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Dynamical Evolution of Layered Reservoirs

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The thermal history of Earth an other planets, their chemical differentiation and reaction of the interior with the atmosphere was largely determined by convective processes. Convection does not always tend to homogenize the interior. Convection can rather establish structures and as such reservoirs which can stay intact for geological significant time. We employ. numerical models, ranging from simple 2D scenarios to fully 3D configurations with strongly temperature , pressure and compositionally dependent rheology , to explore the formation of such reservoirs. Layer formation plays a special role in the pattern formation process. . It will be shown that distinct convective layers can form as self-organized structures from non-layered states, without pre-existing density jumps., once effects of thermal – and compositional contributions to the density are taken into account. A stable compositional gradient, hearted from below and/or cooled from above resembles one reasonable scenario for Earth-mantle after core formation. In this configuration a layered mantle structure emerges. the individual layers display different stabilities. the intermittent breakdown of individual layers leads to a strong episodicity in the thermal and chemical evolution. We also investigate the scenario of an initially unstably stratified mantle. After an initial overturn through a Rayleigh Taylor instability observe again layer generation. Our results indicate the distinct layers and chemical reservoirs in planetary mantles are formed by dynamics fractionation and are thus likely to appear as generic features of planets