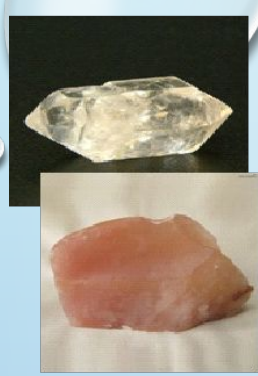
Oxides, hydroxides, carbonates, sulfates

Oxides



Quartz *(SiO_2)* - varieties: rock crystal - colorless transparent crystals, amethyst - violet, morion - black, rauchtopaz - smoky quartz, citrine - golden-yellow and others. Cryptocrystalline quartz is chalcedony and its varieties (carnelian - orange-red, banded - agate, onyx). Jasper is a unclean dense chalcedonic rock, in which are impurities and coloring matter. Silicon is a chalcedony, which highly polluted by impurities of sand and clay. Quartz is determined by the high hardness (h. 7), a very imperfect cleavage, glassy luster, shell-like fracture and form of crystals (Figure 8). In addition, fibrous asbestiform minerals replace quartz and form aggregates called "cat's eye", " hawk's-eye ", "tiger's eye" (from Figure 9).

Origin and paragenesis. Magmatic in acidic igneous rocks, in granitic pegmatites in association with feldspar, mica, topaz, beryl. Hydrothermal with sulfides. A typical mineral of metamorphic rocks: shales, gneisses, jaspilite. Hypergene - silicon and chalcedony. Quartz is resistant under surface conditions. It accumulates in placers, often in association with gold.

Practical importance. Quartz is used in glass industry, ceramic industry, metallurgy. In the radio engineering and optical instruments. Widely used in jewelry crafts. Quartzite - a building material.

Hematite Fe_2O_3 - a brownish-red, dark red, steel-gray color and is recognized by a cherry-red trait, the absence of cleavage, lamellar and sometimes scaly aggregates (Figure 8).

Origin and paragenesis. 1. skarns with magnetite and epidote. 2. hydrothermal in association with quartz and carbonates. 3. metamorphic in jaspilite with magnetite. 4. weathering crust. Hematite is stable under surface conditions, and gradually hydrated and goes into hydrohematite and different iron hydroxides.

Practical importance. Iron ore. Dense hematite - blood-stone is used to make jewelry.

Magnetite ***$FeFe_2O_4$*** - is determined by the color black, black trait, octahedral crystals (Figure 12), a strong magnetic field.

Origin and paragenesis. 1. contact-metasomatic skarns in association with garnet, epidote, chromite, sulfides. 2. Metamorphic in jaspilites in association with hematite. 3. magmatic in connection with the basic rocks. 4. Hydrothermal. It is resistant under surface conditions and is an ordinary mineral of placers. In the oxidation goes into martite - pseudomorph of hematite after magnetite, and then in various iron hydroxides.

Practical importance. The most valuable iron ore. In passing extracted vanadium, nickel and other elements.

Chromite ***$FeCr_2O_4$*** - black color, brown, snuff-coloured trait, nonmagnetic association with serpentine.

Origin and paragenesis. Magmatic in connection with the ultrabasic rocks. Association with olivine, serpentine, magnetite. Chromite is resistant under surface conditions and accumulates in placers.

Practical importance. Chromium ore, used in metallurgy as an impurity in steel, it increases its hardness, viscosity and resistance to corrosion.

Minerals of hydroxides group

Limonite $Fe_2O_3nH_2O$ - formed rusty, brown incrustation, adhesion, dripstone forms, earthy and ocher masses and also found in the form of nodules, oolites. Often pseudomorphs after pyrite and marcasite.

Origin and paragenesis. Hypergene, formed by weathering of iron-bearing minerals. Association - goethite, sphalerite, pyrite, calcite, barite, halite, sylvite.

Practical importance. Iron ore.

Goethite $FeO(OH)$ - color from dark brown to yellow-brown, ocher-yellow trait. dense dripstone masses with a smooth shiny surface, acicular and thin tabular crystals of goethite (Figure 13).

Origin and paragenesis. Hypergene in weathering crust and the oxidation zone of sulfide deposits, as well as chemical and biochemical precipitation. Rarely hydrothermal in association with quartz, calcite, hematite and other minerals.

Practical importance. Iron ore.

carbonates

Calcite $CaCO_3$ - color is white, gray, yellowish, brown (Fe) and reddish (Mn). The impurities of hematite painted it in a brownish-red color, in the case of inclusion of chlorite and malachite - green, carbonaceous matter - black. Transparent variety of calcite with a strong double refraction - iceland spar. Calcite is determined by the rhombohedral and scalenohedral crystal forms (Figure 14), perfect cleavage on the rhombohedron, hardness 3, effervescence in HCl.

Origin and paragenesis. 1. Biogenic, chemogenic sedimentary in the form of limestone. 2. metamorphic in the form of marble. 3. Hydrothermal The main rock-forming mineral of carbonatites.

Practical importance. It is widely used in the production of cement and lime, as well as in the metallurgical industry (flux). Iceland spar - a valuable raw material for the optical industry. Marble - facing material.

Dolomite ***$CaMg[CO_3]_2$*** - colorless or white, yellowish, brownish, glassy luster, perfect cleavage, the characteristic shape of the crystals (Figure 15), weak reacts with the HCl, rapidly effervesces in hot HCl.

Origin and paragenesis. 1. The sedimentary chemogenic in the association with halides, gypsum, anhydrite. 2. Hydrothermal, often with calcite. 3 Metamorphic - dolomitic marbles.

Practical importance. It is used in the construction business, in the production of cement and refractory materials, chemical industry, metallurgy.

Malachite $Cu_2[CO_3](OH)_2$ - is diagnosed by a bright green color, the green trait, the form of aggregates (sinter concentric zonal aggregates, kidney-shaped, fine-fibered, earthy masses); it is easily decomposed in HCl.

Origin and paragenesis. Characteristic mineral of the oxidation zone of sulfide deposits, in a small amount in the form of patina and mineral adhesion. Association with azurite, chalcocite, native copper, iron hydroxides, gypsum.

Practical importance. Dense concentric zonal malachite - a beautiful ornamental stone. It is used for manufacturing the green paint. Because of its green color, malachite is an important prospecting indicator and may point to the oxidation zone of primary copper ores.

Azurite $Cu_3[CO_3]_2(OH)_2$ - is determined by the bright blue color, shape of aggregates - small tabular crystals, druses, brushes, radially fibrous, nodules, solid grainy and earthy aggregates (Figure 15); easily decomposed in HCl.

Origin. Characteristic mineral of the oxidation zone of sulfide deposits. It is more rare than malachite. Association - malachite, limonite.

Practical importance. It has a search value for the assessment of primary copper mineralization. It can be used for production of blue paint.

Mineral of the sulfates class

Barite $BaSO_4$ - is determined by the tabular, prismatic and isometric forms of crystals (Figure 15), perfect cleavage, low hardness (tv. 3-3.5) and high density (4.5 g / cm 3).

Origin and paragenesis. Hydrothermal in association with quartz, calcite, pyrite, galena, sphalerite, cinnabar, fluorite; often in the form of separate barite veins.

Practical importance. The main source of barium. It is used in the rubber and paper industry for the preparation of high quality paints (white), for drilling as a weighting agent of clay solutions, as a filler in the production of of wallpaper, oilcloth, linoleum. Barium salts are used in medicine, as well as in agriculture for pest control.

Gypsum $CaSO_4 2H_2O$ - pure gypsum is colorless transparent or snow-white, has flattened crystals, very perfect cleavage, low hardness (easily scratched with a fingernail), does not react with hydrochloric acid.

Origin and paragenesis. Marine chemical precipitates. It is formed after the calcium carbonate before the halite, during the evaporating of seawater. He also formed during hydration of anhydrite. It can also occur in the oxidation zone of sulfide deposits and native sulfur. Association - calcite, aragonite, halite, anhydrite; pyrite, pyrrhotite, chalcopyrite, sphalerite, malachite, quartz.

Practical importance. Raw materials for construction and paper industries. It is used in the production of paints, enamels, for artistic products, sculptures, in medicine.