The Stratigraphy of Mare Basalts in Oceanus Procellarum: Initial Results from New Crater Size-Frequency Distribution Measurements

H. Hiesinger, J.W. Head III (Dept. of Geological Sciences, Brown University, USA); Wolf, U., Neukum, G. (DLR- Institute of Space Sensor Technology and Planetary Exploration, Germany)

The stratigraphy of basalts in Oceanus Procellarum was previously investigated by Whitford-Stark and Head [1]. Based on morphologic studies, spectral reflectance and other remote sensing information they defined 21 distinctive basalt units, grouped into four formations, the Repsold-, Telemann-, Hermann-, and the Sharp-Formation. We produced a high-resolution Clementine color ratio image, superposed their map, and found that it generally discriminates well between the major spectral basalt types. However, we found that several units can be further subdivided into spectrally different basalt sub-types. The spatial distribution of previously published age data [2, 3] does not correlate with the outline of these spectrally defined units. Therefore we performed new crater size-frequency distribution measurements for spectrally and morphologically defined basalts in order to investigate the stratigraphy of basalts in Oceanus Procellarum. Our crater counts show that active mare volcanism in Oceanus Procellarum occured over a long period of time from about 1.3 b.y. to about 3.6-3.7 b.y. Lichtenberg, a bright ray crater, is partly embayed by basalt flows which cover the bright rays. Consequently, this basalt was thought to be the very youngest basalt, i.e. Copernican in age, and to mark the end of lunar volcanism [4]. However, our data show that the Lichtenberg Basalt is about 2 b.y. old and can no longer be considered the youngest basalt. Several dated units in Oceanus Procellarum exhibit younger ages of about 1.5 b.y. Central Oceanus Procellarum basalts appear to be younger than western peripheral basalts. From this we conclude that the ages of the investigated basalts are not evenly distributed throughout Oceanus Procellarum. In addition, our initial results show that lunar volcanism in Oceanus Procellarum was not evenly distributed in time but clearly shows several fluctuations in activity. Making use of the Clementine 400/730 nm ratio [5] we generated a map of the titanium concentration of basalts in Oceanus Procellarum. In our titanium map the Dechen Basalt is a very homogeneous basalt which is low in titanium content. According to the map of Whitford-Stark and Head [1] Lavoisier and Marius Basalts show a wide range in titanium abundance but are generally lower in titanium than the Schiaparelli Basalt. The highest titanium contents are associated with younger basalts such as the Schiaparelli Basalt, and the Flamsteed Basalt [6]. However, the very youngest identified basalts are not the most titanium-rich basalts, but show slightly lower titanium contents than the dated parts of the Schiaparelli and the Flamsteed Basalt.

References:

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