



Mineral Liberation Analyzer

Turning mineral analysis into profit





The MLA combines a large specimen chamber automated Scanning Electron Microscope (SEM), multiple Energy Dispersive X-ray detectors with state-of-the-art automated quantitative mineralogy software. The software, designed by the Australian mineral technology specialist JKTech, controls SEM hardware to quantitatively analyze mineral and material samples. As an automated system, the MLA can measure up to 16 standard samples overnight without the need for operator assistance. Automated stage control and image acquisition allows for BSE imaging and subsequent x-ray analysis of at least 5,000 particles for a concentrate, and 50,000 or even more particles for a tailing or other low grade material. Automatic recalibration ensures consistent results. All stages of image processing are controlled by powerful algorithms contained in the system's purpose-written software. The analytical SEM platform for the automated mineralogy software is developed, manufactured and supported by FEI, a leading supplier of charged-particle based inspection and characterization tools, represented in over 40 countries worldwide. Partners in MLA, JKTech and FEI together offer the best in quantitative mineralogy, capital equipment sales, global support and design.

The MLA offers a series of tailor-made measurement modes to ensure that you are not just gathering data, but also acquiring valuable mineralogical information. These modes use unique combinations of high-resolution BSE image analysis and advanced X-ray identification techniques to target your analytical requirements. Whether it's analyzing complex base metal ores or searching for sub-micron grains of gold, the MLA provides a measurement solution for your application. The MLA's powerful DataView software allows you to present the analysis results the way you need them: in tabular or graphical format, individually or combined, or exported to other software.

The MLA integrates fully into JKTech's other wide ranging consulting services. MLA users can benefit from application support, such as JKTech's metallurgical and ore characterization expertise or extensive simulation capabilities (eg JKSimMet and JKSimFloat). This expertise is further supported by the outcomes of ongoing industry funded research conducted by the world renowned JKMRC.

Three steps to increase value: measure, interpret and optimize

With the MLA, ore particle cross-sections can be analyzed to better understand, optimize and predict mineral processing circuit performance.

Targeted measurements, high throughput

The MLA can measure base and precious metals, industrial minerals, coal and other materials. Measurements can be customized to minimize measurement time and excess data collection and hence increase sample throughput. The extensive range of distinct measurements, combined with tailored measurement software, can be adapted to your requirements. High resolution BSE imaging allows particles down to 2 μm and mineral inclusions of 0.2 μm to be analyzed.

Interpret your measurements

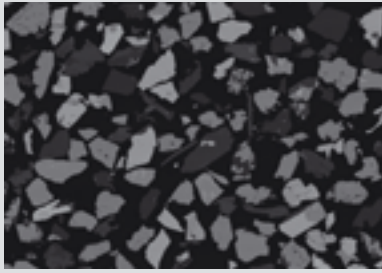
The flexible tabulated and graphical reporting outputs generated by MLA's DataView software include:

- Mineral abundance (modal analysis) and sample elemental distributions (assay)
- Particle and grain size distributions
- Mineral associations, liberation and locking
- Theoretical grade-recovery curves
- Particle densities and shape factors

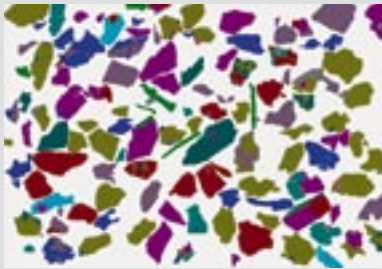
These values can be used to assess the liberation properties of plant streams or to characterize the geometallurgical properties of an ore.

Optimize your processes

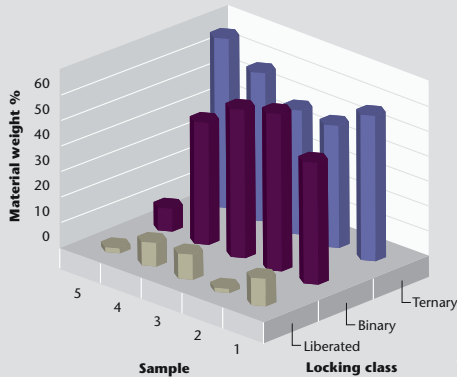
The MLA can analyze future concentrator feeds and the products of batch or pilot-scale separation tests. The efficiency of flotation tests can be assessed using MLA information, such as theoretical grade recovery curves. Information, for example, about the liberation distribution of the valuable minerals is vital in determining whether inefficient separation is due to the presence of unliberated particles or because of poor mechanical, reagent or separator performance. Geometallurgical and ore characterization information, such as mineral association data and grain size distributions, can help optimize plant feed quality by avoiding metallurgically poor ore stocks or facilitating effective ore blending.



- Measure**
- Metals
 - Minerals
 - Coal



- Interpret**
- Liberation analysis
 - Grain size
 - Mineral abundances



- Optimize**
- Improve recovery
 - Optimise circuits
 - Improve yield

Covering the full spectrum of mineral resource industries - from exploration to final products

Gold, silver and PGMs

The MLA can quickly perform high-resolution automated searches in large numbers of particles to identify rare phases such as gold, silver or Platinum Group Minerals (PGMs). Results include:

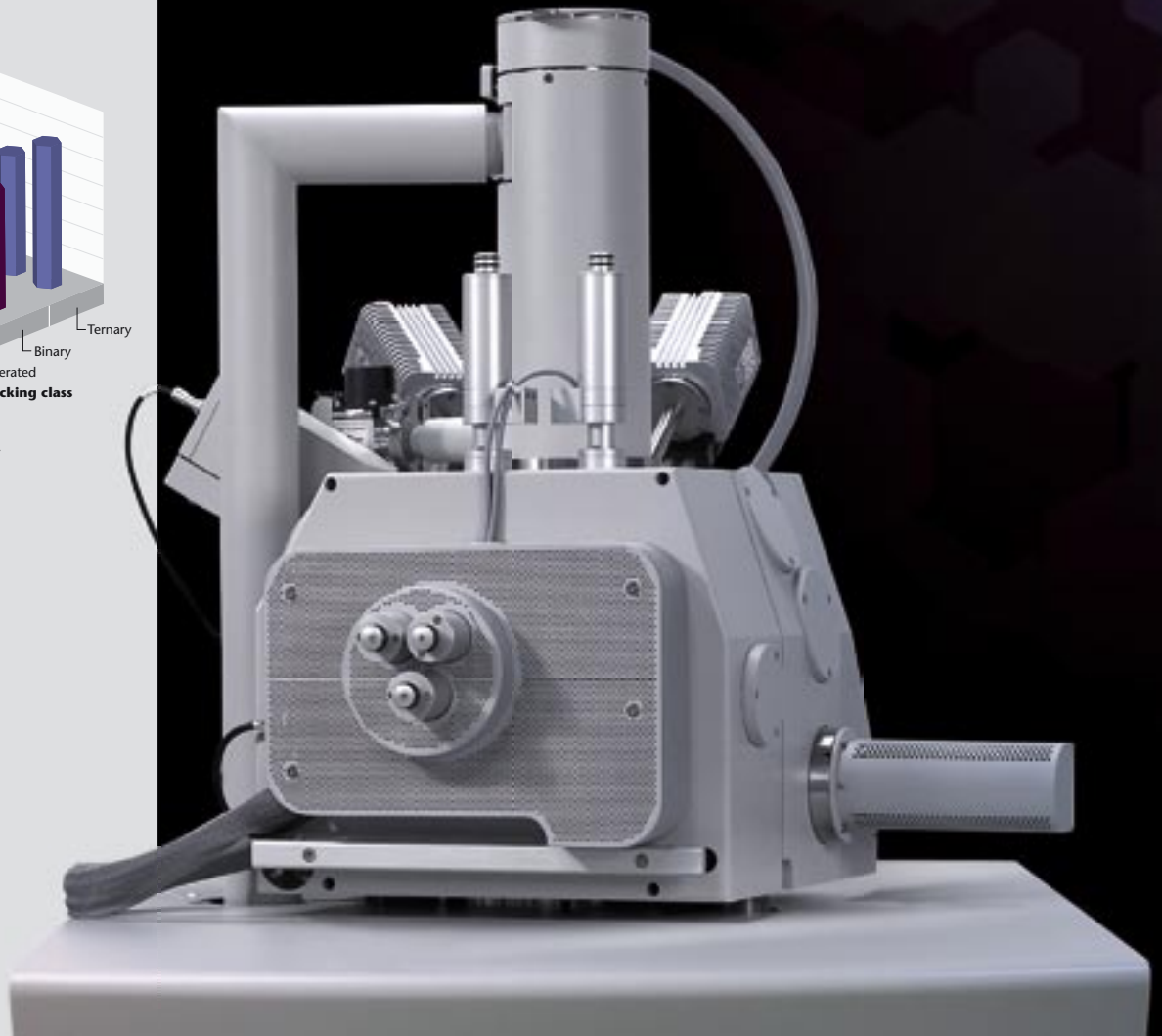
- Identification of mineral species
- Associations and host minerals
- Grain sizes

Uranium

The MLA is used in the detailed ore characterization for geo-metallurgical mapping of a major uranium ore deposit.

Titanium

MLA measurements can provide direct information about the behavior of individual titanium minerals. It can, for example, reveal small differences in the separation behavior of titanium minerals; this is a major improvement over manipulation of elements assay data. This allows the metallurgist to develop strategies to optimize the processing of any particular mineral.

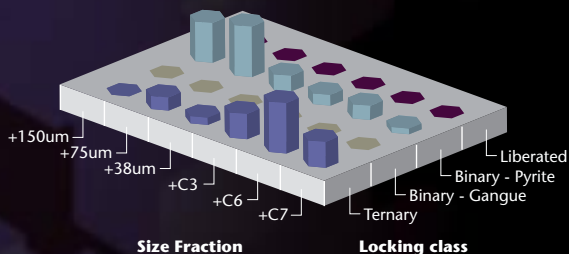


Copper

Quantitative mineralogy measurements by the MLA can be used to determine:

- Mineralogy of future copper ores
- Reasons for copper losses in the tailings
- Sources of penalty elements in concentrate
- Proportion of copper reporting to each of the copper minerals in a plant stream
- Analyze copper floatability

Copper Losses in Final Tail



Identifying the potential for recovering more copper from the tail - characterising the lost copper

MLA - Can you afford not to have one?

The MLA offers mineralogists the flexibility of working with customized turnkey systems. Since it was first introduced in 2000, the MLA has seen rapidly increasing applications with leading companies in the international mineral resources sector. Mining companies are becoming aware of the considerable benefits of using the MLA system to understand their ores, concentrates, tailings and PMG products. Plus, the comprehensive training and support provided to purchasers of MLA systems enables them to start producing invaluable results in a very short timeframe.

Clients currently benefiting from MLA technology include:

Anglo Platinum
Rio Tinto
BHP-Billiton
Federal Institute for Geosciences, Germany
Teck Cominco
Newmont
Kennecott Utah Copper
Inco
Barrick Gold Corporation
Mintek
University of Nottingham
Geological Survey of Finland
Richards Bay Minerals
Jinchuan Group
Peñoles

The Complete Mineral Analysis Solution

The MLA's flexibility can bring value to a wide variety of users at many levels. SEM hardware configurations (chamber sizes, EDS number and type) can be tailored to suit both high throughput production applications, research requirements or simply a budget.

The MLA standards management system can accommodate manual or automated standards collection which makes analyzing new samples more efficient.

The comprehensive range of modes of analysis offered by the automated mineralogy software plus the ability to take advantage of various SEM set ups, such as measurements at a given beam energy, brings a new level of flexibility never seen before in automated mineralogy. The size and shapes of your polished samples are only bound by your SEM chamber and the imagination of the sample holder designer. MLA is truly the complete mineral analysis solution.

Mineral Liberation Analyzer

High resolution, high throughput automated mineralogy for increased value

The Mineral Liberation Analyzer (MLA) is an automated mineral analysis system that can identify minerals in polished sections of drill core, particulate or lump materials, and quantify a wide range of mineral characteristics, such as mineral abundance, grain size and liberation. Mineral texture and liberation potential are fundamental properties of ore and drive its economic treatment; the data gathered by the MLA is therefore invaluable to geologists, mineralogists, and metallurgists for process optimization, mine feasibility studies and ore characterization. Commercially available since 2000, the MLA is being used by leading international resource companies to improve the processing efficiency of copper, nickel, lead, zinc, manganese, iron ore, mineral sands, and precious metals such as platinum, palladium, silver and gold. Its ore characterization capabilities are also used very effectively to evaluate exploration targets.



JKTech and FEI, partners in MLA



About FEI

FEI Company provides advanced micron to nano-scale characterization tools to a range of markets, including materials science, life science, Industry, semiconductors, and data storage. Its electron beam products (SEM and TEM), market-leading SEM/FIB DualBeam(tm) systems, and productivity-enhancing automation software packages enable researchers and manufacturers to characterize, modify and measure micron to nanoscale structures, in two or three dimensions down to the atomic level. The company and its predecessors have been paving the way for micron to nanoscale exploration and discovery since 1946. FEI Company has manufacturing and development facilities in North America and Europe. FEI's manufacturing contribution to the MLA product includes total system factory integration and test, including both conventional Si(Li) and silicon drift EDS detectors. FEI runs sales and service operations in more than 40 countries worldwide.

For more information visit: www.fei.com



About JKTech

JKTech Pty Ltd is the technology transfer company for the Julius Kruttschnitt Mineral Research Centre (JKMRC) at the University of Queensland in Brisbane, Australia. Its role is to take viable research outcomes and transfer them to the international minerals industry. JKTech offers a range of innovative solutions for the minerals industry aimed at increasing productivity and metal recovery. These specialist products and services include consulting, automated quantitative mineralogy, specialist software, specialist equipment, laboratory services and training courses.

For more information about JKTech, visit:
www.jktech.com.au



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