Geol. Soc. Malaysia, Bull. 8, December 1977, pp 89–93.

K-Ar ages on some basic igneous rocks from Peninsular Malaysia and Thailand

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(submitted 14 March 1975, revised version accepted 26 June 1975)

Abstract: The K-Ar data indicate that in East Pahang and Trengganu there have probably been episodes of basic igneous activity during the Jurassic, Cretaceous and Pleistocene. The potassium-rich lavas of Segamat, Johore are at least early Palaeocene in age. A late Miocene age was given by a basalt from Ko Kut, an island in the Gulf of Thailand.

INTRODUCTION

In a reconnaissance study, the K-Ar method has been used to date samples of basic igneous rocks from Trengganu, Pahang and Johore in Peninsular Malaysia, and from Ko Kut, an island in the Gulf of Thailand. The samples all come from bodies that post-date the late Triassic diastrophism that affected the Malay Peninsula but conclusive evidence for the precise stratigraphic age of the Malaysian samples is lacking.

The K-Ar method of dating minerals and rocks, has been described adequately elsewhere (Dalrymple and Lanphere, 1969). It is sufficient to note here that there are no reasons to think that the analysed samples are likely to have incorporated any significant amounts of extraneous argon and hence the ages can be accepted as reliable minima.

Radiogenic argon was determined by isotope dilution using ^{38}Ar as the tracer, and the potassium by flame photometry. Details of the analytical procedures used are given in Bignell, Snelling and Harding (in press).

The analytical data and results are given in Table 1. The precision limits on the ages are at the 95% confidence level.

DOLERITE FROM TRENGGANU

The basic, intermediate and lamprophyric dykes of Trengganu have been described in MacDonald (1967) and Hutchison (1973 b). Both authors quote from the unpublished work of J.R. Paton. Paton believed that the dolerite was intruded shortly after the crystallization of the granitic batholiths and that the variety of the dyke rocks was the result of assimilation of granitic material by the basic magma.

Several of these dykes are well exposed in the JKR Sungai Serai quarry about 15km SSW of Kuala Trengganu (Fig. 1) where they intrude granite. A sample of a dolerite dyke (Table 1, No. 1) has given an early Jurassic age of 189 m.y.

The batholith into which this dyke was intruded is believed to be 250 m.y. old. K-Ar ages of micas from the batholith are concordant with the Rb-Sr whole-rock age, indi-

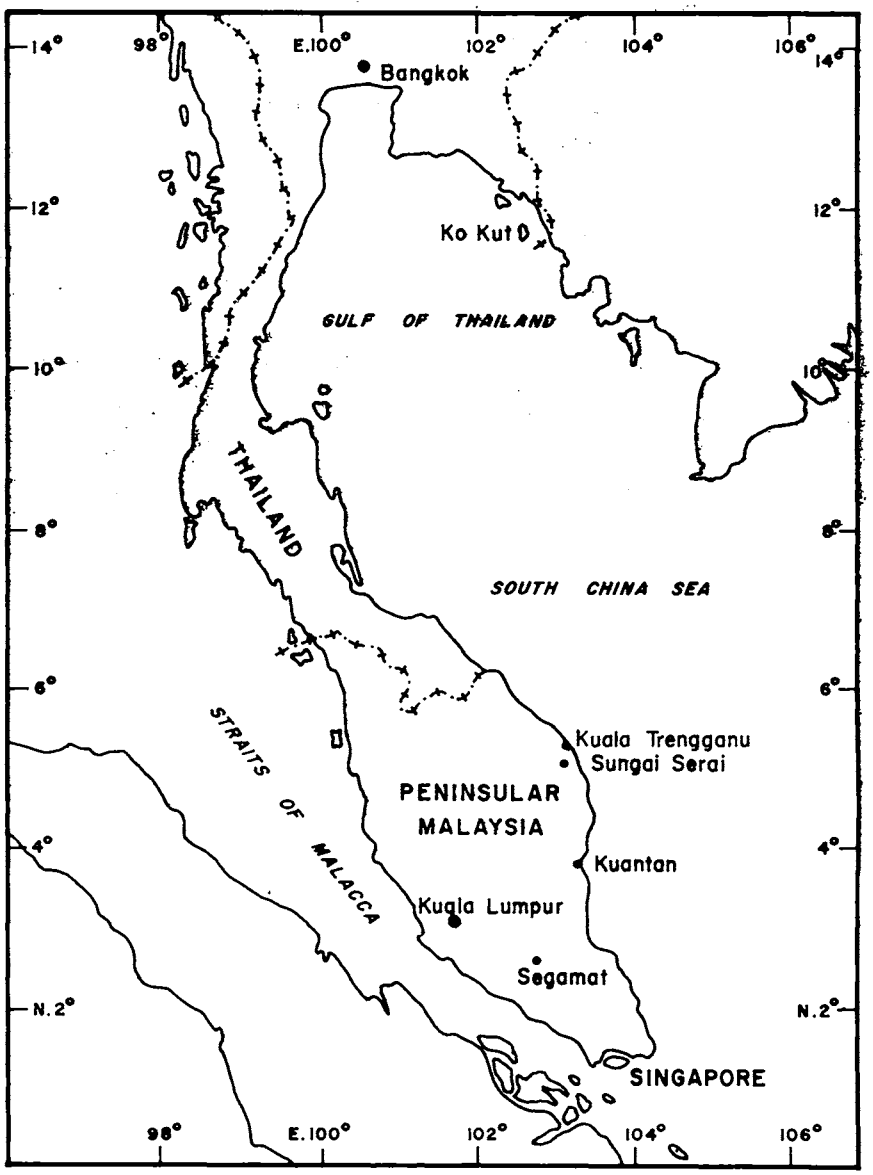
14°
98°
E.100°
102°
104°
106°
Bangkok
12°
Ko Kut
GULF OF THAILAND
10°
THAILAND
8°
SOUTH CHINA SEA
6°
STRAITS OF MALACCA
Kuala Trengganu
Sungai Serai
PENINSULAR
MALAYSIA
4°
Kuantan
Kuala Lumpur
Segamat
N.2°
SINGAPORE

Fig. 1

cating that there has been no significant loss of ^{40}Ar from these micas since the granite cyrstallized (Bignell, Snelling and Harding, in press). By analogy it is argued that the dyke has retained its argon equally well and hence 189 m.y. is probably very close to the actual age of intrusion.

The dyke was therefore intruded well after the main intrusive episode of the area (about 250 m.y.). It is also younger than the relatively minor episode of granite intrusion that occurred in East Malaysia at about 220 m.y. (Bignell, Snelling and Harding, op. cit.). Therefore Paton's concept of the relationship between the dolerites and granites now exposed cannot be correct.

Table 1. K:Ar age data for some basic igneous rocks from Peninsular Malaysia and Thailand.

Sample No.	Analysed material	%K	ppm rg^{40}Ar	Age, m.y.
1	Dolerite, whole rock	0.78	0.01105	189 ± 6
2	Basalt, " "	1.70	0.00019	1.6 ± 0.2
3	Dolerite, " "	0.51	0.00408	111 ± 4
4	Basalt " "	1.49	0.00662	62 ± 2
5	" " "	1.27	0.00076	8.5 ± 1

BASALT AND DOLERITE FROM THE KUANTAN AREA, PAHANG

The basalt flows and the dolerite dykes of this area have been described by Fitch (1952) and Hutchison (1973a and b). The basalt is confined to an area just to the north-west of Kuantan, whereas the dolerite dykes have been found scattered throughout the Kuantan-Sungai Lembing-Gambang area.

A sample of augite-olivine basalt (Table 1, No 2) from the Jeram Kuantan Estate about 8 km north of Kuantan gave a K-Ar age of 1.6± 0.2 m.y. but augite dolerite (Table 1 No 3) from a dyke in the beach just to the east of the town near Tanjong Tembeling gave an age of 111 ± 4 m.y.

K-Ar ages given by micas from granites in the vicinity of Kuantan and indeed throughout the East Coast area indicate that there has been little or no loss of radiogenic argon since the last known episode of granite intrusion at about 220 m.y. Thus it is probable that these basic rocks have quantitatively retained their radiogenic argon and that these ages are close to the age of formation of the rocks.

The Pleistocene age for the basalt was unexpected. However, the basalt can be seen to be the youngest consolidated rock in the area. The highest point at which the basalt is found is Bukit Tinggi, about 8 km. north of Kuantan. The present outcrop of the lava is similar to that which would be expected from a volcano erupting at Bukit Tinggi into an area of similar topography to that of the present. Because of the high rates of erosion in

tropical areas, such topographic features are not likely to survive for very long. Thus what stratigraphic and geomorphological evidence is available is consistent with a very young age. Late Tertiary or Quarternary basic volcanism is relatively widespread in Thailand and Indochina to the north, Borneo to the east, and Sumatra to the west and south.

No sedimentary rocks of Cretaceous age are known from the Kuantan area, but about 120 km to the north-west the deposits of the Gagau Group, of early Cretaceous age, include acidic to basic volcanic rocks (Rishworth, 1974). Thus the age given by the dyke coincides with a period of volcanism in the region.

It had generally been assumed that the widespread basic dykes of the Kuantan area were feeders to the basaltic lava e.g. Fitch, 1952. However, no direct evidence for this view has been published and indeed the available chemical analyses show marked differences between the basalts and doleritic dykes. Thus the K contents of the analysed basalts range from 1.16 to 1.70% and of the dolerites from 0.51 to 0.91% (Fitch, 1952 and this work). The two fully analysed basalts give high contents of normative olivine viz 14.2 and 12.8, whilst one of the analysed dolerites gives only 7% normative olivine and the other has normative quartz.

LAVA FROM SEGAMAT, JOHORE

The potassium rich lavas from Segamat have been described by Grubb (1965). There is no stratigraphic evidence to date the lavas, but they appear to be the youngest consolidated rocks in the area. Grubb speculated that these lavas might be of a similar age to the alkali-rich lava of Kuantan.

The K:Ar determination shows that these lavas are at least 62 m.y. old. However biotites from late Cretaceous (c. 80 m.y.) granite bodies in the Gunong Ledang area (about 25 to 35 km from Segamat) show evidence of argon loss with one K—Ar age as young as 52 ± 4 m.y. (Bignell, Snelling and Harding, op. cit). There is thus the possibility of a disturbance capable of causing argon loss more recently than 52 m.y. in this general area. This same event could have caused slight argon loss from the Segamat lavas and 62 m.y. can consequently only be regarded as a younger limit to their age. It may be noted that the lavas have been tilted and now dip about 20°SW.

BASALT FROM KO KUT, THAILAND

Late Tertiary to Pleistocene basaltic lavas crop out over large areas in Thailand and Indochina. A sample (Table 1, No 5) of one of these lavas from the island of Ko kut in the north-eastern part of the Gulf of Thailand was given to the authors by geologists of British Petroleum Limited. It has given a late Miocene age, which is in accord with the field evidence.

ACKNOWLEDGEMENTS

One of the authors (JDB) gratefully acknowledges the tenure of a Leverhulme Overseas Scholarship at the University of Malaya and a Natural Environment Research Council Award in the Department of Geology & Mineralogy, Oxford.

This note is published with the permission of the Directors of the Institute of Geological Sciences and of the Warren Spring Laboratory.

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