Mineralogical analysis of slag from iron production in the Adirondack State Park

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Abstract

Slag is a byproduct of iron production formed from the melting of iron-bearing rocks. Iron production in the Adirondacks reached a high in the early to mid 1800s, with many blast furnaces in operation throughout Northern New York. Two sets of samples from different regions in the Adirondacks were collected in the summers of 2019-2020. An unknown sample was taken from the Ausable River at Flume Falls near Wilmington, New York, while other samples were collected from the Mt. Hope iron furnace near Fort Ann, New York. Samples were analyzed through the creation of thin sections and x-ray diffraction. Results were compared against existing slag samples to determine origin in the context of the Wilmington slag, while the Mt. Hope slag was compared against nearby samples to compare mineralogy. The minerals Fayalite and Wostite were found in the Wilmington slag through analysis of x-ray diffraction patterns and thin sections.

Introduction

In the Adirondack State park region of New York, the production of iron was an important industry throughout the 19th century and well into the 20th century. Slag is extremely variable, the texture, chemical composition, and mineral content can change based on what company operated the blast furnace, as well as where in the furnace it formed. Using this information, slag samples can be compared against others from known locations to determine the context or formation, as well as similarities in potential bedrock origin.

Fig. 1 (left): Mt. Hope iron furnace in Fort Ann, NY.

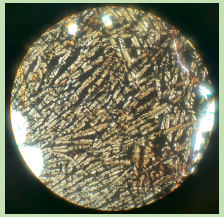
Fig. 2 (right):Map of the Adirondack Park. Locations of slag samples are marked in red.

Methods

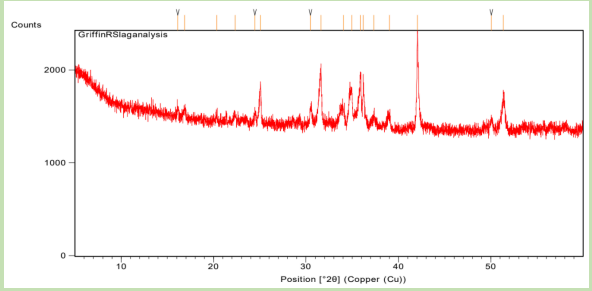
Mineralogy was analyzed through X-ray diffraction (XRD) and light microscopy.

Results

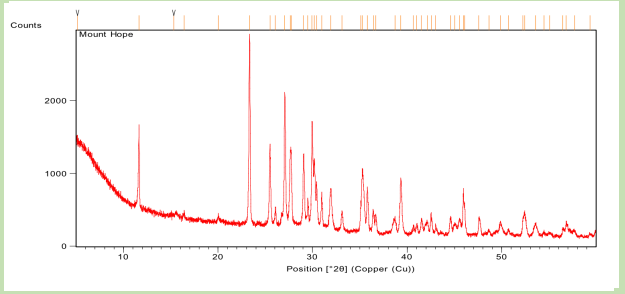
Wilmington Sample:



(PPL, field of view: 4mm)



Fort Ann Sample:



Discussion

Although the ore used at many of the blast furnaces was similar, slag from different furnaces often bear little to no resemblance to each other. This is explained by differences in the smelting processes between furnaces. The mineralogy of the sample taken from Wilmington was found to consist mainly of high-iron bearing minerals, fayalite ($Fe_2(SiO_4)$) and wustite (FeO). Metallic iron was also seen throughout the sample in small pockets, or prills. Analysis of the Wilmington slag through a thin section showing the olivine had a bladed habit resembling the spinifex texture seen in Komatiites. This sample was compared against others taken from the Jay and Black Brook furnaces. The XRD patterns from the Wilmington and Jay slags matched many of the same peaks, consistent with fayalite and wustite. Mt. Hope samples showed evidence of wollastonite ($CaSiO_3$) and diopside ($CaMgSi_2O_6$) when analyzed through XRD. Thin section analysis proved similar. The Wilmington samples showed a significantly lower calcium concentration than the Mt. Hope samples, which were much lower in iron.

Acknowledgements

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