Crystal Genesis in Inhomogeneous Media

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The study is based on modeling crystal growth (formation of mineral individuals) in inhomogeneous media. Until recently, modeling such systems was difficult, first of all for purely technical reasons. Now holographic methods provide such opportunity. Crystal genesis in inhomogeneous media is in a sense contrary to the process of growing perfect and large single crystals. In nature, however, imperfect and small crystals are common. New data on self-organization in the system "crystal-medium" were obtained by using an advanced experimental technique in combination with a new synergetic methodology for interpretation of results. For example, it has been shown that spatial-temporal configurations of alternating steady convection and concentration gradient zones arise in a wide range of thermodynamic parameters (T=20-400°C, P=1-1100 atm), their characteristics being controlled by the growing (dissolving) crystal (crystal association) and environment. Non-linear mass transfer of the major constituent and impurities in the boundary layer accounts for three steady states: steady knot, steady focus, and center. Crystal growth in the regime of either steady focus or center involves periodic impurity entrapment which gives rise to growth pyramids with sectorial or zonal structure. The mechanism and rate of crystal genesis are controlled by the interactions in the molecular system consisting of solvent molecules and molecules (ions) of the dissolved constituent (solvate complex), crystal, and their regular fluctuations in the adsorption boundary layer. This approach not only provides insights into how crystals grow in nature and allows the use of crystals as sources of genetic information, it also underlies synthesis of perfect single crystals (by establishing sources of disturbances and inhomogeneities).