13. Barite (barium sulfate or $BaSO_4$)

Barite occurs in sedimentary rocks as veins or lenses, and where these form sufficiently large deposits, they are mined commercially. It is also a by-product of metal ore mining, because it is a common gangue mineral in sulfide veins (see 1. Galena, 3. Sphalerite, and 4. Chalcopyrite). Barite is an unusual mineral in that it is very dense for a nonmetallic mineral. Barite is usually white or clear but can be brownish yellow or pale blue.

Barite is primarily used in industry as a weighting agent in drilling fluid (called "mud") for oil and gas well drilling. The density of the mud is increased to control the higher pressures that occur with depth in underground reservoirs. Other uses of barite are as a pigment in paints and as weighted filler for paper and cloth. Because it is a strong absorber of X-rays, barite is used in the medical field to picture the digestive system by contrast.

Activities:

K-1: Barite is usually white or clear, but can have many colors. Its pure crystals are in the orthorhombic system and look like rectangular boxes: Color the one on the left light blue, one of barite's colors. Barite can also form flatter crystals in a circle pattern to look like the petals on a flower. When this form is colored red by iron stains, it is called "desert roses." Color the barite rose on the right red.

Blue barite crystal

Red desert rose

K-5: With a high density for a nonmetallic mineral of 4.5 g/cm^3, a piece of barite would weigh about twice as much as a same-size piece of a typical silicate rock. To demonstrate how density can be used to identify minerals, take two 500-mL plastic water bottles. Leave one bottle full but take the cap off the second bottle and use a graduated liquid measuring cup to pour 250 mL of water out of it, leaving 250 mL in the bottle. Put the cap back on the second bottle and put each bottle into a clean sock so that you cannot see which is the full bottle. Now, compare the weight of the two bottles. One bottle is noticeably heavier, even though both bottles are the same size. Remove the bottles from the socks to see which bottle is heavier. Circle the answer:

13. Barite continued

Full 500-mL bottle

250-mL bottle

5-6: Barite is a very useful mineral because of its high density. Although elemental barium and all soluble salts of barium are highly toxic, barium sulfate is nontoxic because it is extremely insoluble in water. To examine solubility, which is the ability to dissolve in water, take two glasses of water and add one teaspoon of salt to one and one teaspoon of pepper into the other. Stir each glass for about 30 seconds. What do you see that is different between the two? _____

_____.

Which is soluble in water, salt or pepper? _____ Which is not soluble in water? _____

6+: Barite crystallizes in the orthorhombic crystal system. The most common crystal pattern has the shape of a trapezoidal prism. Make a 2D view by drawing two trapezoidal prisms, one on top of the other, with the widest parts of the trapezoids sharing the same border (one trapezoid is right side up, the other is upside down, touching each other). Color it yellow.

7+: Just from your current knowledge, which do you think is heavier, iron or barium? _____. Now, look at the periodic table of the elements and find both elements. What is the atomic weight of each: Barium: _____. Iron: _____. Now that you know their atomic weights, which one is heavier? _____.

9+: Barite strongly absorbs X-rays and gamma rays. Although it is notably dense for a nonmetallic mineral, it is also less dense than the lead conventionally used for X-ray shielding in medical applications, such as the apron you wear at the dentist. Barite has a density of 4.5 g/cm^3 and lead has a density of 7.6 g/cm^3. X-ray imaging of the digestive tract may require the patient to drink a solution of barite and crushed barite. Lead absorbs X-rays better than barite, so research why barite would be used for radiology instead (see 1. Galena): _____

_____.