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LETTER

An improved clinopyroxene-based hygrometer for Etnean magmas and implications for eruption triggering mechanisms

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ABSTRACT

We have refined the clinopyroxene-based hygrometer published by Armienti et al. (2013) for a better quantitative understanding of the role of H_2O in the differentiation of Etnean magmas. The original calibration data set has been significantly improved by including several experimental clinopyroxene compositions that closely reproduce those found in natural Etnean products. To verify the accuracy of the model, some randomly selected experimental clinopyroxene compositions external to the calibration data set have been used as test data. Through a statistic algorithm based on the Mallows' C_P criterion, we also check that all model parameters do not cause data overfitting, or systematic error.

The application of the refined hygrometer to the Mt. Etna 2011–2013 lava fountains indicates that most of the decreases in H_2O content occur at P < 100 MPa, in agreement with melt inclusion data suggesting abundant H_2O degassing at shallow crustal levels during magma ascent in the conduit and eruption to the surface.

Keywords: Mt. Etna, clinopyroxene, hygrometer, H_2O content