AGES OF DIKE INTRUSIONS ON THE MOON. A. L. Nahm[1] and V. R. Chierici[1], [1]German Aerospace Center (DLR), Rutherfordstr. 2, 12489 Berlin, Germany. Amanda.Nahm@dlr.de; Valeria.Chierici@dlr.de.

Introduction: Recent work [1] has shown that several of the graben on the lunar nearside are dike-related, based on modeling of graben cross-sectional topography. In this study, we examine 3 regions containing 4 dikes identified by [1]: Rimae Daniell (37° N, 24° E), Rima Ariadaeus (7° N, 13° E), Rima Hyginus (7° N, 7°E), and Rima Hesodius (30° S, 22° W) to determine the age(s) of these graben and, therefore, the age(s) of the dike intrusions. Determination of the ages of these intrusions provides insight into the crustal and magmatic evolution of the lunar crust in both space and time.

Methodology: To determine the ages of the graben and the dike intrusions, we first created geologic maps of the 3 study regions and then determined the ages of the units crosscut by the graben by crater counting.

Geologic mapping was based on chemical composition of the lunar surface determined from spectral data from the Clementine spacecraft (http://www.lpi.usra.edu/lunar/tools/clementine/). To delineate the geologic units, three compositional maps were created: FeO and TiO_2 abundance (wt %) and the standard RGB color ratio map. For each study region, these 3 maps were overlain with varying transparencies in ArcGIS atop the portion of the 100 m/px Lunar Reconnaissance Orbiter (LRO) Wide Angle Camera (WAC) global morphologic map (http://wms.lroc.asu.edu/lroc/view_rdr/WAC_GLOBAL) to create an enhanced color ratio map, as described in [2].

Using the CraterTools extension [3] in ArcGIS, craters larger than 200 m within the units that are crosscut by the rimae were marked on the LROC WAC basemap. Model ages were derived from the crater size-frequency distribution using CraterStats [3]; the production and chronology functions used to determine the ages are from [4].

Results: *Rimae Daniell:* For the Rimae Daniell region, a total of 21 geologic units, ranging from fresh highland material to mature mare, were delineated. The ages derived for the 2 units crosscut by Rimae Daniell were found to be 3.4 Ga and 3.7 Ga [Fig. 1]; thus the maximum age of the dike intrusion here is 3.4 Ga.

Rimae Ariadaeus and Hyginus: For the Rimae Ariadaeus/Hyginus region, a total of 59 geologic units were mapped. The ages derived for the 13 units crosscut by the rimae can be grouped into three age groups: 3.3 Ga, 3.6 Ga, and 3.8 Ga; thus the maximum age of the dike intrusions here is 3.3 Ga.

Rima Hesodius: For the Rima Hesodius region, a total of 58 geologic units were mapped. The ages derived for the 11 units crosscut by the rima can be grouped into three age groups: 3.6 Ga, 3.7 Ga, and 3.8 Ga; thus the maximum age of the dike intrusion here is 3.6 Ga.

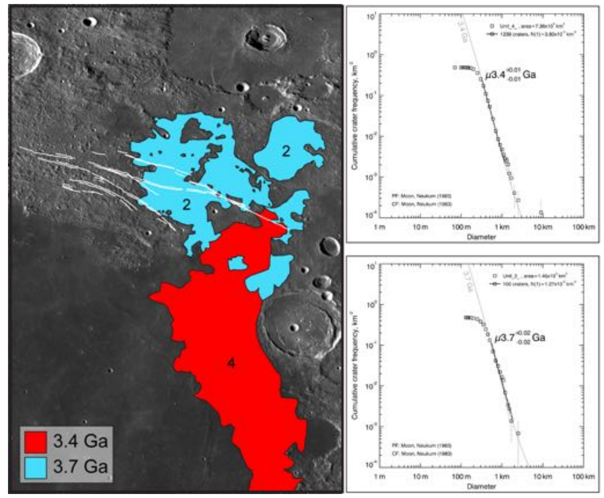

Figure 1. Map of Rimae Daniell (white lines) with numbered geologic units colored according to age. Right: Crater size-frequency distributions and isochrons for the 2 counted units. Basemap: LRO WAC mosaic.

Discussion: Model ages derived for the dike-induced graben in our study regions indicate that linear magmatism (i.e., dikes) and extensional tectonics on the lunar nearside was occurring as recently as 3.3 Gyr ago; this age is much younger than the widely cited age for the formation of the nearside graben of 3.6 ± 0.2 Ga [5]. Our results are consistent with both the ages determined for the Rupes Recta normal fault [6] and of mare basalt (3.93 to 1.2 Ga) [7].

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