Dual open-boundary cellular automaton model of oscillatory zoning in solid solution – Aqueous solution systems

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Use of cellular automata (CA) to model the development of oscillatory zoning (OZ) in solid solution-aqueous solution (SS-AS) systems have been approached in earlier publications [1, 2], each having different supporting principles. In the former case [1], OZ arises in the mean-field approach where the probability of attachment of a molecular unit depends exclusively on the crystal surface composition, while the latter [2] mainly relies in equilibrium thermodynamics where the attachment probability is equal to the SS-AS partition coefficient. These models were conceived to simulate such solid solutions as the barite-celestite $[(Ba,Sr)SO_4]$ or calcite-otavite $[(Ca,Cd)CO_3]$ system, where end-members have very different solubility products and OZ patterns have been obtained experimentally [3].

Previous work [2] has shown that oscillatory patterns can develop in agreement with the mechanisms proposed in [3]. These patterns are likely to develop when solution composition near a mineral surface remains close to a given supersaturation threshold. Under these conditions, and depending on the concentration ratio of end-member components in solution, layers of distinct composition can develop more or less unevenly in width. The solution also develops concentration oscillations of each component along its length. Keeping the cylindrical geometry of the CA, but opened at both ends such that soluble components can move out of the model system opposite to the input boundary, new results were obtained. The OZ patterns become closer in agreement with the experimental ones for equivalent concentration ratios of end-member components.

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Eocene volcanism in the Central Anatolian Crystalline Complex: Geochemical indications for a change from post-collision to extension

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Central Anatolia is a typical area where Late Cretaceous post-collisional magmatism is followed by Eocene extension and basin formation. In this study, major and trace element data of somewhat restricted Eocene volcanics from two different regions (Kırşehir and Yozgat) are evaluated. The lavas, dykes and domes are similar in petrography and show a subalkaline trend with a few samples of alkaline character. They are mainly basalts and basaltic andesites and rarely dacites and rhyolites

Mg # (100MgO/ (FeO+MgO)) of the samples ranges between 19–55. This value indicates that Eocene volcanic rocks do not represent primary magmas. Ni and Cr contents are low which is consistent with the evolved nature of the volcanics. Moreover, they have experienced variable degree of fractional crystallization. The samples evaluated exhibit enrichment in LREE over HREE on the MORB normalized diagrams. Geochemical features of Kırşehir and Yozgat Eocene volcanics suggest that they have undergone similar processes such as variable degrees of melting of the same mantle source or fractional crystallization of common parental magmas. According to REE data the source region of Eocene lavas should be the spinel lherzolites. Partial melting modelling based on REE data suggests that 10-20% melting of spinel lherzolite is required to produce the studied volcanic rocks.

Compared with the Late Cretaceous post-collisional magmatism the effect of lithospheric mantle is more dominant during the Eocene extension.