Individual lava flow thicknesses in Oceanus Procellarum and Mare Serenitatis determined from Clementine Multispectral data

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We use multispectral reflectance data from the lunar Clementine mission to investigate the impact ejecta deposits of simple craters in two separate lunar mare basalt regions, one in Oceanus Procellarum and on in Mare Serenitatis. For a number of craters, we observe differences between the TiO_2 (and FeO) contents of their ejecta deposits and the lava flow units in which they are located (see Figure 1). We demonstrate that, in the majority of cases, these differences cannot plausibly be attributed to uncorrected maturity effects. These observations, coupled with morphometric carter relationships that provide maximum crater excavation depths, allow the investigation of sub-surface lava flow stratigraphy. We provide estimated average thicknesses for a number of lava flow units in the two study regions, ranging from ~80 m to ~600 m. In the case of the Serenitatis study area, our results are consistent with the presence of sub-surface horizons inferred from recent radar sounding measurements from the JAXA *Kaguya* spacecraft[1]. The average lava flow thicknesses we obtain are used to make estimates of the average flux of volcanic material in these regions. These are in broad agreement with previous studies, suggesting that the variation in mare basalt types we observe with depth is similar to the lateral variations identified at the surface.

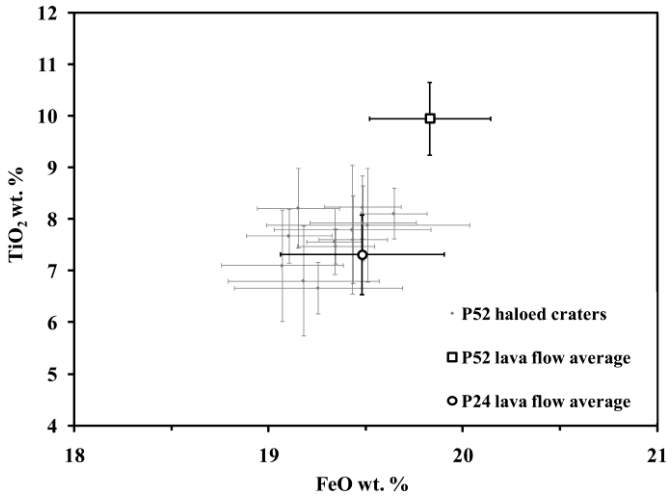

Figure 1. The mean FeO and TiO_2 wt. % contents for the ejecta of a population of craters (grey data points) within Oceanus Procellarum whose compositions are distinct from that of the lava flow in which they are located ('P52'); they are more similar to the composition of an older and neighbouring lava flow unit ('P24').

[1] T.O. Ono, A. Kumamoto, H. Nakagawa, Y. Yamaguchi, S. Oshigami, A. Yamaji, T. Kobayashi, Y. Kasahara, H. Oya, *Science* 323, 909 (2009).