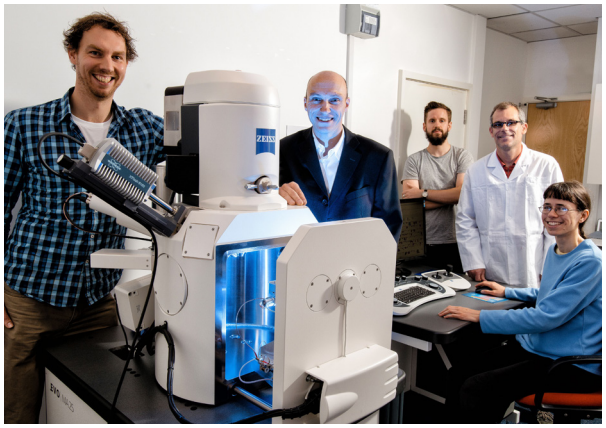
An eye on the future

As worldwide demand for automated microscopy and mineralogy gathers momentum, UK-based Petrolab is ready for action. Rebecca Pool reports



THE PETROLAB TEAM (James Strongman left) with the ZEISS EVO MA-25 SEM with Bruker EDX detector

When geologist, Dr Alan Bromley, set up Cornwall-based Petrolab, he probably didn't envision that 25 years later his start-up would be one of the UK's key commercial laboratories, offering automated mineralogy.

At the time, many houses in Devon and Cornwall had been built using concrete manufactured from local mine waste - mundic - and the so-called mundic block problem of accelerated concrete degradation was rife.

Petrolab's core business was to screen these concrete materials and as Petrolab's current Director, Principal Consultant and mineralogist, James Strongman says: "Alan's background in mining and geology made him the perfect person to do this."

But times change. Come 2007, Bromley had retired, Strongman was heading up the company, and the global financial crisis was taking its toll on businesses worldwide.

Strongman had recruited new staff but as he points out: "What had been our 'bread and butter', mundic testing of houses for mortgage companies, just disappeared."

Business diversification was the only answer and quickly Strongman and colleagues decided to target the mining industry.

"The financial crisis was a mixed blessing as we had to look at alternative markets we could work in," says Strongman. "We really wanted to push into mining as we could see its future was going towards automated microscopy and mineralogy."

The first step was to secure a solid sample preparation set-up, and thanks to a Regional Development Grant from local government, a commercial thin section laboratory was established.

"We knew we would be working with polished sections and obviously there would be external charges for preparing these samples, so bringing this in-house made sense commercially," says Strongman. "Looking to the future, we also knew that when we eventually established automated microscopy, we would have our own lab to deal with high volumes of samples."

Instrumental to the lab, was an automatic thin section machine pioneered by Denmark-based materials and testing business, Pelcon.

Still used by Petrolab technicians today and crucial to business, the instrument uses fixed, abrasive diamond rollers to produce flat, uniform sections from aggregate, concrete and rock while preserving fine, microscopic detail.

"Making these thin sections is an art, which can take years to accomplish," highlights Strongman. "But with this precision machine, we can have someone making reasonable sections in a few months and excellent sections within a year."

In the months that followed, Petrolab scooped up a lot of business from academic institutions as well as researchers from the Natural History Museum and more. From construction materials to fluid inclusion wafers and mounts for laser ablation, the sample preparation business was booming.

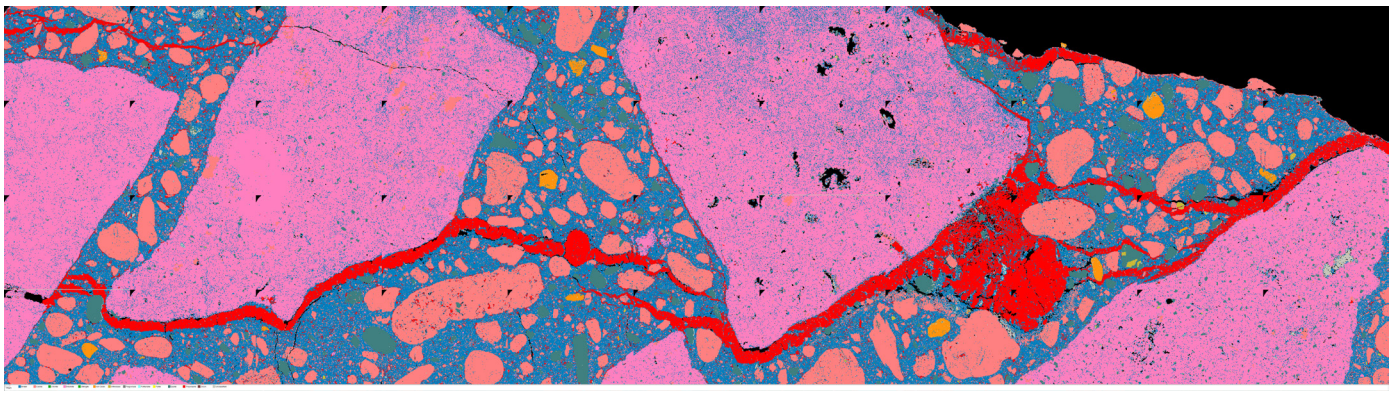
And then Strongman discovered that the nearby University of Plymouth had just set up a new electron microscopy centre, and was soon using the facility's FEG-SEM to image concrete samples and more. Within months, Oxford Instruments' INCAMineral software was added to the SEM, providing automated mineral liberation analysis to boost sample throughput.

But over the next few years, more and more researchers began to use the facilities and Strongman struggled to get the guaranteed SEM time he needed to support his business.

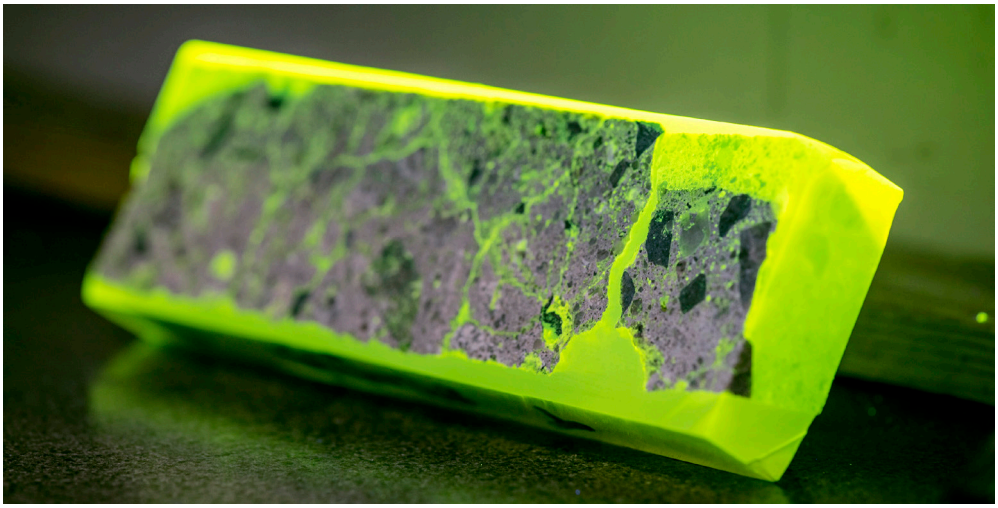
With this in mind, he attended the 2014 Process Mineralogy conference in Cape Town, met up with Carl Zeiss and struck up an industrial collaboration to develop the company's new automated mineralogy platform, Mineralogic Mining.

As he says: "We wrote reporting software to extract data from the platform's database in a way that miners and mineral processors could really use."

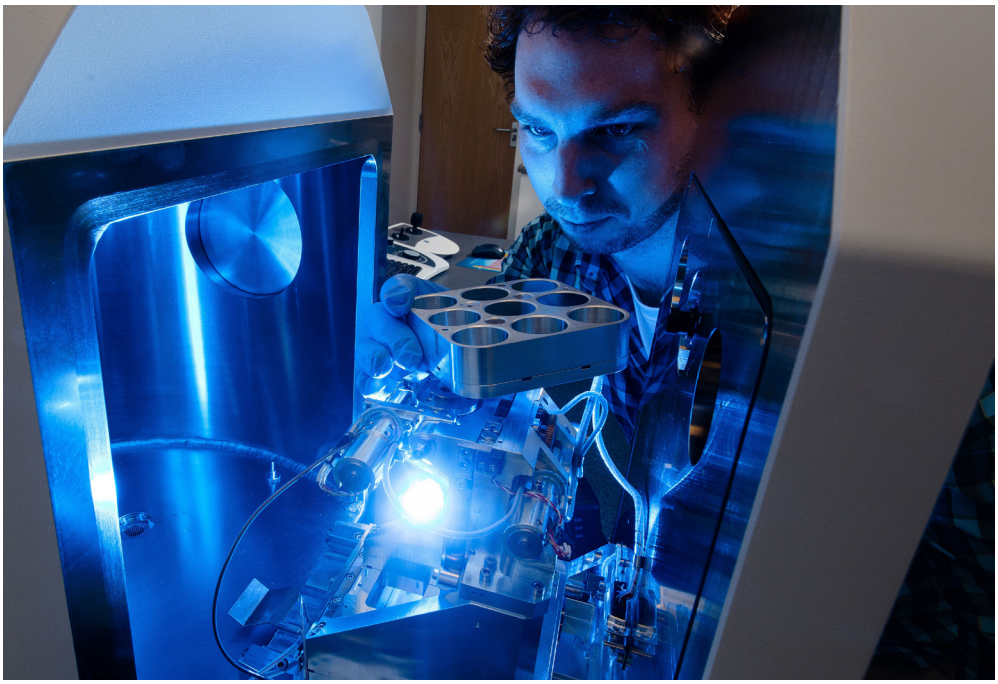
At the same time, Strongman also bought a Zeiss EVO with high throughput automated workflow, which could work with Zeiss's automated mineralogy software while providing a cost-effective alternative to Plymouth



CONCRETE suffering from thaumasite sulphate attack: A montage of false colour field maps from ZEISS Mineralogic analysis



THIN section of concrete bulk impregnated with fluorescent dye to highlight fractures and pores under UV light



PETROLAB director, James Strongman, prepares for an automated mineralogy run; the large sample chamber can accomodate basket ball sized samples

University's FEG-SEM.

"We knew this would perform very long automated mineralogy runs and we opted for a LaB6 filament that lasts for 3000 hours; it never blows, it deteriorates slowly," he adds. "We also chose a very large chamber with variable pressure so we could fit in actual rock and concrete core samples as well as untreated samples."

Come June 2015, Petrolab had its new SEM up and running alongside Mineralogic Mining and Bruker EDS software. And demand for automated mineralogy has been coming in thick and fast from the mining industry and beyond, ever since.

For example, the company is currently carrying out automated mineralogy on core samples from the recently re-opened Devon-based Drakelands Mine, formerly known as Hemerdon Mine. Petrolab intends to optimise operations at the mine, which is home to the world's fourth largest tin-tungsten deposit.

In a separate contract, the company has also been investigating the sulphate attack that has plagued the concrete footings of bridges across the M5 motorway in the West of England.

As Strongman asserts: "Image analysis within Mineralogic allows you to really target what you want to map, reducing sample run-time and making it very cost-effective for us to analyse these samples."

"Crucially, we've adapted the mining software for use in a construction environment which I don't believe has been done before," he adds.

But while automated mineralogy is a growing business for Petrolab, light microscopy still forms the 'bread and butter' of the company's activities.

Using stereoscopic microscopy and then research-grade polarising light microscopes, for transmitted and reflective light microscopy, Strongman and colleagues image as-received cores. These will then be vacuum impregnated with fluorescent resin to detect, for example, fracturing before targeted sectioning.

"The off-cut from this is a very close mirror image of the section, so we often polish that as well so it can be used in the SEM," says Strongman. "Zeiss EVO and Mineralogic can be driven by image navigation so we can, say, take stereographic images and use these to drive the SEM; correlative microscopy is a big thing for us.

New venture

Only weeks ago, Petrolab also unveiled a new venture called iMin Solutions. Joining forces with Australia-based mineralogy and metallurgy consultancy, MinAssist, the partners aim to take automated microscopy to mine-sites around the world.

As the technology partner of iMin Solutions, Zeiss will provide its recently launched portable and rugged MinSCAN automated mineralogy system for use on site. And the team will train mine-site staff how to prepare samples and use Mineralogic to generate mineralogical information on-site. "We'll be equipping a mine to provide the daily analysis that was previously sent off to a laboratory," explains Strongman. "The system will provide very high throughput but we will also provide remote support."

Indeed, remote mineralogy is also where Strongman believes a large slice of Petrolab's future market will lie. "I recently visited Africa's biggest copper mine, in Zambia, to provide an annual review on sample preparation and data analysis," he says. "There's literally hundreds of mines [like this] and this is where we see huge scope for growth.