URBAN ROCKS: INVESTIGATING STONE USED FOR BUILDINGS AND MONUMENTS

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Level: Second grade to senior high

Anticipated Learning Outcomes

- Students will develop an appreciation of the importance of rock material to our civilization.
- Students will observe and develop an appreciation for materials used for buildings and monuments.
- Students will develop observational skills.
- Students will apply information on various aspects of geology, for instance the formation of various rock types, from classroom lectures and laboratories.

Introduction

Our civilization is heavily dependent on geologic materials for constructing roads, bridges, buildings, and monuments. Each year, the U.S. consumption of geological materials is many tons per person (Bates and Jackson, 1982). This includes a great amount of stone.

Stone used for building can be found in virtually any city or town, sometimes in a great many varieties. Urban field trips focusing on building stone have become quite popular in recent years. A number of geologists and educators have fostered the use of building stone as an educational resource by leading field trips and by publishing various materials, including guides to the stone of various cities (e.g. Slagle, 1982) and descriptions of urban field trips (e.g. Fazio, 1981; and Pennington and Mastie, 1984).

The concept of the urban field trip is now well established. Those who wish to develop their own program in urban geology will find it very helpful to read previous work on the topic such as the excellent articles by Fazio and Nye (1980) and Fazio (1981). The field trip guidelines outlined below are in many ways similar to those described in these works but the specifics are based on our work with students in Cleveland (see also Hannibal and Schmidt, in press).
Materials and Human Resources Needed

- Worksheets, designed for particular sites (see sample). These should be used with some kind of backing such as clipboards. Alternatively, students in higher grades can use notebooks for recording observations. (See also Fazio, 1981.)
- Writing instruments (preferably pencils) and coloring materials. Crayons work well for younger students.
- Samples of rocks, minerals, and fossils.
- Drawings or historical photographs related to the field-trip sites (for instance, an illustration showing construction of a building studied on the field trip).
- It is helpful to recruit extra adults to help with street crossing, logistics, passing out worksheets, etc., on the field trip. For younger students it is necessary to have a high ratio of adults to students.
- Magnifying glasses or hand lenses, and rulers may be needed in some cases.

Background and Site Selection

In order to develop a successful unit utilizing building stone one should have a background in geology. It may also be helpful to obtain the aid of a geologist who is familiar with building materials.

Possible sites can include your school, the school's neighborhood, downtown, shopping malls, cemeteries, or practically anywhere there are buildings and monuments.

Downtown areas are particularly good places because guides to the building stone used in a number of downtown areas are already available. Some of the best guides are those by Hebrank (1989), Slagle (1982), and Wilson (1979).

If no guide is available for your city or town, or for the portion of the city you are most interested in, you will need to do some investigating. Instructions for "stone sleuthing" are given in Cvancara (1985, chapter 22). Additional advice can be found in Fazio and Nye (1980), Fazio (1981), and Hannibal and Schmidt (in press). One reasonably-priced work that can aid in identification of building stone is Parsons (1990).

School buildings may be attractive sites, for there is no need for transportation.

Geological Focal Points

Organize your field trip as a series of stops. Focal points at field trip stops could include a medium- to coarse-grained granitic rock. The rock should be chosen carefully so that students will be able to easily distinguish its mineral constituents. Students can sketch and color the minerals in a portion of the stone (see worksheet). Locations with granitic rocks of contrasting grain sizes can be used for discussion of the relationship between grain size and rate of cooling. Also look for igneous features such as flow banding and inclusions (xenoliths).
Comparative observations can be made at places where a single type of stone has been treated in different ways. For example, most of the stone used for a building may be polished, but some of the same type of stone may be left unpolished.

Fossil-bearing limestones are excellent subjects of investigation (Fazio, 1981). One of the most commonly used building stones, known commercially as Indiana limestone, is composed of fragments of sea lilies (crinoids and blastoids), bryozoans, and other fossils. Trace fossils such as sinuous trackways are also fairly common in this material. Worksheets with illustrations of various fossils found in this stone can be prepared so that students can circle types of fossils they observe.

Sedimentary features such as cross-beds in sandstone, and stylolites in limestones, also can be examined.

Weathering of marble and limestone is another possible focal point of urban field trips. Exposed outward-facing surfaces of exterior columns will roughen due to weathering while inward-facing surfaces will be protected and remain smooth. Have students feel the difference. Exterior sculptures and monuments will lose their finely-carved details. (See Fazio and Nye, 1980, for additional activities related to weathering.)

In order to help students make the connection between stone used for buildings and natural rock outcrops it is useful to find information on locally quarried building stone. If stone has been quarried in your area, find locations where that stone has been used, and obtain natural samples or take photographs of an outcrop of the rock for comparison.

Library research can reveal other useful information. With the help of standard geological references one can find such information as the geologic age of specific building stones and the formal geologic names of rock units to which these stones belong.

**Basic Preparation for the Field Trip**

1. Pick buildings or other sites to be visited.
2. Determine route (walking or driving).
3. Devise activity for each stop.
4. Determine approximate amount of time needed for each stop.
5. Get permissions if necessary.
6. Develop worksheets for the trip.
7. Do a run-through yourself, or with a few students, for timing. (It is best to do this at the same time of day and on the same day of the week as the class trip will be taken.) Observe noise levels and other possible distractions.
8. Devise pre-trip activities to introduce the concepts and stone types covered on the field trip.
Comments
Worksheets are necessary as they serve to focus attention at the various stops. The worksheets will vary in complexity with the level of the student. The sample worksheet included here was designed for investigation of a coarse-grained granite at stop 1 and investigation of weathering of exterior marble columns at stop 2. It is modified from worksheets we have used for classes of second-grade students.

Pre-trip activities should introduce basic geologic concepts such as rock classification and weathering. Be sure that the class knows about the general types of stone that will be seen on the trip. Introduction can be through lecture, reading, laboratory examination of stone, or other activities, or, preferably a combination of these. Related activities could include the use of crayons to model rock-forming processes (Birdd, 1990). If magnifying devices are to be used on the field trip the students should be introduced to their proper use before the field trip. It also is useful in many cases to have students do a dry run of activities. For instance, if young students will be drawing and coloring the minerals found in part of a building, they might do the same for a hand sample of rock in the classroom as preparation.

The Field Trip
Take the class to the various stops and provide a brief orientation at each location. Distribute worksheets and help the students in filling out the worksheets. Depending on the level of the class, the students may need some guidance in drawing, making observations, comparing various materials, etc. Reading the material on the worksheets out loud seems to help with younger students, especially when there is much variation in reading level. Answers can be discussed in the field, with individual students describing what they have seen. There will often be variation in individual students' observations.

Follow-up
Discussion of observations made on the trip can continue in the classroom. Slides taken at various stops can serve as useful reminders of features examined during discussions. See Fazio (1981) for additional follow-up activities.

Discussion and Conclusion
Urban field trips should acquaint students with materials they have "seen" previously yet never really noticed. The trips may also foster appreciation of buildings and other urban structures.

While urban field trips can be used as a self-contained unit on geology, the study of building stone can also be combined with other disciplines to form a multidisciplinary unit. Fazio (1981) has integrated mathematical calculations into his program. Trips to classic downtown buildings
can serve as combined lessons in geology and architecture. Examination of sculptures can combine lessons in geology and art. A field trip to one of the state capitol's, or other splendid public buildings built with a variety of building stone, could include lessons in geology, architecture, history, and civics.

Acknowledgements

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References


Wilson, R. L., 1979, Building Stones of Downtown Chattanooga: Published by the author, 63 p.
Name: __________________________________

Stop 1

1. What is the name of this building?

2. Examine the outside of this building. How many colors do you see in the rock?

3. The colors are due to different minerals. In the box below, draw the rock showing the minerals. Color in the minerals.

   [Blank space for drawing]

4. How does the surface of the building feel?

Stop 2

1. What is the name of this building?

2. Examine the columns on this building.
   
   How do the front of the columns feel?
   
   How do the back of the columns feel?
   
   What might have caused the difference?