ROBERTSON GEO
Unlocking Your GeoData

ROBERTSON GEO:

TRE MORFA

A World Class Calibration and Training Facility

The newly opened Robertson Geo headquarters at Tre Morfa features a purpose-built manufacturing facility, spacious offices and a world-class calibration centre and training hub for the RG Academy®, which will provide certificated training for the benefit of our customers and their clients.

The Need for a New Site and Test Facility

The former Robertson Geo site, at Deganwy, was established in 1979 and served the company well for many years. By 2020 the need for new premises was becoming critical to the company's continued expansion and a search for suitable local premises commenced. While Conwy is somewhat of a UK hotspot for geoscience companies, availability of commercial premises of a suitable size in the area was limited.

The need for the new site was driven by the continuing expansion of both sales and services, with personnel numbers and revenues predicted to continue increasing into the foreseeable future. Specific requirements for the site included the development of two boreholes for calibration, conformance testing and training purposes. All Robertson Geo products sold are rigorously calibrated, borehole tested, and conformance certified before despatch, requiring borehole access. The new premises also needed to accommodate the RG Academy® training facility where hands-on borehole training is an important component. With two boreholes, both conformance testing and training could be conducted simultaneously.

Further benefits of the new Tre Morfa site include increased productivity through ergonomic workspace design and better facilities for higher-quality work with new machinery and tooling. The benefits of the open-plan workspace allow for increased collaboration between departments, faster communications and stronger working relationships. All these facilities will directly or indirectly benefit our customers.

Rotary core drilling at Tre Morfa.

Borehole Specification and Drilling

The geology of North Wales and especially around Tre Morfa is extremely variable and the history of drilling in the local area was mostly confined to relatively shallow boreholes. Therefore it was difficult to predict the geology that would be encountered when drilling deeper, potentially to 200mbgl. The drilling specifications for the boreholes were detailed for the borehole construction, but the final depths could only be decided based on the depth where suitable geology could be found.

A rotary core drilling method was selected to produce the best possible quality of borehole for geophysical testing purposes as this drilling method requires careful drilling practices for good core recovery. More pertinently, this method also produces the smoothest borehole walls with low rugosity and low disturbance, the best possible conditions for high quality geophysical logs. Geobor S was used to drill the open hole with a nominal borehole diameter of 146mm with 102mm cores.

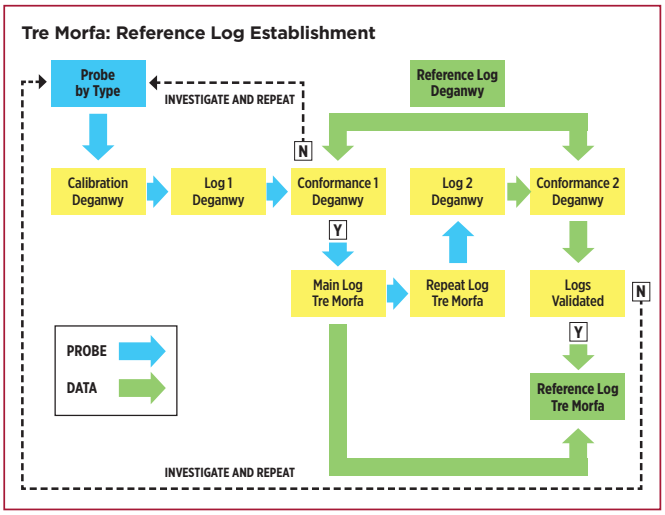
The main borehole TM1, angled at 5° from vertical, was required for probe conformance testing and was drilled first to establish the depth of the "rockhead" below the overlying glacial and later deposits. Drilling then continued until a sufficient section of open borehole in competent rock was found. The TM1 borehole design also required a steel cased grouted section at the top and a steel cased "free pipe" section. These sections were to be used for testing sonic probes and casing collar locator functions. The shallower vertical secondary borehole - TM2, was designed to be free of all steel, with PVC casing from surface to TD, to allow for NMR probe testing and for training where TM1 was not available.

Expert rotary core drillers, Structural Soils Ltd, a long standing client and customer of Robertson Geo, were selected to undertake the drilling. The drilling commenced in November 2024 and continued through to January 2025. Competent rock (rockhead) was found around 26m depth and was determined to be mudstone, which ran all the way to the final TD around 178m. The borehole was steel cased from surface to 26m and included a section of free pipe. The secondary borehole - TM2, was then core drilled to around 60m and cased from surface to 60m with PVC.

Core recovery of the mudstone found throughout both boreholes was excellent and the mudstone exhibited many physical features (bedding and fractures) making it suitable for televiewer logging. Variations in the geophysical properties of the boreholes meant reference logs for all geophysical probes could be readily produced.

Establishing the New Test Facility

The existing building at Tre Morfa, at time of purchase, met all the desired criteria in terms of location, size and modernity. A full refit of the entire premises was however required to configure the office space for manufacturing, development, sales, services and a secure packing area. In addition three outbuildings had to be constructed, one for the borehole testing and calibration centre, another to house the pressure, heat and cold probe testing equipment and thirdly one for a radioactive source store. A crane was also installed to provide probe ingress to the two boreholes for longer and heavier probes. Health and safety requirements for all these new facilities where drawn up in advance to ensure the construction of a safe working environment.



Process to establish reference logs at Tre Morfa for all probe types.

Calibrating the Borehole

The probe calibration model used by Robertson Geo describes a vital process, traceable under an ISO9001 framework, which comprises precision, repeatability, accuracy and a real world borehole test. The reference logs obtained from the TM1 borehole will continue to contribute toward guaranteeing the accuracy and repeatability of data from Robertson Geo probes.

RG Academy® training at Tre Morfa.

The Deganwy borehole had calibrations carried in from established industry reference sites in Hungary and Australia from which "reference logs" were generated. Every Robertson Geo probe manufactured, repaired, rented or serviced undergoes calibration, conformance testing and borehole testing against established "reference logs". Over 45 years, thousands of probe logs have been compared to the reference and only if within an acceptable tolerance is a conformity certificate issued. This is an essential requirement for customer confidence in quantitative measurements obtained with Robertson Geo probes.

The challenge was to faithfully carry the reference logs for all probes from the Deganwy borehole to the TM1 borehole at Tre Morfa. To achieve this a multi-part process was designed to establish accurate reference logs at Tre Morfa (as shown in the diagram). In all cases the time between each stage was kept to a minimum. Using this methodology, reference logs for all probe types were successfully established at Tre Morfa.

Training and the RG Academy®

The RG Academy® has been developed to ensure that world class training is available to all customers, whether sales or rental, so they can confidently achieve the high data quality that their clients expect.

Based at Tre Morfa, the RG Academy® has been set up by Robertson Geo as a centre of excellence for training and quality control. With state-of-the-art classroom facilities and permanent access to boreholes for training, large client groups can be accommodated. Uniquely, all training is conducted by experienced logging engineers who are still actively logging in the field for Robertson Geo Services (RGS), ensuring all information provided reflects the latest and best industry practice.

Training will be provided for all Robertson Geo equipment as well as on all aspects of operations, acquisition, safety and data processing. Training resources are developed in modules, allowing the overall training package to be tailored to the customers equipment and engineers' experience. Training is available for all sales and rental customers, either at Tre Morfa or at a customer's chosen location, anywhere worldwide.

Geophysical borehole logging is essentially a data business and the certified engineer training can demonstrate to potential clients that engineers have been trained to the highest standards of operations, data acquisition, safety and processing.

Core Analyses by Rockwash and Petrostrat

The Tre Morfa borehole cores presented an opportunity to supplement data from Robertson Geo's own geophysical logs with further geological analyses. These analyses could then potentially be used to investigate correlations with geophysical logs.

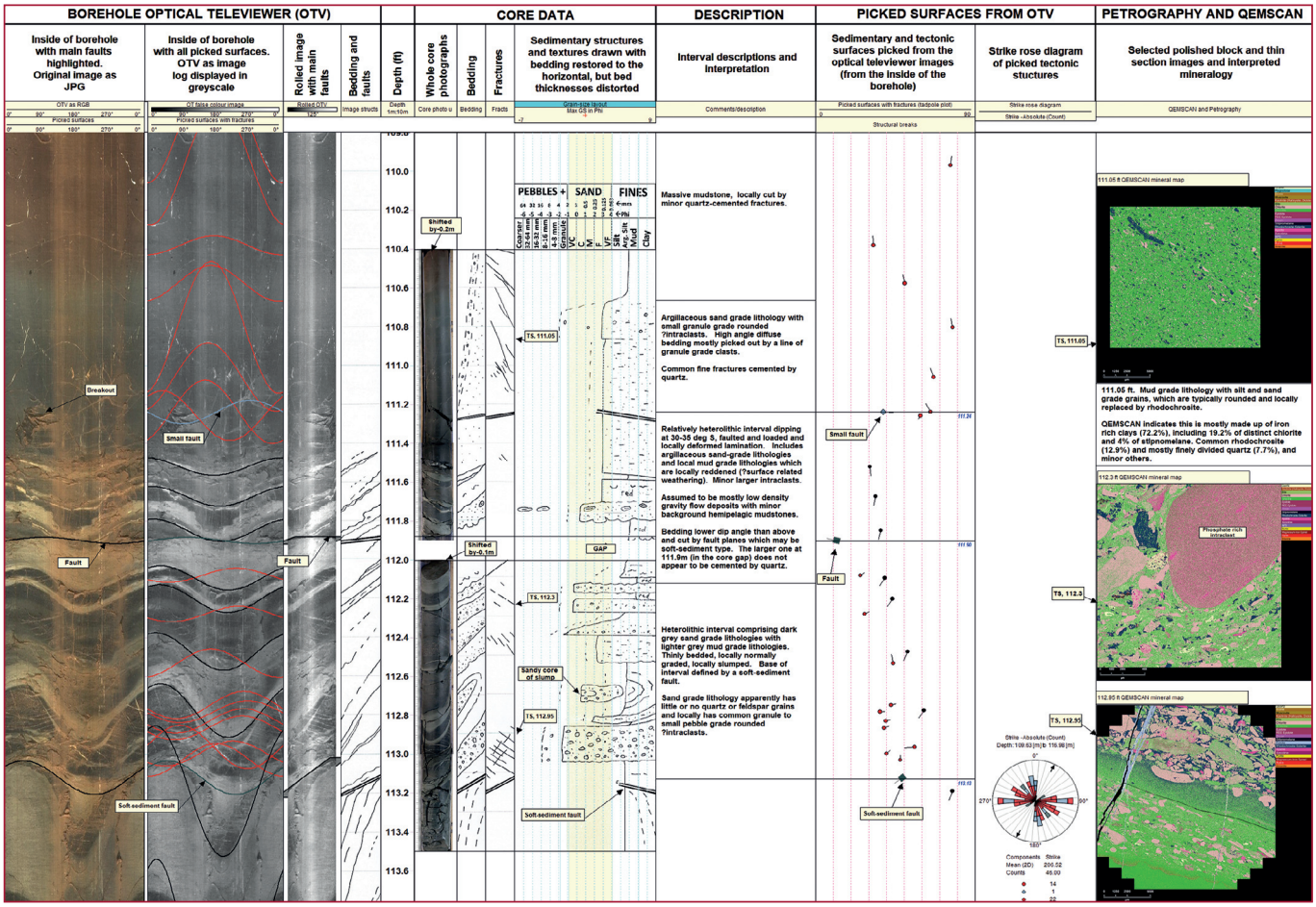
Rockwash are a local company specialising in sample preparation and analysis of cuttings and core samples, typically for the petroleum industry. Douglas Langton, Director of Rockwash, was contacted and Rockwash were subsequently contracted to provide photographs of the entire core sample and to provide XRF (X-Ray Fluorescence) and XRD (X-Ray Diffraction) analyses.

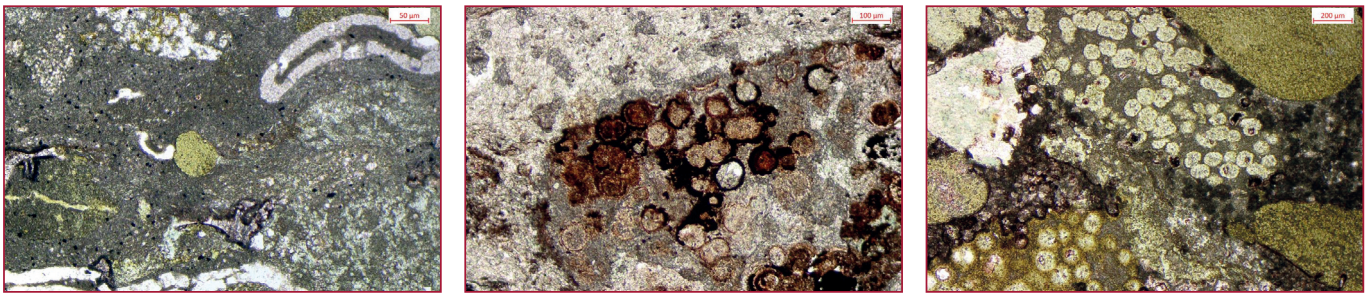
The core photographs would be useful for comparison with the unwrapped borehole wall images derived from televiewer logging, highlighting the relative speed and simplicity of televiewer logging to determine bedding and fracture orientation information.

The XRF analysis was conducted to measure the elemental constitution of small core samples at regular intervals. XRD analysis is a technique used to determine the atomic structure of crystalline materials, in this case to determine the mineralogy of discreet samples.

Rockwash also introduced Robertson Geo to some eminent local geologists who had expressed interest in the cores we had obtained, as deep cores

Core and borehole image log data, courtesy of Petrostrat Ltd.





Thin section micrographs showing potential bioclasts and trilobite fragments, courtesy of Petrostrat Ltd.

from the local area are relatively rare. The geologists were invited to view the core samples, providing insights on the cores themselves and their relation to the local geology.

Through Rockwash, Robertson Geo were introduced to another local company Petrostrat, who specialise in biostratigraphy and sedimentology, mainly for the petroleum industry. A mutually beneficial arrangement was made with Petrostrat whereby, in return for providing sections of core for training purposes, Petrostrat provided Robertson Geo with SEM and QEMSCAN microscopy and petrographic and palynologic analyses.

Geology of the Tre Morfa Borehole

The complex geology of Wales has historical significance as work here by 19th century geologists led to the definition of four ancient periods of geological time, Precambrian, Cambrian, Ordovician and Silurian. News of the drilling at Tre Morfa, when mudstone was confirmed, attracted the interest of eminent local geologists as it presented a rare opportunity to examine deep core samples from these ancient periods.

A group of local geologists were invited to examine the core samples and preliminary data derived from the borehole and cores. The consensus agreement was that the mudstone in the borehole was likely to be of late Ordovician origin circa 450mya. However, attempts to accurately date the mudstone by examination of organic fossil remains in the rocks were inconclusive due to temperatures associated with later mild metamorphosis of the mudstone (> 200°C). Structures resembling trilobite fragments were identified, but their state of preservation was poor, frustrating a definitive date confirmation. Work on these materials by specialists continues with appropriate expertise from local companies co-operating to develop an understanding of the geology of the borehole and rocks of the district.

The drill-core comprises rocks which are variable in colour and texture, mostly reddish with abundant hematite near to the rockhead and grey-blue at depth. The red colour is attributed to a long period of weathering during the Triassic period when eroding rocks were subjected to desert conditions. Bedding in these rocks is not immediately obvious, but regular debris flows with intraclasts and weathered material up to centimetre scale are interposed with structureless mudstones. Due to their orogenic alteration, bedding is consistently very steep and intensive faulting is observed with infill of quartz, carbonates and minor sulphides.

During the Ordovician the area that we call North Wales was situated within a marine basin on faulted crust that was part of the Avalonia micro-continent on the northern edge of Gondwana. At the time, Avalonia was at high latitudes in the southern hemisphere, but moving northwards as the Iapetus Ocean was subducted below Laurentia. The sediments which accumulated in the basin were mostly fine-grained muds, but periodically there were inputs of sand and coarser debris flows from the shallower margins in the form of turbidity currents and occasionally there were major slumps which destroyed the layered structure of the earlier deposits. In the later Ordovician period an island arc was built and volcanic effusions introduced tuffs and volcaniclastic materials to the basin. From the mid-Silurian period there was continental collision with Laurentia and the basin was inverted, with uplift and deformation during the Caledonian Orogeny. The orogenic legacy that is exposed today comprises folded, faulted and cleaved rocks which include the famous deposits of slate.

Local geologists expressed great interest in the ancient cores.

Conclusions and Further Work

The geology found in the Tre Morfa borehole contains ample geological and structural variation to produce good reference geophysical logs across the probe suite, fulfilling the primary requirement of the borehole. Such was the local interest in the borehole geology that suggestions for further work on the core samples were forthcoming from the local geologists, including further research and the potential for publishing academic papers.

We would like to thank everyone who has participated in the successful establishment of the borehole testing and training facilities including:

- **Structural Soils Ltd** for the successful drilling operations
- **Douglas Langton** and **Rockwash**: core photography, XRF and XRD analysis
- **Peter Lucas et al** from **Petrostrat**: core description, petrography, SEM and palynology
- **Jonathan Wilkins** *(Chemist/Mineralogist)*: microscopy sections and geological insights

Eminent local geologists and specialists for their observations and insights including:

- **Patrick Barnard** *(Chemist/Mineralogist)* Geoscience Wales
- **Andrew Barnwell** *(Geologist)* Barnwell Parker Geoscience
- **Sarah Parker** *(Geophysicist)* Barnwell Parker Geoscience
- **Stephan Cornfield** *(Geophysicist)*
- **Jim Harris** *(Sedimentologist)*