

Regolith Depths near the South Pole Aitkin Basin

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The proposed *Moonrise* mission will go to the Moon, collect a sample from the South Pole Aitkin basin, and return it to Earth for analysis. We wish to know the depth of the lunar regolith that *Moonrise* can expect to encounter.

Quaide and Oberbeck [1] experimentally determined the morphology of craters formed in areas covered by varying regolith depths. Figure 1 shows two of their experimental craters. They determined that for flat floored craters, the regolith depth at the crater location can be found by:

$$t = \left(k - \frac{d_f}{d_a}\right) d_a \frac{1}{2} \tan \alpha$$

t = regolith thickness

k = experimentally derived constant = 0.84

d_a = diameter of the crater

d_f = diameter of the flat floor of the crater

α = the angle of repose of the regolith

Apollo 15 took highest resolution images of the southern far side of the Moon. Figure 2 shows Images of four flat floored craters near South Pole Aitkin Basin; we examined a total of 11 craters. These craters have diameters of about two hundred meters. Table 1 lists the location and calculated regolith thicknesses for the 11 craters.

We found the regolith thickness on the southern far side of the Moon to be about 40 m. This value is significantly greater than values found for the near side 3 m (Oceanus Procellarum [2]), 16 m (Hipparchus [2]), and 1-10 m at the Surveyor landing sites [3]. The thicker values obtained for the far side regolith are consistent with the older age of the far side. Once Moonrise arrives in orbit and we acquire high resolution images of the basin itself we can perform a similar analysis at potential Moonrise landing sites, giving our landers the best opportunity for success.

Reference [1] Quaide, W.L., Oberbeck, V.R., Aug. 1968. J. Geophys. Res. 73 (16), 5247-5270. [2] Oberbeck, V.R., Quaide, W.L., 1967. J. Geophys. Res. 72 (18) 4697-4704. [3] Shoemaker et al, 1969 J. Geophys. Res. 74 (25) 6081.