



GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

Mineral Name	Colour	Lustre	Shape	Crystal System	Optic sign and 2V	Refractive Indices	Birefringence	Cleavage	Extinction	Specific gravity	Hardness	Remarks
Actinolite	Light to medium green, bluish green	Vitreous	Euhedral to sub-hedral elongated prisms	Monoclinic	Negative 2V = 80°	$\alpha = 1.614$ $\beta = 1.630$ $\gamma = 1.641$	Strong	Perfect (110)	Inclined 15°-20°	3.0-3.3	5.0	Pleochroic, usually some shade of green, prismatic; common in 1.2 mag. fraction
Anatase	Colourless, white, bluish grey, blue	Adamantine, vitreous, sub-metallic	Occasionally euhedral, generally anhedral, irregular	Tetragonal	Uniaxial negative	$\omega = 2.554$ $\epsilon = 2.493$	Strong	Euhedral grains, perfect (001) and (111)	-	3.9	5.5-6.0	Bluish grains, usually euhedral, anhedral grains often aggregated with quartz; common in 1.2 non-mag. fraction
Andalusite	Colourless to grey black	Vitreous	Subhedral, prismatic	Orthorhombic	Negative 2V = 86°	$\alpha = 1.634$ $\beta = 1.639$ $\gamma = 1.643$	Weak	Perfect (110)	Straight	3.2	7.5	Frequently black or grey due to presence of carbonaceous inclusions; found in 1.2 non-mag. fraction
Apatite	Colourless, white, occasionally bluish and black	Vitreous to dull	Anhedral, rarely euhedral, irregular to prismatic	Hexagonal	Uniaxial negative	$\omega = 1.649$ $\epsilon = 1.644$	Generally weak, but occasionally moderate	Perfect (0001)	Straight	3.23	5.0	Inclusions of black (carbonaceous?) material sometimes present, as are bubbles of fluid or gas; found mainly in 1.2 mag. fraction; occasionally fluoresces light orange under short wave ultraviolet light
Barite	Colourless, white, yellowish, and bluish white	Vitreous, pearly, dull	Anhedral, irregular, occasionally prismatic	Orthorhombic	Positive 2V = 37°	$\alpha = 1.636$ $\beta = 1.637$ $\gamma = 1.648$	Moderate	Perfect (001) and (110)	Straight on prismatic grains	4.5	3.0	Generally irregular grains with moderate birefringence, soft, often colourless to white but occasionally brownish and bluish white; rarely fluoresces faint bluish white in ultraviolet light; found chiefly in 1.2 non-mag. fraction
Biotite	Dark brown	Vitreous, resinous, or dull	Tabular, pseudo-hexagonal	Monoclinic	Negative 2V small	$\alpha = 1.584$ $\beta = 1.648$ $\gamma = 1.648$	Strong	Perfect basal (001)	Straight or slightly inclined	2.9-3.1	2.5-3.0	Dark brown, platy, occasionally with pleochroic haloes; found mostly in the 1.2 mag. fraction
Cerussite	Yellowish	Vitreous	Irregular massive	Orthorhombic	Negative 2V small	$\alpha = 1.804$ $\beta = 2.076$ $\gamma = 2.078$	Strong	Distinct (110) and (121)	-	6.5	3.0-3.5	Found in the 1.2 non-mag. Frantz fraction
Chlorite	Medium to dark green	Pearly to greasy	Scaly, platy, irregular	Monoclinic	Positive 2V small	$\alpha = 1.598$ $\beta = 1.600$ $\gamma = 1.602$	Weak	Perfect (001)	Straight or slightly inclined	2.9	2.5	Sometimes contains inclusions of magnetite; found in 0.2 and 1.2 mag. fractions
Chromite	Black	Metallic to sub-metallic	Euhedral octahedrons	Isometric	Opaque	-	-	-	-	4.5	5.5	Found in 0.2 mag. fraction, opaque
Clinopyroxene (Augite)	Dark green to brown, colourless	Vitreous	Anhedral, irregular, subhedral prismatic	Monoclinic	Positive 2V = 60°	$\alpha = 1.69$ $\beta = 1.68-1.71$ $\gamma = 1.72$	Strong	Good (110)	Inclined 35°-50°	3.2	5.0-6.0	Occurs in 0.2 and 1.2 mag. fractions, often contains black inclusions; most clinopyroxene is probably augite but some diopside may be present
Clinzoisite	Colourless	Vitreous	Subhedral, elongated	Monoclinic	Positive and negative 2V = 65°	$\alpha = 1.72$ $\beta = 1.71-1.73$ $\gamma = 1.73$	Moderate	Perfect (001)	Inclined 2°-15°	3.35	6.5	Found in 1.2 mag. and non-mag. fractions, lower 2V than in epidote
Copper, native	Green, reddish brown	Dull	Rounded to subangular, flat	Isometric	Opaque	-	-	-	-	8.8	2.5-3.0	Surface pitted and mottled rust brown, grey, and pale green; some calcite present in copper, ductile, fresh surface is shiny copper yellow
Dolomite	Colourless, white, or buff	Vitreous to dull	Anhedral, irregular, massive	Rhombohedral (trigonal)	Uniaxial negative	$\omega = 1.681$ $\epsilon = 1.500$	Very strong	Perfect (1011)	Straight	2.9	3.5-4.0	Powder effervesces in HCl; found in 1.2 non-mag. fraction
Epidote	Yellow to yellowish green	Vitreous	Euhedral to subhedral, prismatic	Monoclinic	Negative 2V = 80°-90°	$\alpha = 1.73$ $\beta = 1.76$ $\gamma = 1.77$	Strong	Good (001)	Straight or slightly inclined	3.3	6.0-7.0	Found in 1.2 mag. fraction; weakly pleochroic
Fluorite	Colourless, light purple	Vitreous	Irregular, massive	Isometric	Isotropic	1.434	-	Perfect (111)	-	3.18	4.0	Commonly found in 1.2 non-mag. fraction
Garnet	Light to dark pink, red, brown, and orange	Vitreous	Dodecahedrons and irregular grains	Isometric	Isotropic	1.78-1.80	-	-	-	3.80-4.25	7.0	Found in 0.2 and 1.2 mag. fractions, some grossularite but mostly spessartite, occasionally almost black due to presence of inclusions
Goethite	Medium to reddish brown	Sub-metallic to earthy	Cubic after pyrite	-	Opaque	-	-	-	-	3.9-4.0	5.0	Generally forms pseudomorphs after pyrite, most goethite is a mixture of hematite, goethite, limonite, sometimes with a core of pyrite, found in 0.2 and 1.2 mag. fractions
Gold	Golden yellow	Metallic	Flakes, rounded grains, subhedral to angular grains	Isometric	Opaque	-	-	-	-	15.5-19.4	2.5-3.0	Soft, malleable, mostly yellow, sometimes coated black; found in 1.2 non-mag. fraction
Hematite	Reddish brown, black	Sub-metallic, dull	Irregular masses	Rhombohedral (trigonal)	Opaque	-	-	-	-	5.2	5.0	Some pseudomorphous after pyrite, gives red powder on crushing; found in 0.2 and 1.2 mag. fractions
Hinsdalite	Colourless	Vitreous	Anhedral irregular grains	Rhombohedral (trigonal)	Uniaxial positive, may also be biaxial with small 2V	$\omega = 1.671$ $\epsilon = 1.689$	Moderate	Perfect (0001)	Straight	3.65	4.5	(2PbO. 3Al ₂ O ₃ . P ₂ O ₅ . 2SO ₃ . 6H ₂ O), contains small blue inclusions, identified by X-ray diffraction; found in 1.2 non-mag. fraction
Hornblende	Dark green	Vitreous	Euhedral to subhedral, elongated prismatic	Monoclinic	Negative 2V = 60°-90°	$\alpha = 1.66$ $\beta = 1.67$ $\gamma = 1.68$	Moderate	Good (110)	Inclined 15°-25°	3.31	5.0-6.0	Strongly pleochroic; found in 0.2 mag. fraction
Hypersthene	Light brown to green	Vitreous	Generally euhedral, prismatic	Orthorhombic	Negative 2V = 80°-90°	$\alpha = 1.69$ $\beta = 1.70$ $\gamma = 1.705$	Moderate	Fair (110)	Straight	3.45	5.0-6.0	Usually forms good crystals, often with inclusions of magnetite and ilmenite, pleochroic; found in 0.2 and 1.2 mag. fractions
Ilmenite	Black	Metallic	Flattened, prismatic, and irregular grains	Rhombohedral (trigonal)	Opaque	-	-	-	-	4.5-5.0	5.0-6.0	Occurs as black shiny grains, sometimes enclosed by leucoxene; found in 0.2 and 1.2 mag. fraction
Jarosite	Light tan	Dull	Irregular anhedral masses	Rhombohedral	Uniaxial negative	$\epsilon = 1.72$ $\omega = 1.82$	Very strong	Distinct (0001)	Straight	3.2	3.0	Found in 1.2 mag. fraction
Kyanite	Colourless, bluish	Vitreous, pearly	Elongate blades with irregular terminations	Triclinic	Negative 2V = 82°	$\alpha = 1.71$ $\beta = 1.72$ $\gamma = 1.73$	Moderate	Perfect (100), Fair (010)	Inclined 30° on (100)	3.6	4.0-7.0	Elongated grains, often bluish colour, hardness 4 to 5 on (100) parallel to length of crystal and about 7 on (010); occurs in 1.2 non-mag. fraction
Leucoxene	White, light grey, or creamy	Dull, porcelainous	Irregular aggregates, microcrystalline	Amorphous	Opaque or semi-opaque	High	Strong	-	-	4.0	3.0-4.0	Occurs as rounded irregular masses, probably microcrystalline sphene and anatase alteration products associated with ilmenite; found in 1.2 mag. and non-mag. fraction
Limonite	Yellowish brown	Earthy	Irregular grains or powdery aggregates	Amorphous	Opaque to translucent	-	-	-	-	3.8	4.0	Found in 0.2 and 1.2 mag. fractions, sometimes pseudomorphous after pyrite
Magnetite	Black to iridescent blue	Metallic	Octahedrons, dodecahedrons, and irregular grains	Isometric	Opaque	-	-	-	-	5.1	5.50-5.65	Blue iridescent octahedrons, common in chlorite schists; found in 0.2 mag. fraction
Wad manganese	Black	Earthy	Irregular masses	Amorphous	Opaque	-	-	-	-	4.0	3.0	Very soft, gives no X-ray diffraction pattern; found in 1.2 mag. fraction
Martite	Reddish black	Sub-metallic	Octahedral or dodecahedral, possibly pseudo-morphous, after magnetite	Isometric	Opaque	-	-	Octahedral parting	-	5.0	6.0-7.0	Pseudomorphous after magnetite, found in 0.2 mag. fraction
Micro meteorite	Black	Metallic	Spherical	-	Opaque	-	-	-	-	5.0	5.5	Metallic shiny magnetic balls less than 0.1 mm in diameter, some have been identified as magnetite, found in 0.2 mag. fraction
Monazite	Colourless, light yellow, yellowish brown	Vitreous to resinous	Anhedral irregular	Monoclinic	Positive 2V = 10°	$\alpha = 1.79$ $\beta = 1.80$ $\gamma = 1.84$	Strong	Good (001)	Straight	5.0	5.0	Found in 1.2 mag. fraction
Muscovite (sericite)	Colourless, light green, rusty	Vitreous to pearly	Platy grains or tabular crystals	Monoclinic pseudo-hexagonal	Negative 2V = 30°-40°	$\alpha = 1.558$ $\beta = 1.595$ $\gamma = 1.601$	Strong, but weak in cleavage (001) plates	Perfect (001)	Straight or inclined 2° or 3°	2.9	2.5-3.0	Sometimes with iron oxide stain and occasionally inclusions of zircon, aggregated with other heavy minerals; found in 1.2 mag. fraction and less often in 1.2 non-mag. fraction
Olivine	Colourless to grey	Vitreous to resinous	Prismatic, anhedral, or subhedral	Orthorhombic	Positive 2V = 88°-90°	$\alpha = 1.65$ $\beta = 1.66$ $\gamma = 1.68$	Strong	Poor	Straight	3.3	6.5-7.0	Grains often contain black inclusions, found in 1.2 mag. fraction
Pyrite	Yellow	Metallic, lustrous, some tarnished	Cubes, pyritohedrons, as much as 1/2" square	Isometric	Opaque	-	-	Poor	-	5.0	6.0-6.5	Occurs in fine-grained masses and also as crystals as much as 1/2" square, coarse crystals are often covered with a dark to reddish brown tarnish, crystals are often striated; alters to limonite, goethite, and hematite; is found in 1.2 non-mag. fraction
Rutile	Black, reddish brown, red, reddish orange, yellowish	Metallic, adamantine, vitreous	Elongated prisms, subhedral to euhedral	Tetragonal	Uniaxial positive	$\epsilon = 2.90$ $\omega = 2.61$	Extreme	Good (110) and (100)	Straight	4.2	6.0-6.5	Crystals ranging from yellowish to black, usually striated, weakly pleochroic, found in 1.2 non-mag. fraction
Scheelite	White	Vitreous	Anhedral grains	Tetragonal dipyrnidal	Uniaxial positive	$\epsilon = 1.935$ $\omega = 1.919$	Moderate	Good (101)	Straight	6.1	4.5-5.0	Fluoresces bluish white under ultraviolet light; found in 1.2 non-mag. fraction
Sphalerite	Dark amber brown	Resinous to dull	Irregular grains	Isometric	Isotropic	$\kappa = 2.37$	-	Perfect (110)	-	4.0	3.5-4.0	Usually in brown aggregates; found in 1.2 mag. fraction
Sphene	Grey, white, buff, brown	Vitreous, resinous, dull	Irregular, occasionally euhedral prismatic, diamond or wedge shaped	Monoclinic	Positive 2V = 27°	$\alpha = 1.90$ $\beta = 1.91$ $\gamma = 2.01$	Strong	Good (110)	-	3.5	5.0-5.5	Total extinction seldom observed, weak pleochroism; often found aggregated with epidote, mainly in 1.2 non-mag. fraction
Spinel	Black	Vitreous	Irregular grains	Isometric	Isotropic	$\kappa = 1.718$	-	Poor (111)	-	3.6	8.0	Fragments exhibit conchoidal fracture; found in 1.2 mag. fraction
Staurolite	Orange	Vitreous	Anhedral, irregular	Orthorhombic	Positive 2V = 88°	$\alpha = 1.71$ $\beta = 1.74$ $\gamma = 1.75$	Moderate	Good (010)	Straight	3.7	7.00-7.75	High relief with moderate pleochroism; found in 1.2 mag. fraction
Topaz	Colourless	Vitreous	Prismatic euhedral	Orthorhombic	Positive 2V = 60°	$\alpha = 1.61$ $\beta = 1.62$ $\gamma = 1.63$	Weak	Good (001)	Straight	3.58	8.0	Colourless crystals, some with bubble (gas?) inclusions, also zircon and plagioclase inclusions, high lustre; found in 1.2 mag. fraction
Tourmaline	Black, greyish green, or brown	Vitreous, resinous	Prismatic, euhedral to subhedral, striated	Rhombohedral (trigonal)	Uniaxial negative	$\epsilon = 1.65$ $\omega = 1.69$	Strong	Imperfect (1120) and poor (1011)	Straight	3.10	7.00-7.75	Strong pleochroism, black variety most common, cross-section usually rounded triangle; found in 1.2 mag. fraction
Tremolite	Colourless	Vitreous	Prismatic, elongated, euhedral	Monoclinic	Negative 2V = 80°	$\alpha = 1.61$ $\beta = 1.62$ $\gamma = 1.63$	Strong	Good (110)	Inclined 15°-20°	3.10	5.0-6.0	Usually found in 1.2 non-mag. fraction
Vesuvianite (idocrase)	Colourless	Vitreous	Prismatic irregular	Tetragonal	Uniaxial negative	$\epsilon = 1.705$ $\omega = 1.713$	Weak	-	Straight	3.40	6.5	Sometimes biaxial with 2V = 5°, shows anomalous blue interference colours; found in 1.2 non-mag. fraction
Zircon	Colourless, grey, or brownish pink	Adamantine or vitreous	Euhedral, prismatic, bipyramidal, occasionally rounded	Rhombohedral (trigonal)	Uniaxial positive	$\epsilon = 1.99$ $\omega = 1.94$	Strong	Imperfect (110)	Straight	4.7	7.5	Usually good crystals, fluoresces orange under ultraviolet light, occasionally spherical and pink; found in 1.2 non-mag. fraction
Zoisite	Colourless	Vitreous	Prismatic, euhedral, irregular	Orthorhombic	Positive 2V = 30°-60°	$\alpha = 1.700$ $\beta = 1.703$ $\gamma = 1.718$	Moderate	Perfect (010)	Straight	3.31	6.0-6.5	Anomalous deep blue interference colours; found in 1.2 non-mag. fraction

Table X. Mineralogy of heavy minerals Klondike Area, Yukon Territory.
To accompany GSC Bulletin 173 by C. F. Gleeson