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Petrolab Service Statements

Serving the Mining and Materials Industries for 25 years





Petrolab Team

Petrolab has been operating for 25 years and its staff are specialists in the mineralogical investigation of rocks, mineral resources and manufactured inorganic materials by microscopic analysis. The additional close links with the high concentration of local companies offering world class expertise enables the team to provide high quality interpretative reports that help clients evaluate the potential of their mineral resources or solve materials related problems.



James Strongman
MSci ARSM

Principal Consultant

James has been with Petrolab since 2001, starting under the supervision of its founder, Dr Alan Bromley and subsequently purchasing the company in 2006. He has a wide spectrum of experience in all aspects of the business. However, his specialist field is metalliferous ores, and the application of mineralogy to mineral processing problems.



John Fletcher
BSc MSc

General Manager

John joined Petrolab as a director and joint owner in 2007 with over 20 years of experience in project management, operations and finance. Since joining Petrolab he has been responsible for improving productivity and consistency by developing a custom laboratory information management/ reporting system.



Christopher Brough
CGeol PhD

Senior Mineralogist

Chris is a senior mineralogist specialising in the application of petrology and mineralogy to the minerals and mining industry. He has over 4 years post-doctoral experience working on a diverse range of projects and resource types. He brings experience of environmental mineralogy and ore petrography.



Rachel Garside
MSci

Project Mineralogist

Rachel graduated with an MSci in Geology from the University of Cambridge and joined Petrolab in 2014. She has gained experience in all aspects of the business, from mundic testing and assisting with sample preparation to examination and reporting on a wide variety of minerals and materials.



Jake Harrison
MSc MCSM

Junior Mineralogist

Jake has recently completed an MSc in Mining Geology from Camborne School of Mines. His master's project involved using automated mineralogy to compare predicted and actual processing performance on tungsten ore feed materials from Wolf Minerals' Drakelands Mine.



Nigel Wood

Lab Technician

Nigel is responsible for the production of petrographic thin sections and polished blocks using the first Pelcon thin section machine in the UK. He has extensive laboratory experience from over 20 years working in previous roles for mineral extraction and geotechnical testing laboratories.





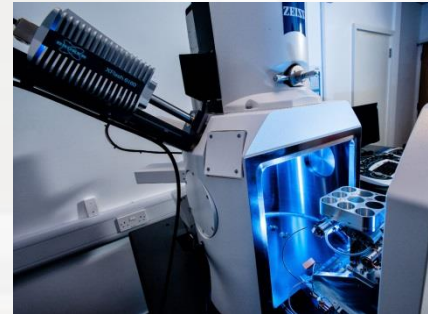
Automated Mineralogy

Automated mineralogy and petrography refers to analytical solutions based on Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDS). These are used to provide rapid and quantitative assessment of mineralogy and texture. Petrolab have purchased a state of the art Zeiss EVO MA-25 with Bruker EDS detectors and Mineralogic Mining software. The Zeiss EVO MA-25 automated system is highly flexible and allows configurable X-ray scanning modes that include line scan, feature scan, spot centroid and mapping. It has already been used on a diverse range of projects including assessment of copper shipments, tungsten rougher feeds and mapping thaumasite sulphate attack in concrete.

Services

Petrolab offers different levels of service depending on the requirements of the project. The typical uses of automated mineralogy are to report on:

- Modal mineralogy.
- Deportment of the target metal(s).
- Liberation yield: either wt. % particle (gravity applications) or % free perimeter (flotation applications).
- Mineral locking and association.
- Particle and grain size distribution.
- Bright phase search (e.g. for gold or contaminants).
- Ore and gangue characterisation.
- Regular auditing of mineral processing circuits to improve efficiency.
- Metallurgical problem solving and testwork.



Our [Zeiss EVO MA-25](#) installed at Petrolab Limited, in the Old Miner's Hospital, Redruth.

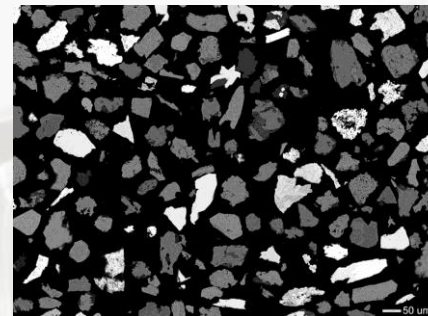


Image taken from research in the use of Mineralogic Mining to profile the magnetic and gravity response of metalliferous ores. This research was presented at the ['Mines to Market'](#) IOM³ conference in Trinity Hall, Cambridge.

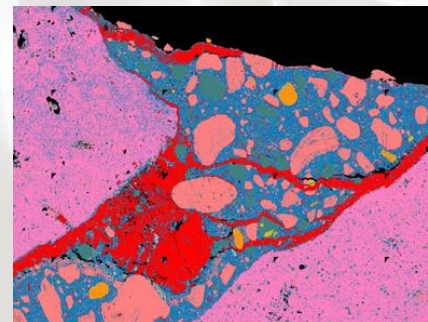


Image of thaumasite sulphate attack taken from a problematic concrete sample. The red represents thaumasite which is forming within the binder and wrapping around the aggregate pieces leading to the destabilisation and swelling of the concrete.



“Mundic” Testing

In many parts of Cornwall and South Devon ample supplies of cheap and often suitably graded aggregate were available as waste materials from the region’s metalliferous mining industry. In particular, the use of ore processing wastes as aggregates is central to the problem of accelerated concrete degradation in the region. It is widely called “the mundic block problem”. Mundic is an old Cornish word for the common sulphide mineral pyrite. Since 1991, Petrolab has completed thousands of concrete screening tests and is highly experienced at undertaking all aspects of this important type of testing.

Services

Petrolab played a significant role in developing the current guidance followed by the Royal Institute of Chartered Surveyors (RICS) undertaking building surveys and valuations in Cornwall and parts of Devon. In line with that guidance Petrolab offers the following services;

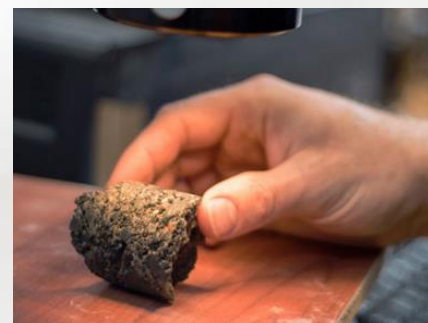
- Stage 1 Examination
- Stage 2 Examination
- Density Determination
- Chemical Analysis for Sulphides
- Stage 3 Moisture Sensitivity (Expansion) Test
- Site Visit (to examine concrete in situ)



Image taken from a house near Camborne showing irregular branching cracks (many recently repaired) in render overlying seriously degraded blockwork. The aggregate is a sulfide-rich copper-arsenic mining waste typical of the northern part of the Camborne - Redruth mineralised district.



Concrete core and chisel samples are received from the surveyor for a Stage 1 screening test. Samples are laid out in numerical order, measured, weighed and washed before analysis.



*Close up of core examined under the microscope. There are 9 broad aggregate types, rising to 40 when sub-types are **considered**. In addition, concrete blocks were frequently prepared from multiple combinations of sub-types. As such microscopical examination is key to the identification of the aggregate(s) used in each concrete.*



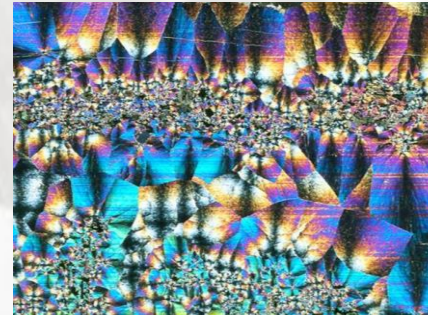
Optical Microscopy

Optical microscopy is a relatively inexpensive method of providing information on ore concentrates, mineral prospects, mine waste and man-made materials including clarification of mineral phases present, modal abundance, textural controls and the estimated deportment of key elements. Optical microscopy can be used in conjunction with automated techniques, particularly to help verify mineral lists. Petrolab has a diverse staff with extensive experience of the use of petrographic microscopes to identify and interpret a wide range of sample types.

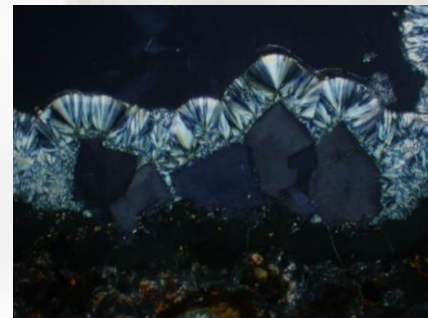
Services

Petrolab uses three standard petrographic microscopes (2*Nikon Microphot-FXA & 1*Nikon Labophot-2), to undertake transmitted and reflected light microscopy. Using these microscopes and staff experience, Petrolab is able to offer the following services:

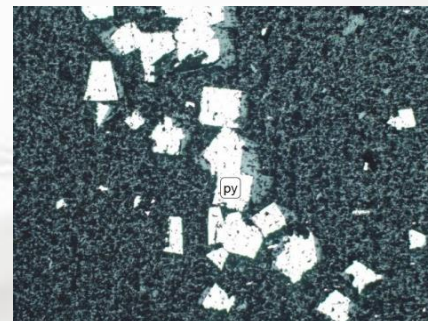
- Grab sample petrography, from prospective ores through to possible mine waste.
- Aggregates, stone and slate – petrography to determine suitability for use.
- Concretes, render and mortar – petrography to determine current material condition.
- Smelter Slags – Analysis of smelter products to determine metal recovery prospects.



Whole slide photomicrograph showing radiating aggregates of zinc-silicate (willemite or hemimorphite) from a Zambian Zinc prospect. Also in the samples were calcite, gahnite and magnetite.



Photomicrograph showing radiating aggregates of illite and chlorite growing in a layer parallel to vesicular edges. These are hosted on pseudocubic chabazite grains. The matrix is dominated by altered porphyritic basalts. Samples taken from prospective quarry material in Wales.



Reflected light photomicrograph of Moorland slate showing coarse euhedral pyrite crystals.



Sample Preparation

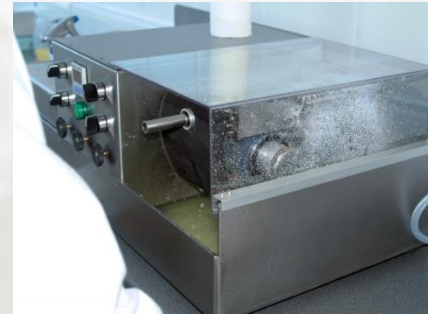
Petrography depends on the production of high quality thin sections and polished blocks from a representative sample. Petrolab offers a reliable materials preparation service producing petrographic thin sections and polished blocks from samples of rock, aggregate, concrete and other similar materials. Petrolab operate the first Pelcon Automatic Thin Section Machine in the UK and a Buehler EcoMet350 Grinder Polisher.

Services

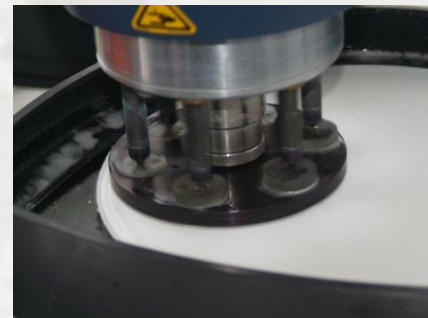
The following sections and polished blocks are offered by Petrolab. Resin can be clear or yellow as requested. Turnaround time for up to 10 thin sections is approximately 7 – 10 working days.

- Standard 30 mm Thin Section (65 x 55 mm).
- Polished Thin Section (46 x 26 mm).
- Solid Polished Block (45 x 30 mm).
- Circular Polished Block (25 or 30 mm).
- Additional section types can be requested.

For samples that contain soluble or water sensitive minerals (e.g. gypsum), sample preparation can be undertaken under alcohol to ensure their preservation.



The Pelcon Automatic Thin Section Machine uses fixed diamond abrasives to produce flat, uniform sections with excellent preservation of microscopic fine detail. The fixed abrasives ensure that there is no contamination of the finished section with carborundum powder.



Petrolab can prepare polished sections for ore mineral analysis using the pictured Buehler EcoMet350 Grinder Polisher. We prepare circular polished mounts suitable for SEM analysis and polished thin sections suitable for optical microscopy.



A concrete sample 'chip' impregnated under vacuum with yellow UV fluorescent dye clearly displays fractures that are pervasive through the aggregate. The impregnated chip is used to prepare the finished thin section.



Aggregates, Stone and Slate

Aggregates, building stone and natural rock are integral parts of the materials industry and testing is frequently required to assess key structural parameters in order to confirm their suitability for use in the construction industry. Testing of these materials to industry standards is essential. Petrolab has extensive international and national experience of this testwork and is able to offer reports tailored to client requirements.

Services

All testing is carried out in line with relevant industry standards. The test methodologies used by Petrolab are;

- BS EN 1997-2:2007 Eurocode 7, Part 2 / BS 5930:1999+A2:2010 Code of Practice for Site Investigation – Description and classification of rock.
- BS EN 12407:2007 Natural stone test methods – Petrographic examination.
- BS EN 12620:2002 Aggregates for concrete.
- ASTM C295 Standard guide for petrographic examination of aggregates for concrete.
- BS EN 932-3 Tests for general properties of aggregates. Part 3. Procedure & terminology for simplified petrographic description.
- BS812-104 1994. Testing Aggregates. Part 104. Method for Qualitative and Quantitative Petrographic Examination of Aggregates.
- BS EN 12326-2 Slate and stone products for discontinuous roofing and cladding – test methods.



Photograph showing several washed aggregate samples from quarries across the UK and the Republic of Ireland.



Photograph showing an example of well-graded and fine-grained river sand aggregate.



Photograph showing an example of a coarse aggregate consisting primarily of a chert gravel.



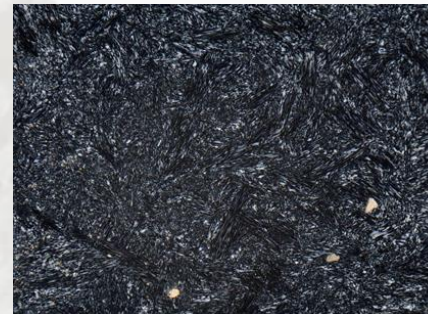
Concrete, Render and Mortar

Concrete, render and mortar degradation can result from a number of different processes from poor mix design to chemical attack. Concrete petrography is a crucial technique to determine constituents, quality and material condition, along with the interpretation of the causes of any observed degradation. Since 1991, Petrolab has gained extensive experience in the assessment of the causes behind concrete, render and mortar degradation.

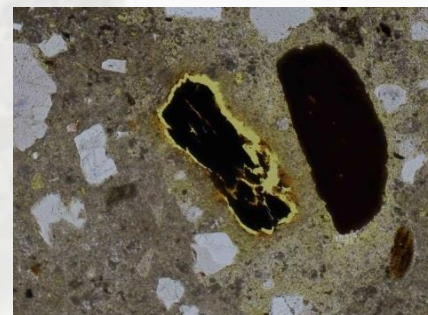
Services

All testing is carried out in line with relevant industry standards and are designed to assess the common causes of concrete degradation. Common causes of degradation include a range of chemical processes (e.g. alkali silica reaction (ASR)) and physical processes (e.g. abrasion and erosion due to traffic). The test methodologies applied to the assessment of concrete degradation are;

- ASTM C856-11 Standard Practice for Petrographic Examination of Hardened Concrete.
- Applied Petrography Group, SR1 & SR2, 2008. Codes of practice for the petrographic examination of concrete, mortars, plasters, renders and related materials.



Photomicrograph showing swirling gypsum from medieval concrete, having long since replaced the binder.



Photomicrograph showing shrinkage cracking of coal aggregate.



Photo showing a sliced section of concrete to be prepared for sectioning and petrographic analysis.



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