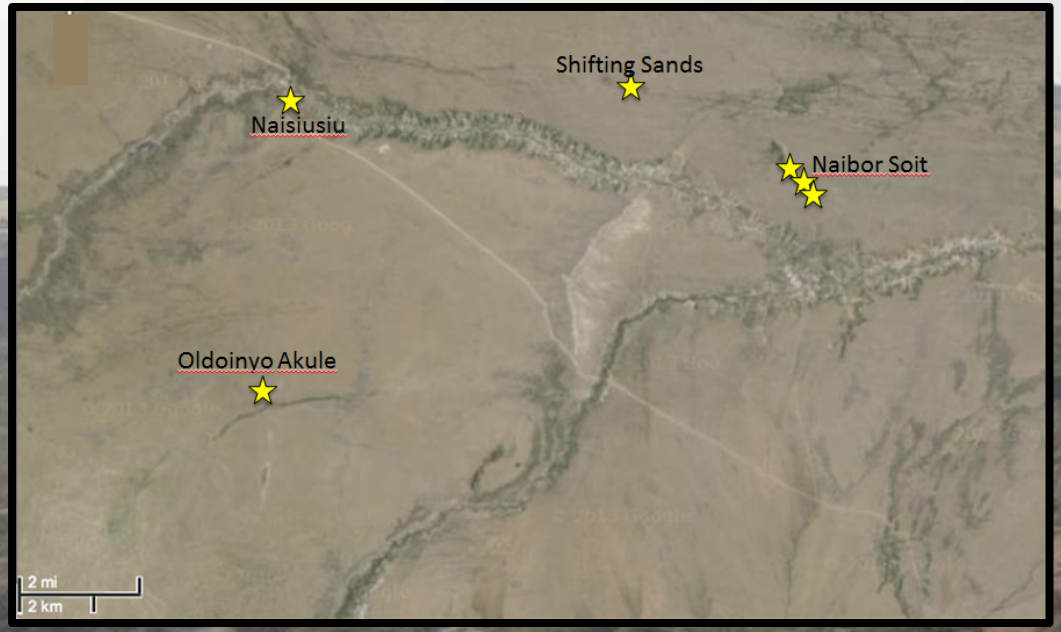
Initial Observations of Olduvai Gorge Samples: Methods for Sourcing Oldowan Artifacts

By Andrew Redifer

Current State of The Art

- (Blumenschine, 2006)
- Methods
  - Determined Size of Artifact
  - Composition of Artifact
  - Performed Distance-from-source estimates
- Blumenschine's Hypothesis:
  - Larger more valuable artifacts would be further from the source than smaller less valuable artifacts.

Determining a Better Method

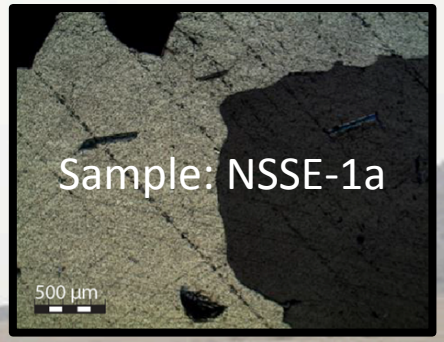


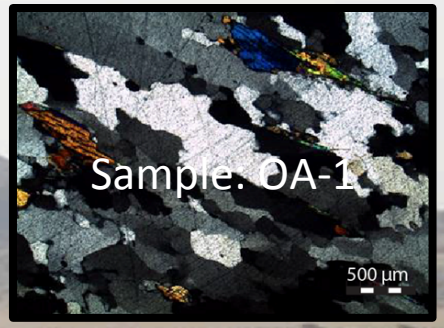
- Rock Samples were collected from different sites for:
  - Thin Section Analysis
  - Trace Element Analysis

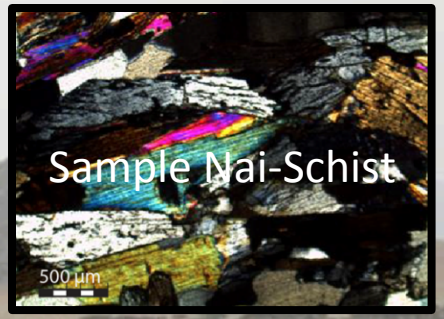
Research Question

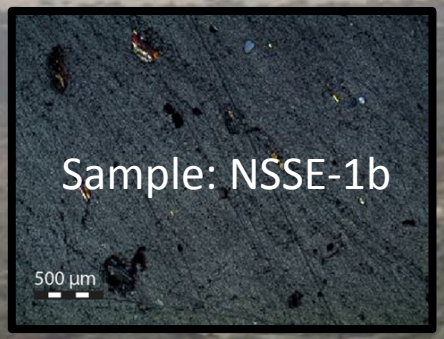
- Are there distinguishable differences between the collected rock samples and if there are can these differences be used to source Oldowan stone artifacts.
- **Thin Section Analysis:**
  - Are there distinguishable differences in texture, grain size and accessory minerals in quartzite samples collected from the Olduvai Gorge?
- **Trace Element Analysis:**
  - Are there distinguishable differences in trace element composition between quartzite samples collected from the Olduvai Gorge?

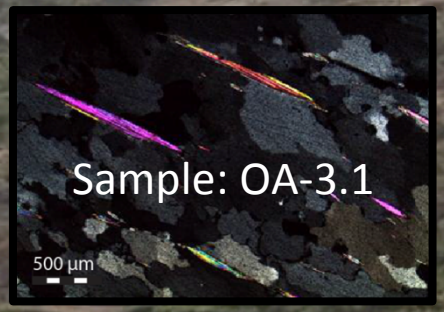
Are Samples Distinguishable in Thin Section?

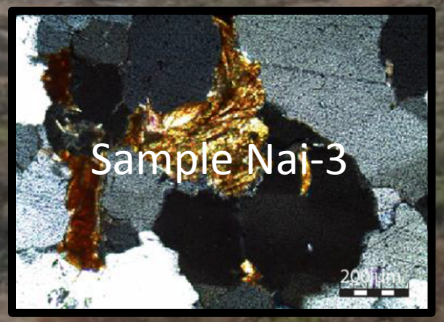












Thin Section Analysis Conclusion

- Collected samples demonstrate distinctive mineralogical and textural characteristics that are detectable using petrographic analysis of thin sections.

Trace Element Analysis

- Methods for digesting samples were adopted from Raza (2010) and Kempe (2002).

Generalized Methods

(Shatter Box Samples to a powder) → (weigh 0.5 (g) of sample) →

(digest in HF) → (take (1/5) of sample & + water) → (+ HNO_3)→

Run Samples through

Initial Results

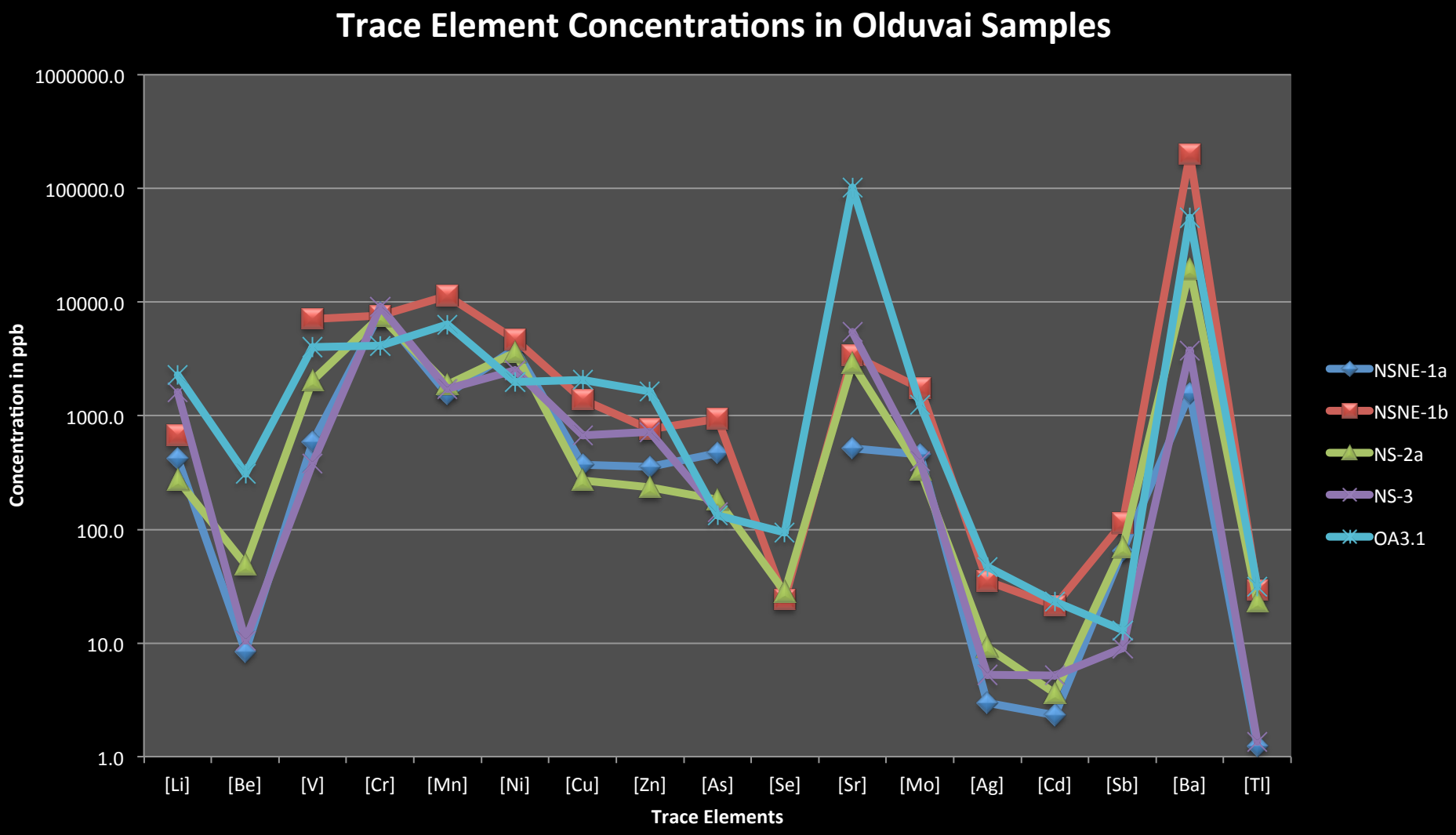
- Trace Elements (In Range):
  - Be, V, Cr, Mn, Ni, Cu, Zn, As, Se, Sr, Mo, Ag, Cd, Sl, Ba, Tl
- Trace Elements (Over Range):
  - Na, Mg, **Al**!, **K**!, Ti, Fe, Co

Trace Elements

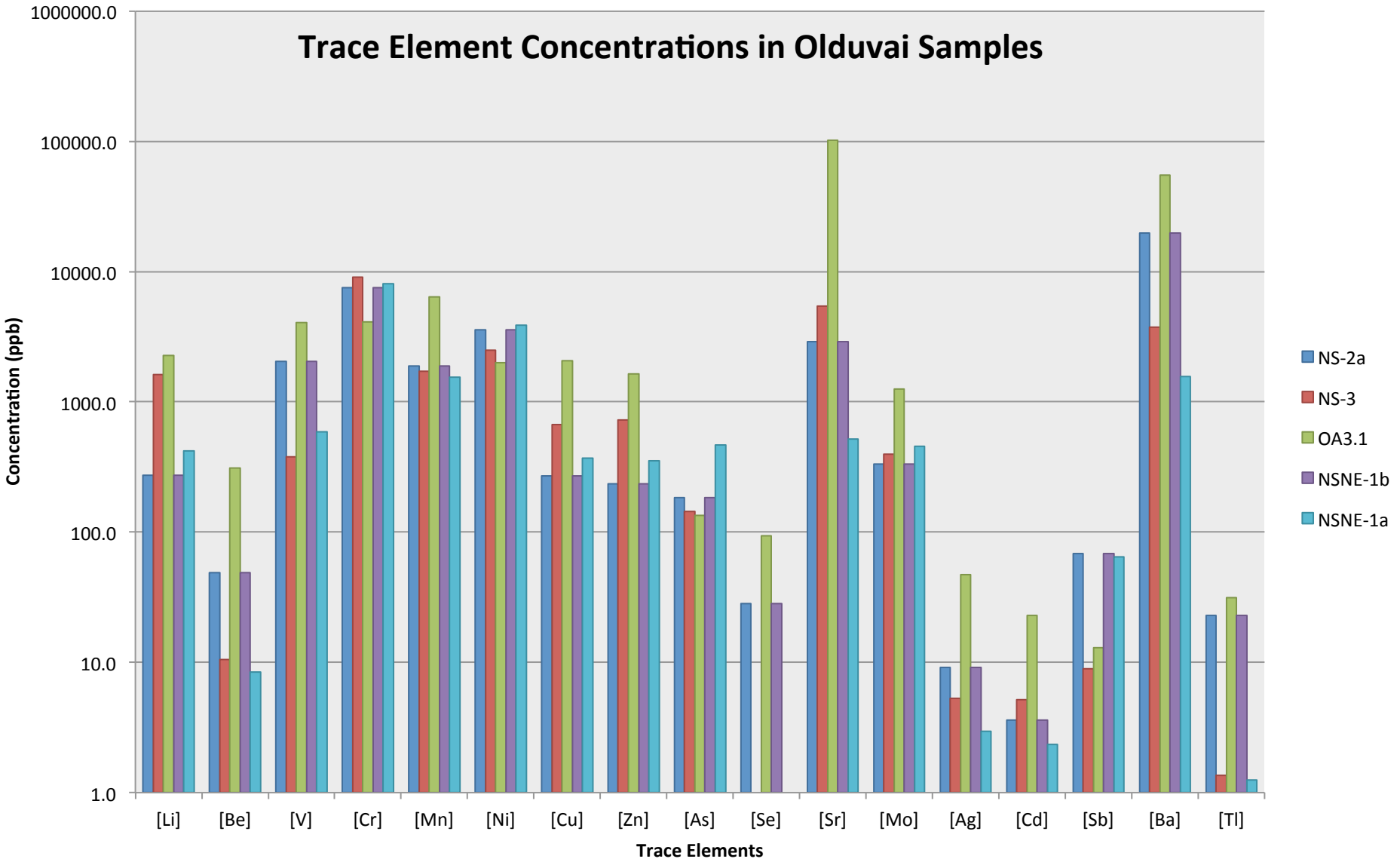
Samples	[Li]	[Be]	[V]	[Cr]	[Mn]	[Ni]	[Cu]	[Zn]	[As]	[Se]	[Sr]	[Mo]	[Ag]	[Cd]	[Sb]	[Ba]	[Tl]
Pure SiO2	1647	22	854	7818	6196	5176	418	635	117	24	6140	1383	54	21	13	4823	6
NSNE-1a	422	8	588	8056	1548	3895	369	354	469		521	458	3	2	65	1559	1
NSNE-1b	670	0	7109	7634	11413	4660	1387	762	942	24	3406	1752	35	21	114	200708	30
NS-2a	273	49	2036	7563	1879	3592	269	235	184	28	2891	332	9	4	69	19681	23
NS-3	1615	11	381	9102	1717	2497	672	724	143		5452	397	5	5	9	3739	1
OA3.1	2282	310	4047	4134	6403	1997	2065	1631	134	94	102503	1256	47	23	13	55230	31

Note: Values are the calculated concentrations (ppb) in rock samples.

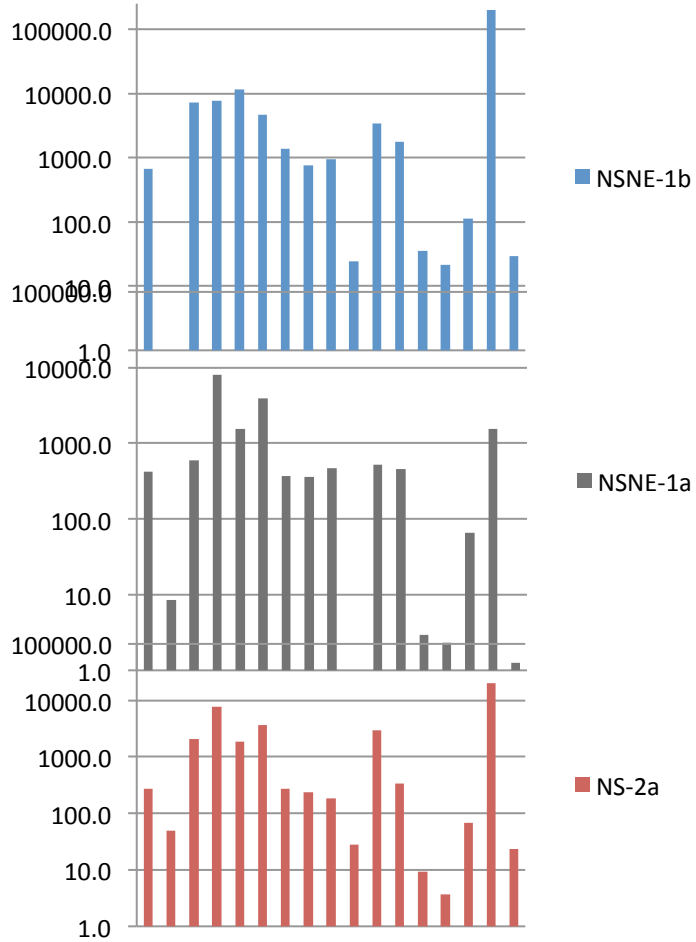
Initial Results

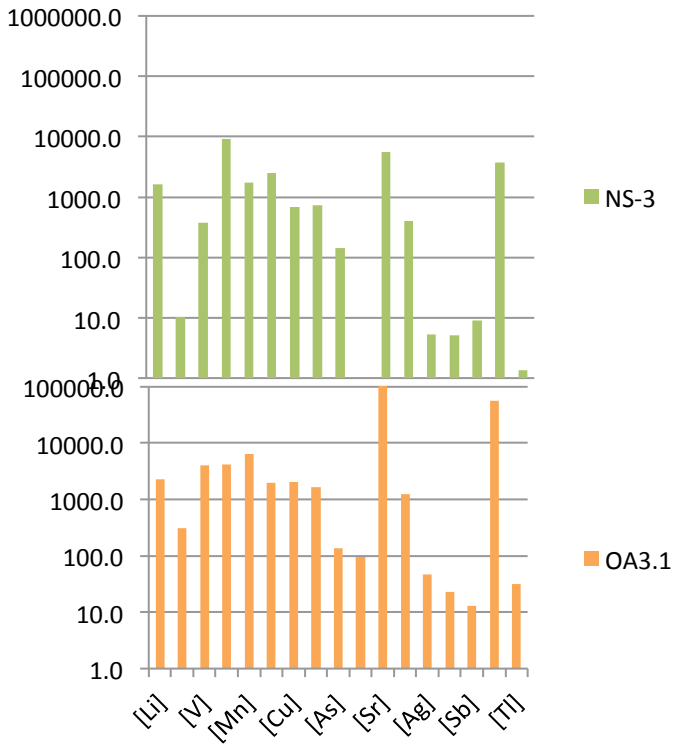


Initial Results



Initial Results





Trace Element Analysis Conclusion

- Initial trace element analysis shows that there are distinguishable differences in trace element composition between quartzite samples.

Which Method Shows the Most Promise?

- Thin Section Analysis
  - Pros
    - Distinct mineralogical and textural characteristics across samples
    - Relatively inexpensive.
  - Cons
    - Would need more samples to verify results.
    - More destructive to tool collection.
- Trace Element Analysis
  - Pros
    - Initial results show some variation in trace element concentrations
  - Cons
    - HF and the use of other corrosive chemicals
    - Very time consuming and expensive
    - Our aliquots may not represent the bulk rock composition