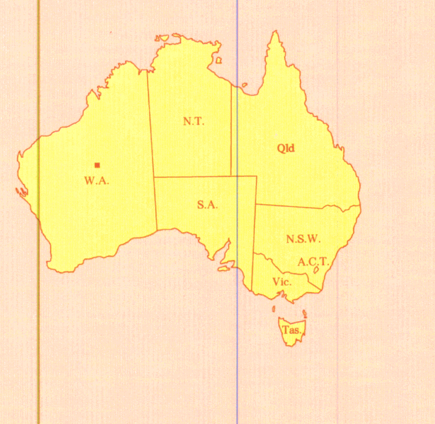
GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

PART SHEETS 3551 AND 3552

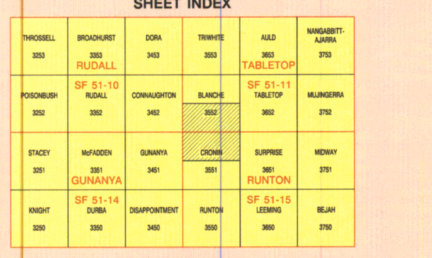








SHEET INDEX



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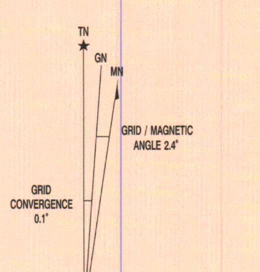
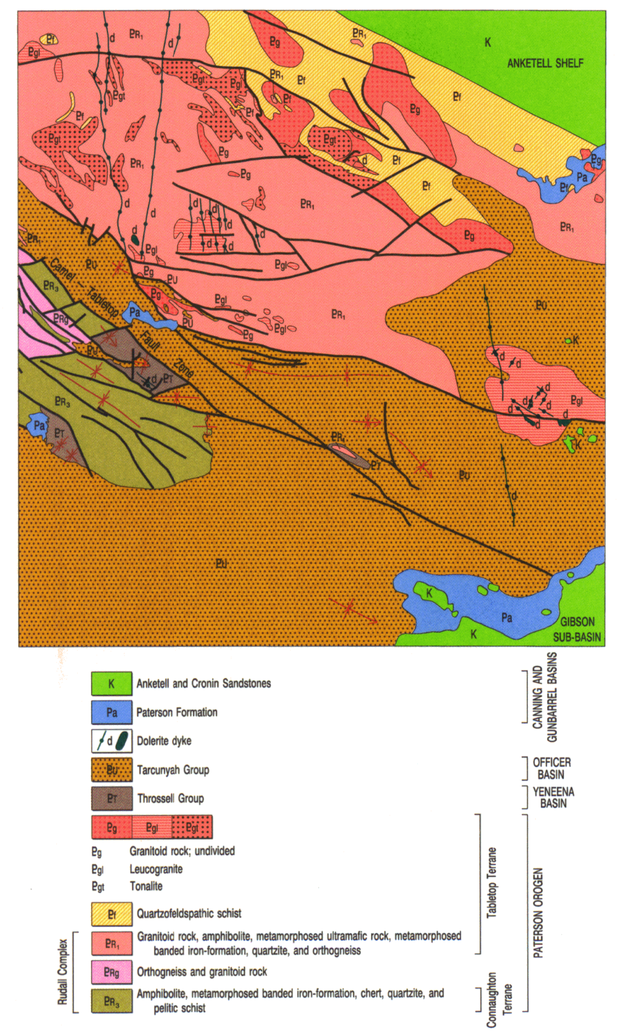
1:250 000 maps shown in brown



True north, grid north and magnetic north are shown diagrammatically for the centre of the map. Magnetic north is correct for 1998 and moves easterly by about 0.1° in 4 years.

SIMPLIFIED GEOLOGY



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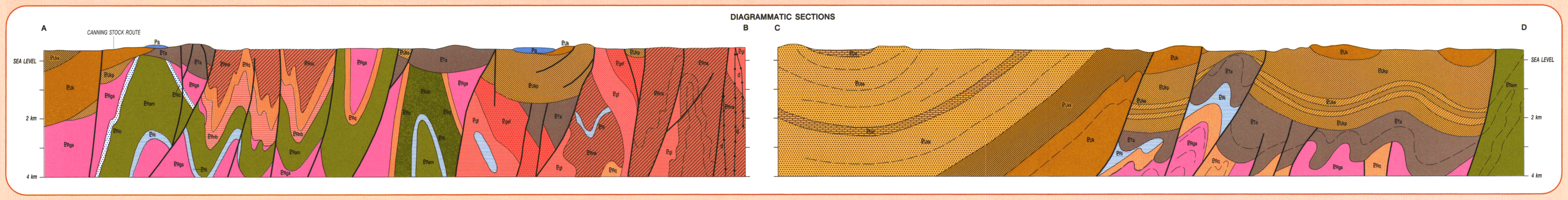
DIAGRAMMATIC SECTIONS



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GEOLOGICAL SURVEY OF WESTERN AUSTRALIA
DAVID BLIGHT, DIRECTOR

SCALE 1:100 000

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

Metres 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

BLANCHE–CRONIN

PART SHEETS 3551 AND 3552