# Episodic growth of continental crust: A 3-D geodynamic model

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The focus of this paper is the question (1) whether the observed zircon age distribution of continental crust (CC) is produced by real crustal growth episodes or is only an artefact of preservation. Question (2): In connection with the second alternative of (1), it has been proposed that there was little episodicity in the production of new CC and that modeling corroborates this opinion. In answer to (1), we conclude that a combination of the two proposals might be possible. In matters of (2), we ascertain that a dynamic modeling of the convection-differentiation system of the mantle reveals the high probability of magmatic episodes. We solve the full set of balance equations in a 3-D spherical-shell mantle. The heat-producing elements are redistributed by chemical differentiation. A realistic solidus model of mantle peridotite is essential. The solidus depends not only on depth but also on the variable water concentration. Furthermore, we introduced realistic profiles of Grüneisen parameter, viscosity, adiabatic temperature, thermal expansivity and specific heat. Our model automatically produces lithospheric plates and growing continents. Regarding number, size, form, distribution and surface velocity of the continents, no rules have been prescribed. Regions of the input parameter space (Ra, σy, k, f3) which are favorable with respect to geophysical quantities show simultaneously not only episodicity of CC growth but also a reproduction of the observed zircon-age maxima referring to the instants of time. Admittedly, we also obtain Archean events for ages greater than 3000 Ma which are not or scarcely visible in the observed zircon ages. Sinusoidal parts of the evolution curve of qob, Ur and Ekin are found superposed with a monotonous decrease. Tmean, however, decreases smoothly and slowly, nearly without pronounced variations. Therefore, we can dismiss catastrophic mechanisms which simultaneously incorporate the whole mantle.

# Role of exopolymeric substances in dolomite biomineralization by coastal sabkha sulfate-reducing bacteria: an *ex situ* study of microbial community-mineral interactions using solid-support imaging

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While the microbial-mediation model has advanced current understanding of modern dolomite genesis, the exact mechanism remains speculative, especially in the context of microbial community architecture. Here we investigate the biofilm aspect of natural SRB growth within a dolomitizing culture via analysis of media chemistry and surface formations. SRB from a coastal sabkha (western Abu Dhabi) were studied vis-à-vis different quantities of exopolymeric substance (EPS), under simulated sabkha pore water conditions, and using inert solid support materials to capture biofilm/biomineral growth. The experimental reactor with the highest EPS content presented the most significant areal distribution of Mg-rich carbonate phases against reactors of lower/no EPS content (mean Mg/Ca molar ratio of 44.1% vs. 27.9%). More detailed microanalyses of major formations also revealed greater incorporation of $Mg^{2+}$ in saturated, partially degraded EPS aggregates (Mg/Ca molar ratio up to 91.2%) compared to a growing biofilm matrix (Mg/Ca molar ratio up to 41.4%). Furthermore, a variety of mineral morphologies with varying levels of Mg incorporation were observed in inoculated reactors supplemented with EPS, hinting at gradual dolomitization. Strategic nucleating sites for Ca-Mg carbonates appeared to be provided by aged EPS, while actively secreted and extensively growing biofilm EPS instead would initially inhibit mineralization through cation binding. Ca-Mg carbonate biomineralization might hence depend on the dynamic interplay of various physical, chemical and physiological conditions of local EPS that would constitute an optimal nucleating microenvironment.


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