Glauconites in the Tertiary Marine Sediments in the Pohang Area, SE Korea

Byeong-Kook Son
Korea Institute of Geology, Mining and Materials (sbk@kigam.re.kr)

1. INTRODUCTION

Glauconite is a hydrous Fe and Mg aluminous silicate clay mineral with a mica-like structure, which is characterized by significant amounts of Fe^{3+} in octahedral sheets and K in interlayers. Recently, Lee et al. (1997) reported the occurrence of glauconite in recent sediments of the Yellow Sea, whereas Lee and Paik (1997) reported it in the Ordovician formation. Similarly, the present study reports the occurrence of glauconite in the Tertiary marine sediments in the Pohang area. The additional objective of this work is to investigate the chemistry of the glauconites from the Tertiary sediments in an attempt to increase the better understanding of glauconization.

Glauconite is commonly developed by contact with the marine environment. Odin and Matter (1981) and Odin (1988) proposed a process of glauconization, which starts with light green faecal pellets that are composed of mud rich in organic matter. In the next stage, the initial biogenic carbonates in the faecal pellets are dissolved to consequently lead to a high porosity in the pellets, and subsequently are replaced by authigenic clays. In the last stage, the volume provoking cracks commonly occurs in grain surface. In addition, well shaped microcrystals (rosettes or flakes) are present within the grains. In the present study, interpretations of the chemical data are based on this premise suggested by Odin (1988).

2. SAMPLES AND METHODS

Samples were collected from cores that were taken from a petroleum exploratory well, which penetrated the Miocene marine sediments within Pohang city. Sandstones were selected from the cores at depths of 300-305 m to precisely examine glauconization. Electron microprobe analyses of glauconite pellets were performed on polished thin sections of sandstones using a JEOL JCXA-733 electron microprobe.

3. RESULTS

In the studied well, glauconites are present sparsely in the sandstones that are cemented by carbonates. The sandstones are sandwiched between impermeable mudstones, which also include glauconites although the amounts are low. The glauconites are easily identified by their indigenous green color and pellet shape in polarizing microscope. In rock samples, however, there is difficulty in finding the glauconite minerals due to rarity. Most of the glauconite pellets have a smooth, rounded or lobate morphology and are internally composed of randomly arranged clay aggregates.

Two grains of glauconite were selected to chemically investigate the process of glauconization (Fig. 1). One of the grains has a well rounded pellet shape with cracks at the surface (grain 2), whereas the other has well developed flakes and an angular surface (grain 1). These glauconites were analyzed by Electron microprobe, in which the analyses were obtained from the spots traversing the grains (Fig. 1). In the number 2 grain, there is an apparent increase in K and Fe contents toward the center of the grain, while Al decreases toward the center. In the number 1 grain, the analyses of the flakes (points 4, 5, 6) show different trends from those of the other part (points 1, 2, 3). The flakes have higher contents of K than the other part of the grain. However, Fe in the flakes is lower than that of the other part of the grain. In addition, Al is much higher in the flakes than in the other part.

When the analyses were plotted within the triangular composition diagram muscovite-celadonite-pyrophyllite, the analyses fall within the region of glauconite-smectite as well as glauconite (Fig. 2). This suggests that compositional variation of the Pohang glauconites might be constrained by component layers in glauconite/smectite. In other words, interstratified glauconite/smectite might be evolved to glauconite, showing a tendency toward the tetrahedral end.

4. DISCUSSION AND CONCLUSIONS

Judging from the evolution model by Odin (1988) and present analyses, developement of glauconite crystals occurs preferentially in the interior of the grain, rather than in the outer part. Furthermore, glauconitic smectite (smectite-like glauconite) is evolved into glauconitic illite (illite-like glauconite) through interstratified glauconite/smectite. The glauconites from this study area show two distinct stages of morphology and variation in chemical composition. The first stage is dominated by interstratified glauconite/smectite with no flakes. In the stage, there are the increases in Fe and K contents and the decrease in Al content through the evolution. The second stage is characterized by the development of flakes of glauconite. There are tendencies for Fe content to decrease and for K and Al contents to increase.

5. REFERENCES

Lee, C. H., Lee, S-R., Lee, C-W., and Choi, S-W., 1997, Geochemical variation of authigenic glauconite from continental shelf of the Yellow Sea, off the SW Korea: Econ. Environ. Geol., 30, 303-312.

Lee, Y. I., and Paik, I. S., 1997, High alumina glaucony from the Early Ordovician Mungok Formation, Korea. Geoscience Journal, 1, 108-114.

Odin, G. S., and Matter, A., 1981, De glauconiarum origine: Sedimentology, 28, 611-641.

Odin, G. S., 1988, Green marine clays, Oolitic ironstone facies, verdine facies, glaucony facies and celadonite-bearing facies- A comparative study: Developments in Sedimentology 45, Elsevier, 445p.

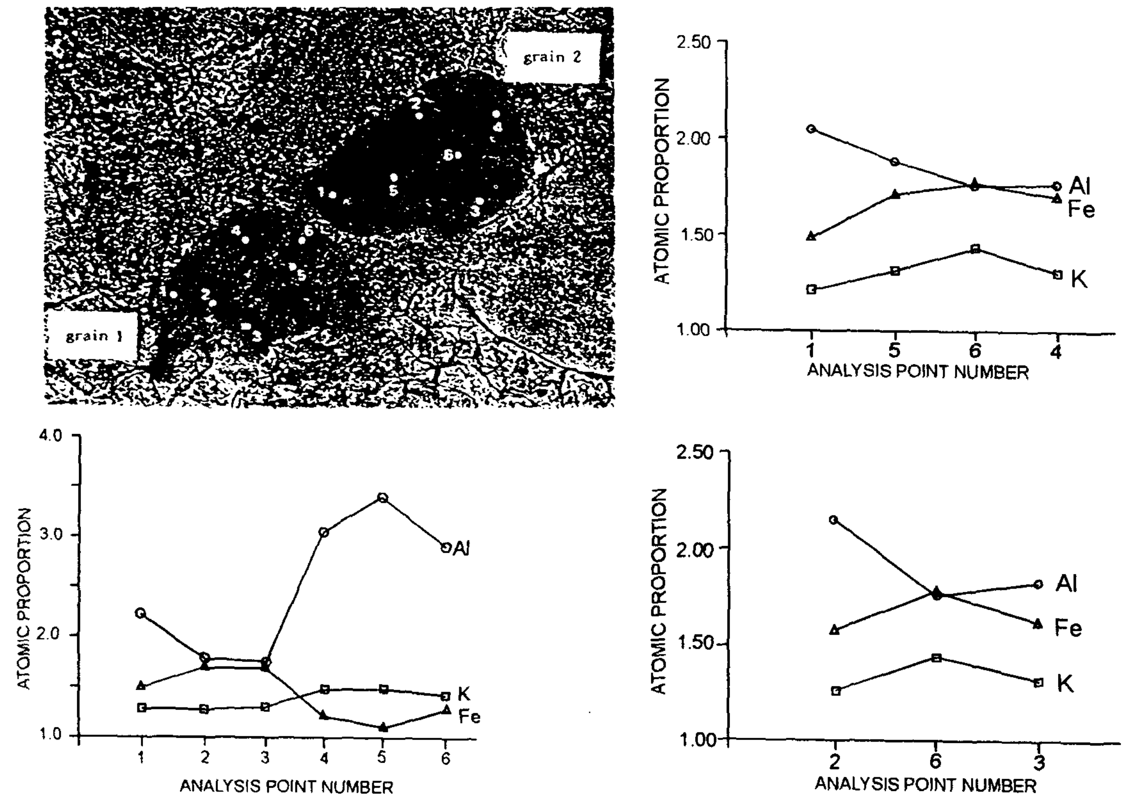

Fig. 1. Chemical variation within the same grains of glauconites.

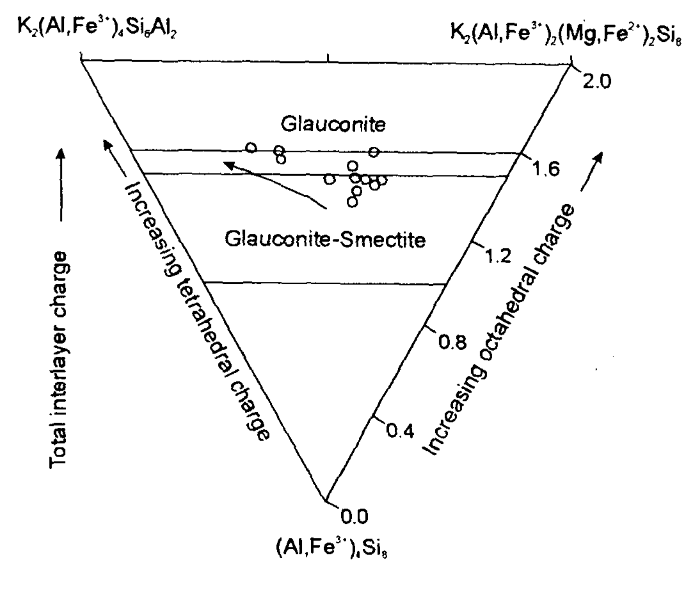

Fig. 2. Position of glauconite analyses within the triangular composition diagram muscovite-pyrophyllite-celadonite.