

## NATIVE ELEMENTS, SULFIDES, AND SULFOSALTS

### Native Elements

The native elements may be divided into metallic, non-metallic, and semi-metallic. The luster shows distinctive changes from one group to another. Except for graphite and sulfur these are all reference specimens so please do not perform destructive tests.

<u>Metals</u>		<u>Non-metals</u>		<u>Semi-metals</u>	
* COPPER	Cu	SULFUR	S	* Bismuth	Bi
* GOLD	Au	GRAPHITE	C	* Antimony	Sb
* SILVER	Ag	* DIAMOND	C	* Arsenic	As
* PLATINUM	Pt				

### Sulfides

This group is composed of sulfides and the closely allied minerals selenides, tellurides, arsenides, and antimonides. Most of these minerals are opaque, and they often have characteristic colors. The general formula is  $A_mX_n$  where A represents metallic elements, X represents a sulfide group element whose oxidation state is -2, and m and n are integers. Many of these minerals are important ore minerals.

Bornite	$Cu_5FeS_4$
GALENA	$PbS$
SPHALERITE	$ZnS$
CHALCOPYRITE	$CuFeS_2$
PYRRHOTITE	$Fe_{1-x}S$ where $x = 0.0 - 0.2$ , usually
Niccoline	$NiAs$
REALGAR	$AsS$
ORPIMENT	$As_2S_3$
STIBNITE	$Sb_2S_3$
PYRITE	$FeS_2$
COBALTITE	$(Co,Fe)AsS$
MARCASITE	$FeS_2$
ARSENOPYRITE	$FeAsS$

MOLYBDENITE	$\text{MoS}_2$
CINNABAR	$\text{HgS}$
CHALCOCITE	$\text{Cu}_2\text{S}$
* Millerite	$\text{NiS}$
* Calaverite	$\text{AuTe}_2$
Smaltite	$(\text{Co,Ni})\text{As}_{3-x}$ where $x = 0.0 - 0.5$ , usually

Notes: Although orpiment ( $\text{As}_2\text{S}_3$ ) and stibnite ( $\text{Sb}_2\text{S}_3$ ) have the same general formula they are not isostructural. Orpiment is monoclinic, stibnite is orthorhombic.

Pyrite and cobaltite are isostructural (isometric system). Pyrite and marcasite are dimorphs (marcasite is orthorhombic).

Galena and sphalerite, although very commonly found together, are not isostructural. Galena is isotypous with halite, while sphalerite has a structure like that of diamond.

### Sulfosalts

In the sulfosalts semimetallic elements substitute, at last in part, for the metallic elements in sulfides.

Tetrahedrite	$\text{Cu}_{12}\text{Sb}_4\text{S}_{13}$
ENARGITE	$\text{Cu}_3\text{AsS}_4 \cdot \text{Cu}_4\text{AsS}_4$

\* Samples denoted with this symbol are reference pieces. DO NOT perform hardness, streak color, or acid tests on these samples.