PHASE 2 INITIAL BOREHOLE DRILLING AND TESTING, SOUTH BRUCE

WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH01

APM-REP-01332-0321 **November 2023**

Geofirma Engineering

nwmo
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Phase 2 Initial Borehole Drilling and Testing, South Bruce

WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH01

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Revision Tracking Table

Revision	Revision Release Date	Description of Modifications/Edits
R0	March 3, 2023	Final release with NWMO comments addressed
R1	June 6, 2023	Re-release of report with additional sample and conclusions section
R2	June 19, 2023	Re-release with updated appendices including an updated pyrogram for SB_BH01_OG019
R3	September 8, 2023	Re-release with updates to Figure 2, Appendix, Reference List, and more detail added to Section 3.2 and Section 4.2
R4	November 1, 2023	Re-release with minor changes to for clarification in Introduction and updated colours in figures 2-7.

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1 INTRODUCTION

Geofirma Engineering Ltd. (Geofirma) was retained by the Nuclear Waste Management Organization (NWMO) to complete a drilling and testing program for two deep bedrock boreholes (SB_BH01 & SB_BH02) as part of the NWMO's Phase 2 Geoscientific Preliminary Field Investigations. The full scope of the drilling and testing program for SB_BH01 is described in the Initial Borehole Characterization Plan.

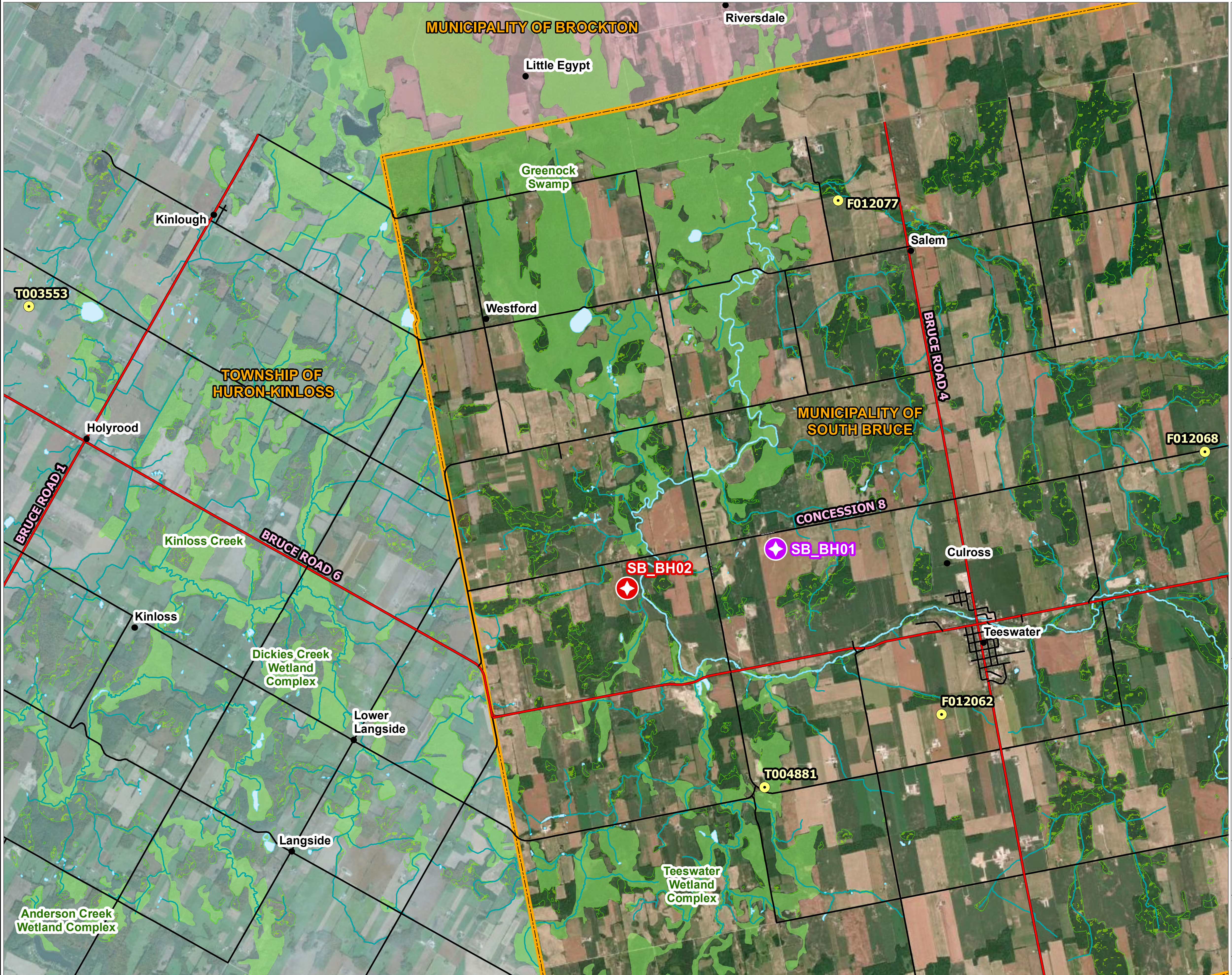
Borehole SB_BH01 is located approximately 3.5 km northwest of the community of Teeswater, Ontario (see Figure 1) and was drilled to 880.84 m below ground surface (m BGS). SB_BH01 was drilled through the entire sedimentary bedrock sequence to approximately 20 m into the Precambrian basement.

The purpose of this study is to provide geoscientific data that can be used to do a preliminary assessment of:

1) the quantity of organic matter present in core samples obtained from selected formations encountered by borehole SB_BH01; and

2) a preliminary assessment of the thermal maturity of the kerogen and clay mineralogy of several formations at the South Bruce Site.

Figure 1: Location of SB_BH01 (following page).



LEGEND

- SB_BH01 Drill Site
- SB_BH02 Drill Site
- Municipality of South Bruce
- Municipality of Brockton
- Township of Huron-Kinloss
- Provincially Significant Wetland
- Wetland
- Waterbody
- Watercourse
- Major Road
- Local / Street
- OGSRL Well Locations

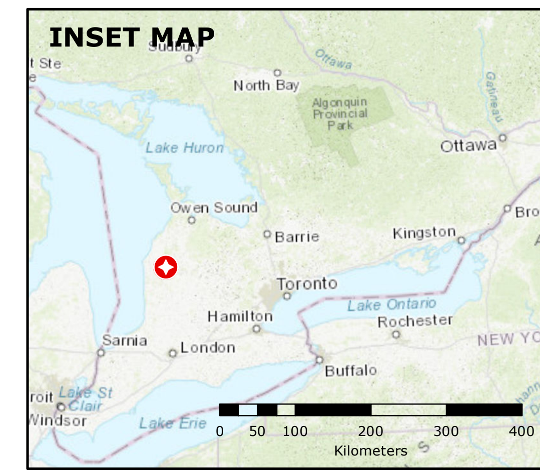


Figure 1
Location of SB_BH02 Drill Site

Scale 1:60,000

0 500 1,000 2,000 3,000 4,000
Meters

N

Projection: NAD 1983 UTM Zone 17N

Source: NWMO, Ontario GeoBase

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster

PROJECT No. 20-211-1

NWMO South Bruce
Drilling and Testing

DESIGN: ADG
CAD/GIS: ADG
CHECK: SNS
REV: 1

GEOFIRMA ENGINEERING

DATE: 2022-11-08

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2 BACKGROUND INFORMATION

2.1 Geologic Setting

The borehole SB_BH01 encountered a sequence of Paleozoic-aged strata that were deposited in the Michigan Basin northwest of the Algonquin Arch in Southwestern Ontario. The Michigan Basin is a circular-shaped cratonic basin that is composed primarily of shallow marine carbonates, evaporites, and shales that were deposited while eastern North America was in tropical latitudes during the Paleozoic Era (Armstrong and Carter, 2010). West of the Algonquin Arch, strata from the Michigan Basin tend to gradually dip westward into the Michigan Basin. Borehole SB_BH01 was drilled through the entire Paleozoic sequence to approximately 20 m into the Precambrian basement, which is composed of high-grade metamorphic rocks of the Grenville Province.

2.2 Technical Objectives

The objective of Work Package 04G (WP04G) is to determine the amount of organic matter and the preliminary quality of the kerogen content of selected formations in the South Bruce Site. This was accomplished through a preliminary assessment of geochemical parameters that characterize the thermal maturity of the sedimentary organic carbon or kerogen and clay mineralogy of several formations. Laboratory testing included total organic carbon (TOC) analysis, reservoir pyrolysis testing by Rock-Eval analysis, and combined whole rock mineral analysis with clay fraction analysis by X-ray diffraction (XRD).

2.3 Description of Testing Procedures

Core Laboratories Canada Ltd. conducted three tests on each of the samples to measure total organic content, hydrocarbon contents, and mineralogy to determine the hydrogen, oxygen, and production indices and kerogen types. Table 1 summarizes the completed tests, testing equipment and methods, and resultant test result parameters. S1 defines the acronyms for test and result parameters.

Table 1: Summary of Tests, Testing Equipment and Test Result Parameters

Test	Testing Equipment	Test Result Parameters
Total Organic Carbon	LECO-SC-632 Analyser	TOC in wt.%
Reservoir Pyrolysis	Rock-Eval 6 Instrumentation	S1, S2, S3 contents in mg/g Tmax in °C Calculated HI, OI and PI Kerogen type
Whole Rock and Clay Mineralogy by XRD	Scintag® Automated Powder Diffractometer	Whole Rock and Clay Fraction Mineralogy in %

Table 2: Summary of Measured and Calculated Parameters

Acronym	Definition
HI	Hydrogen Index: a parameter calculated from S2 and TOC that is used to characterize the origin of organic matter, reported in mg of hydrocarbons per gram of rock
OI	Oxygen Index: a parameter calculated from S3 and TOC that is correlated with the ratio of O to C, used to characterize the origin of organic matter, reported in mg of CO_2 per gram of rock
PI	Production Index: a unitless indicator of thermal maturity calculated using S1 and S2
S1	The amount of free/adsorbed hydrocarbons (gas and oil) in a sample, reported in milligrams of hydrocarbons per gram of rock
S2	The amount of hydrocarbons generated through thermal cracking of non-volatile organic matter, reported in milligrams of hydrocarbons per gram of rock
S3	The amount of CO_2 produced during pyrolysis of kerogen, reported in milligrams of CO_2 and CO per gram of rock
Tmax	The temperature at which the peak of S2 occurs, reported in degrees Celsius (°C)
TOC	Total organic carbon, reported in weight percentage (wt.%)

A total of 14 core samples, with a minimum core length of 10 cm, preserved with plastic film wrap within a vacuum-sealed polyethylene bag contained within a vacuum-sealed aluminum foil bag, were forwarded in coolers under chain of custody procedures to Core Laboratories in Calgary. Core sampling, preservation, handling, and shipment procedures for all core samples provided to Core Laboratories Canada Ltd. for use are fully described in WP03 Data Report: Geological and Geotechnical Core Logging, Photography, and Sampling for SB_BH01 (Geofirma Engineering Ltd., 2022).

A complete list of samples and their locations in SB_BH01 is presented in Figure 2 and Table 3. It should be noted that SB_BH01_OG010 was collected during WP03 as a sample of the Collingwood Member of the Cobourg Formation, which was revised to the Blue Mountain Formation during WP10 activities. Data reported herein uses the final formation picks from WP10: Data Integration. Lithologies listed herein are as logged at the time of sample collection during WP03 activities and it is possible that they do not reflect the lithology as indicated by XRD mineralogy results (see Section 3.2).

Table 3: Sample Locations and Formation Picks in SB_BH01 Core.

Sample ID	Top Depth (mBGS)	Bottom Depth (mBGS)	Formation (WP03)	Formation (WP10)	Lithology (WP03)
SB_BH01_OG002	89.38	89.41	Bois Blanc	Bois Blanc	Limestone
SB_BH01_OG003	289.94	289.97	Salina A1 Carbonate	Salina A1 Unit Carbonate	Limestone
SB_BH01_OG004	341.59	341.62	Goat Island	Goat Island	Limestone
SB_BH01_OG007	474.13	474.16	Queenston	Queenston	Shale
SB_BH01_OG008	534.56	534.59	Georgian Bay	Georgian Bay	Shale
SB_BH01_OG009	633.27	633.30	Blue Mountain	Blue Mountain	Shale
SB_BH01_OG010	641.98	642.01	Cobourg (Collingwood)	Blue Mountain	Shale
SB_BH01_OG019	645.78	645.79	Collected after WP03 completion	Cobourg (Collingwood)	Collected after WP03 completion
SB_BH01_OG012	686.08	686.11	Cobourg (Lower)	Cobourg (Lower)	Limestone
SB_BH01_OG013	716.13	716.16	Sherman Fall	Sherman Fall	Limestone
SB_BH01_OG014	746.18	746.21	Kirkfield	Kirkfield	Limestone
SB_BH01_OG016	797.62	797.65	Coboconk	Coboconk	Limestone
SB_BH01_OG017	824.72	824.76	Gull River	Gull River	Limestone
SB_BH01_OG018	857.52	857.56	Shadow Lake	Shadow Lake	Shale

2.4 Test Apparatus and Procedures

2.4.1 Total Organic Carbon

The core was pulverized and passed through a 40-mesh sieve. Between 20 and 200 mg of pulverized rock was accurately weighed into a Pyrex beaker and reacted with concentrated 6N HCl to dissolve carbonate minerals. Once the reaction was complete, the sample was transferred to a microfiber filter paper using a Millipore filter apparatus and rinsed free of acid using distilled water with vacuum assist. The filter paper with the sample, was then transferred to a LECO crucible and dried. Accelerator was added and the sample was combusted in a LECO model SC-632 combustion furnace at ~1400 °C. CO_2 generated by the combustion of organic matter (OM) in the sample was then measured using an infrared detector.

2.4.2 Rock-Eval Pyrolysis

Samples were pulverized to ~100 µm size. The 60 to 100 mg samples of ground core were then placed into the Rock-Eval crucibles, which were then loaded within an auto sampler into the oven where they were purged. Each sample was then raised into a 150ºC oven for 10 minutes to elute free hydrocarbons (the S1 peak). The oven was then ramped at 25ºC/minute up to 600ºC to crack non-volatile organic matter (S2 peak). CO_2 issued from kerogen cracking was collected and quantified from 300ºC to 390ºC during cooling of the sample giving the S3 peak. S1, S2, and Tmax values are determined with a flame ionization detector (FID) while S3 was measured with a thermal conductivity detector (TCD).

More detailed descriptions of Rock-Eval pyrolysis testing are given by Carvajal-Ortiz and Gentzis (2015, 2018) and Lafargue et al. (1998).

2.4.3 Whole Rock and Clay Mineralogy by XRD

Whole rock X-ray diffraction (XRD) analysis was performed first to permit a reference for the subsequent clay fraction (<4 µm) analysis. The clay fractions were separated from the cores by milling the cores and soaking the resulting powders in purified water, sonicating and decanting the clay fraction after timed sedimentation. The decanted suspensions containing the clay fraction were then passed through a 0.4 µm filter. The suspension was then placed on a glass slide, allowed to dry at room temperature, placed in a desiccator with ethylene glycol, evacuated for 15-30 minutes, and left to saturate overnight. The samples were examined by XRD immediately after retrieving them from the desiccator. Finally, the glycolated samples were heated at 400 ºC and at 550 ºC for 1-2 hours and examined by XRD after each treatment.

XRD analyses of the samples were performed utilizing a Scintag® automated powder diffractometer equipped with a copper source (40kV, 40mA). The whole rock samples were analyzed over an angular range of 2-60 degrees 2θ at a scan rate of one degree per minute. The glycol-solvated clay-fraction mounts were analyzed over an angular range of 2-50 degrees 2θ at a rate of 1.5 degrees per minute.

2.5 Procedures for Analysis of Data

Some of the data collected through the testing procedures described above required further processing, which was done by Core Laboratories Canada Ltd.

2.5.1 Total Organic Carbon

Measured CO_2 (in wt.%) produced by the combustion of organic matter in a demineralized sample is taken as the total organic content of that sample.

2.5.2 Measured Rock-Eval Pyrolysis Parameters – S1, S2, S3 and Tmax

Rock-eval pyrolysis determines four parameters: the amount of free hydrocarbons (gas and oil) in a sample (S1), the amount of hydrocarbons generated through thermal cracking of non-volatile organic matter (S2), the amount of CO_2 and CO produced during pyrolysis of kerogen (S3), and the temperature at which the peak of S2 occurs (Tmax). S1 values greater than 1 mg/g can be indicative of oil showings (Carvajal-Ortiz and Gentzis, 2015), S2 is a quantified indication of the potential of producing hydrocarbons through continued burial and maturation, and S3 is indicator of the amount of oxygen within the kerogen. These parameters are then used to determine hydrogen, oxygen, and production indices.

2.5.3 Calculated Indices: HI, OI, and PI

The Hydrogen Index (HI), the Oxygen Index (OI), and the Production Index (PI) are parameters calculated using the TOC (wt. %), S1 (mg HC/g), S2 (mg HC/g), and S3 (mg CO_2/g) values using the following respective formulas:

Hydrogen Index

$$HI = \frac{100 \times S2}{TOC}$$

Oxygen Index

$$OI = \frac{100 \times S3}{TOC}$$

Production Index

$$PI = \frac{S1}{S1 + S2}$$

2.5.4 Whole Rock and Clay Mineralogy

Semi-quantitative determinations of whole-rock and phyllosilicate mineral amounts were done using Core Laboratories proprietary reference intensity ratios developed by R.C. Reynolds. The total clay mineral (including mica) abundance of each sample was determined from the whole-rock XRD patterns using combined {00l} and {hkl} clay mineral reflections and suitable empirical RIR factors. Clay fraction analyzes focus on illite/smectite, illite and associated sheet silicates, kaolinite, and chlorite fraction determinations.

Determinations of mixed-layer clay ordering and expandability are done by comparing experimental diffraction data from the glycol-solvated clay mineral aggregates with simulated one-dimensional diffraction profiles generated using the program NEWMOD written by R.C. Reynolds of Core Laboratories.

3 LABORATORY RESULTS

All laboratory results for source rock analysis and mineralogy reported herein are provided by Core Laboratories Canada Ltd. Complete results provided by the lab, including data presented in tables and figures, are provided in the appendix.

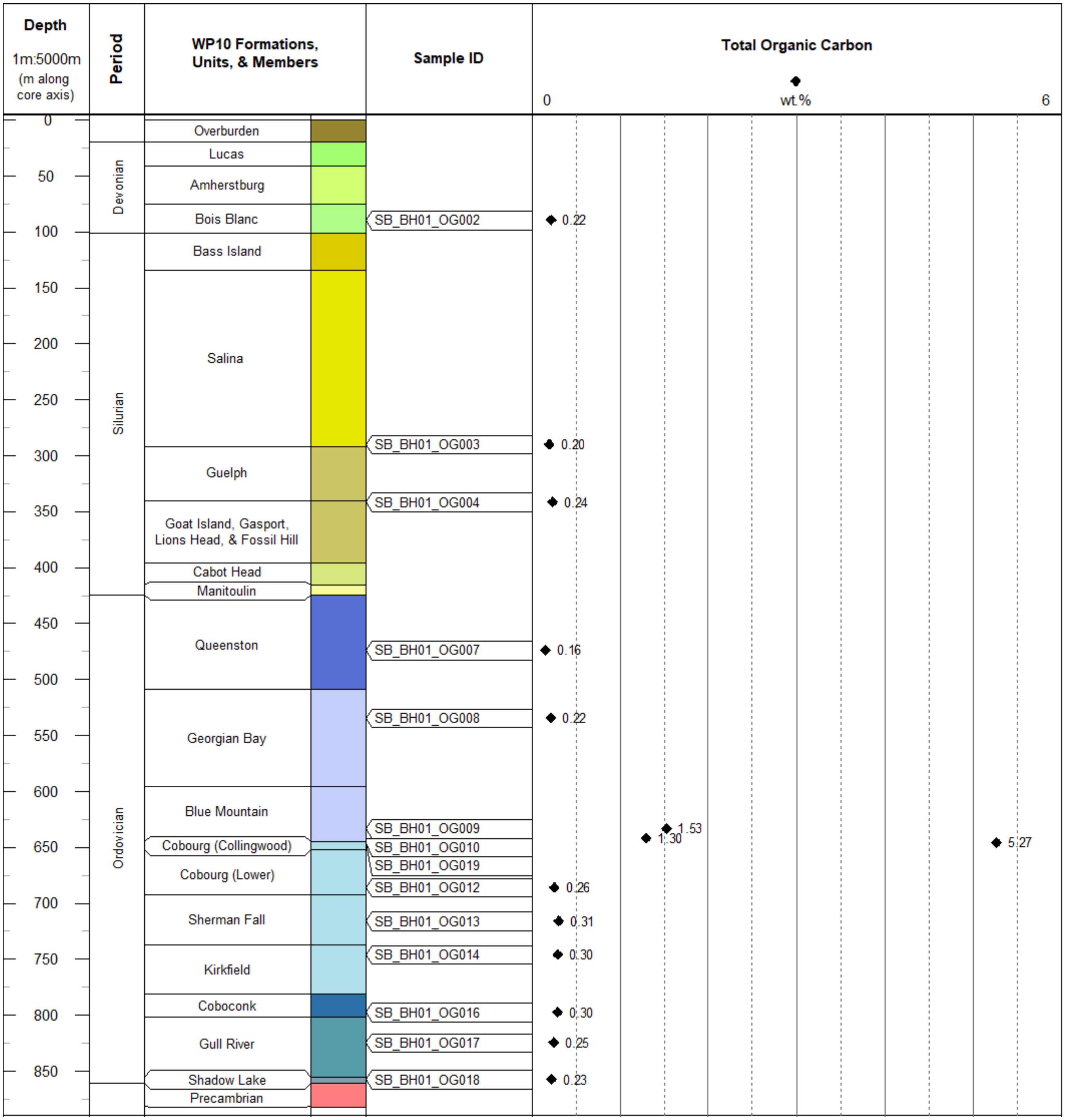

Figure 2: Logged Lithology and Total Organic Carbon Contents of SB_BH01 Core Samples.

3.1 Measured Total Organic Carbon and Rock-Eval Pyrolysis Parameters

All 14 samples have total organic carbon (TOC) contents of less than 5.3 weight percent (wt. %). Samples from the Blue Mountain Formation yield 1.30% and 1.53% TOC and the TOC content is 5.27% for the Cobourg Formation's Collingwood Member. All other samples yield TOC contents less than one (1) wt.%. TOC values for each sample are presented in Figure 2 and Table 4.

Table 4: Pyrolysis Results for SB_BH01 Core Samples.

Sample ID	Formation, lithology	TOC (wt. %)	S1 (mg HC/g)	S2 (mg HC/g)	S3 (mg CO_2/g)	S3 (mg CO/g)	Tmax (°C)
SB_BH01_OG002	Bois Blanc, limestone	0.22	0.02	0.19	0.09	0.02	440
SB_BH01_OG003	Salina A1 Carbonate, limestone	0.20	0.01	0.14	0.03	0.00	435
SB_BH01_OG004	Goat Island, limestone	0.24	0.02	0.26	0.07	0.01	441
SB_BH01_OG007	Queenston, shale	0.16	0.00	0.05	0.78	0.00	486
SB_BH01_OG008	Georgian Bay, shale	0.22	0.01	0.10	0.30	0.00	437
SB_BH01_OG009	Blue Mountain, shale	1.53	0.70	5.29	0.23	0.01	438
SB_BH01_OG010	Blue Mountain, shale	1.30	0.56	3.97	0.24	0.05	442
SB_BH01_OG019	Cobourg (Collingwood)	5.27	2.23	31.87	0.28	0.12	443
SB_BH01_OG012	Cobourg (Lower), limestone	0.26	0.04	0.32	0.39	0.01	439
SB_BH01_OG013	Sherman Fall, limestone	0.31	0.03	0.28	0.93	0.01	436
SB_BH01_OG014	Kirkfield, limestone	0.30	0.03	0.24	0.69	0.01	439
SB_BH01_OG016	Coboconk, limestone	0.30	0.06	0.43	0.03	0.01	440
SB_BH01_OG017	Gull River, limestone	0.25	0.03	0.18	0.27	0.01	437
SB_BH01_OG018	Shadow Lake, shale	0.23	0.01	0.08	0.47	0.00	424

Note: Lithologies are as logged at the time of sample collection during WP03 activities. Sample SB_BH01_OG019 was collected after completion of WP03. HC = hydrocarbons.

Four primary parameters of source-rock evaluation were measured for all 14 samples: S1, S2, S3, and Tmax (see Table 4). Pyrograms (plots depicting the progression of pyrolysis) from which the parameters are derived for each sample are provided in the appendix. S1 and S2 values for all samples are proportional to the respective total organic carbon contents. The amount of free hydrocarbons (S1) is less than 1 mg/g for all samples except for SB_BH01_OG019 (Figure 3). The amount of hydrocarbons generated through thermal cracking (S2) is below 1 mg of hydrocarbons (HC) per g of rock for most samples. Blue Mountain Formation samples (SB_BH01_OG009 and SB_BH01_010) yield slightly higher values of 5.29 mg/g and 3.97 mg/g, respectively and the Collingwood Member sample yield the highest S2 value of 31.87 mg/g The amounts of CO_2 and CO produced during thermal cracking (S3) are all less than 1 mg/g. The temperature at which maximum hydrocarbon release occurs (Tmax; S2 peak) for each sample ranged from 424 to 486 °C.

Results from samples with low total organic carbon contents should be considered carefully since the contents of all samples are low and some near the detection limits of the testing equipment. The detection limit for the LECO device used herein, though variable, is commonly about 0.02 wt.% for shale samples. As low total organic contents near the detection limits of the equipment, the uncertainty of the measurement increases. Not only is the measure of organic carbon content less precise (i.e., greater associated uncertainty), all measured products of pyrolysis (S1, S2, S3, and Tmax) will also have larger associated uncertainties.

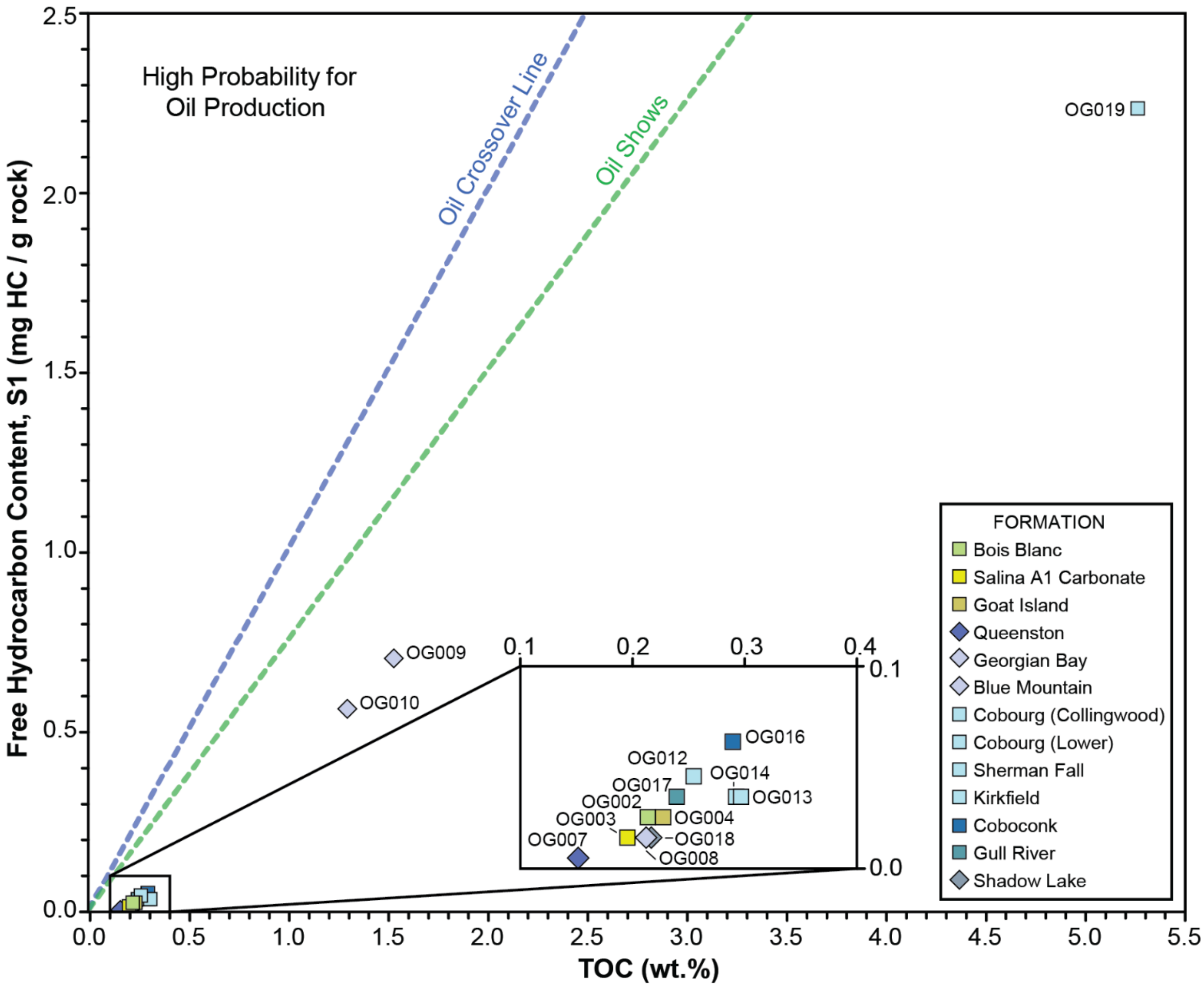

Figure 3: Oil and Gas Showings of SB_BH01 Core Samples.

3.1.1 Calculated Index Parameters

All calculated index parameters for SB_BH01 samples are provided in Table 5.

Hydrogen Index

The Hydrogen Index (HI), a measure of the H to C ratio, was calculated for each sample from the S2 value determined through pyrolysis. Generally, organic matter derived from the remains of marine organisms and algae yield higher HI values than terrestrial plants (Carvajal-Ortiz and Gentzis, 2015). This is attributed to the higher H to C ratios of their lipid and protein constituents compared to the carbohydrate-rich constituents of land plants. SB_BH01 core samples yield hydrogen indices between

31 and 605 mg of hydrocarbons per g of rock (see Table 5). Figures 3 and 5 are diagrams in which the hydrogen indices are used to infer the source of organic matter (kerogen type; see Section 3.1.2 for more details).

Table 5: Calculated Index Parameters for SB_BH01 Core Samples.

Sample ID	Formation, lithology	HI (mg HC / g rock)	OI (mg CO_2 / g rock)	PI
SB_BH01_OG002	Bois Blanc, limestone	85	40	0.10
SB_BH01_OG003	Salina A1 Carbonate, limestone	68	15	0.07
SB_BH01_OG004	Goat Island, limestone	110	30	0.07
SB_BH01_OG007	Queenston, shale	31	486	0.00
SB_BH01_OG008	Georgian Bay, shale	45	135	0.09
SB_BH01_OG009	Blue Mountain, shale	345	15	0.12
SB_BH01_OG010	Blue Mountain, shale	305	18	0.12
SB_BH01_OG019	Cobourg (Collingwood)	605	5	0.07
SB_BH01_OG012	Cobourg (Lower), limestone	121	148	0.11
SB_BH01_OG013	Sherman Fall, limestone	90	299	0.10
SB_BH01_OG014	Kirkfield, limestone	80	229	0.11
SB_BH01_OG016	Coboconk, limestone	144	10	0.12
SB_BH01_OG017	Gull River, limestone	72	109	0.14
SB_BH01_OG018	Shadow Lake, shale	35	208	0.11

Note: Lithologies are as logged at the time of sample collection during WP03 activities. Sample SB_BH01_OG019 was collected after completion of WP03. HC = hydrocarbons.

Oxygen Index

The Oxygen Index (OI), which is calculated from the S3 value, correlates with the ratio of O to C. OI is important for assessing the origin and type of kerogen. Generally, ratios of O to C are higher for organic matter derived from terrestrial plants and residual organic matter (Carvajal-Ortiz and Gentzis, 2015). SB_BH01 core samples yield oxygen indices of 5 to 486 mg CO_2 per g of rock (see Table 5 and Figure 4).

Production Index

The Production Index (PI) is a unitless indicator of the extent to which kerogen has transformed into hydrocarbons (Table 5). This index, along with Tmax, is used to assess the maturity of source rocks (see Figure 6). SB_BH01 core samples yield PI values between 0.00 and 0.14. As PI is calculated from S1 and S2, it should be noted that S2 values are less than 1 mg of hydrocarbons per gram of rock for most samples, which is a source of uncertainty in interpreting PI results.

3.1.2 Inferred Kerogen Types

Calculated HI and OI values are used to infer kerogen types for each sample. These results are summarized in Table 6 and presented in Figures 4, 5, and 7. The majority of samples are inferred to be gas-prone Type III Kerogen. Georgian Bay (SB_BH01_OG008) and Shadow Lake (SB_BH01_OG018) samples yield dry gas-prone Type IV results. Blue Mountain samples (SB_BH01_OG009, SB_BH010) yield mixed Type II/III oil/gas-prone results and the Collingwood Member sample (SB_BH01_OG019) yields Type II oil-prone.

Table 6: Kerogen Types of SB_BH01 Core Samples.

Sample ID	Formation, lithology	Kerogen Type
SB_BH01_OG002	Bois Blanc, limestone	Type III Kerogen (gas-prone)
SB_BH01_OG003	Salina A1 Carbonate, limestone	Type III Kerogen (gas-prone)
SB_BH01_OG004	Goat Island, limestone	Type III Kerogen (gas-prone)
SB_BH01_OG007	Queenston, shale	Mixed Type III/IV Kerogen (dry gas-prone)
SB_BH01_OG008	Georgian Bay, shale	Type IV Kerogen (dry gas-prone)
SB_BH01_OG009	Blue Mountain, shale	Mixed Kerogen Type II/III (oil/gas-prone)
SB_BH01_OG010	Blue Mountain, shale	Mixed Kerogen Type II/III (oil/gas-prone)
SB_BH01_OG019	Cobourg (Collingwood)	Type II Kerogen (oil-prone)
SB_BH01_OG012	Cobourg (Lower), limestone	Type III Kerogen (gas-prone)
SB_BH01_OG013	Sherman Fall, limestone	Type III Kerogen (gas-prone)
SB_BH01_OG014	Kirkfield, limestone	Type III Kerogen (gas-prone)
SB_BH01_OG016	Coboconk, limestone	Type III Kerogen (perhydrous)
SB_BH01_OG017	Gull River, limestone	Type III Kerogen (gas-prone)
SB_BH01_OG018	Shadow Lake, shale	Type IV Kerogen (dry gas-prone)

Note: Lithologies are as logged at the time of sample collection during WP03 activities. Sample SB_BH01_OG019 was collected after completion of WP03.

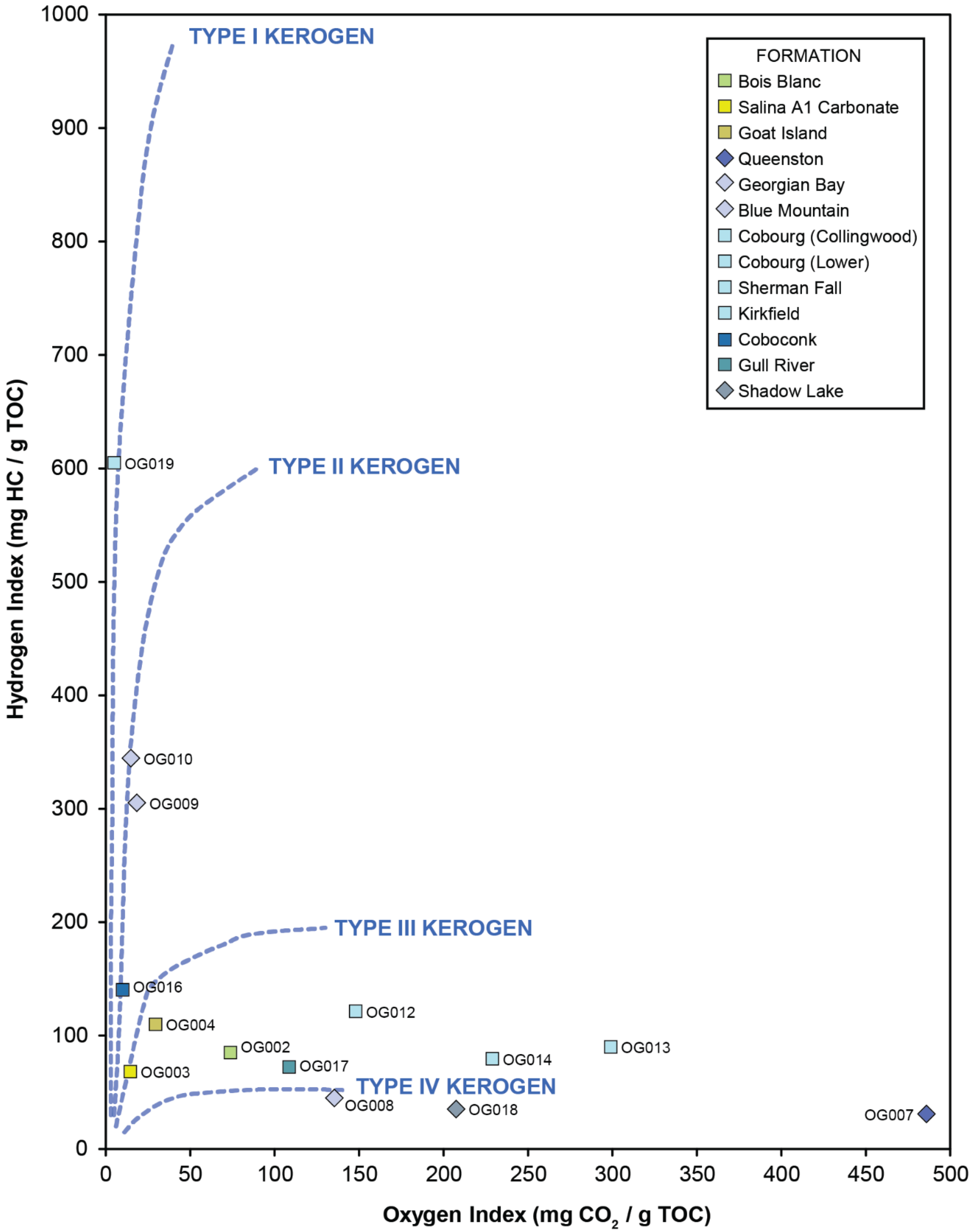

Figure 4: SB_BH01 Core Samples Plotted on a Pseudo–van Krevelen Diagram.

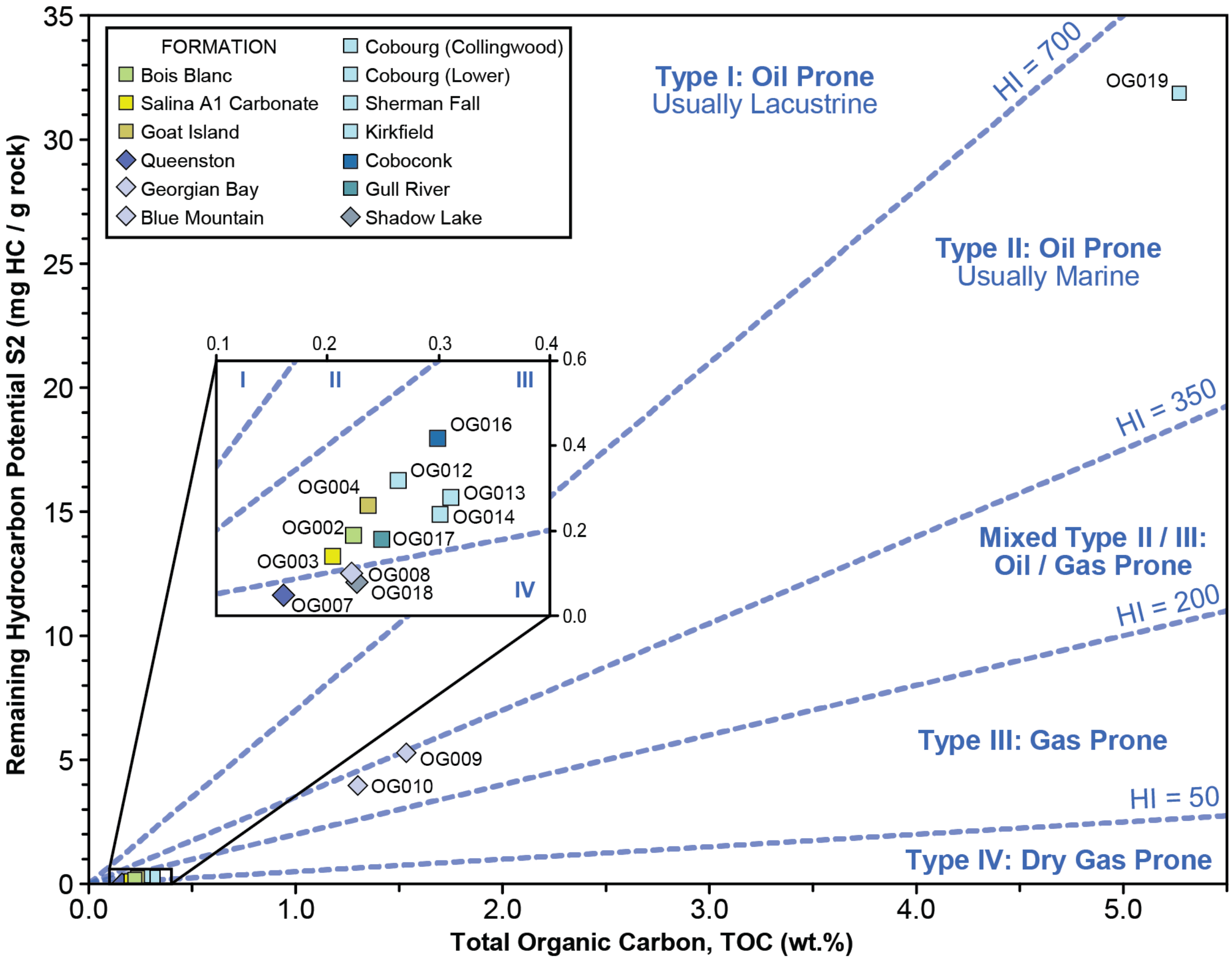

Figure 5: Kerogen Quality of SB_BH01 Core Samples.

3.1.3 Thermal Maturity of Source Rocks

Tmax, the temperature at which maximum hydrocarbon release occurs during pyrolysis, is an indicator of thermal maturity stage of the organic matter. Figures 6 and 7 present oil maturity inferences for SB_BH01 samples. SB_BH01_OG018 plots in the pre-oil window (i.e., immature) and SB_BH01_OG007 plots in the dry gas window. Based on Tmax, all other samples are within the oil window.

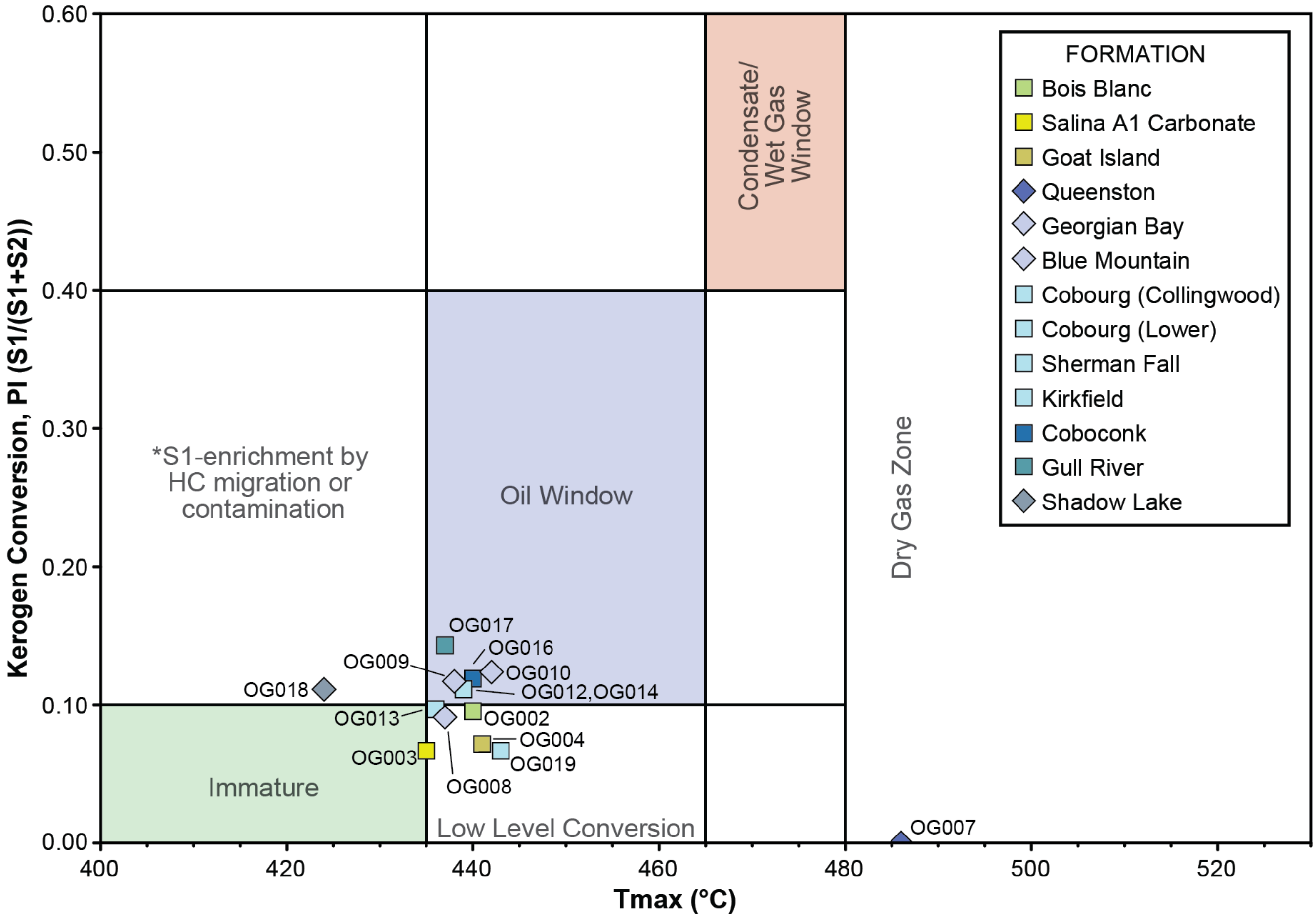

Figure 6: Kerogen Conversion (Production Index) and Maturity of SB_BH01 Core Samples.

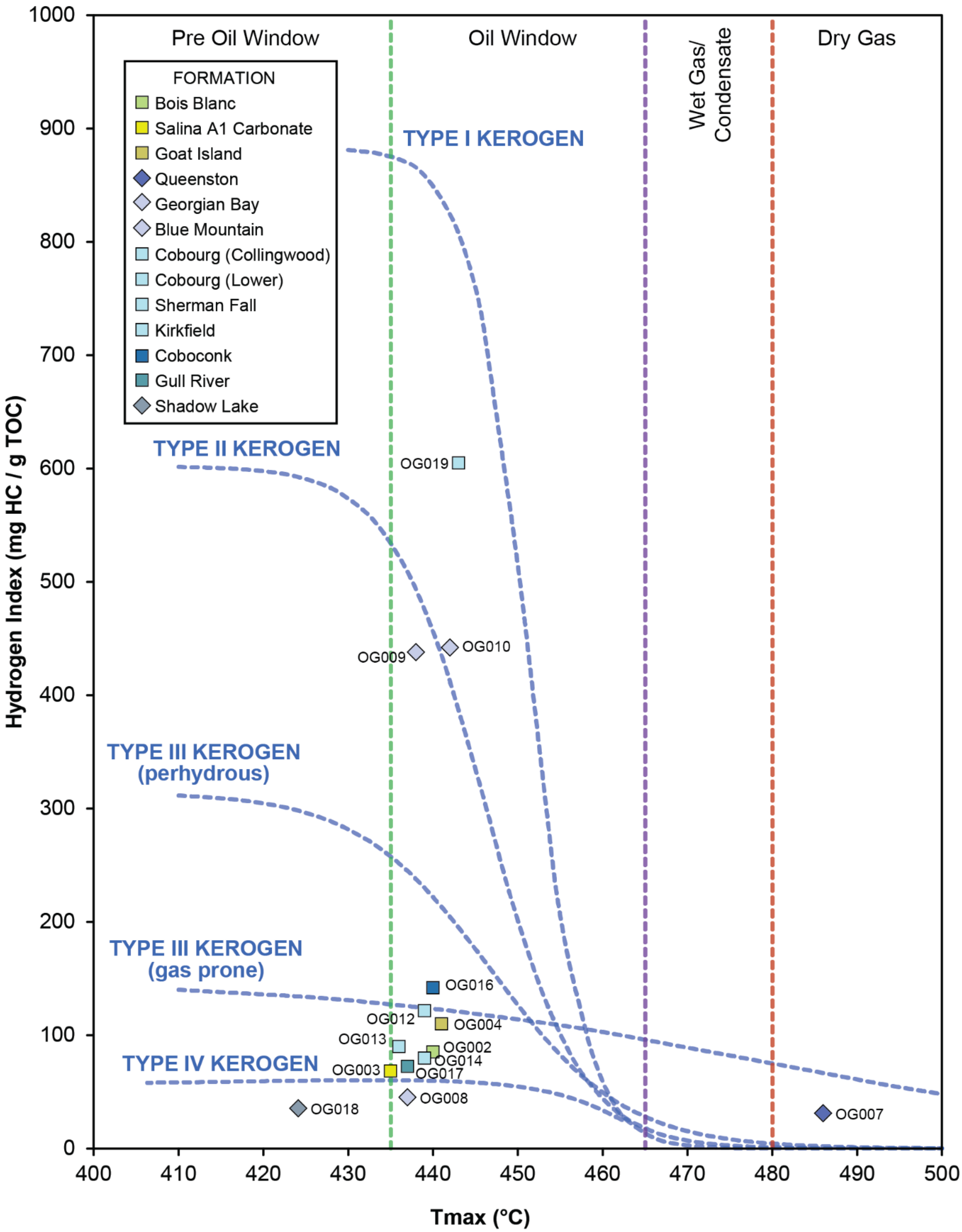

Figure 7: Kerogen Type and Maturity of SB_BH01 Core Samples.

Note: Parameters for organic matter type derived from Green River Shale (Type I), Liassic Shale (Type II), and Cambay Basin coals (Type III).

3.2 Whole Rock and Clay Mineralogy

A number of sheet silicates (phyllosilicates), commonly referred to as 'clay minerals', typically occur in the clay fraction (grains <4 μm in size) of sediments and sedimentary rocks. Non-sheet silicate minerals (e.g., quartz, felspar, calcite) may also be present within the clay-sized fraction and identified by XRD. Respectively, tables 7 and 8 present the XRD whole rock (including non-sheet silicates) and clay mineralogy results for SB_BH01. XRD diffractograms are provided in the appendix.

XRD detection limits are highly variable between minerals, depending on what other minerals are present in the matrix (clay-sized fraction) of the sample (Table 7). Detection limits are larger (less precise) for samples with mix-layered clay minerals, commonly shales, where a more abundant clay mineral may mask the presence of less abundant clay minerals. As such, mineral contents determined to be less than 0.20 wt.%, which is the estimated detection limit for clay-rich samples, are conservatively reported as having trace (Tr) content. Specific mineral contents are more precise for rock types that are not dominated by inter-layered clay minerals such as crystalline rocks and sandstones.

Table 7: XRD Whole Rock Mineralogy SB_BH01 Core Samples.

Sample ID	Sample Depth (mBGS)		Whole Rock Mineralogy (wt.%)									
	Top Depth	Bottom Depth	Quartz	K-Feldspar	Plagioclase	Calcite	Dolomite	Fe-Dolomite	Pyrite	Halite	Gypsum	Total Clay
SB_BH01_OG002	89.38	89.41	8.8	1.4	0.0	52.9	34.1	0.0	0.0	0.0	0.0	2.8
SB_BH01_OG003	289.94	289.97	0.4	0.0	0.0	41.8	57.8	0.0	0.0	0.0	0.0	0.0
SB_BH01_OG004	341.59	341.62	4.7	0.8	0.0	16.0	74.7	0.0	0.3	0.0	0.0	3.5
SB_BH01_OG007	474.13	474.16	16.8	1.0	Tr	6.9	0.0	3.1	0.5	0.0	0.0	71.5
SB_BH01_OG008	534.56	534.59	18.8	1.5	0.0	1.4	0.0	2.8	0.4	Tr	0.2	74.9
SB_BH01_OG009	633.27	633.30	18.7	1.6	1.0	2.3	0.0	0.7	2.6	0.6	0.0	72.5
SB_BH01_OG010	641.98	642.01	20.9	1.2	1.2	2.9	0.0	0.5	3.5	0.0	0.2	69.5
SB_BH01_OG019	645.78	645.79	10.3	2.8	0.0	54.0	0.0	6.5	3.3	0.0	0.0	23.1
SB_BH01_OG012	686.08	686.11	9.4	2.0	0.0	66.3	0.0	5.1	1.0	0.0	0.0	16.1
SB_BH01_OG013	716.13	716.16	11.1	3.5	0.0	27.2	0.0	9.2	2.1	0.0	0.0	46.8
SB_BH01_OG014	746.18	746.21	7.9	1.7	0.0	65.1	0.0	1.3	1.4	0.0	0.0	22.5
SB_BH01_OG016	797.62	797.65	3.9	0.0	0.0	74.4	18.0	0.0	0.8	0.0	0.0	2.9
SB_BH01_OG017	824.72	824.76	2.2	0.9	0.0	22.5	0.0	63.9	0.0	0.0	0.0	10.6
SB_BH01_OG018	857.52	857.56	2.8	3.0	0.0	5.0	0.0	78.5	0.0	0.8	0.0	9.8

Note: Tr < 0.20 wt.%. Total clay is the sum of kaolinite, chlorite, illite and mica, and smectite/illite provided in Table 8.

Whole rock mineralogy results for SB_BH01 are mostly consistent with the rock types logged during WP03. However, a few samples yielded mineral contents that suggest they are of another lithology. SB_BH01_OG017 and SB_BH01_OG018 have Fe-dolomite contents greater than 60%, which indicates that their primary lithologies are dolostone. SB_BH01_OG003, SB_BH01_OG004, and

SB_BH01_OG017 are calcareous dolostone with >15% calcite content. All other samples have mineral contents consistent with their logged lithology—samples logged limestone have calcite contents >50% and samples logged as shale have clay contents >50%.

Table 8: XRD Clay (Phyllosilicate) Mineralogy of SB_BH01 Core Samples.

Sample ID	Sample Depth (mBGS)		Formation, lithology	Clay Mineralogy (wt.%)				% Smectite in I/S
	Top Depth	Bottom Depth		Illite & Mica (I + M)	Kaolinite	Chlorite	Illite/ Smectite (I/S)	
SB_BH01_OG002	89.38	89.41	Bois Blanc, limestone	2.5	0.0	0.2	0.0	-
SB_BH01_OG003	289.94	289.97	Salina A1 Carbonate, limestone	0.0	0.0	0.0	0.0	-
SB_BH01_OG004	341.59	341.62	Goat Island, limestone	3.1	0.5	0.0	0.0	-
SB_BH01_OG007	474.13	474.16	Queenston, shale	52.7	1.0	17.9	0.0	-
SB_BH01_OG008	534.56	534.59	Georgian Bay, shale	49.8	0.4	24.8	0.0	-
SB_BH01_OG009	633.27	633.30	Blue Mountain, shale	48.9	1.0	22.6	0.0	-
SB_BH01_OG010	641.98	642.01	Blue Mountain, shale	49.3	0.0	20.2	0.0	-
SB_BH01_OG019	645.78	645.79	Cobourg (Collingwood)	14.3	0.2	4.8	3.8	5-15
SB_BH01_OG012	686.08	686.11	Cobourg (Lower), limestone	14.2	0.4	1.5	0.0	-
SB_BH01_OG013	716.13	716.16	Sherman Fall, limestone	42.1	0.2	1.5	3.1	5-15
SB_BH01_OG014	746.18	746.21	Kirkfield, limestone	21.0	0.0	1.5	0.0	-
SB_BH01_OG016	797.62	797.65	Coboconk, limestone	2.9	0.0	0.0	0.0	-
SB_BH01_OG017	824.72	824.76	Gull River, limestone	10.0	0.0	0.6	0.0	-
SB_BH01_OG018	857.52	857.56	Shadow Lake, shale	5.5	0.0	4.3	0.0	-

Note: Lithologies are as logged at the time of sample collection during WP03 activities. Sample SB_BH01_OG019 was collected after completion of WP03.

Under the increased pressure and temperature conditions that lead to the conversion of organic matter into hydrocarbons, smectite undergoes diagenetic alteration and converts to illite (Héroux et al., 1979; Kübler et al., 1979). The disappearance of smectite has been directly correlated with the onset of hydrocarbon generation (Powell et al., 1978). As such, the presence or absence of smectite can be used as an indicator of thermal maturity of phyllosilicate-bearing source rocks. SB_BH01_OG019 and SB_BH01_OG013 total clay mineralogy results indicate the presence of smectite and/or illite (see Table 8). Smectite is estimated to comprise 5-15% of the total smectite/illite content for the two samples suggesting that they are thermally immature. The other samples do not contain illite and/or smectite (0.0 wt.% I/S in Table 8) and their thermally maturity cannot be assessed using this indicator.

4 DATA QUALITY

Data quality conforms to standard laboratory practices in the oilfield services industry and in published literature. Results received from Core Laboratories Canada Ltd. were reviewed by Geofirma Engineering Ltd. for completeness, quality of testing, and reporting, by completing Data Quality Confirmation Forms which were accepted by NWMO subject matter experts. These forms were used to document that the data collection activities have been carried out in accordance with the quality requirements of the accepted WP04G Test Plan.

4.1 Calibration of Measurement and Test Equipment

Core Laboratories Canada Ltd. operates a Quality Management System (QMS) which complies with the requirements of ISO 9001:2015. As part of their QMS, Core Laboratories Canada Ltd. operates measurement and test equipment in accordance with manufacturer's specifications and calibration requirements including use of known standards for routine checking of equipment operation.

Equipment calibration standards are routinely used for TOC analyses (one in five samples).

The Rock-Eval instrument is routinely calibrated with standard samples. Standards are run every ten samples to check instrument calibration and status. Random reruns are also performed to check results.

The XRD equipment is calibrated every six months following manufacturers specifications and instructions.

4.2 Limitations of Sample Collection and Test Results

Samples were collected from pre-determined formations as specified in the test plan, including known hydrocarbon-bearing rocks in southwestern Ontario (Armstrong and Carter, 2010). Of these formations, the most apparently organic-rich portions of each formation were assessed based on core observations and targeted for sample collection. As single samples were collected for formations varying in thickness from 5 to 87 m, the samples do not provide insight into the distribution of hydrocarbons within formations nor a sense of hydrocarbon distribution over regular depth intervals. By targeting the most-organic rich portions of the borehole, sample collection herein likely provides an overestimate of the oil production potential. The presence of gas in SB_BH01 was assessed through collection of dissolved gas core samples (WP04C: Porewater Analysis) and fluid samples (WP07: Groundwater Sampling).

XRD detection limits are highly variable between minerals and contingent on the total mineral composition and lithology of the sample. Detection limits are relatively larger (i.e., less precise) for samples containing mix-layered clay minerals and smaller for clay-poor rocks.

5 CONCLUSIONS

The hydrocarbon production potential in SB_BH01 is low based on fourteen samples collected for organic geochemistry testing. All samples yield low total organic carbon content (TOC) results of less than 5.3 wt.%, with most samples having less than 0.5 wt.% TOC. The samples with the highest organic carbon content were also the only samples containing inferred Type II Kerogen (oil prone), with all other samples inferred as Type III or IV gas-prone kerogen types. The thermal maturity (Tmax) and kerogen conversion (PI) of most samples suggest low-level conversion or maturity levels within the oil window with one thermally mature sample (SB_BH01_OG007 of the Queenston Formation) in the dry gas zone. Nonetheless, free hydrocarbon (S1) and total organic carbon (TOC) content results do not yield any oil showings, suggesting a low probability of oil production for all sampled formations.

6 REFERENCES

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Appendix

Core Laboratories Results and Supplemental Data

GEOFIRMA ENGINEERING

Source Rock Analysis
TOC, Kerogen Quality and Thermal Maturity Testing

Rock Eval 6
Version 4.09

LECO SC-632

Geofirma (CL-Calgary)

SB_BH01

CoreLab ATC # 2105355

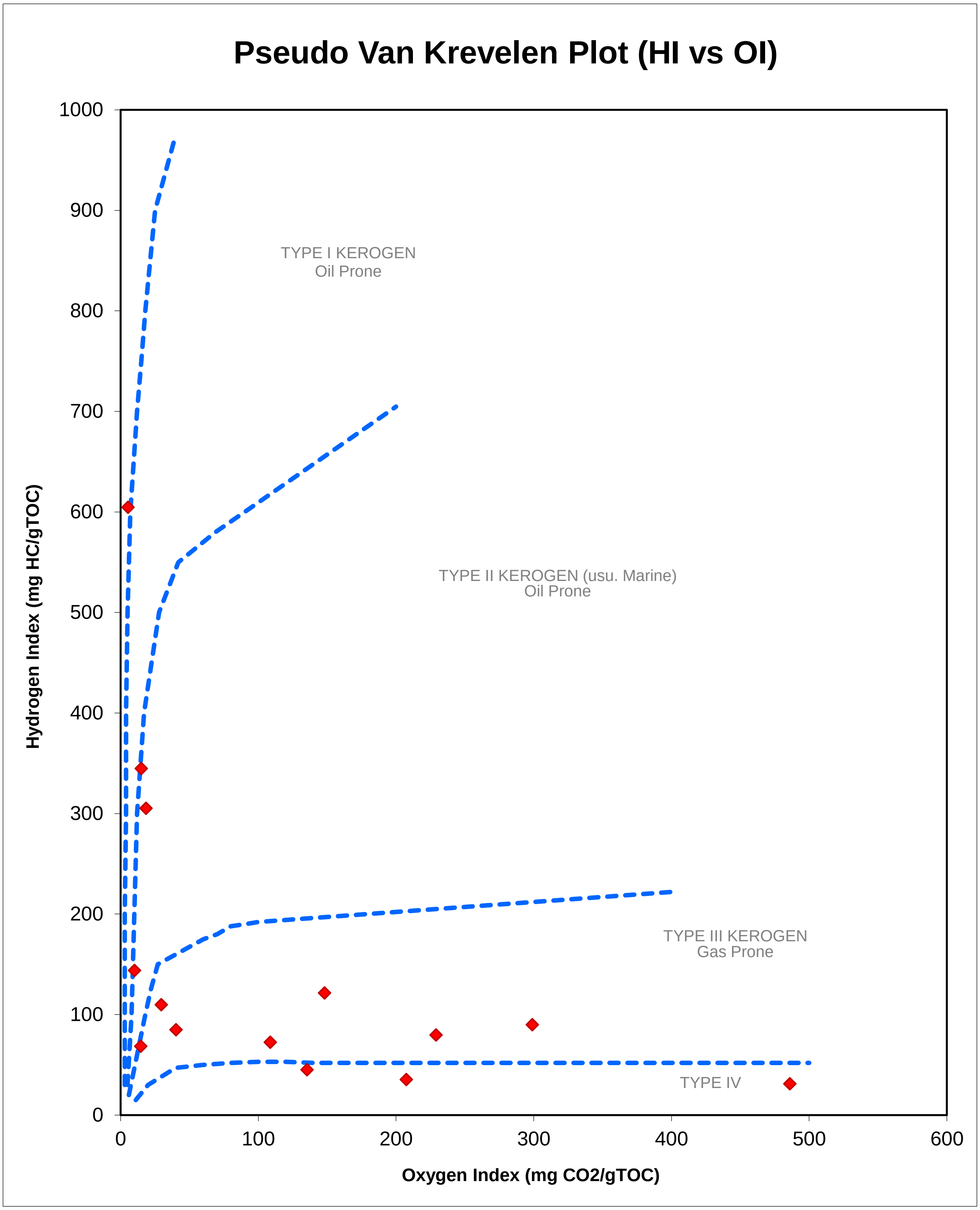
2023-05-24

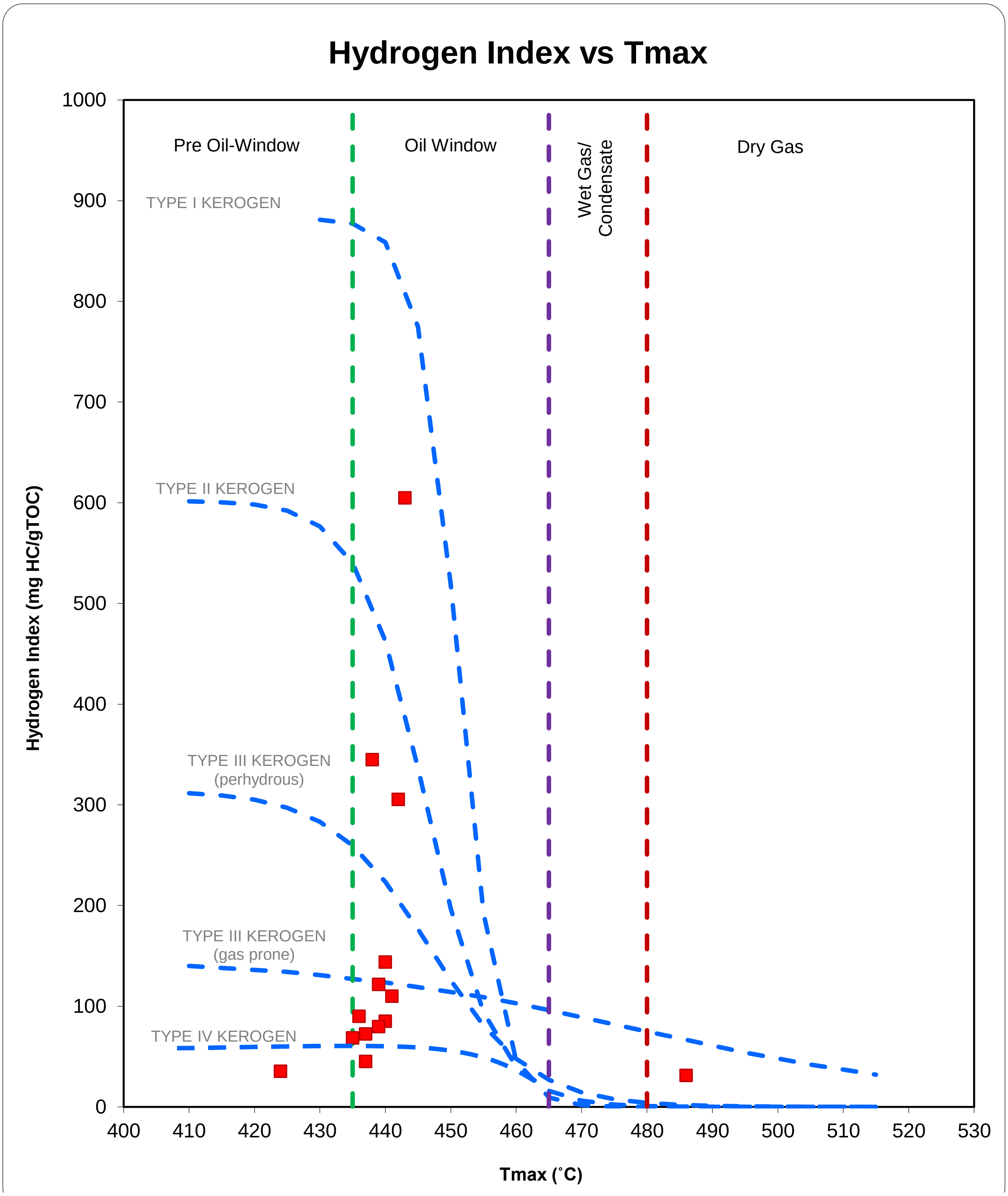
Core Laboratories
6316 Windfern Houston, TX 77040
713-328-2673

2105355

Well Name	Formation	Location	Sample ID	Upper Depth m	Lower Depth m	Median Depth m	Sample Wt. mg	LECO TOC wt%	S1 mg HC/g	S2 mg HC/g	S3 CO_2 mg CO2/g	S3 CO mg CO/g	Tmax ˚C	HI S2x100/TOC	OI S3x100/TOC	PI S1/(S1+S2)	OSI S1x100/TOC	Oil in Rock bbl oil/ac-ft	VRo-Eq (%) che & Second White Spe	VRo-Eq (%) Duvernay Model	VRo-Eq (%) Barnett Model	Remarks Comments
SB_BH01			SB_BH01_OG002	89.38	89.41		59	0.22	0.02	0.19	0.09	0.02	440	85	40	0.10	8.95	0.44	0.81	0.71	0.76	
SB_BH01			SB_BH01_OG003	289.94	289.97		58.9	0.20	0.01	0.14	0.03	0	435	68	15	0.07	4.89	0.22	0.73	0.63	0.67	
SB_BH01			SB_BH01_OG004	341.59	341.62		61.9	0.24	0.02	0.26	0.07	0.01	441	110	30	0.07	8.46	0.44	0.83	0.72	0.78	
SB_BH01			SB_BH01_OG007	474.13	474.16		59.4	0.16	0	0.05	0.78	0	486	31	486	0.00	0.00	0.00				
SB_BH01			SB_BH01_OG008	534.56	534.59		60.3	0.22	0.01	0.1	0.3	0	437	45	135	0.09	4.51	0.22	0.76	0.66	0.71	
SB_BH01			SB_BH01_OG009	633.27	633.30		61.9	1.53	0.7	5.29	0.23	0.01	438	345	15	0.12	45.62	15.32	0.78	0.68	0.72	
SB_BH01			SB_BH01_OG010	641.98	642.01		57.7	1.30	0.56	3.97	0.24	0.05	442	305	18	0.12	43.06	12.26	0.84	0.74	0.80	
SB_BH01			SB_BH01_OG019	645.78	645.79		59.9	5.27	2.23	31.87	0.28	0.12	443	605	5	0.07	42.31	48.81	0.86	0.75	0.81	
SB_BH01			SB_BH01_OG012	686.08	686.11		57.6	0.26	0.04	0.32	0.39	0.01	439	121	148	0.11	15.19	0.88	0.79	0.69	0.74	
SB_BH01			SB_BH01_OG013	716.13	716.16		64.6	0.31	0.03	0.28	0.93	0.01	436	90	299	0.10	9.65	0.66	0.74	0.65	0.69	
SB_BH01			SB_BH01_OG014	746.18	746.21		63.4	0.30	0.03	0.24	0.69	0.01	439	80	229	0.11	9.96	0.66	0.79	0.69	0.74	
SB_BH01			SB_BH01_OG016	797.62	797.65		56.6	0.30	0.06	0.43	0.03	0.01	440	144	10	0.12	20.07	1.31	0.81	0.71	0.76	
SB_BH01			SB_BH01_OG017	824.72	824.76		58.5	0.25	0.03	0.18	0.27	0.01	437	72	109	0.14	12.07	0.66	0.76	0.66	0.71	
SB_BH01			SB_BH01_OG018	857.52	857.56		61.9	0.23	0.01	0.08	0.47	0	424	35	208	0.11	4.42	0.22				

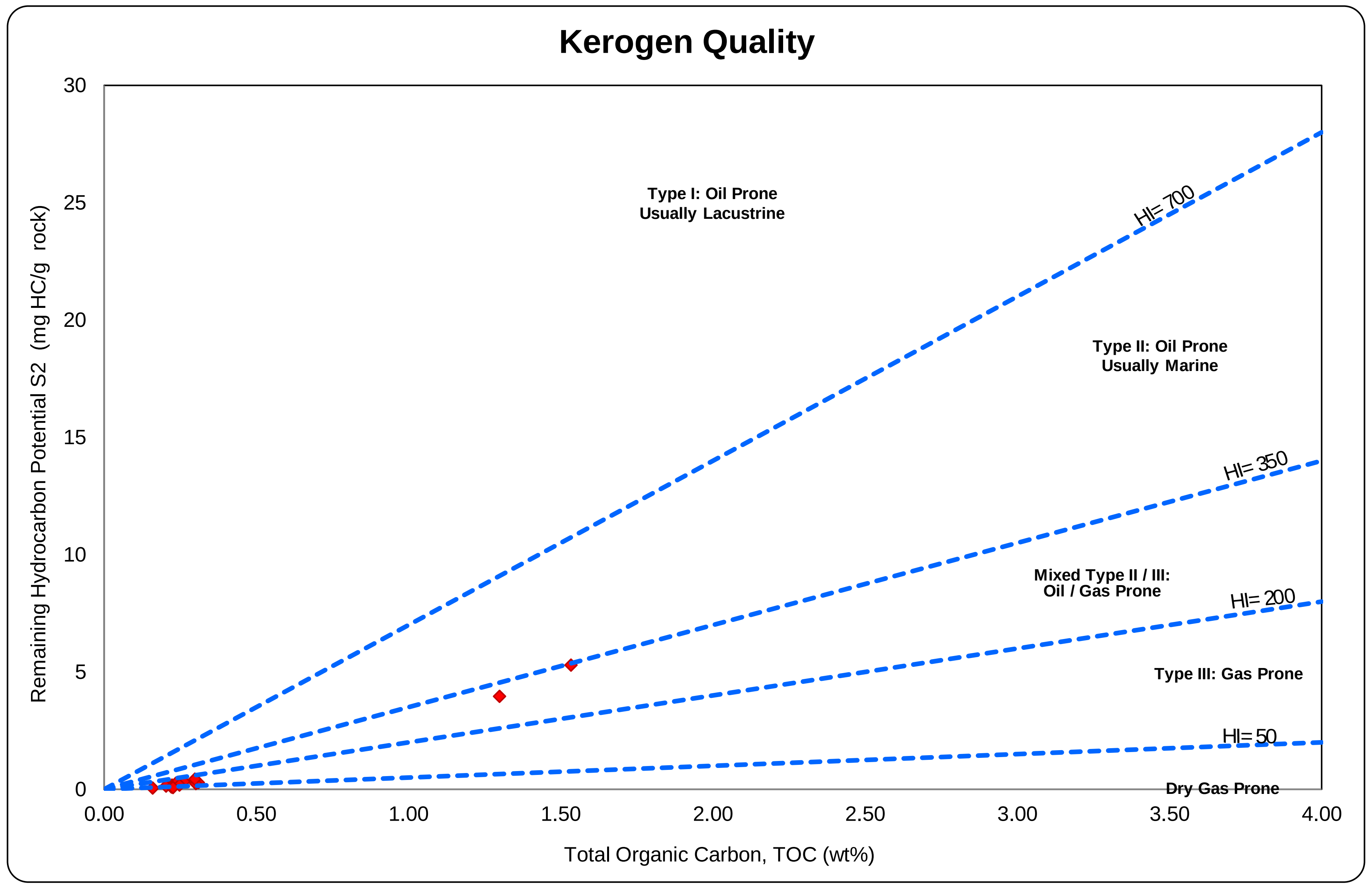
Job Number: CoreLab ATC # 2105355 **Well Name: SB_BH01**

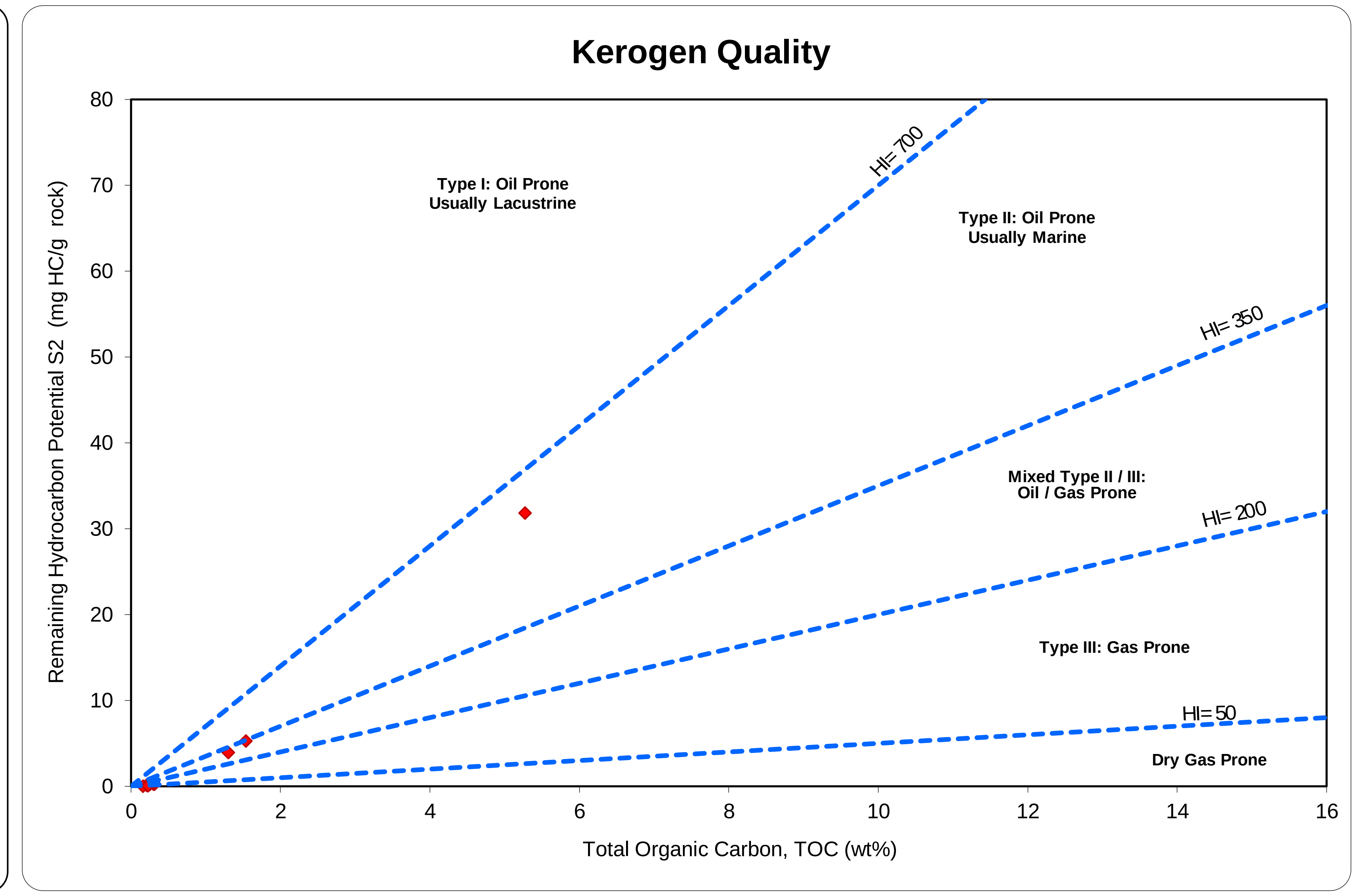


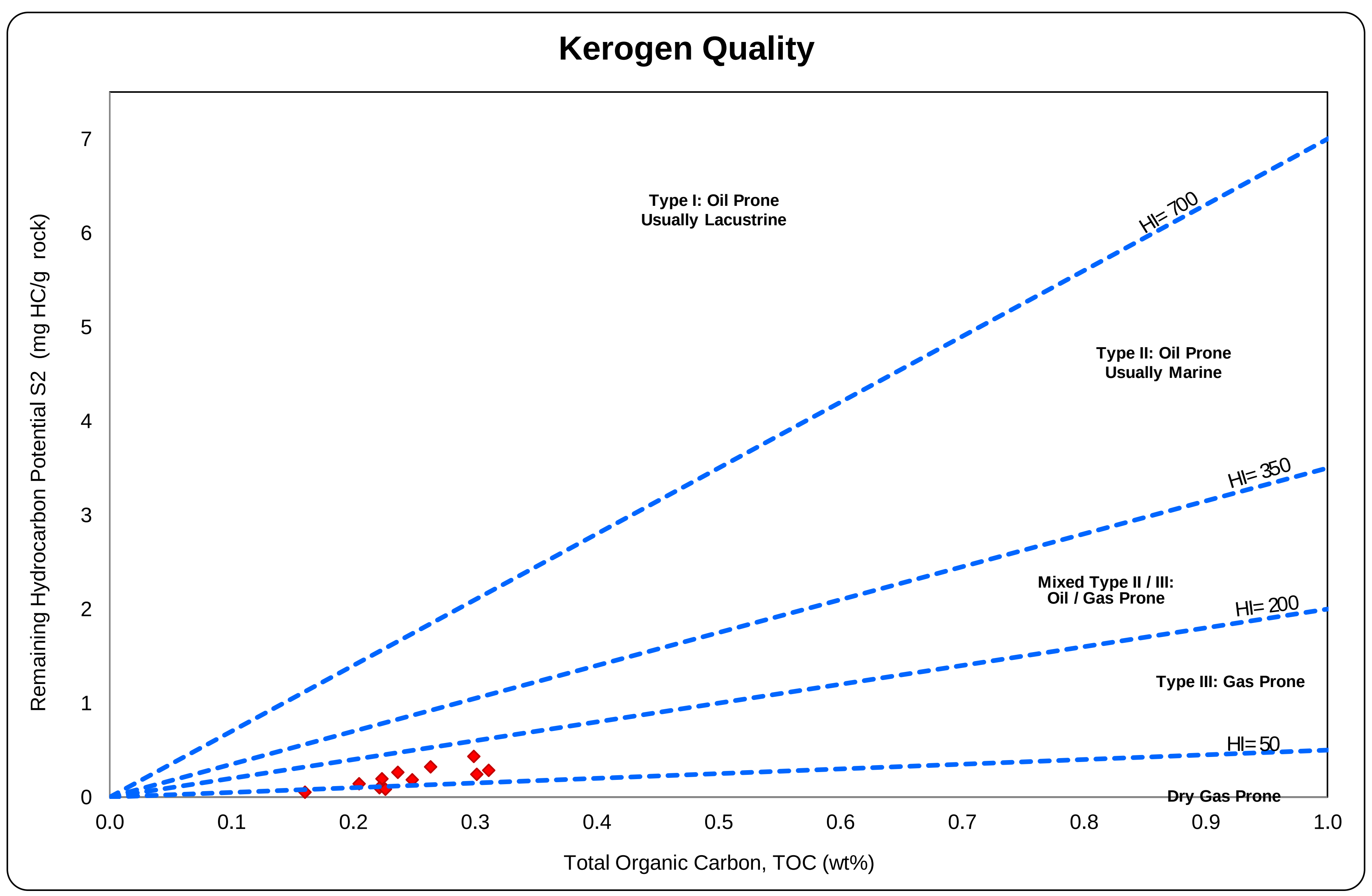

Hydrogen Index vs Tmax
Pre Oil-Window
Oil Window
Wet Gas/
Condensate
Dry Gas
TYPE I KEROGEN
TYPE II KEROGEN
TYPE III KEROGEN
(perhydrous)
TYPE III KEROGEN
(gas prone)
TYPE IV KEROGEN
Hydrogen Index (mg HC/gTOC)
Tmax (˚C)
0
100
200
300
400
500
600
700
800
900
1000
400
410
420
430
440
450
460
470
480
490
500
510
520
530

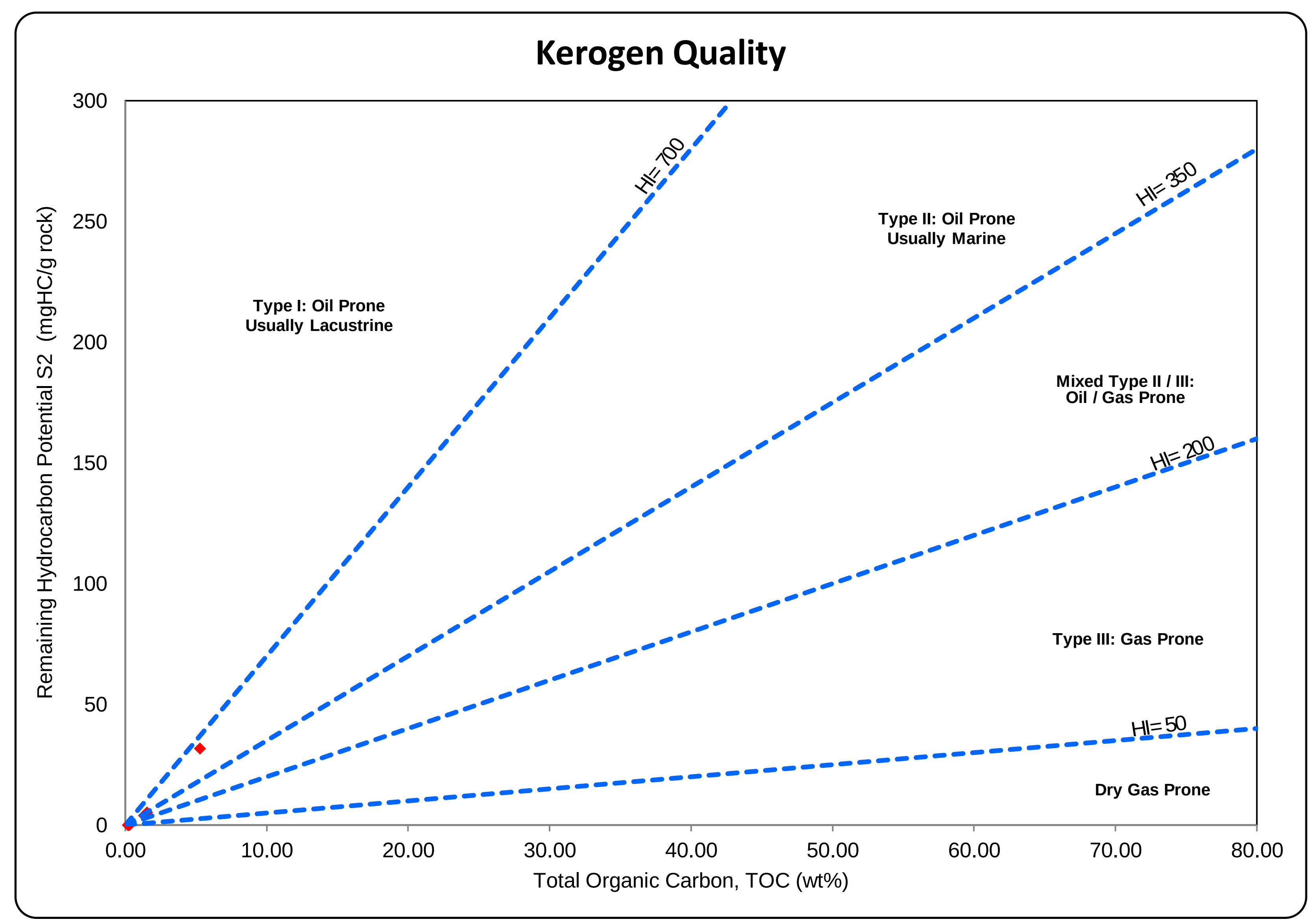
Core Lab

Job Number: CoreLab ATC # 2105355 | Well Name: SB_BH01









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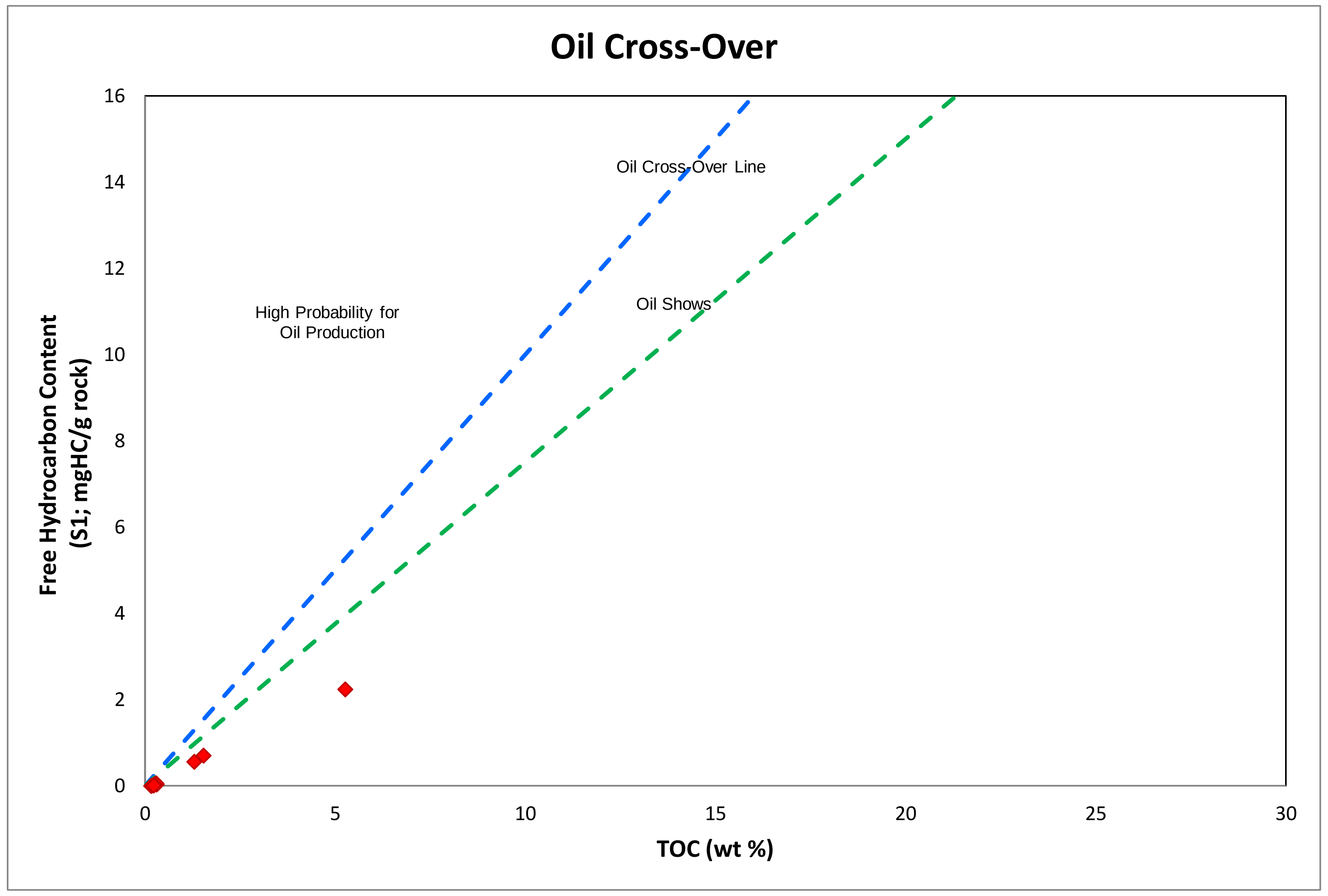

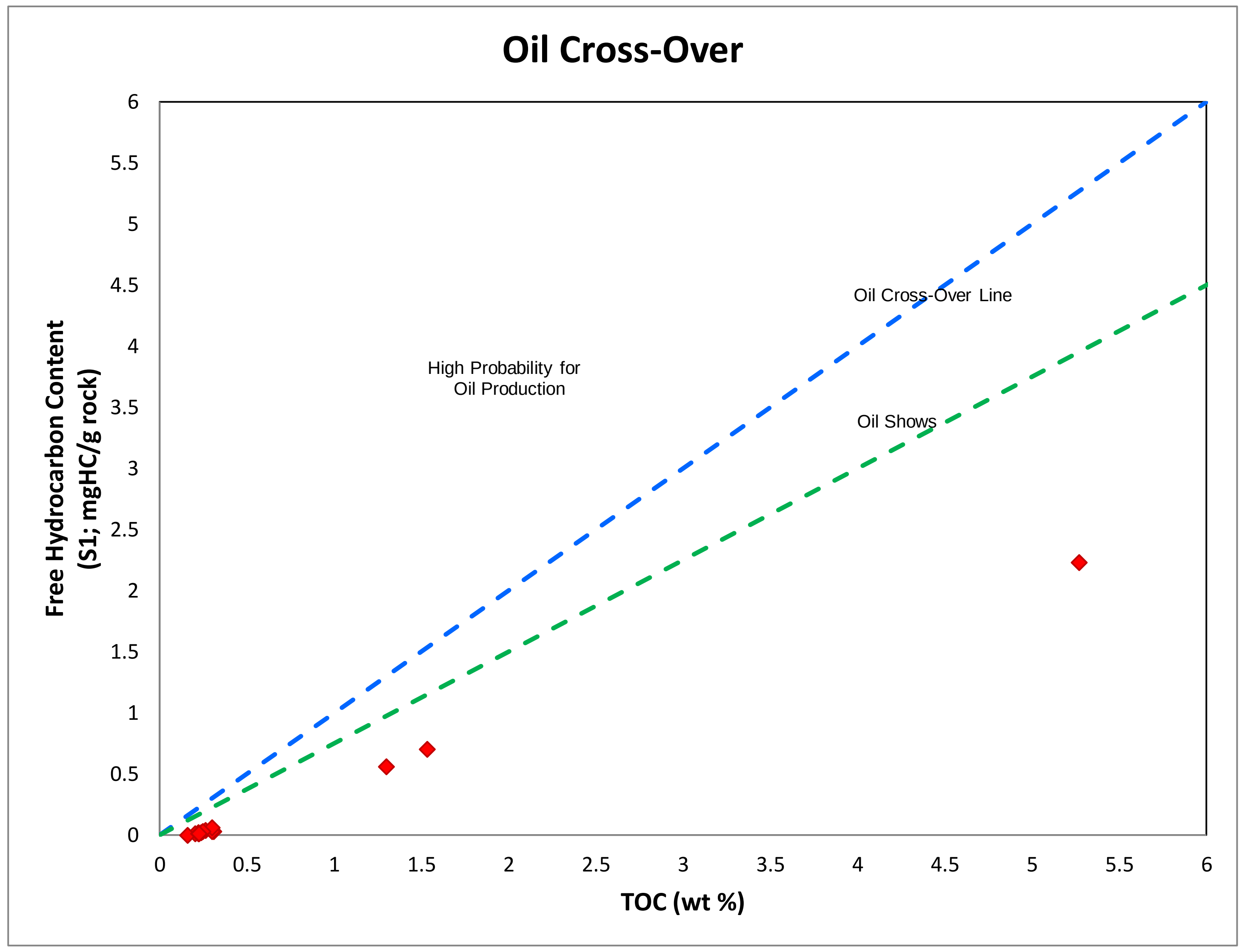

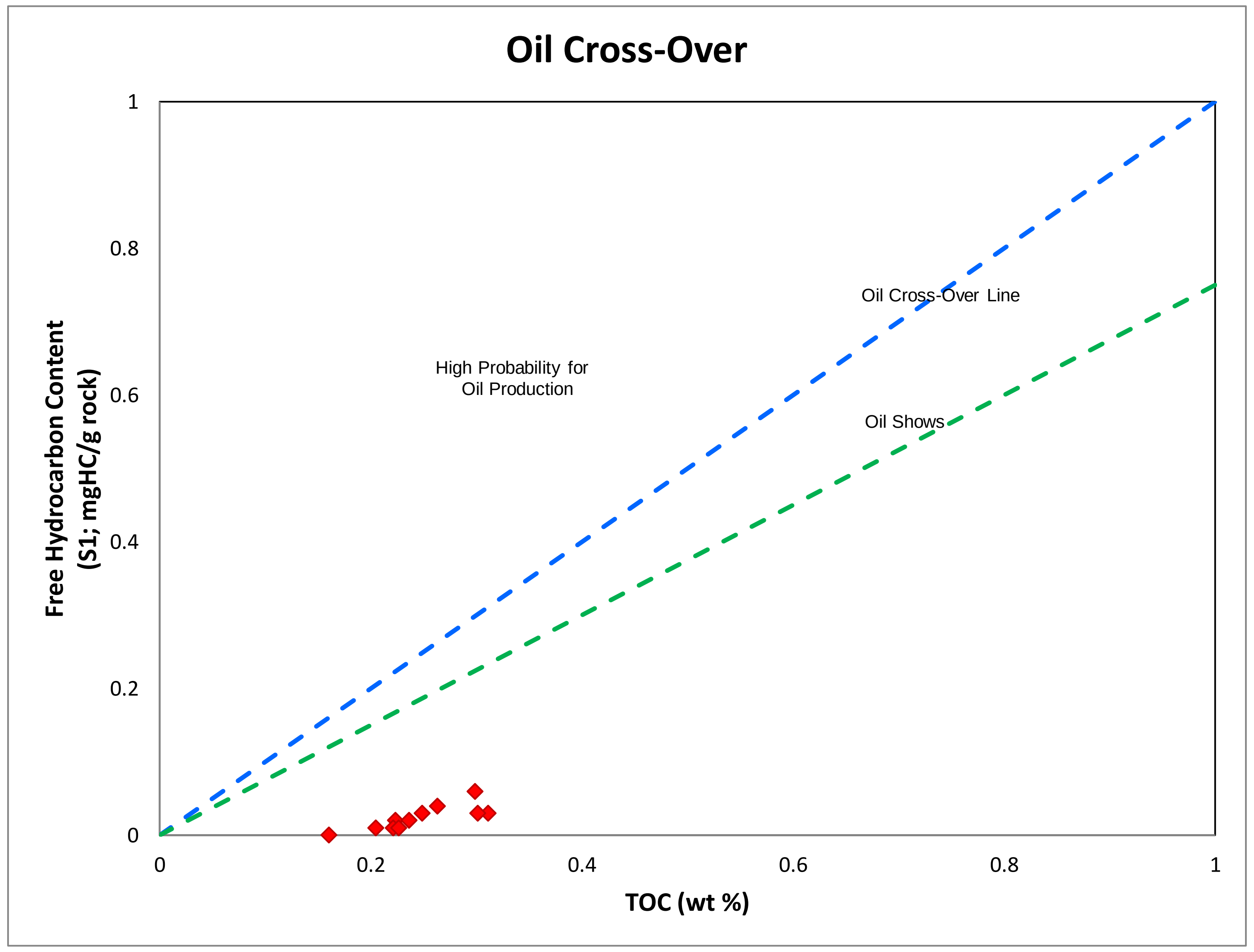

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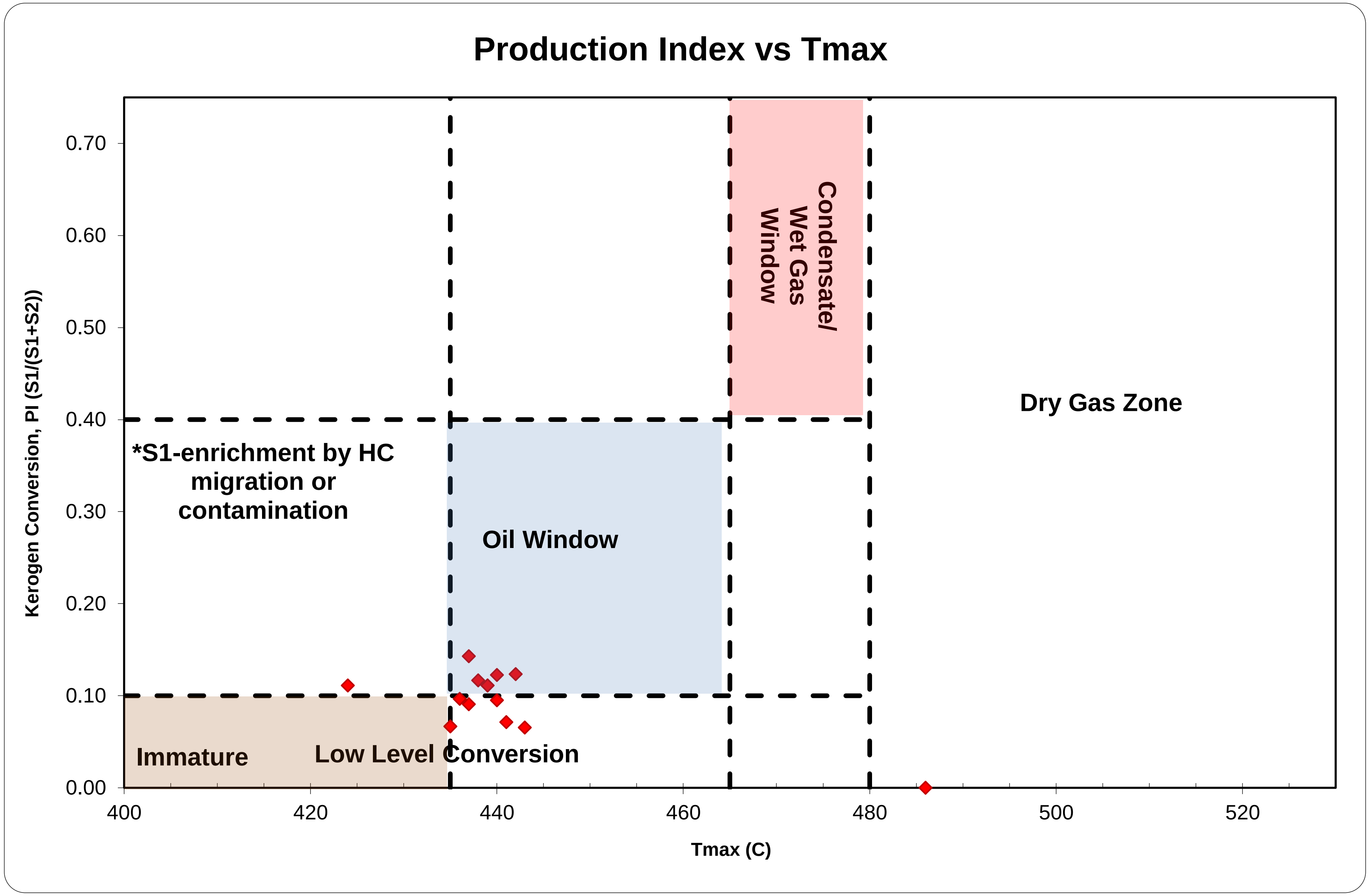
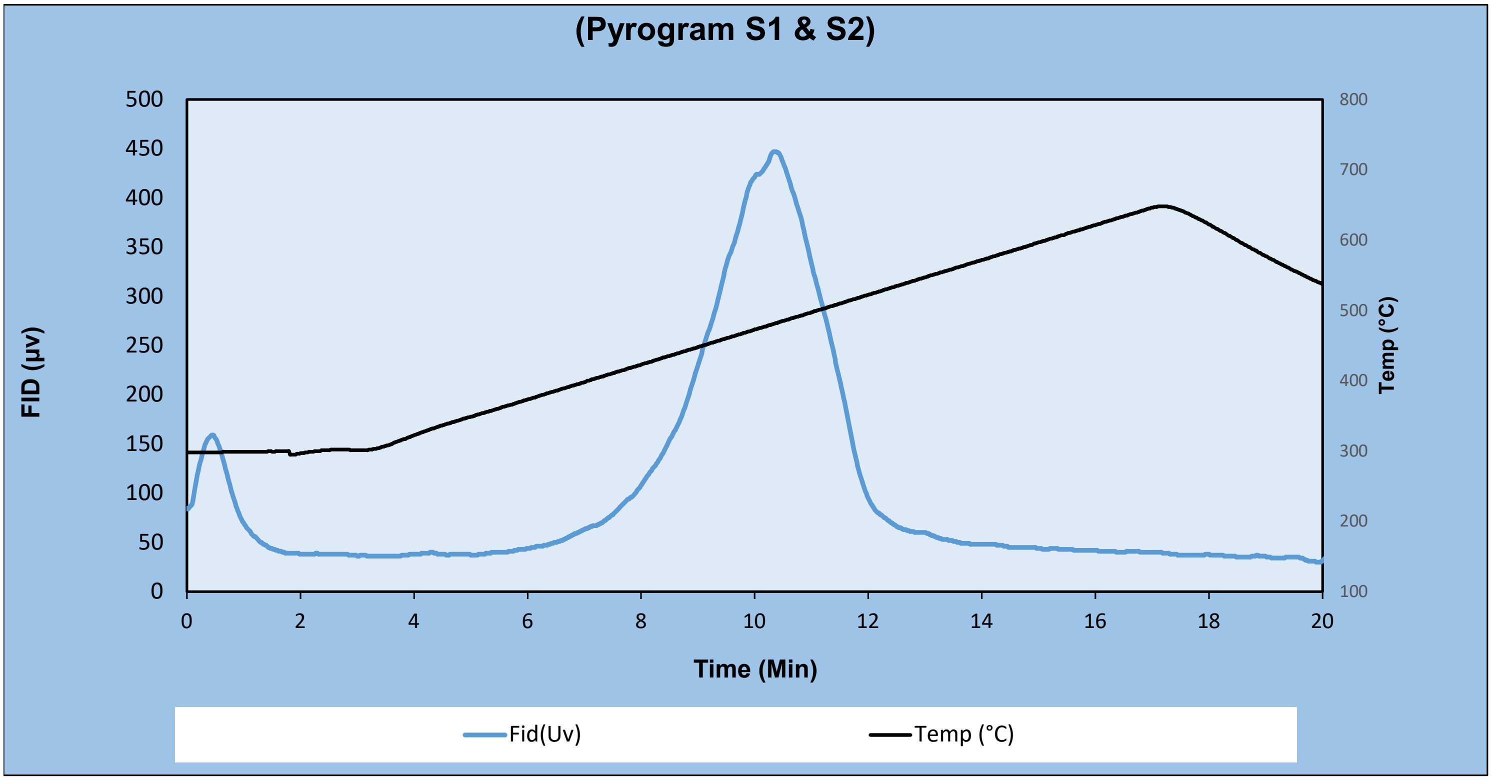
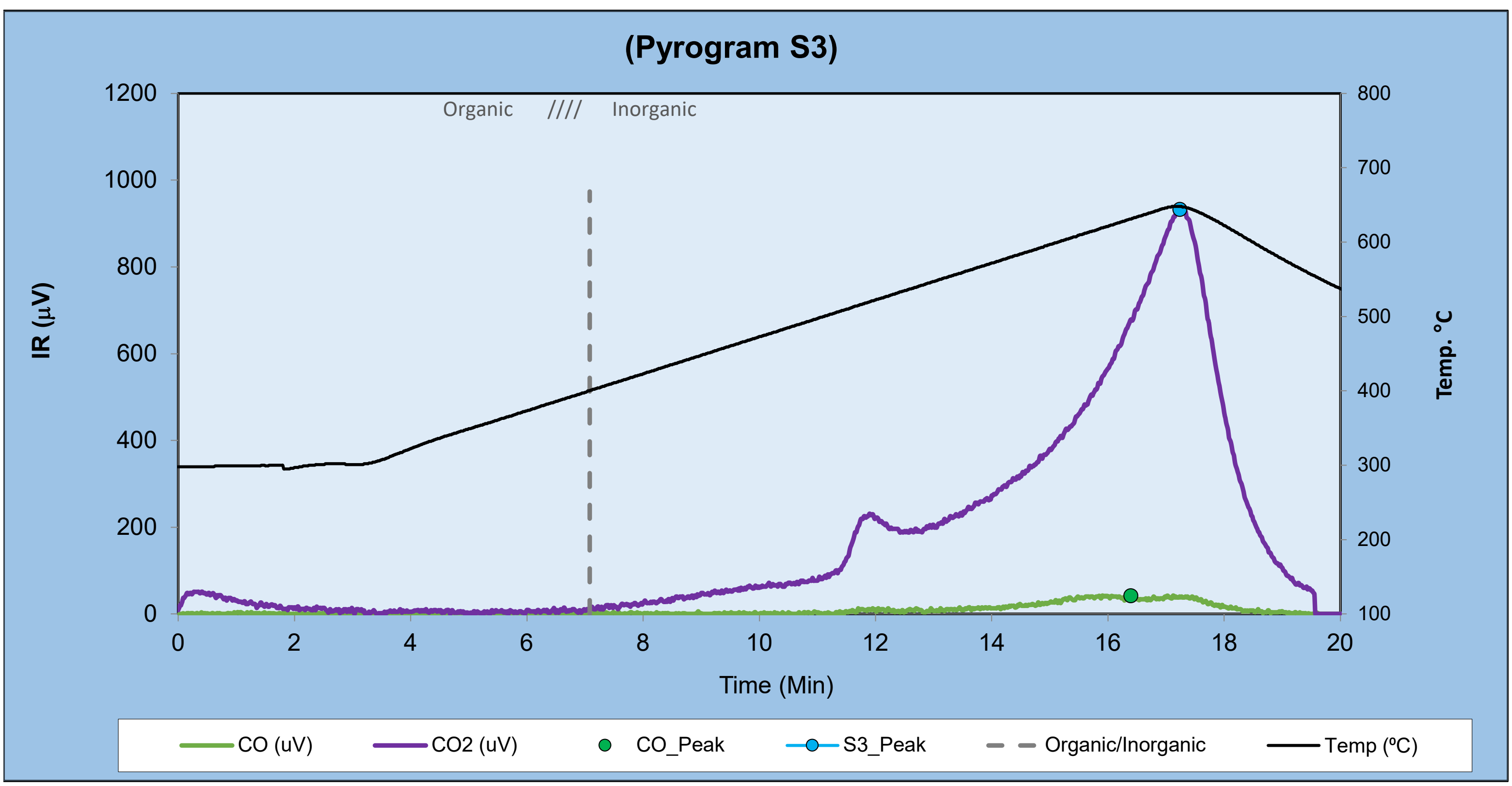


Source Pyrolysis

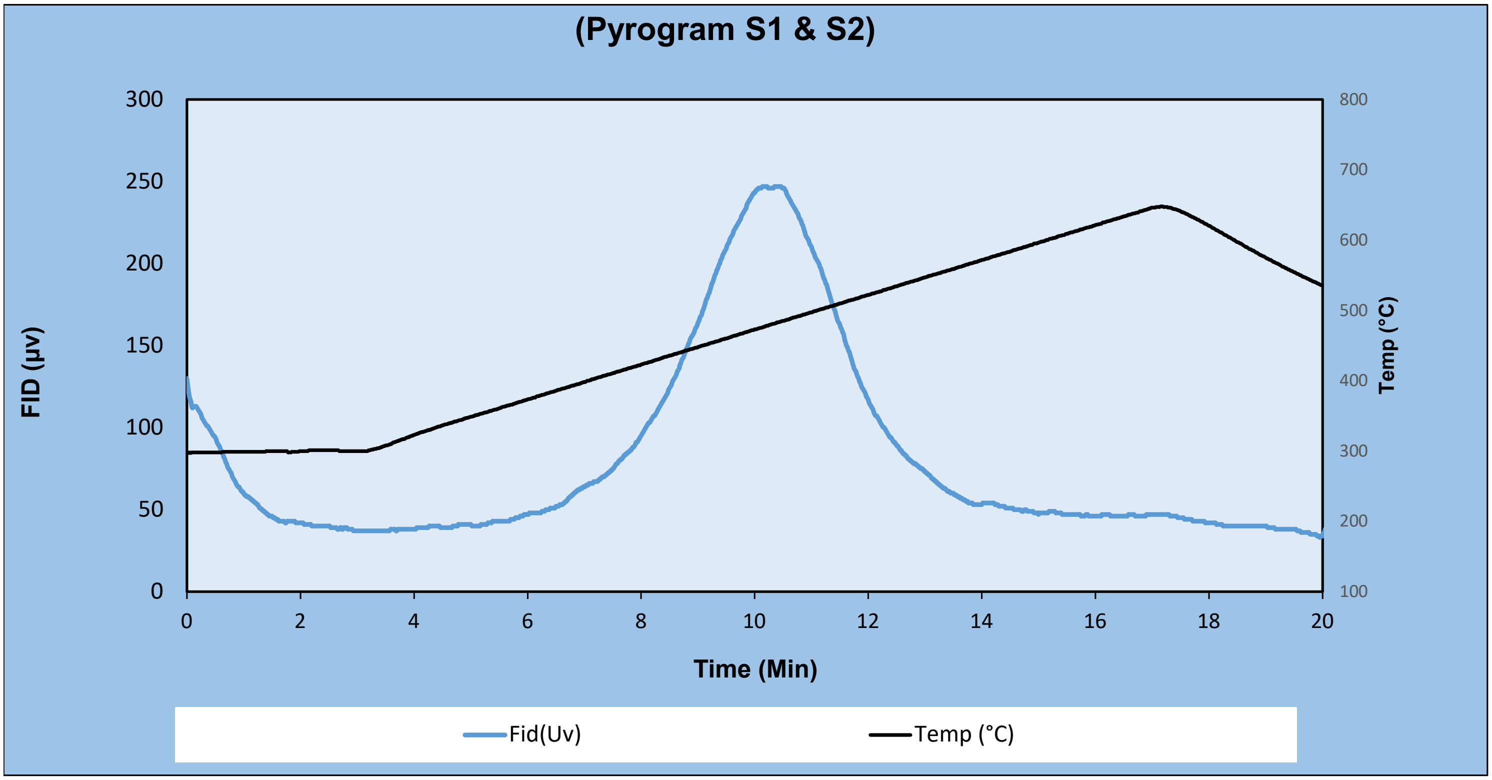
Company:	**Geofirma**	**ID:**	**SB_BH01_OG002**
Well:	**SB_BH01**	**Depth:**	**89.38**
Location:	**Canada**	**TOC:**	**0.22**
Formation:	**NA**	**Tmax:**	**440**

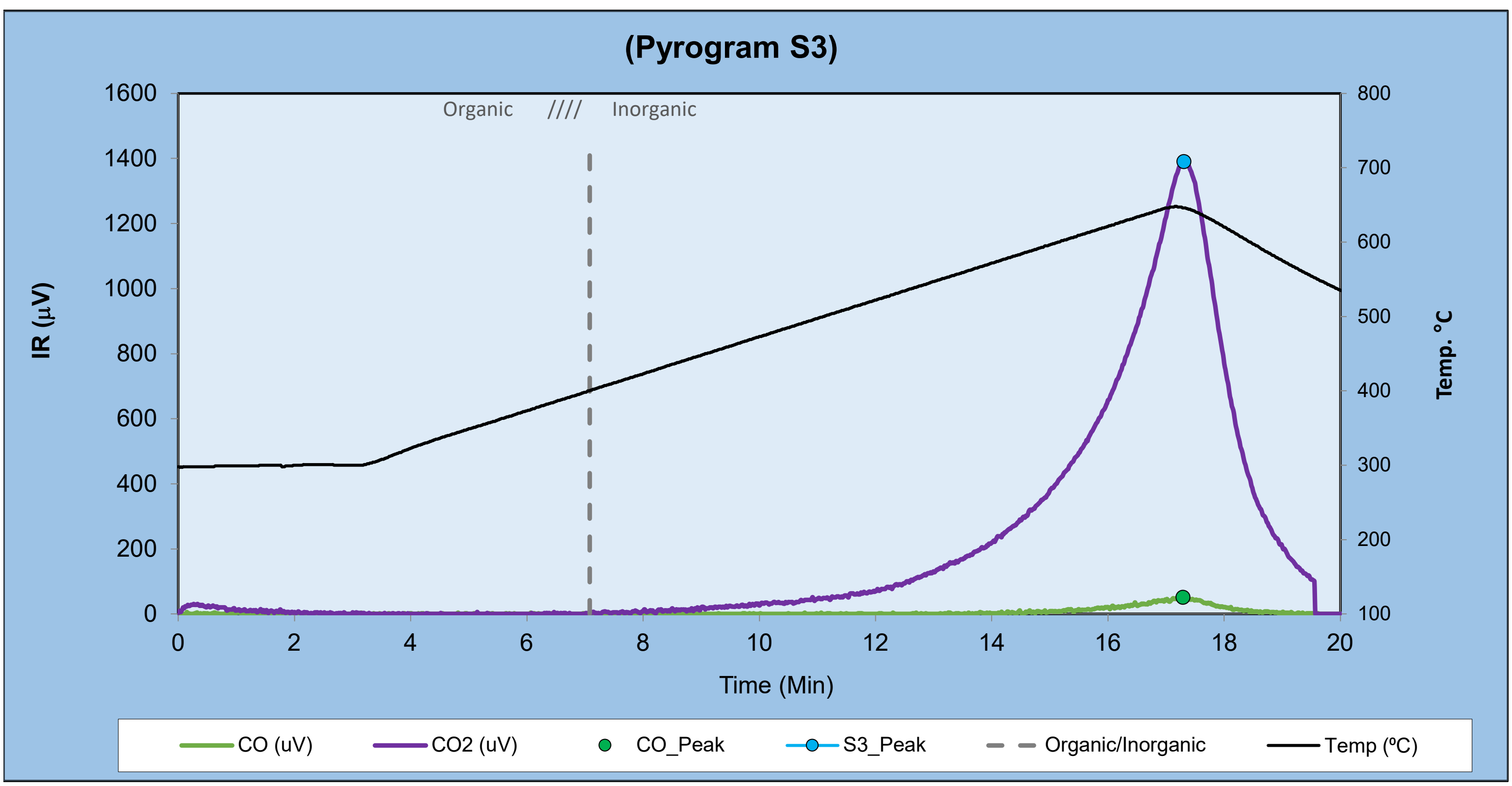




Source Pyrolysis

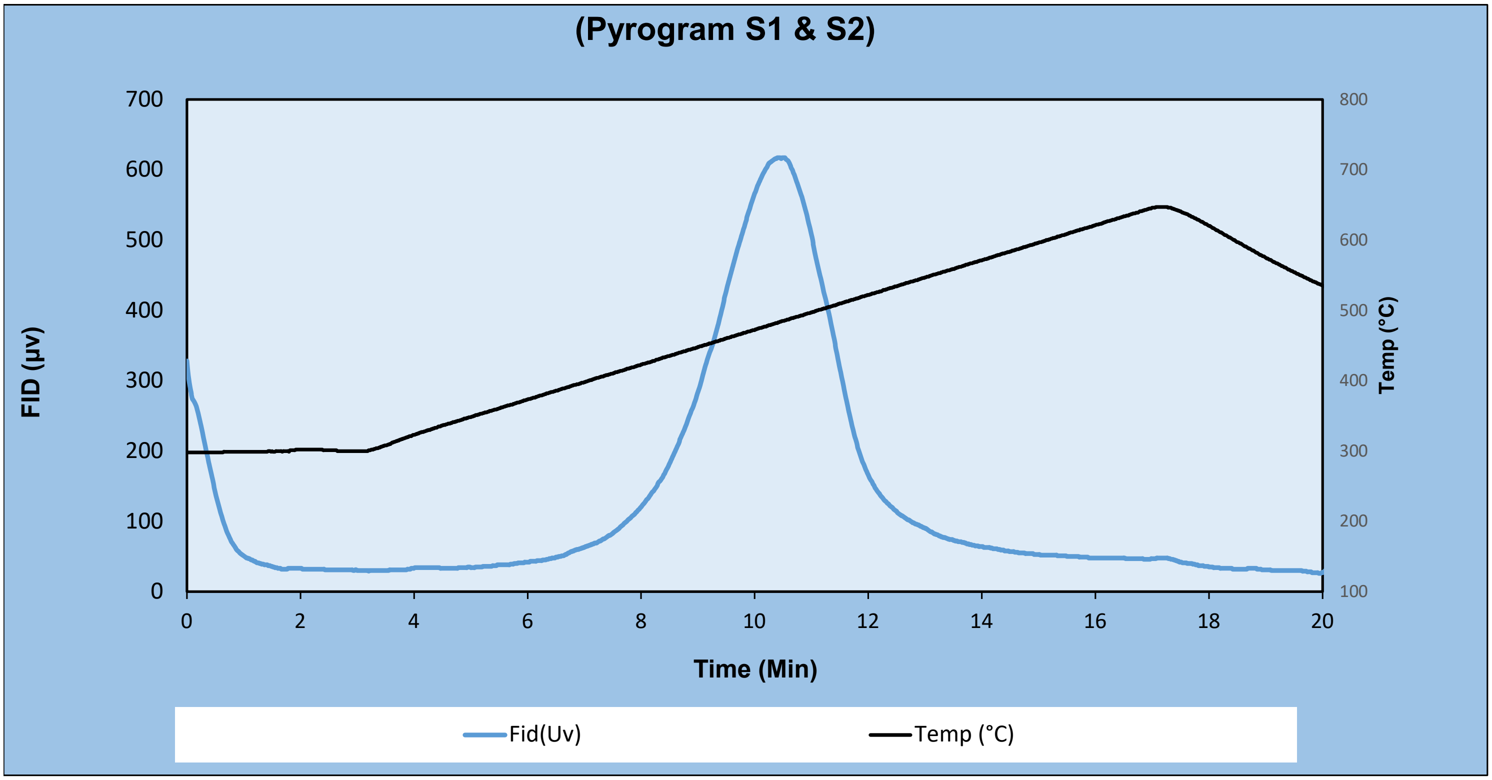
Company:	**Geofirma**	**ID:**	**SB_BH01_OG003**
Well:	**SB_BH01**	**Depth:**	**289.81**
Location:	**Canada**	**TOC:**	**0.20**
Formation:	**NA**	**Tmax:**	**435**

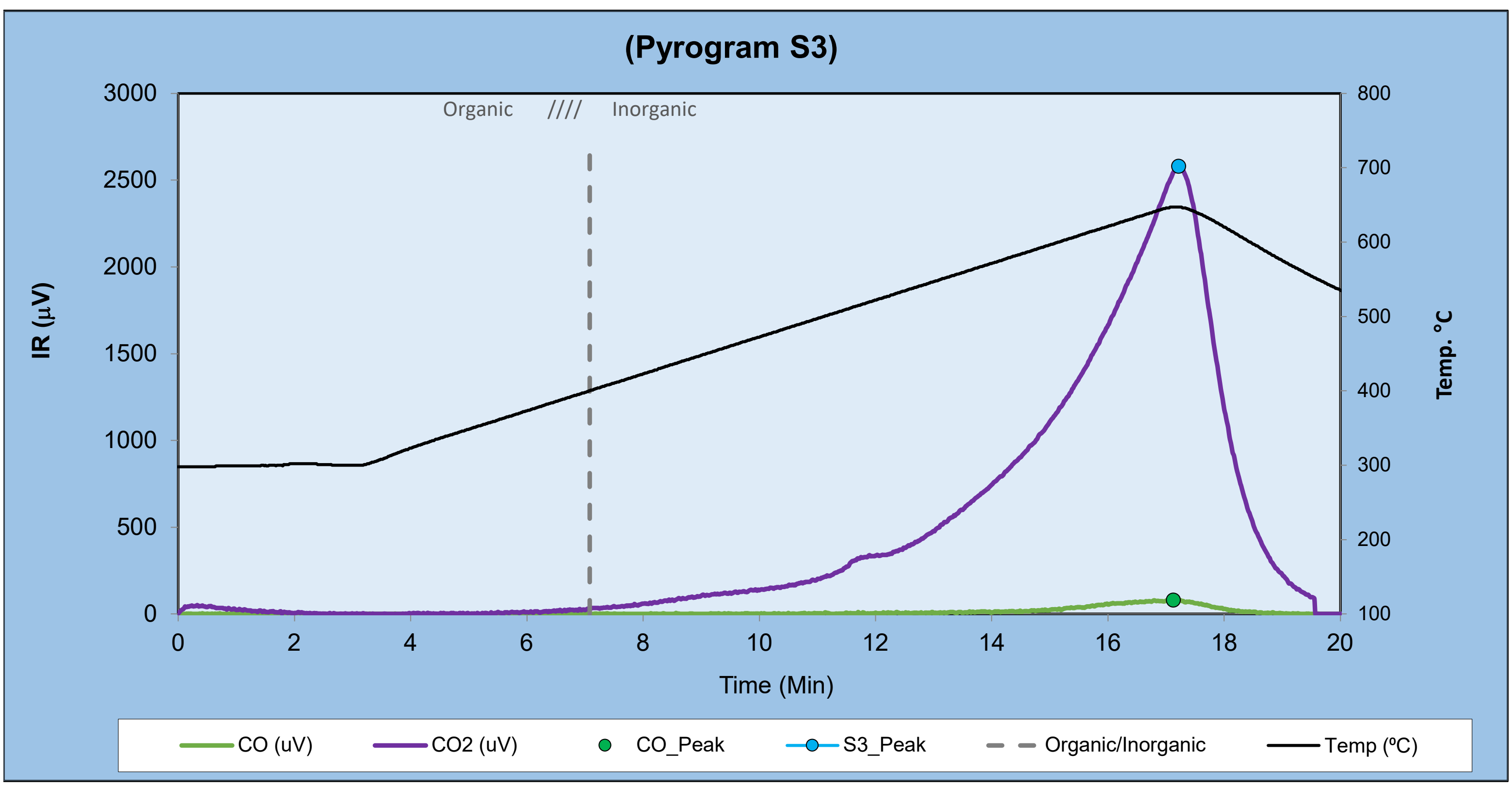




Source Pyrolysis

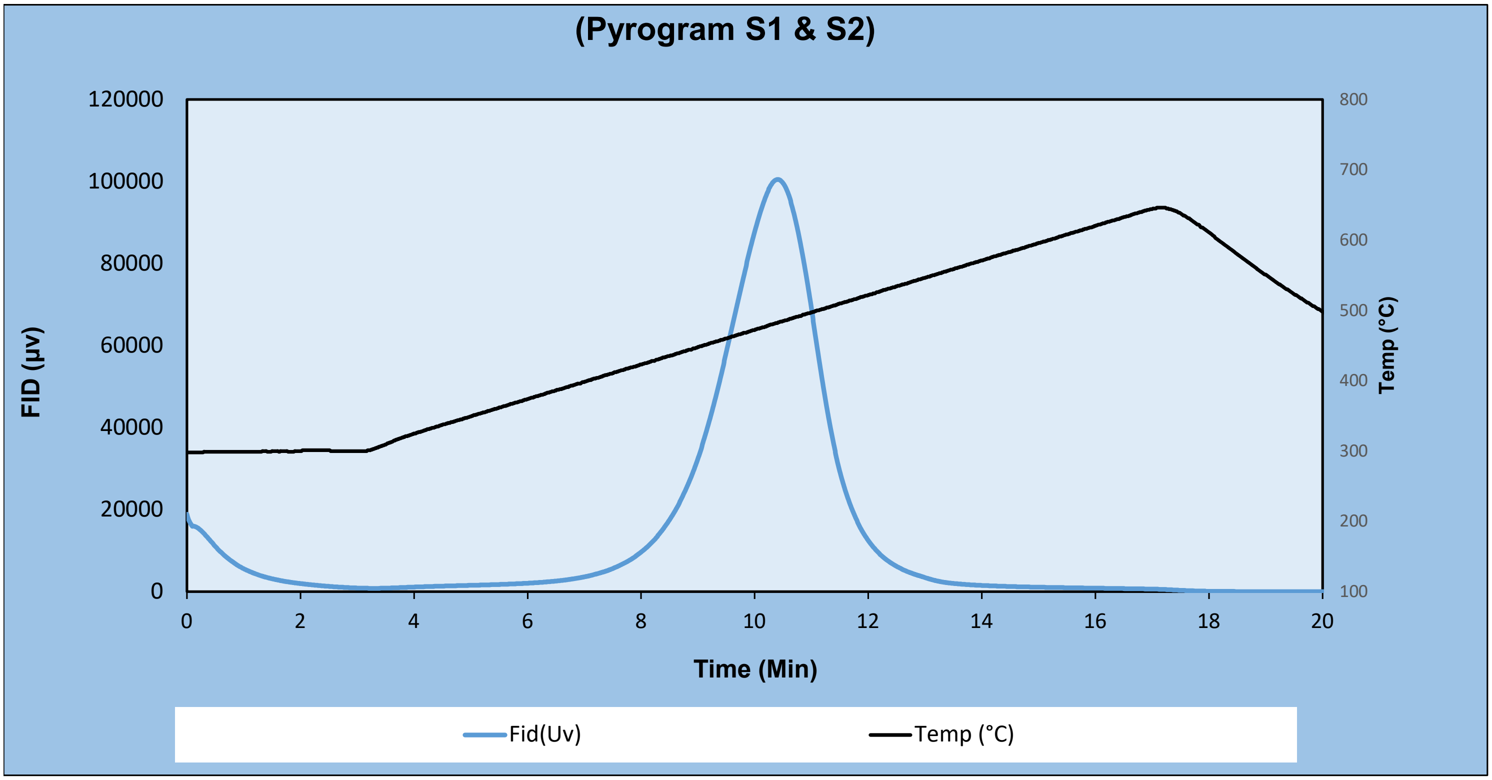
Company:	**Geofirma**	**ID:**	**SB_BH01_OG004**
Well:	**SB_BH01**	**Depth:**	**341.59**
Location:	**Canada**	**TOC:**	**0.24**
Formation:	**NA**	**Tmax:**	**441**

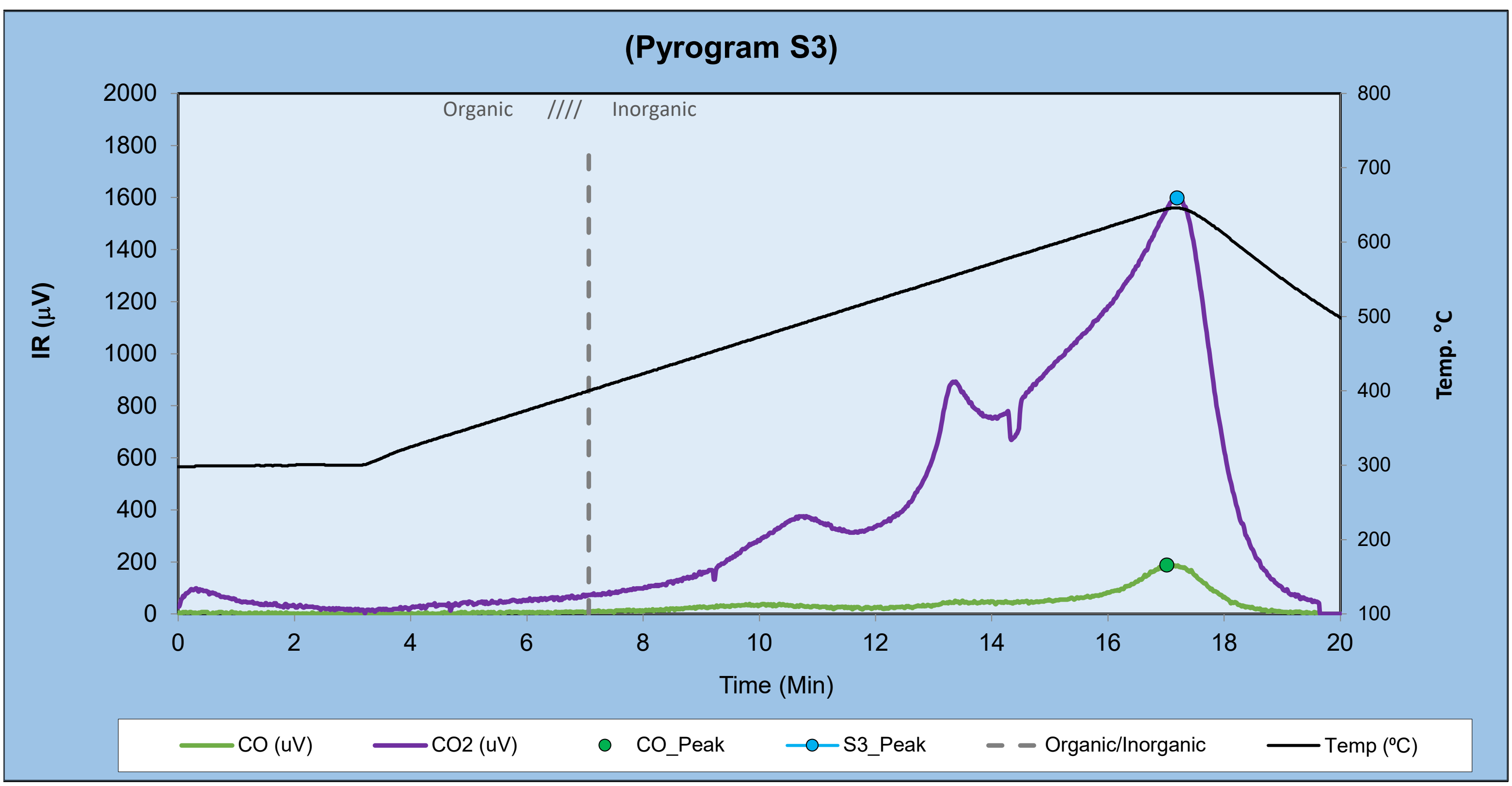




Source Pyrolysis

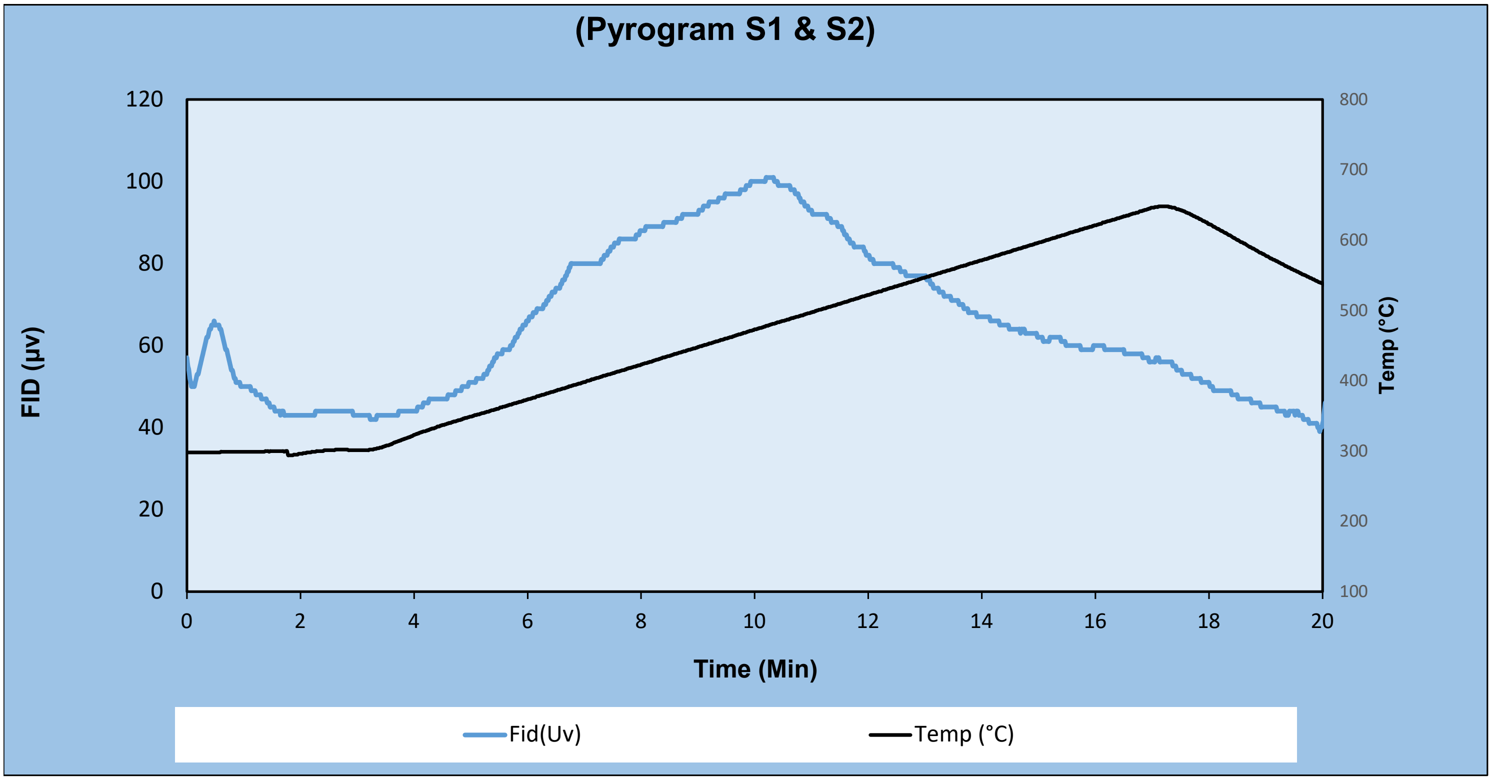
Company:	**Geofirma**	**ID:**	**SB_BH01_OG007**
Well:	**SB_BH01**	**Depth:**	**473.98**
Location:	**Canada**	**TOC:**	**0.16**
Formation:	**NA**	**Tmax:**	**486**

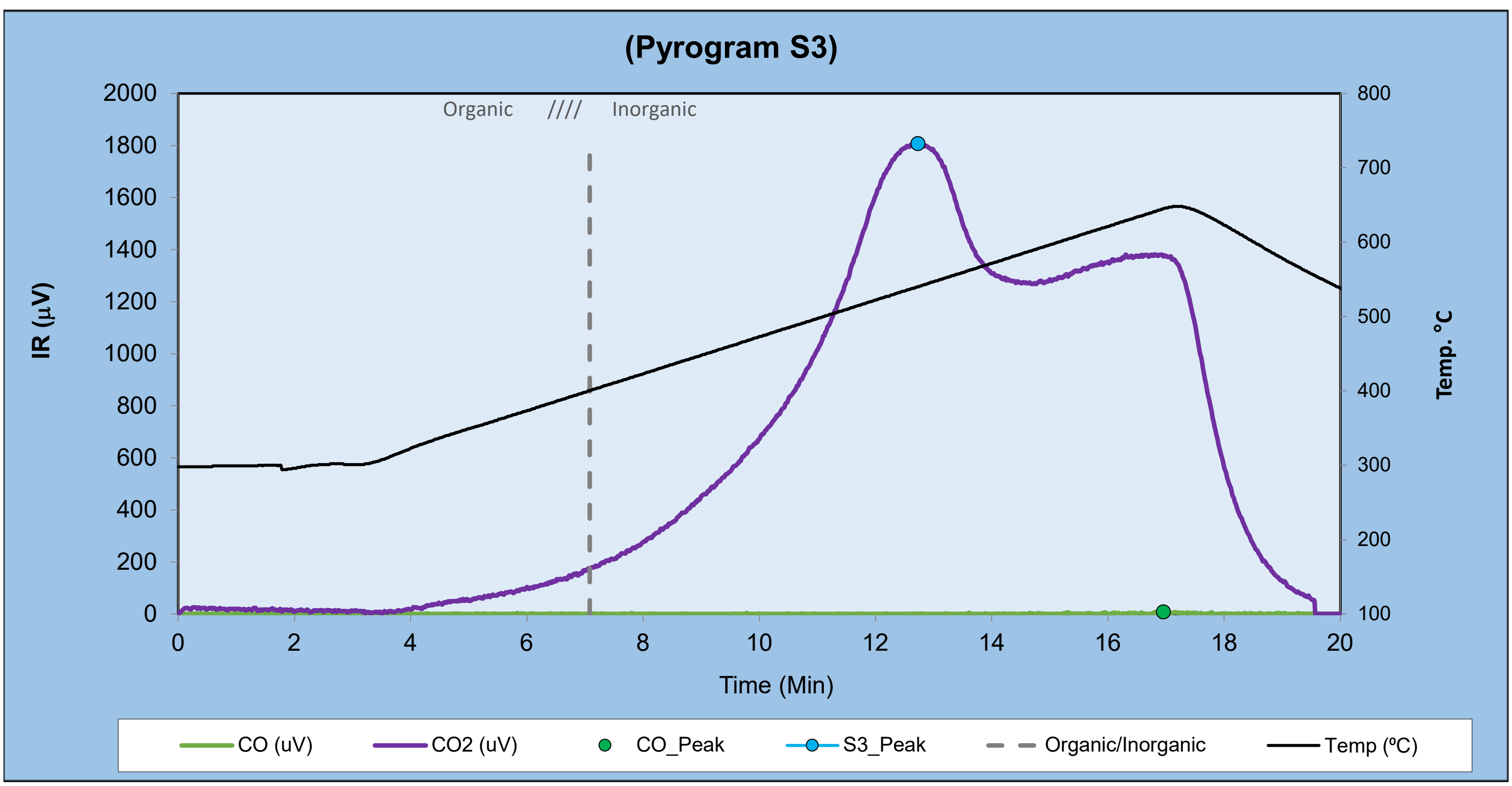




Source Pyrolysis

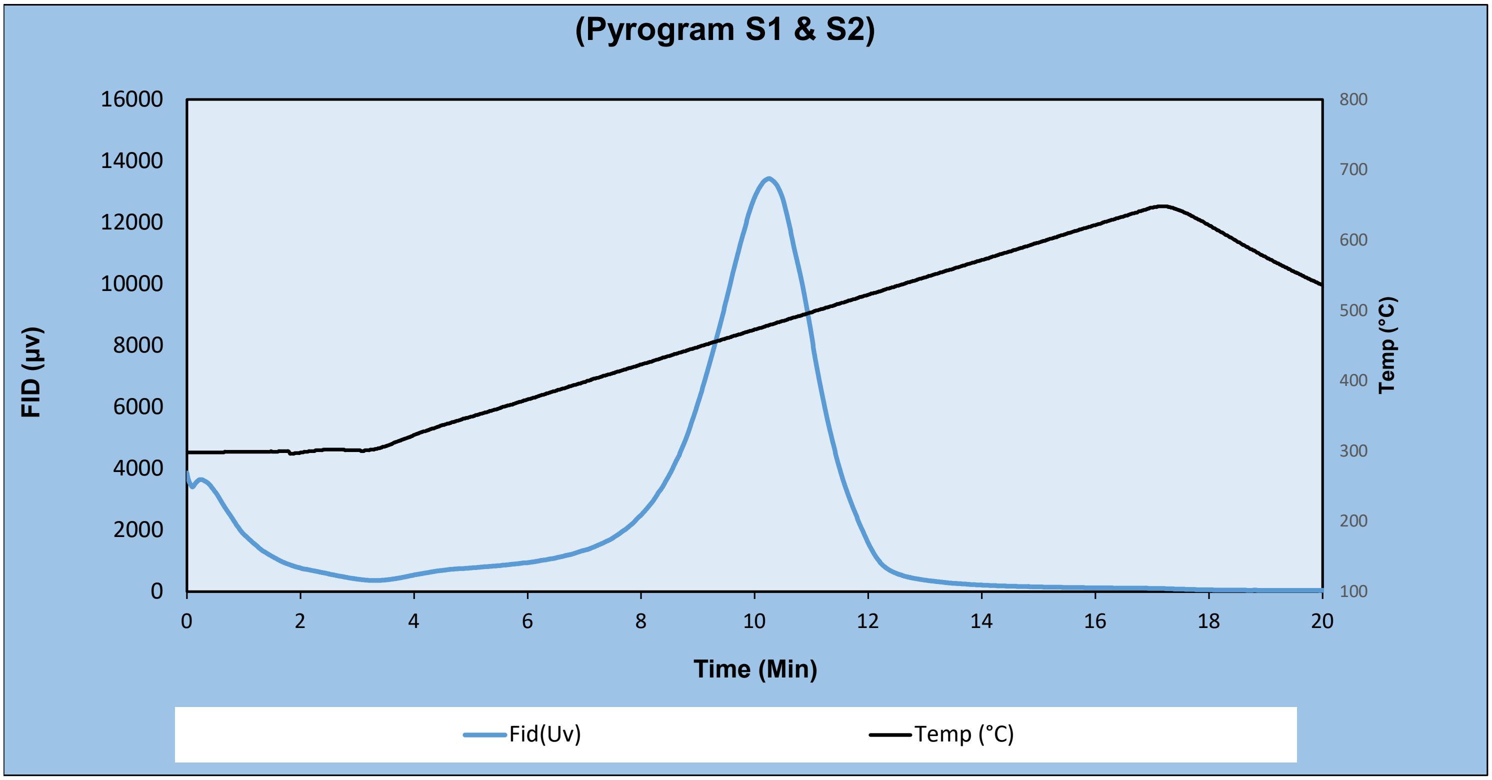
Company:	**Geofirma**	**ID:**	**SB_BH01_OG008**
Well:	**SB_BH01**	**Depth:**	**534.56**
Location:	**Canada**	**TOC:**	**0.22**
Formation:	**NA**	**Tmax:**	**437**

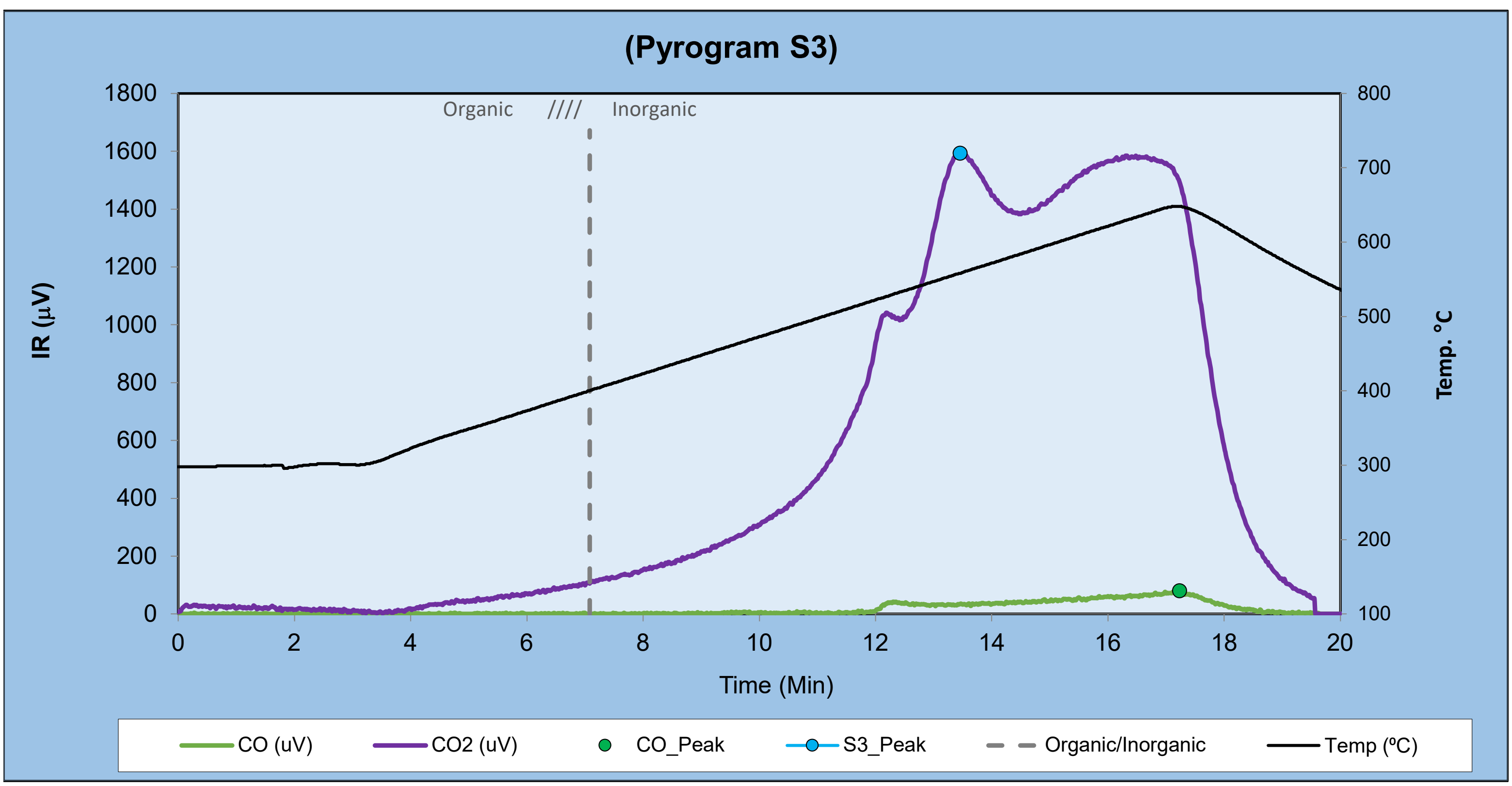




Source Pyrolysis

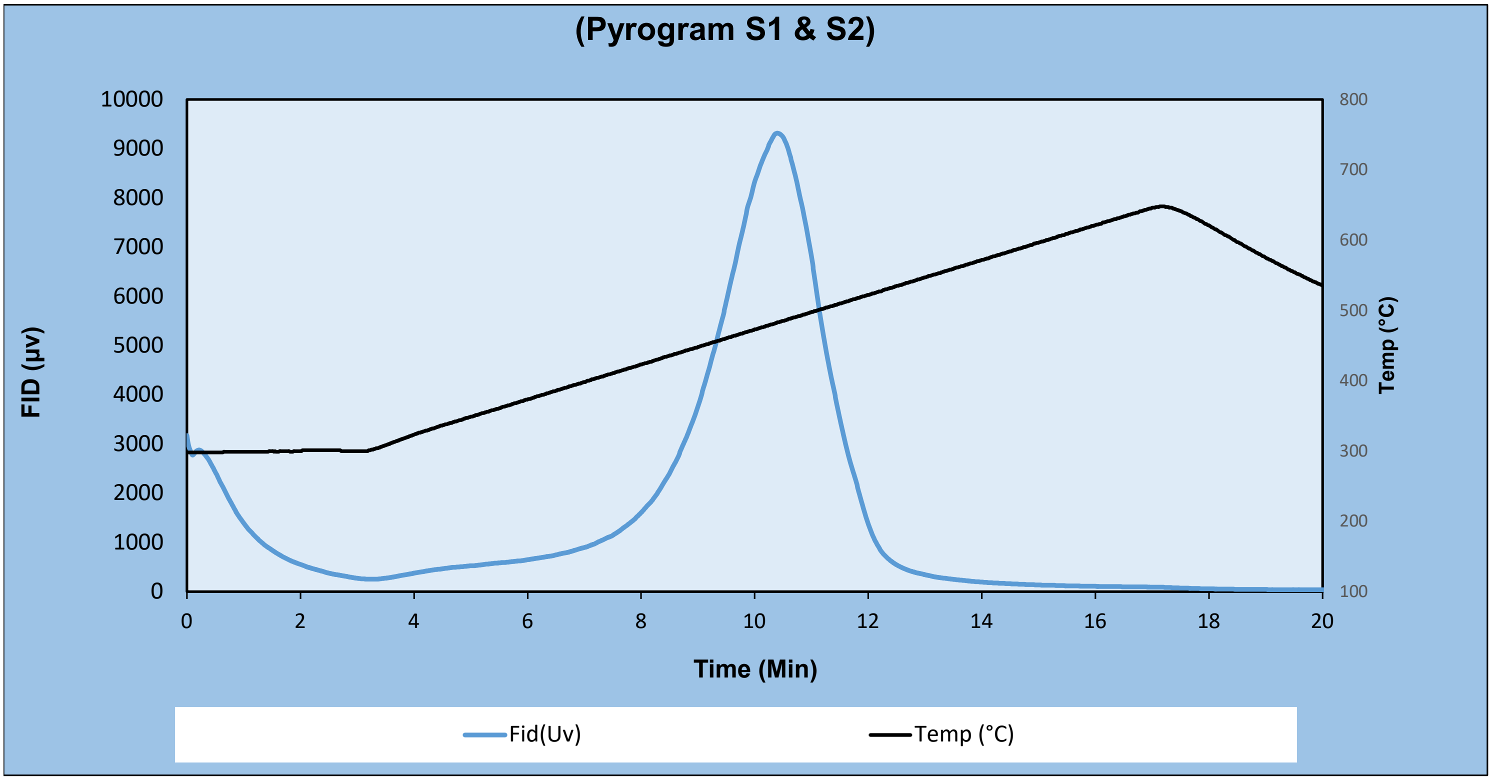
Company:	**Geofirma**	**ID:**	**SB_BH01_OG009**
Well:	**SB_BH01**	**Depth:**	**633.17**
Location:	**Canada**	**TOC:**	**1.53**
Formation:	**NA**	**Tmax:**	**438**

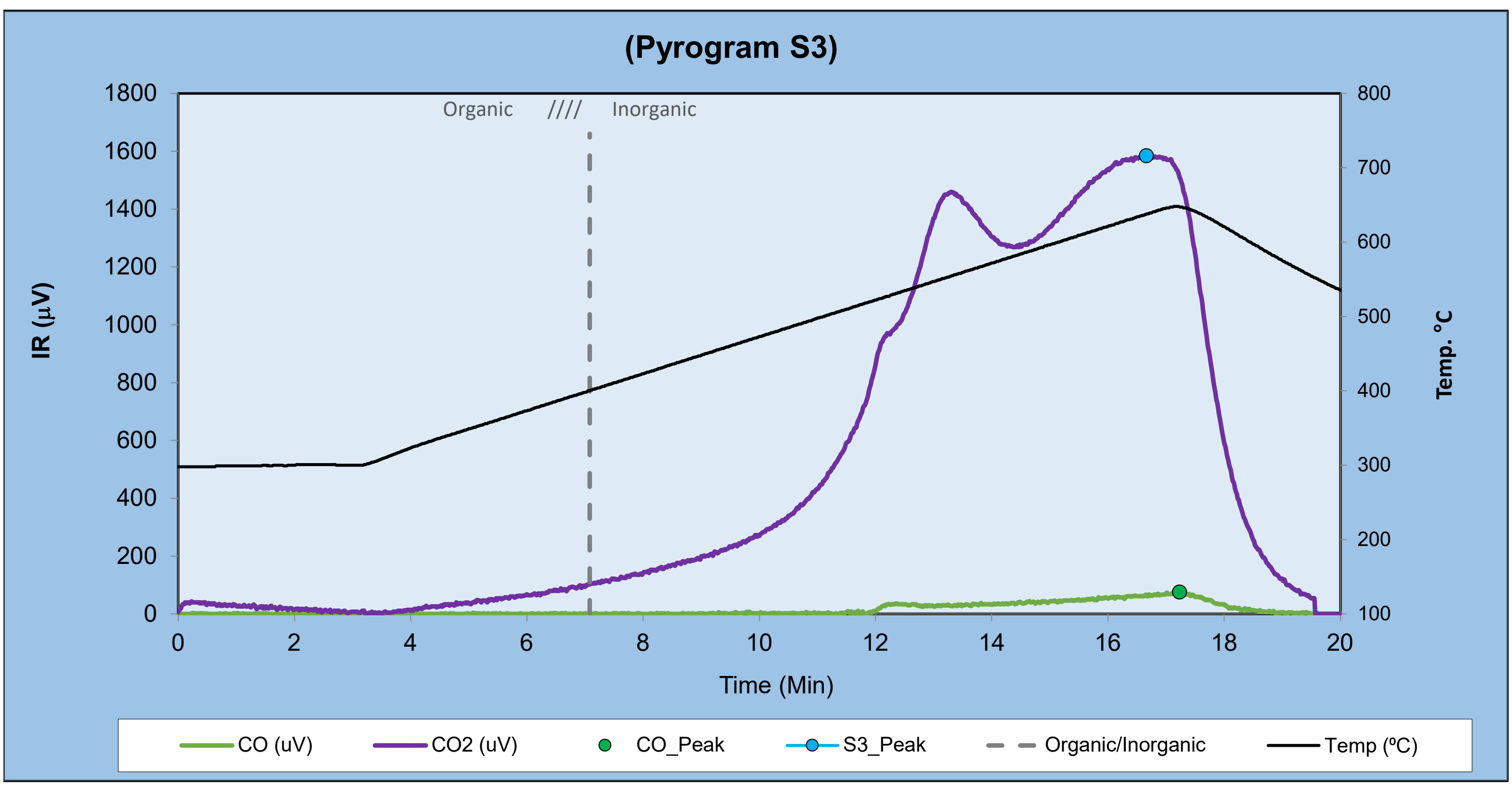




Source Pyrolysis

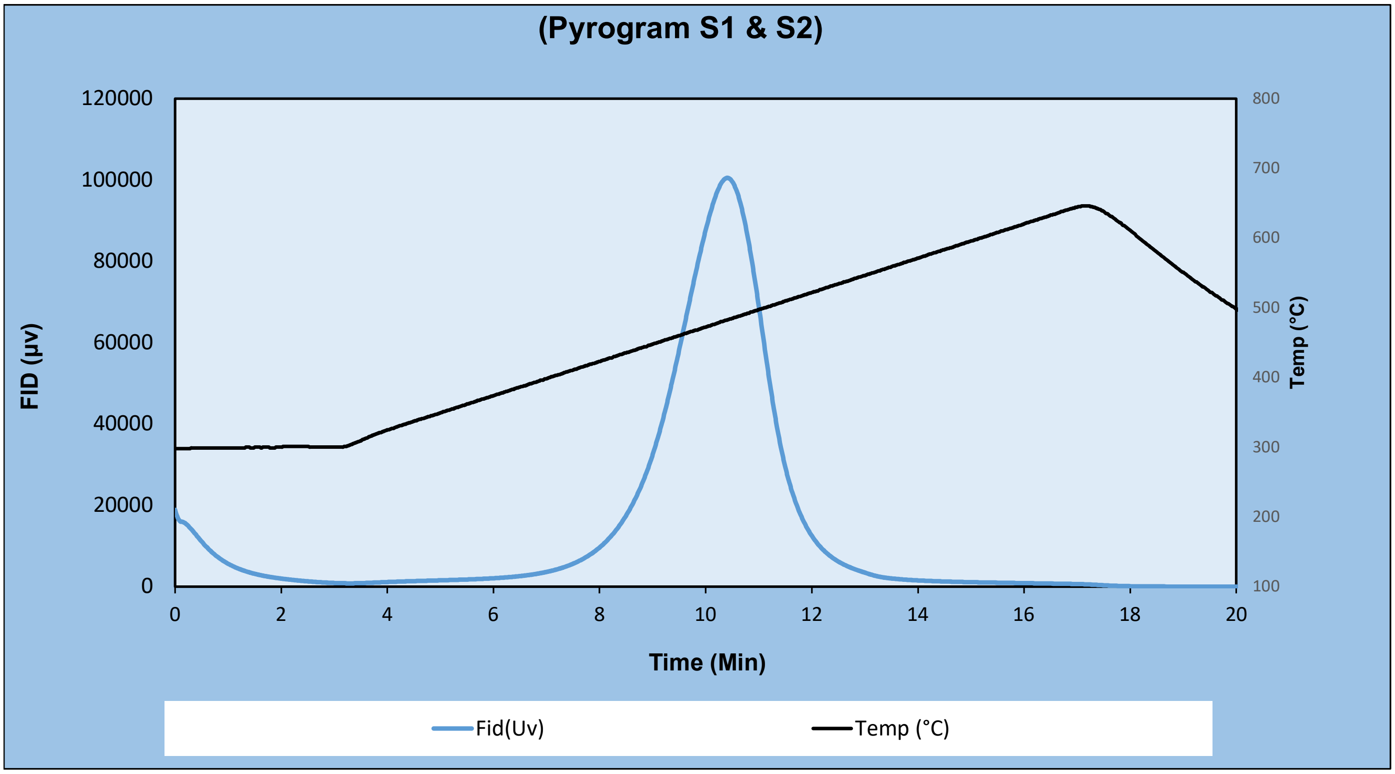
Company:	**Geofirma**	**ID:**	**SB_BH01_OG010**
Well:	**SB_BH01**	**Depth:**	**641.9**
Location:	**Canada**	**TOC:**	**1.30**
Formation:	**NA**	**Tmax:**	**442**

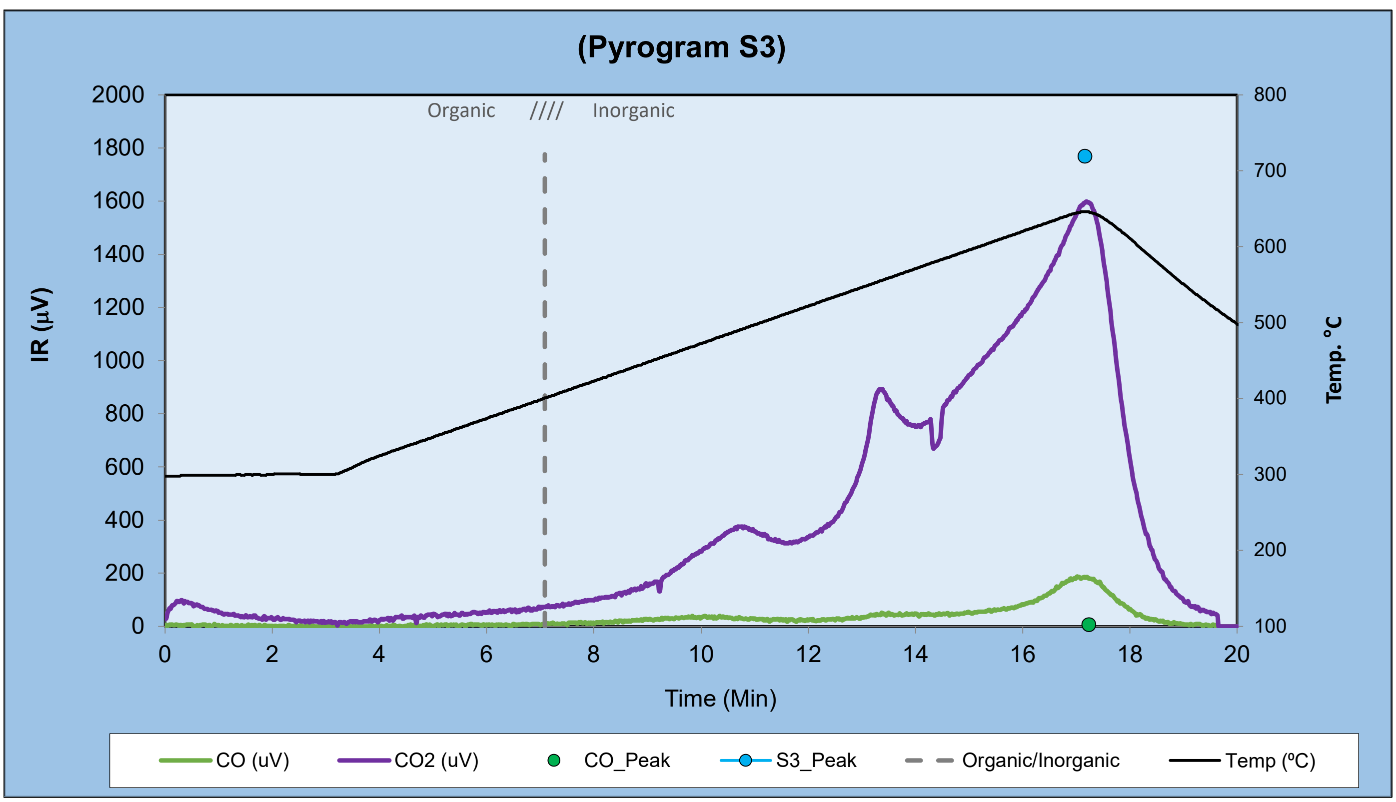




Source Pyrolysis

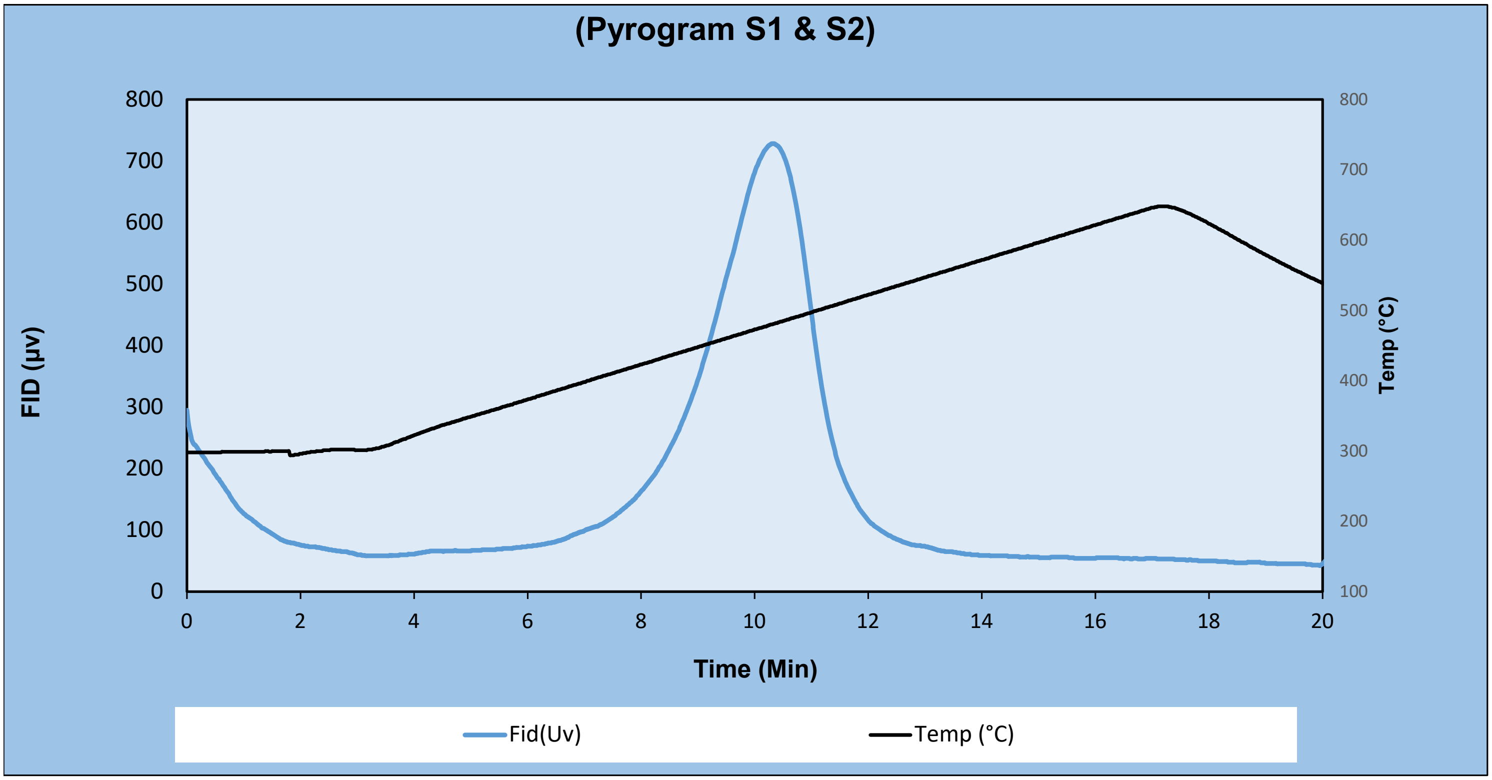
Company:	**Geofirma**	**ID:**	**SB_BH01_OG019**
Well:	**SB_BH01**	**Depth:**	**645.78**
Location:	**Canada**	**TOC:**	**5.27**
Formation:	**NA**	**Tmax:**	**443**

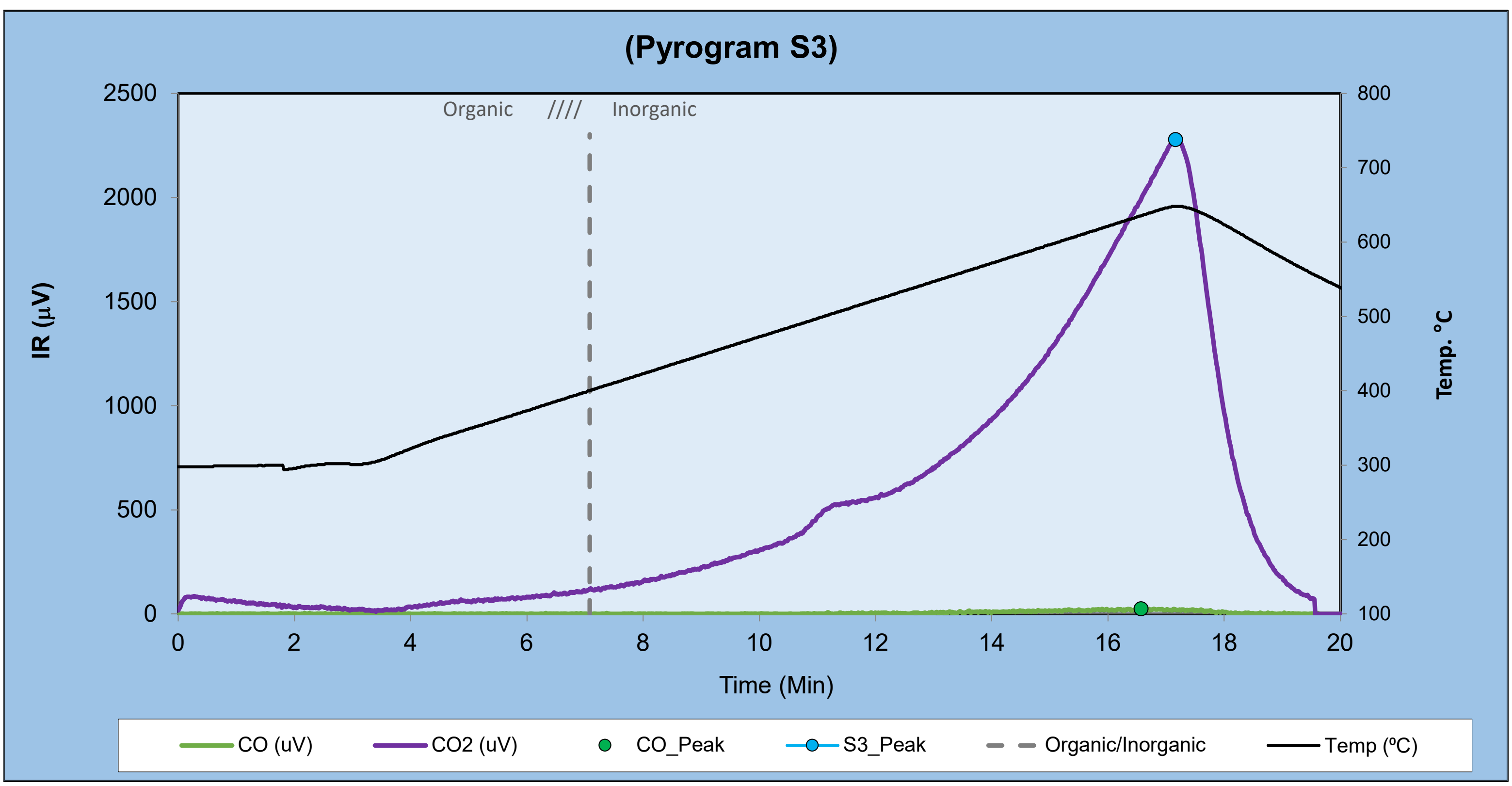




Source Pyrolysis

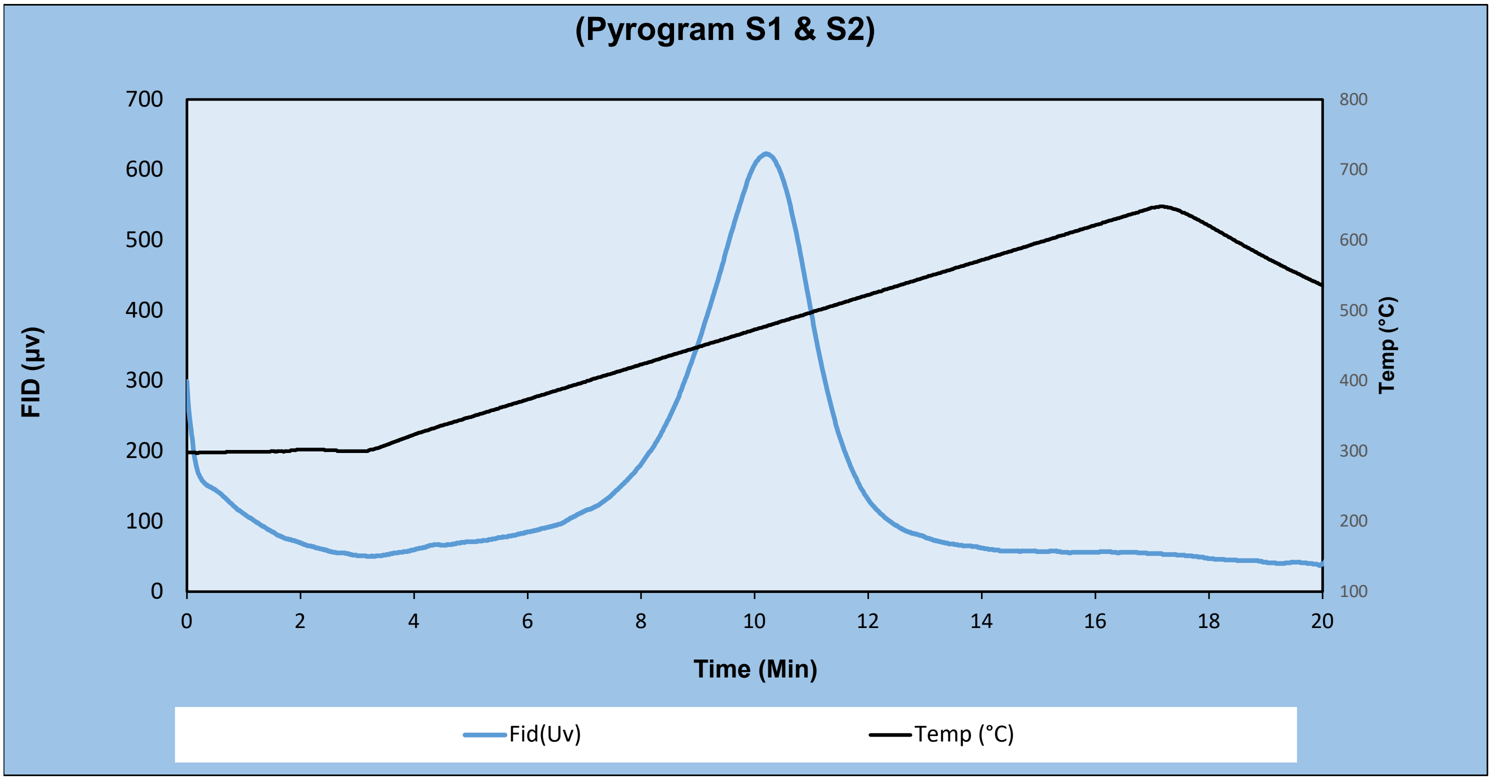
Company:	**Geofirma**	**ID:**	**SB_BH01_OG012**
Well:	**SB_BH01**	**Depth:**	**686**
Location:	**Canada**	**TOC:**	**0.26**
Formation:	**NA**	**Tmax:**	**439**

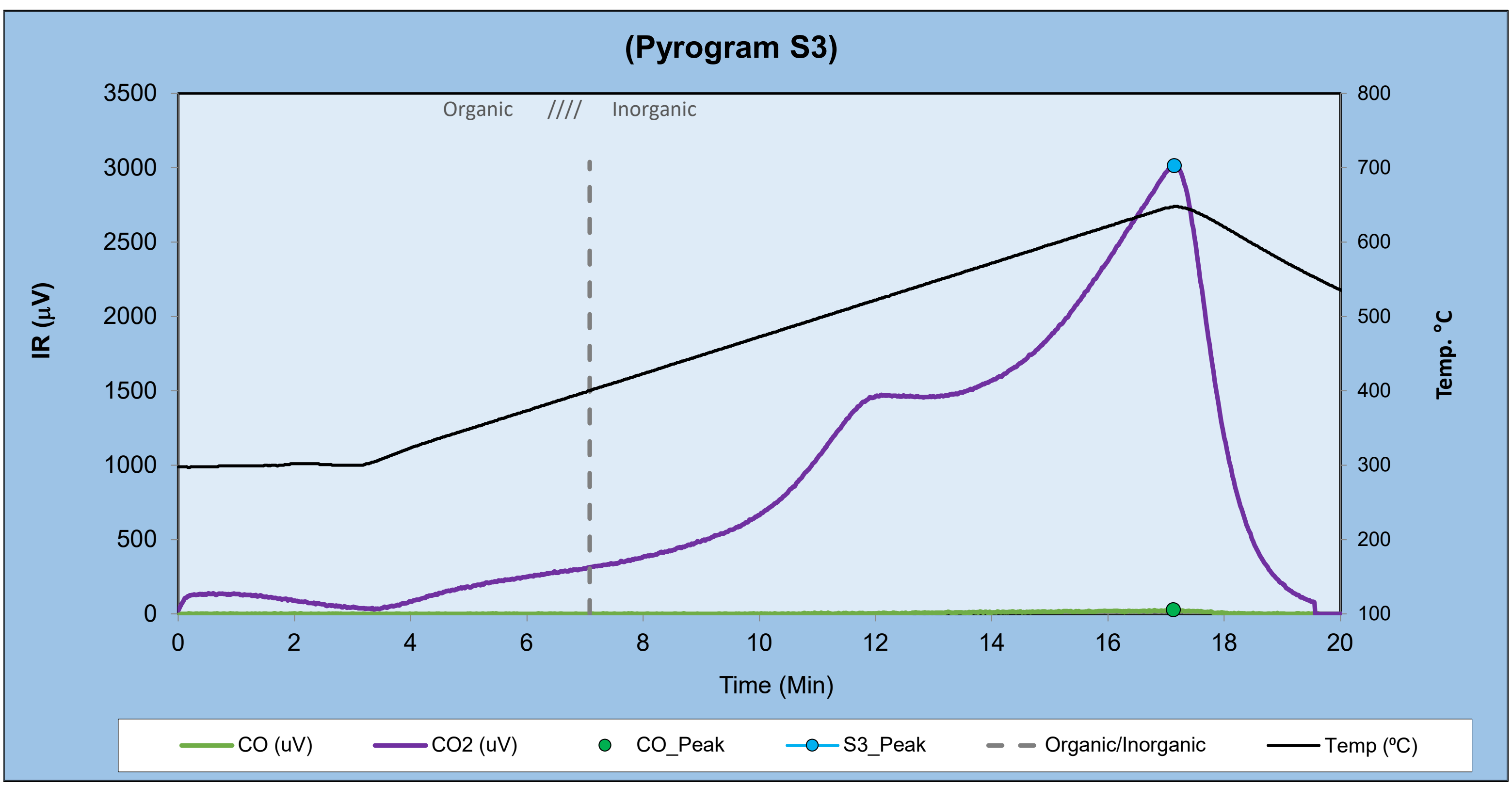




Source Pyrolysis

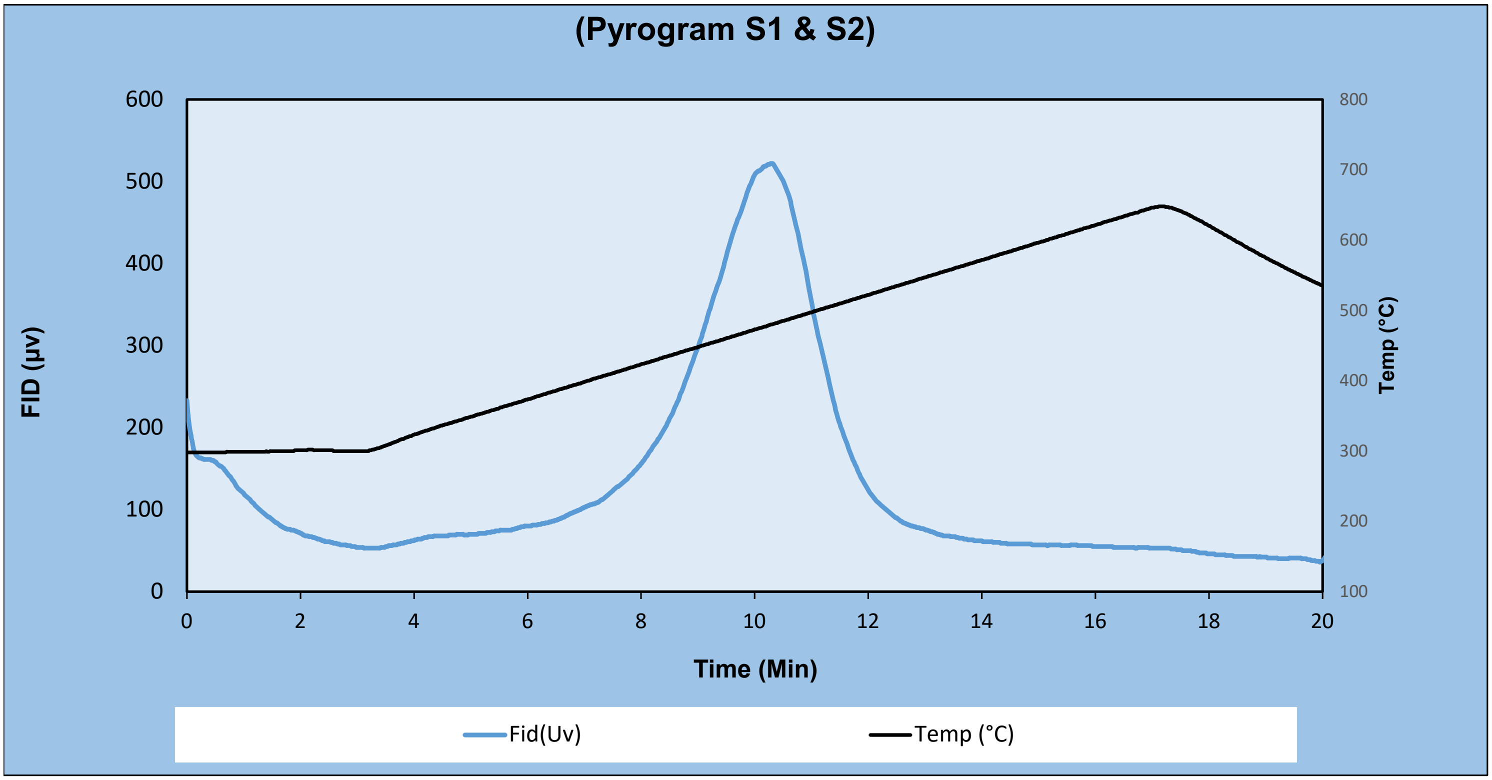
Company:	**Geofirma**	**ID:**	**SB_BH01_OG013**
Well:	**SB_BH01**	**Depth:**	**716.04**
Location:	**Canada**	**TOC:**	**0.31**
Formation:	**NA**	**Tmax:**	**436**

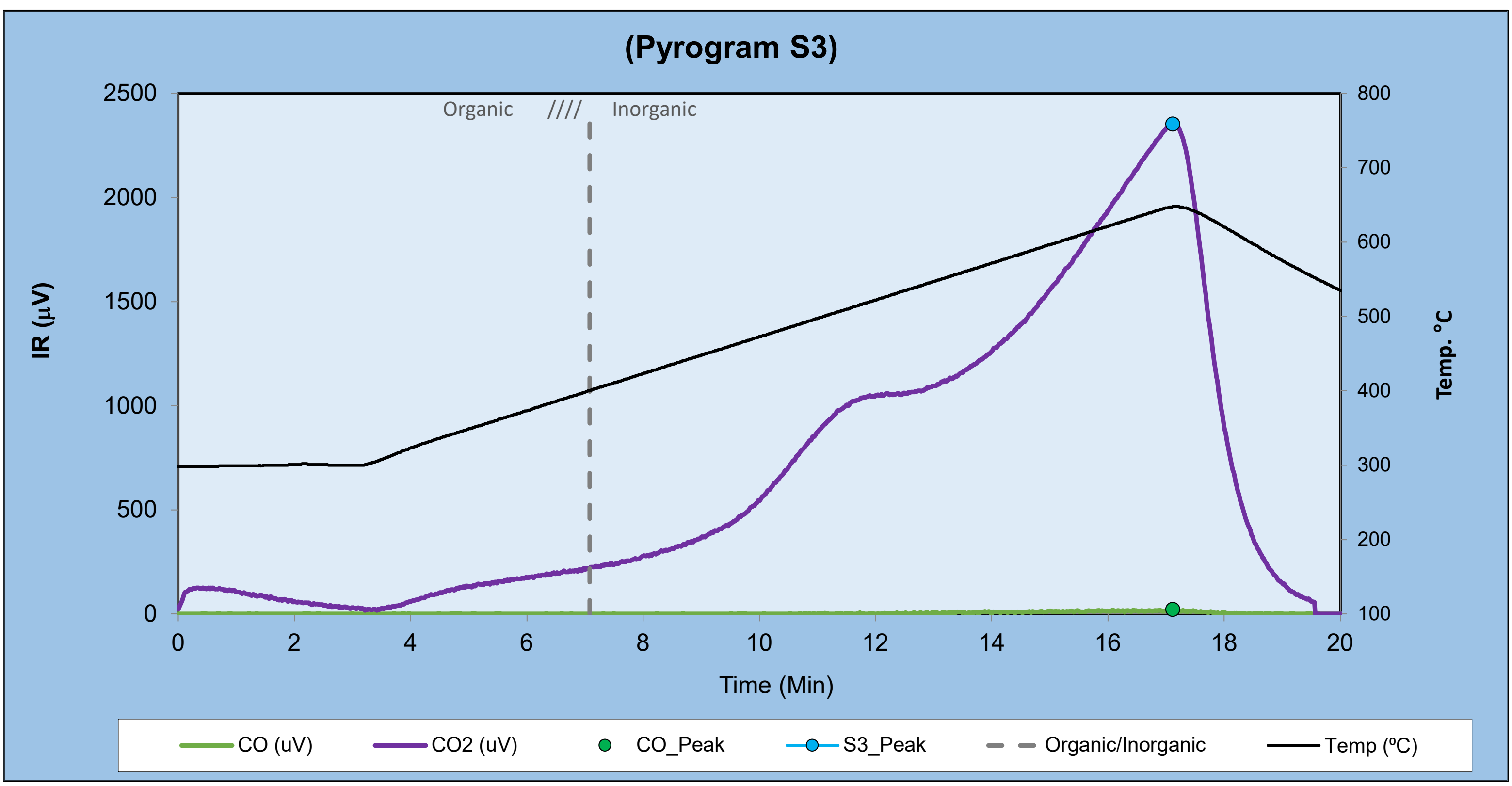




Source Pyrolysis

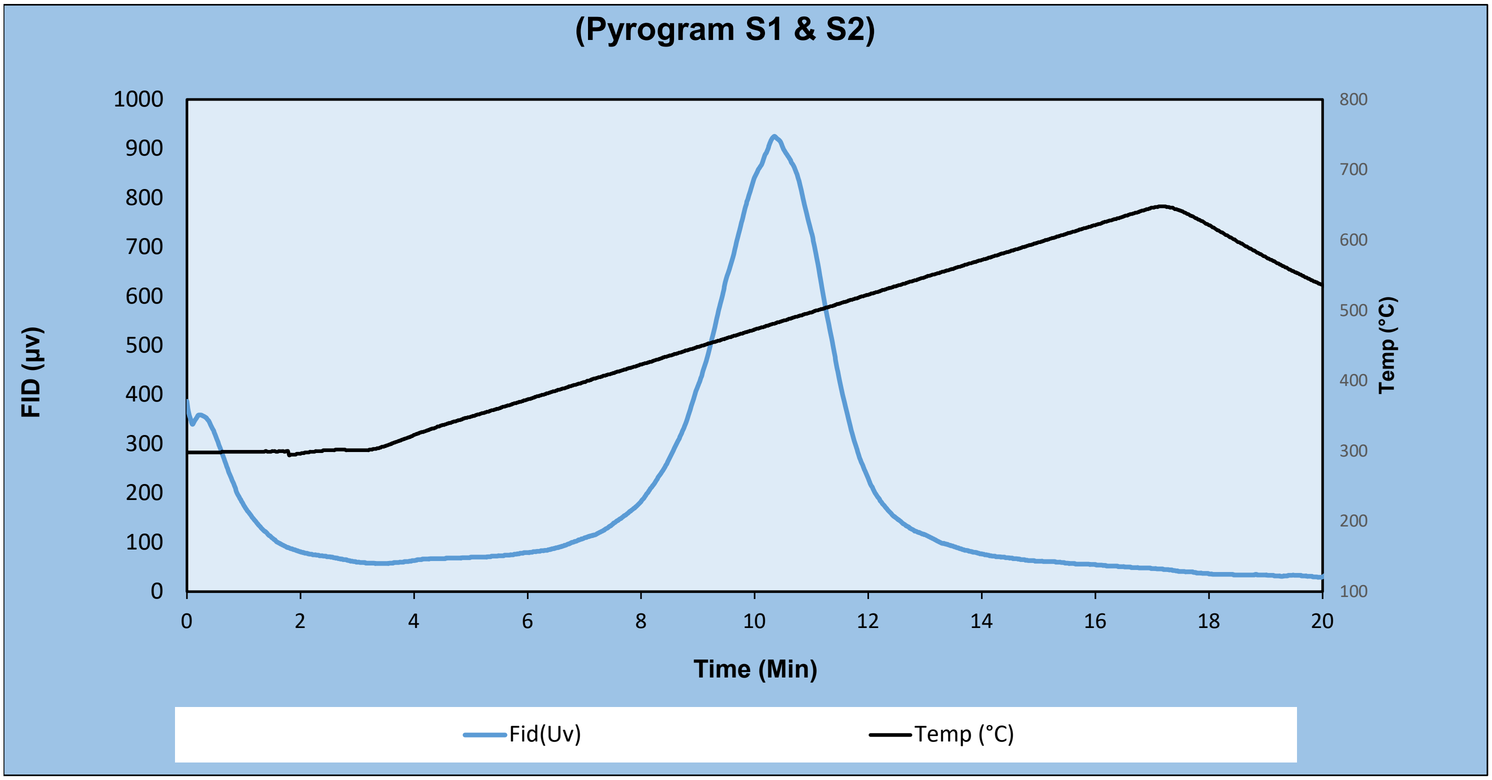
Company:	**Geofirma**	**ID:**	**SB_BH01_OG014**
Well:	**SB_BH01**	**Depth:**	**746.18**
Location:	**Canada**	**TOC:**	**0.30**
Formation:	**NA**	**Tmax:**	**439**

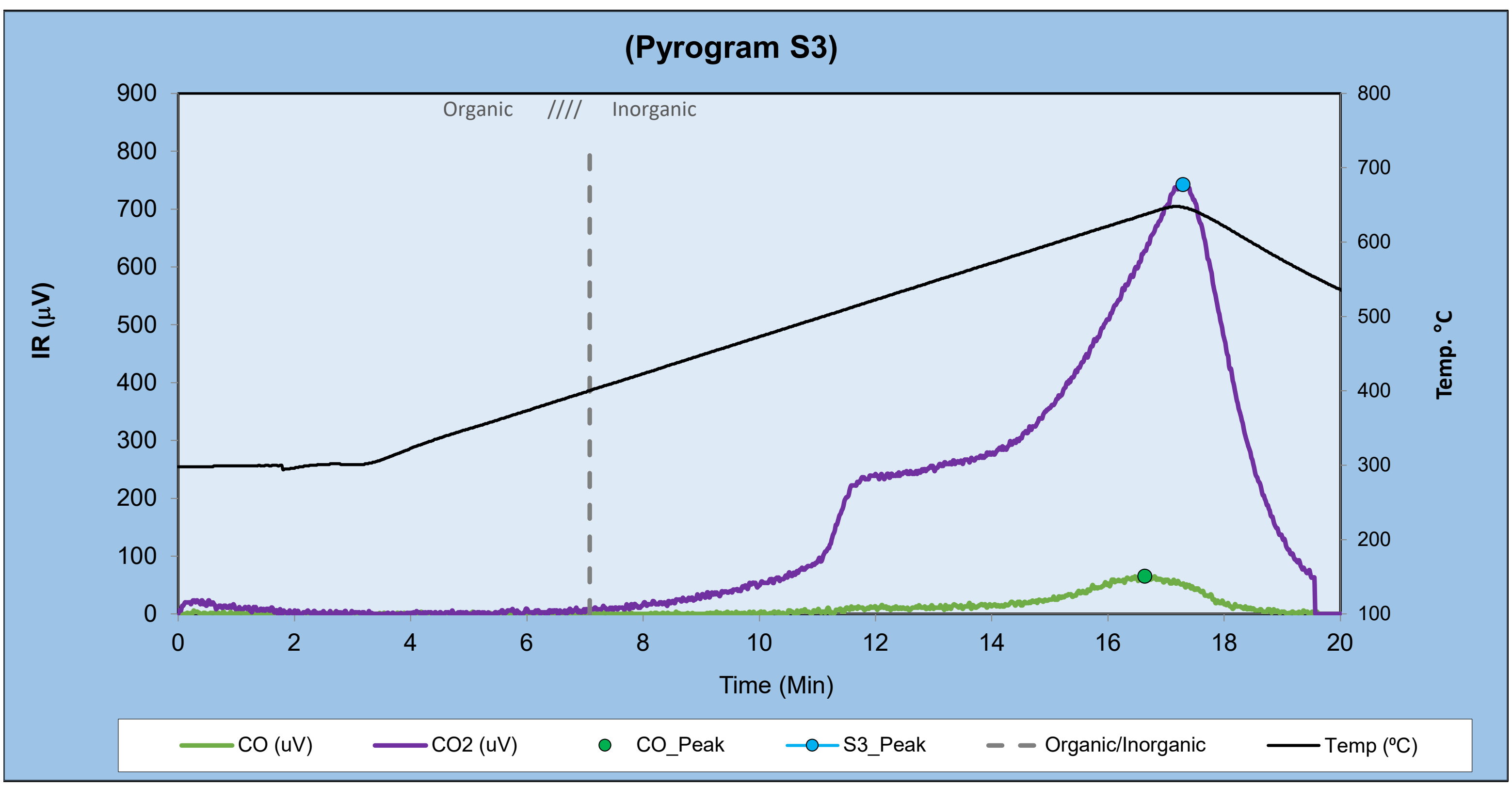




Source Pyrolysis

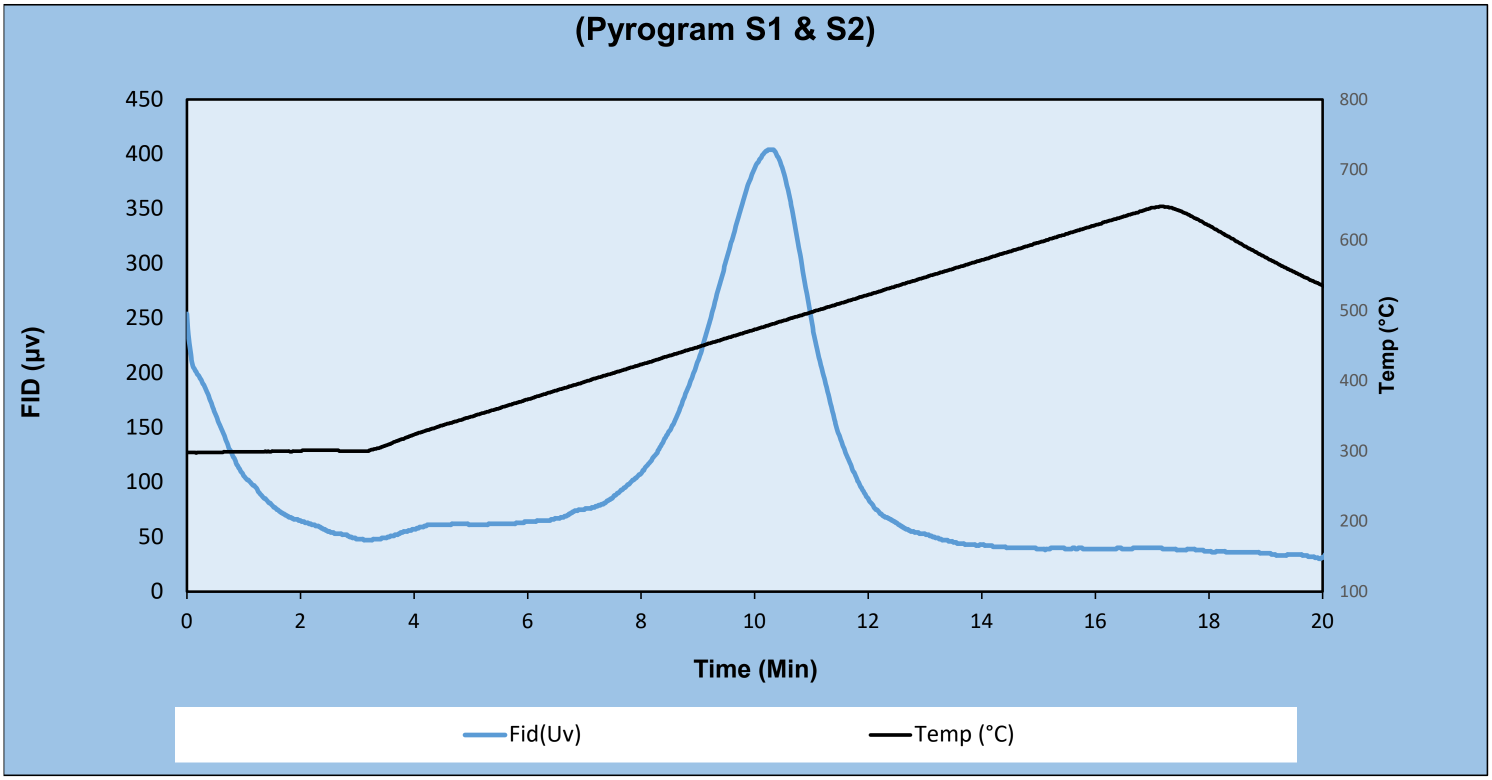
Company:	**Geofirma**	**ID:**	**SB_BH01_OG016**
Well:	**SB_BH01**	**Depth:**	**797.62**
Location:	**Canada**	**TOC:**	**0.30**
Formation:	**NA**	**Tmax:**	**440**

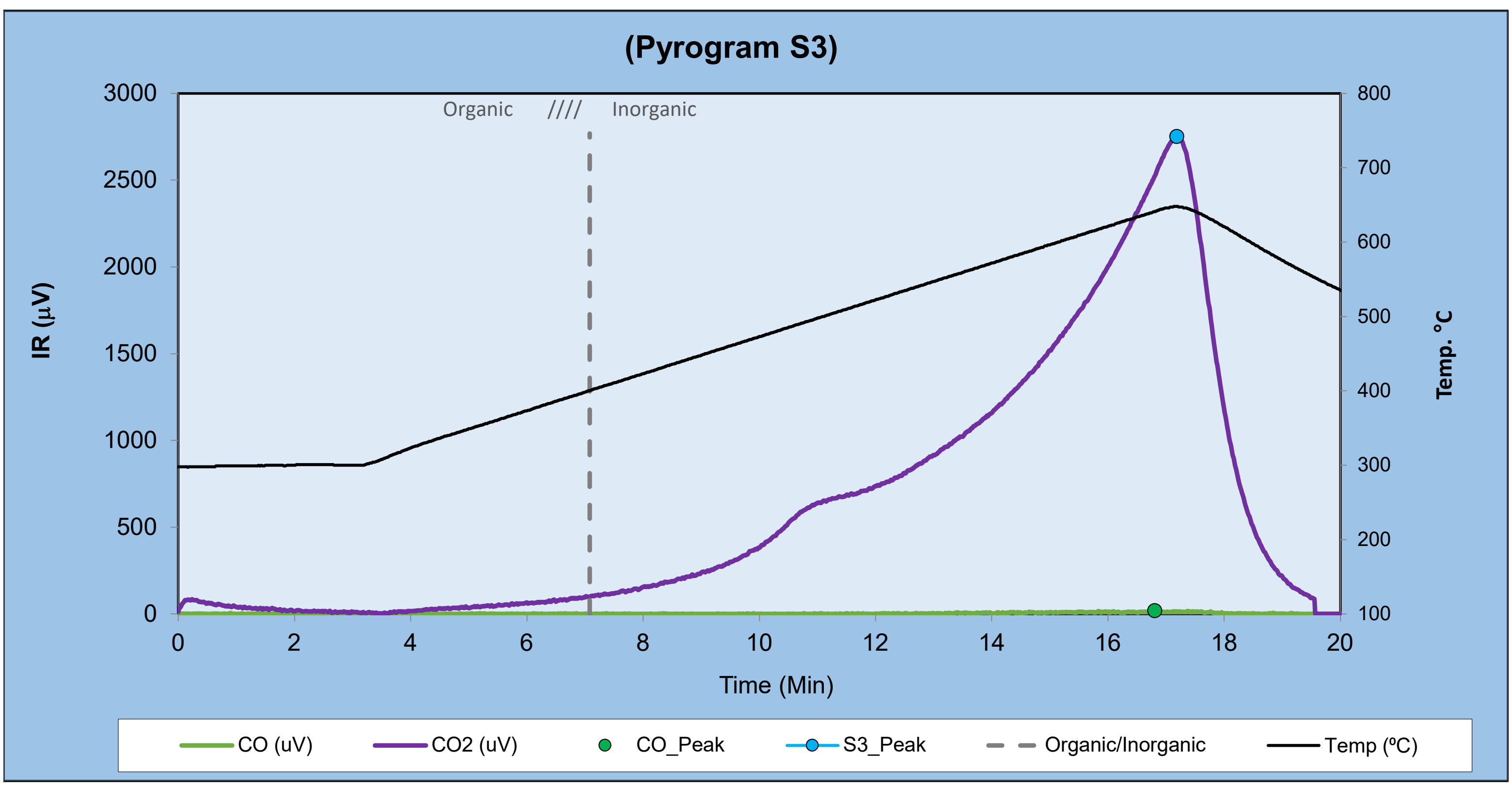




Source Pyrolysis

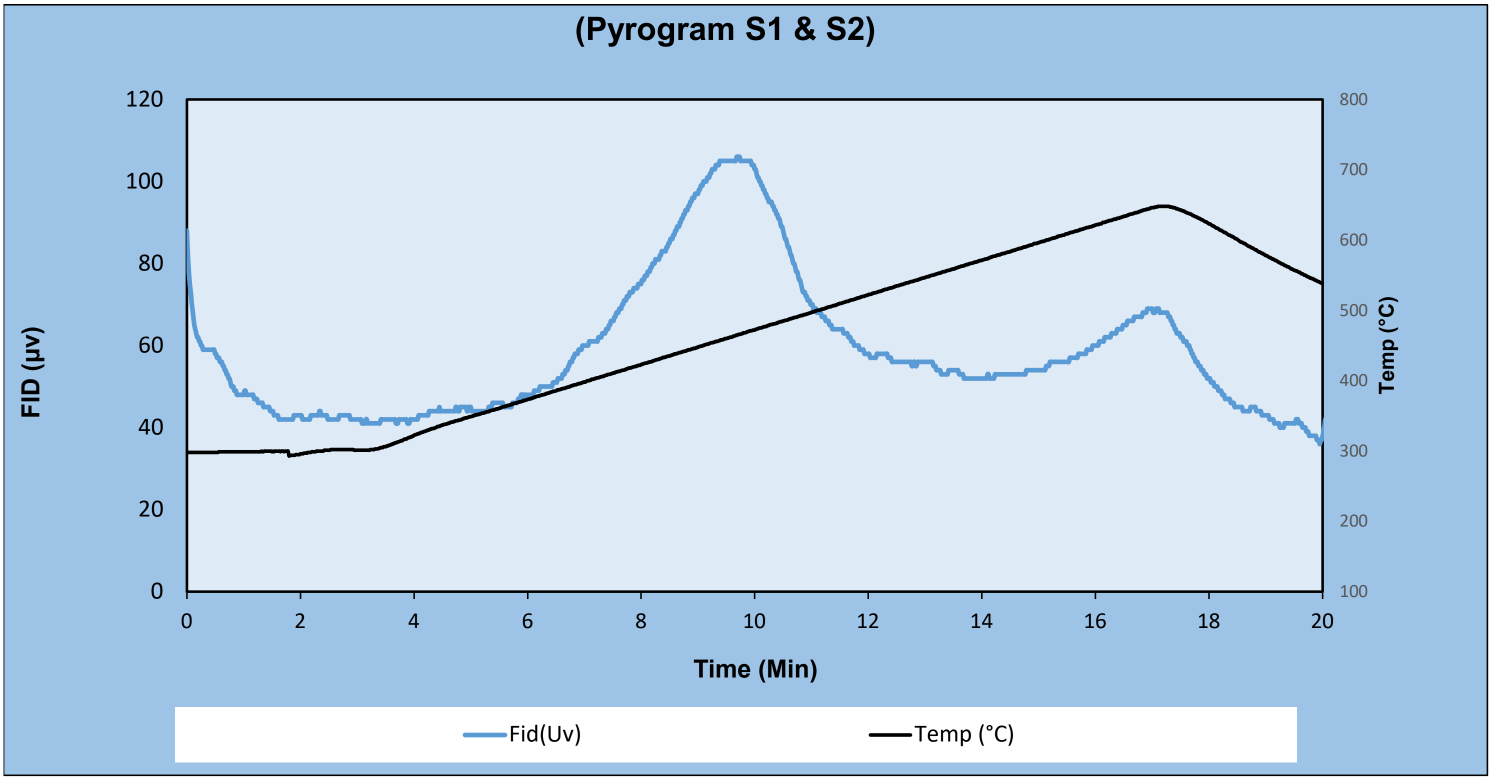
Company:	**Geofirma**	**ID:**	**SB_BH01_OG017**
Well:	**SB_BH01**	**Depth:**	**824.72**
Location:	**Canada**	**TOC:**	**0.25**
Formation:	**NA**	**Tmax:**	**437**

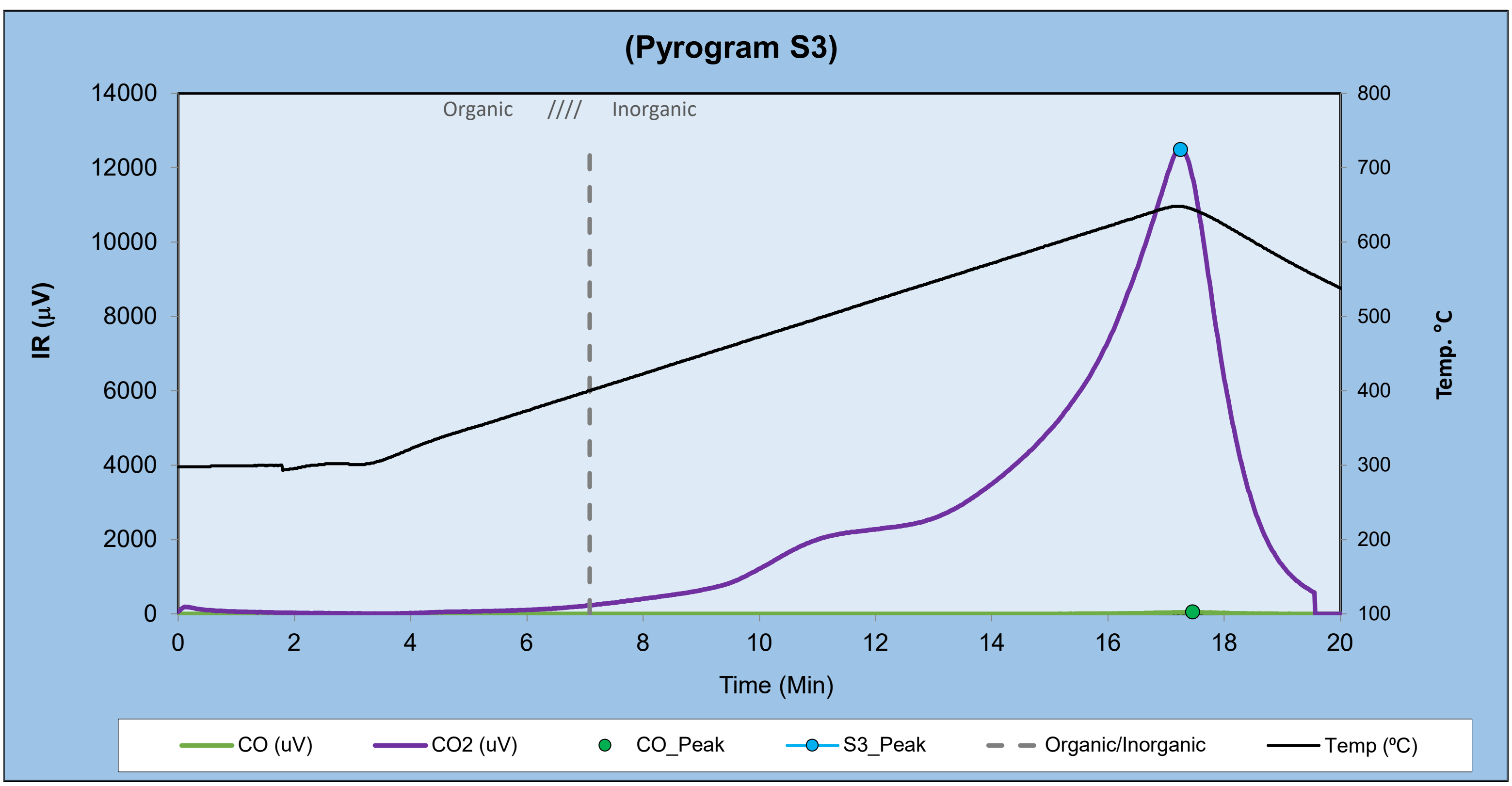




Source Pyrolysis

Company:	**Geofirma**	**ID:**	**SB_BH01_OG018**
Well:	**SB_BH01**	**Depth:**	**857.52**
Location:	**Canada**	**TOC:**	**0.23**
Formation:	**NA**	**Tmax:**	**424**





Composition Determined by X-ray Diffraction and TOC Analyses

Company: GEOFIRMA
Well: SB_BH01
Job File: 202105355

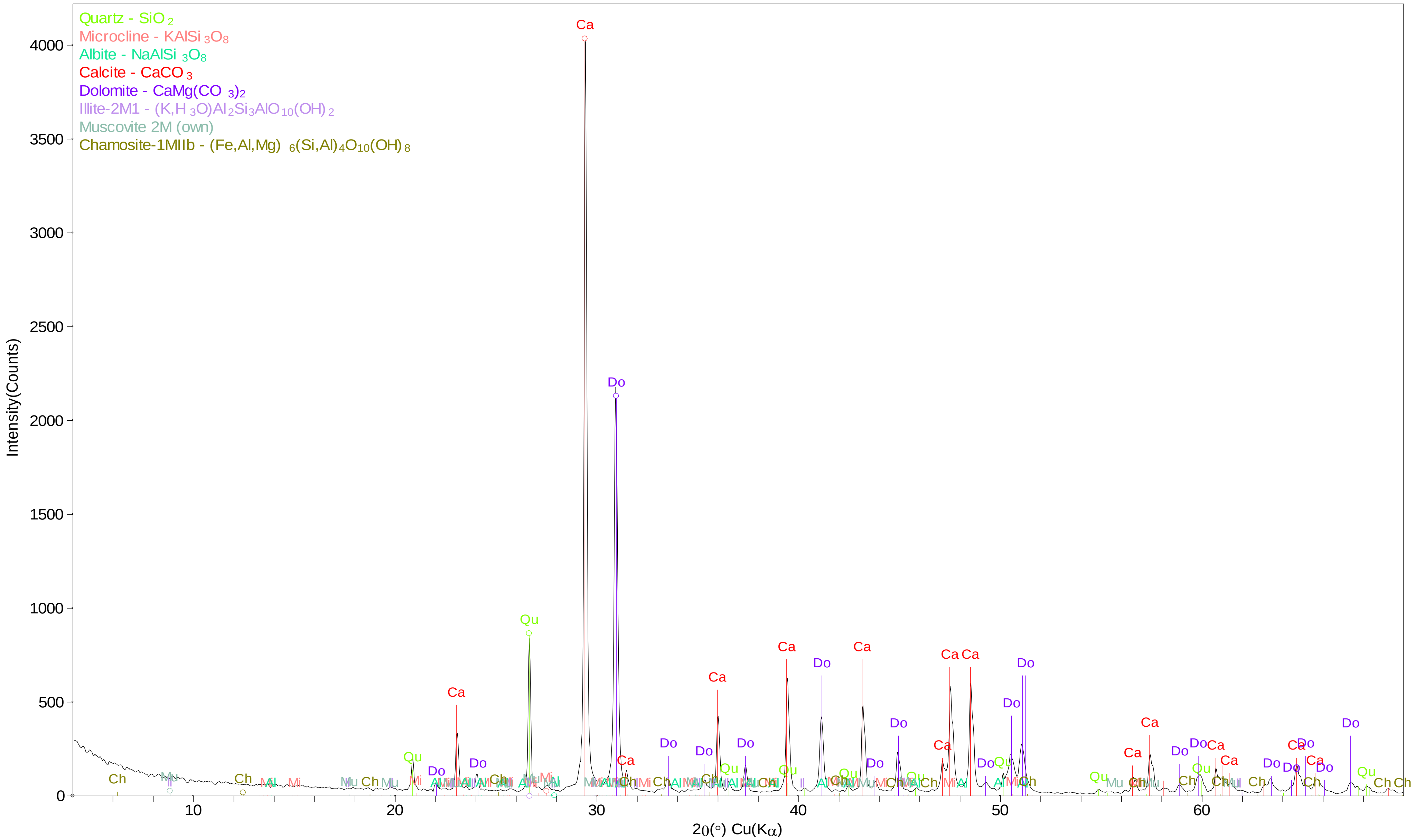
Sample No	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**14**	**08**	**09**	**10**	**11**	**12**	**13**
Sample ID	**SB_BH01_OG002**	**SB_BH01_OG003**	**SB_BH01_OG004**	**SB_BH01_OG007**	**SB_BH01_OG008**	**SB_BH01_OG009**	**SB_BH01_OG010**	**SB_BH01_OG019**	**SB_BH01_OG012**	**SB_BH01_OG013**	**SB_BH01_OG014**	**SB_BH01_OG016**	**SB_BH01_OG017**	**SB_BH01_OG018**
Top Depth (m)	**89.38**	**289.81**	**341.59**	**473.98**	**534.56**	**633.17**	**641.9**	**645.78**	**686**	**716.04**	**746.18**	**797.62**	**824.72**	**857.52**
Bottom Depth (m)	**89.54**	**289.97**	**341.74**	**474.16**	**534.66**	**633.3**	**642.01**	**645.79**	**686.11**	**716.16**	**746.29**	**797.74**	**824.85**	**857.69**
TOC wt%	**0.22**	**0.20**	**0.24**	**0.16**	**0.22**	**1.53**	**1.30**	**5.27**	**0.26**	**0.31**	**0.30**	**0.30**	**0.25**	**0.23**
Weight % Mineralogy														
(without TOC)														
Quartz	8.8	0.4	4.7	16.8	18.8	18.7	20.9	10.3	9.4	11.1	7.9	3.9	2.2	2.8
K-Feldspar	1.4	0.0	0.8	1.0	1.5	1.6	1.2	2.8	2.0	3.5	1.7	0.0	0.9	3.0
Plagioclase	0.0	0.0	0.0	0.1	0.0	1.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calcite	52.9	41.8	16.0	6.9	1.4	2.3	2.9	54.0	66.3	27.2	65.1	74.4	22.5	5.0
Dolomite / Fe-Dolomite	34.1	57.8	74.7	3.1	2.8	0.7	0.5	6.5	5.1	9.2	1.3	18.0	63.9	78.5
Pyrite	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Halite	0.0	0.0	0.3	0.5	0.4	2.6	3.5	3.2	1.0	2.1	1.4	0.8	0.0	0.0
Gypsum	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Clay	2.8	0.0	3.5	71.5	74.9	72.5	69.5	23.1	16.1	46.8	22.5	2.9	10.6	9.8
Relative Clay %														
Illite/Smectite (I/S)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.4	0.0	6.5	0.0	0.0	0.0	0.0
Illite & Mica	91.6	0.0	87.0	73.6	66.4	67.4	70.9	62.1	88.0	89.9	93.3	100.0	94.3	56.0
Kaolinite	0.0	0.0	13.0	1.4	0.5	1.4	0.0	0.8	2.6	0.4	0.2	0.0	0.2	0.0
Chlorite	8.4	0.0	0.0	25.0	33.1	31.2	29.1	20.7	9.3	3.1	6.5	0.0	5.5	44.0
% Smectite in I/S	-	-	-	-	-	-	-	5-15%	-	5-15%	-	-	-	-
Sum Bulk	100.0	100.0	100.0	99.9	100.0	100.0	99.9	99.9	99.9	99.9	99.9	100.0	100.1	99.9
Sum Clay	100.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.9	100.0	100.0	100.0	100.0
Volume % Mineralogy														
(includes TOC as kerogen)														
Quartz	9.1	0.4	5.0	17.2	19.3	18.6	20.9	9.2	9.6	11.3	8.1	4.0	2.4	3.0
K-Feldspar	1.5	0.0	0.8	1.1	1.5	1.6	1.3	2.6	2.1	3.6	1.8	0.0	0.9	3.3
Plagioclase	0.0	0.0	0.0	0.2	0.0	1.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calcite	53.5	43.0	16.6	6.9	1.4	2.2	2.9	47.5	66.1	27.1	64.8	74.8	23.1	5.2
Dolomite (ferroan?)	32.5	56.0	73.0	2.9	2.6	0.6	0.5	5.4	4.8	8.7	1.2	17.0	61.9	77.0
Pyrite	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Halite	0.0	0.0	0.2	0.3	0.2	1.4	1.8	1.5	0.6	1.2	0.7	0.5	0.0	0.0
Gypsum	0.0	0.0	0.0	0.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Illite/Smectite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	3.1	0.0	0.0	0.0	0.0
Illite & Mica	2.6	0.0	3.2	53.4	50.5	48.3	49.1	12.8	14.3	42.6	21.2	2.9	10.4	5.8
Kaolinite	0.0	0.0	0.5	1.1	0.4	1.0	0.0	0.2	0.4	0.2	0.1	0.0	0.0	0.0
Chlorite	0.2	0.0	0.0	16.7	23.2	20.6	18.5	3.9	1.4	1.4	1.4	0.0	0.6	4.2
Kerogen	**0.6**	**0.6**	**0.7**	**0.4**	**0.6**	**4.1**	**3.5**	**13.5**	**0.7**	**0.8**	**0.8**	**0.8**	**0.7**	**0.7**
Total	100.0	100.0	100.0	100.2	99.9	100.0	100.1	100.0	100.0	100.0	100.1	100.0	100.0	100.0
Vclay	**2.8**	**0.0**	**3.7**	**71.2**	**74.1**	**69.9**	**67.6**	**20.3**	**16.1**	**47.3**	**22.7**	**2.9**	**11.0**	**10.0**
Calc. G.D. (g/cc)	**2.747**	**2.794**	**2.819**	**2.712**	**2.720**	**2.691**	**2.703**	**2.556**	**2.709**	**2.712**	**2.705**	**2.734**	**2.797**	**2.830**

(Note: Due to 'rounding issues values for 'Totals' (both bulks and clays) might differ from 100.0 by +/-0.2 %)

Dolomite observed here appears to be non-stoichiometric, most likely ferroan.

Tr < 0.2wt%

Whole Rock X-Ray Diffractogram SB_BH01_OG002 (89.38 - 89.54 m)



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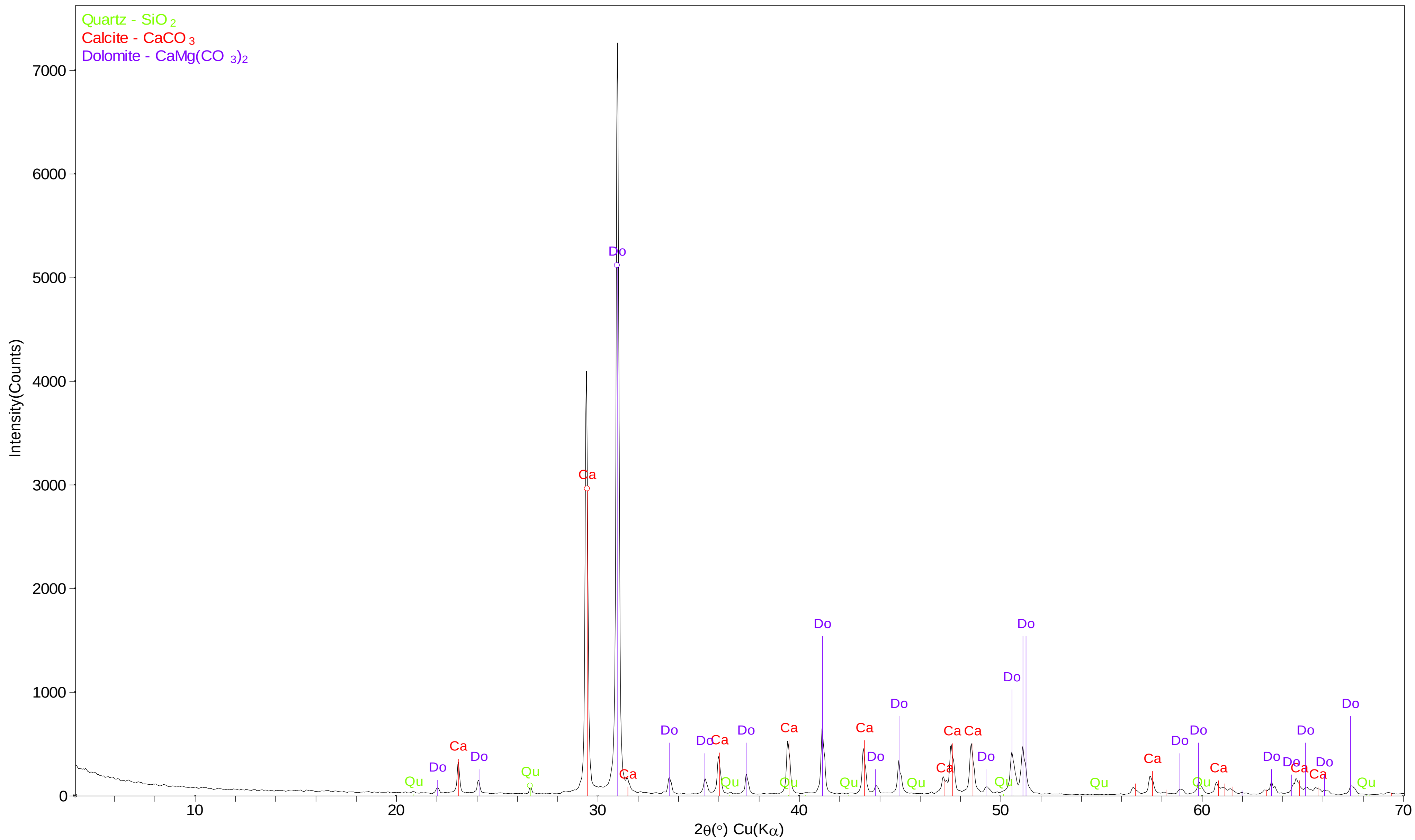
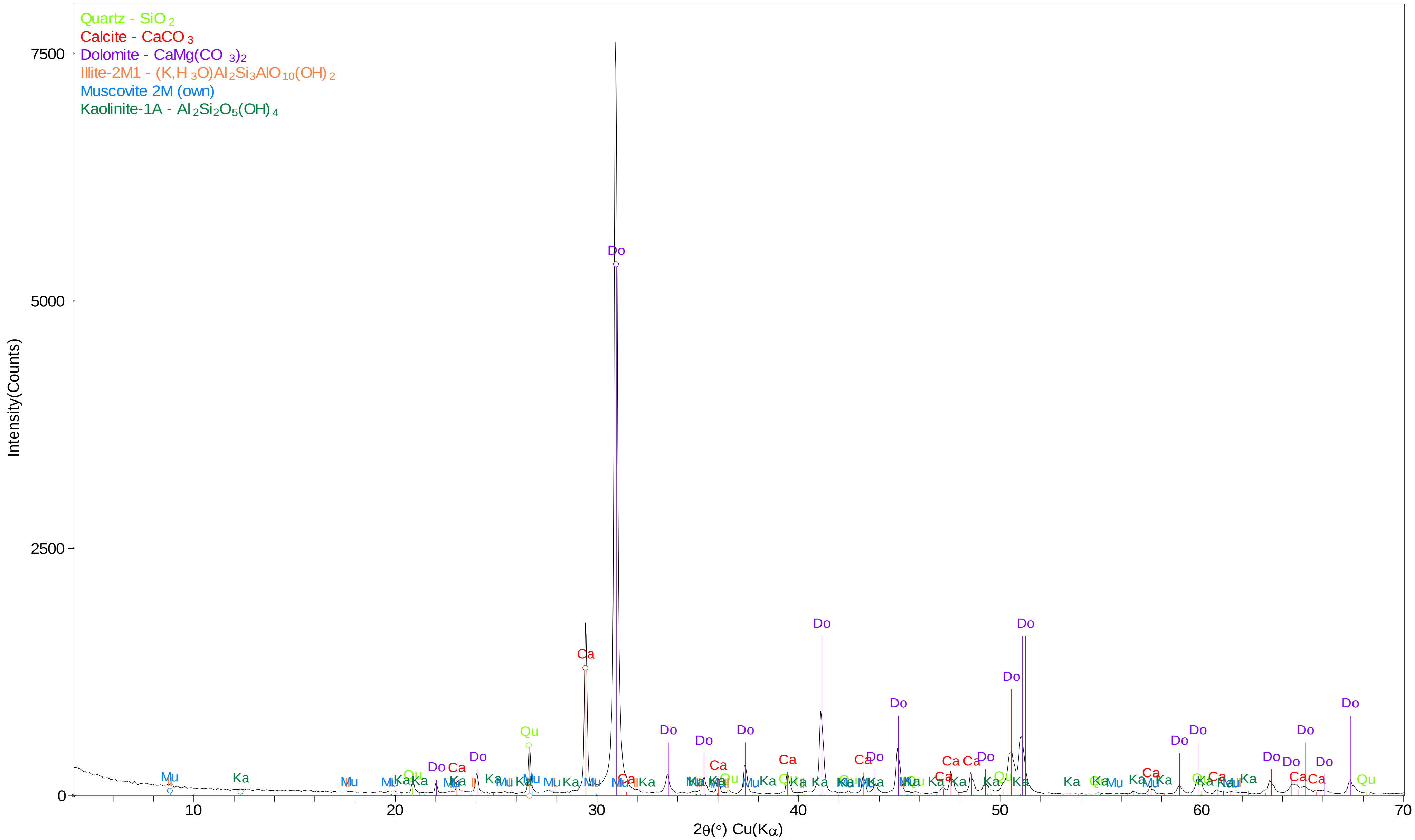
Whole Rock X-Ray Diffractogram SB_BH01_OG003 (289.81 - 289.97 m)



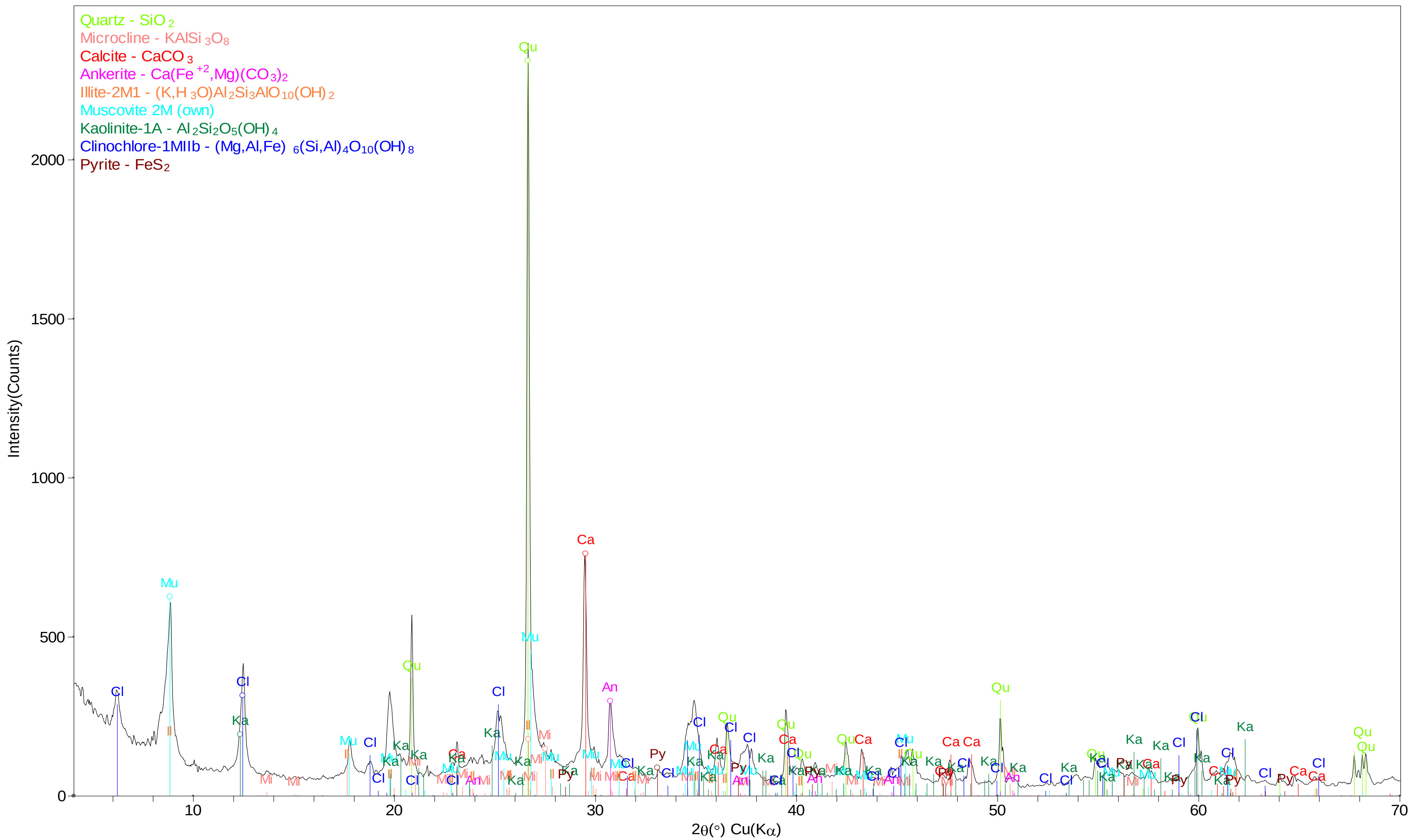
Core Laboratories (U.K.) Ltd

Whole Rock X-Ray Diffractogram SB_BH01_OG004 (341.59 - 341.74 m)

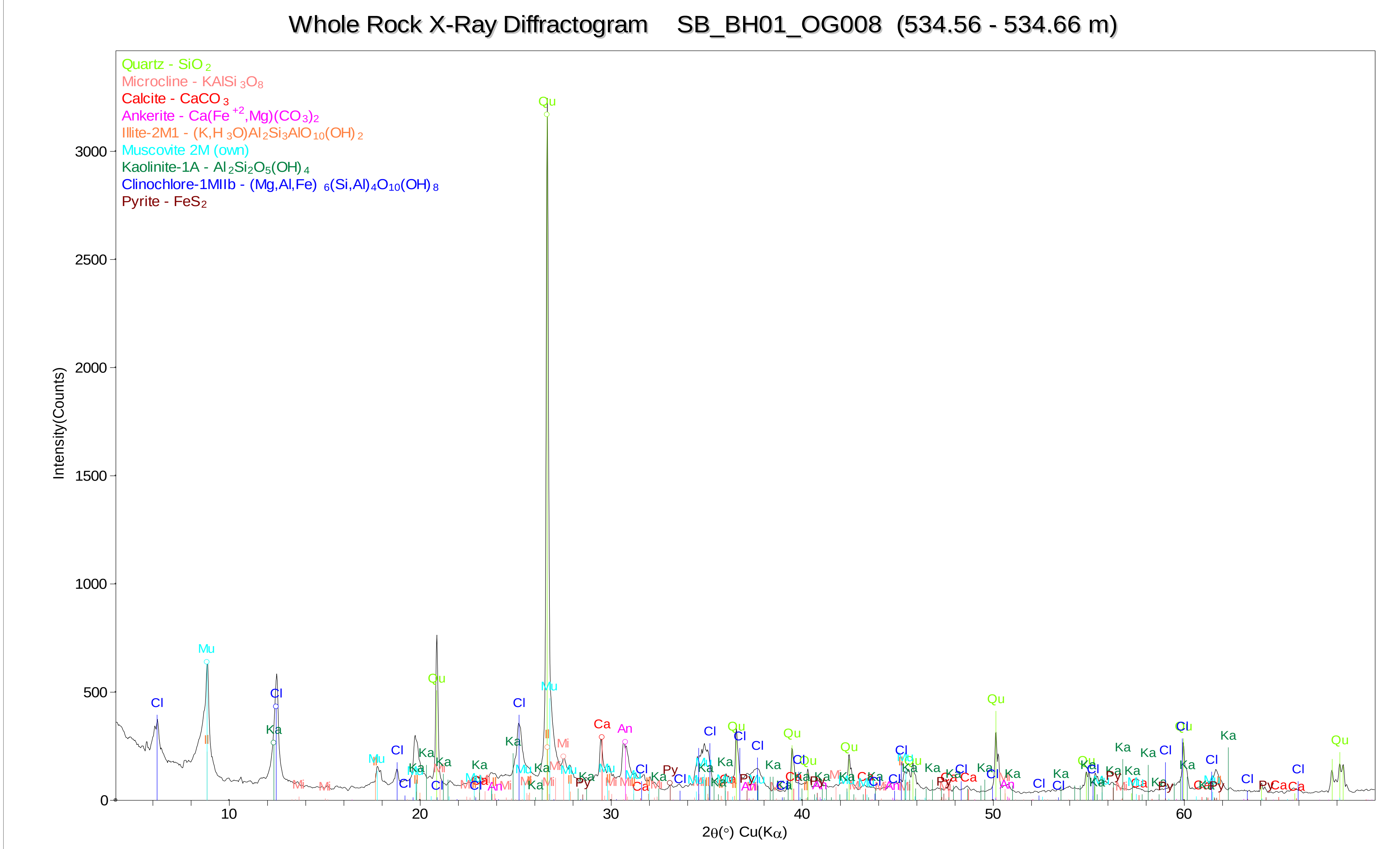


Core Laboratories (U.K.) Ltd

Whole Rock X-Ray Diffractogram SB_BH01_OG007 (473.98 - 474.16 m)

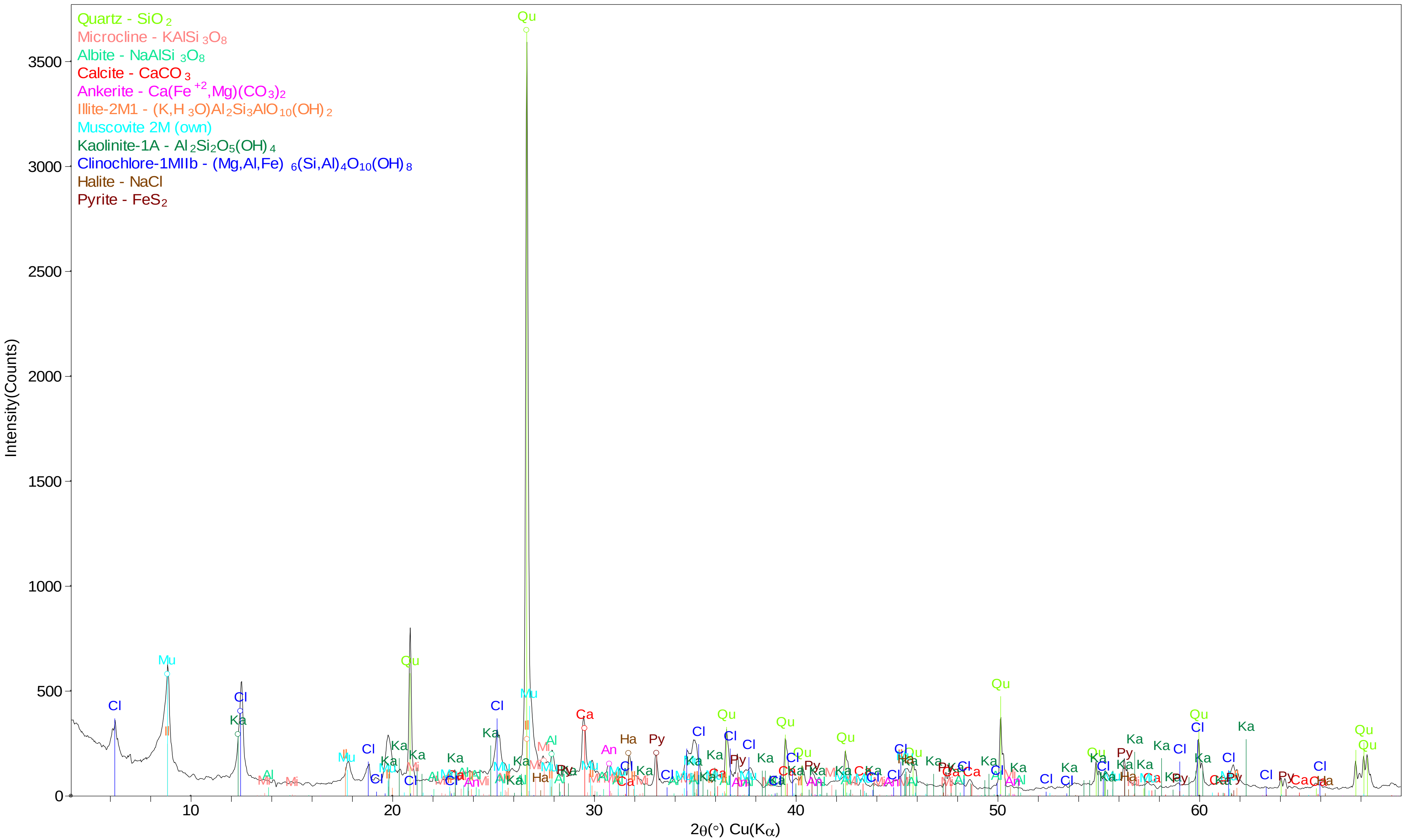


Core Laboratories (U.K.) Ltd

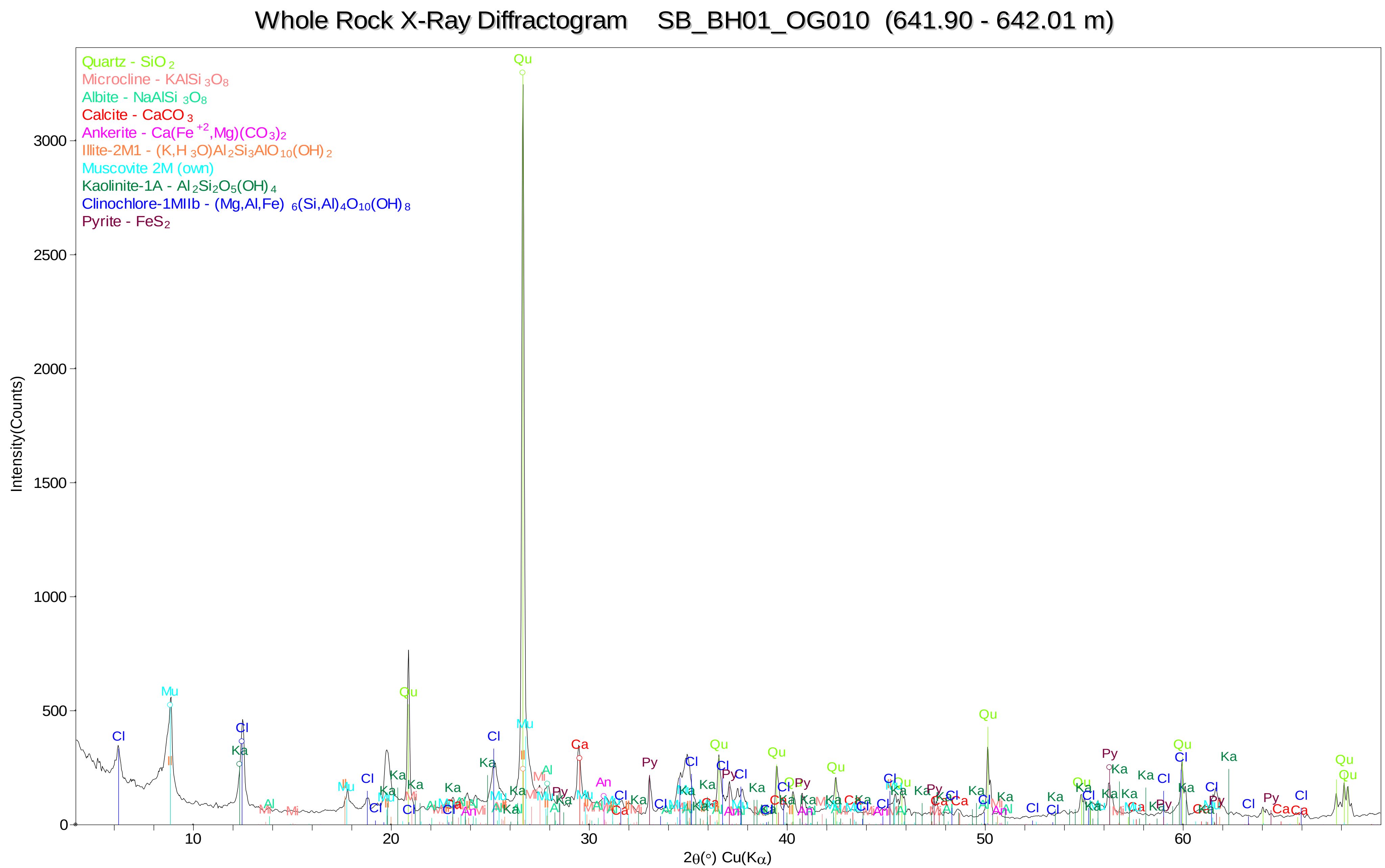


Core Laboratories (U.K.) Ltd

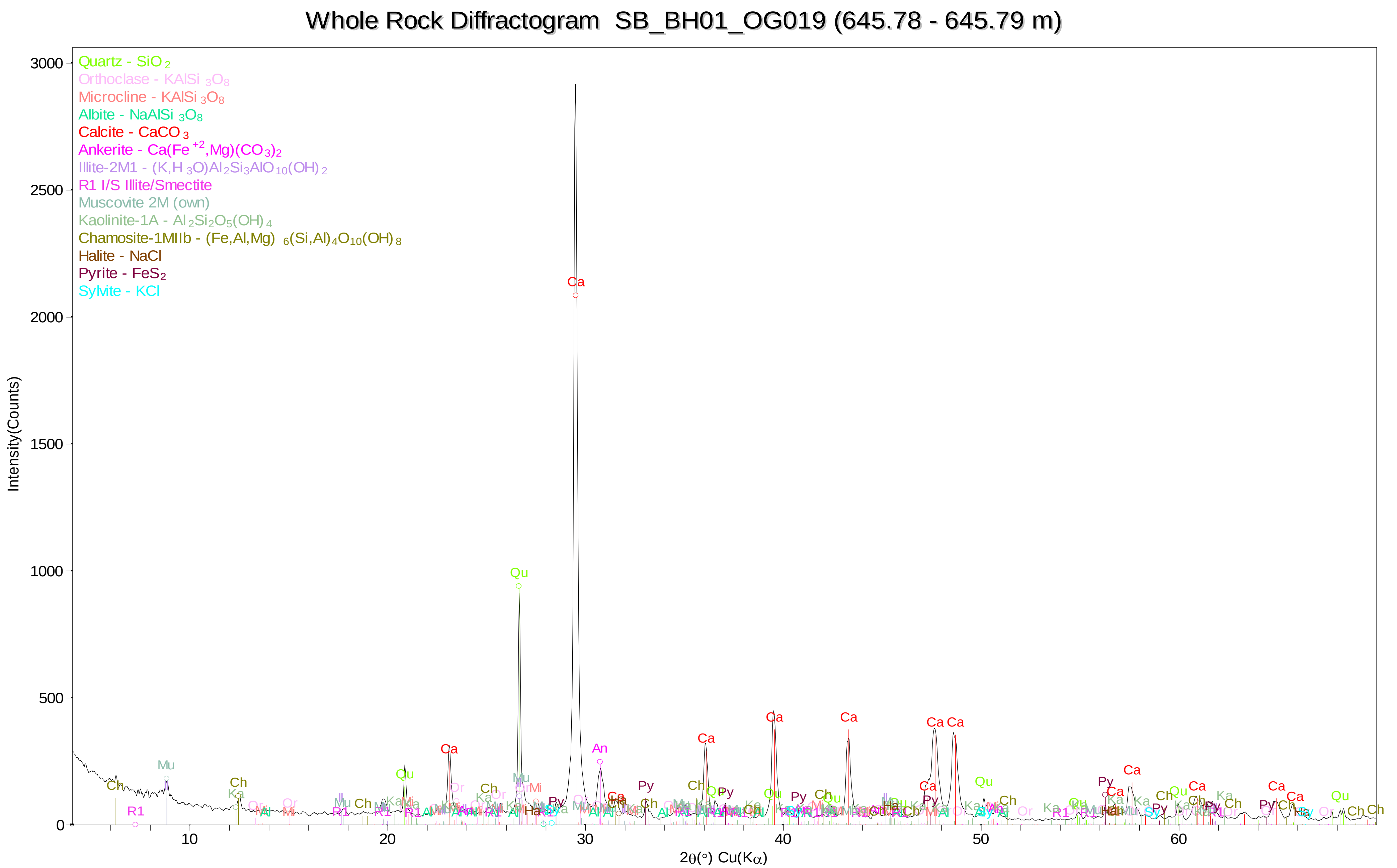
Whole Rock X-Ray Diffractogram SB_BH01_OG009 (633.17 - 633.30 m)



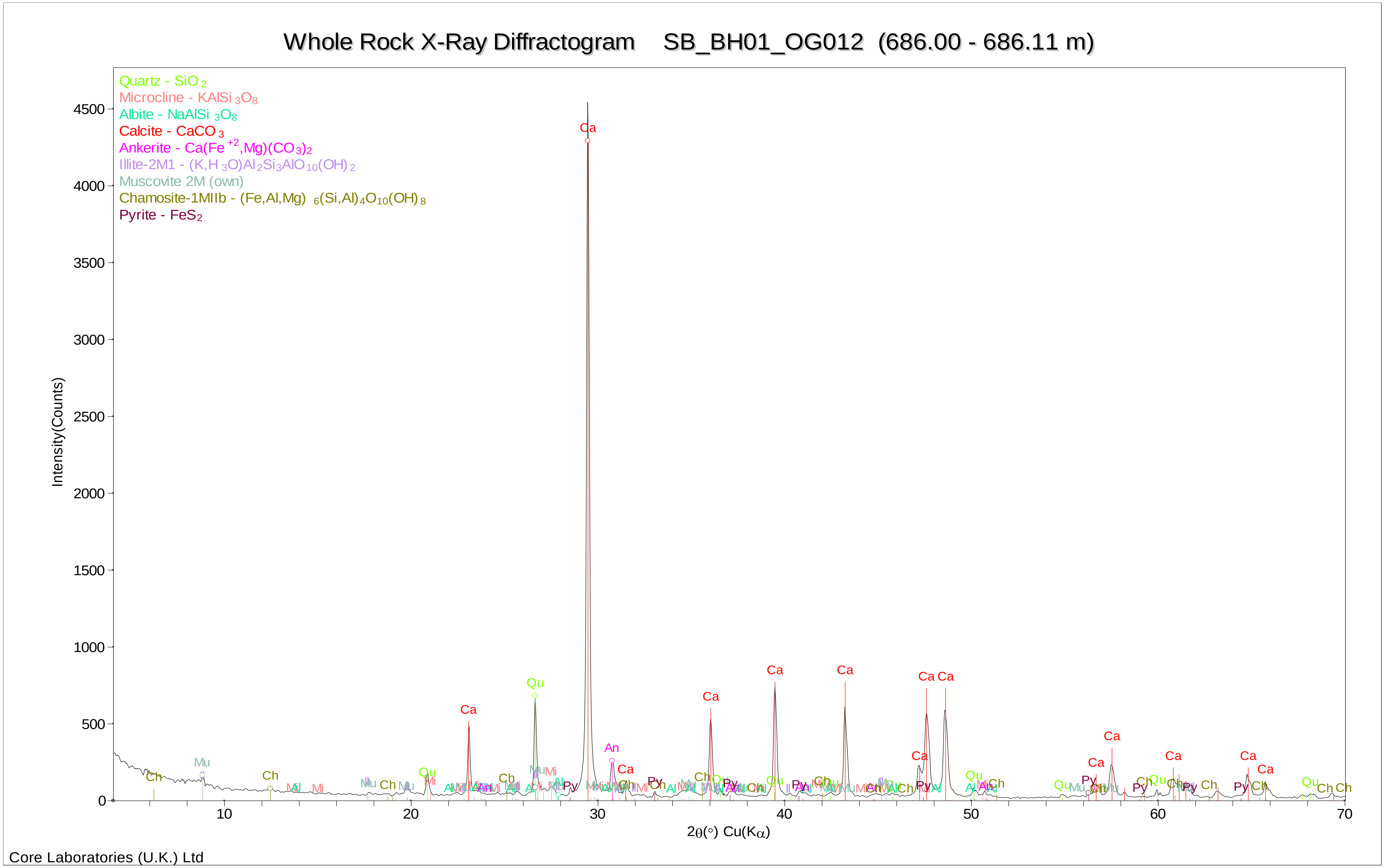
Core Laboratories (U.K.) Ltd



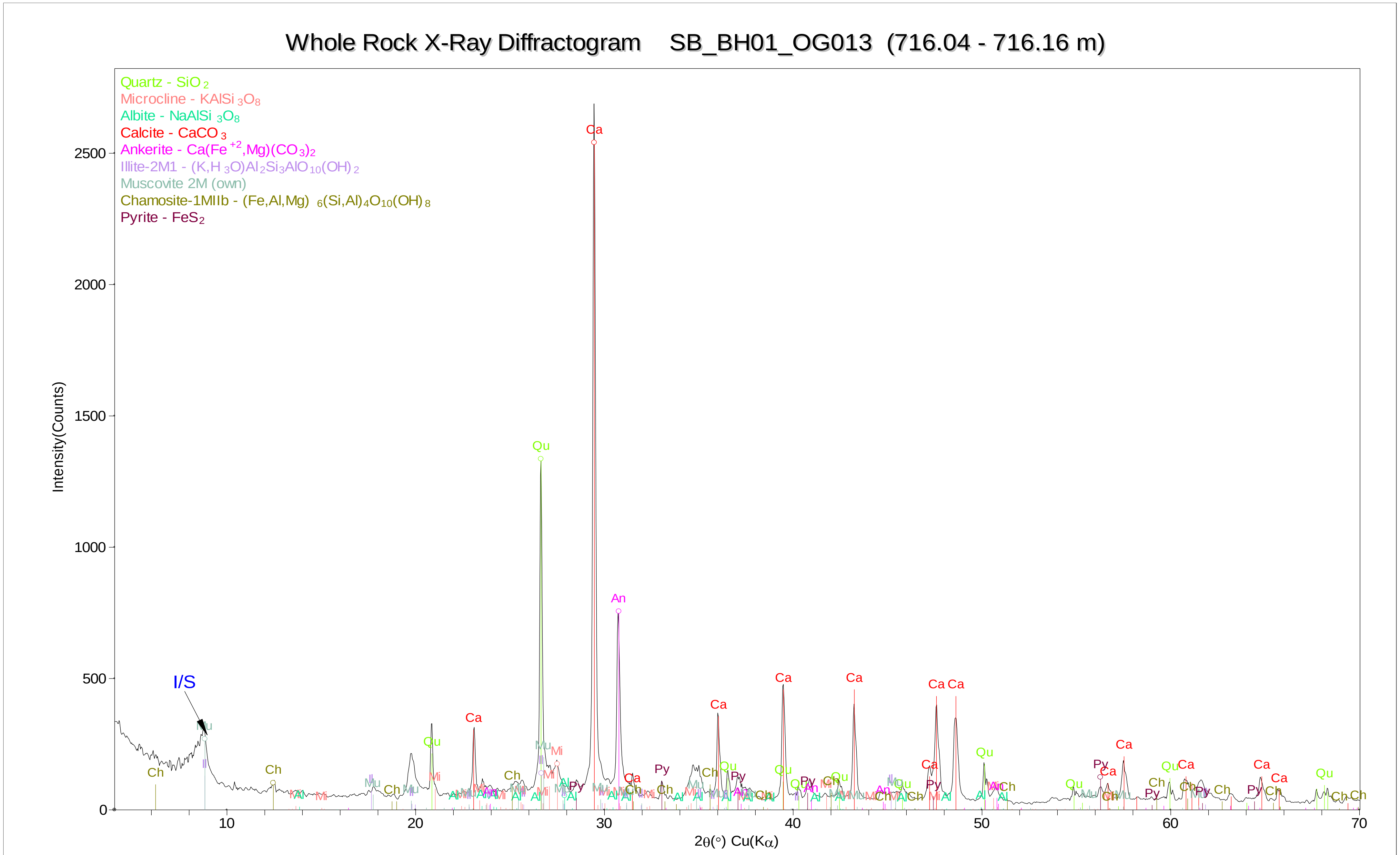
Core Laboratories (U.K.) Ltd



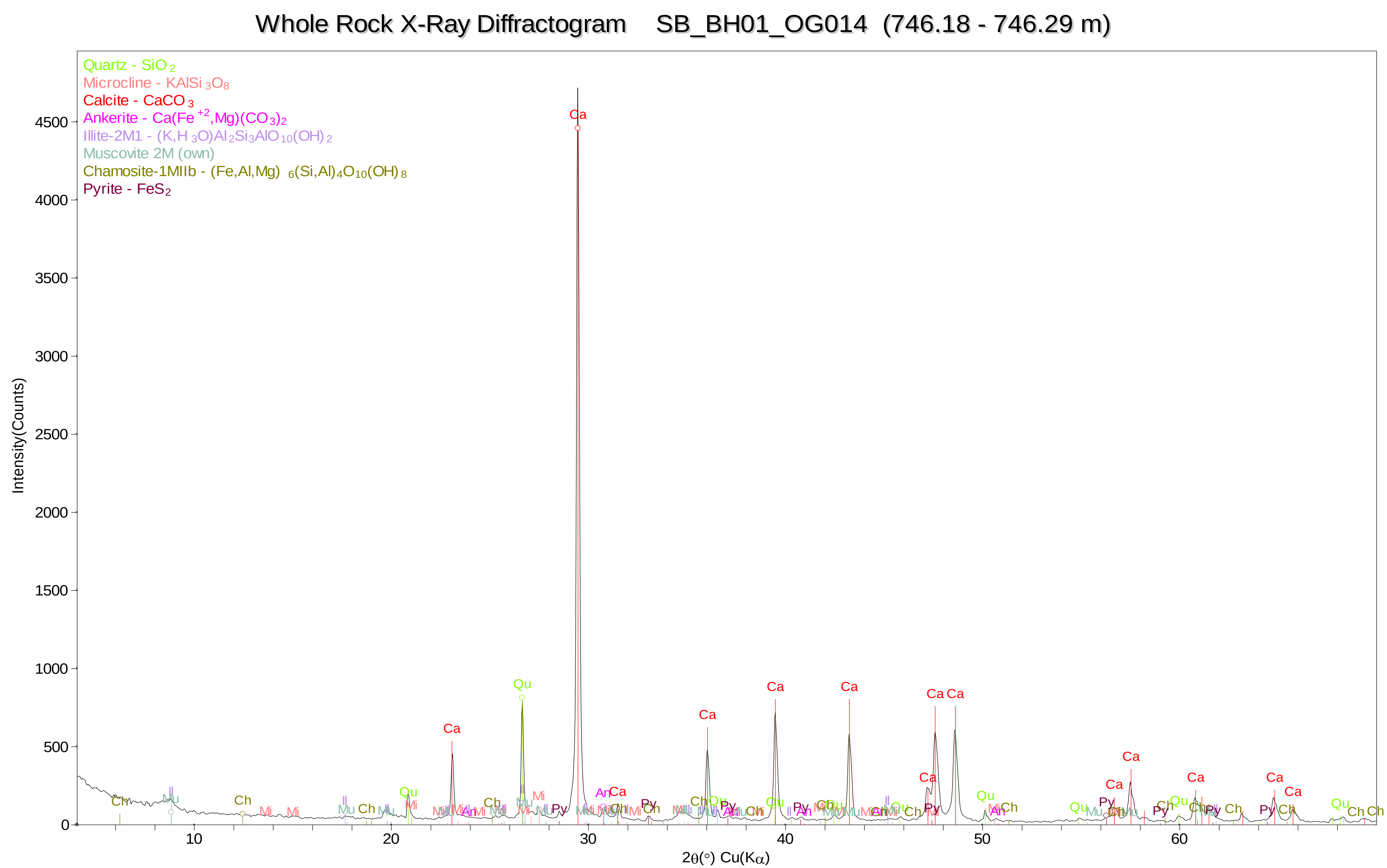
Core Laboratories (U.K.) Ltd



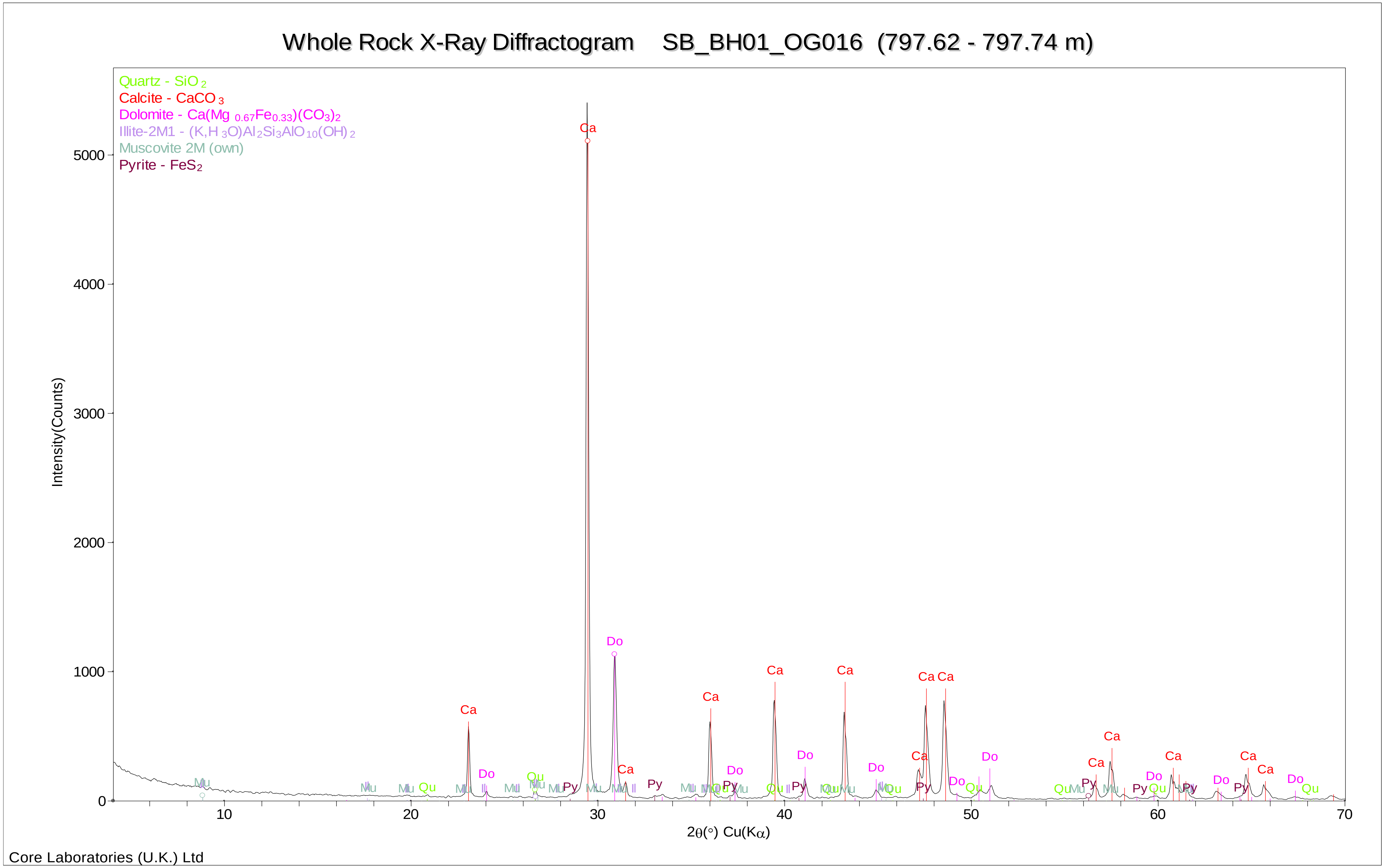
Whole Rock X-Ray Diffractogram SB_BH01_OG012 (686.00 - 686.11 m)
Quartz - SiO2
Microcline - KAlSi3O8
Albite - NaAlSi3O8
Calcite - CaCO3
Ankerite - Ca(Fe+2,Mg)(CO3)2
Illite-2M1 - (K,H3O)Al2Si3AlO10(OH)2
Muscovite 2M (own)
Chamosite-1MIIb - (Fe,Al,Mg)6(Si,Al)4O10(OH)8
Pyrite - FeS2
Intensity(Counts)
2θ(°) Cu(Kα)
Core Laboratories (U.K.) Ltd



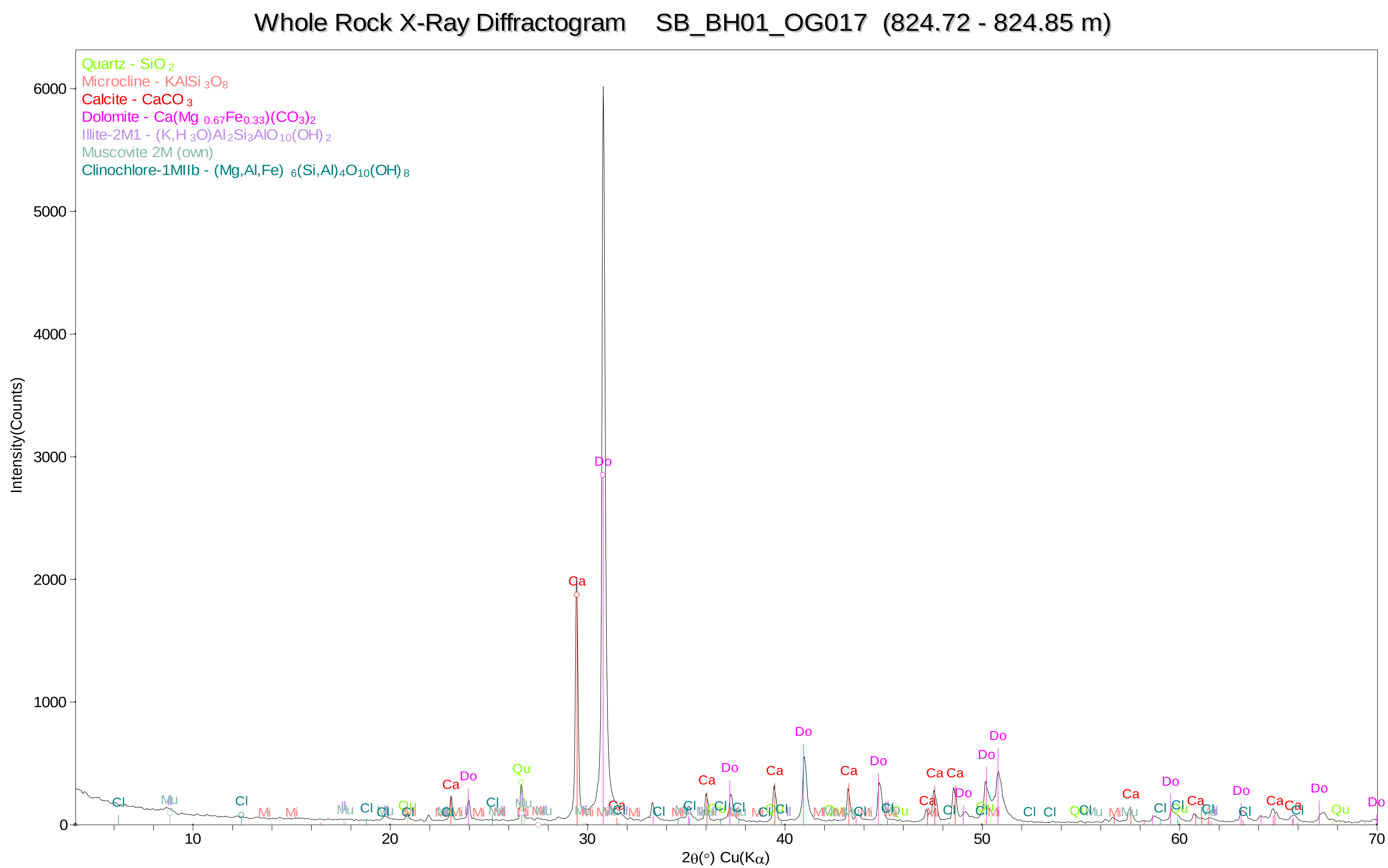
Core Laboratories (U.K.) Ltd



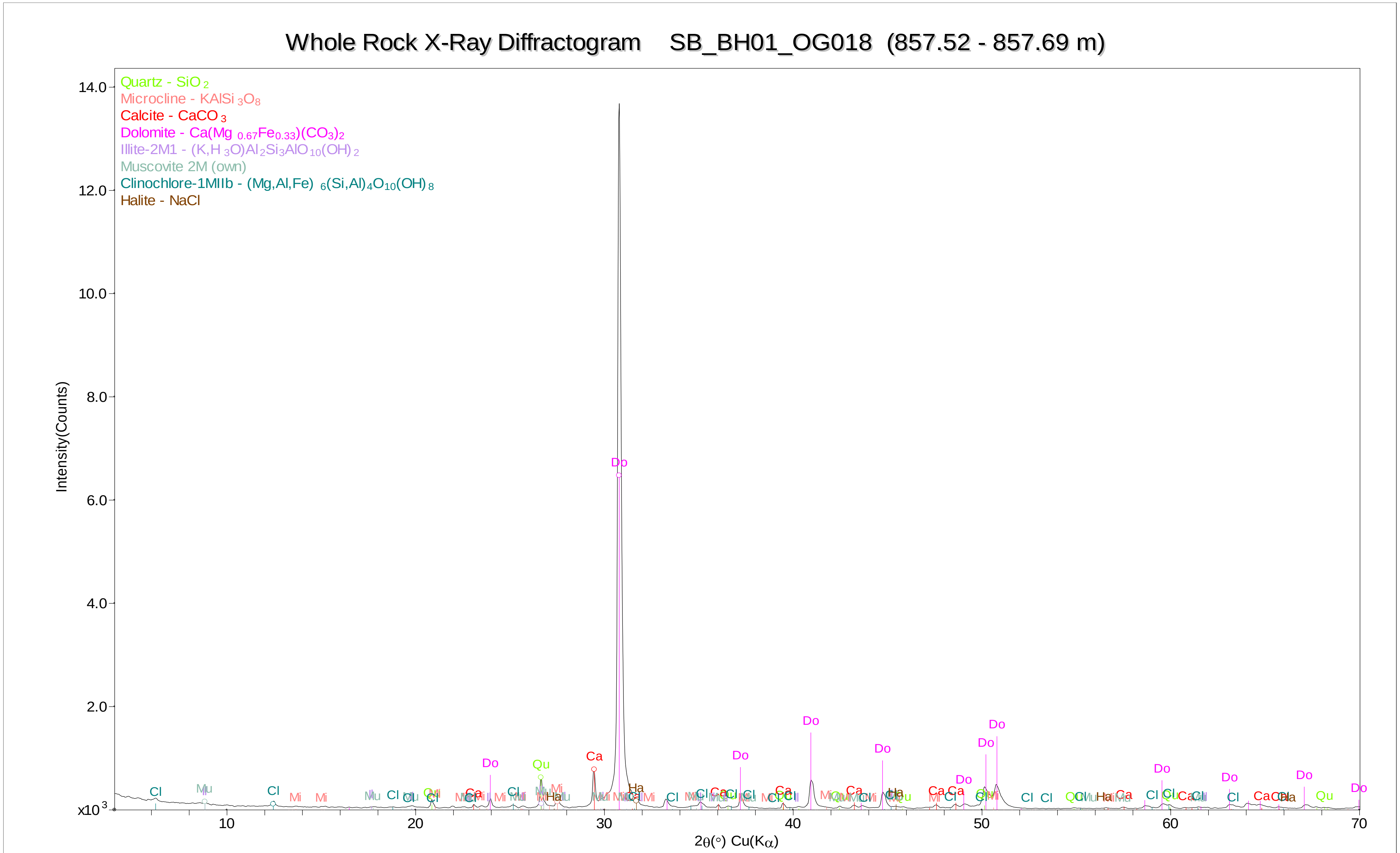
Core Laboratories (U.K.) Ltd



Core Laboratories (U.K.) Ltd



Core Laboratories (U.K.) Ltd



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