A MODEL OF AGATE CHALCEDONY STRIATION

RAKIN, V.I., KODANEV, I.V.

The simple mechanism of formation of one basic type of agate striation (chalcedony generations) is proposed. The mathematical model of the phenomenon was constructed and tested numerically by computer simulations. We consider growth, nucleation and geometrical selection of chalcedony fibers. The assumption is made about the way that some impurity influences on the nucleation of quartz crystals (e.g. Fe2+, Fe3+, Al3+, organic molecules which may exist in solution initially). The impurity is expected to provoke formation of quartz nucleus if the certain critical concentration of the impurity is attained. Then the chalcedony generations change takes place due to the intensive formation of quartz seeds in the thin zone adjacent to the growth front where the critical impurity concentration is gained by front advancing.The process is governed by set of partial differential equations which we solve numerically to estimate the plausibility and to catch the peculiarities of the mechanism. We conceive a spherical agate nodule in which formation of chalcedony is initiated at walls due to the gradual temperature fall and proceeds towards the center. Plausible values of the parameters were chosen and it was shown that the model demonstrated reasonable behavior and various zones widths could be obtained. Besides one could observe three different types of zones width transformations along the cavity depth.We conclude that proposed mechanism of formation of chalcedony striation is self-consistent and may account for the chalcedony generations in agates.