

ENV 110 Future of Natural Resources
Mineral Resources Project

Project Description

Minerals are mined all over the world but specific minerals are found in predictable geologic settings. We are learning about many economically important and politically influential minerals from our reading and we are learning some of the fundamental properties of minerals, how they come to be formed in rocks through a variety of geologic processes, and developing some skills in identifying rocks and minerals. Our project will allow us to focus in on a real example of important minerals once mined in NJ in a very unique geologic setting. We are fortunate to have access to the mine and mineral experts to learn about the mine and geology.

To focus our work, we will devise a way to study the occurrence of the most economically important minerals in the Sterling Hill Mine Museum in northern NJ. Because we have access to tunnels in the mine, when we visit we will devise a way to quantify the occurrence of the minerals in some of the tunnel walls so as to determine if there is enough present to make it worthwhile economically to re-open the mine. *This is a hypothetical situation.* However, the work we will do has not been done before and thus we will be able to provide information to the mine museum that they do not yet have. As such, we are creating new knowledge and helping the museum better characterize the natural resources that visitors are able to observe.

[Working with the mine geologist, we selected a section of the mine tunnel to map out the occurrence of some of the zinc-rich minerals; those we selected are dark-colored zinc-rich minerals found in white marble. White zinc-rich minerals likely present in some quantity could not be distinguished but would thus only increase the concentration of Zinc in the deposit. Thus our estimate would constitute a conservative estimate of the presence of Zinc. Students were given measuring poles and tape measures to determine location of transects, and frequency of darker zinc-rich minerals in the white marble formation after deciding together the spacing of data points along transects.]

During our next class, we analyzed all groups' results to create a "map" of all % zinc-mineral measurements and calculate a final total estimate of zinc minerals present in the wall section studied. This step revealed that students struggled to reason mathematically to calculate an estimate of the % dark Zn-rich minerals from the data collected and some guidance was inserted into their work. [This issue will be addressed proactively when the course is offered in fall 2015 via a guided inquiry activity that ends with the final calculation needed.] We also discussed the limitations of our methods and what could be concluded from our results. Students were then tasked to complete a project report draft with the following outline:

Mine Analysis Research Report

- History
 - Mine
 - Political influences (information from mine tour)
 - Economic influences (information from mine tour and readings)

- Earth processes (information from class lectures and activities)
 - Tectonic origins
 - Mineral source rock
- Purpose of study
- Methods Summary
- Data Summary – including tables, graphs and written summaries
- Data Analyses – including results and explanations and interpretations of analyses
- Conclusion/Recommendations-explanation of whether the section of tunnel studied is worth mining again considering results of this study as well as political and economic influences summarized?

Project Completion Process

Students were introduced to numerous basic geologic principles and processes relevant to this project via inquiry activities and lectures. The students helped plan out a tentative plan to collect measurements in the mine before our visit. During the mine visit, the mine geologist, Earl Everbeek provided the history tour of the mine then gave us access to a tunnel section for the group to study. During the class following the field trip, students were guided to analyze results.

After completing their report draft, each student received feedback and was required to submit a revised report. Final reports were evaluated based on the completeness of each section for: inclusion of key content provided (through lectures, activities, guest speakers, readings) and for reasoning in explanations. Reports were assessed to qualitatively by identifying challenges students had so as to determine what additional guidance should be added when course is offered again.

Challenges identified:

- Sufficiently summarizing results in words (which limits some students from developing sound reasoning for explanations)
- Taking initiative to consider appropriate methods to estimate mineral occurrence
- Summarizing/explaining some of the tectonic origin of the ore deposit
- Incorporating background information

For end of semester independent projects, some students opted to refine the methodology used for this project given the limitations of results discussed in class, and repeat the study.