

The crustal filter in magmatic distillation columns across tectonic settings

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Volcanic edifices, as large as they may be, are only the tip of gigantic magmatic “heatbergs”; they cap plumbing systems extending down to the upper mantle, growing and maturing over time. The paths that magmas take through these transcrustal columns influence the compositional ranges that reach the surface, and eruption frequencies, while also controlling the formation of plutonic roots and ore deposits. However, in these complex magmatic plumbing systems, the dominant mechanisms that control the intrusive/extrusive ratios and compositions reaching the surface remain poorly understood. In this talk, we will discuss new results on processes and timescales that can be decrypted from the study of (1) fluid dynamics model outputs in reservoirs and conduits, (2) global databases of magmatic rocks (including geochemical compositions and physical properties of magmas), (3) crustal cross-sections from different tectonic environments, such as an island arc (Famatian region, Argentina) and a post-collisional rifting environment (Ivrea zone, Italy). In particular, we will review important processes occurring in magma reservoirs and conduits that control the chemical signatures of volcanic and plutonic rocks throughout these magmatic distillation columns, and what may allow some magmas to reach the surface while others get trapped on their way up.