Rock Hound 2024 Coaching Workshop

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Information covered in this presentation

- Tips for the identification of rock
- Why chemical composition of rocks is important
- Environments of formation
- Metamorphic facies and index minerals
- A basic understanding of environments of formation of rocks and minerals
- Tips for the identification of minerals
- Mineral properties
- Chemical classes of minerals
- Knowing the vocabulary
- Study strategies
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- Placing information on the 8 ½ x 11 reference sheet
- Sample questions

Identification of rock and mineral specimens

SAMPLE A

- The ability to identify the samples is very important.
- Even if the question does not ask for an identification of a sample directly, many of the questions will rely on their knowledge of the rock or mineral properties.
- An example of this type of question is:

1. Sample A has
   - A. Conchoidal fracture
   - B. A hardness of 2.5
   - C. Blood – red streak
   - D. Grayish- black streak

The correct answer is C. The students will have to identify the sample as hematite to answer the question correctly.

Identifying rocks and minerals

- When working with a particular specimen, try to focus on what is unique to that specimen.
- Some examples:

For copper, it could be its distinctive copper-red color.

COPPER

For pumice, it could be its vesicular texture.

PUMICE

For garnet, it could be its dodecahedral crystal habit.

GARNET

Identifying rocks and minerals by texture

- When given samples that do not have a unique look, use your other senses to find ways that they stand out.
- Texture can be an identifying property.

Sandstones usually have a rough or gritty feel.

Talc has as smooth, soapy or greasy feel.

Identifying rocks and minerals by density

Density is the ratio of mass to volume. In other words, how heavy an object is in relation to its size

- In general, with igneous rocks, felsic(light-colored) rocks are less dense than mafic(dark colored) rocks.
- Metallic minerals are usually denser than nonmetals

GRANITE
2.65 to 2.75 g/cm

BASALT
2.804 to 3.010 g/cm3

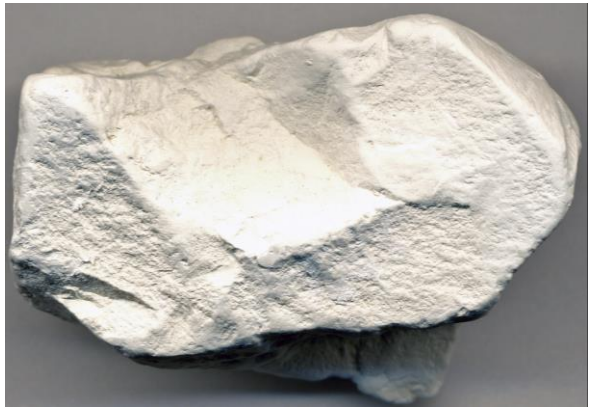
HALITE
DENSITY-2.16 g/cm^3

GALENA
DENSITY-7.6 g/cm^3

Identifying rocks and minerals

- Two other senses that you can use to identify samples are smell and sound.

Kaolinite has a distinctive earthy smell.



Shale can be distinguished from shale by using the “tink test”. When struck, thin pieces of shale will “thunk” while thin pieces of slate will “tink”.

SHALE

SLATE

Why chemical composition is important

- Chemical composition is an important property to know because it can explain other properties that rocks and minerals exhibit.
- Referring to the previous slide, all three of the examples that I used are clay minerals or rocks.
- The properties that I mentioned are due to this clay mineral composition.
- Kaolinite has the earthy odor of soil because clay is really refined dirt .
- Both shale and slate are mostly composed of clay minerals in combination, with quartz, and other minerals.
- When shale is subjected to metamorphic forces, the pressure and higher temperatures are combining to “cook” these clay minerals in a way similar to making ceramics.
- The clay minerals become harder, and this is the reason you hear a clearer “tink” sound in the slate.

Chemical composition (continued)

- Chemical composition is also responsible for the difference between felsic and mafic igneous rock density.
- Felsic igneous rocks have a larger proportion of silica (quartz) and aluminum, which have a lower density than the minerals (magnesium, iron) found in mafic minerals.

Environments of formation - Igneous

- We don’t study rocks and minerals just because they’re pretty.
- By looking at the physical and chemical characteristics of them, we can learn what the ancient world looked like at that time.
- Igneous rocks are formed by the melting of solid rock.
- Depending on the texture of the resulting rock, we can tell whether that rock solidified over a long period of time underground or quickly above ground.
- Whether the rock is light-colored, dark or somewhere in between (felsic, mafic, or intermediate), we get an idea of minerals that make up that rock.
- Knowing the minerals that make up the rock, we can learn whether the rock was formed from continental crust, or ocean floor and what type of plate boundary it was formed from.

Environment of formation - Sedimentary

- Sedimentary rocks are formed by the weathering, erosion, transportation, deposition, cementation and lithification(turning of sediments into stone) of sediments.
- By looking at the grain size, shape and how well these sediments are sorted, we can tell whether those sediments were deposited by water or wind, in a quiet deep marine environment or an active shore.
- Deep marine environments will produce rocks that are well sorted, with uniform grains. High energy marine environments will produce rocks that have grains that are of not well sorted, or contain broken shell fragments,
- We can tell whether the sediments were transported over long distances, or they were lithified near where they were eroded and weathered.
- Rounded, well-sorted grains reflect longer transportation. Angular, unsorted grains have been transported over shorter distances.

Environment of formation - Metamorphic

- Metamorphic rocks are formed by pressure and high temperatures acting on existing rocks.
- These forces are produced by faults, folds, mountain building events (orogeny), heating of the neighboring rocks produced by magma intrusions, or subduction zones when tectonic plates collide.
- By looking at the textures of metamorphic rocks we can determine the type of metamorphism that produced them.
- Foliated(banded) rocks are produced by high degrees of metamorphism with high pressures and temperatures. Gneiss is an example of this kind of metamorphism.
- Non-foliated rocks like marble are produced by low grade, contact metamorphism.
- Contact metamorphism occurs when magma is forced into an existing body of rocks. This melts the rocks that surround the magma.
- Contact metamorphism is defined by low pressure.

Metamorphic facies and index minerals

- Metamorphic facies are a group of minerals found in metamorphic rocks that formed under similar pressures and temperatures.
- These facies are grouped by a range of temperature and pressure using the index minerals that are typically found in them.
- The three index minerals that teams are responsible for in this metamorphic focus year are garnet, kyanite, and staurolite.
- The facies that I expect the teams to know are greenschist, blueschist, amphibolite, and eclogite.
- They should know what type of metamorphism produces each facies, and the minerals from the rules that coincide with that facies.

Identifying minerals

- A mineral is a naturally occurring inorganic element or compound having an orderly internal structure and characteristic chemical composition, crystal form, and physical properties.
- Like rock identification, if possible, you should look for something unique about the appearance of the mineral that sets it apart from other minerals.
- Color can be used for some minerals like pink feldspar.

- Many minerals can occur in various colors or in a color that occurs in other minerals.
- For most minerals, you will need to use some combination of color, luster, crystal habit, cleavage, and fracture.

Mineral properties

- Luster describes how a mineral's surface reflects light.
- Crystal habit is the tendency for specimens of a mineral to grow into characteristic shapes. Some minerals will show a few crystal habits, with one or two being predominate, while some minerals will exhibit a larger number.
- Cleavage is the tendency of a mineral to break along flat planar surfaces that are determined by their internal structure.
- Fracture is the property of a mineral breaking in a fairly random pattern with no smooth planar surfaces.
- For a more in-depth explanation of these properties, see the 2024 mineral presentation posted on the website.

Chemical class

- Along with minerals physical properties, minerals are also classified according to their chemical class.
- Except for the native element class, the basis for classifying minerals is the anion, which is a the negatively charged ion that usually shows up at the end of the chemical formula of the mineral.
- **The teams only need to know the which class the mineral is in and that an anion is used to group it. They do not need to know the chemical formula.**

Knowing the vocabulary

- I can’t stress enough that your students not only know the terms, but that they know what that term means.
- Example: one of the crystal habits that fluorite can be is octahedral.
- I may ask them to pick a crystal habit for fluorite and for that question, knowing that octahedral is one of fluorite’s habits is enough.
- But if I show them examples of crystals and ask which one is an octahedron, they need to know exactly what that shape is.
- When you are studying, if there is a term that your student may not know, ask them to tell you what it means.

Study strategies

- Use the blank worksheets that I have posted on the website to pull information from the posted slides
- At first, have the students copy information from the slides onto the worksheets.
- As they become more familiar with the information, ask them to fill in specific information from their memory.
- Along with the worksheets, play memory games. These games would have the teammates compete against each other.
- One game that I used was giving them a difficult clue that was worth 5 points. Each additional clue was easier and worth fewer points until the most obvious clue that was worth 1 point was given.
- Jeopardy style games and flash cards were also helpful.

Practicing for the test

- **Teach them to fill out a ZipGrade form.**
- Make practice stations. These don’t have to be extensive.
- Time them. There will only be one minute at each station, so get them used to what that feels like.
- Use this time to figure out which team member is more comfortable working with the reference sheet and which member is more comfortable with filling the ZipGrade form.
- **Don’t argue. Its waste of time.**

Placing information on the 8 ½ x 11 reference sheet

- Please be aware that the size of the reference sheet has been reduced to **8 ½ x 11** this year.
- The teams are limited to **1 reference sheet**. Please do not send each member in with their own.
- Anything that your team would like to include can be added to the reference sheet.
- Don’t include so much that it makes it difficult to find specific information.
- The best types of information to include would be items that are not easily memorized, such as densities and Moh’s hardnesses.
- Diagrams can also be helpful.
- Have your team practice finding information on the sheet.

Sample questions

- The following questions are samples.
- Some are from previous years.
- The material asked in these questions are **not** in the scope of this year’s rules. And I do not expect the teams to know that information.

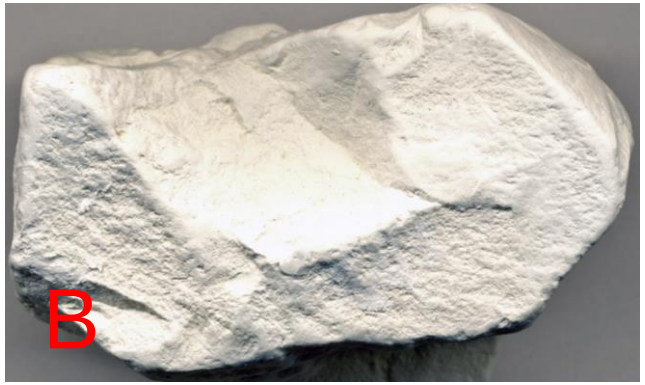
Sample question 1

1. Which of the samples was formed in the highest energy environment?
    A. A
    B. B
    C. C

2. What variety of rock are these all types of?
    A. Coal
    B. Feldspar
    C. Limestone
    D. Gypsum

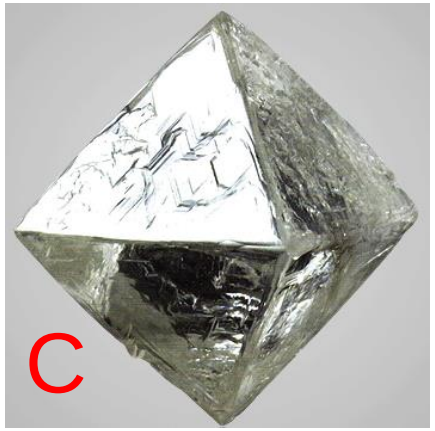
3. Which of these was **not** formed in a marine environment?
    A. A
    B. B
    C. C

Sample question 2



1. What is the luster of Sample C?
    A. Vitreous
    B. Dull
    C. Greasy
2. Which of the samples has the highest density?
    A. A
    B. B
    C. C
3. Which of these has basal cleavage?
    A. A
    B. B
    C. C

Sample question 3



1. What mineral can exhibit the crystal habit shown in B?
   A. Halite
   B. Calcite
   C. Kyanite
2. Which of these crystals has 6 faces, none at 90^0?
   A. A
   B. B
   C. C
3. What is the name of the crystal habit shown in sample C?
   A. Cubic
   B. Rhombohedral
   C. Octahedral

Sample question 4

1. If a rock is formed from lava, would it be..
    A. Extrusive
    B. Intrusive
    C. Felsic
2. If gas is trapped in magma, what could be a texture of the rock that is formed from it?
    A. Foliated
    B. Vitreous
    C. Vesicular