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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
REGIONAL SURVEYS SECTION

REPORT ON A VISIT TO THE AUSTRALIAN NATIONAL UNIVERSITY,, THE BUREAU OF MINERAL RESOURCES, & OTHER UNIVERSITIES

by

A. R. Crawford

1. As the writer is one of several members of the Geological Survey involved in a major age-determination project jointly being undertaken with the Australian National University (involving also A.M.D.L. and the Bureau of Mineral Resources) and has been the one most concerned with it, he was granted three days' official duty in Canberra while taking recreation leave in the eastern States. In fact, four days were spent at the A.N.U. and one at the Bureau. Later, three days were spent visiting the University of New England, Armidale and one at the University of Sydney.

2. Detailed discussions covering the whole of the age-determination project were held with Dr. Compston, who is in charge of the rubidium-strontium work at A.N.U. Provisional results using this method which are confidential at this stage and not for release in any circumstances to persons or bodies outside the Geological Survey are given below.

In addition other methods of age-determination, and other mass-spectrometer work were discussed at the request of various members of the School of Physical Sciences, and the techniques demonstrated.

Problems in the palaeomagnetic work on the Adelaide System which is being undertaken by Mr. J. C. Briden under the supervision of Mr. E. Irving were discussed. For reasons not well understood,

all the samples from sites carefully chosen by Mr. B.P. Webb have turned out to be useless, showing a chaotic scatter. It was agreed that attention should be ultimately diverted to the Wooltana volcanics and Gawler Range porphyry. One possible source of error is thought to be some kind of magnetic effect from millenia of diurnal change on exposed surfaces. As it would be relatively easy to extract samples from within columnar structures such as frequently outcrop in the Gawler Ranges, it might be possible to eliminate this error. Some sampling from the bottoms of holes blasted in the volcanics for age determination sampling may be desirable also. However, the need to deal now with some Tasmanian rocks has first priority.

The experiments of Dr. Mervyn Paterson on deformation of rocks under very high pressures were discussed with him and the equipment demonstrated. Plans are in hand for construction of equipment for work in intensely high pressures and on heated rocks, using steel which has been tested several times to detect any flaws. The pressures achieved and the accompanying danger can be imagined when it is realized that if the equipment exploded and if all the energy could be directed upwards, the piston in the present equipment would fly 50 km. into the air, where no doubt it would compete with other fashionable objects but would be more difficult to retrieve.

The writer was also fortunate in being able without injury to visit the huge homopolar generator at a time when 100 million joules were put through the wiring. This equipment did blow up 2 days later, injuring 4 men, one seriously.

At the request of Professor Jaeger the writer gave a seminar tomembers of both parts of the University to which officers of the Bureau were invited. About 50 people attended this talk, the title of which was 'The Wooltana Volcanics and the Gawler Range Porphyry, South Australia.' The pleasure of being asked to give this talk was mildly marred by the obligation to deliver it in a building inconveniently sited between those in which the two potentially very explosive pieces of equipment were assembled.

This possibly explains why none of the audience fell asleep.

As a result of delivering this talk the writer met Mr. Colin Branch of the Bureau, who has for 5 years been working on the North East Queensland igneous province, where he has discovered large ring structures (including many ring dykes) - though not of Gawler Ranges scale - in volcanic and granitic rocks. The association of these with tin mineralization is of great interest, as this association occurs in the Gawler Ranges volcanic complex, where a fluorite-bearing vuggy granite intrusive into the main southern porphyry at Hiltaba was recently discovered by the writer with J. Johnson in checking an area of significantly different appearance on the mosaics.

Kunkar and Quaternary matters generally were discussed with Mr. J. R. Jennings, Senior Lecturer in Geography in the School of Pacific Studies, and a lengthy discussion on South Australian geology was held with Dr. Alan White at the Department of Geology, School of General Studies (who was responsible for the mapping of the western half of our Mannum one-mile sheet). Dr. White is making petrofabric studies of rocks from the Palmer area, from which he has been obliged to draw certain conclusions which I suggested simultaneously to him (to his satisfaction), which we had independently arrived at merely by logical deduction from a study of the apparently anomalous age determinations made by A.N.U. on the Palmer and Encounter Bay granites.

A lecture by Professor Charles Park of Stanford University U.S.A., was attended at the invitation of Professor D. A. Brown. Professor Park's lecture on stratigraphic-type manganese mineralisation was of great interest. He has studied numerous occurrences in North, Central and South America and all of these are apparently associated with underlying dolomitic rocks and overlying tuffaceous rocks. This is very interesting as the important Pernatty Lagoon occurrence in South Australia is underlain by dolomitic rocks. The overlying beds (which are, significantly, copper-bearing) are described in Dickinson's Bulletin No. 20 (p. 32) as 'red sandstones

and grits'. As the rock known as the Moonabie Grit is now known to be a tuff and not a grit, and as the Pernatty occurrence lies on the northward projection of the Middleback lineament at the southern end of which the Moonabie tuff occurs (a lineament I regard as a fissure source), I am of the opinion that there is a very good chance of our finding that the Pernatty Manganese is of the same type as the American ones studied by Professor Park. It is therefore very desirable that he sees this occurrence, of which he was unaware, and I have asked him to request that his programme in South Australia does in fact make this possible.

At the Bureau the writer discussed the age determination work with Dr. B.P. Walpole; volcanics with Mr. Colin Branch (~~who for five years has been engaged in what seems a first-rate study of the large north Queensland igneous province, where tin mineralisation is closely associated with large ring structures~~); the Bureau's mapping programme and techniques with Mr. W. Dallwitz; and Palaeozoic stratigraphy (especially of western N.S.W. and Victoria) with Dr. A. A. Öpik. Dr. Öpik informed him that the Mootwingee Series of western N.S.W. is undoubtedly Lower Ordovician; fossil evidence was shown to me.

At the University of New England, Armidale, Professor A. H. Voisey, Dr. J.L. Harrington and Mr. S. M. Richards spent two days with the writer in the field and much discussion was held in the University. Professor Voisey, who is a great admirer of our maps, particularly asked for my advice on the layout and style of a series of black-and-white one-mile maps of New England which are being prepared by him and his colleagues and students for publication, in lieu of any mapping programme in that vast terrain on the part of the N.S.W. Geological Survey. Dr. Harrington was interested in obtaining advice on areas of geological stratigraphy and structure in South Australia which were South Australian Lands Department air photographs and would be suitable for teaching exercises. This I promised to look into. Mr. Richards, who is engaged in studies of the Banded Iron Formation at Broken Hill and the Potosi Gneiss, described his results so far.

A Dr. J. Whetton from the University of Iowa, U.S.A., and at present on a research study based at Armidale dealing with Permian glacials, asked if it would be possible to be conducted through the classical Permian coastal localities of South Australia in January or February of next year. I said that I was sure that this could be arranged if he would be kind enough to write to the Director giving us a little notice.

At the University of Sydney the writer discussed volcanics and structural geology in S.A. and northern N.S.W. with Professor C. B. Marshall and also talked with Dr. T.H.B. Jenkins.

PROVISIONAL AGE-DETERMINATIONS ON SOUTH AUSTRALIAN ROCKS

BY W. COMPSTON, A.N.U.

USING STRONTIUM-RUBIDIUM METHOD.

(Confidential)

WOOLTANA VOLCANICS (All trachytes)

		Age (M.Y.)
342	Merinjina Upper (1 ml. S. of Wooltana H.S.) Apparently 'preserved' and reliable.	1250 ± 100
345	Arkaroola Creek, Old Paralana mail track crossing (10 mls. N. of Wooltana H.S.)	1270 ± 100
346	'Triangle of volcanics' (12 mls. NNW of Wooltana H.S.) Compston suggested this rock suffered extensive addition of Rb or loss of Sr during Lower Palaeozoic orogeny (or both). In opinion of A.R.C. it is from a neck which could well be younger than the surrounding rocks and conceivably Cambrian.	"Cambrian-Ordovician"
349	2 creeks N. of Wooltana H.S. less than ½ mile west of main lineament flanking Flinders Ranges. Chemically like 346; field occurrence (lava in bedded form) suggests that chemical change took place due to orogeny and location	ditto

DEPOT CREEK, WILKATANA

353	A Willouran trachyte, but ½ mile east of main lineament flanking west side of S. Flinders Ranges. Apparent age by	

		Age (M.Y.)
353(contd.)	'total rock' method is 750 M.Y. (maximum). Age indicated by albite is Ordovician, so minerals at least have not been closed systems. True age may be as old as Roopenas and 'preserved' Wooltanas.	

CRAPARINNA

351	A trachyte thought at first to be in place but now realized to be diapirically placed. Albite apparent age is younger than 'total rock' apparent age. Maximum apparent age is approx. 1050 M.Y. True age indefinite.	

ROOPENA LAVAS

369 & 370	Trachytes 10 miles east of Iron Knob petrographically very similar to the Wooltana rocks and underlying conglomerates mapped by Miles et al as Corunna Conglomerate i.e. exactly the same age as the Wooltanas.	1270 ± 25

CHARLESTON GRANITE (often known as Midgee Granite)

481	Replicate analyses on biotite and by 'total rock' are in exact agreement.	1520 ± 30

MOONABIE PORPHYRY (intruded by Charleston Granite)

387	One analysis only so far	1720

BURKITT HILL (TOR) GRANITE(immediately SE of Gawler Range Porphyry main mass, and north-west of Iron Knob.)

480	One analysis only so far.	1720

GAWLER RANGE PORPHYRY

366	CORALBIGNIE
367	KOLENDO
368	KUNDERY

		Age (M.Y.)
	Those three all give an age of	1530 ± 30
	This is particularly satisfying as they are all from what A.R.C. regards as one main body.	
374	KOKATHA (renamed now CAMEL HUMP TANKS as Kokatha M.S. area 25 miles N.W. is a separate volcanic complex)	
	One analysis only so far	1590
	This is from an area well north of 366-368 and which is of uncertain relation as yet to the main southern body.	
370	CORUNNA	
	One analysis only	1430
	This is from an area in the extreme S.E. of the G.R.P., and which extends in outcrop as a long finger-like projection from the main body strongly suggestive of a huge dyke. It is radial to the arcuate boundary of the main body hereabouts. As the nearby intrusion of G.R.P. into the Corunna conglomerate noted first by Johns and Solomon (1953) has been regarded by A.R.C. as a 'late phase' of the volcanics and is in a somewhat analogous position, this result is of much interest.	
	<u>WILGENA (WARNA WELL, 'TARCOOLA') GRANITE</u>	
?	Biotite result only.	1510

TRURO TRACHYTES (Lower Cambrian, as mapped by R. P. Coats)

A specimen thought at first by Dr. Compston to provide a reliable result has after further work on the albite (cogenetic with the microcline) given a definite Upper Ordovician age. Compston regards the veins from which these minerals were extracted as the result of greenschist metamorphism experienced in Upper Ordovician time, states that the lava is definitely older, but is unable to say by how much. Other samples from locations which Mr. Coats has mapped will be sent to Dr. Compston.

MOUNT PAINTER COMPLEX

Determinations on these rocks, some of which have been completed, were not discussed for lack of adequate time. The general state of work on them is not so far advanced as on those listed above.

Dr. Compston (together with Dr. Aldrich from U.S.A.) wishes to visit the Wooltana area in September to examine sample locations and to sample intensely a small area, which will enable him to cope with Sr/Rb loss/gain in samples from 'one point'. As sample 345 (Arkaroola Creek Crossing) is the most reliable of the eight sampled in 1961, and is also a locality where outcrops are extremely good it is provisionally proposed to tackle that locality.