Petrography of Kimberlite from Mengyin Mine, Shandong Province, China

Nicharee Chawit-Viengvises[1] and Visut Pisutha-Arnond[1*]

[1]Department of Geology, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand
*E-mail: pvisut@gmail.com

Abstract

The petrography of the kimberlite from the Mengyin diamond mine in Shangdong Province of China was studied; subsequently, it is classified as a serpentine-calcite-phogopite-rich kimberlite.

Keywords: kimberlite, petrography, mineral composition, Mengyin mine.

1. Introduction

The Mengyin diamond mine is located about 150 km from Jinan town to the south east in Shandong Province of China. Diamond there was found in 1965, and later exploration discovered kimberlite pipes and veins (Wight, 2005). The age of kimberlite rocks was estimated at around 80 Ma, whereas the diamonds probably originated older than 450 Ma. The kimberlite rocks expose onto the surface as small volcanic pipes, dikes and sills. The kimberlite pipe there spits into two bodies as it reaches the surface. The larger pipe is 75x45 m^2 and the smaller one is 75x20 m^2. However, the smaller one is more productive (Wight, 2005). The kimberlite bodies appear to extend in NNE to NW directions which are controlled by the Tanlu Faults. In addition, kimberlite also occurs as small veins ranging from 10 to 100 m long and 0.5 to 2 m thick (Wight, 2005). A large specimen observed at the mining site is shown in Fig. 1.

Fig.1 A large boulder of kimberlite at the Mengyin mine containing many light-colored xenoliths in dark gray, fine-grained groundmass.

Fig.2 A slab of Mengyin kimberlite hand specimen showing many fragments of pinkish-light-gray xenoliths in dark greenish grey groundmass.

2. Sample Collection and Analytical Technique

Altogether five hand-specimens of kimberlite obtained from raw material, being fed into the diamond separation of the Mengyin diamond mine, were used for this study. These kimberlite samples are diamond-bearing rocks. They were slab-cut for the megascopic observation and prepared as standard thin–sections and polished thin-sections for petrographic investigation under a polarizing microscope and Electron Probe Micro-Analysis (EPMA). All analytical techniques and sample preparations were carried out at Department of Geology, Faculty of Science, Chulalongkorn University.

3. Petrography and EPMA Result

The Mengyin kimberite is a dark-colored, hybrid volcanic rock composing of host kimberlite magma and xenoliths (Fig. 2). The kimberlite has been heavily serpentinized and altered such that some of the original minerals are hardly recognized.

The kimberlite host is porphyitic and composed of 60-70% megacrysts and 40-30% groundmass. The shapes of megacrysts appear as, anhedral to euhedral crystals and their sizes range from 0.5 to 5 mm. The megacrysts are mainly serpentine polymorphs. The groundmass is somewhat finer-grained and often poorly-shaped crystals probably due to alteration. The groundmass is composed of serpentine, calcite, phlogopite, chlorite, perovskite and opaque minerals.

The predominant minerals in the kimberlite magma are serpentine (~45%), calcite (~20%) and phlogopite (~15%) that constitute about 80 % of the kimberlite magma. Much of the serpentine occurs as pseudomorphs of olivine and probably some pyroxene in the form of rounded megacryst and polygonally-shaped crystals typical of olivine as well as in the groundmass (Figs. 3 and 4). Based on the EPMA analyses, the composition of serpentine is almost pure $Mg_3Si_2O_5(OH)_4$ with only minor substitution of Fe and possibly Ca for Mg, and minor Al for Si. Much of the calcite fills interstitial in the groundmass and also replaces in megacrysts. The composition of the calcite appears to be pure $CaCO_3$. The phlogopite, the third most abundant mineral, occurs as a single tabular or lath-shaped megacryst or crystal aggregate with distinct boundary (Fig. 4) and mostly as fine aggregates associated with irregular calcite and perovskite in the groundmass. The composition of phlogopite is slightly off from the pure end-member ($K_2Mg_6Si_6Al_2O_{20}(OH)_4$) in which there are minor substitutions of Ba for K, minor Fe, Al (possibly Ti) for Mg, as well as minor Al for Si. Chlorite (~10 %) occurs as aggregates mainly in the groundmass and some replacement in megacrysts. The composition of the chlorite is probably a Mg-Fe-rich member. The perovskite (~5 %) occurs as small euhedral to subhedral dark brown crystals mainly in the groundmass. It is a primary mineral of kimberlite magma. The magnetite occurs in minor amount in the groundmass and may have formed along a fracture or cleavage plane in serpentine peudomorph grain.

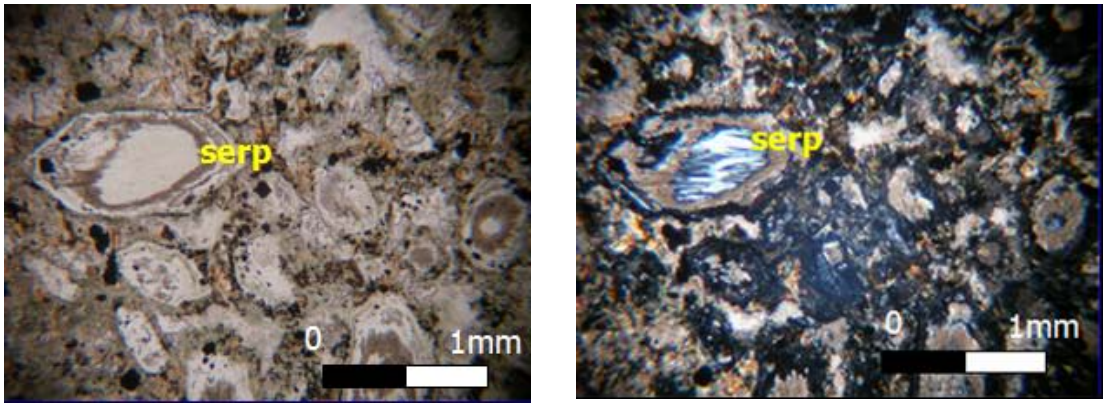

Fig.3 Photomicrographs showing the polygonal-shaped megacrysts (serp) typical of olivine crystals that are almost completely altered to serpentine and calcite in fine-grained groundmass, most of which represent the kimberlite magma (left: plane-polarized light, right: crossed nicols).

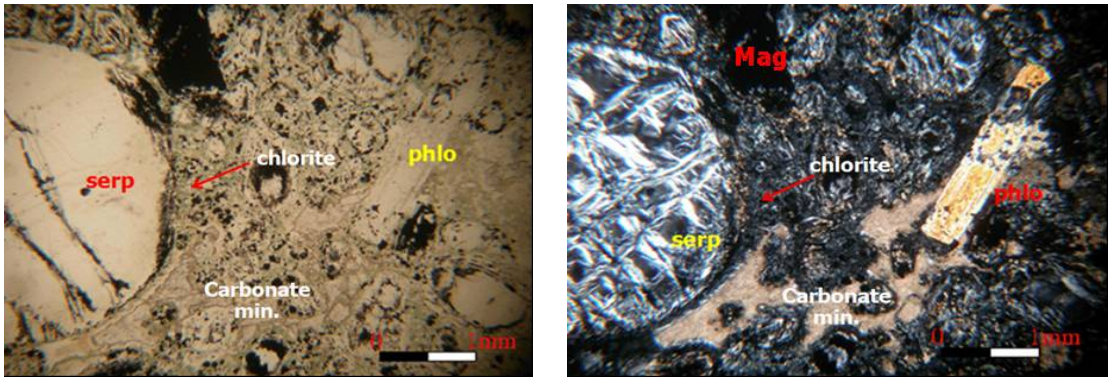

Fig.4 Photomicrographs showing lath-shaped phlogopite megacryst (phlo) and rounded serpentine-after-olivine megacryst (serp) in the finer-grained groundmass of serpentine, chlorite, perovskite, calcite and magnetite, all of which represent the kimberlite magma (left: plane-polarized light, right: crossed nicols).

The xenoliths in the Mengyin kimberlite are generally obscured by the retrograde alteration probably from the volatile component of the magma. At least two kinds of xenolith are distinguishable, diorite and eclogite. The main primary mineral assemblages of the diorite xenolith probably are pyroxene (partially altered to actinolite-tremolite, calcite and many other unidentified fine-grained minerals) and plagioclase (subjected to K metasomatism). The eclogite xenolith (Fig. 5) is composed of garnet (mostly altered to calcite, epidote and other unidentified minerals) and clinopyroxene (mostly altered to actimolite-tremolite and many other unidentified fine-grained minerals).

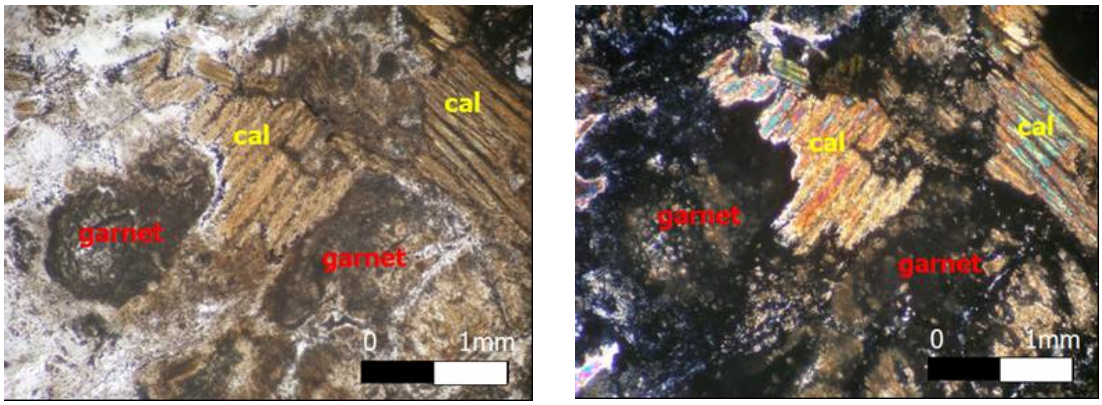

Fig.5 Photomicrographs of an eclogite xenolith showing garnet (altered to calcite, epidote and other unidentified minerals) and clinopyroxene (cal) (left: plane-polarized light, right: crossed nicols).

4. Conclusion

This petrographic study indicates the Menyin kimberlite is a serpentine-calcite-phlogopite-rich variety.

5. Acknowledgements

The authors are grateful to the Geology Department for the excess of laboratory equipment.

References

Wight, Q., 2005. A report of the 29th International Gemmological Conference, Wuhan, China, in *Elements, an International Magazine of Mineralogy, Geochemistry, and Petrology*. V.1, No.2 p.64, March 2005.