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DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
REGIONAL GEOLOGY DIVISION

PROPOSED QUARTERLY GEOLOGICAL NOTE THE ENGENINA ADAMELLITE AND BALTA GRANITE OF THE MOUNT WOODS INLIER

by

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DEPARTMENT OF MINES AND ENERGY
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PROPOSED QUARTERLY GEOLOGICAL NOTE THE ENGENINA ADAMELLITE AND BALTA GRANITE OF THE MOUNT WOODS INLIER

The Mount Woods Inlier is an area of exposed Precambrian rocks on the BILLA KALINA 1:250 000 map sheet which coincides with a conspicuous belt of high Bouguer gravity and aeromagnetic intensity anomalies on the northeastern margin of the Gawler Craton. There are nearly 70 separate outcrops over an area of 800 km^2, emergent through the Cretaceous Mount Anna Sandstone and Bulldog Shale and overlying Quaternary sediments.

The crystalline basement rocks have not been previously subdivided (Whitten, 1965) but present mapping indicates that there are two granitic bodies, intrusive into metamorphics (Flint and Benbow, 1977). The metamorphics consist of a wide variety of rock types including cordierite, garnet, and sillimanite-bearing granofelses, garnetiferous and leucocratic gneisses, banded iron formations and rare metaconglomerates. Metamorphism reached granulite-facies grade and the metamorphic rocks are assigned an ? Archaean - Lower Proterozoic age by analogy to similar lithologies of the Tarcoola area (Daly et al., 1978).

The metamorphics are intruded by two Carpentarian granitoids. The Engenina Adamellite* is foliated and porphyritic, while the later Balta Granite* is non-foliated and often porphyritic.

*New name

ENGENINA ADAMELLITE

The name is derived from Engenina Creek which drains northwards through the inlier into Lake Cadibarrawirracanna.

Distribution and Field Relationship

Outcrops of the Engenina Adamellite are restricted to the centre of the inlier (Fig. 1). Adamellite intrusion postdates the granulite-facies metamorphism and foliation in the neighbouring metamorphics.

Petrography and Geochemistry

The predominant rock type is a grey, porphyritic, foliated adamellite, however porphyritic granites and granodiorites are also present. Tabular to ovoid feldspar phenocrysts 20 mm across are ubiquitous and generally aligned subparallel to the foliation. Phenocrysts are orthoclase, microcline and plagioclase, in which Carlsbad, grid-iron and polysynthetic twinning are all common (Whitehead, 1977). Small patches of myrmekites often extend into large microcline phenocrysts.

The high biotite content (10-15%) defines a foliation that has a near vertical dip (Fig. 1). The groundmass of quartz and feldspar shows extensive recrystallization; quartz exhibits extreme undulose extinction and quartz aggregates are aligned parallel to the foliation. In comparison with the world average of silicate analyses for adamellites (Le Maitre, 1976) the Engenina Adamellite shows a deficiency in SiO_2 and marginally higher content for most of the other oxides (Table 1).

Geochronology

Six total rock samples of the Engenina Adamellite yielded a Model 1 Rb/Sr isochron of 1641 $\pm$ 38 Ma and an initial Sr 87/Sr 86 ratio of 0.7081 (Webb, 1977). (The decay constant used was

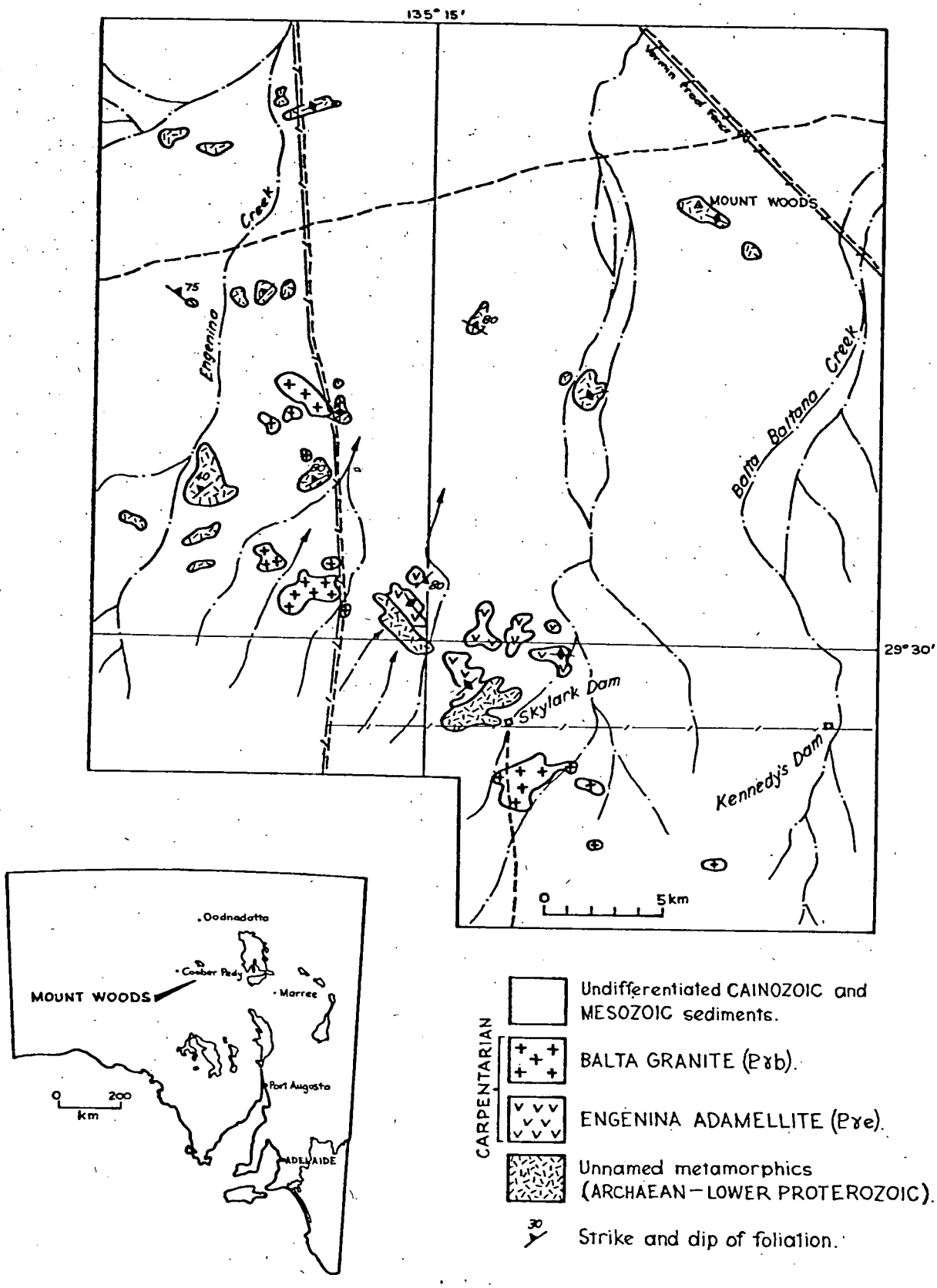

FIG. 1

	DEPARTMENT OF MINES–SOUTH AUSTRALIA	Scale: 1:250 000
Compiled: R.B.F.	MOUNT WOODS INLIER GEOLOGICAL PLAN	Date: 16-8-78
Drn. A.F. | Ckd.		Drg. No. S13605

500—11.76 H1081 O

Rb 87 = 1.42 x 10^{-11} yr^{-1}.) If the foliation and intrusion are synchronous then the geochronology suggests a Carpentarian age for intrusion of the Engenina Adamellite.

BALTA GRANITE

The name is adapted from Balta Baltana Creek which drains northwards past Mount Woods and into Lake Cadibarrawirracanna.

Distribution and Field Relationships

Outcrops of the Balta Granite are widespread in the southern and central portions of the inlier. The Balta Granite is generally non-foliated and exhibits cross-cutting boundary relationships with the foliation in the metamorphics.

Petrography and Geochemistry

The Balta Granite consists of a variety of porphyritic and non-porphyritic granitoids which exhibit a range in colour, texture and mineralogy. These granitic rocks can be allocated to one of four general types.

a. Brick-red granites. The distinctive colour is due to the high (60%) microcline content; the microcline ranges in grain size from 0.5 to 1.5 mm with occasional larger crystals up to 4 mm. Quartz, and to a lesser extent plagioclase, are the other dominant constituents with minor biotite, muscovite and opaque minerals (Whitehead, 1976).

b. Fine porphyritic granites. Grey to red fine porphyritic granites and adamellites are characterised by subidiomorphic phenocrysts (up to 5 mm) of microcline, plagioclase and to a lesser extent quartz set in a groundmass with a grain size of

0.2 to 0.8 mm, comprising quartz, microcline, hornblende and plagioclase. Biotite and muscovite are generally absent though hornblende is present in small quantities (2-3%).

c. Coarse porphyritic granites. Coarse porphyritic granites have a groundmass with a grain size of 0.5 to 1.0 mm, large (10-15 mm) red potash feldspar phenocrysts, and smaller white to pale green plagioclase phenocrysts. The potash feldspar phenocrysts are microcline and orthoclase and both exhibit ropy to ribbon-like perthitic intergrowth, while plagioclase phenocrysts exhibit well-developed polysynthetic twinning. The interstitial groundmass comprises inter-locking quartz, microcline, plagioclase, biotite (5-10%), and opaque minerals (Radke, 1976; Whitehead, 1976, 1977).

d. Hybrid granite. Banded hornblende, biotite, scapolite-rich hybrid granites in the northern outcrops of the Balta Granite are distinguished by a layering which is defined by the parallelism of numerous red ovoid, feldspar xenocrysts up to 50 mm across, xenoliths of coarse-grained quartz and feldspar, and quartz feldspar segregations. The hybrid granite comprises up to 15% hornblende and scapolite.

The Balta Granite (based on only two silicate analyses of a porphyritic leucogranite and an adamellite) has less Na_2O and more K_2O than the world average for granites (Le Maitre, 1976). In the trace elements the Balta Granite shows lower abundances in Cr, Li, Ni, Pb, Sr, Zn than the Engenina Adamellite. Additional trace elements analyses are recorded in Flint and Benbow (1977).

Geochronology

Samples were taken from the brick-red granite and fine and coarse-grained porphyritic granites for geochronology. However, six total rock samples yielded a non-linear distribution. Approximate ages can be obtained by assigning initial Sr 87/Sr 86 ratios of 0.708 (from Engenina Adamellite) which yield individual dates for each sample in the range 1450-1550 Ma (Webb, 1977).

TABLE 1

Silicate analyses (%) and trace element abundances (p.p.m. for the Engenina Adamellite and Balta Granite.

	A	B	C	D	E	F
SiO_2	65.38	64.07	68.65	76.51	69.83	71.30
TiO_2	.66	.62	.54	.15	.46	.31
Al_2O_3	15.40	15.01	14.55	11.47	13.53	14.32
Fe_2O_3	2.21	1.98	1.23	2.15	1.27	1.21
FeO	3.41	3.00	2.70	.24	3.03	1.64
MnO	.15	.13	.08	.01	.13	.05
MgO	1.50	2.49	1.14	.09	.51	.71
CaO	2.43	2.91	2.68	.21	1.19	1.84
Na_2O	3.28	3.29	3.47	2.74	2.63	3.68
K_2O	4.27	4.94	4.00	5.92	5.79	4.07
P_2O_5	.22	.30	.19	.05	.13	.12
H_2O+	.57	.74	.59	.14	.60	.64
H_2O-	.33	.29	.14	.33	.30	.13
Total	99.80	99.76	99.96	100.02	99.40	100.02

	A	B	D	E	G
Au	<.05	<.05	<.05	<.05	.004
Ba	1000	1350	660	1950	600
Co	5	<5	<5	<5	1
Cr	70	110	70	35	4
Cu	25	17	13	7	10
Li	81	41	5	22	33
Mo	<3	<3	<3	<3	2
Ni	45	50	20	20	.5
Pb	26	55	6	12	20
Rb	240	250	180	170	150
Sr	290	640	50	140	285
Th	30	55	60	10	17
U	8	10	8	4	4.8
V	45	70	5	<5	20
Zn	77	68	7	550	40
Zr	290	730	410	570	180

A. Porphyritic granodiorite of Engenina Adamellite.
Specimen 5935 RS 8

B. Porphyritic adamellite of Engenina Adamellite.
Specimen 5939 RS 16

C. Average analysis of 113 adamellites from Le Maitre (1976).

D. Porphyritic leucogranite of Balta Granite.
Specimen 5938 RS 2.

E. Adamellite of Balta Granite. Specimen 5939 RS 14.

F. Average analysis of 2236 granites, from Le Maitre (1976).

G. Trace element abundance for granites, from Berkman (1976).

Analyses A, B, D, E by the Australian Mineral Development Laboratories.

GEOPHYSICAL PROPERTIES

The Mount Woods Inlier is the only area of exposed basement rocks which coincides with a conspicuous belt of high Bouguer gravity and aeromagnetic intensity anomalies on the northeastern margin of the Gawler Craton. Hence to aid interpretation of geophysical surveys in the region the specific gravity (s.g.) and magnetic susceptibility (m.s.) of various rocks within the inlier were determined by Flint and Benbow (1977) and are summarised here in Table 2. Values for the porphyritic granitoids of the Balta Granite were not determined. The s.g. values for the Engenina Adamellite and Balta Granite fall within the range of values quoted for granitic rocks in Berkman (1976), however the m.s. are significantly higher.

TABLE 2

	SPECIFIC GRAVITY		MAGNETIC SUSCEPTIBILITY ($\times 10^{-6}$ cgs units)		NO. SAMPLES
	Mean	Range	Mean	Range	
ENGENINA ADAMELLITE	2.65	2.62-2.70	220	9-655	7
BALTA GRANITE (Brick-red granites)	2.59	2.58-2.61	35	0-145	6
BALTA GRANITE (hybrid granite)	2.66	2.61-2.70	460	8-1200	12

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REFERENCES

Berkman, D.A., 1976. Field geologists' manual. Australas. Inst. Min. Metall., Victoria.

Daly, S.J., Webb, A.W., Whitehead, S.G., 1978. Archaean to Early Proterozoic banded iron formations in the Tarcoola region. South Australia. Trans. R. Soc. S. Aust., (in press).

Flint, R.B., and Benbow, M.C., 1977. Geology of the Mount Woods Inlier. S. Aust. Dept. of Mines report 77/134 (unpublished).

Le Maitre, R.W., 1976. The chemical variability of some common igneous rocks. J. Petrology 17 : 589-637.

Radke, R., 1976. Petrography of eleven rocks from the DALHOUSIE and BILLA KALINA sheets. Amdel report No. MP 171/76 (unpublished).

Webb, A.W., 1977. Geochronology of stratigraphically significant rocks from South Australia. Amdel report Project AN 1/1/126. Progress report No. 16 (unpublished).

Whitehead, S., 1976. Description of metamorphic and igneous rocks from the Coober Pedy area. Amdel report No. MP 3788 and 3789/76 (unpublished).

Whitehead, S., 1977. Description of metamorphic and igneous rocks from the crystalline basement, Mount Woods Inlier. Amdel report No. MP 308/77 (unpublished).

Whitten, G., 1965. Report on two aeromagnetic anomalies near Mount Woods, S. Aust. Dept. of Mines report 60/24 (unpublished).