

## CHEMICAL STUDIES OF EVAPORATION RESIDUES PRODUCED IN A SOLAR FURNACE

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King (1982) used a solar furnace to produce evaporation residues from the Murchison and Allende meteorites in air and from a Columbia Plateau basalt in vacuum, in H<sub>2</sub> and in air. MacPherson *et al.* (1982) described the petrography and mineralogy in detail and the chemistry in brief of some of the run products. More details of the chemical compositions are given here. A bulk sample of a basalt residue produced in H<sub>2</sub>, CPB1-13, contains CaAl<sub>4</sub>O<sub>7</sub>, spinel, CaAl<sub>2</sub>O<sub>4</sub>, perovskite, metallic iron (8% Si) and Ca-Al-rich glass. Relative to the starting material, it is most enriched, and uniformly so, in Ca, Al, Ti, Sc, REE, Sr, Ba, Ta, Zr, Hf, Th and U, lithophile elements known to be refractory in a gas of solar composition. From the average enrichment factor for these elements, ~74% of the starting material was volatilized. V is only enriched by 50%, but an Fe bead removed from the residue contains 3800 ppm V. Mg, Fe, Si, Co, Mn, Na and K are all depleted in the bulk residue relative to the starting material. The top of CPB1-4, a basalt residue produced in air, contains CaAl<sub>4</sub>O<sub>7</sub>, CaAl<sub>2</sub>O<sub>4</sub> and spinel. Uniform enrichment in many refractory lithophiles indicates that ~75% of the starting material was volatilized from it. Ce, U, Ba and V, predicted to be refractory under reducing conditions but volatile under oxidizing ones, are strongly depleted relative to Sm compared to CPB1-13. The top of CPB1-21, a basalt residue produced in vacuum (< 1 mm Hg), contains CaAl<sub>4</sub>O<sub>7</sub> and CaAl<sub>2</sub>O<sub>4</sub>, while the bottom contains spinel, anorthite, melilite and glass in addition to these. From the uniform enrichments of refractory lithophiles in each, the top was more severely volatilized than the bottom, as expected: ~84% vs. ~71%. In both samples, Ce, U, Ba and V are strongly depleted relative to Sm, the top more so than the bottom. This suggests oxidizing conditions during volatilization, probably from air being present due to the relatively poor vacuum. The top sample is also depleted in Eu and Sr relative to Sm compared to the starting material, but the bottom is not. The top is much more strongly depleted in Na, Mg, Mn, Fe, Co and Si relative to the starting material than is the bottom. Relative to the starting material, the amorphous material that condensed from the vapor produced during volatilization of CPB1-21 is only enriched in Si, Ce, Ba and Ti. Relative to the starting material, the condensate tends to be higher in those elements depleted in the residue than in those which are enriched in the residue, although the enrichment patterns are not exactly complementary to one another.

The tops of two Murchison residues produced in air, CM2-6 and CM2-3, are composed of olivine+glass and olivine+glass+spinel+magnetite and represent volatilization loss of 71% and 66% of the starting material, resp. Both are depleted in V, Ce and Eu relative to Sm by factors ranging from 1.3 to 7.6 compared to the starting material because of oxidizing conditions. Ir and Os are much more strongly depleted relative to Sm, by factors of > 10<sup>3</sup> and > 35, resp. This is noteworthy because these two siderophiles are very refractory under reducing conditions. This effect is even more striking in the top and bottom of an Allende residue produced in air, A11-1. Concentrations of refractory lithophiles compared to the starting material show that only 15% of the material in the top was volatilized and a negligible fraction of that in the bottom. Despite the relatively mild heating, > 99.8% of the Ir and ≥ 91% of the Os were lost. It is unlikely that this is due to loss of a metal phase from the portions of the residue which were sampled, as the Ir/Co and Os/Co ratios are < 5.3 × 10<sup>-3</sup> and ≤ .22 of their values in the starting material, resp. Ir and Os may form extremely volatile compounds during rapid heating of chondritic material.

King, E.A., 1982. *LPS XIII*, 389.

MacPherson, G.J. *et al.*, 1982. *LPS XIII*, 459.