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The mineralogical composition of dark dunes in Martian craters – A global view

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A global selection of about 70 impact craters comprising multiple different types of dark material deposits, such as single dunes, huge dune fields or thin sand sheets was chosen for this study. By analyzing the mineralogy of these deposits, we want to examine whether there is any correlation between the mineralogical composition and the geographical location, or the dune surface induration, which was established previous works [1], respectively.

For this analysis, MarsExpress-OMEGA spectral data were corrected for solar irradiance and atmospheric absorptions. The mineral detection was done using an IDL routine that applies a rationing technique on corrected data sets. The implemented rationing technique, as well as the spectral parameters (spectral criteria) used for mineral detection, were developed and described in detail by [2]. They include the typical absorption features for every mineral of interest, such as high- and low-calcium pyroxenes, olivine (forsterite and fayalite) and hydrated minerals.

We present a global map showing the mineralogical composition of the selected intracrater dark material occurrences. Besides the well-known mafic mineral composition (pyroxene & olivine), we could assess that most of the dark deposits show strong pyroxene absorptions. The minor part has olivine absorptions, whereas forsterite occurs in most cases. The results show no mineralogical difference between unconsolidated and consolidated dunes. There is also no correlation between the mineralogical

composition and the geographical location recognizable. The unoxidized mafic nature of the material indicates that is was not affected by aqueous weathering. Thus, mechanical weathering could be the major process that caused the comminution of the material. In some places, a portion of the dark material shows absorption features of hydrated minerals indicating that the material has partly underlain a chemical alteration process. The hydration might have been caused by the supply of water, e.g. by melting H_2O-frost layers. There is no obvious correlation between hydrated minerals and consolidated dune surfaces. However, it is notable that the positive detection of hydrated minerals concentrates in craters located in Arabia Terra and that all of these intra-crater materials show pyroxene absorptions and no olivine features. Although there is no correlation between the detected mineralogical composition and the dune surface induration, it cannot be excluded that the surface consolidation might correlate to any other minerals that could not be detected by OMEGA.

References: [1] Tirsch, D., et al. (2007), *LPSC XXXVIII,* Abstract #1596. [2] Poulet, F., et al. (2007), *JGR 112*, doi: 10.1029/2006JE002840.