MAJOR ELEMENT TRENDS IN APOLLO 15 GREEN GLASS B R. O. Colson and A. M. Steele, Dept. of Earth and Planetary Sciences & McDonnell Center for the Space Sciences, Washington University, St. Louis, MO 63130.

Peculiar trends in Apollo 15 green glass, especially prominent in green glass "B", include positive correlations between Ni, Co, and incompatible elements and between SiO_2 and Mg# [1,2]. These trends are contrary to terrestrial experience where Ni and Co are inversely correlated with incompatibles and Mg# is inversely correlated with SiO_2. Various assimilation [3] or source heterogeneity [4] schemes have been proposed to account for these trends.

Results of recent experiments on behavior of metals in silicate melts at low fO_2 [5] have led to the proposal that Ni and Co can be incompatible at low fO_2 in silicate compositions similar to A15 green glass [6]. This observation introduces the possibility that the positive correlations among Ni, Co, and incompatibles obtain from a more traditional partial melting model, without recourse to assimilation, sulfide immiscibility, or delicate source heterogeneity, as discussed elsewhere in this volume [6]. Before such a model can be accepted as a possible history for A15 green glass, it must be demonstrated that other trends, such as the major element trends, can also be obtained by the same model. Such a demonstration is made here.

Early explanations of major element trends in A15 green glass (before separate groups of green glasses were identified [2] and before positive correlations between transition metals and incompatibles were observed [1]) included a simple batch partial melting scheme with the liquid composition controlled by the high-pressure cotectic, ol + 2 px [7]. However, because this scheme proposes that the amount of SiO_2 and FeO in the melt both decrease with increasing degrees of partial melting, it does not adequately explain the positive correlation between Mg# and SiO_2. The problem of the positive correlation between Mg# and SiO_2 can be overcome by realizing that, at high-pressure, increasing degrees of partial melting can result in *increases* in the concentration of SiO_2 in the melt. This is demonstrated for the binary, Ol-SiO_2, in Fig. 1 [8], and for the ternary, Ol-SiO_2-An, in Fig. 2 [9].

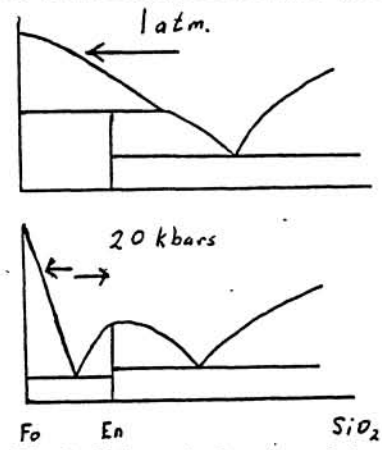


Fig. 1 Schematic drawing of the Ol-SiO_2 binary. Arrows indicate direction of change of melt composition with increasing degree of partial melting.

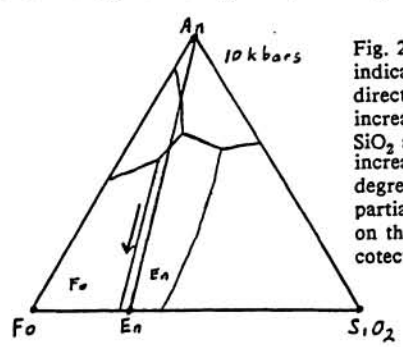


Fig. 2 Arrow indicates direction of increasing SiO_2 and increasing degree of partial melting on the Ol-Opx cotectic.

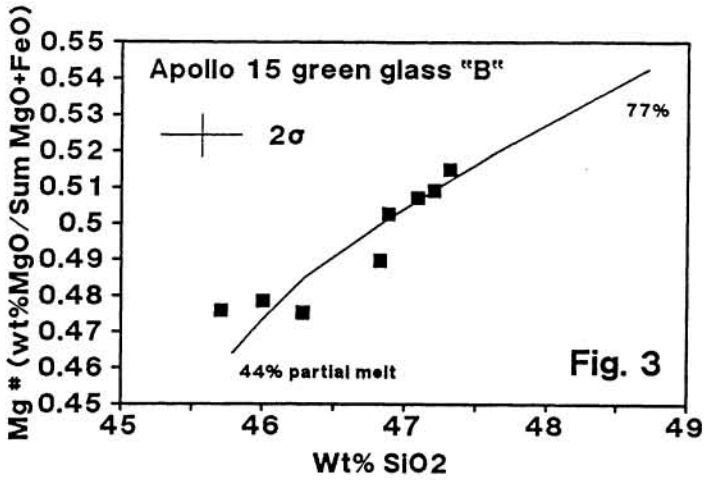
This general relationship is also true for the more complex green glass melts. We used the phase-equilibria program SILMIN [10] to model the compositions and proportions of phases on the cotectic at 10kbars as a function of degree of partial melting. Aluminum concentrations in the phases were calculated from [11] and [12], because SILMIN does not consider Al in Ol or Opx in its calculations.

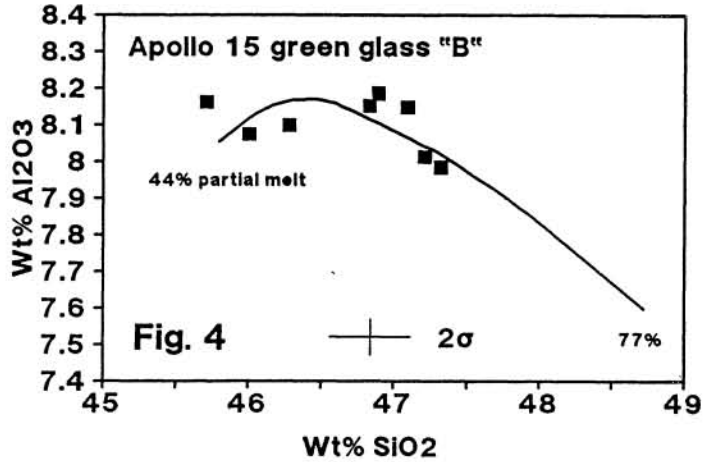
Table 1

SiO_2	52.4
TiO_2	0.2
Al_2O_3	6.0
FeO	13.5
MgO	21.7
CaO	6.2

A close fit to the observed trends in A15 green glass "B" are obtained by using the composition in Table 1 as the system composition and partially melting it 48 to 63% (batch equilibrium melting [13]). Data for green glass "B" [14] are compared with calculated curves in Figs. 3 and 4. It can be

seen that these major element trends are reasonably modeled by this scheme. The trend for CaO (not shown) is not modeled well (using partition coefficients from [15] to estimate the concentrations of CaO in Ol and Opx). This discrepancy can possibly be explained by the presence of a small amount of Cpx on the liquidus, which was not predicted by the SILMIN program.





Summary: At high pressure, concentration of SiO_2 in a partial melt can increase with increasing degree of partial melting. This can result in positive correlations between Mg# and SiO_2. Modeling the phase equilibria at high-pressure using the SILMIN program, major element trends in A15 green glass "B" can be successfully modeled by simple batch equilibrium melting.

Acknowledgements: We thank NASA for support through UA/NASA space engineering center for utilization of local planetary resources and through grant NAG 9-56.

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