# Tectonic Discrimination on Geochemistry of Metagreywacke in the Myogyi area, Yengan Township, Southern Shan State

**Aye Aye Mar[*], HninWin Kyi[**]**

## Abstract

The $SiO_2$ content of the samples of metagreywacke ranges from 62.0298% to 76.722%. $Fe_2O_3$ varies between 1.908%to 5.0685% and MgO between 0.805% to 5.6916% and CaO between 0.0455% to 0.3147% and $Al_2O_3$ 10.6745% to 14.9831%. $SiO_2/Al_2O_3$ ratio may indicate the source rock. The sample which has $SiO_2/Al_2O_3$ value about 3 indicates the basic rock source; 5 acidic rock source, and more than 5, mature sedimentary rock source. Most of the samples of metagreywacke in the study area have the $SiO_2/Al_2O_3$ value 5.3939 to 7.085. They may indicate the mature sedimentary rock source. Discrimination of tectonic setting on the basic of major element data was also proposed by Roser and Korsch (1998); these include passive margin, active continental margin and island arc setting and Bhatia (1983); these include oceanic island arc, passive margin, active continental margin and continental island arc setting. Metagreywacke is composed of a thick sequence of metagreywacke with narrow interculation of quartzite. The metagreywacke predominantly contains chlorite, sericite and biotite. Quartz and biotite are related to metamorphic recrystallization. Sericite, epidote and chert are the products of the interplay of diagenesis and low–grade metamorphism. Apatite, Fe–Ti oxide are usual accessories and have slight enrichment in $K_2O$. The metagreywacke is distantly rich in Rb, Sr, Zr, Ce and depleted in Ni, and Zn. The area is an elevated upland with steep sloping hills and the area as a whole is a brought synclinal structure which is typically found in the northern part of the area. The metagreywacke laid down the later stage of geosynclinal deposits. Geochemical data suggest that these metagreywackes were laid down in progressively changing basin geometry from a passive to active continental margin and island arc setting.

Key words – passive margin, active continental margin, island arc setting, geosynclinal deposits

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## Introduction

## Geochemistry

### Analytical Methods

The representative samples from the Myogyi area were sent to the Chemistry Department in Monywa University. Major element analysis of the whole rock and trace element concentrations were also analyzed by XRF method.

The main purpose of this study is to evaluate the major element geochemistry of the metagreywacke in the study area in order to infer their provenance tectonic setting.

To interpret the tectonic setting of the metagreywacke in the study area, tectonic discrimination diagrams were illustrated by using Roser and Korsch (1998) and Bhatia (1983).

### Geochemical Characteristics of the Metagreywacke in the Study Area

For geochemical study, the major oxide and trace element compositions of the five representative samples from the study area have been selected and analyzed.

The $SiO_2$ content of the samples ranges from 62.0298% to 76.722%. $Fe_2O_3$ varies between 1.908%to 5.0685% and MgO between 0.805% to 5.6916% and CaO between 0.0455% to 0.3147% and $Al_2O_3$ 10.6745% to 14.9831%.

### Source rock of composition by major elements

$SiO_2/Al_2O_3$ ratio may indicate the source rock. The sample which has $SiO_2/Al_2O_3$ value about 3 indicates the basic rock source; 5 acidic rock source, and more than 5, mature sedimentary rock source ( Le maître, 1976, Roser et al, 1996 in Akarish and El-Gohary, 2011). Most of the samples of metagreywacke in the study area have the $SiO_2/Al_2O_3$ value 5.3939 to 7.085. They may indicate the mature sedimentary rock source.

Table (1) Major oxides composition of the rocks in the study area

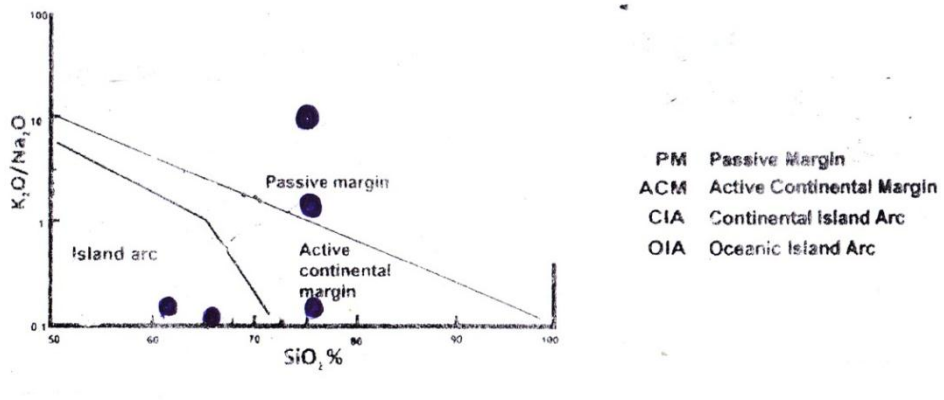
| | Mt–1 | Mt–2 | Mt–3 | Mt–4 | Mt–5 |
|---|---|---|---|---|---|
| $Na_2O$ | 16.2417 | 9.5499 | 3.5502 | 0.632 | 0.238 |
| MgO | 3.1077 | 5.6916 | 5.5482 | 1.079 | 0.805 |
| $Al_2O_3$ | 11.5194 | 14.9831 | 10.6745 | 12.027 | 14.133 |
| $SiO_2$ | 64.922 | 62.0298 | 75.6396 | 76.722 | 76.222 |
| $P_2O_5$ | 0.021 | 0.0145 | 0.0798 | 0.115 | 0.039 |
| K2O | 1.7077 | 2.4867 | 0.9551 | 2.492 | 3.256 |
| CaO | 0.0455 | 0.0821 | 0.3147 | 0.187 | 0.167 |
| $TiO_2$ | 0.3 | 0.645 | 0.437 | 0.485 | 0.592 |

| | | | | | |
|---|---|---|---|---|---|
| MnO | 0.006 | 0.025 | 0.011 | 0.096 | 0.022 |
| $Fe_2O_3$ | 1.908 | 4.064 | 2.563 | 5.685 | 4.068 |
| $Cr_2O_3$ | 0.007 | 0.018 | 0.013 | 0.014 | 0.014 |
| $Rb_2O$ | 0.007 | 0.013 | 0.005 | 0.014 | 0.016 |
| SrO | 0.001 | 0.002 | 0.004 | 0.003 | 0.002 |
| $Y_2O_3$ | 0.003 | 0.006 | 0.003 | 0.005 | 0.006 |
| $ZrO_2$ | 0.017 | 0.029 | 0.002 | 0.025 | 0.03 |
| NbO | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 |
| $La_2O_3$ | 0.104 | 0.226 | 0.121 | 0.247 | 0.201 |
| $CeO_2$ | 0.06 | 0.108 | 0.036 | 0.111 | 0.137 |
| $HfO_2$ | 0.007 | 0.009 | 0.005 | 0.009 | 0.008 |
| $Ta_2O_5$ | 0.014 | 0.017 | 0.018 | 0.05 | 0.043 |

Tectonic Discrimination of Metagreywacke

Discrimination of tectonic setting on the basic of major element data was also proposed by Roser and Korsch (1998); these include passive margin, active continental margin and island arc setting and Bhatia (1983); these include oceanic island arc, passive margin, active continental margin and continental island arc setting.

According to $SiO_2$ versus $K_2O/Na_2O$ diagram of Roser and Korsch (1988), some of

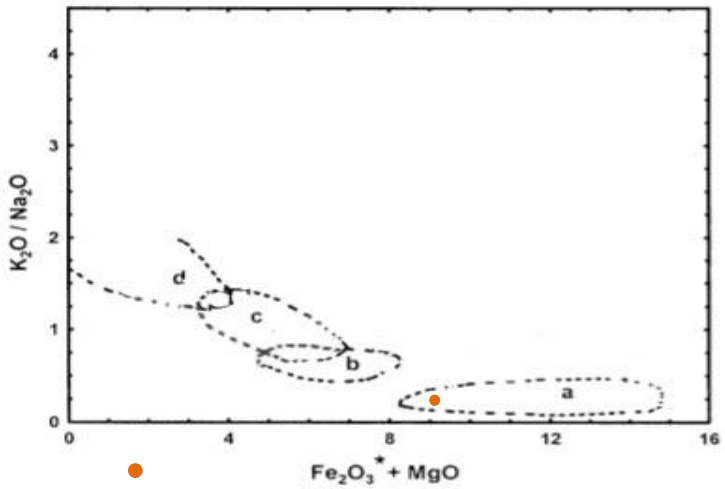



the samples in the study area fall in the passive margin, active continental margin and oceanic island arc setting (Figure 1).

(Figure 1) $SiO_2$ versus $K_2O/Na_2O$ diagram of (Roser and Korsch, 1988)

According to $K_2O/Na_2O$ versus $Fe_2O$ + MgO diagram of Bhatia (1983), the sample in the study area falls in the oceanic island arc (Figure 2).

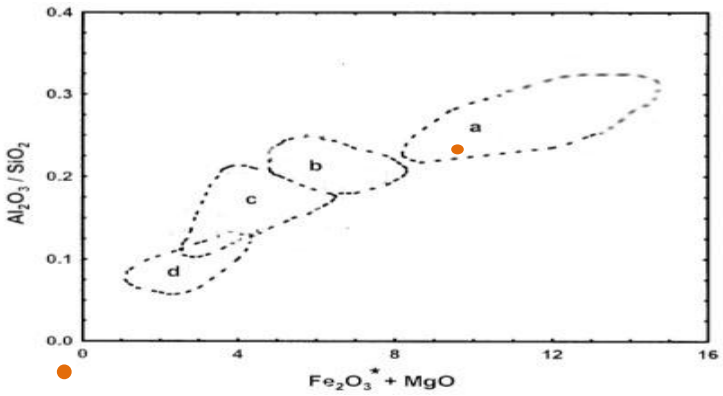
● Metagreywacke




a. oceanic island arc
b. continental island arc
c. active continental margin
d. passive margin

Figure (2) $K_2O/Na_2O$ versus $Fe_2O$ + MgO diagram (Bhatia 1983)

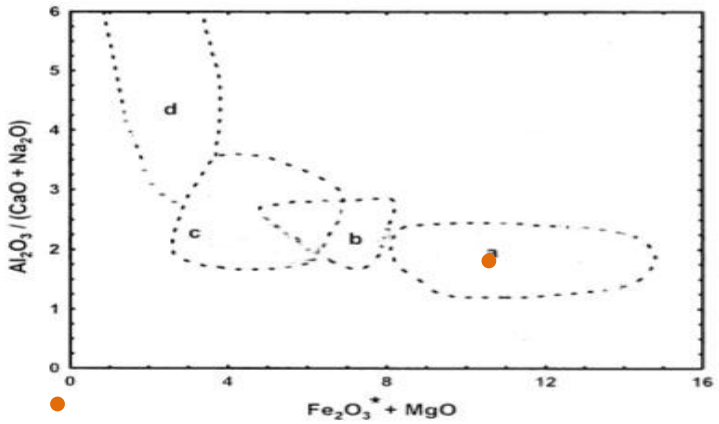
According to $Al_2O_3/SiO_2$ versus $Fe_2O$ +MgO diagram of Bhatia (1983), the sample in the study area falls in the oceanic island arc (Figure 3).




a. oceanic island arc
b. continental island arc
c. active continental margin
d. passive margin

Figure (3) $Al_2O_3/SiO_2$ versus $Fe_2O$ +MgO diagram (Bhatia 1983)

According to $Al_2O_3$/ (CaO + $Na_2O$) versus $Fe_2O_3$ + MgO diagram of Bhatia (1983), a few sample in the study area falls in the oceanic island arc (Figure 4).




a. oceanic island arc
b. continental island arc
c. active continental margin
d. passive margin

Figure (4) $Al_2O_3$/ (CaO + $Na_2O$) versus $Fe_2O_3$ + MgO diagram (Bhatia 1983)

Description on petrography and geochemistry of the metagreywacke in the Study Area

Metagreywacke is composed of a thick sequence of metagreywacke with narrow interculation of quartzite. The metagreywacke predominantly contains chlorite, sericite and biotite.

The metagreywacke is all typically immature containing coarser clasts of mostly plagioclase (10%), orthoclase (35%) and quartz (45%) Lithic fragments(10%) are common. The matrix is dominated by mafic material.

Quartz and biotite are related to metamorphic recrystallization. Sericite, epidote and chert are the products of the interplay of diagenesis and low-grade metamorphism. Apatite, Fe-Ti oxide is usua

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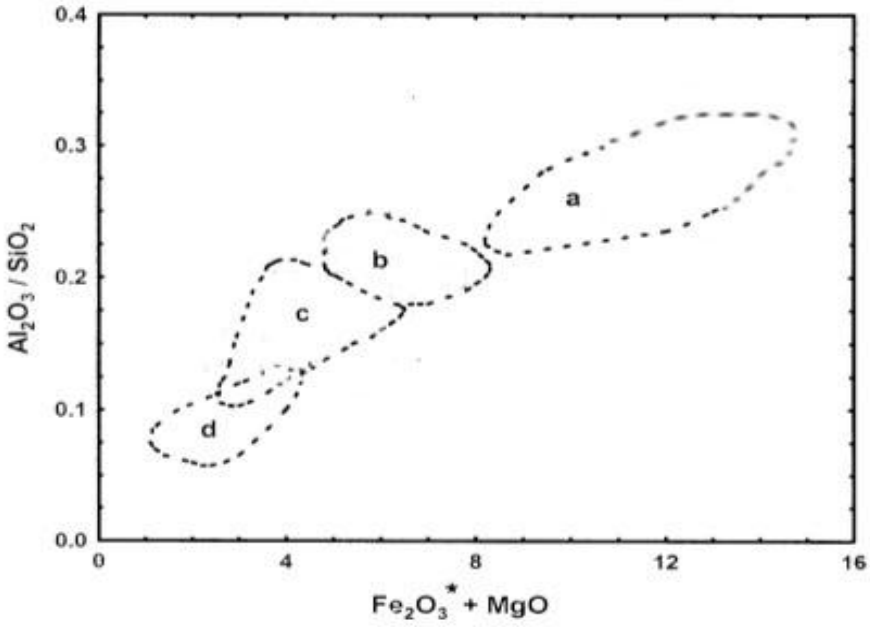
Geochemical data sugges
changing basin geometry
setting (figure 1).



The major elements of geochemistry of the metagreywacke in the study area infer their provenance tectonic setting. To interpret the tectonic setting of the metagreywacke in the study area, tectonic discrimination diagrams were illustrated by using Roser and Korsch (1998) and Bhatia (1983).

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## Acknowledgements

I would like to express my sincere thanks to Dr Mg Mg Naing, Rector of Yadanabon University for his kindness and valuable support, Pro–rectors of Yadanabon University, Dr Htay Win, Professor and Head of Geology Department and Dr Khaing Khaing San, Professor, Geology Department, Yadanabon University for their encouragement. Finally, all the teaching staff members from Geology Department, Yadanabon university are highly thanked for their cooperation.

## References


Amos, B.J. 1975. Stratigraphy of the Upper Paleozoic and Mesozoic carbonate rocks of the Eastern Highlands: London, Institute of Geological Sciences.

Aung, Aye Ko, cocks, L.R.M., 2017. Chapter 14. Chambrian, Devonian stratigraphy of the Shan Plateau, Myanmar. In: Barder, A.J., Zaw, Khin, Crow, MoJ. (Eds.) Myanmar: Geology, Resources and Tectonics 48. Geological Society London, Memoir.

Bender, F., 1980. *Geology of Burma*; Gebruder Borntracger, Berlin.

Chhibber, H.L 1983. *The Geology of Burma*. Mac. Millin& Co. London.

Ganson, M.S., Amos, B.J., Mitchell, A.H.G., 1976. *The geology of the country around the Neyaungga and Ye–ngan, Southern Shan States, Burma.* London Institute of Geological Sciences, Overseas Division, Memoir, 2.

Ko Ko Myint. June, 1989, Geology of the Myogyi Area Ye–Ngan Township. Unpublished M.Sc Thesis. Department of Geology, University of Mandalay.

La Touche, T.H.D., 1913. Geology of the Northern Shan State. *Memoirs of the Geology Survey of India,* Vol 39, pt. II, Calcutta.

Mitchell, A.H.G., 2018. Geological Belts, Plate Boundaries and Mineral Deposits in Myanmar. E/sevier, Amsterdam.

Myint Lwin Thein, 1973. The lower Paleozoic Stratigraphy of the western part of the Southern Shan States; Geol, Malaysic Bull., Bilugyum area, Chaungzon Township, Mon State.

Myint Thein, *etal*. 1984. Geological Reinvestigation and the Jurassic–Cretaceous Sedimentation of the Area east of Kyaukse–Belin, Mandalay Division: University of Mandalay. (Unpbl)

Pascoe, E.H. 1959, A manual of the Geology of India and Burma; Vol. II.3rd ed. Govt.

Romana Dew*et al*, 2019, Age and provenance of the Chaung Magyi Group, Yeywa Dome, Myanmar, based on U–Pb dating of detrital zircons, *Journal of Asian Earth Sciences.*

Rollinson, Hugh R.1993 Using Geochemical Data. Evaluation, Presentation, Interpretation, Longman Scientific & Technical.

San San Win, 2014. Petrology and characterization of the copper and base metals occurrence in the Pein Ye–Taung Le Lon Taung area, Mandalay region, Unpublished M.Sc Thesis. Department of Geology, University of Mandalay.

Tin Ma Gyi. 1974. Geology and Paleontology of the Myogyi Area, Southern Shan State; D.A.G Dissertation, R.A.S.Su.