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K-Ar mica dates for granites from the Bujang Melaka area

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Abstract: K-Ar analysis of micas from 12 localities in the Bujang Melaka pluton yielded dates ranging from 131 ±5 Ma to 235 ± 8 Ma. The anomalously old dates are ascribed to samples that have been probably contaminated with sources of radiogenic argon. On the other hand, thermal influence in the vicinity of fractures is deemed responsible for the partial resetting of the K-Ar systems in samples which are too young. In general, the rest of the K-Ar dates are in agreement with those of Bignell and Snelling (1977), and are concordant with their established Rb-Sr whole-rock isochron age of 218 ± 5 Ma for the Bujang Melaka pluton. No significant time lapse is evident from the K-Ar data for the different varieties of granites in the area, thus suggesting that these probably represent different consanguineous phases of the same pluton. A single K-Ar date of 211 ± 6 Ma for muscovite from greisen in the Chenderiang area (Bignell and Snelling, 1977) supports the hypothesis that the pegmatites and associated mineralisation of tin are related to the residual aspect of this same intrusive event.

INTRODUCTION

The area studied is situated at the southeastern flank of the Kinta Valley about 35 km SSE of Ipoh. It is bounded by latitudes 4°14'N to 4°23'N and longitudes 101°9'E to 101°15'E (Figure 1).

The granites in the area outcrop as a dome-like structure, roughly elliptical in shape, and elongated in a northerly direction. They occupy an area of approximately 200 km^2 and represent an offshoot from the Main Range batholith. Three distinct types of granites have been described by Askury (personal communication) viz. a medium to coarse-grained porphyritic granite (the Bujang Melaka type), a fine to medium-grained variably porphyritic to non-porphyritic variety (the Relau type) and a silicified medium-grained granite (the Temoh type). The finer-grained varieties occur as a core within the coarser grained type. Spatial relationships observed in the field suggest that the former is younger although it was not possible to ascertain whether it represents a distinctly younger episode. Riley (1968), however, is of the opinion that the finer-grained varieties are distinctly younger than the coarser-grained type.

Tourmaline aplites, in the form of veins or dykes, commonly occur as a marginal feature of the main granite mass. Pegmatites are more localised and have been reported in the Chenderiang area and at Ulu Petai. These are known to be associated with tin mineralisation. Ingham and Bradford (1960) described the tin deposit at Ulu Petai as a pegmatite pipe in aplite. This deposit was spo-

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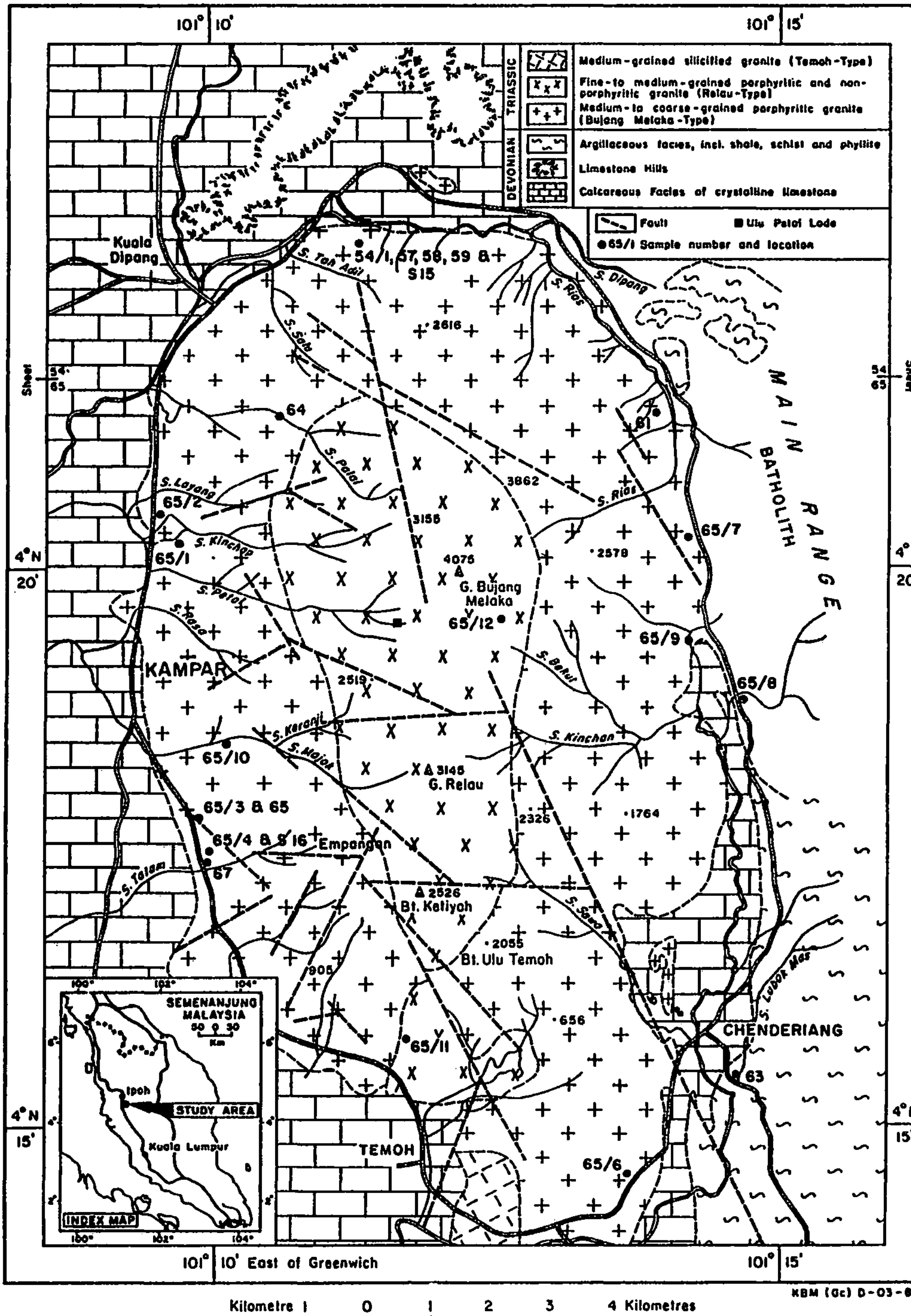

Figure 1: Bujang Melaka: Geology and sample locations.

radically mined between 1908 and 1929. It carried cassiterite, wolframite, galena, pyrite, chalcopyrite, arsenopyrite and sphalerite besides being very rich in tourmaline, topaz and fluorite.

Xenoliths are abundant, particularly at the northern part of Bujang Melaka near Kuala Dipang and Kampar. Two varieties have been observed viz. a melanocratic type and a leucocratic type. The former variety predominates and consists of bands of biotite in an aggregate of quartz and feldspar. It is believed that these xenoliths represent fragments of shale that had been assimilated by the granite.

The surrounding country rocks are part of the Calcareous Series of Ingham and Bradford (1960) which is predominantly made up of recrystallised limestone (the Calcareous Facies) with minor interbeds of shale, schists, phyllite and rare quartzite (the Arenaceous Facies).

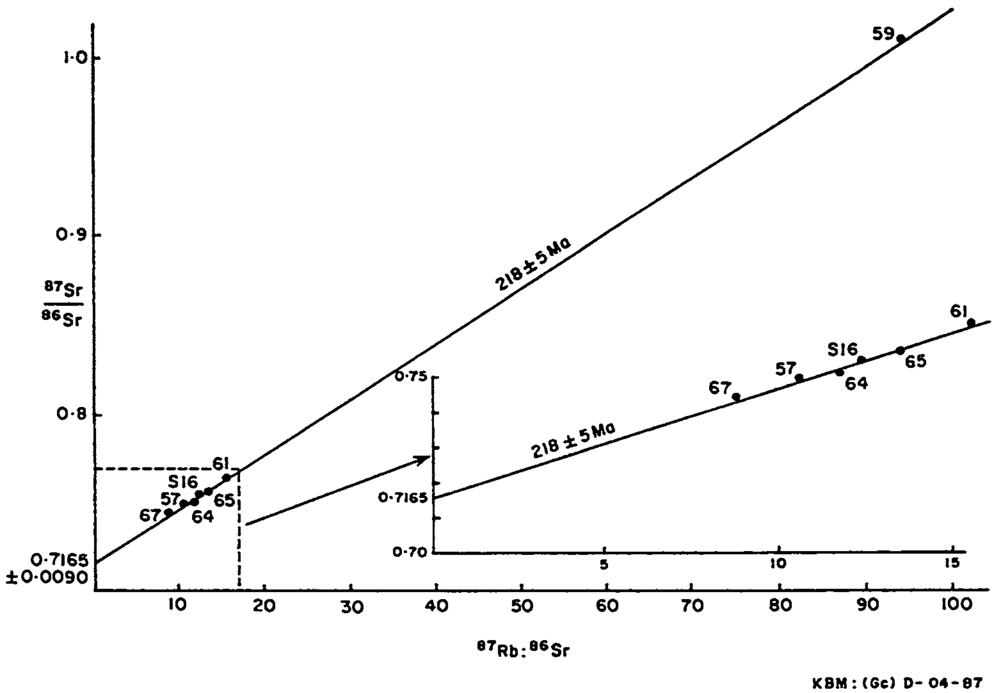

Figure 2: Isochron diagram for granites from Bujang Melaka (Bignell and Snelling, 1977). Age recalculated using the constants recommended by Steiger and Jaeger, 1977.

Table 1a : K-Ar age determinations of granites from Bujang Melaka (Bignell and Snelling, 1977).

Sample No.	% K	Vol. $^{40}Ar_{rad}/g$ (x10^{-6} ccm STP)	Age in Ma
58 Bi	6.66	56.82	207 ± 4
63 Mu	6.43	55.87	211 ± 6
S15 Bi	7.36	72.51	210 ± 5
S16 Bi	6.53	55.47	205 ± 4

Table lb : Whole-rock Rb-Sr data for granites from Bujang Melaka (Bignell and Snelling, 1977).

Sample No.	ppm Rb	ppm Sr	$^{87}Rb:^{86}Sr$	$^{87}Sr:^{86}Sr$
57	332	91.2	10.57	0.7500
59	689	21.2	94.26	1.0111
61	355	66.1	15.55	0.7650
64	349	86.3	11.73	0.7512
65	359	77.7	13.43	0.7575
67	302	99.3	8.82	0.7449
S16	335	78.1	12.33	0.7549

PREVIOUS GEOCHRONOLOGICAL WORK

Bignell and Snelling (1977), included the Bujang Melaka pluton in their geochronological study of the Malayan granites. The analytical data for both their K-Ar and Rb-Sr work are summarised in Figure 2, Tables 1a and 1b. The ages have been recalculated using the constants recommended by Steiger and Jaeger (1977) for comparison.

K-Ar analysis of 3 biotites from 2 localities yielded ages ranging from 205 ± 4 Ma to 210 ± 5 Ma while a solitary muscovite age of 211± 6 Ma was recorded for a specimen of greisen from the Chenderiang area (Table 1a).

The Rb-Sr results for 7 whole-rock granite samples gave an isochron age of 218 ± 5 Ma, R_i= 0.7165 ± 0.0090 (Fig. 2 & Table 1b). All samples analysed for Rb/Sr belong to the Bujang Melaka type except Sample No.59 which is of the finer-grained Relau type.

PRESENT WORK

For the present study, a total of 12 samples (30 kgs each) were collected and conventional methods of sample treatment involving use of magnetic separators and shaking tables were employed to obtain the mica concentrates. The 60 to 80 ASTM mesh size fraction was selected for isotopic age determinations. The measurements of potassium were carried out by using a flame photometer with a lithium internal standard. The precision for this equipment is quoted to be better than ± 0.61% relative standard deviation. The argon isotopic compositions were determined by the isotope dilution technique with a VG 1200MM mass spectrometer operating in the static mode (Flisch, 1982), employing an enriched ^{38}Ar spike. K-Ar ages were computed using the IUGS recommended constants (Steiger and Jaeger, 1977). The error for these computations is estimated to be less than 4% at the 95% confidence level.

RESULTS

Table 2 summarises the K-Ar analytical results. The dates for biotites range from 131± 5 Ma to 253 ± 8 Ma while those for muscovites range from 203 ± 6 Ma to 212 ± 7 Ma. Biotite dates from 3 localities viz. 54/1, 65/1 and 65/7 are apparently high while 2 other samples viz. 65/4 and 65/8 gave anomalously low values. All other mica dates generally agree with those reported by Bignell and Snelling (1977).

Table 2 : Analytical data and K-Ar mica dates for granites from Bujang Melaka.

No.Sample No		% K	Vol. $^{40}Ar_{red}$/g (x10^{-6} ccm STP)	% $^{40}Ar_{red}$	Age in Ma
54 / 1	Bi	6.10	63.00	94.3	248 ± 8
65 / 1	Bi	4.78	49.15	87.6	247 ± 8
65 / 2	Bi	7.20	6.15	96.8	209 ± 8
65 / 3	Bi	3.53	29.48	86.7	203 ± 7
65 / 4	Bi	2.30	13.53	82.9	145 ± 6
65 / 6	Bi	6.00	49.62	97.1	201 ±6
65 / 6	Mu	8.70	74.73	95.7	208 ± 6
65 / 7	Bi	5.80	61.18	96.1	253 ± 8
65 / 8	Bi	7.25	38.31	72.1	131 ±5
65 / 9	Bi	7.60	64.20	97.8	205 ± 7
65 / 10	Bi	6.75	60.65	98.4	218 ± 7
65 / 11	Mu	8.55	74.88	96.7	212 ± 7
65 / 12	Bi	7.10	60.72	95.9	208 ± 6
65 / 12	Mu	7.48	62.55	97.3	203 ± 6

INTERPRETATION

The older K-Ar dates have been assigned to samples that were collected from outcrops with abundant xenoliths, particularly the melanocratic variety. These xenoliths are probably the source of contamination which had contributed the excess radiogenic argon. The samples that yielded younger K-Ar dates, on the other hand, were collected in the vicinity of fractures which may have served as channels for the thermal influence that was responsible for the partial resetting of the K-Ar systems in these samples.

The remaining K-Ar mica dates (including those of Bignell and Snelling, 1977) are between 201 ± 6 Ma and 218 ± 7 Ma. These are considered to be concordant with the 7-point Rb-Sr whole-rock isochron age of 218 ± 5 Ma established by Bignell and Snelling (1977) for the Bujang Melaka pluton.

The K-Ar biotite and muscovite dates for the finer-grained Relau type yielded concordant values ranging from 203 ± 6 Ma to 212 ± 7 Ma. These dates substantiate the hypothesis that there is no significant time lapse between the emplacement of the different types of granites encountered in the Bujang Melaka area, thus indicating that they are different contemporary phases of the same intrusion.

A single K-Ar date of 211 ± 6 Ma had been analysed by Bignell and Snelling (1977) for muscovite from greisen associated with pegmatites in the Chenderiang area. This suggests that the tin mineralisation and the related pegmatites represent a residual phase of the granite intrusion in the Bujang Melaka area.

CONCLUSION

The K-Ar mica dates are generally concordant with the Rb-Sr whole-rock isochron age of 218 ± 5 Ma established by Bignell and Snelling (1977) for the Bujang Melaka pluton.

No significant time lapse is evident from the K-Ar data for the various types of granites in the area. As such, these different varieties of granites are considered to be different consanguineous phases of this pluton.

The single K-Ar date for muscovite from greisen in the adjacent Chenderiang area suggests that the pegmatites and the related tin mineralisation are representative of the residual aspect of this intrusive event.

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