QEMSCAN OPERATIONAL MODES

SGS HIGH DEFINITION MINERALOGY

OVERVIEW

QEMSCAN is an acronym for Quantitative Evaluation of Materials by Scanning Electron Microscopy, a system which differs from image analysis systems in that it is configured to measure mineralogical variability based on chemistry at the micrometer-scale.

QEMSCAN utilizes both the back-scattered electron (BSE) signal intensity as well as an Energy Dispersive Spectra Signal (EDS) at each measurement point. It thus makes no simplifications or assumptions of homogeneity based on the BSE intensity, as many mineral phases show BSE overlap. EDS signals are used to assign mineral identities to each measurement point by comparing the BSE signal and EDS spectrum against a mineral species identification program (SIP) or database.

There are three general types of measurement, those using the linear intercept and those based on particle mapping.

- Bulk Mineral Analysis (BMA) is performed using the linear intercept method, and is used to provide statistically abundant data for mineral identification, speciation, distribution and quantification.
- Particle mapping modes, including Particle Mineral Analysis (PMA), Specific Mineral Search (SMS) analysis and Trace Mineral Search (TMS) analysis, provide information on spatial relationships of minerals, including liberation and association data and provide a visual representation of mineral textures. The particle mapping modes of measurement also allow for advanced analysis of the minerals of interest, including grade vs. recovery relationships and mineral release curves. Specific details of the measurement modes are presented below, while visual examples of these two measurement classes are presented in Figures 1 and 2.
- The Field Scan (FS) mode of measurement maps a rock or core chunks sample that has been mounted in the polished section. It collects a chemical spectrum at a set interval within the field of view. Each field of view is then processed offline to produce a low resolution digital map of the field of view. This is presented in Figure 3.

BULK MINERAL ANALYSIS

Bulk Mineral Analysis, or BMA, is performed by a linear intercept method, in which the electron beam is rastered at a pre-defined point spacing (variable with particle size) along several lines per field. BMA analyses, analyse the entire polished section providing sampling statistics in the tens of thousands. An example of a BMA measurement image is shown in Figure 1. This measurement provides a robust data set for determination of the bulk mineralogy, with mineral identities and proportions, along with estimated grain size measurements.

PARTICLE MINERAL ANALYSIS

Particle Mineral Analysis (PMA) is a two-dimensional mapping analysis aimed at resolving liberation and locking characteristics of a set of particles. A pre-defined number of particles are mapped at a point spacing approximately selected to spatially resolve and describe mineral textures and associations present within the sample. This mode is often selected to characterize concentrate products, as both commodity minerals and locked gangue phases tend to have relatively high abundances.

SPECIFIC MINERAL SEARCH

Specific Mineral Search, or SMS, is a particle analysis method, which only analyses a pre-determined subpopulation of the particles present. The packages are based on the premise that the target phases have a

higher back-scattered electron brightness than the bulk of the gangue phases.

This enables each block to be scanned for particles containing the target phase(s), and only those that are brighter are fully analysed. As the entire block is scanned, this also produces the highest possible statistical population for the trace phase.

This mode of measurement would be most appropriate for ores of low sulphide grade, searching specifically for particles containing sulphide minerals.

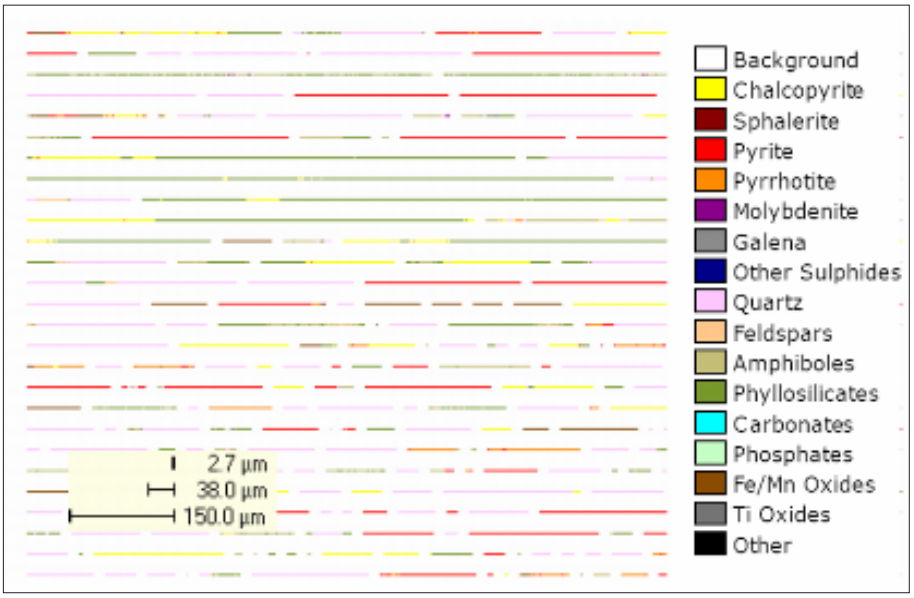

Figure 1. BMA Measurement Mode

TRACE MINERAL SEARCH

Trace Mineral Search (TMS) is an additional mapping routine, where a phase constituent and can be located by thresholding of the back-scattered electron intensity. The objective of this routine is to reject barren fields and increase analysis efficiency. The outputs are otherwise identical to the SMS routine. This mode of measurement is often used for advanced studies of gold and PGE ores, or trace minerals of interest such as molybdenite.

It is important to note that SMS and TMS results pertain only to the target minerals. PMA must be selected if quantitative gangue characterization is required. That is, the analysis modes are designed to analyse only the target-bearing sub-population, and the results therefore do not reflect the bulk mineralogy of the overall sample. As a result, these target search studies are commonly paired with BMA analyses to provide bulk mineralogical context to the SMS/TMS results.

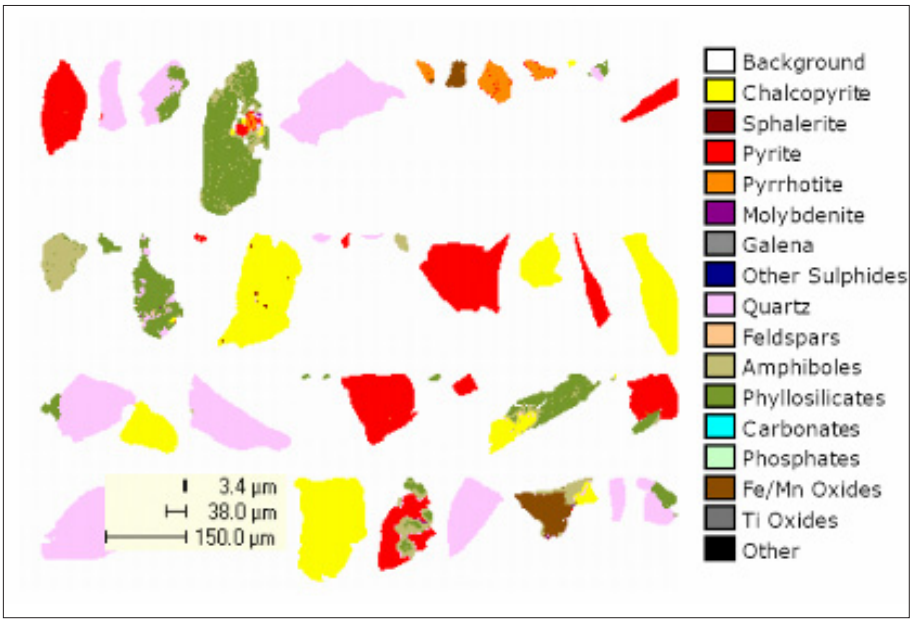

Figure 2. Particle Mapping (PMA, SMS or TMS) Measurement Mode

FIELD SCAN

The Field Scan (FS) mode of measurement maps a rock chip or core sample that has been mounted in the polished section. It collects a chemical spectrum at a set interval within the field of view. Each field of view is them processed offline to generate a single integrated image and a false-colour image of the core sample is produced.

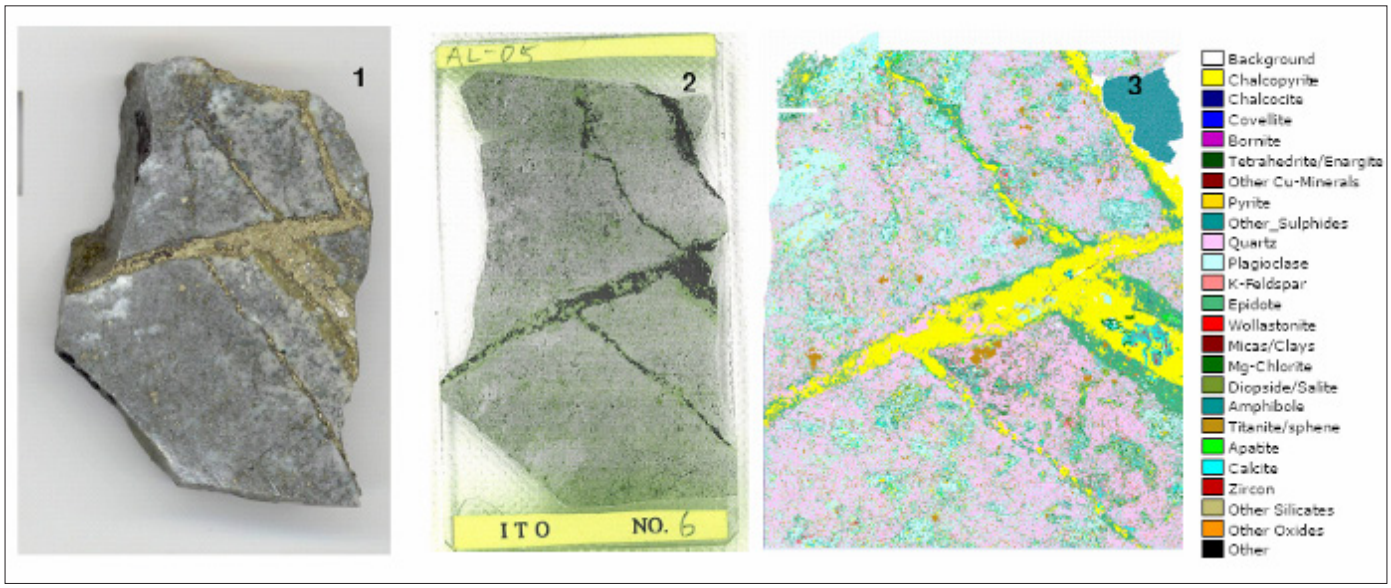

Figure 3. Field Scan Mode of Measurement;

Image 1: Selected Core Sample

Image 2: Polished Thin Section

Image 3: QEMSCAN™ False-colour Image of the Polished Thin Section with Legend/Mineral List

CONTACT INFORMATION

Email us at minerals@sgs.com
www.sgs.com/mining