STATISTICAL COMPARISON OF THE CHEMISTRY OF LUNAR AND TERRESTRIAL ROCKS. S. K. Saxena, A. Benimoff and N. Pingitore, Geology, Brooklyn College, City University of New York, Brooklyn, N.Y. 11210.

Factor analysis using the method of principal components was performed on 2188 terrestrial rocks (see Fig. 1 for data type) to obtain factors which can be used to construct variation diagrams for a comparative chemical study of lunar and terrestrial rocks.

The composition matrix consisted of 12 major oxides SiO_2, Al_2O_3, Fe_2O_3, FeO, MgO, CaO, Na_2O, K_2O, H_2O, TiO_2, ZrO_2 and P_2O_5. The varimax rotated factors were used to calculate the 12 transformed variables (TR1 to TR12) for each rock analysis from the equation of the type:

$$TR1 = F_{11}X_1 + F_{12}X_2 + \ldots\ldots F_{112}X_{12}$$

where X_1 is the weight percent of oxide 1 and F_{11} is the first coefficient in factor 1, etc. Plots of transformed variables taken two at a time, showed that the best separation of the terrestrial differentiation trends such as tholeiitic, calc-alkaline and alkali-olivine was obtained in the plot of TR1 against TR2 (Fig. 2). The coefficients for the two TR's are:

	SiO2	Al2O3	Fe2O3	FeO	MgO	CaO
Factor 1	0.143	0.059	-0.012	-0.203	-0.264	-0.346
	Na2O	K2O	H2O	TiO2	ZrO2	P2O5
	0.933	0.206	0.002	-0.039	0.034	0.008
Factor 2	SiO2	Al2O3	Fe2O3	FeO	MgO	CaO
	-0.151	0.979	-0.033	-0.112	-0.270	0.062
	Na2O	K2O	H2O	TiO2	ZrO2	P2O5
	0.071	0.026	-0.070	-0.157	-0.020	0.010

Percent variance for factor 1 is 38 and for factor 2 it is 15.

Using these two factors, we calculated TR's for 604 lunar rock analyses (LSDS, J. Warner) which included rocks from Apollo 11 (94), Apollo 12 (122), Apollo 14 (95), Apollo 15 (191), Luna 20 (8) and Apollo 16 (90). Fig. 2 shows schematic spread of the lunar data points. For comparision, we have shown the composition of the Skaergaard rocks. Following are the important conclusions of this plot; 1) The lunar rocks plot distinctly separated from the terrestrial rocks. 2) None of the three trends of differentiation which account for bulk of the magmatic terrestrial rocks are present in the lunar data. 3) The differentiation trend of the Skaergaard layered series is similar to the spread of the lunar data.

The third result, which has been obtained purely from a comparision of the bulk chemistry, supports the hypothesis that lunar crustal rocks represent a series of related cumulates. The important difference in the composition of the lunar rocks and the Skaergaard rocks is the paucity of Na_2O in the former. To substantiate the similarity between the two differentiation trends, we have recalculated TR's for three Skaergaard samples by removing the albite component. The result is very gratifying.

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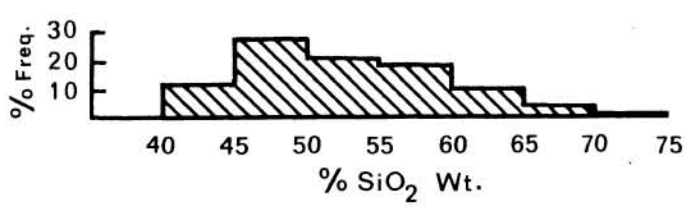

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