Q&A

The Drakelands project will be the UK's first new mine for more than 40 years, and it will use ZEISS's Mineralogic Mining automated mineralogy system. **Rhiannon Garth Jones** speaks to **Dr Benjamin Tordoff**, Segment Manager for Mining and Minerals at ZEISS, about the mine and the technology.

FIRST, TELL ME A LITTLE BIT ABOUT THE PROJECT.

Hemerdon is the third-largest tungsten and tin resource in the world and the Drakelands Mine project, based there, will provide a secure supply of tungsten and valuable export revenue for the UK. The project will create more than 200 jobs and pump hundreds of millions of pounds into the Plymouth, Devon and UK economies over the next decade. Its estimated production of 5,000 tonnes per annum of tungsten concentrate and 1,000 tonnes of tin concentrate will mean the £123 million mine will contribute around 3% of global tungsten supply.

WHAT HAS BEEN THE TIMEFRAME FOR THIS PROJECT?

Tungsten was discovered at Hemerdon in 1867 and the deposit was identified as being a large tungsten-tin vein complex in 1916, during exploration for metal resources to contribute to the war effort – it was subsequently used by government agencies in both world wars.

In 1986, after an extensive drilling programme and public enquiry, Amax Exploration UK and Hemerdon Mining and Smelting UK Ltd obtained planning permission to open the mine as an opencast operation working to a depth of 200m. At that time, increased tungsten production by China brought about a considerable reduction in the commodity price and, as a result, the Hemerdon project was placed into care-and-maintenance.

In 2007, the Hemerdon prospect was acquired by Wolf Minerals Ltd, which has taken the project forward. Extensive investigations and a comprehensive feasibility study (published May 2011) confirmed the extent of reserves and Wolf Minerals successfully assembled the finance and equity investment to develop the project, which is fully funded through to positive cash flow.

In March 2015, Wolf Minerals announced a 34% increase in ore reserves for the Hemerdon project, following a successful geotechnical-drilling programme. Consistent with the expansion plans for the project, the drilling programme was designed to better understand the strength of the wall rocks with a view to steepening the final pit slope, resulting in a deeper open pit and increased ore reserves.

HOW WILL THE TUNGSTEN AND TIN BE EXTRACTED?

Most of the valuable tungsten and tin at the Drakelands Mine is found within large granite deposits. The ore extraction will occur through open-pit mining. Ore removed from the pit will be transported to the processing plant, where it will be crushed and ground. Tin and tungsten will be separated from rock using various gravity methods. The equivalent of one truck per day of tungsten and tin concentrates will leave the mine for export to specialist off-takers in Europe and the USA.

WHAT DO YOU ESTIMATE TO BE THE IMPACT OF THIS PROJECT?

Beyond its impact on the local economy, the project is an extremely important asset to the UK, and has received strong support from UK Trade and Industry (UKTI) because of the contribution it will make to the nation's export market.

DRAKELANDS MINE WILL BE THE FIRST TO OPEN IN THE UK IN 40 YEARS, AND IT LOOKS LIKE MORE COULD FOLLOW. DO YOU THINK WE ARE WITNESSING A RESURGENCE IN UK MINING?

It is likely that as the world around us changes, the supply of critical metals causes us to focus on national supply, which may well bring about the development of further mining operations in the UK. As we now live in a globalised society, the viability of a mine is heavily dependent on commodity prices and a detailed scientific understanding of the entire life of the asset. The UK is ideally placed to contribute significantly to these developments.

HOW HAS MINING TECHNOLOGY CHANGED IN THE PAST 40 YEARS?

Mining technology was concerned with improvements to extraction of bulk rock and the recovery of the target resource was optimised through trial and error, with limited prediction or modelling. The advent of computers in the 1970s hugely increased the efficiency of mining operations, allowing modelling to form a major part of a mine plan and bringing intelligent automation to the operation itself.

The development of automated mineralogy in 1978, by Alan Reid and researchers in Australia, and its commercialisation in the mid-1980s, brought significant scientific data to the feasibility and mineral processing segments of the market. This technology complimented metallurgical testwork and improved the accuracy of predictive geometallurgy, which allowed the mining operations to predict the behavior of rocks in the mineral processing circuit with a higher degree of accuracy. The technology also enabled advances in the environmental management of mining operations and which brought about more complete modelling of the mine's life.

DO WE STILL HAVE THE TECHNOLOGY IN THE UK TO DEAL WITH THIS KIND OF OPERATION?

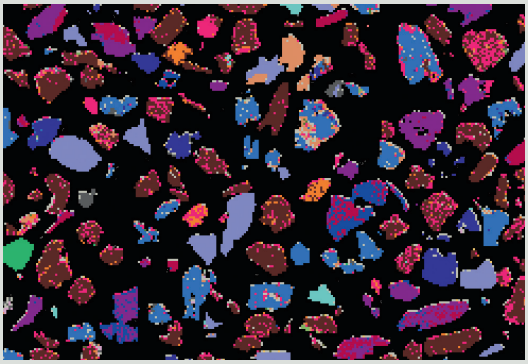
Historically, the UK has been a pioneer in mining technology, with institutes such as Camborne School of Mines and the Royal School of Mines producing leading research and graduates. A mining technology cluster has formed in the southwest of England, encompassing skills covering the entire mining value chain, from exploration through to mineral processing and environmental management. Automated mineralogy technology, key to mining operations, continues to be developed in the UK by ZEISS, in collaboration with groups from the mining technology cluster and academia. The UK mining technology industry is extremely healthy and growing.

HOW DOES THE MINERALOGIC MINING AUTOMATED MINERALOGY SYSTEM WORK?

The system operates by automatically controlling a scanning electron microscope (SEM) and energy dispersive X-ray spectrometer to automatically detect and measure the mineralogy and quantify the geological texture of the sample. Mineralogic Mining uses quantitative EDX to identify minerals in combination with advanced data acquisition, image processing and interpretation. This enables a high degree of accuracy in the data, which gives greater confidence in results.

HOW DOES THIS COMPARE WITH OTHER SIMILAR SYSTEMS?

The combination of quantitative EDX and advanced image processing is new in automated mineralogy and has opened up applications that were previously not well covered (or covered at all) by other automated mineralogy systems. Its ability to quantify texture and correlate results with other imaging and analytical techniques, such as optical microscopy and X-ray microscopy, contributes to this. The benefit is a greater degree of accuracy and a better understanding of the sample, with the ability to ask new questions of samples.



As part of the social license to operate the new mine, the UK Government stipulated that the mine operators should use local skills and employ local experts, where appropriate, to maximise the benefit of the mining operation to the UK economy. Petrolab Ltd, a Cornwall-based mineralogy services business started around 20 years ago by Alan Bromley, the former head of Geology at Camborne School of Mines, will provide automated mineralogy data interpretation services to optimise the mine's operation. A core competence of Petrolab is sample preparation and, having won a grant from the University of Plymouth and a local newspaper, Petrolab has expanded its capability in this area to meet the demand in capacity from the mine.