DRIP TECTONICS UNDER MAGMATIC ARCS

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Drip tectonics in compressional (subduction and collision) environments is a form of (mostly) vertical tectonics and is driven by density instabilities. Drips are lower lithospheric domains (crust or mantle); they can be tens of kilometers in diameter, have demonstrable negative buoyancy and sink/founder if they have the ability to detach from the overlying material. The idea of drip tectonics evolved from a particular form identified as delamination by Peter Bird in the late 1970s and applied to the Laramide orogeny of the Southwestern US. There is a certain amount of convergence between the end member concepts of delamination, slab roll back and drip foundering although they can be triggered by rather different dense assemblages in a number of unrelated tectonic scenarios. Drip tectonics is particularly efficient under magmatic arcs. Ultramafic cumulates residing in the lower crust and mantle lithosphere under major arcs can detach and sink into the underlying mantle recycling sizable fractions of the lithosphere into the Earth's interior. Most granitoids formed throughout the Earth's history require that some form of foundering took place under them. I will review evidence for that from trace elemental data in granitoids and accessory zircon preserved as detrital mineral. The process has been best documented both geologically and geophysically in the Sierra Nevada, California, where presumably arc root assembles of the great Sierra Nevada batholith underwent drip foundering. Rock assemblages dominated by pyroxenes with garnet (better known as arclogites), which form as complements to large batholiths, are the main triggers to foundering in sub arc environments. I will review the evidence and ideas surrounding the concept of root foundering in the Sierras and similar environments. Geodynamic modeling provides additional insights into the speeds and shapes in drip tectonics, and some relevant finds will be summarized here. Finally, I will present some geochemical tools put forward towards testing drip tectonics using regional basaltic magmatism and exemplify with new data from the Persani region in the Eastern Carpathians.

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