

### 3 Mineralogical description

<i>Mineral</i>	<i>Formula</i>	<i>-2mm+250µm Wt%</i>	<i>-250µm +150µm Wt%</i>	<i>-150µm+75µm Wt%</i>	<i>-75µm+10µm Wt%</i>
Pyrite / Marcasite	FeS <sub>2</sub>	99.4	98.1	98.9	96.4
Chalcocite	Cu <sub>2</sub> S	0.3	0.7	0.5	3.1
Gangue	SiO <sub>2</sub>	0.3	1.2	0.7	0.6
Chalcopyrite	CuFeS <sub>2</sub>	trace	trace	trace	trace
Sphalerite	ZnS	trace	trace	trace	trace
Iron oxide	Fe <sub>2</sub> O <sub>3</sub>	trace	trace	trace	trace

The sample is a massive pyrite ore, it consists almost entirely of pyrite. The principal copper ore mineral is chalcocite. There are traces of chalcopyrite. The main gangue mineral is quartz. The mineralogy does not vary significantly through the four size fractions except for an increase in copper sulphide (chalcocite) in the finest fraction.

**Pyrite.** There are three types of pyrite.

- i) **Primary colloform pyrite.** It forms microcrystalline, colloform-banded masses (plate 1A). Usually, it has high microporosity. It often contains interstitial quartz (< 40 µm) and rare, minute inclusions of sphalerite (< 10 µm).
- ii) **Euhedral pyrite.** It occurs as fragments of large zoned crystals (> 1 mm). Examination using the electron microprobe shows crystals contain cobalt in structurally controlled growth zones (appendix 2). The cobalt-rich zones appear as narrow, parallel planes, less than 5 µm wide. The growth zones are probably a result of recrystallisation though they may have formed by diffusion banding of later cobalt-rich fluids. It is unlikely that the cobalt-rich bands are inherited from colloform-banded pyrite because there are no cobalt-rich zones in the latter.
- iii) **Cobalt-enriched fracture filling.** Some euhedral pyrite is fractured. The cracks are annealed by later cobalt-rich pyrite. This material contains the highest cobalt concentrations, up to 15.97%wt Co. The fracture fillings are usually < 10 µm wide. There also appears to be some cobalt enrichment at pyrite grain boundaries. The fracture-filling pyrite can only be recognised under the electron microscope.

**Chalcocite** occurs as liberated grains and as composite grains with pyrite ± quartz. It shows radial and colloform growth. The chalcocite has a porous structure which is seen under the microscope by its poor polishing. Occasionally, chalcocite grains have cores of chalcopyrite, indicating that it is probably alteration product of chalcopyrite.

**Chalcopyrite** forms simple to moderately sutured inclusions in euhedral pyrite. They are between 5 µm and 75 µm in size. There are rare composite grains of chalcocite and chalcopyrite. Chalcopyrite is nearly always locked.

**Sphalerite** occurs rarely as fine inclusions in colloform pyrite, < 10 µm in size. They are too fine to determine if they were syn-depositional with pyrite or if they are a later interstitial phase.

**Gangue.** The main gangue mineral is quartz. It occurs as an interstitial phase in fractured pyrite and in colloform pyrite.

## 4 Summary

- The main mineral is pyrite.
- The principal host to copper mineralisation is chalcocite. There are minor amounts of chalcopyrite.
- Chalcocite is almost completely liberated. Therefore, recovery of copper is likely to be relatively simple.
- There are two phases of cobalt mineralisation, both are hosted in cobaltiferous pyrite.
  - i. Fine oscillatory growth zones in euhedral pyrite (moderate Co values).
  - ii. Late fracture filling pyrite (high Co values).
- The only important gangue mineral is early banded colloform pyrite. It is likely to be difficult to separate from the more coarsely crystalline pyrite, unless the finer grain size and therefore greater number of grain boundaries may make it more susceptible to grinding.