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Erebus volcano: pumping out mantle CO_2 for millennia

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Erebus is the archetype of an open-vent volcano. Not only because of its persistently degassing lava lake at the surface but also because its phonolitic reservoir is permeable to volatile input from underlying primitive basanitic magma. Olivine-hosted melt inclusions entrapped at mantle depth in basanite record CO_2 concentrations up to 8000 ppm. CO_2 escaping from the basanite reaches the phonolite magma system in which it dehydrates the melt, stabilising a phase assemblage dominated by large and abundant anorthoclase feldspar crystals. At the surface, the flux of volatiles out of the lava lake is accordingly dominated by deeply-sourced CO_2. During ascent, sulphur degassing drives the melt to more reducing conditions. Carbon equilibrates with the melt and gets progressively reduced as reflected in an original CO_2/CO molar ratio of $\sim$200 in basanite at mantle depth that drops to about 10–15 in phonolite at the surface. The influx of volatiles in the shallow phonolitic reservoir promotes convection and delivers heat, preventing the system from cooling over time. This has been achieved without significant recharge from primitive magma for at least the last 18 ka. The Erebus magmatic system acts as a stable and efficient pump delivering mantle carbon to the surface.