



# Automated Nikon photo-microscope supports world-leading rock analysis

Computerized PETROG inspection system provides better understanding and faster analysis of rock samples

Founded in 1997 by Dr Barrie Wells and his partner, Mark Gorst, Conwy Valley Systems in North Wales has become a global leader in the supply of computerized photo-microscopy systems for inspection, statistical analysis and classification of rock samples to assist oil and gas exploration.

Known generically as a digital petrography tool and marketed under the trade name, PETROG, the inspection system is powered by a Nikon Eclipse 50iPOL binocular microscope equipped with a DS-series digital camera.

The advance in this branch of technology has been so profound that it has become almost essential for petrophysicists and remote sensing geophysicists to use it for calibrating and ground-truthing their measurements of rock structures.

Rock sample structures are described in a quantitative and unbiased way with a statistical technique called point counting.. A thin section of rock sample is therefore viewed under the microscope to identify a large number of points on the slide, recording exactly what is seen at each point and then assembling a description from all the information recorded. In order to be a statistically valid representation, the number of points that need to be described is typically 300 - 500, a significant task.

The automated point-counting system is a much faster and more accurate alternative to visual microscopy accompanied by manual tick-box recording of results. The user has a much



*The heart of a PETROG system is the low profile, motorised, rotating stepping stage, seen here fitted to the Nikon microscope.*

better understanding of the rock sample, its constituent minerals, oil-bearing capacity and extraction potential. PETROG displays results almost immediately on the screen and has the added advantage of storing all photographic images for future re-analysis, if required.

Another alternative way of testing rock is crushing analysis, which simply calculates the porosity of the sample and hence the amount of oil it could contain, but it gives no indication of how the holes were interconnected and thus how well oil would flow.

The uniqueness of PETROG derives from the invention of a stepping stage which allows the polarizing microscope stage to rotate automatically. Unlike a conventional microscope on which the slide and stage are fixed, apparatus for looking at rock has to view light at different angles through a polarizing filter. Only in this way it is possible to distinguish between different constituents such as feldspar, quartz and clay, hence the need to index the stage in known increments. The system is equally suited to studying samples illuminated episcopically (by reflected light) or diascopically (by transmitted light).

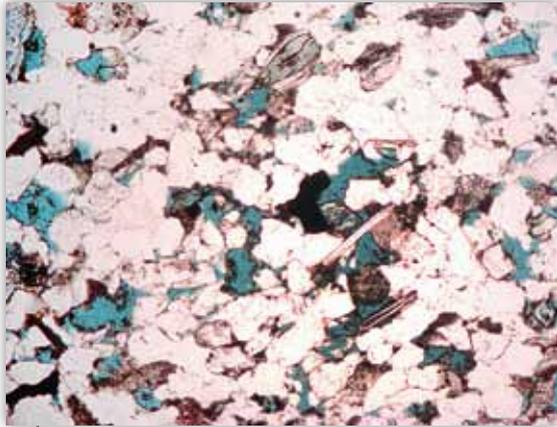
A further application in the energy sector is the analysis of coal samples to assess the quality of a sample. It enables a mine to determine how to blend its output and where it should be sold. For instance, a steel mill is able to use information on the coal's microstructure to calculate how long it will burn at blast furnace temperature, allowing the steelmaking process to be controlled and optimized.



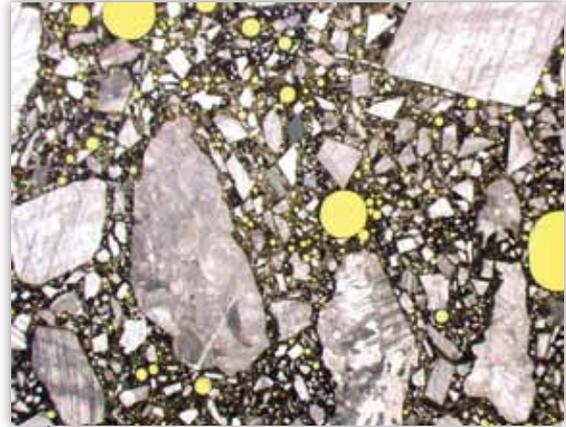
*The PETROG system comprises a Nikon Eclipse 50iPOL binocular microscope fitted with a Nikon Digital Sight DS-Fi2 5-megapixel camera which relays overlapping photographs of the rock sample to a computer for analysis via a Nikon FireWire control unit, DS-U3.*



*The automated point-counting system is a much faster and more accurate alternative to visual microscopy with manual tick-box recording of results.*



*A photo-micrograph of sandstone from an oilfield, with the pores highlighted by the addition of blue dye.*

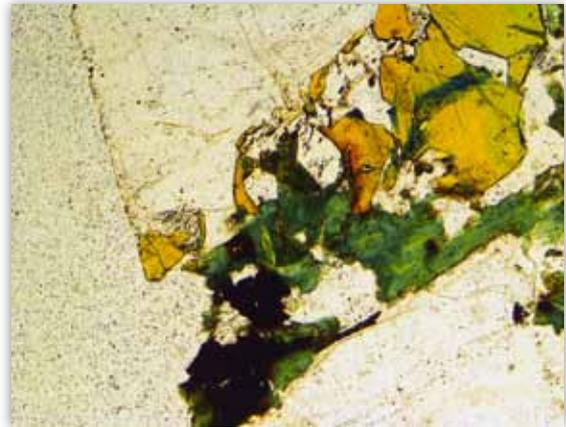


*A photo-micrograph of a concrete sample taken by CEDEX, Spain. The pores appear yellow because the concrete is impregnated with epoxy and a fluorescent dye has been added. The porosity in this sample is quite moderate. The aggregate is limestone, which can be granitic, while the brownish matrix is cement paste. Picture height is 13.6 mm.*

The construction industry also benefits from PETROG, since a sample of man-made concrete can be analyzed as easily as natural rock. It is an important new target market for Conwy Valley Systems. A recent success was the purchase by CEDEX, a Spanish government research agency in Madrid, of the digital petrography tool for monitoring the integrity of civil engineering structures in Spain's built environment, including critical structures such as dams, looking for early warning signs of failure in the concrete structure.

The first application in this sector dates back to 2004, when a PETROG system was installed in Cornwall, UK, to support mortgage providers by checking for a specific impurity in locally made concrete that can potentially cause cracking. The so-called mundic tests are needed because, before 1950, houses in the South West of England were often built with concrete block containing aggregate consisting of copper or lead mine waste which in turn contains sulphides that can oxidize and accelerate degradation.

Conwy Valley Systems won "The Queen's Awards for Enterprise" in the Innovation category in 2011 and has today installations in more than 40 countries. Key to the company's service are the supply and fitting of the stepping stage to the microscope, the digital camera and PETROG software. The latter interfaces with the Nikon digital cameras' control software and enables that images can be captured remotely and embedded for petrographical analysis.



*A polished thin section of rock sample from the Chicxulub meteorite impact site in Mexico, which is suspected of having caused the dinosaurs to die out 65 million years ago. The rock shows the effects of high stress and high temperature alteration.*