



7 SULFATES, CHROMATES, MOLYBDATES, TUNGSTATES

This class groups around 250 species. It includes ionic compounds with radicals of the XO_4 .

➤ Type: **X** = **S** (sulfates); **Cr** (Chromates); **Mo** (Molybdates); **W** (tungstates).

Sulfates (220 species) generally of low density and hardness, can be anhydrous like barite, anhydrite, but most often are hydrated like gypsum.

Chromates (12 species) and molybdates (15 species) are quite rare with the exception of wulfenite. Tungstates are mainly represented by wolframite and scheelite, both important tungsten ores.

Sulfate Group		Chemistry	System
Sulfates anhydres			
	Barytine	BaSO_4	Orth.
	Celestite	SrSO_4	Orth.
	Anglesite	PbSO_4	Orth.
	Anhydrite	CaSO_4	Orth
Hydrated Sulfates and Basics			
	Gypsum	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	Mono
	Chalcanthite	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	Tric
	Alunite	$\text{KAl}_3(\text{OH})_6(\text{SO}_4)_3$	Rhom
	Epsomite	$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ FeSO_4	Orth
	Melanterite	$7\text{H}_2\text{O}$	Mono
	Cyanotrichite	$\text{Cu}_4\text{Al}_2(\text{OH})_{12} \text{SO}_4 \cdot 2\text{H}_2\text{O}$	Orth.
Chromates :			
	Crocoïte	PbCrO_4	
Molybdates :			
	Wulfenite	PbMoO_4	Quadr
Tungstates			
	Scheelite	Ca WO_4	Quadr
	Wolframite	$(\text{Fe}, \text{Mn}) \text{WO}$	Mono

BARYTIN



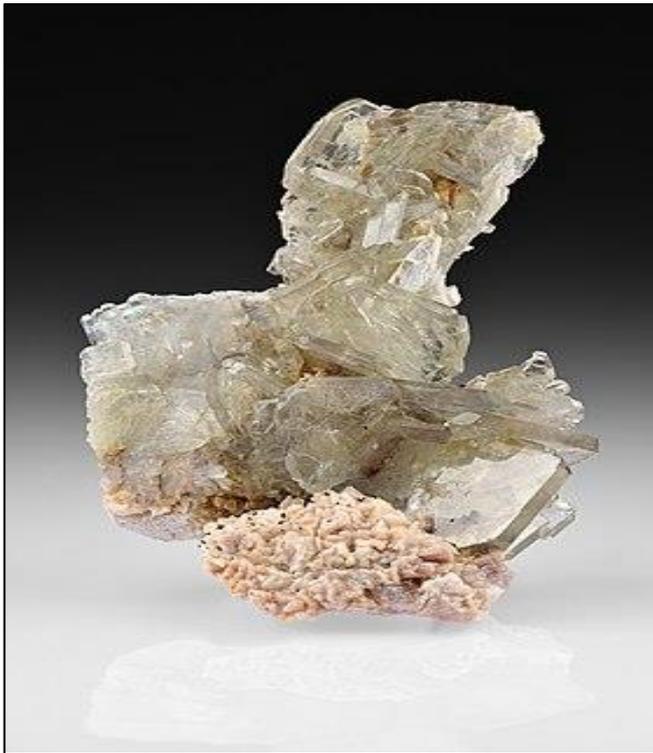
Orthorhomic

Etymology: from the Greek “barus”, heavy

Elongated tabular or prismatic crystals. Compact or lamellar masses often crested.

D = 4.5 / H = 3 to 3.5. Good cleavages. Transparent to translucent; glassy shine; colorless, white, light shades

Very common mineral. Hydrothermal vein especially of low temperature, alone or associated with quartz, fluorite, galena, siderite, dolomite, stibnite. Stratiform masses in sedimentary terrains. Common in cracks on all terrains.



Uses: drilling mud, white paint, stationery, glass industry, medicine, protection against radiation, etc.

CELESTITE



Orthorhombic

Flattened crystals or elongated prism resemble those of barite. Fibrous or radiated aggregates. Laminar, fibrous, finely grained masses.

D = 4 / H = 3.5. Uneven breakage. Good cleavages. Color colorless to pale blue, white. Transparent to opaque. Glassy shine.



Celestite is found mainly in sedimentary levels, as products of lagoon evaporation or as diagenetic concretion in limestones and marls. Sometimes in hydrothermal deposits in clusters and small veins.



ANHYDRITE



Orthorhombic.

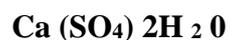
Rare automorphic crystals; most often in crystal masses showing the three orthogonal cleavages. Perfect cleavages.

D = 3/ H = 3 to 3.5. Transparent to translucent. Glassy shine. Colorless, often tinged with gray blue or purple. Hydrates in gypsum.



Product of evaporation of marine waters. Sedimentary banks with gypsum, rock salt, limestone, dolomites.

GYPSUM



Monoclinic

Crystals often large (up to several meters), generally flattened, sometimes acicular (fibrous). Sometimes lenticular crystals grouped in rosettes ("sand roses"). In lamellar or fibrous or saccharoid masses. Macles: "dovetailed", very common; "spearhead", frequent. Very easy cleavage.

D = 2.3/ H = 2 (scratchable with a fingernail). Transparent to translucent, silky in fibrous varieties. Colorless, white or pale shades. White dust. Slightly soluble in water.

Variety: alabaster, very fine grain.

The most common sulfate. Deposit of evaporation of marine waters, with rock salt, anhydrite, clays (abundant in the Triassic). Secondary hydration mineral of anhydrite.

Use: Heated to around 130-170°, it produces plaster by partial dehydration.



GYPSUM



GYPSUM

SCHEELITE



quadratic

Crystals generally in octahedrons, rarely in tablets. Most often massive or grainy.

D = 6/ H = 4.5 to 5. Fragile. Uneven breakage. Transparent to translucent, bold shine. Color: colorless, white, grayish, yellowish, brownish. Bright bluish-white fluorescence under UV light.

High temperature mineral. Contact metamorphism deposits between granites and limestones (skarns); scheelite is associated with skarn silicates (garnet, diopside, idocrase, epidote), frequently with fluorite, molybdenite, pyrrhotite, chalcopyrite. High temperature hydrothermal veins, pegmatites, with wolframite, fluorite.

Use: tungsten ore.

WOLFRAMITE



monoclinic

Commonly tabular crystals. Lamellar masses or isolated vertical blades reaching large dimensions. Perfect cleavage.

D = 7 to 7.5 increasing with the Fe/Mn ratio; H = 4 to 4.5. Opaque or somewhat translucent in thin flakes. Submetallic shine. Black. Reddish brown dust.

Easy alteration into Limonite, Mn oxides.



