

Verification of damage by polishing of sheet-like minerals

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Sheet-like minerals such as mica, serpentine, clay minerals and graphite are affected by shearing due to polishing. In addition, a damage due to electron beam irradiation during observation by the electron microscope also occurs. In this study, the damage due to polishing and irradiation of the electron beam for sheet-like minerals of graphite and serpentine minerals was evaluated by Raman spectroscopic analysis. First, we evaluated the crystallinity change of graphite in each polishing stage. As a result, a decrease in crystallinity was observed in all stages from rough polishing to fine grain polishing by diamond paste. The chemical polishing with colloidal silica also lowered the crystallinity of graphite. In order to reduce the shearing effect to graphite, we tested a low load polishing using the polisher ISPP-1000 (Ikegami Seiki Co., Ltd.) which is controlling the load by a weight. However, it was revealed that even a load of only 25g was damaged to graphite. Next we examined the polishing effect of serpentine minerals. Raman spectroscopic analysis was performed after polishing, however no spectral change at each polishing stage like graphite was detected. On the other hand, the antigorite Raman spectra after SEM-EBSD analysis showed a decrease in intensity at the depth of about 3 micrometre from the surface, suggesting that the crystal structure was damaged by electron beam irradiation. We also tried a low load polishing for serpentine minerals, and we detected an electron backscatter pattern of lizardite for the first time. In the case of pure lizardite sample, a clear Kikuchi band was confirmed. On the other hand, almost no pattern was detected for serpentine minerals (antigorite, lizardite, chrysotile) in the serpentinite samples, because of the contrast of hardness with surrounding hard minerals such as olivine. For analysis of sheet-like minerals contained in rock samples including minerals of various hardness, further improvement of the polishing method or other methods such as ion milling is needed.

Keywords: graphite, antigorite, lizardite, low load polish, Raman spectroscopy, EBSD