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

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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.