



Amelunxen Mineral Processing Ltd.

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## **Microscopy Studies on Geometallurgical Ores**

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**Jan 2006**

# 1 Introduction

This is a Basic procedure to execute microscopy studies on geo-metallurgical ores for incorporation into feasibility studies. This report pertains to the modal analysis of process products. Modal analysis is an important aspect of metallurgical testwork in that the mineral constituents are defined for

- Abundance
- Liberation
- Binary associations
- Sizing

## 2 Sample Collection

Most geo-metallurgical samples destined for modal analysis need to be screened in order to perform a reliable microscopy test. For economical reasons and for expedience samples are screened where possible to produce four products, including the pan.

A sample requiring microscopy needs to be

- a) Screened for the sizing used in the testwork
- b) The products of each screen need to be separated into samples for:
  - a. )Assays (needs pulverizing)
  - b. )Microscopy (DO NOT pulverize)
- c) The microscopist needs to have assays and approximately 10-20 g of sample.

## 3 Mineral Counts

Just as the geologists need to have the ores defined by the rock type, the mineral processors need to have the valuable minerals defined. Generally these valuable minerals are defined according to the process used: if the process calls for a reverse flotation of hematite, the metallurgist will be interested in the association of silica/hematite and other gangue minerals. In the case of base metal flotation, the metallurgist will be interested in copper/zinc/lead/molidenum minerals abundance and associations. Often the counts are reported as volume counts. This is of no use to mineral processors.

**All counts must be translated to weight percent**

If the content of the mineral is very small, it is best to express its presence in terms of a ratio, i.e. Chalcopyrite/Pyrite, Chalcopyrite/Covellite and eventually this will lead to a table that pinpoints the %weight of each mineral.

In reporting associations, care must be taken that a mineral is not counted twice, once as Mineral A associated with B and a second time as Mineral B associated with A. For this, a useful table (see Table 1) has been prepared to aid the microscopist in doing a count.

**Table 1**  
Table showing the % weight of minerals found in a specimen. Sample = Total 100.0

Measured Minerals	Liberated	Binary Associations											Measured Total Wt%	Final %Wt		
		Cc	Cv	Cp	En	Bn	Cux	Py	AsPy	Md	Sp	Mg			Gangue	
Cc	0.0562		0.0562												0.112	0.123
Cv	0.3772	0.08													0.457	0.501
Cp															0.000	0.000
En								0.072							0.072	0.079
Bn															0.000	0.000
Cux															0.000	0.000
Py	5.336	3.092													8.948	9.796
AsPy												0.52			0.000	0.000
Md	0.01185	0.0352													0.097	0.106
Sp	0.36														0.518	0.567
Mg															0.000	0.000
Gangue	81.14														81.140	88.829
													91.34445	100.000		

The microscopist will need to have his own “working” table where the count is expressed in volume. These need to be re-converted back to weight % using the corresponding mineral specific gravities. The final mineral count needs to be checked against the measured assays: these and back-calculated assays from the mineral count must coincide. This needs to be done using an error analysis in conjunction with the Solver feature in Excel. An example in Excel has been provided that shows how all is done.

## 4 Specifics

Ore: Agua Rica

Assays: Au, Ag, Cu, Fe, S<sup>-2</sup>, As, Zn, Mo

Screens : 105, 75, 25 and -25 microns

Minerals:

	symbol	% Cu	% Fe	% S	% As	% O	% Zn	% Mo	Grav. Esp.
Chalcocite	Cu <sub>2</sub> S	Cc	79.9		20.1				5.65
Covellite	CuS	Cv	66.5		33.5				4.68
Chalcopyrite	CuFeS <sub>2</sub>	Cp	34.6	30.4	34.9				4.20
Enargite	Cu <sub>3</sub> AsS <sub>4</sub>	En	48.4		32.6	19.0			4.44
Bornite	Cu <sub>5</sub> FeS <sub>4</sub>	Bn	63.3	11.1	25.6				5.07
Copper Oxide	CuO	Cux	57.9			42.2			3.86
Pyrite	FeS <sub>2</sub>	Py		46.5	53.5				5.02
ArsenoPyrite	FeAsS	AsPy		34.3	19.7	46.0			6.00
Molibdenite	MoS	Md			40.1			59.9	4.68
Sphalerite	ZnS	Sp			32.9		67.1		4.00
Magnetite	Fe <sub>3</sub> O <sub>4</sub>	Mg		72.4		27.6			5.17

Gangue will be considered all those minerals NOT listed in the table above.