GEOLOGY AND STRATIGRAPHY OF MARE FECUNDITATIS. David Rajmon[1,2] and Paul Spudis[2] 1. Dept. Geosciences, Univ. Houston, Houston TX 77204-5503; 2. Lunar and Planetary Institute, Houston TX 77058 E-mail: drajmon@bayou.uh.edu

Introduction: Mare Fecunditatis occupies a pre-Nectarian impact basin (center: 0.7°S, 56.3°E; 690 km diameter) filled by ejecta from younger basins (Nectaris (oldest), Crisium, and Imbrium (youngest)). On this brecciated, highlands-composition, basement were deposited multiple basalt flows ranging from ~3.5-3.75 b.y. to 3.4 b.y. Late 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].

Method: Mosaics of Clementine images were made covering Mare Fecunditatis, using the 415, 750, and 950 nm filters, and Fe and Ti concentration maps were generated [2, 5]. High Fe contrasts between mare basalt and highland substrate allow identification of craters that have penetrated mare basalt. Excavation depths were estimated from diameters assuming morphologic parameters of the craters according to [6] and [3]. Average Fe concentrations in ejecta can be estimated from the iron map and the true color mosaic. A simple linear mixing model was used, using average highlands and fresh mare basalt as end members, to calculate fractions of excavated basalt and highland substrate. The fractions were fit back into a spherical cavity to estimate the pre-impact thickness of mare basalt for each crater (Table 1).

False color image (R = 750/415, G = 750/950, B = 415/750) exaggerates color differences of individual units within the mare and allow the identification of individual geologic units.

Results: The soils of Mare Fecunditatis contain significant amounts of highland material. The contamination decreases toward the center of the mare and its distribution and volume is associated with Langrenus and Taruntius crater ejecta and surrounding highlands. A few craters within the mare excavating highland basement can not account for this pattern as suggested by [10].

The Fecunditatis basalts are mostly Ti-poor, but in some places intermediate to high-Ti flows occur. At least two or three units can be distinguished within the maria based on their color differences in false color mosaic (Fig. 1) and Ti content.

Mare Fecunditatis, as well as previously studied Mare Tranquillitatis [9], is relatively shallow (Table 1), in agreement with estimates for different lunar maria from photogeology [7], regolith petrology [8] and geochemistry [10]. Most of Mare Fecunditatis is filled with flows that reach a few hundred meters thick in total but in central Fecunditatis, the basalts are over 1000 m thick.

These thickness values are rough estimates. The largest error comes from estimates of Fe concentration in ejecta; a 1% change in Fe content changes the estimated basalt thickness by ~ 30 %. This error is included in the Fe map itself plus another 1% error may be associated with our estimates of ejecta Fe content. Fe content in ejecta from small (~1 km) craters may be affected by composition of contaminated regolith. Thus the ejecta from such craters may show lowered Fe concentration although the craters did not penetrate the basalt. The basalt thickness then would be underestimated.

Implications: The lavas of Mare Fecunditatis are extensive, but thin. High-Ti basalts may represent ilmenite reserves suitable for oxygen production similarly as in Mare Tranquillitatis [9]. Use of this resource can be facilitated by mining the loose regolith.

We are continuing the studies of Mare Fecunditatis and Tranquillitatis to determine lava stratigraphy, including buried basalt units, and to refine estimates of lava volume and the distribution of lava thicknesses.

Figure 1. The false color image of Mare Fecunditatis.

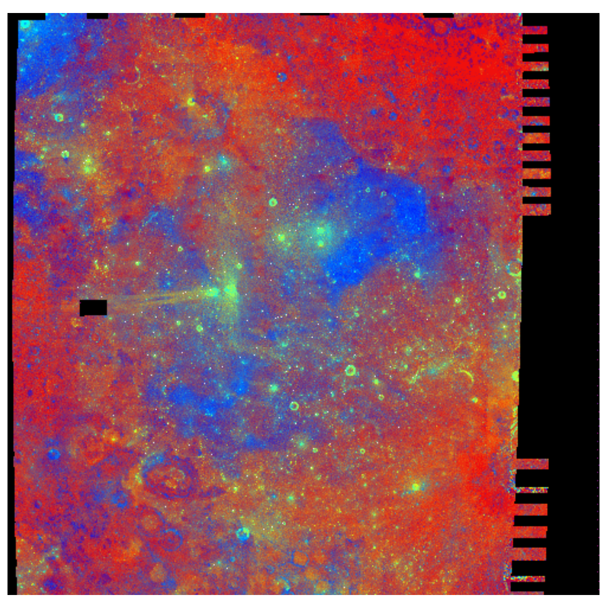

Table 1. Estimated basalt thickness at selected craters in Mare Fecunditatis. D_t/D = 0.84 for simple craters (D = up to 15 km) and ~0.6 for complex craters, where D is final crater diameter, D_t is transient cavity diameter. Craters without names where assigned numbers.

Crater	**D (km)**	**Mean FeO% in ejecta**	**Excav. depth (m)** *h/D = 0.1*	**Basalt thickness (m)**	**Excav. depth (m)** *h/D = 0.14*	**Basalt thickness (m)**
23	1	15-16	84	33-38	118	46-54
25	1	18-19	84	>84	118	>118
9	1.5	12-14	126	33-43	176	46-61
12	2	17	168	90	235	125
15	2	16-17	168	76-90	235	107-125
22	2	14-15	168	58-66	235	81-93
5	2.5	18-19	210	>210	294	>294
8	2.5	12	210	55	294	77
11	2.5	15-16	210	83-96	294	116-134
16	2.5	16-17	210	96-112	294	134-157
19	2.5	17	210	112	294	157-157
3	3	18-19	252	>252	353	>353
13	3	15	252	100	353	139
14	3	16-17	252	115-134	353	161-188
20	3	16	252	115	353	161
24	3.5	13-14	294	89-101	412	124-142
26	3.5	18	294	192	412	269
Messier GB	3.5	17	294	157	412	219
2	4	18-19	336	>336	470	>470
21	4	15-16	336	133-153	470	186-214
Coglenius UD	4	17	336	179	470	251
Langrenus DB	4	13	336	101	470	142
Messier GA	4	17	336	179	470	251
1	4.5	18-19	378	>378	529	>529
6	4.5	17	378	202	529	282
Langrenus FD	4.5	17	378	202	529	282
Messier E	4.5	17	378	202	529	282
4	5	14	420	145	588	203
7	5	12-13	420	110-126	588	154-177
10	5	17-18	420	224-274	588	313-384
17	5	14	420	145	588	203
Coglenius AA	5	17	420	224	588	313
Secchi A	5	17-18	420	224-274	588	313-384
Secchi B	5	17-18	420	224-274	588	313-384
Taruntius EA	5	16-17	420	191-224	588	268-313
18	6	11	504	115	706	160
Secchi X	6	17	504	269	706	376
Taruntius N	6	15-16	504	199-229	706	279-321
U	6	12	504	132	706	185
Langrenus KA	7	15	588	232	823	325
Messier B	7	17-18	588	313-384	823	439-537
Secchi A	7	15	588	232	823	325
Taruntius B	7	16	588	268	823	375
Taruntius K	7	19-19.5	588	>588	823	>823
Taruntius O	7	14	588	203	823	284
Coglenius UA	8	16	672	306	941	428
Langrenus DA	8	13-14	672	202-232	941	283-324
Langrenus FE	8	17	672	358	941	502
Langrenus FF	8	14-15	672	232-265	941	324-372
Taruntius P	8	18-19	672	>672	941	>941
Webb B	8.5	13	714	215	1,000	301
Webb S	8.5	15	714	282	1,000	395
Messier D	9	16-17	756	344-403	1,058	482-564
Cauchy D	10	16	840	382	1,176	535
Langrenus D	10	16	840	382	1,176	535
Messier	10	18-19	840	>840	1,176	>1176
Taruntius E	10	15-16	840	332-382	1,176	464-535
Taruntius H	10	18	840	548	1,176	767
Taruntius F	10.5	13-15	882	266-348	1,235	372-488
Cauchy	12	16	1,008	459	1,411	642
Coglenius A	12	15-16	1,008	398-459	1,411	557-642
Messier A	12	18-19	1,008	>1008	1,411	>1411
Taruntius C	12	14-15	1,008	347-398	1,411	486-557
Webb H	13	13	1,092	329	1,529	460
Taruntius A	14	7	1,176	132	1,646	184
Messier G	15	16	1,260	574	1,764	803
Taruntius G	15	15	1,260	498	1,764	697
Langrenus C	17	16	1,190	542	1,666	758
Bellot	19	11-16	1,235	281-562	1,729	393-787
Webb	25	13	1,500	452	2,100	632
Average thickness of mare basalts				**261-276**		**366-387**

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