THE GEOLOGICAL CURATOR

VOLUME 10, NO. 4

CONTENTS

EDITORIAL
by Matthew Parkes 146

WILLIAM BUCKLAND'S CONNECTIONS TO THE LAST SURVIVING PLEISTOCENE COLLECTIONS FROM YEALM BRIDGE CAVERNS, DEVON
by Jan Freedman 147

ADDITIONAL INFORMATION ON CHARLES. W. PEACH (1800-1886)
by Michael A. Taylor and Lyall I. Anderson 159

CRESWELL CRAGS FOSSIL MATERIAL IN THE NOTTINGHAM NATURAL HISTORY MUSEUM, WOLLATON HALL, UK
by Jordan Bestwick and Adam S. Smith 181

EDITORIAL

I wish to record a big thank you to all those subscribers who responded to the recent survey as to how GCG should best provide the journal to subscribers. The final sample was sufficiently large to gain a reasonable picture of what people would like. There is large majority who definitely wish to continue to receive hard copy through the post and we will continue to provide this as standard. However a significant minority would prefer to receive the journal in digital format and for the imminent future, this will be in pdf format.

The precise delivery method is being organised amongst the committee members, but the important point to note is that electronic **delivery of digital copy will be a choice you can opt for**. Our default position will be to continue sending you a paper printed journal by post unless you choose to get electronic copy. Renewal notices and forms will have this option but the onus is on you to let us know if you prefer to receive digital copy.

If you pay your subscription by standing order you will need to let the membership secretary know if you are electing for digital copy. Lastly, while we implement these changes, there are bound to be some teething troubles and we ask for your patience and support. Please let us know of any problems, but also if it works well.

Matthew Parkes

WILLIAM BUCKLAND'S CONNECTIONS TO THE LAST SURVIVING PLEISTOCENE COLLECTIONS FROM YEALM BRIDGE CAVERNS, DEVON

by Jan Freedman

Freedman, J. 2015. William Buckland's connections to the last surviving Pleistocene collections from Yealm Bridge Caverns, Devon. *The Geological Curator* 10 (4): 147-158.

In 2012, Plymouth City Museum and Art Gallery received a large donation of sub-fossil bones excavated from several caves on the Kitley Estate, Yealmpton, Devon. Included in this collection of over 4000 specimens, was a small wooden box holding 184 bones and teeth from Yealm Bridge Cavern. The specimens present in the collection include wolf (*Canis lupus*), fox (*Vulpes vulpes*), bear (*Ursus* sp.), spotted hyena (*Crocuta crocuta*), horse (*Equus caballus*), woolly rhinoceros (*Coleodonta antiquitatis*), red deer (*Cervus elaphus*), reindeer (*Rangifer tarandus*), bison (*Bison priscus*), sheep (*Ovis aries*), woolly mammoth (*Mammuthus primigenius*) and rat (*Rattus rattus*). An accompanying hand written note with the box suggested that these specimens were sent to William Buckland for identification. Supported by a generous grant from the Marc Fitch Fund, this paper outlines the research undertaken to discover when this collection was collected, who collected it and the links to William Buckland. The grant also allowed for the specimens to be re-packed into more appropriate storage to safeguard it for the future. Comparing the fauna to other sites with radiocarbon dates suggests the Yealm Bridge Cavern collection dates to around 40,000 - 35,000 years BP.

Jan Freedman, Curator of Natural History, Plymouth City Museum and Art Gallery, Drakes Circus, Plymouth, PL4 8AJ, UK. *Received 21st July 2015. Accepted 21st November 2015*

Introduction

Within the hard, grey Devonian limestone of Plymouth and the surrounding areas several significant Pleistocene deposits have been discovered. A large number of these include some of the earliest sub-fossil sites to have been discussed in the scientific literature: Hoe Beach was excavated in 1808 (Worth 1886); Oreston brought to the attention of science in 1817 (Buckland 1823; Cottle 1829); Stonehouse was discovered around 1835 (Worth 1886); and Cattedown a little later, in 1886 (Worth 1887). Many of these sites have been built upon since the specimens were excavated. And, sadly, a large number of the collections were lost during World War 2: the only specimens from Hoe Beach, along with many Stonehouse, Oreston and Cattedown specimens were stored at the Plymouth Athenaeum (Chamberlain and Ray 1994) and destroyed when the Athenaeum was hit during WW2. The collections from Oreston held at the Royal College of Surgeons, London, were also lost during WW2 (Chamberlain and Ray 1994).

The Quaternary collections held at Plymouth City Museum and Art Gallery (PCMAG) includes specimens from a variety of sites in the South West: Cattedown Caves, Yealmpton, Kent's Cavern, Torbryan, Joint Mitnor, and Cheddar Caves. PCMAG holds no specimens from Oreston, as the museum opened almost a century after the site was excavated. Specimens from the Oreston Caves can be found in the collections at Bristol Museum and Art Gallery, Torquay Museum, Leeds City Museum, and the Natural History Museum, London (Chamberlain and Ray 1994). The only remaining specimens from Stonehouse in Plymouth can be found at Torquay Museum (Chamberlain and Ray 1994).

In October 2012, a substantial collection of sub-fossil material, along with associated archives, was donated to PCMAG by the Kitley Estate. This paper attempts to identify the origin of these specimens, potential links to William Buckland, how the collection has been repacked, and how this small collection sheds a little light into the Pleistocene of Kitley, Devon. The research presented here has been made possible to a generous grant from the Marc Fitch Fund.

The Kitley Caves Collections

Kitley Estate lies about 3 miles East of Plymouth, in the South West of England (Figure 1). There are records of a very small number of specimens from early excavations at Kitley being donated to two other museums. Some bones and flints from Kitley Shelter Cave are held at Cambridge University Museum of Archaeology and Anthropology (Chamberlain and Ray 1994), likely to be those described by Burkitt (1926). Bones from 'hyena, wolf, ox, badger, fox, sheep and birds' were given to the Plymouth Institution (Worth 1879), but their whereabouts are unknown today: it is very likely they were lost during WW2 along with the specimens mentioned above.

Consisting of more than 4,000 specimens from several sites under the Kitley Estate, this donation to PCMAG was a very important addition to the collections. The majority of the specimens were collected in the later 1980s and throughout the 1990s, where a number of caves were discovered and explored: Bobs Cave, Roberts Cave, Kitley No Name Cave, Hen's Hole Cave and Wish Cave.

The collection holds a large variety of species demonstrating continuous use of the caves throughout the Late Pleistocene. Notable fauna such as narrow-nosed rhinoceros (*Stephanorhinus hemitoechus*) and hippopotamus (*Hippopotamus amphibius*) indicate a date of around 125,000 years ago (Oxygen Isotope Stage 5e) (Currant and Jacobi 2001). There are numerous specimens across all sites of the familiar species from the Middle Devensian, around 30,000 years ago (Currant and Jacobi 2001), such as spotted hyena (*Crocuta crocuta*), cave bear (*Ursus spelaeus*), woolly rhinoceros (*Coleodonta antiquitatis*), and woolly mammoth (*Mammuthus primigenius*). Along with flint implements, human (*Homo sapiens*) specimens have been found at some of the sites.

With such a diverse fauna present, and evidence of human occupancy at a number of the sites, surprisingly very little research has been carried out on these collections. One human bone from Bob's Cave was radiocarbon dated to 5,035 years before present (yrs BP) (Chamberlain 1996). A small number of fauna has been dated, including reindeer (*Rangifer tarandus*) (9,670 yrs BP) and lynx (*Lynx*

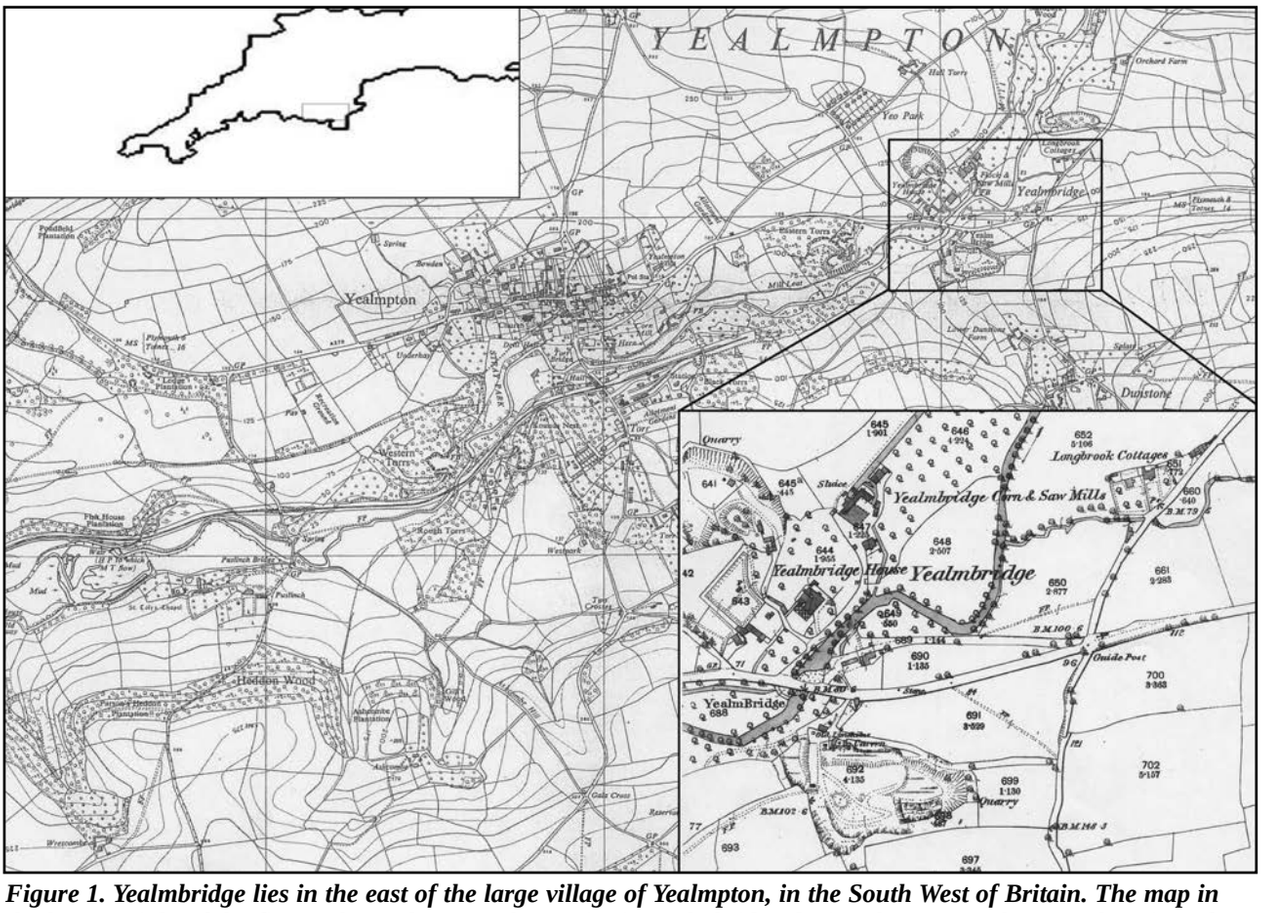

Figure 1. Yealmbridge lies in the east of the large village of Yealmpton, in the South West of Britain. The map in the bottom right of the figure shows the several quarries in Yealmbridge during the 1800s. The exact location of Yealmbridge Cavern is unknown, however, the quarry in the South, just below old limekilns is labelled 'Cavern'. (Large map of Yealmpton from Map of Yealmpton, SX55E, 1954. Map of Yealmbridge from Map of Yealmbridge area, Ordnance Survey, 1887. All maps from Plymouth Libraries.)

lynx) (8,930 yrs BP) both from Shelter Cave (Coard and Chamberlain 1999), and horse (*Equus caballus*) (500 yrs BP) from Kitley No Name Cave and aurochs (*Bos primigenius*) (12,290 yrs BP) from Bobs Cave (Bailey *et al.* 1996). Two publications use the Kitley Estate to assess the potential use of ground penetrating radar to map underground cave sites (Sellers and Chamberlain 1998; Chamberlain *et al.* 2000). This large collection offers a rich source of fresh research into the Pleistocene of South West England.

An enigmatic note

Within this large collection was a very small, but very significant collection of sub-fossil teeth and bones collected from Yealm Bridge Cavern. What makes this small collection so important is an accompanying hand-written note (Figure 2), which reads:

> "Found, in considerable number, in a small cave in a limestone quarry at Yealm Bridge, near Yealmpton, about 60 years since, when the Turnpike Road was altered and the present bridge built.
>
> They were afterwards submitted to the notice of the late Professor Buckland, and named by him.
>
> Large number of bones were on that occasion buried in the foundation of the road by the workmen, before attention had been drawn of their existence" (Bastard 1895)

Here was a collection of 184 teeth and bones from Yealm Bridge Cavern, with a potential link to William Buckland. The collection lay undisturbed for over 150 years until it was re-discovered in Kiley House on 3rd April 1986 (Wright undated). Roger Jacobi visited the Yealm Bridge Cavern collections in 1992, where he made notes about the specimens present (Jacobi 1992) and checked and updated the identification of the specimens (Wright 1992). In the *Catalogue of Quaternary Fossil-Bearing Cave Sites in the Plymouth Area*, the authors list the specimens from Yealm Bridge Cavern and note that "*the bones were apparently excavated around 1830 and were identified to taxa by William Buckland*" (Chamberlain and Ray 1994. p. 56). This small collection has been known about, but the potential significance of its historical importance has been missed until now.

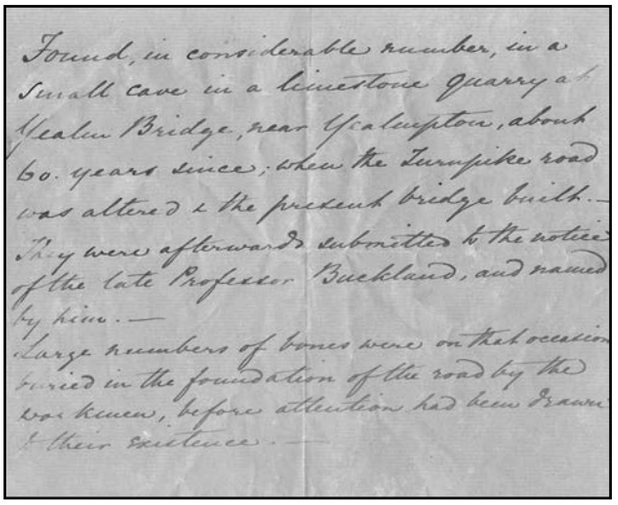
Found, in considerable number, in a
small cave in a limestone quarry at
Yealm Bridge, near Yealmpton, about
60. years since; when the Turnpike road
was altered & the present bridge built.—
They were afterwards submitted to the notice
of the late Professor Buckland, and named
by him.—
Large numbers of bones were on that occasion
buried in the foundation of the road by the
workmen, before attention had been drawn
to their existence.—

Figure 2. The original handwritten note accompanying the Yealm Bridge Cavern Collection. Written by Mrs Bastard of the Kitley Estate. (In the Natural History Archives at Plymouth City Museum and Art Gallery. KC/YBC1)

When the collection came into PCMAG very little information was known: Where was Yealm Bridge Cavern and when was it excavated? Did William Buckland visit Kitley? Who wrote the labels which accompany many of the specimens?

First bone discoveries

Lying on top of Devonian limestone, Kitley Estate has been a site with a rather productive quarrying history in the 18th and 19th centuries. One of the more famous items to come out of Kitley is the Kitley Marble, which is not a marble, but a limestone (Figure 3). An unusual rock with a unique colour made the Kitley Marble a very sought after building stone. It has been used in many buildings, and can be seen in the walls of the Natural History Museum, London (Anon. undated a). Quarrying at Yealmpton also led to the discovery of the iron ore hematite, which has been mined from the sites (Worth 1874).

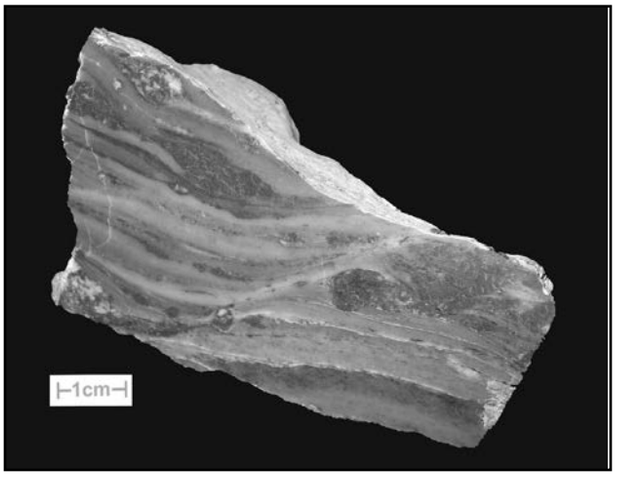

Figure 3. The sought after Kitley Marble used for many buildings in the 1800s. Specimen from the collection at Plymouth City Museum and Art Gallery.

With these incredibly rich limestone surroundings, the Estate has also been a big producer of lime. From 1800 to the mid-1800s, there were a number of working lime kilns on the Estate, producing lime through burning the hard limestone which was essential to fertilise the land so it was less acidic (Anon. undated b). Burning limestone was, of course, thirsty work and part of the workers wage was often paid in cider (Anon. undated b).

The first published note of any sub-fossil finds at Yealm Bridge was made by Dr John Bellamy where he records bones being discovered in Yealm Bridge Quarry in 1834 (Bellamy 1835a; Bellamy 1835b; Bellamy 1835c). Bellamy (1835a) suggests that around 3 cartloads of bones have been lost as a result of quarrying activities. Workers used explosives in 1832 to destroy one suggestively large fissure at nearby Yealmbridge Quarry (Bellamy 1835c) and it is more than likely that others were destroyed prior to this. There have been recordings at Oreston of workmen discarding bones they have found from not fully understanding their significance (Worth 1879), and bones at Yealm Bridge were also destroyed, discarded or lost (Bellamy 1839), including a small number of hyena skulls (Pengelly 1870). Quarrying at Yealm Bridge was used to make the roads by breaking up and crushing the limestone (Anon. undated a), and often the workers would actually use bones to fill in the road (Pengelly 1870).

Although Bellamy was the first to record the discovery of the bone rich caves in the literature, Captain Mudge (later Colonel) appears to have taken the credit (Bellamy 1839). In a paper to the Geological Society, London, Mudge (1836) describes caves at Yealm Bridge in much more detail. And the cave sounded a fair size: with a 'western chamber' going on for 43 feet, and an 'eastern' chamber' going on for at least 10 feet (Mudge 1836). The paper presented includes more details about the layers and different types of deposits along with the thicknesses. Unfortunately, it appears that most of the cavern was excavated without any knowledge of recording, or the importance of recording.

Here was a substantial cavern holding the remains of many animals, including 'hyena', 'elephant', 'rhinoceros', wolf, 'bear', hare, deer and horse (Pengelly 1870). Much has been lost. This collection from Yealm Bridge Cavern held at PCMAG maybe the last surviving specimens from the site.

Who collected these specimens?

It appears both Bellamy and Mudge collected fossils from Yealm Bridge, however, there is no collector information with these specimens now held at PCMAG. There were no relevant records relating to Yealm Bridge and Mudge, or Yealm Bridge and Bellamy at the Plymouth and West Devon Records Office, or in the archives at the Natural History Museum, London. There were also no relevant related records at the British Geological Survey and the Geological Society, London archives.

Bellamy's *The Natural History of South Devon* (1839) includes a great detail throughout about the Yealm Bridge Cavern and the finds which were made. Included in this book also illustrations of fossils of corals, and sub-fossil fauna from Devon. After "Fig. 1. representing the molar of a small species of *Elephant*." Bellamy adds a footnote, which reads:

> "The drawing of this tooth, now at Kitley, was obligingly lent to this work by the Rev. J. Yonge of Puslinch, together with many specimens." (Bellamy 1839. p.438)

This 'elephant' tooth is a young woolly mammoth and is *the* tooth that is in the Yealm Bridge Cavern collections held at PCMAG (Figure 4). Was J. Yonge the collector?

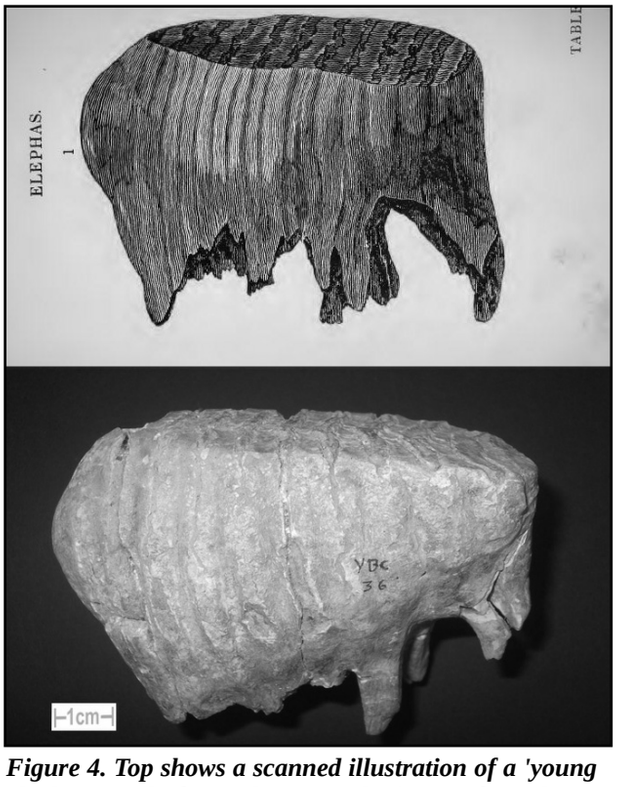

Figure 4. Top shows a scanned illustration of a 'young elephant tooth' from The Natural History of South Devon. (Bellamy, 1839. p. 439). Below is the specimen of the juvenile woolly mammoth (*Mammuthus primigenius*) from Yealm Bridge Cavern collections held at Plymouth City Museum and Art Gallery (PLYMG.2015.1.1.36).

A letter from the archives at Oxford University Museum of Natural History written in November 1835 by Mudge sheds more light (Mudge 1835). The letter is addressed '*My Dear Sir*', however it was certainly written to William Buckland as there was a note relating directly to Buckland's *Reliquiae Diluvianae* (1823) where Mudge writes: "*I mentioned also that you were individually particularly interested on the subject of having an intention of publishing a second volume of the Relique*." (Mudge 1835). Providing a detailed description of the site, Mudge is keen for Yealm Bridge to be included in a second edition of Buckland's *Reliquiae*.

The collector of these bones may in fact have been Mudge accompanied by Mr J. Yonge of Puslinch. Yonge is mentioned by Bellamy in his book on *The Natural History of South Devon* (1839): the note with the plates says the specimens were lent by Yonge. In his letter to Buckland, Mudge mentions the "*tooth of a very young elephant*" (possibly the same one as in Figure 4) which he found along with lots of hyena teeth when he examined the site with Yonge (Mudge 1835).

It would appear that this small collection was collected by Mudge accompanied by Mr Yonge. The specimens were sent to William Buckland to be examined. On their return they were left at Kitley Estate where they lay for 150 years.

Old feuds

In a classic Victorian style feud, Mudge clearly did not approve of Bellamy's excavations. Mudge (1835) writes:

> "…a Mr Bellamy, had helped himself to principle level of the remains found…[and] filled some hampers the most of which he sent to Plymouth".

Mudge goes on to say how

> "these are the gentleman alluded to in [Yonge's] daughters letters as unwilling to confirm what he had collected."

Bellamy, it appears, does not take a fancy to Mudge either. In a short footnote in *The Natural History of South Devon* (1839), Bellamy is none too pleased that Mudge has taken credit for the discovery of the Yealm Bridge Cavern:

> "On September 1st 1835, I published the account of this cavern in the 'South Devon Monthly Museum' with a feigned signature and on March 23rd, 1836, Colonel Mudge, who had in the interim heard of, and examined into the facts, read a memoir on the subject before the Geological Society, in which however, the discovery is ascribed to me. In the Penny Cyclopaedia [sic] Colonel M. in implied as the discoverer!" [Bellamy 1839. p.84)

Wanting to be sure that he is known as the first to discover the Cavern, and perhaps prove that he is more observant and scientific, he adds:

> "....By reference to Nos. 23 and 37 of the 'Edinburgh Journal of Natural History' it will be seen that I have acknowledged two extracts from the Colonel's account in ta new report of my discovery, and have in return, set Colonel Mudge right on some important particulars which I had superior opportunities of becoming aware of." [Bellamy 1839. p.84)

Mudge recognized the scientific importance of the site and the specimens. He is keen to let Buckland know that he wrote to the landowner to try to prevent Bellamy's friends from hoarding specimens which they knew little about and keeping them from scientific knowledge (Mudge 1835). There is also a hint of Bellamy wanting the specimens, and associated glory, for himself, as Mudge writes, *"…the silence of Mr Bellamy the surgeon when a timely announcement…would have earlier attracted your attention…"* (Mudge 1835).

Mudge was very keen to bring the specimens and the site to the eyes of science. As fate would have it, Mudge did succeed. These specimens now held at PCMAG from Yealm Bridge Cavern are the last known surviving collections from this site. It is unknown where the specimens collected by Bellamy and friends currently are.

William Buckland connections

Prior to finding the letter from Mudge to William Buckland in the archives at the Oxford University Museum of Natural History, it was unknown if Buckland visited Kitley Estate, or if the specimens were sent to him. There were no records relating to William Buckland in the archives at the Plymouth and West Devon Records Office to suggest Buckland visited. It is more likely that the specimens were sent to Buckland. Mudge describes how much of the caverns were destroyed and most of the specimens were removed and notes that only a few feet of the cavern is left (Mudge 1835): it is unlikely that Buckland would have travelled from Oxford if there was not much of the Cavern left to see.

An intriguing sentence in the letter written by Mudge suggests this letter may have in fact been sent along with some specimens to Buckland: *"I hope I have made the* [illegible] *honorable by sending a portion to you*" (Mudge 1835). And the accompanying labels with the Yealm Bridge Cavern specimens indicates that Buckland returned the specimens.

There were several hand-written labels associated with the specimens. Two labels were written by Mudge (Figure 5), which were identified by comparing the handwriting with the letter from Oxford (Mudge 1835). Two labels were written very neatly for the woolly mammoth and woolly rhinoceros specimens: the card the labels were written on is the same card as some invitations send out by the Kitley Estate owners (Figure 6) and they may have been written by Mrs W. E. P. Bastard (Wright undated).

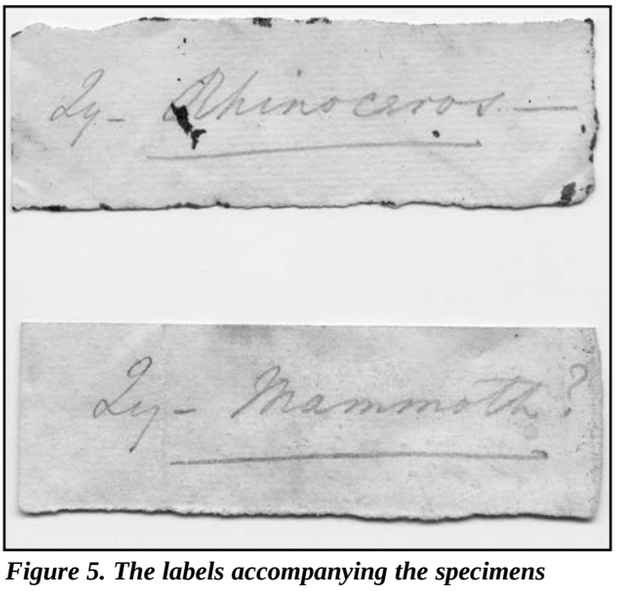

Figure 5. The labels accompanying the specimens written by Mudge. Top: is the label with the woolly rhinoceros molar (PLYMG.2015.1.1.37). Bottom: is the label with the woolly mammoth molar (PLYMG.2015.1.1.36).

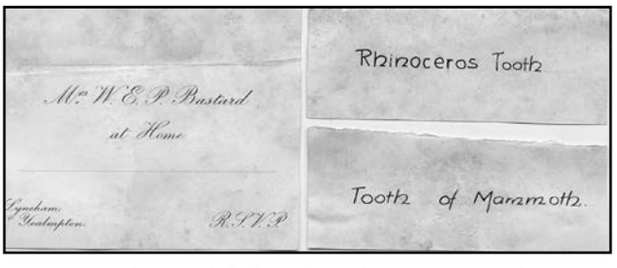

Figure 6. The two labels written by Mrs Bastard to accompany the woolly rhinoceros and woolly mammoth specimens. The card the labels were written on is the same card as some invitations send out by the Kitley Estate.

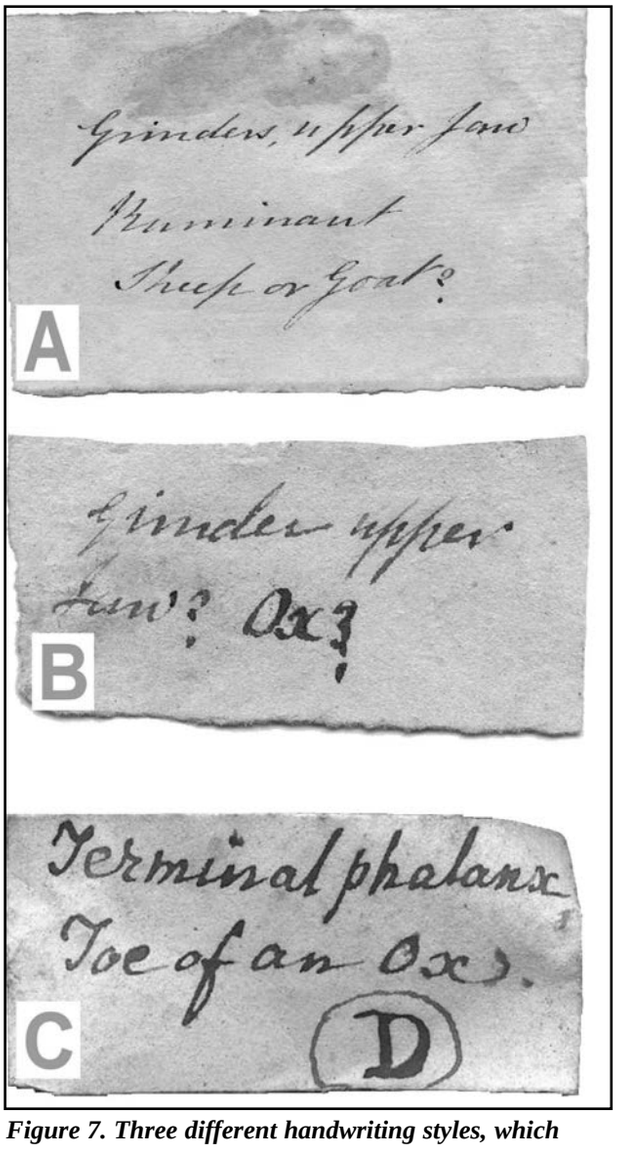

Figure 7. Three different handwriting styles, which possibly come from the same writer. In (A) the 'G' in Grinder is fairly distinct, and is repeated in label (B). In label (B) the 'x' in 'ox' is the same style as the 'x' in label (C), suggesting that the three different labels were written by the same hand at separate times. (All labels in the collections at Plymouth City Museum and Art Gallery. Label (A) is from specimen PLYMG.2015.1.1.118. Label (B) is from specimen PLYMG.2015.1.1.2. Label (C) is from specimen PLYMG.2015.1.1.42.)

There were other hand-written labels that identify a large number of the specimens. It appears that some of the handwriting does match that of William Buckland. Examining several letters from the archives at the Natural History Museum, London, and the Oxford University Museum of Natural History, key letters within words written by Buckland have been identified on the labels. There are three distinctive label types: a number written with a fine nib, several written with a slightly thicker nib and appears the writer is faster, and a small number written on different paper and very neatly (see Figure 7). The three styles can be correlated to

one another, implying the same writer. However, it may be possible that some were written by Mary Buckland, but at present only one set of Mary's handwriting has been checked (Buckland 1834), and the husband and wife team do appear to have fairly similar handwriting. Further detailed analysis on these labels will confirm if they were all written by the same hand or if Mary Buckland assisted in the identifications.

Conservation of the collection

Before the Yealm Bridge Cavern specimens entered PCMAG, the collection had been stored in poor environmental conditions. For over 150 years the wooden box lay in hiding at Kitley House. After it was rediscovered it was then stored in Kitley Museum for 25 years where there was no environmental monitoring and conditions fluctuated dramatically throughout the seasons. Surprisingly, apart from a small amount of mould present, the specimens were in very good condition when they were examined at PCMAG.

All 184 specimens arrived at PCMAG in a wooden storage box. This is the same box that they were in when they were rediscovered in Kitley House in 1986. It is possible this is the box the specimens were in when they were sent to William Buckland. However, there is no evidence written in the Kitley Archives at PCMAG, or attached to the box that this is *the* box sent to Buckland. Inside the box were separate layers that would be pulled out to examine the specimens. Teeth and bones were divided by sections and supported on a thin layer of cotton wool (Figure 8).

Figure 8. The original wooden box the specimens were stored in for over 150 years. It is quite possible that this is the box in which the specimens were sent to William Buckland, but there is no evidence with the box, or in the Kitley Archives.

Retaining the collection within the wooden box was problematic. The box was old and because it was stored in such damp conditions for so long the joints had become loose and it was falling apart. Each internal layer was divided by wooden slats, most of which were broken. With the expansion of the wood from the damp conditions, the internal layers fitted so tightly inside the box that it was very difficult to take out a layer to view the specimens below, especially as the layers did not have any handles. The biggest problem was that several specimens were stored together in one section, increasing the risk of damage to specimens through direct contact (Figure 9).

Figure 9. The box contained 4 layers which could be pulled out. Here several teeth and bones are stored in one section, which could knock against each other and cause damage.

After very careful consideration and discussions with our conservator, it was decided to repack the specimens into new storage. The historically important specimens were potentially at more risk if they remained in the box, even if the box was restored. Photographs of how the specimens were originally stored, along with notes illustrating which specimens were stored where, were documented and attached to the relevant database records as recommended by Sheldon and and Johnson (1995).

Some of the specimens had mould present on them as did a number of the associated labels (Figure 10). The entire collection was moved to a controlled environment to prevent further mould growth (Timbrook 2015). It was decided to remove the mould using cotton wool swabs soaked in 70% IMS and gently brushed over the affected areas. The IMS was used to kill any mould spores preventing re-growth.

All the specimens were placed inside a clear polystyrene box. Pieces of LD45 Plastazote (closed cell cross-linked polyethylene foam) were cut to fit

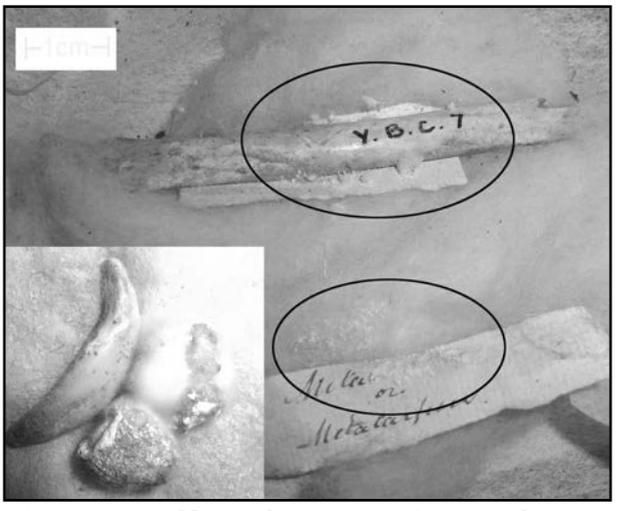

Figure 10. Mould growth on two specimens in the Yealm Bridge Cavern Collection. The accompanying labels also had mould growth.

Figure 11. Examples of the new storage of the bones in clear polystyrene boxes, with specimens sat in Plastazote cut outs. (Left: PLYMG.2015.1.1.110; Right: PLYMG.2015.1.1.133)

the boxes, and then cut around the outline of the specimen. The specimen was then placed in the Pastazote cut out, where it nested securely (Figure 11). The clear boxes protected the specimens against dust whilst also allowing the specimen to be viewed reducing the need for direct handling (Freedman 2011). Drastically different from its original storage, the collection is now safe for future generations.

The Yealm Bridge Cavern fauna

The Yealm Bridge Cavern collection covers 12 identified species with some elements of certain species more abundant than others (Table 1). The specimens were originally identified by William (and/or Mary) Buckland around 1835. In 1992, Roger Jacobi visited the Kitley Estate where he checked and updated the identification of the collection (Wright 1992). Species identifications have been re-checked and confirmed by the author using comparative material at PCMAG, along with Schmid (1972) and Walker (1985).

The species of bear is currently unknown: with only one canine and one molar present, it is difficult to ascertain if they belonged to the cave bear (*Ursus spelaeus*) or the brown bear (*Ursus arctos*). Here it is presented as *Ursus* sp.. This paper identifies the hyena specimens as those from the spotted hyena (*Crocuta crocuta*). Historically European Pleistocene hyenas have been named as a separate species (*C. spelaea*) or sub-species (*C. crocuta spelaea*). Recent genetic research from Rohland *et al.* (2005) demonstrated the continual gene flow through Africa, and is one species, *C. crocuta*.

Although not adding significant species to the faunal list, there are records of many other finds. Worth (1879) notes specimens of hyena, wolf, ox, badger, fox, sheep and birds were given to the Plymouth Institution. Bellamy (1839) notes numerous remains being found: bones of young and old hyena along with abundant coprolites, and 'rhinoceros' was very common, followed by 'elephant' and two or three well preserved hyena skulls. Mudge appears to have sent a number of specimens to Richard Owen and William Clift for identification, and the species list included 'elephant',' rhinoceros', horse, ox, sheep, hyena, dog, fox, wolf, hare, water rat and bird (Mudge 1836). The Yealm Bridge Cavern was clearly once very rich in fossils.

Dating the Yealm Bridge Cavern Fauna

None of the Yealm Bridge Cavern specimens have been radiocarbon dated. The species present can provide information about the time, and the environment, that they lived in when they were alive.

Currant and Jacobi (2001) developed a mammalian biostratigraphy highlighting the key fauna present at British Late Pleistocene sites along with absolute dating. Here key assemblages have been proposed that can only be found in certain times within the Late Pleistocene. For example, the Joint Mitnor Cave mammal assemblage-zone includes recognizable species such as the straight-tusked elephant (*Palaeoloxodon antiquus*), the narrow-nosed rhinoceros (*Stephanorhinus hemitoechus*) and hippopotamus (*Hippopotamus amphibius*). Hippopotamus is the key species for this mammal assemblage-zone, so Currant and Jacobi (2001) propose that sites with hippopotamus correlate to the Joint Mitnor Cave mammal assemblage-zone, dating to around 120,000 yrs BP (Marine Isotope Stage 7). A total of six assemblage-zones are identified: the fauna present being linked to that specific assemblage-zone.

Species	Common name	Element
Canis lupus	Wolf	Phalanx
Vulpes vulpes	Fox	Calcaneus, astragalus, radius (2), metacarpoid (5), phalanx (3), radius frag (2), metatarsus, canine (5), jaw frag. (4), molar, incisor
Ursus sp.	Bear	Canine, molar
Crocuta crocuta	Spotted Hyena	Phalanx, incisor (2), molar (canine), premolar, vertebra, astragalus (2), metacarpal (3), coprolite (4)
Equus caballus	Horse	Molar (9), incisor (2)
Coleodonta antiquitatis	Woolly Rhinoceros	molar
Cervid	Deer	Hoof (3), incisor (3), molar, vertebra, sacrum, astragalus (5)
Cervus elaphus	Red Deer	Incisor (2), tibia, antler frag.
Rangifer tarandus	Reindeer	Phalanx (15), molar (10), vertebra (2), calcaneum (2), metacarpal (3), tibia, radius
Bovidae	Bovidae	Tarsal, hoof (2), molar (2), vertebra, femur frag.
Bos sp.	Ox	Molar, phalanx (2), astragalus
Bison priscus	Bison	Molar, phalange, vertebra
Ovis aries	Sheep	Jaw frag (3), molar (15), humerus
Mammuthus primigenius	Woolly Mammoth	Molar
Rattus rattus	Rat	Incisor (3)
Gnawed fragments (4)	Unknown species	

Table 1. A list of the species and elements present in the Yealm Bridge Cavern fauna held at Plymouth City Museum and Art Gallery.

Species present in the Yealm Bridge Cavern collection (Table 1) correlate to the Pin Hole mammal assemblage-zone, dating between 42,000 and 20,000 yrs BP (Currant and Jacobi 2001). In this assemblage-zone spotted hyena (*Crocuta crocuta*) is one of the most typical species, along with woolly mammoth (*Mammuthus primigenius*), and woolly rhinoceros (*Coleodonta antiquitatis*). The records from the early literature (e.g. Mudge 1836; Bellamy 1839; Worth 1879) along with these important specimens held at PCMAG, strongly suggest a correlation with the Pin Hole mammal assemblage-zone.

On his visit to Kitley Estate, Jacobi noted that the fauna from Yealm Bridge Cavern dated to 'probably 30,000 - 40,000' yrs BP (Wright 1992). Jacobi's theory ties into some key species present. Woolly rhinoceros fossils from Kent's Cavern, Devon have been radiocarbon dated with results ranging from 45,000 yrs BP to 35,150 ±150 yrs BP (Higham *et al.* 2006).

Data suggests that the youngest woolly rhinoceros specimens are found in Scotland, demonstrating that as the tundra environment retreated north to make way to more wooded landscapes, the woolly rhinoceros followed (Jacobi *et al.* 2006). Spotted hyena remains have been radiocarbon dated from several sites across Britain, with the youngest so far dated, dating to around 27,200 yrs BP from Caldey Island, South Wales (Stuart and Lister 2014).

Looking at the fauna present in the collections and published radiocarbon dates, the Yealm Bridge Cavern fauna correlates with the Pin Hole mammal assemblage-zone. The presence of woolly rhinoceros (Figure 12) suggests a date of around 40,000 - 35,000 yrs BP.

The Yealm Bridge Cavern environment

The occurrence of woolly mammoth and woolly rhinoceros indicates a tundra environment, part of the Mammoth Steppe which spread across Eastern Europe through to Russia. Woolly rhinoceros were well adapted for cold tundra type environment with little snow, indicated by their feet which lack padding (Kahlke 1999). They are also adapted to eating low shrubs and grasses, typical of the tundra environment, with their big lips and low slung heads (Stuart and Lister 2012; Shreeve *et al.* 2013). The presence of thick, strong woolly mammoth molars that were adapted for eating tough vegetation also suggest Mammoth Steppe.

Figure 12. The only woolly rhinoceros fossil in the Yealm Bridge Cavern collection, which hints at date for the fauna around 35-40,000 years ago. (PLYMG.2015.1.1.37)

A very small number of elements from spotted hyena are present in the collections, including coprolites (Table 1), which alone does not suggest a hyena den, as it may be the remains of one individual. Four gnawed bones of unidentified species are present, but again this is too little to suggest a hyena den. It is in the old literature describing the first discoveries of Yealm Bridge Cavern where we find strong evidence of use by hyenas.

In his original descriptions of the site, Bellamy (1839) notes that there were well preserved hyena skulls. There were also specimens of young and old hyena along with numerous gnawed specimens (Bellamy 1839), strongly indicating that the site was occupied by a clan of spotted hyena on at least one occasion. Other authors also suggest that Yealm Bridge Cavern was once home to hyenas (Mudge 1836; de la Beche 1839; Murray 1865; Pengelly 1870)

Summary

Discovered in the early 1830s, and first described in the scientific literature in 1835 (Bellamy 1835a; Bellamy 1835b; Bellamy 1835c), Yealm Bridge Cavern once held an enormous amount of sub-fossil remains (Mudge 1839; Pengelly 1870). After obtaining permission from the Kitley Estate landowner, in 1835, accompanied by the Rev Yonge, Mudge collected a number of fossils from Yealm Bridge. It appears very likely that some of these specimens collected by Mudge are the specimens held at PCAMG.

Future work can still be carried out on this small collection. None of the specimens have yet been radiocarbon dated which would provide a more absolute date for this site and more detailed information on this area during the Pleistocene. Presently the accompanying labels have been tentatively identified as being written by William Buckland, but there is a possibility that some may have been written by his wife, Mary: future palaeography work will assist in finding the true hand(s).

At the time of writing the author knows of no other museums holding specimens from Yealm Bridge Cavern. This collection may appear small, but the historical and scientific significance is very big. The story of this last surviving collection of Late Pleistocene fauna from Yealm Bridge Cavern is just beginning.

Acknowledgements

Thank you to Christopher Catling, and all the trustees at the Marc Fitch Fund for providing a generous grant to clean and re-pack the specimens from Yealm Bridge Cavern and fund the research into the history of this important collection. Thank you to Michael Bastard, the owner of the Kitley Estate, and John Wright for their assistance and knowledge on the history of the site and the collection. The following people checked their archives for relevant documents relating to Yealm Bridge Cavern; Anne Morgan and Debbie Watson at the Plymouth and West Devon Records Office; Caroline Lam, at the Geological Society London (Caroline also offered really useful advice on the handwriting); Alison Ksiazkiewicz, visiting scholar at St Andrews university; Eliza Howlett at the Oxford University Museum of Natural History; Kate Tyte in the Archives at the Natural History Museum, London; Kathleen Diston at the Archives and Library at Oxford University Museum of Natural History. Thanks also for additional help from Pip Brewer at the Natural History Museum, London. Trevor Price at the Dinosaur Isle Museum provided information on where may have Thomas Webster's handwriting, and Chris Manias at the University of Manchester gave information on which institutions hold examples of Mary Buckland's handwriting.Nigel Larkin provided useful confirmation of successful treatment to remove mould from specimens. Graham Naylor, at Plymouth Libraries kindly sourced copies of maps used in this paper. Thank you to my enthusiastic volunteer Shirley Ryan for her help re-packing the specimens, and cleaning and organizing the entire Kitley Caves Archives. Thank you to the anonymous reviewer who provided useful advice for developing this paper.

References

ANON. (undated a). Kitley Quarries. Unknown date. In the natural history department archives at Plymouth City Museum and Art Gallery. KA/G/7.

ANON. (undated b). The Limekilns. Unknown date. In the natural history department archives at Plymouth City Museum and Art Gallery. KA/G/8.

BAILEY, J. F., RICHARDS, M. B., MACAULAY, V. A., COLSON, I. B., JAMES, T., BRADLEY, D. G., HEDGES, R. E. M., and SYKES, B. C. 1996. Ancient DNA suggests a recent expansion of European Cattle from a diverse Bovid progenitor species. *Proceedings of the Royal Society of London*. **B263**, 1467-1473.

BASTARD, W. E. P. 1895. Handwritten note about the Yealm Bridge Cavern collections. In the

natural history department archives at Plymouth City Museum and Art Gallery. KA/YBC/1.

BELLAMY, J.C. 1835a. Fossils of the Neighborhood. *South Devon Monthly Museum*. September.

BELLAMY, J.C. 1835b. Fossils of the Neighborhood. *South Devon Monthly Museum*. October.

BELLAMY, J.C. 1835c. Fossils of the Neighborhood. *South Devon Monthly Museum*. November.

BELLAMY, J.C. 1839. *The Natural History of South Devon*. London: Simpkin, Marshall and Co.

BUCKLAND, W. 1823. *Reliquiae Diluvianae*. John Murray, London.

BUCKLAND, M. 1834. Letter to Jonathan Walker: "Dr Buckland begs your acceptance of a restoration of the animals of ancient Dorsetshire…" In the archives at the Oxford University Museum of Natural History, Letters: box 1 /B16.

BURKITT, M.C. 1926. Archaeological Notes. *Man. A Monthly Record of Anthropological Science*. **XXV1**. pp.10-13.

CHAMBERLAIN, A.T. 1996. More dating evidence for human remains in British Caves. *Antiquity*. **70** (270). pp.950-953.

CHAMBERLAIN, A.T. and RAY, K. 1994. A catalogue of Quaternary Fossil-Bearing Cave sites in the Plymouth Area. *Plymouth Archaeology*. Occasional Publication. No.1.

CHAMBERLAIN, A.T., SELLERS, W.I., PROCTOR, C. and COARD, R. 2000. Cave detection in limestone using ground penetrating radar. *Journal of Archaeological Science* **27**, 957-964.

COARD, R. and CHAMBERLAIN, A.T. 1999. The nature and timing of faunal change in the British Isles across the Pleistocene/Holocene transition. *The Holocene* **9** (3), 372-376.

COTTLE, J. 1829.Description of the Oreston Caves, with reflection on their animal contents. *In* Cadel, L.T. (Ed). *Malvern Hills, with minor poems and essays*. 4th edition, London. pp. 478-503.

CURRANT, A. and JACOBI, R. 2001. A formal mammalian biostratigraphy for the Late Pleistocene of Britain. *Quaternary Science Reviews* **20**, 1707-1716.

De la BECHE, H.T. 1839. *Report on the Geology of Cornwall, Devon and West Somerset*. Her Majesty's Stationery Office.

FREEDMAN, J. 2011 Storage of the Radioactive Mineral Collections at Plymouth City Museum and Art Gallery, UK. *Collections A journal for Museum and Archives Professionals* **7**(2), 201-212.

HEDGES, R.E.M., PETTIT, P.B., BRONK RAMSEY, C., and van KLINKEN, G.J. 1998. Radiocarbon dates from the Oxford AMS system. Archaeometry datelist 26. *Archaeometry* **40**, 437-455.

HIGHAM, T.F.G., JACOBI, R.M., and BRONK RAMSEY, C. 2006. AMS radiocarbon dating of ancient bone using ultrafiltration. *Radiocarbon* **48**(2), 179-195.

JACOBI, R.M. 1992. Photocopy of notes made during visit to Kitley Caves on 27th August 1992. In the natural history department archives at Plymouth City Museum and Art Gallery. KA/YBC/133.

JACOBI, R.M., HIGHAM, T.F.G., and BRONK RAMSEY, C. 2006. AMS radiocarbon dating of Middle and Upper Palaeolithic bone in the British Isles: improved reliability using ultrafiltration. *Journal of Quaternary Science* **21**(5), 557-573.

KAHLKE, R-D. 1999. *The history of the origin, evolution and dispersal of the Late Pleistocene Mammuthus - Coelodonta fauna complex in Eurasia (Large Mammalia)*. Fershe Companies. Rapid City. SD.

MUDGE, Capt. 1835. Letter to William Buckland. In the archives held at the Oxford University Museum of Natural History. Eyles Colln/15.

MUDGE, Capt. 1836. On the Ossiferous Cavern of Yealm Bridge, 6 miles south-east from Plymouth. *Proceedings of the Geological Society of London* **Vol ii**, 399-400.

MURRAY, J. 1865. *A handbook for travelers in Devon and Cornwall*. John Murray.

PENGELLY, W. 1870. The Literature of the caverns near Yealmpton, South Devon. *Transactions of the Devonshire Association* **Vol. iv**., 81-105.

ROHLAND, N., *et al.* 2005. The Population History of Extant and Extinct hyenas. *Molecular Biology and Evolution* **22**(12), 2435-2443.

SCHMID, E. 1972. *Atlas of Animal Bones*. Elsevier Publishing Company. Amsterdam.

SELLERS, W.I. and CHAMBERLAIN, A.T. 1998. Ultra sonic cave mapping. *Journal of Archaeological Science* **25**, 867-873.

SHELDON, S.Y. and JOHNSON, J.S. 1995. Conservation of sub-fossil bone. *In* Collins, C. (Ed). 1995. *The Care and Preservation of Paleontological Materials*. Butterworth-Heinmann.

SHREEVE, D., HOWARD, A., CURRANT, A., BROOKS, S., BUTEUS, S., COOPE, R., CROCKER, B., FIELD, M., GREENWOOD, M.,

GREIG, J., and TOMS, P. 2013. A Middle Devensian woolly rhinoceros (*Coelodonta antiquitatis*) from Whitemoor Haye Quarry, Staffordshire (UK): palaeoenvironmental context and significance. *Journal of Quaternary Science* **28**(2), 118-130.

STUART, A.J. and LISTER, A.M. 2012. Extinction chronology of the woolly rhinoceros *Coleodonta antiquitatis* in the context of late Quaternary megafaunal extinctions in northern Eurasia. *Quaternary Science Reviews* **51**, 1-17.

STUART, A.J., and LISTER, A.D. 2014 New radiocarbon evidence on the extirpation of the spotted hyaena (*Crocuta crocuta* (Erxl.)) in northern Eurasia. *Quaternary Science Reviews* **96**, 108-116.

STUART, A.J., SULERZHITSKY, L.D., ORLAVA, L.A., KUZMIN, Y.V., and LISTER, A.M. 2002. The latest woolly mammoths (*Mammuthus primigenius* Blumenbach) in Europe and Asia: a review of the current evidence. *Quaternary Science Reviews* **21**, 1559-1569.

TIMBROOK, J. 2015. Curating ethnographic specimens. *In* Salick, J, Konachar, K, and Nesbitt (Eds). *Curating Biocultural Collections: A Handbook*. 2015. Kew Publishing.

WALKER, R. 1985. *A guide to post-cranial bones of East African mammals*. Hylochoerus Press. Norwich, England.

WORTH, R.N. 1886. Notes on the Early History of Stonehouse. *Journal of the Plymouth Institution*. 1886-1887. pp.371-374.

WORTH, R.N. 1874. Notes on the Limestone of Yealmpton and its Associated Rocks. *Transactions of the Devonshire Association* Vol. **vi**, 703-706.

WORTH, R.N. 1879. The bone caves of the Plymouth District. *Transactions of the Plymouth Institution*. Vol. **7**. 1878-1881. pp.87-117.

WORTH, R.N. 1887. On the Occurrence of Human Remains in a Bone Cave at Cattedown. *Transactions of the Devonshire Association* **19**, 419-438.

WRIGHT, J. 1992. Notes made on Yealm Bridge Cavern bones during visit by Dr Roger Jacobi, Archaeologist from Nottingham University. In the natural history department archives at Plymouth City Museum and Art Gallery. KA/YBC/29-31.

WRIGHT, J. undated Notes on the Yealm Bridge Cavern collection. In the natural history archives at Plymouth City Museum and Art Gallery. KA/YBC/3.

ADDITIONAL INFORMATION ON CHARLES W. PEACH (1800-1886)

by Michael A. Taylor and Lyall I. Anderson

Taylor, M. A. and Anderson, L. I. 2015. Additional information on Charles W. Peach (1800-1886). *The Geological Curator* 10 (4): 159 - 180.

An earlier paper by the authors, on Charles William Peach (1800-1886), notable marine biologist and geologist, is extended and corrected in the light of new information. Peach's family origins and those of his wife are clarified, and information on their children extended. His religious affiliation is identified as Unitarian, helping to explain hitherto anomalous information such as Peach's collecting fossils on a Sunday. Unitarians tended to support science, and their role deserves more attention in the history of 19th Century geological collections, as does Sabbatarianism, which they opposed. Peach made no geological mark in his brief stay at Lyme Regis and his first real impact was in Cornwall. Another notable Cornish naturalist, Jonathan Couch (1789-1870), wrote a private assessment of Peach about 1850, which is republished here. It throws light on Peach as well as on tensions over the discovery and identification of local fossils. Further evidence for Peach's ability to deploy patronage includes a collection sent to Prince Albert, a bequest from his patron Roderick Impey Murchison, and an appeal made to support Peach's daughter Jemima after Peach died. A summary is given of other relevant information, including the presence of Peach specimens in the collection of Hugh Miller (1802-1856), now in National Museums Scotland, and in the Natural History Museum, London, and comments on archaeological and zoological specimens, and his reputed custody of 'Granny' the septuagenarian sea anemone. Further collections research is needed to understand the full extent and evolution of Peach's collection and his labelling practices, which might have evolved in response to the needs of the Geological Survey.

Michael A. Taylor, Research Associate, Department of Natural Sciences, National Museums Scotland, Chambers Street, Edinburgh EH1 1JF, Scotland, and Honorary Research Fellow, Department of Museum Studies, University of Leicester. Email mat22@le.ac.uk; disambiguator: http://orcid.org/0000-0002-1495-8215; and Lyall I. Anderson, Honorary Research Fellow, Department of Museum Studies, University of Leicester. Email lia3@le.ac.uk. *Received 13th November 2015. Accepted 1st December 2015.*

Introduction

Anderson and Taylor (2008) reviewed the life and work of the notable fossil collector and marine biologist Charles W. Peach (1800-1886), alongside an account of his collection of Scottish plant fossils in National Museums Scotland. We were then unable to make much sense of Peach's religious affiliation. In the present paper, we report further research on Peach's family history and background which clarifies this aspect. We explore the implications for his scientific work, and also report new findings on Peach's work in Cornwall; Peach's use of patronage; and miscellaneous topics, including portraits, fossils from Eathie, and the evolution of his specimen labelling style. This paper should be used in conjunction with the 2008 paper. We also draw attention here to three other publications, an obituary by Dixon (1887), a biographical entry on Peach by Finnegan (2004), and a paper on Peach's friendship with the poet Alfred Tennyson, including Ben Peach's conviction that the original 'passion-flower at the gate' in 'Maud' was that in the Peaches' garden (Anderson and Taylor 2015).

Archival sources and repository abbreviations: unless a published source is given, all birth, marriage, census, electoral roll, death and probate information is from the usual records, accessed via www.ancestry.co.uk, www.familysearch.org, www.probatesearch.service.gov.uk and www.scotlandspeople.gov.uk (more specific references are given when necessary). CUL, Cambridge University Library; NHMUK, Natural History Museum (formerly British Museum (Natural History)), London; NMS, National Museums Scotland, Edinburgh; TRC: Tennyson Research Centre, Lincoln Central Library, Lincoln.

Family history

The increased availability of documents and local newspapers online has enabled us to carry out further research on Peach and his family, which provides important evidence for his Nonconformist affiliation. The known problems with researching such affiliations in the early 19th Century make it necessary to go into family history in some detail. This does, however, provide a fascinating insight into Peach's early life.

Charles Peach was born at Wansford, then in Northamptonshire, on 30 September or 12 October 1800[1] to the saddler Charles William Peach (c. 1777-1826) and his wife Elizabeth Vellum (c. 1772-11 June 1810), 'both of a yeoman stock' (Anon. 1826; Bonney 1895; inscription on their gravestone, Wansford churchyard, www.findagrave.com, items 83238583 and 83238435, accessed 2 November 2015). Charles senior was baptised in the Abbey Church (Church of England) at Thorney in 1777. He became a small farmer and, sometime around 1810, innkeeper in Wansford, where he was latterly also postmaster (Smiles 1878, p. 240; local newspapers on www.britishnewspaperarchive.co.uk, searched September 2015). Elizabeth was baptised at Crowland, again in the Church of England, in 1772 and died in 1810. Her husband remarried in 1812 (Anon. 1812) to a Sarah Wilson. This is one possible reason why his son Charles was sent to school at Folkingham in Lincolnshire from 1812 till 1815. The younger Charles then worked at home till he left in 1824 to become a coastguard in north Norfolk. Charles senior died in 1826. Genealogical sources and trawls in the local papers show that his wife continued to run the pub which was taken on, after her death in 1834 (Anon. 1834), by her son and our Charles's stepbrother Thomas (1814-1860). The business latterly also included a butcher's shop (Anon. 1854b). At this time Thomas's brother Charles was appearing in the newspapers as a notable naturalist. Charles was sometimes described in local newspapers as the brother of Thomas Peach of Wansford - for instance in accounts of the 1844 meeting of the British Association for the Advancement of Science (Anon. 1844a). Around this time, at least, he was making donations of such things as minerals and zoological material from Cornwall to the museum of the Institution at Stamford near Wansford which was 'greatly e[nrich]ed by Mr Peach's presents' (Anon. 1844b, 1844c, 1846). After Thomas died in 1860, his wife Mary carried on as innkeeper till her own death in 1873 (Anon. 1860b, 1873; 1861 census). She had originally come from Collyweston, and their children Thomas Edward and Mary, now Mrs Ward, were still living in the area in the 1881 census (at Peterborough and Leicester, respectively). This corroborates Anderson and Taylor's (2008, p. 403) suggestion that Charles's collecting of fossils at Collyweston, on the eve of his 75th birthday, was linked with his presence in the area for a family reunion. However, this might also have been the occasion which prompted Peach to comment in a letter a few years later, in 1878, to his friend William Pengelly (1812-1894), that 'I have wept as I walked up the street of my native village, no one knowing me to say, "Charles, how do you do?"' (Pengelly 1897, p. 254). The 1861 census recorded Charles's son Ben Peach visiting one Charles Bodger, draper of Huntingdon, who was born at Thornhaugh and whose mother was Mary Ann Peach, undoubtedly a sister of Charles (Nicholas Shillaker, pers. comm. 2015): presumably Ben was having time off from attending the Royal School of Mines (or was doing some fieldwork in his ancestral terrain).

The pub where Charles the naturalist spent much of his childhood and early adult life was The Marquis of Granby (here named perhaps for the first time in the Peach literature). It fronted onto the then Great North Road, where this main road from London to Edinburgh crossed the east-west Leicester-Peterborough road (today, both routes bypass Wansford) (Figures 1, 2). It seems to have been a beer house, rather than an elite coaching inn comparable to the Haycock on the other side of the River Nene. From the brief references and the perhaps telling omission of its name in Peach's biography (Smiles 1878, p. 241), one gets the impression it was something of a boozer. This is perhaps corroborated by the early deaths of Charles's father, his brother Thomas and nephew Charles William (c. 1835-1862), and the great obesity of the latter pair. Nephew Charles's death made the *Gentleman's Magazine*; weighing in at 27 stone, he was called the second Daniel Lambert (Anon. 1862; Daniel Lambert (1770-1809), in his time the fattest man in England, had lived in nearby Stamford). His father Thomas had been even fatter though this was perhaps because he had been bedridden for several

[1] 30 September is given, for instance, by Oldroyd (2004), presumably from Bonney (1895). Thomas G. Bonney (1833-1923), petrologist and Cambridge don, used 'private information', possibly from Peach's son Ben, also a geologist, and obituaries, and it would be odd if Peach's children did not know their father's birthday. However, FreeREG, apparently based on the original Wansford church register, shows Peach's birth on 12 October and baptism on 6 November (http://freereg2.freereg.org.uk/, accessed 23 November 2015). We leave the matter open as we have so far been unable to check it against an image of the original register.

Figure 1. The only known photograph of Charles Peach's late childhood and early adult home, the Marquis of Granby inn at Wansford, before demolition. The photograph is taken from the London road where it slopes southwards behind the photographer to the bridge over the River Nene. This was once the main road between London and Edinburgh. The churchyard wall is just visible on the left, with the Leicester road and then the Mermaid Inn behind. The Marquis of Granby is partly visible behind the houses on the right, though this is not very clear in the photograph as the Peterborough road to the right is concealed by the change of slope and the staggering of the junction. (Houses on the right with dormer windows are on this side of the Peterborough road.) This was a nasty junction in stagecoach times and was even worse in the early motor-car days of the 1920s when an Automobile Association patrolman was permanently stationed here to deal with the Mr Toads of the day. He may be the uniformed figure in the photograph. From an old postcard, courtesy Paul Young.

years before his death, because of a traffic accident (Anon. 1860a, 1860b). Peach's lifelong abstinence or temperance, which allegedly did not please his family, was in reaction to the drinking habits of those in the pub and (in fairness) the village as a whole. This shows a certain bloody-minded self-will or, as Smiles (1878, p. 241) put it in High Victorianese, 'a proof of moral courage at an early age'. This is perhaps also reflected, in Smiles's portrayal, by Peach's brisk way with smugglers in later years. One wonders if Peach would have been very sorry to learn that both the Marquis, by now just a butcher's shop and slaughterhouse, and the Mermaid Inn opposite, were demolished in 1938 (Figure 2). This was to widen the lethal crossroads and create a new village green, and the site of the Marquis of Granby is now tarmac and grass (Gilbert 1982, p. 9; Stuart-Mogg 2007, pp. 25-28; David Stuart-Mogg, pers. comm. 2015).

We were unable in our 2008 paper to identify the origins of Jemima Mabson, Peach's wife. We later found that her place of birth was transcribed on ancestry.co.uk from the 1871 Scottish census as

Figure 2. The Marquis of Granby being demolished in 1938 to open up the crossroads. This photograph was previously labelled as being of the Mermaid Inn opposite, but it is clearly of the Marquis given the location, which can be matched from the buildings to the front right and in the distance, which survive today. The photographer is standing just outside, or perhaps in, the churchyard, and looking northeast. The A1 runs from far left to near right, the Leicester road to the near left in front of the picket fence, and the Peterborough road to the right distance. The dormer window on the right is visible in Figure 1. Courtesy Paul Young, from an old and now unidentifiable newspaper photograph.

'Ratford north Inverness[shire]'. In combination with the 'Presbyterian' baptism of their son Benjamin (the first) in 1831 (on which see below), this had us wondering whether Charles Peach had married one of the Scots fisherfolk who migrated annually round the coasts of Britain with the herring fleets to process their catch. In fact, this is an object lesson in the need always to check the original document in case of modern transcription errors in the online data. The careless compiler of the 1871 Scottish census had, unnecessarily, but helpfully, actually written 'Hertford[shire] - North Mims' (other Scottish censuses correctly state just 'England'). So we can now identify Jemima as the daughter of James Mabson, farmer, of 'North Mims' (presumably *recte* North Mymms), Hertfordshire (confirmed by birth certificates for her children William, Jemima and Henry, Protestant Dissenters' Birth Registry, 1824-1837, Dr Williams's Library, certificates 9749-9751). Jemima's father James Mabson (1775-1841) was born in Kelsale, Suffolk, and married her mother Jemima Mills (c. 1783-1824) there in 1801, but this is a long way from Cley-next-the-Sea in Norfolk where the Peaches married on 26 April 1829 and where Jemima was then said to be 'of that parish' and 'of Cley' (Anon. 1829a, 1829b). In the 1841 census Jemima was being visited by (almost certainly) her sister Adaline, or Adeline, Mabson, born in 1823 to James Mabson and his 'late' (by November 1828) wife Jemima now of Sutton Valence, near Maidstone, Kent. Adaline and her probable sister Caroline, aged 5 and 12 years, had been baptised on 18 November 1828 and 31 December 1833 in the 'Independent' Ebenezer Chapel at Sutton Valence. Reinforcing the link, Nicholas Shillaker (pers. comm. 2015) pointed out that Charles Bodger's sister (and Charles Peach's niece) Jemima married one Reuben William Tavener whose father Charles Tavener married thirdly Caroline Mabson, of Kent, daughter of James Mabson, in a wedding witnessed by Jemima M. Peach, surely Caroline's niece and our Charles's daughter, in Marylebone parish church, London, in 1863.

New information on Charles and Jemima Peach's children resolves some anomalies and gaps in Anderson and Taylor (2008), and corroborates what is known of the movements of the family. The ninth child remains untraced: perhaps stillborn.

- The full name of the eldest son, Charles William Peach, is confirmed. He was baptised on 20 February 1830 at Cley-next-the-Sea, Norfolk, where the family were then resident. He died at Newcastle, Northumberland, New South Wales, Australia, on 14 February 1856 (Anon. 1856e, 1856f).
- Benjamin Neeve Peach (the first) is confirmed as born at Beer, Devon, on 1 or 10 February 1831 (register entry dated 28 February 1831, Higher Meeting (Presbyterian), Sidmouth, 1753-1836; the date is unclear). His death is untraced, but presumably before the 1841 census, and his younger namesake's baptism in 1842.
- William Betts Peach, born on 24 January 1833, must be the gold 'miner' in Australia of that distinctive name listed on the 1856 electoral roll for Victoria (Talbot, Carisbrook Division), as resident at Maryborough (Anon. 1856d).
- There are entries for William and his younger two siblings Jemima Mary and Henry Thomas in the Protestant Dissenters' Birth Registry, 1824-1837 (Dr Williams's Library, certificates 9749-9751) which were evidently compiled simultaneously and retrospectively in April 1837. Those indicate a Nonconformist affiliation (but give no more detail). They confirm that, as we stated (2008), Jemima and Henry were born at Gorran Haven, in 1834 and 1836, respectively, as shown by the witnesses who signed them - a 'surgeon' from nearby Tregony and a 'nurse' named Jane Real, which is the name of the wife of the fisherman living next door to the Peaches in the 1841 census. *The Alphabetical Register of Births at Dr Williams's Library* has a series of consecutive entries for the three, evidently compiled retrospectively in 1837, which states that they were all born in Torquay. However, this must conflate the data for William with that for the other two.
- Henry Thomas Peach, born on 7 April 1836, died at Fowey on 23 November 1845 (Anon. 1845a, 1845b).
- Greenly (1928) and Mendum and Burgess (2015) give biographical accounts of Benjamin Peach (the second) which include his early days.

We wondered if William's and the younger Charles's going to Australia in the 1850s gold rushes was to do with Peach's patron Roderick Murchison's continued pronouncements in favour of gold mining in Australia - however scientifically ill-founded they were in hindsight as well as to some at the time (Stafford 1989). However, the brothers' original intentions, or perhaps more likely their parents', had seemingly been more boringly sensible. Their father wrote to Adam Sedgwick, from Wick, on 21 June 1854:

> I am delighted to tell you my two sons are doing well in Australia although not digging Gold they are sending money both being in the Government Service in Victoria, both having the confidence of their Superior Officers & both rising in their offices. (CUL Add. 7652, II/X/80)

But sadly Charles died in Australia as noted earlier. This Australian connection must surely be the origin of the apocryphal legend amongst some descendants that Charles his father was a 'famous geologist, known as the "Father of modern geology" [... and that] he left England for Australia and bought a mine called the "Mother Lode", where he discovered the largest gold nugget (now the second largest) that currently sits in a glass display case in the Victorian Albert Museum in London' (from the http://peachfamilyhistory.webs.com/famouspeaches.htm site, now, 2015, defunct). William himself seemingly did not find enough gold to make much difference. By the 1861 census he was in London, boarding with a Dundee-born couple in Clerkenwell, and working as a 'Commission Traveller', and by the 1871 census he was married with a position as a Customs clerk (almost certainly obtained with his father's help). William was certainly not wealthy at the time of his death in Edmonton, Middlesex, in April 1907, with an estate worth just £26.

Religious affiliation, the Unitarians, and geological collections

In our first paper, we were unable to make any definite remarks about Charles Peach's religious belief and affiliation, which is a significant deficit in any biographical account, and doubly so if the subject is a Victorian geologist. We can now show that Peach 'was a member of the Unitarian Church', as noted by a fellow Cornish naturalist in 1850 (Couch in Wheeler 1983, pp. 119-120; quoted in full below). This is confirmed by the Cornish-born Canadian astronomer Andrew Elvins (1823-1918). Some time in the early 1840s, as a young lay preacher for the Bible Christians (a West Country offshoot of Wesleyan Methodism), Elvins was preaching at Gorran Haven. Here he met Peach who took him home to dinner and showed him his cabinet of geological specimens. The deeply impressed Elvins 'received a new impetus in his scientific studies; and afterwards, when he learned that Mr. Peach was a Unitarian, his admiration was doubled for the man who could receive one so kindly after he had roundly denounced his religious views' (Chant 1918, p. 100). It is all the more significant that Peach was a Unitarian, because he was not born into a Unitarian family (there is no sign of any nonconformist, let alone Unitarian, affiliation among Peach's parents and immediate relatives, who all seem to have been Church of England). He plainly made the decision to become one. Yet Unitarians were rare (in 1851 about 0.6% of the churchgoing population on one estimate; Anon. 1854a, table A). Moreover, Peach plainly remained Unitarian to the end of his life. When his wife died in 1882, her funeral was conducted by the Rev. Robert Blackley Drummond (c. 1828-1921), minister at St Mark's Unitarian Chapel, Edinburgh (Anon. 1882b). When Peach himself died, he was described in two Unitarian journals as 'certainly one of our Unitarian Worthies, and a most kind-hearted philanthropist', and 'an earnest Unitarian, a member of the congregation of St Mark's', while a third listed him among 'leading laymen who were distinguished for their fidelity to Liberalism, both in religion and politics' (Anon. 1886b, 1886c, 1887a). (Hugh Barlow (pers. comm. 2013) noted the similarity of name to the notable Unitarian minister Charles Peach (1862-1943), who however does not seem to be closely related to our Peaches, if at all.)

The Unitarian Church was (and remains today) one of the varied Christian denominations in England and Wales collectively called Dissenters, and latterly Nonconformists, which refused to accept the authority of the State religion of the Church of England (Webb 1986; Smith 2006). Unitarians espoused 'rational dissent', emphasising individual thought, and discouraging uncritical faith whether in priestly ritual or in the literal reading of the Bible. One distinctive element (and the reason for their name) was a rejection of the doctrine of the Holy Trinity. Unitarians regarded Christ as a lesser figure than all-powerful God, and perhaps even as wholly human rather than divine. This was a breach of the religious doctrine of the English state, and Unitarianism was therefore legally defined as blasphemy and banned till 1813.

It is not quite clear when Charles Peach became Unitarian. One obituary (Anon. 1886a) said that Peach had been 'for a great number of years' a member of the Unitarian Church and that 'a Unitarian tract which fell into the hands of Mr. Peach more than half a century ago [i.e. before 1836] was the means of identifying him with our views, for he said after reading the tract, "These have all along since I could think have been my religious views." He then resided thirty miles from a Unitarian place of worship. Notwithstanding this he did at times attend.' This is not much help as it could fit Wansford (just over 30 miles from, at a guess, the Unitarian chapel at Leicester), or his coastguard stations in north Norfolk (a little less than 30 miles to the chapel at Norwich). There is also some question about when Charles could publicly admit to being Unitarian. Even in 1824 Charles's employers might have frowned on any Unitarian affiliation, the church having very recently been viewed as linked with dissent, radicalism, and opposition to Church and

State. On the other hand, they might be very glad to have an eminently respectable subordinate who could be relied on not to fraternise in pubs with the more disreputable natives (and potential smugglers) wherever he was stationed.

That Peach had moved to Unitarianism, or at any rate Nonconformism, by 1829 is suggested (though not confirmed) by marriage to Jemima Mabson (who, as we have seen, was born into an Independent dissenting family). Did they meet at Sunday chapel? But we now run into the problems of researching such affiliations in early 19th Century England. The Peaches' marriage was in the Church of England, but perhaps simply because that State church held a monopoly of marriage till 1837. The baptisms of their children are a safer guide to true affiliation, but are hard to interpret because of patchy records and because they might have followed Jemima's views rather than Charles's, or more simply, they might have been determined by what was available in the area. In country places there might not be any Unitarian congregation within a reasonable distance. In 1830, the Peaches' son Charles was baptised in the parish church at Cley-next-the-Sea, but this might have been to do with the distance from the nearest Unitarian congregation in (probably) Norwich. This issue is complicated by the doctrinal drift of some individual Dissenting congregations. Moreover, many Unitarian congregations had nominally, but prudently, claimed to be Presbyterian during the years of the ban, and could now discard this cloak when Unitarianism was legalised in 1813 (Smith 2006). In 1831, when the family was at Beer, the first Benjamin was baptised at the 'Presbyterian' Higher Meeting at nearby Sidmouth. We had assumed (Anderson and Taylor 2008) that this congregation was indeed Presbyterian, but in fact it had become overtly Unitarian by 1820 (Murch 1835, pp. 347-348; Gordon and Mercer, 2004; Hugh Barlow and Robert Crick, pers. comm. 2013; the 'Higher' was probably to distinguish it from the Marsh Independent Chapel down by the sea). The geologist Charles Moore (discussed below) was likewise born into a nominally Presbyterian, but in fact Unitarian, congregation at Ilminster (Murch 1835, 229-237; Torrens and Taylor 2004). It is hard to draw conclusions from the incomplete records of the baptisms of the Peaches' later children, except that three of them in Cornwall (see above) were recorded centrally as Nonconformist (but not what affiliation). This probably reflects the fact that Cornwall only had two organised Unitarian congregations, both on the Fal estuary some way from where the Peaches lived (Ruston 1989). It remains an open question whether the Peaches compromised by using a more local Dissenting chapel. In Scotland Unitarians were again few and far between, outside the cities and larger towns of the south, and it is not yet known what the Peaches did in Peterhead and Wick.

We had wondered if Peach's Unitarianism was only token, a socially acceptable excuse for not attending the local parish church. But plainly we should take it seriously. Unitarians tended to be well educated (their religion being rather more intellectual than some) and better off than most Dissenters. Peach cannot be called well educated, at least in a formal sense, or well off. But the doctrinal liberalism of Unitarianism, as well as the need to have some courage to adopt a contrary view to what others thought, certainly match what little we had found out about Peach's religious views (Anderson and Taylor 2008). His criticism of the rigidly religious fits well, as do his Sunday fossil-hunting (cf. Unitarian opposition to Sabbatarianism, see below) and his abstinence from liquor (cf. Unitarian support for temperance, Webb 1986, p. 25). Interestingly, Peach's Cornish friend William Pengelly (1812-1894), the noted cave geologist, who became a Quaker, was also a teetotaller (Bishop 2004).

It is significant, moreover, that Peach was Unitarian for much, perhaps all, of the period during which he was an active naturalist and geologist. A major theme of recent research has been the relationship between religion and science during the 19th Century (for this paper, and concerning Unitarians, we used especially Raymond and Pickstone 1986; Webb 1986; Klaver 1997; Brooke 2004; Helmstadter 2004; Wood 2004; Cantor 2005; O'Connor 2007a, 2007b; Kölbl-Ebert 2009). It has for some time been clear that this is no simple story of religion versus geology, but that Christians were themselves split in their attitudes to geological findings on the age of the Earth, evolution, and the origin of humans, versus literal readings of the Bible account of creation in Genesis. It is also now clear that the balance between the various views differed between the various English churches. Unitarians and the Society of Friends (also known as Quakers) tended to be more positive about science, compared to Congregationalists (the later term for Independents), Baptists and Methodists. Some of this seemingly arose from different levels of education. Unitarians and Quakers tended to be better off, and so better educated and more familiar with scholarly thinking on such things as the literal truth of the Bible. Maybe, also, Unitarians were simply less discouraged than, say, Congregationalists from taking an interest in geology because of apparent conflicts with the Bible. However, there were also specific doctrinal differences which

contributed to a positive outlook on geology. The Unitarians emphasised 'rational dissent' and the use of reason in all fields of knowledge, and traditionally regarded science as useful and broadening the mind. The Quaker concept of the 'Inner Light' put emphasis on personal experience, as in the direct appreciation and study of nature.

Of course, those statements are only relative. Some Unitarians and Quakers did not have much confidence in the moral benefits of science (e.g. the Unitarian missionary quoted by Secord 2013, p. 129), and others were actually unhappy with modern geological and evolutionary thought, while some members of other denominations took geological findings seriously. For instance, the geologists William Conybeare (1787-1857), William Buckland (1784-1856) and Adam Sedgwick (1785-1873) all held positions within the Church of England, and, of course, the latter two taught geology as part of their jobs, the Universities of Oxford and Cambridge being primarily Anglican organizations. And the noted Congregationalist John Pye Smith (1774-1851) wrote a book to encourage fellow members of his church to accept the findings of geology (Helmstadter 2004). Yet it is highly relevant that two major reinterpreters of geology and biology had Unitarian links. Charles Lyell became an Unitarian in later life, and Charles Darwin came from a mixed liberal Anglican and Unitarian family (Browne 1995, pp. 12, 21, 244; Klaver 1997, pp. 75-84; Herbert 2005, pp. 187, 193; Desmond and Moore 1991, 2009). This correlation of Unitarianism with support for science is, of course, statistical and does not prove or predict anything about a single person such as Charles Peach, but it is a useful indicator. There remains, of course, the question of whether it was being a Unitarian which encouraged someone to be interested in science (or the other way round) or whether both arose from a certain attitude of mind, as we suspect for Peach.

The example of Charles Peach raises the question of whether Unitarians had a disproportionate role in making geological collections, and establishing the museums and other institutions which supported those collections. There is certainly suggestive evidence elsewhere in the West Country. Unitarians were a small minority in Bath (just over 1% of church attendees in the 1851 religious census). Yet one of the greatest Somerset fossil collectors, Charles Moore (1815-1881) of Ilminster and then Bath, was a Unitarian, active in the work of the Bath congregation, and two successive ministers to this congregation, Joseph Hunter (1783-1861) and Jerom Murch (1807-1895), were key supporters of the Bath Royal Literary and Scientific Institution, with its fine geological collection provided in large part by Moore (Anon. 1881a, 1881b; [Murch] 1881; Godfrey 1983; Kolaczkowski 1995, 1996; Copp *et al.* 2000; Torrens 2005). Intriguingly, 'museum studies', whatever they were, were said to be part of Murch's student curriculum at the University of London (Kolaczkowski 1995). Another Somerset geologist, the Rev. William A. Jones (1818-1873), was a Unitarian minister at Taunton, where he was for many years Secretary of the Somerset Archaeological and Natural History Society, which held another important Somerset natural sciences collection (Rabson 2009, 2015). And in Bristol the noted Unitarian Rev. Lant Carpenter (1780-1840) was a key figure in establishing the Bristol Institution for the Advancement of Science, Literature and Art, and thereby its descendant the City of Bristol Museum and Art Gallery (Neve 1983; Taylor 1994). His son, the biologist William B. Carpenter (1813-1885), certainly knew Peach, though most probably through their common scientific interests rather than shared Unitarianism; for instance, he advised Peach on buying a microscope (Nuttall 2004).

Much of this is no doubt to be expected when Unitarians and Quakers were relatively strongly represented in local elites with substantial disposable income. And some of that activity, at least by others, was specifically targetted not at the geological side of museums, or even at museums in general, so much as at wider civic improvement and the creation of non-sectarian arenas for social and intellectual activities. In any case, plenty of museum founders and fossil collectors were not Unitarian, simply because of the variety of attitudes to science within the other churches, but also because there were so many more non-Unitarians than Unitarians. The Norfolk cleric with a fine collection of local fossils, who encouraged the young coastguard Peach to take an interest in natural history, was an Anglican curate, the Rev. James Layton (1780-1859), then of Catfield (Woodward 1833, p. 31; Smiles 1878, pp. 242-243; Anon. 1882a; Venn 1951, p. 120). Moreover, fossil collecting could be decoupled from the theoretical interpretation of the results, so that a liberal attitude to the relationship between geology and Genesis was not needed. One need only consider the Rev. George Young (1777-1848), Presbyterian minister of Whitby. He was a keen collector, fossil dealer, and activist in the establishment of the Whitby Literary and Philosophical Society and its Museum - but also a biblical literalist, as his publications show (Knell 2000; O'Connor 2007a, 2007b). Nevertheless, the role of Unitarians in creating and maintaining geological collections seems well worth further

attention, following work already done on the Society of Friends, perhaps the closest to Unitarians within the Dissenting realm (Weindling 1983; Torrens 2009).

Peach's story raises another, and seemingly surprisingly neglected, question concerning the interaction of religion and geology during the middle and later decades of the 19th Century in Britain. This period saw a rise in Sabbatarianism, the doctrine that Sunday was a holy day and that neither work, recreation nor pleasure should take place on it, lest God (for instance) strike down the British for their sin in breaching the Sabbath (Wigley 1980). Sabbatarianism must have been a severe constraint on natural history and geology, particularly for the less wealthy who had to work during the week, as Saturday was usually a working day. Of course, many naturalists willingly shared this belief. But militant Sabbatarians tried to impose their beliefs on others. For instance, they prosecuted the organisers of a highly respectable evening lecture for illegally conducting an entertainment, simply because the audience had laughed at a comment by the speaker (Barton 2014). Sabbatarians forced through new legal measures, such as the banning of Sunday trains, which in itself made field trips much more difficult for the less wealthy; Peach, for instance, depended on trains for his field work (Anderson and Taylor 2008). Sabbatarianism was unpopular and actively opposed by many people, including many Christians. They thought it uncharitable and inhumane to make life unpleasant and difficult for those who had to work on the other six days in the week and had only Sunday for recreation. Nevertheless, another triumph of legislative sabbatarianism was the closure of museums and libraries on Sundays (Wigley 1980). Some of those institutions were therefore forced to open on weekday evenings to give the working classes some chance to visit, despite the cost, dirt and fire risk of gas lighting (Swinney 1999; Swinney and Heppell 1997). But social pressure and custom were also important forms of Sabbatarianism. Robert Dick’s only clear day for fieldwork was Sunday because of the pressure of work in his bakery, but had trouble with his fellow townsmen over this, as he complained to Peach (Smiles 1878, pp. 267-269). Notably, Dick seemingly felt Peach would sympathise, and this is certainly consistent with our previous finding that Peach occasionally went fossil-hunting on Sundays even after he was retired and could do so on other days of the week, as the labels on his fossils show (Anderson and Taylor 2008). This had puzzled us as it seemed odd for a Presbyterian (as we had thought him) in Scotland at the time. However, it makes much better sense for a Unitarian. Unitarians were prominent in the coalition which formed in opposition to Sabbatarians and in favour of a more recreational Sunday (Wigley 1980). So here is another way in which Unitarians played a role in the history of museums and collections.

Rather surprisingly, there seem to be no studies of the impact of Sabbatarianism on 19th and early 20th Century geology and natural history. There do exist a number of contemporary anecdotes. Archibald Geikie (1835-1924), for instance, had several stories, including the time he nearly died of exposure in Scotland thanks to uncooperative locals who would only have retorted that it was all his fault for going on fieldwork on the Sabbath (Geikie 1904, especially pp. 128-131). Nevertheless, a great deal must have remained unsaid. Some would have seen no need to justify or even mention what was obvious to them - Hugh Miller, for instance, would have had no doubt about preserving the Sabbath (Knell and Taylor 2006; Taylor 2007). But many others, even the unsabbatarian, would have kept quiet about their Sunday activities, and avoided bringing a sensitive and controversial issue of religion into the neutral ground of natural history. It was already difficult enough to maintain a respectable image for natural history in an era when merely meeting in a pub's function room could seriously damage the reputation of a working men's botanical club (Secord 2013).

Charles Peach, Mary Anning and Lyme Regis

As Anderson and Taylor (2008) noted, Peach was a coastguard stationed at Charmouth and Lyme in 1830-1831, at a time when Mary Anning and other collectors were making major finds in the Lias rocks there (Torrens 1995). This raises the questions of whether Peach attended the Independent Chapel (in fact, Congregational) at Lyme Regis and whether he met Mary Anning, for this was her family place of worship at least till later life (Torrens 1995).

Peach's stay in Lyme Regis at Charmouth was brief, lasting only a few months (Smiles 1878, p. 244). Still, it would be surprising if Peach did not meet Anning on the beach, which he would have patrolled both for his official duties and for his natural history interests. He might have been kept busy at this station, which at least at some times in this period was short-handed; this was a known smuggling area, while the shore was busy with quarriers mining the limestone and local seamen taking it away (Fowles 1982; Lacey 2011), and there was an established trade in fossils as curios. As a coastguard and incomer Peach might have found it difficult to get to

know the locals, many of whom resented the customs taxes and would perhaps have been wary of being too publicly friendly with him. Even the respectable Mary Anning was fondly remembered by a local as carefully concealing any valuable item she found washed up on the beach (and which was 'wreck' reportable to the authorities), and later telling some poor person how to retrieve it (Lang 1950, pp. 187-188). Peach might have been wary of spending much time alone collecting on the shore for his own personal safety, though this does not seem to have affected him elsewhere. One might well wonder whether Peach ever let slip that he originally owed his coastguard position to the patronage, around 1823, of the then Lord Privy Seal, John Fane, tenth earl of Westmorland (1759-1841), whose seat was at Apethorpe near Wansford (Anon. 1882a). Until the Reform Act of 1832, the Fanes held Lyme Regis as their pocket borough. They ruthlessly controlled local politics to ensure that their candidates gained the borough's two Parliamentary seats, and had, at least in earlier decades, corrupted the Lyme customs service (Fowles 1982, pp. 25-27; Thorne 2004-2008). One might also wonder if it was entirely coincidence that Fane had in fact intended Peach for a job in the Customs, the coastguard position being temporary till a Customs post came up; it was only because of his political downfall that Fane was unable to implement this (Anon. 1882a).

Davey (1911, p. 7) stated that Peach at Lyme 'was so constantly finding fossil remains that his enthusiasm [for them] was greatly stirred'. But otherwise there is no known report of Peach being involved in geological activity there, and he certainly did not make a mark, so far as is known (Hugh Torrens, pers. comm. 2011). Perhaps this is explained by the factors outlined above, together with the brevity of his stay in the area and the competition. There seem to be few if any fossils from Lyme in the portion of Peach's surviving collections so far examined by us, although this is hardly a reliable indicator. His time at Lyme must nevertheless have helped make him aware of the potential financial value of fossils, as sold openly in Anning's shop on the main street. It might also have made him aware of the more specialist end of the trade, where scientifically important specimens were offered to specialists and museums - an important aspect of Peach's later activities. Peach would also have his own experience, on the marine biological side, of supplying specimens to specialists.

Jonathan Couch and Cornish fossils

Peach made his real geological mark only when he moved to the palaeontologically barely explored coast of Cornwall and saw the opportunities there, collecting stratigraphically important fossils at a time when the dating of local rocks was a major problem (Crowther 2003; Anderson and Taylor 2008).

Jonathan Couch (1789-1870), one of the key figures in Victorian natural history in Cornwall, was a surgeon of Polperro, a few miles from Gorran Haven where Peach was first stationed in Cornwall, and they exchanged specimens and information. Johns (2010) has published an interesting biography of Couch, which drew our attention to a personal and, presumably, private memoir written by him and finally published by Wheeler (1983). In a passage written in the second half of 1850, Couch assessed Peach (in Wheeler 1983, pp. 119-120):

> At the Christmas [1849] last named, Charles William Peach was removed from Fowey to a new station at Peterhead in Scotland, and as his name will be associated with the history of Cornish Geology, I record the following notes of what I know concerning him. I believe he was born in Northamptonshire, and that his father was an Inn-keeper. His first office under the Government was that of a Riding Officer in the Coast Guard, at a time when this office was not subordinate to the Lieutenant R. N. who commanded the Boat and floating Guard. His appointed station in Cornwall was at Gorran; where he very zealously pursued the study of Geology - and communicated his observations and collections - first to the Royal Institution of Cornwall at Truro and afterwards to the Royal Geological Society of Cornwall at Penzance. He also communicated to the R. Cornwall Polytechnic Society; by which he became known to Sir Charles Lemon Bart. who is a good patron of Science. But what may be regarded as the crisis of his fate, was his visit to the Meeting of the British Association for Science at Plymouth in 1840, and as it was I who urged him to this attendance, he has been free to confess the fact, that to me he is indebted for all the advantages that followed. By the interest of Sir Charles Lemon he was transferred from the Coast Guard to the situation of Landing Waiter in the Customs at Fowey: from whence now he is transferred to the situation of Subcontroller in the Custom House at Peterhead, to which his family has removed in June 1850.
>
> Besides this, his wife received an annuity of £15 by the gift of Lady Peel - the wife of the Prime Minister. Cornish Geology is much indebted to

> Peach's zeal; and when he left Fowey he sold his collection, what remained with him after presenting a collection to H. R. H. Prince Albert, to the R. Cornwall Geological Society for £20.0.
>
> My impressions of Peach as a geologist are, that industrious zeal was his chief characteristic, for his knowledge was neither extensive nor accurate, and however positive he might be in regard to his names, they cannot by any means be depended on. He said and wrote all he knew; and it may be said without injustice, sometimes more. On other departments of science he was still more deficient in knowledge, but his eagerness to secure whatever was new or interesting could not fail to lead to some interesting results. From his eagerness also to spread the knowledge of what he knew or found of Cornish Geology, he was led to mention things which caused the impression that he was the discoverer of them. Such, for instance, as the discovery of what are termed the fish beds at Polperro: but in fact they were discovered by myself: it is true I did not believe them to be remains of fishes, but of corals, and such I think them still, but when Peach supposed them fishes, he meant the bones of cuttle fishes, though this was changed afterwards. Peach was always eager to get the price of what he could obtain, and all his efforts were under the bias of a wish for promotion, all of which was in a degree excusable, because he had a numerous family entirely dependant on him. I believe him a warm hearted and honest man, with a good degree of vanity, but ready to do good to any one according to his power. He was [...] in regard to Science not capable of writing a book on any subject although he could materially assist one who could do so.

This is an interesting but problematic assessment. Couch might be thinking of a book such as his own on the marine biology of Cornwall, with which Peach helped (Naylor 2010). His assessment of Peach's publication potential was accurate (see the reference list in Anderson and Taylor 2008). But this was surely also because of the costs and risks involved in writing specialist books likely to have only a limited commercial sale. Moreover, Couch was distinctly superior socially and financially to Peach, as well as being better educated, both generally and in terms of scientific training from his medical schooling.

Couch's assessment of Peach was perhaps affected by tensions over their supposed finds of fossil fishes in Cornwall, being written halfway through that episode which also involved their mutual friend William Pengelly, from 1836 resident in Torquay where he was schoolmaster, tutor and lecturer (Bishop 2004). Pengelly's (1868) detailed account of the affair was possibly intended to head off, or by now perhaps rather damp down, a priority dispute which was also a territorial one, for Couch at least. Originally, Couch had found the fish site, but Pengelly and especially Peach went on to collect more specimens and find more sites, and Peach reported on his finds at the original site to the next meeting of the British Association of the Advancement of Science at Cork in 1843. (This meeting was poorly attended, resulting in financial trouble, so it might seem surprising to find Peach there; but, of course, he was in a good position in Cornwall to take ship over to Cork.) Couch complained that Peach 'was led to mention things which caused the impression that he was the discoverer of them. Such, for instance, as […] the fish beds at Polperro'. Whether this was deliberate is another matter, and Peach was not, of course, responsible for how others reported his findings. Certainly at least one local newspaper seemed to give Peach all credit in its coverage of the 1843 Presidential Address of his supporter Sir Charles Lemon F. R. S., M. P. (1784-1868), to the Royal Geological Society of Cornwall (Anon. 1843). Peach certainly acknowledged Couch and his son in the British Association's official published summary (Peach 1844), and Pengelly stressed that Peach's next paper, to the Royal Geological Society of Cornwall, fulsomely acknowledged Couch and his son.

Peach and Pengelly assessed some of the finds as fishes with some, if equivocal, support from Hugh Miller. This was ultimately confirmed despite disagreement from Couch, and scepticism from some very eminent palaeontologists, one of whom, Professor McCoy, described some of these fossils as a sponge, *Steganodictyum* (Pengelly 1868; see also Crowther 2003).

Originally Peach evidently had trouble identifying his fish finds in detail - even when he came to consider them as fishes, he referred them to an unlikely-seeming assortment of genera. Couch's gibe about cuttlefish was in fact correct, if only for some of the fossils for some of the time, as Peach confirmed in a letter to Adam Sedgwick (21 June 1854, CUL Add. 7652, II/X/80): 'These wanderings over the fish beds of Caithness have convinced me that some of the *spines* I obtained in Cornwall are *true fish spines* & that some of the *lumps* I got are *coprolites*. If that - neither are the spines & coprolites here, the *remains of fishes*. I had quite given up the flat & curiously reticulated pieces being fish. I thought they might be *Cuttle fishes but not higher*. -

I should rejoice to go to Penzance & have the spines cut and polished & ex[amine]d. under the microscope - I will *one day I possibly can get* to. [paragraph break] With all deference to Professor McCoy I firmly believe that *fishes* as well as *sponges* existed in the times of the Seas of the ancient rocks of Cornwall. Why not?' This is not entirely surprising. The characteristic oval plates of such fishes as *Pteraspis* resembled the internal skeleton of cuttlefish such as *Sepia*, to the degree that *Pteraspis* had originally been believed to be such a cephalopod. In any case, that identification problem only applied to that specific fossil, and there were plenty of other remains such as spines and coprolites. It is clear that Peach held very early that there were fish in the deposit even if believing temporarily that some of the remains might be cuttlefish.

Pengelly commented finally (1868, pp. 441-442):

> […] we should be cautious in drawing conclusions from imperfect materials. […] Let the local geologist learn that in very many cases the solution of problems in his own district is to be found in comparatively distant localities […]. Mr. Peach, who, wherever he has been located - whether in Cornwall or in Caithness - has done very much to elucidate the geological history of the district, has, again and again, told me that though many, perhaps most, of the "Polperro fossils" might be sponges, he had no doubt that there were fish-remains amongst them. Twenty-five years ago he first introduced the fossils to the scientific world as fish. For eight years their claims were unquestioned, though the authorities regarded them as ichthyic enigmas. Then came the decision - supposed to be final, but confessedly based on imperfect materials - that they were sponges. For seventeen years this has remained the prevalent opinion, but it now proves to be incorrect. Mr. Peach's judgment has received the fullest justification, and we all congratulate him heartily on the fact.

Pengelly (1868, pp. 439-440, also Symonds 1872) effectively credited the resolution of the problem to the Reverend W. S. Symonds F.G.S. (1818-1887), Rector of Pendock in Herefordshire and a noted amateur geologist familiar with the Old Red Sandstone fossils of that area. During an examination of Pengelly's collection on a rainy day in 1868, Symonds spotted *Pteraspis* remains in the Cornish fossils. Confirmation of this fish identification (Lankester 1868; Powrie and Lankester 1868-1870, esp. p. 61) soon came from the biologists Thomas Henry Huxley (1825-1895) and E. Ray Lankester (1847-1929), and James Powrie of Reswallie (1815-1895), another collector of Scottish Old Red Sandstone fish (Davidson and Newman 2003). Peach's inscribed and/or annotated copies of these papers survive in NMS (Lankester 1868; and parts of Powrie and Lankester 1868-1870, of which the 1868 one is inscribed to Peach from Lankester). As it happened, however, the work by Lankester (1868), confirming that the 'sponge' *Steganodictyum* was a fish, was not directly based on Charles Peach's specimens (unless, of course, his material lay in collections owned by others and credited to them), but Powrie and Lankester (1870, p. 61) did draw upon Peach's collection, and perhaps any specimens in the Royal Geological Society of Cornwall that he had provided.

It is beyond the scope of our paper to trace all the ins and outs of this interesting story. The matter is complicated by the poor preservation of the specimens, and the fact that the story worked on different levels - credit being due to the finder of a site, the collector of its individual fossils, the person who recognised their novelty and drew the attention of science to them, the person who spotted their actual taxonomic identity, and the specialist who wrote the formal paper. But we also note that when Peach's son Ben made a point of including some specimens sent to Miller in his exhibition of the Miller collection (see below), he stated without qualification in the intended accompanying guide that the elder Peach 'made the first discovery of fish remains from the Devonian rocks of Cornwall' (Peach undated).

Patronage and position

In our original paper (Anderson and Taylor 2008) we argued that Peach had cannily adapted to the realities of his social, financial and educational limitations. He used his fossil-collecting activities to benefit his family and himself by playing the patronage game, especially with Roderick Murchison, but also with others, for instance to obtain positions for his sons. We noted the precarious state of the family finances and the need for Peach to sell specimens, do curatorial work, and seek grants to pay for his science and to help with the family budget, as Couch (above) confirmed. Peach's activities were undoubtedly limited by his work as a coastguard and then a Customs officer, and the cost of travel. This, or perhaps illness, might explain why, in 1853, he had his paper on the blenny fish read on his behalf to the Banff Institution by David Grieve, a Customs colleague at Banff (Bertie 2004).

An additional source of income not mentioned by

Anderson and Taylor (2008) came at the Annual General Meeting of the Geological Society of London in February 1859. Charles Darwin received the Wollaston Medal for that year (presently on display in the Sedgwick Museum of Earth Sciences, University of Cambridge). That year's balance of the Wollaston Fund was, however, given to Peach, Roderick Murchison accepting on behalf of the absent Peach, and he and the President, John Phillips, giving addresses which were highly complimentary about Peach (Anon. 1859). The famously wealthy Darwin did not need the moneys and we wonder whether he suggested that they should be allocated to Peach, well known to be in chronic need of funds, in view of Peach's assistance with Darwin's barnacle work some eight years before (Anderson and Lowe 2010).

In an important study of natural science and antiquarianism in Cornwall, Naylor (2005, 2010, 2011) has independently stressed how Peach had a number of influential colleagues and admirers such as Tennyson (see also Anderson and Taylor 2015). Peach maintained areas where he could be authoritative, especially in developing an understanding of what was, in a real sense, his physical territory, and establishing a reputation within the field, but all the time without trespassing beyond the limits of a provincial geologist's abilities. He provided specimens and observations to his intellectual superiors to pronounce on, as in the geological élite and, latterly, the professionals of the Geological Survey (to whose work, of course, Peach's fossils had contributed when De la Beche commenced the Survey's work in the West Country). Naylor (2010, p. 175) commented that while Peach's Cornish contemporary Henry Boase 'acted as an intellectual equal to those same people [i. e., the élite scientists] (and was very publicly put down for it), Peach by contrast assumed a studied provinciality and was duly rewarded with improved prospects'. Indeed, we feel that Couch's comment about Peach not writing a book should be read in the light of the knowledge that Peach would have failed disastrously had he tried to write a book on, say, the Palaeozoic geology of Cornwall: a hideously expensive project in itself, but also one which would plunge him into one of the fiercest controversies of geology, in which even De la Beche and his new Survey were lucky to survive (Rudwick 1985).

The evidence that Peach played the patronage game well lies, of course, in the many fossils, collecting trips, grants in aid, and approving public remarks, as well as the positions in the coastguard, Customs, and Geological Survey for himself and his family, some chronicled in Anderson and Taylor (2008). Three further and illuminating examples have come to light. Prince Albert, consort of Queen Victoria, sent Peach, or rather his wife Jemima, a copy of *The Natural History of Deeside* by William Macgillivray, including of course the area around the royal retreat of Balmoral (Anon. 1856a). Peach was not, of course, unique in this, for copies were sent to various societies and individuals such as Alexander Croal (1809-1885), botanist and latterly the first curator of what is now the Smith Art Gallery and Museum, Stirling (Anon. 1856b, 1856c). But this might reflect Peach's gift of a collection to Prince Albert, which is presumably that mentioned by Couch (see above) and made during the summer of 1848 (as adumbrated in a letter to Henry De la Beche dated 22 April 1848; Sharpe and McCartney 1998, p. 85). Interestingly, 1848 is the year after Gideon Mantell presented the Prince Consort with a collection of fossils to accompany a copy of his book of geological excursions in the Isle of Wight and Dorset (Dean 1999, pp. 218-219). Perhaps Peach saw an opportunity here.

An interesting insight into the relationship between Peach and his major patron Sir Roderick Murchison (1792-1871), latterly Director of the Geological Survey, is that Murchison remembered Peach in his will (Anon. 1871; Murchison will, proved 14 November 1871; *contra* Morton 2004, p. 250 who reads 'Peach' as 'Stark'). Peach was one of a number of people to whom Murchison bequeathed £100 each as 'remembrances', but Murchison made special provision in Peach's case for the bequest to go to Peach's widow or eldest son if Peach predeceased him. The beneficiaries of those £100 gifts included various relatives of Murchison's, as well as friends such as George Anderson WS of Inverness near Tarradale, which was the seat of the Murchison family (and who was also an early geological correspondent of Hugh Miller's), and the Continental geologists Edouard de Verneuil and Alexander von Keysering. The largest group of those beneficiaries, however, comprised other British geologists and palaeontologists, some connected with the Survey, including W. T. Aveline, H. W. Bristow, T. H. Huxley, John Morris, T. W. Newton, Andrew Ramsay, J. W. Salter and Warrington Smyth (T. R. Jones and Archibald Geikie got more, but they were expected to deal with Murchison's papers). So perhaps Peach was thought of as one of Murchison's support unit.

Peach was evidently unable, despite his efforts discussed by Anderson and Taylor (2008), to leave enough after he died to support his unmarried, and possibly disabled, daughter Jemima. Concern for her led to a memorial to Government, to ask for Jemima (who, in hindsight, would live till 1899) to be given

a Civil List pension, no doubt in view of Peach's services to science. The 'about 140 eminent persons' who signed seemingly included the poet Alfred, Lord Tennyson (Anderson and Taylor 2015). This memorial resulted only in a one-off grant of £200, which was thought so inadequate that an appeal was made to raise more funds, with a target of £500, by an Edinburgh-based committee which included some notable men of science, such as Sir William Turner, Sir Joseph Hooker, Archibald Geikie, 'Professor Tait' (presumably Peter Guthrie Tait), Edwin Ray Lankester, John Murray (Director of the *Challenger* Expedition Commission) and Pengelly (Anon. 1886d). In Cornwall, also, William Bolitho, Jr., of Ponsandane, who was treasurer of the Royal Cornish Geological Society, made an appeal for support (Bolitho 1886). We have not found any report whether the target of £500 was met, but it is yet another testament to the regard in which Peach was held.

Further portraiture, commemorative plaque and diary

Davey (1911, opp. p. 14) published an oil portrait of Peach by one Goldsworthy, apparently a local Cornish artist, which was put on show in the 1843 exhibition of the Royal Cornwall Polytechnic Society. This does not, however, mean that it became part of the Society's collection. Davey (fn, p. 15) thanked his son Ben Peach for permission to reproduce it in his memoir, which suggests that Ben then had the portrait in his possession. We are not aware of its current location. It would be unfair to judge the painting solely from the photograph, but it is noticeably different from the fine photograph by Hill and Adamson reproduced by Anderson and Taylor (2008). Wallace (1917, pp. 13, 81) mentioned a portrait of Peach then on display in Inverness Museum, but what this was is not at all clear, and it could have been anything from an original oil painting to a copy of the engraving in Smiles' book. It has not been located in a recent search (Jeanette Pearson, pers. comm. 2015).

Also untraced (Anon. 2011; Roscoe *et al.* undated) is a 'Bust of Charles William Peach, Esq., FR, PSE', sculpted by Neville Northey Burnard (1818-1878) who was of Cornish origins (Burnard and Peach 2010). The 'FR, PSE' must be an error for FRPSE, that is, Fellow of the Royal Physical Society of Edinburgh, though Peach was only a Member in 1850 and not elected to fellowship till 1867 (Anderson and Taylor 2008). Peach sat for this 'plaster bust' before he left for the north. This is an indication that his hard work and networking had been successful and that he had established himself in his position before he left Cornwall. The bust was displayed in the 1851 exhibition of the Royal Cornwall Polytechnic Society. It was purchased by the Society's President, Peach's supporter Sir Charles Lemon, and presented to the Society. The bust was placed in the 'collection of worthies which grace the front of the gallery' of the Polytechnic Hall (Anon. 1851a, 1851b, 1852; Harpley 1886, pp. 65-66; Davey 1911, p. 18; Anon. 1912, p. 77; Peters 2005). However, the bust has not so far been located in the Society today (Michael Bradley and Nicholas Heartland, pers. comm. 2013; Michael Carver, pers. comm. 2015), or in the Royal Cornwall Museum (Angela Broome, pers. comm. 2015). The Polytechnic today does hold some of Burnard's letters to its Secretary, W. W. Rundell. Peach is mentioned in those dated 30 March 1849 (in which Burnard reports Tennyson describing Peach as a 'sweet fellow'), and 4 and 20 October 1851. It is possible that Tennyson and his wife also owned a copy of the bust, but this remains uncertain (Anderson and Taylor 2015).

A commemorative plaque was placed on the old Custom House in Gorran Haven on 30 September 2000, the bicentenary of Peach's birth. This was to mark his time in the town, though the Peach family's actual dwelling remains unidentified (Butcher 2001; Crowther 2003).

Charles Peach is now known to have kept a diary, apparently covering at least the Cornish years. It is mentioned in a letter by his son William to the poet Tennyson dated 7 October 1892 (TRC/LETTERS/4097; Anderson and Taylor 2015). The diary was seemingly held by Ben Peach, but we have not so far located it, if it survives.

Scottish palaeontology

The Hugh Miller collection. Charles Peach sent various specimens to Hugh Miller (for example, Cornish fossils, Durness Limestone invertebrates and Quaternary fossils from Caithness). As we have noted, he was also recruited to do curatorial work on the Miller collection after it came to the Edinburgh Museum of Science and Art (a precursor of NMS) after Miller's death (Anderson and Taylor 2008). From about 1918 to 1939, a special permanent display based on Hugh Miller's collection was on show in the museum, by then renamed the Royal Scottish Museum (now NMS) (Taylor and Anderson, research in progress). This display was arranged, or at least completed, by Charles's son Ben Peach (1842-1926) (Curle 1920, p. 6). Ben took the chance

to highlight some specimens which his father Charles had sent to Miller in the accompanying *Guide to the Hugh Miller Collection* of about 1920 (Peach undated). This was never issued, thanks probably to spending cuts, and we intend to publish it. It is an interesting source on the Peach family and what Ben thought of his father's work, though it should be used with caution as the surviving text is plainly a draft rather than a fully checked submission.

Thin sectioning and transfer mounts. Anderson and Taylor (2008) noted the prevalence in NMS of many Peach specimens of Carboniferous plants transferred from the matrix to glass slides, and of thin sections on glass slides, and wondered what techniques Peach was using. Sara Stevenson (pers. comm. 2012) has pointed out to us that at the 1868 meeting of the British Association for the Advancement of Science in Norwich, James Thomson F. G. S. (1823-1900), Glaswegian commercial traveller and keen amateur geologist, was showing off some of his fine thin slices of fossils of such things as Carboniferous corals from the (modern) intertidal zone at Dunbar, East Lothian (Anon. 1868, 1869, 1870). Thomson had developed techniques to make such slices, transferring the finished sections from the thick working glass mounts to thin glass slides. He etched the surfaces of some sections and used them for direct printing, while he used others as negatives for direct photography of the sections and apparently even for slide projection with oxyhydrogen lanterns. Peach doubtless saw those slides at the Norwich meeting, where he was presenting a paper on Cornish fossil fishes (Peach 1869). The basic concept of a thin section was not, of course, new, and was already well practised in Scotland (Morrison-Low 1992). Peach had been polishing, or having a lapidary polish for him, specimens at least as early as the 1850s (e.g. Old Red Sandstone 'wood' and 'shells', in litt. to Adam Sedgwick, 21 June 1854, CUL Add. 7652, II/X/80; note that this was not necessarily thin-sectioning as such). But Thomson's refinements perhaps inspired Peach's own experiments with slide mounts (however different, in fact, Peach's final results might have been). It is unclear whether Thomson actually helped Peach; he seems to have been rather secretive about his methods ([Jones] 1910). But Peach was certainly making his own slide and transfer mounts in the early 1870s, very soon after 1868, at least as shown by the specimens illustrated by Anderson and Taylor (2008). It will be interesting to see whether further examination of Peach's collections confirms this possible technical and temporal relationship.

Old Red Sandstone arthropods. When Ben Peach (1883) published a paper on eurypterid material from the Old Red Sandstone of Caithness, he pointed out (pp. 343-344) that, in the fourth edition of *Siluria*, Murchison had noted his father's discovery of important zonal Old Red Sandstone fossils in Caithness, but credited Charles with discovering the fish *Pteraspis*, rather than (correctly) the eurypterid *Pterygotus*. Interestingly, this error was not corrected in the next edition (Murchison 1872, pp. 257-258).

Fossils from the Jurassic of Eathie and Carboniferous of the Midland Valley in NHMUK. NHMUK V3944 (Figure 3) is a 'cone' of the plant *Williamsonia scotica* from the Upper Jurassic of Eathie, near Cromarty, apparently from the Charles Peach collection and figured by Hugh Miller (1857, p. 480, fig. 138, *pace* Anderson 2005 who identified the drawing as being of a NMS specimen). The specimen is a beach-rolled cobble that has been split. It survives only in part, but a coloured plaster cast accompanies the specimen. It bears numbers in dribbly red paint which, in our experience, characterise (at least) the Hugh Miller specimens used by the Cambridge palaeobotanist A. C. Seward (1863-1941) in his work on the Jurassic plants of Scotland (Anderson 2005). Unfortunately, Miller's text does not make it quite clear who collected and owned the specimen, but he acknowledges other collectors for other specimens elsewhere in the same section, implying that the cone was Miller's own specimen. What is not clear is what this important specimen was doing in the Peach collection, as Miller seemingly had no time to return (or give) the specimen to Peach before he died on the same evening that he - supposedly - finished the proofs of the book. For Miller's own collection was put in store and then sold in 1859 to what is now NMS (Miller 1857, p. xii; Taylor and Anderson, research in progress; NMS registers). However, some final checking and captioning of the illustrations was done by Professor John Fleming (1785-1857) of the Free Church College, Edinburgh (Miller 1857, p. xii). It is possible that some fossil plants had been separated from the collection, to send to the engraver or Professor Fleming, for the last few figures in the book and that those plants somehow ended up with Seward and were only much later reunited with the rest of the Miller collection in Edinburgh. This would explain the separate and anomalous accession NMS.G.1911.9.1-24, in the words of the register 'Fossil plants from the Hugh Miller Collection, some figured in the "Testimony of the Rocks"; revised and named by Professor Seward, Cambridge, 1911'.

Peach did seemingly collect at Eathie, on the

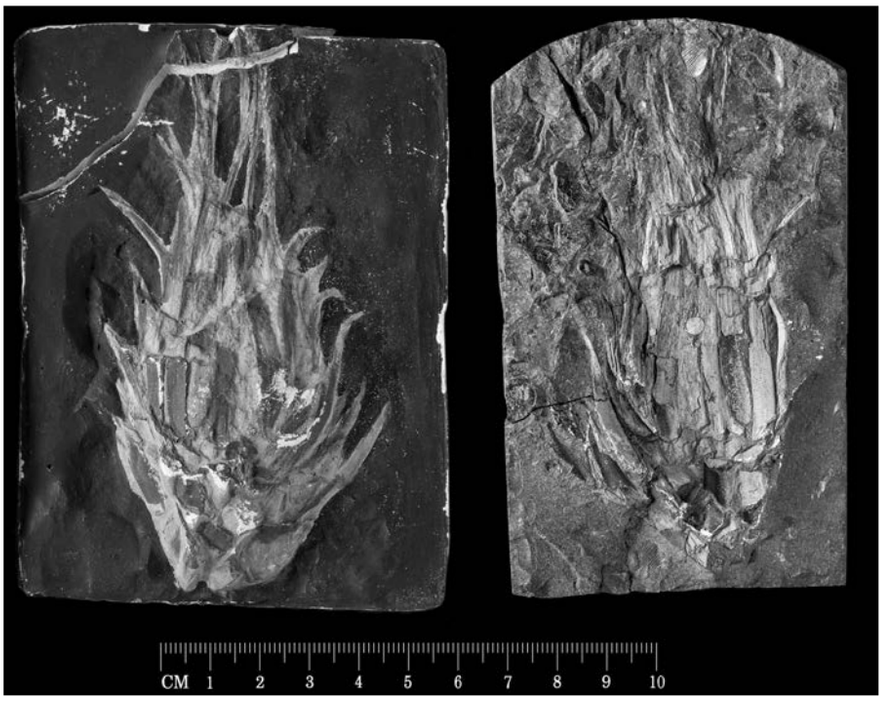

Figure 3. The 'cone'* Williamsonia *from the Upper Jurassic of Eathie, near Cromarty and a plaster cast of it on the left (NHMUK V3944). Apparently from the Peach collection, but figured by Hugh Miller in his* Testimony of the Rocks*. The unresolved problem of the specimen's original ownership is discussed in the text. Photograph by Harry Taylor, courtesy Natural History Museum, London.

evidence of a pterosaur bone whose label has been identified as being in his writing (Steel and O'Sullivan 2014). The 1850 date on the specimen is certainly consistent with his move to Peterhead in 1849, from which Cromarty was easily accessible by coastal steamer or cargo smack. Perhaps Peach and Miller had even been collecting at Eathie together. Miller usually spent some weeks in the north every summer, visiting his mother and other Cromarty relatives, as well as doing fieldwork in the region, and he certainly did so in September 1850 (Anon. 1850a, 1850b). The specimen reached what is now NHMUK via the collection of Frederick Harford (1820-1895), raising the question of whether Peach sold specimens to dealers such as Edward Charlesworth (1813-1893), whose customer Harford is known to have been (Cleevely and Cooper 1981).

There are a few other Jurassic plant specimens in the Peach material in NHMUK, from Helmsdale. There is further Peach Carboniferous palaeobotanical material in NHMUK, mostly Lothians oil shale fossils from some of the same sites as, and including microscope slides of similar construction to, those described by Anderson and Taylor (2008).

Archaeological and biological work, and 'Granny'

There has recently been published a study of Peach's provision of barnacles to Charles Darwin for the latter's famous, and evolutionarily very important, taxonomic review of the group (Anderson and Lowe 2010). There is obviously more to be found out about Peach's biological and archaeological material at NMS and elsewhere. For instance, the NMS Zoology register contains the (presumably belatedly catalogued) 'animal remains accompanying Roman pottery from Water Newton near Wansford, Northamptonshire' (Z.1941.7.1). Those last were presumably collected from the Roman town there on a trip to his native village, perhaps when he was there for his 75th birthday (Anderson and Taylor 2008). The 'specimen of the Tailless Trout (*Salmo fario*) from Islay' (Z.1882.85) is also interesting, as Peach had drawn scientific attention to the population of such tailless - or more precisely tail fin-less - fishes in one lochan on Islay, after one Colin Hay, the whisky distiller at Ardbeg, sent him specimens (Peach 1872; Traquair 1872). A group of 4 narwhal tusks was purchased from one Miss J. M. Peach for £2 6s (Z.1887.10); this is almost certainly Charles Peach's daughter Jemima who after his death in 1886 also sold other items to NMS (Anderson and Taylor 2008). They might have been acquired by Charles during his years at Peterhead, which was a noted whaling port, or by his son Joseph who was also in the customs at Wick and Leith till his death in 1868. We also previously noted the story that Peach was the, or rather a, custodian of the famous septuagenarian sea anemone 'Granny', which lived in captivity from 1828 to 1887. As Swinney (2011, p. 222) remarked, Granny is a very rare example of an invertebrate gaining a pet name to compare with such characters as Alfred the Gorilla at Bristol Zoo and then Museum (the only other example he could adduce was Paul the Octopus, famous for allegedly predicting the results of the 2010 World Cup football

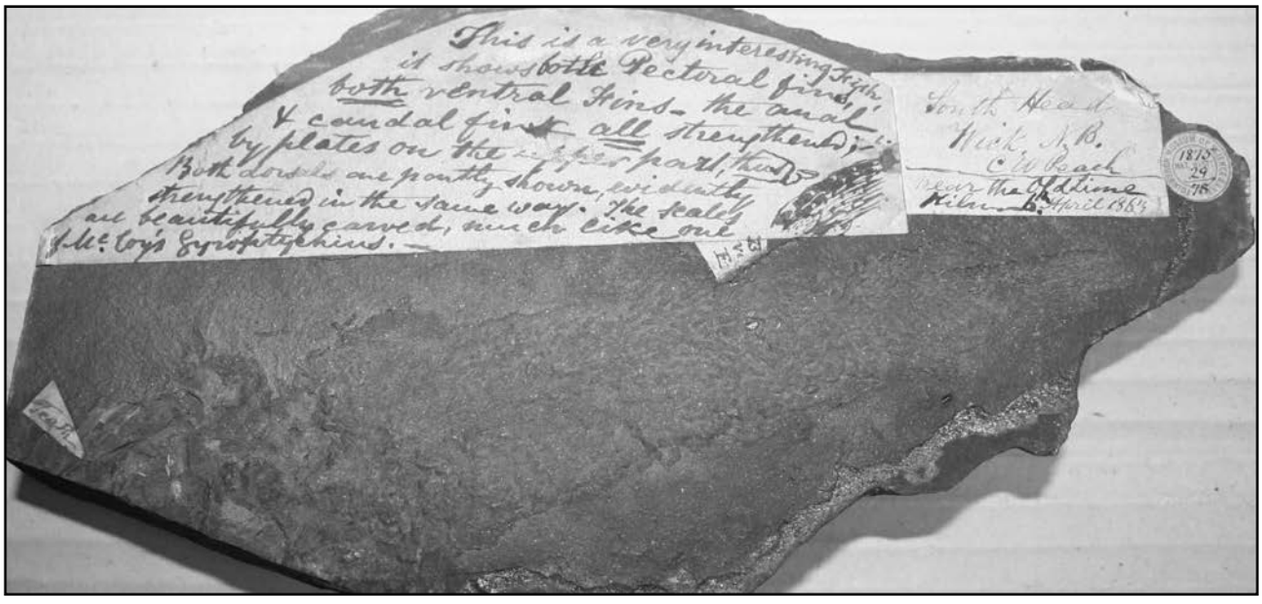

Figure 4. One of Charles Peach's more exuberant labels, on NMS.G.1875.29.78,* Thursius macrolepidotus *(Sedgwick and Murchison, 1829). This 'very interesting fish' from the Old Red Sandstone was collected near the old lime kiln [or kilns?], South Head, Wick, Caithness, on 6 April 1863. A, specimen 249mm longest dimension over matrix. B. close-up of comments label. Anderson and Taylor (2008) suggested that his careful labelling was in part informed by his contacts in the Geological Survey and in part a response to having to sell on many of his specimens, which therefore, so to speak, had their register entries written directly on them. This level of documentation helps make them attractive research specimens today. Photos courtesy of the Trustees of National Museums Scotland. N.B. was 'North Britain', a postal abbreviation for Scotland.

matches). Swinney (2007) was unable to confirm the Peachian link and dismissed it. But perhaps there was one after all, for the pseudonymous author of a syndicated column, published in several newspapers, affirmed that Granny 'had latterly been under the care' of Peach, whom she (the author, not the coelenterate!) claimed to know personally ('Penelope', 1887). The coelenterate was kept in the Royal Botanic Garden, Edinburgh, which was not that far from Peach's house (Anon. 1887b; Anderson and Taylor, 2008). Maybe Peach was indeed responsible for Granny's fortnightly care for a time, or looked after her while her regular keeper was away.

Conclusions and Peach's labelling

The information presented here might seem somewhat miscellaneous, but it has substantially strengthened, corrected and modified the picture of Peach given in our original paper (Anderson and Taylor 2008). The family information reveals Peach's unexpected religious affiliation as Unitarian, resolving anomalies in the previous paper. It also suggests that more attention ought to be paid to this aspect of 19th and early 20th Century geologists and collectors, to fix them within the complexity of religious affiliations of this period. Jonathan Couch plainly had an axe to grind, but his portrayal of Peach is all the more interesting for having been written up in a private diary, and in its assessment of the quality of his research. Naylor's study of Cornish science, and the findings about Murchison's legacy and the collection for Peach's daughter, all throw light on Peach's ability to work within the limitations of his life and to establish strong patron-client relationships.

There remains much more work to be done on Peach, in both archives and especially collections. Our original paper (Anderson and Taylor 2008) was, as we then noted, written to inform a planned full online catalogue of the Peach Collection in NMS. Such a fuller work has not transpired, thanks to the refurbishment of the Royal Museum building, the creation of greatly improved storage for the fossil collections, including the Peach material (Ross 2013), and our own departure from the NMS staff. The Peach fishes and fossil invertebrates at NMS remain unreviewed, though both groups will throw new light on Peach when properly examined. For instance, Sarah Stewart (pers. comm. 2009) pointed out that some of Peach's fossils from Durness in Sutherland in NMS bear labels dated August 1857. This is, significantly, several years later than the original discovery which Murchison used as a stratigraphic marker to claim the rocks of much of northern Scotland as Silurian (Peach 1858 [the 1853 date for the session is plainly a misprint as the paper was delivered orally in 1855]; Oldroyd 2004). But it is also the year *before* Peach and Murchison tramped the same coastline together after their meeting with

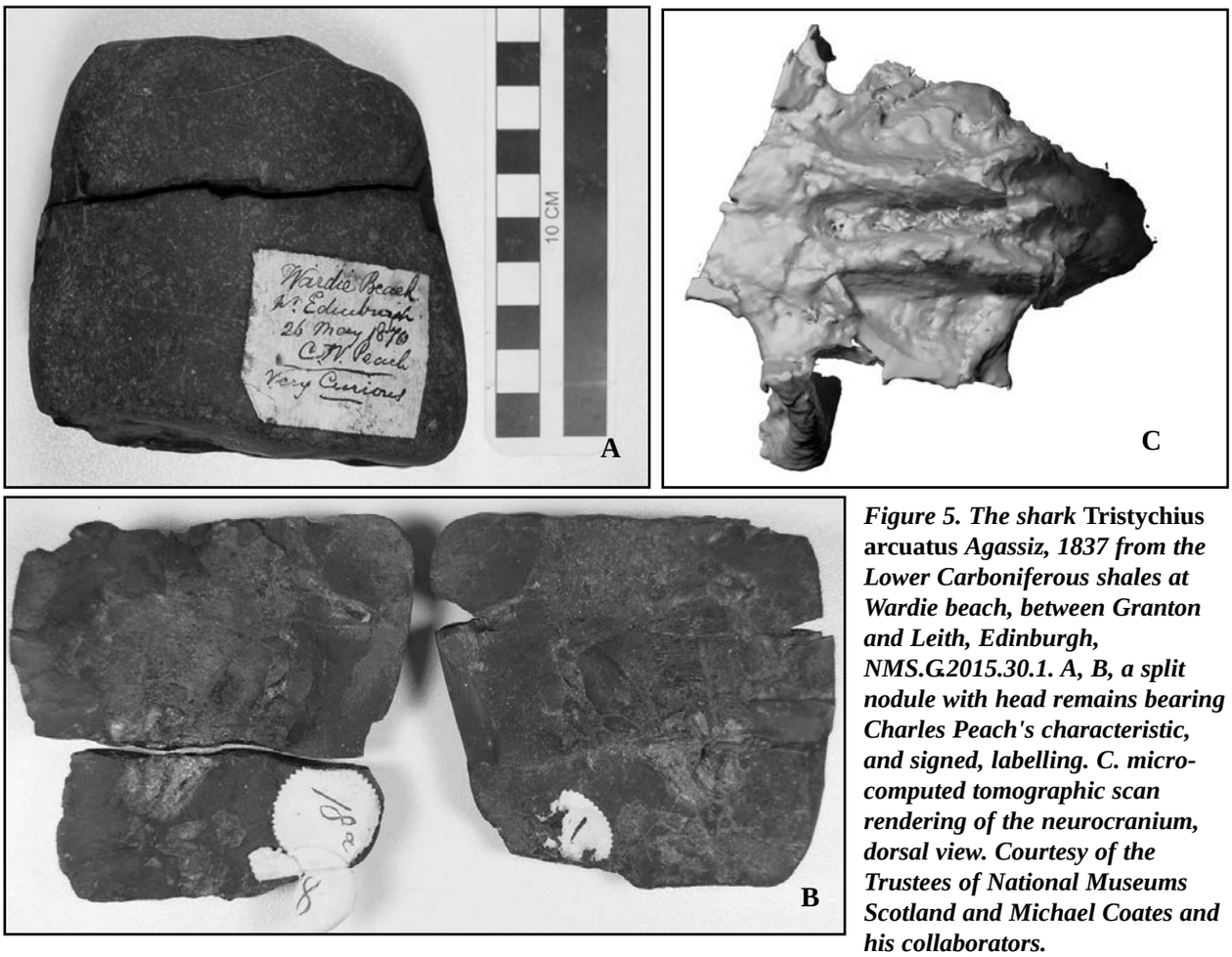

Figure 5. The shark* Tristychius arcuatus *Agassiz, 1837 from the Lower Carboniferous shales at Wardie beach, between Granton and Leith, Edinburgh, NMS.G.2015.30.1. A, B, a split nodule with head remains bearing Charles Peach's characteristic, and signed, labelling. C. micro-computed tomographic scan rendering of the neurocranium, dorsal view. Courtesy of the Trustees of National Museums Scotland and Michael Coates and his collaborators.

Dick in Thurso in 1858, a year before Ben Peach, perhaps as a result of an agreement on this field trip, was sent to the School of Mines in 1859 (Greenly 1928). So all those return visits to a remote area indicate Peach's persistence, in agreement with Couch's comments. The 1857 labelling is also the oldest indication so far found of Peach employing the more precise labelling system which we discussed in our paper, so perhaps we were correct to suggest that this was encouraged by his contacts with the Geological Survey (Anderson and Taylor 2008), but wrong in suggesting that the influence was his son Ben, who joined the School of Mines only later. It might have been Murchison himself, though John Phillips's known concern for the improved documentation of specimens offers another possibility (Knell 2000). This would also tie in with the comparative brevity of the labelling of the 1850 pterosaur. It will be interesting to see what level of documentation is borne by the specimens in Peach's 1856 sale to the Survey.

We hope that this and the original paper will encourage people to take an interest in Peach's fossil collections in NMS and elsewhere, such as the specimens at the Hancock Museum in Newcastle (Sarah Glynn, pers. comm. 2007). Apart from our previous paper and that by Crowther (2003), there is little in the way of recent curatorial studies of Peach fossil collections. But the studies by Donovan (2012) and Donovan and Fearnhead (2014), on Lower Devonian crinoids, remind us of the scientific value of his Carboniferous invertebrate collections. Meanwhile, two interesting specimens of fishes came to light during the NMS collections moves. One is a fish from the Old Red Sandstone of Wick, clearly labelled as to locality and with a characteristically Peachian comment on the specimen's interest (Figure 4). Another, this time from the Carboniferous of Wardie in north Edinburgh, was, until very recently, in the unregistered backlog (Figure 5). Amply confirming Peach's label annotation 'Very Curious', it is a very fine specimen of the early shark *Tristychius*. Micro-CT scanning of this specimen has generated a detailed picture of the anatomy of this genus which is critical to understanding the early evolution of sharks (Michael Coates, pers. comm. 2013). Peach's labelling habits have greatly helped make this specimen useful for such a modern project.

Acknowledgements

We thank Gary Peach and Jean Peach for their discussion of family history, and Nicholas Shillaker for advice on Charles and Jemima Peach's parentage and John Mendum and Anne Burgess for discussing Ben Peach. We are also grateful to Hugh Barlow, David Bertie, Richard Bull, Robert Crick, Alan Jones, Jeremy Rowett Johns, Anne Secord, Sara Stevenson, Sarah Stewart, David Stuart-Mogg, Geoff Swinney, Hugh Torrens, and Stephen Upex for discussion and information. We thank Michael Coates (University of Chicago), Peta Hayes (NHMUK), and Stig Walsh (NMS) for specimen information and provision of photographs, and the Natural History Museum and Trustees of National Museums Scotland for permission to publish photographs of their specimens, and Paul Young of http://www.peterboroughimages.co.uk for Wansford photographs. Michael Bradley, Michael Carver and Nicholas Heartland (Royal Cornwall Polytechnic Society), Angela Broome (Royal Institution of Cornwall), and Jeanette Pearson (Inverness Museum and Art Gallery) searched for the Peach portraits and bust in their collections. Susan Killoran of Harris Manchester College, Oxford, provided obituaries from the Unitarian periodicals. We thank the Royal Institution of Cornwall for permission to reproduce the passage from the Couch diary, kindly checked by Angela Broome. The Peach-Sedgwick correspondence is quoted by permission of the Syndics of Cambridge University Library, whom we thank. We thank the staff of the National Library of Scotland and the Libraries of National Museums Scotland and the Universities of Cambridge, Edinburgh and Leicester for their support, and Steve Donovan for his prompt and thorough review.

References

AGASSIZ, J.L.R. 1837. *Recherches sur les poissons fossiles*. Vol. 3. Petitpierre, Neuchatel, viii + 72pp.

ANDERSON, L.I. 2005. Hugh Miller: introducing palaeobotany to a wider audience. *In* Bowden, A.J., Burek, C.V. and Wilding, R. (eds). *History of Palaeobotany: Selected Essays*. Geological Society, London, Special Publications **241**, 63-90.

ANDERSON, L.I. and LOWE, M. 2010. Charles W. Peach and Darwin's barnacles. *Journal of the History of Collections* **22**, 257-270.

ANDERSON, L.I. and TAYLOR, M.A. 2008. Charles W. Peach, palaeobotany and Scotland. *The Geological Curator* **8**, 393-425.

ANDERSON, L.I. and TAYLOR, M.A. 2015. Tennyson and the geologists. Part 1. The early years and Charles Peach. *Tennyson Research Bulletin* **10.5**, 340-356.

ANON. 1812. Married. *Stamford Mercury* 12 Jun., 3.

ANON. 1826. Died. *Stamford Mercury* 8 Sept., 3.

ANON. 1829a. Married. *Norfolk Chronicle* 2 May, 3.

ANON. 1829b. Married. *Bury and Norwich Post* 6 May, 3.

ANON. 1834. Died. *Stamford Mercury* 20 Jun., 3.

ANON. 1843. Royal Geological Society of Cornwall. *Royal Cornwall Gazette* 20 Oct., 1.

ANON. 1844a. 'At the late meeting of the British Association[...].' *Stamford Mercury* 18 Oct., 3.

ANON. 1844b. Stamford Institution. *Stamford Mercury* 29 Nov., 2.

ANON. 1844c. Laudable patronage! *Stamford Mercury* 6 Dec., 4.

ANON. 1845a. Deaths. *Royal Cornwall Gazette* 28 Nov., 3.

ANON. 1845b. Died. *Inquirer*, 767.

ANON. 1846. Stamford Institution. *Stamford Mercury* 25 Sept., 3.

ANON. 1850a. 'Mr Hugh Miller [...]', *John O'Groat Journal* 13 Sept., 3.

ANON. 1850b. 'Mr Hugh Miller [...]', *Inverness Courier* 26 Sept., 2.

ANON. 1851a. Royal Cornwall Polytechnic Society. *Royal Cornwall Gazette* 10 Oct., 4-5.

ANON. 1851b. Royal Cornwall Polytechnic Society. *Royal Cornwall Gazette* 19 Dec., 6.

ANON. 1852. Royal Cornwall Polytechnic Society. *Royal Cornwall Gazette* 1 Oct., 5.

ANON. 1854a. *Census of Great Britain, 1851. Religious worship in England and Wales. Abridged from the official report* [...]. Routledge, London, 141pp.

ANON. 1854b. 'On Monday last, in St Martin's, Stamford [...]', *Stamford Mercury* 21 Apr., 4.

ANON. 1856a. Royal present. *John o' Groat Journal* 8 Feb., 3.

ANON. 1856b. Gift of Royalty. *Montrose, Arbroath and Brechin Review*, 8 Feb., 4.

ANON. 1856c. Natural history of Deeside. *Aberdeen Journal* 20 Feb., 4.

ANON. 1856d. Legislative Assembly. District of Talbot to wit Division of Carisbrook. List of persons [...]. *Mount Alexander Mail* 27 May, supplement, 12.

ANON. 1856e. Deaths. *Royal Cornwall Gazette* 22 Aug., 8.

ANON. 1856f. Deaths. *Inquirer*, 551.

ANON. 1859. Award of the Wollaston Medal and Donation Fund. *Quarterly Journal of the Geological Society* **15**, xxiii-xxv.

ANON. 1860a. Deaths arranged in chronological order. *Gentleman's Magazine* Oct., 438-446.

ANON. 1860b. Died. *Stamford Mercury* 24 Aug., 4.

ANON. 1862. Deaths arranged in chronological

order. *Gentleman's Magazine* Dec., 787-794.
ANON. 1868. Stone-negatives. - Geological applications of photography. *The Illustrated Photographer* **1**, 18 Sept., 400.
ANON. 1869. Report on the BAAS meeting, Exeter. *The Illustrated Photographer* **2**, 17 Sept., 438.
ANON. 1870. North of England Institute of Mining and Mechanical Engineers - meeting at Glasgow. *Mechanics' Magazine* **93**, 2 Sept., 172-173.
ANON. 1871. 'Sir Roderick Murchison has left a legacy [...].' *Greenock Telegraph and Clyde Shipping Gazette* 3 Nov., 3.
ANON. 1873. Died. *Stamford Mercury* 5 Sept., 4.
ANON. 1881a. Obituary. Charles Moore, F. G. S., of Bath. (From the *Bath Herald.*) *Inquirer,* 838.
ANON. 1881b. The late Mr. Charles Moore, of Bath. *Christian Life,* 612.
ANON. [1882a]. [Untitled MS account of the life and work of Charles Peach.] National Library of Scotland MS Ac 10073/6 [see Anderson and Taylor (2008)].
ANON. 1882b. Mrs. C. W. Peach. *Inquirer,* 123.
ANON. 1886a. The late Charles William Peach of Edinburgh. *Christian Life,* 113.
ANON. 1886b. Science. Charles William Peach. *Inquirer,* 166.
ANON. 1886c. 'A valued correspondent [...].' *Inquirer,* 178.
ANON. 1886d. 'Mr Charles William Peach, [...]'. *Nature* **35**, 83 only.
ANON. 1887a. Obituary. *Inquirer,* 9.
ANON. 1887b. A remarkable sea anemone - 'Granny'. *Aberdeen Evening Express* 11 Oct., 2.
ANON. 1912. Portrait Gallery of the Royal Cornwall Polytechnic Society. 1. - Sir Charles Lemon, Bart., M. A., F. R. S. First President (1833-67). *Annual Report of the Royal Cornwall Polytechnic Society*, new series **2**, 75-78.
ANON. 2011. Neville Northey Burnard. *Mapping the practice and profession of sculpture in Britain and Ireland 1851-1951*, University of Glasgow History of Art and HATII, online database [http://sculpture.gla.ac.uk/view/object.php?id=msib7_1219669083 accessed 10 Sept. 2013].
BARTON, R. 2014. Sunday lecture societies: naturalistic scientists, Unitarians and secularists unite against Sabbatarian legislation. *In* Dawson, G. and Lightman, B. (eds.). *Victorian scientific naturalism. Community, identity, continuity*. University of Chicago Press, London, 189-219.
BERTIE, D.M. 2004. Hugh Miller's graptolite revisited. *The Geological Curator* **8**, 43-45.
BISHOP, M.J. 2004. Pengelly, William (1812-1894). *Oxford Dictionary of National Biography*, online edition [http://www.oxforddnb.com/view/article/21838 accessed 11 Sept. 2013].
BOLITHO, W. 1886. An appeal. *Royal Cornwall Gazette* 26 Nov., 8.
BONNEY, T.G. 1895. Peach, Charles William (1800-1886), naturalist and geologist. *Dictionary of National Biography*, Volume **44**, 131. Smith, Elder & Co., London.
BROOKE, J.H. 2004. Science and dissent: some historiographic issues. *In* Wood, P. (ed.). *Science and dissent in England, 1688-1945*. Ashgate, Aldershot, 19-38.
BROWNE, J. 1995. *Charles Darwin. Voyaging*. Cape, London, xiii + 605pp.
BURNARD, A. and PEACH, A. 2010. Burnard, Neville Northey (1818-1878). *Oxford Dictionary of National Biography*, online edition [http://www.oxforddnb.com/view/article/4048 accessed 10 Sept. 2013].
BUTCHER, N.E. 2001. Charles W. Peach (1800-1886) honoured. *History of Geology Group Newsletter* **13**, 13 only.
CANTOR, G. 2005. *Quakers, Jews and science. Religious responses to modernity and the sciences in Britain, 1650-1900*. Oxford University Press, Oxford, xii + 420pp.
CHANT, C.A. 1918. Andrew Elvins (1823-1918). *Journal of the Royal Astronomical Society of Canada* **13**, 98-131.
CLEEVELY, R.J. and COOPER, J. 1981. Edward Charlesworth and the British Natural History Society 3. Material in the British Museum (Natural History). *Geological Curator* **3**, 99-119.
COPP, C.J.T., TAYLOR, M.A. and THACKRAY, J.C. 2000. Charles Moore (1814-1881), Somerset geologist. *Proceedings of the Somerset Archaeological and Natural History Society* **140**, 1-36.
CROWTHER, P.R. 2003. The Charles W. Peach (1800-1886) collection of Cornish fossils. *The Geological Curator* **7**, 323-328.
CURLE, A.O. 1920. *Report for the year 1919-20 by the Director on the Royal Scottish Museum, Edinburgh*. His Majesty's Stationery Office, London.
DAVEY, F.H. 1911. *Charles William Peach, A.L.S. Reprinted from the Report of the Royal Cornwall Polytechnic Society for 1910*. Penryn, 33pp.
DAVIDSON, R.G. and NEWMAN, M.J. 2003. James Powrie, chronicler of the Scottish Lower Devonian. *Proceedings of the Geologists' Association* **114**, 243-246.
DEAN, D.R. 1999. *Gideon Mantell and the discovery of dinosaurs*. Cambridge University Press, Cambridge, xix + 290pp.
DESMOND, A. and MOORE, J. 1991. *Darwin*. Michael Joseph, London, xxi + 808pp.
DESMOND, A. and MOORE, J. 2009. *Darwin's*

sacred cause. Race, slavery and the quest for human origins. Allen Lane, London, xxi + 485pp.

DIXON, H.N. 1887. Charles William Peach, A. L. S. *Journal of the Northamptonshire Natural History Society and Field Club* **4**, 33-40.

DONOVAN, S.K. 2012. Notes on Lower Devonian crinoids in the collections of the British Geological Survey, Keyworth. *Proceedings of the Yorkshire Geological Society* **59**, 115-120.

DONOVAN, S.K. and FEARNHEAD, F.E. 2014. The British Devonian Crinoidea. Part 1. Introduction and Camerata. *Monographs of the Palaeontographical Society* 168 (643), 1-55 + i-viii.

FINNEGAN, D.A. 2004. Charles W. Peach. Vol. 3, pp. 1554-1555 *in* Lightman, B. (ed.). *Dictionary of nineteenth-century British scientists*. Thoemmes Continuum, Bristol, 4 vols.

FOWLES, J. 1982. *A short history of Lyme Regis*. Dovecote Press, Wimborne, 53pp.

GEIKIE, A. 1904. *Scottish reminiscences*. Maclehose, Glasgow, vii + 447pp.

GILBERT, J.L. 1982. *Thornhaugh-cum-Wansford its historic buildings & businesses*. Rev. G. Bradshaw, Wittering, 12pp.

GODFREY, P.B. 1983. Joseph Hunter 1783-1861. *Transactions of the Unitarian Historical Society* **18**, 17-23.

GORDON, A. and MERCER, M.J. 2004. Butcher, Edmund (1757-1822). *Oxford Dictionary of National Biography*, online edition [http://www.oxforddnb.com/view/article/4174, accessed 23 Nov. 2015].

GREENLY, E. 1928. Benjamin Neeve Peach: a study. *Transactions of the Edinburgh Geological Society* **12**, 1-11.

HARPLEY, W. 1886. [Obituary, Charles W. Peach.] *Report and Transactions of the Devonshire Association for the Advancement of Science, Literature and Art* **18**, 64-66.

HELMSTADTER, R. 2004. Condescending harmony: John Pye Smith's Mosaic geology. *In* Wood, P. (ed.). *Science and dissent in England, 1688-1945*. Ashgate, Aldershot, 167-198.

HERBERT, S. 2005. *Charles Darwin, geologist*. Cornell University Press, Ithaca, xx + 485pp.

JOHNS, J.R. 2010. *Doctor by nature. Jonathan Couch: surgeon of Polperro*. Polperro Heritage Press, Clifton-upon-Teme, 200pp.

J[ONES], T.R. 1910. James Thomson, F.G.S. *Geological Magazine* (5) **7**, 479-480.

KLAVER, J.M.I. 1997. *Geology and religious sentiment. The effect of geological discoveries on English society and literature between 1829 and 1859*. Brill, Leiden, xvi + 215pp.

KNELL, S.J. 2000. *The culture of English geology, 1815-1851. A science revealed through its collecting*. Ashgate, Aldershot, xxii + 378pp.

KNELL, S.J. and TAYLOR, M.A. 2006. Hugh Miller: fossils, landscape and literary geology. *Proceedings of the Geologists' Association* **117**, 85-98.

KÖLBL-EBERT, M. (ed.) 2009. *Geology and religion. A history of harmony and hostility*. Special Publication **310**. Geological Society of London Publishing House, Bath.

KOLACZKOWSKI, A. 1995. Jerom Murch and Unitarianism in Bath 1833-45. *Transactions of the Unitarian Historical Society* **21**, 15-29.

KOLACZKOWSKI, A. 1996. Jerom Murch and Bath politics, 1833-1879. *Bath History* **6**, 155-173.

LACEY, P. 2011. *Ebb and flow. The story of maritime Lyme Regis*. Dovecote Press, Wimborne Minster, 280pp.

LANG, W.D. 1950. More about Mary Anning, including a newly-found letter. *Proceedings of the Dorset Natural History and Archaeological Society* **71**, 184-188.

LANKESTER, E.R. 1868. On the discovery of the remains of cephalaspidian fishes in Devonshire and Cornwall; and on the identity of *Steganodictyum*, McCoy, with genera of those fishes. *Quarterly Journal of the Geological Society* **24**, 546-547.

MENDUM, J. and BURGESS, A. 2015. Benjamin Neeve Peach (1842-1926). *Edinburgh Geologist* **57**, 19-25; fuller version available online, http://www.edinburghgeolsoc.org/eg_pdfs/issue57_peach.pdf.

MILLER, H. 1857. *Testimony of the rocks; or, geology in its bearings on the two theologies, natural and revealed*. Constable, Edinburgh, xiv + 454pp.

MORRISON-LOW, A.D. 1992. William Nicol, FRSE, c. 1771-1851, lecturer, scientist and collector. *Book of the Old Edinburgh Club*, new series, **2**, 123-131.

MORTON, J. 2004. *King of Siluria: how Roderick Murchison changed the face of geology*. Brocken Spectre, Horsham, 272pp.

MURCH, J. 1835. *A history of the Presbyterian and General Baptist Churches in the West of England;* [...]. Hunter, London, xviii + 579pp.

[MURCH, J.] (as 'J.M.') 1881. 'To this tribute [...].' *Inquirer*, 838.

MURCHISON, R.I. 1872. *Siluria. A history [...]*. 5th edition. Murray, London, xvii + 566pp.

NAYLOR, S. 2005. Writing the region: Jonathan Couch and the Cornish fauna. *Interdisciplinary Science Reviews* **30**, 33-45.

NAYLOR, S. 2010. *Regionalizing science. Placing*

knowledges in Victorian England. Science and culture in the nineteenth Century: 11. Pickering and Chatto, London, xiv + 245pp.

NAYLOR, S. 2011. Geological mapping and the geographies of proprietorship in nineteenth-century Cornwall. *In* D.N. Livingstone and C.W.J. Withers (eds.). *Geographies of nineteenth-century science*, University of Chicago Press, Chicago, 345-370.

NEVE, M. 1983. Science in a commercial city: Bristol 1820-60. *In* Inkster, I., and Morrell, J. (eds.). *Metropolis and province. Science in British culture, 1780-1850*. Hutchinson, London, 179-204.

NUTTALL, R.H. 2004. 'An outdoor man': Charles Peach and the luminosity of the sea. *Quekett Journal of Microscopy* **39**, 783-791.

O'CONNOR, R. 2007a. Young-earth creationists in early nineteenth-century Britain? Towards a reassessment of 'scriptural geology'. *History of Science* **45**, 357-403.

O'CONNOR, R. 2007b. *The Earth on show. Fossils and the poetics of popular science, 1802-1856*. University of Chicago Press, Chicago, xiv + 541pp.

OLDROYD, D.R. 2004. Peach, Charles William (1800-1886). *Oxford Dictionary of National Biography*, online edition [http://www.oxforddnb.com/view/article/21665 accessed 11 Sept. 2013].

PEACH, B.N. 1883. On the occurrence of *Pterygotus* and a limuloid in the Caithness Flagstones, and on the nature and mode of formation of 'Adam's Plates.' *Proceedings of the Royal Physical Society of Edinburgh* **7**, 343-350.

PEACH, B.N. undated [c. 1920]. *Guide to the Hugh Miller Collection in the Royal Scottish Museum, Edinburgh*. Unpublished typescript, NMS Library, Director's Papers, Box 8.3.

PEACH, C.W. 1844. On the fossils of Polperro in Cornwall. *Annual Report of the British Association for the Advancement of Science* **for 1843**, Transactions of the Sections, 56-57.

PEACH, C.W. 1858. Notice of the discovery of fossils in the limestones of Durness, in the county of Sutherland. *Proceedings of the Royal Physical Society of Edinburgh* **1**, 23-24.

PEACH, C.W. 1869. On the fossil fishes of Cornwall. *Annual Report of the British Association for the Advancement of Science* **for 1868**, Transactions of the Sections, 76-77.

PEACH, C.W. 1872. On the so-called tailless trout of Islay. *Annual Report of the British Association for the Advancement of Science* **for 1871**, Transactions of the Sections, 133-134.

'PENELOPE', 1887. Our ladies' column. *Western Times* 7 Nov., 4.

PENGELLY, H. 1897. *A memoir of William Pengelly, of Torquay, F. R. S., geologist, with a selection from his correspondence*. John Murray, London, xii + 342pp.

PENGELLY, W. 1868. The history of the discovery of fossil fish in the Devonian rocks of Devon and Cornwall. *Transactions of the Devonshire Association for the Advancement of Science, Literature, and Art* **2**, 423-442 [offprints were repaginated from page 1 onwards].

PETERS, D. 2005. Neville Northey Burnard. *The Poly. The magazine of the Royal Cornwall Polytechnic Society* **for 2005/2006**, 20-23.

POWRIE, J. and LANKESTER, E.R. 1868-1870. A monograph of the fishes of the Old Red Sandstone of Britain. Part 1. The Cephalaspidae. *Palaeontographical Society Monographs*.

RABSON, D. 2009. From Taunton to the Pyrenees: the Revd William Arthur Jones and the early days of the Society. *Proceedings of the Somerset Archaeological and Natural History Society* **152**, 203-215.

RABSON, D. 2015. *From Somerset to the Pyrenees in the steps of the Reverend William Arthur Jones geologist and antiquary*. Somerset Archaeological and Natural History Society, Taunton, x + 109pp.

RAYMOND, J. and PICKSTONE, J. 1986. The natural sciences and the learning of English Unitarians: an exploration of the roles of Manchester College. *In* Smith, B. (ed.). *Truth, liberty, religion. Essays celebrating two hundred years of Manchester College*. Manchester College, Oxford, 127-164.

ROSCOE, I, HARDY, E. and SULLIVAN, M.G., undated. *A biographical dictionary of sculptors in Britain 1660-1851* [http://217.204.55.158/henry moore/index.php accessed 10 Sept. 2013].

ROSS, A. 2013. The new Palaeobiology Store at National Museums Scotland. *Edinburgh Geologist* **54**, 19-22.

RUDWICK, M.J.S. 1985. *The great Devonian controversy. The shaping of scientific knowledge among gentlemanly specialists*. University of Chicago Press, Chicago, 528pp.

RUSTON, A. 1989. Unitarianism in Cornwall. *Transactions of the Unitarian Historical Society* **19**, 168-180.

SECORD, A. 2013. Elizabeth Gaskell's social vision: the natural histories of *Mary Barton*. *In* Marsden, B., Hutchinson, H. and O'Connor, R. (eds.). *Uncommon contexts: encounters between science and literature, 1800-1914*. Pickering and Chatto, London, 125-143.

SEDGWICK, A. and MURCHISON, R.I. 1829. On

the structure and relations of the deposits contained between the primary rocks and the Oolitic series in the north of Scotland. *Transactions of the Geological Society of London* (2) **3**, 125-160.

SHARPE, T. and McCARTNEY, P.J. 1998. *The papers of H. T. De la Beche (1796-1855) in the National Museum of Wales.* Amgueddfeydd ac Orielau Genedlaethol Cymru/National Museums and Galleries of Wales, Cardiff, 257pp.

SMILES, S. 1878. *Robert Dick baker of Thurso geologist and botanist*. Murray, London, xx + 436pp.

SMITH, L. 2006. *The Unitarians. A short history*. Lensden Publishing, Arnside, 208pp.

STAFFORD, R.A. 1989. S*cientist of empire: Sir Roderick Murchison, scientific exploration and Victorian imperialism*. Cambridge University Press, Cambridge, xii + 293pp.

STEEL, L. and O'SULLIVAN, M. 2014. A Scottish pterosaur in London: the first record of Pterosauria from the Upper Jurassic (Kimmeridgian) of Eathie (Ross and Cromarty), Scotland. *Historical Biology* **27**, 723-728.

STUART-MOGG, D. 2007. *The story of Wansford*. The author, Wansford, 59pp.

SWINNEY, G.N. 1999. Gas lighting in British museums and galleries, with particular reference to the Edinburgh Museum of Science and Art. *Museum Management and Curatorship* **18**, 113-143.

SWINNEY, G.N. 2007. Granny (c. 1821-1887), 'a zoological celebrity'. *Archives of Natural History* **34**, 219-228.

SWINNEY, G.N. 2011. An afterword on afterlife. *In* Alberti, S.M.M. (ed.). *The afterlives of animals*. Univ. of Virginia Press, Charlottesville, 219-233.

SWINNEY, G.N. and HEPPELL, D. 1997. Public and privileged access: a historical survey of admission charges and visitor figures for part of the Scottish national collections. *Book of the Old Edinburgh Club* new series **4**, 69-84.

SYMONDS, W.S. 1872. Fish-remains in the Devonian beds of Cornwall. *Geological Magazine* (1) **9**, 239-240.

TAYLOR, M.A. 1994. The plesiosaur's birthplace: the Bristol Institution and its contribution to vertebrate palaeontology. *Zoological Journal of the Linnean Society* **112**, 179-196.

TAYLOR, M.A. 2007. *Hugh Miller. Stonemason, geologist, writer*. NMSE Publishing, Edinburgh.

THORNE, R. 2004-2008. Fane, John, tenth earl of Westmorland (1759-1841). *Oxford Dictionary of National Biography*, online edition [http://www.oxforddnb.com/view/article/9136 accessed 30 Sept. 2015].

TORRENS, H.S. 1995. Mary Anning (1799-1847) of Lyme; 'the greatest fossilist the world ever knew'. *British Journal for the History of Science* **28**, 257-284.

TORRENS, H.S. 2005. The life and times of Hastings Elwin or Elwyn and his critical role in founding the Bath Literary and Scientific Institution in 1823. *Geological Curator* **8**, 141-168.

TORRENS, H.S. 2009. Dissenting science: the Quakers among the Founding Fathers. *In*: Lewis, C. L. E. and Knell, S. J. (eds.). *The making of the Geological Society of London*. Geological Society, London, Special Publication **317**, pp. 129-144.

TORRENS, H.S. and TAYLOR, M.A. 2004. Further information on the life of Charles Moore (1815-1881), Somerset geologist. *Proceedings of the Somerset Archaeological and Natural History Society* **147**, 181-182.

TRAQUAIR, R.H. 1872. On the so-called tailless trout of Islay. *Journal of Anatomy and Physiology* **6**, 411-416.

VENN, J.A. 1951. Alumni Cantabrigienses. *A biographical list of all known students, graduates and holders of office at the University of Cambridge, from the earliest times to 1900. Part II. From 1752 to 1900. Volume IV*. Cambridge University Press, Cambridge, 615pp.

WALLACE, T. 1917. *Guide to Inverness Museum and objects of scientific interest in the surrounding district*. Inverness Museum, Inverness, 81pp.

WEBB, R.K. 1986. The Unitarian background. *In* Smith, B. (ed.). *Truth, liberty, religion. Essays celebrating two hundred years of Manchester College*. Manchester College, Oxford, 1-30.

WEINDLING, P. 1983. The British Mineralogical Society: a case study in science and social improvement. *In* Inkster, I., and Morrell, J. (ed.). *Metropolis and province. Science in British culture, 1780-1850*. Hutchinson, London, 120-150.

WHEELER, A. 1983. The private memoirs of Jonathan Couch (1789-1870) of Polperro. *Journal of the Royal Institution of Cornwall*, new series **9**, 92-145.

WIGLEY, J. 1980. *The rise and fall of the Victorian Sunday*. Manchester University Press, Manchester, 216 pp.

WOOD, P. 2004. Introduction: stepping out of Merton's shadow. *In* Wood, P. (ed.). *Science and dissent in England, 1688-1945*. Ashgate, Aldershot, 1-18.

WOODWARD, S. 1833. *An outline of the geology of Norfolk*. Stacy, Norwich, 54pp.

CRESWELL CRAGS FOSSIL MATERIAL IN THE NOTTINGHAM NATURAL HISTORY MUSEUM, WOLLATON HALL, UK

by Jordan Bestwick and Adam S. Smith

Bestwick, J. and Smith, A.S. 2015. Creswell Crags fossil material in the Nottingham Natural History Museum, Wollaton Hall, UK. *The Geological Curator* 10 (4): 181-192.

The Creswell Crags gorge on the Nottinghamshire-Derbyshire border contains a series of caves in which Holocene and Late Pleistocene deposits accumulated. Fossils from these deposits were acquired by the Nottingham Natural History Museum, Wollaton Hall (NOTNH), during the late 19th century and early 20th century. This study provides the first published review of the entire NOTNH Creswell Crags collection. Overall, there are 274 fossil specimens from Creswell Crags consisting of 466 individual elements. However, only 11.7% of specimens can be attributed to specific caves and none retain any detailed stratigraphic data. This compromises the scientific value of the collection. The collection contains a total of 160 attached labels (on 146 individual elements) comprising ten different types. An assessment of the faunal abundances was conducted to compare with historical excavations. 61% of the NOTNH elements have been identified to genus level and the collection consists of 17 genera from six orders: Carnivora, Artiodactyla, Perissodactyla, Proboscidea, Lagomorpha and Primates. The NOTNH collection contains proportionately more woolly rhinoceros (*Coelodonta*) elements than the 1870s excavations but fewer hyaena (*Crocuta*), reindeer (*Rangifer*), and woolly mammoth (*Mammuthus*). We attribute these discrepancies to a possible 'donation bias'.

Jordan Bestwick, Nottingham Natural History Museum, Wollaton Hall, Nottingham NG8 2AE, UK and Department of Geology, University of Leicester, University Road, Leicester LE1 7RH. Adam Smith, Nottingham Natural History Museum, Wollaton Hall, Nottingham NG8 2AE, UK. Email: adam.smith@nottinghamcity.gov.uk
Received 06th October 2015. Accepted 5th December 2015.

Introduction

Creswell Crags on the border between Derbyshire and Nottinghamshire consists of a 450m long Early Permian Magnesian Limestone gorge with cliff faces up to 19m high (Mello 1875; Charles and Jacobi 1994; Jacobi *et al.* 1998; Stewart and Jacobi 2015). The walls of the gorge contain a system of caves, fashioned by a vertically shifting fault scarp along the western edge of the site, in which Holocene and Late Pleistocene deposits accumulated (Jacobi *et al.* 1998; Stewart and Jacobi 2015).

There are 21 caves and fissures distributed across the Creswell Limestone Heritage Area that are associated with Pleistocene material (Wall and Jacobi 2000). At Creswell Crags there are ~23 caves, some of which have yielded fossil material including a diverse fauna of large Pleistocene mammals such as spotted hyaena (*Crocuta crocuta*), woolly rhinoceros (*Coelodonta antiquitatis*), giant Irish deer (*Megaloceros giganteus*) and humans (*Homo sapiens*) (Currant and Jacobi 2001). In addition, numerous flint, quartzite and bone artefacts (Mello 1875, 1876, 1877; Dawkins 1877; Armstrong 1925, 1930, 1932a; Jenkinson 1984), and occurrences of cave art, have also been found within the caves (Pike *et al.* 2005). Independent radiometric dating studies on fossil and human-modified material from Pin Hole Cave and Robin Hood Cave in Creswell Crags dated the Pleistocene fauna, and human-related activities to around 31,000-59,000 and 23,000-53,000 years old respectively (Jacobi *et al.* 1998; 2006). These age ranges have become established as the Pin-Hole Mammal Assemblage Zone (MAZ), named after the first excavated Creswell Crags cave in the 1870s, Pin Hole Cave (Currant and Jacobi 2001; Jacobi *et al.* 2006), and falls within the Middle Devensian (Jenkinson 1984; Jenkinson and Gilbertson 1984; Jacobi *et al.* 1998). Evidence suggests that at this time a fauna of large mammals, including humans, had recently returned to Britain following the end of the previous glacial maximum

(Currant and Jacobi 2001). In contrast, the Creswell Crags cave known as Mother Grundy's Parlour contains a different fauna. Although no quantitative dating studies have currently been conducted on the Mother Grundy's parlour material, this cave is the only one from Creswell Crags which has yielded conclusive evidence of hippopotamus (*Hippopotamus amphibius*) and the narrow-nosed rhinoceros (*Dicerorhinus hemitoechus*) (Dawkins and Mello 1879; Armstrong 1925). These animals are believed to have been present in the UK during the Ipswichian interglacial stage which spanned ~130,000-80,000 years ago (Jenkinson and Gilberston 1984; van Kolfschoten 1992). Fully understanding the relative abundances of Pleistocene species at Creswell Crags is therefore important for determining temporal and spatial faunal movements across the UK and Europe during glacial and interglacial periods (Jacobi *et al.* 1998; Wall and Jacobi 2000; Currant and Jacobi 2001).

The palaeontological significance of Creswell Crags was first elucidated by Reverend John Magens Mello (1836-1914) who led the initial explorations of the caves from 1874-1876 with assistance from Thomas Heath and William Boyd Dawkins (Jenkinson and Gilbertson 1984). A range of mammalian fauna and human implements from several caves were excavated and identified during this time (Busk 1875; Mello 1875, 1876, 1877; Dawkins 1877). The initial explorations involved eight caves at Creswell Crags but focused primarily on the first 12-15m from each cave entrance (Mello 1875). This early excavation work was continued in the 1880s by the enigmatic Dr Robert Laing, but little is known of the man or his work (Jenkinson and Gilbertson 1984; Charles and Jacobi 1994; Wall and Jacobi 2000). It was not until 50 years later that deeper excavations led by Albert Leslie Armstrong uncovered more animal remains, increasing known abundances of fauna in the Pin Hole MAZ (Armstrong 1925, 1929, 1930, 1931, 1932a, 1932b; Jenkinson and Gilbertson 1984). Excavations were also undertaken by John Campbell and Simon Colcutt in the 1970s in an attempt to explain the stratigraphy of Creswell Crags and changes in faunal assemblages and human activities across finer time-scales (Jenkinson and Gilbertson 1984). Further work on the cave fauna was carried out by Rogan Jenkinson and others in the 1970s-80s (Jenkinson 1984), however, much of this is unpublished (Wall and Jacobi 2000).

Material from Creswell Crags is distributed across dozens of institutions across the UK and beyond (Wall and Jacobi 2000), including Nottingham Natural History Museum, Wollaton Hall (NOTNH) (Turner 2000; Wall and Jacobi 2000). This 'distributed collection' is summarised broadly on the 'Creswell Crags Distributed Collections Portal' (http://www.creswell-crags.org.uk/learning-resources/distributed.aspx). The main aim of this paper is therefore to provide a history and detailed account of the Creswell Crags fossil material (Pleistocene and Holocene) held at NOTNH, to increase awareness of the collection, place it in its historical context, and provide an itemised account for inclusion in the portal. Turner (2000) listed a small amount of previously cited and figured Creswell Crags material at NOTNH (see below), and Wall and Jacobi (2000) also provided a brief summary of the collection. However, to our knowledge, the majority of the fossil specimens have not been listed or figured in the literature, so their potential for contributing to our understanding of Creswell Crags and Pleistocene Britain remains unclear.

In addition, we assess the relative faunal abundances within the NOTNH collections compared to those listed from the 1870s and 1920s excavations, to determine whether the NOTNH collection is representative or subject to collecting bias.

History of the collection

The NOTNH Creswell Crags material is part of a larger collection of approximately 40,000 individual fossils from various horizons from all over the UK (Turner 2000; Smith 2015). Most of the Creswell Crags material originated from Reverend John Magens Mello, who donated, sold and bequeathed a large number of specimens to the NOTNH in a series of acquisitions towards the end of the 19th century and the early 20th century. The first group of specimens was donated to the NOTNH in 1876 (NH Acq. Ref: 1875.01), when the museum and its collections were located at Wheeler Gate in central Nottingham (under the name of Nottingham Free Museum; Turner 1993; 2000). Acquisition records state that specimens within this donation included *Coelodonta antiquitatis*, *Crocuta crocuta* and wild horse (*Equus caballus*) along with other large mammals. The majority of these specimens were collected in 1875, with a small remainder collected in 1876.

A second acquisition (NH Acq. Ref: 1887.16) of specimens was received a decade later in 1887, purchased from Mello for £5, by which time the museum had relocated to Nottingham University College (Turner 1993; 2000). Most of the specimens

in this acquisition, listed as a "large number of Fossil Specimens from Creswell Crags", were also collected in 1875.

The third and final acquisition (NH Acq. Ref: 1914.10) from Mello was bequeathed by his solicitors following his death in 1914 (Turner 1993). This acquisition, listed in the register as a "collection of fossils and implements", included some human artefacts such as flint and quartzite tools collected by Mello. These are probably the implements transferred to the Nottingham Castle Museum and Art Gallery in 1972 (NCM Day Book F, p. 205) and accessioned as NCM 1994-20/1-148. The third acquisition also included a small collection of rocks and minerals, unrelated to Creswell Crags. The focus of this study is on the Creswell Crags fossil material, so a review of the human implements and the other rocks and minerals bequeathed by Mello is beyond the scope of this paper.

The entire natural history collection, including the Creswell Crags material, was moved to Wollaton Hall in 1926 where it remains today (Smith 2015). It is worth noting that not all of the Creswell Crags material at the NOTNH was necessarily acquired from Mello. Only one other 'acquisition' of fossil material from Creswell Crags is listed in the register (NH Acq. Ref: 1882.12). This consisted of a woolly mammoth (*Mammuthus primigenius*) milk tooth, discussed by Metcalfe (1885) and Owen (1885), temporarily loaned from the British Museum. However, the register is incomplete, and does not account for all of the material in the NOTNH. Some of the Creswell Crags and possible Creswell Crags material is unlabelled, so other donations may have been received but not recorded.

Turner (2000) previously catalogued all cited and figured Creswell Crags material within the NOTNH. This material comprises 21 specimens collected by Mello, and includes carnivores *Crocuta* and *Ursus*, artiodactyls *Megaloceros* and *Rangifer*, and perissodactyls *Coelodonta* and *Equus*. Two of these specimens were discussed by Mello (1876) and are present in the collection today (Figure 1). In the early 1990s several NOTNH specimens were recognised by Roger Jacobi in an historical photograph of some of the material excavated by Mello (Turner 1993). This photograph, taken some time prior to the NOTNH acquisitions, shows a selection of specimens pinned to a display board propped on a chair, and was subsequently published by Mello in 1891 (Mello 1891). The Nottingham City Museums and Galleries (NCMG) archive holds an original

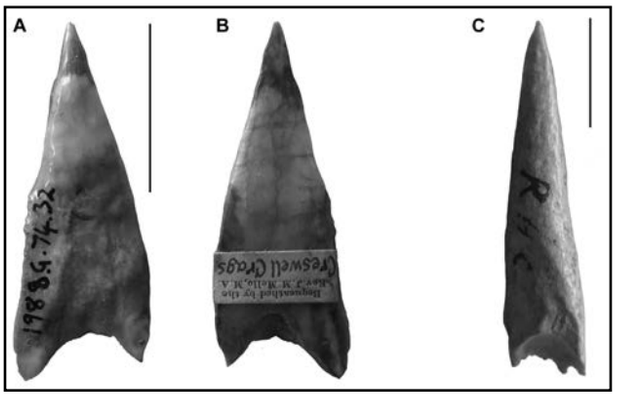

Figure 1. Photographs of specimens previously cited or illustrated by Mello (1876). A-B. NOTNH FS4339, tooth fragment originally regarded by Mello (1876) as a human made implement, according to Turner (2000). C. NOTNH FS4353, fragment of ivory illustrated by Mello (1876, fig 1) and originally thought to be a piece of antler worked into a point, now thought to be naturally-shaped (Turner 2000). Scale bars = 10 mm.

annotated print of this photo (NCMG 2015-53), reproduced here in Figure 2 with the NOTNH material indicated. The 19 specimens in this photograph are present and in good condition in the NOTNH today (Figure 3). Turner (2000) cites the numbers annotated on the photograph in Mello (1891). However, we identified some minor corrections (Table 1). To our knowledge, the majority of the NOTNH Creswell Crags fossil specimens have not been figured in the literature.

The material

Storage conditions

The NOTNH Creswell Crags collection is stored in a wooden cabinet with removable glass-topped drawers (Figure 4). This cabinet also contains Quaternary material from Nottinghamshire and other UK sites. The Creswell Crags specimens are distributed among 14 drawers and small elements are housed in cardboard trays to prevent damage from them moving around. Wall and Jacobi (2000) noted that some of the Creswell Crags material was beginning to dry out and crack. During this study we noted some of the larger specimens such as the *Coelodonta* and *Bison* limb bones were cracking and several vertebrae, including those of *Megaloceros*, among other bones were abrading against the wooden drawers and cardboard trays. An ongoing collection care project involving volunteers at the NOTNH is improving storage conditions of the entire fossil collection. This is achieved by padding elements with acid-free paper and/or Plastazote®, a light, non-toxic foam formed from nitrogen expanded closed-cell cross-linked polyethylene

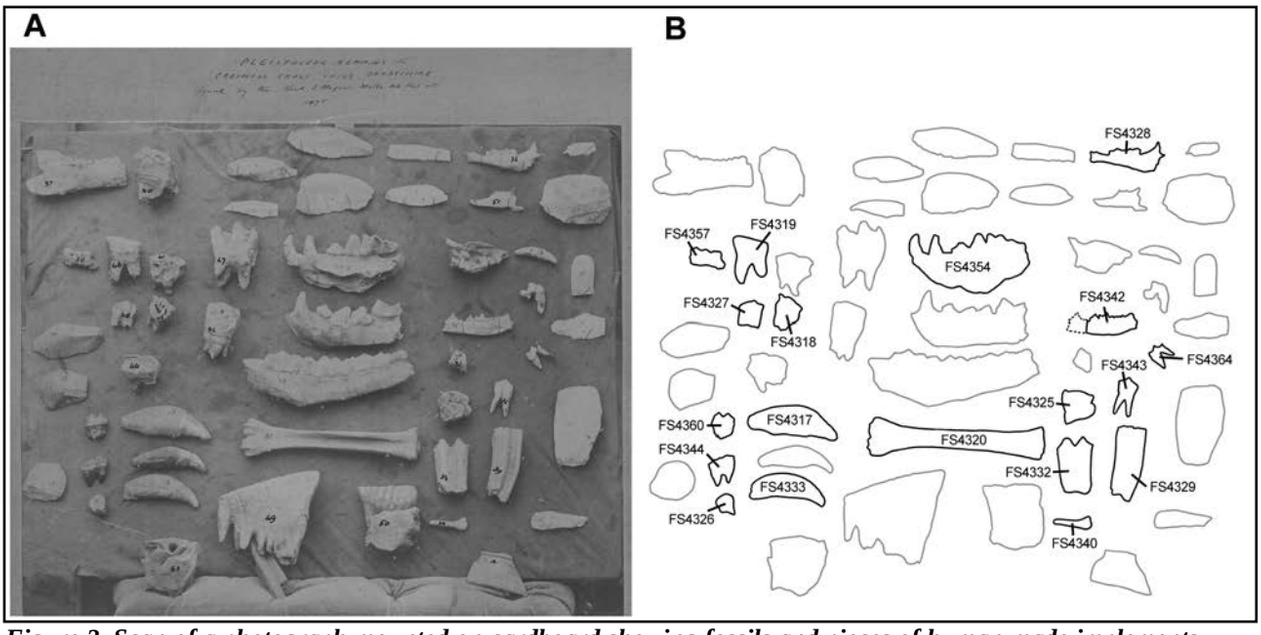

Figure 2. Scan of a photograph mounted on cardboard showing fossils and pieces of human made implements found at Creswell Crags by Mello, 1875. A. scanned photograph. B. Interpretation. The hand-written text in the photograph caption reads "PLEISTOCENE REMAINS etc Creswell Crags CAVES, DERBYSHIRE Found by the Revd J. Magens Mello MA, FGS, etc. 1875". Each specimen in the photograph (A) is annotated with a hand-written number. This photograph is held in the Nottingham Natural History Museum, Wollaton Hall (NCMG 2015-53). A version of this photograph was figured and annotated by Mello (1891). The sequence of annotated numbers in this photograph does not match the sequence in Mello (1891). 19 of the specimens are housed in the NOTNH today, as indicated in B. The dotted line in NOTNH FS4342 indicates a broken and missing portion of this specimen.

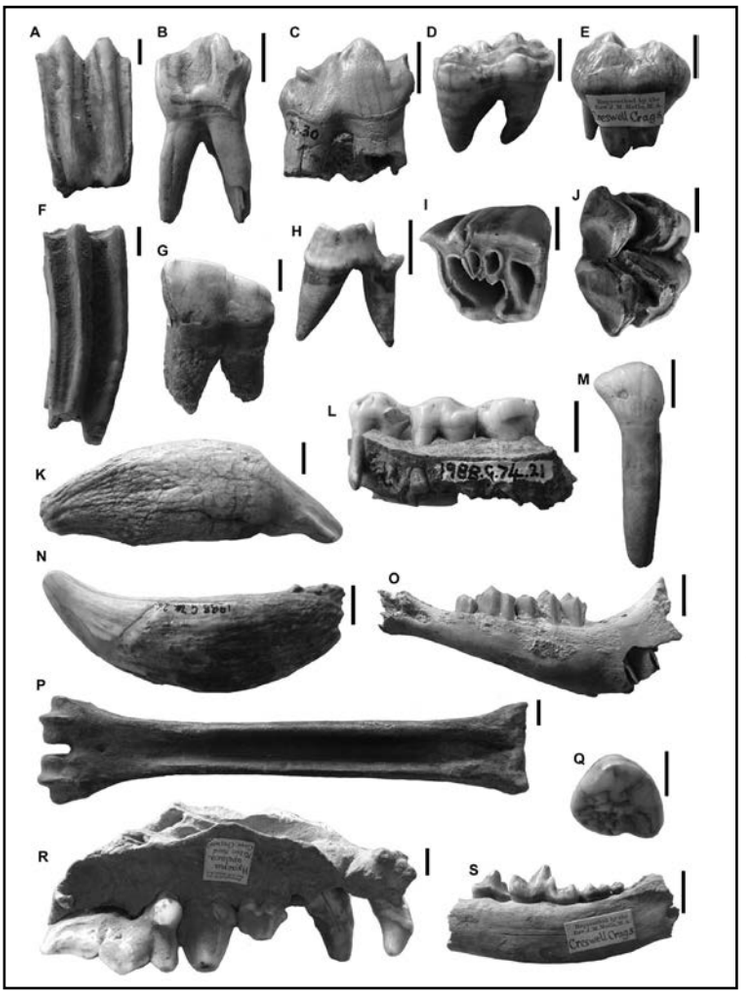

Figure 3. Photographs of 19 NOTNH Creswell Crags specimens previously figured in an historical photograph (NCMG 2015-53; see Figure 2). The following identifications are taken from the NOTNH database. A. NOTNH FS4332,* Bison priscus*, a 'cheek tooth'. B. NOTNH FS4343,* Bos longifrons*, molar or premolar. C. NOTNH FS4327,* Coelodonta antiquitatis*, molar. D. NOTNH FS4344,* Ursus *sp., molar or premolar. E. NOTNH FS4360,* Ursus *sp., molar or premolar. F. NOTNH FS4329,* Equus *sp., molar. G. NOTNH FS4319,* Coelodonta antiquitatis*, 'cheek tooth'. H. NOTNH FS4364,* Crocuta crocuta*, DM4 tooth. I. NOTNH FS4318,* Coelodonta antiquitatis*, upper molar. J. NOTNH FS4325,* Megaloceros *(in database as '*Megaceros*'), molar. K. NOTNH FS4317.* Ursus *sp., canine. L. NOTNH FS4357,* Sus scrofa*, part of lower jaw. M. NOTNH FS4340, Bovid incisor. N. NOTNH FS4333,* Ursus *sp., canine; O. NOTNH FS4328,* Ovis *sp. half of a lower jaw. P. NOTNH FS4320,* Rangifer tarandus*, metapodial, probably a metacarpal. Q. NOTNH FS4326,* Ursus *sp. premolar or molar. R. NOTNH FS4354,* Crocuta crocuta*, left upper jaw. S. NOTNH FS4342,* Vulpes vulpes*, partial right mandible. Scale bars = 10 mm.

Figure 4. Cabinet housing the Creswell Crags collection (and other Pleistocene material) at the Nottingham Natural History Museum, Wollaton Hall.

(Larkin 2013). The Creswell Crags material will receive this treatment in due course to preserve the future integrity of the collection. A few Creswell Crags fossil specimens are on public display in the NOTNH, and one specimen (NOTNH FS4545) is on loan to Creswell Crags Museum and Heritage Centre where it is on display.

Provenance data and historical labels

Hunt *et al.* (2015) noted that "the excavations at Creswell Crags by Dawkins…were truly ground-breaking at the time" (p.110) but also acknowledged they were severely limited by contemporary knowledge. Jenkinson and Gilbertson (1984) went so far as to say that Dawkins and Mello rushed the excavations, using dynamite and workmen to clear large chambers over a short period of time. This may be backed up by the lack of provenance data associated with the NOTNH Creswell Crags collection. Wall and Jacobi (2000) calculated that 12% of the NOTNH Creswell Crags "finds" were provenanced to a specific cave. Today, 32 specimens, consisting of 47 elements, retain information regarding the specific cave they were excavated from (Figure 5). This corresponds to 11.7% of specimens (with at least one element with cave information), but only 10.1% of total individual fossil elements (Figure 5). Specimens that retain specific locality information originate from one of four caves: Church Hole Cave (CHC), Mother Grundy's Parlour (MGP), Pin Hole Cave (PHC) and Robin Hood Cave (RHC). The largest percentage of these specimens (62%) comes from Robin Hood Cave (Figure 5).

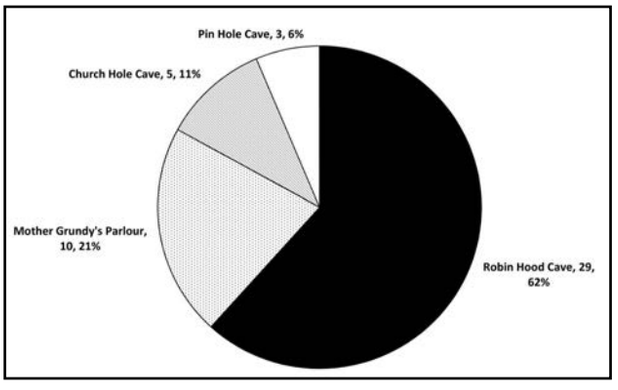

Figure 5. Summary of known provenance data for elements for which specific cave of origin is known (10.1% of the NOTNH Creswell Crags collection).

The stratigraphic data associated with the specimens is also poor, possibly due to the haste with which the specimens were removed (Jenkinson and Gilbertson 1984), although it is possible that provenance data was recorded and has since been lost. Whatever the reason, the general lack of provenance data limits the scientific value of the collection. Dawkins personal papers are housed at Buxton Museum and may contain notes on these excavations.

In total there are 160 historical (before ~1960) labels attached to elements. The labels occur in ten types, which provide potential information on the collector, excavation, etc. (Figure 6). 110 specimens (which may include one or more elements) include at least one element with a label attached. In total, 146 elements have at least one type of label attached. 14 elements have two different types of label attached. The most common type of label designates specimens that were "Bequeathed by the Rev. J. M. Mello, M.A." (in printed lettering) with specific details added by hand (type A, Figure 6A). This label (or slight variants of it) is associated with 98 specimens (131 elements). The remaining nine label types are far fewer, together comprising just 18% of all recorded attached labels (Figure 6B-J). A white rectangular label with serrated edges, a narrow coloured bar (sometimes red, sometimes green), and handwritten text, occurs on seven elements (type B, Figure 6B). One variant of this type has four green striped bars (Figure 6B). These appear to be the edges from perforated sheets of stamps (or press sheets) that have been used as convenient self-adhesive labels. The significance of label type B is otherwise unknown to us, but some of them are also associated with type A labels. Rectangular white strip-like labels with straight edges and handwritten pencil identifications occur on seven elements (type C, Figure 6C). A blue and white octagonal label occurs on six elements and is known to be associated with the 1870s excavations of Mello (type D, Figure 6D). Some type D labels appear blank while others

Figure 6. Types of labels found attached to NOTNH Creswell Crags material. A. Label type A, "Bequeathed by the Rev. J. M. Mello, M. A.", Three variants, left to right: small version with "Creswell Caves" in handwriting (example NOTNH FS4310), large variant with additional taxon identification in handwriting (example NOTNH FS4308), and large variant with additional cave details (example NOTNH FS4307). B. Label type B, white rectangular label with serrated edges in four variants, left to right: broken red bar variant with additional small red stripe (example NOTNH FS4481), solid red bar variant (example NOTNH FS4371), solid green bar variant (example NOTNH FS4369), and four green striped bars variant (example NOTNH FS4551). C. Label type C, rectangular white strip-like label with straight edges (example NOTNH FS4501). D. Label type D, blue octagonal label in two variants, left to right: thick bordered variant (example NOTNH FS12061), thin bordered variant with central blue line (example NOTNH FS12079). E. Label type E, circular label with jagged edges (example NOTNH FS4491). F. Label type F, large rectangular label with straight edges and typed lettering (example NOTNH FS4550). G. Label type G, rectangular label with straight edges and 'grid' (example NOTNH FS4370). H. Label type H, semi-circular label with serrated curved edge and flat straight edge (example NOTNH FS4359). I. Label type I, large rectangular label with typed identification (example NOTNH FS4308). J. Label type J, circular label with smooth edges (example NOTNH FS4498). Photographs not to scale.

have handwritten text (Figure 6D). Circular labels with jagged edges and pencil handwriting occur on three elements (type E, Figure 6E). Type E labels are never associated with any other labels and their significance is unknown to us. A large rectangular label with straight edges has typed lettering that reads "Genus…Species…Locality…Rock" and spaces for handwritten data (type F, Figure 6F). This type of label is widespread in the general NOTNH fossil collection and was probably applied to the elements after their acquisition. A rectangular label with straight edges, a 'grid', and typed lettering with handwritten taxon identification, occurs on one specimen (type G, Figure 6G) and is associated with label type A. Label type G denotes material from the 1870s excavation. The typed lettering on the single type G label reads "Creswell Cave Churchhole cave Exploration, 1876". A white semicircular label with a serrated curved edge, with identification in handwriting is present on one element (type H, Figure 6H). A large white rectangular label (type I, Figure 6I) is found on one element, and is associated with label type A. The final type of historical label attached to elements is a single circular label with smooth edges (type J, Figure 6J) present on one specimen and unassociated with any other labels.

Some loose labels and notes are also associated with the material (Figure 7). These include scraps of brown paper with rough handwriting in pen (Figure 7A), card with handwriting in pen (Figure 7B), cards and papers with red borders and handwriting in pen (Figures, 7C and D), and loose labels (Figure 7E) that are identical to attached label type F. Some loose labels and notes have become disassociated from their elements. Some elements are also marked with pencil but these are often indecipherable or unclear.

Number of specimens

All of the NOTNH Creswell Crags Pleistocene and Holocene fossil material is listed in catalogue form, available on request from the authors. In total there are 274 fossil specimens comprising 466 elements, of which 283 have been identified to genus level (Figure 8A). These identifications are taken from the museum database, which is based on associated labels and research conducted on the collection by Andrew Currant, Roger Jacobi, Rosemary Powers and Neil Turner. It is possible that some specimens in the NOTNH may be re-identified in the future. The identified specimens consist of 17 genera from six orders; Carnivora (*Canis*, *Crocuta*, *Ursus*, *Vulpes*), Artiodactyla (*Bison*, *Bos*, *Hippopotamus*, *Megaloceros*, *Ovis*, *Rangifer*, *Sus*), Perissodactyla (*Coelodonta*, *Dicerorhinus*, *Equus*), Proboscidea (*Mammuthus*), Lagomorpha (*Lepus*) and Primates (*Homo*) (Figure 8B). The NOTNH collection is dominated by *Coelodonta* (25.5%) and *Equus* (22.0%), while *Crocuta* is the most common identified carnivore (12.8%). Proboscidea, Lagomorpha and Primates together comprise less than 8% of the entire identified collection (Figure 8B). Many of the above taxa were common in Britain during the Holocene (e.g. *Bos*, *Ovis*, *Sus*, *Lepus*, *Vulpes*, and others) (Dawkins 1877), so a considerable proportion of the NOTNH fossil collection may be Holocene (rather than Pleistocene). The stratigraphic data is compromised not just due to excavation quality, but also due to rain- and flood-waters entering the caves, and intrusive burials by Neolithic *Homo sapiens* disturbing the stratigraphic integrity (Heath 1879). To resolve this issue, Creswell Crags bones can be subjected to radiocarbon dating techniques to quantify relative ages of particular taxa (Jacobi *et al.*

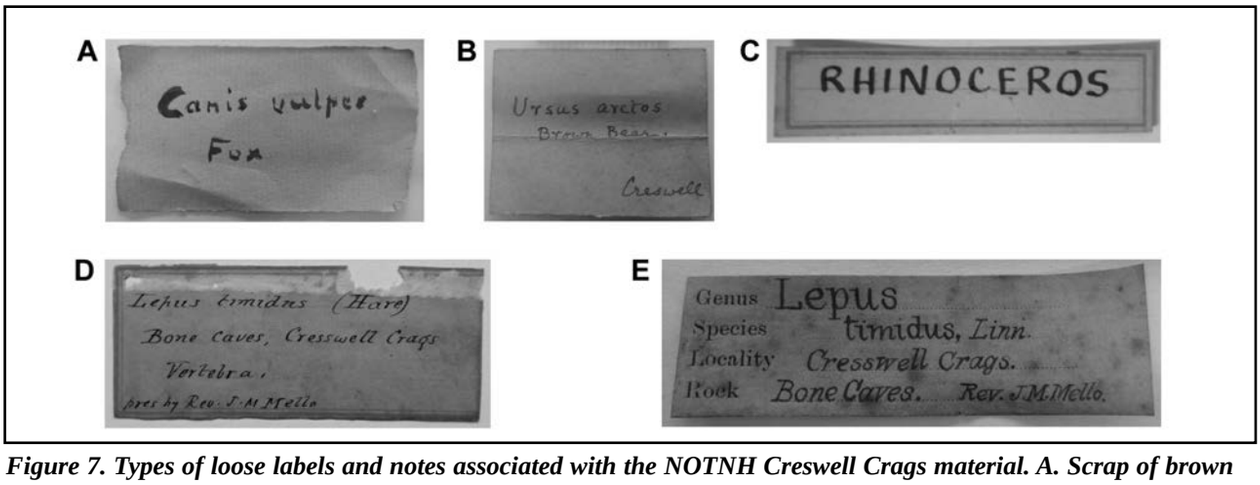

Figure 7. Types of loose labels and notes associated with the NOTNH Creswell Crags material. A. Scrap of brown paper with rough handwriting in pen. B. Card with handwriting in pen. C. Card with red border and handwriting in pen. D. Paper label with red border and handwriting in pen. E. Rectangular label with typed lettering and handwriting in pen, identical to the attached label type F (see Figure 6F). Photographs not to scale.

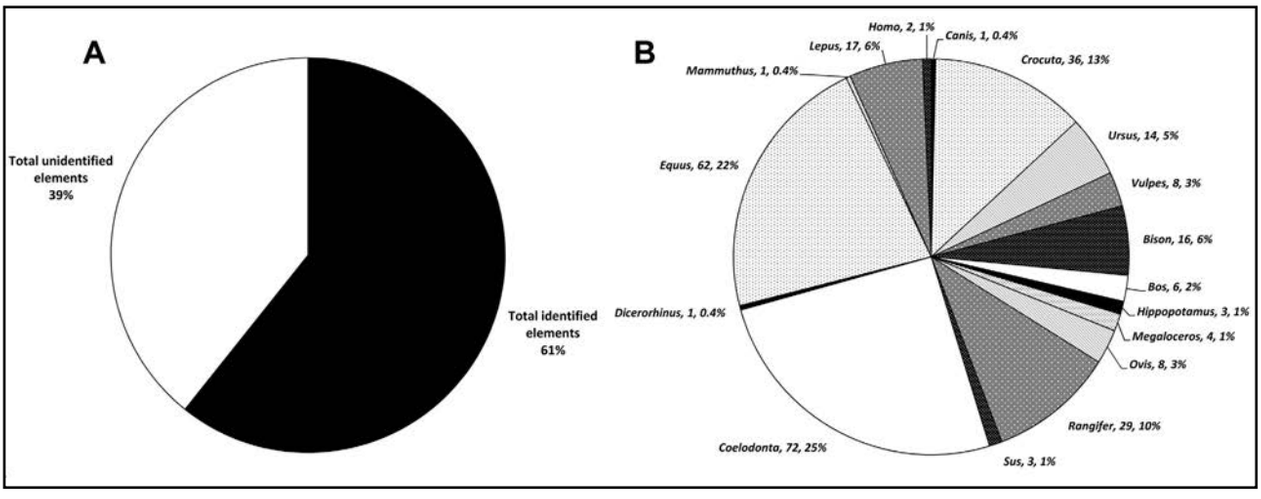

Figure 8. Abundances of faunal elements from Creswell Crags housed at Nottingham Natural History Museum, Wollaton Hall. A. Abundances of elements identified to genus level and 'unidentified' elements (some 'unidentified' material is identified to higher taxonomic levels). Identifications were taken from the museum database which is based on associated specimen labels and research by Andrew Currant, Roger Jacobi, Rosemary Powers and Neil Turner. B. Taxonomy of the material identified to genus level (taxa ordered as in Dawkins 1877).

1998; 2006; Pike *et al*. 2005). There is also scope to distinguish between Pleistocene and Holocene material in the future based on assessing preservation, although such an approach is less rigorous and is strongly influenced by the depositional environment.

The collection also contains three specimens (consisting of six elements) which are plaster casts. These include NOTNH FS13716, consisting of a single *Coelodonta* molar, which is a replica of NOTNH FS4960/1. NOTNH FS12386 consists of two *Coelodonta* premolars which are both replicas of NOTNH FS4476/1 and one *Coelodonta* molar which is a replica of NOTNH FS4476/2. The final specimen, NOTNH FS4368, consists of two different *Dicerorhinus* molars which are replicas of a Manchester Museum specimen with the number P1846. These casts were not included in the analyses. Part of a *Rangifer* antler (NOTNH FS12061) joins a specimen in the British Geological Survey (BGS G5 and A85).

Comparison with 1870s excavations

Comparison between the entire NOTNH Creswell Crags collection (Pleistocene and Holocene) and the material listed by Dawkins (1877) (both Pleistocene and Holocene) shows the same four most common genera: *Crocuta*, *Equus*, *Rangifer* and *Coelodonta* (Figure 9). However, some differences are still present in the abundances of these four taxa as *Coelodonta* are more abundant in the NOTNH collection, whereas *Crocuta* and to a lesser extent *Rangifer*, are less abundant in the NOTNH collection (Figure 9).

Other notable discrepancies include *Bison*, which is twice as abundant in the NOTNH, and *Bos*, which is three times as abundant (Figure 9). In addition, the Ipswichian *Hippopotamus* and *Dicerorhinus* are present in the NOTNH collection, but are not recorded by Dawkins (1877). This discrepancy may be explained because these taxa in the NOTNH are exclusively from Mother Grundy's Parlour, which was excavated by Mello and Dawkins in 1877 (Dawkins and Mello 1879), too late to be published in Dawkins (1877). *Mammuthus* on the other hand is substantially less abundant in the NOTNH collection compared to Dawkins (1877) (Figure 9). One could speculate that this is the result of a 'donation bias,' in which Mello separated out the *Mammuthus* material for other museums/collectors.

Dawkins (1877) recorded the presence of *Panthera* specimens in both Church Hole Cave and Robin Hood Cave. These were believed to belong to the Eurasian cave lion (*Panthera leo spelaea*) and leopard (*Panthera pardus*) (Dawkins 1877). A tooth in the NOTNH collection originally identified as a lion canine was re-identified as a bear in the 1980s/90s by A. Currant and R. Jacobi (NOTNH FS4308). Conclusive remains of British Pleistocene leopards are restricted to southern England (Diedrich 2013), so their remains could have been brought in by Palaeolithic man from mainland Europe (Freedman and Evans 2015), or could have been misidentified.

The scimitar-toothed cat *Homotherium*, originally named '*Machairodus*' by Dawkins (1877), is absent from the NOTNH collection (or has not been

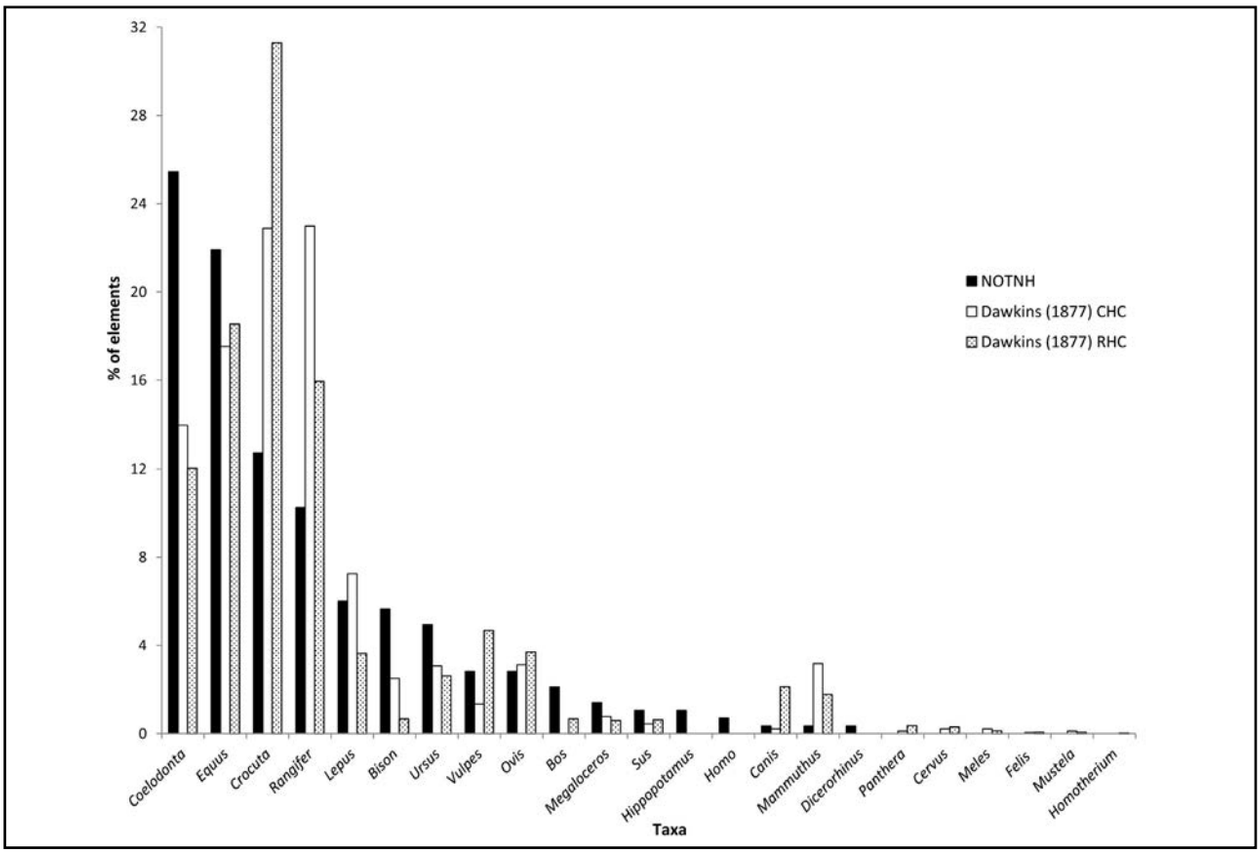

Figure 9. Abundances of identified specimens held at the Nottingham Natural History Museum, Wollaton Hall (NOTNH), compared with abundances of specimens from the initial 1870s excavations of Church Hole Cave (CHC) and Robin Hood Cave (RHC) as reported by Dawkins (1877). N.B. Specimens identified by Dawkins (1877) may have since been re-identified, and specimens in the NOTNH may also be re-identified in the future.

identified), although only one specimen belonging to this taxon has been recorded from Creswell Crags (Dawkins 1877, fig 3; Jenkinson and Gilbertson 1984; Barnett 2014). However, this tooth specimen was originally disputed by Thomas Heath as a deliberate plant (Heath 1880) and this interpretation has since been generally accepted (Jenkinson and Gilbertson 1984). Even if genuine, the tooth would likely have been brought in by Palaeolithic man from mainland Europe (Currant and Jacobi 2001; MacFarlane and Lundberg 2013), and therefore would not be part of the Pin Hole MAZ in Britain.

Limited significance can be attached to the above comparisons because they contain collections of mixed provenance. However, six taxa are exclusively Pleistocene in age in Britain: *Crocuta*, *Bison*, *Coelodonta*, *Mammuthus*, *Hippopotamus* and *Dicerorhinus*, although in Britain the latter two are only found in pre-Devensian deposits. The relative abundances of these taxa may therefore potentially provide a meaningful comparison between Pleistocene Pinhole MAZ collections and/or fauna.

Collecting biases may have arisen in the Creswell Crags caves as Dawkins and Mello were primarily focused on large, characteristic Pleistocene fauna, so smaller animals may have been less intensively studied or even ignored (Jenkinson and Gilbertson 1984). Later, more detailed excavations certainly found smaller specimens, including Arctic fox (*Vulpes lagopus*), European water voles (*Arvicola terrestris*) and several species of lemming (Armstrong 1929, 1930, 1931, 1932a, 1932b). The lack of such taxa in the NOTNH Creswell Crags collection suggests this may have been the case, further highlighting that the collection does not contain a representative faunal assemblage of Creswell Crags.

Reconciliation of specimens with the database

A database of NOTNH material was compiled as part of a documentation initiative (The Baseline Database Project) in the 1990s. Following this project, as of 01/08/2003, there were 252 fossil records with the 'find spot' listed as Creswell Crags in the database (an additional specimen of cave earth is not a fossil: NOTNH FS12153). 15 of these had no acquisition details. In the current study all 252 of these specimens were accounted for in the collection. The

specimen details in the database were double-checked against the physical labels and updated accordingly. As a result of this project, the details were updated for 127 records.

In addition we identified 26 more specimens (consisting of 73 elements) from Creswell Crags on the basis of; (1) physical labels that had been previously unrecorded (four specimens in total) and (2) data in 'collections note' field of the baseline database (22 in total, plus the four labelled specimens).

There are also 24 specimens (consisting of 192 elements) labelled as "probably from Creswell Crags." The specimen NOTNH FS12380 consists of a small drawer, separate from all other Creswell Crags specimens, containing 75 bones and teeth mounted by nails in the drawer bottom (Figure 10A). This specimen is labelled "?Creswell Crags" in the baseline database but contains no other stratigraphy or acquisition details, so this is presumably just an educated guess by the curator at the time (the handwriting belongs to Jim Owens, Museum Assistant, 1939-1954, and Assistant Curator: Geology, 1954-1984). The remaining 23 specimens (containing 117 elements) are in two drawers in the cabinet (Figure 4), with 11 specimens (containing 75 elements) in Drawer 9 (Figure 10B) and 12 specimens (containing 42 elements) in Drawer 11 (Figure 10C). Both drawers are physically labelled "probably from Creswell Crags" (in Jim Owens' handwriting) but have no other stratigraphy or acquisition details recorded on the labels or in the database. Therefore this is also presumably just an educated guess. Although the taxonomic identities of some probable Creswell Crags specimens had previously been tentatively deduced, their scientific value remains low and have therefore all been excluded from our analyses.

Reconciliation of specimens with the acquisition registers

The NOTNH register of acquisitions was compiled retrospectively as part of a service-wide documentation initiative in the 1990s/2000s immediately preceding the Baseline Database Project (see above). Each Mello acquisition in the register does not include an itemised list of individual Creswell Crags specimens (see 'History of the Collection'). Therefore, there is no way to confidently distinguish between the various bequests, purchases and gifts, so reconciliation of the individual specimens with separate Mello acquisitions is difficult. However, it may be possible to reconcile some specimens with acquisitions on the basis of their labels. Those specimens with type A labels (Figure 6A; 98 specimens in total) might be part of the third acquisition.

Conclusions and future directions

The NOTNH Creswell Crags collection contains a diverse Pleistocene and Holocene mammalian fauna. Although it is not always certain which epoch particular taxa or specimens may belong to, elements could be subjected to radiocarbon dating techniques to quantify relative ages of taxa (Jacobi *et al.* 1998; 2006; Pike *et al.* 2005).

Work is ongoing to classify the unidentified specimens to provide more accurate faunal abundances of the NOTNH collection and Creswell Crags and the Pin Hole MAZ. This can be aided by resolving whether the "probable Creswell Crags" specimens are indeed from these caves. Whilst the NOTNH Creswell Crags collection can be considered important for future palaeontological research, the lack of site provenance and stratigraphic data limits its scientific value. This could in part be rectified by focusing on specimens and elements which retain pencil or pen annotations

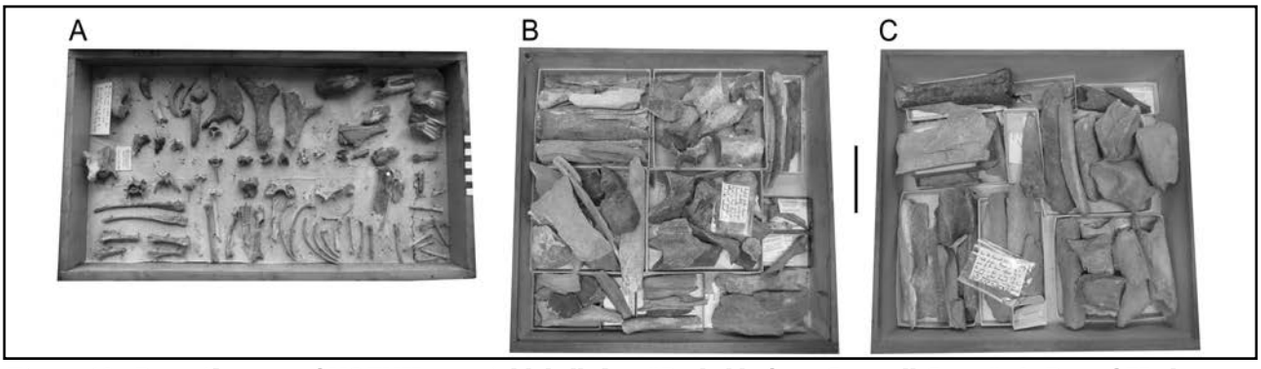

Figure 10. Boxes/drawers of NOTNH material labelled as "Probably from Creswell Crags". A. Box of 75 elements with a single specimen number (NOTNH FS12380). B. Specimens stored in drawer 9. C. Specimens stored in drawer 11. Scale bar 10cm.

Specimen number	Acquisition number	Description	Photograph number given by Turner (2000)	Actual photograph number
NOTNH FS4317	1988.G.74.11	*Ursus* canine tooth	18	22
NOTNH FS4318	1988.G.74.8	*Coelodonta* molar tooth	45	42
NOTNH FS4319	1988.G.74.9	*Coelodonta* molar tooth	46	38
NOTNH FS4329	1988.G.74.6	*Equus* molar tooth	39	51

Table 1. Corrections to Turner (2000). All other photograph numbers cited by Turner (2000) are correct. Note that specimen numbers have taken precedence over acquisition numbers in the NOTNH for identification purposes since 2000.

on the fossils themselves and/or their associated loose notes. Deciphering these marks could potentially uncover the person or persons who originally wrote them and consequently from when and where they were excavated.

Projects such as this one will hopefully encourage other museums with Creswell Crags material to document and publish their collections in more detail. This may help deduce whether museums that received donations of Creswell Crags material were indeed subjected to 'donation biases' with respect to specific taxa being acquired, and might provide more data for understanding spatial and temporal faunal movements during the Ice Age (Wall and Jacobi 2000; Currant and Jacobi 2001).

Acknowledgments

This paper benefitted from the help of several individuals. Jane Ford provided several invaluable papers, useful discussion about the identity of several carnivore elements and commented on an earlier version of this manuscript. Fred Owen helped us locate several papers, provided valuable discussion and commented on an earlier version of this manuscript. Andy King assisted with the documentation of the collection and archives. Chris Orgill commented on an early version of the manuscript. Ros Westwood from the Buxton Museum and Art Gallery helped with our enquiry about the origin of the historical photograph. Paul Sheperd provided information on material held in the British Geological Survey. We also thank an anonymous reviewer for helpful suggestions that improved the manuscript.

References

ARMSTRONG, A.L. 1925. Excavations at Mother Grundy's Parlour, Derbyshire, 1924. *Journal of the Royal Anthropological Institute* **55**, 146-178.

ARMSTRONG, A.L. 1929. Excavations at Creswell Crags, Derbyshire. 1926-28. *Transactions of the Hunter Archaeological Society* **3**, 332-334.

ARMSTRONG, A.L. 1930. Pin Hole Cave excavations, Creswell Crags, Derbyshire. Discovery of an engraved drawing of a masked human figure. *Proceedings of the Prehistoric Society of East Anglia* **6**, 27-29.

ARMSTRONG, A.L. 1931 Excavations in the Pin-Hole Cave, Cresswell, Derbyshire. *Man* **31**, 113.

ARMSTRONG, A.L. 1932a Excavations at Creswell Crags, Derbyshire. 1928-32. The Pin Hole Cave. *Transactions of the Hunter Archaeological Society* **4**, 178-184.

ARMSTRONG, A.L. 1932b Excavations in the Pin Hole Cave, Creswell Crags, Derbyshire. *Proceedings of the Prehistoric Society of East Anglia* **6**, 330-334.

BARNETT, R. 2014. An inventory of British remains of *Homotherium* (Mammalia, Carnivora, Felidae), with special reference to the material from Kent's Cavern. *Geobios* **47**, 19-29.

BUSK, G. 1875. Appendix. List of the Mammalian Remains collected by the Rev. JM Mello in the Rock-Fissure Cavern in Creswell Crags, Derbyshire. *Quarterly Journal of the Geological Society* **31**(1-4), 683-691.

CHARLES, R. and JACOBI, R.M. 1994. The Lateglacial fauna from the Robin Hood cave, Creswell Crags: a re-assessment. *Oxford Journal of Archaeology* **13**, 1-32.

CURRANT, A. and JACOBI, R. 2001. A formal mammalian biostratigraphy for the Late Pleistocene of Britain. *Quaternary Science Reviews* **20**, 1707-1716.

DAWKINS, W.B. 1877. On the Mammal-Fauna of the Caves of Creswell Crags. *The Quarterly Journal of the Geological Society of London* **33**, 589-612.

DAWKINS, W.B and MELLO, J.M. 1879. Further discoveries in the Creswell caves. *The Quarterly Journal of the Geological Society of London* **35**, 724-735.

DIEDRICH, C.G. 2013. Late Pleistocene leopards across Europe - northernmost European German population, highest elevated records in the Swiss Alps, complete skeletons in the Bosnia Herzegowina Dinarids and comparison to the Ice Age cave art. *Quaternary Science Reviews* **76**, 167-193.

FREEDMAN, J. and EVANS, J. 2015. Working with the Public: How an Unusual Museum Enquiry Turned into Travels Through Time and Space. *Open Quaternary* **1**, 1-14.

HEATH, T. 1879. *An Abstract Description and History of the Bone Caves of Creswell Crags.* Wilkins and Ellis, Derby, 1-17.

HEATH, T. 1880. *Creswell Crags V. Professor Boyd Dawkins*. Edward Clulow, Jun., Derby, 1-40.

HUNT, C.O., GILBERTSON, D.D., HILL, E.A. and SIMPSON, D. 2015. Sedimentation, re-sedimentation and chronologies in archaeologically-important caves: problems and prospects. *Journal of Archaeological Science* **56**, 109-116.

JACOBI, R.M., HIGHAM, T.F.G. and RAMSEY, C.B. 2006. AMS radiocarbon dating of Middle and Upper Palaeolithic bone in the British Isles: improved reliability using ultrafiltration. *Journal of Quaternary Science* **21**, 557-573.

JACOBI, R.M., ROWE, P.J, GILMOUR, M.A, GRUN, R. and ATKINSON, T.C. 1998. Radiometric dating of the Middle Palaeolithic tool industry and associated fauna of Pin Hole Cave, Creswell Crags, England. *Journal of Quaternary Science* **13**, 29-42.

JENKINSON, R.D.S. 1984. *Creswell Crags Late Pleistocene Sites in the East Midlands*. BAR British Series 122, Oxford, 371pp.

JENKINSON, R.D.S. and GILBERTSON, D.D. 1984. *In the shadow of extinction: a Quaternary archaeology and palaeoecology of the lake, fissures and smaller caves at Creswell Crags SSSI*. Nottinghamshire and Derbyshire county councils.

VAN KOLFSCHOTEN, T. 1992. Aspects of the Migration of Mammals to Northwestern Europe during the Pleistocene, in particular the Reimmigration of *Arvicola terrestris*. *Courier Forsch.-Inst. Senckenberg* **153**, 213-220.

LARKIN, N.R. 2013. Literally a 'mammoth task': The conservation, preparation and curation of the West Runton Mammoth skeleton. *Quaternary International* **228**, 233-240.

MacFARLANE, D.A. and LUNDBERG, J. 2013. On the occurrence of the scimitar-toothed cat, *Homotherium latidens* (Carnivora; Felidae), at Kents Cavern, England. *Journal of Archaeological Science* **40**, 1629-1635.

MELLO, J.M. 1875. On some bone-caves in Creswell Crags. Quarterly *Journal of the Geological Society of London* **31**, 679-691.

MELLO, J.M. 1876. The bone-caves of Creswell Crags. - 2nd Paper. *Quarterly Journal of the Geological Society of London* **32**, 240-258.

MELLO, J.M. 1877. The bone-caves of Creswell Crags. -3rd Paper. *Quarterly Journal of the Geological Society of London* **33**, 579-588.

MELLO, J.M. 1891. Handbook of the geology of Derbyshire. 2nd Edition. Bemrose and Sons, London.

METCALFE, A T. 1885. On the discovery in one of the bone-caves of Creswell Crags of a portion of the upper jaw of Elephas primigenius, containing in situ the first and second milk-molars (right side). *Quarterly Journal of the Geological Society of London* **41**, 30.

OWEN, R. 1885. Notes on remains of *Elephas primigenius* from one of the Creswell bone-caves. *Quarterly Journal of the Geological Society of London* **41**, 31-34.

PIKE, A.W.G., GILMOUR, M., PETTIT, P., JACOBI, R., RIPOLL, S., BAHN, P. and MUÑOZ, F. 2005. Verification of the age of the Palaeolithic cave art at Creswell Crags, UK. *Journal of Archaeological Science* **32**, 1649-1655.

SMITH, A.S. 2015. Behind the Scenes at the Museum, Fossils at the Nottingham Natural History Museum, Wollaton Hall, UK. *The Palaeontological Association Newsletter* **88**, 35-38.

STEWART, J.R. and JACOBI, R.M. 2015. The long Term Response of Birds to Climate Change: New Results from a Cold Stage Avifauna in Northern England. *PLoS ONE* **10**, e0122617.

TURNER, N.S. 1993. Report on the Geological Collections of the Natural History Museum, Wollaton Hall, Nottingham. *Mercian Geologist* **5**, 49-64.

TURNER, N.S. 2000. Catalogue of the type, figured and cited fossils in the Nottingham Natural History Museum, Wollaton Hall, Nottingham, U.K. *The Geological Curator* **7**, 111-121.

WALL, I.J. and JACOBI, R.M. 2000. *An Assessment of the Pleistocene collections from the cave and rockshelter sites in the Creswell Area*. Creswell Heritage Trust.