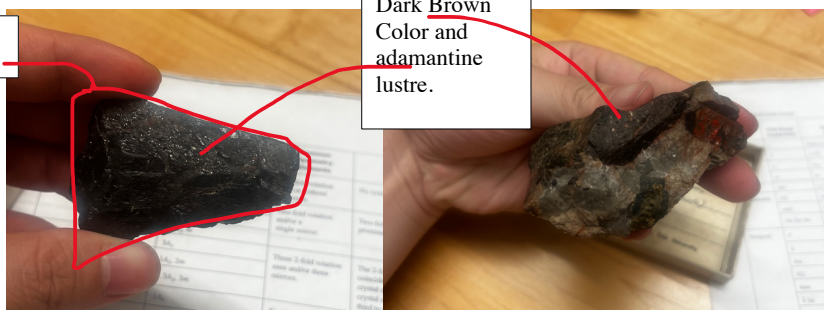
Mineral name: Sphene / Titanite

General Mineral formula: $CaTiSiO_5$
Mineral chemical class: Nesoillicate

Specific Gravity: Medium – Heavy 3.48 - 3.6	**Crystal System: Monoclinic**
Hardness: 5 - 6	**Crystal Class: 2/m**
Cleavage: Rough cleavage on one plane {110}	**Crystal description (common forms, habit, etc.):** • Fairly subhedral • Wedge shape like a rhombohedron almost
Luster: lightly adamantine	
Streak: brown / dark orange	
Characteristic Color(s): brown / dark red	

Environment (where you find the mineral): • Embedded in rock • Accessory Mineral in igneous and metamorphic rocks	**Common Mineral Associations (in samples; also consult text, notes):** • Quartz, Biotite, Hornblende, Albite • Leucoxene

Scientific use/significance: • Used in geochronometer for dating due to uranium and thorium	**Industrial or societal use/significance:** • Used to extract titanium • Gemstone	**Environmental significance:** •



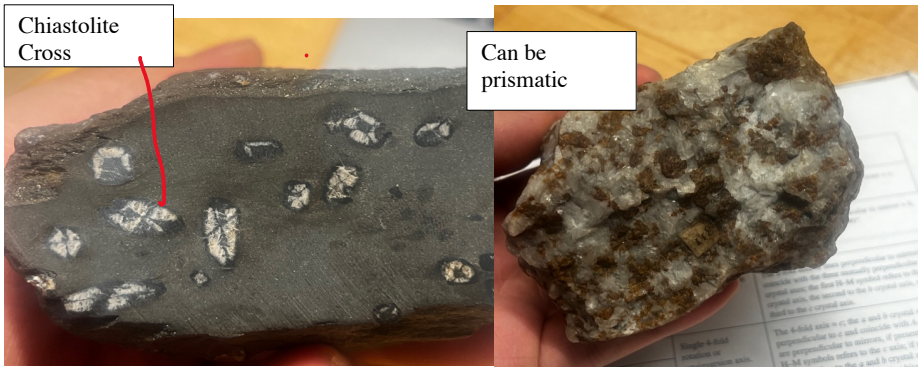
Mineral name: Andalusite

General Mineral formula: Al_2SiO_5
Mineral chemical class: Nesosillicate

Specific Gravity: 3.31-3.16	**Crystal System:** Orthorhombic
Hardness: 6.5-7.5	**Crystal Class:** 2/m 2/m 2/m
Cleavage: Irregular	**Crystal description (common forms, habit, etc.):** • Chiastolite cross (sort of a rhombedron with a cross in the middle) appears. • Prismatic, kinda pyrimidal
Luster: Greasy / Sub-vitreous	
Streak: White	
Characteristic Color(s): White, tinges of brown	

Environment (where you find the mineral): • Low temperatures and pressures • Contact, low-grade metamorphic environments • In Mica shist	**Common Mineral Associations (in samples; also consult text, notes):** • Sillimanite, Kyanite, Staurolite • Micas

Scientific use/significance: •	**Industrial or societal use/significance:** • Refectory bricks in or and steel industry for furnaces. • Gemstone	**Environmental significance:** • Peltic rocks



Mineral name: Topaz

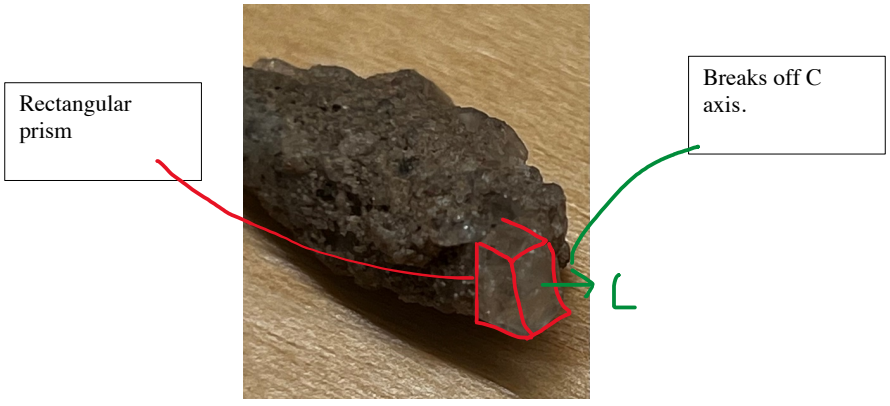
General Mineral formula: $Al_2SiO_4(F,OH)_2$
Mineral chemical class: Nesosillicate

Commented [AH1]: Generally smaller prismatic shards, common found in yellowish color with clean orthorhombic face and clean breaking prism.

Specific Gravity: Medium Heavy – 3.49-3.57	**Crystal System:** Orthorhombic
Hardness: 8	**Crystal Class: 2/m 2/m 2/m**
Cleavage: 1 plane of cleavage	**Crystal description (common forms, habit, etc.):** • Prismatic, elongated, rectangular prism. • Euhedral •
Luster: Vitreous	
Streak: White	
Characteristic Color(s): Clear/White or yellow	

Environment (where you find the mineral): • occurs in felsic igneous rocks, and may also be found in hydrothermal systems • can grow in cavities in rhyolitic volcanos	**Common Mineral Associations (in samples; also consult text, notes):** • Pegmatites • Granites, Tin

Scientific use/significance: •	**Industrial or societal use/significance:** • Gemstone • Historic medical treatments for eyes, gout, poisons	**Environmental significance:** • Grows out of fluorine-rich granatic rocks.



Mineral name: Staurolite

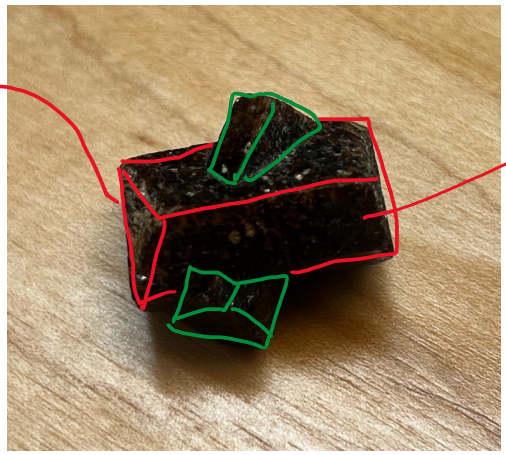
General Mineral formula: $Fe_2Al_9O_6(SiO_4)_4(O,OH)_2$
Mineral chemical class: Nesosillicate

Specific Gravity: medium-heavy	**Crystal System:** Monoclinic
Hardness: 7-8	**Crystal Class:** 2/m
Cleavage: Mostly irregular cleavage, potential one orthogonal to the length of the prismatic axis.	**Crystal description (common forms, habit, etc.):** • Form penetration twinning – 60 degrees • Prismatic / Rhombohedron
Luster: Resinous	
Streak: Gray	
Characteristic Color(s): Dark-brown – dark red	

Commented [AH2]: Crystals can look orthorhombic

Environment (where you find the mineral): • medium-grade metamorphic rocks	**Common Mineral Associations (in samples; also consult text, notes):** • Altered to Mica, Chlorite • Kyanite, Andalusite, Garnet, • Chloritoid, muscovite, biotite

Scientific use/significance: •	**Industrial or societal use/significance:** • Sandblasting abrasive • Jewelry	**Environmental significance:** • Zinc indicator • Indicates temperature, pressure, and depth of rock metamorphizing



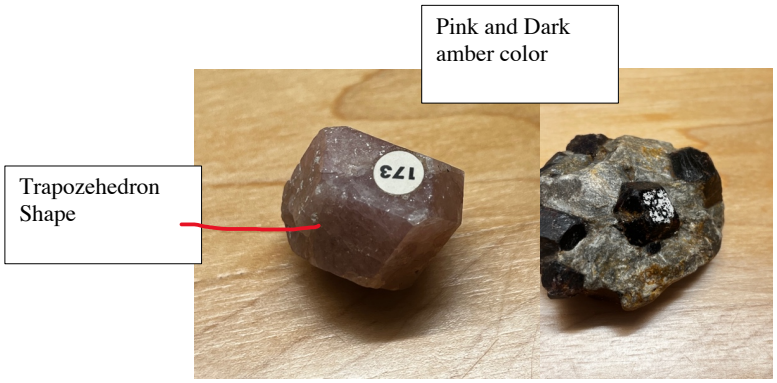
Mineral name: Garnet

General Mineral formula: $A^{2+}_3B^{3+}_2(SiO_4)_3$
Mineral chemical class: Nesosillicates

Specific Gravity: 3.1-4.2 (heavy)	**Crystal System: Isometric**
Hardness: 7	**Crystal Class: 4/m 3 bar 2/m**
Cleavage: None / irregular cleavage	**Crystal description (common forms, habit, etc.):** • Dodecahedron / Trapezoidhedron shape • Euhedral
Luster: Vitreous	
Streak: White	
Characteristic Color(s): Deep red / pinkish | almost like amber	

Environment (where you find the mineral): • common in many metamorphic rocks, such as schists and eclogites, and also occurs in some igneous rocks, like pegmatites • contact metamorphic rocks	**Common Mineral Associations (in samples; also consult text, notes):** • pyralspite, grandite groups • Hornblende

Scientific use/significance: • Can be used for dating	**Industrial or societal use/significance:** • Gemstone • Abrasive • Water filtering	**Environmental significance:** • Can be used to indicate time-pressure-temperature history



Mineral name: Olivine

General Mineral formula: $(Mg,Fe)_2SiO_4$
Mineral chemical class: Nesosillicate

Specific Gravity: Medium (3.22 – 4.29)	**Crystal System:** Orthorhombic
Hardness: 7	**Crystal Class:** 2/m 2/m 2/m
Cleavage: Rough cleavage on one plane / conchoidal fracture	**Crystal description (common forms, habit, etc.):** • Just like a rough object. Mildly rhomobohedric • Anhedral.
Luster: Waxy / Vitreous	
Streak: White	
Characteristic Color(s): Olive green.	

Environment (where you find the mineral): • mafic igneous rocks, such as basalts and gabbros, and also in mantle peridotite xenoliths.	**Common Mineral Associations (in samples; also consult text, notes):** • Peridot • Wadsleyite, ringwoodite • calcite, dolomite, diopside, epidote-group minerals, grossular garnet, tremolite

Scientific use/significance: • Most abundant mineral in upper mantle	**Industrial or societal use/significance:** • Gemstone • Molds for industry • Previously thought to have health benefits	**Environmental significance:** • Important in subduction zones when in morphs from olivine to spinels, that cause seismic discontinuities

Mineral name: Kyanite

General Mineral formula: Al_2SiO_5
Mineral chemical class: Nesosillicate

Specific Gravity: Medium-Heavy (3.53-3.67)	**Crystal System:** Triclinic
Hardness: 7	**Crystal Class: 1 bar**
Cleavage: 2 planes of cleavage, nearly 90 degrees	**Crystal description (common forms, habit, etc.):** • Thin sheets that are bladed, almost fibrous in looks. • Subhedral,
Luster: Vitreous / Waxy (Like a painting encased in a polymer.)	
Streak: White	
Characteristic Color(s): sky blue	

Environment (where you find the mineral): • metamorphic rocks at higher pressures	**Common Mineral Associations (in samples; also consult text, notes):** • andalusite, sillimanite, staurolite, cordierite, or garnet

Scientific use/significance: • Kyanite, andalusite, and sillimanite are polymorphs	**Industrial or societal use/significance:** • Ceramics	**Environmental significance:** • Pressure-Temperature indicators

Sky blue and bladed layers

Mineral name: Sillimanite

General Mineral formula:
Mineral chemical class:

Specific Gravity: 3.23-3.27	**Crystal System: Orthorhombic**
Hardness: 6.5-7.5	**Crystal Class: 2/m 2/m 2/m**
Cleavage: None that appear, but apparently on one plane.	**Crystal description (common forms, habit, etc.):** • Embedded in rock, long thin prismatic "cylinders" / rhombuss • White fibers • subhedral •
Luster: Vitreous	
Streak: White	
Characteristic Color(s): White	

Environment (where you find the mineral): • aluminum-rich metamorphic rocks at higher temperatures	**Common Mineral Associations (in samples; also consult text, notes):** • Kyanite, Andalusite

Scientific use/significance: •	**Industrial or societal use/significance:** • Used for synthesizing high temp industrial ceramics	**Environmental significance:** •

Fibrous white crystals

Mineral name: Zircon

General Mineral formula: $ZrSiO_4$
Mineral chemical class: Nesosillicate

Specific Gravity: 4.68	**Crystal System:** Tetragonal
Hardness: 7-8	**Crystal Class: 4/m 2/m 2/m**
Cleavage: No easily visible, seems to conchoidally fracture.	**Crystal description (common forms, habit, etc.):** • tetragonal prismatic that end on dipyramids • Euhedral
Luster: Dull / Waxy (Supposed adamantine)	
Streak: White	
Characteristic Color(s): Grayish, tinge of red	

Environment (where you find the mineral): • Characteristics on metamorphic rocks	**Common Mineral Associations (in samples; also consult text, notes):** • calcite, dolomite, tremolite, diopside, • wollastonite, and epidote.

Scientific use/significance: • Detailed microprobe analysis used to inf er the time temperature pressure histories	**Industrial or societal use/significance:** • Gemstone • Abrasives • Water filtration	**Environmental significance:** •

Mineral name: Chloritoid **General Mineral formula:**

Mineral chemical class: Nesosillicate

Specific Gravity: 3.46-3.80	**Crystal System: Monoclinic**
Hardness: 6.5	**Crystal Class: 2/m**
Cleavage: Basal Cleavage / flakes like micas	**Crystal description (common forms, habit, etc.):** • Platy / Tabular sheets in hexagonal prism • Lamellar Twinning •
Luster: Pearly	
Streak: White/ Grayish	
Characteristic Color(s): greenish gray or greenish black	

Environment (where you find the mineral): • low to medium grade regional metamorphic settings	**Common Mineral Associations (in samples; also consult text, notes):** • garnet, chlorite, muscovite, and staurolite.

Scientific use/significance: • Identify metamorphic rocks	**Industrial or societal use/significance:** •	**Environmental significance:** •