



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 subhedral elongated prisms                                | Monoclinic                 | Negative 2V = 80°                                    | $\alpha$ = 1.614<br>$\beta$ = 1.630<br>$\gamma$ = 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<br>$\epsilon$ = 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<br>$\beta$ = 1.639<br>$\gamma$ = 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<br>$\epsilon$ = 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<br>$\beta$ = 1.637<br>$\gamma$ = 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<br>$\beta$ = 1.648<br>$\gamma$ = 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<br>$\beta$ = 2.076<br>$\gamma$ = 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<br>$\beta$ = 1.600<br>$\gamma$ = 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<br>$\beta$ = 1.68-1.71<br>$\gamma$ = 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<br>$\beta$ = 1.71-1.73<br>$\gamma$ = 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<br>$\epsilon$ = 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<br>$\beta$ = 1.76<br>$\gamma$ = 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<br>$\epsilon$ = 1.689                    | Moderate                                  | Perfect (0001)                           | Straight                      | 3.65             | 4.5       | (2PbO. 3Al <sub>2</sub> O <sub>3</sub> . P <sub>2</sub> O <sub>5</sub> . 2SO <sub>3</sub> . 6H <sub>2</sub> 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<br>$\beta$ = 1.67<br>$\gamma$ = 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<br>$\beta$ = 1.70<br>$\gamma$ = 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<br>$\omega$ = 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<br>$\beta$ = 1.72<br>$\gamma$ = 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, porcelanous                  | 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<br>$\beta$ = 1.80<br>$\gamma$ = 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 pseudohexagonal | Negative 2V = 30°-40°                                | $\alpha$ = 1.558<br>$\beta$ = 1.595<br>$\gamma$ = 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<br>$\beta$ = 1.66<br>$\gamma$ = 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 splendent, some tarnished | Cubes, pyritohedrons, as much as $\frac{1}{8}$ " square               | Isometric                  | Opaque   | —   | —   | Poor                                     | —                             | 5.0              | 6.0-6.5   | Occurs in fine-grained masses and also as crystals as much as $\frac{1}{8}$ " 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<br>$\omega$ = 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 dipyramidal     | Uniaxial positive                                    | $\epsilon$ = 1.935<br>$\omega$ = 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<br>$\beta$ = 1.91<br>$\gamma$ = 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<br>$\beta$ = 1.74<br>$\gamma$ = 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<br>$\beta$ = 1.62<br>$\gamma$ = 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<br>$\omega$ = 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<br>$\beta$ = 1.62<br>$\gamma$ = 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<br>$\omega$ = 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<br>$\omega$ = 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<br>$\beta$ = 1.703<br>$\gamma$ = 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.

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