

PETROLOGY OF HIGH PRESSURE METAMORPHIC ROCKS FROM LUK ULO MELANGE COMPLEX, KARANGSEMBUNG, CENTRAL JAVA-INDONESIA

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ABSTRACT

Luk Ulo Melange Complex is situated in Central Java, this complex is characterized by the occurrence of Tertiary and Pre-Tertiary rocks as fragments embedded in sheared clay matrix. The fragments consist of ophiolite, metamorphic, chert and carbonate rocks. This research is focused to high pressure metamorphic rock which is represented by glaucophane schist. The rocks consists of albite, augite and ferroaugite, Mg - cataphorite, glaucophane, ferrian and crossite, almandine spesartine, quartz; and rarely can be observed lawsonite, hornblende, tremolite and actinolite. The latter mineral assemblage indicates that the rock was formed at 580°C - 500°C and 14,5 - 4 kbar. Temperature and pressure obtained from glaucophane schist indicated that the rock came from the lower interval of the subduction environment and the possibility have already been in retrograde stage. This is showed by recrystallization of amphibole-glaucophane to sericite or chlorite, and chlorite after garnet. This may represent the retrograde stage in lower temperature-pressure conditions. This data explains the accretion and exhumation history of high pressure metamorphic rocks from subduction depth to the surface condition.

Keywords: Lok Ulo, Melange, Tertiary and Pra Tertiary, High Pressure Metamorphic Rock, glaucophane schist

ABSTRAK

Komplek Melange Luk Ulo, Jawa Tengah dikarakteristikan oleh hadirnya fragmen batuan berumur Tersier dan Pra Tersier yang tertanam dalam matrik lempung yang tergeruskan. Fragmen ini terdiri atas batuan ofiolit, metamorf, rijang, karbonat. Penelitian ini difokuskan kepada batuan metamorf tekanan tinggi yang diwakili oleh sekis glaukofan. Batuan ini terdiri atas mineral albit, augit, dan Fe-augit, Mg-kataforit, glaukofan, ferian dan krosit, almandine spesartin, kuarsa, lawsonit, hornblende, tremolit, dan aktinolit. Kumpulan mineral ini mengindikasikan bahwa batuan terbentuk pada 500°C – 580°C dengan tekanan 4 kb – 14,5 kb. Hasil Pengukuran P dan T pada sekis glaukofan menunjukkan bahwa batuan ini berasal dari lingkungan subduksi pada interval lebih rendah dan kemungkinan terbentuk pada tahap *retrograde*. Ini ditunjukkan oleh adanya rekristalisasi amfibol-glaukoan ke serisit dan klorit, klorit menggantikan garnet yang mewakili tahap *retrograde*. Data – data ini menjelaskan sejarah akresi dan pemunculan batuan metamorf tekanan tinggi dari proses subduksi sampai kondisi di permukaan.

Kata kunci: Luk Ulo, Melange, Tersier dan Pra – Tersier, Batuan metamorf tekanan tinggi, sekis glaukofan

INTRODUCTION

The Java metamorphic rocks can be found in Ciletuh, West Java; Karangsembung and Bayat areas, Central Java; Meratus Mountain, South Kalimantan; Bantimala, Barru, and Wasuponda, South Sulawesi; Palu and Pompangea, South East Sulawesi; Seram, and Papua (Kadarusman et al;2005). The metamorphic rock is product of subduction of Indian oceanic crust beneath the Eurasian continental margin occurrence since Last Cretaceous to Early Tertiary in age (Asikin, et al; 1980).

The Luk Ulo Melange Complex consist of Pre – Tertiary and Tertiary

rock as a fragments embedded in sheared clay matrix. The fragments consist of ophiolite, metamorphic, chert and carbonate rocks (Asikin, et al; 1980). That complex is Early Cretaceous - Paleocene in age (Asikin, 1974). According to Suparka (1987), the age of mica schist range between 85,03 ± 4,25Ma to 101,71 ± 5,15Ma. Wakita et al., (1996) reported that Luk Ulo Melange Complex is Early Cretaceous - Last Cretaceous in age based on radiolarian analyze.

METHOD

In this paper, petrography and chemical mineral analysis have

applied to describes various and the origin of metamorphic rock and the tectonic environment of high pressure metamorphic rock of Luk Ulo Melange Complex.

Cameca SX100 electron microprobe with five wave length-dispersive spectrometers to determine the concentrations of Na, Mg, Al, Si, K, Ca, Ti, Cr, Mn, Ni, Fe and Ba. The applied acceleration voltage and electric current were 15 kV and 15 nA, respectively. The mineral chemistry data is calculated based on 8 atom oxygen for plagioclase; 14 atom oxygen for chlorite; 22 atom oxygen for mica; 8 cation and 12 oxygen for garnet; 4 cation and 6 atom oxygen for pyroxene; 8 cation and 12,5 atom oxygen for epidote; amphibole is calculated on 23 atom oxygen with assume Fe^{2+}/Fe^{3+} assumed cation Σ 13 and 24,5 atom oxygen for tourmaline.

PETROLOGY

Based on petrography and the chemical analyses from some sample of glaucophane schist (Lamuk, GOA and Kalimuncar) shown albite type of plagioclase; type amphibole are dominated glaucophane and Mg kataphorite, Rarely actinolite, tremolite, hornblende, baroisite; some type of clinopyroxene: salite, ferrosalite, augite, ferroaugite, pigeonite; garnet almandin spesartin with secondary mineral: epidote, chlorite, muscovite and tourmaline with accecory mineral, sphene (picture 2).

If we look from mineral association (clinopyroxene, garnet and hornblende type of amphibole) we can say that this rock form in high temperature in the beginning (eclogite rock). But with the present of glaucophane type of amphibole as a result from hornblende and clinopyroxene crystalization and the present of baroisite indicated pressure increasing and temperature decreasing. The present of tremolite

and actinolite also support this conclusion.

P - T Estimation

To illustrate P - T history in investigation area, we take some mineral data from some samples of glaucophane schist.

From measurement of a pair garnet - cclinopyroxene (Powell'85 ; Perchuk'92 ; Bermann, et al., 1995) we can make conclusion that glaucophane schist is formed in peak pressure at 14,5 kbar and temperature 580°C and this rock has a retrograde on P 4 kbar and T 500°C (garnet - chlorite; Patrick Evans, 1989) (Picture 3). Its mean that the rock was a resulted from oceanic lithosphere metamorphism, colded and subductized until upper mantle (50,75 km) and indicated that the rock formed in retrograde stage.

This situation characterize with glaucophane, baroisite and also the present of tourmaline mineral that shows tourmaline from along retrogration and exhumation (Altherr et al., 2004). And also in some area eclogite rock has a recrystalized to glaucophane schist that means retrograde metamorphism has happen.

From petrography, we could see pyroxene has recrystalized to glaucophane, and some glaucophane has changed into chlorite, garnet replaced by chlorite that shown retrogradation metamorphism because of subduction and accretion has happen.

CONCLUSION

High pressure metamorphic rock of Luk Ulo melange complex, Karangsambung, Center Java is represented by glaucophane schist was product from subduction between Eurasia crust and Hindia-australia Crust. The rock formed of retrograde stage based on result of mearesument pressure and temperature and recrystallization of amphibole-

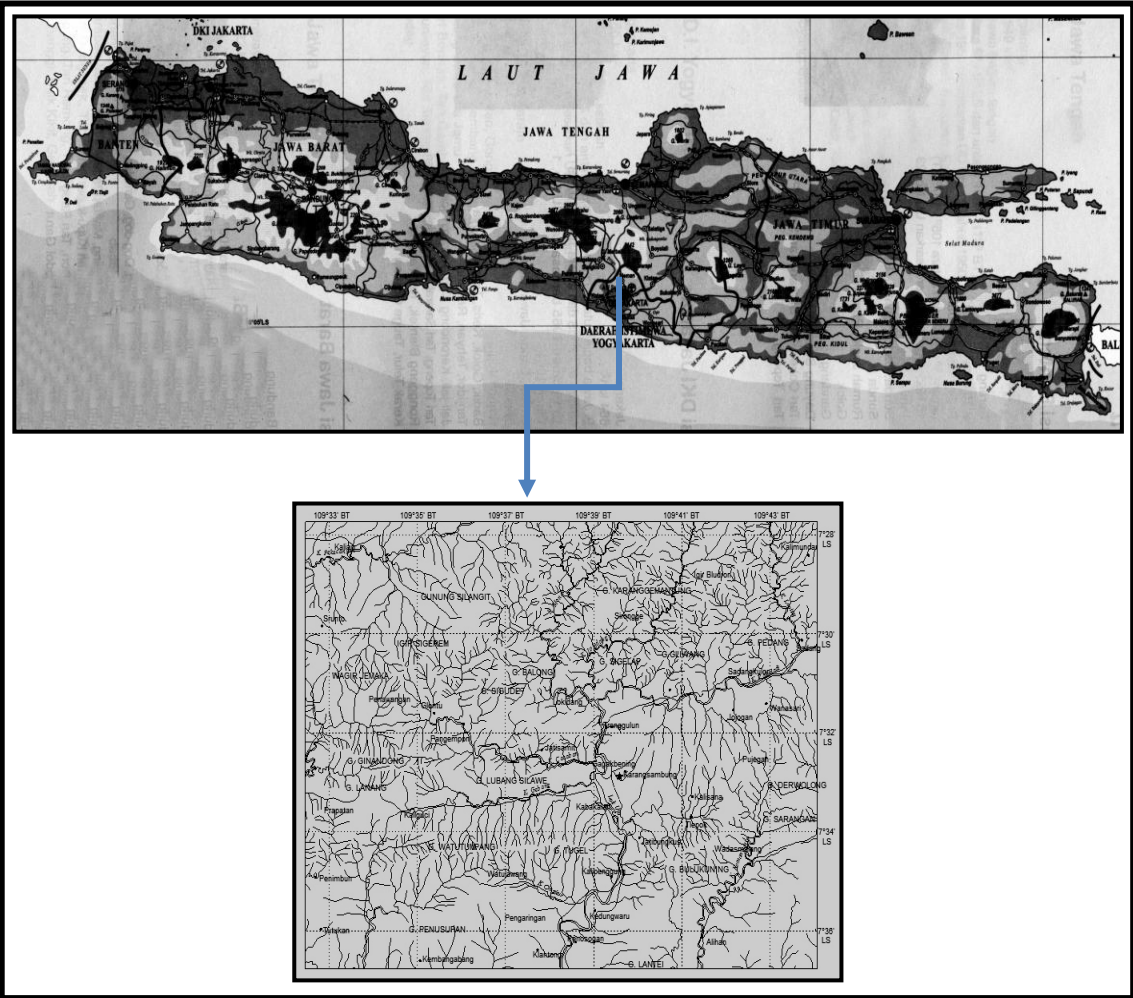
glaucophane to sericite or chlorite, and chlorite after garnet.

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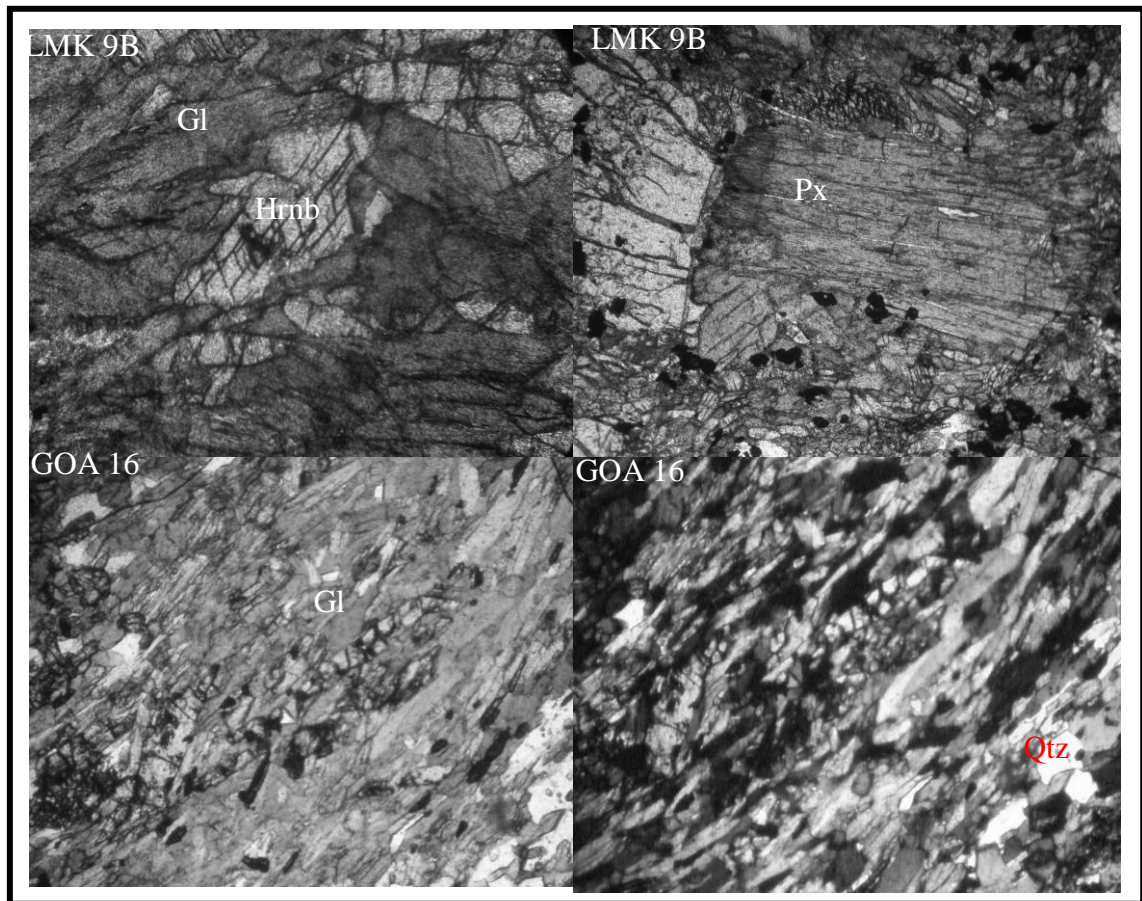
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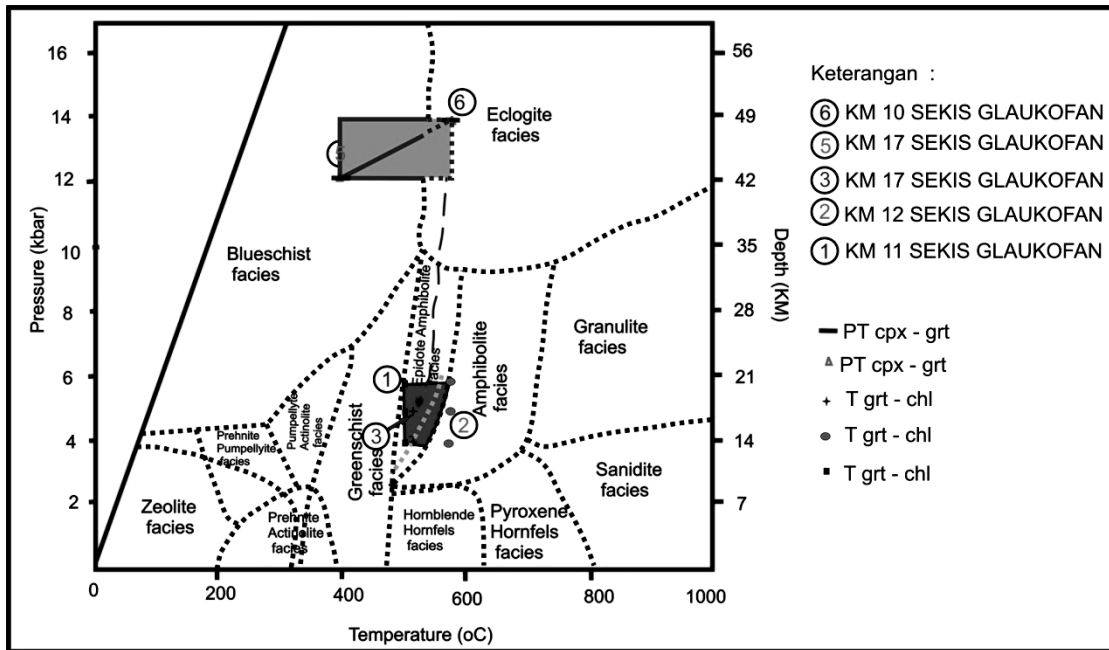
Picture 1.

The research area is part of Kebumean district, Central Java Province (no scale)



Picture 2.

Glaucophane schist at GOA 16 and LMK 9B1, Karang Sambung and Banjarnegara. The rock consist of pyroxene, hornblende, glaucophane, garnet, epidot, plagioclase, secondary quartz with opa μ mineral as the accesorics.



Picture 3.

The picture show that Glaucophane schist was formed at 14,5 kbar and the temperature 580°C. The rocks had retrograde *metamorphism* until 4 kbar and the temperature 500°C (Barker, 1990).