Moganite distribution and aluminum content in agate

Koichi Momma[1]; Toshiro Nagase[2]; Yasuhiro Kudoh[1]; Takahiro Kuribayashi[3]

[1] Tohoku Univ; [2] Tohoku Univ. Muse.; [3] Tohoku Univ.

Moganite is a silica mineral, which is thought to have no stability field. Moganite is one of major constituents of microcrystalline quartz varieties crystallized from low-temperature solution. The widespread occurrence of moganite is attracting attention to a question: how and in what environment does it crystallize?

Agate is composed of microcrystalline quartz and moganite. Agate displays repetitive bands texture, consisting of twisted and non-twisted fibers, or fibers elongated along different crystallographic orientation. Moganite distribution in agate changes with bands. Aluminum is suspected as a cause of texture formation of agate because trace amount of aluminum concentration in agate systematically changes with the alternating bands texture. Aluminum content in quartz is a function of temperature when crystallization condition is close to equilibrium. However, aluminum content in agate is higher than that of coexisting macroscopic quartz. Aluminum is also known to inhibit the growth rate of quartz. Although several factors are pointed out as a cause of moganite occurrence so far, the above facts suggest that aluminum affects the crystallization of moganite. Therefore, this study focused on the correlation between moganite distribution and aluminum content in agate.

Samples used in this study are agate geodes from Brazil. The ratio of moganite to quartz was extracted from integrated Raman intensity ratio of the main symmetric stretching-bending vibration of moganite (501 cm^{-1}) over quartz (465 cm^{-1}). Aluminum content was measured by EPMA. Etching of the samples by hydrofluoric acid was performed to observe the layered texture of agate. The etched samples were observed by SEM and reflection microscope. Polarization microscopy and cathode luminescence were also used to observe the agate texture.

The optical property of the samples is length-fast. Etching by hydrofluoric acid showed clear band contrast between high and low etching rate regions. Bands with high moganite content are more readily etched by acid than bands with low moganite content.

Correlation among impurity content, moganite/quartz ratio, etching rate, and grain size is now being investigated.