COMPARISON OF HAWAIIAN BASALTS

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GEOLOGY 422: PETROLOGY

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INTRODUCTION

- The Hawaiian Islands were formed as a result of the Pacific Plate moving Northwest over a hotspot in the Earth's mantle.
- The islands in the southeast are the youngest and most volcanically active.
- Hawai'i (the Big Island) is composed of a group of five volcanoes, with Mauna Loa being the world's largest volcano and Kilauea being the world's most active volcano (Saini-eidukat and Schwert, 2013).

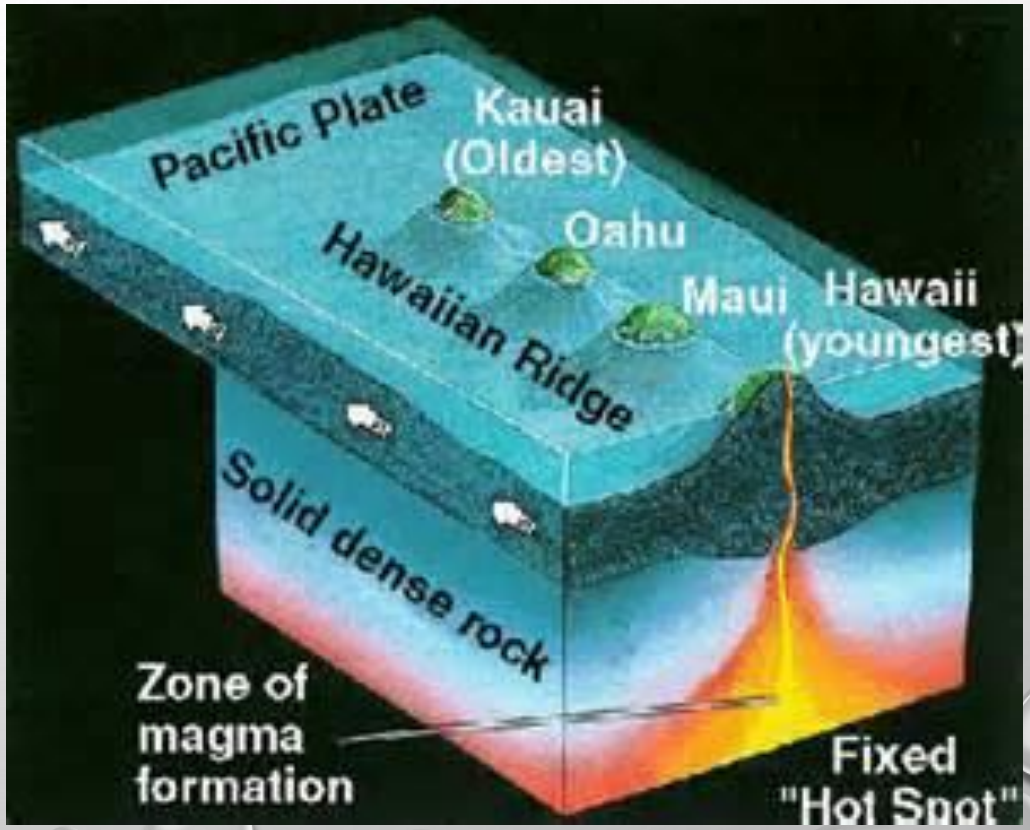


Image Source: U.S.G.S.

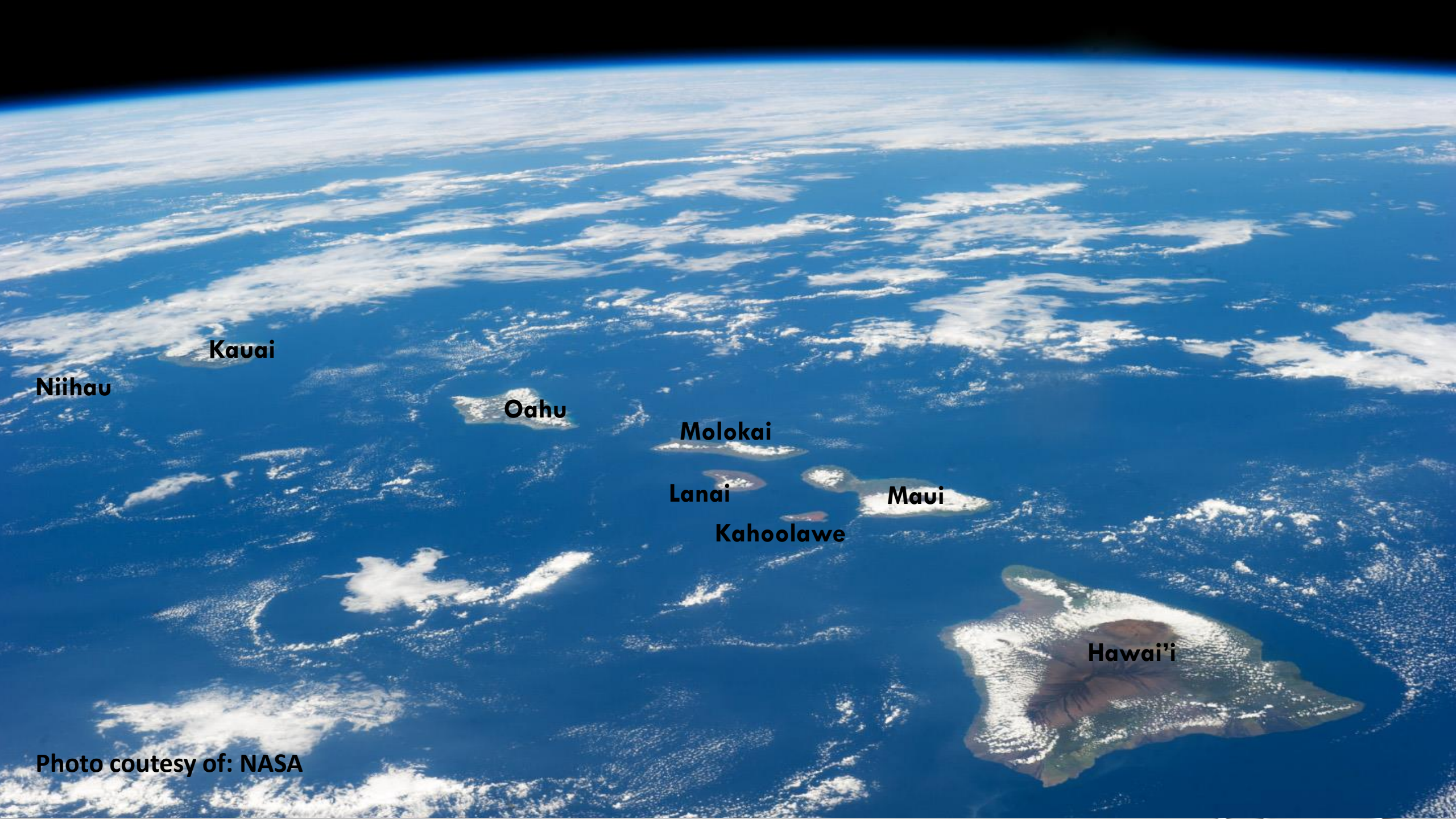


Photo coutesy of: NASA

HAWAI'I (THE BIG ISLAND)

- Two samples were obtained from the big island. Sample 130309 was obtained from Kohala and sample 130315 was obtained from Hualalai.
- Our initial hypothesis was that the sample from Kohala is a benmorite, and the sample from Hualalai is a basalt.

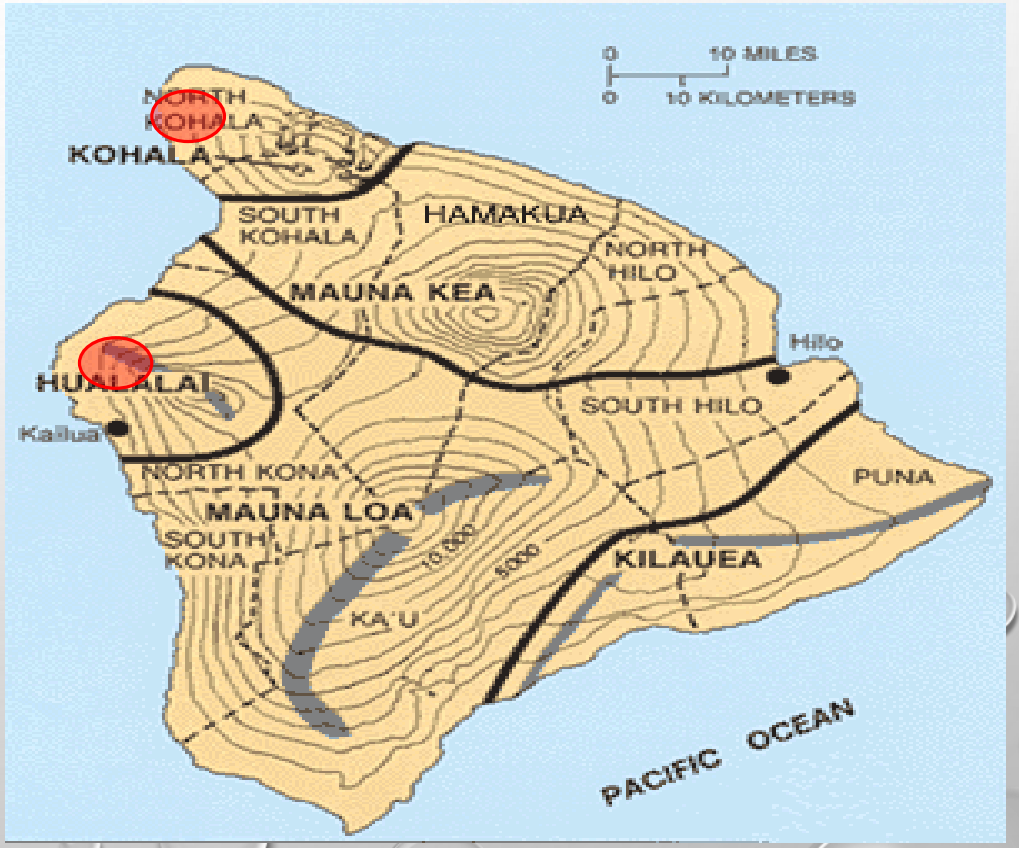


Image source: U.S.G.S.

RESEARCH & METHODS

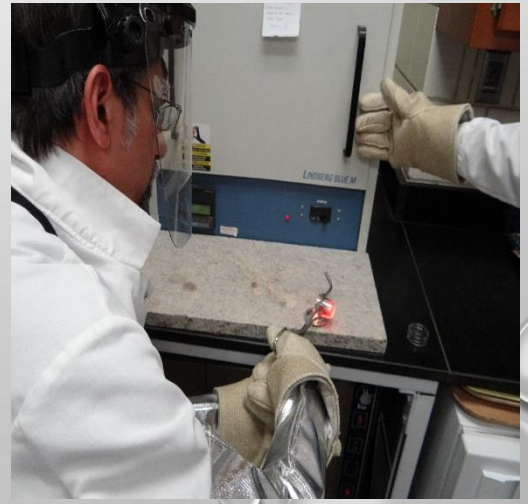
- To begin, we took our samples and put them in a jaw crusher.
- For sample number 130315, there was some olivine and calcite that may have formed as a xenolith. An attempt was made to remove as much of the secondary minerals as possible.
- Both samples were taken to Dr. Lewis's lab, where a ring pulverizer was used to grind the fragments into a powder.
- Thin sections were also prepared for conceptual purposes.

Sample: 130315

Sample: 130309

RESEARCH & METHODS

- Both sets of powder underwent loss on ignition (LOI) in a muffle furnace. This was initially done at 105^{o}C.
- Next was a process of removing carbon from the samples. This was done at 1000^{o}C. Samples were left overnight to cool.
- Separate powder samples were turned into glass. 0.5g of sample were mixed with 7.5g of flux and 0.5g of ammonium nitrate and placed in a platinum crucible.
- The mixtures were heated for 9 minutes at 1100^{o}C. Safety is extremely important!

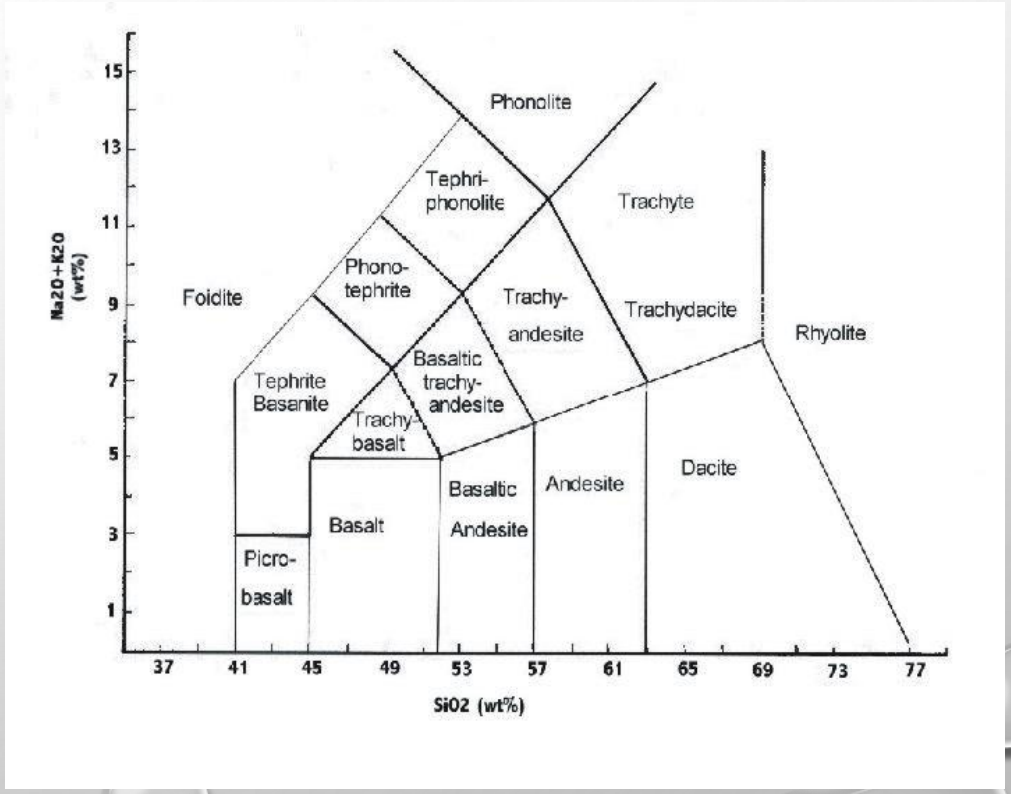


RESEARCH & METHODS

- The glass samples were taken to the XRF (X-Ray Fluorescence) spectrometer for element analysis.
- Data was plotted into Petrograph.

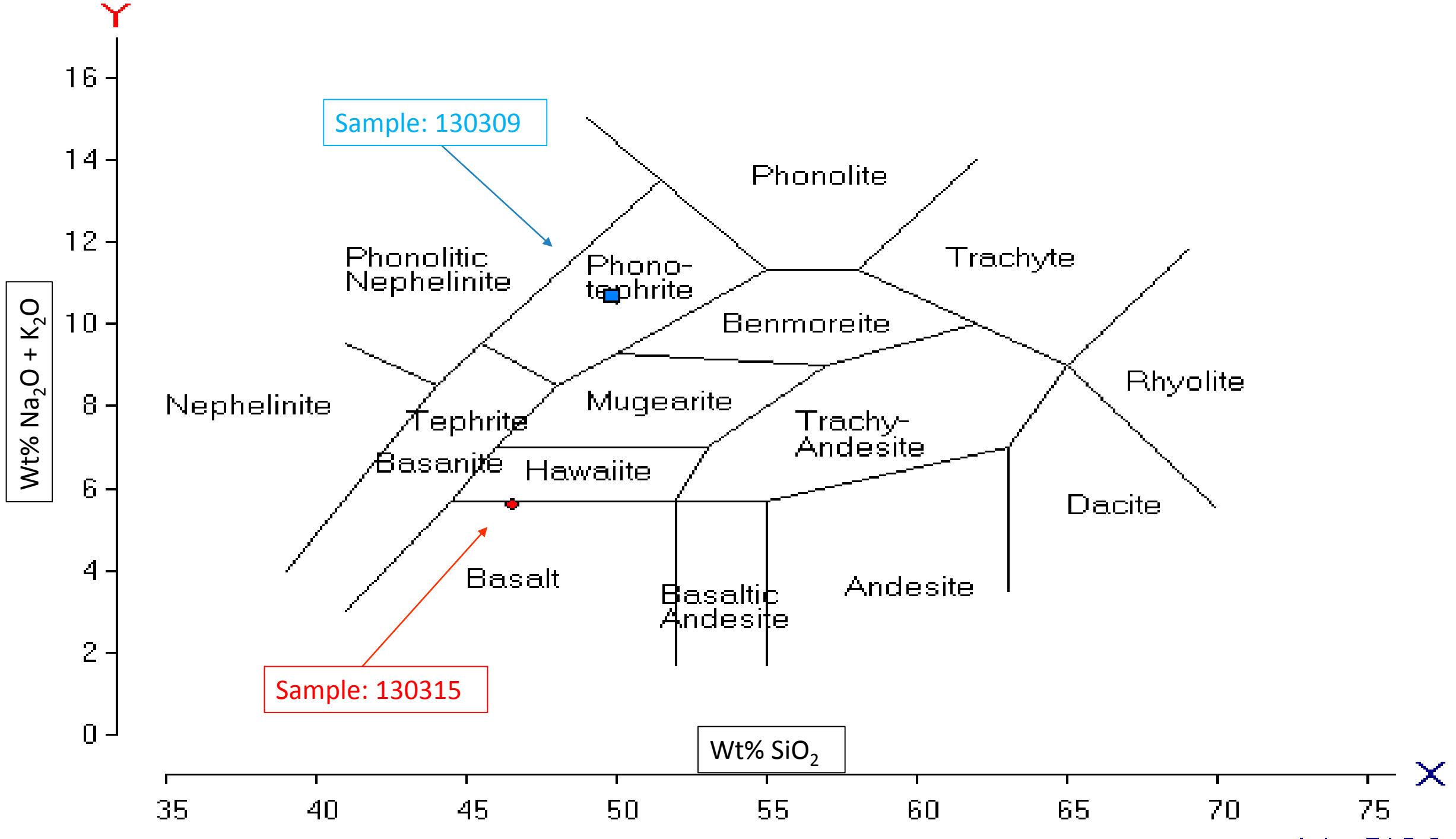
RESULTS

- The lower mantle is part of the mantle that is enriched in heavier elements, while the upper mantle is depleted of rare earth elements.
- After analysis using XRF, we found that sample 130309 was depleted of heavier elements, leading us to believe that it was derived from the upper mantle.
- 130315 was used as an “average basalt” from Hawaii. This was done to indicate how 130309 was richer in lighter elements.



RESULTS

- XRF data showed that 130309 was more alkali-rich than 130315.
- Data indicates that 130309 is a phonotephrite as opposed to a benmorite.
- The primary differences between the two is that olivine and quartz are absent from phonotephrites.
- Sample 130309 has a lower amount of Mg and Fe than 130315, this is due in part to 130309 having its Mg and Fe being used in hornblendes. The Mg and Fe in 130315 is being used to produce olivine as a xenolith.


Sample: 130309
Phonolite
Phonolitic Nephelinite
Phono-tephrite
Trachyte
Benmoreite
Rhyolite
Nephelinite
Tephrite
Mugearite
Trachy-Andesite
Basanite
Hawaiite
Dacite
Basalt
Basaltic Andesite
Andesite
Sample: 130315
Wt% $Na_2O + K_2O$
Wt% SiO_2
0
2
4
6
8
10
12
14
16
35
40
45
50
55
60
65
70
75

LOSS ON IGNITION DATA (LOI)

Sample ID	top rack rep 1 crucible #	Avg. Crucible weight (105°C) (g)	Dried soil at Room Temp (g)	oven dried soil (105°C) + crucible (g)	Dried soil after (105°C) (g)	Moisture Content %	Muffle furnace (1000°C) soil + crucible (g)	Muffle furnace (1000°C) + soil (g)	LOI%	%OM	%OC
130309-ps	41	23.6286	1.0009	24.6111	0.9825	1.84	24.6031	0.97	0.81	0.76	0.44
130315-ps	37	23.2897	1.036	24.3216	1.0319	0.39	24.3075	1.02	1.37	1.28	0.74

ELEMENTAL PERCENT COMPOSITION

	SiO2	Al2O3	Fe2O3	CaO	MgO	MnO	Na2O	K2O	P2O5	TiO2
130309	48.75	9.465	18.051	4.604	1.067	0.47	8.321	2.073	2.796	2.066
130315-BS	45.906	8.676	21.968	11.024	2.356	0.26	5.495	0	0.201	2.609

CONCLUSION

- Sample 130315 was confirmed to be a basalt.
- The sample that was originally thought to be benmorite was found to be phonotephrite.
  - This was done with XRF data transferred to a TAS diagram.


THANK YOU!