Geol. Soc. Malaysia, Bulletin 13, December 1980; pp. 57–62

Some geochemical studies of the metaquartzites of the Jerai Formation, Kedah.

K.T. CHOW,
Petronas, P.O. Box 2407, Kuala Lumpur

Abstract: The following types of metaquartzites from the Jerai Formation (Cambrian) can be distinguished—white metaquartzite, micaceous metaquartzite and calcareous-micaceous metaquartzite. The compositions of the white and micaceous metaquartzites overlap but the white variety appear to be generally more aluminous but less alkali-rich compared to the micaceous variety. The metaquartzites contain high K_2O comparable to granitic rocks and indicating that the probable source rocks are acid igneous rocks. The Rb/Sr ratios of the metaquartzites also are comparable to the Main Range granites which give rise to the thought that the source may be similar crustal rocks.

INTRODUCTION

Two formations are recognised in the Gunung Jerai area, the Jerai Formation and the Patani Formation by Bradford (1972). On the southern part of the Gunung Jerai area, lies igneous rocks such as granites, pegmatites, aplites and quartz veins. Within the Jerai Formation, there exists a type of rock known as quartz porphyry which has been interpreted to be of igneous origin (Chow, 1979; Lim, 1979).

The Jerai Formation which is probably of Cambrian age consists of metaquartzites and schists with a few calcareous lenses. The Jerai Formation has been correlated with the Machinchang Formation (Cambrian) in the Langkawi Islands but this is still uncertain because of lack of fossils in the Jerai Formation. Its thickness has been estimated to be about 1.5 km (Bradford, 1972).

The Patani Formation is believed to overlie conformably the Jerai Formation and is partly comparable in age with the Setul Formation of Langkawi Islands which is Ordovician-Silurian. The Patani Formation consists of 3 units: the argillaceous unit, the arenaceous unit, and the calcareous unit.

The ages of the granites and pegmatites were dated by Bignell and Snelling (1977) who suggested that the granites and pegmatites were probably emplaced during the Permo-Carboniferous period.

PETROLOGY OF THE METAQUARTZITES

The metaquartzites show variation in mineralogy and texture which give rise to various types. Three types of metaquartzites, based on lithology, can be distinguished. They are:

(1) white metaquartzite

(2) micaceous metaquartzite

(3) calcareous-micaceous metaquartzite

In this section, the white metaquartzite consists almost entirely of quartz with few xenoblastic crystals of biotite and alkali feldspars. They are generally fine- to medium-grained.

The micaceous metaquartzite consists essentially of quartz and mica with subordinate amount of feldspars and accessory amount of epidote and iron oxide. Generally, they are fine-grained.

The calcareous-micaceous metaquartzite consists of quartz, mica, epidote, clinozoisite with accessory amounts of sphene, tourmaline and magnetite. Feldspars appear to be very little.

GEOCHEMISTRY OF THE METAQUARTZITES

13 samples of metaquartzites and 1 sample of calc-silicate rock were analysed for major and minor elements (Table 1). The locations of the samples are given in Fig. 1.

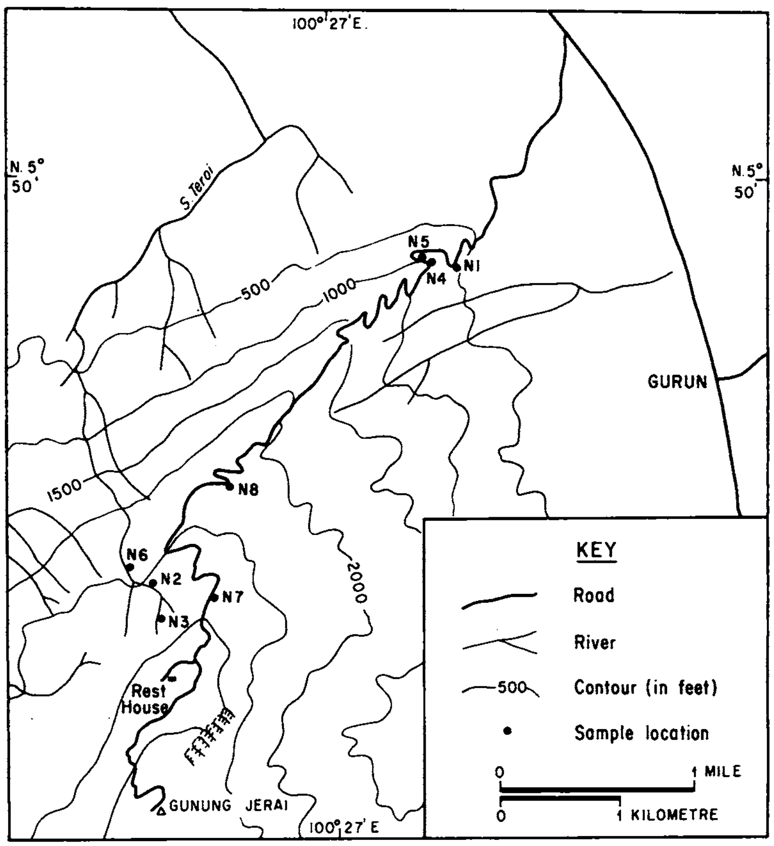

Fig. 1. Location of sample localities.

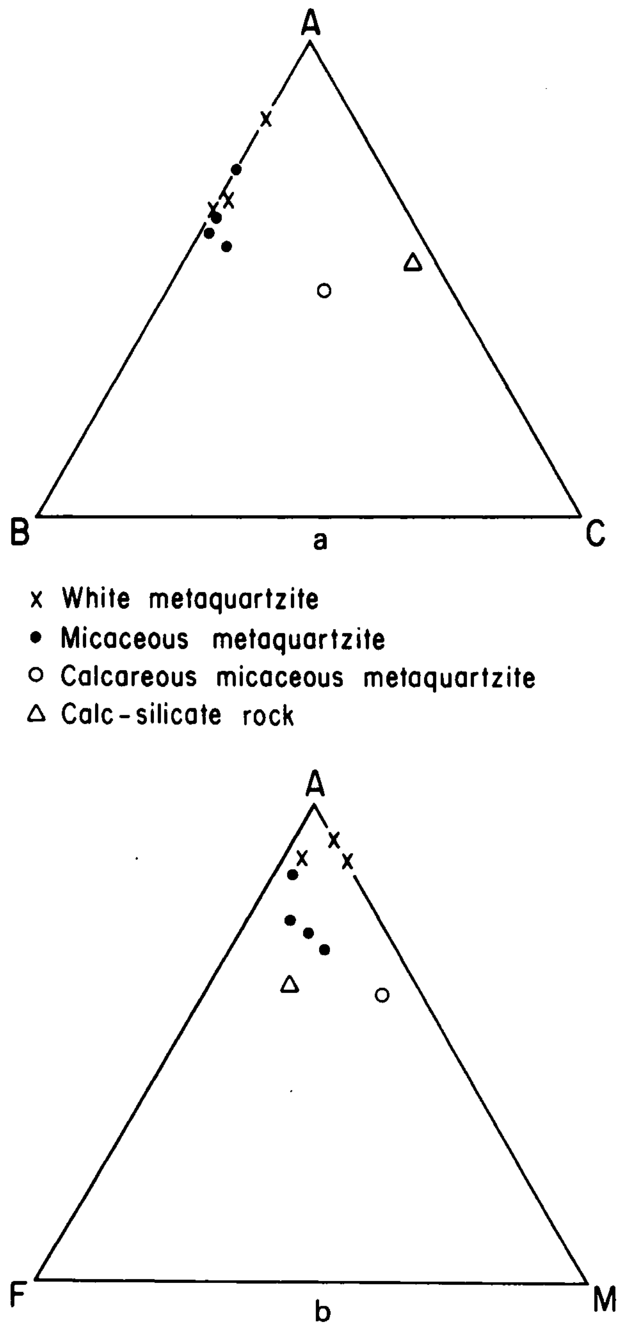

Fig. 2. Compositional plots of samples analysed.
a) $A = Al_2O_3$, $B = K_2O + Na_2O$, $C = CaO$ (all in molecular proportions).
b) $A = Al_2O_3$, $F = Fe_2O_3$ (total iron), $M = MgO$ (all in molecular proportions).

DISCUSSION OF RESULTS

Major elements

The K_2O values in the metaquartzite are generally high whereas the Na_2O values are relatively low. This probably indicate that the feldspars present in the rocks are mainly potash feldspars. However, the potash feldspars appear not to be in significant amounts from microscopical observation, suggesting that most of these feldspars are probably untwinned and not easily distinguishable from quartz.

The CaO values are generally low except the calcareous rocks which have high values.

Fig. 2a and Fig. 2b show the compositional plots of the metaquartzite. In Fig. 2a, the compositions of the white metaquartzite and the micaceous metaquartzite appear to overlap but the white metaquartzite appears to be generally more aluminous and has less alkali compared with the micaceous metaquartzites which are more alkali-rich. This is probably due to the presence of muscovite in the white metaquartzite whereas biotite is predominant in the micaceous metaquartzite. The overlapping fields indicate that the compositions of the white quartzite gradationally changed to that of the micaceous metaquartzite. The compositions of the calcareous rocks are separated from the compositional fields, evidently because of the higher CaO content.

In Fig. 2b, the compositions of the white metaquartzite and the micaceous metaquartzite also form 2 separate fields. Here the micaceous metaquartzite shows higher Fe_2O_3 (total iron) values due to the presence of biotite.

Minor elements

Table 1 shows the Rb:Sr ratios of the metaquartzites, except for 2 samples, range from 2.6 to 10.5 which are relatively high values. The Rb:Sr ratios of the Main Range granites (of late Paleozoic) exhibit a tight grouping from about 2 to 9 (Bignell and Snelling, 1977) and the Rb:Sr ratios of the metaquartzites appear to be comparable with those of the Main Range granites. It is possible that the metaquartzites may have been derived from similar crustal materials.

Zircon grains obtained from the metaquartzites by heavy mineral separation method, show good prismatic form. The shape of the zircon grains seems to indicate the original sandstones were deposited only a short distance from their source.

CONCLUSIONS

From the results above, the metaquartzites generally have similar chemical composition to that of Main Range granites, suggesting that they are derived from similar crustal material. The high values of K_2O and quartz content further indicate its acid igneous derivation.

ACKNOWLEDGEMENTS

I would like to thank Dr. T.T. Khoo for his advice and encouragement in this project which was carried out at Universiti Malaya. Thanks also go to Universiti Malaya for support from the F-vote grant of Dr. T.T. Khoo.

TABLE 1.

RESULTS OF PARTIAL CHEMICAL ANALYSIS OF THE METAQUARTZITES BY X-RAY FLOURESCENCE METHOD.
(major elements are denoted in percentage)

Specimen No.	Description of Rock	Al_2O_3	K_2O	Na_2O	CaO	MgO	TiO_2	Fe_2O_3 (Total iron)	Sr (ppm)	Rb (ppm)	Rb/Sr
N1	White metaquartzite	13.7	5.3		0.2	0.2	0.4	2.3	56	144	2.6
N3	White metaquartzite	6.8	3.2	0.1	tr	0.2	0.3	tr	12	84	7.0
N2	White metaquartzite	2.2	0.5	tr	tr	0.1	0.4	tr	35	tr	very low
N4	Micaceous metaquartzite	12.3	5.7	0.3	0.1	0.8	0.7	3.7	20	168	8.4
N5	Calcareous micaceous metaquartzite	8.1	4.3	0.2	2.7	1.8	0.3	1.4	38	152	4.0
N6	Micaceous metaquartzite	12.4	4.2	tr	tr	0.5	0.6	4.3	tr	118	extreme
N7	Micaceous metaquartzite	13.4	6.8	0.8	0.7	1.3	0.6	3.9	20	211	10.5
N8	Micaceous metaquartzite	14.5	6.9	1.4	0.2	0.2	0.3	3.1	34	145	4.3
B17	Calc-silicate rock	9.3	0.8	tr	4.1	0.9	0.5	5.7	43	84	1.9

REFERENCES

BIGNELL, I.D. & SNELLING, N.J. (1977). *Geochronology of Malayan Granites*. Overseas Geology and Mineral Resources No. 47, Institute of Geological Sciences, HMSO, 70p.

BRADFORD, E.F., (1972). *The geology of the Gunung Jerai area, Kedah*. District Memoir 13, Geol. Survey Malaysia. 242p.

CHOW, K.T. (1979). *Geology of the Yan-Ayer Puteh Area, Kedah*. Unpubl. B.Sc. (Hons) thesis, Universiti Malaya, 63p.

LIM, B.K. (1979). The nature of the contact between the 'quartz porphyry' and the Jerai Formation in the Rest House area, Gunung Jerai, Kedah. *Warta Geologi*, 5, 67–72.