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Summary

Potassium-argon ages on biotite and hornblende from each of three granites in the Eungella area, west of Mackay, range from 122 to 128 m.y. The agreement between the biotite and hornblende ages suggests that this is an intrusive age. This is the first evidence for Cretaceous granites outside the Maryborough Basin. There is no sign of orogeny accompanying the intrusion of the granites.

Granites of Lower Cretaceous age have been discovered in the course of a joint programme of radioactive dating of the granites in the Bowen Basin by the Bureau of Mineral Resources and the Department of Geophysics, Australian National University. These granites occur near Eungella, west of Mackay, on the north-eastern margin of the Bowen Basin, and were described by Wyatt in 1958, and by combined field parties of the Bureau of Mineral Resources and Geological Survey of Queensland between 1960 and 1962. The mapping of the field relationships between the granites and the surrounding Lower Bowen Volcanics has been hampered by the nature of the terrain. Rugged mountains rise up to 4,000 feet in height, and are covered with dense rain forest on the coastal edge. Vehicular access is limited. The Lower Permian Lower Bowen Volcanics are intruded by granites, but there is no upper limit to their age. Estimates of the age of the granites include Permian or older (Gradwell, in Hill and Denmead, 1960, p.249), and Upper Carboniferous to Upper Triassic (Malone, *et al.* 1962). Three granites from the Urannah Complex, which occur between 30 and 100 miles north of this area, have K-Ar ages of 270 m.y. (Webb, *et al.* 1963).

Two of the present samples are from the Mount Barker Granodiorite, a stock 10 square miles in area, which intrudes the Lower Bowen Volcanics, about 8 miles west of Eungella. The third sample is from the main mass of the Urannah Complex, about one mile from Eungella on the road to Mackay. It is not possible to state whether this sample is from an extensive granite body, or a small stock like the Mount Barker Granodiorite. Wyatt (1958) has mapped this rock type as cropping out only in the valley of Cattle Creek and on the slopes of the range east of Eungella. The rocks are biotite-hornblende granodiorites, and are similar chemically and petrographically to the older granodiorites of the Urannah Complex already dated.

Biotite and hornblende were separated from each sample. Potassium was determined by flame photometry as described by Cooper (1963); replicate analyses agreeing to better than 1 per cent. Argon was measured by isotope dilution (McDougall, 1963); duplicate analyses generally agreeing to better than 2 per cent. The analytical data are given in Table 1. The ages obtained range from 122 to 128 m.y., and correspond to Lower Cretaceous on the time-scale of Kulp, (1961). The close agreement between the biotite and hornblende ages for each sample is strong evidence that a definite geological event occurred at this time; either the intrusion of the granite, or a strong and widespread thermal metamorphism. The absence of signs of metamorphism in the surrounding Permian volcanics, outside the narrow contact aureoles, suggests that the age determined is an actual intrusive age.

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These granites occur in an unusual tectonic setting. The only known area of Cretaceous orogeny in Australia is the Maryborough Basin; but the measured ages of granite intrusion in this basin (140 m.y. and 110 m.y., Evernden and Richards, 1962) do not correspond with the ages of the granites in the Eungella area. There is no evidence of orogeny in this region since the folding phase which closed sedimentation in the Bowen Basin in the Triassic. Most post-Triassic intrusions in eastern Australia are volcanic, while the granodiorites near Eungella appear to be plutonic. They have a normal granite texture and composition, and if they were associated with extrusives, these volcanics have since been removed by erosion. They appear to be high level, post-tectonic granites, and although their position in space, in the site of the old Permian pluton, would suggest that these granites accompanied the orogeny which folded the rocks of the Bowen Basin, the age measurements indicate they were emplaced at least 70 m.y., after the last folding movement.

The most probable conclusion is that the intrusion of these granites accompanied some so far undetected event in the Lower Cretaceous. A long and straight structure, trending east-west, controls the course of Cattle Creek and the Pioneer River. This penetrates the Clarke Range for some distance and ends abruptly just to the east of Eungella. The Cretaceous granites lie to the west of this point, and in line with it. The nature and age of this lineament is unknown, but it is possible that this line controlled the emplacement of the Lower Cretaceous granites.

The mineral separations were done by J.M. Rhodes and R. Rudowski. J.A. Cooper determined the potassium. E.J. Malone and A.R. Jensen collected the samples and critically read the manuscript.

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TABLE 1

POTASSIUM-ARGON AGES FROM THE EUNGELLA AREA,
QUEENSLAND

GA No.	Mineral	Average % K	$^{40}\text{Ar}/^{40}\text{K}$	% Atm. Ar_{40}	Age $\times 10^6$ yrs.
781	Biotite	7.0	0.007373	11.2	122
	Hornblende	0.307	0.007399	41.3	123
782	Biotite	6.78	0.007562	13.2	125
	Hornblende	0.296	0.007366	65.6	122
792	Biotite	7.10	(1) 0.007730	6.4	128
			(2) 0.007644	3.5	127
	Hornblende	0.467	0.007544	21.4	125
$\lambda_B = 4.72 \times 10^{-10} \text{ yr}^{-1}$		$\lambda_K = 0.584 \times 10^{-10} \text{ yr}^{-1}$		$\text{K}^{40} = 1.22 \times 10^{-4} \text{ g/g}$	

Sample LocationsGA 781 : Mt. Barker Granodiorite. Lat. $21^\circ 9\frac{1}{2}'$ Long. $148^\circ 23'$ GA 782 : Mt. Barker Granodiorite. Lat. $21^\circ 8\frac{1}{2}'$ Long. $148^\circ 24'$ GA 792 : Urannah Complex. Lat. $21^\circ 8'$ Long. $148^\circ 30\frac{1}{2}'$