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Monsters and dragons of the past: the ichthyosaur of Mary Anning

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Abstract

In 1811, following the discovery of a skull by her brother Joseph, Mary Anning (1799-1847), then aged 11, discovered the fossil remains of what would be identified as the first complete ichthyosaur, a decisive breakthrough in the history of understanding past life. This contribution examines the discovery of the ichthyosaur not as an isolated event, but as part of a wider network of female contributions to early nineteenth-century geosciences. Despite their exclusion from formal education and scientific institutions, women such as Mary Anning, certainly the best known, Elizabeth Philpot (1779-1857), Charlotte Hugonin Murchison (1788-1869) and Mary Morland Buckland (1797-1857) played crucial roles in the development of early nineteenth-century geosciences, collaborating with each other and with male geologists, often without recognition. Through manuscript and printed sources, we reconstruct how their expertise, from fossil preparation to scientific illustration, shaped disciplines then in the making.

The story of Anning and the other women geologists offers an emblematic case study of the gender dynamics in nineteenth-century science, between male appropriation of knowledge and female resistance.

Keywords: Women in geosciences, History of palaeontology, Ichthyosaurus, Fossils.

1. Introduction

When the young Charles Darwin embarked as shipboard naturalist on the H.M.S. Beagle vessel in 1831 for the famous round-the-world voyage, among the books he took with him was the *Dictionnaire Classique d'Histoire Naturelle* by Bory de Saint-Vincent (1778-1846), a work that enjoyed great success and popularity (Bory de Saint-Vincent, 1826). In Volume IX, under the heading *Lias*, there was a description of the extraordinary discoveries made by Mary Anning (1799-1847), a self-taught English palaeontologist: *"who collected almost all the fossils of the Lias on the coast of Lyme Regis, which have since become famous for the work to which they gave rise*" (Bory de Saint-Vincent, 1826). Her discoveries, including the first complete skeletons of ichthyosaur, plesiosaur and pterosaur, not only confirmed the existence of extinct species but also profoundly influenced the scientific debate on evolution and the geological history of the planet (Torrens, 1995; Davis, 2012).

In late 1811 and early 1812, the bones of a strange, yet unknown animal, which would later become known as the ichthyosaur, emerged from the rocks of Lyme Regis, Dorset. The discovery and meticulous reconstruction of the skeleton was the work of a young girl, Mary Anning. Of humble origins, she had been orphaned by her father Richard, a carpenter, from whom she had learned the techniques for extracting fossils, on the sale of which the very survival of the poor family depended.

Here, leaving aside Anning's biography, for which we refer to the essential bibliography (Torrens, 1995; Davis, 2012), we will follow the events surrounding the history of the ichthyosaur to illuminate the complex web of relationships and events that revolved around it.

Reconstructing the events surrounding the discovery of the mysterious marine reptile and its secrets is, in fact, tantamount to embarking on a journey through the everyday life of a large group of women and men who shaped the development of geology and palaeontology. The traces scattered among printed works and manuscripts clearly reveal the extent to which the work of Mary Anning, Elizabeth Philpot (1780-1857), Charlotte Hugonin (1788-1869) and Mary Morland (1797-1857) contributed to the development of these disciplines. The first discovery of the ichthyosaur and the affair related to this fossil remnant allows us to take a closer look at the female scholars who intertwined their lives and activities, carving out their own space within a predominantly male universe.

2. A scientific alliance: Mary Anning and Elizabeth Philpot

In 1810, Mary Anning found along the cliffs of Dorset an ammonite known at the time as a "*cornemonius*". She was only ten years old and, on her way back, "*something occurred as she was returning which decided at once her future destinies*": a woman, looking at what she was holding in her hand, offered her half a crown. It was then that Mary decided "*to go down 'upon beach' again*" (Roberts, 1834).
The exact place and year in which the two brothers made their first important discovery are unknown. The most widely accepted version claims that it was around 1810-1811 that her brother Joseph unearthed the skull of a mysterious "*crocodile*" (this is how the ichthyosaur was initially considered to be) under the Black Ven (Figure 1). Mary Anning, following a meticulous and laborious search, managed to unearth some 60 vertebrae and several ribs a few months later.

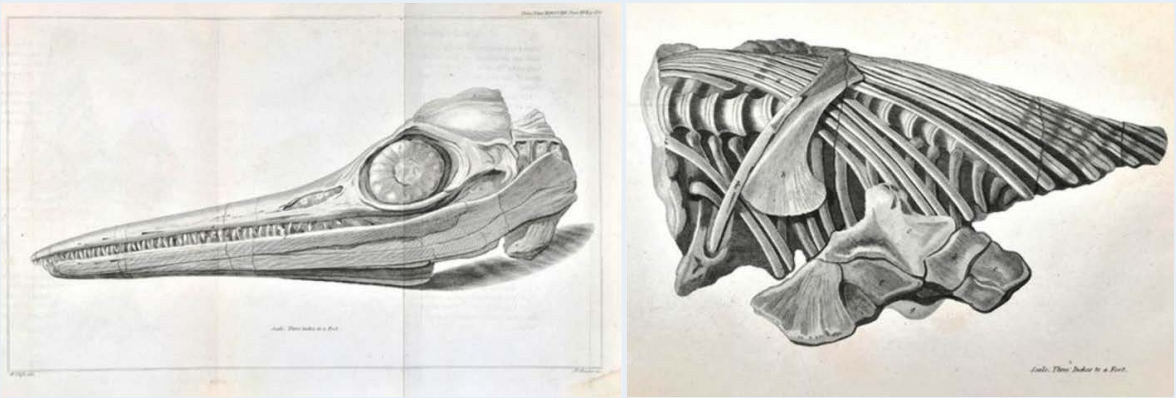

Figure 1. *Engravings of the partial ichthyosaur discovered by Joseph and Mary Anning from Home (1814).*

The fossil was sold for £23 to a local gentleman, Sir Henry Hoste Henley (Howe, 2013). Today, the skull is kept at the Natural History Museum in London, while the spine found by Mary has been lost (Davis, 2012). Although not the first European specimen, as evidenced by Joshua Brooks' sketch and article in the Medical and Physical Journal (Brooks, 1811), these remains attracted the attention of the scientific community for the first time (Figure 2).
It was in this first important discovery that Elizabeth Philpot played a decisive role. Elizabeth had settled in Lyme Regis in 1805 with her sisters, Mary and Margaret,

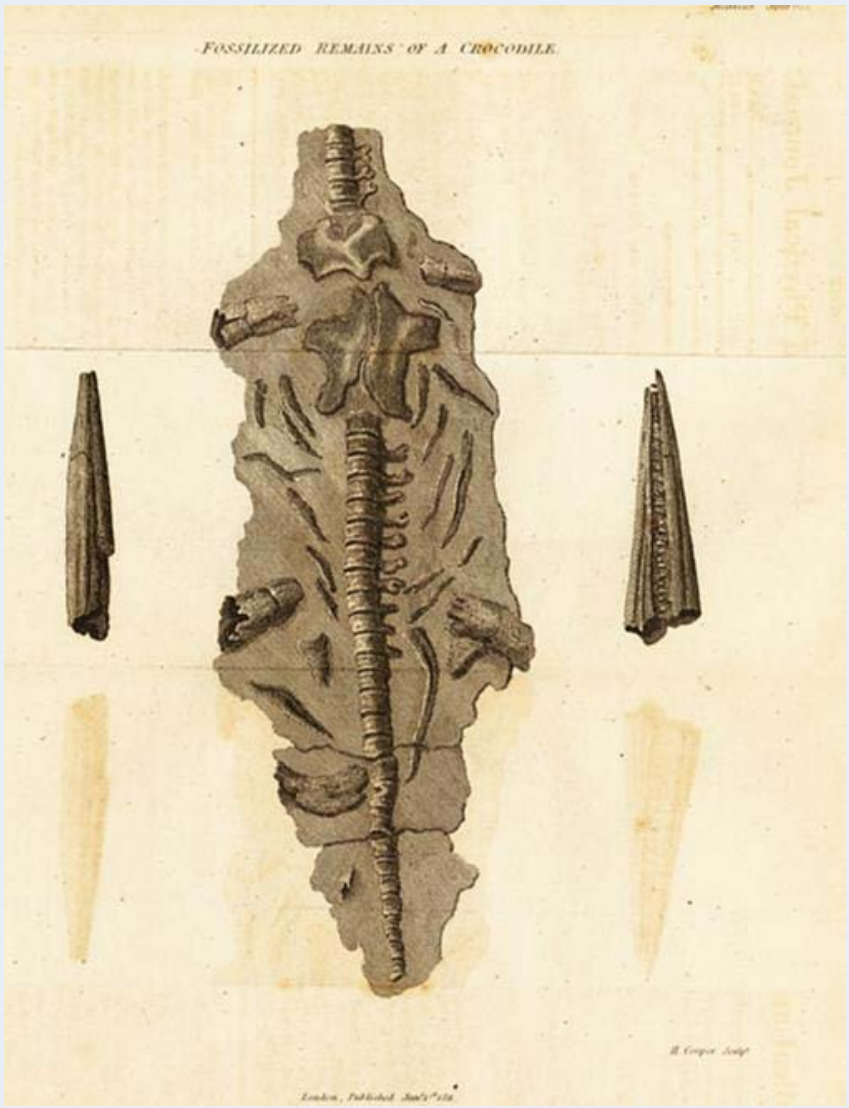

Figure 2. *Sketch of fossil "crocodile" attached to Brooks (1811).*

and from early on she had befriended the little girl of just six who was searching for fossils on the cliff under the careful guidance of her father (Ogilvie and Harvey, 2000). Different in age and social background, they were, however, united by their passion for fossils.

When little Mary unearthed the fossilised remains of the ichthyosaur in 1812, Elizabeth financed the recovery and transport to Mary's workshop, where the fossil

was cleaned (Emling, 2009). Furthermore, it was Elizabeth who was instrumental in Mary's scientific education by allowing her to consult her extensive library, to read works and articles on geology, and by keeping her informed of her correspondence with scholars of the time.
If her role may seem marginal, it was in fact decisive: she not only collaborated with Mary but also curated a valuable collection of fossils.
Entering Philpots' house was like visiting a rudimentary museum, with several glass fronted cases and low boxes in the dining room, upstairs and on the landing, all full of fossils and each with a little note on it (Torrens, 1995).
Elizabeth Philpot's collection of around 400 fossils soon became a popular and valuable destination for geologists of the period, including William Buckland (1784-1856) and Louis Agassiz (1807-1873), who did not fail to mention it in their writings (Buckland, 1829a; Agassiz, 1833-43).
On the other hand, the collection was considered so important that it was purchased by the Oxford University Museum as early as 1880: among the most notable fossils are the holotype of *Dapedium punctatum* and part of the holotype of *Squaloraja polyspondyla*, both dating from the Lower Jurassic (Taylor, 1986).
The importance of the Philpot sisters' work was such that, even today, the Lyme Regis Natural Science Museum, built where the Anning Fossil Depot once stood, is named after them (Taylor, 1986).

3. The Ichthyosaur and the Colonel

In 1818 Thomas Birch (1768-1829), a retired lieutenant-colonel with a passion for fossils, arrived in Lyme Regis. During his stay he met the Anning family and discovered Mary's talents as well as their financial difficulties. That same year, Mary unearthed an exceptionally complete ichthyosaur and Birch helped her extract it. The Colonel's support for the young woman led to much gossip, fuelled by their age difference, about an alleged affair between the two.
The economic situation of the Anning family was very precarious at the time. Since the discovery of the second ichthyosaur, which had not been as successful as the previous one, there had been no further significant finds. For these reasons, in March 1820, Birch wrote to the geologist and palaeontologist Gideon Mantell (1790-1852), informing him of his intention to organise an auction to sell the fossils (Figure 3) and donate all the proceeds to the Anning family: "*I have not forgotten my promise to select for you some fine things from the blue lias [the rock in which the Lyme fossils occur] – I cannot however, perform it yet as I have great occasion for every individual specimen I can muster. The fact is that I am going to sell my collection for*

the benefit of the poor woman [Molly] and her son [Joseph] and daughter [Mary] at Lyme who have in truth found almost all the fine things, which have been submitted to scientific investigation […]. *I may never again possess what I am about to part with; yet in doing it I shall have the satisfaction of knowing that the money will be well applied*" (original from Torrens, 1995).

Figure 3. *The fossil was included in Home (1819). The specimen, owned by Lt. Col. Thomas James Birch, was sold in 1820 to benefit Anning and her family.*

It is an important document, both because it is the first time the Colonel has credited Mary with a series of finds, and because it is evidence that the scientific world was beginning to talk about Mary as a prominent fossilist. Birch's auction was held at Bullock's Museum in Piccadilly. Many of the fossils were bought by the British Museum, the best specimens went to the Museum of the Royal College of Surgeons in London, the Anning-Birch ichthyosaur sold for £100 (Torrens, 1995). At the end of the sale, Birch made around £400, which he personally handed over to the Anning family (Torrens, 1995). On this occasion, he gave Mary a small dog, Tray, so that she would not be alone during the long and dangerous search along the cliffs (Figure 4).

4. Cuvier, the ichthyosaur and the work of Mary Anning

In 1818, the year of the Anning-Birch ichthyosaur discovery, Georges Cuvier, father of comparative anatomy, visited Oxford and London, where he met the British physician and palaeontologist Sir Everard Home (1756-1832). Home had erroneously

described the 1811-12 fossil as "*the fish* [...] [*but*] *not of the family of shark or rays*" (Home, 1814). After further studies, in 1819, Home renamed it *Protosaurus*, classifying it among amphibians and lizards (Home, 1819, 1833). However, as early as 1817, Charles König (1774-1851) had already coined the term *Ichthyosaurus*, which was formalised in 1825 (König, 1825).

Despite nomenclatural conventions, König's term was preferred, relegating *Protosaurus* to the status of a *nomen oblitum*. Cuvier took advantage of Home's presence to examine the remains of an ichthyosaur and was struck by their uniqueness: "*Nous voici arrivé à ceux de tous les reptiles, et peutêtre de tous les animaux fossiles, qui*

Figure 4. *Portrait of Mary Anning with her dog Tray; unknown artist, before 1842.*

ressemblent le moins à ce que l'on connaît, et qui sont le plus faits pour surprendre le naturaliste par des combinaisons de structures qui, sans aucun doute, paraîtraient incroyables à quiconque ne serait pas à portée de les observer par lui même, ou à qui il pourrait rester la moindre suspicion sur leur authenticité" ("*We have now come to those reptiles, and perhaps all fossil animals, that least resemble those we know today and most surprise naturalists with combinations of structures that would undoubtedly seem incredible to anyone who had not had the opportunity to observe them in person or who had the slightest doubt about their authenticity*") (Cuvier, 1824). From 1818 to 1824, Cuvier devoted considerable attention to the discoveries along the cliffs of Lyme Regis and to the work of Mary Anning. He was informed of the auction organised by Birch and acquired notable specimens for the Muséum National d'Histoire Naturelle in Paris (Taquet, 2003), including the partial ichthyosaur skull described and illustrated by Home in 1819 (Home, 1833).

5. New evidence from the past

The first systematic description of ichthyosaurs was published in 1821 by the geologists William Conybeare (1787-1857) and Henry De la Beche (1796-1855) (De la Beche and Conybeare, 1821). In May of the same year, the first complete specimen of *Ichthyosaurus Platyodon* was discovered. The writer and amateur palaeontologist George Cumberland (1754-1848), a multi-talented British intellectual and influential member of the Geological Society of London, claimed responsibility for the discovery: "*the very finest specimen of a fossil Ichthyosaurus ever found in Europe,* [...] *of that remarkable aquatic animal, which we owe entirely to the persevering industry of a young female fossilist, of the name of Hanning [sic: Anning] of Lyme in Dorsetshire, and her dangerous employment*" (Cumberland, 1829; Torrens, 1995). In describing her meticulous daily work among the perilous cliffs, Cumberland documented what scientific institutions still overlooked: Anning's crucial role. Subsequent finds and experience changed her approach, from a skilled explorer to a careful observer capable of critical analysis that would revolutionise palaeontology, as the curious affair of the coprolites demonstrated.

5.1. The secret of the ichthyosaur

The English geologist Roderick Murchison (1792-1871) wrote to George William Featherstonhaug (1780-1866), a fellow Englishman who had moved to America, about how Mary Anning had first identified the fossil faeces around 1824, sowing

the intellectual seeds of this insight in the mind of William Buckland (Duffin, 2012). The discovery was officially recognised in 1829, when Buckland himself published a study explicitly citing Anning as the author of the unprecedented discovery and emphasising her insight and genius (Buckland, 1829b).

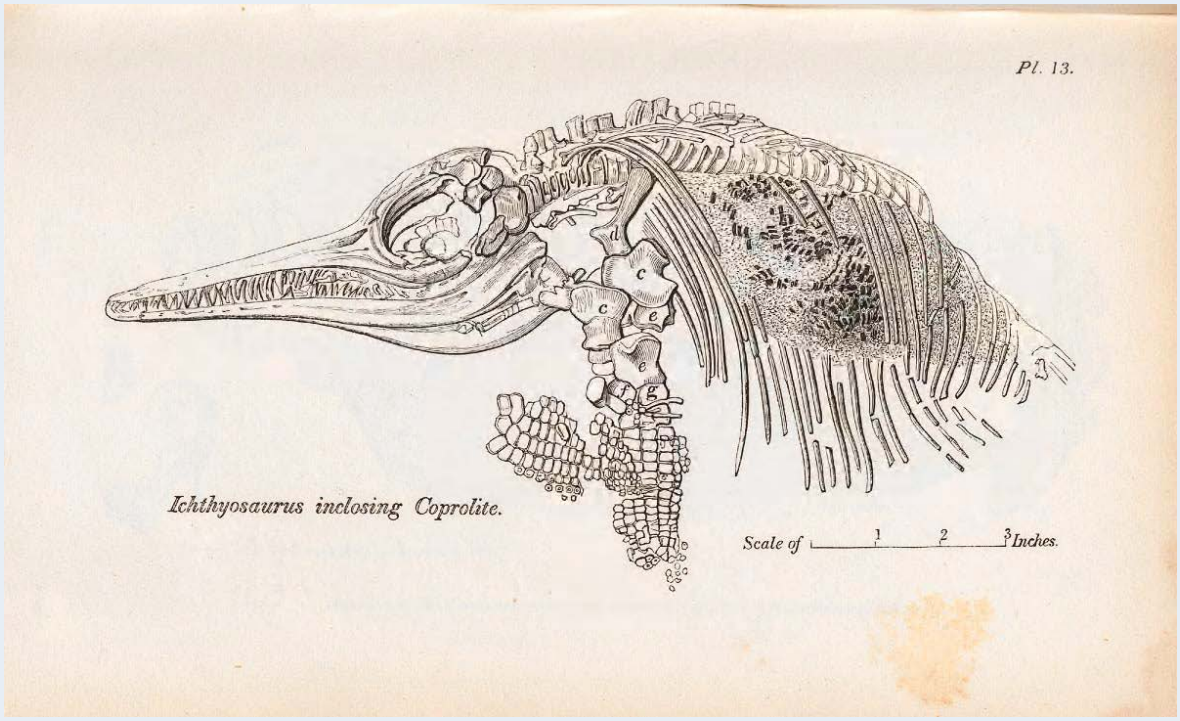

Figure 5. *An illustration of Mary Anning's ichthyosaur skeleton inclosing coprolite appeared in Buckland (1836), Plate 13.*

The uniqueness of this public recognition of a woman was combined with the revolutionary nature of the discovery: the Lyme Regis bezoars, used as amulets, contained *"scales, and occasionally the teeth and bones, of fishes"* (Buckland, 1829b). Buckland thus reported that "*Miss Anning*", in analysing various specimens, had observed that they lay between the thorax and pelvis of ichthyosaurs. Furthermore, two specimens found near a fossil appeared to have been evacuated during a deadly battle (Buckland, 1829b).

The conclusion was clear: they were fossil faeces, christened "*coprolites*" (Figure 5). In Mary Anning's little workshop, the foundations of palaeocoprology had been laid.

The "*ancient*" ocean began to take on darker and darker hues, and life in the abyss took on more and more dynamic features: "*these monsters of the ancient deep, like many of their successors in our modern oceans, may have devoured the small and weaker individuals of their own species*" (Buckland, 1829b).

5.2. The fossil ink

On 9 December 1833, Elizabeth Philpot sent Mary Morland a letter containing a very peculiar drawing (Figure 6). Mary Morland, who had become Buckland's wife in 1825, was an enthusiast of palaeontology and geology (Gordon, 1894; Kölbl-Ebert, 1997a). The sketch sent was truly extraordinary: the skull of an ichthyosaur drawn with fossil belemnite ink, an organism that lived around 200 million years ago (Philpot, mss[1] 1833). This technique, which became popular among local artists, originated from the shared intuition of Philpot and Mary Anning. In 1828, Anning – already fascinated

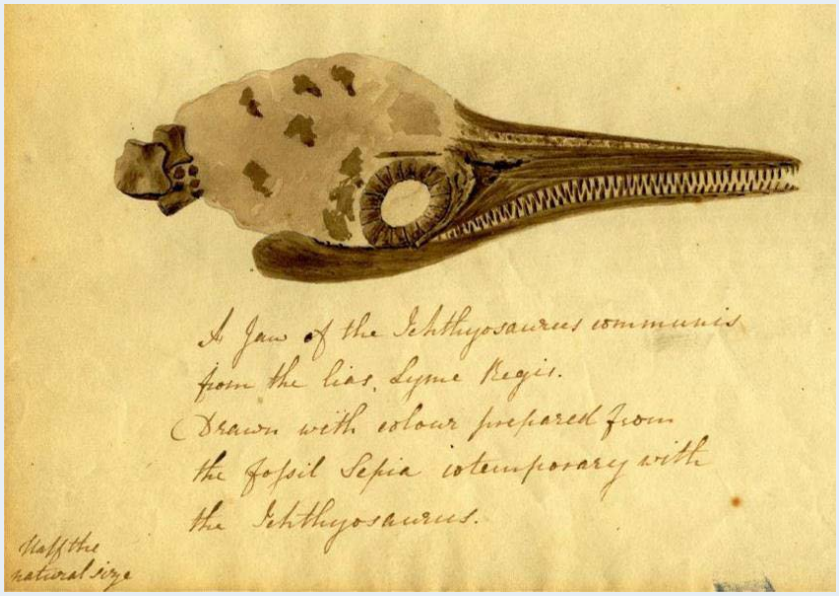

Figure 6. *The letter from Elizabeth Philpot to Mary Buckland dated 9 December 1833. Oxford University Museum of Natural History, WB/A/3/022.*

[1] 'mss' is an abbreviation for manuscripts.

by belemnites then called "devil's fingers" and associated with lightning (Taylor, 1998; Romano, 2024) – had discovered a fossilised ink chamber in one of the cephalopods. It was Philpot who suggested rehydrating it with water, resulting in a unique writing substance (Emling, 2009). Buckland announced the discovery (Buckland, 1829b), which provided scientists with an innovative means of documenting fossils, attracted curious visitors to Lyme Regis to purchase ancient drawings and symbolised the key role of women in palaeontology.

6. Women's collaboration

An undated letter from Elizabeth Philpot to William Buckland, accompanied by a detailed "*natural size*" drawing of an ichthyosaur (Figure 7), demonstrated her attention to both the scientific and economic value of fossils: "*the head is a little crushed therefore each side of the frontal bone is shewn and the blower is very evident*

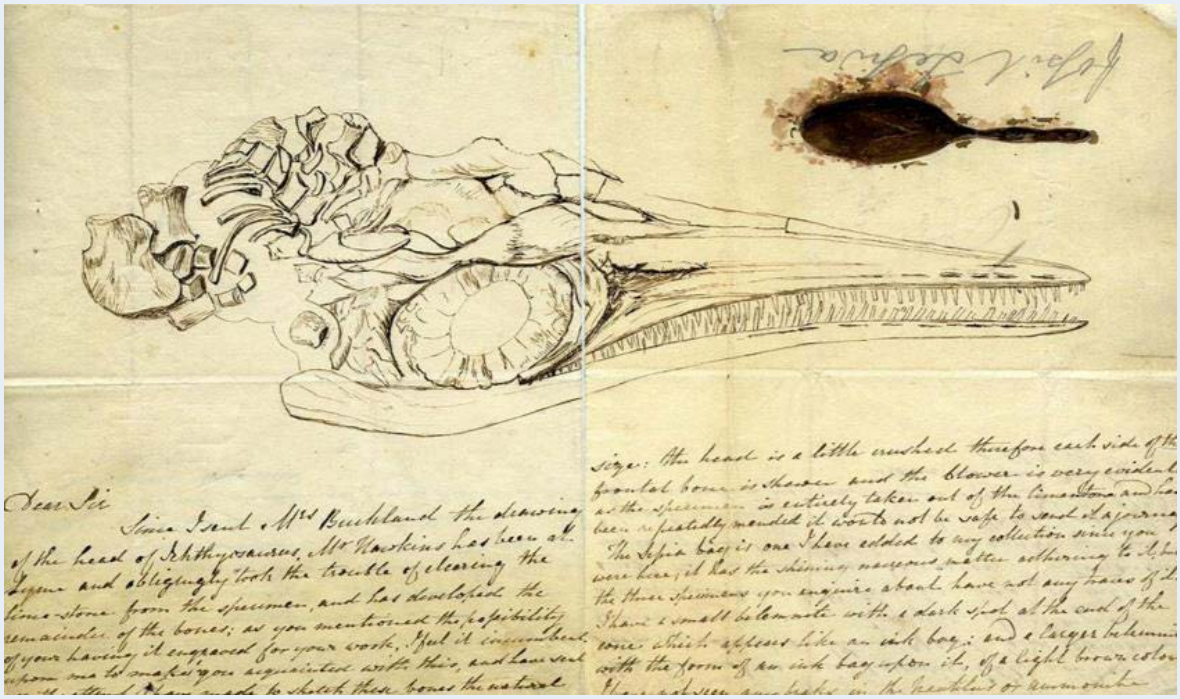

Figure 7. *The "natural size" drawing of an ichthyosaur in the letter from Elizabeth Philpot to William Buckland, Oxford University Museum of Natural History, Box 2/P7.*

as the specimen is taken entirely out of the limestone and has been repeatedly mended it would not be safe to send it a journey" (Philpot, mss undated).
Philpot used her drawings to attract the interest of the scientists with whom he corresponded, while Anning employed them as scientific documentation, as in the case of the Shark-Raya sold to John Naish Sanders. The latter, in an 1838 letter to Philpot, lamented: "*If Miss A. had not forgotten her promise to me, a portion of the tail, subsequently found, would now be attached to the fossil*" (Sanders, mss 1838), revealing how Philpot also acted as a mediator in Mary Anning's transactions.
On 10 December 1823, Mary Anning discovered the remains of a marine vertebrate with a very long neck and a tiny head, a morphology so unusual that it aroused scepticism. George Cuvier, who had received a sketch of the fossil from Georges Cumberland, accused Anning of fraud, believing that she had assembled parts of different animals by joining the neck of a snake to the body of an ichthyosaur (Vincent et al., 2014).
The accusation threatened the reputation and economic survival of Anning, who made her living selling fossils. Despite the young woman's despondency, Conybeare and Buckland organised an official presentation at the Geological Society in London on 20 February 1824, supported by a scientific study confirming the authenticity of the find (Torrens, 1995). Anning could not be admitted as a woman but was not even mentioned in Conybeare's presentation (Conybeare, 1824).
The authors of the communication then sent Cuvier detailed documentation, including anatomical sketches made by Mary Morland, based on Anning's drawings.
In fact, this evidence convinced Cuvier, who withdrew his accusations and treated Anning with great respect, quoting her regularly in his publications: "*Le beau squelette de plesiosaurus, recueilli par miss Mary Anning, et donné an Muséum d'Histoire Naturelle par M. Prevost. Il est décrit dans cet ouvrage huitième partie, chap, v, deuxième section. Comme la tête et la plus grande partie du cou y manquent, on a ajouté ces parties, figurées, d'après un autre squelette qui appartient au duc de Buckingham*" ("*The beautiful plesiosaur skeleton, collected by Miss Mary Anning and donated to the Natural History Museum by Mr Prevost. It is described in this work, part eight, chapter V, section two. Since the head and most of the neck are missing, these parts have been added, depicted on the basis of another skeleton belonging to the Duke of Buckingham*") (Cuvier, 1834).

6.1. Girl genius

It was not only the scientific world that became aware of Mary Anning's dedication and determination. On 17 September 1824, Lady Harriet Silvester (1753-1843),

widow of the former Recorder of the City of London, visited Lyme Regis and met the famous fossil hunter. In her diary she noted: "*the extraordinary thing in this young woman is that she has made herself so thoroughly acquainted with the science that the moment she finds any bones she knows to what tribe they belong. She fixes the bones on a frame with cement and then makes drawings and has them engraved… It is certainly a wonderful instance of divine favour – that this poor, ignorant girl should be so blessed, for by reading and application she has arrived to that degree of knowledge as to be in the habit of writing and talking with professors and other clever men on the subject, and they all acknowledge that she understands more of the science than anyone else in this kingdom*" (Welch, 1968-70).

This is an important testimony because it shows how "*professors and other clever men*" were confronted with Mary's expertise and, consequently, how it was recognised by the scientific community. On the other hand, it is interesting to note how the need was felt to attribute the abilities and skills of this "*poor ignorant girl*" to "*divine favour*".

Similarly, in 1834, the Lyme Regis historian George Roberts described Mary Anning as "*a genius for discovering where the Ichthyosauri lie imbedded*", and not only that, but to such skill one had to add "*great judgment in extracting the animals, and infinite skill and manipulation in their development, must be superadded*" (Roberts, 1834). Once again, genius and determination were highlighted as the dominant traits of Mary Anning's character. Roberts's description ends on an ironic but very true note: "*Under the head Geology appears a list of all that is found here. Miss Anning, on visiting the several great museums, may exclaim, Quæ regio in terris nostri non plena laboris! (What region of the earth is not full of our labour!)*" (Roberts, 1834).

Moreover, most of the specimens "*to be seen in the great collections in this and other countries, found at Lyme, have been discovered and extricated by our townswoman, at intervals, since the year 1811*" (Roberts, 1834).

7. Lyell's visit

Having recognized Mary Anning's skill and reliability, Cuvier decided to send the French geologist Constant Prévost (1787-1856) to England to acquire new specimens (Vincent et al., 2014). In May 1824, Prévost was welcomed by the Scottish geologist Charles Lyell (1797-1875), and in July the two travelled to Lyme Regis, where they met Mary Anning.

At Mary's home on Cockmoile Square (Prideaux and Liddon, 1842), Lyell had the opportunity to admire an impressive *Ichthyosaurus tenuirostris* over three meters in length, which the researcher had discovered just two weeks earlier. Lyell described the event in a letter to Gideon Mantell, dated 9 July 1824: "*Three weeks*

since a magnificent specimen of an Ichthyo-saurus (tenuirostris?) was discovered at Lyme by the celebrated Mary Anning. It is about the size of the Plesio-saurus which you saw in town. M. Prevost took a drawing of it, which I have traced, and I send it you, that you may see it, as it will be long probably ere it is published. The sketch was taken by measurement, and, although rapidly, yet may be depended upon" (Lyell, 1881). During their stay in Lyme, Lyell and Prévost also witnessed a fossil discovery firsthand: "*while we were at Lyme, we were present at the discovery of a magnificent skeleton of the Ichthyosaurus vulgaris, by Miss Anning. It was perfect, except the tail, which had been crushed by a cart wheel. It was two feet long*" (Lyell, 1881). These accounts not only highlight Mary Anning's remarkable skill and passion but also underscore her essential contribution to palaeontology at a time when scientific recognition for women was far from guaranteed (Figure 8 and 9). Lyell's letters conveyed a sincere admiration for Anning, albeit filtered through the formal conventions of the period.

Figure 8. *A perfect Dragon from Lyme Regis, excavated in the autumn of 1833, in Hawkins (1840), plate VIII.*

Some years later, in a letter dated 23 April 1830, Lyell informed Mantell of a new "*extraordinary fish*" discovered by Anning – likely yet another ichthyosaur – and noted how William Buckland had hurried to see her; clearly, there was "*something in the air – a paper on the new beast, perhaps, that fish-like thing which Mary Anning wants to make into a great wonder*" (Lyell, 1881).
Lyell's letters reveal what his published works did not: Mary Anning was not merely a fossil collector, but a keen observer and a pioneer of palaeontology. The precision with which Lyell described the anatomical details of Anning's discoveries demonstrates how these letters also served a scientific purpose and circulated among members of the geological community.

7.1. Hugonin: the mediator

In a long letter dated 25 February 1829, Mary Anning reported her latest fossil discoveries to Charlotte Hugonin, the wife of Roderick Murchison (Anning, mss 1829). The two women had first met in 1825, when Charlotte arrived in Lyme Regis to "*amuse herself, and become a good practical fossilist, by working with the celebrated Mary Anning of that place*" (Geikie, 1875). Recent studies have shed light on the crucial role Charlotte Hugonin played in the scientific development and work of her husband, Roderick Murchison (Kölbl-Ebert, 1997b; Buckland, 2024).
It is enough to recall here that Charlotte was a highly skilled fossil collector, and her contributions were acknowledged by James De Carle Sowerby, who honoured her

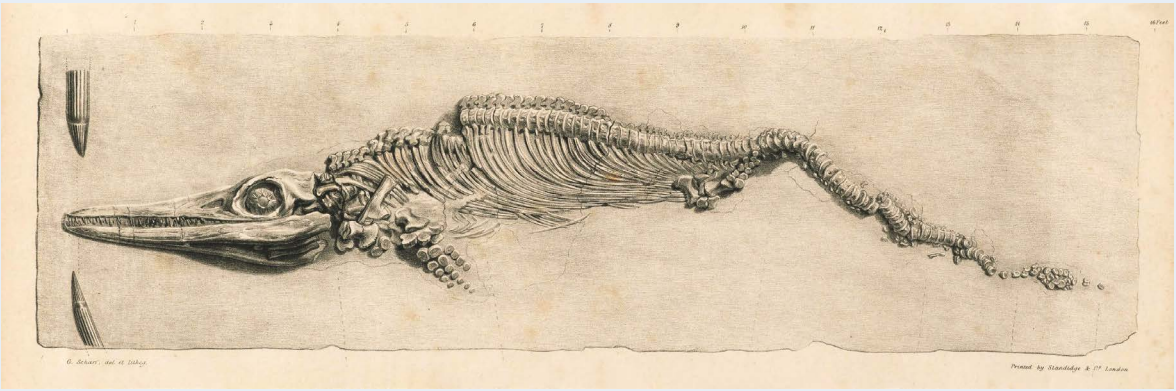

Figure 9. *Dragon from Lyme Regis. Discovered in 1835. Plate II in Hawkins (1840).*

by naming *Ammonites Murchisonae* after her (Sowerby and Sowerby, 1829). Her illustrations were included in her husband's scientific publications, which recognised their value (Murchison, 1826). Hugonin also kept an important travel notebook, where she recorded geological, palaeontological, and landscape observations (Hugonin, mss 1835). Moreover, throughout her life she advocated for the inclusion of women in geology lectures and pushed for the opening of scientific societies to women (Rudwick, 1975a; Patterson, 1983).

In Mary Anning's life, Charlotte Hugonin served both as a friend and confidante, as shown by a poignant letter from 1833, in which Anning described the tragic death of her dog Tray during a field trip and the dangers of fossil excavation along the cliffs (Anning, mss 1833). Charlotte was also a valuable intermediary for connecting Anning with prominent scientists of the time, as evidenced by a letter from 1829: "*I have got a very good head of an Ichthyo vulgaris about two feete in length which I value at five £ – and this day I have found a beautiful Ammonites Obtusus about a foote across which I value at one pound, pray do you think it will do for Mr Lyle if so Madam you will have the kindness to write me word, I will send immediately*" (Anning, mss 1829). Mr. Lyell was not only in need of fossils from Anning but also of geological field observations. As noted in his *Scientific Notebook* (No. 30), he decided to contact "*Mrs Murchison to ask Mary Anning for rate of waste at Lyme*" (Sharpe, 2024). Anning carried out the requested measurements at Church Cliffs, near Lyme Regis, with the assistance of the local surgeon Thomas Coulson Carpenter (1778-1833), who had previously taken similar measurements in 1800, marking a distance of 30 paces from a hedge to the cliff edge. By December 1829, the distance had decreased by 29 meters, confirming the intense erosion reshaping the coastline (Lyell, 1830).

These data were included by Lyell in his *Principles of Geology* (1830-33), though he made no mention of Anning, referring only to the measurements taken by Carpenter in 1800 and 1829 (Lyell, 1830). In the second edition of the *Principles*, however, he added: "*as I am informed by Miss Mary Anning, of Lyme*" (Lyell, 1832). It was only in the fourth edition, in 1837, that this note was expanded to highlight that Anning was "*well known by her discoveries in fossil remains*" (Lyell, 1837). Although belated, this acknowledgement marked an important step toward Anning's inclusion in the history of science. Nevertheless, in the ninth edition, published in 1853 after Mary's death, the recognition vanished, and only Carpenter's measurements were retained (Lyell, 1853).

The fame of the ichthyosaur and its role in scientific debate was immortalised in Henry De la Beche's famous cartoon *Awful Changes* (1830), in which "*Professor Ichthyosaurus*" lectures a class of ichthyosaurs and plesiosaurs while displaying the fossilised skull of an extinct human (Figure 10). The drawing mocked Lyell's cyclical view of Earth history and the possible return of extinct species. Ironically,

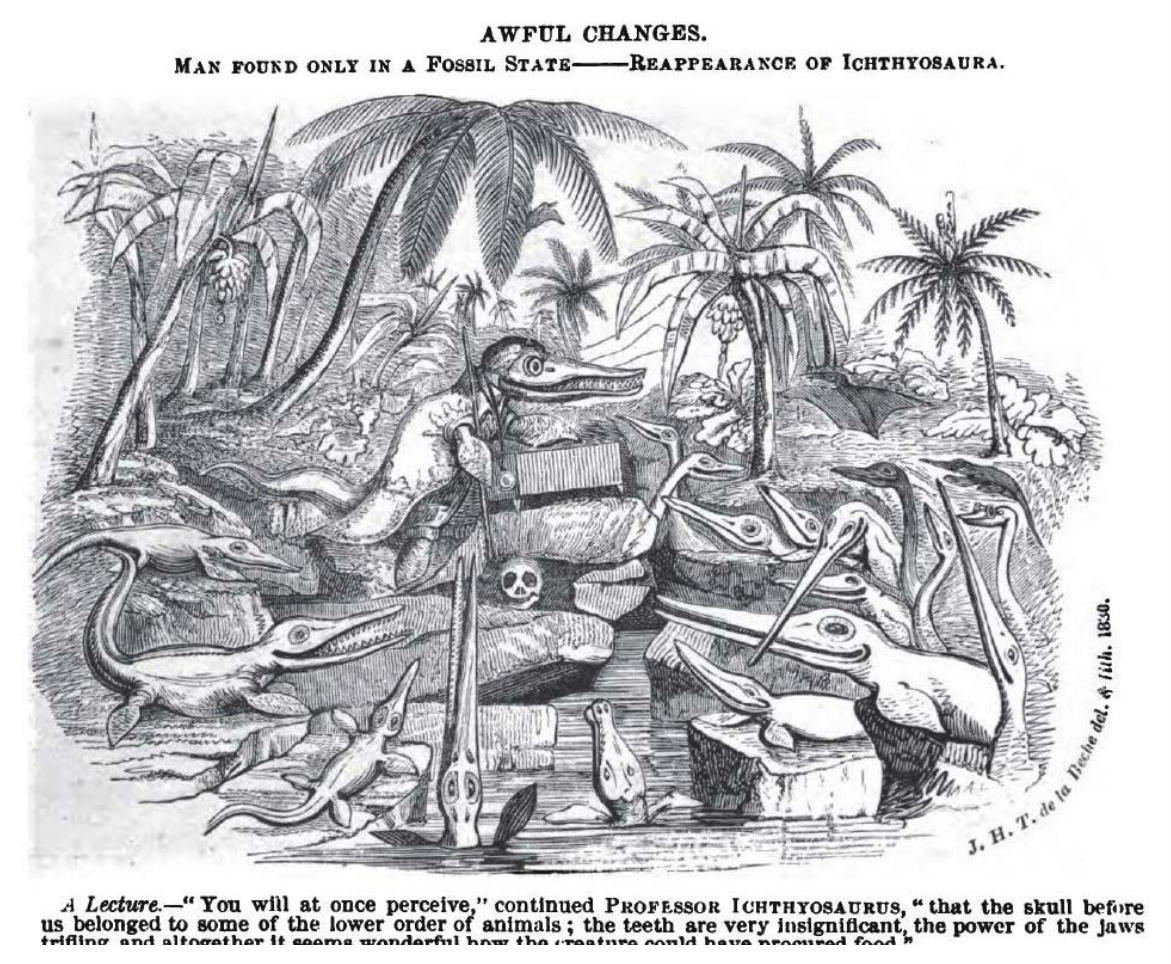

Figure 10. *Henry Thomas de la Beche's Awful Changes, lithograph, 1830. Public Domain.*

the fossil that had made Mary famous was now a symbol in disputes among scientists, while she herself remained on the margins of the theoretical discourse (Rudwick, 1975b).

8. The only publication

Anning faced a double disadvantage due to both her status as a woman and her impoverished background, which had deprived her of a proper formal education.

Nevertheless, she managed to educate herself and developed a substantial geological knowledge that enabled her to engage with the leading scholars of her time, as we have seen.

Moreover, in 1839, a short piece by Anning appeared in *The Magazine of Natural History*, edited by Edward Charlesworth (Charlesworth, 1839). This was her only publication in a scientific journal: *Note on the supposed frontal spine in the genus Hybodus* (Anning, 1839). It was a brief communication derived from a letter, in which she commented on the fossil remains of a species of *Hybodus*, specifically concerning a presumed frontal spine: "*In reply to your request I beg to say that the hooked tooth is by no means new; I believe that M. De la Beche described it fifteen years since in the Geological Transactions, I am not positive; but I know that I then discovered a specimen, with about a hundred palatal teeth, and four of the hooked teeth, as I have since done several times with different specimens. I had a conversation with Agassiz on this subject; his remark was that they were the teeth by which the fish seized its prey, milling it afterwards with its palatal teeth. I am only surprised that he has not mentioned it in his work. We generally find the Ichthyodorulites with them, as well as cartilaginous bones*" (Anning, 1839).

The publication of this letter was not only a significant opportunity for Anning to gain recognition for her work, but also a testament to her increasing involvement in the scientific debates of her time.

9. Sea-Dragons of a remote past

The knowledge of these strange and terrible "*dragons*" (Figure 11) of the past was the result of the contributions of several scholars, including Buckland, Conybeare and De la Beche, but, as Thomas Hawkins (1802-1889) rediscovered (Hawkins, 1834), their work would not have been possible without Anning's discoveries and efforts: "*But although many obligations are owing to the zelous efforts of these justly eminent personages, yet it must never be forgotten how much the exertions of Miss Anning, of Lyme, contributed to assist them. This lady, devoting herself to science, explored the frowning and precipitous cliffs there, when the furious spring-tide conspired with the howling tempest to overthrow them, and rescued from the gaping ocean, sometimes at the peril of her life, the few specimens which originated all the fact and ingenious theories of those persons, whose names must be ever remembered with sentiments of the liveliest gratitude*" (Hawkins, 1834).

Hawkins, a fossil collector with a passion for ichthyosaurs and plesiosaurs, visited Mary Anning in Lyme Regis in 1832. Together they found part of the fossil skull of *Chiroligostinus* (Hawkins, 1834) on the cliffs. On another excursion in July 1832,

Figure 11. *Plesiosaurus battling Ichthyosaurus, front piece of The book of the Great Sea Dragons by Hawkins (1840).*

Anning discovered part of the body of an ichthyosaur. Convinced that the rest of the skeleton might still be there, Hawkins obtained permission from the landowner to excavate further (Hawkins, 1834). Hawkins described this episode with great enthusiasm: "*Who can describe my emotion at the sight of the colossal skeleton! My eyes were the first to see it*" (Hawkins, 1834). Fascinated by the find, the palaeontologist realised the importance of the discovery and of Anning's help in preserving it, despite the difficulties. After days of intensive excavation, the remainder of the skeleton, which weighed about a ton when packed, was recovered (Hawkins, 1834).
Hawkins' discovery and his enthusiastic report illustrate not only the importance of their collaboration, but also Anning's indispensable contribution to the success of palaeontological research at the time. Hawkins' extraordinary collection of ichthyosaurs and plesiosaurs, including some of Anning's specimens, is now kept at the Natural History Museum in London.

10. Conclusion

The discovery of the ichthyosaur by Mary Anning in 1811 was not only a turning point for palaeontology, but also the spark that ignited a broader cultural and scientific shift. Anning, a self-taught fossil hunter of humble origins, unearthed the remains of a strange marine vertebrates from the cliffs of Lyme Regis – a find that would soon be recognised as the first complete ichthyosaur skeleton. Her discoveries, including those of the plesiosaur and pterosaur, challenged prevailing ideas about extinction and the history of life on Earth, profoundly influencing nineteenth-century debates on geology and evolution.

Yet Anning was not alone. Her fossil finds formed the nucleus of a larger, often-overlooked network of women who actively shaped the nascent field of geoscience. The lives of Mary Anning, Elizabeth Philpot, Mary Morland Buckland and Charlotte Hugonin Murchison reveal how female collaboration defied nineteenth-century conventions. Elizabeth Philpot, with her vast culture and fossil collection, was not only a mentor to Mary Anning, but also an independent scientist whose observations and discoveries were later taken up and published by male colleagues without always receiving due recognition. Similarly, Charlotte Hugonin Murchison, a skilled illustrator and geologist, was not merely the "helper" of her husband Roderick, but an active researcher whose technical skills and insights were crucial to her explorations. It was she, among other things, who mediated between Mary Anning and Charles Lyell, in the sale of specimens and scientific confrontation.

Mary Morland Buckland, finally, embodied another face of female science: that of the illustrator and naturalist whose precision in drawing made accessible discoveries otherwise confined to verbal description. Her sketch of the plesiosaur, based on Mary Anning's drawings, was instrumental in convincing Georges Cuvier of the fossil's authenticity, defying accusations of fraud that could have destroyed the fossil hunter's reputation.

These women shared not only a genuine passion for science, but also the same struggles against a system that denied them access to scientific societies, academic publications and formal education (Rudwick, 1975a; Patterson, 1983).

Today, recovering their biographies is not only an act of historical justice, but also a warning for the present. At a time when STEM disciplines are still struggling to achieve full gender equality, we must remember what George Roberts wrote in 1834, paraphrasing Virgil: "*These women could look upon the museums of the world and exclaim: "Quæ regio in terris nostri non plena laboris?" (What region of our land is not full of work?)*" (Roberts, 1834). Today, at last, we are beginning to see how this "*ours*", too long erased, is instead essential.

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