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# Magma chamber paradox: decompression upon replenishment

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The invasion of active magma chambers by fresh magma of deeper provenance is invariably assumed to cause chamber pressurization. Pressure increase thus stands as an intuitive consequence of magma chamber replenishment. However, new numerical simulations demonstrate that pressure evolution is highly non-linear, and that decompression dominates when large density contrasts exist between injected and resident magmas. This apparent paradox originates from the compressible nature of volatile-rich magma and the dynamics of convection associated with injections of buoyant magma. While decompression can dominate in a shallow chamber, pressure increase develops in the connected deep regions of magma provenance. These results contradict classical views adopted to interpret observations at active as well as fossil magma chambers, and demonstrate that a simple reliance on intuition is insufficient: what may be perceived as a paradox – magma chamber decompression upon replenishment – is instead likely, and rooted in the complex physics that governs the multiphase, multi-component dynamics of magma transport in geometrically composite, spatially extended magmatic systems.