

# Solutions for Ore Refining and Processing



Mining Industry



# Responsible and Sustainable Production for High-Quality Products

FIND OUT MORE



[www.anton-paar.com/apb-mining-solutions](http://www.anton-paar.com/apb-mining-solutions)

Sustainable mining of natural resources is a cornerstone of our standard of living and prosperity. With a wide range of applications, mined materials play a critical role in various segments of our lives, including construction and power generation, and are used as commodities for industrial applications and luxury goods. They also contribute to current green technologies – like wind turbines, solar panels, and electric vehicles – and are an integral aspect of the effort to counter climate change. Exploring new exploitable deposits and recycling raw materials have to be done responsibly for mining to have a sustainable economic role in society. Mined metals and minerals must be extracted, transported, stored, and processed according to quality control processes that deliver safe and high-quality products. We have a wide array of instruments that contribute to every step of this development and production chain.

Optimize the mining process and plan downstream processing requirements

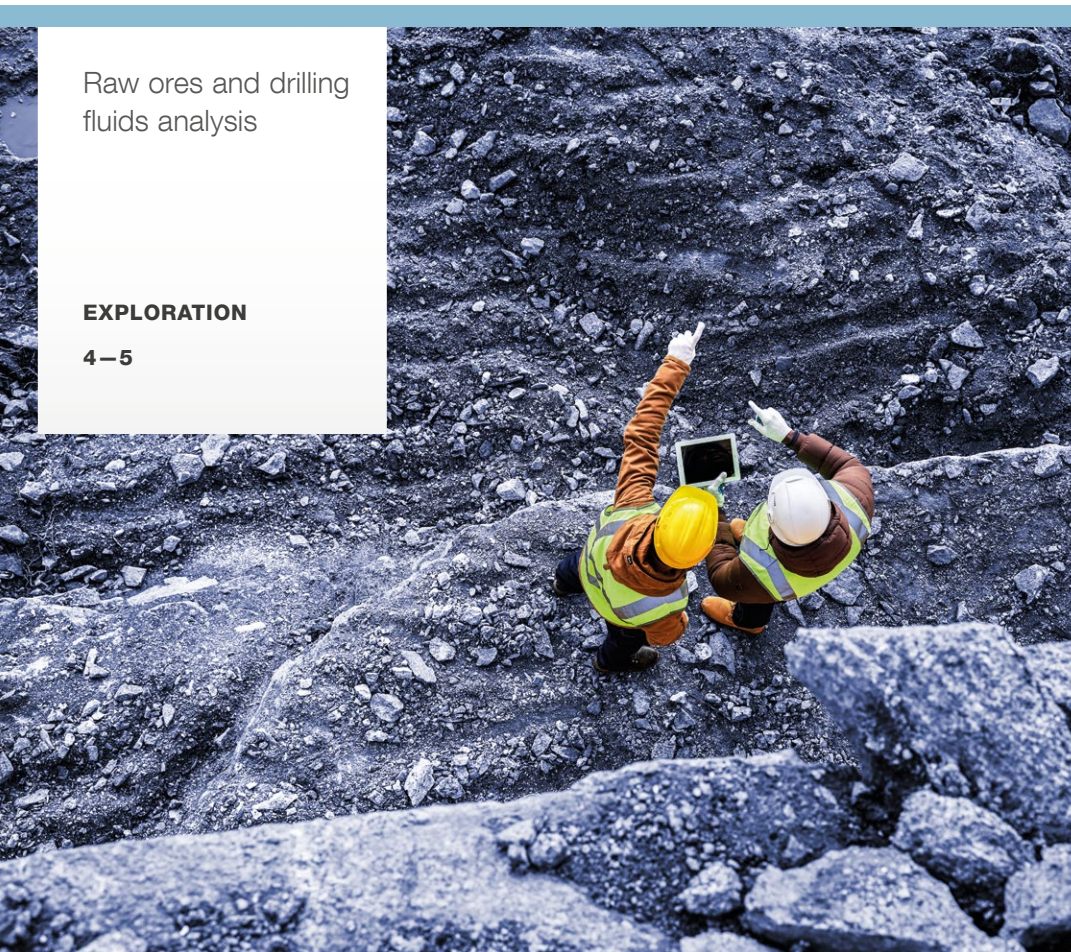
Discover possible recovery losses ahead of time

Increase efficiency and stabilize plant conditions

Reduce the costs and environmental impact of ore processing

Evaluate groundwater movement and pollution

Prevent energy waste on unnecessary grinding



Raw ores and drilling fluids analysis

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Processed ore and tailings analysis

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# Raw Ores and Drilling Fluids Analysis



Several instruments from our portfolio help you optimize your exploration process.

**X-ray diffraction:**

XRDynamic 500, an automated multipurpose powder X-ray diffractometer

**Mercury intrusion porosimetry:**

PoreMaster, a mercury intrusion pore size analyzer

**Gas pycnometry:**

Ultrapyc, the most versatile single-station gas pycnometer

**Microwave acid digestion:**

Multiwave GO Plus, 5000, and 7000, modern microwave digestion systems

**Laser diffraction:**

The PSA series, determines the particle size distribution of liquid dispersions and dry powders

**Rheometry:**

The MCR series, the world's most versatile and trusted rheometer brand

**Viscometry:**

ViscoQC and RheolabQC, rotational viscometers



CHALLENGE	BENEFIT	TECHNOLOGY
Identifying and quantifying high-value deposits and other types of minerals at an exploration site	Optimize the mining process and effectively plan downstream processing requirements	X-ray diffraction
Identifying non-extractable ore forms for yield estimates that can't be done via chemical analysis alone	Discover possible recovery losses ahead of time to optimize the extraction process	X-ray diffraction
Quantifying rock porosity and pore size	Measure porosity and pore size distribution for a full site evaluation for groundwater movement and pollution, which has both safety and environmental concerns	Mercury intrusion porosimetry Gas pycnometry
Obtaining optimum mud density for hydrostatic pressure and circulation (i.e., density ideal for bringing cuttings to the surface)	Measure the density of both dry solids and formulations for accurate fine-tuning of density from individual values and blends of cuttings, barite, clays, and other solids to minimize cost while preventing blow-out	Gas pycnometry
Ensuring reliable characteristics of cement powder and sand (i.e., those fit for well-bore cementing)	Determine the skeletal density and, with this value, calculate the target solid's percentage with confidence and improve the accuracy of Blaine measurement to produce a cement with proper support and isolation	Gas pycnometry
Obtaining a precise estimation of the elements that drilling samples/rocks contain	Perform high-temperature microwave digestion with minimum acid consumption to prepare samples for analysis by atomic spectroscopy (ICP-OES, ICP-MS, AAS)	Microwave acid digestion
Detecting low-gravity solids (LGS) of reused drilling mud as they build up	Monitor the particle size distribution in order to know how long drilling mud can be reused before risking sudden downtimes	Laser diffraction
Ensuring a smooth fracking process	Predict the flow behavior of fracking fluids at high pressures and various shear rates, and even the possible yield point	Rheometry
Ensuring proper viscosity of bentonite at rest and during pumping	Smooth processing when drilling mud is transported as well as no sudden downtime	Viscometry

## Powders and slurries analysis



Several instruments from our portfolio help you optimize your ore transport and processing.

**X-ray diffraction:**

XRDynamic 500, an automated multipurpose powder X-ray diffractometer

**Gas pycnometry:**

Ultracyc, the most versatile single-station gas pycnometer

**Gas adsorption surface area analysis:**

The Nova series, surface area and pore size analyzers

**Laser diffraction:**

The PSA series, determines the particle size distribution of liquid dispersions and dry powders

**Rheometry:**

The MCR series, the world's most versatile and trusted rheometer brand

**Viscometry:**

ViscoQC and RheolabQC, rotational viscometers



CHALLENGE	BENEFIT	TECHNOLOGY
Delivering consistent mineralogy to the processing plant	Increase efficiency and stabilize plant conditions via optimal grade selection through phase identification of the minerals present in mined ore	X-ray diffraction
Exploiting ore deposits of lower-ore grades requires frequent monitoring of the mined material	Optimize operational efficiency of the mining process and the beneficiation process of the ore by rapid qualitative and quantitative analysis of the mineral composition	X-ray diffraction
Difficulties during transport and storage of powder raw materials	Simulate the mechanical transport of solid raw materials in order to avoid issues during transport and storage of powdery materials	Powder rheometry
The slurry gets stuck while pumping	Analyze the yield point of the ore slurry and lower the yield point so that less force is needed to initiate sample flow, which results in smooth and efficient transportation process during production	Rheometry Viscometry
Optimum processing viscosity for processing of metal extracted from slag	Perform temperature-dependent viscosity measurements and thus reduce processing cost by minimized temperatures and reduced wear of container materials	High-temperature rheometry
Calculating the proper amount of slurry dispersant/stabilizer	Measure true powder surface area so that the minimum particle surface coverage required can be calculated	Gas sorption surface area analysis
Accurately calculating sedimentation times of tailings/washings	Measure density for more efficient operation and lifecycle management to reduce overall costs and land use	Gas pycnometry
Optimizing the density of fluids in float-sink tanks for coal washing to meet end-user specifications	Measure density of sink and float fractions to maximize the economics of separating coal from rock and minerals	Gas pycnometry
Optimizing ore grinding by preventing fine and ultrafine particles, and wastage of energy on unnecessary grinding	Constantly monitor the particle sizes, which leads to lower energy consumption and cost reduction	Laser diffraction
Producing uniform particle size to prevent ore separation bias	Adapt the ore comminution process based on the resulting particle size distribution and reach a more efficient and faster separation, and higher yields	Laser diffraction

## Processed ore and tailings analysis



Several instruments from our portfolio help you optimize your quality control.

**X-ray diffraction:**

XRDynamic 500, an automated multipurpose powder X-ray diffractometer

**Gas pycnometry:**

Ultrapyc, the most versatile single-station gas pycnometer

**Automated representative sampling:**

The Micro Rotary Riffler, an automated representative sampler

**Microwave acid digestion:**

Multiwave GO Plus, 5000, and 7000, modern microwave digestion systems

**Hot block digestion:**

Multicube 48, a hot block digestion system

**Laser diffraction:**

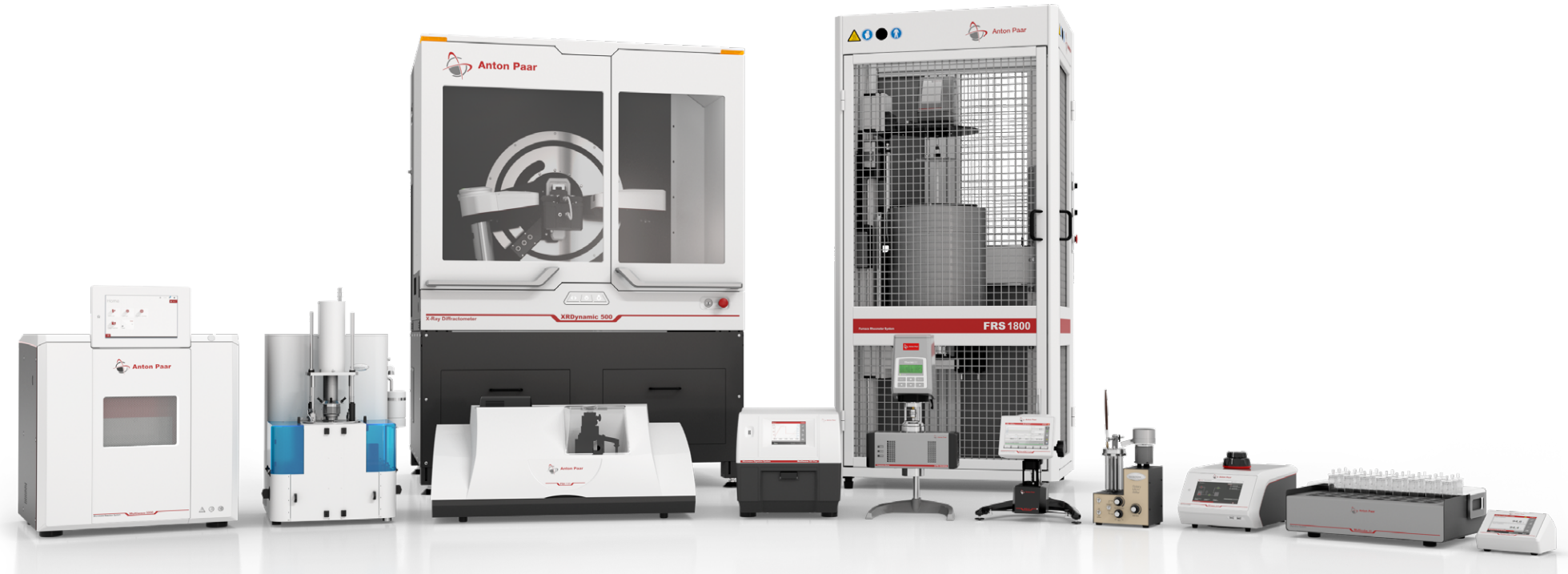
The PSA series, determines the particle size distribution of liquid dispersions and dry powders

**Rheometry:**

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**Viscometry:**

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CHALLENGE	BENEFIT	TECHNOLOGY
Continuous monitoring of processed ore quality	Fast phase identification and quantification in order to quickly respond to changes in processed products to ensure optimal quality and reduced wastage	X-ray diffraction
Large quantities of materials with potential reusable value may end up in tailings	Identify compounds of value that can be recovered from tailings and thus reduce wastage and potential environmental damage	X-ray diffraction
Analyzing water and soil for contamination with harmful elements	Digest 48 samples at once, 24/7, at up to 180 °C	Hot block digestion
Caustic leaching of bauxite samples to determine available alumina and reactive silica	Highly temperature-dependent extraction process makes elements of interest available for analysis	Microwave acid digestion
Fast acid digestion of process QC samples for elemental composition	Reliable data for process control	Microwave acid digestion
For metal analysis, it's important to take a small aliquot from ground/milled material that has the same composition as the larger sieved sample	Use the most effective representative sampling technique that provides you with eight equivalent aliquots, from a single split, which can be directed towards digestion and/or multiple physical and chemical analytical methods	Automated representative sampling
Assuring correct volume of powderized rock (ore)	Measure density to provide accurate mass calculations for all materials prior to distribution and export	Gas pycnometry
Efficient dilution of tailings to enable pumping while minimizing discarded material	Analyze flowability with variable degrees of dilution to remove a yield point so that sample flow is possible	Rheometry Viscometry
Coal ash sticks to reactor walls and needs to be mobilized by heating/melting and subsequent removal	Being aware of temperature and composition at which a predefined viscosity (viscosity to flow down the reactor wall) is reached. This ensures smooth operation and long-term running of the plants/gasifiers	High-temperature rheometry
Continuous particle size distribution (PSD) monitoring of processed ore in order to ensure consistent quality of the final product	Measure the PSD for constant quality of the final product, suited for the planned application	Laser diffraction

# Anton Paar Instruments



## XRDynamic 500

XRDynamic 500 ensures optimized processes at every stage of the mining operation via rapid as well as precise phase identification and quantification of metals and minerals.

- Right out of the box: Best-in-class resolution / signal-to-noise ratio
- TruBeam™ concept: Larger goniometer radius and evacuated beam path
- Full automation: X-ray optics and beam geometry change



## Ultrapyc series

Measurements with the Ultrapyc gas pycnometers take less than 10 minutes, so they're perfect for controlling the quality of your solid materials and slurries throughout exploration and processing.

- PowderProtect: Measure fine powders without instrument contamination
- Built-in Peltier temperature control for superior thermal stability
- Accurate results for sample volumes from 4.5 cm<sup>3</sup> to 135 cm<sup>3</sup>



## Multiwave GO Plus, Multiwave 5000, Multiwave 7000

Multiwave digestion systems are the perfect sample preparation instrument for the mining industry.

- Budget-friendly disposable vials and inserts for economic sample preparation
- Innovative features (e.g., library with more than 500 methods, hands-free door opener) make microwave digestion easier and more convenient than ever
- Clever instruments and vessel concepts, state-of-the-art sensor technology, and the highest safety standards (ETL and GS safety certificates)

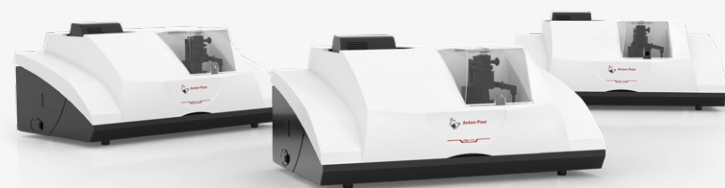
“  
We're confident in the high quality of our instruments. That's why we provide **a full warranty for three years.**  
”

All new instruments\* include repair for three years. You avoid unforeseen costs and can always rely on your instrument. Alongside the warranty, we offer a wide range of additional services and maintenance options.

\*Due to the technology they use, some instruments require maintenance according to a maintenance schedule. Complying with the maintenance schedule is a prerequisite for the three-year warranty.

### SERVICE AND SUPPORT DIRECTLY FROM THE MANUFACTURER

Our comprehensive service provides you with the best individual coverage for your investment so that maximum uptime is ensured.



## PSA series

The PSA instrument has market-leading robustness when it comes to ground vibrations, dusty environments, and abrasive samples.

- Permanently aligned solid-state lasers – durable and resistant to ground vibrations
- No glass in the dry path of the sample and exceptionally robust glass in the liquid path
- Compact 2-in-1 design to conduct both wet and dry measurements in a single setup



## MCR rheometer series

Your solution for material flow optimization, from designing raw material powder transport to predicting flow behavior of tailings suspensions and optimizing slag processing.

- 15 rheometers and over 200 accessories mean all of your samples and requirements are covered
- A range of smart features do the work so you can do the thinking
- Continuous development of the portfolio in response to customer feedback and new ideas



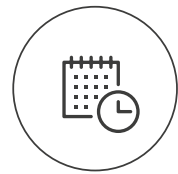
## ViscoQC, RheolabQC

For quick and convenient dynamic viscosity measurements, ViscoQC and RheolabQC rotational viscometers ensure the quality of your substance for the best pumpability and workability results.

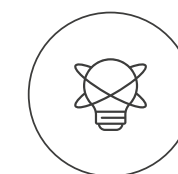
- Save time with the fast and highly accurate sample temperature control delivered by the Peltier temperature devices PTD 80 and PTD 175
- Unique features provide error-free and efficient operation
- Economical consumption of resources with a small footprint



**SAFEGUARDING YOUR INVESTMENT**



**THE SHORTEST RESPONSE TIMES**



**CERTIFIED SERVICE ENGINEERS**



**OUR SERVICE IS GLOBAL**

