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Title: Fossil hunting and grinding in the Coal Measures: William Cash (1843-1914), his associates, and their work on the fossil plants of the Carboniferous period

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Source: Baker, R. A. & Gill, D. S. (2018). Fossil hunting and grinding in the Coal Measures: William Cash (1843-1914), his associates, and their work on the fossil plants of the Carboniferous period. *Journal of Natural Science Collections, Volume 5*, 89 - 97.

URL: <http://www.natsca.org/article/2436>

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# Fossil hunting and grinding in the Coal Measures: William Cash (1843-1914), his associates, and their work on the fossil plants of the Carboniferous period

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Received: 03/04/2017

Accepted: 03/11/2017

**Citation:** Baker, R.A. and Gill, D.S., 2018. Fossil hunting and grinding in the Coal Measures: William Cash (1843-1914), his associates, and their work on the fossil plants of the Carboniferous period. *Journal of Natural Science Collections*, 5, pp.89-97.

## Abstract

William Cash (1843 – 1914) was an important amateur palaeobotanist based in Halifax, Yorkshire, but with connections at Owens College, Manchester. He worked with both the important amateur and professional palaeobotanists of the day, including Professor W. C. Williamson at Manchester. His important collection of over 700 microscope slides is at Manchester Museum. These slides have been scanned and catalogued, and include specimens mounted by associated workers of the time. Other museums in Britain have related material.

**Keywords:** William Cash, William C. Williamson, Thomas Hick, plant fossils, microscopy, slide preparation, slide collection, Manchester

## Introduction

Botany was a popular subject amongst amateur, especially working class, naturalists living in southwest Yorkshire and the areas around Manchester during the period when William Cash was active (late 19th – early 20th century), and several of them are well known. The study of fossil plants was a specialised offshoot; partly botanical, partly geological, but also microscopical. Specimens were relatively easy to obtain, especially if you lived near to coal seams, were a miner, or knew someone working in the coal industry. Amateurs provided the professionals with their raw materials, and the latter relied on them for a regular supply. People such as Professor William C. Williamson, of Owens College, Manchester, were “garnering a rich harvest from the

efforts of these reapers” (Howell, 2005). The Manchester connection is strong in the development of this topic, and Owens College, founded in 1851 (the forerunner of the University of Manchester), could rightly claim to be at the centre of where Palaeobotany in Britain was established on a scientific basis.

There appears to have been a good working relationship between the amateurs and professionals working on fossil plants. Some of the former went beyond collecting, and prepared thin sections to study the microscopical anatomy of the fossils themselves. From the point of view of the amateurs working on fossil plants, Cash was “perhaps the best known of the enthusiasts” (Howell, 2005).



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Figure 1. Portrait of William Cash (from Sheppard, 1915).

## William Cash

### Life and career

There are several obituaries to Cash, including those of Roebuck (1915), Kendall (1918), and Sheppard (1915), which give full details of Cash's life and professional work.

William Cash (Figure 1) was born in Leeds on 28 April 1843. His father, Isaac, was a dyer and his mother, Love Cash (née Brown), died giving birth to William. William had a sister, Mary Hannah (who died before he was born), and also an older brother, John. On the demise of his mother, records relating to his father disappear, and William is thereafter recorded in the household of his mother's brother, William Oddy. William married Sarah Ann Patchett of Halifax at South Parade Wesleyan Chapel in 1866, and they had three children (Mary, Annie, and John Percy). Sarah died in 1896, aged 53. One of Sarah's brothers, George Patchett (1820 -1898), founded a successful wiredrawing business at Sedburgh Mills, Halifax, and his sons became pillars of the local community (Patchett, 2016).

Described as having a "*charming personality*" (Sheppard, 1915) and a "*cheerful and genial optimism*" (Roebuck, 1915), Cash began his career working for the Halifax and Huddersfield Union Banking Company, and later, around 1893, set up independently as an accountant and Insurance and Mortgage Broker in the town. It would appear that shortly before his demise his accountancy practice was in some difficulty, and he retired from business in somewhat straightened circumstances (Kendall, 1918). It may well have been this situation that prompted the disposal of his slide collection, although he frequently sent material and slides to Professor W. C. Williamson and others. He died, aged 71, on 16 December 1914. He was working on the morning of the day he died, for Professor Kendall of Leeds University. The end came the same afternoon, when he fell in the garden after a walk and died, probably from a haemorrhage (Anon., 1914). A very full obituary can be found in the *Halifax Courier* (Anon, 1914).

A man of "*wide knowledge and multifarious activities*" (Roebuck, 1915), which included politics, religion, freemasonry, literature, and languages, it was in science that he was best known. When the geologist Professor Kendall arrived in the north, he was impressed with the amateurs and their work, and none more so than Cash. In his obituary to Cash, Kendall described him as a man "*to possess the widest outlook...deeply imbued with the true spirit of a naturalist as any man I have met*" (Kendall, 1918). In the absence of any specific evidence, it must be assumed that William, who hailed from the poorer echelons of society (William Oddy, his uncle, was a Clothdresser), took full advantage of the numerous night-classes and supported schools of the neighbourhood (as did many of the 'artisan naturalists' of that locale) to gain his scientific education.

One obituary (Anon, 1914) described "*his happy way of imparting [the] interest to others*". Cash was a popular and stimulating lecturer, and took great care in his preparation for this work (Kendall, 1918). He travelled to Mexico in 1899, and on his return gave several lectures on his experiences and on the flora and fauna. He also gave talks on fungi, volcanoes, fossils, marine animals, and the natural history of the Channel Islands (Anon, 1914).

### Society memberships

William Cash was very active in local affairs. He was one of the founders and twice President of the Halifax

Scientific Society (Cash, 1897) and President of the Halifax Geology Field Club, Treasurer of the Halifax Literary and Philosophical Society (Sheppard, 1915), and, for a period, governor and honorary curator of the Halifax Museum (Anon., 1914). He also served the Halifax School Board in various capacities (1883–1892), including Chairman (1889) (Sheppard, 1915).

It is difficult to imagine that, in addition to his professional work as a banker and accountant, Cash could be active in so many societies at both local and national level. Apart from the work in his adopted town, Cash was a Fellow of the Linnean Society (1888), Fellow of the Geological Society (1876) and Fellow of the Royal Microscopical Society (1888), Honorary life member of the Yorkshire Naturalists' Union (YNU), and secretary of the YNU Fossil Flora Committee. He was also an Honorary member of the Bradford Natural History Society. In geology, as a member of the Yorkshire Geological Society, he acted in most capacities including being a Council member, editor of the Society's Proceedings, treasurer, and was later a Life Member. He was a member of the British Association for the Advancement of Science (BAAS) from 1873, and submitted reports on several occasions at their meetings in the 1880s (Anon., 1914; Kendall, 1918).

#### Scientific interests

Cash was, first and foremost, a collector, but he was much more than that. In addition to his expertise in palaeobotany, his main zoological interest was in molluscs (conchology), both fossil and present-day forms, and he started and ended his scientific career publishing papers on this phylum. One example of his interest in shells is an advert he placed in a North American magazine, for shells "from all parts of the world" (Figure 2). He was a member of the Leeds Conchological Club and a Life member and one-time President of the Conchological Society of Great Britain. For a period in his life, he also specialised in the Cephalopoda (squid, cuttlefish and octopus).

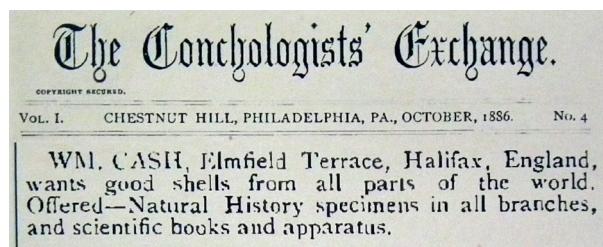


Figure 2: Title from *The Conchologists' Exchange* (October 1886) and the exchange entry of William Cash, from the same edition.

An indication of his broad interest in natural history can be found in his entries in the Exchange columns of *Hardwicke's Science-gossip* (later simply *Science-gossip*), the popular Victorian science magazine. From looking for "fresh specimens of any Cuttlefish or Squids" to "good specimens of local objects of Natural History in every department (animal, vegetable, mineral, and fossil)", he was also looking for books, and was willing to offer shells, insects, microscope slides, cephalopods, echinoderms, books, and even money in exchange, although the emphasis was on shells (Cook and Taylor, 1865–1893; Carrington, 1894–1902).

#### The early palaeobotanists

Cutting and grinding to produce thin specimens of rock for viewing under the microscope was a time consuming, difficult, and specialised process, and great care was required to obtain the right thickness: "Perhaps no branch of Palaeontology presents greater difficulties to the geological student than that of Fossil Botany, and this is especially true of the fossils in the Palaeozoic rocks" (Cash and Hick, 1878). There was a network of early palaeobotanists, including James Binns, John Butterworth, and James Spencer, who developed and refined preparation techniques.

#### James Binns

In the 1891 Census, James Binns was recorded as living at 15 Walsh Street, Halifax, Yorkshire, and listed as aged 59, a Stone Dresser, born in Ovenden, Yorkshire. He was married to Grace Binns, aged 51, born Warsley, Yorkshire. They had a boy and two girls, all of whom worked in a Worsted mill. James Binns was a member of the Lancashire and Yorkshire Palaeobotanical Society (founded 1893), and was one of the many amateurs who prepared fossil plant specimens for W. C. Williamson (Howell, 2005).

#### John Butterworth

John Butterworth, F.R.M.S., was a Corresponding Member of the Manchester Microscopical Society in 1890 and 1891 was living then at Shaw near Oldham. He was still a Corresponding Member in 1896 and 1897–1899, and was then living at 122 Rochdale Road, Shaw, but interestingly the F.R.M.S. is no longer cited. John Butterworth wrote to *Hardwicke's Science Gossip* concerning proposals for a circulating cabinet of slides (Butterworth, 1865). More extensive details of his life and activities have been published via the Internet (Stevenson, 2014).

### James Spencer

James Spencer (1834-1898), born in Luddenden, Yorkshire, was interested in the fossil flora of the Halifax Hard Bed Coal Measure, and discovered the club moss *Lepidodendron spenceri* (Williamson, 1878). He was Chairman of the Yorkshire Fossil Flora Committee. Examples of his slides are illustrated below (Figure 3).



Figure 3. Sample slides by James Spencer. Images: D.S. Gill.

Much of the early work in palaeobotany was done by James Spencer, who, before meeting John Butterworth, found it slow and painstaking: "he had to break the petrified stems of plants out of the hard nodules, then chip thin pieces off with a chisel, then rub them down on the sink-stone until they were so thin light would shine through them. Then they had to be polished and mounted on glass" (Stevenson, 2014). Butterworth taught Spencer quicker and more scientific ways of preparing slides, and in turn Spencer helped Cash. This network of likeminded individuals - both amateur and professional - worked well, and the amateurs in particular were generous in giving their time in preparation, advice, and borrowing material.

### Cash's collaborators

"There was a bevy of working men in the Lancashire-Yorkshire area producing thin sections of fossil plants" (Howell, 2005).

Cash knew many of the amateur and professional botanists and geologists in Lancashire and Yorkshire, and wrote obituaries for several of them, including James William Davis, Thomas Hick, Robert Law, Walter Percy Sladen, and W. C. Williamson. Hick and Williamson were professionals on the staff at Owens College, Manchester. Some of these people, and

several others named above, were important in Cash's work.

The eminent Scottish palaeobotanist Robert Kidston also provided a useful source of reference and help. Robert Kidston (1852- 1924) F R S, F.R.S.E., F.G.S. was born in Renfrewshire and based in Stirling. He had close contacts with Scottish university botanists, and had great knowledge of and published widely on Carboniferous plants. An expert photographer and artist, his collection of thin-sections is now housed at the Hunterian Museum, University of Glasgow. The main bulk of his material - the compression floras - resides at the British Geological Survey, Keyworth. Cash's main collaborators are discussed below.

### W. C. Williamson

William Crawford Williamson (1816-1895). M.R.C.S. (1840), LL.D. Edin. (1883), F.R.S (1854), the Professor of Natural History at Owens College, Manchester, was born in Scarborough on the 24th November 1816 (he died at Clapham, Surrey 23 June 1895). After an early grounding in natural history from his father, Williamson trained for a career in medicine and, after accepting the appointment of Curator of the Manchester Natural History Society Museum in 1835, practiced medicine for a time in Manchester. Described as the founder of modern palaeobotany, he was the first Professor of Natural History (later surrendering his Zoological duties and becoming Professor of Botany until 1892). Williamson became an expert on fossil plants, publishing extensively in the Philosophical Transactions of the Royal Society (Williamson, 1887, 1880, 1889, 1893), and combined with William Cash to present a paper at the British Association meeting in Manchester in 1887 (Williamson and Cash, 1887): 'On investigating the Carboniferous flora of Halifax and its neighbourhood'. Cash also reported at other British Association meetings in his own right, and also as a member of committee (Cash, 1881; Hick and Cash 1881; Williamson and Cash, 1882; Williamson et al., 1883). Williamson wrote his reminiscences, edited by his wife and published after his death (Williamson, 1896).

### Thomas Hick

Thomas Hick (1840-1896) BA, BSc, ALS, was born in Leeds on the 5th May 1840 and died at the home of his son in Laisterdyke, Bradford, on the 31st July 1896. Hick received his academic training in London under Thomas Huxley and William Turner Thiselton-Dyer, and several of Cash's early papers on fossil plants were written with Hick (see Sheppard, 1915). Hick had worked in a mill but, owing to an accident in which

he lost some fingers, he became a schoolmaster and then a headmaster in Leeds, and taught science at a school in Pannal, Harrogate, before Williamson brought him to Manchester. Hick was Assistant Lecturer and Demonstrator in Botany in Williamson's department, and they worked closely together. When Williamson retired, Hick and others (Miles Martineau Buckley, John Butterworth, William Cash, Thomas Hick, James Lomax, Thomas Mitchell, and George Wild) kept the community of palaeobotanists together by forming the Lancashire and Yorkshire Palaeobotanical Society in September 1893. John Butterworth was its first President, and Thomas Hick the Secretary. James Spencer, James Binns, and Isaac Earnshaw joined shortly afterwards. The first meeting of the Society was held at Hick's home in Rusholme (see Howell, 2005).

#### *James Lomax*

To an extent, James Robert Lomax (1857-1934) F.R.M.S. was the outsider, driven by commercial interests as well as science. Although he cut sections for Williamson, there was nothing to be gained financially by writing scientific papers, even if he had the ability to do so (Howell, 2005). Finding new species of fossil plants and cutting sections of them was far more profitable, as they brought a good price. Lomax was born at Radcliffe, Bury, and after leaving school, worked at Elton collieries, where his father was manager. Working at other collieries in different capacities for many years, his interest in geology was aroused by the fossil plant remains found in the mines. He became skilled in microscopy, producing high quality rock sections and, encouraged by W.C. Williamson, for whom he prepared slides, he later became a full-time commercial manufacturer, firstly in his home and then in premises under the title 'The Lomax Palaeobotanical Laboratories' (Bracegirdle, 1998), and later as the 'Lomax Palaeobotanical Company' in Bolton. Bracegirdle (1998) states that Lomax's slides are "*now much sought-after*".

The following illustration shows some of the slides made by him (Figure 4). He collected and prepared material for teaching, research, museums, and private collections, and pioneered new techniques for preparing slides. However, many of these are of limited use scientifically as the known examples are often inadequately labelled. Also, serial sections are required when studying anatomical features, and these were often unavailable (Howell, 2005). Cash produced one paper with Lomax (Cash and Lomax, 1890).

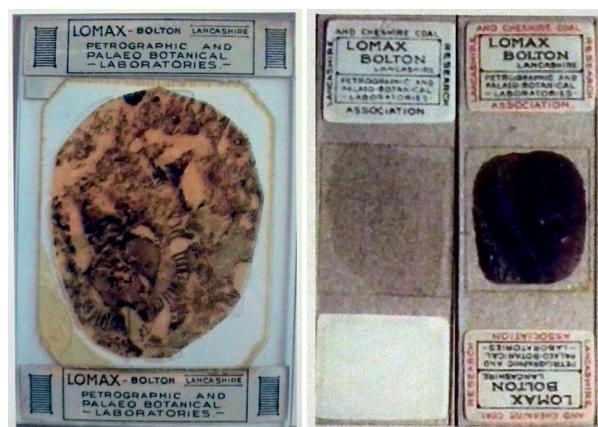


Figure 4. Examples of slides by Lomax under the auspices of the Petrographic and Palaeo Botanical Laboratories Images: D.S. Gill.

#### **The Coal Measures and their fossil plants**

At the time of the coal measures (late Carboniferous Period, circa 300 million years ago), there were dense forests growing on low-lying swampy ground, with raised banks providing drier ground. As plants died, they partially decomposed in the wet, anaerobic conditions of the swamps. As they were compressed over time, water, oxygen, and hydrogen were slowly removed, producing coal deposits containing fossilised plant remains. (West Yorkshire Geology Trust, n.d.; Natural History Museum, n.d.).

There were no flowering plants in the late Carboniferous Period, and many of the plants that lived at this time are now extinct. The dominant plants were the club mosses (*Lycopodiales*) including the closely-related *Lepidodendron* (scale tree) and *Sigillaria*, together with *Calamites* (a genus of horsetails), medullosaleans and lyginopteridaleans (seed-plants), and occasionally ferns. *Lepidodendron* was to become an important fossil plant in the studies made by Cash, and he worked with both Thomas Hick (Hick & Cash, 1889) and James Lomax (Cash and Lomax, 1890) on the anatomy and histology of this plant. The quality of their microscope slides is apparent as they were able to describe in detail the anatomy of the stem, root, cortex, leaves, and fruits. For this work, Hick and Cash wrote that "we have been greatly indebted to Messrs Spencer, Binns and Lomax, who have kindly allowed us to examine their specimens of *Lepidodendron* and to compare them with those in our own cabinets" (Hick and Cash, 1889). Their work clearly relied on the preparations of others. They were borrowing and obtaining slides from several sources all the time and refining their understanding of the plants with each specimen. For example, Hick and Cash (1884) described the vascular bundles, cambium, and cortex of the horsetail

Calamites from "a species [that] has come into our hands which presents a more perfect view of the transverse section of a Calamite than we have previously met with".

Cash published a paper in 1906 which is full of practical advice on fossil plants, their collection and preservation, the naming of species, notes for guidance in dealing with them, and the strata in which they are found. Full and correct documentation and labelling of the specimens is emphasised, and he recommended suitable literature. However, a distinction is made here between collecting, documenting and describing fossil plants obtained from field work (Cash, 1906), and laboratory work examining their detailed internal anatomy and histology by means of microscopy (Hick and Cash, 1884; Hick and Cash, 1889).

Cash eventually became an expert on The Halifax Coal Measure fossil flora, and published several works on this bed. He found and described several specimens that were new, but some of the more important ones were described by W. C. Williamson. Cash worked with Hick on fossil fungi (Cash and Hick, 1879). Some of the slides from the Cash Collection

held at Manchester Museum are illustrated below (Figure 5). A full list of Cash's publications (1877 to 1912) is given at the end of Sheppard's (1915) obituary, and reproduced in Appendix I.

### Collections

There over 700 of Cash's collection of microscope slides at the Manchester Museum, referred to as the Cash Collection, and these have been scanned and catalogued (Gelsthorpe, 2016). The collection includes mounted specimens by James Binns, J. P. Cash, James Spencer, and Frederick Ernst Weiss. Cash also presented many valuable specimens to other museums, including institutions in London, Edinburgh, and Bradford.

Bradford Museums and Galleries purchased Cash's Carboniferous Coal Measures fossils (79 specimens in all) for £2-2-0 in 1913, a year before Cash died. They have an accession date of 31 May 1913 (City of Bradford Corporation, 1913). Some of the fossil plants are from Monckton Main Colliery (Barnsley), Darfield Quarry and Church Lane colliery near Dodworth (McGowan, 2016). Bradford Museums and Galleries also have echinoderm material attributed to Cash.



Figure 5. Coal Sections from the Cash Collection of Manchester Museum.  
Q514 (1st left): *Stigmaria* sp. Lycopsida. Carboniferous Coal Measures "Oldham"  
Q515 (2nd Left): *Stigmaria* sp. Lycopsida. Carboniferous Coal Measures "Dulesgate"  
Q519 (3rd left): *Stigmaria* sp. Lycopsida. Carboniferous Coal Measures "Halifax Hard Bed"  
Q518 (right): *Stigmaria* sp. Lycopsida. Carboniferous Coal Measures "Head of sporangiophore Cal. Binna?" "Halifax Hard Bed"  
Images: Manchester Museum, University of Manchester (reproduced with permission).

Hartley et al. (1987) lists museums in Yorkshire which hold Cash documents and material. Bolton Museum houses material either purchased from or donated by James Lomax (Stenhouse, 2016).

W. C. Williamson's fossil plant microscope slides are in the Natural History Museum in London. Thomas Hick's fossil plants and slides are held at Manchester Museum (Cash, 1896).

### Discussion and conclusions

In terms of plant fossils from the Coal Measures in the North of England, William Cash was an important figure and made a significant contribution. He had good links and working relationships with both the amateur naturalists and the relevant professional biologists at Owens College, Manchester. He published widely on the subject and these papers, plus his collections, are his legacy.

### Acknowledgements

Thanks are due to David Gelsthorpe of Manchester Museum for help with the Cash Collection, housed therein. Gerard McGowan at Bradford Museums and Galleries, Don Stenhouse at Bolton Museum and John Patchett from West Yorkshire (Calderdale) Archives at Halifax, all provided useful additional information which the authors are pleased to acknowledge.

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## Appendix I

### William Cash – Bibliography (after Shepherd 1915)

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