

THE COCHNO STONE

A proposal prepared by:

- Ferdinand Saumarez Smith: Curator, The Factum Foundation for Digital Technology in Conservation.
- May Miles Thomas: Film Director, Screenwriter, Artist.
- Dr Kenneth Brophy: Senior Lecturer in Archaeology, the University of Glasgow.

For the Attention of:

- Dr David Mitchell, Director of Conservation, Historic Scotland.
- Dr Lyn Wilson, Project Manager in the Centre for Digital Documentation and Visualisation, Historic Scotland.

Contents:

1. Location.
2. The History of the Cochno Stone – *Ferdinand Saumarez Smith*
3. Project Introduction – *Ferdinand Saumarez Smith*
4. The ‘Druid’ Stone - *May Miles Thomas*
5. Neolithic Cup and Ring Markings – *Dr Kenneth Brophy*
6. Excavation Plan – *Dr Kenneth Brophy*
7. Recording Plan – *Ferdinand Saumarez Smith and Pedro Miro (Head of 3D Scanning, the Factum Foundation)*
8. Facsimile Plan – *Ferdinand Saumarez Smith*
9. Dissemination Plan - *Ferdinand Saumarez Smith, May Miles Thomas, Dr Kenneth Brophy.*
10. Contact Details.

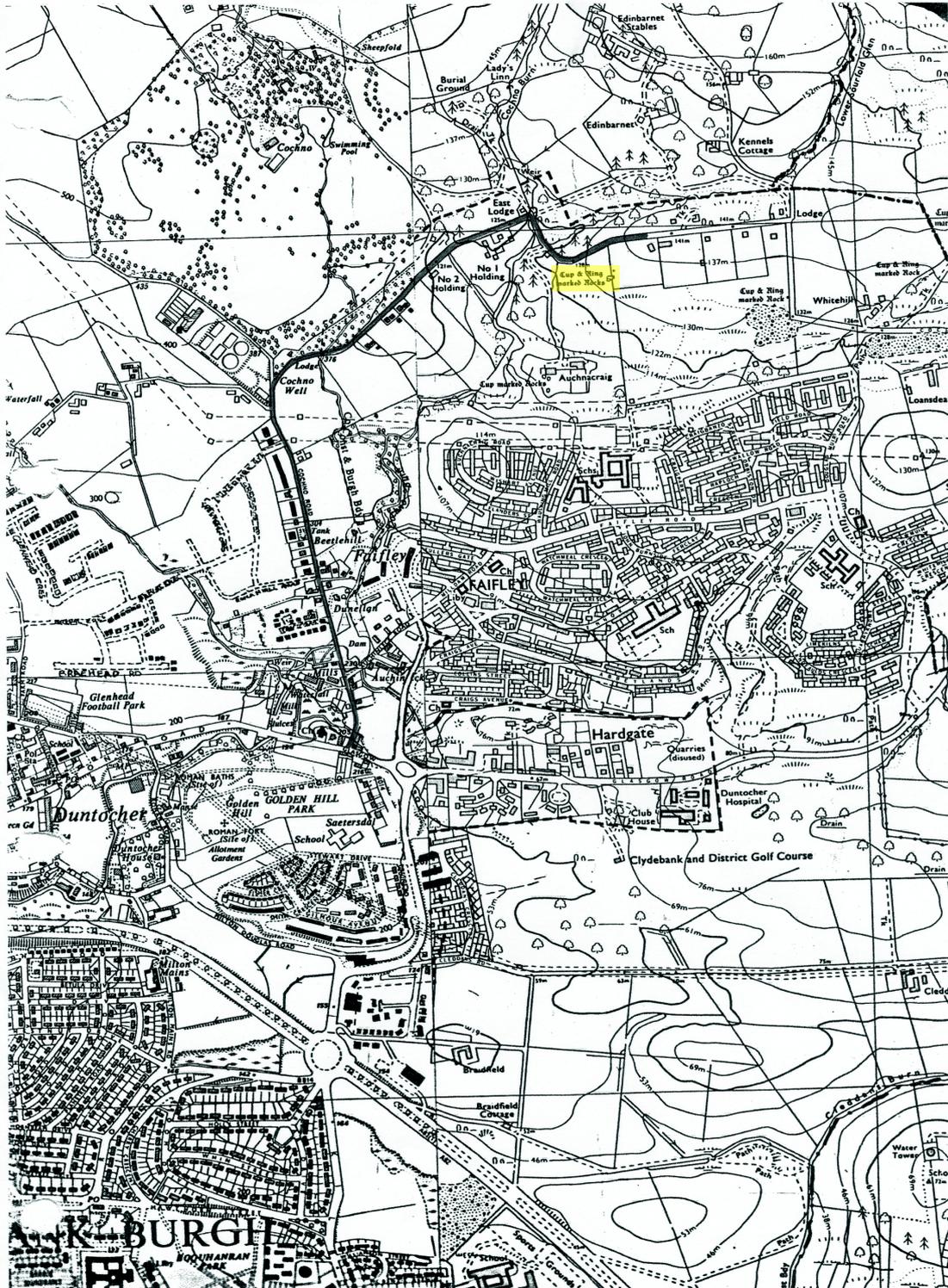
Appendix:

1. Previous Projects: Factum Foundation for Digital Technology in Conservation.
2. Technology Data Sheets (attached).

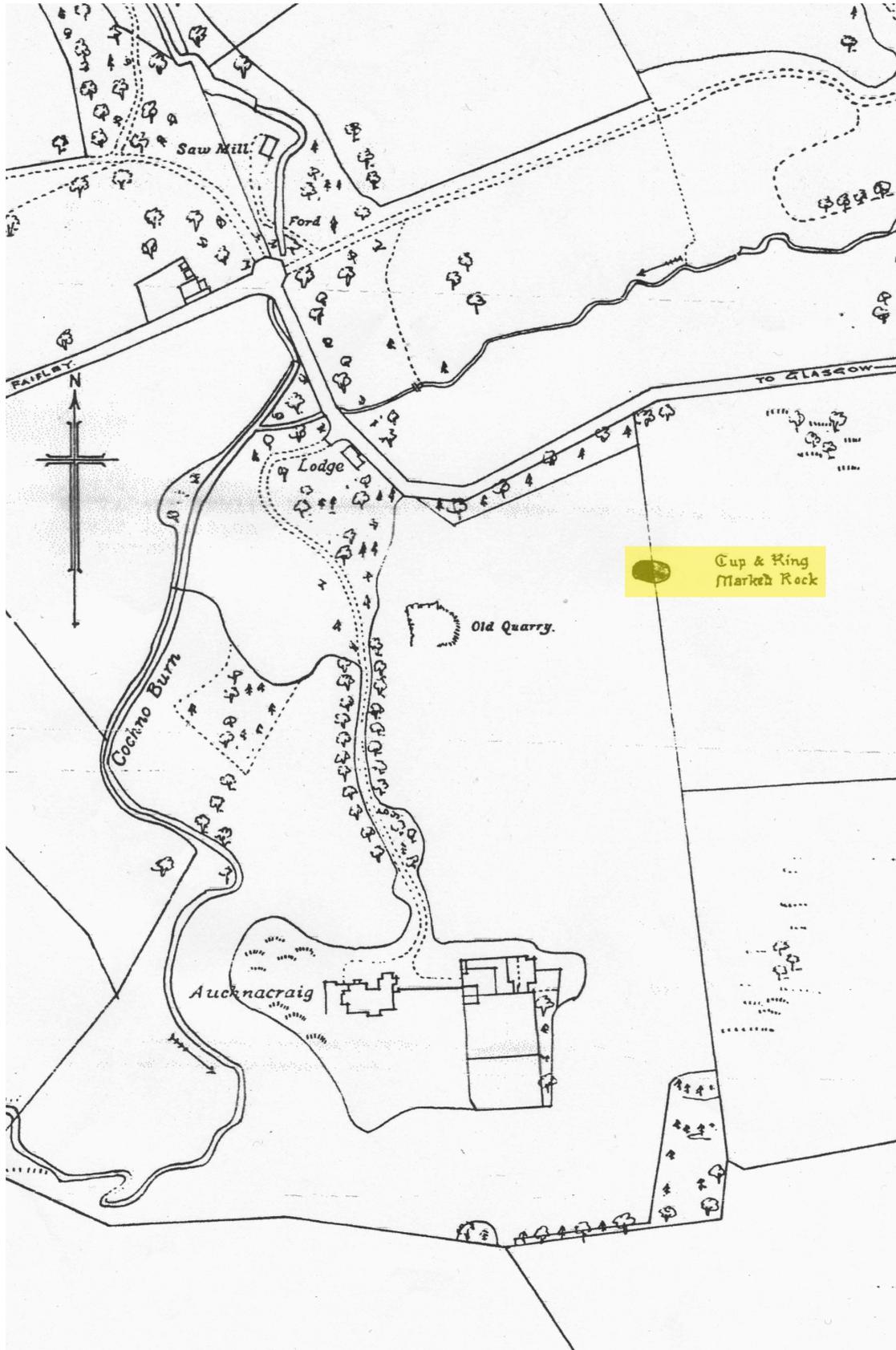
1.

Location.

Map 1 - Surrounding area.



Map 2 – Exact Location.



2.

The History of the Cochno Stone.

‘Though large surfaces of these rocks have been lately uncovered revealing these cup and ring markings, I believe much still lies concealed from view. Evidently the district in which these sculpturings have been found, lying as it does on the pleasant slopes of the Kilpatrick hills, and commanding an extensive view of Clydesdale, had been a favourite resort of these ancient rock-engravers; and it is my hope that, in the course of time, with a little labour, more of these mysterious hieroglyphs may be brought again to the light of day, and perhaps the veil that shrouds from us their meaning may be withdrawn.’

Rev. James Harvey, M.A., Duntocher.

The discovery of the full extent of the Cochno Stone (locally known as the ‘Druid Stone’) and its subsequent appraisal in an objective archaeological manner was by the Reverend James Harvey in 1887, after he first found markings on an exposed section at the site near Auchnacraig, West Dunbartonshire. Rev. Harvey noted that it was known previously amongst local shepherds and gamekeepers and expressed surprise at his archaeological survey as being the first. However, in looking at the origin of the name ‘Cochno’ can be found an indication of a much older local familiarity, since ‘Cochno’ is derived from the Gaelic ‘Cauchanach’ – ‘place of little cups’. It is however conceivable that this applied to the scattering of other cup-and-ring marked rocks in the near vicinity.

The majority of the sandstone rock was covered with a layer of turf that, after application to the then current owner of the land, Mr. G. J. Ferguson, was removed to reveal the entirety of the rich variety of what was described by Rev. Harvey in the language of the time as ‘sculpturings’. The markings are spread over roughly half the total area of the stone that measures 55 feet at its greatest length from east to west and 35 feet at its greatest width from north to south. A record was made consisting of an extensive description of its various marks with reference to the morphology established in Sir James Young Simpson’s 1867 study ‘Archaic Sculpturings of Cups, Circles, &c. upon Stones and Rocks in Scotland, England and other Countries’. A drawing of the whole and rubbings of certain sections were also made and the entirety was eventually reported in the Journal of the Society of Antiquaries of Scotland in 1889.

From the rare handful of images that have come down to us of the Cochno Stone there is one in particular that stands out: a tweed-coated figure crouching down within a stone dyke perimeter, appearing to inscribe a series of mysterious runes and grids on an enormous stone surface. The man pictured is key to a broader understanding of the equal measures of fascination and frustration that have gone into attempting to understand cup-and-ring markings. Ludovic Maclellan Mann, although now a largely forgotten figure, was at the time famous in Scotland for his unorthodox ‘mytho-celestial’ reading of the markings and his role as an early populariser of archaeology in the media. The picture is one of a series that makes up the majority of our photographic record of the stone and originates from a visit by the Glasgow Archaeological Society in 1937. For this visit Mann painted in the marks, as well as a grid over the entirety of the surface to illustrate his thesis that the purpose of the stone was a star-map relating to other Neolithic sites in the area. In November of the same

year the Cochno Stone, or as it was then referred to ‘the Monument known as the cup-and-ring marked rock’ was officially listed in accordance with the Ancient Monuments Acts of 1913 and 1931.



Ludovic Maclellan Mann: painting in the cup-and-ring markings, 1937.

The astronomical interpretation is one of a vast number of these put forward with regards to the meaning of the cup-and-ring markings. Although it is perhaps valid in broad terms, where it is probable that Mann goes too far is in the level of specificity of his reading. It seems highly unlikely that the exactness of his measurements, for example with the movement of a planetary body per day on the arc of one concentric ring representing 0.2338 inches, reflects Neolithic thought. Or, that ‘the Cat God: *The Sun’s Most Valiant Defender*’ is anything more than the projection of his own eccentric fantasies! The most beneficial attitude to take seems to be that of Ronald W.B Morris, an amateur archaeologist who spent much of the 1970’s cataloguing Scottish cup-and-ring marked sites. In his survey ‘Rock Art of Galloway & the Isle of Man’ he begins by listing 104 ideas known to him, ranging from the likely to the risible. In my own opinion the general approach to take is that they should be looked at as the first ‘sprouts’ of language, pre-syntax, but beginning to be abstracted from purely pictorial representation. As such they are likely to have embraced many different usages in different contexts in a similar manner to the manifold different meanings that one symbol can enfold within itself today.

By 1964 the integrity of the Cochno Stone was considered to be sufficiently under threat to lead to its being buried by soil to prevent any further degradation as a result of neglect and damage from graffiti. And there it has remained for 50 years – lying dormant whilst the mystery around it has grown.

3.

Proposal Introduction.

This proposal is an application to Historic Scotland for approval and support for:

- An initial trial excavation of a portion of the Cochno Stone and its subsequent recording to establish work methods with regards to excavating and recording the entirety. This will demonstrate the quality of the data the Factum Foundation is capable of recording. It would also be an opportunity for all parties to meet and a detailed and informed logistical plan to be formulated including timing and dates.

If this trial is successful the project will proceed with:

- The full excavation of the Cochno Stone by the Archaeology Department of the University of Glasgow, under the direction of Dr Kenneth Brophy.
- A 3D recording of the Cochno Stone by the Factum Foundation for Digital Technology in Conservation and the Centre for Digital Documentation and Visualisation, Historic Scotland.
- A 2D parallel photographic recording undertaken by the Factum Foundation.
- The post processing of the 3D data with a view to the manufacture of a facsimile, under the direction of the Factum Foundation.
- The post processing of the parallel photographic data.
- The dissemination of the results of the project, under the direction of the Factum Foundation and May Miles Thomas with further assistance from media partners Craig Brown, columnist at the Scotsman.

At all stages of the organisational process Mrs Marks, proprietor of Silver Firs House, on whose property half of the Cochno Stone lies, will be consulted with for her approval.

Pending on Historic Scotland's approval and the aforementioned site visit a more detailed budget would be calculated by the Factum Foundation.

Following this the Factum Foundation would co-ordinate an application with Dr Kenneth Brophy and May Miles Thomas for an 'Open Project Funding' grant for the required sum from Creative Scotland to undertake the work. This sum of money will cover the organisation, recording costs and the production of digitally routed samples from the recorded 3D data with a view to establishing the aesthetic standard achievable in making a facsimile using digital technologies. Pending on confirmation of the involvement of either Oxford Film and Television or Young Films and the broadcast involvement of BBC Scotland, May Miles Thomas will submit a parallel submission for funding from Creative Scotland's Screen Fund for Production to make a film about the Cochno Stone that will hopefully generate the kind of informed discussion that is vital to ensuring its safe future and its further investigation.

If the importance of making a facsimile is established by all parties involved further efforts to secure funding including another application to Creative Scotland will be made. At this point it will be crucial in establishing a Museum partner for the display of the facsimile. The Factum Foundation is currently in negotiation with the Bodleian Library, Oxford to develop an exhibition about their collection of maps. This is an example of an exhibition the Cochno Stone project could be connected to.

4.

The 'Druid' Stone.

Submission to Historic Scotland

In 2007 I won the SAC Creative Scotland Award for my project *The Devil's Plantation*, inspired by the late Harry Bell's *The Secret Geometry of Glasgow: The City's Oldest Mystery*. Through Bell's writings I became aware of the Cochno Stone and for the last seven years I've documented my project and the hundreds of field trips taken in the course of making an interactive website (winner of a BAFTA New Talent Award in 2010), an app (garnering a five star review from *The Guardian*) and a feature-length film (selected for GIFF 2013 and nominated for a BAFTA/Cineworld Audience Award).

In 2012, I was contacted by a Mr. David Marks who having read my blog, informed me that he owned one half of the Cochno (or Druid) Stone. The site of the Stone was claimed by Bell to be of significance in his theoretical Network of Aligned Sites – a series of alignments based on ancient tracks in the Clyde Valley area. Of all the locations I filmed from 2007-2009, the Stone proved the most elusive. Accepting Mr. Marks' invitation to visit the site, he offered me copies of documentation to prove his half-ownership of the Stone. Previously he had been approached by Ronald B. W. Harris, author of *The Prehistoric Rock Art of Southern Scotland* (B.A.R., 1981). Through this meeting, Mr. Marks expressed a keen interest in what lay buried on the periphery of his 3-acre garden and his interest in an excavation, subject to agreement with the relevant parties.

At Mr. Marks' request, I contacted Donald Petrie, Access Officer at West Dunbartonshire Council, whose land borders the Marks' property. In an email he stated he was unclear whether Historic Scotland had/has jurisdiction over the other half of the Stone so kindly offered me the relevant contacts at HS - Martin Brann and John Malcolm. In an exchange of emails, I suggested that all parties should conduct a site visit and discuss the viability of unearthing the Stone, even temporarily. At that time of writing – September 2012 - I spotted an opportunity – that 2014 marked the 50th anniversary of the Stone's burial, following a survey conducted by Glasgow University's Department of Archaeology. I also pointed out the opportunity to mark this occasion through the substantial cultural funding available through the Commonwealth Games Culture Fund.

A site visit arranged for early October 2012 had to be cancelled when Mr. Marks suddenly died. Out of respect to his family I felt that it would be inappropriate to pursue the matter further. It appeared that the Stone had eluded me once again, but I have since continued my contact with Mrs. Marks.

In July this year, I was approached by Craig Brown, a journalist at *The Scotsman*. Having seen the film version of *The Devil's Plantation*, he expressed his interest in the story of the Cochno Stone. The resulting article attracted almost 10,000 Facebook 'likes' and led to further media interest from *The Herald* and BBC Radio Scotland.

Clearly there is a high level of public interest in the Cochno Stone. I believe there is also an appetite for a greater understanding of its provenance and meaning. Cited in the (now defunct) website, *The Clydebank Story*, the Stone is described thus:

Evidence of man's prehistoric settlement in the area was found at Auchnacraig in 1887 when the Reverend James Harvey discovered the Druid (or Cochno) Stone. This sandstone rock, some 60 feet in diameter has, possibly, the finest "cup and ring" carvings in existence.

As a filmmaker, my interest in the Stone continues. I believe the Stone is as historically and culturally significant, if not greater, than other celebrated cup-and-ring marked stone sites in the UK and internationally. That it is based in a remote corner north-east of Glasgow and was buried in 1964 to deter vandalism has only contributed to its obscurity.

Recently I was contacted by Factum-Arte with an immensely exciting proposal: a temporary excavation, replication and exhibition of the Stone. This approach I believe offers the best possible outcome for the Stone, by offering the parties involved to:

- a) ensure that the Stone has not been adversely affected by root damage in the past 50 years.
- b) offer a new generation of academics and archaeologists the opportunity to conduct field work, using new methods.
- c) satisfy the extant public interest in the Stone and to engage with the local community, particularly those who recall the Stone prior to its burial.
- d) raise greater awareness among the wider public for this unique artefact.

In conclusion, I would be pleased to work with Factum-Arte and all other partners in this exciting endeavour. I also welcome the opportunity to document the entire process by producing a film, suitable for both broadcast and theatrical exhibition, that celebrates and promotes the Cochno Stone for the benefit of all.

May Miles Thomas, Elemental Films Limited

5.

Prehistoric Cup and Ring Markings.

One of the great enigmas of British prehistory is rock-art. Abstract shapes and forms known as cup-and-rings marks, and rarer variations, have for centuries captured the imagination (and puzzled) archaeologists and the wider public. We know surprisingly little about abstract rock-art, and in particular the type of symbols that appear on the Cochno Stone.

Cup-and-rings marks can be found in various stony places, from outcrops and boulders, to standing stones and cists (stone coffins). Geographically they occur most commonly in northern Britain, although variations have been identified across Europe. Motifs tend to be dominated by simple rounded hollows (known as cups) sometimes with concentric rings around them. In some cases linear 'gutters' run from cups to beyond the exterior ring. A series of other equally abstract forms have been found in conjunction with cup-and-rings marks, mostly geometric and abstract in nature, although these are much rarer than the standard motifs: the weird 'footprints' on the Cochno Stone are a notable example of such markings. The chronology of rock-art is little understood, but they are believed to belong to the Neolithic period (and perhaps the early Bronze Age), in other words the period 4000-2000 calBC. The tools used for carving are rarely discovered, but it seems likely stone (and perhaps later metal) objects were used to painstakingly peck or pound patterns into the rock.

Until recently, approaches to these ancient symbols have been dominated by attempts to carefully record and translate them, as if they encoded some message that we could read, rather like Egyptian hieroglyphics. This work was largely undertaken by enthusiastic amateurs in the absence of serious consideration by professional archaeologists. In Scotland, much of the legwork of documenting and trying to make sense of rock-art was carried out by Ronald Morris (a retired solicitor) and in a series of books published between 1965 and 1989 he documented hundreds of rock-art sites in Scotland. He also offered possible explanations and 'collected' interpretations for these mysterious symbols, famously publishing a list of over 100 theories in his 1979 book *The prehistoric rock art of Galloway and the Isle of Man*. It could be argued, however, that such theories were almost all unprovable, often fanciful and ultimately did little to forward our understanding of the people who made the carvings.

However, in the last two decades, professional archaeologists have begun to make take rock-art seriously. This has included survey and excavation, and an increased focus on the *context* of rock-art rather than the symbols themselves. Research has focused on the rocks and stones chosen for carvings, as well as looking at where rock-art is located within the landscape, and what activity went on around rock-art panels. This change in emphasis has allowed us to have a better sense of the chronology and role of rock-art in Neolithic and Bronze Age societies. Notable excavations in Scotland include work by teams led by Andy Jones at Torbhlaren, Argyll and Richard Bradley at Ben Lawers, Perth and Kinross. In both cases, excavations revealed deposits within cracks on rock-art panels, and evidence for activities going on beside the panels, such as deposition, fire-setting and even the construction of light timber structures. Secondary dating and environmental evidence has also been gathered. At other excavations near rock-art panels, such as at Hunterheugh in Northumberland, worked stone tools, cup-marked pebbles and red ochre (dye) have been found.

6.

Proposed Archaeological Work.

The context within which we view rock-art today is very different from when the Cochno Stone last saw the light of day in 1964. New methodological approaches to recording the stones themselves, and investigating the surrounds of the rock-art, coupled with a stronger chronological framework and less emphasis on 'translating' the symbols, mean that we are now in a better position than ever to make sense of the remarkable Cochno Stone in ways that Harvey, Bruce, Mann and Morris would not have considered possible.

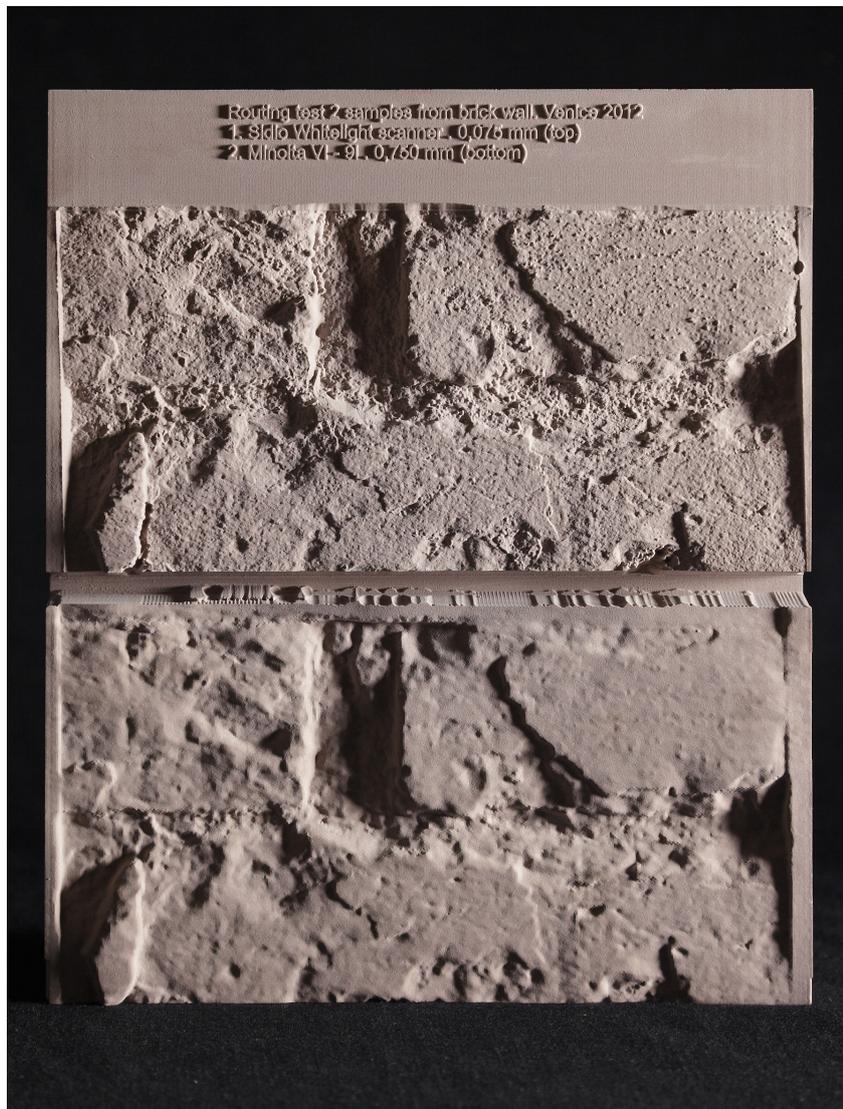
A modest series of archaeological interventions are proposed as part of this wider project outlined in this document. Most of this work is non-invasive, but reflects the fact that the exposure of all or part of the Cochno Stone represents a remarkable opportunity to record and explore one of the most dramatic and extensive panel of cup-and-ring marks discovered in Britain. This work will fall into two phases, one related to the trial exposure, the other if the project then develops more fully.

The trial exposure of a proportion of the surface of the Cochno Stone will be accompanied by a series of monitoring and recording activities, akin to those one would expect on an archaeological 'watching brief'. This would include monitoring topsoil stripping from over the Stone and any detailed recording activity that takes place. As well as observing the uncovered stone, this process will also allow the nature of the topsoil covering to be analysed and recorded, and any impact this has had on the Cochno Stone e.g. leaching or staining. Archaeological observations at this stage will feed into future management strategy for the Stone but also allow recommendations and planning for the next stage of the project.

If the project then develops more fully, a more extensive range of archaeological activities is envisaged. This would include again the monitoring of all topsoil stripping (now informed by what we know of the topsoil) and any laser-scanning activities that follow. The complete topsoil strip would allow the first ever comprehensive record of this Stone to be made: photographic and drawing records would be made of the entire stone, including natural cracks, veins and inclusions, and the extent of the stone assessed (recorded by Morris in 1981 as 13m x 8m). In turn this will allow an assessment to be made of the accuracy of earlier sketches. A clear overview of the whole rock-art panel will allow us to look for evidence of phasing in the carvings (for instance, overlapping motifs or differential levels of weathering). Other aspects of the stone will also be recorded, including the modern (evidence of previous archaeological investigation / vandalism / deposition before burying) and the ancient (notably a non-invasive investigation of cracks, fissures and hollows). If time, conditions and finance allows, a small-scale excavation consisting of in several small slot trenches running from the edge of the outcrop will be undertaken to look for evidence for activity contemporary with the rock carving and dating. Any lithics discovered during this work will be examined by Dr Dene Wright of the University of Glasgow. Finally, a comprehensive review will be taken of all rock-art panels across the locality will be undertaken, including a few panels found subsequent to the publication of Morris's review of the area in 1981.

7.

Recording Plan.



3D scanning comparison, routed output.

Data Comparison:

For exact technical specifications please see attached data sheets.

The above image was a test made by the Factum Foundation comparing the Sidio White Light Scanner with the Minolta VI-9i. Although the Minolta was faster, the results pictured speak for themselves with regards the quality of the output. The output used the same router bit and therefore the image shows only the difference in data gathered from each scanning system. The point to be stressed is that whereas the Minolta records shape, the Sidio records surface detail. However, the Sidio is not a scanner that is practical to use in the field. The systems Factum would use are the Lucida Laser Scanner and the Breuckmann SmartsScan HE, the former of which has a higher resolution output than pictured and the latter of which, with the correct calibration plate, records the quality of resolution as pictured.

Lucida Laser Scanner:



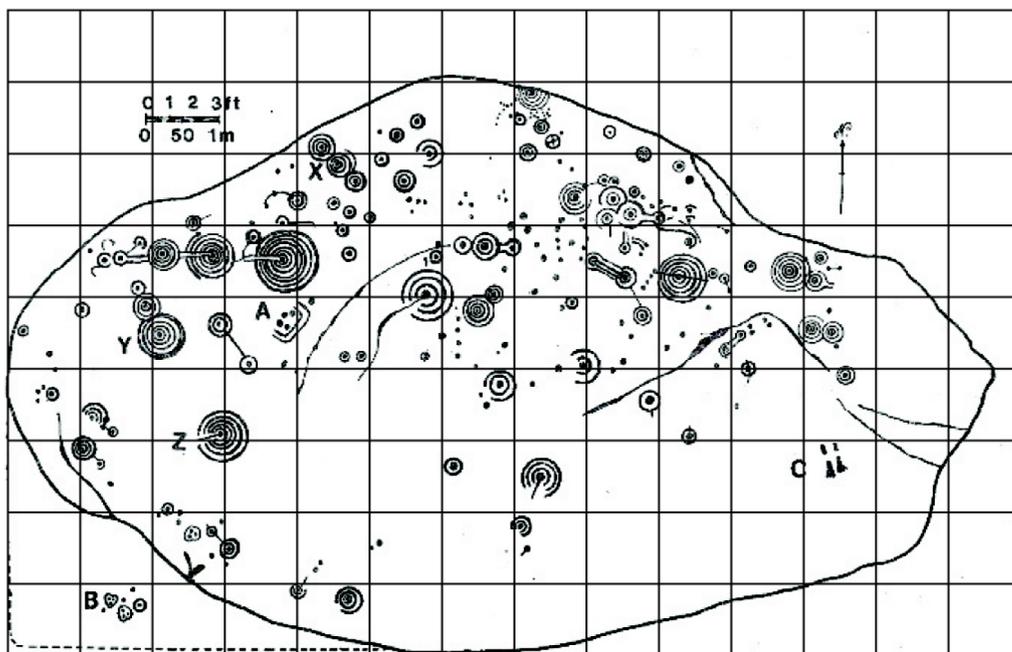
The Hereford 'Mappa Mundi'.



Lucida Laser Scanner, routed output of the Hereford 'Mappa Mundi'.

Technology:

- Custom designed support system. The particulars of this system will need to be established following a site visit. The system will allow for both 2D and 3D recording system mounts. The main requirements will be adjustable and foam protected feet so that the structure may adapt to the surface of the stone and also distribute the weight it will be carrying evenly.
- Marquee/Tent. This will block natural light and allow for a higher quality of data to be gathered and also prevent the necessary cessation of work due to rain or other adverse weather conditions.
- Faro Laser Scanner.
- Breuckmann Smartsan 3D - HE, structured light scanner. M-200-850 calibration plates.
- Lucida Laser Scanner.
- Canon 5D Mk III DSLR.



Process:

The following is a general outline of work methods with an approximation of time scales that would be refined after the site visit.

1. Faro Laser Scan. This will give a broad survey of the site and establish a template onto which higher resolution data can be mapped

Time Needed: 1 day.

2. 3D: Scan all areas of the Cochno Stone either not possible or not worthwhile recording with the Lucida Laser Scanner (i.e sections with a large difference in depth of field and sections without markings) using the Breuckmann Smartsan. The selection of the calibration plate of the Breuckmann will be chosen on site to meet the specific demands of the area to be scanned (i.e finer

detail will require a higher resolution and therefore smaller calibration plate). Using a tent or marquee to block out natural light is the option for optimum results that allows for working in the day. Alternatively, the work may be undertaken at night.

Time Needed: 5 days (or nights).

3. Lucida Laser Scanning of the recordable/marked areas of the Cochno Stone with a view to digitally routing samples.

Time Needed: Variable as to the extent of the markings on the Cochno Stone to be recorded. From the existing drawing an estimate of their coverage is roughly 30 meter squared. 1 meter squared takes roughly one day with the Lucida Laser Scanner.

4. 2D: Parallel photography using a Canon 5D Mk III mounted onto the support system.

Time Needed: 2 days.

5. Post processing of the 2 & 3D data. The photographic images will be processed and stitched by the Factum Foundation. The 3D data will be processed in individual tiles because the information generated is far too large to contain in a single file.

Time Needed: Variable with regards to the type of data recorded in points 2 & 3.

To Note:

1. Our knowledge of the exact nature of the surface of the Cochno Stone has come down to us only in a handful of photographs. In the majority of these photographs the surface looks to be relatively flat and will therefore allow for the extensive use of the Lucida Laser Scanner. There is however an area in one photograph, corroborated by a shaded area in the drawn plan, which indicates a section with significant variation in depth of field. This is the reason why the Lucida Laser Scanner will be complemented by the use of the Breuckmann Smartscan.
2. In designing the support system it will need to be established with the University of Glasgow whether resting on the surface of the stone with rubber tipped feet poses a significant threat to the integrity of the surface. Likewise whether it will be possible to walk over the stone with protective sheets of foam laid down to prevent any actual contact.
3. The time needed may be overlapped since different areas of the Cochno Stone may be recorded with different methods simultaneously.

8.

Facsimile Plan.



Completed panel from Factum Arte's project to recreate the Eastern End of the throne room of Arshunasipal II. 3D scanned, routed and cast with scagliola.

- Having processed the 3D data for each of the individual tiles of the Cochno Stone, the sections would be digitally routed (creating a positive).
- The positive would then be assembled and bolted to check the continuity of the surface.
- The positive would then be divided up into 12 sections (with an area of approximately 5.5 meters by 2.14 meters to allow a section to fit into a shipping container) and cast creating a set of moulds (creating a negative).
- One of Factum Arte's particular areas of expertise is with scagliola (a sculptural material made from selenite, glue and natural pigments). A scagliola casting medium would be researched and developed to match the surface of the Cochno Stone. This would be the material in which the final positive would be cast.
- The facsimile would be fully dis and re-assemblable to allow for a wide range of options for its exhibition.

9.

Dissemination Plan.

A crucial aspect of the success of the entire project is to communicate to a wide audience - local, national and international - of the importance of the work being undertaken and also of the Cochno Stone itself.

Open Day (Local)

When the work has been successfully undertaken and, especially if it is eventually decided that the best decision for the future of the Cochno Stone is its reburial, then an event should be organised which allows people in the local area to visit. This would represent an opportunity to explain the work that has been undertaken and generate an informed and democratic discussion about its safe future.

Education (Local)

Working with local schools to get children and young adults interested in Rock Art by running a workshop that gets them to question what the symbols might mean and to experiment with designing their own versions in an art class. The best of these designs could be used creatively in park and urban context in the neighbourhood.

Rock Art Trail (Local)

This would link the Cochno Stone with other Rock Art sites in the near vicinity.

Documentary (National/International)

The Factum Foundation is currently in negotiation with BBC Scotland, National Geographic, Oxford Film and Television, Young Films with regards to producing a documentary about the history, excavation and recording of the Cochno Stone (to be directed by May Miles Thomas).

Website (National/International)

This will provide both a source of information for the general public and more in-depth information for academic use.

Data viewer: This will allow the surface of the stone to be inspected in 2 & 3 dimensions in different levels of detail within a browser.

Archaeological Context: The website can be used as a platform for future investigations into the surrounding area of the Cochno Stone. The next phase of the project that would lead to an even greater understanding would be to organise a thorough archaeological dig in the immediate surrounding area, hopefully leading to discoveries that may shed new light upon the meaning of the markings.

Education

The Cochno Stone project encompasses connections with two prestigious educational establishments: the University of Glasgow Archaeology Department and the Digital Department of the Glasgow School of Fine Art. The opportunity should be taken to forge a relationship with both that looks towards educating and inspiring students about how new technologies affect issues surrounding our cultural heritage.

This could be achieved by:

- Lecture Series.
- Internship Opportunity offered by the Factum Foundation for particularly promising students.

10.

Contact Details.

Ferdinand Saumarez Smith – Ferdinand@factumfoundation.org

May Miles Thomas – may@elementalfilms.co.uk

Dr Kenneth Brophy – Kenny.brophy@glasgow.ac.uk

Appendix 1.

Related previous projects: The Factum Foundation for Digital Technology in Conservation.

2014: Installation in a specially prepared series of underground chambers of the exact facsimile of the Tomb of Tutankhamun and sarcophagus together with exhibition centre.

2014: Delivery to Iraq's new Ashurbanirpal Library facsimiles of the known fragments of the throne room of Ashurnasirpal II.

2013: High-resolution 3D scanning of the façade of the Basilica di San Petronio.

2013: High-resolution scanning and production of a facsimile of the surface of the Hereford Mappa Mundi.

2012/3: Scanning, analysis and condition report on the Romanesque cloisters of the Cathedral of San Tudela.

2012/3: Digital re-unification and restoration of the wall paintings in the cloisters of San Baudelio.

2011: Recording of the frescoes in the Sala Bologna in the Vatican Apostolic Palace and production of a facsimile of the 16th painted map for the Museo della Città, Bologna.

2011: Production of a facsimile of the only existing Merz building by the Dada Artist Kurt Schwitters for the permanent display 'Schwitters in Norway' at the Henie Onstad Museum, Oslo.

2011: High-resolution 3D and colour scanning of paintings by Peter Paul Rubens and Tiziano Vecellio (Titian) for the Museo del Prado, Madrid.

2010 to 2014: The Piranesi Collection – Eight objects produced from Piranesi's designs, produced in conjunction with the Fondazione Giorgio Cini.

2011: 3D Scanning of Jacopo della Quercia's figure of San Petronio on the façade of the church of San Petronio, Bologna.

2011: Recording of George Henslow's teaching charts for the Whipple Museum of the History of Science, Cambridge University.

2009 – 2011: Complete high resolution colour and 3D scanning of the burial chamber and Sarcophagus from the Tomb of Tutankhamun and the realization of a facsimile of the burial chamber and sarcophagus.

2009- 2011: Design and production of a 3D concrete printer for the artist Anish Kapoor, the results of which were exhibited at Anish Kapoor's exhibition at the Royal Academy of Arts, London.

2011: 3D scanning and production of a facsimile of a set of Califal weighing scales for the Conjunto Arqueologico Madinat al-Zahara.

2010: 3D scanning and production of a facsimile of Princess Walada's carved ivory box (made in 966 AD) for the Conjunto Arqueologico Madinat al-Zahara.

2010: High-resolution recording of 3 paintings by Michelangelo Merisi (Caravaggio) in the church of San Luigi de Francesi, Rome.

2006: The production of a facsimile of Veronese's Wedding at Cana, installed in its original location in Palladio's refectory in Venice, produced in conjunction with the Musée du Louvre, Paris and the Fondazione Giorgio Cini, Venice.

2005 – 2006: Recording the known fragments from the throne room of Ashurnasirpal II in Nimrud and the production of a facsimile. The recording took place in The British Museum, The Pergamon Museum, Princeton Art Museum, Harvard Sackler Art Museum and the Dresden Museum.

2005: Production of a mercury gilded bronze facsimile of the missing lion made by Matteo Bonarelli. The lion was one of eight forming 2 tables that were commissioned by Velazquez for Charles II. The missing lion was destroyed in a fire. The facsimile was made for the Museo del Prado during the restoration of the tables.

Appendix 2.

Please see attached Technical Data Sheets.