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Scientists, collectors and illustrators: the roles of women in the Palaeontographical Society

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RH: Women in Palaeontographical Society

Abstract: Women have taken on a range of roles in scientific societies since the early twentieth century. The oldest society dedicated to palaeontology, the Palaeontographical Society, was established in 1847 principally for the publication of monographs on British fossils. Since its foundation women have been involved, initially as collectors and illustrators, then authors, and latterly as elected members of council. Early contributors include well-known female scientists such as Gertrude Lilian Elles (1872–1960) and Ethel Mary Reader Wood (1871–1946), to the enigmatic 'Miss Pike'. Although there have been female monograph authors and council members since 1901, their number has not risen significantly since the early twentieth century. The increased female presence on the Society's Council since 2009 is promising, but to date there have been only three female vice-presidents and no female presidents in almost 175 years. Although things have undoubtedly improved since its founding, the Palaeontographical Society—like similar geosciences societies—still has some distance to travel to reach gender parity. This paper contributes to that process by recognising the many talented women who have played formative roles in the development, and continued success, of this organisation.

Women were not absent from palaeontological activities and research in the nineteenth and early twentieth centuries (Creese & Creese 1994; Kölbl-Ebert 2002; Kölbl-Ebert & Turner 2016), but their contributions were often overlooked. As in geology, female roles in the study of fossil life were predominantly as collectors and illustrators until the 1900s. It was only after this point that women were more regularly admitted to scientific societies and their activities became more focused towards scientific research.

The Palaeontographical Society is the world's oldest society dedicated to palaeontology, with almost 175 years since its foundation (*Anon.* 1896, p. 32). At the time of the society's creation, almost all of those recognised in the field of palaeontology were men, and many came from the landed, professional classes such as doctors or solicitors, or the small academic community. Although a few women collected fossils, this was usually seen as part of a wider Victorian passion for natural history that encouraged women and girls to collect and illustrate specimens, but not to pursue their scientific study. Such scientific work was usually undertaken by men, sometimes on behalf of the women who collected them.

At the beginning of the twentieth century, women increasingly contributed to published scientific literature. The opening of female membership meant they could expand to be involved in running societies, and they were subsequently elected to council membership. However, it is widely known that even in the twenty-first century, most scientific societies—including in geosciences—have fewer female members on their elected councils.

The Palaeontographical Society

Founded in 1847, the Palaeontographical Society is the oldest society specifically dedicated to palaeontology. Although earlier organisations in Britain, such as the Royal Society and the Geological Society of London, published papers on fossils, the Palaeontographical Society set out with the purpose of producing monographic descriptions and illustrations of British fossils. It has since expanded its role by establishing a number of awards and funds to support ongoing palaeontological research, and related projects.

The genesis of the Palaeontographical Society is described in a report of Council in 1896 as originating from an 1845 meeting of the 'London Clay Club' (established around 1836) (*Anon.* 1896 p. 32). The report states that naturalist James Scott Bowerbank suggested a new publication to speed up the slow progress of the *Mineral Conchology* (Sowerby & Sowerby 1812-1846). Subsequently, at a meeting of the Geological Society on 3rd February 1847, fellow naturalist Edward Forbes noted that published information on Britain's fossils was scattered across multiple publications. Bowerbank canvassed attendees, and the Palaeontographical Society was formally established on 23rd March 1847 at a meeting held in the Geological Society's apartments in Somerset House, London, where it was resolved that the new society's goal should be 'to figure and describe as completely as possible a stratigraphic series of British Fossils' (Anon. 1896, p. 32; Thackray 2003, pp. 145-7; Herries Davies 2007, p. 105).

The founders and first council members included well-known figures in British palaeontological history: Sir Henry Thomas De la Beche (President), Searles Valentine Wood (Treasurer), and Bowerbank (Secretary and Editor) (Anon. 1896). Later council

members and presidents included Sir Richard Owen and Thomas Henry Huxley, and among the regular members were Gideon Mantell, Sir Roderick Murchison and Charles Darwin.

Although women were admitted as members from the outset, the lack of significant female presence in palaeontological circles in the 1840s in Britain is reflected in the initial membership of the Society. In 1848, the year after it was founded, all of the council members as well as the 37 local secretaries were male, and from a membership of 300 or so only 24 were women (Table 1). It is possible that the subscription fee for the Society of one guinea per year was prohibitive for most self-supporting women (it equalled approximately a week's salary for a teacher at the time).

Little is known of the palaeontological contributions of these early female members, and for most even their fundamental personal information is unknown. Two exceptions are Elizabeth Philpot and the Marchioness of Hastings. Philpot was the noted fossil collector of Lyme Regis who befriended young Mary Anning (Ogilvie and Harvey 2000; Kölbl-Ebert 2002). Her collection, and that of her sister Margaret, is now in the Oxford University Museum of Natural History (Edmonds 1976). The Marchioness of Hastings was a prolific fossil collector, geologist and author, who sold thousands of specimens to the British Museum (Natural History) (Kölbl-Ebert 2004).

Tracing the contributions of women to the Palaeontographical Society, we outline their presence from 1847 to the present day. They were initially illustrators and collectors, and comprised a small portion of the membership. Later they began to contribute as authors to the monograph series, and as council members. However, the number of such contributions remained small until the last decade. The restricted parts played by women in the Palaeontographical Society reflect their role more generally in geoscience and in wider scientific practice and societies. It is of particular interest as palaeontological societies try to address longstanding diversity issues in their institutions, and across scientific disciplines as a whole.

Collectors and Illustrators

There is a clear shift in the contribution of women to the Palaeontographical Society from initially only collecting and illustrating, to later authoring monographs, and council membership (Table 2). The male authors of monographs often drew on the artistic talents of their female family members—talents that were encouraged in the social circles from which most authors came (Kölbl-Ebert 2012). Their valuable contributions were under-acknowledged, often only meriting a name at the bottom of a lithograph despite the fact that their male relatives benefited greatly from their skills. These women were recently dubbed 'The Quiet Workforce' (Wyse Jackson and Spencer Jones 2007, p. 98), and most often comprised the daughters and wives of fossil collectors.

Without doubt, the majority of specimens utilised by early monograph authors were held within their own personal cabinets, or in those of their friends. Towards the end of the Victorian era many of these collections had been donated to or purchased by various institutions, with the majority of major collections ending up in the British Museum (Natural History) (Kölbl-Ebert 2004). During the early and mid-1900s fossil collecting was more often carried out for scientific investigation, and private collections were seldom retained. It

continued to be difficult for women to conduct fieldwork (Burek & Kölbl-Ebert 2007)—the first female geological field officer of the British Geological Survey was only appointed in 1969 (Higgs and Wyse Jackson 2007, p. 150)—and this is reflected in the low proportion of female contributors to the Palaeontographical Society's compilation of British fossiliferous localities (Anon. 1954). Of the seventy-two contributors only two were women: Gertrude Elles and A. Brading.

The collections made by a number of women were utilised by authors of monographs, but those assembled by Elizabeth Anderson Gray (1831–1924) (Fig. 1) constitute volumetrically the largest, and taxonomically the most diverse. There are 14 monographs that contain descriptions of her specimens, largely from the Girvan district of Scotland (Fig. 2, Table 2). These include works on trilobites (Reed, 1903–1935; Whittington 1950; Lane, 1971; Owens 1973; Howells 1982), brachiopods (Davidson 1866–1871; Cocks 1978; Harper 1984) and crinoids (Ramsbottom 1961; Donovan 1986). Cleevely *et al.* (1989) document her collections, field methodologies, and the acquisition of her collections by the Natural History Museum, London, and subsequent use by scientific researchers.

Collections of Crag molluscs made by Mary Ann Alexander (Table 1)—later Mrs Corder (Cleevely 1983, p. 40)—of Ipswich were in a monograph by Wood (1848), where her specimen of *Natica multipunctata* was figured (Plate 9e). In the comprehensive monograph of the ammonites of the Gault Clay, Spath (1923-30) was able to draw on specimens in the collections of the British Museum (Natural History) made by Mary Angus of Dundee, fellow cephalopodologist Éliane Basse of the Sorbonne, Paris, and Mary Sophia Johnston (1875–1955) of Wimbledon (who was also an elected member of the Society's council, see below).

The earliest illustrations provided by a woman for a Palaeontographical Society monograph were drawn by Gulielma Mary Holmes (b. 1828) and published in 1855. Five plates credited to 'Miss Holmes' in Owen (1855) were based on drawings of dinosaur bones from her father's collection. She was the eldest daughter of George Bax Holmes (1803-1887), a wealthy fossil collector and extensive property owner in Horsham, West Sussex (Cooper 1992), who acquired dinosaur remains from various Sussex localities, including *Iguanodon* bones from nearby Stammerham Quarry in 1848. George Holmes sent his daughter's drawings to Richard Owen in May that year for identification (Cooper 1992, p. 387; Ingles and Sawyer 1979, p. 140, f. 162 and 163). These 'accurate and beautiful drawings' (Owen 1855, p. 20) were later lithographed by James Erxleben for publication in a monograph on Wealden reptiles (Owen 1853-1858) (Fig. 3). A sixth plate, also credited to 'Miss Holmes' (Owen 1857, pl. 5), was drawn by another daughter, Mary (b. 1832) (Cooper 1992, p. 387, fig. 6; Ingles and Sawyer 1979, p. 138, f. 153b). The sisters' contribution to Owen's publications is significant in light of their pivotal part in the history of palaeontology (his monographs are among the earliest and most comprehensive British Victorian scientific works on dinosaurs).

Alongside the Holmes sisters' artwork in Owen's monograph was an earlier single drawing by Mary Morland (1797-1857), who became Mrs William Buckland in 1825. An accomplished illustrator, she provided drawings for the likes of famous French anatomist Georges Cuvier, geologist and palaeontologist William Conybeare, and Buckland himself, before their marriage (Kölbl-Ebert 1997). Her drawing of a *Megalosaurus* sacrum in Oxford University Museum had already been lithographed for Buckland's classic paper on the animal (Buckland 1824), the first dinosaur to be scientifically described. Over three decades later,

the German lithographer James Erxleben lithographed it again for Owen (1857—the year Mary died). Apart from being mirror images, there are clear differences between the two versions, suggesting Erxleben did not simply copy the previously published plate, but also modified it. Aside from these contributions by Holmes and Morland, most of the plates in Owen's monograph were produced by Erxleben and fellow commercial illustrator-lithographer, Joseph Dinkel.

Mary Buckland also made a posthumous contribution to a monograph on *British Pleistocene Mammalia* (Dawkins & Sandford 1866-1872). According to the authors their plate 25 in part 4, depicting bear teeth excavated in 1826 from Kent's Cavern, Torquay, was 'intended to have formed a portion of the 'Cavern Researches' of the Rev. John MacEnery [1796-1841]'. At the time of MacEnery's original research he had been encouraged by William Buckland, and anticipating timely publication Mary drew some of the specimens, which were lithographed by the German-born but London-based lithographer and artist George Scharf. However, nothing was published until long after MacEnery's death (MacEnery 1859; see Rudwick 2008, pp. 228-229).

Phoebe Anna Traquair (1852-1936) was an artist originally from Dublin who co-illustrated a monograph by her husband on Carboniferous fishes (Traquair 1877-1914) (Fig. 4). She is considered a significant and important figure in British art, contributing widely to the Arts and Crafts movement (National Galleries Scotland 2020). She was trained at the Royal Dublin Society where she met Ramsay Heatley Traquair (1840-1912) (then Keeper of the Royal Dublin Society Museum), who became Keeper of Natural History at the Royal Scottish Museum in Edinburgh (now National Museum of Scotland) the year they married, 1873. Phoebe contributed drawings to 25 of the 40 plates in her husband's monograph, with most plates credited jointly to 'Dr and Mrs Traquair' (lithography by others), although some figures carry only her initials.

The most numerous and diverse illustrations were made by the Woodward sisters, Ellen Caroline (1859–1943), Gertrude Mary (1861–1939) and Alice Bolingbroke (1862–1951). They were three of five daughters and two sons of Henry Woodward (1832–1921), Keeper of Geology at the British Museum (Natural History) from 1880 to 1901. As a monograph author, council member (from 1870), and Palaeontographical Society President (from 1895 until his death in 1921), it is little wonder that Henry Woodward's artistic daughters contributed so much to the work of the Society.

Ellen Caroline Woodward, the eldest sister, is the least well known and least prolific of the three. She was responsible for just four lithographic plates on Eocene plants (Gardner 1883-1886). She was also responsible for plates in the *Catalogue of the Fossil Fishes in the British Museum* (Woodward 1889). Although clearly a competent, trained lithographic illustrator—she also lithographed plates for the *Proceedings* and the *Transactions of the Zoological Society of London* (Nissen 1966-1978)—Ellen saw herself as an artist (metal-worker and silversmith) within the Arts and Crafts tradition. Ellen and her better-known younger sister Alice, shared studios near their family home, and both were members of the Women's Guild of Arts, an organisation established in 1907 as a female antidote to the men-only Art Workers Guild (Thomas 2015).

Alice Woodward was trained at the Westminster School of Art and the South Kensington School of Art (later the Royal College of Art). She moved into commercial work and later

found considerable fame as an accomplished illustrator of children's books (Turner *et al*. 2010), most notably the first illustrated edition of J.M. Barrie's play *Peter Pan* (published with Daniel O'Connor as *The Peter Pan Picture Book* in 1907). Throughout her career she was also recognised for her fine technical illustrations, including a series of reconstructions of extinct animals and palaeoenvironments for the *Illustrated London News*, Henry Knipe's popular *Nebula to Man* (1907) and *Evolution in the Past* (1912), and the Rev. H.N. Hutchinson's 1910 edition of *Extinct Monsters and Creatures of Other Days.* She provided three plates for two monographs of crustaceans (Jones *et al.*1884; Jones and Woodward 1888-1899) (Fig. 5). For more information on Alice Woodward, and how some of her original drawings came to the British Museum (Natural History) after her death in 1951, see Turner *et al.* (2010, pp. 135–138).

Gertrude Woodward was by far the most prolific female illustrator to be employed by the Palaeontographical Society. She was responsible for drawing and lithographing 63 plates of mostly fossil arthropods (Fig. 6), plants and fish in six monographs, over a publication period of 36 years (H. Woodward 1883-1884; Gardner 1883-1886; Jones and Woodward 1888-1899; Reed 1903-1906; Pocock 1911; A.S. Woodward 1916-1919). Two of the monograph authors she worked with were her father, who was president of the Society at the time, and the vice-president Arthur Smith Woodward (unrelated). She was credited with drawing text-figures in A.S. Woodward's *Fishes of the English Chalk* (1902-1912). Gertrude contributed substantial work to other major scientific publishers for many years, including the British Museum (Natural History), Geological Society of London, Zoological Society of London, *Geological Magazine* and *Palaeontologia Indica* (Nissen 1966-1978; Turner *et al*. 2010). The Natural History Museum holds considerable archive material, including artwork and correspondence. Several modern references to Gertrude (including Wikipedia) identify her year of birth as 1854, which would have made her the oldest Woodward sister. However, the UK Censuses of 1861-1911 consistently indicate a birth year of 1861, with Ellen's as 1859.

Minutes from a Palaeontographical Society council meeting in January 1885 (see Acknowledgments) record payments to all three sisters, as well as a fourth 'Woodward ES' for trilobite illustrations. While there is no fourth sister with the initials ES, their mother was Ellen Sofia. The only trilobite monograph published by the Society around this time was Part 2 of Henry Woodward's *British Carboniferous trilobites* (1883-1884), and as his daughter Gertrude was paid for only three plates but credited with all four on the plates themselves (Part 2, pls 7-10), perhaps Henry's wife Ellen was responsible for the extra plate, but it became wrongly attributed to Gertrude on the plate's credit line. The Woodward sisters' design and graphic skills were also called upon in 1896 when, at the November Council meeting (see Acknowledgments), a payment of £1.15.0 was made to 'Woodward Misses' (how many is unclear) for the Society's Annual Dinner menu card.

The commercial scientific illustrator-lithographers routinely employed by the society were almost exclusively male. Payments made to them were recorded in the handwritten minutes of Council meetings. Although payees were routinely referred to by surname only, the rare appearance of 'Miss', plus common references elsewhere to first names, usually confirm gender. However, it remains possible that some of the individuals known only from their initials and surnames on published plates may have been women. Five plates of ammonites by 'Miss Suft' appear in Wright (1878-1886) (Fig. 7), alongside those of another commercial illustrator, who was male. Both were paid about the same rate per plate: £3.5.0 to £3.17.0.

For comparison, a qualified class teacher at the time might have achieved annual earnings of up to £95 (male) or £65 (female) (e.g. Birchenough 1938).

Although there is nothing to suggest that Wright himself was unhappy with the quality of any of the published plates, in the *Synoptic Supplement to T. Wright's 'Lias Ammonites' (1878-86)* (Donovan 1954) the author comments on the inaccuracy of many of Wright's original plates, including all five of Mary Suft's, describing them as 'very unsatisfactory', 'careless' and 'badly drawn'. However, Suft was clearly considered a competent illustrator at the time: a few years later she contributed to 25 of the 38 plates in the *Catalogue of the fossil sponges in the Geological Department of the British Museum (Natural History)* (Hinde 1883) and is credited with one plate (also of sponges) in *Report on the zoological collections made in the Indo Pacific Ocean during the voyage of HMS* Alert *1881-2* (Coppinger 1884). She also illustrated *Nototherium mitchelli*, an extinct Australian marsupial, in Owen's 1882 paper published in the *Quarterly Journal of the Geological Society*, and was a competent plant illustrator. Two of her images of Dog Violet species were published in Mansel-Pleydell (1877), and those of *Bactris*, a palm from the Amazon, in the *Journal of Botany* in the same year (Trail, 1877).

Payments were also approved by the Palaeontographical Society council for 'drawings' made by 'Miss Pike' or 'Helen Pike' for *Carboniferous Lamellibranchiata* Parts 2-5 (Hind 1896-1900), at five meetings between November 1896 and March 1900 (see Acknowledgments). Intriguingly, none of this work is acknowledged on the published plates, all 54 of which are credited identically: 'A.H. Searle del. et lith.' The author, Wheelton Hind's day-job was as a doctor in Stoke-on-Trent, so one might speculate that Helen Pike was employed by the Society to help illustrate key material he was unable to visit personally. Her final payment, approved by Council on 23 March 1900, was for '17 drawings and casts of Carbon. Lamell. for 1900 vol.', indicating that she was also making casts of specimens on Hind's instructions, for Searle to lithograph. Plenty of specimens figured in Searle's plates for the 1900 volume (Part 5, pls 40-54) are described as 'casts', but if any were made by Pike they are not distinguished from natural fossil casts. Based on the amount of payment, it seems likely that Pike was contributing individual drawings rather than finished plates. One Council minute of 7 January 1898 notes a payment of 12/6 was approved for '5 drawings for Carbon. Lamell. For 98 vol.', which is just a half crown (2/6) per drawing. In the 1890s, Council commonly paid its lithographic artists between £3.10.0 and £5.10.0 per plate (depending partly on complexity), with Searle receiving about £4.4.0 for his plates in the same monograph as Pike.

Eileen Barnes (1876–1956) worked as an illustrator and artist for the National Museum of Ireland for the whole of her career. She is best known for her botanical illustrations of Ireland's flora (Lucey 2015). It is perhaps not surprising then that she also drew the bones of *Megaloceros giganteus*, the Irish elk. Her illustrations of various fossil deer from the museum in Dublin appear in two monographs on Pleistocene faunas (Reynolds 1929, 1933).

Authors

The first Palaeontographical Society monograph written by women (Elles and Wood 1901–18) was co-authored by two famous early female geologists: Gertrude Lilian Elles (1872–

1960) and Ethel Mary Reader Wood (later Dame Ethel Shakespear) (1871–1946)—Wood was also the illustrator. The pair had become friends at Newnham College, University of Cambridge, in the early 1890s, where they both studied Natural Sciences. Elles is well known for her work on graptolites from Wales and the Lake District, for which she received the Lyell Fund of the Geological Society of London in 1900. She was unable to collect it however, as women were still barred from scientific meetings. She was awarded the Murchison Medal in 1919, and became one of the first female Fellows of the Geological Society in the same year.

Wood was appointed Charles Lapworth's assistant at Mason College, Birmingham in 1896. She used a camera lucida to make large scale drawings of graptolites, which were then photographically reduced and printed life size as collotype plates. The methodology was described by Charles Lapworth in his editor's introduction to Elles and Wood's monograph (1901: pp. 2-3). The Society's minute books record that Lapworth had offered a monograph on British graptolites as early as January 1885, which was accepted. It was re-offered and accepted again by Council in May 1890, but not until the joint offer from Lapworth, 'Miss Elles' and 'Miss Wood' in February 1900 was the work finally undertaken. When the monograph appeared Lapworth's contribution amounted to a short introduction.

Monograph author Ida Lilian Slater (1881–1969) was a pioneering geologist and palaeontologist who studied geology at the University of Cambridge (also at Newnham College) at the very beginning of the twentieth century (Sendino *et al.* 2018). In 1903 Slater was appointed Secretary of the Sedgwick Club, a student society dedicated to earth sciences at the University—Gertrude Elles had also been Secretary, and President in 1902 (Burek 2007, p. 20). Women were not allowed to graduate from Cambridge at that time, so Slater travelled to Dublin to receive her degree, as had Elles and many others (Higgs and Wyse Jackson 2007). Later she was appointed a demonstrator in geology at Bedford College, London which was run by the noted female geologist Catherine Raisin (Burek 2007).

As well as being a scientist, Slater was a skilled illustrator, and although only the final plate in her own conulariid monograph (Slater 1907) has a credit line, there is no doubt that she was also responsible for the other four plates. Her monograph included 12 specimens from the collections of Elizabeth Anderson Gray (Fig. 2). Slater is credited jointly with Ethel Wood for the component drawings of the six collotype plates which accompanied Part 8 (1911) of Elles and Wood's *British graptolites* (1901-1918)—the only part for which Wood shared her illustrator role. Slater's years in Cambridge coincided with Elles and Wood's initial work on their classic monograph, and in 1906 she published a joint paper with Gertrude Elles on high Silurian stratigraphy near Ludlow (Elles and Slater 1906).

Marjorie Elizabeth Jane Chandler (1897–1983) was another natural sciences graduate of Newnham College, Cambridge (1919). Chandler's drawings of Eocene plant fossils for her Palaeontographical Society monograph (Chandler 1925-1926) were reproduced as collotype plates. A palaeobotanist, she is best known for her longstanding scientific partnership with Eleanor Mary Reid (1860–1953). Their most influential work was their monograph *The London Clay Flora* (Reid and Chandler 1933) published by the British Museum (Natural History), of which they were both associates.

In the 1930s Helen Muir-Wood (1895–1968) authored a monograph on the Great Oolite brachiopods (Muir-Wood 1936). Muir-Wood studied Geology under Catherine Raisin, and was employed at the British Museum (Natural History). She was awarded the Lyell Fund by the Geological Society of London in 1930, and the Lyell medal in 1958, and is considered the doyenne of brachiopod palaeontologists.

Dorothy Hill (1907–97) published a monograph on Scottish Carboniferous rugose corals (Hill 1938–41). She was born in Brisbane, Australia, obtained her PhD from Cambridge, and returned home to carve out a stunning career as a geologist and palaeontologist. Hill was the first female professor at an Australian university, being awarded a personal chair at the University of Queensland, and the first female president of the Australian Academy of Science (Runnegar and Jell 1983; Turner 2007). Perhaps recalling her work on Scottish fossils she established the Queensland Palaeontographical Society in 1962 (Haines and Stevens 2001, p. 133).

During the period 1970 to 1999 five women published monographs: Jana Elizabeth Hutt (1974–75) on Llandovery graptolites of the Lake District; Yvonne Howells on Scottish Silurian trilobites (1982—based on her PhD thesis completed at Keele University); Joan Watson, a palaeobotanist at the University of Manchester and her student Caroline Sincock (see Watson 2005) on Bennettitales of the Wealden (Watson and Sincock 1992); and Kathleen Histon on Irish Carboniferous cephalopod nautiloids (Histon 1998–99), a revision of an earlier monograph (Foord 1897–1903). Histon was educated at the National University of Ireland, Galway, obtaining her PhD from Trinity College Dublin, and continues her research on fossil cephalopods while living in northern Italy.

Since the turn of the current century five women have published monographs. Joanne Snell authored a study of Silurian bryozoans from the West Midlands (Snell 2004). This was only the second monograph on bryozoans published by the Palaeontographical Society, the first having been on Crag faunas (Busk 1859). Svetlana Nikolaeva of the Palaeontological Institute of the Russian Academy of Sciences in Moscow, revised the Carboniferous ammonoids from the Gilbertson Collection (Nikolaeva 2008; originally described by John Phillips in 1836). This work gathered information on many type specimens thought to have been lost or mislabelled. Fiona Fearnhead—who also served as a member of Council—and Rosanne Widdison were co-authors of a monograph on Silurian crinoids (Donovan *et al*. 2009–12). Fearnhead has also begun another monograph on Devonian crinoids with co-author Stephen Donovan (who was Society Secretary and later President) (Donovan and Fearnhead 2014). The most recent female monograph author was Angela Kirton, who co-authored a monograph on Jurassic ichthyosaurs with Benjamin Moon (Moon and Kirkton 2016–18).

Council Members

Despite the Palaeontographical Society's vintage, it took 55 years for the first female council member to be elected, and almost 166 years before the first female vice-president was elected. There has never been a female president. From about the turn of the twentieth century, the Society and similar national organisations in Britain began to elect women as members and officers of their governing councils and committees. Although this meant women could also become members of council, they rarely occupied the main roles of president, vice-president or secretary until the second half of the twentieth century.

On the 22nd June 1900, Scottish palaeontologist, geologist and politician Maria Matilda Ogilvie Gordon (1864–1939) was named by the Palaeontographical Society as Local Secretary for Aberdeen. It appears that the ten local secretaries were considered officers of the Society, but not technically council members. Ogilvie Gordon was a distinguished geoscientist: in 1893 she was the first women to be awarded a doctorate of science by the University of London, and then the first to receive a PhD from the University of Munich (Wachtler and Burek 2007). She is best known for her extensive work in the Tyrolean Alps and Dolomites (e.g. Ogilvie Gordon 1927), and was a productive field geologist. She was among the first women elected to the council of the Geological Society of London, and later received the Lyell Medal.

The first female full member of the Palaeontographical Society's Council was Margaret Chorley Crosfield (1859–1952) (Fig. 8). She became a council member in June 1902 (and again in 1903–1907, and 1912–1920). She is largely remembered for her studies of structural geology in Wales (Burek and Malpas 2007; Burek 2014) and was one of the first six women to be elected Fellows of the Geological Society of London in 1919. Not long after, Mary Jane Longstaff née Donald (1855–1935) was elected to Society Council in 1908 (and 1909, 1911 and 1912). She was a Scottish malacologist who, although not formally trained, specialised in Carboniferous gastropod systematics, winning the Geological Society's Murchison award in 1898 and being elected a Fellow of the Linnean Society in 1906. In 1910 the stratigrapher and fossil collector Mary Sophia Johnston (1875-1955) (Fig. 9) was elected to Society council (she also served 1911–1913, 1916–1920). Johnston continued to hold close links with the Society throughout her life and in 1939 she provided funding that was acknowledged at the Annual Meeting (Anon. 1939). Crosfield, Longstaff and Johnston were therefore all members of council in the same year, 1912—three women in a sixteen-person council (*Annual Reports of the Palaeontographical Society* 1900–1920)—the highest number of women on council simultaneously until the twenty-first century. The work of all three women is discussed in some detail in Creese and Creese (1994).

The inclusion of women in running the Palaeontographical Society has increased in the last four decades. Jana Hutt, also a monograph author (Hutt 1974-75, see above), was elected an Editor in 1985, and continued in this key role until 1996, during which time she stewarded many monographs. Since 2011 there have been nine female ordinary members of council (Table 2), and in 2014 Emma Bernard was elected as Marketing Manager, and subsequently Publicity Officer in 2018.

Three women have been Vice-Presidents in the Society's history: Jane Francis, palaeoclimatologist and Director of the British Antarctic Survey (2016–19) (Fig. 10); Caroline Buttler, an invertebrate palaeontologist and Head of Palaeontology at the National Museum of Wales (2019–20), and Susan Evans, Professor of Vertebrate Palaeontology at University College London (elected in 2020). To date, there has never been a female president of the Palaeontographical Society.

Discussion

Looking at the contributions of women to the Palaeontographical Society since its establishment in 1847, there is a clear shift from collection and illustration, to authorship of

Society monographs and membership of council (Table 2). This reflects a concurrent shift in the roles possible for women in geological sciences. The illustrators included here were mostly lithographers (with exceptions like Eileen Barnes). However, line drawings were also included in many monographs, and some of these may have been produced by women. These contributors may therefore await recognition.

The rise in the number of women's published contributions in the early twentieth century coincided with the expansion of formal geological education for women in institutions such as Bedford College, under the direction of Catherine Raisin, and at Newnham College, Cambridge (Burek 2007). Elles, Wood, Crosfield, Slater and Chandler all received their education there, and although the University would not allow them to graduate, Elles and Slater were among the numerous women who crossed the Irish Sea between 1904 and 1907 to receive their degrees from Trinity College, University of Dublin, (Higgs and Wyse Jackson 2007). In Dublin they were known as the 'Steamboat Ladies' due to their mode of transportation across the Irish Sea (Parkes 2004). Herries Davies (2009) documents a number of the earliest contributions published by women in the *Quarterly Journal of the Geological Society* in the 1890s, and from 1901 onwards women were publishing significant and ground-breaking palaeontological monographs. Similar changes took place in Australia, where the University of Sydney enrolled women into geological courses for the first time in the 1890s (Turner 2007).

The gender gap (as well as lack of ethnic diversity) in scientific publications has persisted in the last 50 years (Holman *et al*. 2018). Despite the increasing number of female authors in geoscience publications, there has only been a modest improvement in the actual percentage of female authors. In the journal *Palaeontology* for example, their number (including co-authors) has remained below 20% since 1957 (Warnock *et al*. 2020). Although the absolute number of female authors has grown, the increase has been in line with the rising number of male authors, and therefore their relative contribution has not significantly changed.

The authorship of the Palaeontographical Society's monographic series has seen two periods of increased female authorship. Between 1901-1941 there were six female monograph authors. It is not until 1974 that the next female author was published, and since that time there have been only nine female authors in over 100 published monographs.

A number of the women who contributed to the early activities of the Palaeontographical Society were also among the first to be elected as Fellows of the Geological Society of London. On the 21st May 1919, Crosfield, Gordon, Johnston, and Longstaff, as well as Elles and Wood all became Fellows. Their contribution to multiple societies reflects the links between the various geological organisations. Of these pioneering women two, Gordon and Wood, were later awarded DBEs for other services to society.

Beyond the Palaeontographical Society, local societies also began to elect women council members from the early 1900s—for example glaciologist Sydney Mary Thompson (1847–1923), who was elected to the general committee of the Belfast Naturalists' Field Club from 1892 to 1901 (Wyse Jackson 2009). The Field Club elected its first woman President in 1929, teacher and amateur botanist Willielma Jane Sayers (c.1870-1959) (Kertland 1960). The Geologists' Association was established a decade after the Palaeontographical Society (1858—Sweeting 1958), and elected their first female president, Muriel Arber (1913–2004) in

1972 (Robinson 2007). There have been two female presidents since then: Susan Brown in 2000, and Danielle Schreve in 2008. Women have also been elected to roles such as Secretary for Field Meetings (M.C. Foley, 1904), Librarian (Margaret Crosfield, 1919), and Secretary to the Publication Committee (Mary Sophia Johnston, 1910). In 1982 the Geological Society elected its first female President, Janet Watson, and their second in 2008, Lynne Frostick.

There are other ways in which women have contributed to the Palaeontographical Society. In the last 15 years two distinguished female palaeontologists have been invited to deliver the Palaeontographical Society Annual Lecture. In 2015, Jane Francis (who was also a Vice-President from 2016-2019) presented the Ninth Annual Address. In 2017, Jenny Clack of the University of Cambridge gave the Eleventh Annual Address. In 2014 the Society instituted a new medal in recognition of continued and important contributions to systematic and taxonomic palaeontology in Britain, and Clack was to become the fourth recipient in 2020, for her lifelong work on the earliest tetrapods (Ahlberg 2020). Sadly she passed away (26 March 2020) before the medal could be presented. Funding awards made by the Society in the last decade have been given to at least six female students and researchers, as evidenced by recipients of the Richard Owen Research Fund (Anon. 2013-2019).

Historically it comes as no surprise that the number of contributions by women to the Palaeontographical Society and similar organisations were far less numerous than those made by their male colleagues. Unfortunately this remains the case to the present day. Recognising the ongoing lack of parity, scientific societies are working to address gender imbalance and diversity in their membership, elected councils, and publications (for example the diversity study recently carried out on behalf of the Palaeontological Association [2018]). These issues reflect ongoing lack of parity at an institutional level in museums and universities.

Conclusion

It is clear that women have played an important role in the Palaeontographical Society since its foundation in the mid-nineteenth century. As seen in other geoscience organisations, they initially participated predominantly through association with their male relatives, as ordinary members, and by illustrating fossils often held in private collections. More broadly in the geosciences, they were often key principle collectors of new material, although relatively few of their collections were utilised directly by authors of Palaeontographical Society monographs.

At the turn of the twentieth century the Society welcomed women's participation as elected members of council, and as authors of their flagship monograph series. This coincided with the opening of scientific society membership to women across Britain. Like other organisations in recent years, the Palaeontographical Society has seen an increase in elected female council members, but this increase is concentrated in the last decade, and to date there has not been a female president.

Gender and ethnic diversity in scientific societies has rightfully received attention in the past two decades. The Palaeontographical Society monograph authorship is distinguished by contributions from some of the doyennes of geoscience, particularly in the first half of the twentieth century. However, authorship has not significantly increased and remains

predominately male. In highlighting the contributions made by women throughout the Society's long history, we hope that it will not be long before the first female president is elected, and that gender parity is eventually achieved in all aspects of Society business.

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Author Contributions

EP: initial concept (lead), project administration (lead), data collection (equal), writing (equal), investigation (lead); **PNWJ:** concept (supporting), data collection (equal), writing (equal); **PRC:** data collection (equal), writing (equal).

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Table 1: *Women members of the Palaeontographical Society in 1848, one year after the Society's formation. It is compiled from two separate membership lists for 1848 published in the first and second annual volumes (March 1848 and July 1849).*

Miss Alexander, Goldrood, Ipswich
Miss M. Alexander, Ipswich [one of these two subscribers will be Mary Ann Alexander (1815–1913)]
Mrs Basevi, 6 Berkeley Place, Cheltenham
Miss C. Broderick, 9 King St., Grosvenor Square (London)
Mrs Cotsworth, Reading
Frances Mary Richardson Currer (1785–1861), Eshton Hall, Skipton, Yorkshire. She was a noted book collector (DNB) which may explain her interest in the monographic series.
Isabella Lady Eardley (née Carr) (d. 1860), Frognell, Torquay
Eliza Ellis (*c.* 1824-1913), Belgrave Hall, near Leicester
Miss Falkener, 21 Bloomsbury Square (London)
Barbara Rawdon-Hastings (1810–1858), The Marchioness of Hastings, Efford House, Lymington, Hants. Also listed at 7 Cavendish Square, London
Mrs J. Head, Ipswich
Miss Hutchins, Alton, Hants
Miss Jackson, Manor House, Lexden, near Colchester
The Hon. Mrs Kenyon, 7 Russell Square (London)
Mrs Mills, Legden Park, near Colchester
Charlotte Garnham Pattisson (née Luard), Witham, Essex. Wife of Jacob, a solicitor.
Elizabeth Philpot (1779–1857), Lyme Regis. Her sister was Margaret, who died in 1845.
Mrs Sarah Ransome (née Coleby) (1794–1863), Ipswich. She was married to Robert, the younger son of the founder of Ransome's which made agricultural equipment.
Lady Sinclair, Pilmuir, Torquay

Miss S. Thompson, Stamford, Lincolnshire
Miss Tillard, Hastings
Mrs E. M. Townsend, Spring Field, Norwood, wife of Richard Edward Austin Townsend.
Henrietta Wollaston (d. 1873), Clapham Common. Daughter of George Hyde Wollaston and niece of William Wollaston who discovered palladium. She was the second wife of Field-Marshall Sir George Pollock.
Mrs Col. Wood, Spardon Hall, near Derby, and also Rectory House, Wrekham, Bishops Witham [sic – but probably Wickham Bishops, near Witham, Essex].

Table 2: *Female collectors, illustrators, authors and council members of the Palaeontographical Society. Birth and death dates given for deceased given where known.*

Name and Birth and Death Dates	Date of contribution	Contribution				Details of Contribution
		Collector only	Illustrator	Author	Council	
Miss Mary Ann Alexander (later Mrs Corder) (1815–1913)	1848	x				Molluscs, Wood (1848)
Gulielma Mary Holmes (b. 1828)	1855		x			Dinosaurs, Owen (1853-1889; Pt 2, pls 9, 11, 12, 14, 15)
Mary Holmes (b. 1832)	1857		x			Dinosaurs, Owen (1853-1889; Pt 3, pl. 5).
Mary Morland (later Buckland) (1797-1857)	1857 / 1872		x			Dinosaurs, Owen (1853-1889; Pt 3, pl. 1). Incl. *Megalosaurus bucklandi*, first dinosaur described. / Pleistocene mammals, Dawkins & Sandford (1866-1872; Pt 4, pl. 25)
Elizabeth Anderson Gray (1831–1924)	1866–1871 / 1978 / 1984 / 2019	x				Brachiopoda, Davidson (1866–1871) / Cocks (1978) / Harper (1984) / Cocks (2019)
"	1903–1935 / 1950 / 1971 / 1973 / 1982	x				Trilobites, Reed (1903–1935) / Whittington (1950) / Lane (1971, see note in Cleevely *et al.,* 1989, p. 237) / Owens (1973) / Howells (1982)
"	1907	x				Conularia, Slater (1907)
"	1914–1940	x				Asterozoa, Spencer (1914–1940)
"	1920–1921	x				Bellerophontacea, Reed (1920–1921)
"	1961 / 1986	x				Crinoids, Ramsbottom (1961) / Donovan (1986)
"	1973-1984	x				Cystoids, Paul (1973–1984)
Phoebe Anna Traquair (1852-1936)	1877–1914		x			Carboniferous ganoid fishes, Traquair (1877-1914; Pt 1, pls 2-7; Pt 2, pls 8-12, 15-18; Pt 3, pls 19-21, 23; Pt 4, pls 27, 30; Pt 5, pls 31, 33; Pt 6, pls 38, 39)
Miss Mary Suft	1879-1882		x			Ammonites, Wright (1878-1886; Pt 2. pl. 17; Pt 3. pls 24-26; Pt 5. pl. 52A)
Gertrude Mary Woodward (1861–1939)	1883-1884		x			Carboniferous trilobites, Woodward (1883-1884; Pt 1, pls 1-6; Pt 2, pls 7-10)
"	1884		x			Eocene flora, Gardner (1883-1886; Vol. 2, Pt 2, pls 13, 14)
"	1888		x			Palaeozoic Phyllopoda [crustaceans], Jones and Woodward (1888-1899; Pt 1, pls 2, 12)
"	1903-1906		x			Palaeozoic trilobites, Reed (1903-

						1906; Pt 1, pls 1-6; Pt 2, pls 7-13; Pt 3, pls 14-20)
"	1911		x			Carboniferous Arachnida, Pocock (1911; pls 1-3; drew text-figs)
"	1902-1912		x			Fishes, Woodward (1902-1912; drew text-figs)
"	1916-1919		x			Fishes, Woodward (1916-1919; Pt 1, pls 1-10; Pt 2, pls 11-20; Pt 3, pls 21-26)
Ellen Caroline Woodward (1859–1943)	1884-1886		x			Eocene flora, Gardner (1883-1886; Vol. 2, Pt 2, pls 11, 12; Pt 3, pls 21, 23)
Alice Bolingbroke Woodward (1862–1951)	1884 / 1888		x			Carboniferous Entomostraca [crustaceans], Jones *et al*. (1874-1884; Pt 2, pls 6, 7) / Palaeozoic Phyllopoda [crustaceans], Jones and Woodward (1888-1899; Pt 1, pl. 1)
Miss Helen Pike	1896-1900		x			Carboniferous Lamellibranchiata, vol. 1, Hind (1896-1900; unidentifiable drawings and casts)
Dame Dr Maria Matilda Ogilvie Gordon (1864–1939)	1900				x	Local Secretary
Dr Gertrude Lilian Elles (1872–1960)	1901–1918			x		Graptolites, Elles and Wood (1901–1918)
Dr Ethel Mary Reader Wood (Dame Ethel Shakespear) (1871–1946)	1901–1918		x	x		Graptolites, Elles and Wood (1901–1918)
Margaret Chorley Crosfield (1859–1952)	1902-1907 / 1912-1920				x	Council Member / Council Member
Ida Lilian Slater (1881–1969)	1907 / 1911		x	x		Conulariae, Slater (1907; all plates) / Graptolites, Elles and Wood (1901-1918; Pt 8, pls 46-51)
Mary Jane Longstaff née Donald (1855–1935)	1908-1909 / 1911-1912				x	Council Member / Council Member
Mary Sophia Johnston (1875–1955)	1910-13 / 1916-20 / 1923–1930	x			x	Council Member / Council Member / Ammonoidea, Spath (1923–1930)
Mary Angus	1923–1930	x				Ammonoidea, Spath (1923–1930)
Éliane Basse (1899–1985)	1923–1930	x				Ammonoidea, Spath (1923–1930)
Marjorie Elizabeth Jane Chandler (1897–1983)	1925–1926		x	x		Eocene flora, Chandler (1925-1926; all plates)
Eileen Barnes (1876–1956)	1929-1933		x			Pleistocene deer, Reynolds (1929, 1933; text-figs)
Dr Helen Muir-Wood (1895–1968)	1936			x		Brachiopods, Muir-Wood (1936)
Dr Dorothy Hill (1907–1997)	1938–1941			x		Rugose corals, Hill (1938–1941)
Dr Jana Elizabeth Hutt	1974–1975 / 1985-1996			x	x	Graptolites, Hutt (1974–1975) / Editor
Dr Yvonne Howells	1982			x		Silurian trilobites, Howells (1982)
Dr Joan Watson (Mrs	1992			x		Bennettitales, Watson and Sincock

C.M.B. Henderson)						(1992)
Dr Caroline A. Sincock	1992			x		Bennettitales, Watson and Sincock (1992)
Dr Kathleen Histon	1998–1999			x		Carboniferous nautiloids, Histon (1998-1999)
Dr Joanne Snell	2004			x		Silurian bryozoans, Snell (2004)
Dr Svetlana V. Nikolaeva	2008			x		Carboniferous ammonoids, Nikolaeva (2008)
Dr Fiona E. Fearnhead	2009-2012 / 2014 / 2014-2016			x	x	Silurian crinoids, Donovan *et al.* (2009-2012) / Devonian crinoids, Donovan and Fearnhead (2014) / Ordinary member
Rosanne Widdison	2009-2012			x		Silurian crinoids, Donovan *et al.* (2009-2012)
Dr Martha Richter	2011-2012				x	Ordinary member
Prof. Margaret Collinson	2011-2013				x	Ordinary member
Prof. Susan Evans	2013-2015 / 2020-				x	Ordinary Member / Vice-President
Prof. Dame Jane Francis	2015 / 2016-2019				x	9th Annual Address: *When Antarctica was green: fossil plants reveal Antarctica's climate history* / Vice-President
Dr Angela M. Kirton	2016–2018			x		Jurassic ichthyosaurs, Moon and Kirton (2016-2018)
Ms Emma Bernard	2014-2018 / 2018-				x	Marketing Manager / Publicity Officer
Dr Lucy McCobb	2017-2019				x	Ordinary member
Prof. Jenny Clack (1947-2020)	2017-2019 / 2017 / 2020				x	Ordinary member / 11th Annual Address / Palaeontographical Society Medal
Dr Caroline Buttler	2018-2019				x	Vice-President
Dr Elsa Panciroli	2018-2020				x	Ordinary Member
Dr Samantha Giles	2019-2022				x	Ordinary Member

Figures

Fig 1. Elizabeth Anderson Gray in 1922. © The Trustees of the Natural History Museum, London.

Fig 2. Specimen from the Gray Collection, *Conularia plicata* NHMUK PI CL 410, held at the NHM, London. Described and figured in Palaeontographical Society monograph by Ida Slater (Slater 1907). ©The Trustees of the Natural History Museum, London.

Fig 3. Five views of *Iguanodon* tail vertebra by Gulielma Holmes, lithographed by James Erxleben (from Owen 1855, pl. 9). Accessed via the Biodiversity Heritage Library.

Fig 4. Phoebe Anna Traquair's illustration of *Gonatodus punctatus* and smaller fragments of fossil fish, from her husband's monograph (from Traquair 1907, pl.19). Accessed via the Biodiversity Heritage Library.

Fig 5. Alice Woodward's illustration of fossil crustacean *Ceratiocaris ludensis* (from Jones and Woodward 1888-1899, pl. 1). Accessed via the Biodiversity Heritage Library.

Fig 6. Gertrude Woodward's illustration of a 'phyllopod' crustacean (from Jones and Woodward 1888-1899, pl. 12, fig. 2a). Accessed via the Biodiversity Heritage Library.

Fig 7. Miss Suft's illustrations of the Lias ammonite '*Aegoceras angulatum*' (from Wright 1879, pl. 17). Accessed via the Biodiversity Heritage Library.

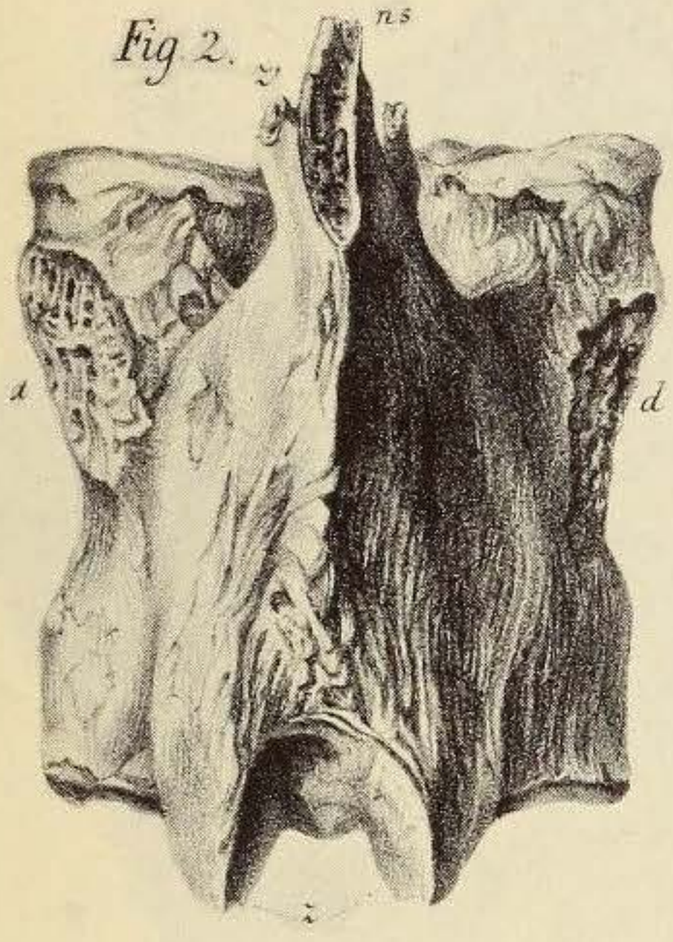
Fig 8. Margaret Chorley Crosfield, taken by Mary Johnston (from Burek 2014).

Fig 9. Mary Sophia Johnston (from Burek 2014)

Fig 10. Jane Francis, first female Vice-President of the Palaeontographical Society from 2016–19 (credit: Jane Francis/BAS).

Fig 11. A member of the Society, Jenny Clack (1947-2020), was the first woman to win the Palaeontographical Society medal in 2020 (credit: Michael Cockerham).

Fig 2.



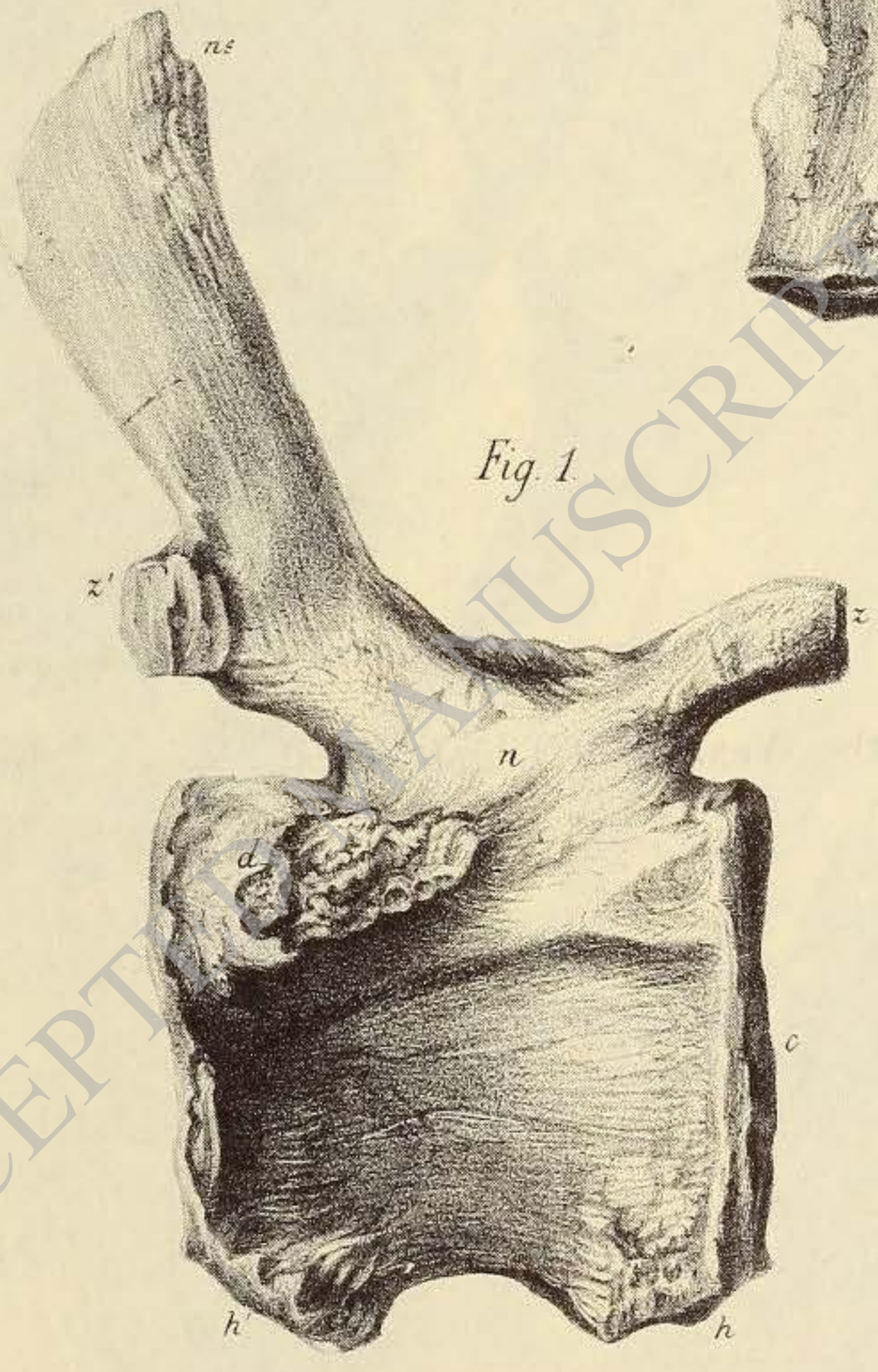


Fig. 1.

Fig 5.

Fig. 4.

Fig. 3.

Drawn from Nature by Miss Holmes. on Stone by J. Erxleben.

Day & Son, Lith.rs to the Queen.

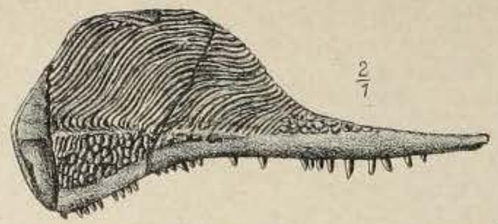


Fig. 2.

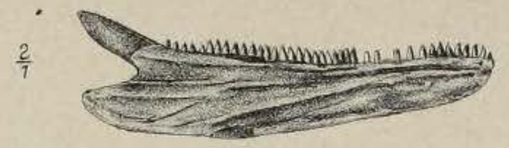
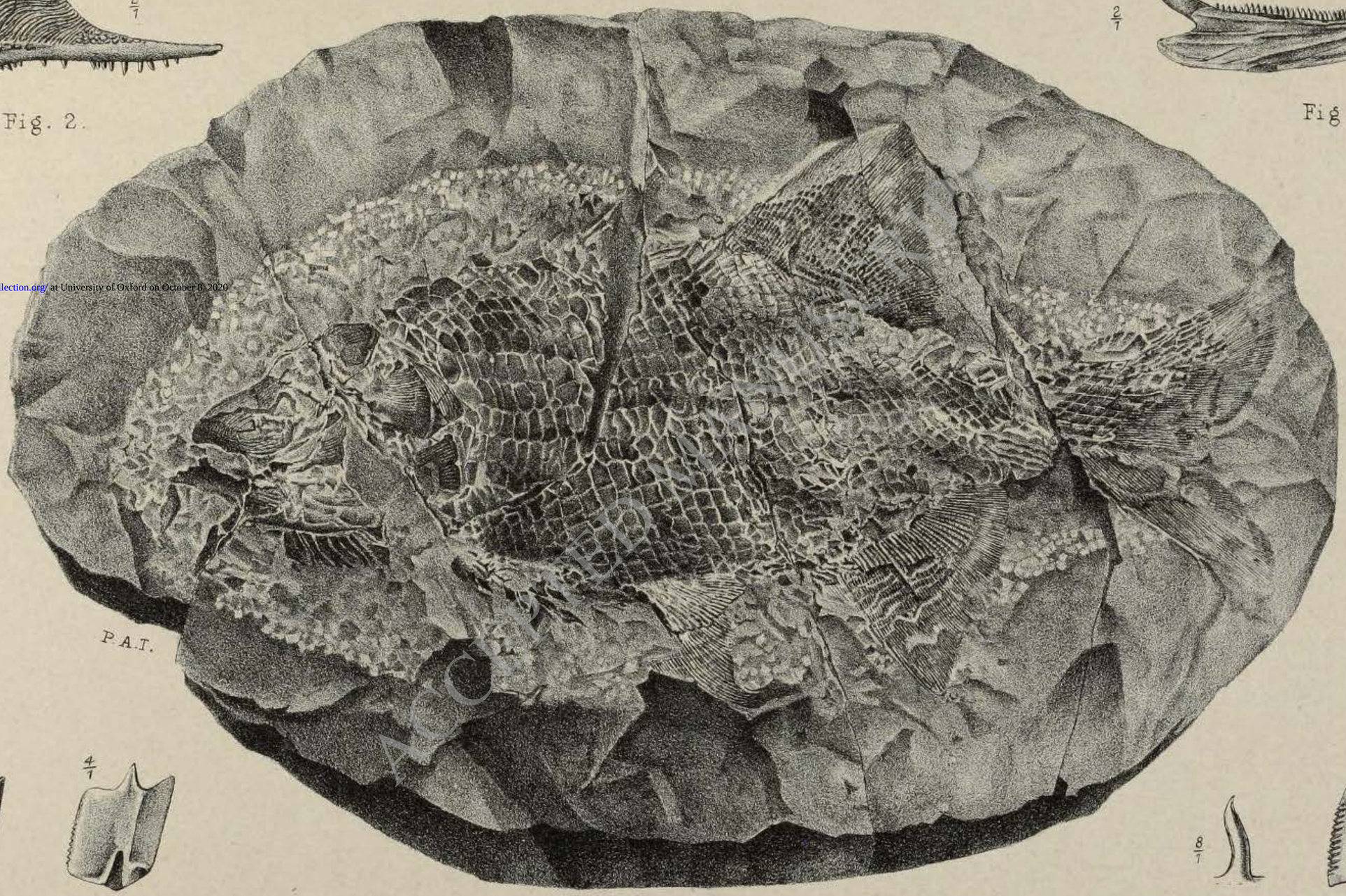


Fig. 3.



P.A.T.

Fig. 5.

Fig. 6.

Fig. 1.

Fig. 4.

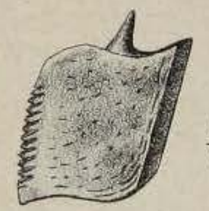


Fig. 7.

AA

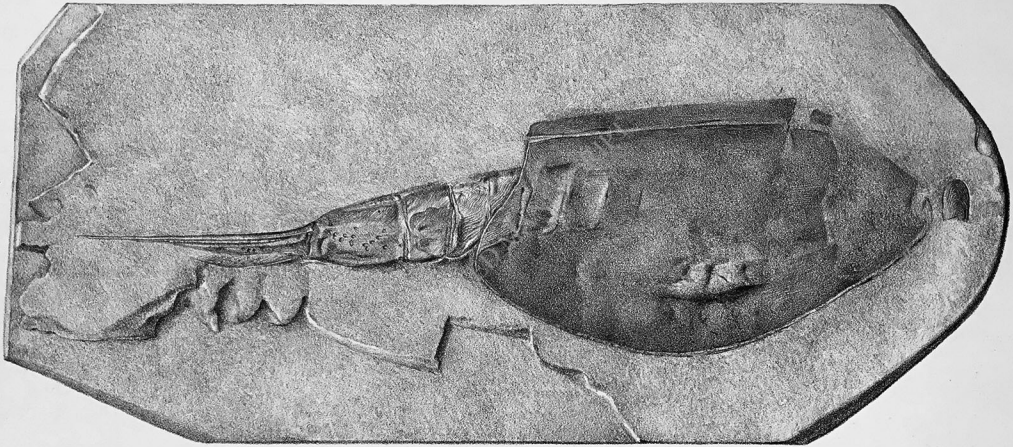
BB

CC

A.B. Woodward del et lith

West, Newman & C° imp.

BRITISH FOSSIL PHYLLOPODA.



2a

G.M. Woodward del. et lith.

West, Newman & Co. imp.

Fig. 1.

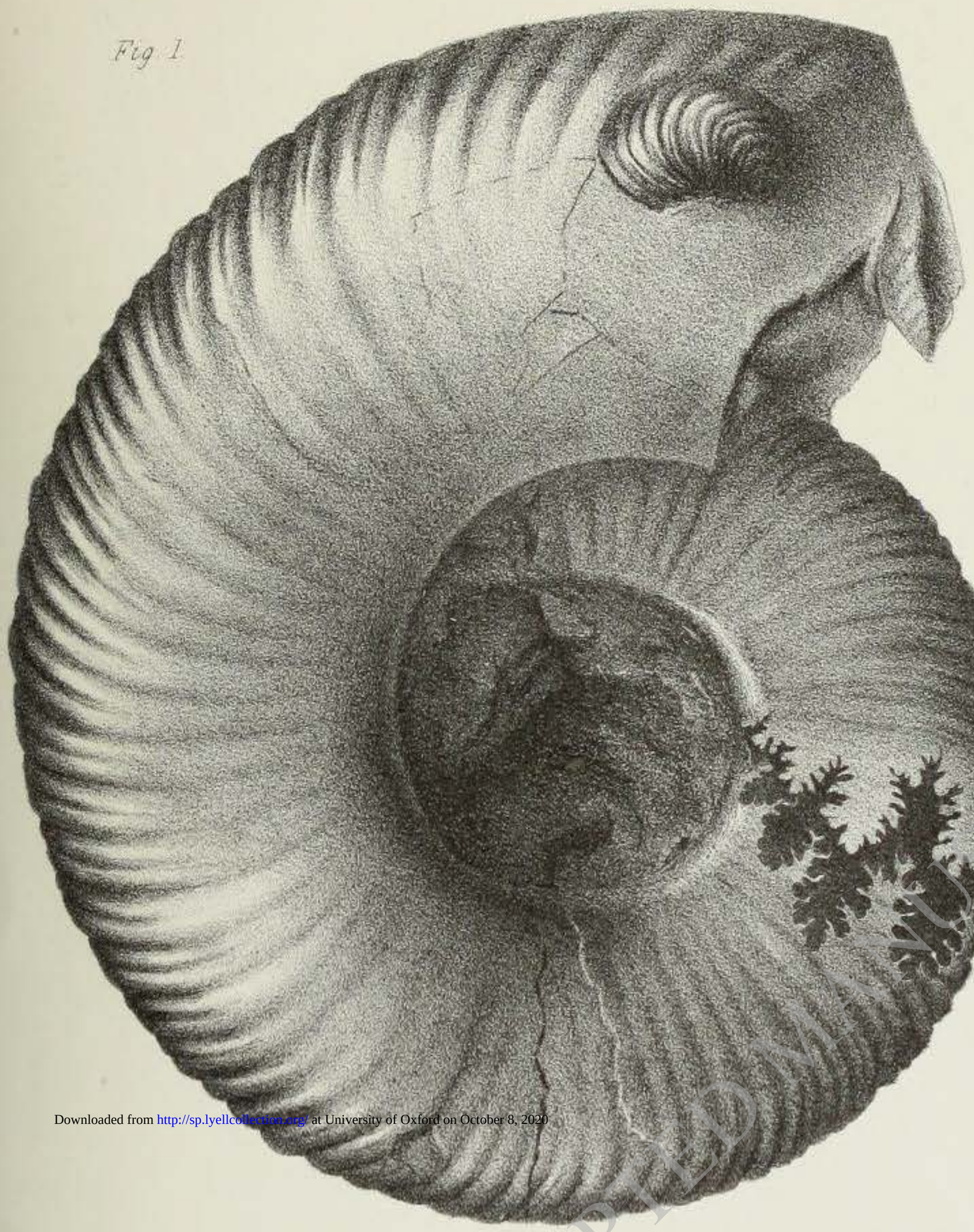


Fig. 2.

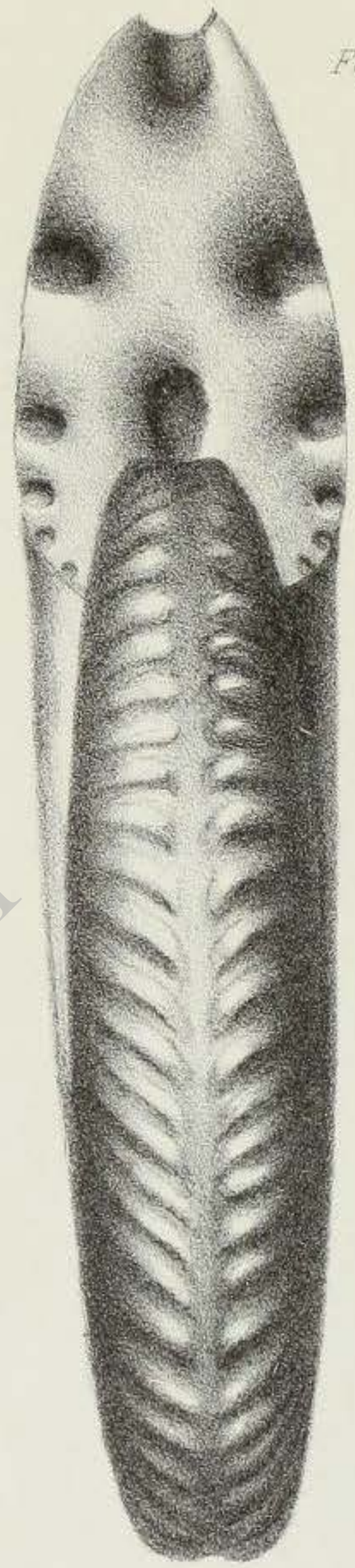


Fig. 3.

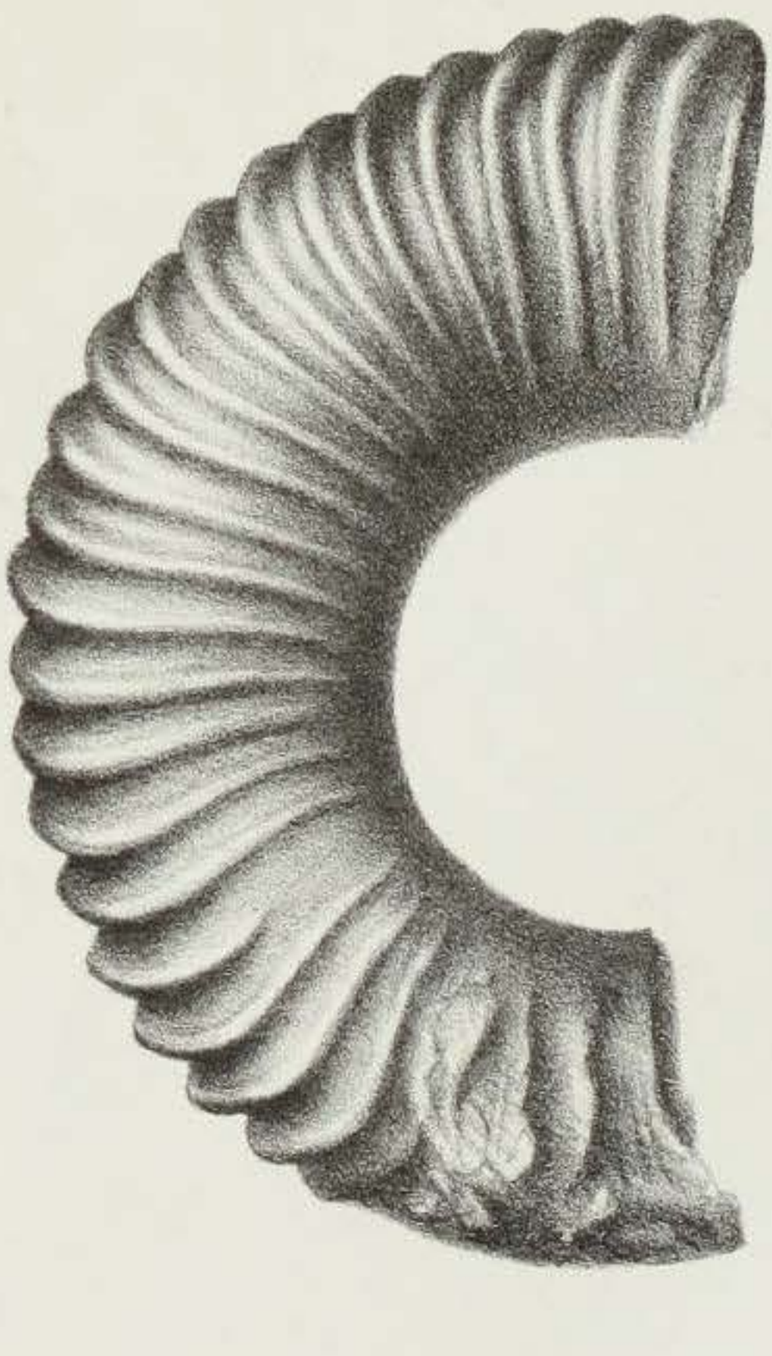


Fig. 4.

Fig. 5.

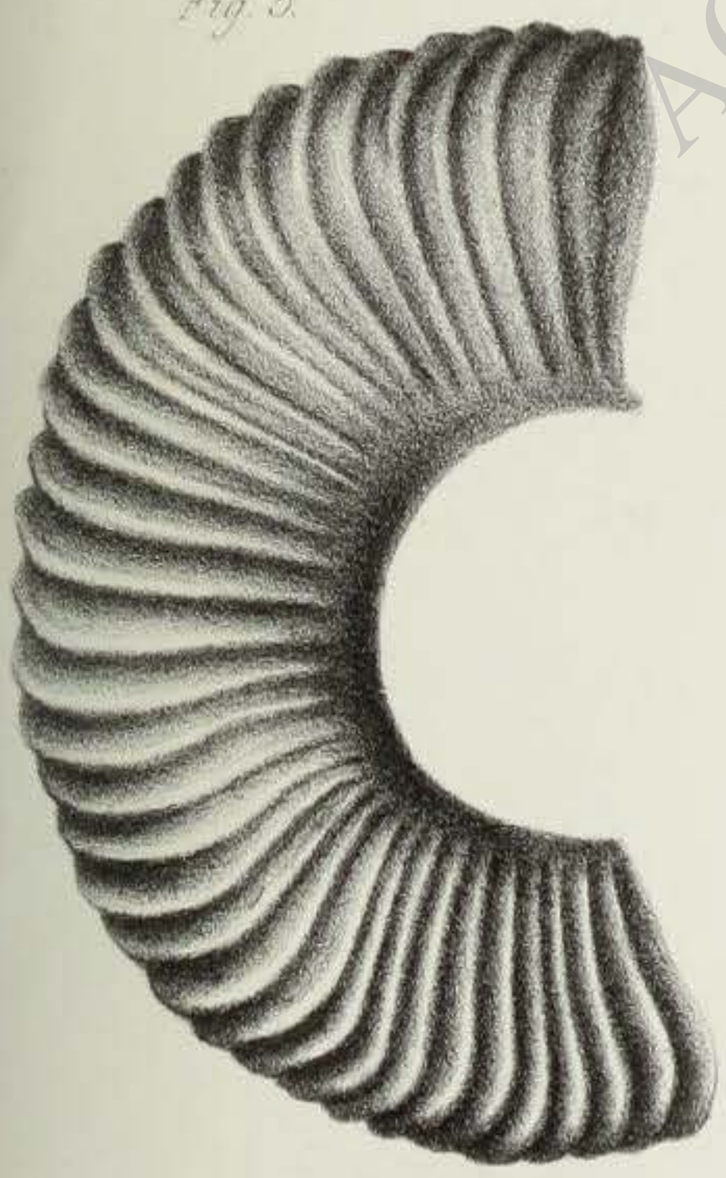


Fig. 6.

Mary Suft, del. et lith.

Hanhart imp