DISTRIBUTION AND STRATIGRAPHY OF BASALTIC UNITS IN MARE TRANQUILLITATIS. D. Rajmon[1,2], P. Spudis[2], 1. Dept. Geosciences, Univ. Houston, Houston TX 77204-5503; 2. Lunar and Planetary Institute, Houston TX 77058

Introduction: Mare Tranquillitatis occupies a pre-Nectarian impact basin (center: 7°N, 40°E; 800 km diameter) filled by ejecta from younger basins (Nectaris (oldest), Crisium, Serenitatis, and Imbrium (youngest)), which provide a brecciated, highlands-composition basement to the lavas [1], multiple basalt flows ranging from about 3.8 b.y. to an (~ 3.4-3.3 b.y) Upper Imbrian age. [1]. Identification of the individual flows and estimating the lava thickness in Mare Fecunditatis serve to constrain the magmatic and thermal history of the Moon [4]. Ti-rich Apollo 11 basalts [2] are a potential lunar oxygen resource through ilmenite reduction by heated hydrogen [3]. Estimating the lava volume in Mare Tranquillitatis determines potential ilmenite reserves.

Method: Mosaics of Clementine images covering Mare Tranquillitatis were made, using the 415, 750, and 950 nm filters. The mosaics were used to generate "true" color and false color images and Fe and Ti concentration maps [5,6]. False color image (R = 750/415, G = 750/950, B = 415/750) exaggerates color differences of individual units within the mare and allows the identification of individual geologic units. Basalts appear blue to orange, fresh basalt is yellow to green, highland is red and fresh anorthosites appear blue. High Fe contrasts between mare basalt and highland substrate allows identification of craters that have penetrated mare basalt. Such craters served to estimate total basalt thickness in Mare Fecunditatis [7] and Tranquillitatis [8]. The same approach applied to Ti map allows to track vertical and lateral extends of different basalt units defined by their Ti content.

Results: Mare Tranquillitatis shows a range of FeO (13-24 wt.%) concentration in soils. It reflects variation in basalt thickness but also age of the soils. The iron map reveals very uneven morphology of Tranquilitatis basement. Old crater rims with basement composition occur on several places. Ti concentration of the soils of Mare Tranquillitatis vary from 0 to 11 wt.% TiO_2. This variation is caused in part by highland contamination (as indicated by Fe map) but also by variation in the flow composition. We currently distinguish 4-5 basalt units defined by TiO_2 content: A (1-2 %TiO_2), B (2-5%), C (4-7 %), D (7-9 %), E (8-11%).

The definition of A and B units is clear. A unit appears orange in false color image and is heavily cratered. It is exposed in the north and locally at several craters in the E, NE and N and close to mare margin in other areas. It typically crops out through B unit. A unit might be an extension of similar basalts from Mare Fecunditatis, where these appear to be very extensive and thick [9]. It certainly underlies the B-type basalts in Mare Serenitatis (NW corner of the mosaic). B unit appears orange in false color image with many yellow craters. It covers marginal areas of M. Tranquillitatis (mostly in the N, E and S). B unit is locally exposed by large craters through out the M. Tranquillitatis. M. Serenitatis in the NW is also covered by basalts of B unit and these basalts probably extend into M. Tranquillitatis under Ti rich basalt (exposed by Dawes crater).

C, D and E units are not defined so clearly. They appear purple to blue in false color. These units seem to form large patches through out the M. Tranquillitatis. Together these units constitute most of the mare surface. These patches typically partly contrast neighboring unit and partly transit gradually. Therefore spatial localization of these units is very difficult. Sometimes the C and D units could be explained by mixing of very thin E unit and B unit bellow. C or D unit certainly forms surface of Lamont area, which is also densely cratered. Systematic characterization of FeO, TiO_2, and crater density will hopefully distinguish these units clearer.

Implications: Stratigraphic relations of the A-E units generally support an idea that magmatic activity in M. Tranquillitatis started with Ti-poor lavas and gradually changed toward Ti-rich lavas. Several linear vents, which show range of basalt types, document that the volcanic centers either migrated with time or were closing off. Volumes of different basalt types seem to be rather similar however. This is in contrast with M. Fecunditatis, where Ti-poor lavas constitute most of the mare basalts and Ti-rich lavas formed only thin localized patches [9].

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Fig. 1
False color image of M. Tranquillitatis