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metasomatic instability and constitutional oversaturation

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Migrating interface derived from interdiffusion of ionic species in permeable solution in the plate boundary rocks occurs as wavy boundary between mono- and bi-mineralic bands. Simple examples are found in the banded basic schists of the Sambagawa metamorphic belt. Albite - quartz - calcite bands having wavy interface are commonly sandwiched by thin chlorite bands and sometimes by thin epidote bands. The trails of hematite grains are continuously pervaded into albite - quartz bands from chlorite band, indicating the advancement of interface into chlorite bands.

The wavelength of the interface increases firstly and then reaches the constant level with width of albite - quartz band. It suggests that the preferable wavelength of the interface develops with time, considering the increasing width of albite - quartz band with time. However, the ratios between width of band and wavelength of the interface varies in different rock specimens.

The modeling of the wavy interface development should be constructed in the system of chemical equilibrium of solution with albite, chlorite, quartz and calcite. At the interface chemical equilibrium attains but being apart from the interface, the diffusion of ionic species relevant with chlorite and other minerals should make change in equilibrium concentrations. As the concentrations gradients of ionic species in grainboundary solution makes constitutional oversaturation (1) of one side mineralogy, the interfacial geometry becomes unstable for small waveform perturbation. The selective wavelength in this case is governed by the ratio of oversaturation degree and interfacial energy. In this study, the authors can propose the capillarity effect constitutional oversaturation instability of the metasomatic banding interface. This is called as metasomatic instability which controlled by velocity of interface advance.

Reference

(1) W.Kurz and D.J.Fisher, Fundamentals of solidification, Trans Tech Pub., 1986.

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