**Motivation**
- Determine how strongly chalcophile elements partition into sulfur-bearing phases in a basaltic melt.
- Understand the cycling of chalcophile elements in the crust and mantle.
- Gain a better understanding of ore formation at various tectonic settings.

Here, the behavior of eleven chalcophile and siderophile elements (Ga, Ge, Ag, Cd, In, Sn, Sb, W, Tl, and Bi) is examined in a differentiated basaltic olivine basalt.

**Kilauea Iki Lava Lake**
- Formed in 1959 as basaltic lava ponded in a pre-existing crater.
- Differentiated and cooled over four decades while being cored by the USGS.
- Primarily composed of olivine basalt, but also contains internal differentiation (segregation veins and bone caving).
- Differentiated and cooled over four decades while being cored by the USGS.
- Evolved melt was segregated from the basalt.

**Chalcophile Element Behavior during Differentiation**
- Cu appears incompatible, but is a major constituent of Cu-Fe sulfide blebs that form at ~13 wt% MgO.
- Scattered in some elements may reflect divergent liquid lines of descent as low-density melt migrated through the lake.
- Extreme enrichments (Bi, Sn, Mo, Sb) in the two erupted lavas may be associated with sample contamination and initial processing.

**Partition Coefficients**
- Left: Partition coefficients measured between immiscible sulfide and glassy matrix in two segregation veins. Sample 79-3-158 is more chalcophile, while 79-3-158-2 and 4 wt% MgO.
- Conditions in Kilauea Bi:
  - TD – T < 750°C
  - T > 925 – 1030°C
- Sulphide composition: Fe-Cu-S solution.
- Cu ranges between 10 and 55 wt%.

**Other Tectonic Settings**
- In MORB, sulfides saturate at ~10 wt% MgO.
- In back-arc settings sulfides saturate between 2 and 4 wt% MgO.

**Main Findings**
- In the Kilauea Iki Lava Lake, sulfides form at 13 wt% MgO, but do not fractionate from the evolving melt as do olivine and Fe-Ti oxides.
- This may be due to the sulfides sticking to other crystals, inhibiting removal.
- Sulfide saturation occurs earlier than is observed in MORB and arc settings.
- Sulfides are observed to fractionate from MORB and arc lavas. This suggests that sulfide and, thus chalcophile element behavior, is dependent on tectonic setting.

"Chalcophile elements" display a range of affinity for the sulfide phases. Bi, Ag, Cd, In, Sn, Sb are strongly chalcophile, Ti, Ge, Mo are weakly chalcophile, while W and Ga are not chalcophile.

- Mo and Ga display slight compatibility in Fe-Ti oxides (Mo may substitute for Ti and Ge for Fe).
- Cu and Ga display slight compatibility in Fe-Ti oxides.
- Ag, In, and Sn partitioning behavior depends on the abundance of Cu in sulfide phases.

**References**