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New Absolute Model Ages of Basalts in Mare Crisium

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Head et al. [1] identified three major basalt groups in Mare Crisium: (1) Fe- and Mg-rich high Ti basalts similar to Luna 16 samples (Group I), (2) very low Ti ferrobasalts similar to Luna 24 samples (Group II), and (3) low Ti ferrobasalts similar to Apollo 12 samples (Group III). Group I basalts are apparently the oldest deposits in the basin, are exposed in the SE region of the basin, and are excavated by major post-mare impact craters, including Picard, Peirce, Greaves, and Cleomedes F. Group II basalts were presumably emplaced in two stages, around the outer edge of the basin to the NE (Group IIB), and in the NNW half of the basin (Group IIA). There are several smaller occurrences of Group IIA basalts in the south, the easternmost of which contains the Luna 24 landing site. Finally, Group III basalts occur in the SSE half of the basin.
The geologic maps of [2,3] show that Mare Crisium is mostly covered by Imbrian-age basalts (Im). However, there are small, isolated areas of presumably Eratosthenian or Imbrian age (EIm), e.g., NE of crater Einmart C and east of Picard X. The easternmost region of the basin was also mapped as EIm and roughly corresponds to the Group I basalts of [1]. Radiometric ages of the Luna 24 samples indicate ages of 3.34 to 3.44 Ga [4] or 2.52-3.45 Ga [5]. The map of Boyce and Johnson [6] shows an age of 3.50 Ga for this landing site, and ages throughout the basin that range from 2.5 Ga to 3.65 Ga.
Our crater counts for Mare Crisium basalts reveal a wide range of ages, similar to the map of [6]. According to our preliminary results, basalts in Mare Crisium range from 2.71 to 3.61 Ga, thus indicating Eratosthenian and Imbrian ages. The unit including the Luna 24 landing site is 3.4 Ga old, which is in excellent agreement with the radiometric ages of [4,5]. Our oldest unit (3.61 Ga) is found along the western mare/highland boundary, west of crater Yerkes. Our second oldest unit (3.27/3.60) is located in the east, consistent with the data of [1] and [6]. We find young ages in the NE and E for the Group IIB basalts, i.e. 2.95-3.41 Ga, consistent with [6]. While mapped as Group IIB [1], basalts east of Cleomedes F are significantly older (3.50 Ga). We find young ages of 3.03 and 3.12 Ga along the southern mare/highland boundary, which was dated to be 3.2 Ga old [6]. However, compared to the ages of [6], we do not find 3.65 Ga old basalts in the central region east of crater Picard. Our ages are significantly younger, i.e. 3.41-3.47 Ga. The unit west and north of crater Peirce has an absolute model age of 2.71 Ga, hence being much younger than in the map of [6]. Our preliminary ages might indicate that the northwestern Group IIA basalts are younger (2.78, 3.00, 3.38 Ga) than the southeastern Group III basalts (3.41, 3.47, 3.04/3.49 Ga).
[1] Head et al. (1977) GCA, Supp. 9, 43. [2] Casella and Binder (1972) USGS, Map I-707 (LAC 44). [3] Olson and Wilhelms (1974) USGS, Map I-837 (LAC-62). [4] Papike and Vaniman (1977) GCA, Supp. 9, 371. [5] Fernandez and Burgess (2005) GCA 69, 4919. [6] Boyce and Johnson (1978) Proc. Lunar Planet. Sci Conf. 9th, 3275.