





### Holyoke Range

- Strikes east to west (Mass Audubon, Accessed: 03/13/2025)
- .Encompasses the towns of Amherst, Belchertown, Easthampton, Granby, Hadley, Holyoke, South Hadley, West Springfield. Westfield, and the counties of Hampshire, and Hampden (Mass Audubon, Accessed: 03/13/2025)
- Geologic Makeup: Granby Basaltic Tuff, Hampden Basalt, East Berlin Formation, Holyoke Basalt, Shuttle Meadow Formation, (pale red conglomerate and arkosic sandstone), diabase, dikes, and sills, Hitchcock Volcanics, and New Haven Arkose (Geologic Map of Massachusetts)

## **Connecticut River Valley**

- Goes through the towns of West Springfield, Springfield, Agawam, Longmeadow, South Hadley Falls, South Hadley, Hadley, Hatfield, Amherst, East Whately, South Deerfield, East Deerfield, and Mt. Hermon
- Geologic Makeup: Portland Formation, New Haven Arkose, Williamsburg Granodiorite, Feldspar-quartz-muscovite pegmatite, Biotite-muscovite granite, Middlefield Granite, Finegrained hornblende diorite, Biotite granitic gneiss, Belchertown Complex, Hornblende peridotite, Hornblendite, Intrusive breccia mafic and ultramafic fragments in quartz diorite matrix, Biotite tonalite of marginal stocks, Inclusions of amphibolite, granofels, hornfelsed dacite porphyry, and Prescott Complex (Geologic Map of Massachusetts)

## **Hartford Basin**

- South of South Hadley and encompasses West Springfield, Springfield, Agawam, and Longmeadow
- Geologic Makeup: Portland Formation and Reddish-brown to pale red conglomerate and arkose (Geologic Map of Massachusetts)

#### **General Info**

- The Granby Tuff is a friable, well-bedded dark tuff, commonly incorporating sediment fragments (Geologic Map of Massachusetts).
- The Holyoke Basalt is a thick, columnar quartz tholeiite containing local gabbroic segregations, thins eastward, and is interpreted as one or more thick ponded lava (Geologic Map of Massachusetts)
- It is currently unknown if the Holyoke Basalt and the Granby Tuff formed from the same eruptive event. The purpose of this research is to perform geochemical analysis on the Granby Tuff and Holyoke Basalt.



Figure 1: Geologic map of the Holyoke Range. Blue star is where samples were collected. (Geologic Map of Massachusetts Modified by Josiah Stessman)

Figure 2: Geologic map of Connecticut River and Hartford Basin. (Geologic Map of Massachusetts)

# The Mineralogical and Chemical Compositional Comparison of The **Granby Tuff and Holyoke Basalt**

Josiah Stessman & Dr. Christine Brandon Department of Geological Sciences, Bridgewater State University

**Mesoscopic & Microscopic Analysis** Three samples were collected and labeled SH-1, SH-2, and SH-3. SH stands for South Hadley. SH-1 was Holyoke Basalt and SH-2 and SH-3 was Granby Tuff. In thin section, SH-1 contained pyroxene, plagioclase, opaque minerals, calcite, and the minerals were fine grained. A few things that were noticed in the SH-1 sample was a low-grade alteration of the minerals and there was a rind found on some of the minerals. SH-2 in thin section contained plagioclase, opaque minerals, calcite, pyroxene, and they were finer grained minerals. SH-3 in thin section also had plagioclase, opaque minerals, calcite, and the minerals were finer grained. One thing noticed in the SH-3 sample was the minerals were weathered Figure 3: SH-1 Thin Figure 5: SH-3 Thin Figure 4: SH-2 Thin Section (magnification: Section (magnification Section (magnification 2.5x) 2.5x) 2.5x) **Geochemical Results** The geochemistry of the samples were derived using a Rigaku XRF (X-ray Fluorescence) and a Rigaku XRD (X-ray Diffraction). Each sample was labeled SH-1-3. Then each sample was cut into a smaller piece using a rock cutter and then crushed into a fine powder using a rock crusher. The powder was subdivided into two portions. They were pressed into glass beads and was used in XRD instrument to get analyzed. The pressed pellet was used for XRF analysis. Table 1. Main Elements (%) **Table 2. Trace Elements** Trace Elements (ppm) SH1 SH2 SH3 Sample # SH1 335 51.1 50.3 **C:** 51  $\mathbf{J}\mathbf{U}_2$ ЭT Rb 34 TiO<sub>2</sub> 138 1.1 Sr 30 13.7 13.6 13.4  $A_2O_3$ Zr 91 15.6 16.7 15.2 **FeO**<sub>T</sub> Zn 101 0.2 0.2 59 MnO 0.2 Ba 70 Со 5.4 MgO 5.1 5.4 Cr 40 9.2 CaO 8.9 8.5 Cu 86 2.5 2.8 Na<sub>2</sub>O 20 Ga Nb K<sub>2</sub>O 0.9 0.5 0.7 36 Ni 0.1  $P_2O_5$ 0.1 0.1 Nd 16 99.4 99.6 99 1734 Total Mn Sc 44 Gd 6594.5 Ti ΑΙ



