

## MINERALOGICAL AND CHEMICAL DATA ON APOLLO 12 LUNAR FINES

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Quantitative chemical analyses are reported of the bulk fines below 37 microns in size, and of 11 samples from different sites in the Apollo 12 landing area (table 1). The latter analyses show significant differences that correlate with modal analyses of the phases present, notably the relative amounts of pyroxene and plagioclase. All of the analyses differ from those of the Apollo 11 fines in containing, in general, less Ti and more Si and Mg. The main phases present in the fines include several different pyroxenes, a small range of calcic plagioclase, olivine, glass over a range of compositions, ilmenite, nickel-iron globules and meteorite fragments, tridymite, cristobalite, and silica glass. Glass is less abundant than in the Apollo 11 material. The range of glass composition is smaller than in Apollo 11, with almost all of the material falling in the range of index of refraction from about 1.57 to 1.71; the abundance maximum also is at a lower index than in Apollo 11. Glass spheroids are notably less abundant and of smaller average size.

Grain size analysis of the bulk fines below 1 mm in size shows a bimodal distribution, similar to that in Apollo 11, with a maximum near 100 microns and another near 10 microns for the smaller sizes. The average grain size is less than in Apollo 11, and the proportion of material below 37 microns is larger. Study of grain shapes shows evidence of mechanical abrasion, with some grains subrounded or rounded.

Microcraters produced by hypervelocity impacts of small particles were observed on glass spheres and metal grains but are very much less abundant than in Apollo 11. The average crater size also is smaller. Considered together with earlier evidence from Apollo 11, the microcratering is believed to be a transient event, probably associated with major meteorite impacts on the lunar surface, and not due to a continuing infall of hypervelocity particles from outer space.

Table 1. Chemical Analyses of Lunar Fines and Gabbro.

	Average Fines 12001	Fine Fines 12001	Gabbro 12021-23	Fines 12003	Fines 12030	Fines 12032	Fines 12033
SiO <sub>2</sub>	45.6	46.1	46.2	45.9	46.6	46.5	46.2
TiO <sub>2</sub>	3.0	2.9	3.9	3.6	3.5	2.9	2.7
Al <sub>2</sub> O <sub>3</sub>	13.9	14.8	13.0	14.2	14.7	15.2	16.2
Cr <sub>2</sub> O <sub>3</sub>	0.30	0.27	0.26	0.35	0.30	0.26	0.27
FeO (tot.)	16.2	15.6	19.4	15.4	14.3	14.1	14.0
MnO	0.21	0.19	0.24	0.22	0.21	0.20	0.19
MgO	10.2	9.05	5.70	9.7	9.0	9.4	8.5
CaO	10.25	10.81	11.33	10.4	10.7	10.7	11.0
Na <sub>2</sub> O	0.45	0.45	0.29	0.43	0.49	0.59	0.62
K <sub>2</sub> O	0.23	0.23	0.04	0.24	0.31	0.36	0.38
P <sub>2</sub> O <sub>5</sub>	0.25	0.22	0.08	---	---	---	---
NiO <sup>5</sup>	~0.01	~0.01	not detected	---	---	---	---
ZrO <sub>2</sub>	~0.05	~0.05	~0.03	---	---	---	---
S	<0.1	<0.1	<0.1	---	---	---	---
Total	100.65	100.68	100.47	100.4	100.1	100.2	100.1
	Fines 12037	Fines 12041	Fines 12042	Fines 12044	Fines 12057	Fines 12060	Fines 12070
SiO <sub>2</sub>	44.8	46.8	46.1	46.7	45.8	45.3	46.0
TiO <sub>2</sub>	3.5	2.7	3.2	3.6	2.9	4.2	3.1
Al <sub>2</sub> O <sub>3</sub>	15.1	15.4	15.1	14.6	14.5	12.6	15.7
Cr <sub>2</sub> O <sub>3</sub>	0.36	0.27	0.33	0.28	0.29	0.32	0.29
FeO (tot.)	14.9	14.2	14.1	14.2	15.4	16.9	14.2
MnO	0.25	0.20	0.21	0.21	0.23	0.27	0.20
MgO	10.2	9.1	9.8	9.5	9.5	9.6	9.4
CaO	10.5	10.9	10.9	10.6	10.8	10.5	10.4
Na <sub>2</sub> O	0.65	0.43	0.41	0.43	0.45	0.38	0.45
K <sub>2</sub> O	0.38	0.25	0.26	0.24	0.26	0.20	0.25
Total	100.6	100.2	100.2	100.4	100.1	100.3	100.0