SUB-10-MICRON AND RESPIRABLE PARTICLES IN LUNAR SOILS. B. L. Cooper[1], D. S. McKay[2], L. M. Riofrio[1] L.A. Taylor[3] and C. P. Gonzalez[4] [1]Oceaneering Space Systems (bonnie.l.cooper@nasa.gov), [2]NASA Johnson Space Center, [3]Planetary Geosciences Institute, University of Tennessee, Knoxville TN, [4]Jacobs ESCG, Houston TX.

Introduction: Based on published lunar soil grain size distribution data, we estimate that 1-3% of the mass of typical mature lunar soils is comprised of grains less than 2.5 micrometers in diameter. These particles are in the respirable range (small enough to be inhaled). Estimates are used because the early methods of obtaining grain size distributions did not give reliable results below about 10 micrometers.

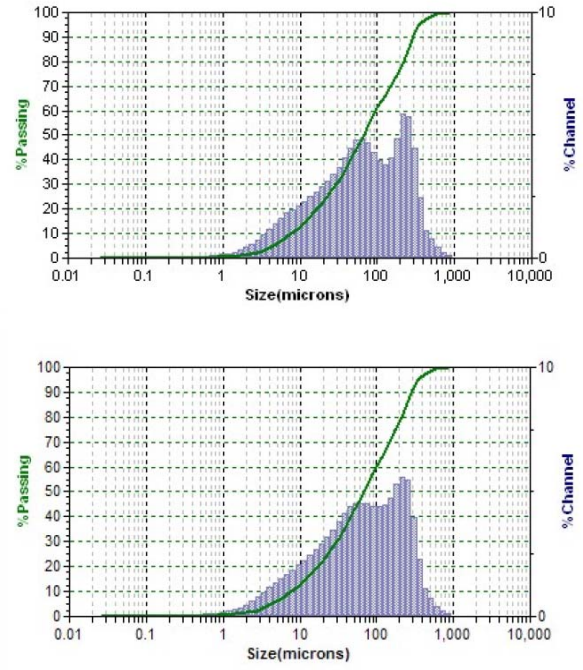

Figure 1. Particle size distribution of lunar soil 10084,2005 measured with the Microtrac™ laser diffraction instrument. The graphs represent two subsamples, each approximately ten milligrams. In these measurements, 2.08% and 1.58% respectively of the volume of the (sub millimeter) sample is 2.0 μm or smaller.

Method: As a first step in validating the estimate of the amount of fine material in mature lunar soils, we measured the particle size distribution of lunar soil 10084,2005 with a Microtrac™ laser diffraction particle size analyzer (Figure 1). Our results, along with those of previous workers [1-3], are shown in **Error! Reference source not found.**. Although all of the measurements in the table resulted in a median diameter between 55.1 and 67.96 μm, there is a much larger spread of values for the mean diameters. It has been argued that measurement methodology, rather than allocation inhomogeneity, is the primary source of measurement variation [3].

Our measurements of mean diameter for this soil are larger than those reported previously, suggesting that some sample agglomeration was occurring during the diffraction-based analysis [4]. However, the less-than-ten μm fraction in our two measurements accounts for 18.3% and 22.2% of the total volume of the sample—a higher value than previously measured by sieving. This value is consistent with the high maturity of this soil [3].

We compare our results at the 10-micrometer diameter to those of previous workers, because this is the smallest diameter previously reported, and is a point of comparison between all of the measurements. We found that this lunar sample has on the order of 1.8% by volume respirable (2.5 μm or smaller) dust, validating our original estimate that 1-3% would be in this size range.

Conclusions: Grain size analyses of Apollo 11 soil 10084 by a laser diffraction technique shows that this soil contains roughly 2% by volume in the respirable grain size, in agreement with our prior estimate.

References: [1] Duke, M.B., et al. (1970), Proc. Apollo 11 Lunar Sci. Conf., Geochim. et Cosmochim. Acta Suppl., 1: p. 347. [2] King, E.A., et al. (1971), 2nd Lunar Sci. Conf., 1: p. 737–746. [3] Basu, A., et al. (2001) Meteoritics and Planetary Science, 36: p. 177. [4] McKay, D.S., et al. (2009), Unique Properties of Lunar Dust Critical to Human Health, unpublished.

Table 1. Measurements of subsamples of Apollo 11 lunar soil 10084.

Source	Sub-sample No.	Median	Mean	Less Than 10 μm	Less Than 2 μm
Duke et al. (1970)	79	61.64	85.38	6.4 %	n.d.
King et al. (1971)	79	55.67	52.0	9.2%	n.d.
Basu et al. (2001)	n.d.	55.1	51	14.2%	n.d.
McKay et al. #1 (2007)	2005	66.49	117.0	18.3%	2.08%
McKay et al.#2 (2007)	2005	67.96	115.5	22.2%	1.58%