GEOLOGY AND GEOCHEMISTRY OF THE FLAMSTEED REGION OF OCEANUS PROCELLARUM: A PRELIMINARY REPORT BASED ON REMOTE SENSING AND LUNAR SAMPLE INFORMATION. C. Pieters\textsuperscript{1}, J. B. Adams\textsuperscript{2}, R. Bryan\textsuperscript{3}, J. W. Head\textsuperscript{4}, T. B. McCord\textsuperscript{5}, S. Zisk\textsuperscript{6}. \textsuperscript{1}Dept. of Earth and Planetary Sci.; M.I.T., Camb., Ma. 02139; \textsuperscript{2}Dept Geol. Sci., Univ. Wash., Seattle; \textsuperscript{3}Dept. Geol. Sci., Brown Univ., Prov., R.I. 02912; \textsuperscript{4}Univ. Hawaii at Manoa, Honolulu, 96821; \textsuperscript{5}NEROC Haystack Observ., Westford, Ma. 01886.

The Flamsteed region of Oceanus Procellarum displays a number of mare and highland geologic units which are important in the geologic framework and volcanic history of the western maria. Fig. 1 shows the distribution of major units in the Flamsteed region and was derived using remote sensing techniques and lunar sample information. The principal techniques (1) used in defining unit boundaries included a) vidicon spectral ratio images, b) earth-based photographs (albedo), c) orbital photography. Other techniques essential for unit characterization and interpretation include a) reflectance spectra (0.3-1.1 \textmu m), b) radar backscatter maps, c) radar topography, d) spectra and compositional analysis of returned samples from the Apollo sites. Relative ages were obtained by superposition relationships and crater degradation techniques (2).

On the basis of unit characteristics, distribution, and superposition relationships, the following history is outlined: A cratered uplands existed in the region prior to mare emplacement and consisted of normal feldspathic highland crust (U) and local development of a spectrally red unit similar to other "red spots" (U\textsubscript{r}) (3,4,5). Earliest exposed mare material is a series of low-Ti basalts (L,l,m) which flooded the upland topography. Mare ridges developed on these units and the crater Flamsteed formed prior to the emplacement of later basalts. The last major phase of volcanism was characterized by moderately high-Ti basalts (H\textsubscript{2}, h\textsubscript{2}, h\textsubscript{3}) spreading as relatively thin flows over preexisting maria. Flow emplacement is generally controlled by preexisting local and regional topography including mare ridges developed on earlier maria.

The geochemical characterization of these units is based primarily on spectral reflectance measurements (0.33-1.06 \textmu m) of small (-10 km) regions within the units and similar laboratory reflectance measurements (0.35-2.5 \textmu m) of returned lunar soil samples. The spectrally defined basaltic units are characterized with respect to other basalt types for the frontside of the moon (6). Although a number of units can be distinguished from each other with this data, characterization of the mineralogy is incomplete until spectra to 2.5 \textmu m can be obtained for fresh craters within each unit.


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SYMBOL  | DESCRIPTION | INTERPRETATION
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C | High albedo; high frequency of rays and satellitic craters surrounding Kepler. | Kepler ejecta; underlying material significantly affected by cratering event.
Mare | Low albedo; type area NE interior of Flamsteed P indicated with dashed circle; continuum slope (40/46 μm) relatively blue; 1 μm absorption feature (Fe²⁺) stronger and broader than Tranquillity soils. Several associated sinuous rilles. | Titaniferous basalt. A young basalt with a soil composition that ranges from 5-8.5% TiO₂; probably different from older eastern high-Ti basalts in mineralogy; more glass-rich than basalts of Mare Humorum (h₃); related to Imbrium high-Ti basalts. Unsampled.
H₂ | Spectrally much like H₂ but with continuum slope slightly (1-2%) less blue. | Titaniferous basalt. A young medium-high-Ti basalt with soil TiO₂ 3-5%; related to H₂ in mineralogy. Unsampled.
h₂ | Continuum slope equally blue as h₂ but distinct from H₂ and h₂ in infrared spectral character; 1 μm feature (Fe²⁺) strong but less broad. | Titaniferous basalt. A young medium-high-Ti basalt with soil TiO₂ 3-5%; related to medium-high-Ti basalts of NE Mare Humorum (4). Unsampled.
h₃ | Continuum slope comparable to Apollo 12; most extensive unit of the region (no spectra exist to allow further investigation). | Low-Ti basalt. Soil composition 2-3% TiO₂; older than H₂, h₂, and h₃ basalts. Unclassified.
m | Continuum slope slightly red (comparable to Apollo 15 landing site); not an extensive surface unit in this region. | Low-Ti basalt. Soil composition 1.5-2% TiO₂. Unclassified.
l | High albedo; relatively red continuum slope; 1 μm feature stronger than for other low-Ti units of the region. Extensive development of mare rilles. | Low-Ti basalts. Soil composition possibly less than 1.5% TiO₂. Unsampled.
U | Moderately high albedo; continuum slope relatively red. Topographically higher than mare. | Crater remnants and associated uplands. Mostly feldspathic islands surrounded by mare material.
U₄ | Moderately high albedo; upland plains and crater remnants; strong UV absorption causing very red continuum slope; regionally high. | Undesignated highlands. Suspected of being related to other uniquely red highland regions, some of which may be of volcanic origin.
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