Intro to Geology
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Contact between Anorthosite and Gabbro in Silver Bay, MN

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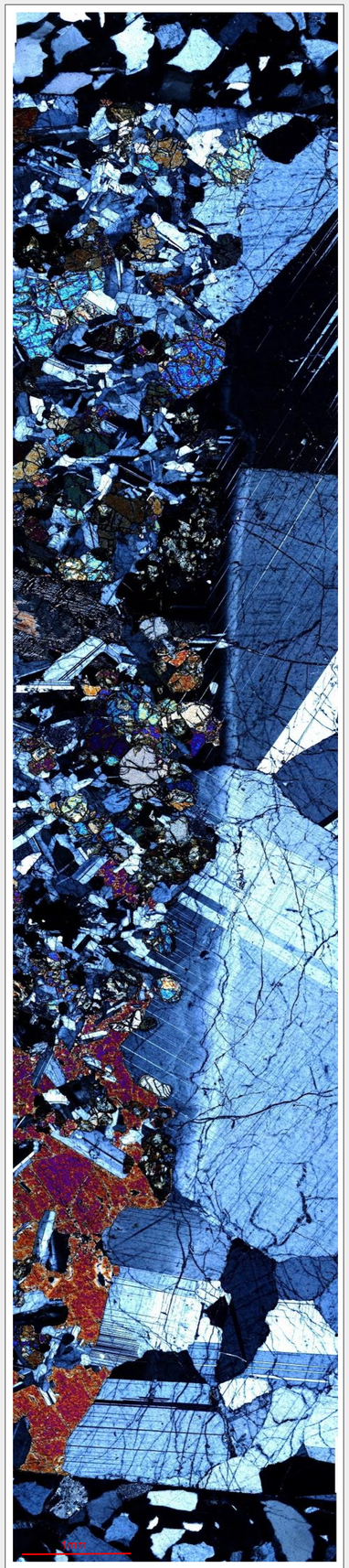

Figure 1. Stitched Image of the contact of BH250-193-51

Introduction

The purpose of our project was to investigate the contact between anorthosite and gabbro from Silver Bay, MN. Our goal was to determine the relative ages of the rocks and how the contact formed.

Figure 2. Sample of BH250-193 showing contact

Geology of Silver Bay, MN

The gabbro is part of the Beaver Bay complex, specifically the Beaver River Gabbro Pluton, formed 1.1 b.y.a. This complex has many inclusions of anorthosite which are clustered at the top of the pluton. Other research on the isotopic composition of the Beaver Bay complex indicated that the anorthosite and gabbro were not comagmatic. Figure 8 shows a hypothetical model of how this process could have occurred.

Figure 3. Outcrop in Silver Bay, MN

Methods

We took photomicrographs along the contact line of thin-section BH250-193-51 under cross and non-polarized light. We located several points of interest along the contact line, such as gabbro inclusions in the anorthosite, fractures in both rocks, and an undulatory extinction in the anorthosite. We used the Scanning Electron Microscope (SEM) to analyze the elemental composition of the gabbro, anorthosite, and the intermediate phase (near the contact and within fractures).

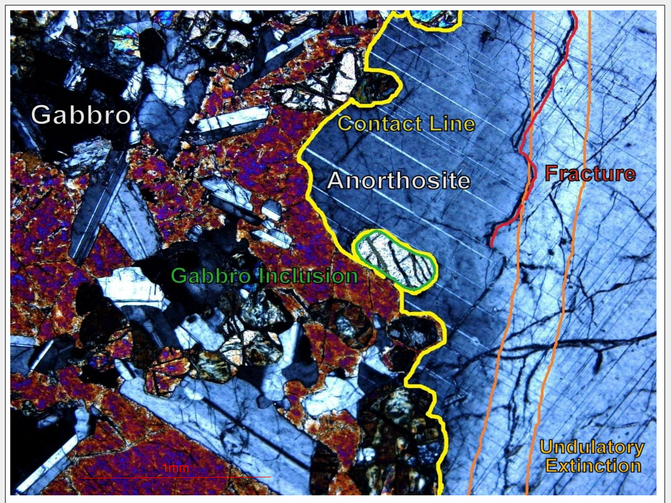

Figure 4. Cross-polarized photomicrograph at 4x magnification

Results

The photomicrographs taken with the microscope reveal gabbro inclusions, fracture lines, and an undulatory extinction in the anorthosite (see Figure 4). The SEM analyses indicate the presence of an intermediate phase along the contact, within the fractured gabbro inclusion, and within fractures in the anorthosite (see Figure 6 and Figure 7). The composition of the intermediate phase includes minerals found in both anorthosite and gabbro, showing the transfer of elements between both rocks.

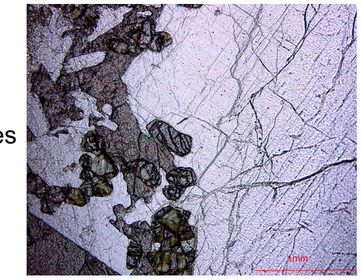

Figure 5. Non-polarized photomicrograph at 4x magnification

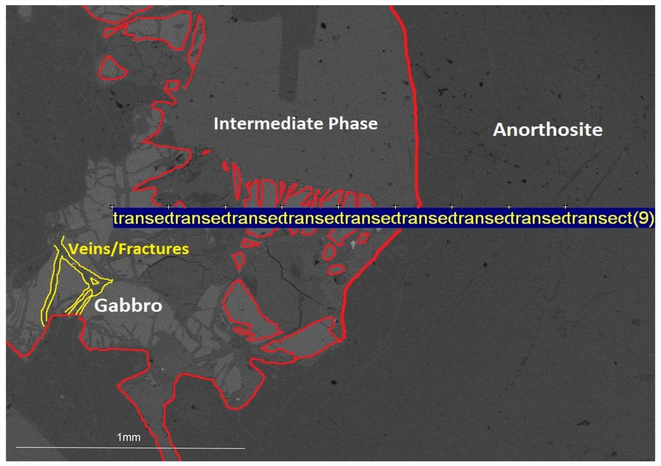

Figure 6. SEM image of the contact

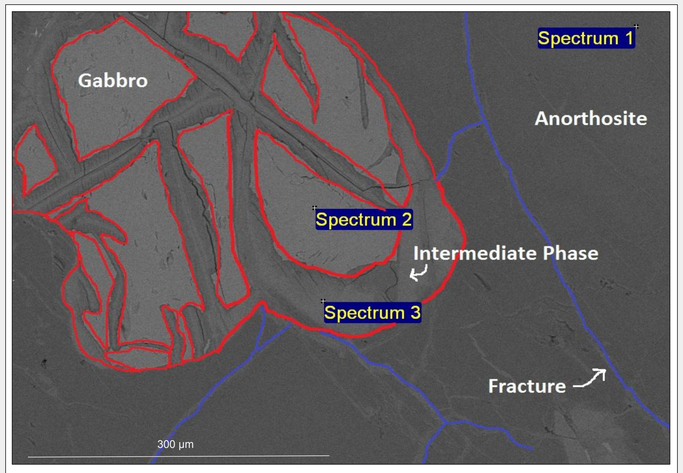

Figure 7. SEM image of a gabbro inclusion

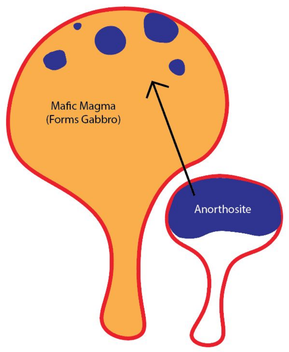

Figure 8. Diagram of formation hypothesis

Conclusion:

Our initial conclusion was that the gabbro formed before the anorthosite, but that both rocks were not completely solid at the time of contact. This conclusion was based on the presence of gabbro inclusions in the anorthosite, visible in Figure 4. Additionally, the intermediate phase in the gabbro, which contains elements found in anorthosite, suggests heat-induced element transfer (Spectrum 3 in Figure 7), which would have occurred if the rocks were partially molten.

However, after taking into consideration the history of the Silver Bay region, we concluded that the anorthosite had in fact formed before the gabbro. This is supported by the presence of stress lines and the undulatory extinction seen in the anorthosite, the gabbroic fractures in the anorthosite, and the larger intermediate areas in gabbro that are much less present in the anorthosite.

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