**AGSO – GEOSCIENCE AUSTRALIA**

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# THE GEOLOGY OF THE MOUNT EDGAR AND CORUNNA DOWNS IGNEOUS COMPLEXES; EAST PILBARA CRATON, WESTERN AUSTRALIA

**John P. Sims & Leesa J. Carson**
**Geoverde Pty Ltd**

***Minerals Division, AGSO – Geoscience Australia,***
***GPO Box 378, Canberra, ACT, 2601***
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*Chief Executive Officer: Neil Williams*



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**CONTENTS**

## INTRODUCTION and PREVIOUS WORK

The Mount Edgar and Corunna Downs Igneous Complexes are located near the eastern margin of the Pilbara Craton in northwest Western Australia. The Mount Edgar Igneous Complex occurs on parts of the 1:250,000 geological sheets: Yarrie, Port Hedland, Marble Bar and Nullagine. The Corunna Downs Igneous Complex occurs on parts of the 1:250,000 geological sheets: Marble Bar and Nullagine. The regional geological setting of the Pilbara Craton is described by Hickman (1983).

The first geological observations were by explorer F.T. Gregory in 1861. In the 1890s there were several geological investigations of the Pilbara Craton by the Government Geologist H. P. Woodward to assess mineral discoveries and to describe the geology (Hickman, 1983). The first geological survey of the Pilbara Craton was by Maitland (1904, 1905, 1906, 1908). The surveys by Maitland formed part of the 1:250,000 geological sheets Marble Bar and Nullagine published by Noldart & Wyatt (1962). Further regional mapping of 1:250,000 geological sheets included Balfour Downs (de la Hunty, 1964), Port Hedland (Low, 1965), Roebourne (Ryan, 1966), and Pyramid (Kriewaldt & Ryan, 1967). During the period 1972 to 1975 another regional mapping program covered Yarrie (Hickman & Chin, 1976), Marble Bar (Hickman & Lipple, 1978), Nullagine (Hickman, 1979), and Port Hedland (Hickman, 1977).

More detailed studies in the igneous geology commenced in the late 1970’s. The Geological Survey of Western Australia undertook a regional reconnaissance rock sampling program in the Mount Edgar and Corunna Downs Igneous Complexes to assess the potential for tin deposits (Blockley, 1980). Davy & Lewis (1981) undertook a geochemical study of Mount Edgar Batholith producing geochemical maps showing widely divergent patterns between different components with no evidence for systematic fractionation or differentiation. Detailed mapping, structural analysis, geochemistry and Rb-Sr isotopic systematics were undertaken by Collins (1983) to determine the nature, origin and evolution of the Mount Edgar Igneous Complex. A regional geochemical and petrography study within the Corunna Downs Igneous Complex was undertaken by Davy (1989).

To enhance the geological understanding of the north Pilbara region, airborne surveys measuring total magnetic intensity, gamma-ray spectrometry, and surface altitude with a flight line spacing of 400m were undertaken during 1995-1996. The interpretation of these data is discussed by Wellman (1999).

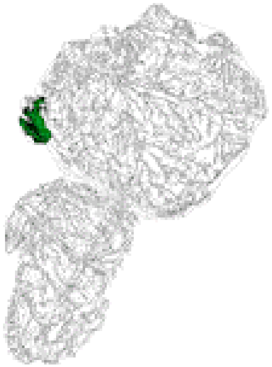
This report is based on a reconnaissance level field survey, detailed air-photo interpretation, in conjunction with analysis and interpretation of airborne gamma ray spectrometric and magnetic surveys (Wellman, 1998, 1999). Detailed interpretation of aerial photography and geophysical imagery over the Mount Edgar and Corunna Downs Igneous Complexes suggests the presence of a numerous discrete units. Where these units fall geographically within defined suites and have similar rock properties to these suites they are included as a sub-unit though they have not been formally named. Where the units fall geographically outside obvious suites they have been organised on the basis of geographic distribution and/or common rock properties and are labelled as Ungrouped. Although these units have been labelled separately, many do not have detailed descriptions.

# ARCHAEAN

## MOUNT EDGAR IGNEOUS COMPLEX

The Mount Edgar Igneous Complex is a roughly circular shaped granitiod body ranging in composition from granite to trondjhemite and including large portions of granodiorite and tonalite intruded by numerous dykes and containing areas of older gneiss. Granitic units within the Mount Edgar Igneous Complex have mostly produced isotopic ages around 3210-3220 Ma, however older intrusive ages (3466) do occur in the west. The southeast through to the southwest margins of the complex are defined by a zone of intense shearing (Mount Edgar Mylonite Complex) whereas the northwest and northeast margin of the complex are intrusive contacts. Collins (1983) has mapped at least 30 identifiable plutons within 7 geochemical suites and a gneiss complex, while Collins & Gray (1990) have broadly divided the complex into three main components: gneiss terrain in the south and west, granite suites (*sensu lato*) and the Moolyella Suite. The suite names used in this report are based on those of Collins (1983).

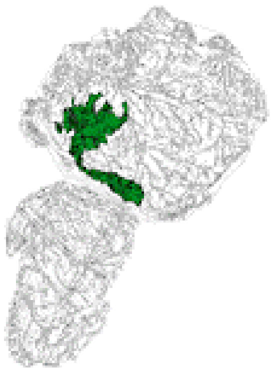
### *Warrulinya Suite* *(AgEw_)*



The Warrulinya Suite forms the western most elliptical shaped body of the Mount Edgar Igneous Complex. The rocks within this suite have not been metamorphosed beyond the greenschist facies and lie along the western Mount Edgar Igneous Complex and to the west to the Mount Edgar Mylonite Complex. Outcrop varies from scattered to abundant boulders on low hills to low slabs. The suite contains three unnamed units, AgEwg, AgEwm and AgEwu. A (reset) Rb-Sr age of 3210 ± 31 Ma was determined by Collins & Gray (1990), while Nelson, (1998) has produced a Shrimp U-Pb age of 3466 ± 2 Ma.

The Warrulinya Suite consists of a medium- to coarse-grained, biotite-hornblende granodiorite to biotite monzogranite ranging from sparsely developed feldspar-porphyritic to seriate and locally leucocratic. Davy & Lewis (1981) described the AgEwu unit as the most mafic of the Mount Edgar Igneous Complex consisting of andesine, hornblende and quartz. The suite contains minor mafic schlieren, mafic enclaves and locally magnetite intergrown with hornblende and pegmatite dykes. The suite is weakly to strongly foliated.
Monzogranite and granodiorite units within the Warrrulinya Suite have moderate radiometric total counts and have moderate magnetic susceptibility (Table 2).

### *Mount Edgar Gneiss Complex* *(AEgc_)*



The Mount Edgar Gneiss Complex forms an irregular shaped body in the southwestern sector of the Mount Edgar Igneous Complex. Outcrop ranges from scattered boulders to low flat slabs. The complex contains the unnamed units, AEgc, AEgcmf, AEgcm, AEgcx, AEgco and AEgcu.

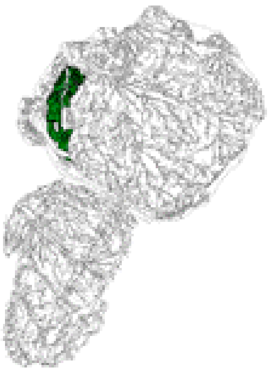
Collins & Gray (1990) undertook regional sampling of the centre of the gneiss complex. The units sampled included granitic, migmatitic and banded units. A Rb-Sr whole rock isochron of gneiss samples produced a 3224 ± 37 Ma age, while granitoid bodies within the gneiss complex gave a Rb-Sr age of 3247 ± 124 Ma. A Rb-Sr age of

3063 ± 206 Ma was determined for the amphibolitic layers concordant with banded gneiss Collins & Gray, 1990; Table 1).

The Mount Edgar Gneiss Complex is a composite suite consisting of medium- to coarse-grained, biotite monzogranite, biotite-hornblende granodiorite, biotite-hornblende tonalite to felsic-intermediate-mafic orthogneiss and amphibolite. The rocks vary from seriate to feldspar-porphyritic with minor hornblende and magnetite. The suite contains minor mafic schlieren, quartz veins and pegmatite dykes. The suite is moderately to strongly foliated, is locally sheared and contains multiple fold generations.

Table 2 presents radiometric counts and magnetic susceptibility data for gneiss, monzogranite, granodiorite, pegmatite, tonalite and amphibolite units within the Mount Edgar Gneiss Complex. The gneiss and monzogranite have relatively moderate radiometric total counts and have moderate magnetic susceptibility. The granodiorite has a relatively low radiometric total count and has high magnetic susceptibility. The pegmatite and tonalite units have low to moderate radiometric total counts and have low magnetic susceptibility. The amphibolite has a moderate to high radiometric total count and has very high magnetic susceptibility.

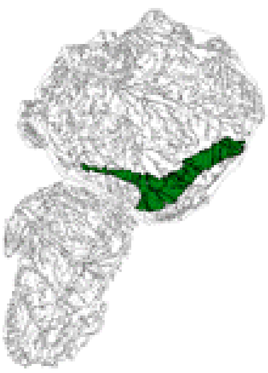
***Ungrouped* (AgEu_)**



These ungrouped units, which include AgEubm, AgEubg, AbEuu and AgEumm, form an elongated shaped body in the west of the Mount Edgar Igneous Complex. Outcrop varies from scattered to abundant boulders, tors and low slabs. The units range from a fine- to coarse-grained, biotite granodiorite to biotite monzogranite, which are mainly seriate to sparsely developed feldspar-porphyritic textured and include a porphyry-textured biotite-hornblende tonalite. All of the units are weakly to strongly foliated.

Table 2 presents the radiometric counts and magnetic susceptibility for monzogranite, granodiorite, gneiss and porphyry units within this ungrouped unit. The monzogranite, granodiorite and gneiss have moderate radiometric total counts and have moderate magnetic susceptibilities. The porphyry has a very low radiometric total count and has low to moderate magnetic susceptibility.

***Yandicoogina Suite* (AgEy_)**

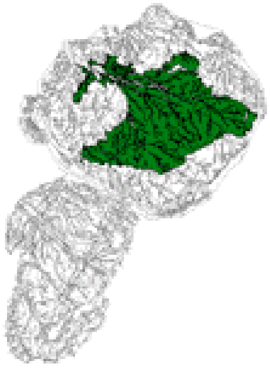


The Yandicoogina Suite forms an elongate body in the southern section of the Mount Edgar Igneous Complex. Outcrop varies from scattered to abundant boulders, tors to low flat slabs. The suite contains three unnamed units, AgEy1, AgEy2 and AgEy3. Collins & Gray (1990) Rb-Sr dated plutons within the Yandicoogina Suite at 3212 ± 47 Ma (Table 1).

The Yandicoogina Suite consists of a fine- to coarse-grained, biotite monzogranite to biotite-hornblende granodiorite, with localise magnetite and titanite. The rocks varying from sparsely developed feldspar-porphyritic, to locally moderately developed hornblende porphyritic, to seriate. The suite contains minor mafic schlieren, mafic enclaves, mafic xenoliths and aplite dykes and is variably foliated.

Granodiorite and monzogranite units within the Yandicoogina Suite have relatively moderate radiometric total count and have moderate to high magnetic susceptibility (Table 2).

### *Boodallana Suite* *(AgEb_)*



The Boodallana Suite extends across much of the central-eastern section of the Mount Edgar Igneous Complex. Outcrop varies from low rubble, granite slabs, abundant tors and boulders and has good exposure in creeks and rivers. There are four unnamed units within this suite, AgEb, AgEbm, AgEbx and AgEbmu. Collins & Gray (1990) determined an Rb-Sr age of 3210 ± 90 Ma for the Boodallana Suite (Table 1).

The Boodallana Suite consists of a fine- to coarse-grained, biotite monzogranite to biotite-hornblende granodiorite, biotite syenogranite and biotite tonalite. The units are mostly seriate with moderately developed feldspar-porphyritic and leucocratic textures, with local occurrences of hornblende-porphyritic and quartz-porphyritic textures. The suite has locally well developed mafic schlieren, magnetite bearing layers and compositional layering. The suite contains large mafic clots of biotite-magnetite-epidote, dispersed magnetite, minor mafic enclaves, minor to abundant pegmatite veins, aplite veins and fine-grained granite dykes. The suite is weakly to strongly foliated and contains discrete mylonite zones.

Table 2 shows the radiometric count and magnetic susceptibility for monzogranite, granodiorite, syenite and pegmatite units within the Boodallana Suite. The monzogranite has a moderate radiometric total count and has moderate magnetic susceptibility similar to monzogranites from the Coppin Gap Suite. The granodiorite has a moderate radiometric total count and has relatively high magnetic susceptibility. The syenite has a relatively high radiometric total count and has moderate to high magnetic susceptibility. The pegmatite has a very high radiometric total count and has low to moderate magnetic susceptibility.

### *Coppin Gap Suite* *(AgEc_)*

The Coppin Gap Suite forms the northern most part of the Mount Edgar Igneous Complex and extends along the northeastern margin. The suite consists of several unnamed units, AgEco, AgEcog, AgEcoh, AgEcom, AgEcomm and AgEcox. Outcrop varies from scattered to abundant boulders, small to large tors and minor slabs. The Coppin Gap Suite has a strong discordant contact with the supracrustal rocks and surrounding granites.

The distinctive lobe of the AgEco unit was dated at 3204 ± 45 Ma by Collins & Gray (1990). Granitic rocks associated with Mo-Cu mineralisation at Coppin Gap have been dated at 3234 ± 117 Ma (De Laeter & Martyn, 1986; Table 1).

The Coppin Gap Suite varies from a fine- to coarse-grained, biotite granodiorite to biotite monzogranite, and locally quartz-rich monzogranite and biotite-hornblende monzogranite. The rocks are seriate to sparsely developed feldspar-porphyritic textured with locally developed incipient granular textures. The suite contains minor small mafic enclaves, mafic and ultramafic xenoliths, aplite veins, quartz veins and pegmatite dykes. The rocks are weakly to moderately foliated.

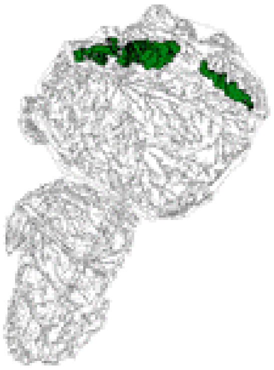
Monzogranite and granodiorite units within the Coppin Gap Suite have moderate radiometric total counts and have moderate magnetic susceptibilities (Table 2).

### *Ungrouped* (*AgEt_*)

These ungrouped intrusives consists of 3 units, AgEtx, AgEtg and AgEtuu, which extend along the northwestern margin of the Mount Edgar Igneous Complex. Outcrop is limited to small areas and boulders.

The units consists of medium-grained, seriate-textured, biotite monzogranite. The units are weakly to strongly foliated and are intruded by pegmatite veins. The monzogranite has a moderate to high radiometric total count similar to the monzogranites of the Munganbrina Suite and the Mount Edgar Igneous Complex and has a low magnetic susceptibility (Table 2).

### *Munganbrina Suite* (*AgEmu_*)

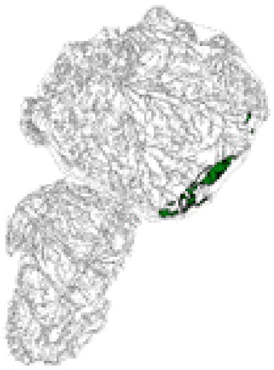


The Munganbrina Suite extends across the northern section of the Mount Edgar Igneous Complex. Outcrop varies from rubble, scattered to abundant boulders, large tors, low slabs and gorges. This suite consists of several distinct (unnamed) units, these include: AgEmu, AgEmumm, AgEmugm, AgEmum1, AgEmum2, AgEmum3, AgEmum4, AgEmum5 and AgEmuu. A whole rock isochron age of 3178 ± 41 Ma was determined for a unit of this suite by Collins & Gray, (1990).

The Munganbrina Suite consists of a fine- to coarse-grained, biotite monzogranite to biotite granodiorite and biotite-muscovite-garnet monzogranite, and are mainly seriate with sparsely to moderately developed feldspar-porphyritic and leucocratic textures. The suite is weakly to strongly foliated. It is intruded by abundant aplite, pegmatite veins (some garnet-bearing) and dykes. Mafic schlieren, mafic xenoliths and magnetite are common.

Table 2 shows the radiometric count and magnetic susceptibility for several different units within the Munganbrina Suite. The monzogranite has a relatively moderate to high radiometric total count and has moderate magnetic susceptibilities. The granodiorite and granite units have relatively moderately radiometric total counts, and very low to low magnetic susceptibilities. Pegmatite has a high radiometric total count and has high magnetic susceptibility.

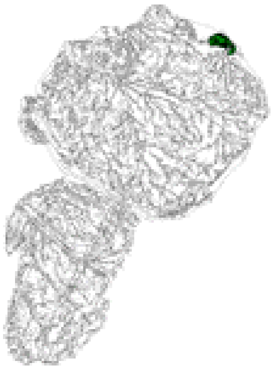
### *Ungrouped* (*AgE_*)



The ungrouped units include AgEbg, AgEs, AgEm, AgEu1 and AgEu2. These ungrouped units form irregular elongated bodies in the southeast of the Mount Edgar Igneous Complex. The outcrop style is characterised by scattered boulders and small tors.

The units range from a medium- to coarse-grained, biotite granodiorite to biotite monzogranite are mainly seriate with a sparsely developed feldspar-porphyritic texture. The units are foliated.

### *Chimingadgi Suite* (AgEch_)



The Chimingadgi Suite comprises the ***Chimingadgi Trondjhemite*** (AgEch) and the unnamed units AgEcha, AgEchx and AgEchp. This suite forms a semi-elliptical body in the northeast of the Mount Edgar Igneous Complex. Outcrop is restricted to scattered rubble and forms a low relief. The Chimingadgi Trondjhemite (AgEch) forms an elliptical pluton, which intrudes the older Munganbrina Suite and is unconformably overlain by the basal Fortescue Group (Williams, 1998).

The Chimingadgi Trondjhemite is a medium-grained, biotite trondjhemite with a seriate texture and is moderately foliated. It also contains a hybrid amphibole-rich granitoid rock with mafic and ultramafic xenoliths and a medium-grained, quartz-feldspar porphyry.

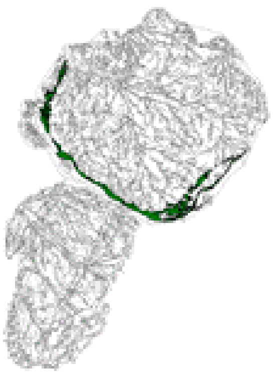
Geochemical analysis by Collins (1983) indicated high $Na_2O$ (4.3-5.0%) and a high $Na_2O/CaO$ ratio. The tonalite and porphyry units of the Chimingadgi Suite have relatively low radiometric total counts and have low to moderate magnetic susceptibilities (Table 2).

### *Ungrouped* (AgEqt_)

***Miningarra Trondjhemite*** (AgEqtm) forms an oval-shaped pluton of c. 5km maximum diameter along the northeastern margin of the Mount Edgar Igneous Complex. Outcrop of this unit is limited to rare scattered boulders. The Miningarra Trondjhemite is a medium- to coarse-grained, quartz-rich, biotite trondjhemite containing quartz, plagioclase, biotite (5%) and accessory magnetite. The unit is moderately foliated. The Miningarra Trondjhemite has a moderate radiometric total count and has moderate magnetic susceptibility (Table 2).

***Wiluna Pluton*** (AgEqtw) forms a pear-shaped pluton of c. 10km maximum diameter with well developed intrusive contacts on the outer southeastern margin of the Mount Edgar Igneous Complex. It is a coarse-grained, quartz-rich, biotite trondjhemite with a seriate texture and is weakly foliated. Mineralogically, the unit is composed of quartz, euhedral zoned oligoclase and biotite with accessory microcline (Davy & Lewis, 1986). A Shrimp U-Pb age of 3324 ± 6 Ma was determined by Collins, *et. al.*, (1998; Table 1). The pluton has a relatively low radiometric total count and has moderate magnetic susceptibility (Table 2). Locally the veins and dykes of the Wiluna Pluton intrude and are sheared within the Mount Edgar Mylonite Complex, suggesting coeval emplacement of the pluton with a stage of displacement within the mylonite complex.

### *Mount Edgar Mylonite Complex* (Amx)

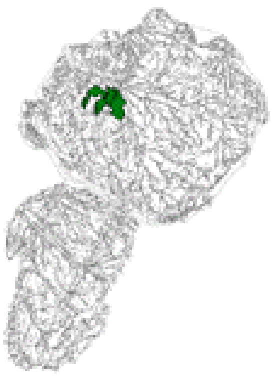


The Mount Edgar Mylonite Complex wraps around the southwestern, southern and southeastern margins of the Mount Edgar Igneous Complex. The strongly sheared felsic-mafic banded gneiss has a well-developed S & C mylonitic fabric and contains minor amphibolite pods and magnetite-bearing pegmatite veins. The tectonic fabric is generally parallel to the margin of the Mount Edgar Igneous Complex, however, kinemitic indicators and mineral lineations suggest several episodes of displacement at moderate metamorphic grades. The Mount Edgar Mylonite Complex includes several well-foliated intrusive bodies: these include, seriate, medium- to coarse-grained, biotite-garnet monzogranite to biotite tonalite and leucocratic, sparsely feldspar-porphyritic biotite-garnet monzogranite**.**

Table 2 shows the radiometric count and magnetic susceptibility for the monzogranite, tonalite and gneiss units within the complex. The monzogranite has a relatively high radiometric total count and has moderate magnetic susceptibility in comparison to the rest of the igneous complex. Similarly, the tonalite and gneiss have relatively low radiometric total counts and have moderate magnetic susceptibilities.

Collins & Gray (1990) collected biotite and felsic gneiss samples along Chinaman Creek in the south of the Mount Edgar Igneous Complex. The felsic layer, which consisted of white quartz and sodic plagioclase with diffuse biotite schlieren, produced a Rb-Sr age of 3061 ± 357 Ma (Table 1). However, Collins & Gray, (1990) have suggested that this is a composite age produced when older isotopic material was physically mixed with younger material during an event at 3200 Ma. Correlation of syn-emplacement shearing of dykes eminenting from the Wiluna Pluton suggest displacement along the mylonite was active around 3324 Ma.

***Moolyella Suite* *(AgEmy)***



The Moolyella Suite crops out over 55km$^2$ of rugged terrain in the west of the Mount Edgar Igneous Complex; it forms an irregular "M" shaped pluton with three southwest trending lobes. This suite is well exposed has relatively high topographic relief, and shows sharp intrusive contact with the surrounding units.

First recognised by Blockley (1970), it was named the Moolyella Granite by De Laeter & Blockley (1972), later defined and named the Moolyella Adamellite by Hickman & Lipple (1975). De Laeter & Blockley (1972) have dated the Moolyella Suite at 2613 ± 93 Ma using Rb-Sr, while Collins & Gray, (1990) have produced an age of 2804 ± 62 Ma using whole-rock isochron (Table 1). Recent U-Pb zircon dating, however, has produced an age of 3213 Ma (Hickman, pers. comm.).

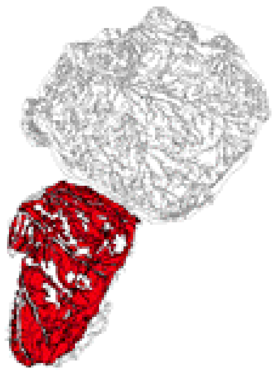
The Moolyella Suite consists mostly of a medium-grained, quartz-rich, biotite monzogranite with a sparsely developed quartz-feldspar porphyritic texture. The monzogranite has high K, U and Th radiometric counts and has low magnetic susceptibility (Table 2).

The Moolyella Suite differs from the older surrounding granitoids texturally, mineralogically and chemically (Davy & Lewis, 1986). The rocks of this suite are massive, granular, undeformed and highly homogenous containing few xenoliths and only occasional large rafts of gneiss (Collins, 1980). Mineralogically it contains quartz, approximately equal proportions of microcline and albite, with increasing plagioclase content towards the western margin (Hickman, 1983). Biotite is the main ferromagnesian mineral typically comprising between 3 to 6 per cent of the total mineral content. Albite is altered to sericite, epidote and carbonate minerals, whereas microcline is generally fresh; biotite is partly altered to chlorite (Hickman, 1983). Common accessory minerals include epidote, fluorite, spessartine, topaz, zircon, apatite and secondary muscovite (Hickman, 1983, Blockley, 1980).

The Moolyella Suite contains both primary and secondary tin deposits. The primary deposits are tin bearing aplite-pegmatites and are relatively unimportant economically. The secondary deposits include detrital concentrations, shallow sheet-wash deposits, residual deposits, tin-bearing gravel in streams and deep leads adjacent to the suite (Blockley, 1980).

Chemically the Moolyella Suite is highly fractionated, it has high values of $Na_2O$, $K_2O$, Rb, Th, Sn, U, high Rb/Sr ratio (>10) and a very low K/Rb ratio (<100) (Davy & Lewis, 1986; Blockley, 1980). Rb vs. $SiO_2$ (Harker diagram) shows the Moolyella Suite has a very different composition relative to the older granitiods. The Moolyella suite is readily distinguished from the older granitoid based on an Rb vs $SiO_2$ Harker diagram (e.g. Davy & Lewis, 1986).

## CORUNNA DOWNS IGNEOUS COMPLEX



Corunna Downs Igneous Complex is a pear shaped body that is broad in the north, narrowing to the south. There are three main suites within the complex: the Bookargemoona Suite in the northwest; the Carbana Suite in the centre, south and east; and, in the south, the Mondana Suite. Rock types range from tonalite to granodiorite and monzogranite. In general the complex has a low $Na_2O$ (<4%) content relative to >4% mean $Na_2O$ content of most Archaean granitoids (Davy, 1989). In general and in comparison to the Mount Edgar Igneous Complex, the Corunna Downs Igneous Complex is poorly exposed, weathered, and is extensively covered by Cainozoic units.

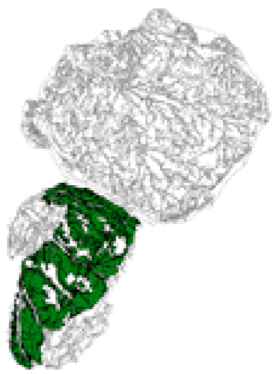
### *Bookargemoona Suite (AgOb_)*

The Bookargemoona Suite forms an elliptical shaped body in the northwest of the Corunna Downs Igneous Complex. Outcrop varies from the scattered boulders to slabs, and is locally well exposed in river cuttings. The suite contains several unnamed units, AgObm, AgObfg, AgObcg, AgObbm, AgObhm and AgObu.

The Bookargemoona Suite consists of a fine- to coarse-grained, hornblende-biotite monzogranite to biotite-hornblende granodiorite with a seriate to sparsely developed feldspar porphyritic texture. The suite contains minor mafic xenoliths, feldspar porphyritic xenoliths and pegmatite and aplite veins. The suite is locally foliated.

Monzogranite and granodiorite units of the Bookargemoona Suite have moderate radiometric total counts and have low magnetic susceptibilities (Table 2).

### *Carbana Suite (AgOc_)*

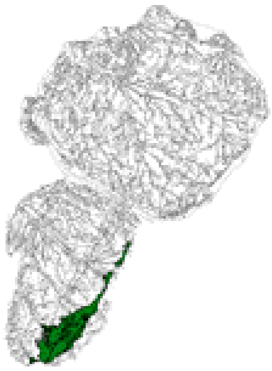


The Carbana Suite extends across much of the northern, central, southern regions of the Corunna Downs Igneous Complex. Outcrop ranges from isolated slabs in creeks and rivers to minor rubbly, very sparse scattered to abundant boulders and tors. The suite consists of several unnamed units; AgOchm, AgOcsm, AgOcqm, AgOcl, AgOcx, AgOcbm, AgOcs, AgOcgm, AgOcp2, AgOcx1, AgOcmd, AgOcmu and AgOcw. A Shrimp U-Pb age of 3313 ± 9 Ma was determined by Barley & Pickard (1999).

The Carbana Suite consists of a fine- to coarse-grained, biotite monzogranite to biotite-hornblende monzogranite with minor porphyritic feldspar granite and biotite granodiorite Texturally the rocks vary from seriate to granular, to sparsely to moderately feldspar porphyritic, and are locally quartz porphyritic and leucocratic. Units of this suite contains rare to dispersed magnetite, minor mafic schlieren,

mafic xenolith, aplite dykes, epidote-quartz-carbonate veins and pegmatitic segregates. The suite varies from apparently undeformed to moderately foliated.
Table 2 presents radiometric count and magnetic susceptibility data for monzogranite, granodiorite and porphyry units of the Carbana Suite. The monzogranite and granodiorite units have relatively moderate radiometric total counts and have low magnetic susceptibilities. The porphyry has a moderate radiometric total count and has very low magnetic susceptibility.

***Mondana Suite** (AgOm_)*



The Mondana Suite forms an elliptical shaped body in the southeast and east of the Corunna Downs Igneous Complex and extends as a narrow body along the northeast margin. Outcrop ranges from rubble, boulders, to small tors and slabs. The suite has well defined intrusive contacts with adjacent units. The suite contains three unnamed units, AgOmqm, AgOm1 and AgOm2. A Shrimp U-Pb age of 3317 ± 2 Ma was determined by Barley & Pickard (1999).

The Mondana Suite consists of a fine- to coarse-grained, quartz-rich, biotite monzogranite with seriate to sparsely developed feldspar porphyritic texture. The suite is locally foliated and contains enclaves of Boobina Porphyry (see below). Monzogranite units within the Mondana Suite have a moderate radiometric total count and have low magnetic susceptibility (Table 2).

**ARCHAEAN DYKES AND SMALL INTRUSIONS**

***Black Range Dolerite Suite***

The Black Range Dolerite Suite (Afdb) forms several prominent ridges trending north-northeast. Two main dykes intruded the centre of Mount Edgar Igneous Complex and four main dykes intruded near the east and west margins of the Corunna Downs Igneous Complex. The dykes form an intermittent en echelon pattern to a discontinuous form. The dykes vary in width from 50m up to 200m (Lewis *et. al.*, 1975). There are marked chilled margins with hybridization and remelting of the adjacent granite country rock (Williams, 1998). Contact metamorphism of the country rock occurs within 3m and the metamorphic aureole and can extend up to 70m from individual dykes (Hickman, 1983). The suite is thought to be a feeder dyke system for the basal Fortescue Group (Williams, 1998). The Black Range Dolerite Suite has been dated at 2772 ± 2 Ma using Shrimp U-Pb geochronology (Wingate, 1999).

The Black Range Dolerite Suite consists of a medium- to course-grained, dolerite and gabbro dykes. The suite consists of subophitic intergrowths of plagioclase and anhedral augite crystals with scattered large orthopyroxene crystals (Williams, 1998).

***Other Archaean intrusives***

Fluorite-bearing quartz porphyry dykes and small intrusions (Apff) are associated with the Chimingadgi Suite within the Mount Edgar Igneous Complex. These dykes form east-northeast trending intrusions. The dykes consists of euhedral quartz and K-feldspar phenocrysts set in a coarse-grained, spherulitic groundmass (Williams, 1998).

Pegmatite dykes (Ap) form a complex series of irregular and discontinuous intrusions in the southeastern corner of Corunna Downs Igneous Complex. The dykes intrude the Mondana Suite (AgOmgm & AgOm1) and extend into the Boobina Porphyry (Apf & Apf1).

Hornblende monzogranite and granodiorite bodies (Agh) intrudes the Coppin Gap Suite in the north of the Mount Edgar Igneous Complex. Three small plutons form distinct high relief outcrops. Williams & Hickman (2000) suggest a zircon age of 2757 ± 7 Ma for these units.

## OTHER ARCHAEAN UNITS

The ***Mount Ada Basalt*** (Awm) was defined and described by Hickman (1977). The unit is discordantly intruded and contact metamorphosed by the Coppin Gap Suite and an age of >3471 Ma is assigned to the unit (Williams, 1998). According to Hickman (1983) the Mount Ada Basalt is fine-grained, and comprises amphibolite (after basalt), and siliceous meta-basalt, minor metachert, and ultramafic rocks. The metabasalts are blue-grey to dark-green, fine-grained, actinolite rich rocks with varying amounts of chlorite, epidote and plagioclase.

The ***Duffer Formation*** (AWd) crops out along the northern margin of the Mount Edgar Igneous Complex. The Duffer Formation was defined and described by Lipple (1975). The formation disconformably overlies the Mount Ada Basalt and the Coppins Gap Suite. The Duffer Formation is assigned an approximate age of 3470Ma (Thorpe, *et. al.*, 1992). It consists of dacitic lava, tuff and pyroclastic fall deposits with subordinate rhyolite, basalt, chert and porphyritic intrusions. The principal minerals are plagioclase and quartz with abundant biotite, hornblende, epidote and chlorite (Hickman, 1983).

Hornblende-plagioclase schist replacing dolerite intrusions (Awoh) outcrops in the vicinity of the Chimingadi Trondjhemite in the Mount Edgar Igneous Complex.

Undivided metamorphosed volcanic, mafic intrusives and sedimentary rocks (AW) occur as isolated outcrops in the north of the Mount Edgar Igneous Complex.

Serpentinite (Auc) crops out in the south west of Mount Edgar Igneous Complex. It is a massive, granular, green to green-grey schist composed of serpentine, which is typically replaced by tremolite-talc-chlorite assemblages.

Undivided ultramafic rock (Au) crop out as isolated bodies in the central regions of the Mount Edgar Igneous Complex. The ultramafic bodies are either altered primary rocks of indeterminate origin or layered ultramafics. Williams (1998) described the units in the north as serpentinized peridotite and tremolite-serpentine-chlorite talc schist.

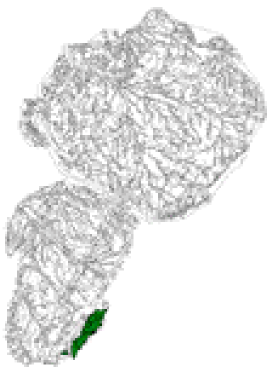
Basalt and andesite bodies (Ab), which typically contain amphibole, quartz, albite, epidote, chlorite with minor sericite, sphene, clinozoisite, carbonate minerals, opaques, prehnite and pumpellyite occur as scattered outcrops across the Corunna Downs Igneous Complex, and near the inner margins of the Mount Edgar Igneous Complex. Deformation and metamorphism has resulted in medium-grained, mafic schist and amphibolite units consisting of largely secondary amphibole and altered plagioclase.

Volcanic deposits (Aav) consisting of angular clasts of felsic lava and rare chert in a groundmass of tuff or lava occur in the northwest of the Corunna Downs Igneous Complex. The rocks are massive and contain clasts from 0.2m up to metres in diameter (Hickman, 1983).

A tuff unit (Aat) occurs in the northwest margin of the Corunna Downs Igneous Complex. It consists of plagioclase, quartz fragments, devitrified glass shards and pumice in a fine groundmass (Hickman, 1983). The tuff displays sedimentary-type structures such as cross bedding and diagenetic injections (Hickman, 1983).

Rhyolite to dacite lavas (Aa) consisting of porphyritic quartz and feldspar phenocrysts in a fine grained to glassy groundmass occur on the west margin of the Corunna Downs Igneous Complex. According to Hickman (1983) these units are commonly massive, porphyritic and vesicular and show varying styles of alteration.

Chert units are mapped along the margins of the Corunna Downs Igneous Complex. The cherts are banded and the band thickness varies from 1mm to 10mm. The red/white banded chert (Acj) outcrops on the northwest margin of the Corunna Downs Igneous Complex, while black/white and grey/white banded chert (Acw) outcrops along the southern margin.



The ***Boobina Porphyry*** (Apf, Apf1) crops out along the southeast margin of the Corunna Down Igneous Complex. Two units were differentiated on the basis of distinct airphoto appearance. The porphyry has a sharp intrusive contact with surrounding units.

The Boobina Porphyry was defined and described by Lipple (1975). An age of 3307 ± 19 Ma was determined by Pidgeon, (1984), while Barley & Pickard, (1999) have produced a Shrimp U-Pb age of 3315 ± 2 Ma.. It is a dark feldspar-quartz-biotite porphyry consisting of euhedral to subhedral phenocryst of oligoclase and subordinate quartz in a dark grey-green to black aphanitic groundmass (Hickman, 1983). Accessory minerals include, zircon, iron oxide, apatite and tourmaline and secondary minerals of chlorite, carbonate, sericite and rutile.

# PROTEROZOIC

## DYKES, SMALL INTRUSIONS AND QUARTZ VEINS

A number of hornblende monzogranite and granite plutons (Pgh) intrude the Mount Edgar Igneous Complex north of the Chimingadi Trondjhemite. Williams (1998) describes these plutons as fine- to medium-grained, with hypidiomorphic- to allotriomorphic-granular textures. The mineral assemblage consists of plagioclase, K-feldspar, green to light brown hornblende and quartz (Williams, 1998). The plutons are thought to be related to swarms of porphyritic trachyandesite dykes that intrude the Chimingadi Trondjhemite. An age of <2560 Ma is assigned to the unit (Williams, 1998).

Hornblende-feldspar-biotite porphyry dykes and plugs (Php) intrude predominantly within the Mount Edgar Igneous Complex. Williams (1998) described these as porphyritic trachyandesite dykes comprising mafic phenocrysts, acicular or platy hornblende with minor biotite and clinopyroxene. Several bodies occur in the north intruding the Chimingadi Trondjhemite and in the central eastern side of the Mount Edgar Igneous Complex. The small porphyry bodies and north and northwest trending sinuous dykes intrude the Coppin Gap Suite and extend beyond the Mount Edgar Igneous Complex in the north. An isolated irregular group of dykes and small intrusions also crop out outside the northeastern margin of the Corunna Downs Igneous Complex. Quartz dykes or veins (q) of various ages are widespread in the Mount Edgar and Corunna Downs Igneous complexes. Large north-trending massive quartz veins occur across the Mount Edgar Igneous Complex, possibly intruding major fractures or joints. Several large northwest-trending quartz veins also crop out on the northern margin of Corunna Downs Igneous Complex.

Undifferentiated felsic, mafic and ultramafic dykes (d) of various ages intrude the Mount Edgar and Corunna Downs Igneous complexes. They are widespread and predominately trend northeast to east-northeast and northwest to west-northwest. The dykes are thin, linear and are generally less than 1km in outcrop length. A high concentration of discontinuous short dykes intrude the western margin of the Mount Edgar Igneous Complex. These north-east, east-northeast and east-southeast trending dykes crop out mainly with the Warrulinya Suite. A U-Pb Shrimp age of 755±3Ma for these dykes was determined by Wingate (1999).

## CAINOZOIC

### *Undifferentiated deposits and palaeosols* ***(Czau, Czp)***

Dissected, undifferentiated calcrete (Czau) including pisolitic, silicified and ferruginous deposits are associated with older drainage channels in both the Mount Edgar and Corunna Downs Igneous complexes. Distinct palaeosols (Czp) are also interpreted in the north of Mount Edgar Igneous Complex.

## QUATERNARY

### *Alluvial and eluvial deposits* ***(Qaas, Qao, Qrg)***

Unconsolidated alluvial sand, clay, silt and gravel (Qaas) are found in active drainage channels. Overbank deposits (Qao) of alluvial sand, silt and clay are preserved on floodplains adjacent to main drainage channels. Quartzo-feldspathic eluvial sand (Qrg) with quartz and rock fragments occur in some plain areas. The eluvial sand overlies and is interpreted as being derived from the underlying granitoid rock.

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| Unit | Age | Dating method | Reference |
|---|---|---|---|
| Undifferentiated felsic, mafic & ultramafic dykes (d) | 755 ± 3 Ma. | SHRIMP U-Pb | Wingate, 1997. |
| Hornblende monzogranite & granite plutons (Pgh) | < 2560 Ma. | Relative relationship | Williams, 1998. |
| Hornblende monzogranite & granodiorite plutons (Agh) | 2757 ± 7Ma | Zircon age | Williams & Hickman, 2000. |
| Black Range Dolerite Suite (AFdb) | 2772 ± 2Ma. | SHRIMP U-Pb baddeleyite geochronology | Wingate, 1997, 1999. |
| Moolyella Suite (AgEmy) | 2623 ± 93 Ma (a), 2804 ± 62 Ma (b). | (a) Rb-Sr isotopes, (b) Rb-Sr (whole rock isochron). | de Laeter & Blockey, 1972, Collins & Gray, 1990. |
| Mt Edgar Mylonite Complex (Amx) | 3061 ± 357 Ma, pre-3200 Ma ©. | © older isotopic system within the mylonite complex. | Collins & Gray, 1990. |
| Wiluna Pluton (AgEqtw) | 3324 ± 6 Ma | SHRIMP U-Pb zircon | Collins *et. al.*, 1998 |
| Chimingadgi Suite (AgEch_) | 3205 ± 58 Ma | Rb-Sr (whole rock isochron) | Collins & Gray, 1990. |
| Munganbrina Suite (AgEmu_) | 3178 ± 41Ma | Rb-Sr (whole rock isochron) | Collins & Gray, 1990. |
| Coppin Gap Suite (AgEc_) | 3204 ± 45 Ma (d), 3314 ± 13 Ma (e), 3234 ± 117 Ma (f). | (d) Rb-Sr whole rock isochron, AgEco unit - metamorphic resetting, (e) SHRIMP U-Pb zircon, AgEcoh unit - age of crystallisation, (f) granitic rocks associated with Mo-Cu mineralisation. | (d, e) Collins & Gray, 1990, (f) de Laeter & Martyn, 1986. |
| Boodallana Suite (AgEb_) | 3210 ± 90 Ma. | Rb-Sr (whole rock isochron) | Collins & Gray, 1990 |
| Yandicoogina Suite (AgEy_) | 3212 ± 47 Ma. | Rb-Sr (whole rock isochron) | Collins & Gray, 1990. |
| Mt Edgar Gneiss Complex (AEgc_) | 3224 ± 37 Ma (g), 3247 ± 124 Ma (h), 3063 ± 206 Ma (i), >3400 Ma (j) | (g) Whole rock isochron, (h) granitiods bodies within the gneiss, (i) amphibolite layers, (j) Sr model age. | Collins & Gray, 1990. |
| Warrulinya Suite (AgEw_) | 3210 ± 31 Ma (k), 3466 ± 2 Ma (l) | (k) Rb-Sr (whole rock isochron), (l) SHRIMP U-Pb | (k) Collins & Gray, 1990, (l) Nelson, 1998. |
| Corunna Downs Igneous Complex | 3270 ± 22 Ma, 3232 ± 27 Ma | SHRIMP U-Pb | Cooper, 1982. |
| Mondana Suite (AgOm_) | 3317 ± 2 Ma | SHRIMP U-Pb | Barley & Pickard, 1999 |
| Carbana Suite (AgOc_) | 3313 ± 9 Ma | SHRIMP U-Pb | Barley & Pickard, 1999 |
| Boobina Porphyry | 3307 ± 19Ma, 3315 ± 4 Ma (m) | SHRIMP U-Pb | Pidgeon, 1984, (m) Barley & Pickard, 1999. |
| Warrawoona Group: Duffer Formation (AWd) | 3471 ± 5 Ma, 3465 ± 3Ma | Conventional zircon U-Pb dating. | Thorpe *et. al.*, 1992 |

**Table 1.** Geochronology of the Mount Edgar and Corunna Downs Igneous complexes.

| Units | Rock type | No of readings | K | U | Th | K/Th | K/ U | Th/ U | Total Count | Magnetic Suscept. |
|---|---|---|---|---|---|---|---|---|---|---|
| **MT EDGAR IGNEOUS COMPLEX** | | | | | | | | | | |
| Moolyella Suite (AgEmy) | Monzogranite | 3 | 9.54 | 1.77 | 1.14 | 8.30 | 5.24 | 0.63 | 85.07 | 3 |
| Mt Edgar Complex (Amx) | Monzogranite | 3 | 5.64 | 1.61 | 0.38 | 18.3 | 4.16 | 0.26 | 62.06 | 121.65 |
| | Tonalite | 2 | 2.02 | 0.4 | 0.15 | 14.83 | 5.30 | 0.37 | 23.4 | 63.5 |
| | Gneiss | 2 | 3 | 0.85 | 0.05 | 11 | 4.17 | 0.05 | 31.75 | 102 |
| Miningarra Trodjhemite (AgEqtm) | Trondjhemite | 1 | 3.3 | 1.2 | 0.17 | 19.41 | 2.75 | 0.14 | 32.77 | 349.5 |
| Wiluna Pluton (AgEqtw) | Trondjhemite | 3 | 1.4 | 0.3 | 0.1 | 6.33 | 4.94 | 0.28 | 20 | 269.33 |
| Chimingadgi Suite (AgEch_) | Tonalite | 1 | 1.57 | 0.37 | 0.1 | 15.7 | 4.24 | 0.27 | 16 | 160 |
| | Porphyry | 1 | 1.27 | 0.43 | 0.2 | 6.35 | 2.95 | 0.47 | 20.1 | 46 |
| Munganbrina Suite (AgEmu_) | Monzogranite | 19 | 5.39 | 1.69 | 0.39 | 19.15 | 4.06 | 0.23 | 64.51 | 123.11 |
| | Granodiorite | 3 | 3.28 | 0.61 | 0.26 | 13.07 | 5.53 | 0.43 | 38.9 | 95.1 |
| | Pegmatite | 1 | 6.9 | 2.3 | 1.2 | 5.75 | 3 | 0.52 | 112 | 598 |
| | Granite | 1 | 3.87 | 0.63 | 0.27 | 14.33 | 6.14 | 0.43 | 48.27 | 2.83 |
| Talga Subgroup (AgEt_) | Monzogranite | 3 | 4.24 | 1.48 | 0.41 | 10.66 | 3.48 | 0.32 | 41.6 | 9.42 |
| | Tonalite | 1 | 4.9 | 0.9 | 0.4 | 12.25 | 5.44 | 0.44 | 34.3 | 19.75 |
| Coppin Gap Suite (AgEc_) | Monzogranite | 15 | 3.44 | 0.98 | 0.19 | 21.79 | 3.54 | 0.20 | 39.59 | 316.17 |
| | Granodiorite | 7 | 2.80 | 0.74 | 0.20 | 18.01 | 3.98 | 0.28 | 34.17 | 367.93 |
| Boodallana Suite (AgEb_) | Monzogranite | 40 | 4.0 | 1.26 | 0.22 | 20.77 | 4.16 | 0.23 | 51.22 | 270.10 |
| | Granodiorite | 15 | 2.51 | 0.77 | 0.19 | 18.77 | 3.80 | 0.26 | 35.11 | 510.65 |
| | Syenite | 2 | 4.45 | 0.8 | 0.55 | 9.21 | 5.5 | 0.66 | 43.45 | 309 |
| | Pegmatite | 4 | 6.13 | 1.63 | 0.53 | 14.26 | 4.82 | 0.34 | 80.35 | 142 |
| Yandicoogina Suite (AgEy_) | Granodiorite | 10 | 1.78 | 0.56 | 0.18 | 11.07 | 3.62 | 0.42 | 24.93 | 521.3 |
| | Monzogranite | 8 | 2.68 | 0.57 | 0.13 | 18.63 | 5.60 | 0.30 | 28.6 | 344.13 |
| Ungrouped (AgEu_) | Monzogranite | 8 | 3.63 | 0.88 | 0.22 | 13.77 | 4.61 | 0.29 | 39.74 | 271.44 |
| | Granodiorite | 3 | 1.59 | 0.51 | 0.2 | 9.02 | 2.97 | 0.36 | 22.6 | 387.67 |
| | Gneiss | 1 | 2.7 | 1.5 | 0.1 | 27 | 1.8 | 0.07 | 30.2 | 288 |
| | Pophyry | 1 | 1.3 | 0.5 | 0.3 | 4.33 | 2.6 | 0.6 | 23.5 | 72 |
| Mt Edgar Gneiss Complex (AEgc_) | Gneiss | 9 | 3.14 | 0.88 | 0.14 | 20.85 | 5.42 | 0.19 | 32.93 | 196.56 |
| | Monzogranite | 9 | 2.13 | 0.70 | 0.20 | 15.08 | 3.03 | 0.32 | 28.22 | 123.65 |
| | Granodiorite | 3 | 1.95 | 0.77 | 0.17 | 4.5 | 3.42 | 0.27 | 29.33 | 536.67 |
| | Pegmatite | 2 | 4.7 | 0.5 | 0.05 | 26 | 10 | 0.13 | 50.85 | 66.5 |
| | Tonalite | 2 | 3.45 | 0.9 | 0.4 | 12.08 | 4.46 | 0.42 | 34.5 | 19.5 |
| | Amphibolite | 1 | 4.3 | 0.7 | 0.1 | 43 | 6.14 | 0.14 | 30.4 | 758 |
| Warrulinya Suite (AgEw_) | Monzogranite | 4 | 2.70 | 1.10 | 0.21 | 11.8 | 3.65 | 0.19 | 46.73 | 210.6 |
| | Granodiorite | 1 | 1.7 | 1 | 0.13 | 13.08 | 1.7 | 0.13 | 36.13 | 145 |
| **CORUNNA DOWNS IGNEOUS COMPLEX** | | | | | | | | | | |
| Mondana Suite (AgOm_) | Monzogranite | 4 | 3.42 | 2.05 | 0.15 | 23.55 | 1.66 | 0.07 | 73.48 | 43.73 |
| Carbana Suite (AgOc_) | Monzogranite | 55 | 3.02 | 1.31 | 0.16 | 23.23 | 2.76 | 0.14 | 55.54 | 43.02 |
| | Granodiorite | 4 | 1.70 | 0.75 | 0.12 | 18.84 | 2.25 | 0.19 | 31.35 | 31.1 |
| | Porphyry | 3 | 2.70 | 1.24 | 0.10 | 32.38 | 2.31 | 0.10 | 49.26 | 7 |
| Bookargemoona Suite (AgOb_) | Monzogranite | 6 | 2.65 | 0.85 | 0.15 | 23.63 | 3.27 | 0.18 | 34.63 | 7.59 |
| | Granodiorite | 4 | 1.58 | 0.58 | 0.06 | 32.29 | 3.01 | 0.10 | 29.37 | 19.41 |

**Table 2.** Rock property characteristics of the Mount Edgar and Corunna Downs Igneous complexes. All measurements are from hand-held meters. Where more than 1 reading is indicated, measurements have been averaged. Raw data is stored in OZROX in AGSO.

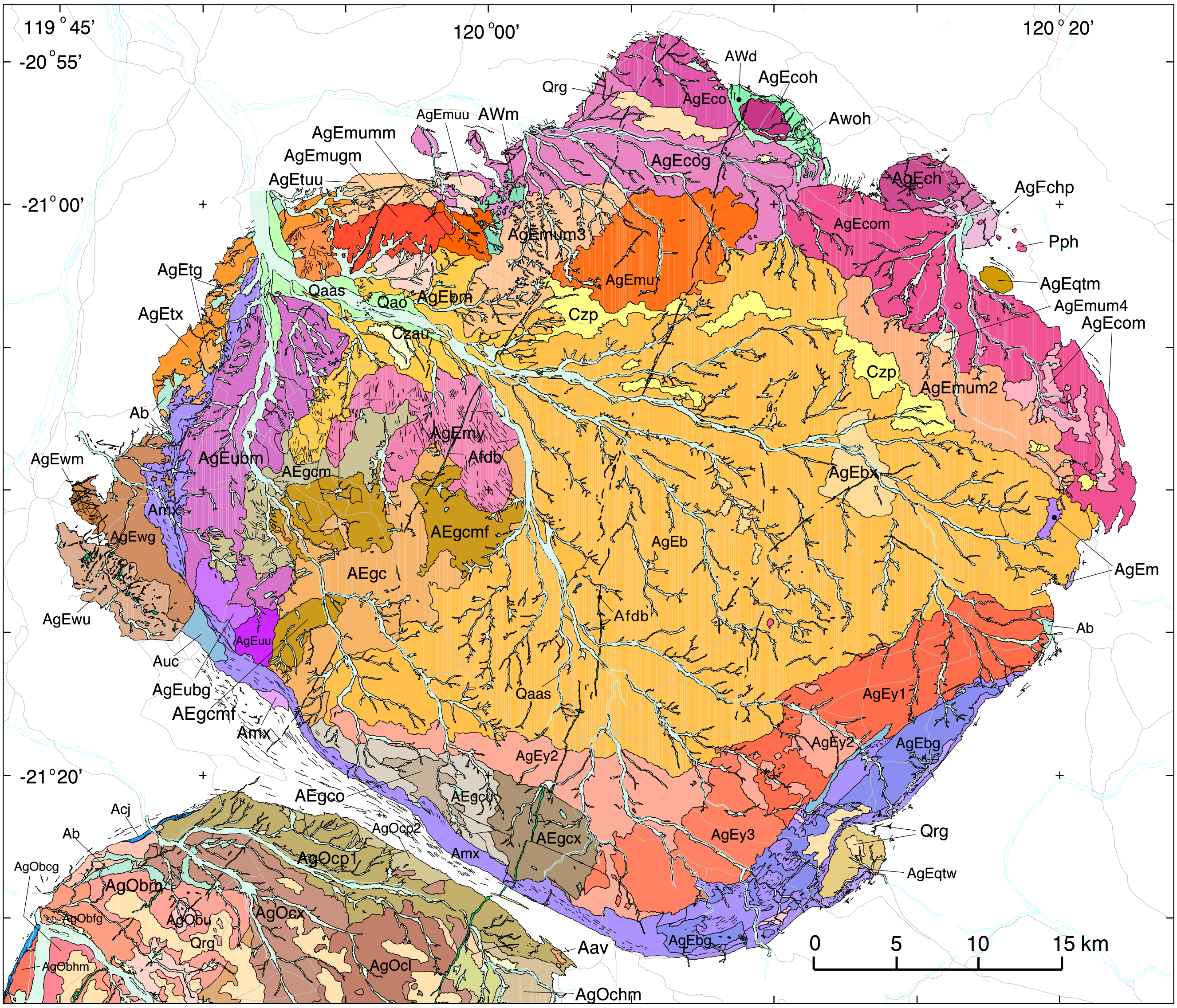


Figure1. Mount Edgar Igneous Complex

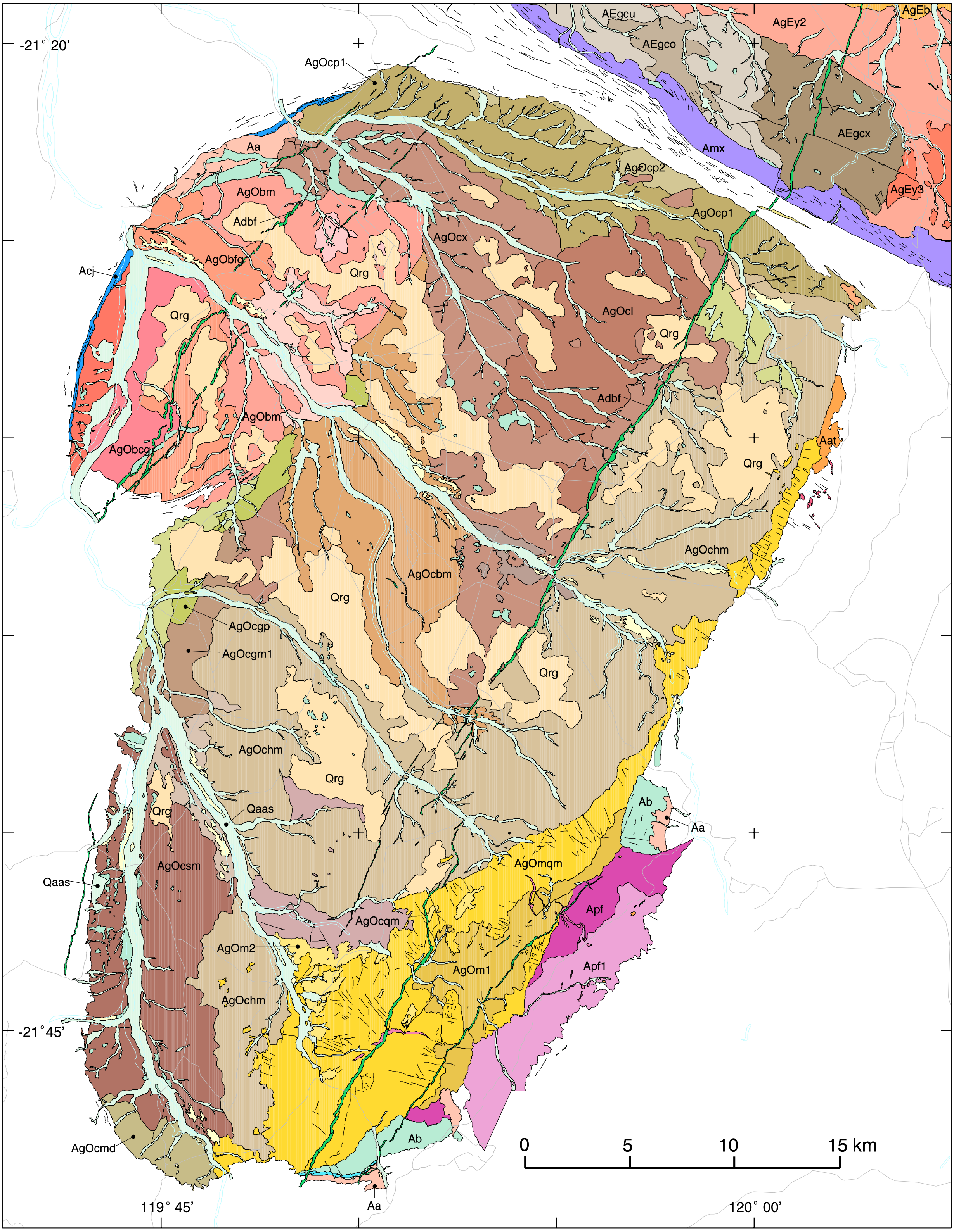


Figure 2. Corunna Downs Igneous Complex

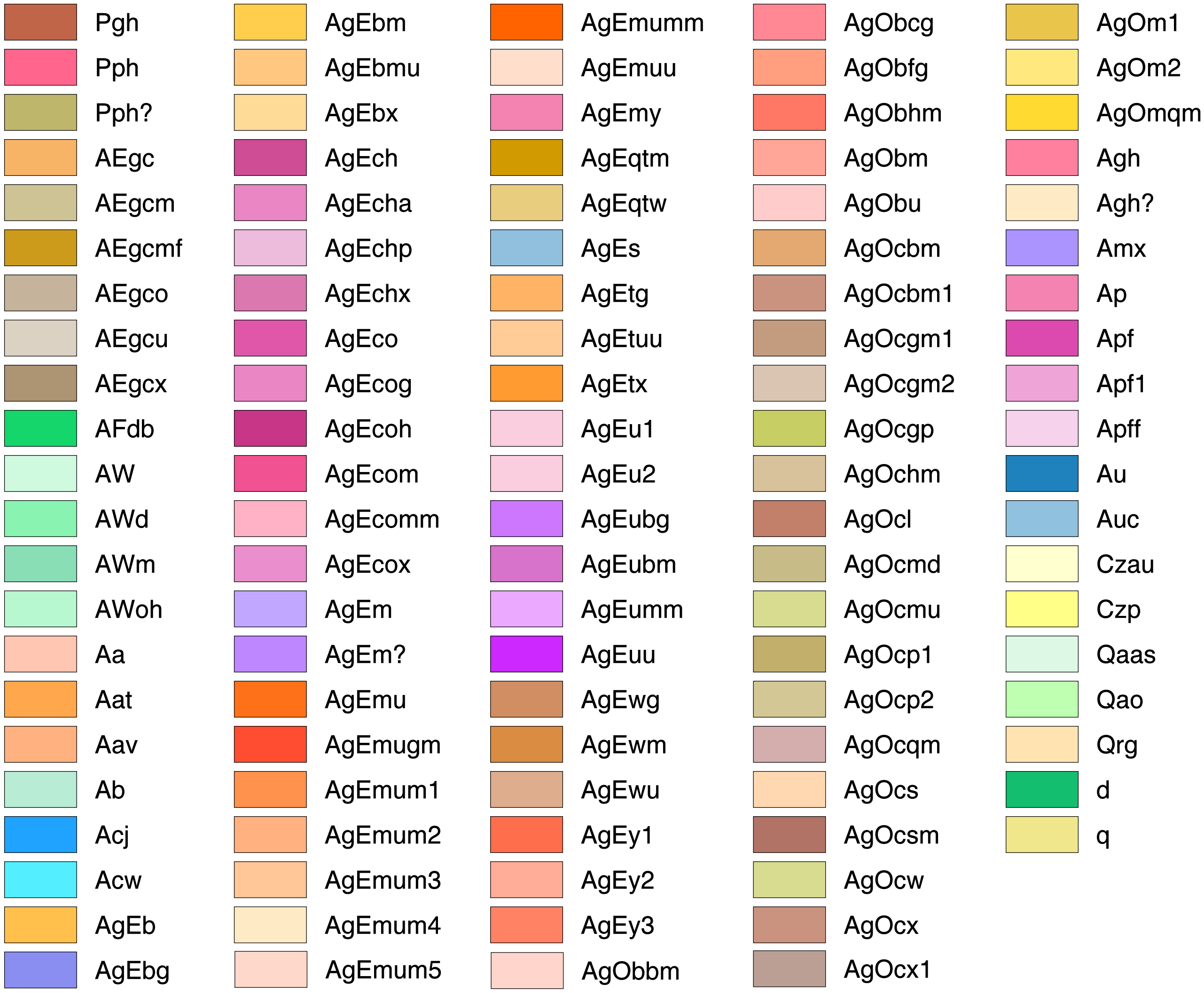


Figure3. Legend for Mount Edgar and Corunna Downs complexes