Our ref: 2690-d1-200428-Report

28 April 2020
by email (phil@goldholme.com)

Mr Phil Kerry
Goldholme Stone Limited
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Dear Phil,

Investigation of Clipsham Stone Samples
Hooby Lane Quarry – North Phase

Introduction

Independent Building Investigation Services Limited (IBIS) has prepared this letter report in accordance with your instructions by letter dated 11 March 2020. The letter of instruction was received along with two samples of advised Clipsham Stone from Hooby Lane quarry. Also received was a copy of the "driller's log" for the borehole from whence the stone samples were obtained.

Initially you requested that petrographic examination and brief reporting on the quality of Clipsham Stone represented by the larger of the two core samples be carried out. After an initial visual examination and basic density assessment by IBIS, suggesting that the two materials were quite different, IBIS believed that petrography should be carried out on both samples. Three more samples of Clipsham Stone from different depths were received on 23.03.20 for similar investigation.

Petrographic Examination

A representative specimen was cut from each sample for petrographic examination. A visual and low-power microscopic examination was carried out assisted by a Leica MZ16 binocular zoom microscope employing magnifications up to x160. This examination was supported by a variety of simple physical and chemical tests. The examination was used to select specimens for the preparation of thin-sections for high-power microscopical examination. The thin-sections were prepared after impregnation with an epoxy resin containing an ultraviolet light sensitive fluorescent dye.

High-power microscopical examination was carried out using both the polarising binocular zoom function of the Leica MZ16 microscope and also a Leica DM RXP petrological microscope at different magnifications up to x3000. The thin-sections were examined in both transmitted plain and cross-polarised light and reflected ultraviolet light. High-power photomicrographs (photographs taken down the microscope) were prepared to illustrate microscopical features of importance.

The detailed petrographic examination results are provided in **Annexes 1** and **2**. **Annex 1** provides comparative photomicrographs for all five samples, each page providing a similar view from each sample taken at the same magnification and under the same illumination. **Annex 2** presents a series of five pages, one for each sample, with all photomicrographs taken shown along with a classification and description. The results have been provided in this way to allow easier comparison. The results are discussed later in this letter report.

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Elemental Analysis Using X-Ray Fluorescence

A representative piece taken from each of the five Clipsham Stone samples was subjected to XRF analysis to identify the elemental proportions. The analyses were carried out using a Niton XL2 980 GOLDD analyser. The analyser was within calibration at the time of the analyses. The analyses were each carried out using the Niton 'Mining' calibration with both heavy and light minerals being detected separately, both over a time of 30 seconds and the findings then normalised. Three analyses were taken from each sample, at different locations, and the findings were then averaged.

The detailed XRF elemental analysis results are provided in **Annex 3**. A summary of the findings is provided in **Table 1**.

Table 1: Summary of XRF Elemental Analyses

IBIS Ref	2690-S1	2690-S2	2690-S3	2690-S4	2690-S5
Client Ref	CLB (4.0 m)	CLB 9 1.76 m)	BH7 (6.0 m)	BH7 (9.5 m)	BH7 (12.0 m)
Element	Elemental Percentage				
Ca	40.3	42.8	41.2	41.6	43.1
Mg	0.0	0.0	2.4	0.0	1.7
Fe	0.4	0.4	0.4	0.7	0.5
Si	0.4	0.1	0.1	0.3	0.1
S	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Sr	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Balance	57.8	55.4	55.8	55.8	54.4

Note: the "Balance" is the proportion of undetectable elements, namely the lighter elements from hydrogen up to sodium.

Basic Density Determination

The five samples of Clipsham Stone were each subjected to a basic determination of their density using measurement of their dimensions and their mass determined to the nearest 0.5 g. This test is undertaken to provide a very general guide to the properties of a stone. The stones were left to air dry for at least 100 hours prior to testing. The results of this test are given in **Table 2**.

Table 2: Basic Density

IBIS Ref	2690-S1	2690-S2	2690-S3	2690-S4	2690-S5
Client Ref	CLB (4.0 m)	CLB 9 1.76 m)	BH7 (6.0 m)	BH7 (9.5 m)	BH7 (12.0 m)
Mass (g)	1160.0	770.0	294.5	353.5	661.0
Volume (cm^3)	531.1	323.7	142.9	176.5	279.3
Density (Mg/m^3)	2.18	2.38	2.06	2.00	2.37

Discussion of Findings

The five samples of advised Clipsham Stone from the Hooby Lane Quarry site were all confirmed to be limestone of similar type. Both the petrographic examinations and basic density testing identified that there were significant differences in the qualities of these five materials. The qualities of the five stones are discussed separately in the following sections to avoid any confusion.

IBIS has a number of thin-sections of Clipsham Stone derived from historic jobs that IBIS has carried out. These thin-sections were used to assist with the assessment of the apparent quality of each of the Clipsham Stone samples.

You advised that the following sequence of material was present at Borehole No. 4, this to help put the samples into perspective. The sequence from the top down was as follows:

Surface down to head of rock	13.4 m
Small broken layers	1.5 m
Clipsham Large Block	4.0 m
White Large Block	1.36 m
Clipsham Large Block	1.76 m
Fractured White Limestone	2.0 m
White Large Block	1.77 m
Limestone block continues for	9.0 m

Sample 2690-S1 – CLB (4.0 m)

This was found to be a medium to very coarse-grained shelly oolitic limestone that comprised mostly calcite ($CaCO_3$). Ooliths dominated the grains and these were typically between 200 µm and 750 µm in diameter. Shell fragments and other fossil materials were present, the largest remnants reaching up to 30 mm in size. The density was considered to be typical of published data, but at the lower end of a range that does vary considerably.

Based on the available historic data and the features exhibited by this sample, the following basic properties are predicted:

Compressive strength	15-25 MPa
Flexural strength	2.5-5.0 MPa
Absorption	5-10 %
Porosity	10-25 %
Saturation Coefficient	0.75-0.80
Salt crystallisation loss	20-50 %

The stone should be successful for use in basic block masonry structures such as walls, but should not be placed into locations where it might be subjected to prolonged wetting, such as plinths. The stone can hold a reasonable edge and so can be carved into more robust forms; finer work will be more difficult and detail may be lost relatively quickly. Use for more exposed masonry such as sills and copings may be possible but only with great care and attention to detail and the correct use of additional protection.

Sample 2690-S2 – CLB (1.76 m)

This was found to be a medium to very coarse-grained shelly oolitic limestone that comprised mostly calcite ($CaCO_3$). Ooliths and pellets dominated the grains and these were typically between 200 µm and 600 µm in diameter. Shell fragments and other fossil materials were present, the largest remnants reaching up to 10 mm in size. The density was considered to lie in the middle of the range of typical published data.

Based on the available historic data and the features exhibited by this sample, the following basic properties are predicted:

Compressive strength	20-35 MPa
Flexural strength	4.0-10 MPa
Absorption	3-8 %
Porosity	8-20 %
Saturation Coefficient	0.75-0.85
Salt crystallisation loss	5-30 %

The stone should be successful for use in basic block masonry structures such as walls, but should not be placed into locations where it might be subjected to prolonged wetting, such as plinths. The stone can hold a reasonable edge and so can be carved into more robust forms; finer work will be

more difficult and detail may be lost relatively quickly. The stone could be used for more exposed masonry such as sills and copings, potentially without additional protections such as lead cappings, although sharp details are likely to be lost.

There are shelly horizons within the stone that may prove to be more resistant to weathering. However, if such horizons are small they may result in the stone weathering out in bands over a long period of time (60+ years).

Sample 2690-S3 – BH7 (6.0 m)

This was found to be a medium grained pelitic limestone that comprised mostly calcite ($CaCO_3$). Ooliths and pellets dominated the grains and these were typically between 50 µm and 500 µm in diameter. Shell fragments and other fossil materials were present, the largest remnants reaching up to 3 mm in size. The density was considered to lie outside or at the limits of the low end of the range of typical published data.

Based on the available historic data and the features exhibited by this sample, the following basic properties are predicted:

Compressive strength	10-20 MPa
Flexural strength	2.0-4.0 MPa
Absorption	8-15 %
Porosity	15-35 %
Saturation Coefficient	0.80-0.90
Salt crystallisation loss	40-100 %

The stone should be able to be used in basic block masonry structures such as walls, but should not be placed into locations where it might be subjected to prolonged wetting, such as plinths. When carved the stone produced a rough edge and detail is likely to be lost relatively quickly. The stone should not be used for more exposed masonry such as sills and copings, even with additional protections in place. Variations in the quality of the stone due to different competency bands are likely to develop and be shown relatively quickly.

Sample 2690-S4 – BH7 (9.5 m)

This was found to be a medium to coarse-grained shelly oolitic limestone that comprised mostly calcite ($CaCO_3$). Ooliths and pellets dominated the grains and these were typically between 200 µm and 1000 µm in diameter. Shell fragments and other fossil materials were present, the largest remnants reaching up to 8 mm in size. The density was considered to lie outside the low end of the range of typical published data. It is noted here that of all the samples received this was by far the most awkward to measure and it is accepted that there may be a significant error in the basic density assessment, the petrographic findings suggesting this material may be denser than indicated, with a value more typical of the low end of the published range.

Based on the available historic data and the features exhibited by this sample, the following basic properties are predicted:

Compressive strength	20-35 MPa
Flexural strength	4.0-10 MPa
Absorption	5-10 %
Porosity	10-25 %
Saturation Coefficient	0.75-0.85
Salt crystallisation loss	20-50 %

The stone should be able to be used in basic block masonry structures such as walls, but should not be placed into locations where it might be subjected to prolonged wetting, such as plinths. When carved the stone produced a rough edge and detail is likely to be lost relatively quickly. It is debateable whether the stone should be used for more exposed masonry such as sills and copings, either with or without additional protections in place.

Sample 2690-S5 – BH7 (12.0 m)

This was found to be a coarse-grained oolitic limestone that comprised mostly calcite ($CaCO_3$). Ooliths dominated the grains and these were typically between 400 µm and 1000 µm in diameter. Shell fragments and other fossil materials were present, the largest remnants reaching up to 8 mm in size. The density was considered to lie in the middle of the range of typical published data.

Based on the available historic data and the features exhibited by this sample, the following basic properties are predicted:

Compressive strength	20-40 MPa
Flexural strength	5.0-10 MPa
Absorption	2-7 %
Porosity	5-15 %
Saturation Coefficient	0.80-0.90
Salt crystallisation loss	5-25 %

The stone should be successful for use in basic block masonry structures such as walls, but should not be placed into locations where it might be subjected to prolonged wetting, such as plinths. The stone is able to take a very good edge and allowing it to be finely carved, although such detail may be lost relatively quickly where weathering occurs. The quality of stone is unusual in that it can almost take a polish due to the sparry calcite matrix. The stone could be used for more exposed masonry such as sills and copings, potentially without additional protections such as lead cappings.

Conclusions and Recommendations

Five samples of Clipsham Stone have been received, these advised to have been taken from different beds or horizons within the Hooby Lane quarry site. All five samples exhibited significant variations compared to each other, although they were formed under similar circumstances and contain similar materials.

Two of the stones exhibited properties that may allow them to be used for almost the full range of block stone masonry items that may be found on a structure. Only the most exposed locations where water is retained for prolonged periods may prove to be problematic.

Two of the stones exhibited properties that would also allow them to be used across much of the range of block stone masonry items that may be found on a structure. These stone qualities may require a degree of assistance from additional protections where more exposed to weathering influences.

One of the stones exhibited properties that would be suitable only for the more basic block stone masonry items such as walls. Use of the stone for more intricate masonry is unlikely to be successful.

All five stone qualities should be subjected to the full suite of recommended natural stone tests to confirm their likely performance suggested by the current investigation. Such testing will be necessary prior to placing the materials on the market.

The variation in quality of the five samples received suggests that there are likely to be other qualities of stone present within the resource. The presence of such qualities of stone should be identified and these then assessed to assist with any future development plan for the resource.

Remarks

The observations and comments provided must be regarded as very general given the limitations of the brief. However, it is hoped that the investigation findings provide a sufficiently accurate and usable picture of the conditions presented. Natural stone resources may exhibit both lateral and vertical variations in composition and properties and single or small samples may not be reliably representation of a resource or even specific locations within that resource.

I would like to take this opportunity to confirm that the opinions provided are given independently and to the best of my ability. It is acknowledged that my opinions may be based on potentially incomplete information and thus I reserve the right to alter my opinions should new information present itself that requires their reconsideration.

Mr Hunt is a Chartered Geologist and Chartered Surveyor with over 30 years' experience in the investigation of construction problems, specialising in materials properties. Mr Hunt is a member of the Stone Federation of Great Britain's Technical Committee and has been involved in the production of many of the current British and European Standards dealing with natural stone and related materials.

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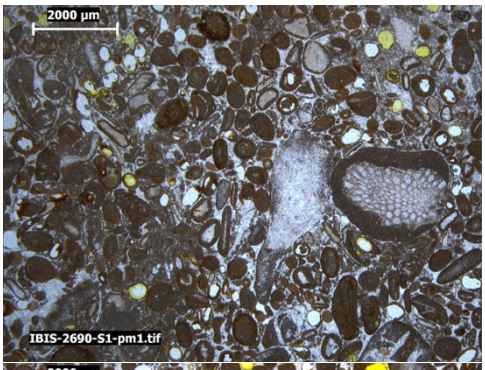
If you require any further assistance with this or any other matter please do not hesitate to contact IBIS.

Yours sincerely

Barry J Hunt
BSc MSc MASI MCIOB CGeol EurGeol FGS CSci MRICS FRMS
Director, IBIS Limited

Encl. *Annex 1, Petrographic Comparisons, 9 pages.*
Annex 2, Petrographic Examination Findings, 5 pages.
Annex 3, XRF Elemental Analysis Results, 20 pages.



Sample 2690-S1 – CLB (4.0 m)

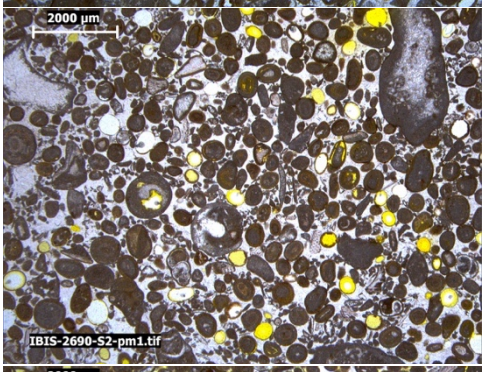
Typical view of the fabric with a variety of rounded grains supported by a mixed sparitic and micritic matrix.

Grains include ooliths, pellets, coated grains, shell pieces and rock fragments. Grain size up to 2.0 mm.

Scattered voids visible.

Density of 2.18 Mg/m^3

Sample viewed in plane polarised light



Sample 2690-S2 – CLB (1.76 m)

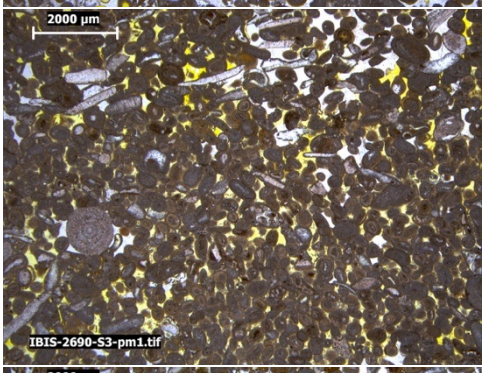
Typical view of the fabric with a variety of rounded grains supported by a mostly sparitic matrix.

Grains include ooliths, pellets, coated grains, shell pieces and rock fragments. Grain size up to 2.0 mm.

Scattered voids visible.

Density of 2.38 Mg/m^3

Sample viewed in plane polarised light



Sample 2690-S3 – BH7 (6.0 m)

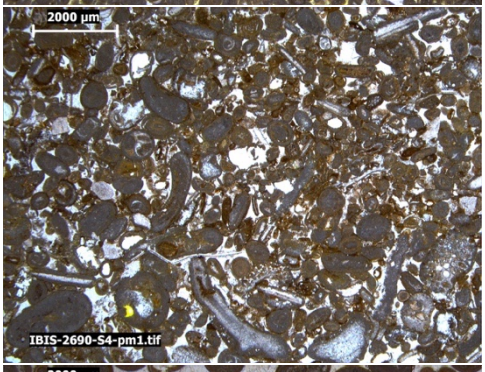
Typical view of the fabric with a variety of rounded grains including some mixed mostly sparitic and some micritic matrix.

Grains include ooliths, pellets, coated grains, shell pieces and rock fragments. Grain size up to 2.0 mm; a higher proportion of medium-sized grains apparent.

Interconnected voidage with low quantity of actual matrix.

Density of 2.06 Mg/m^3

Sample viewed in plane polarised light



Sample 2690-S4 – BH7 (9.5 m)

Typical view of the fabric with a variety of rounded grains supported by a mixed sparitic and micritic matrix.

Grains include ooliths, pellets, coated grains, shell pieces and rock fragments. Grain size up to 4.0 mm.

Few voids apparent, low density suggests a high microporosity.

Density of 2.00 Mg/m^3

Sample viewed in plane polarised light

Sample 2690-S5 – BH7 (12.0 m)

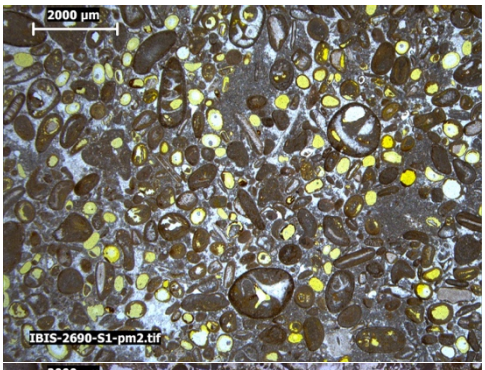
Typical view of the fabric with a variety of rounded and often elongated grains supported by a sparitic matrix.

Grains include ooliths, pellets, coated grains, shell pieces and rock fragments. Grain size up to 4.0 mm.

No voids visible, the sparite crystals are interlocking.

Density of 2.37 Mg/m^3

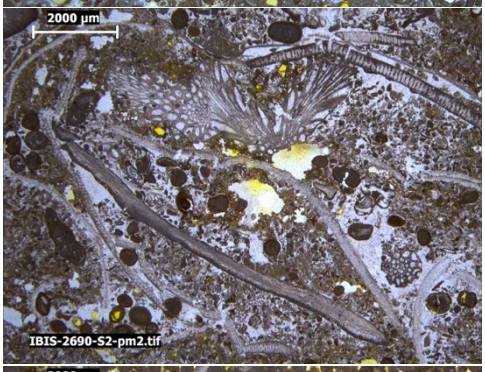
Sample viewed in plane polarised light



Sample 2690-S1 – CLB (4.0 m)

Another view of the stone where a higher proportion of voids is visible, as is a higher proportion of micritic matrix around the grains.

Sample viewed in plane polarised light

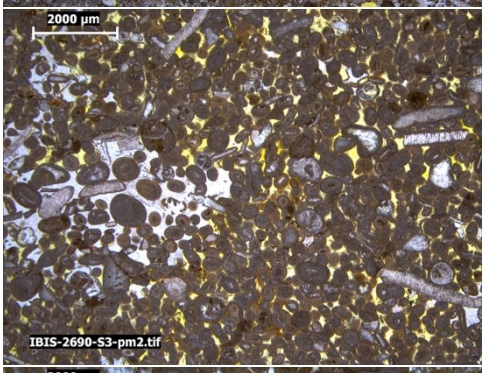


Sample 2690-S2 – CLB (1.76 m)

A shelly bed within the stone where the grain size suddenly increases up to around 8.0 mm. There are matrix compaction variations in the shadow of the larger shell fragments.

The remains of apparent bryozoans are visible above centre. There is a wide variety of fossil types present.

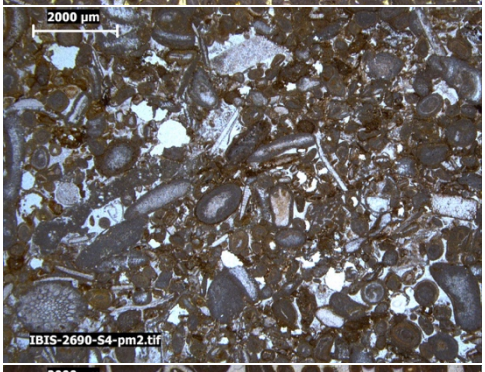
Sample viewed in plane polarised light



Sample 2690-S3 – BH7 (6.0 m)

To the left of centre is one of the small patches of sparite matrix that were occasionally present. Otherwise the grains exhibited relatively little matrix material between them.

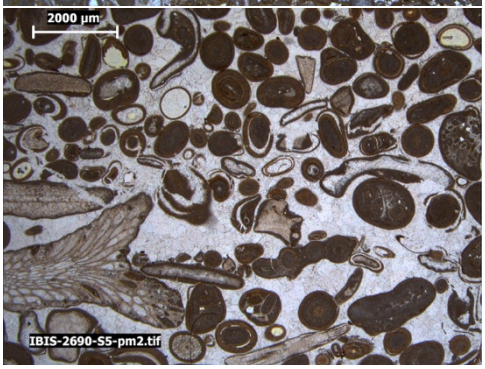
Sample viewed in plane polarised light



Sample 2690-S4 – BH7 (9.5 m)

There is a high proportion of finer micritic matric throughout this stone and thus it generally appears relatively dark in thin-section. There is a variety of fossil types packing the stone.

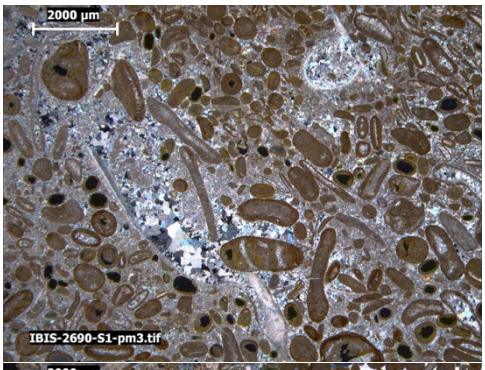
Sample viewed in plane polarised light



Sample 2690-S5 – BH7 (12.0 m)

The grains infrequently touch in this quality of stone, the sparry calcite (sparite) matrix providing support. There appeared to be many ooliths and few pellets.

Sample viewed in plane polarised light

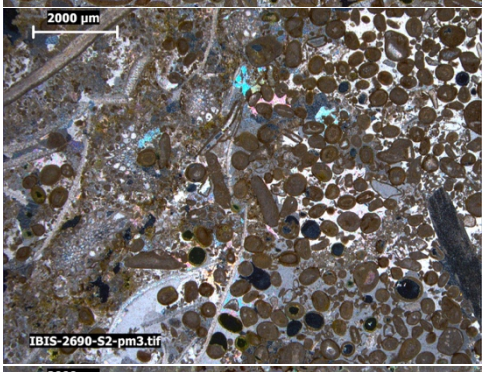


Sample 2690-S1 – CLB (4.0 m)

The band running top left-bottom right has coarser sparry calcite present and fewer apparent grains, although they maybe are a little larger on average here.

The coated nature of many grains is more apparent where there are sparry calcite cores, these appearing much lighter compared to the darker micritic outer coating (or coatings where ooliths).

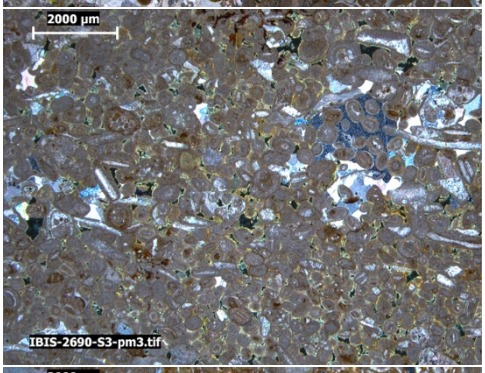
Sample viewed in cross polarised light



Sample 2690-S2 – CLB (1.76 m)

The right hand side has very large sparry calcite crystals cementing high numbers of grains together and reducing the voidage.

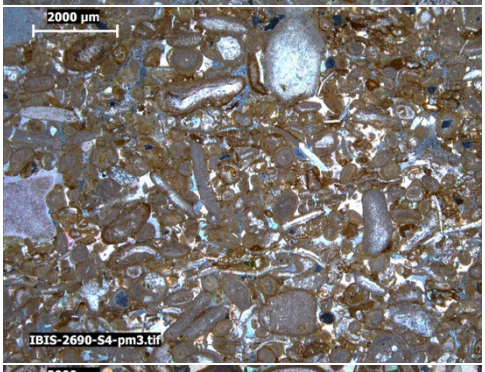
Sample viewed in cross polarised light



Sample 2690-S3 – BH7 (6.0 m)

Although grain supported the bright patches help to reveal some of the sparite present helping to cement the grains together.

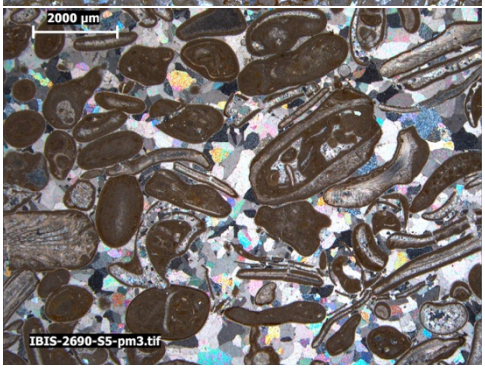
Sample viewed in cross polarised light



Sample 2690-S4 – BH7 (9.5 m)

There is an increased level of darkness evident in the matrix due to the apparent presence of dark materials including both iron compounds and organic materials.

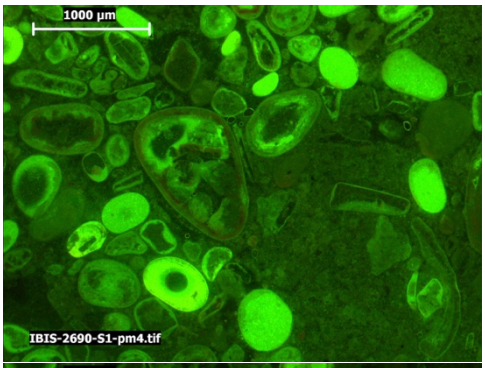
Sample viewed in cross polarised light



Sample 2690-S5 – BH7 (12.0 m)

Compared to all the other qualities of Clipsham stone being investigated, this one clearly has the largest and/or most defined grains.

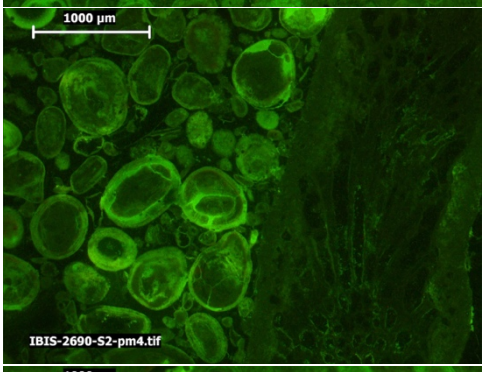
Sample viewed in cross polarised light



Sample 2690-S1 – CLB (4.0 m)

There is variable microporosity with some of the grains exhibiting relatively high porosity, these the ooliths and pellets.

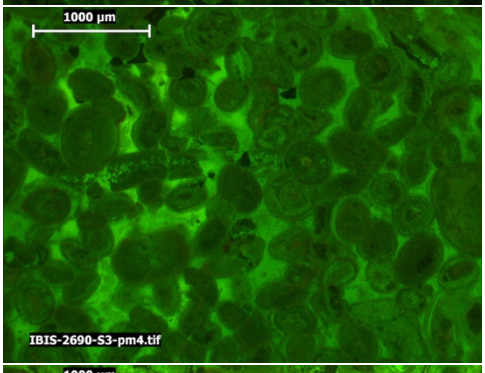
Sample viewed using secondary fluorescence



Sample 2690-S2 – CLB (1.76 m)

A byozoan particle fills much of the right hand side and is relatively low in microporosity, as is the matrix surrounding the particles on the left hand side. The outer coatings of the particles appear to be more microporous.

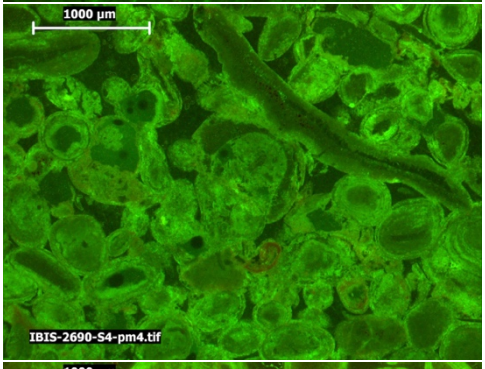
Sample viewed using secondary fluorescence



Sample 2690-S3 – BH7 (6.0 m)

The matrix exhibited a relatively open structure which is seen here by the high level of fluorescence on the left. The fluorescence of the matrix to the right side is slightly less due to the presence of sparry calcite. Most of the finer ooliths and pellets appear to be microporous.

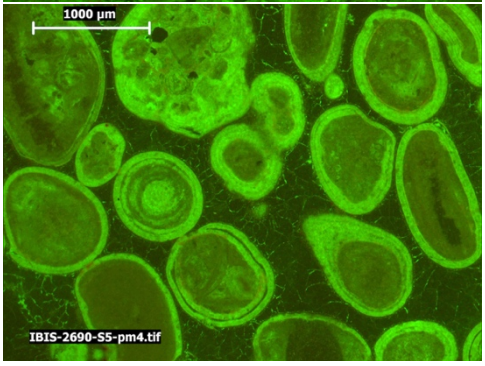
Sample viewed using secondary fluorescence



Sample 2690-S4 – BH7 (9.5 m)

The particles mostly appear to be microporous within a low microporosity matrix of mostly sparry calcite.

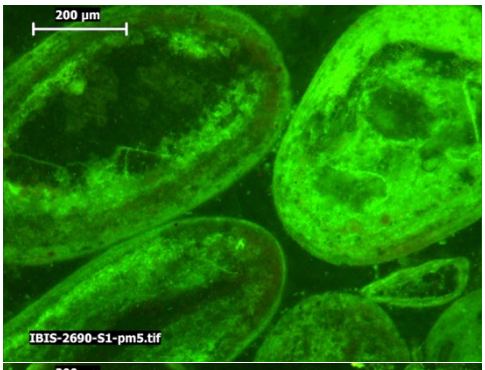
Sample viewed using secondary fluorescence



Sample 2690-S5 – BH7 (12.0 m)

The sparry calcite matrix is clearly very low in microporosity whilst the layered structure of many of the grains is revealed by the variation in microporosity of the different layers.

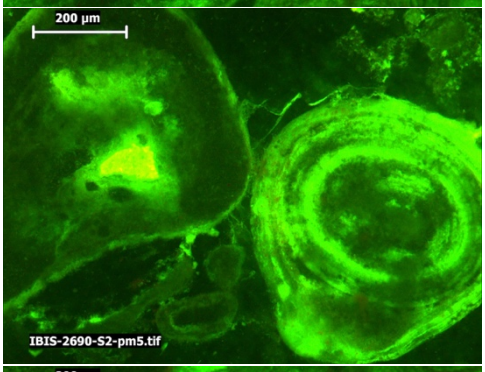
Sample viewed using secondary fluorescence



Sample 2690-S1 – CLB (4.0 m)

Closer view of some of the grains and variations in their internal structure revealed by changes in the apparent levels of microporosity. Layered structures are clearly visible.

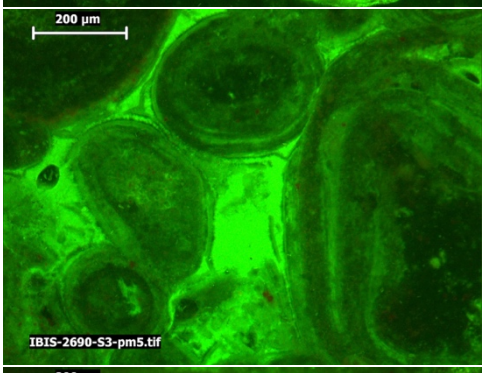
Sample viewed using secondary fluorescence



Sample 2690-S2 – CLB (1.76 m)

To the right is a multiple concentric ring structure typical of a developed ooid. To the left is a poorly structured grain, possibly a peloid.

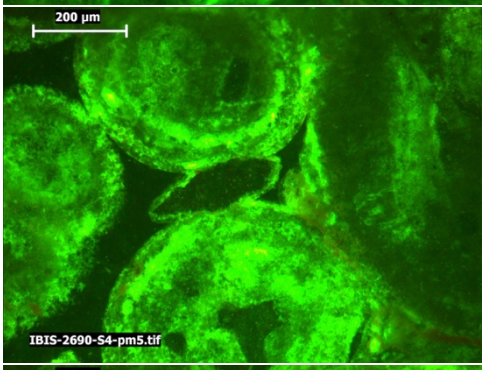
Sample viewed using secondary fluorescence



Sample 2690-S3 – BH7 (6.0 m)

The lack of matrix makes the space between the grains appear relatively bright. The grains are mostly ooliths with a concentric ring appearance highlighted by variation in the microporosity of the different layers.

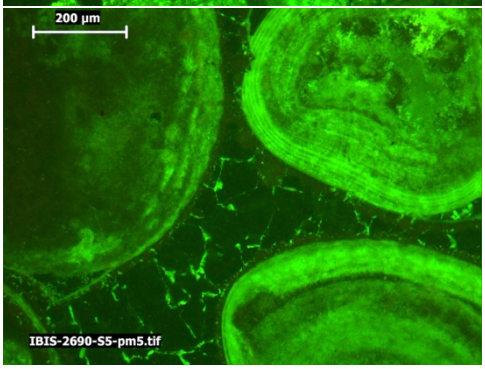
Sample viewed using secondary fluorescence



Sample 2690-S4 – BH7 (9.5 m)

Variations in the grain structures due to differences in formation, with some grains appearing highly microporous due to their relatively high brightness.

Sample viewed using secondary fluorescence

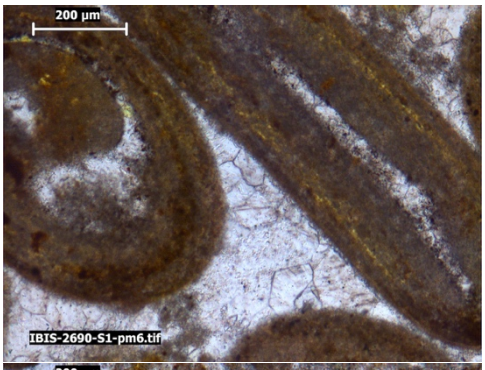


Sample 2690-S5 – BH7 (12.0 m)

The dark sparry calcite matrix between the grains does have some apparent microporosity between the crystals (the grain boundaries).

The ooid to the top right may have around 15 layers of formation.

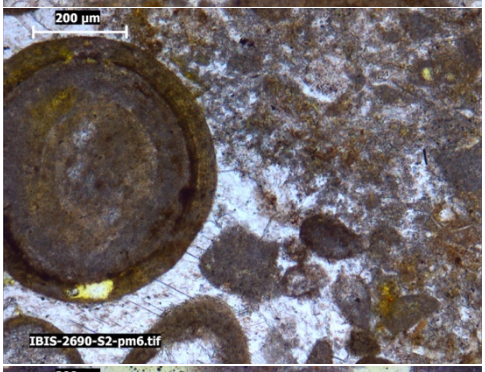
Sample viewed using secondary fluorescence



Sample 2690-S1 – CLB (4.0 m)

Area showing the light sparry calcite matrix and the micritic grains with sparry calcite cores.

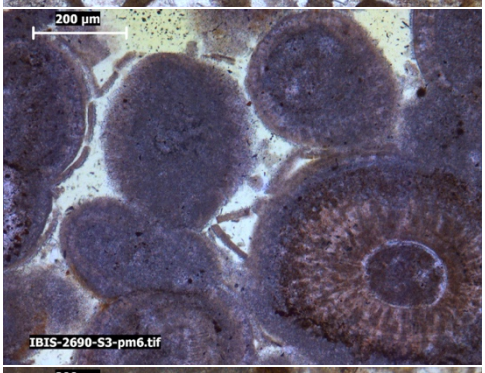
Sample viewed in plane polarised light



Sample 2690-S2 – CLB (1.76 m)

There is mixed micritic and sparitic matrix in this location. The sparry calcite does appear to be a secondary development as it partly encapsulates the finer matrix materials.

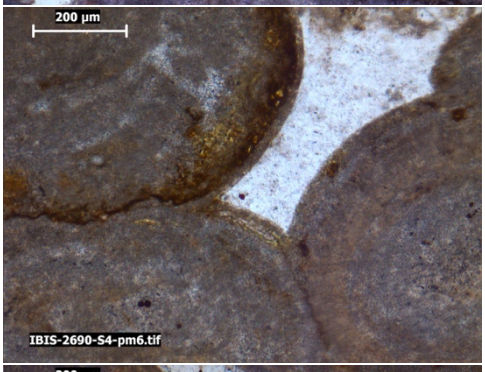
Sample viewed in plane polarised light



Sample 2690-S3 – BH7 (6.0 m)

Some of the outer layers of the ooliths here are peeling away. The grains are typically touching as there is minimal matrix.

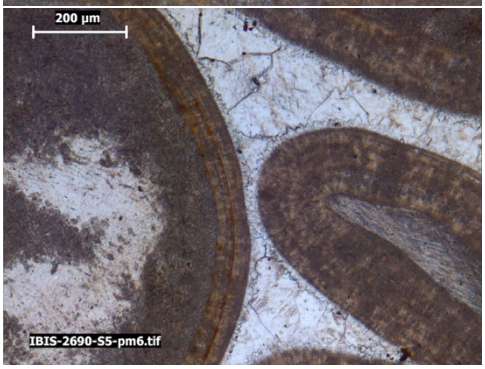
Sample viewed in plane polarised light



Sample 2690-S4 – BH7 (9.5 m)

The grains shown here have been pressed together and have now formed small suture lines between them. All the grains here are micritic whilst the space between them is sparitic.

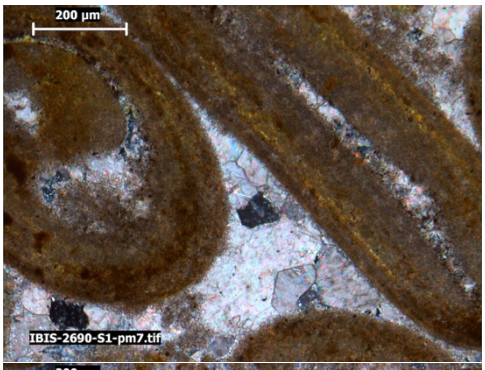
Sample viewed in plane polarised light



Sample 2690-S5 – BH7 (12.0 m)

The sparry calcite matrix originally formed as a corona to the grains here, a 'ghost' of this growth just being visible around the outer surfaces/edges of the grains.

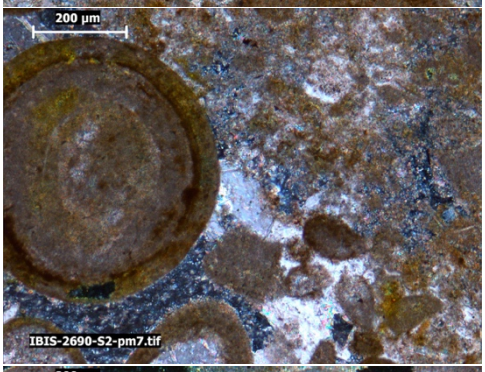
Sample viewed in plane polarised light



Sample 2690-S1 – CLB (4.0 m)

Same view as shown on the previous page for this sample but under different illumination, this helping to highlight the presence of sparry calcite crystals.

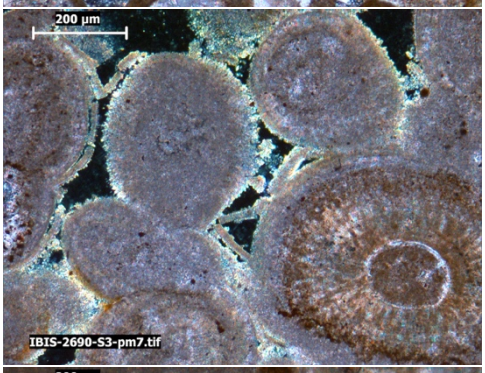
Sample viewed in cross polarised light



Sample 2690-S2 – CLB (1.76 m)

Same view as shown on the previous page for this sample but under different illumination, this helping to highlight the presence of sparry calcite crystals.

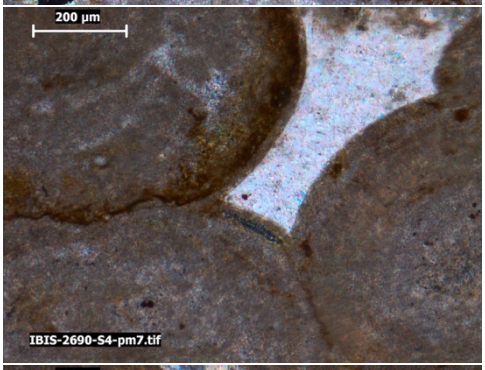
Sample viewed in cross polarised light



Sample 2690-S3 – BH7 (6.0 m)

Same view as shown on the previous page for this sample but under different illumination. The dark patches help to confirm the lack of matrix materials between the grains.

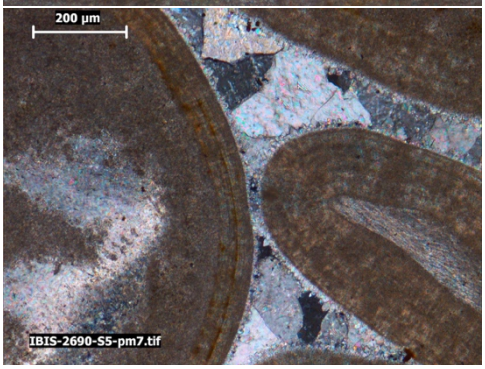
Sample viewed in cross polarised light



Sample 2690-S4 – BH7 (9.5 m)

Same view as shown on the previous page for this sample but under different illumination, this confirming the presence of sparry calcite to the top right.

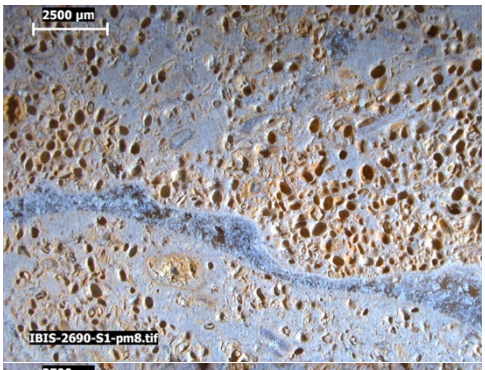
Sample viewed in cross polarised light



Sample 2690-S5 – BH7 (12.0 m)

Same view as shown on the previous page for this sample but under different illumination, this helping to highlight the presence of interlocking sparry calcite crystals between the grains.

Sample viewed in cross polarised light

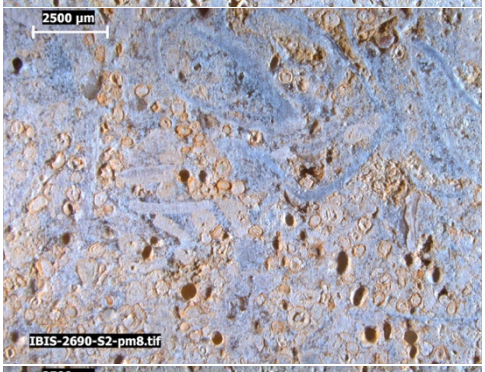


Sample 2690-S1 – CLB (4.0 m)

The grey areas are shelly materials which contrast with the pock-marked appearance of the granular structure that forms the bulk of the rock mass.

This is a freshly sawn surface and there are clear differences in the competency of the various materials.

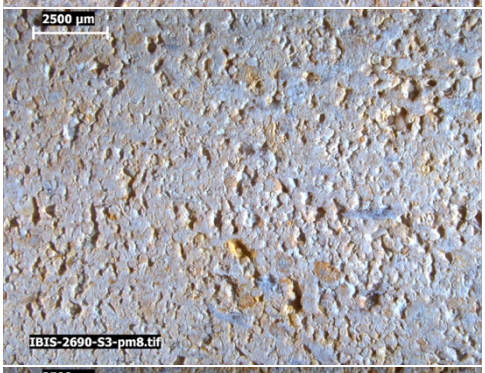
Sample viewed in low angle incident light



Sample 2690-S2 – CLB (1.76 m)

This is a freshly sawn surface in a location where there is a high volume of shelly materials.

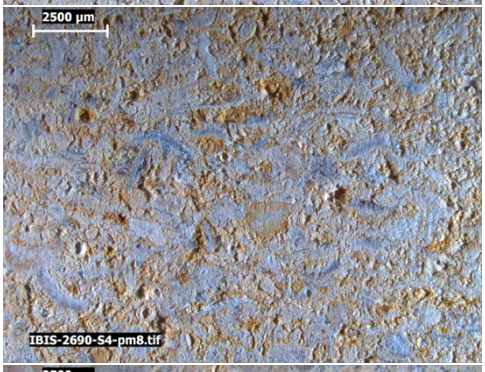
Sample viewed in low angle incident light



Sample 2690-S3 – BH7 (6.0 m)

Relatively few shelly materials are seen in this area of sawn surface, whilst the grains appear to be a little smaller than the other samples under investigation.

Sample viewed in low angle incident light

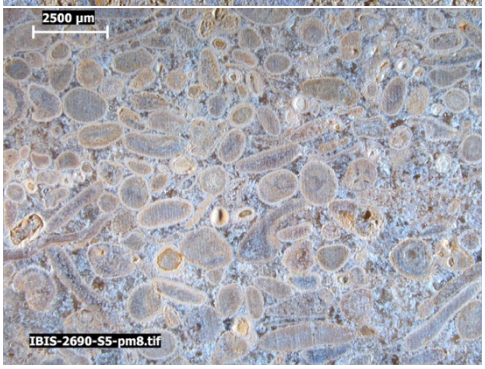


Sample 2690-S4 – BH7 (9.5 m)

This location exhibits a significant amount of shelly fragments that are smaller than seen in the other samples where such materials are present in significant amounts.

The matrix has a darker brown appearance that may be due to an increased iron and/or organic material content.

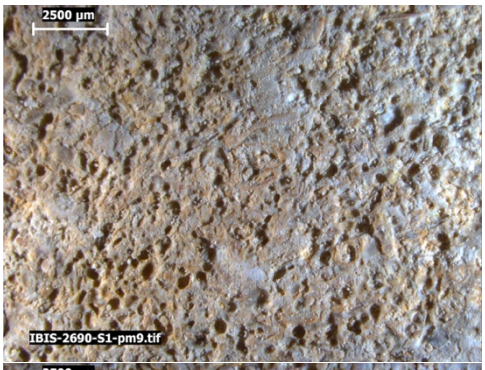
Sample viewed in low angle incident light



Sample 2690-S5 – BH7 (12.0 m)

Very few voids or plucked grains are apparent in this sample where the grains were clearly matrix supported by an interlocking sparry calcite matrix.

Sample viewed in low angle incident light



Sample 2690-S1 – CLB (4.0 m)

Weathered outer core surface shown here, with features more difficult to identify. The matrix generally appears to be quite closed.

Sample viewed in low angle incident light

Sample 2690-S2 – CLB (1.76 m)

Weathered outer core surface shown here, with some of the shelly materials standing proud. The matrix generally appears to be more open.

Sample viewed in low angle incident light

Sample 2690-S3 – BH7 (6.0 m)

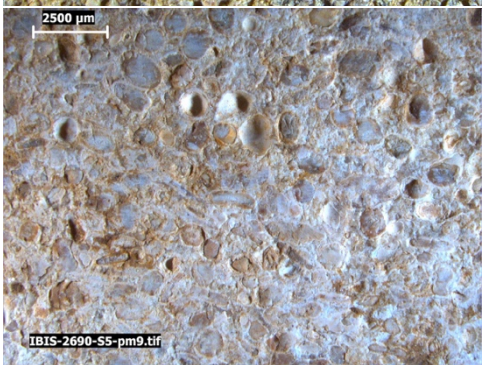
Weathered outer core surface shown here, with features more difficult to identify, the surface appearing relatively rough. The matrix generally appears to be more open.

Sample viewed in low angle incident light

Sample 2690-S4 – BH7 (9.5 m)

Weathered outer core surface shown here, with features more difficult to identify than the other samples as it is relatively very rough. The colour of the sample generally is more yellow/brown possibly due to weathering factors.

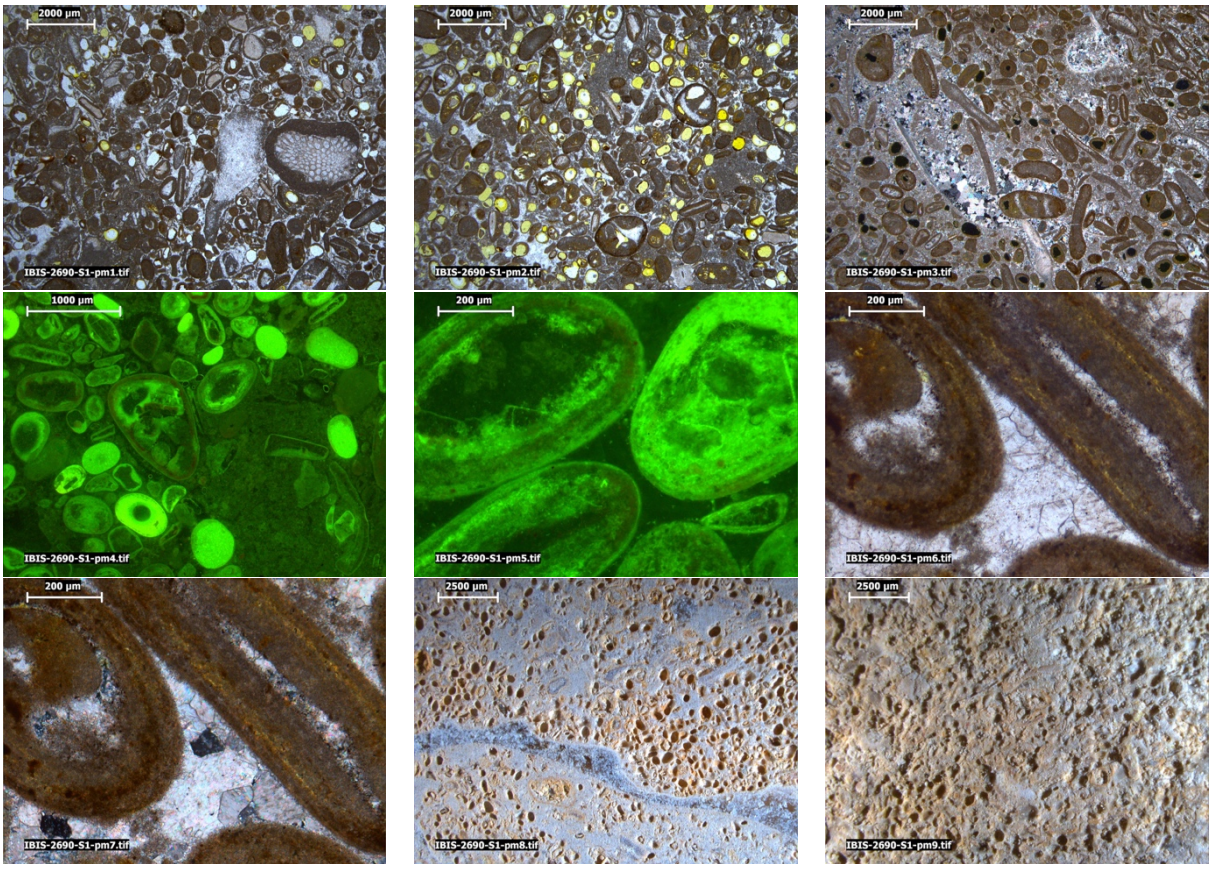
Sample viewed in low angle incident light



Sample 2690-S5 – BH7 (12.0 m)

Outer core surface shown here, with minimal apparent weathering having taken place. The matrix appears to be very closed; a couple of particles have plucked out.

Sample viewed in low angle incident light



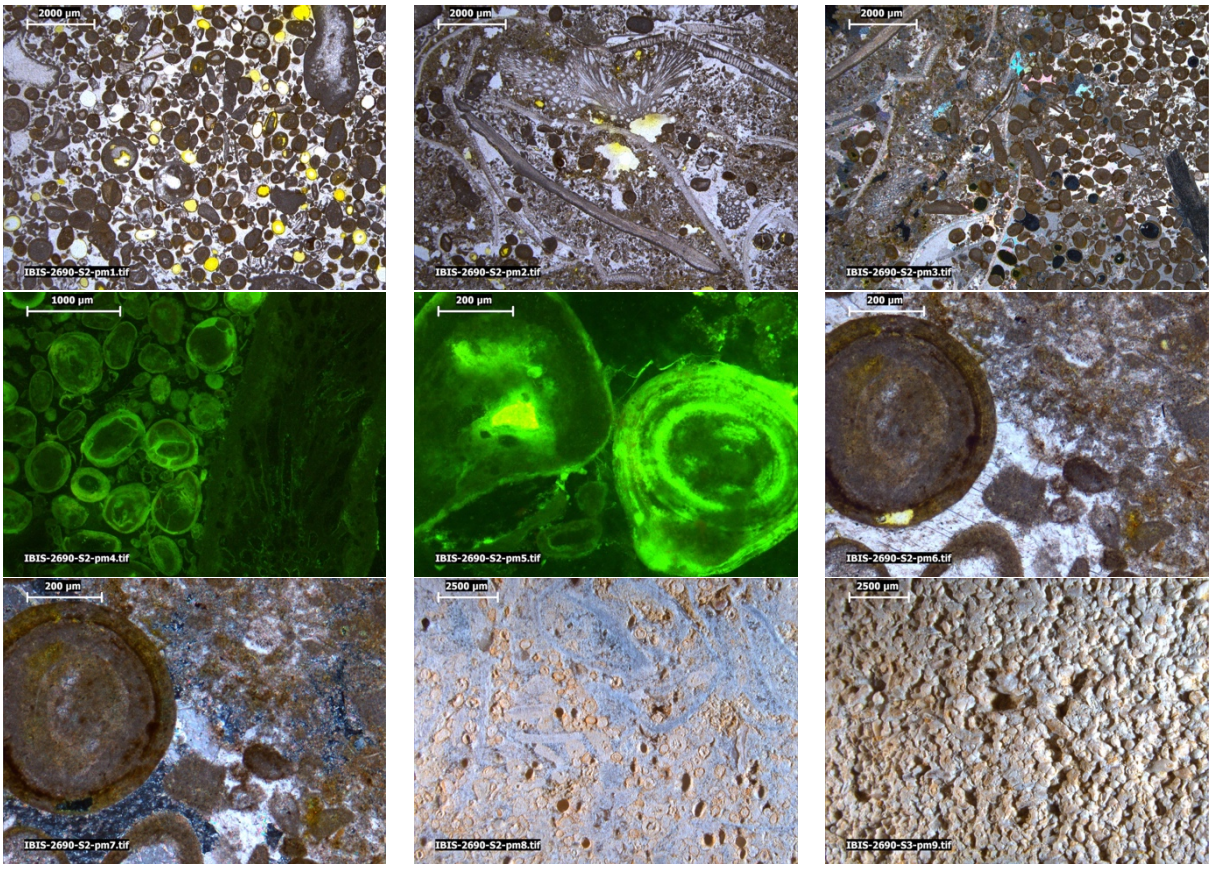
Illumination: top left: plane polarised; top middle, plane polarised; top right: cross polarised; centre left: secondary fluorescence; centre: secondary fluorescence; centre right: plane polarised; bottom left: cross polarised; bottom middle: low-angle incident; bottom right: low-angle incident.

Sample 2690-S1 – CLB (4.0 m)

Basic description: medium to very coarse-grained shelly oolitic limestone
Folk Limestone Classification: poorly washed/unsorted oo-biosparite
Dunham Limestone Classification: packstone

Notable Features
Sub-parallel alignment of elongated grains and fragments relative to apparent bedding plane.
Patches of sparry calcite matrix enclosing grains.
Ooliths and pellets with highly microporous zones.

Other Details
Grains and matrix both appeared to comprise calcite ($CaCO_3$) with no evidence of significant dolomite or other carbonate minerals being present.
Evidence of secondary growth of the sparite around the grains.
Ooliths typically 200 µm to 750 µm in diameter
Shell fragments and other larger fossil fragments reaching up to 30 mm in size.
Fossils included fragments of mostly bivalves with some bryozoans and echinoderms.



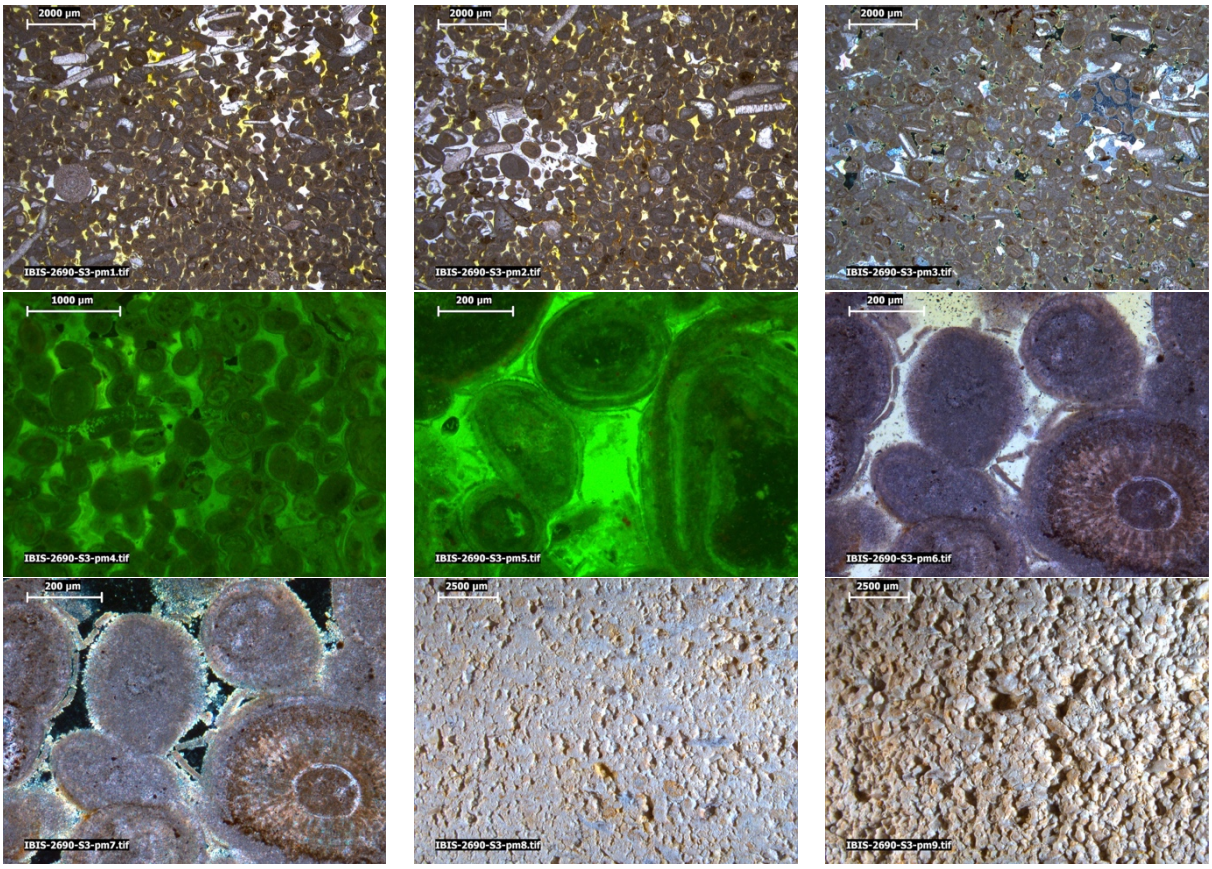
Illumination: top left: plane polarised; top middle, plane polarised; top right: cross polarised; centre left: secondary fluorescence; centre: secondary fluorescence; centre right: plane polarised; bottom left: cross polarised; bottom middle: low-angle incident; bottom right: low-angle incident.

Sample 2690-S2 – CLB (1.76 m)

Basic description: medium to very coarse-grained shelly oolitic limestone
Folk Limestone Classification: unsorted oo-biosparite
Dunham Limestone Classification: packstone

Notable Features
Sub-parallel alignment of elongated grains and fragments relative to apparent bedding plane.
Large areas of sparry calcite matrix enclosing grains.
Ooliths and pellets with highly microporous zones.

Other Details
Grains and matrix both appeared to comprise calcite ($CaCO_3$) with no evidence of significant dolomite or other carbonate minerals being present.
Evidence of secondary growth of the sparite around the grains.
Ooliths typically 200 µm to 600 µm in diameter
Shell fragments and other larger fossil fragments reaching up to 10 mm in size.
Fossils included fragments of mostly bivalves and bryozoans with some brachiopods and echinoderms.
Rock fragments typically were former limestone.



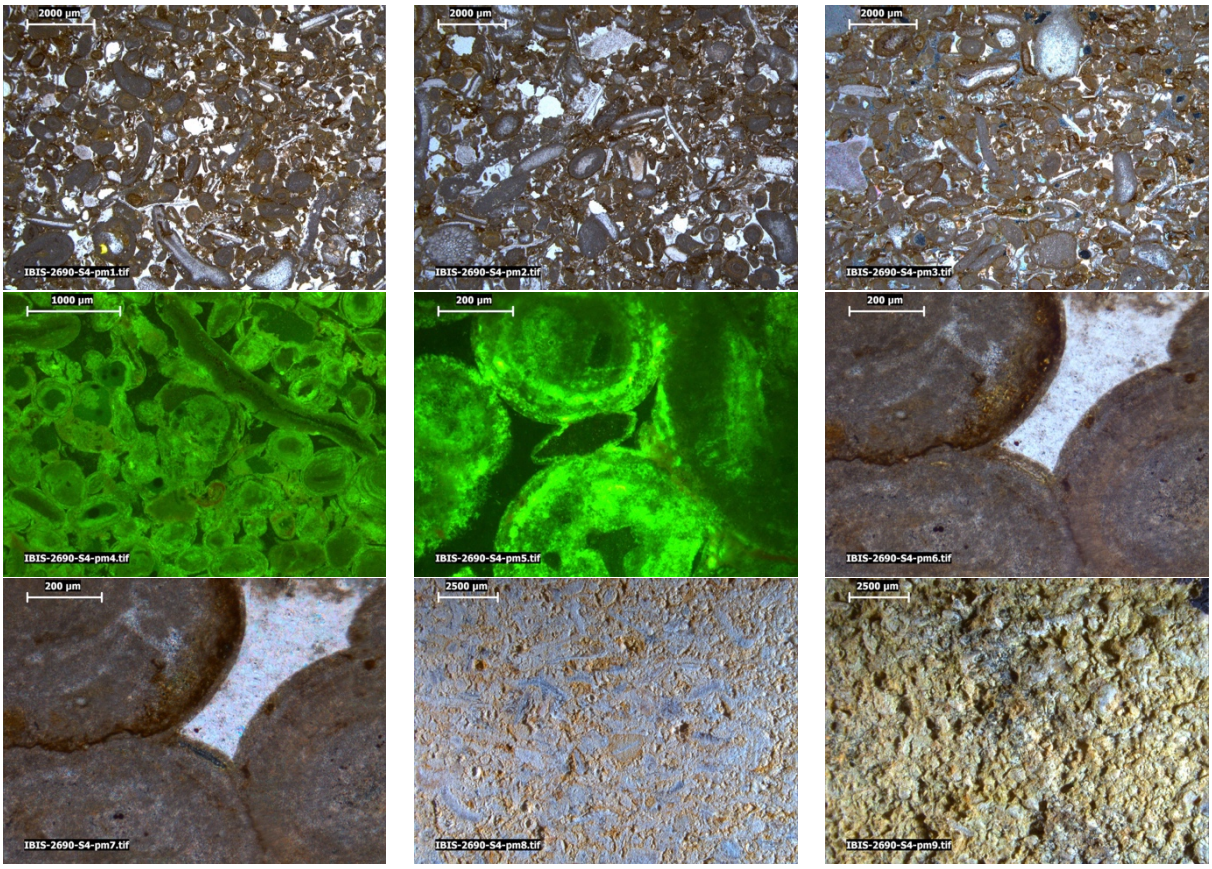
Illumination: top left: plane polarised; top middle, plane polarised; top right: cross polarised; centre left: secondary fluorescence; centre: secondary fluorescence; centre right: plane polarised; bottom left: cross polarised; bottom middle: low-angle incident; bottom right: low-angle incident.

Sample 2690-S3 – BH7 (6.0 m)

Basic description: medium-grained pelitic limestone
Folk Limestone Classification: unsorted oo-pelsparite
Dunham Limestone Classification: packstone/grainstone

Notable Features
Interconnected pores, almost forming a honeycomb.
Sutured contacts between grains and some loss of outer grain surfaces.
Sub-parallel alignment of elongated grains and fragments relative to apparent bedding plane.
Patches of sparry calcite matrix enclosing grains.

Other Details
Grains and matrix both appeared to comprise calcite ($CaCO_3$) with no evidence of significant dolomite or other carbonate minerals being present.
Evidence of secondary growth of the sparite around the grains.
Ooliths typically 100 µm to 500 µm in diameter; pellets typically 50 µm to 400 µm in diameter
Shell fragments and other larger fossil fragments reaching up to 3 mm in size.
Fossils included fragments of mainly bivalves with minor bryozoans, brachiopods and echinoderms.
Rock fragments were typically formerly limestone.



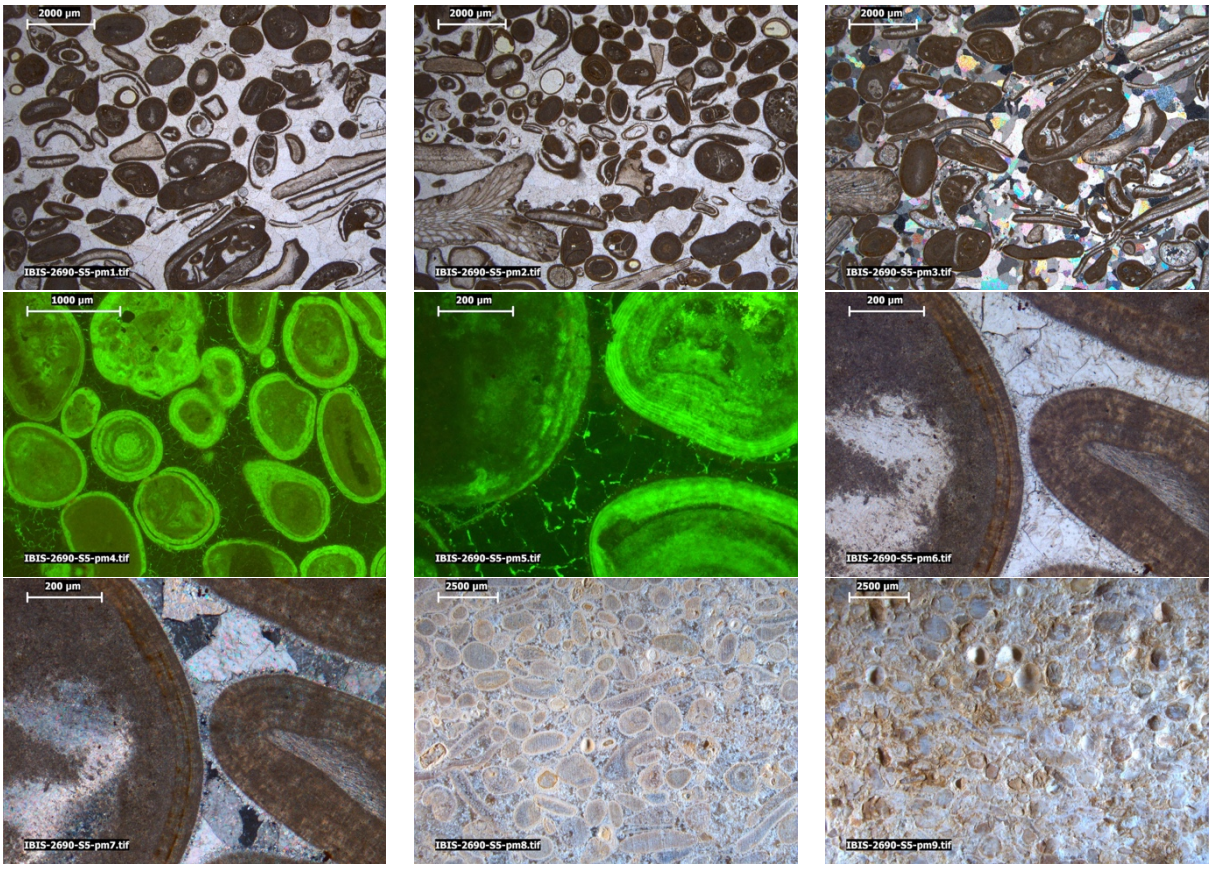
Illumination: top left: plane polarised; top middle, plane polarised; top right: cross polarised; centre left: secondary fluorescence; centre: secondary fluorescence; centre right: plane polarised; bottom left: cross polarised; bottom middle: low-angle incident; bottom right: low-angle incident.

Sample 2690-S4 – BH7 (9.5 m)

Basic description: medium to coarse-grained shelly oolitic limestone
Folk Limestone Classification: poorly washed oo-biosparite
Dunham Limestone Classification: packstone

Notable Features
Sutured contacts between grains.
Some sub-parallel alignment of elongated grains and fragments relative to apparent bedding plane.
Very few obvious pores or voids.
Ooliths and pellets with highly microporous zones.
Evidence of weathering with discoloration from iron compounds and/or organic materials.

Other Details
Grains and matrix both appeared to comprise calcite ($CaCO_3$) with no evidence of significant dolomite or other carbonate minerals being present.
Evidence of secondary growth of the sparite around the grains.
Ooliths typically 200 µm to 1000 µm in diameter
Shell fragments and other larger fossil fragments reaching up to 8 mm in size.
Fossils included fragments of bivalves, brachiopods, gastropods, bryozoans and echinoderms.
Rock fragments were typically formerly limestone.



Illumination: top left: plane polarised; top middle, plane polarised; top right: cross polarised; centre left: secondary fluorescence; centre: secondary fluorescence; centre right: plane polarised; bottom left: cross polarised; bottom middle: low-angle incident; bottom right: low-angle incident.

Sample 2690-S5 – BH7 (12.0 m)

Basic description: coarse-grained oolitic limestone
Folk Limestone Classification: sorted oo-biosparite
Dunham Limestone Classification: grainstone

Notable Features
Sparry calcite (sparite) matrix without obvious pores.
Minimal contact between grains.
Sub-parallel alignment of elongated grains and fragments relative to apparent bedding plane.
Ooliths with highly microporous zones, particularly the outermost concentric rings.

Other Details
Grains and matrix both appeared to comprise calcite ($CaCO_3$) with no evidence of significant dolomite or other carbonate minerals being present.
Evidence of secondary growth of the sparite around the grains.
Ooliths typically 400 µm to 1000 µm in diameter
Shell fragments and other larger fossil fragments reaching up to 6 mm in size.
Fossils included fragments of bivalves, brachiopods, gastropods and echinoderms.
Rock fragments were typically formerly limestone.

IBIS Limited
10 Clarendon Road
London E18 2AW

Certificate of Verification

XL2-74339

Reading No	56
Mode	Mining
Time	2020-04-24 16:38
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S1
LOCATION	CLB - 4.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
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Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
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Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.034	+/-	0.002
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Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
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Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.400	+/-	0.028
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	40.718	+/-	0.995
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.376	+/-	0.042
Cl	0	:	N/A
S	0.043	+/-	0.006
Mg	1.474	+/-	0.967

Supervised By: _____

IBIS Limited
10 Clarendon Road
London E18 2AW

Certificate of Verification

XL2-74339

Reading No	57
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Duration	60.00
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Sigma Value	2
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Flags	
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INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
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Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
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Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.031	+/-	0.002
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As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
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Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
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Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	39.799	+/-	0.970
K	0.050	+/-	0.026
Al	0	:	N/A
P	0	:	N/A
Si	0.364	+/-	0.040
Cl	0	:	N/A
S	0.041	+/-	0.006
Mg	0	:	N/A

Supervised By: _____

IBIS Limited
10 Clarendon Road
London E18 2AW

Certificate of Verification

XL2-74339

Reading No	58
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Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
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LOCATION	CLB - 4.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	57.255	+/-	1.027
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.032	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.387	+/-	0.027
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	40.245	+/-	0.963
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.324	+/-	0.040
Cl	0	:	N/A
S	0.041	+/-	0.006
Mg	1.554	+/-	0.962

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Certificate of Verification

XL2-74339

Reading No	59
Mode	Mining
Time	2020-04-24 16:41
Duration	180.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
AVERAGE	Avg of 56-58
LOCATION	CLB - 4.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	57.805	+/-	1.021
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.032	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.417	+/-	0.029
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	40.254	+/-	0.976
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.355	+/-	0.041
Cl	0	:	N/A
S	0.042	+/-	0.006
Mg	0	:	N/A

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Certificate of Verification

XL2-74339

Reading No	60
Mode	Mining
Time	2020-04-24 16:44
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S2
LOCATION	CLB - 1.76m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0.028	+/-	0.018
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	54.150	+/-	1.108
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.035	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.401	+/-	0.028
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	43.635	+/-	1.054
K	0.128	+/-	0.028
Al	0	:	N/A
P	0	:	N/A
Si	0.170	+/-	0.037
Cl	0.007	+/-	0.004
S	0.045	+/-	0.006
Mg	0	:	N/A

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Certificate of Verification

XL2-74339

Reading No	61
Mode	Mining
Time	2020-04-24 16:46
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S2
LOCATION	CLB - 1.76m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	57.172	+/-	1.011
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.040	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.452	+/-	0.030
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	42.181	+/-	1.003
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.115	+/-	0.034
Cl	0	:	N/A
S	0.038	+/-	0.006
Mg	0	:	N/A

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Certificate of Verification

XL2-74339

Reading No	62
Mode	Mining
Time	2020-04-24 16:48
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S2
LOCATION	CLB - 1.76m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	54.895	+/-	1.093
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.035	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.408	+/-	0.028
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	42.588	+/-	1.026
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.102	+/-	0.034
Cl	0	:	N/A
S	0.045	+/-	0.006
Mg	1.924	+/-	1.037

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Certificate of Verification

XL2-74339

Reading No	63
Mode	Mining
Time	2020-04-24 16:48
Duration	180.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
AVERAGE	Avg of 60-62
LOCATION	CLB - 1.76m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	55.406	+/-	1.071
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.037	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.421	+/-	0.029
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	42.801	+/-	1.027
K	0.043	+/-	0.027
Al	0	:	N/A
P	0	:	N/A
Si	0.129	+/-	0.035
Cl	0	:	N/A
S	0.042	+/-	0.006
Mg	0	:	N/A

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XL2-74339

Reading No	64
Mode	Mining
Time	2020-04-24 16:50
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S3
LOCATION	BH7 - 6.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	56.680	+/-	1.036
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.030	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.425	+/-	0.028
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	41.014	+/-	0.977
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.065	+/-	0.033
Cl	0	:	N/A
S	0.061	+/-	0.006
Mg	1.723	+/-	0.981

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XL2-74339

Reading No	65
Mode	Mining
Time	2020-04-24 16:52
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S3
LOCATION	BH7 - 6.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	55.782	+/-	1.057
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.029	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.402	+/-	0.028
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	41.561	+/-	0.986
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.077	+/-	0.034
Cl	0	:	N/A
S	0.065	+/-	0.006
Mg	2.080	+/-	1.014

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XL2-74339

Reading No	66
Mode	Mining
Time	2020-04-24 16:53
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S3
LOCATION	BH7 - 6.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	54.933	+/-	1.088
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.029	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.444	+/-	0.029
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	41.070	+/-	0.975
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.082	+/-	0.034
Cl	0	:	N/A
S	0.060	+/-	0.006
Mg	3.361	+/-	1.073

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XL2-74339

Reading No	67
Mode	Mining
Time	2020-04-24 16:53
Duration	180.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
AVERAGE	Avg of 64-66
LOCATION	BH7 - 6.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	55.798	+/-	1.060
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.030	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.424	+/-	0.028
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	41.215	+/-	0.979
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.075	+/-	0.034
Cl	0	:	N/A
S	0.062	+/-	0.006
Mg	2.388	+/-	1.022

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XL2-74339

Reading No	68
Mode	Mining
Time	2020-04-24 16:56
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S4
LOCATION	BH7 - 9.5m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0.034	+/-	0.019
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	55.512	+/-	1.090
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.046	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.689	+/-	0.040
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	41.546	+/-	1.012
K	0	:	N/A
Al	0.344	+/-	0.174
P	0	:	N/A
Si	0.374	+/-	0.042
Cl	0	:	N/A
S	0.045	+/-	0.006
Mg	0	:	N/A

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Certificate of Verification

XL2-74339

Reading No	69
Mode	Mining
Time	2020-04-24 16:57
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S4
LOCATION	BH7 - 9.5m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	56.588	+/-	1.023
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.045	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.600	+/-	0.035
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	40.982	+/-	0.962
K	0.077	+/-	0.029
Al	0	:	N/A
P	0	:	N/A
Si	0.211	+/-	0.038
Cl	0	:	N/A
S	0.043	+/-	0.006
Mg	0	:	N/A

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Certificate of Verification

XL2-74339

Reading No	70
Mode	Mining
Time	2020-04-24 16:58
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S4
LOCATION	BH7 - 9.5m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	55.326	+/-	1.096
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.047	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.685	+/-	0.040
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	42.330	+/-	1.034
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.218	+/-	0.038
Cl	0	:	N/A
S	0.058	+/-	0.006
Mg	0	:	N/A

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Certificate of Verification

XL2-74339

Reading No	71
Mode	Mining
Time	2020-04-24 16:58
Duration	180.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
AVERAGE	Avg of 68-70
LOCATION	BH7 - 9.5m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	55.809	+/-	1.070
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.046	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.658	+/-	0.038
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	41.619	+/-	1.003
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.268	+/-	0.039
Cl	0	:	N/A
S	0.048	+/-	0.006
Mg	0	:	N/A

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Certificate of Verification

XL2-74339

Reading No	72
Mode	Mining
Time	2020-04-24 17:01
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S5
LOCATION	BH7 - 12.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0.045	+/-	0.019
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	54.882	+/-	1.082
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.038	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.595	+/-	0.036
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	44.290	+/-	1.068
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.105	+/-	0.036
Cl	0	:	N/A
S	0.043	+/-	0.006
Mg	0	:	N/A

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Certificate of Verification

XL2-74339

Reading No	73
Mode	Mining
Time	2020-04-24 17:02
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S5
LOCATION	BH7 - 12.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	55.461	+/-	1.061
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.033	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.530	+/-	0.033
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	42.173	+/-	1.002
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.097	+/-	0.034
Cl	0	:	N/A
S	0.039	+/-	0.006
Mg	1.664	+/-	1.021

Supervised By: _____

IBIS Limited
10 Clarendon Road
London E18 2AW

Certificate of Verification

XL2-74339

Reading No	74
Mode	Mining
Time	2020-04-24 17:04
Duration	60.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
SAMPLE	2690-S5
LOCATION	BH7 - 12.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	52.841	+/-	1.136
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.036	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.498	+/-	0.031
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	42.926	+/-	1.017
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.135	+/-	0.036
Cl	0	:	N/A
S	0.060	+/-	0.006
Mg	3.433	+/-	1.126

Supervised By: _____

IBIS Limited
10 Clarendon Road
London E18 2AW

Certificate of Verification

XL2-74339

Reading No	75
Mode	Mining
Time	2020-04-24 17:04
Duration	180.00
Units	%
Sigma Value	2
Sequence	Final
Flags	
AVERAGE	Avg of 72-74
LOCATION	BH7 - 12.0m
INSPECTOR	BJH-IBIS
MISC	Clipsham
NOTE	Hooby Lane Quarry

	%	+/-	Error
Ba	0	:	N/A
Sb	0	:	N/A
Sn	0	:	N/A
Cd	0	:	N/A
Pd	0	:	N/A
Ag	0	:	N/A
Bal	54.395	+/-	1.093
Mo	0	:	N/A
Nb	0	:	N/A
Zr	0	:	N/A
Sr	0.036	+/-	0.002
Rb	0	:	N/A
Bi	0	:	N/A
As	0	:	N/A
Se	0	:	N/A
Pb	0	:	N/A
W	0	:	N/A
Zn	0	:	N/A
Cu	0	:	N/A
Ni	0	:	N/A
Co	0	:	N/A
Fe	0.541	+/-	0.033
Mn	0	:	N/A
Cr	0	:	N/A
V	0	:	N/A
Ti	0	:	N/A
Ca	43.129	+/-	1.029
K	0	:	N/A
Al	0	:	N/A
P	0	:	N/A
Si	0.112	+/-	0.035
Cl	0	:	N/A
S	0.048	+/-	0.006
Mg	1.699	+/-	1.043

Supervised By: _____