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GEOLOGICAL CURATORS' GROUP

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The Group is affiliated to the Geological Society of London. It was founded in 1974 to improve the status of geology in museums and similar institutions, and to improve the standard of geological curation in general by:

- holding meetings to promote the exchange of information
- providing information and advice on all matters relating to geology in museums
- the surveillance of collections of geological specimens and information with a view to ensuring their wellbeing
- the maintenance of a code of practice for the curation and deployment of collections
- the advancement of the documentation and conservation of geological sites
- initiating and conducting surveys relating to the aims of the Group.

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Cover: Rescue collection of a crinoid bed. See paper by McDermott and Buttler inside.

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GEOLOGICAL CURATORS' GROUP - December 2016

GUEST EDITORIAL

This is the age of the big geological journal, published by leading houses, such as Elsevier, Springer, Wiley-Blackwell, the Geological Society and others, and with subscriptions to hundreds of libraries worldwide. These are the journals that your boss wants you to publish in. These are the journals that are considered to make an impact, recorded to three decimal places in any and many citation indices. Thirty years ago I would write a paper and decide where to submit it for publication. Now, I fancy that at least some researchers decide where they want to publish and then find a project to lead to the necessary publication. All the while, the smaller geological journals persist, with a smaller circulation, not appearing on any or all citation indices and not listed for an impact factor. Some may go to the wall, for whatever reasons. *Fossil Forum, Mesozoic Research* and *Scripta Geologica* are three that come to mind immediately; I published in all of them and was editor of *Scripta Geologica*. But even quite high profile journals can disappear - remember *Modern Geology*?

The Geological Curator (= *Curator*) fits the small geological journal profile - peer reviewed, but not the property of a big publishing house and not on the Science Citation Index. Twice per year, the *Curator* is published for the elucidation and entertainment of the Geological Curators' Group. In the current climate of academic publishing, maintaining adequate numbers and quality of papers for *GC* is tough and can only get tougher. It is only by publishing in high profile journals that our careers will progress in 2017 and after. Publishing in the *Curator*, while always creditable, may not be a high priority for many potential contributors. My simple question is how can we ensure the future good health of the *Geological Curator*?

Maintaining adequate copy for a small journal can be problematic. When I edited *Journal of the Geological Society of Jamaica*, it was top-heavy with papers on palaeontology and ichnology with good reason. I am a palaeontologist/ichnologist, and much of the *Journal* was being written by me and by those colleagues/co-workers whose arms I could twist for copy, bless 'em. Matthew Parkes has not taken this route. *The Curator* has a wider potential constituency of readers and contributors than the Journal, so there is a potential of exploiting other routes to generate copy for the future.

A successful method of filling an issue for many journals is to have thematic sets of invited papers which are commonly compiled by a guest editor(s). That there are two thematic sets in the pipeline for the *Curator* is therefore no surprise. If the guest editor is sufficiently enterprising (that is, they are good at twisting arms), the thematic set will fill a complete issue. But with only two issues of the *Curator* per year, it would be best if only one thematic issue, at most, was published annually. Otherwise, contributors of regular articles could be discouraged while waiting an inordinately long time before publication. This happened to me recently; two papers submitted to a journal in 2015 will not be published in hard copy until 2017 due to a glut of thematic/memorial issues. Although both papers are available on the said journal's web page, I am still impatient to see them in print.

What else? Well, encouragement. I encourage you to write for the *Curator* and, in turn, hope you will encourage your colleagues to contribute. What is needed is a regular flow of papers. No editor can publish what ain't submitted. When a journal is accused on not publishing enough (however defined) on a given subject X, then I ask the accuser how this might be changed. The options are limited. Probably the most effective solution is to invite an expert on X to write a review paper. This and variations on the theme of leaning on and enticing experts to write are all time consuming, of course, and the solid work of editing *sensu stricto* must take priority. The way around this might be, again, to encourage a guest editor to take the lead with a thematic issue.

Then there is the short stuff. All of us have odd, unpublished bits and pieces - techniques, historical facts, odd specimens in strange situations - that would make the subject of an interesting short communication. Have you just attended a relevant meeting? Write a report. Did you just read a pertinent book? Then write a book review. The limits of the short communication format are only defined by our imagination or lack of it. One last thought. Our Editor is about to become our Chairman. Two responsible jobs, twice as much work (at least). Now would be the perfect time to finish your next paper for the *Curator*. The Editor/Chairman will have enough on his plate without needing to drum up copy. Don't wait for that knock on the door - write now!

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CONSERVING AND MOUNTING A LARGE 300 MILLION-YEAR OLD FOSSILISED GIANT CLUBMOSS PLANT FROM NORTH WALES FOR DISPLAY

by Nigel R. Larkin and Caroline J. Buttler

Larkin, N.R. and Buttler, C.J. 2016. Conserving and mounting a large 300 million-year old fossilised giant clubmoss plant from north Wales for display. *The Geological Curator* 10 (6): 243 - 252.

In 2004 a large and exceptionally well preserved 300 million year old fossilised giant clubmoss plant was discovered in a newly exposed fossil forest site near Wrexham, north Wales. The location, a former steelworks that had operated for over 100 years, was being redeveloped as a heritage site and was subsequently designated as a SSSI so there was a desire to put the specimen on display locally. Cleaning, conserving and mounting the fossil for exhibition required specific bespoke solutions as the specimen was in 90 pieces, weighed almost a ton and stood 2.25 m tall with a root span of 3.5 m. Also, as the specimen was to be displayed in various locations and would have to be dismantled and transported, a modular mount able to be easily assembled and dissembled was required. This was made in sections from welded steel with lockable heavy duty wheels.

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Introduction

Brymbo Fossil Forest near Wrexham, North Wales, was discovered in 2004 during the restoration of the site of the former Brymbo Steelworks. Large 'tree' stumps and numerous *Calamites* (horsetail) stems were found, most still in their growth position. Other beautifully preserved plant fossils included fern-like foliage, stems, cones, seeds and megaspores. They were all preserved during the Late Carboniferous period about 300 million years ago (Appleton *et al.* 2011). The scientific importance of the site was realised very early on and Brymbo fossil forest was designated as a Site of Special Scientific Interest (SSSI).

During the restoration work on the steelworks the fossils were collected by the local Brymbo Heritage Group. The smaller specimens with display or research potential were temporarily stored in domestic premises but appropriate permanent storage had to be found for the rare and fragile specimens, including potential new species, in addition to a representative selection of fossils. Ideally this would have been located in north-east Wales but no organisation there had the space or experience to deal with such a task. Amgueddfa Cymru - National Museum Wales (AC-NMW) had the facilities and expertise and after careful discussions a memorandum of understanding was drawn up between Amgueddfa Cymru, Brymbo Heritage Group and Brymbo Developments Limited, the latter being the site owners and hence the owners of the fossils. The result was a framework for co-operation between the three groups, enabling them to work in partnership to preserve specimens for future enjoyment, research and general educational purposes. In 2013 the transfer of title to the selected fossils was signed and ownership passed to Amgueddfa Cymru.

More than 20 large lycophyte (giant clubmoss) stumps were found at Brymbo preserved as casts in the Carboniferous sandstone and these included one exceptionally well preserved and rare example (Thomas and Seyfullah 2015; Roberts *et al.* 2016) of a *Stigmaria* root system with a large portion of the trunk (Figure 1). This was carefully excavated and stored in the former machine shop at the former steelworks site, although the cold and damp conditions there were not ideal.

In 2015 an exhibition about the fossil forest was planned for Wrexham Museum, jointly curated by staff from Amgueddfa Cymru and Wrexham. It was hoped that the impressive *Stigmaria* fossil could be the 'star' object but extensive conservation and a mounting system were required. Finance for this was

Figure 1. Trunk and* Stigmaria *(root system) of the giant clubmoss in situ, as revealed during excavations at the former Brymbo Steelworks in 2004, showing its three-dimensional nature and giving an indication of its size (courtesy of Peter Appleton).

raised by Amgueddfa Cymru with assistance from Natural Resources Wales and Wrexham County Borough Council, and Brymbo Developments Limited donated the specimen to Amgueddfa Cymru. The cleaning, conservation and mounting of the specimen was subsequently undertaken by the senior author.

Condition of the specimen

During the excavation of the large *Stigmaria* root system and trunk in 2004, detailed notes and photographs had been taken that proved invaluable in reconstructing the fossil. The huge specimen was laid out in a former machine shop of the steelworks amongst hundreds of other plant fossils found on the site and lay there for many years until the summer of 2015. The wide root base (approx. 3.5 m across) and the large, heavy trunk (approx. 2.25 m high, 0.55 cm diameter and 0.8 tonnes in weight) of the specimen presented very specific conservation, logistic and health and safety issues if it was to be mounted for display.

The specimen was in about 90 pieces including three heavy sections of trunk weighing around a quarter of a tonne each and sections of root each weighing up to about 20 kg. The pieces were dusty and dirty with bird and rodent droppings over their surfaces along with cobwebs and other detritus from a decade of storage in the old steelworks building (Figure 2). Carboniferous rock still adhered to the roots in places. Some of the surfaces of the fossil were flaky and friable and a number of pieces had fallen off or broken apart whilst the specimen was stored. Some repairs had been undertaken at the time of the excavation and excess adhesive had flowed out of some repaired cracks. To remove the animal faeces

Figure 2. The specimen was collected in pieces but had suffered further deterioration since excavation.

Figure 3. The proximal portion of the rear root (showing bird droppings etc) before cleaning and consolidation (left) and after cleaning and consolidation (right).

that represented biohazards and to have clear surfaces for gluing sections together all the surfaces had to be thoroughly cleaned with an adequate method to remove all the dirt and any unwanted matrix without causing any damage to the sometimes friable and flaky surfaces of the specimen.

Before any work could start the weight of the larger pieces had to be determined so that safe working could be planned. Smaller fossils from the site were weighed and then submerged in water to accurately quantify their volume. Their average density was determined to be 2.65 g/cm^3 and this figure was used to determine the weight of the largest pieces of the *Stigmaria* fossil. The combined weight of the main sections of the trunk (i.e. not including the roots) was found to be around 0.81 tonnes, with each of the three sections weighing in the region of a quarter of a tonne. Therefore the central piece of metalwork that the trunk was to be mounted on was designed to safely accommodate at least one tonne.

Cleaning and conservation of the specimen

All cleaning and conservation work undertaken on this specimen was as gentle, non-invasive and reversible as possible. The ethyl-methacrylate copolymer Paraloid B72 was used as an adhesive and as a consolidant (in acetone) as required when undertaking repairs due to its reliability, strength, stability and reversibility and also its long-established suitability for use with fossil material (Koob 1986; Shelton and Johnson 1995; Down *et al.* 1996). Initially, to remove the dirt, dust and detritus from the surfaces of the specimen a soft wide artist's brush was used alongside a vacuum cleaner with gauze taped over the end (to prevent the loss of small pieces). Stubborn areas of dirt, dried bird excrement for instance, required stiffer brushes and occasionally were cleaned with an air abrasive unit utilising compressed air (max 60 psi) which when necessary was lightly laced with sodium bicarbonate powder. In turn, this powder was removed with compressed air, vacuum cleaner and soft brushes. Some excess matrix was removed with scalpels.

Once all the pieces of the specimen were clean the surfaces of each segment were consolidated with a couple of applications of Paraloid B72 at 5% in acetone (weight:volume) to strengthen the friable surfaces, give them long-term protection and to bring back the natural colour of the fossil which had become quite grey (Figure 3). The smaller segments of *Stigmaria* root could then be glued back together where appropriate to form sections that were not so big and heavy that they would break under their own weight nor were too difficult to lift. Such repairs were undertaken with Paraloid B72 adhesive. Small gaps where there were breaks and parts of the fossil were missing were filled with plaster of paris after further consolidation of the edges of the break. The plaster was then painted with artists' acrylic paints to almost match the surrounding fossil.

The middle section of the trunk, that had been stored since the excavation wrapped in a thick rubber mat secured with metal bands (Figure 1) because it was

Figure 4. Middle section of the trunk before cleaning (left) and after cleaning and consolidation, stored on the sturdy permanent bespoke pallet (right).

badly shattered in the ground, required a lot of consolidation and gluing (Figure 4). This was not easy as the specimen could not be manoeuvred into different positions without risking further breaks or at least falling apart along old breaks, so the effect of gravity on the consolidant and adhesive was therefore constantly being fought rather than being advantageous for infiltration.

For the heavy middle and upper trunk sections that each weighed about a quarter of a tonne, bespoke permanent wooden pallets were made that would be suitable for transport, display and storage (Figure 4). Wooden beams (standard 4" x 2", approximately 10 cm by 5 cm in cross-section) were cut to length and put on their side, had 10 mm thick plywood screwed to them, then a series of batons running width-wise were screwed to the plywood, then another sheet of plywood screwed in place on top. These sturdy rigid pallets were then painted black. The specimens were manoeuvred carefully on to their pallets, with Plastazote® foam (see below) between the fossil and the wood.

Manufacturing the bespoke permanent metal mount

The metal mountwork required to support the roots and the trunk for display had to be modular so that the specimen could be dismantled and re-assembled in sections for transport, display or storage. The design had to ensure that no single section was too heavy to move but also that there would be a choice of which roots could go on display, depending on the space available at any future location i.e. the rear root could be left in storage and the specimen positioned close to a wall behind it. Appropriately enough, considering that the fossil was found at Brymbo steelworks during a project to preserve and celebrate the heritage of the manufacturing site, steel was the most suitable material to use throughout the mounting process due to the weights involved. Where the specimen was supported by metalwork it would have to be lined with a suitable protective foam, to prevent damage to the fossil. Plastazote® foam was used, specifically LD33 Black. This is a chemically inert, low density, closed cell, cross-linked polyethylene foam of archival quality.

Although it weighed over a quarter of a tonne the lowermost section of the trunk to which the roots attached had to be easily manoeuvrable so that it could be positioned exactly where required on display or in storage. It therefore had to be on wheels, but the wheels also had to be lockable, to keep it securely in place. To start the mounting process, a piece of 30 mm thick medium-density fibreboard (MDF) was cut to the shape of the underside of the base of trunk, making sure that it would not interfere with the adjoining sections of root. MDF is not normally recommended for the permanent storage or display of specimens as it emits volatile organic compounds (VOCs). However, this specimen was not going to be enclosed within a

Figure 5. The roots assembled into position against the base of the trunk. All the white pieces in the specimen are where large gaps were filled with plaster of paris to complete the root.

display case so there was no risk of a build-up of VOCs. However, as a precaution, all MDF wood used was treated with two applications of Dacrylate clear acrylic emulsion varnish, a standard preventive conservation technique. The specimen sitting on the MDF base board was winched up to what seemed to be about the right height off the floor, judging by the photographs of the excavation. This was executed with a 'Tralift' manual chain hoist capable of safely lifting one tonne, with suitable straps slung underneath the MDF and padding placed between the straps and the fossil. A series of pallets and sturdy temporary wooden 'tables' were placed beneath and the specimen rested on these, still held securely in place by the straps connected to the hoist. All the pieces of the roots were then assembled together as tightly as possible against the base of the trunk in their correct positions, resting them on temporary wooden 'tables' and piles of wooden offcuts and card to get each piece to the right height and wedging them in place so they did not roll (Figure 5). This had to be done to see where the tips of the roots ended, as the very lowest root tips needed to be just above the floor. The whole specimen had to be raised higher a few times before the base of the trunk was at exactly the right height. Detailed photographs and measurements were taken of the layout and in particular of the exact height of the underside of the MDF and its shape so that a suitable wheeled mount could be designed. Whilst all the pieces of the roots were sitting in as tight a fit as possible to one another and to the base of the trunk, major gaps where pieces of the fossil were missing were filled with plaster of paris (Figure 5) (edges of breaks had already been consolidated) and the plaster was shaped with knives, scalpels, files and sandpaper.

To make suitable mounts for the root sections, metal 'cradles' had to be made for the underside of each portion. However, this was impossible to achieve whilst the roots were in their correct orientation. The pieces had to be turned upside-down whilst maintaining their exact three-dimensional relationships with one another. Therefore temporary bespoke resin cradles had to be made for each root that could correctly maintain their exact three-dimensional shape when turned upside-down. Sections of plastic sheet were draped over the top sides of every root, then Jesmonite acrylic resin (AC100) and glass fibre were applied in layers to build up a thick sturdy jacket (Figure 6). Multiple splints were added to each jacket as required, screwing wooden batons to one another and securing them in place with more Jesmonite resin and glass fibre. As each jacket was completed it was carefully removed, turned upside-down and the pieces of the root laid within the jacket in their correct association and position (Figure 6).

Figure 6. Left: a temporary support jacket being made out of resin and glass fibre for the upper side of the right root. Right: the left root lying upside-down in its temporary support jacket ready for the metal brackets to be made.

The steel brackets could now be made for the underside of each section of root. Flat steel bar 20 mm wide and 6 mm thick was cut into sections that, when heated red hot and shaped into the right curve, would fit (when cool) width-wise across the root in the appropriate place, leaving enough space for a strip of 10 mm thick Plastazote® foam between the metal and the curve of the fossil. For each root section two or three C-shaped brackets were made this way and then one or two pieces, depending on the need, were shaped to lie lengthwise along the root section, so that they would support the brackets when the fossil was turned the right way up. Foil was placed between the metal brackets and the fossil to protect the specimen from the heat of welding. The pieces of the metal brackets were held in place with large magnets and were 'tacked' together with a MIG (Metal Inert Gas) welder. This was undertaken in short bursts so that the metal did not get too hot and damage the fossil and also to avoid the chances of the metal distorting due to overheating. The bracket was then removed from the fossil and welded more robustly. The welding was ground-down as smooth as possible with flap-disks on an angle grinder, and strips of 10 mm thick Plastazote® foam were glued with Paraloid B72 into place on the C-shaped sections that would hold the fossil.

Once the brackets were made the sections of root were taken out of their upside-down jackets and reassembled the right way up on the temporary wooden tables, piles of wood and wedges of cardboard around the base of the trunk, this time sitting within their new metal brackets. Once they were tightly positioned in place, the legs for the brackets could be made. Generally an inverted 'V' shape made two legs at the proximal end of the root section where the heaviest weight was to be taken and at the distal end a single rod was used for a leg, creating a 'tripod' effect so there should be no wobbling. In some cases, due to the shape of the root and the distribution of weight more legs were required, particularly where the heaviest sections of roots joined the trunk. For the 'inverted V' legs, sections of flat steel (20 mm x 6 mm) would be heated in the mid-point and bent into shape. For the 'single' legs, sections of steel rod (10 mm diameter) was simply cut to length. Each leg or pair of legs was trimmed, shaped and adjusted until they fitted snugly under the section of the bracket where the weight was to be taken, then were cleaned with an angle grinder before being attached. This welding was often unavoidably undertaken when lying on the floor, with all the wooden supports in the way, working upwards underneath the fossil which was not ideal. Therefore the legs were simply tacked into place with the MIG welder, then the wooden supports were carefully removed, the legs checked and then the mount could be removed from the fossil to enable further welding. The partially melted Plastazote® foam had to be removed first, the metal cleaned again and then welding would continue. After this the welding was smoothed with an angle grinder, more welding applied where required and ground down again and then the metalwork was cleaned again with an angle grinder and wire brushes.

Plastazote® foam strips were cut to size again for each bracket and then the roots were reassembled on the mounts to check that the brackets had not distorted when being heated by welding. Finally each root was disassembled again, the Plastazote® foam removed and the metalwork sprayed black. Then the

Figure 7. Left: the completed mount on wheels for the base of the trunk. Right: the mount in place under the base of the trunk with the unpainted casts in place on top.

final strips of Plastazote® foam were glued to the brackets, the brackets were labelled on their rear ends and all the root sections were reassembled to check that they still made a good fit.

Making the support on wheels for the trunk

The mount for the upright trunk of the specimen needed to permanently take the weight of the lowermost section which weighed about a quarter of a tonne and also either the cast of the rest of the trunk or possibly at some point in the future the rest of the actual fossil, a combined weight of about 0.81 tonnes. Therefore the wheels had to be able to take up to a tonne in weight, allowing for the weight of the mount itself and a margin of error. The structure could easily be made top heavy and unstable once the specimen was sitting on it, so the mount had to be kept as broad as possible without interfering with the mountwork for the roots or the roots themselves. To get the height exactly right and to take the weight and to spread it as broadly as possible, box section steel girders 50 mm by 50 mm were welded to one another in layers (Figure 7) at the angles dictated by the shape and height required of the stump which in turn was dictated by the depth of the deepest root tip.

The lockable 'extra heavy duty' 150 mm diameter polyurethane wheels (Figure 7) that were used can each take 800 kg. The swivel plates of these were bolted onto steel plates with pre-drilled holes that had been welded in place on the base of the mount. Three right-angled brackets with pre-drilled holes were welded into place on the side of the finished mountwork so that, when the mount was wheeled into place and the lowermost section of the trunk on its MDF base was lowered exactly into position with the hoist, the mount could be secured to the MDF base with screws running through the holes in the brackets. The lowermost section of the trunk had already been held in place on the MDF base with strategically shaped and placed wedges of MDF (treated with Dacrylate varnish) glued to the MDF base. All the MDF was painted black, to match the metal mounts that had been sprayed black.

Moulding sections of the trunk to make casts

The middle and upper sections of the trunk were so heavy (approximately 210 kg and 265 kg respectively) that they presented serious challenges in terms of health and safety if they were to be placed on top of one another and on top of the lowermost section of the fossil trunk, as well as posing a significant risk of damaging the lowermost section in the process. Therefore the decision was taken to make moulds of these two sections to produce painted casts to place on the lowermost section of the trunk. However, due to the size and weight of the fossils and the fragility of the middle section which had been extensively consolidated and repaired (Figure 4) even making the moulds presented a significant challenge.

The large specimens had already been cleaned, consolidated and placed on Plastazote® foam on

sturdy bespoke permanent pallets. To prepare both sections for the moulding process more consolidant was applied to ensure the surfaces were well protected. All the cracks and gaps in the specimens then had to be filled to prevent the moulding rubber from penetrating the fossil when it was applied. If this was not done and the rubber had penetrated the cracks, gaps and holes and then set, during the de-moulding process the mould would tear in some places, leaving rubber behind in the specimen and in other places it would break the specimen apart and the rubber would take pieces of the fossil with it. Most of the gaps were filled with reversible water soluble putty made from polyethylene glycol 4000, glycerol, water and precipitated chalk (Rixon 1976). However, the many large gaps in the middle section were carefully filled with low-oil Plasticine. This is quicker and less expensive to use than the water soluble putty but it would have been difficult to fully remove it from the smaller gaps and cracks that the water-soluble putty was used for. As two-part moulds were to be made, a Plasticine 'dam' was constructed along the midline of each specimen, ensuring the line of this followed the best route along the contour of the fossil so that the 'flashline' (where the two pieces of the cast would eventually join) would be the least visible possible and so that the two sections of the mould would come apart most easily. Mounds were made in this Plasticine dam to produce 'keys' so that the two halves of the mould would lock together securely when making the cast.

The silicone rubber used for moulds was Silastic 3481 base (about 40 kg was required) cured with 81F catalyst. Some thixotropic additive was used to thicken the rubber to the required consistency for each application. The first layer was quite fluid, to take up as much detail as possible, and the following layers were quite thick and viscous, as there was a lot of surface area that was nearly vertical. After many applications of rubber to build up a thick mould that would not distort and without undercuts so that the rigid portion of the mould could be removed during de-moulding, the rigid portion of the mould was made with several layers of Jesmonite acrylic resin (AC100) and woven glass fibre. Once this had set, the Plasticine dam and its wooden supports were removed before the task of turning over the heavy specimen without damaging or disturbing the mould could begin. A pallet truck was raised under the pallet to get the specimen to the right height and then it was very carefully and slowly rolled over (using wooden levers and Plastazote® foam protection) onto a foam-lined pallet positioned beside it at a slightly lower level, making sure that the edge of the mould did not take any weight. Once it was safely in position Vaseline® was applied to the edges of the rubber mould and the mould was made for the second side. After the moulds were removed the specimens were cleaned of all the Plasticine and water soluble putty.

The two casts were made from Jesmonite AC100 acrylic resin with woven glass fibre matting and were joined together using Jesmonite resin. The combined resin cast - approximately 150 cm tall by 50 cm diameter - was painted with artists' acrylic paints to match the original specimen.

The tall cast was potentially unstable on top of the base of the trunk so a method of securing the two was devised. A hole was drilled about 10 centimetres into the centre of the top of the base of the fossil trunk and a metal rod inserted, held in place with plaster. This rod projected out of the top of the trunk and inserted into a hole in the base of the cast so that the cast could not be dislodged. A thin sheet of Plastazote foam was placed between the base of the cast and the top of the base of the trunk, to protect the fossil from abrasion. Drilling the small hole into the top of the base of the trunk was less than ideal in terms of conservation ethics but it was a necessary measure to prevent an accident. The large cast is heavy enough to cause injury and certainly could severely damage the roots if it fell. The alternative would have been a significant amount of external metalwork to hold the cast in place.

Installation

The fossil and its mount were disassembled, carefully packed up and transported to Wrexham Museum. It was installed in January 2016 as the star specimen in a six-month exhibition entitled 'Swamp Land: Brymbo 300 Million Years Ago' telling the story of the Fossil Forest. The two heavy sections of trunk were displayed on their pallets behind the mounted root system and the cast of the trunk (Figure 8).

During installation, as the specimens were quite cool when brought into the warm museum environment from the van in which they were transported, condensation formed on the surfaces of the fossils when they were unpacked. This condensation was wiped away with lint-free tissue. Out of interest, sections of the specimen were photographed with an infrared thermal-imaging camera (Larkin 2013) and it was noted that although all the fossil material had been exposed to exactly the same environmental conditions, various sections were at quite different temperatures, varying by over 3°C (Figure 9).

Figure 8. The complete* Stigmaria *specimen installed at Wrexham Museum, January 2016.

Although there was some difference due to where gallery lights were shining, this did not account for most of the effect observed. It is possible that different sections of the fossil were replaced by slightly different minerals in the burial environment and that these have different emissivity values, suggesting that infrared thermal imaging photography may have more uses in a museum context than simply assessing storage environments.

The final destination of the specimen is intended to be a permanent display at the Brymbo Heritage site itself but in the interim the specimen is currently stored in Cardiff where it may also be put on display temporarily.

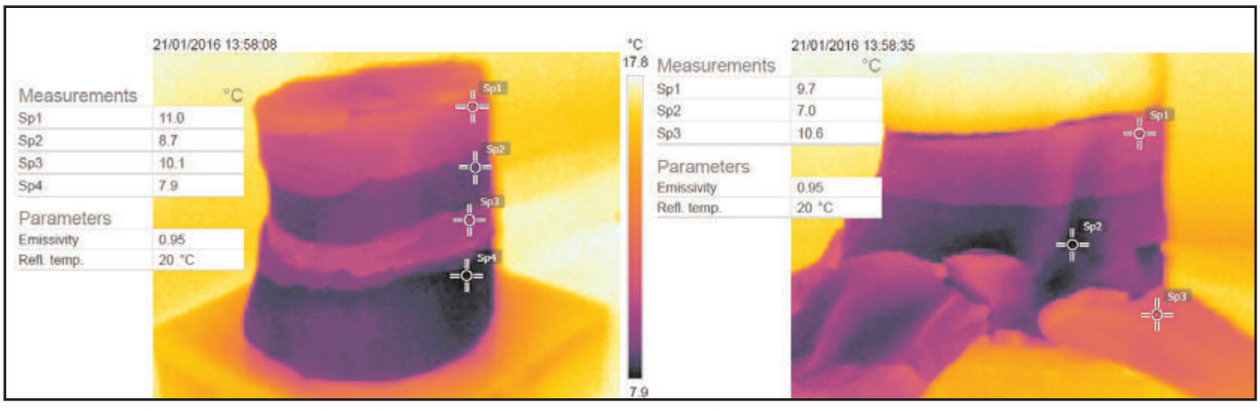

Figure 9. Left: mid-section of the fossil trunk photographed in infrared during installation. Right: lower section of the trunk and the proximal sections of the left and right roots photographed in infrared during installation.

Discussion

The total time spent on this project including transportation, cleaning, conservation, mounting and installation was 67 days. The total cost of all materials (including for conservation, moulding and casting, making the permanent pallets and transport crates plus the mounts and all transport costs) was £3,198. A wide range of health and safety issues had to be considered and processes put in place to minimise the risks from moving extremely heavy weights, working with hot metal, and creating fumes and dust when welding and grinding.

Large mounted Carboniferous *Stigmaria* fossils are very rare and this specimen has proved to be a popular exhibit in Wrexham with local people taking great pride in their heritage. The mounting system is strong but not too intrusive. The brackets supporting the roots have the appearance of rootlets that would have existed in life. It is also fitting that the structure is created from steel, the material made for over a century on the heritage site where it was discovered.

The project was only possible due to partnership working with Amgueddfa Cymru, Brymbo Heritage Group, Wrexham County Borough Council, Natural Resources Wales and Brymbo Developments Limited. This collaboration will continue as Brymbo Heritage Group hope to excavate the fossil area to expose more plants and *Calamites* standing where they grew, with a protected boardwalk system for visitor access, all enclosed within a single structure. A heritage officer, funded by Heritage Lottery, has been appointed to develop and secure funding opportunities for the group in conjunction with partner organisations and local communities. If this can be achieved it is hoped that this impressive *Stigmaria* fossil will form the centrepiece of a permanent exhibit of the Brymbo Fossil Forest.

Acknowledgements

This project was funded by: Amgueddfa Cymru - National Museum Wales , Natural Resources Wales (NRW) and Wrexham County Borough Council (WCBC). The specimen itself was kindly donated to Amgueddfa Cymru by Brymbo Developments Limited. Brymbo Heritage Group collected the specimen and Sheila Jarvis and Peter Appleton took photographs and made detailed notes during and after the excavation which were invaluable to the conservation project. Our thanks are also due to the referee Lu Allington Jones for helpful suggestions.

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UPPER ORDOVICIAN CRINOID PAVEMENT LAGERSTÄTTE FROM SOUTH WALES - THE DISCOVERY AND RESCUE

by Patrick D. McDermott and Caroline J. Buttler

McDermott, P.D. and Buttler, C.J. 2016. Upper Ordovician crinoid pavement lagerstätte from South Wales - the discovery and rescue. *The Geological Curator* 10 (6): 253 - 257.

In 2012 a new relief road was built in Carmarthenshire, South Wales cutting through fossiliferous rocks of Upper Ordovician age and revealing new geological sections. The engineering company undertaking the construction work developed a good working relationship with palaeontologists wanting to collect from new temporary exposures. This was extremely valuable when a bed revealing large accumulations of a single species of fossil crinoids was discovered. Due to engineering deadlines the specimens had to be excavated rapidly but cooperation with company allowed access to the site until all the material was removed.

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Introduction

Construction work on the A477 St Clears to Red Roses Road Improvement Project (Carmarthenshire, South Wales) was initiated by the SRB Civil Engineering Group in 2012. The new relief road, six miles in length extends westward of the village of Llanddowror and cuts through the Late Ordovician Mydrim Shale, Sholeshook Limestone and Slade and Redhill Mudstones formations, as well as the Old Red Sandstone. The Sholeshook Limestone Formation and Slade and Redhill Mudstones Formation are locally highly fossiliferous and extend for approximately three miles along the route. Approximately one mile of the route lies in an 18 metre deep cutting.

Despite the abundance and diversity of the Slade and Redhill Mudstones Formation assemblages, there has been relatively little descriptive work on these faunas, and even less on those of the Llanddowror area. (Salter 1849, 1853, 1864) provided early descriptions of the fauna from around the Haverfordwest area. (Strahan *et al.* 1909) and (Evans 1906) listed faunas from around Llanddowror. More recently, some of the trilobites were reviewed by Price (1977; 1980), while Donovan and Veltkamp (1993) described some of the crinoids. The most recent research is the consequence of 10 years of collecting by one of us (PMcD) and includes the large collection made at the Relief Road cutting. This collection has so far facilitated research on the brachiopod faunas (Cocks 2014) a cystoid (Lanc *et al.* 2015a) and a mitrate (McDermott and Paul 2015).

Discovery of crinoid bed

From the beginning of the road project SRB Civil Engineering Group were receptive to approaches made by palaeontologists who wanted to examine the sections as they were excavated. They also had a desire to engage with the local community and had appointed an environmental officer to liaise with them. Local palaeontologists kept the company updated on what was being collected and provided material and information for display in the site office. An open day at the site which included a safety induction course was organised, local amateurs and staff from Natural Resources Wales, Amgueddfa Cymru - National Museum Wales and British Geological Survey attended.

On the open day, the opportunity was provided for everyone to walk the cutting. At this time, the cutting had been excavated to a depth of one metre. One of the first fossils to be found was an external mould of an articulated echinoderm with seven pentameral plates almost perfectly in place. This was a rhombiferan cystoid. No articulated specimens have previously been found in the UK. This specimen is now known to belong to *Caryocrinites rugatus* (Forbes), and was redescribed by (Lanc *et al.* 2015b).

Figure 1. A block from the pavement showing crowds of large crinoids.

This specimen was not found *in situ*. Given the exceptional preservation of this specimen it was decided that it was a priority to return to the site and locate the horizon from which it came. Whilst searching for the cystoid horizon, a horizon covered with numerous specimens of a single species of a large articulated crinoid was discovered (Figure 1). The rescue collection of these specimens became a priority.

Uncovering the pavement

It took three days to find all of the crinoid horizon, on the first day a couple of articulated crinoids were found, and on the second, further specimens were discovered, not *in situ*, but they suggested that the horizon from which they came was close. On the third day the bedding plane was located. The mudstone was fractured into 25-30 mm blocks laterally, and with the top 12 mm, blocks were levered up to uncover an area 300 mm^2. After excavating to a depth of about 200 mm, the crinoid bed was exposed. It was only 25 mm thick; but completely covered with articulated, large crinoids of the same species. The specimens have thecae 30 mm across, 30 pinnate arms, and a stem about 100 mm long, whilst the columnals are pentameral and rounded, and smooth in profile, the holdfast is a distal coil about 12mm wide. All the material is preserved as external moulds.

Once the bed had been found, the top barren horizons resting on the crinoid bed were cleared. This was relatively easy at first, but due to the strike and dip of the rocks, the amount of overburden increased as more of the crinoid bed was uncovered. By the time a square metre of the crinoid bed had been revealed the base of the bed was at a depth of 500 mm. On the second day an area one metre by two metres had been exposed.

Working at the bypass was challenging, as there were constant vehicle movements with the excavation and dumping of material. At this point it was recognised that assistance would be required in order to rescue all the specimens before this part of the site was prepared for the new road. A request was made to the SRB environmental officer that the area might be temporarily preserved while assistance was raised to undertake the work required. The company kindly agreed to a temporary reprieve and ordered the area cordoned off with various markers to delineate the area.

Rescue

A team from the Palaeontology Section at Amgueddfa Cymru - National Museum Wales assembled to help with the rescue (Figure 2). After two days work using a pinch bar to lift the rock out, as much of the bed as could be practically removed

Figure 2. Rescue collection of the crinoid bed.

had been removed. The extracted blocks were laid out on large trays plastic trays in order to keep the associated pieces crowded with crinoids together. Adjacent pieces were marked so that in the future they could be reconstructed to examine the orientation and taphonomy of the individual animals. SRB Civil Engineering Group kept open the location open and available for a week, enabling most of the bed to be collected. The site now lies under the A477.

After the excavation of the crinoid beds the horizon containing the cystoid bed was located. This took a week of painstaking observation within the 18 metre deep portion of the cutting. Another 25 mm layer of large, articulated crinoids of the same species as those rescued was found, as well as an arenaceous horizon, 50 mm thick and crowded with bryozoans (McDermott and Paul 2016). On splitting the rock, it proved to contain a diverse community of articulated fossils that included asteroids, ophiuroids, trilobites, cystoids, mitrates and brachiopods, some of which have been described: brachiopod faunas (Cocks 2014); a cystoid (Lanc, *et al.* 2015a) and a mitrate (McDermott and Paul 2015) whilst others, for example the trilobites, await description.

Preparation

After collection, the crinoids were prepared mechanically using a pin to remove the surrounding matrix. They were then vacuum cleaned to remove any remaining loose material. The surface of each of the specimens was stabilised by applying several coats of a very weak solution of Paraloid B72 dissolved in acetone at a ratio by weight of c.1:80.

In order to examine and photograph individual specimens, silicone casts were prepared using Silastic P1 silicone base to which black silicone pigment (2%) was added, a Silastic curing agent (10%) was thoroughly mixed in. The curing agent 10% is critical and is administered with a pipette on a small set of 100 gm scales, as only a small amount either way and the specimen will be ruined. A 20 mm high wall made of Blu Tack™ was placed around the moulds of individual specimens. The pigmented silicone was poured into the mould. The specimens were then placed in a vacuum cylinder and the pressure reduced to 3 bar for half an hour. This ensured that any bubbles were lifted from the surface of the specimen, and that the silicone penetrated every available space.

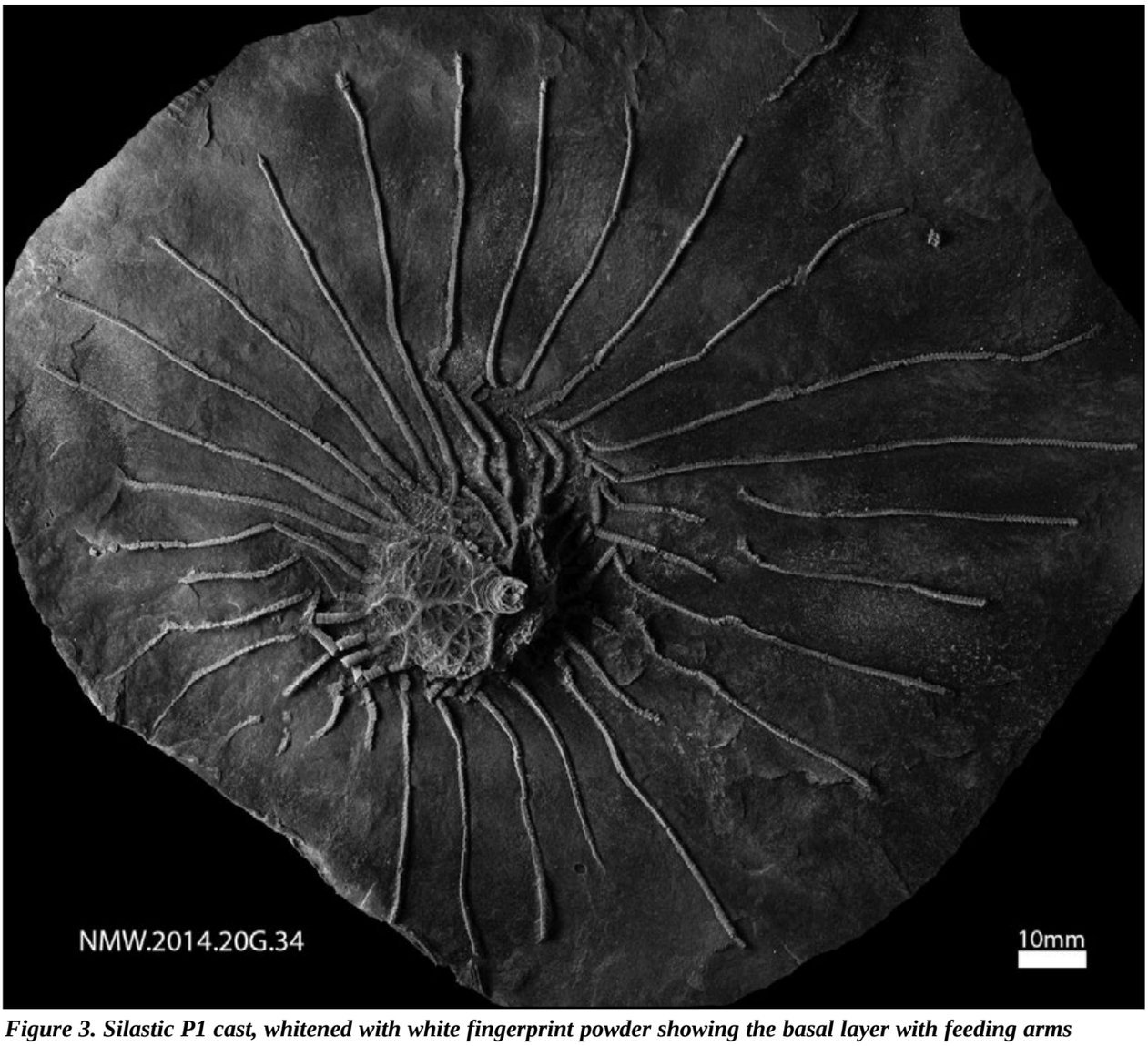

Figure 3. Silastic P1 cast, whitened with white fingerprint powder showing the basal layer with feeding arms splayed out.

To aid curing, the specimens were placed in an oven at 18°C. Having set they were then placed in a freezer for thirty minutes until cold, in order to aid the removal of the Blu Tack™, which loses its adherence, and can easily be separated from the mould and the silicone cast. The silicone cast may then be carefully separated from the mould once it has warmed to room temperature.

The moulds were coated in white flake aluminium fingerprint powder from "Tetra Scene of Crime Limited" applied with a squirrel hair brush and photographed using a Nikon D800 DSLR attached to a digital focusing rail. The imaging software package Helicon Focus enabled multiple images to be stacked so that sharp final images could be generated.

Importance of site

Ordovician localities with large accumulations of articulated crinoids are globally rare. As such the importance of this site should not be underestimated. (Donovan and Veltkamp 1993) recognised the status of the site on the basis of a few small blocks collected during the survey for the Carmarthen memoir (Strahan, *et al.* 1909). They correlated this unit with the Lady Burn Starfish Bed at Girvan, the only other crinoid pavement of Ashgill Age known from in the UK. That site is a Site of Special Scientific Interest.

At the Llanddowror road cutting site one layer with seven or eight specimens were found. They were all face down with all the pinnate arms splayed out radially, none were in contact with each other (Figure 3). Baumiller *et al.* (2008, figs. 1.9 and 1.10) show crinoids with a similar preservation and size (30 arms and distally coiled holdfasts) from the Devonian, Bell Formation, of Michigan, USA. They describe how during rapid burial the drag on an attached crinoid in feeding mode would force the crown downwards towards the sediment.

Conclusions

The successful outcome of this project arose both from the perseverance of an amateur palaeontologist (PMcD) who had the time and patience to search for the crinoid bearing bed, and through the understanding and cooperation of SRB Civil Engineering Group, who were prepared to delay and reorganise their work to enable the beds to be collected.

Acknowledgements

We would like to thank SRB Civil Engineering for permission to access and collect from the site also the valuable help and support given by their Environmental Officer - Fiona Lanc. We are grateful to Lucy McCobb, Cindy Howells and Trevor Bailey from Amgueddfa Cymru-National Museum who helped excavate the material. Ced Conolly kindly gave us very valuable advice and David Evans provided a helpful review

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BE A CURATOR: DEVELOPING A NEW GEOLOGICAL CURATORS' GROUP ACTIVITY TO ENGAGE THE PUBLIC WITH GEOLOGICAL CURATION

by Luanne Meehitiya

Meehitiya, L. 2016. Be A Curator: Developing a new Geological Curators' Group activity to engage the public with geological curation. *The Geological Curator* 10 (6): 259 - 261.

A new outreach activity developed by the author for GCG is briefly described. The Be A Curator activity is aimed at use in FossilFestivals and similar events, and for loan by curators for local use. The activity is based around a range of labels on a magnetic board and introduces people to the idea of curation.

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Introduction

Public engagement with geology has always formed part of the remit of the Geological Curators' Group (GCG). Over the last few years this has become a higher priority and the group has participated in more geological outreach events such as fossil festivals. Starting over a decade ago, fossil festivals have become a great success story in public engagement with geological sciences. Two of the largest are held at either end of the Jurassic coast each year; the Lyme Regis Fossil Festival and the Yorkshire Fossil Festival held at Scarborough. Fossil festivals typically combine stalls run by organisations such as museums, universities and societies with activities such as talks and fossil walks. They appeal to a wide audience, especially schools and families.

Be A Curator activity

In early 2015 the GCG committee decided to create a new public engagement activity with fossil festivals in mind and successfully approached the Curry Fund of the Geologists Association for funding. We felt that the current wide range of activities gave more insight into geological research and preparation than geological curation. We also felt that we needed some sort of activity to build on conversations with members of the public about creating their personal collections at GCG related stands at fossil and rock festivals. At previous Lyme Regis Fossil Festivals children have had the opportunity to learn about fossil preparation by excavating a model ichthyosaur from a fake matrix using real tools. People could learn about research through using identification keys or seeing a scanning electron microscope (SEM) in action. There are also many creative activities such as drawing or modelling dinosaurs plus activities that neatly demonstrate concepts such as explaining coastal erosion by placing model houses on sandcastles surrounded by water and comparing their longevity with different water levels and wave action.

There are some activities that involve an element of curation, mostly involving microfossils. People could identify fossils within sieved sediment under a microscope and add these to labelled slides. However, we felt that the importance of labelling and storing a fossil collection correctly wasn't explicitly demonstrated. The benefits of an activity around curation are two-fold. Firstly, it creates awareness of curation as a profession, which helps to demonstrate the value of the role in difficult funding circumstances. Secondly, the public do create fossil collections and are interested in how to look after these. Taking the time to curate a fossil collection, rather than just stuffing assorted fossils collected on holiday together in a shoebox, can help to maintain a fledgling interest after the end of a holiday. These collections grow into the fossil collections of all sizes that are eventually offered to museums by members of the public with some rare specimens becoming the subject of scientific publications. A recent example of this is the discovery of some fossil bones by four-year old Daisy Morris on the Isle of Wight in 2008 that led to the publication of a new genus and species of pterosaur in 2013, given the name V*ectidraco*

daisymorrisae (Naish, Simpson & Dyke 2013). Some early advice could improve the quality of these collections and their data long into the future.

There may be a good reason why there are few outreach activities about curation. Curation involves storing specimens safely for long term preservation and recording collections data. In the words of Principal Skinner from the Simpsons, "You get all the fun of sitting still, being quiet, writing down numbers, paying attention... Science has it all." The challenge was to turn this subject into a satisfying drop-in activity for kids of a variety of ages. This challenge was taken up by GCG committee members Isla Gladstone and Luanne Meehitiya who developed an activity called Be A Curator.

Figure 1. Alison and Nicola learn about geological curation at the Yorkshire Fossil Festival in 2015 (thank you to their family for permission to use the photograph).

We came up with the idea of a display stand that would turn the private activity of writing a label into something public. With a designer, we developed a magnetic board and a range of magnetic labels. The labels gave categories such as My name, Collected from, Fossil age, Fossil type, Date collected and Fossil number. We also developed illustrated magnetic labels with answers for the most common fossil festival finds, for example Lyme Regis, Jurassic and Ammonite. Blank magnetic labels allow the collector's name, the date and fossil catalogue number to be handwritten. People use this board to curate either their own fossil (often found on a fossil walk at the festival) or one from the handling collection we developed. We also developed the idea of creating an online collection for each festival. Using a hashtag such as #LymeFossilFinds15 people are invited to tweet pictures of the fossils they find. Often people take pictures of themselves with the board and their curated fossil. We also tweet pictures from the @OriginalGCG twitter account after asking people to fill in photo permission forms.

This activity has now been run by the GCG's volunteers at the Lyme Regis and Yorkshire Fossil Festivals in 2015 and 2016 and has also been borrowed by other groups. So what have we learnt? We haven't carried out any formal assessment as this is quite difficult to gather during busy fossil festivals. Informally, we have found that many families at fossil festivals have a high level of interest in how to curate a fossil collection. They enjoy the activity and go away saying that they will label their own collections. The activity works particularly well when people bring a fossil that they have found themselves, which does happen frequently at fossil festivals. To build on this, we would like to develop more resources demonstrating good curation including posters, leaflets and packs that include everything needed to get started in curating a collection. We are also working with festival

organisers to link the activity to fossil walks so that people come and curate their finds immediately after they come off the beach. We would also like to increase the advance advertisement of our activity so that we can be a forum for people to bring any specimen that they may have in their collections at home.

We have found that the activity can be quite hard work for some families though, as it involves a lot of reading and writing. This can be particularly tricky for children who are younger, have special needs such as dyslexia or simply have a different learning style and prefer more kinaesthetic activities. We are looking to respond to this by developing more hands-on tasks around safely storing fossils and by including drawing and creativity as part of the fossil labelling. The activity is also hard to scale up to accommodate large groups and added activities would help with this. We are currently looking for funding to continue to develop the offer.

The next outing planned for Be A Curator is the Lyme Regis Fossil Festival in May 2017. If you would like to borrow the Be A Curator stand for your event or if you would like to be involved in a fossil festival with the GCG please contact me. We would also like to start a conversation about how to engage the public with curation so please also contact me if you have seen any good examples.

Contact

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Acknowledgements

Thanks to the Curry Fund of the Geologists Association for their funding. Isla Gladstone co-created the activity and Giles Miller worked on the funding bid. Thanks to everyone who has volunteered to help run the activity and who has donated the handling fossils. Thanks to Giles Miller and Paolo Viscardi for reading and improving this article.

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LOST & FOUND

Enquiries and information, please, to Matthew Parkes (National Museum of Ireland - Natural History, Merrion Street, Dublin 2, Ireland; e-mail: mparkes@museum.ie). Include full personal and institutional names and addressess, full biographical details of publications mentioned, and credits for any illustrations submitted.

The index to 'Lost & Found' Volumes 1-4 was published in *The Geological Curator* 5(2), 79-85. The index for Volume 5 was published in *The Geological Curator* 6(4), 175-177.

Abbreviations:

CHALMERS-HUNT - Chalmers-Hunt, J.M. (Ed.) 1976. *Natural history auctions 1700-1972: a register of sales in the British Isles*. Sotheby Parke Bernet, London, 189pp.

CLEEVELY - Cleevely, R.J. 1983. *World Palaeontological Collections*. British Museum (Natural History) and Mansell Publishing Company, London, 365pp.

FENSCORE - http://fenscore.natsca.org/

GCG - *Newsletter of the Geological Curators' Group*, continued as *The Geological Curator*.

LF - 'Lost & Found' reference number in GCG.

SHERBORN - Sherborn, C.D. 1940. *Where is the - Collection? An account* [...]. Cambridge University Press, Cambridge, 149 pp.

273. The Reverend David Williams F.G.S. (1792-1850) of Bleadon, and his collection of ichthyosaurs and a plesiosaur from the Lower Lias of Somerset

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The Reverend David Williams F.G.S. (1792-1850) was, from 1820, rector (i.e. parson) of the parish of Bleadon, at the seaward end of the Mendip Hills southeast of Weston-super-Mare, Somerset. He is best known as a keen geologist, collector and researcher in the Palaeozoic stratigraphy of the West Country of England and in the Quaternary bone caves of Somerset (Currant 2000; Woolrich 2004; Bromwich 2011; Benton 2012). The Palaeozoic fossils, in particular, helped involve him as a minor player in the 'Great Devonian Controversy' over the geology of south-west England, exemplifying the sometimes problematical relationship of provincial geologists with the gentlemen of the Geological Society of London, and the new professionals of the Geological Survey (Rudwick 1985; Sharpe and McCartney 1998, p. 140; Knell 2000, pp. 230-237, 321). However, Williams was also interested in fossil vertebrates more generally, such as those from Lyme Regis (Taylor and Torrens 1987). He owned a small but significant collection of fossil marine reptiles from the Lower Lias of the West Country. Little seems to have been published on this material, and I outline its history briefly by way of drawing attention to it. Williams's collection as a whole is now mostly held in the Museum of Somerset of the South West Heritage Trust (Museums Service), on behalf of the Somersetshire Archaeological and Natural History Society.

Williams died on 7 September 1850. A fulsome obituary (Anon. 1850a) described a visit to his rectory some years before:

> [...] We found the retreat of science encumbered, within and without, with the imperishable *exuviae* of the ransacked hills. Not a table, a chair, or a sofa without its antediluvian occupant. The very lawn and the approaches to the house strewed with fossil remains such as few museums can boast. In the midst of a large room so densely tenanted sat the geologist, as on a narrow isthmus between the labours of the past and the triumphs of the future; like Marius amidst the ruins of Carthage, or (if you will) like a half-tide rock in a mounting sea. He told us that we saw only his inferior specimens, that the best were already in London in the engraver's hands […].

Those engravings were for a projected book, never completed:

> This true labour of love comprises the entire geology of Somersetshire, Devonshire, and Cornwall; and from the Mendip range to the Land's End, we may almost literally say that he has not "left a stone unturned".

Little has since been published specifically on Williams's life and work, other than the *Oxford dictionary of national biography* entry by Woolrich

(2004) and its *Dictionary of national biography* predecessor, a brief summary of his collection as a whole and its then state of curation (Hallam 1937), and a study by Benton (2012) focussing on his dealings with the Bristol Institution for the Advancement of Science, Literature and the Arts, over fossils from the Dolomitic Conglomerate at Bristol.

Williams's will made no specific provision for his collection (The National Archives, PROB 11/2135). His son Wadham Pigott Williams, an executor, wrote on 28 October 1850 to Henry De la Beche, offering it to the 'Society', which must be the Geological Society of London of which De la Beche had recently been President (Sharpe and McCartney 1998, p. 143). Nothing seems to have come of this for Williams's collection was advertised for sale in the *Athenaeum* of 21 December (Anon. 1850b):

> […] a choice Collection of Cave Bones from the Mendips; splendid Saurians, including the one figured No. 9 in Buckland's 'Bridgewater Treatise'; with a large number of Palaeozoic Fossils from Devon and Cornwall, &c. &c.

There is no mention of an auction, and no such auction is listed by Chalmers-Hunt (1976). Presumably sale by private treaty was intended. Williams's 'Geological and Scientific' library was evidently disposed of separately to a Bristol bookseller, who advertised the availability of a catalogue (Anon. 1851d).

A Weston-super-Mare newspaper suggested in January 1851 that Williams's collection would make a fine nucleus for a local museum and 'an honourable tribute to the memory of the most able geologist of the district' (Anon. 1851a). Nothing, however, seems to have come of this. At the September meeting of the Somersetshire Archaeological and Natural History Society (today the Somerset Archaeological and Natural History Society), it was proposed to organise a subscription to purchase the Williams Collection (Anon. 1851b, 1851c). Early in January 1852 it was reported that the collection had been examined by 'three gentlemen of well acknowledged judgement' (Anon. 1852b, 1852d). Those were William Baker (1787-1853), Secretary of the Society (Bowen 1854), and a Dr Pring and Mr Moore. Pring must be James Hurley Pring (d. 1889), the Weston-super-Mare physician who had attended Williams in his last illness and was an active antiquarian and member of the Society (Anon. 1850a, 1889a, 1889b). And Moore is surely the noted geologist Charles Moore (1815-1881), who was also active in the Society. A price of £250 was agreed, to which £100 for 'placing the same in the Society's museum' was added to give a total target of £350 for the subscription appeal, which was now well under way (Anon. 1852b). Meanwhile the Society was making inquiries about using an 'unoccupied room in the [Taunton] market premises' to house the collection (Anon. 1852a). The subscription reached £240 by the end of February (Anon. 1852c), and was successful in time for the sale to be concluded and the collection deposited in the museum in Taunton by the publication of the second volume of the *Proceedings* and the September 1852 meeting of the Society (Anon. 1852e, 1853). Baker, the Secretary, gave an account of the collection to the meeting, beginning with these words:

> It is now my pleasing task to speak of the large and highly interesting addition to our museum lately obtained, viz., the geological collection of the late Rev. David Williams, of Bleadon, which was procured by means of a liberal subscription, raised amongst the friends of this Society. Some of the most striking specimens are now set in frames, and displayed on the walls of the museum; and thousands of fossils are stored away in drawers and boxes, to be exhibited as we can procure proper cases [...]. (Baker 1853, p. 5)

This must have been the original museum, in the New Market House at Taunton, as the Society did not acquire Taunton Castle till the 1870s (Rabson 2015).

Interestingly, Baker (1853, p. 7) also noted that the Society then, in 1852, came into 'possession of' the manuscript of Williams's unpublished book of the 'Geology of Somerset, Devon and Cornwall', with geological maps and field sections, 'with the strata numbered, so that the Palaeozoic fossils, which are also numbered to correspond with the numbers on the diagrams, can be readily referred to their proper beds'. In fact, there seems to have been rather more to the matter than that. The Williams family had imposed a covenant on the sale to specify that if the Society had not published the manuscript within an agreed time, which evidently lapsed sometime before September 1854, the Society was bound to return it (Anon. 1855). Happily, the family let the Society retain the manuscript for a longer period, which was just as well as it was evidently critical for the documentation of the collection. Some time by August 1860, Mr Parfitt the curator had succeeded in decoding Williams's manuscript, so to speak, and thereby obtained approximate locality information for many specimens; 'the collection, comparatively useless before, is now of great value' (Sanford 1860, p. 150). The book does not seem ever to have been published, and the manuscript would be of real interest today if it can be located. However, it is not clear whether the book ever existed as a discrete

manuscript. Nothing of the sort has been noted by recent researchers, nor is it listed in the Society's archives or the catalogue of the Somerset Heritage Centre, or in the curatorial files (Martin Rudwick, pers. comm. 2016; Hugh Torrens, pers. comm. 2016; Tony Woolrich, pers. comm. 2016; David Bromwich, pers. comm. 2016; Dennis Parsons, pers. comm. 2016). Despite the obituary (Anon. 1850a) and Baker's reference to a 'manuscript book' (1853, p. 7), the later references are to the 'manuscript […] relating to the geological collection' (Anon. 1855, p.2) and just 'manuscripts' (Sanford 1860, p. 149). This shift raises a suspicion that, on further scrutiny, the vaunted book manuscript turned out to be nothing more than the collection of notebooks which is in the archives today. However, the possibility remains that the book did exist and was withdrawn by the family, who were defeated by the likely cost, and the problems of publishing such a document as Williams left it while coping with its increasing obsolescence as time passed. They were doubtless lucky that Williams made no stipulation in his will concerning the manuscript.

The Society planned to sell duplicates from the Williams Collection to raise money to pay for its display furniture, and for further acquisitions. Baker and 'Mr Moore', doubtless Charles Moore, soon, in 1852, identified specimens for retention by the Society (Baker 1853, p. 8). Baker noted that discussions had been held with the British Museum [now Natural History Museum], the Museum of Practical Geology [now British Geological Survey], the Cambridge Museum [now Sedgwick Museum], and a 'private gentleman'. Next year, at the September 1853 annual meeting, it was reported that Baker had been involved in the arrangement, labelling and display of the geological collections (apparently the Williams Collection was meant here), with the assistance of Mr Salter, one of the curators of the Museum of Practical Geology (Anon. 1854, pp. 2-3). In fact, Salter had been so helpful that he was given honorary membership. This must be John William Salter (1820-1869) (Secord 2004), the country's leading expert on Palaeozoic fossils, which is consistent with the importance of those specimens in the Williams Collection. But because of an 'unfortunate misunderstanding, as to what fossil specimens the Society felt itself justified in parting with, only a small sale of duplicates has as yet taken place', and Baker's illness had prevented him from 'making any report as to the probability of any farther sale being eventually effected' (Anon. 1854, p. 3). Matters had evidently been sorted out by the time of the next year's meeting in September 1854; 'hundreds of duplicates' had been sent to 'the Museum of Practical Geology, the British Museum, and other institutions' (Anon. 1855, pp. 2-3). Only the first museum, buying a 'collection of Devon and Cornish fossils', is listed under the entry for the Society by Cleevely (p. 270). There is no mention of the Williams Collection, or any sale by the Society about this time, there or in the standard history of the British Museum (Natural History) (Anon. 1904-1912, vol. 1). Sherborn (1940, p. 145) merely refers to the Taunton collection, but Cleevely (p. 311) lists Devon material in the British Geological Survey and Yorkshire Museum, York, the latter donated in 1837, and Baker (1853, p. 6) referred to Williams supplying the 'museums of London, Oxford, Bristol, etc.' with 'good and abundant specimens' from the Mendip bone caves. There might also have been outright losses, besides sales of duplicates. The geological collections at Taunton, as a whole, are known to have suffered severe curatorial problems and the disposal of material at times (Hallam 1937; Taylor 1986; Copp *et al*. 2000, pp. 25-26; Currant 2000, pp. 39-40), and it can be hard to reconcile the old records with what survives today (Dennis Parsons, pers. comm. 2012). So further research would be necessary to try and elucidate those dispersals of Williams material, including those during life, and whether any included fossil reptiles.

Baker's 1852 meeting report gives a useful sense of the marine reptiles in the collection (Baker 1853, pp. 5-6):

> The specimens displayed on the walls of our museum are ichthyosaurus tenuirostris, intermedius, communis, parts of the huge platiodon, and a large and almost unrivalled plesiosaurus dolichodirus, which was found near Watchet. Besides these, there are numerous portions of saurians of the different species. One of our specimens is an infant tenuirostris; another has the sclerotic, the bony ring, beautifully preserved, one part of which laps down on what appears to be the crystalline lens; another has two masses of food preserved between the ribs; and one is especially interesting, being the identical tenuirostris represented on plate 9, fig. 1, of Dr Buckland's 'Bridgwater Treatise.'
>
> Most of these Saurians were obtained by the late Mr Williams, from the Lias Quarries, of Street, near Glastonbury.

This suggests that Williams had a fair though by no means complete range of Lower Liassic marine reptiles, with the bonus of a plesiosaur skeleton - always rare. Baker's account implies at least three substantially complete ichthyosaur skeletons, but

perhaps no more than that, and one plesiosaur, in addition to the usual spectrum of partial skeletons and more fragmentary remains down to isolated bones and teeth. In terms of the size of his collection, therefore, Williams must be considered a minor figure compared to such as Thomas Hawkins (1810-1889) and Charles Moore (Copp *et al.* 2000; Taylor 2005).

The Williams collection does not appear to have received much if any academic interest during the 19th century, one exception being the ichthyosaur figured by Buckland. However, at least one cast of the plesiosaur was made, probably by or for Charles Moore, and placed in the Bath Royal Literary and Scientific Institution (Taylor and Evans 2016). William's collection is a valuable contribution to the Museum of Somerset today, especially the plesiosaur which is, somewhat belatedly, of considerable scientific interest (Taylor and Evans 2016). A trawl of the donations lists in the Society's *Proceedings* suggests that his specimens might have comprised something of the order of half the collection of marine reptiles from Somerset once in the museum. Further research, in the surviving Williams manuscripts in the Somerset Heritage Centre, and on the collection, would be necessary to confirm this and to find out what more can be said about the original collection and to determine what survives today.

One obvious question is how Williams collected the reptiles: by his own fieldwork, purchase from commercial collectors, quarrymen and beachcombers, or purchase of a pre-existing collection. Watchet plesiosaurs are rare, and it may be significant that one is known to have been in the collection of Henry Ball (c. 1783-?1856), surgeon of Watchet, in 1840, who was forced to sell his collection the next year (Taylor and Torrens 2016). This obviously offered a chance for Williams to buy it either directly or through Robert H.W. Bartlett (c. 1814-1887), the opportunist lawyer who bought the Ball collection. So perhaps the plesiosaur came to Williams from Ball, though maybe not Williams's other reptiles if Baker (1853) was right in attributing most of them to Street. Another obvious question is the fate of now lost items. One would have thought that the Society would be reluctant to dispose of prize items such as complete and near-complete ichthyosaurs, especially in the years immediately after their acquisition. Be that as it may, the ichthyosaur figured in the Bridgewater Treatise, and obviously regarded as a prize acquisition in the 1850s, cannot now be found in the Taunton collection, and an appropriate appeal for information is published separately (Taylor 2016), as are others on casts of the Watchet plesiosaur (Taylor and Evans 2016) and the Ball collection (Taylor and Torrens 2016).

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274. A lost ichthyosaur from the Lower Lias of Somerset in the collection of the Rev. David Williams F.G.S. (1792-1850), and figured in William Buckland's Bridgewater Treatise of 1836

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I am seeking a lost ichthyosaur, and any plaster casts of it, from the collection of Reverend David Williams F.G.S. (1792-1850) of Bleadon, Somerset (general details of collection in Taylor 2016).

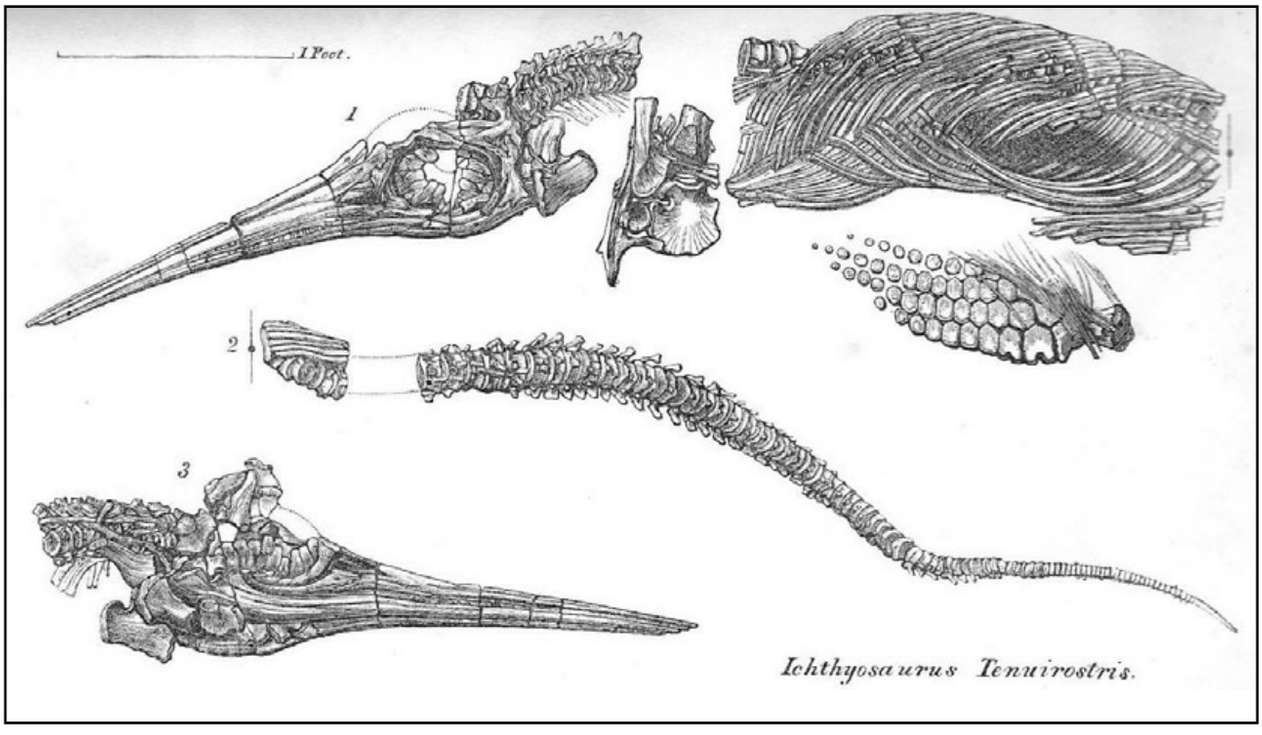

Figure 1. Plate 9 from William Buckland's Bridgewater Treatise showing 'Ichthyosaurus Tenuirostris' (Buckland 1836, vol. 2). The specimen is partly shown from both sides and must therefore have been in loose blocks, at least at the time. The scale bar on the drawing is one imperial foot, indicating a skull length of approximately 66 cm.

In a report to the 1852 annual meeting of the Somersetshire Archaeological and Natural History Society, printed in a number of local newspapers, Baker (1853, p. 6) highlighted one of the reptiles in their recent purchase of the Williams Collection and then in the Society's museum at Taunton as 'especially interesting, being the identical tenuirostris represented on plate 9, fig. 1, of Dr Buckland's "Bridgwater Treatise".' William Buckland (1784-1856) had indeed figured one of Williams's specimens in his famous Bridgewater Treatise, *Geology and mineralogy*. This was an 'Ichthyosaurus Tenuirostris, from the lias of Street, near Glastonbury': in modern terms, probably a *Leptonectes tenuirostris* (Conybeare, 1822) from the Lower Lias, lowermost Jurassic (Buckland 1836, vol. 1, p. 170fn., vol. 2, p. 21, plate 9, reproduced as Figure 1 here).

Baker evidently considered the specimen one of the highlights of the Williams Collection. He was not clear as to whether it was mounted on the wall in the usual cement and wooden frame common in those days and used for other specimens in the collection (Baker 1853, p. 5; Taylor and Evans 2016). The specimen was obviously in loose blocks when Buckland's artist had drawn it some years before (Figure 1), and might have remained in this state.

I have not come across any further reports of the specimen in the Taunton collection (now held by the South West Heritage Trust (Museums Service) for the Society). Dennis Parsons (pers. comm. 2016) kindly advises me that he has not located the specimen there. Possibly it was discarded due to deterioration or disposed of during the collection's 20th century travails (Taylor 2016). Another possibility is transfer to another museum, perhaps later in the 19th or 20th centuries, as it is unlikely that the Society would have contemplated disposal of such a prize in their 1850s deliberations. If perhaps for want of any better guess, the Royal Literary and Scientific Institution at Bath is the most obvious recipient on grounds of (then) common Somerset geography, and the known transfers of parts of the Moore collection to Taunton - though it would seem odd to send an ichthyosaur there in return, in view of Bath's already large collection of ichthyosaurs (Copp *et al*. 2000). But Tom Sharpe (pers. comm. 2012) and Matt Williams (pers.comm. 2016) kindly advise me that the specimen does not appear to be with the Moore ichthyosaurs now stored in Amgueddfa Cymru - National Museum Wales, Cardiff, or at Bath.

I would welcome information on the specimen's current location, and any plaster casts of it. It should be borne in mind that the specimen may still be in loose blocks, perhaps scattered throughout a collection and making it harder to spot.

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275. A plesiosaur from the Lower Lias of Watchet, Somerset, in the collection of the Reverend David Williams F.G.S. (1792-1850), and its casts

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We are seeking casts of a plesiosaur in the collection of Reverend David Williams F.G.S. (1792-1850) of Bleadon, Somerset, now held by the South West Heritage Trust (Museums Service) for the Somerset Archaeological and Natural History Society in the Museum of Somerset (see Taylor 2016 for information on the Williams collection in general).

One of the most important specimens in the geological collections of the Museum of Somerset is the plesiosaur TTNCM 8348, the holotype of *Eoplesiosaurus antiquior* Benson, Evans and Druckenmiller, 2012 (Figure 1 here). The skeleton had evidently been partly dismantled and stored during an unfortunate episode in the Museum's curatorial history (refs. in Taylor 2016). It was brought forth piecemeal in the 1970s and 1980s, and put together again as a complete but headless skeleton (Glenn W. Storrs and MAT, pers. obs. 1995). What was left of the old wooden mount, bearing the body, limbs and tail, bore a painted inscription indicating that it was a Williams Collection specimen from Watchet (Dennis Parsons, pers. comm. 2012). Complete or near-complete plesiosaurs from the Lower Lias are rare finds, still more so from the Somerset coast; the Museum had to wait more than a century for its second coastal find (Parsons 2002; Larkin *et al.* 2010). So this must surely be the plesiosaur mentioned in a report to the 1852 annual meeting of the Somersetshire Archaeological and Natural History Society on the newly acquired Williams Collection: 'a large and almost unrivalled plesiosaurus dolichodirus [sic], which was found near Watchet' (Baker 1853, p. 6).

What is not yet clear is whether an isolated plesiosaur cranium also found in the Taunton collection (TTNCM 9291) had been mounted on the end of the neck of this headless skeleton for display, and whether it originally belonged to the skeleton, which is not the same thing at all. Unfortunately, the only available image of the skeleton in the original display at Taunton Castle is too foreshortened to resolve this (Figure 2).

A cast of this plesiosaur can be seen in an old photograph of the Bath Royal Literary and Scientific Institution, in the room housing the large collection of Somerset Lower Lias reptiles made, at least mostly, by the notable Somerset geologist Charles Moore (1815-1881) (Williams 2008, p. 50; Figure 3). This cast is presumed to have been lost or destroyed during the Bath collections' own 20th century tribulations (Copp *et al.* 2000). There are obvious differences between this Bath image and the original shown in Figures 1 and 2. Nevertheless, if one ignores the similarities that arise simply from both skeletons being of plesiosaurs, and focusses on details of the taphonomic vagaries of bone disturbance, especially around the limbs, the Bath skeleton is clearly a cast of the Taunton skeleton. Some visible differences, such as the angles of the neck and tail, simply reflect the nature of the original specimen with a central mass and projecting neck and tail. This would be unnecessarily costly to cast as a single mass. The odd shape of the frame of the Taunton specimen, with the narrow extension for the neck (and possible head), would force it to be assembled from sections anyway. So it seems likely that the main pieces of the plesiosaur were each cast in individual blocks, and the cast sections were later embedded in cement/plaster in a rectangular frame.

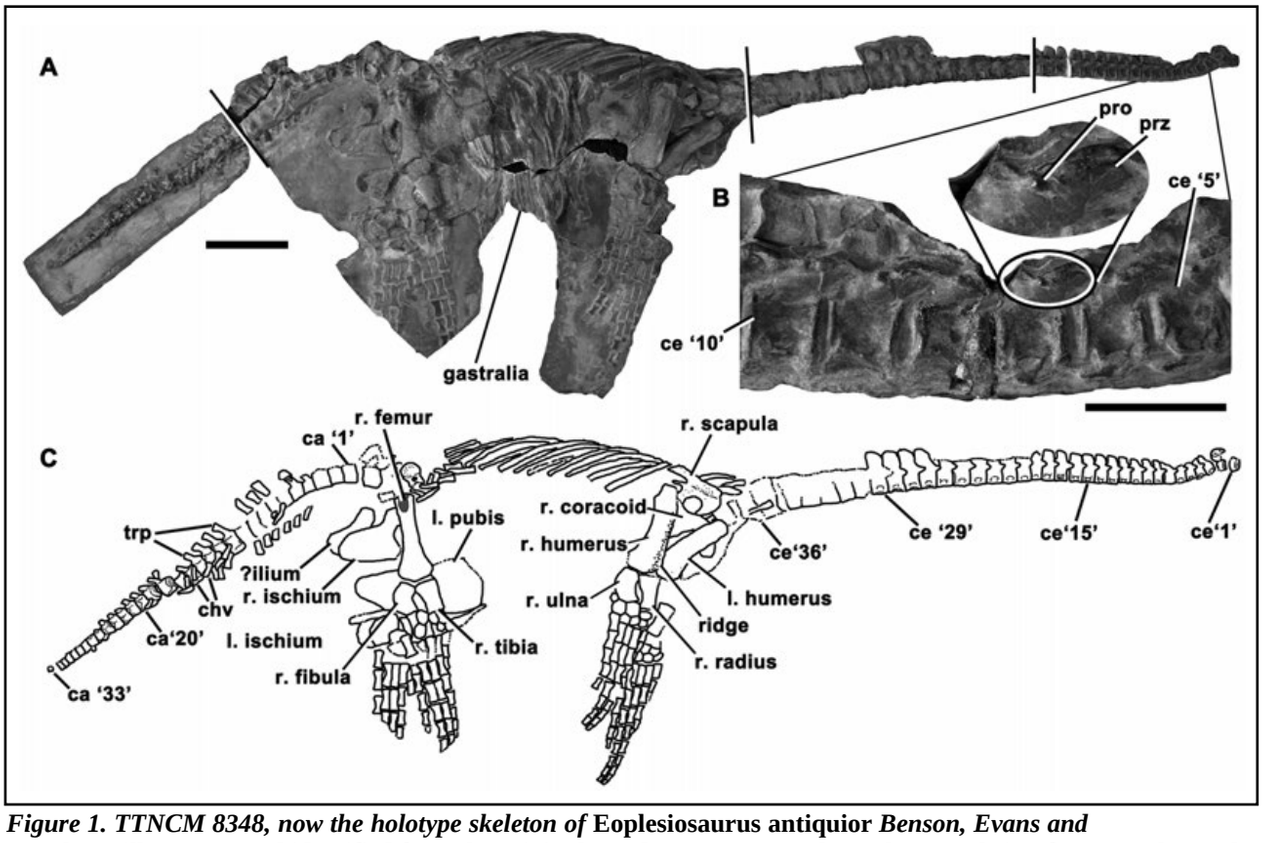

Figure 1. TTNCM 8348, now the holotype skeleton of* Eoplesiosaurus antiquior *Benson, Evans and Druckenmiller, 2012, and identified from the original wooden mount (not shown here) as being from Watchet and the Williams Collection (Dennis Parsons, pers. comm. 2012). Scale bars, 200 mm (A, C) and 50 mm (B); abbreviations as in Benson* et al. *(2012). © Roger Benson, from Benson* et al. *(2012, Figure 3) under Creative Commons Attribution License terms.

Figure 3. Cast of the Williams Collection plesiosaur, detail taken from a photograph of the Moore Room, Bath Royal Literary and Scientific Institution (Williams 2008, p. 50). Matt Williams (pers. comm. 2016) kindly points out that this must date from some time between the late 1850s and early 1870s, as the original photograph lacks the iron gantry around the room which Moore built ca. 1874. The painted inscription on the wooden plaque actually referred to the fine collection of slab-mounted Mesozoic marine reptiles spread out on the walls of this room; the plesiosaur's mount was just a convenient ledge on which to fix the plaque. It appears to read: 'The Organic Remains in this Room are the result of the Scientific Labours of CHARLES MOORE Esq., F.G.S. Of this City, By whom they were deposited for the Public Benefit'. © Bath Royal Literary and Scientific Institution Collection (BRLSI.L09246.10).

One can well imagine that the cast was perhaps transported in those original blocks to Bath before final assembly and embedding, to save transport costs and damage. It would be all too easy to assemble the chunks of cast plesiosaur in angles which were slightly different from the original, for a better final appearance or just by accident. Indeed, there might not have been anything to be followed, if the original plesiosaur had not yet been mounted. Baker (1853, p. 5) said that 'Some of the most striking specimens are now set in frames, and displayed on the walls of the museum' (our emphasis). This may mean that the Society had had to mount (or remount) Williams's skeletons in their wooden and cement/plaster frames.

This difference of angulation also tends to refute the suggestion that the Bath and Taunton skeletons are one and the same, which is not in itself an unreasonable hypothesis in view of known transfers from Bath to Taunton (Copp *et al.* 2000). If they were the same, the skeleton would have had to be dismantled and remounted, which is not impossible but makes it that much less likely.

Moreover, in the Bath skeleton, the arcuate line behind the pelvic region and the hind paddles in particular appears to be the edge of the cast proper, beyond which the embedding medium has a different texture. This line is not present on the Taunton specimen (compare Figures 1, 2 and 3). A cast can look very different from the original depending on how it was painted, still more so if it was repainted decades later, and depending on how the contrast between bone and matrix was executed by the painter (see the varying treatment of casts of the same original ichthyosaur in Taylor and Clark forthcoming).

Unfortunately, one key issue, the presence of the head, is hard to judge from those images. There was obviously a head on the Bath cast, irrespective of whether one was present on the original, but it is hard to judge from the photo just what this was: a restoration, perhaps, or a replica of the spare head noted above. Finding an extant cast would therefore be useful.

Any documentation associated with a further copy of the cast would also be useful in establishing when, and at whose initiative, this cast was made. Resolving those issues would throw further light on the network of cast donation, exchange and sale amongst marine reptile collectors and museums at that period, partly explored for this area by Taylor and Clark (forthcoming). It is possible that Williams or, later, the Society initiated the cast. However, there is no mention of the cast's acquisition, or disposal, in

Facing page: Figure 2. The museum displays in the Great Hall of Taunton Castle, ca. 1900. The Williams plesiosaur is visible on the lower left, considerably foreshortened. © South West Heritage Trust (Museums Service). A slightly less end-on, but grainier, view of the plesiosaur can be seen in an old postcard currently online on* http://www.bbc.co.uk/somerset/content/image_galleries/somerset_county_museum_gallery.shtml *(accessed 28 November 2016).

the records of the Royal Literary and Scientific Institution, which suggests that it came as part of the Moore Collection (Matt Williams, pers. comm. 2016). It would be understandable that Charles Moore sought casts of Somerset plesiosaurs to complement his collection of ichthyosaurs, perhaps with the justification of public display in the Royal Literary and Scientific Institution. Indeed, in the original photograph from which Figure 3 is cropped, the Watchet plesiosaur cast is seen displayed next to a cast of the lectotype of the plesiosaur *Thalassiodracon hawkinsii* (Owen, 1838) from Street, Somerset. Moore is not known to have had the luck to obtain a plesiosaur for himself - always much rarer than ichthyosaurs in the Lower Lias (pers. obs. of his collection). He was almost certainly the Mr Moore who helped assess the Williams collection prior to purchase, and sort it afterwards into material to keep and duplicates to sell (Taylor 2016). So he would have been in a good position to seek to cast the Williams plesiosaur in 1852, an early date consistent with its central location in the Moore Room display. And it would be sensible to have the cast made before the plesiosaur was put on display at Taunton; indeed, the original plesiosaur might well have been in the same workshop to be prepared for display.

One other question is, of course, how Williams obtained his plesiosaur in the first place, given the rarity of Watchet plesiosaurs. Interestingly, one turns up in the collection of Henry Ball (1793-?1856) of Watchet in 1840, but it was (presumably) sold in 1841, and its final fate is still uncertain, leaving open the question of any Williams link (Taylor and Torrens 2016). We would welcome any information on the Williams plesiosaur and on any casts of it.

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276. Henry Ball (c. 1783-?1856), fossil collector of Watchet, Somerset, and the forced sale of his collection in 1841 to Robert H.W. Bartlett (c. 1814-1887)

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This note records a poorly known geological collector, Henry Ball, surgeon of Watchet in Somerset, his collection of local Liassic fossils, and its opportunist purchaser, Somerset lawyer Robert H.W. Bartlett. Genealogical information, unless stated, is taken from the usual sources accessed on www.ancestry.co.uk, www.familysearch.org and FreeBMD, with the kind help of Ball's modern-day relatives Pat Hewson and Roz Searle (both pers. comm. 2016).

In June 1840 the *Dorset County Chronicle* ran a piece about recent geological discoveries at Watchet, evidently seeking to talk up its potential as a resort, especially for those interested in geology (Anon. 1840b; the *Sherborne Mercury* had just run a similar piece, misspelling Ball's name, Anon. 1840a). The

piece continued:

> The discoveries of Mr Ball, and his free and candid explanations of them, every one who visits him must greatly appreciate - his large and perfect plesiosaurus, and his collection of fossils, are well worthy the inspection and deep attention of every inquiring mind. The 'organic remains of a former world' which he has collected, most amply display his acuteness in discovering, and his perseverance in bringing to light the monsters of a world departed, and no one will see his collection without being reminded that in the world destroyed there was the same Almighty design in the creation as there is visible to every eye in the beautiful world which we now inhabit.

The piece ended in praise of the new landowner's encouragement of the development of Watchet as a resort. Evidently someone from Watchet, perhaps Ball himself, had placed it in the hope of encouraging custom from tourists.

But development perhaps did not come quickly enough. A year later, in June 1841, in an obvious piece of 19th century advertorial (Anon. 1841a), Ball is reported as having:

> announced for sale his unrivalled collection of fossils from the lias and other formations in his neighbourhood [of Watchet]. An inspection of this collection, got together by Mr. Ball with unparalleled devotion and extraordinary perseverance and labour during eight years, will amply repay a visit from a long distance it being rich in rare specimens of plesiosauri, fossil fish, &c., some of which are in unique perfection. It will be a source of great regret if such a foundation for a county museum should be permitted to leave the county of Somerset.

The sale was to be by private contract, as the actual advertisement specified (Anon. 1841b). But he evidently had no satisfactory offer, for in November he publicised his intention to put the collection on display in Taunton, presumably to drum up interest (Anon. 1841c, 1841d). This was seemingly to no avail, if it happened at all. The next report is an advertisement for the forthcoming auction, at Watchet on 22 December 1841 'under an Execution by the Sheriff', of Ball's 'valuable and extensive collection of fossils and geological remains' (Anon. 1841e). This is not listed in the standard reference (Chalmers-Hunt 1976). Evidently, a creditor of Ball's had sued in law court for his collection to be seized and sold to pay off the debt.

This Henry Ball had been born in St Decuman's (the parish which includes Watchet and Williton) to John and Joan Ball, and baptised on 21 April 1783. John Ball died in 1802, evidently a man of some wealth as his will was deposited in the Prerogative Court of Canterbury (The National Archives, PROB 11/1379/334). This will described him as 'surgeon' of Williton and showed that Henry was his only surviving son, with four sisters. John must thus be the 'surgeon in Williton' of that name noted for experimenting with the commercial growing of rhubarb and opium in England for medical purposes (Anon. 1790, p. 72, 1796; Berridge and Edwards 1981).

Henry attended Blundell's School at Tiverton as son of 'John Ball, gent[leman]' from 1796, when he was aged 13, to 1800 (Fisher 1904, p. 41). This birth date of about 1783 roughly matches the rounded age of the Somerset-born man of this name recorded at Watchet as 'surgeon' in the 1841 census, married to one Harriet (or Harriett), maiden name unknown. They seem soon to have moved to London, for she is likely to be the woman of that name who died aged 55 in the parish of St George the Martyr, Holborn, and was buried on 27 August 1842. 1783 also precisely matches the 68 year old Williton-born retired surgeon of this name in a lodging house in Gravesend, Kent, in the 1851 census, now married to Emily Land (c. 1804-1879), a surgeon's daughter from Maidstone, Kent. She had married Henry on 9 December 1844 in St George the Martyr; he was then described as a surgeon of that parish. Henry himself almost certainly died in the Gravesend registration district in the second quarter of 1856. Emily duly turns up as a widow in the 1861 census, staying with her brother Edward T. Land (1815-1876), pianist, composer, and 'professor' of music (Hadden and Golby 2004), and their also musical sister Charlotte (d. 1872), in Cambridge Place, St Pancras, London. Emily died wealthy, worth about £12,000. We have found no probate records for Henry. This lack of a will may simply indicate a sudden and unexpected death, with Emily still receiving funds. But further research would be needed to decide between this and the alternative that Henry died in poverty, as the Gravesend lodgings suggest, with Emily's money coming from her brother who had predeceased her with an estate of around £14,000.

Ball perhaps hoped that a fine geological collection would add lustre to his medical reputation, and attract potential trade to his medical practice, though this did not work when tried by another and much more famous fossil-collecting surgeon, Gideon Mantell (1790-1852) (Torrens and Cooper 1986, p. 257). And, strictly speaking, we have not confirmed

that Ball was a practising surgeon at Watchet. It is also possible that, even before his involuntary involvement in 1841, Ball was active in the fossil trade, selling to visitors or dealers perhaps as a sideline, as James Marder (1824-1888), fossil-collecting chemist of Lyme Regis, might have done (Cleevely, p. 196). There is too little information to decide, especially as he might have been careful to avoid any overt advertisement of dealing activities in order to maintain a social position as a professional; he would have lost status if regarded as someone engaged in trade. Cleevely (p. 47) notes under 'Ball, Henry' only 'Lower Lias fossils', and Moore *et al.* (1991, p.67) a 'spongeous flint from the Chalk' donated in 1845, all presented to the Geological Society and presumably now in the British Geological Survey. However, Henry Ball is such a common name that we are reluctant to link these with our Watchet man. Yet there is plenty of Lias around Watchet, and Chalk in adjacent counties. The reference to eight years' collecting (non. 1841a) could suggest that he had lived elsewhere till about 1832 (or had been in Watchet all the time, and simply took up geology then).

These reports of Ball's 'large and perfect plesiosaurus' (Anon. 1840a) are particularly interesting in view of the great rarity of reasonably complete plesiosaurs from the Lower Lias of the Somerset coast. Indeed, they immediately raise the question of what happened to Ball's animal. One obvious possibility is that it is the plesiosaur from near Watchet owned by the Rev. David Williams (1792-1850) of Bleadon, near Weston-super-Mare, as part of a small but significant collection of Somerset Lias reptiles, and now in the Museum of Somerset as the holotype of *Eoplesiosaurus antiquior* Benson, Evans and Druckenmiller, 2012 (TTNCM 8348; Taylor 2016; Taylor and Evans 2016). It is not a 'large' species as plesiosaurs go, even by the standards of 1840. *Plesiosaurus dolichodeirus* Conybeare, 1824 is markedly larger. But that is a Dorset form, and 'large' could simply be 1840s marketing hype - or one way of expressing how impressive a near-complete specimen was.

It is also worth bearing in mind that such forced sheriff's sales were apt to be organised with minimal consideration for getting a good price, just so long as enough was raised to pay the debt and the costs. The Watchet sale certainly did not bode well for Ball. The notice in the *Sherborne Mercury* is the only one we have so far found in searches of available online sources (Anon. 1841e); it was dated on 17 December 1841, but actually appeared on 20 December, two days before the sale on the 22nd, which was only three days before Christmas. And the sale was in Watchet, then a village on the Somerset coast. This was fairly remote (by land, though not sea); the Great Western Railway had got only as far as Bridgwater, never mind Taunton. Those were atrocious conditions for the sale of ordinary household goods, and still more so a highly specialist collection like Ball's. Prices at such sales were sometimes so low that the owner or his relatives could buy back his property. There was no guarantee that Williams would see the advertisement. But if he did react in time, he had a considerable advantage over most potential buyers. He was well off, with a good living at Bleadon near Weston-super-Mare not too far away, and would have been familiar with the Watchet area, and probably Ball's collection, from his own geologising. So he was well placed to benefit from being a purchaser in a potentially very thinly attended sale.

In the event, it seems that Williams missed out. George Brettingham Sowerby the first (1788-1854), conchologist, author and artist, and dealer in natural history specimens, received a letter from one Robert Henry Bartlett at Wiveliscombe, near the Somerset/Devon border:

Withycombe House, Wiveliscombe
29 December 1841

Sir

A short time since I became the [possessor *crossed out*] purchaser of a very extensive collection of Fossils and Geological remains the property of Mr Henry Ball of Watchet who has expended a very large sum of money in making the Collection & intirely ruined himself by doing so. It is my intention to dispose of them again and Dr [John Gifford] Croker [MD Erlangen] of Bovey Tracey Devon has informed me that you are likely to become a purchaser. They were valued by the late proprietor in £1,300 but from the peculiar circumstances under which I became possessed of them I can dispose of them a great bargain. They require some arrangement and classification which as I am no judge of the science it is of course impossible for me. If you should consider them worth your attention. I shall be happy to treat with you. The collection is at present at Watchet a Sea port Town and only a short distance from the terminus of the Great Western Railroad at Bridgewater. I shall be obliged by your early reply as there are several people who wish to become purchasers.

I am Sir

Yours very obedtly

Robert Henry Bartlett
(© Amgueddfa Cymru - National Museum Wales, published with permission; letter NMW 1838 kindly located by Cindy Howells; Matheson 1964, p. 224, partly published this letter, giving Ball as 'Bale').

But it remains to be seen how much of this was brass-necked marketing-speak, how much was sheer ignorance from someone professedly 'no judge of the science', and how much an over-optimistic memory of the 1820-1830 period when plesiosaurs were reportedly selling for two hundred pounds a skeleton (and one actually did). The sum of £1300 seems incredible as a value for the early 1840s, when even Mary Anning (1799-1847) of Lyme Regis could only obtain £10 or £20 for perfectly acceptable ichthyosaurs (Taylor and Torrens 1987, pp. 143-146).

The letter-writer must be Robert Henry *William* Bartlett (c.1814-1887), sometimes recorded as Robert Henry Bartlett or just Robert Bartlett. He was the son of Robert Bartlett (1787-1875) and Mary Stone (?c. 1791-?1880). This elder Robert was born at Branscombe in east Devon, and was 'of Axminster' when he married Mary at Chipstable in Somerset, the next village to Wiveliscombe, in 1814. He later appears as a chemist in Shepton Mallet in the 1841 census, and as a farmer in Withycombe House in Chipstable in the 1851 census; it was here that he, and seemingly, his wife died. Censuses indicate that their son the lawyer-to-be was born around 1814, variously outside Somerset (1841 census), at Axminster (1861 census, Wolverhampton, and 1871 census, Litherland), and Withycombe (1881 census, Ormskirk). He was evidently born in Axminster as his father's residence in 1814 also suggests and spent some of his childhood in 'Withycombe' - but we cannot be sure whether it was the village of that name near Watchet that was being remembered in 1881, or, more probably, a slip for 'Withycombe House' in Chipstable. He was articled to a Shepton Mallet lawyer from 1834 to 1839, when he qualified, being admitted as an attorney of the Court of Queen's Bench. He appears as a solicitor aged about 24 in the 1841 census at the same address as in the Sowerby letter of that year (but wrongly transcribed as 'Robt' in computer databases). He had cousins born in Bovey Tracey (they were staying with his parents in the 1851 census). In 1844 not far away, and now 'of Wellington', he married Emily E. C. Warrington (c. 1812-1871) of Hayes, Middlesex, at Tormoham (now Torquay; Anon. 1844).

It is apparent that Bartlett had strong family connexions with the Chipstable-Wiveliscombe area, only some 12 miles from Watchet. (It is possible that the name of Withycombe House indicates links with Withycombe village, which is still closer to Watchet, but this is not at all certain, as the house, also known as Withycombe Farm, had been in the Stone family under those names for many years before the Bartlett marriage in 1814). As a lawyer he would know what was happening in the Somerset courts (and might even have been involved in the Ball case). He could take a chance on buying something that was obviously going very cheaply. He could easily know the geological Dr Croker of Bovey Tracey. Moreover, his childhood years in Axminster might have offered visits to nearby Lyme Regis, as well as visits to Watchet from Chipstable. One can imagine how, from such trips and from local newspapers, this - presumably - complete non-geologist would have 'known' that Lias fossils were worth huge sums of money. Bartlett is an excellent suspect, so much so that we unhesitatingly identify him as the letter-writer.

Bartlett was also a suspect in other ways. In 1849, now living in Epsom, he was prosecuted for the rape of his wife's 15-year-old servant-companion in a case which helped fill the newspapers for days (Anon. 1849a onwards to Anon. 1849b; Jackson 2013). He undoubtedly committed adultery in the marital home with her, and he then sent her to Liverpool on her own on a spurious errand for some never admitted reason, but which was probably to damage the girl's reputation and credibility as a witness, or worse. The magistrates took the view that he had gravely ill-used the child, but arguably let him off on a technicality, and when this was known three cheers were given outside the pub close to his house. Bartlett was also forced in court to pay a long-standing debt to an Exeter tradesman, after trying to palm him off with a possibly dud promissory note from another lawyer (Anon. 1847); he fare-dodged on the railway, and tried to get off by arguing that the company's ticket-collecting practices were illegal (Anon. 1850); and he evidently claimed, falsely (and improbably, given his time as a law clerk), to be a graduate of Worcester College in the University of Oxford (Anon. 1887, cf. Foster 1888, vol. 1, p. 69, as kindly confirmed by Emma Goodrum, Archivist of Worcester College, pers. comm 2016). He was also bankrupt at least twice, once at the time of the rape case and again in 1872 (Anon. 1849c, 1872). One wonders whether it was a lack of financial judgement, a rush to leave the West Country, or an outright lie, when Bartlett claimed in court in 1847 to have sold his law practice for less than a third of the price he had paid (Anon. 1847). But he ended his career in Lancashire, still

active as a solicitor in Liverpool through to at least 1883. He advised the Licensed Victuallers' Association, enjoyed coursing, and bred greyhounds (Anon. 1883, 1887).

One can well imagine that this character would have no compunction about buying Ball's collection for as little as possible. Nevertheless, we do not know what happened with the collection after that. It is also unclear whether Bartlett made a clean sweep of the original collection, as he perhaps implied. The wording of the 1841 auction notice refers only to 'fossils and geological remains' (Anon. 1841e). This failure to mention potential star items doubtless reflects the lack of effort put into such sheriff's sales. But it leaves the possibility that Ball had in fact sold some material privately, such as the prize plesiosaur, and again Williams would be a prime suspect. We would welcome more information on Henry Ball and his collection, and on Robert Henry William Bartlett and the fate of the collection in his hands.

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277. 19th Century plaster casts of Lower Jurassic ichthyosaurs and plesiosaurs in the Bristol Institution for the Advancement of Science, Literature and the Arts, and the Academy of Natural Sciences, Philadelphia

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This note seeks information on casts of certain ichthyosaurs and plesiosaurs in museums and other collections. The Bristol Institution for the Advancement of Science, Literature and the Arts (BIASLA; collections now in City of Bristol Museum and Art Gallery) was an important institutional collector of Lower Liassic ichthyosaurs and plesiosaurs from the West Country of England from the 1820s onwards. Recent work has shown that it was also a more significant centre for the production and distribution of plaster casts of those reptiles during the 19th century, more specifically 1830-1890 and especially 1830-1850, than had been realised (Taylor and Clark forthcoming). Unfortunately the Institution's collection was in large part destroyed, including most of the slab-mounted marine reptiles and casts, when the Bristol Museum was burnt out during an air raid in 1940.

Some of those casts were of originals in the Institution's own fine collections. But others were of specimens which had been bought by Edward Wilson (1808-1888) of Tenby in South Wales. He often acted as agent for his brother, Dr Thomas Bellerby Wilson (1807-1865) of Newark, Delaware, in buying up European natural history specimens and collections which Thomas donated to the Academy of Natural Sciences, Philadelphia, U.S.A. In return for helping Edward Wilson obtain specimens of ichthyosaurs and plesiosaurs, Samuel Stutchbury (1798-1859), Curator of the BIASLA from 1831 to 1850, was allowed to make moulds and casts of some specimens. It is not yet clear if this was under the official auspices of the Institution or, so to speak, in his spare time. The actual work might have been contracted out to specialists in the local fine art trade. But the Institution cannot have been too unhappy, as it received copies.

As part of a wider project to locate or reconstruct lost type and figured specimens of West Country marine reptiles, I am seeking further examples of ex-Bristol casts of ichthyosaurs to add to the known ones listed here (and would welcome information on any other unrecognised plaster casts of ichthyosaurs and plesiosaurs). I am particularly anxious to learn of any associated documentation, such as accession registers and original labels. Such data have proved indispensable in reconstructing some of the history of the original specimens and of their casts, and in resolving a major taxonomic muddle and provenance confusion affecting the first two ichthyosaurs illustrated here (Taylor and Clark forthcoming). I have also included several ANSP specimens which might also have been replicated, although no casts have so far been located.

This note, and Taylor and Clark (forthcoming), extend the account previously published in *The Geological Curator* of the ichthyosaur cast in the Cheltenham Art Gallery and Museum collection (Torrens and Taylor 1990). Amongst the donors of geological material to that collection listed in this paper are Edward Wilson's son Dr Edward T. Wilson F.R.C.P. (*ca*. 1833-1918), Cheltenham medic, and his own son Edward A. Wilson (1872-1912), who would die with Scott in the Antarctic.

Unless otherwise stated, full details, references and acknowledgements are given by Taylor and Clark (forthcoming). Taxonomic identifications given are those believed to have been used originally, where known, and the most likely to be found in 19th century acquisition documentation. However, these could and sometimes did change, so any ichthyosaur or plesiosaur cast is of potential interest.

Abbreviations: ANSP, Academy of Natural Sciences, Philadelphia, USA; BIASLA, Bristol Institution for the Advancement of Science, Literature and the Arts, now BRSMG; BNSS, Bournemouth Natural Science Society, Bournemouth; BRLSI, Bath Royal Literary and Scientific Institution, Bath; BRSMG, City of Bristol Museum and Art Gallery, Bristol; CHLGM, Cheltenham Art Gallery and Museum, Cheltenham; NHMUK, Natural History Museum, London; NMW, Amgueddfa Cymru - National Museum Wales, Cardiff; OUMNH, Geological Collections, Oxford University Museum of Natural History, Oxford; ROM, Royal Ontario Museum, Toronto, Canada.

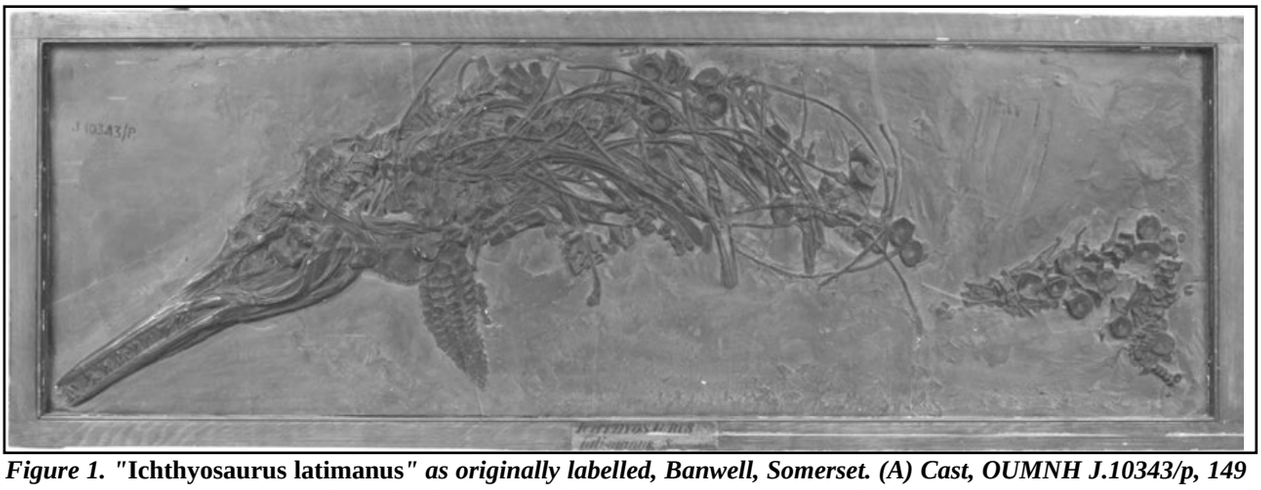

***Figure 1.* "Ichthyosaurus latimanus*" as originally labelled, Banwell, Somerset. (A) Cast, OUMNH J.10343/p, 149 cm long within inside edges of wooden frame. © Oxford University Museum of Natural History. (B) Variant cast showing only the anterior portion, BNSS 30489. © Ray Chapman, Bournemouth Natural Science Society.**

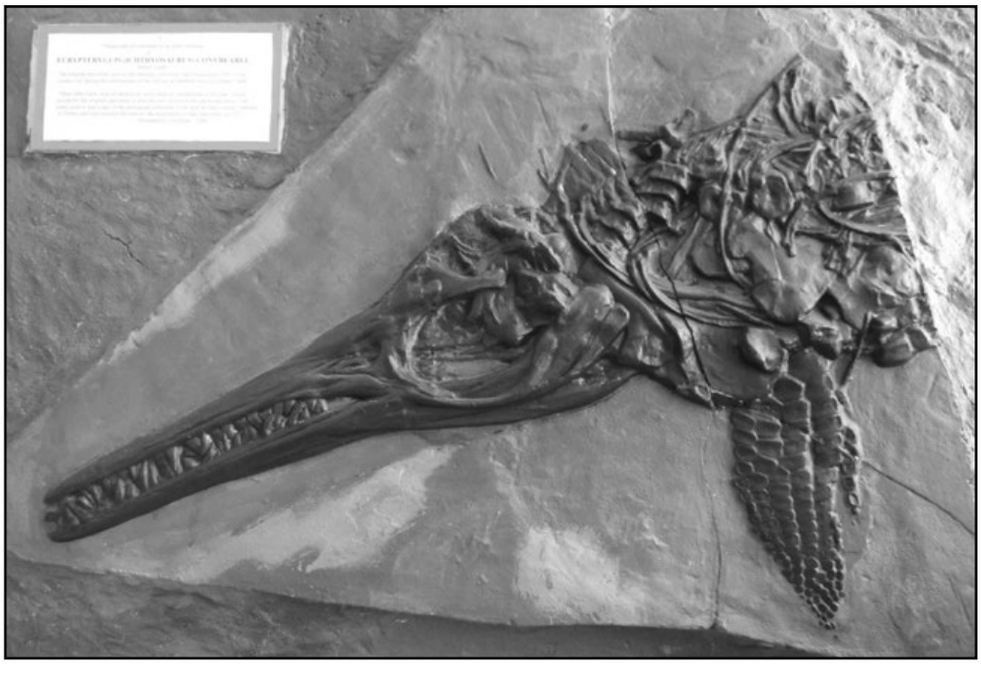

Figure 1B.

1. "*Ichthyosaurus latimanus*", Banwell, Somerset

Original BRSMG Cb2464, type specimen of *Ichthyosaurus latimanus* Owen, 1840, presumed destroyed 1940. Known casts: ANSP 17426; NHMUK PV OR 1064, not located; OUMNH J.10343/p (Figure 1A); possibly also collection of Purnell B. Purnell (1791-1866) of Stancombe Park, Gloucestershire (now dispersed). A variant cast shows only the anterior portion (including head and forelimb). Only one copy of this variant is known to exist: BNSS 30489 (Figure 1B), originally held by the Frome Literary and Scientific Institution; other copies are believed to have gone to the Institutions at Ludlow and Swansea, but cannot be located.

2. "*Ichthyosaurus intermedius*", Banwell, Somerset

Original BRSMG Cb2462, presumed destroyed 1940. Known casts: CHLGM 1931:11a, presumed ex collection of Purnell B. Purnell; OUMNH J.10342/p (Figure 2); NHMUK PV OR 1065; ANSP, now missing.

3. "*Ichthyosaurus intermedius*", locality unknown

Original ANSP 15766 (Figure 3). Known cast: BRLSI M3580 (presently housed in NMW), ex collection of Charles Moore (1815-1881).

4. "*Ichthyosaurus tenuirostris*" or "*Ichthyosaurus communis*", probably from "Glastonbury" (more likely Street or Edgarley, Somerset)

Original ANSP 17307. Known cast: BRSMG Cb2486, presumed destroyed 1940 (. Modern glass-reinforced resin casts also exist: ANSP 20668 (Figure 4), ROM.

*Figure 2. "***Ichthyosaurus intermedius***" as originally labelled, Lower Lias of Banwell, Somerset, cast, OUMNH J.10342/p, 188.5cm long within edges of wooden frame. Note the presence of a coracoid and phalanges scattered near the snout, and a ?faecal mass below the neck as seen here. These are variably omitted in some other casts of this specimen. © Oxford University Museum of Natural History.*

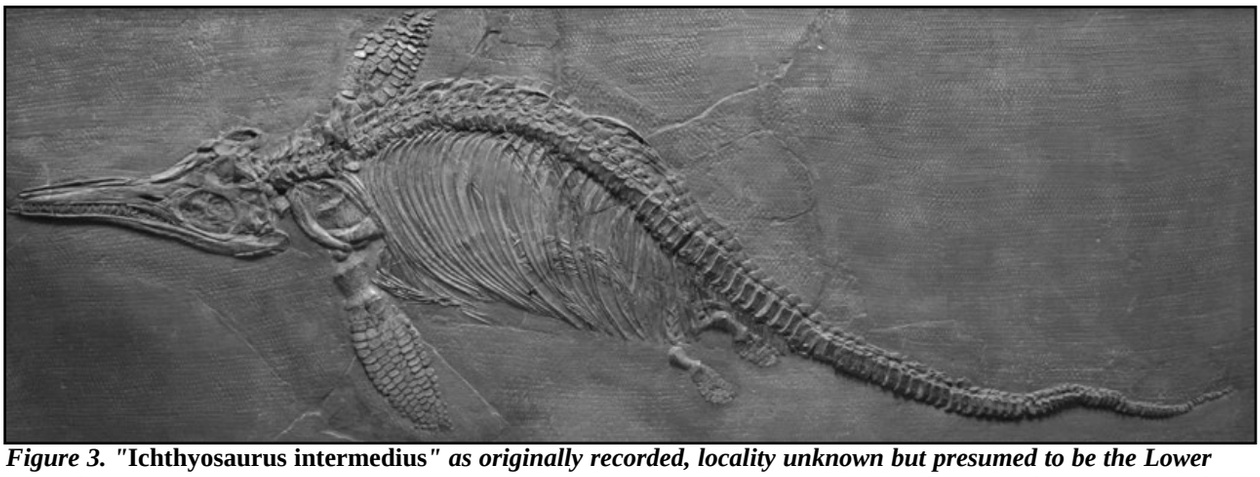

*Figure 3. "***Ichthyosaurus intermedius***" as originally recorded, locality unknown but presumed to be the Lower Lias of Somerset or Dorset, ANSP 15766. Approximately 215cm long in straight line from tip of snout to end of tail. © Academy of Natural Sciences of Philadelphia.*

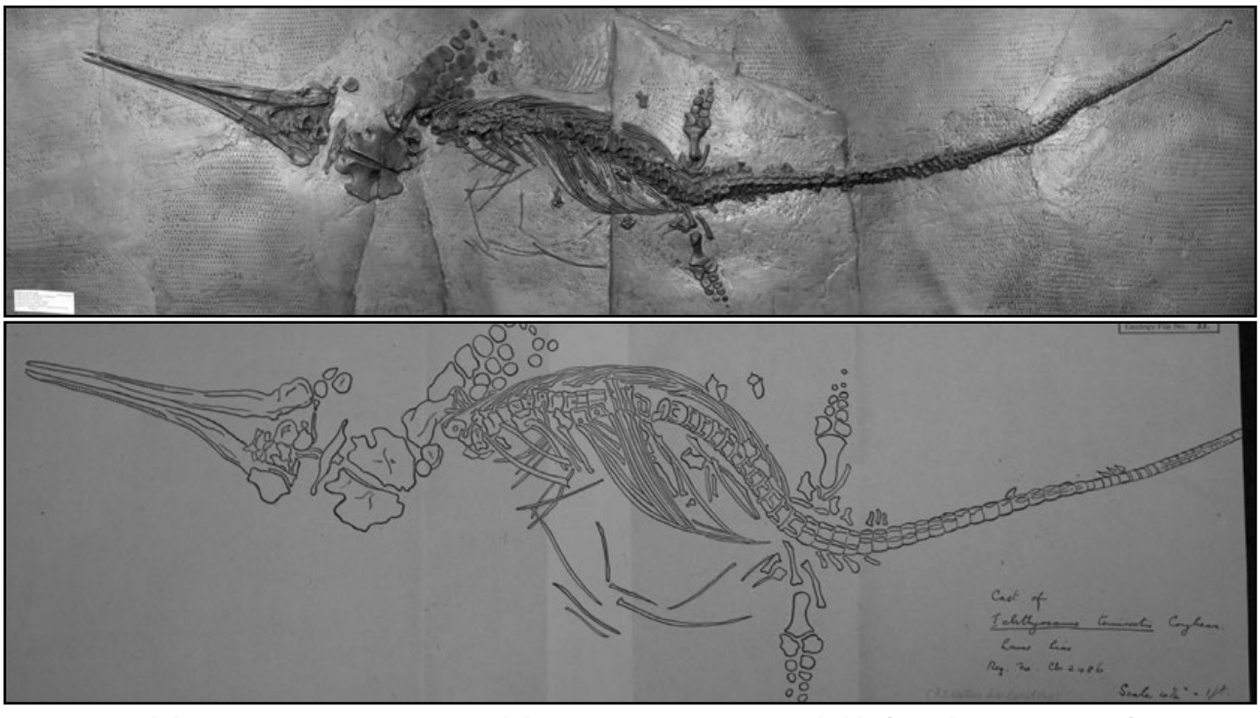

Figure 4. "Ichthyosaurus tenuirostris" or "Ichthyosaurus communis", probably from the Lower Lias of "Glastonbury" (more likely Street or Edgarley, Somerset). (A) Modern GRP cast, ANSP 20668, showing the distinctive disposition of the head and coracoids. © Academy of Natural Sciences of Philadelphia. (B) Sketch of cast BRSMG Cb2486 presumed destroyed in 1940, by F.S. Wallis of Bristol City Museum, © Bristol Culture. Whole animal approximately 232cm long in straight line from tip of snout to end of tail.

Figure 5. Ichthyosaur, original identification and provenance uncertain, presumed Lower Lias, possibly Somerset. ANSP 17428. Snout to tail length, in straight line, approximately 217cm. © Dean Lomax, courtesy of Academy of Natural Sciences of Philadelphia.

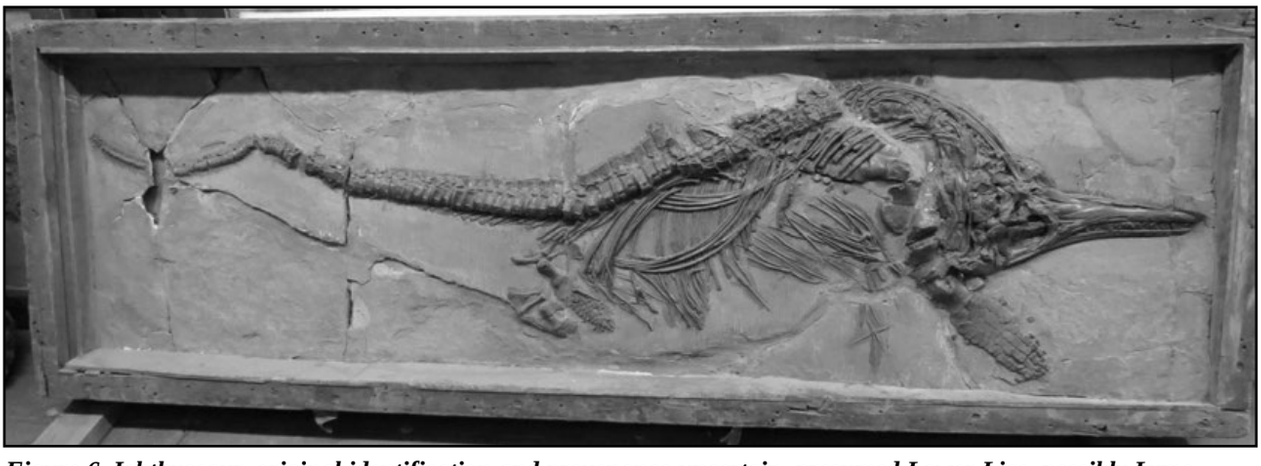

Figure 6. Ichthyosaur, original identification and provenance uncertain, presumed Lower Lias, possibly Lyme Regis. ANSP 17429. Snout to tail length, in straight line, approximately 193cm. © Dean Lomax, courtesy of Academy of Natural Sciences of Philadelphia.

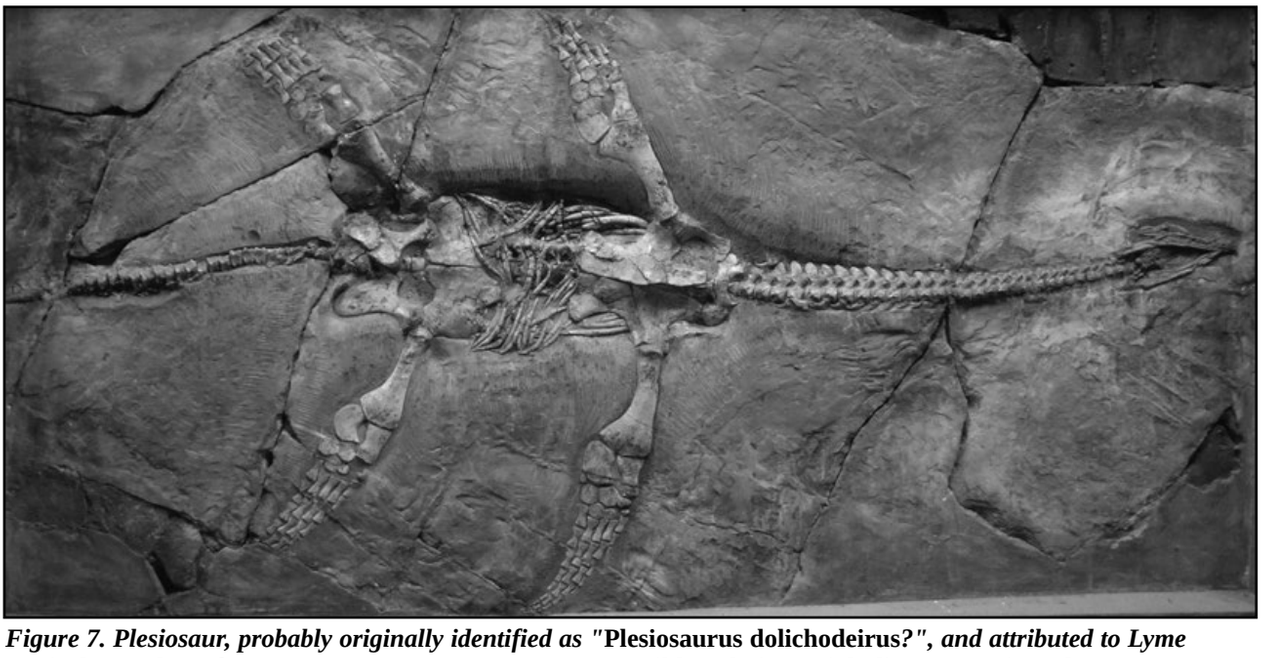

Figure 7. Plesiosaur, probably originally identified as "*Plesiosaurus dolichodeirus*?", and attributed to Lyme Regis, but perhaps from Somerset. ANSP 15767. Snout to tail length, in straight line, approximately 192cm. © Academy of Natural Sciences of Philadelphia.

5. Ichthyosaur, original identification and provenance uncertain
Present ANSP 17428 *Leptonectes tenuirostris*, presumed Lower Lias, possibly Somerset (Figure 5). No casts so far known.

6. Ichthyosaur, original identification and provenance uncertain
Present ANSP 17429, presumed Lower Lias, possibly Lyme Regis (Figure 6). No casts so far known.

7. Plesiosaur, probably identified as "*Plesiosaurus dolichodeirus*?" from Lyme Regis
Present ANSP 15767 (Figure 7). Straight line length from snout to tail, about 75.5" = 192cm, so the specimen is presumed to be the T.B. Wilson deposit of 1847 described as 76" long by Anon. (1847). This report refers to "*Plesiosaurus dolichodeirus*" from Lyme Regis, but one modern identification is *Thalassiodracon hawkinsii* Owen, 1838 (Benson *et al.* 2012, p.3), and the provenance is therefore much more likely to be from the Lower Lias of Street or Watchet in Somerset. No casts so far known.

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278. A lost ichthyosaur from the Lower Lias figured in William Buckland's Bridgewater Treatise of 1836, and possibly owned by the Geological Society of London or Viscount Cole F.G.S., later Earl of Enniskillen (1807-1886)

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We are seeking a lost ichthyosaur, which William Buckland (1784-1856) figured in his famous Bridgewater Treatise: a 'young Ichthyosaurus communis, in the collection of the Geological Society of London, found in the Lias at Lyme Regis' (Buckland 1836, vol. 1, p. 170fn., vol. 2, p. 21, plate 8, fig. 1, reproduced as Figure 1 here).

One of us first attempted to identify the two ichthyosaurs in Buckland's plate in the 1990s (http://www.ucmp.berkeley.edu/history/anning.html, accessed 29 November 2016). One of the two ichthyosaurs has now been located, and confirmed from documentary evidence as a specimen collected by Mary Anning (1799-1847) of Lyme Regis (Taylor 2014). The other ichthyosaur, the subject of this note and perhaps also an Anning specimen, could not then be found except for a plaster cast at the Oxford University Museum of Natural History (OUMNH J.10341/p, Figure 2), and records of another plaster cast formerly at the Bristol Institution for the Advancement of Science, Literature and the Arts.

More recently Judy Massare (pers. comm. 2014) has independently recognised and located the OUMNH cast, and found a second at the Sedgwick Museum, University of Cambridge (CAMSM X.50259). Unfortunately the provenances of the two casts are unknown, and neither cast bears label data (Eliza Howlett, pers. comm. 2014; Matt Riley, pers. comm. 2012, 2014).

This Bristol cast was probably destroyed in a 1940 air raid. It poses a problem because it was seemingly donated in 1832 by William Willoughby Cole F.G.S. (1807-1886) (City of Bristol Museum and Art Gallery, Geology MS. No. 14, *Catalogue of Fossil Reptiles*, p. 13, item 9; Cb register, entry for Cb2338; Geology File 008; OUMNH specimen file for J.10341/p). By implication, therefore, the original was in Cole's collection, contrary to Buckland's Geological Society attribution.

This obvious conflict of owner/donor provenance makes it hard to trace the original ichthyosaur's fate. We are therefore seeking information on further copies of casts of this attractive little ichthyosaur in the hope of independent provenance data - and also, of course, the original ichthyosaur itself. It is worth bearing in mind that Buckland's plate was notably tidied up compared to reality (Figures 1, 2); and that William Willoughby Cole was styled Viscount Cole until his father died in March 1840 and he himself

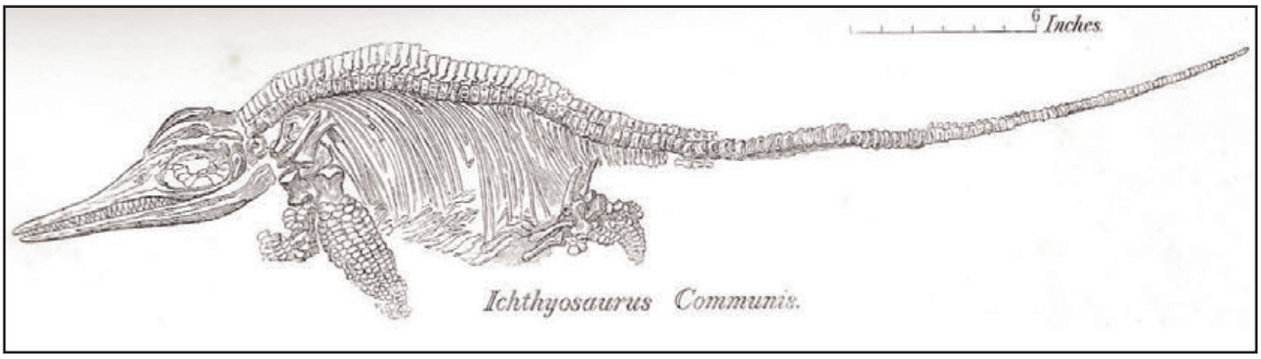

Figure 1. Lost ichthyosaur specimen, from the original illustration by Buckland (1836, pl. 8, fig. 1), stated there to be* Ichthyosaurus communis *from the Lower Lias of Lyme Regis, in the Geological Society of London. Note that the drawing has been tidied up for clarity, omitting certain loose bones present in the original (compare with Figure 2). The original was evidently a fairly small specimen, about 42 inches long (107cm) in a straight line from end of snout to tip of tail as scaled from the drawing, which acceptably matches actual measurement from known casts (Figure 2). Also notable is the broad forepaddle with six digits.

Figure 2. OUMNH J.10341/p, cast of the same ichthyosaur showing the actual state of the original skeleton, 108 cm in a straight line from snout to tip of tail (Eliza Howlett, pers. comm. 2014). Elements of the right side of the head appear to have been scattered beside the jaw and the pelvic region as seen. The animal was evidently buried lying on its left side, preserving this side in good order compared to the right side bones which were exposed to decay and scavenging. It was then prepared from the bottom upwards as found. © Oxford University Museum of Natural History.

became the third Earl of Enniskillen, so any donations could be listed under one of those alternative names.

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279. A specimen of chalk from the Betchworth Lime Works

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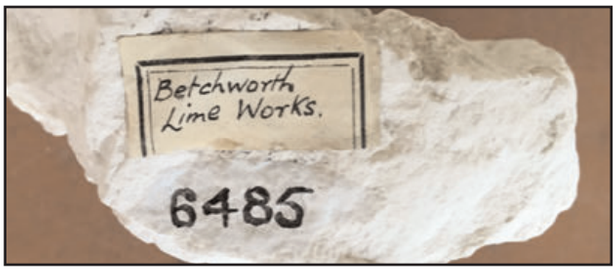
Keyworth, Nottingham, NG12 5GG

A specimen of chalk with brachiopod from the Betchworth Lime Works has "turned up" in the NIGL laboratories at Keyworth. How it arrived here is unknown, but it appears to be from a major collection - possibly palaeontological. The label says "Betchworth Lime Works" and the registration number "6485" has been applied by hand. Does anyone recognise the label, numbering or handwriting?



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