No. 135 POLARIZATION-ALBEDO RELATIONSHIP FOR SELECTED LUNAR REGIONS*

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ABSTRACT

Polarization measurements were performed at several wavelengths on "pure" examples of maria, highlands and mountains. It was found that the different topographies do not obey the same P(λ) law. This suggests differences in particle sizes or compositions on the various topographies.

I have tested the accepted theory that there is a strong inverse relationship between brightness and polarization on the lunar surface, by measuring the polarization of several examples of "pure" maria (dark and light), highlands and mountains in five passbands with a photoelectric Wollaston polarimeter. The effective central wavelengths were 3360 Å, 3640 Å, 4500 Å and 5340 Å and the bandwidths (half-response points) ranged from 330 to 560 Å. The short wavelengths are uncertain (±30 Å) because of unknown atmospheric extinction. Observations of the 30 sec of arc diameter regions were made within a sufficiently short period of time during each observing session that the lunar phase angle (−107°) did not change by more than ±1·5°. The probable error was ±0.06 per cent in polarization. The observations were made on June 14, 1967, and May 4, 1968, UT. Some of the regions were measured on both dates.

The average polarization values of the topographical types at the two extreme wavelength bands are shown in Table 1, which also gives the coordinates of the regions. The darker and lighter maria show approximately twice the polarization to that shown by the mountains and the highlands respectively. The difference in polarization of 2·5 per cent between highlands and mountains was not expected, for their albedoes are almost indistinguishable.

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TABLE 1

LUNAR REGIONS OBSERVED AND AVERAGE POLARIZATIONS BY TYPE

TOPOGRAPHIC TYPE	SELENOGRAPHIC LONGITUDE	SELENOGRAPHIC LATITUDE	AVERAGE POLARIZATIONS λ5340 Å (PER CENT)	AVERAGE POLARIZATIONS λ3360 Å (PER CENT)
Dark maria	+24°	+17°	15·8	30
	+28	+26·5		
Light maria	+26	+21·5	13·5	26
	+19	+25·5		
Mountains	+18·5	+39	8	14·5
	+ 4·5	+48		
Highlands	+21	−23·5	6·6	12
	+ 6·5	−22		

The influence of albedo on the polarization was removed by normalizing the light maria, the highlands and the mountains to the observed values for dark maria at the longest wavelength (5340Å). The slope $dP/d\lambda$ of the $P(\lambda)$ curves is different for each of the topographies (*Fig.* 1). The normalized curves depart from one another and from the dark maria by amounts which increase as the short wavelengths are approached (Fig. 1).

Other examples of these topographical types were measured at other phase angles and the same trends were found.

These data suggest that there are differences in the mean internal optical pathlength of the particles that cover the different topographies. The mean internal optical pathlength is a function of the effective refractive index (wavelength) and the particle size. Furthermore, the relative magnitude of external scattering between the particles compared with internal pathlengths might differ on the topographic types.

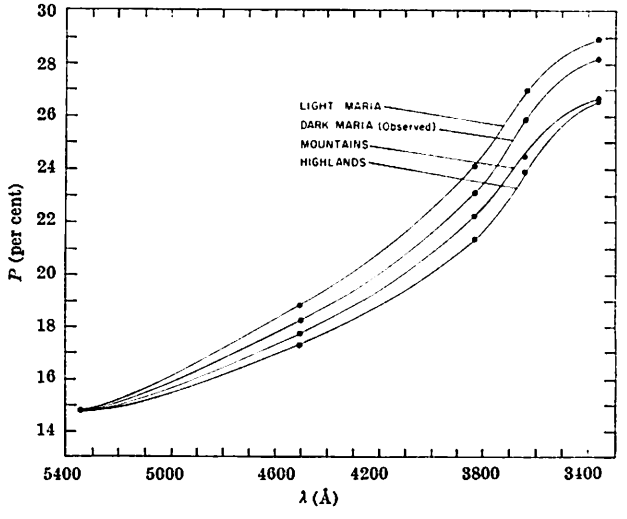

Fig. 1 Normalized values of the average polarizations of the lunar regions studied showing the different dependences on wavelength for the topographical types.