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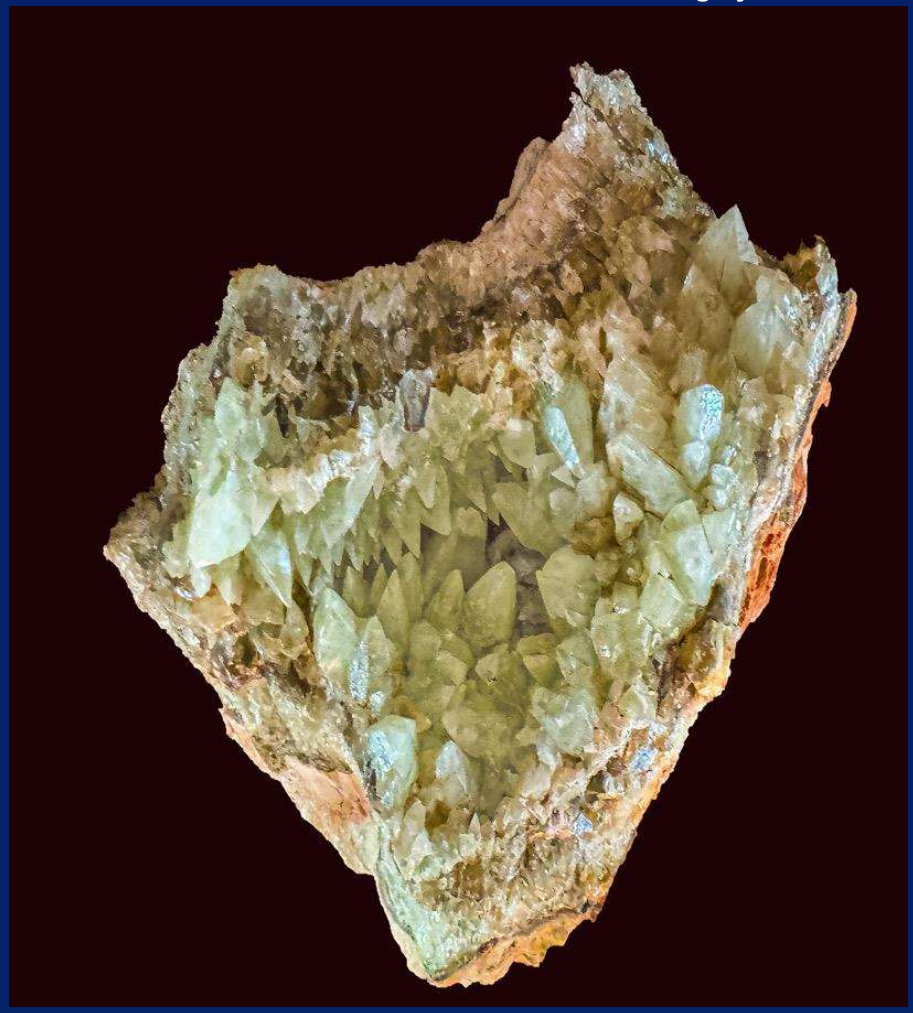
Mineral Identification

A Guide for Rockhounds



Agenda

1. Introduction to Minerals and Rocks
2. Local Mineral and Rock Characteristics
3. Identification Techniques
4. Matching results to Data Bases
5. Take Aways

Introduction to Minerals and Rocks

What Sets Minerals Apart

Minerals: Pure Substances

- Each mineral has a unique chemical formula and structure.

Rocks: Mixtures of Minerals

- Rocks are made of two or more minerals blended together.

Identification Methods Differ

- Mineral ID focuses on properties like hardness, streak, and crystal form.
- Rock ID relies on texture, mineral content, and formation process.

Why It Matters

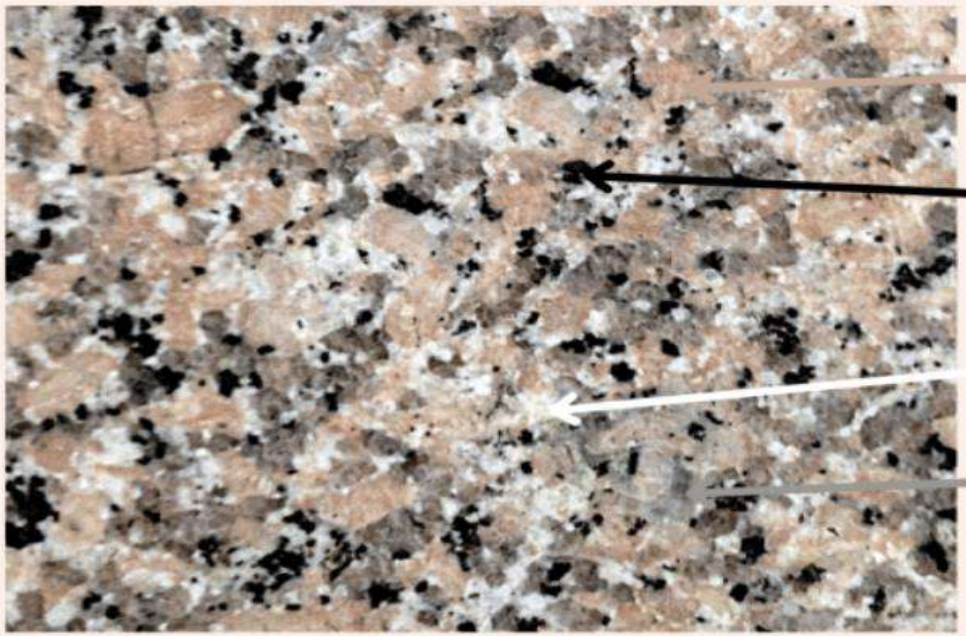
- Knowing the difference helps collectors and scientists classify finds accurately.

What Is the Difference Between Rocks and Minerals?

A rock is a solid made up of minerals. A mineral is an inorganic solid with a crystalline structure and characteristic chemical composition.

rock

Granite



minerals

minerals fit like puzzle pieces

K-Feldspar

Biotite or Hornblende

Na-Feldspar

Quartz

Location Matters

Collection Site Reveals Clues

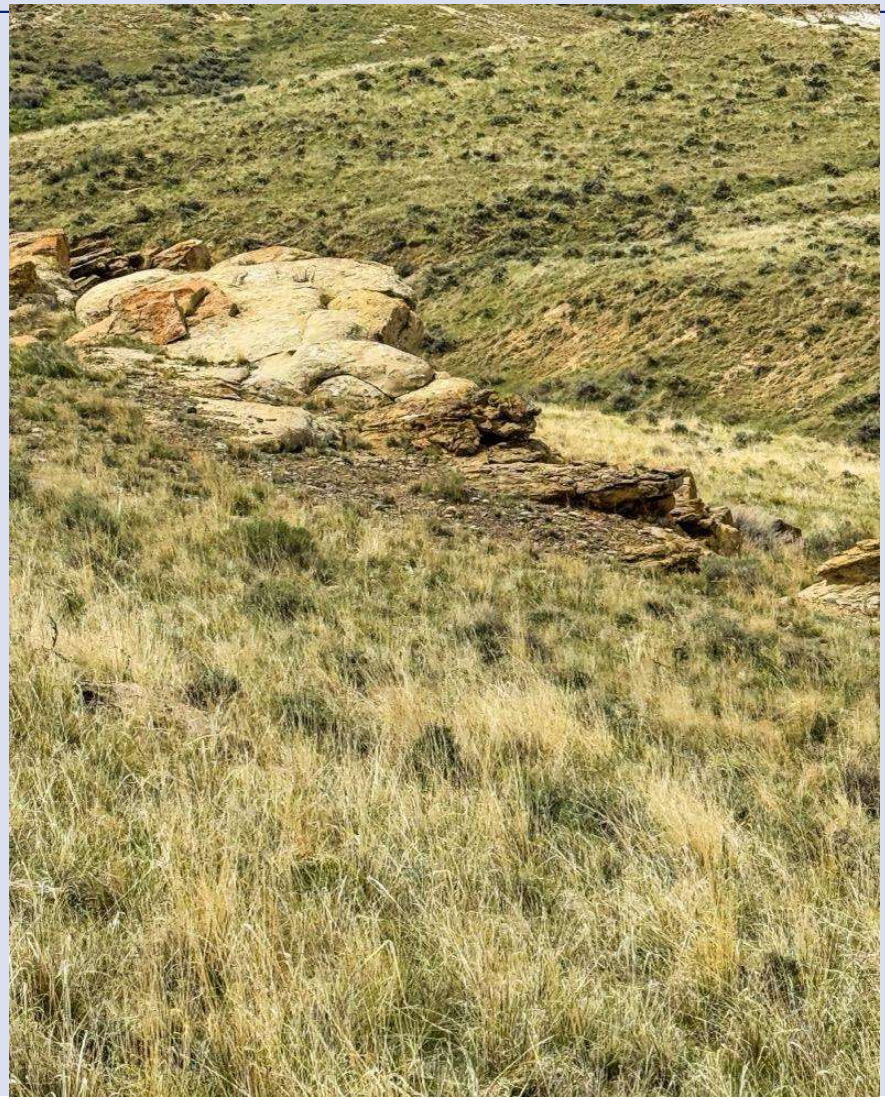
Local geology narrows down possible minerals and rocks.

Regional Context Boosts Accuracy

Knowing the area helps avoid misidentification.

Bighorn Basin Example

Knowing what minerals and rocks occur here and where helps with id. We differ, in some cases a lot, from other regions.



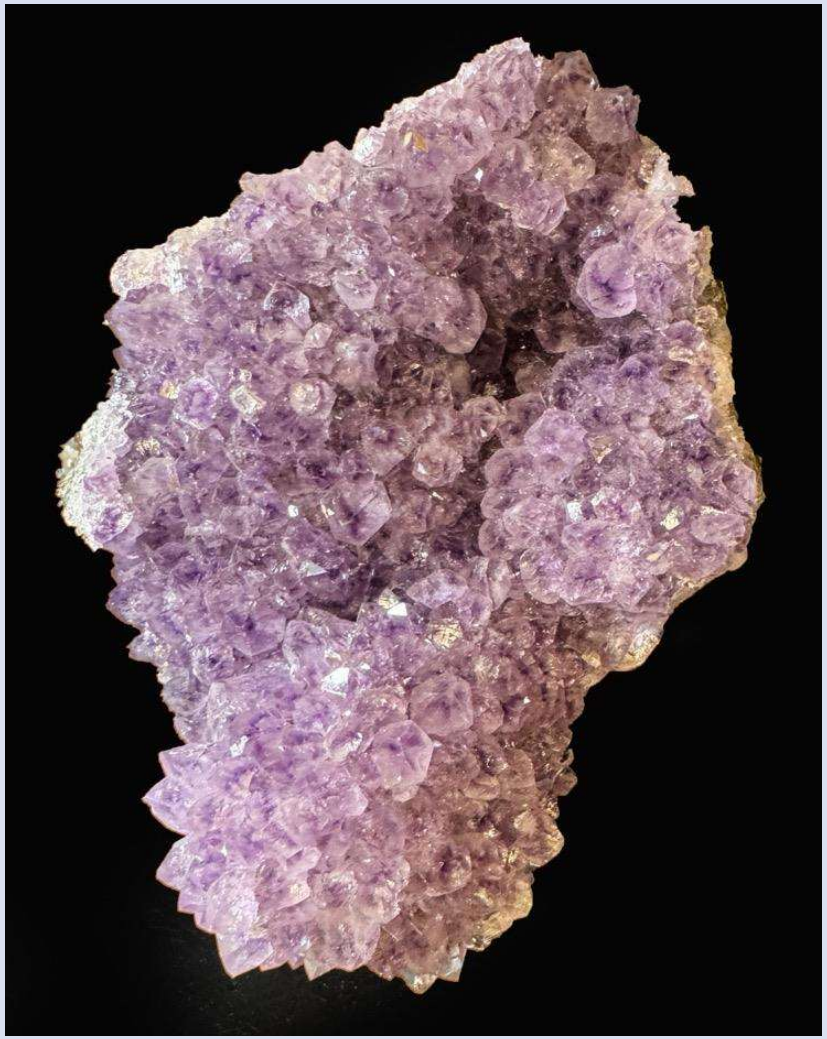
Local Minerals and Rock

Common Minerals of Bighorn Basin

Quartz Is the most Commonly Collected Mineral. Lots of Varieties:

Crystalline Varieties:
Amethyst
Smokey Quartz
Rose Quartz
Milky Quartz

Cryptocrystalline Varieties:
Agate
Dendritic Agate
Chalcedony
Jasper
Flint
Chert

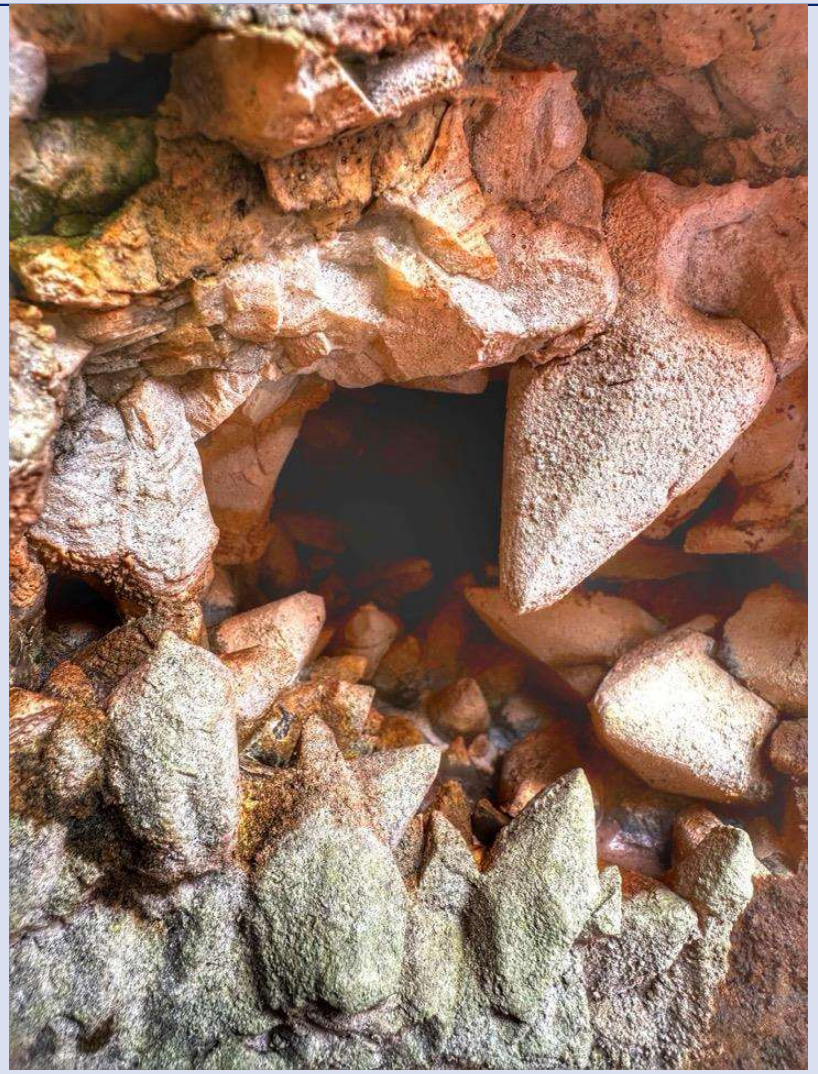


Minerals of Bighorn Basin Area

Common
Calcite
Gypsum (Selenite)
Aragonite
Feldspar (various)
Muscovite (mica) –In Rocks
Biotite (mica) –In Rocks
Epidote –In Rocks
Hornblende -In Rocks
Pyrite
Hematite
Limonite

Findable In Right Location
Apatite (nodules)
Dahllite/CA Hydroxylapatite (nodules)

Findable Con't
Malachite
Azurite
Pectolite
Native Sulfur
Lepidolite
Fuschite
Beyrl
Barite
Chalcopyrite
Gold
Tyutymunite
Carnotite
Tetrahedrite/ Tennantite
Analcime
Natrolite
Other Zeolites



fuchsitic quartzites
Porphyry
lepidolitic

Common Rocks of Bighorn Basin Area

Limestone
Dolomite
Sandstone
Shale/Claystone
Siltstone
Conglomerate
Breccia
Andesite+
Rhyolite+
Basalt+
Diabase Porphyry
Volcanic Breccia
Obsidian*
Travertine
Unakite
Granite
Gneiss
Schist
Lepidolitic Schist
Fuschitic Schist
Quartzite
Wyoming Jade
Bentonite
Coal

Mineral or Rock?

Mineral vs. Rock: What's Your Goal?

- Decide if you want to identify a **single mineral** or the entire rock.

Mineral ID: Focused Analysis

- Look for unique properties like color, hardness, and crystal form.

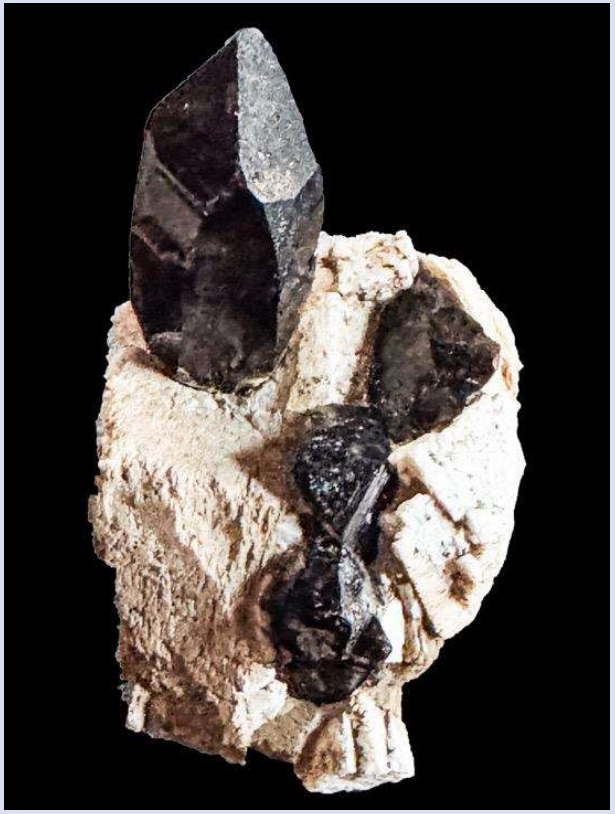
Rock ID: Composite Approach

- Examine the mix of minerals and textures within the rock.

Choosing Your Path

- Start with your curiosity—are you drawn to a shiny crystal or the whole specimen?

This Presentation will focus on Mineral ID. Rock ID is saved for another day



Identification Techniques

Experience

In Mineral Idntification: Nothing Substitutes for Experience

Pattern Recognition

Initial Observations

First Impressions Matter

Initial look guides your identification process

Color as a Clue

Observe natural hues for hints about mineral type

Luster and Transparency

Check how light reflects and passes through the sample

Testing Hardness

Moh’s Scale: Ranking "Hardness"

Ranks Mineral Hardness 1 to 10

A relative, ordinal scale based on a mineral's ability to scratch or be scratched by another

It is not a linear scale, meaning the intervals between
numbers are not equal; rather, it indicates the ability
resist scratching.

Mohs Hardness Scale

Increasing Hardness

Mineral Name	Scale Number	Common Object
Diamond	10	
Corundum	9	Masonry Drill Bit (8.5)
Topaz	8	
Quartz	7	Steel Nail (6.5)
Orthoclase	6	
Apatite	5	Knife/Glass Plate (5.5)
Fluorite	4	Copper Penny (3.5)
Calcite	3	
Gypsum	2	Fingernail (2.5)
Talc	1	







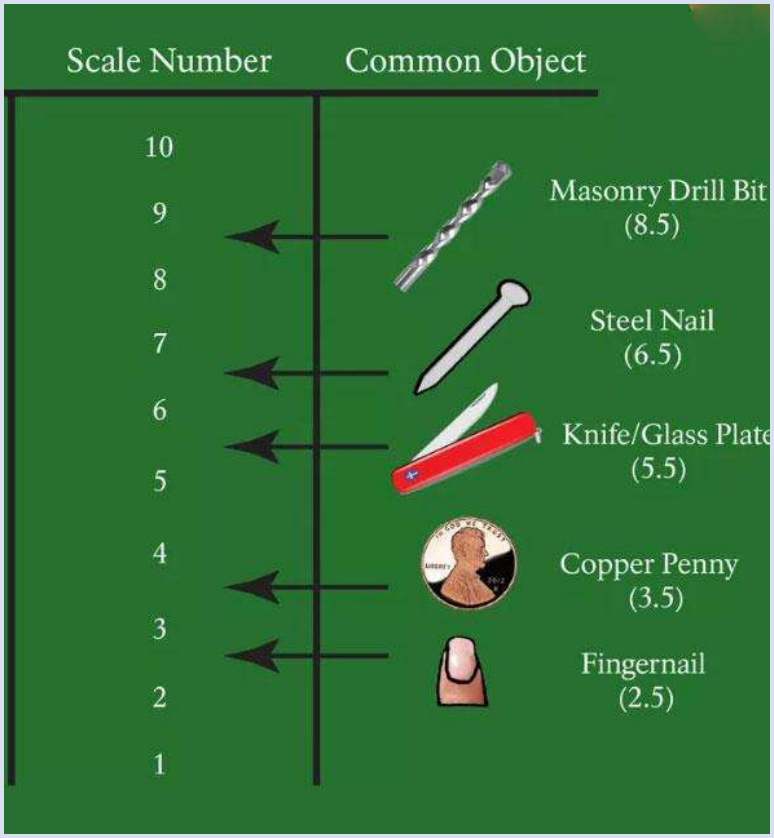


Specimen Based Test Kit

Professional Hardness Kit

$ 107.80 Geotools
~$125.00 Amazon

Build Your Own



Notes:

6.5 use a steel nail or steel file

5.5 Glass can vary a little but most glass for windows will work as well as a knife blade.

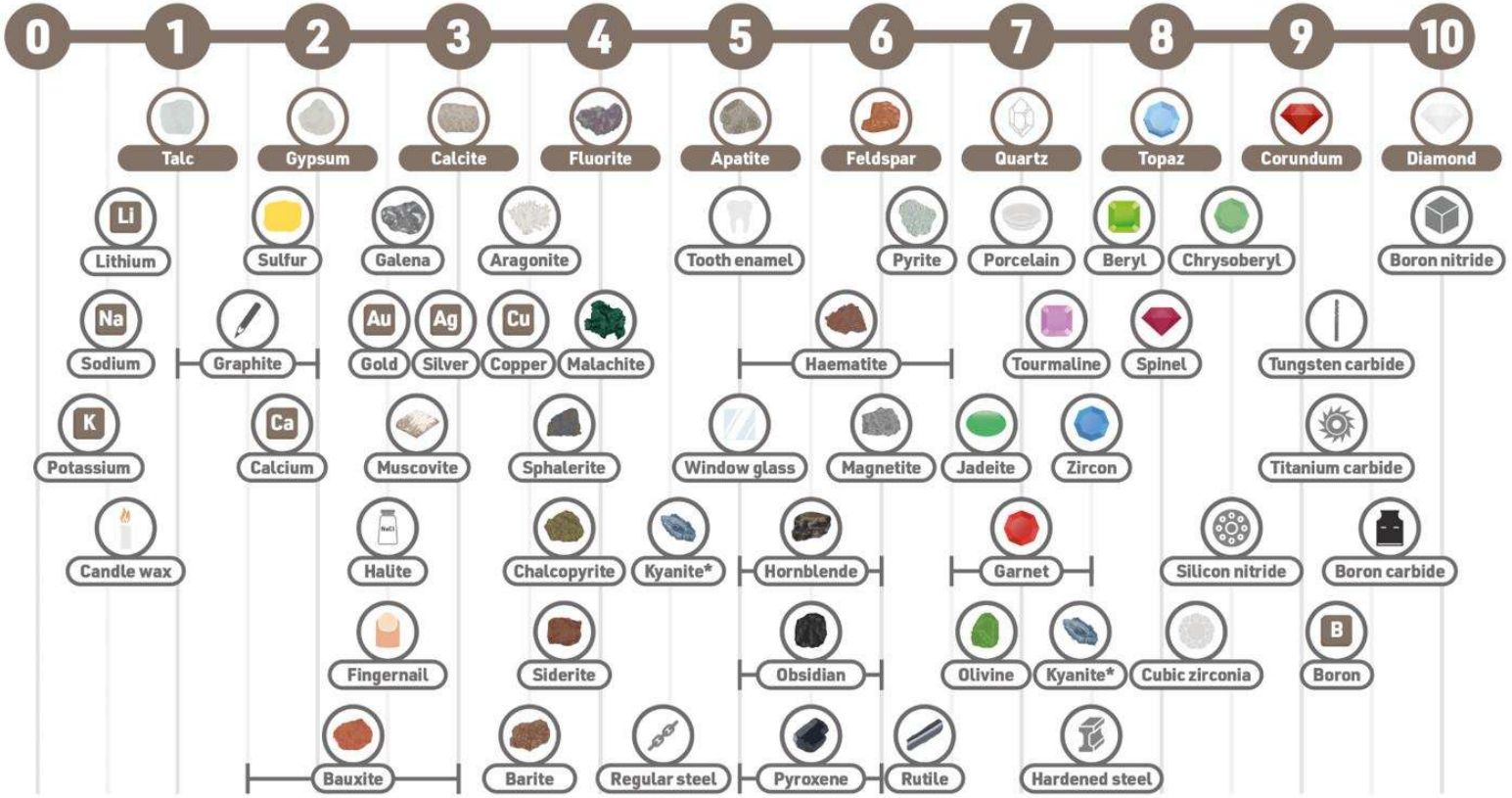
Today's pennies have a hardness of 2.0 to 2.5. Can use them instead of fingernail. Pre 1982 pennies were 2.5 – 3.0. Indian head pennies were about 3.5. For 3.0 hardness think about using a copper wire or copper pipe fitting.

Test you home scale item with a professional test kit. The Cody 59ers has one for club members.

The Mohs Mineral Hardness Scale

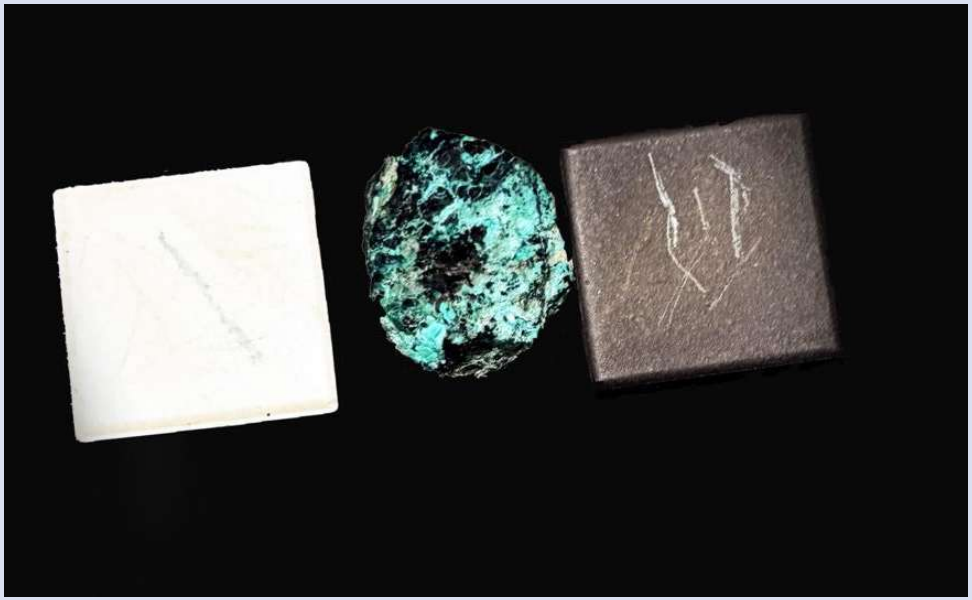
COMPOUND INTEREST

German Geologist Friedrich Mohs introduced the Mohs hardness scale in 1812. It is based on the ability of one mineral to scratch another: a mineral that scratches another will be above that mineral in the scale. The scale is a relative ranking, with no fixed difference in hardness between each point on the scale.



* Kyanite's hardness differs depending on the direction in which it is tested – softer when tested parallel to crystals, and harder when tested perpendicular.

Streak



Streak Test: Revealing True Color

- Rub mineral on streak plate to observe powder color
- Streak color often differs from surface color
- Useful for distinguishing similar-looking minerals

Streak is simply the color of a mineral powder. Many minerals have a different color when powdered than they do in crystal or massive forms. The color may be entirely different, or it may be a different shade. Quite a few minerals give a powder streak that is lighter in color than the whole crystal or massive pieces. **A streak is usually obtained by dragging a sharp edge, grain, or point of a crystal across a streak plate – which is simply an unglazed piece of porcelain tile, such as those used in bathrooms and kitchens.**

Streak Tips

- A porcelain streak plate has a relative hardness of about 6½. Minerals of that hardness and greater can not be tested on it – they'll only scratch it.
- Some geologists use a steel file to test the streak of minerals with a hardness of 6 to 6½.
- Streak plates tend to end up covered with traces of mineral powder in various colors. They can be "refreshed" washing them with windex or by sanding them with fine emery sandpaper –220 grit or higher. Do not use a coarser grit, as it will roughen the surface of the streak plate.
- It can be difficult to get a good powdered streak from some minerals. As with other tests, repetition usually pays off. Always try to use a sharp edge or point, rather than just dragging the mineral across the streak plate. While some soft minerals give a streak easily no matter how you drag them, others will not streak well unless you use a small surface area of the mineral to get the streak. Get in the habit of looking for and using a sharp edge, grain, or the point of a crystal.

Streak Identification Example

Specific Gravity

Specific gravity (or relative density) is the ratio of a substance's density to the density of a reference substance, typically water in the case of minerals

Specific Gravity: Density Matters

- The Density of water = 1g/cm
- Now we need the Density of the Rock.
- Density = Mass/Volume
- Weigh the mineral and get it mass in grams. But we now need its volume. (See next slide)

Specific Gravity: Density Matters

- To get the rock volume place the beaker of water on the scale and zero it out
- The submerge the rock in water without touching sides or bottom. The weight on the scales is the weight of the water displaced by the rock which is equal to its volume.
- The density of the rock is its mass ÷ volume.
- The specific gravity of the rock is then its density ÷ density of water (which is 1)
- The units cancelled out and Specific Gravity is unitless.

- Light Minerals 1.8-2.5: halite, gypsum, borax
- Average Minerals: 2.5-3.5: quartz (2.65), feldspars (2.5-2.8), calcite (2.7), dolomite (2.84-2.86), Nephrite jade (2.9to 3.03), Flourite (3.1-3.3), jadeite (3.30-3.38)
- Heavy Minerals > 3.5: Topaz(3.49-3.57), Diamond (3.5), Barite (4.5), Hematite (5.3), Gold (19.3)

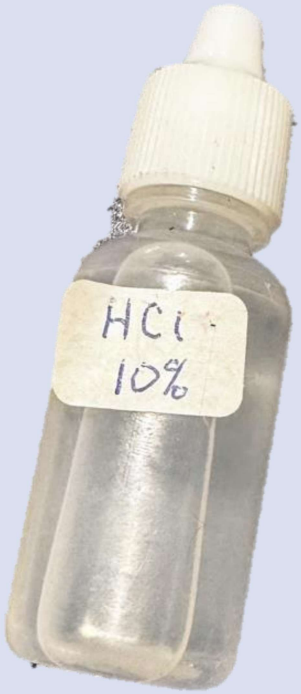
Why Specific Gravity Matters

- Light Minerals 1.8-2.5: halite, gypsum, borax

- Average Minerals: 2.5-3.5: quartz (2.65), feldspars (2.5-2.8), calcite (2.7), dolomite (2.84-2.86), Nephrite Jade (2.9to 3.03), Fluorite (3.1-3.3), jadeite (3.30-3.38)

- Heavy Minerals: > 3.5: Topaz(3.49-3.57), Diamond (3.5), Barite (4.5), Hematite (5.3), Native Copper (8.7-8.95), Native Silver (10.1-11.1), Gold (19.3), Native Osmium (22.59) (The heaviest but extremely rare)

Acid Reactivity



Acid Reaction Test Guide (10% Hydrochloric Acid)

Hydrochloric acid (HCl) is commonly used by geologists and collectors to identify carbonate minerals. Most mineral testing uses approximately **10% HCl**. Carbonate minerals release carbon dioxide gas when they react with acid, producing visible bubbling called **effervescence**.

General reaction

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2\uparrow$

Common Minerals That React Vigorously with 10% HCl

Calcite
Aragonite
Vaterite (pearls)
Malachite

Weak Reaction Minerals (Usually Require Powder)

Dolomite
Ankerite
Siderite
Azurite

Rare Carbonate Minerals that will react with HCl

- Rosasite
- Aurichalcite
- Azurmalachite
- Georgeite
- Bastnäsite
- Parisite
- Synchysite
- Artinite
- Hydromagnesite
- Dypingite
- Rutherfordine

Acid Use Cautions

Common Mistakes When Using the Acid Test

- **Caliche coatings** can fizz even when the mineral underneath is not carbonate
- Limestone or calcite **dust contamination** may cause false reactions
- Calcite cement causes sedimentary rocks to fizz strongly
- Dolomite may appear non-reactive unless powdered
- Always test a **clean or freshly scratched surface**

Specimen Protection Reminder

Avoid placing acid directly on display crystals.

Acid can:

- etch crystal faces
- dull polished surfaces
- dissolve delicate specimens

Best method

1. Scratch a small powder sample from the **back of the specimen**
2. Apply acid to the powder
3. Rinse with water afterward

Wbere do I get HCl Acid?

HCl acid can bebought at most most hardware stores. It is called Muratic Acid and contans 30-33% HCl.

Do not use it full strength. Dilute it with tap water 3 parts water to 1 part HCl.

Always pour the acid into the water not vice versa. Use rubber gloves and apron.

Acids can be dangerous. Always supervise older children. Keep away from younger ones.

Vinegar (Aceitic acid) can be used also. Commercial grades are needed as the grocery store version are too weak. It smells bad.

There are other mineral attributes and properties that can be used. They are not covered in this talk.

Color
Crystal Habit
Crystal shape
Tenacity

Luster
Cleavage
Fusibility
Fracture

Magnetic Properties
Radioactivity
Play of Color
Luminescence/Flourescence

Mindat Mineral Lookup Data Base

https://www.mindat.org/advanced_search.php

Key Takeaways

Start with Location

Knowing where a specimen was found narrows down possibilities.

Observe Key Properties

Examine color, luster, transparency, and crystal habit.

Test Hardness, Streak, Specific Gravity

Use Moh's scale and streak plates for quick identification.

Check for Special Reactions

Acid tests and UV checks reveal unique mineral traits.

Consult Reference Materials

Compare observations with guides or databases for confirmation.

Stay Curious and Methodical

Careful observation and curiosity lead to accurate IDs.