

A table of systematic mineralogy II: redox implications

<p>Minerals consisting of uncharged atoms (i.e., in elemental state)</p>	<p>Minerals consisting of cations bonded to single anions (no radical groups or complex ions)</p>	<p>Minerals consisting of cations bonded to negatively-charged radical groups (i.e., to complex ions like CO_3^{2-} or AsS_3^{2-})</p>	<p>Fluorides Fluorite (CaF_2)</p> <p>Chlorides Halite (NaCl)</p> <p>Bromides Bromargyrite (AgBr)</p> <p>Iodides Iodargyrite (AgI)</p>	<p>Fluosalts: Fluoborates Ferruccite (NaBF_4) Fluosilicates Hieratite (K_2SiF_6)</p>	<p>Negative charge in mineral comes from halide anions</p>
<p>Native elements Sulfur (S) Diamond (C) Copper (Cu) Formation of these minerals typically requires intermediate or reducing redox conditions, because all elements that form native minerals also have charged valence states, commonly oxidized states, that they might otherwise take.</p>	<p>Oxides Hematite (Fe_2O_3) Formation of these minerals requires at least somewhat oxidizing conditions, because elements involved (e.g., C, N, P, S) have more reduced valence states as alternatives. These minerals thus commonly form in near-Earth-surface environments.</p>	<p>Oxysalts: Silicates Borates Carbonates Nitrates Phosphates Sulfates Vanadates Chromates Niobates Molybdates Tantalates Iodates Tungstates Calcite (CaCO_3) Arsenates Selenates Antimonates Tellurates Iodates Tellurites Sulfites Arsenites Selenites Antimonites Tellurites</p>	<p>Negative charge in mineral comes from anions of Group VI elements</p>		
<p>"Group VI -ides" (and thus minerals with 2- anions)</p>	<p>Sulfides Galena (PbS)</p> <p>Selenides Achavalite (FeSe)</p> <p>Tellurides Altaite (PbTe)</p>	<p>Sulfosalts: Sulfarsenates Sulfovanadates Sulfogermanates Sulfantimonates Sulfostannates Sulfobismuthites Sulfarsenites Sulfantimonites Sulfobismuthites Selenioantimonates Seleniobismuthites Permingeaitite (Cu_3SbSe_4) Volynskite (AgBiTe_2) Pyrrargyrite (Ag_3SbS_3)</p>	<p>Negative charge in mineral comes from anions of Group IV and V elements</p>		
<p>"Group V -ides" (and thus minerals with 3- anions) Antimonides & Bismuthides</p>	<p>Nitrides Osbornite (TiN)</p> <p>Phosphides Barringerite ($\text{Fe,Ni}_2\text{P}$)</p> <p>Arsenides Löllingite (FeAs_2)</p> <p>Sobolevskite (PdBi)</p>	<p>Telluralsalts: Telluribismuthites</p>	<p>Negative charge in mineral comes from anions of Group IV and V elements</p>		
<p>"Group IV -ides" (and thus minerals with 4- anions)</p>	<p>Carbides Moissanite (SiC)</p> <p>Silicides Guepuite (Fe_3Si)</p>	<p>Formation of these minerals requires reducing conditions, because elements involved (e.g., C, N, P, S, As, Se, Sb) have more oxidized valence states as alternatives. For example, most nitride, phosphide, carbide, silicide, etc. minerals are known largely or only from meteorites, cosmic dust, or deep-earth samples. Likewise, many sulfides and sulfosalts are known from ore deposits that formed at depth rather than at the Earth's surface.</p>	<p>Negative charge in mineral comes from anions of Group IV and V elements</p>		

The characterizations above are only generalizations about entire classes of minerals. For example, siderite ($\text{Fe}^{2+}\text{CO}_3$) requires somewhat reducing conditions to form, whereas molybite ($\text{Fe}^{3+}\text{Cl}_3$) would likely form in oxidizing conditions.