

ON THE SOLAR WIND ELEMENT CONTENT AND THE BULK CHEMICAL COMPOSITION OF LUNAR SOILS, Abhijit Basu, Dept. of Geol., Indiana Univ., Bloomington, IN 47405 USA.

During the last decade of lunar sample analysis, many measurements have shown that solar wind elements are implanted on the surfaces of the exposed particles; some of these experiments also show that different minerals and particles retain different proportions of solar wind elements despite identical irradiation histories (1-7). For example, ilmenite can retain solar wind elements by about two orders of magnitude more efficiently than plagioclase (op. cit.). It follows that if there were monomineralic soils on the moon, given identical irradiation histories the soils would retain different quantities of solar wind elements. Although there is no monomineralic soil on the moon (rare exceptions would be the very restricted occurrences of orange glass, etc.), it is common knowledge that soils from different sampling stations even within a single landing site have different mineralogic compositions. In other words, despite all the "gardening" and mixing due to impacts of various dimensions, complete mineralogical homogenization has not been achieved. Therefore, it is permissible to anticipate that "abundances of the solar gases are indeed mineral specific and that they are not governed by the irradiation histories of the different minerals" (8).

One way to test this statement would be to use a set of soils with identical exposure ages, and find if there exists a correlation between the solar wind element abundances of these soils with their modal mineralogy. Surely, if the abundances of solar gases in lunar soils are mineral specific (9), a very strong correlation is expected between mineralogy and SWE for at least equally irradiated soils. Unfortunately, there exists no single set of standardized mineralogical data on the soils for which solar gas data are available. Therefore, until the modal mineralogy for all (or the majority) of lunar surface soils is known, the bulk chemical composition of the soils can be used as a first approximation. Indeed, Hintenberger et al. (2) used TiO_2 content as an indicator for ilmenite and found an apparent correlation between solar wind elements and TiO_2 in a few Apollo 17 soils.

We have carried out a set of preliminary tests with 78 lunar soils from different Apollo missions. We have used carbon as a representative of solar wind elements, Fe, Al, and Ti as indicators of the mafic, felsic, and ilmenite content of the soils. We have then grouped the soils according to their maturity using FMR values of Morris (9). Such a grouping more or less assures that the soils in each group have similar maturity i.e. similar exposure ages and irradiation histories.

Regression analysis and F-tests showed that there is absolutely no correlation between C and any of the major elements in any group of the soils (Table 1). Clearly, the major element concentrations of the soils (which controls the mineralogic composition to some extent) are not responsible for the abundances of solar wind elements retained by the bulk soils.

FMR values for all 78 soils and the abundance of C shows a strong correlation, significant at better than 99.9% level. This indicates that irradiation histories and exposure ages are the prime controls on the abundances of solar gases in bulk lunar soils.

REFERENCES: (1) Eberhardt et al. (1970), Apollo 11 LSC, 1037; (2) Hintenberger et al. (1974), PLSC 5th, 2005; (3) DesMarais et al. (1975), PLSC 6th, 2353; (4) Signer et al. (1977), PLSC 8th, 3657; (5) Basu, A. (1980), *E&S*, 61, 287; (6) Etique et al. (1978), PLPSC 9th, 2233; (7) Warhaut et al. (1980), PLPSC 10th, 1531; (8) Wieler et al. (1979), *Meteoritics*, 14, 565;

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(9) Morris (1978), PLPSC 9th, 2287.

Table 1. Results of linear regressions run between C (solar wind implanted) and Fe, Al, and Ti content of 78 lunar soils from different Apollo missions. The soils are grouped according to their maturity estimated from FMR values (I_s/FeO from Morris, 1978). Other data are from Warner (1978).

Maturity (I_s/FeO)	Variables C vs. (El)	Corr. Coeff. (r)	F-value	Significance
Immature (<30) n = 15	Fe	0.07	0.06	<90%
	Al	0.13	0.21	<90%
	Ti	0.11	0.15	<90%
Submature (30-60) n = 29	Fe	0.20	1.17	<90%
	Al	0.23	1.49	<90%
	Ti	0.34	3.63	<90%
Mature (>60) n = 34	Fe	0.24	1.89	<90%
	Al	0.28	2.72	<90%
	Ti	0.01	0.002	<90%
All Soils (n = 78)	C vs I_s/FeO	0.80	136.4	>99.9%