Observations: Abundances were determined in the Martian soil for several elements by the Viking x-ray fluorescence experiment. It has been difficult to rectify the high values measured for iron and sulphur, and the low values for aluminum and calcium, with crustal rock that appears to be dominated by basalt. Clark and Baird (11) were the first to seriously propose a large primative component in the soil, but did not provide a convincing mechanism. Figure 2 shows remarkable agreement for eight major elements between the Viking measurements and a 40% carbonaceous chondrite, 60% tholeiitic basalt mixture suggested by the calculation outlined above. The four minor elements measured, Rb, Sr, Y, and Zr, are also in reasonable agreement. The only measured element not explained by this mixture is chlorine, which is mobile enough that other sources can be invoked.

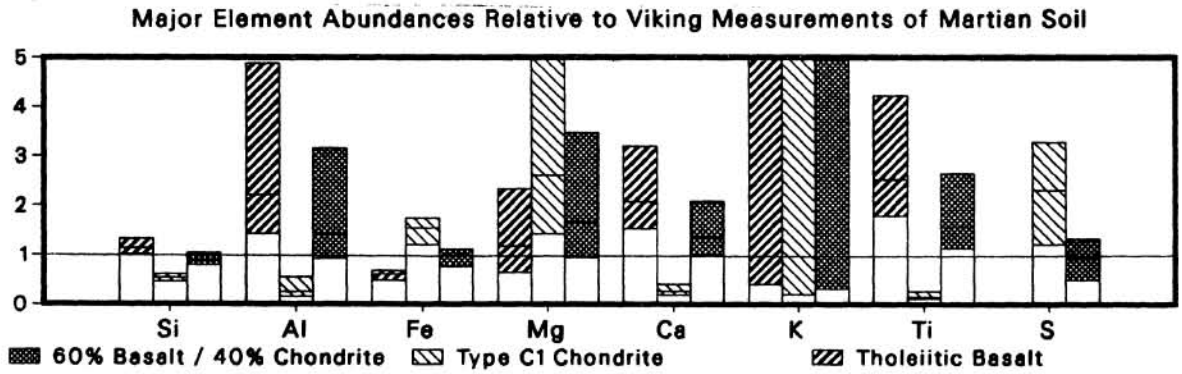

Figure 2. Elemental abundances of three materials have been divided by those measured by the Viking landers, so values of unity indicate agreement. The range of values is indicated by the shaded part of the bars (best values are shown by horizontal lines). The range is large due to uncertainties in Viking values.

Conclusions: Experiments, calculations and observations are all consistent with a Martian soil that is enriched in meteoritic material due to shock-activated selective chemical weathering. This suggests that Mars is more highly differentiated than the chemistry of the fines imply; the solid rock does not contain the large primative component measured in the fines. Since shock-activation is a global process, the crustal composition of Mars can be more variable than implied by the uniformity of the fines.

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