Degassing of Erebus lava lake, Antarctica

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Open system degassing was first observed at Erebus volcano, Antarctica, over a century ago, in the form of a lava lake in its summit crater. The persistent activity of the lava lake provides an opportunity for continuous measurements and observations of changes on a range of timescales. Gas emissions from Erebus lava lake have been measured using open–path Fourier transform infrared spectroscopy, during each austral summer field season from 2004 to 2012. The technique works particularly well at Erebus, thanks to the aridity of the Antarctic atmosphere, and the availability of a permanent 'infrared lamp' in the form of the lava lake itself. At Erebus, it is straightforward to measure both water and CO_2 in the gas emissions, something that is challenging at most volcanoes by OP–FTIR spectroscopy.

The sustained passive degassing and turnover of the lava lake is sporadically punctuated by Strombolian explosions. Both types of activity have been captured in the gas measurements. The measurements also identify longer–term changes to plume composition during and between field seasons (i.e. time scales of a few weeks to interannual variability). While the connection between surface observations of the lake behaviour and the plume composition is fairly clear, measured gas ratios have also been used with the thermodynamic model 'D–Compress' to investigate deeper processes. The model simulates the equilibrium composition of melt and gas as a function of pressure (depth). We report here on the application of 'D–Compress' in investigating magmatic source conditions likely to generate the observed plume gas composition.