Zonation in anorthoclase feldspar megacrystals reveals dynamics of the magma conduit feeding the lava lake at Erebus volcano, Antarctica

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Anorthoclase megacrysts are a striking feature of many peralkaline trachyte and phonolite lavas. At Mt Erebus volcano (Antarctica) they reach up to 7 cm long, and display two interesting properties: perfect oscillatory zoning and large melt inclusions. By combining experimental and analytical approaches we can recreate the *P*-*T*-H_2O-fO_2 history of these crystals and illuminate the magma dynamics of the plumbing system feeding Erebus' lava lake. Phase equilibrium experiments indicate a correlation between the anorthoclase composition and both pressure and temperature. After imaging the melt inclusion by X-ray tomography to assure they are fully enclosed, melt inclusions confined within anorthoclase zones of known composition were analyzed by electron probe, ion probe and Fe K-edge micro-x-ray absorption near-edge structure spectroscopy (XANES). We found a correlation between the CO_2 content in melt inclusions and the chemistry of their host zone suggesting that oscillatory zoning in these megacrystals reflects crystallization at different depths within the conduit. This finding allows us to decode each crystal and track its history of circulation up and down the magmatic conduit.