FABRIC AND WHOLE ROCK CHEMICAL ANALYSES OF SHEARED GRANITIC ROCKS FROM MOUNTAIN, WISCONSIN

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OVERVIEW:

The purpose of our research is to gain a better understanding of what causes shear zones to form in rocks. Our research is focused on the Mountain Shear Zone exposed near the town of Mountain, Wisconsin. This shear zone was formed approximately 1.8 billion years ago. Most of the shear zones of comparable age in Wisconsin are buried under glacial deposits, so the exposed Mountain Shear Zone provides an excellent opportunity to study rock deformation processes that have taken place deep within the earth.

Our goal is to see whether whole rock chemistry changes with shear deformation. We have collected both deformed and undeformed granitic rock samples from the study area, and recorded their locations using a hand-held GPS unit (***Figure 1***). We have analyzed the whole rock geochemistry of selected samples using X-Ray Fluorescence (XRF) to see how the chemistry differs in deformed and undeformed rocks. We also used a Magnetic Susceptibility Meter SM 30 to measure how the magnetic susceptibility values change within the same samples.

The analyzed samples can be classified as granodiorite (***Figure 2***). The major minerals in the samples are quartz, potassium feldspar, plagioclase, biotite and hornblende. Based on (***Figure 3***), the samples can be classified as peraluminous, S-type granite common in orogenic belts. The deformed and undeformed samples show similar mineralogy.

We used Samples M0513-O, M0513-Q, and M1003 (***Figures 4a-4c***) as examples of undeformed samples, and M1002-1, M1002-2 and M1002-A were taken from different parts of a sample showing a shear zone (***Figure 5***). The results of chemical analyses (***Figure 6***) show that even the undeformed samples have very different chemistry. One explanation for this might be that there was more than one episode of minor granitic magma intrusion after the shearing event (***Figure 5***).

The magnetic susceptibility values per unit area of rock surface changes with distance (***Figures 7a-7b***) but seems to show no correlation with mineral alignment. ***Figures 8a-8b*** show some of the rock samples we used for this analysis. This variation might be due to higher concentration of magnetic minerals like magnetite in some parts of the analyzed samples.

METHODS:

- We collected undeformed and deformed granitic rock samples from the Mountain Shear Zone and recorded their locations using a hand-held GPS unit (***Figure 1***).
- We analyzed the chemical composition of some rock samples using X-Ray Fluorescence (XRF) at UW Milwaukee. Chemical analyses data are shown in ***Figures 2, 3, and 6***.
- We cut approximately1 cm thick serial sections in two mutually perpendicular directions for selected samples and used a Magnetic Susceptibility Meter SM 30 to measure the levels of magnetic susceptibility on those sections. The results are shown in ***Figures 7a and 7b.***

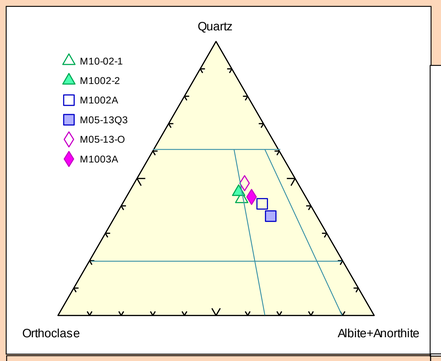


Figure 2: We calculated the modal mineralogy of our samples based on the CIPW norm. All our samples fall in the granodiorite field on the QAP diagram.

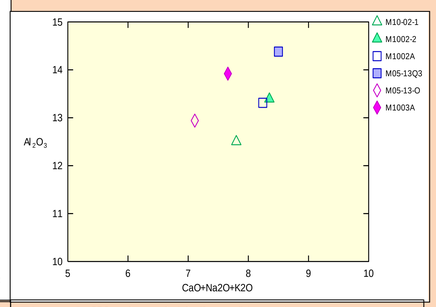


Figure 3: We plotted Al_2O_3 wt% against ($CaO+Na_2O+K_2O$) wt% of our samples. For each of our samples Al_2O_3 > $CaO+Na_2O+K_2O$.

RESULTS:

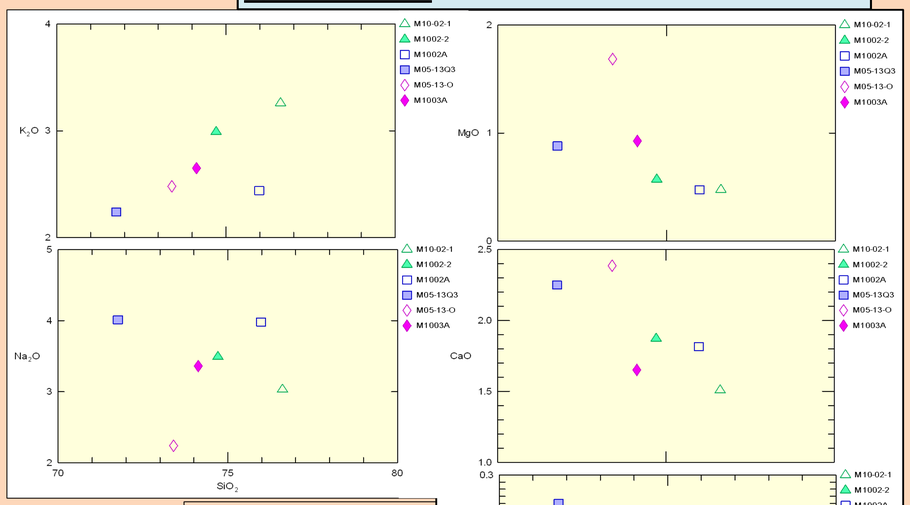


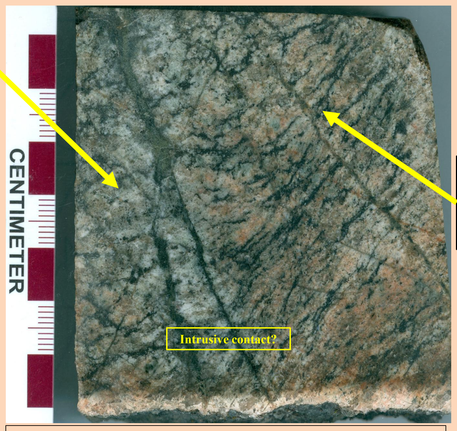
Figure 6: Harker Diagrams showing variations of different oxides with SiO_2

Figure 4a M0513-O Undeformed sample

Figure 4b M0513-Q Moderately deformed sample

Figure 4c M1003 No distinct foliation. Relatively undeformed sample

This part of the sample shows no apparent sign of deformation



This part of the sample shows a shear zone

Figure 5: Sample M1002-A-1. We used samples M1002-1, M1002-2 and M1002-A from three different parts of this sample

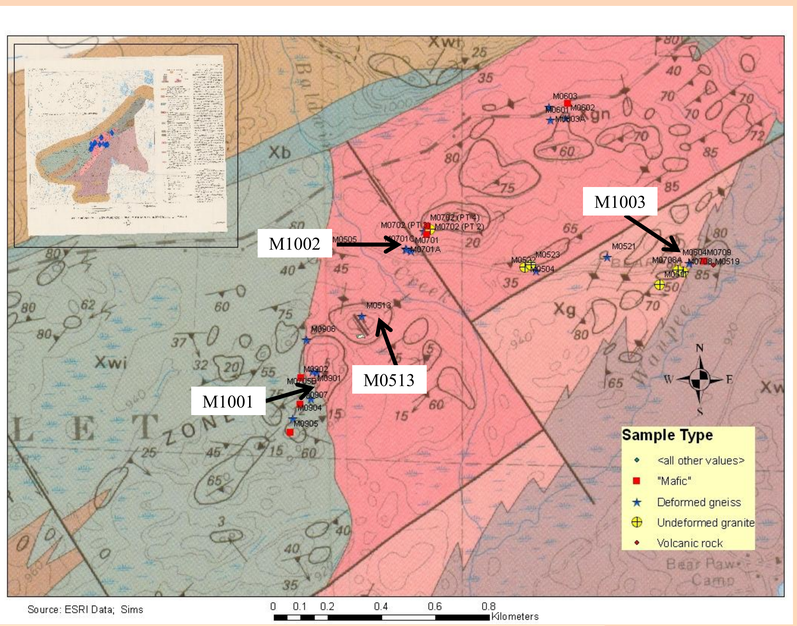


Figure 1: Our field area in Mountain, Wisconsin showing our sample locations.

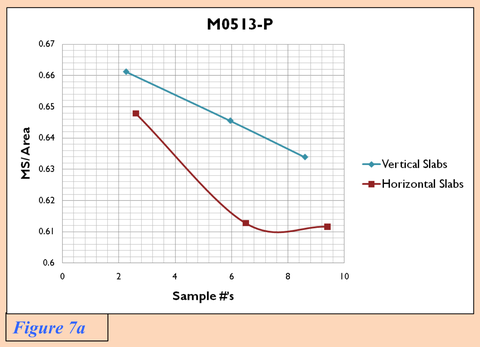


Figure 7a

Figure 8a M0513-P

Figure 8b M1001-A

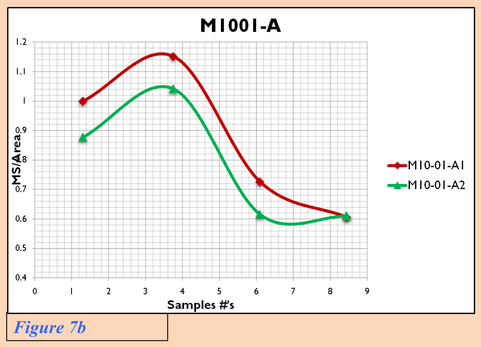


Figure 7b

Figure 7a and 7b: The two graphs show how the magnetic susceptibility values per unit area change for two of our representative samples. The magnetic susceptibility values are 10^{-3} SI units. The area is in cm^2.

Figure 8a and 8b: The samples we used for measuring magnetic susceptibility values shown in figures 7a and 7b.

SUMMARY AND FUTURE WORKS:

Our results show that there might be more than one episode of granitic magma intrusion after the shearing event in the study area, and the differences in whole rock geochemistry between deformed and undeformed samples might not always be related to shear deformation. The analyzed samples show little or no relationship between magnetic susceptibility values and mineral alignment.

We need to conduct detailed geochemical analyses including REE and trace element analyses to see if we can identify different generations of granite in the study area.

We also need to conduct detailed mineralogical and textural analyses using an optical microscope to study the effects of shearing on our samples.

We need to determine how the magnetic susceptibility values change in three dimensions in deformed and undeformed samples.

Acknowledgements: Loryn Zachariasen for her help at every stage of this project and UW Whitewater Undergraduate Research Program for funding