Polytypes and higher-order structures of antigorite: A TEM study

BERNARD GROBÉTY*

Institut de Minéralogie et Pétrographie, Université de Fribourg, CH1700 Fribourg, Switzerland

ABSTRACT

The structure of the members of the antigorite polysomatic series is based on corrugated octahedral layers with tetrahedral layers attached at the convex side. The half-waves in the basic antigorite structure are characterized by constant medium aperture angles of 20.3° that are independent of the wavelength. Higher-order antigorite structures based on half-waves with aperture angles that are a multiple of 20.3° are possible. Antigorite aggregates found in ophicarbonates from different localities in the Alps, replacing chlorite (chl) and tremolite (tr), show a systematic orientation relationship characterized by an angle of 20.3° or multiples thereof between the basal planes of adjacent grains. This angular relationship is explained by the presence of a wave with an aperture angle >20.3° connecting the neighboring grains. The first antigorite crystals with twice the basic aperture angle and with a wavelength of 10.0 nm were found in oceanic serpentinites from Hess Deep (Pacific Ocean). The average experimental amplitude of 0.7 ± 0.05 nm is close to the calculated amplitude of 0.732 nm for a second class antigorite with the observed wavelength. Antigorite that nucleates and/or replaces type-II chlorites in the studied samples shows a doubling of the c-axis length. The contrast in HRTEM images is compatible with a two-layer structure based on unit-cell twinning, the antigorite thereby inheriting the orientation of the octahedral layers of the primary chlorite.