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# Mary Anning: Princess of Palaeontology and Geological Lioness

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**Figure. 1.** Portrait of Mary Anning, in oils, probably painted by William Gray in February, 1842, for exhibition at the Royal Academy, but rejected. The portrait includes the fossil cliffs of Lyme Bay in the background. Mary is pointing at an ammonite, with her companion Tray dutifully curled beside the ammonite protecting the find. The portrait eventually became the property of Joseph, Mary's brother, and in 1935, was presented to the Geology Department, British Museum, by Mary's great-great niece Annette Anning (1876-1938). The portrait is now in the Earth Sciences Library, British Museum of Natural History. A similar portrait in pastels by B.J.M. Donne, hangs in the entry hall of the Geological Society of London. Reproduced with the permission of the British Museum of Natural History (London).

# MARY ANNING
# PRINCESS OF PALAEONTOLOGY[1] AND GEOLOGICAL LIONESS[2]

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[1]Reference to Princess of Palaeontology made by the German explorer Ludwig Leichhardt, "…we had the pleasure of making the acquaintance of the Princess of Palaeontology, Miss Anning. She is a strong, energetic spinster of about 28 years of age, tanned and masculine in expression…" Aurousseau, 1968, *The Letters of F.W. Ludwig Leichhardt.*

[2]Less than flattering remark made by Gideon Mantell, "…sallied out in quest of Mary Anning, the geological lioness…we found her in a little dirt shop with hundreds of specimens piled around her in the greatest disorder. She, the presiding Deity, a prim, pedantic vinegar looking female; shrewd, and rather satirical in her conversation." Curwin, 1940, *The Journal of Gideon Mantell, Surgeon and Geologist.*

## ABSTRACT

On April 17, 2005, delegates at the 39th Biennial Convention of the Society of Sigma Gamma Epsilon passed a motion to include Mary Anning as one of the guiding pillars of geology in the Ritual of the Society. Mary Anning, of Lyme Regis, England, was a 19th century collector of fossils who made significant contributions to the growth of British palaeontology. Among her finds was one of the most complete specimens of *Ichthyosaurs* found in Britain, as well as the discovery of the first British *Plesiosaurus* and *Dimorphodon* (pterosaur). Mary Anning also discovered the true nature of coprolites. However, only recently has Mary Anning received credit for her remarkable discoveries.

**KEY WORDS:** Mary Anning, William Buckland, Henry De la Beche, Jurassic, Lyme Regis, ichthyosaurs, plesiosaurs, coprolites

## INTRODUCTION

Who was Mary Anning, Princess of Palaeontology and Geological Lioness (fig. 1)? Obviously, she was revered by some and apparently, despised by others. Why was Mary Anning selected by the Society of Sigma Gamma Epsilon (hereafter, The Society) to serve as the woman's voice in the Ritual? Will she serve as an inspiration to women, and men, initiated into The Society? Hopefully the following will provide a glimpse into the life of a most remarkable woman, and an answer for the first two questions, while time (hopefully, not geologic time) will eventually provide the answer to the latter.

The answer to the second question requires a brief historical overview of The Society. The Society was founded in 1915, as a professional fraternity for men in the geosciences. The first attempt to admit women to The Society was initiated by the Xi Chapter at Washington State University in 1927, but admission of women to The Society was an arduous task. Women were finally granted full membership on November 1, 1967, more than a half century after The Society's founding. For a more detailed historical perspective see Steinker (2002).

The Ritual, which outlines the initiation ceremony of The Society, was written by The Society's founder, William H. Twenhofel in 1915, and proscribes a historical journey during which initiates receive instructions from 'icons' of Geology (Steinker, 2002, p. 70). The 'instruction' is meant to inspire and challenge new initiates to The Society. The icons, all men, were Agricola, Charles Lyell, Abraham Gottlob Werner, and James Wright Dana. Of course, when the Ritual was first written, Geology departments were dominated by men, and, in the author's opinion were, the last bastions of maleness in the sciences. However, by the 1980s, male domination of the geosciences had waned, and, in some departments, women constituted the majority of the undergraduates. As a consequence, there was a shift in the gender numbers of The Society. During the 36th Biennial Convention in 1997, the Ritual and Insignia Committee recommended an appropriate woman's voice be added to The Ritual (see Minutes, 1999 and Steinker, 2002, for further details). Florence Bascom was suggested by The Ritual committee but no further action was taken. I was present at the 36th Biennial Convention serving as the Western Province National Vice President and I clearly remember Don Steinker, National Editor of *The Compass*, suggesting Mary Anning as another possibility. For me, Mary Anning became a persistent thought because, as a palaeontologist, I was intrigued by this woman, who had made such remarkable fossil finds in the first half of the 19th century. To that end, I immediately began to investigate Mary Anning's history, but little information was immediately available. However, within two years there seemed to be an outbreak in interest about Mary Anning, especially by authors of children's books. In 1999, a symposium was convened by Sir Crispin Tickell in Lyme Regis as a bicentennial celebration in honor of "the first woman geologist" – *Mary Anning and Her Times: The Discovery of British Palaeontology, 1820-1850.* Ultimately, in 2005, and 2007, I traveled to Lyme Regis, England, Mary Anning's home, to satisfy my increasing curiosity of this remarkable woman; a woman my wife has referred to as my 19th century mistress, but I digress from the topic at hand.

The issue of adding a woman to the Ritual was again raised at the 37th (2000) and 38th (2002) Biennial Conventions, but without action. The Society continued to struggle with finding a suitable candidate; a pioneering woman geologist known to have contributed significantly to the founding of the Geosciences, but Dan Steinker as pointed out …"women generally were not publishing original scientific work at that time" (Steinker, 2002, p. 71). If publication of original scientific work was a major criteria for selection, then Steinker's nomination of Mary Anning at the 36th Biennial Convention certainly didn't 'fit the bill', for Mary Anning has only one, short published work (see Anning, 1839).

During the 2005 - 39th Biennial Convention, hosted by the Eta Theta Chapter at Florida Atlantic University, the issue of adding voice and perspective of a prominent female was once again raised and delegates acted upon Steinker's (2002) recommendation of Mary Anning for inclusion in the Ritual of the Society of Sigma Gamma Epsilon. The Ritual and Insignia Committee drafted language to be included in a revision of the Ritual and set forth a motion to the delegation. On April 17, 2005, the delegation passed the motion and Mary Anning became the 'newest' member of The Society of Sigma Gamma Epsilon. Now we can answer the first question regarding who Mary Anning was and what were her contributions to the Geosciences.

## WOMEN GEOLOGISTS OF THE 19TH CENTURY GREAT BRITAIN

Near the turn of the 19th century Britain's emerging industrialization ushered in a period of canal digging and major quarrying operations. These activities revealed sedimentary strata and fossils – the 'pages of geologic history'. Britain's industrialization demonstrated a need for understanding the bedrock geology of the country, and resulted in the emergence of geology as a scientific discipline.

Another important aspect of the birth of British geology was the landed gentry's interest in natural history. Collecting fossils and mineral specimens was a fashionable pursuit, as well as an acceptable topic for discussions at dinner parties and other social events. Women, who were not seen as serious competition for employment, were free to participate within informal, non-professional venues (Kölbl-Ebert, 2007). Palaeontology, in particular, fit into the role of women as 'caretakers of life' (Kölbl-Ebert, 2002), and was seen as a relatively 'easy' pursuit.

An interest in the sciences was viewed by the public, as well as by the learned naturalists of the day, as an avocation. Various scientific societies were forming, such as the Geological Society of London (13 Nov 1807), with the stated purpose of…

> …making geologists acquainted with each other, of stimulating their zeal, of inducing them to adopt one nomenclature, of facilitating the communications of new facts and of ascertaining what is known in their science and what remains to be discovered. (Geological Society of London, 2008)

During this time, women, while barred from membership in scientific societies, were allowed to attend lectures. It is important to note that 19th century British society was extremely stratified and these scholarly activities only occurred within the upper echelon of British social standing. It would be very unusual for individuals of a 'lower station' to participate, especially a woman.

It was not uncommon for the wives of prominent geologists of the time to work with their husbands, and they were referred to as 'wife-assistants' by Creese and Creese (1994). The most prominent of these women were Mary (née Moreland) Buckland (1797-1857), wife of Reverend William Buckland; Mary Ann (née Woodhouse) Mantell (1795-1869), wife of Dr. Gideon Mantell; Charlotte (née Hugonin) Murchison (1789-1869), wife of Sir Roderick Murchison; and Mary Elizabeth (née Horner) Lyell (1808-1873), wife of Sir Charles Lyell, the Father of Modern Geology. All of these women accompanied their husbands on trips and assisted in collecting specimens, and Charlotte Murchison and Mary Buckland were in possession of their own fossil

collections (Kölbl-Ebert, 1997a, b). It is clear now that Mary Buckland, Charlotte Murchison, and Mary Lyell were making important observations, sketches and illustrations, and assisting in the preparation and writing of papers (Patterson, 1983). Sir Roderick Murchison, one of the best-known of early British geologists, would likely never have reached his position of prominence in geology without his introduction to rocks, minerals, and fossils by Charlotte. Charlotte Murchison's intimate association with 'geology *ala* Sir Roderick' leads to the conclusion that Roderick's views were equally Charlotte's views (Kölbl-Ebert, 1997b). Most dinosaur enthusiasts are familiar with the story of Mary Mantell who, according to legend, actually discovered the teeth of *Iquanodon*, which led to her husband's publication of an important paper announcing the discovery of a new giant reptile (Creese and Creese, 1994). Mary Mantell also drew the forty-two plates of fossils which embellish Mantell's (1822) *Fossils of the South Downs; or Illustrations of the Geology of Sussex.*

Other 19th century British women worked independently, and include Etheldred Benett of Wilshire (1776-1845) and Barbara (née Yelverton) Hastings (1810-1858) and the Philpot sisters (Margaret, __?-1845; Mary, 1773?-1838; Elizabeth, 1780-1857). All of these women made important contributions to the understanding of the palaeontology and stratigraphy of southern England, and as was typical of the time, all were of high social standing.

A financially independent, temperamental spinster, Etheldred Benett's fossil collecting spanned a period of 34 years. Inspired by William Smith, one of the founders of modern stratigraphy and publisher of the first geologic map of England, Benett documented the stratigraphic and geographic distribution of fossils of Wiltshire (Benett, 1831a, b). Although not formally published, Benett did produce several manuscripts which are now in the collections of the Geological Society of London (Geological Society of London, 1846). Many of the specimens collected by Benett were illustrated in Sowerby's *Mineral Conchology of Great Britain (1812-1845).* Although barred from membership in geological societies due to her gender, Benett maintained a scientific collaboration and correspondence with some of the leading men of science of the day, including William Buckland and Gideon Mantell. She contributed stratigraphic information for the Wilshire region to George Greenough, who published the *Geologic Map of England and Wales* in 1819 (Creese and Creese, 1994). She was frequently acknowledged in the publications of palaeontologists and geologists throughout Europe (Torren, *et al.*, 2000). Following her death, much of her collection was purchased by Thomas Wilson, an English expatriate of Newark, Delaware, who donated the collection to the Academy of Natural Sciences of Philadelphia (Bogan and Torrens, 1989; Spamer, *et al.*1989; Nash, 1990). Torrens, *et al.* (2000) has suggested Etheldred Benett should be known as 'first lady geologist'.

Barbara Hastings, 20th Baroness Grey de Ruthyn and Marchioness of Hastings, is known for the 'Hastings Collection', consisting of several thousand fossil specimens from England and Europe, some of which she purchased, but others she collected from the Hordle and Beacon Cliffs on the Hampshire coast. Sir Richard Owen named a new species of crocodile, *Crocodilus hastingsae,* to honor "the accomplished lady by whom the singularly perfect example of the

species had been recovered and restored" (Owen, 1848). The Hasting Collection is now housed in the British Museum (London). Later, Barbara Hastings settled in Efford House, between Milford and Lymington near the English Channel just east of Mary Anning's home in Lyme Regis, where she collected fossils from exposed beds. She worked out the detailed stratigraphy of the region and prepared a colored, to scale, section of the beds indicating the stratigraphic position of the fossils she collected. She published her findings in *Description géologique des falaises d'Hordle, et sur la côte de Hampshire, en Angleterre* (Hastings, 1851-52) and *On the tertiary beds of Hordwell, Hampshire* (Hastings, 1853). Sir Richard Owen, the eminent British palaeontologist of the day, noted the care with which Hastings extracted, re-adjusted, and restored the fossils of crocodile skulls and turtle shells to their original condition (Owen, 1848). While Barbara Hastings did see herself as a serious student of the local stratigraphy, her high social standing secured a more open reception within some scientific circles than was open to other women (Creese and Creese, 1994).

In about 1805, the Philpot sisters were settled at Morley Cottage, 1 Silver Street, Lyme Regis by their older brother John Philpot, and soon after the sisters began collecting fossils. The Philpot sisters, especially Elizabeth, amassed an important collection of fossils from the Lower Lias (Jurassic Period) of southern England. The Philpot Collection (approximately 400 specimens) is now housed in the Oxford University Museum and contains a number of holotypes, syntypes, and lectotypes [specimens key to descriptions of fossil and living organisms] (Powell and Edmonds, 1976). Due to their social standing, the Misses Philpot easily mixed with the learned geologists of the day, including William Buckland, Richard Owen, James Sowery, Louis Agassiz, William Conybeare, and Henry De la Beche. The sisters freely loaned specimens from their collections to be described. The report on British fossil reptiles published by Owen (1840a) has descriptions of *Plesiosaurus* and *Ichthyosaurus* specimens from the Philpot Collection, and Buckland's (1829a) description of sepia ink (fossil ink-bags) from belemnites were based on specimens from the Philpot Collection, and were actually discovered by Elizabeth Philpot and Mary Anning. Louis Agassiz (1843) made considerable use of specimens from the Philpot Collection in his 5-volume *Recherches sur les poisons Fossils* (1833-44) and even named the fossil fish *Eugnathus philpotia* in recognition of Elizabeth Philpot's contributions to fossil ichthyology.

## MARY ANNING OF LYME

Despite her low social station, Mary Anning of Lyme has become the most celebrated of the 19$^{th}$ century British women in geology and palaeontology. As many women in Great Britain were contributing to the growth and understanding of geology at the time, one has to wonder what made Mary Anning stand out among the women previously mentioned. In reality, Mary's contributions were as a 'collector and seller' of fossils, and other than a few letters and one short note on the details of *Hybodus*, a fossil shark (Anning, 1839), Mary left no written record of her discoveries, and she was seldom given credit by the men of science who published descriptions of the fossils she sold. Nonetheless, in recent years, Mary Anning has become a popular 'female

role model' for young girls and her story has been incorporated into some elementary school curriculums. There have been a number of books (Goodhue, 2002, 2004; Pierce, 2006) and short pamphlets (Clarke, 2003; Draper, 2004; Tickell, 1996) published which outline her life and times (readers are directed to these for more details, the most comprehensive account is by Goodhue, 2004). More recently, two authors (Emling, 2009; Chevalier, 2010) have published books on the life of Mary Anning for general audiences and both have received literary acclaim. There are at least ten children's stories devoted to Mary Anning (Brighton, 2000; Atkins and Dooling, 1999; Brown, 1999; Bush, 1965; Cole, 2005; Day, 1995; Fradin and Newsom, 1997; Hartzog, 1999; Moxley and Anholt, 2007; Walker and Saroff, 2007).

Mary Anning was born on 20 May 1799, in the small coastal village of Lyme Regis, Devon on Lyme Bay in southwestern England (fig. 2). Lyme Bay forms the southern terminus of Jurassic strata that sweeps in a shallow arc from the North Sea in east-central England. Except for small sections of the coast where rivers enter, the bay is an exposure of near vertical, crumbling cliffs of gently dipping, medium- to thinly-bedded shales, limestones, and sandstones (fig. 3). Invertebrate fossils (ammonoids, belemnites, nautiloids, gastropods, bivalves) are abundant in these strata and are commonly found on the beach after weathering out of the strata of the nearby cliffs. Fossil of fish, ichthyosaurs, plesiosaurs, brittle stars, crinoids, sea urchins, and coprolites are less common. The strata are particularly noted for the many species of ammonoids (fig. 3). These exposed strata and coastal beaches became Mary's childhood playground and later the principle source of her livelihood. Roberts (1834, p. 179) noted the popularity of Lyme Regis' many inducements, including fossils, and stated, "The fossilist and geologist look upon this place as the sportsman does upon Melton Mowbray." While professionals, as well as amateurs, visited Lyme Regis to collect fossils, undoubtedly many found the colorful character of Mary Anning and her fossil shop the main attraction (Edmonds, 1976).

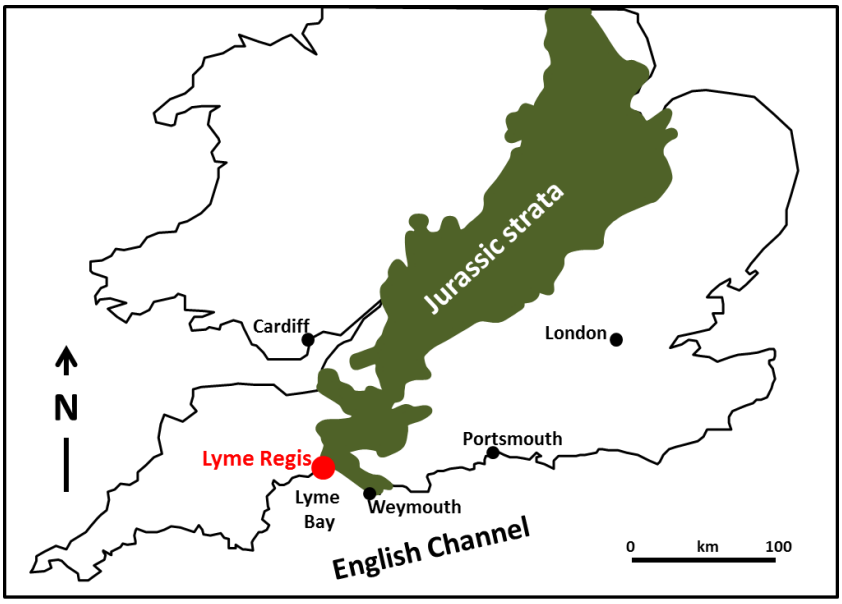



**Figure 2.** Map of southern England and Wales illustrating the location of Mary Anning's birth place, Lyme Regis, at southern end of the Jurassic strata.

**Figure 3.** The lower Jurassic Blue Lias, Black Ven Marls, Belemnite Marls and middle Cretaceous Green Sands of the Spittles, which rise approximately 120 m above sea level, are just to the east of Lyme Regis where Mary Anning collected Jurassic fossils. The wave-cut platform in the foreground is the Blue Lias, which contains specimens of the ammonoid *Coronicerasi*, some of which are nearly a meter across.

**Figure 3.** *Asteroceras obtusum*, a small ammonoid common to the Blue Lias.

Mary and her brother, Joseph, were the only surviving children (of nine) of Richard and Molly (née Moore) Anning. Richard Anning, who probably came from Devon, settled in Lyme in the early 1790s. Richard was a cabinet maker and carpenter, and one of the first sellers of curiosities (fossils) in Lyme. The Anning home and shop were located, until 1826, on the present site of the Philpot Museum (fig. 4). Mary learned the craft of finding and selling fossils from her father. Unfortunately, Richard, weakened from a fall from a cliff near Charmouth, east of Lyme, contracted tuberculosis and died when Mary was only 10-years old. Richard Anning left his family £120 in debt (Draper, 2008), which is roughly equivalent to $120,000 USD, today!


**Figure 4.** Plaque on the wall of the Philpot Museum commemorating the location of Mary Anning's home and fossil shop.

Mary's mother, Molly, seems to have disliked her husband's fossil collecting, and, according to Roberts (1823, p. 286), when Richard went out to the sea cliffs to collect, "his wife was very angry, and was want to ridicule his pursuit of such things." Following Richard's death, however, Molly did help Mary with the fossil shop. A long time resident of Lyme remembered Molly in her old age as "…the fossil woman's mother, a very old lady in a mop cap and large white apron, who sometimes came with feeble steps into the shop," and also recollected that Mary and her mother were very close (Draper, 2008). Molly Anning died in 1842, at the age of 78.

Joseph Anning, the surviving son, was 3-years older than Mary, and he apprenticed as an upholsterer. As an adult, Joseph became a leading citizen in Lyme Regis, a property owner, and a member of the Anglican Church. Like Mary, Richard spent time with his father collecting and selling fossils. It is most likely Joseph who, in 1811, at the age of 15, found the famous ichthyosaur (fig. 5).

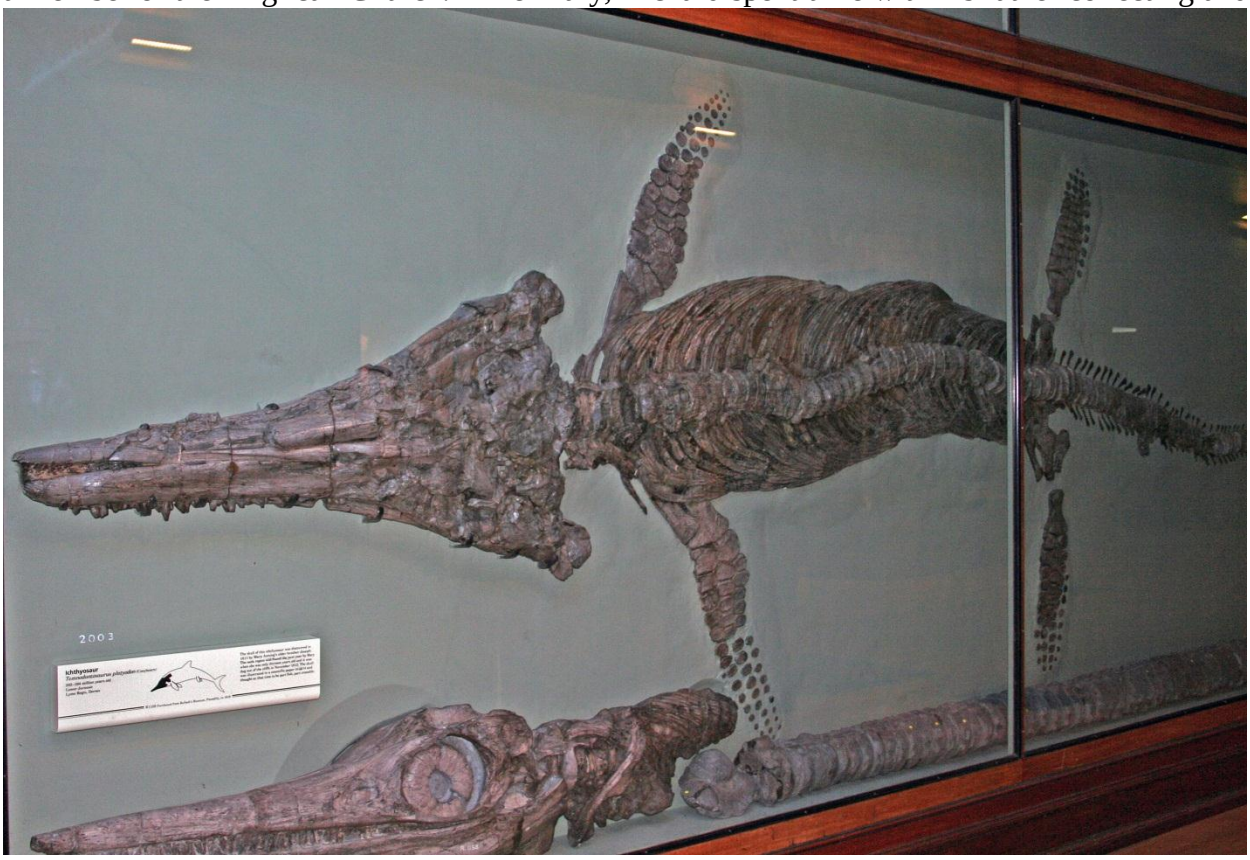



**Figure 5.** The ichthyosaur *Temnodontosaurus platyodon* (Conybeare), BMNH 2003, is from the Lower Jurassic, Lyme Regis. The skull, BMNH 2149, at the bottom of the case, was discovered in 1811 by Richard Anning. The remainder of the skeleton, presumably lost, was recovered from the Church Cliffs by Mary Anning in 1812 at the age of 13. The ichthyosaur vertebral column, BMNH 2150, represents a separate specimen. All three specimens were purchased from the Thomas Hawkins Collection by the British Museum of Natural History.

Little is known of Mary's childhood, although her escape from lightning strike at age 15-months, which killed her nurse and two 15-year old girls, is a popular story (Lang, 1959). Mary's parents attended Congregationalist services at the Independent Chapel on Coombe Street, and is was here, while attending Sunday school, that Mary learned to read and write. Her letters in the Owen's Papers at the British Museum of Natural History (London) well illustrate Mary's clear and direct style of writing, which is relatively free of spelling and grammatical errors. While in her 20s, Mary taught herself French in order to read the works of Cuvier, the great French anatomist and palaeontologist. Mary was familiar with the scientific literature and transcribed numerous papers, including illustrations, for her own personal library (figs. 6 and 7).

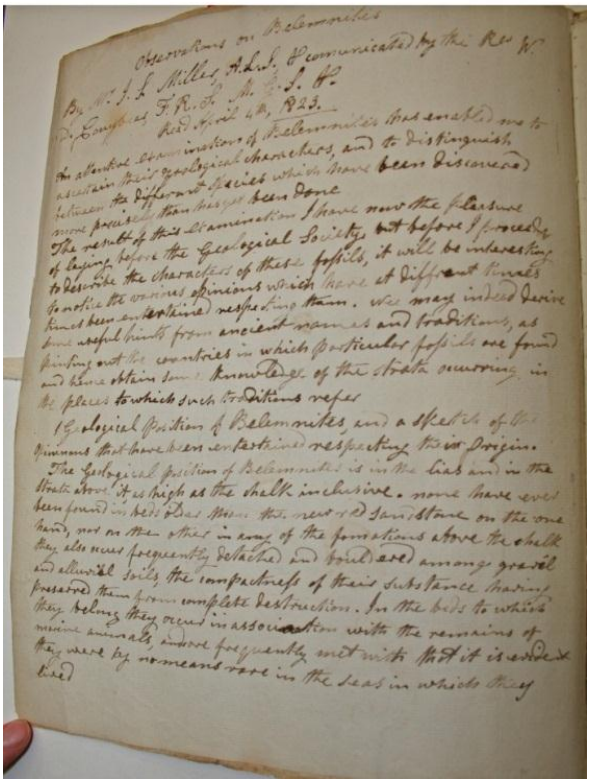


**Figure 6.** First page of Mary Anning's transcription of J.S. Miller's "Observations on Belemnites", *Transactions of the Geological Socieity of London,* v. 2, p. 45-62, 1822. The entire transcription is part of the 'Richard Owen's Papers' in the British Museum of Natural History-London.

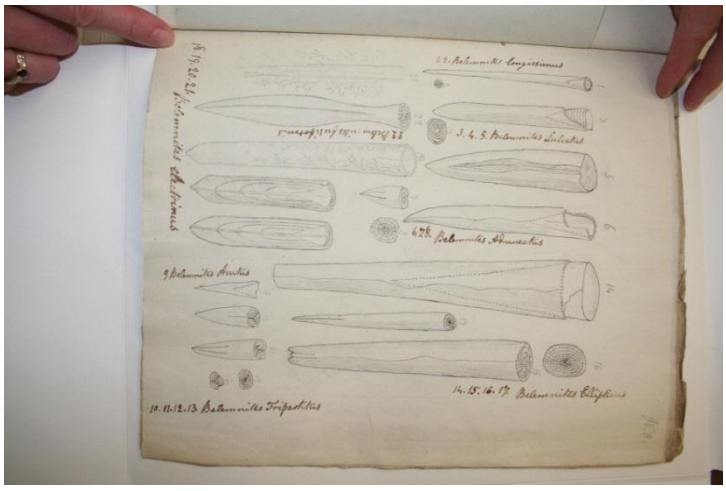


**Figure 7** (below)**.** Mary Anning's drawings in her transcription of in J.S. Miller's "Observations on Belemnites". The entire transcription is part of the 'Richard Owen's Papers' in the British Museum of Natural History-London.

According to Roberts (1834), a shortly after the death of Mary's father in 1810, an event occurred which was to establish Mary's destiny. "A lady in the street, seeing the fossil in her [Mary's] hand, offered her half-a-crown for it, which she accepted, and from that moment fully determined to go down 'upon the beach' again" (Roberts, 1834, p. 288). Certainly by 1811, at the age of 12, Mary was a persistent seeker and vender of fossils, at least to interested local collectors.

The prevailing story is that shortly thereafter, Mary discovered among the ledges of the Lias the bones of an ichthyosaur, where upon she hired men to extract the specimen from the cliff in 1812. As mentioned previously, however, Mary's brother Richard is really due the credit for finding the ichthyosaur. The ichthyosaur specimen was sold to H.H. Henley, Esq., the Lord of the Manor, for £23 (approximately $2,300 USD in today's money), thus establishing Mary as a true capitalist by the age of 13. Specimens known, or suspected, to have been collected and sold by Mary Anning are now in the British Museum of Natural History (London) and in the Sedgwick Museum, Cambridge University, although specific details are not always clear. Casts of marine reptiles, likely collected by Mary Anning from the Lias near Lyme Regis, are in the Bristol City Museum and Trinity College, Dublin, Ireland (Wyse Jackson, 2004). Using correspondence between Adam Sedgwick and Mary Anning, Price (1986) has worked out some of the details of purchases of specimens from Anning for the museum at Cambridge University, which include a couple of nearly complete ichthyosaur skeletons as well as other specimens (see Price, 1986, for details). What is clear from this correspondence is that Mary Anning was a shrewd business woman who clearly understood the value of the specimens she put up for sale. Although it is difficult to make precise correlations, some of Mary Anning's specimens, which were sold for £100-120 in the 1830s, would be valued at $200,00-$400,000 in today's U.S. dollars!

With the exception of two portraits (fig. 1) (one being, in all respects, a facsimile of the other) and a caricature drawn by her friend Henry de la Beche in the 1830s, very little is known of Mary's appearance. A short reference is made in *Chamber's Journal,* which describes Mary as "…rather masculine appearance. She braved all weathers…," was written 10-years after her death (Anonymous, 1857, p. 383). In June, 1837, Ludwig Leichhardt refers to Mary as "…a strong, energetic spinster of about 28 years of age, tanned and masculine in expression…" (Aurousseau, 1968, p. 62-63). Lichhardt's reference to Mary's age as being twenty-eight is an interesting observation as she would have been thirty-eight at the time. There was certainly the less flattering description made by Gideon Mantell, "…a prim, pedantic vinegar looking female; shrewd, and rather satirical in her conversation" (Curwin, 1940, p. 108), but then again, Mantell may well have seen his own reflection in the window. [Author's note: Some portraits of Mantell show him as a sour, cheerless individual. His wife, Mary Mantell, eventually sued for divorce due, in part, to his brooding and severe personality.]

There are references to Mary's good nature. In a note to the poem titled *To Mary Anning*, author John Kenyon writes, "Those who know her personally, will be no less eager to bear

testimony to her kindly temper, her straightforward character, and her fresh and strong intellect" (Kenyon, 1838, p. 109).

> "Miss Anning the Fossil woman…She would serve us with the sweetest temper, bearing with all our little fancies and never finding us too troublesome as we turned over her trays of curiosities…she was very thin and had a high forehead, and large eyes which seemed to me to have a kindly consideration for her little customers" (Lang, 1950, p. 187).

However, Mary's personality had a darker side, and one could argue, rightly so. While she had friends among those of a higher station, Mary was not held in very high regard by the residents of Lyme, the local children being the exception. The people of Lyme allegedly remarked "…her death was, in a pecuniary point, a great loss to the place, as her presence attracted a large number of distinguished visitors," in other words, her chief value was *"as bait for tourists"* [Dickens, 1865, p. 62]. It is likely Mary had felt 'used' by some, and according to [Dickens] (1865, p. 62) Mary is said to have written to a young girl in London stating, "I beg your pardon for distrusting your friendship. The world has used me so unkindly, I fear it has made me suspicious of everyone."

I believe it is fair to say, Mary was a proud woman, secure in the 'world of men', and a true feminist, albeit a half-century early. In an essay in her notebook, titled *Woman!*, Mary writes,

> "And what is a woman? Was she not made of the same flesh and blood as lordly Man? Yes, and was destined doubtless, to become his friend, his helpmate on his pilgrimage but surely not his slave, for is not reason hers? Are not her claims 'to share redeeming low' as great? ...Woman seen throughout the sacred scripture…more than even man the object of this pure benevolence." (Anning, unpublished).

Mary's younger and wealthy friend, Anna Maria Pinney, noted in her journal (Lang, 1955, p. 147),

> "She has been noticed by all the cleverest men in England who have her to stay at their houses, correspond with her on Geology &c. This has completely turned her head, and she has the proudest and most unyielding spirit I have ever met with. Much 'learning has made her mad'. She glories in being afraid of no one, and in saying everything she pleases. She would offend all the world, were she not considered a privileged person. She says the world has used her ill and she does not care for it, according to her account these men of learning have sucked her brains, and made a great deal by publishing works of which she furnished the contents, while she derived none of the advantages. She says she stands still and the world flows by her in a stream, that she likes observing it and discovering the different characters which compose it. But in discovering these characters, she takes most violent likes and dislikes…she frankly owns that the society of her own rank is become distasteful to her, but yet she is very kind and good to all her

> own relations, and what money she gets by collecting fossils, goes to them or to anyone else that wants it."

Mary's relationship with the geologists of the day was a mixed bag, but, for the most part, there was a considerable amount of respect both ways. A small group of geologists interested in the Lias of Dorset were responsible for a stained glass window being placed in the St. Michael's Church in Lyme dedicated to her memory (fig. 8). The inscription states:

> "This window is sacred to the memory of Mary Anning of this parish, who died 9 March AD 1847 and is erected by the vicar and some members of the Geological Society of London in commemoration of her usefulness in furthering the science of geology, as also of her benevolence of heart and integrity of life."

Admiration of her abilities can be seen in the writings of the day. For instance, in the journal of Thomas Alan [dated, 25th June, 1824, Lyme Regis], he states,

> "Mary Anning the Geologist of this Place is a very interesting person, and the scientific are entirely indebted to her for the preservation of some of the finest remains of a former world that are known in Europe…Mary Anning's knowledge of the subject [here referring to Plesiosaurus] is quite surprising – she is perfectly acquainted with the anatomy of her subjects, and her account of her disputes with Buckland, whose anatomical science she holds in great contempt, was quite amusing" (Lang, 1939, p. 153-154).

It should be noted, however, that Mary Anning's correspondence with Buckland does not bear out Allan's remarks regarding 'her contempt', and, in fact, she held Buckland's counsel in high regard. In a letter to Buckland, dated 8 February 1829, Mary writes,

> "I embrace the first opportunity of informing you that I have discovered another plesiosaurus superior to one purchased by the Duke of Buckingham…Sir is there hope of coming to Lyme again soone [sic: soon]. Respectful your obliged humble servant Mary Anning [postscript] Sir I shall feel greatly obliged by your sending me a line to say what you think I had best do in regard to disposing of it. I must write to the Bristol Institution to say I got such a thing" (Anning, 1829).

Henry De la Beche was the preeminent supporter of Mary Anning, and following her death (9 March 1847), De la Beche (1848a, p. xxiv-xxv, 1848b), by then Director of Her Majesty's Geological Survey and President of the Geological Society of London, published an obituary notice about Mary in the *Quarterly Journal of the Geological Society of London.* The obituary notice is significant, in part, because only Fellows of the Society are so honored. Additionally, since women were not admitted to the Geological Society of London until 1904, there was no chance for Mary Anning to become a Fellow.

> "I cannot close this notice of our losses by death without adverting to that of one, who though not placed among even the easier classes of society, but who had to earn her daily bread by her labour, yet contributed by her talents and untiring researches in no small degree to our knowledge of the great Enalio-saurians, and other forms of organic life entombed in the vicinity of Lyme Regis. MARY

ANNING was the daughter of Richard Anning, a cabinet-maker of that town, and was born in May, 1799. … From her father, who appears to have been the first to collect and sell fossils in that neighbourhood, she learnt to search for and obtain them. Her future life was dedicated to this pursuit, by which she gained her livelihood; and there are those among us in this room who know well how to appreciate the skill she employed (from her knowledge of the various works as they appeared on the subject), in developing the remains of the many fine skeletons of Ichthyosauri and Plesiosauri, which without her care would never have presented to comparative anatomists in the uninjured form so desirable for their examinations. The talents and good conduct of Mary Anning made her many friends; she received a small sum of money for her services, at the intercession of a member of this Society with Lord Melbourne, when that nobleman was premier."

**Figure 8.** Stain glass window in St. Michael's Church in Lyme Regis dedicated to Mary Anning.

Mary Anning was extremely loyal to her friends, among whom was Sir Roderick Impey Murchison, the subject of a poem [below] written by her (Anning, 1846 or 1847?) in honor of Murchison's accomplishments. At the same time she pokes fun at Adam Sedgwick's devotion to the old story of creation and William Buckland's suggestion that coprolites could be utilized as fertilizer.

[Preface]
*What is going on in the world of science?*
*I am glad the country has confirmed the honors of Russia in respect to the Lavant whom you first mention. He won them well.*

***'Enocmium Murchisonium first'***
*Who first surveyed the Russian states?*
*And made the great Azoic dates?*
*And worked the Scandinavian states?*
*Sir Roderick*

*Who calculated nature's shocks?*
*And proved the low Silurian rock*
*Detritus of more ancient flocks?*
*Sir Roderick*

*Who knows of what all rocks consist?*
*And sees his way where all is mist*
*About the metamorphic schist?*
*Sir Roderick*

*Who draws distinctions clear and nice*
*Between the old and new gneiss?*
*And talks no nonsense about ice.*
*Sir Roderick*

*Let others than, their stand maintain,*
*Work all for glory, nought for gain,*
*And each finds faults, but none complain.*
*Sir Roderick*

*Let Sedgwick say how things began,*
*Defend the old creation plan,*
*And smash the new one, if he can.*
*Sir Roderick*

*Let Buckland set the land to rights,*
*Find meat and peas, and starch in blights,*
*And future food in coprolites*
*Sir Roderick*

*Let Agassiz appreciate tails,*
*And like the virgin old the scales,*
*And Owen draw the teeth of Whales.*
*Sir Roderick*

*Take Thou thy orders hard to spell,*
*And titles more than man can spell.*
*I wish all such were earned so well.*
*Sir Roderick*

As many paleontologists can attest, the search for fossils is unpredictable and challenging. Even though Mary was a keen fossilist, she too experienced frustration, as well as the peril. In a letter to Charlotte Murchison, dated October 11, 1833, Mary writes,

> "I would have answered your kind letter by the return of post, if I had been able. Perhaps you will laugh when I say that the death of my old faithful dog quite upset me, the Cliff fell upon him and killed him in a moment before my eyes, and

close to my feet, it was but a moment between me and the same fate" (Lang, 1945, p. 171).

Mary Anning's dog is portrayed in the well-known portrait (fig. 1). According to local lore, Mary bid her dog to sit next to fossils along the beach as a marker while she went for tools to exhume specimens.

The cliffs and slope along the coast where Mary collected are very unstable, and even today people are warned about getting to close to the cliff face. In her letter to Charlotte Murchison, Mary continues, "…at present I have not anything fine or rare, for the last year I have been very unsuccessful but hope as the stormy season is coming on I may be so…" (Lang, 1945, p. 171). Mary's mention of the stormy season likely refers to December through February along the Dorset coast when winter storms pound the coastline, eroding the limestones and shales in the cliffs (fig. 9) and exposing new fossils. Some of Mary's most famous discoveries were made in December! Even today, fossil collecting is best during the winter, but one needs to be extremely careful (Howe, 2008). I think it is fair to say that Mary was persistent, and in order to brave the elements, physically strong – resilient. Mary did have a keen eye for fossils and had certainly developed that '$6^{th}$ sense' of where to look; "a genius for discovering where the Ichthyosauri lie embedded" and "great judgment in extracting the animals, and infinite skill and manipulation in their development" (Roberts, 1834, p. 290).

**Figure 9.** Wave-cut platform into the Blue Lias Limestone where large ammonoids are commonly seen on the bedding surface, and the constantly eroding cliffs along the shore of Lyme Bay where Mary Anning did most of her collecting.

**Mary Anning's Contributions to Palaeontology**

Mary Anning was an extraordinary fossil collector. Learning the craft from her father, Mary began collecting at a very early age. Undoubtedly, the most common fossils Mary recovered from the beach and cliffs around Lyme Regis were cephalopods, primarily ammonids (fig. 10) and belemnites (fig. 11). Even today, nautiloids, ammonoids, and belemnites are the most common fossils collected by amateurs and professionals alike, and common fossils sold in the fossil shops of Lyme Regis. Some of the ammonoids, such as *Arietites bucklandi* are quite large and can be observed on bedding planes in the Blue Lias Limestone near Church Cliff where Mary Anning did much of her collecting (fig. 12). Also of interest are the pyritized ammonids, of which *Echioceras sp.* and *Promicroceras planicosta* are particularly common. Her fame, however is linked to her finding of ichthyosaurs plesiosaurs, the pterosaur *Dimorphodon macronyx*, the fish *Dapedius sp.*, the shark *Hybodus deabecheii*, and the primitive chimaera fish *Squaloraja polyspondyla*.

**Figure 10.** Ammonoids are so common that specimens have been used in stone walls. Two different ammonoids can be seen just to the right of the author in this retaining wall of the car park behind the Royal Lion Hotel in Lyme Regis.


**Figure 11.** Belemnite *Passaloteuthis apicurvata*. Specimens are part of the Mary Anning display in the Philpot Museum in Lyme Regis.

**Figure 12.** Wave-worn example of the ammonoid *Arietites bucklandi* in the Blue Lias Limestone. The specimen is approximately 50 cm in diameter. Specimens of *Arietites bucklandi* are relatively common in the coarse beach gravels below the Church Cliff where Mary Anning did much of her fossil collecting.

## Ichthyosaurs

The commonly held story is that Mary was the discoverer of the first British ichthyosaur, although it was her brother Richard who actually found the skull and likely pointed to where the remainder of the skeleton laid hidden. It was the 'Anning' ichthyosaur (fig. 5) which was described by Home (1814) and drawn by others, including William Buckland (fig. 13 and 14). Although Home (1814, p. 572) does not give any credit to the Annings, he does describe the specimen as having been buried in sand along the seashore after falling from a cliff, 30- to 40-feet above the level of the seashore. Home (1814, p. 572) does reference to the great pains and skill exerted in bringing the specimen into view.

There is considerable evidence that the 'Anning' ichthyosaur was not the first British ichthyosaur (see DeLair, 1969 for further discussion). Regardless of whether or not Mary Anning was the discoverer of the first British ichthyosaur, it is clear ichthyosaur bones were commonly found by Mary Anning and sold to museums and collectors. At least six ichthyosaur specimens in the Sedgwick Collection of the Sedgwick Museum, Cambridge University, are considered to have been collected by Mary Anning (Price, 1986).

**Figure 13** (below)**.** Drawing of Temnodontosaurus (Ichthyosaurus) platyodon from the Lias at Lyme Regis. (From Buckland, 1837, plate 7, with discussion on pp. 20–21).

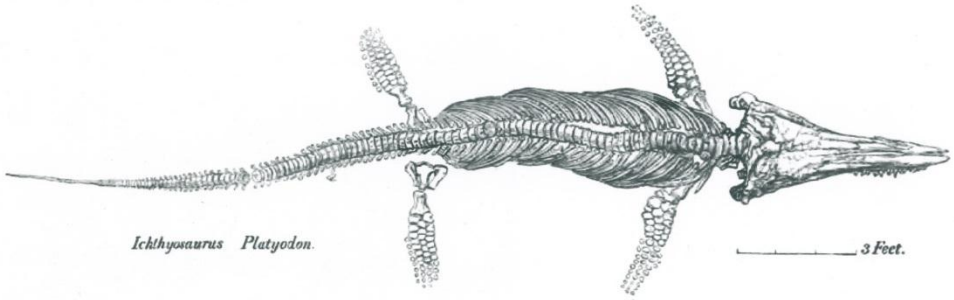
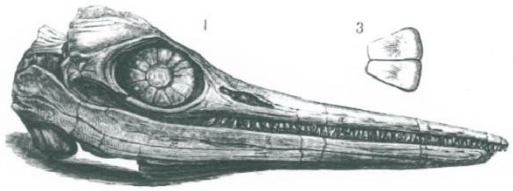



**Figure 14** (below)**.** Drawing of the head of *Temnodontosaurus (Ichthyosaurus) platyodon* (1) from the Lias at Lyme Regis in the British Museum of Natural History (London) with two sclerotic plates illustrated (3). Drawing was copied by William Buckland from Sir E. Home's figure in the Philosophical Transactions. Figure from Buckland (1837, plate 10, with discussion on p. 21).




A 5-foot long specimen of *Ichthyosaurus communis* was discovered by Mary in May 1821, and, according to De la Beche exceeded the preservation of any ichthyosaur yet found. Ultimately, this specimen was given to the Bristol Institution (City of Bristol Museum and Art Gallery), but unfortunately it was destroyed in the bombing of Bristol during World War II. Of this particular specimen, only the names of the donors to the Bristol Institution had been recorded, but George Cumberland (1829) did reveal Mary's role in the discovery (although, he did get the spelling her name wrong) –

> "…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. This persevering female has for years gone daily in search of fossil remains of importance at every tide, for many miles under the hanging cliffs at Lyme, whose fallen masses are her immediate object, as they alone contain these valuable relics of a former world, which must be snatched at the moment of their fall, at the continual risk of being crushed by

the half suspended fragments they leave behind, or be left to be destroyed by the returning tide."

**Plesiosaurs**

In 1821, De la Beche and Conybeare published a study of fossil remains, which included specimens almost certainly discovered by Mary Anning. One of the specimens, which was missing the head, was described as being another ancient swimming reptile other than *Ichthyosaurus* and was called *Plesiosaurus* ('near to lizards') (Goodhue, 2004, p. 37). It was clear to Conybeare that many scientists were suspicious of their [De la Beche and Conybeare] description of a new swimming reptile, and Conybeare (1824, p. 381) later states,

> "…there might have then appeared reasonable ground for the suspicion that, like the painter in Horace, I had been led to constitute a fictitious animal from the juxtaposition of incongruous members, referable in truth to different species."

It is likely that Mary Anning's greatest discovery occurred in December, 1823. Shortly after his discovery she writes to William Buckland describing a strange skeleton she has uncovered under the Black Ven as being about 8 or 9 feet long and 4 feet from the point of one fin to the other, with a head only 6 or 7 inches and resembling a serpent. Upon receipt of Mary's description, William Buckland convinced Richard Grenville, 1st Duke of Buckingham, to purchase the specimen. When William Conybeare heard of Mary's discovery, he rushed to examine the specimen, and shortly thereafter announced to the Geological Society of London of "the magnificent specimen recently discovered at Lyme has confirmed the justice of my former conclusion in every essential point connected with the organization of the skeleton" (Conybeare, 1824, p. 381). The plesiosaur, *Plesiosaurus dolichodeirus*, to which Conybeare refers is now on display in the British Museum of natural History (London) (fig. 15). Unfortunately, nowhere in Conybeare's description is there a mention of Mary Anning. Eventually, Mary does receive due credit for her great discovery, which firmly establishes her reputation as a consummate finder of fossils and the news spreads rapidly to geologists and collectors (Goodhue, 2004, p. 38-39). Mary ultimately found several plesiosaur specimens, including one described by Owen (1840b) as *Plesiosaurus macromus.*

The problem with plesiosaurs was that the creatures resembled nothing in the modern world. At least ichthyosaurs were 'crocodilian' in appearance. Conybeare insisted that *Plesiosaurus* was 'striking proof of the infinite riches of creative design' (Goodhue, 2004, p. 40). Mary Anning continued to make discoveries of organisms which failed to fit into the established framework of life on Earth, and her discoveries were not limited to large marine reptiles.

**Figure 15.** The plesiosaur, *Plesiosaurus dolichodeirus* (Conybeare), collected from the Lower Jurassic, Lyme Regis, by Mary Anning in 1824, and purchased by the Natural History Museum (London) from the Duke of Buckingham in 1848. This specimen is the holotype (BMNH 22656). This was the first articulated plesiosaur skeleton ever found, and one of Mary Anning's greatest discoveries. The specimen now hangs in the Mary Anning Hall of the Natural History Museum. Photo is reproduced with the permission of the British Museum of Natural History (London).

**Pterosaurs**

The first pterosaur ('winged lizard') was discovered in the Solnhofen Limestone in Bavaria, Germany in 1784, and described as a marine creature (Wellnhofer, 1991). It was Cuvier (1801) who first suggested that pterosaurs had the power of flight, and suggested the name *Pterodactyle* ('winged finger'). The existance of pterosaurs was already established by the time Mary Anning had become a serious collector of fossils, and Buckland (1829a, p. 219) suspected the presence of pterosaurs in the Lias of Lyme. Buckland's suspicion was based on the discovery of a long, thin fragment of flat bone with minute, flat, lancet-shaped teeth in the collection of the Miss Philpots. Then in December, 1828, Mary made her next important discovery – the first pterosaur skeleton discovered outside Germany. Although Buckland does not refer to how he acquired the specimen, he does begin the announcement to the Geological Society of London of the discovery with,

> "In the Blue Lias Formation at Lyme Regis, in so many specimens of Ichthyosaurus and Plesiosaurus have been discovered by Miss Mary Anning, she has recently found the skeleton of an unknown species of that most rare and curious of all reptiles, the Pterodactyle…" (Buckland, 1829a, p. 217).

In his description, Buckland proposes the name *Pterodactylus macronyx* for 'his' discovery, which was later renamed *Dimorphodon macronyx* by Owen (1859). Later, in Buckland's discussion on pterodactyls in *Geology and Mineralogy Considered with Reference to Natural*

*Theology* (Buckland, 1837), there is no mention of Mary Anning as the discoverer of the first British pterosaur.

**Fish**

Late in 1829, Mary makes her fourth important discovery – *Squaloraja polyspondyle*, a fish. The first mention of the fossil is in a letter from Mary to geologist Charles Lyell, dated 15 December 1829, which reports, "…discovered a non-discript [sic: undescribed] creature for a description of which I must refer you to Mrs Murchsion, as it is impossible to describe it here" (Taylor and Torrens, 1987, p. 135). The story of Mary's find and its ultimate disposition is quite convolute and involves a host of individuals, including William Buckland, Charles Lyell, Gideon Mantell, and Adam Sedgwick, among others. The reader is referred to Taylor and Torrens (1987) for a comprehensive discussion. What is interesting about Mary's correspondence is her understanding of anatomy, which she learned by dissecting modern organisms. In a letter to J.S. Miller of the Bristol Museum, dated 20 January 1830, Mary states,

> "…I have discted [sic: dissected] a Ray since I received your letter, and I do not think it the same genus, the Vertebrae alone would constitute it a different genus being so unlike any fish vertebrae they are so closely anchylosed [sic: connected?] that they like [sic: look] like one bone but being dislocated at two places show that each thin line is a separate vertebrae with the ends flat…" (Taylor and Torrens, 1987, p. 135).

In the same letter she ends with, "…the tide warns me I must leave of scribilling [sic: scribbling]" (Taylor and Torrens, 1987, p. 135). It would appear from this last statement, she was describing the specimen while on the beach where it was located and the tide was rising. The specimen, less the tail, was ultimately purchased by the Bristol Museum. The tail was later recovered by Elizabeth Philpot. The Anning specimen was first described by Riley (1833) in a paper read to the Geological Society of London and later re-described by Agassiz in 1835 (Taylor and Torrens, 1987, p. 143). The Philpot specimens of *Squaloraja* eventually became part of Oxford University Museum with the rest of the Philpot Collection (Edmonds, 1976), but Mary's specimen of *Squaloraja* is presumed to have been lost in the destruction of the Bristol Museum by a German bombing raid in November, 1940.

Early in 1839, Mary discovered the jaw of the shark *Hybodus*. *Hybodus* is an extinct genus of shark, which first appeared in the Permian, and became extinct in the early Cretaceous. The jaws of *Hybodus* are interesting in that the teeth have two different shapes – a sharp set for seizing slippery prey, such as fish and squid, and a set of flat, robust teeth for crushing skeletal material, such as molluscs and echinoids.

The find, only 8 years before her death, is one of the most significant finds made by Mary. The genus *Hybodus* had been described by Agassiz in 1837 (Agassiz, 1843). As was typical of her finds, she sold the specimen, and this particular specimen was sold to Edmund Higgins of Cheltenham. Charlesworth (1839, p. 243) refers to Higgins as a *"very ardent collector of fossils remains"* and "…brought for my inspection the beautiful specimen…the joint

discovery of himself and Miss Anning, in the Lias of Lyme Regis." There is, however, no evidence Higgins was actually connected to the discovery of this specimen. Charlesworth (1839, p. 247) describes the specimen and names it *Hybodus delabecheii* in honor of Henry De la Beche, who, according to Charlesworth, had been the first geologist to draw attention to the fossil remains of the genus.

Mary writes to Charlesworth, editor of *The Magazine of Natural History* (who had described *Hybodus delabecheii* in the same journal) in an effort to set the record straight regarding her discovery. Unfortunately, Charlesworth only published a portion of the letter (Anning, 1839, p. 605), but in the letter Mary writes,

> "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."

In this letter (Anning's only truly 'published work'), Mary shows a degree of boldness, some might say audacity, in standing up to a reputable scientist. The letter also illustrates again Mary's association with respected scientists, as well as a familiarity with the scientific literature of the day.

**Coprolites**

Walk along the beach at low tide near Lyme Regis and you may discover small (4-8 cm), dark grayish-brown lumps, typically with black spots. During Mary Anning's time, local people called them 'Bezoar stones' because they were similar in shape and size to the gallstones of Bezoar goats (Buckland, 1835, p. 221). William Buckland (1835) initially thought 'Bezoar stones' to be recent lumps of clay formed by waves striking the beach, but later concluded the lumps of clay were "…the petrified faeces of Saurian animals…" or coprolites (Fig. 16). Eventually, Buckland gives Mary credit for discovering the true nature of coprolites. Mary recovered many 'Bezoar stones', often closely associated with ichthyosaur remains, and Buckland (1835, p. 224) states in his paper,

> "…Miss Anning informs me that since her attention has been directed to these bodies, she has found them within ribs or near the pelvis of almost every perfect skeleton of Ichthyosaurus which she has discovered, and …the so-called Bezoars are most abundant in those parts of the formation in which the bones of Ichthyosauri and Plesiosaurui are most numerous".

Buckland (1837, v. II, plates 13/14) illustrates the occurrence of coprolites in the body cavity of *Ichthyosaurus* (fig. 17), and describes coprolites as being so numerous in Lyme Regis that "they lie in some parts of Lias like potatoes scattered in the ground". Mary may well have felt slighted by Buckland's claims of discovery, as she makes reference to coprolites in her poem: "Let

Buckland set the land to rights, Find meat and peas, and starch in blights, And future food in coprolites" (Anning, 1846 or 1847?).

**Figure 16.** Coprolites from the collection of Mr. Paddy Howe of the Philpot Museum (Lyme Regis), which were collected along the beach between Lyme Regis and Charmouth.

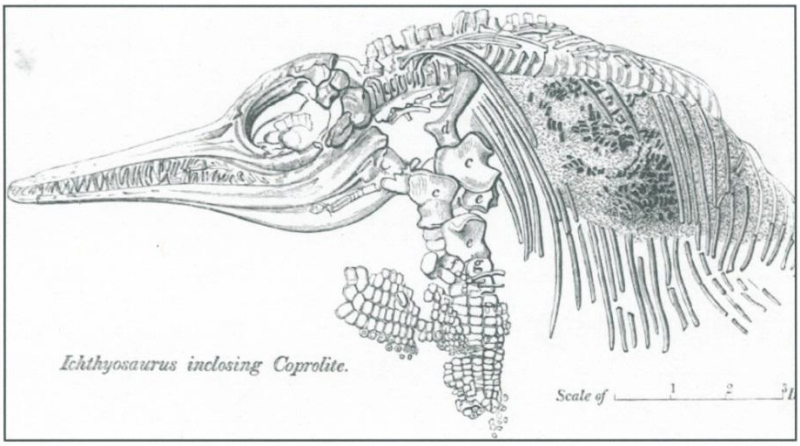



**Figure 17.** Skeleton of small Ichthyosaurus from the Lias at Lyme Regis with digested bones of fishes in the state of coprolite (small, black features in the region of the ribs). From Buckland, 1837, v. II, plate 13, with discussion on pp. 25–26.

**Belemnites**

Mary Anning is certainly best noted for her discovery of vertebrate fossils, and, as she was in the business of selling fossils, vertebrate fossils certainly commanded a much higher value than invertebrate fossils. But, she did find many invertebrate fossils and provided [or sold] them to collectors and scientists, such as the brittle star *Ophioderma egetoni* given to Adam Sedgwick or the lobster *Coleia antique* given to the Earl of Enniskillen. John Phillips (1909) acknowledges the belemnites she collected, and it is the abundance of belemnites in the Lias of Lyme, which led to an interesting discovery by Mary Anning and Miss Philpot.

In a letter to Buckland, dated 6 February 1829, Mary writes,

> "Do you remember the live creatures you had put in spirits (if so my description may be acceptable). I got two more, one alive and it whenever it was touched ejected a purple fluid (this one Mr. De la Beach [sic: Beche] coveted, and has taken to some Naturalist to be described). The second I dissected at Miss Philpot's, it first had a shell this shape [sketch inserted] very like a smooth pectin only more concave, also a sac or ink bag exactly resembling the small bag (like the gizzard [sic: gizzard] of a fowel [sic: fowl}…"

Mary and Elizabeth Philpot had made the connection with ink sacs in belemnites and modern cephalopods. It was Agassiz who, in 1834, brought to the attention of Buckland the significance of this discovery. In fact, both Mary and Elizabeth Philpot made a number of drawings of fossisl in their correspondence using sepia ink. Buckland (1837, p. 70 and plate 44) describes and illustrates belemnite ink sacs (fig. 18) and in the description states, "…ink-sac of Belemno-sepia, discovered by Miss Anning, in 1828 in the Lias of Lyme Regi, and noticed by Dr. Buckland (Lond. and Edin. Phil. Mag. May, 1829, p. 388,) as derived from some unknown Cephalopod, nearly allied in its internal structure to the inhabitant of the Belemnite."

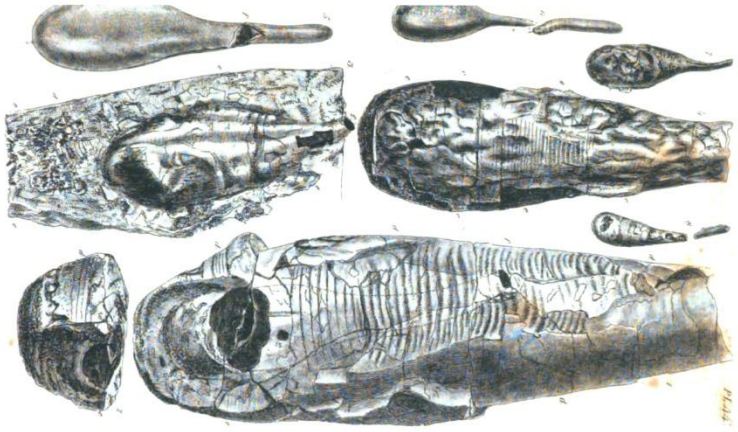


**Figure. 18.** Buckland's drawings of belemnite ink sacs. From Buckland, 1837, plate 44.

**Summary**

Mary died of cancer at the age of 47, on March 9, 1847. Although Mary was raised a Nonconformist, she was buried among the Anglicans in the cemetery of St. Michaels on the Church Cliffs (the same cliffs from which she had collected many fossils). Mary's brother Joseph, who died two years later, is buried beside her (fig. 18).


**Figure 18.** Grave marker for Mary Anning and her brother Richard in the cemetery of St. Michaels Church in Lyme Regis.

I suspect most of the readers know of Mary Anning without knowing it. Fifty years following her death, the story of Mary Anning inspired Terry Sullivan (1908) to write the familiar tongue-twister:

*She sells sea-shells on the sea-shore,*
*The shells she sells are sea-shells, I'm sure*
*For if she sells sea-shells on the sea-shore*
*Then I'm sure she sells sea-shore shells.*

Hopefully, this brief biography illuminates why Mary Anning is the Princess of Palaeontology. Although she did not provide paleontology with great manuscripts to which later workers would refer, she did reveal to the learned men of the time important fossils; fossils which played a key role in the growth of palaeontology as a scientific endeavor. According to Draper (2008), Mary Anning was in the right place at the right; at a time when three of Britain's most influential geologists were present - Henry De la Beche, William Buckland, and William Conybeare, which, as a result, tied Mary to the Geological Society of London. In his *Memoirs on Ichthyosauri and Plesiosauri* Thomas Hawkins (1834, p. 9) honors Mary's contribution to science,

> "…But although many obligations are owing to the zealous efforts of these justly eminent personages [referring to Buckland, De la Beche, Conybeare and others], 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".

Mary's fossils helped dispel the religious dogma which had, until then, resisted the ideas of extinction and evolution. Although she was not part of any organized effort, she certainly represents early feminist thought and she was not afraid to break through both the gender and social barriers of the day.

Is Mary Anning a proper exemplar for today's women geologists and members of Sigma Gamma Epsilon? In my opinion - yes. She was persistent in her endeavors, and, according to Torrens (1995, p. 279), is "a figure of enormous historical significance." Over the past several years, I've often wondered, given today's opportunities, what great achievements could she have made? I believe she would have been among the brightest stars in the sky. I am proud to be a member of Sigma Gamma Epsilon as we celebrate in the Ritual the contributions of Mary Anning - Princesses of Palaeontology and Lioness of Geology.

## ACKNOWLEDGEMENTS

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## REFERENCES CITED

Agassiz, L., 1843. *Recherches sur les Poissons Fossiles.* Petitpierre, Neuchatel, Switzerland.

Anning, M., 1829. Unpublished letter to William Buckland, dated 8 Feb 1829. Owen Collection, DF 100/2/5, British Museum of Natural History (London).

Anning, M., 1839. Note on the supposed frontal spine in the genus *Hybodus*. *Magazine of Natural History*, III new series, p. 605.

Anning, M., [no date]. Unpublished "4th Notebook". C.D. Sherborn papers, Lang Collection, Dorset County Museum, Dorchester, England.

Anning, M., [1846 or 1847?]. *Enocmium Murchisonium* first. Owen Collection, OC 62.1, 151, British Museum of Natural History (London).

Anonynmous, 1857. The fossil-finder of Lyme Regis. *Chamber's Journal of Popular Literature, Science, and Arts,* v. 7, p. 382-384.

Atkins, J. and Dooling, M., 1999. *Mary Anning and the Sea Dragon.* Farrar, Straus and Giroux Publishing, New York.

Aurousseau, M., (ed). 1968. *The Letters of F.W. Ludwig Leichhardt*. Cambridge University Press, London.

Benett, E., 1831a. A catalogue of Wiltshire fossils, *in*, Hoare, R.C., *The Modern History of South Wiltshire.* London: Nichols and Nichols.

_____1831b. *A Catalogue of the Organic Remains of the County of Wilts.* J.L. Vardy, Warminster, England.

Bogan, A.E. and Torrens, H.S., 1989. Recovery of the Etheldred Benett collection of fossils mostly from Jurassic-Cretaceous strata of Wiltshire, England, analysis of the taxonomic nomenclature of Benett (1831, and notes and figures of type specimens contained in the collection. *Proceedings of the Academy of Natural Sciences of Philadelphia,* v. 141, p. 115-180.

Brighton, C., 2000. *The Fossil Girl: Mary Anning's Dinosaur Discovery.* Frances Lincoln Children's Books, London.

Brown, D., 1999. *Rare Treasure: Mary Anning and Her Remarkable Discoveries.* Houghton Mifflin, Boston.

Buckland, W., 1837. *Geology and Mineralogy Considered with Reference to Natural Theology* (Bridgewater Treatise). William Pickering, London.

_____ 1835. On the discovery of coprolites, or fossil faeces, in the Lias at Lyme Regis, and in other formations. *Transactions of the Geological Society of London,* v. 3 (2nd series), p. 221-236.

_____ 1829a. On the discovery of a new species of pterodactyle in the Lias of Lyme Regis. *Transactions of the Geological Society of London,* v. 2 (2nd Series), p. 217-222.

_____ 1829b. On the discovery of a new species of Pterodactyle; and also of the faceces of the ichthyosaurus; and of a black substance resembling sepia, or India ink, in the Lias at Lyme Regis. *London and Edinburgh Philosophical Magazine*, v.5, p. 387-388.

Bush, H., 1965. *Mary Anning's Treasures.* Puffin Books, London.

Charlesworth, E., 1839. On the fossil remains of a species of *Hybodus* from Lyme Regis. *Magazine of Natural History*, III new series, p. 242-248.

Chevalier, T., 2010. *Remarkable Creatures*, New York, Dutton Publishing.

Clarke, N.J., 2003. *Mary Anning 1799-1847: A Brief History.* Nigel J. Clarke Publications, Lyme Regis, England.

Cole, S., 2005. *The Dragon in the Cliff: A Novel Based on the Life of Mary Anning.* Universe Inc., Lincoln, NE.

Conybeare, W.D., 1824. On the discovery of an almost perfect skeleton of the *Plesiosaurus. Transactions of the Geological Society*, 1 ( 2nd series), p. 381-389.

Creese, M.R.S. and Creese, T.M., 1994. British women who contributed to research in the geological sciences in the nineteenth century. *British Journal for the History of Science*, v.27, p. 23-54.

Cumberland, G., 1829. Some account of the order in which the fossil saurians were discovered. *Quarterly Journal of Literature, Science, and the Arts*, v.27 (new series 5), p. 345-349.

Curwin, E.C. (editor), 1940. *The Journal of Gideon Mantell, Surgeon and Geologist*. Oxford University Press, London.

Cuvier, G., 1801. Extrait d'un ouvrage sur les espèces de quadrupeds don't on a trouvé les ossemens dans l'inténieur de la terre. Journal de Physique, de Chimie et d'Historie Nturelle, v. 52, p. 253-267.

Day, M., 1995. *Dragon in the Rocks: A Story Based on the Childhood of the Early Paleontologist, Mary Anning.* Greey de Pencier Books, Toronto.

De la Beche, H.T., 1848a. Obiturary notices. *Quarterly Journal of the Geological Society of London*, v. 4, p. xxiv-xxv.

_____ 1848b. Anniversary address of the president, February 14, 1848. *Quarterly Journal of the Geological Society of London*, v. 4, p. xxi-cxx.

_____ and Conybeare, W.D., 1821. Notice of the discovery of a new fossil animal, forming a link between the *Ichthyosaurus* and the crocodile, together with general remarks on the osteology of *Ichthyosaurus. Transactions of the Geological Society of London*, v. 5, p. 559-594.

De Lair, J.B., 1969. A history of the early discoveries of Liassic ichthyosaurs in Dorset and Somerset (1779-1835). *Proceedings of the Dorset Natural History and Archaeological Society*, v. 90, p. 115-127.

[Dicken, C.] 1865. Mary Anning, the fossil finder. *All the Year Round*, v. 13 (Feb 11), p. 60-63. [The author is unlisted, but Charles Dickens, owner and editor of the magazine, wrote most of the articles.]

Draper, J., 2004. *Mary Anning's Town - Lyme Regis*. Dorset County Council Printing Services, Dorchester, England.

_____, 2008. Personnel communication, 3 January 2008, Philpot Museum, Lyme Regis.

Edmonds, J.M., 1976. The fossil collection of the Misses Philpot of Lyme Regis. *Proceedings of the Dorset Natural History and Archaeological Society*, v. 98, p. 43-48.

Emling, S., 2009. *The Fossil Hunter: Dinosaurs, Evolution, and the Woman Whose Discoveries Changed the World.* New York, Palgrave Macmillan.

Fradin, D.B and Newsom, T., 1997. *Mary Anning: The Fossil Hunter (Remarkable Children).* Silver Burdett Press, Englewood Cliffs, NJ.

Geological Society of London, 2008. History of the Society. http://www.geolsoc.org.uk/gsl/null/lang/en/page335.html

Geological Society of London, 1846. *Catalogue of the books and maps in the library of Geological Society of London.* London.

Goodhue, T.W., 2002. *Curious Bones: Mary Anning and the Birth of Paleontology.* Greensboro, N.C., Morgan-Reynolds Publishing, Greensboro, N.C.

_____, 2004. *Fossil Hunter: The Life and Times of Mary Anning (1799-1847).* Academica Press, LLC, Bethesda, MD.

Hartzog, B., 1999. *Ichthyosaurus and Little Mary Anning (Dinosaurs and Their Discoverers).* New York: Rosen Publishing Group, New York.

Hastings, B., 1853. On the tertiary beds of Hordwell, Hampshire. *Philosophical Magazine*, v.6, p. 1-11.

_____, 1851-52. Description géologique des falaises d'Hordle, et sur la côte de Hampshire, en Angleterre" and On the tertiary beds of Hordwell, Hampshire. *Bulletin de la Société Géologique de France*, v. 9, p. 191-203.

Hawkins, T. 1834. *Memoirs on Icthyosauri and Plesiosauri: Extinct Monsters of the Ancient Earth.* Relfe and Fletcher, London.

Home, E., 1814. Some account of the fossil remains of an animal more nearly allied to fishes than to any other classes of animals. *Philosophical Transactions of the Royal Society of London*, v. civ, p. 571-577.

Howe, P., 2008. Personal communication, 5 January 2008. Philpot Museum paleontologist, Lyme Regis.

Kenyon, J., 1838. *Poems: For the Most Part Occasional*. Edward Moxon, London.

Kölbl-Ebert, M., 1997a. Mary Buckland (née Morland) 1797-1857. *Earth Sciences History*, v.16, p. 33-38.

_____, 1997b. Charlotte Murchison (née Hugonin) 1788-1869. *Earth Sciences History*, v. 16, p. 39-43.

_____, 2002. British geology in the early nineteenth century: a conglomerate with a female matrix. *Earth Sciences History*, v. 21, p. 3-25.

_____, 2007. The role of British and German women in early 19th-century geology: a comparative assessment. *in*, Burek, C.V. and Higgs, B. (editors) *The Role of Women in the History of Geology, Geological Society, London, Special Publication* v. 281, p. 155-163.

Lang, W.D., 1939. Mary Anning and the pioneer geologists of Lyme. *Proceedings of the Dorset Natural History and Archaeological Society*, v. 60, p. 145-147.

_____, 1945. Three letters by Mary Anning, "fossilist," of Lyme. *Proceedings of the Dorset Natural History and Archaeological Society*, v. 66, p. 169-173.

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

_____, 1955. Mary Anning and Anna Maria Pinney. *Proceedings of the Dorset Natural History and Archaeological Society*, v. 76, p. 146-152.

_____, 1959. Mary Anning's escape from lightning. *Proceedings of the Dorset Natural History and Archaeological Society*, v. 80, p. 91-93.

Mantell, G., 1822. *Fossils of the South Downs or Illustrations of the Geology of Sussex.* Lupton Relfe , London.

Minutes, 1999. 36th biennial national convention held at Oneonta State University of New York September 19th through September 21st, 1997. *The Compass, Journal of Earth Sciences Sigma Gamma Epsilon*, v. 75(1): 8-28.

Moxley, S. and Anholt, L., 2007. *Stone Girl Bone Girl: The Story of Mary Anning.* Frances Lincoln Children's Books, London.

Nash, S.E., 1990. The collections and life history of Etheldred Benett (1776-1845). *Wiltshire Archaeological and Natural History Magazine*, v. 83, p. 163-169.

Owen, R., 1840a. *Report on British fossil retiles. Report of the Ninth Meeting of the British Association for the Advancement of Science, 1839.* John Murray: London, p. 43-126.

_____, 1840b. A description of a specimen of the *Plesiosaurus macrocephalus*, Conybeare, in the collection of Viscount Cole, MP, DCL, FGS, & c. *Transactions of the Geological Society of London*, v. 5, p. 559-594.

_____, 1848. On the fossils obtained by the Marchioness of Hastings from freshwater Eocene beds of Hordle Cliffs. *Reports of the British Association for the Advancement of Science, Part 2:* 65-66.

_____, 1859. On a new genus (*Dimorphodon*) of pterodactyle, with remarks on the geological distribution of flying reptiles. *Report of the British Association for the Advancement of Science*, v. 28 (1858), p. 97–103.

Patterson, E.C., 1983. *Mary Somerville and the Cultivation of Science, 1815-1840*, Boston, Martinus Nijhoff Publishers.

Phillips, J., 1909. *A Monograph of British Belemnitidae: Jurassic. Palaeontographical Society (Great Britain)*, London.

Pierce, P., 2006. *Jurassic Mary: Mary Anning and the Primeval Monsters.* Gloucestershire, England: Sutton Publishing Ltd, Gloucestershire, England.

Powell, H.P. and Edmonds, J.M., 1976. List of type-fossils in the Philpot Collection, Oxford University Museum. *The Dorset Natural History and Archaeological Society Proceedings*, 98: 48-53.

Price, D., 1986. Mary Anning specimens in the Sedgwick Museum, Cambridge. *Geological Curator*, v. 4, p. 319-324.

Riley, H., 1833. On a fossil in the Bristol Museum and discovered in the Lias of Lyme Regis. *Proceedings of the Geological Society of London*, v. 1, p. 483-484.

Roberts, G., 1834. *The History and Antiquities of the Borough of Lyme Regis and Charmouth.* Samuel Bagster, Printer, London.

_____, 1823. *The History of Lyme Regis, Dorset.* Langdon & Harker, Sherborne, England.

Spamer, E.E., Bogan, A.E., and Torrens, H.S., 1989. Recovery of the Etheldred Benett collection of fossils mostly from Jurassic-Cretaceous strata of Wiltshire, England, analysis of the taxonomic nomenclature of Benett (1831) and notes and figures of type specimens contained in

the collection. *Proceedings of the Academy of Natural Sciences of Philadelphia*, v. 141, p. 115-180.

Sowerby, J. and Sowerby, J.C., 1812-1845. *The Mineral Conchology of Great Britain*. W. Arding, London.

Steinker, D.C., 2002. Admission of women into Sigma Gamma Epsilon and proposed inclusion of a woman in the Ritual: historical perspective. *The Compass, Journal of Earth Sciences Sigma Gamma Epsilon*, v. 76(4), p. 69-71.

Taylor, M.A. and Torrens, H.S., 1986. Saleswoman to a new science: Mary Anning and the fossil fish *Squaloraja* from the Lias of Lyme Regis. *Proceedings of the Dorset Natural History and Archaeological Society*, v. 108, p. 135-148.

Tickell, C., 1996. *Mary Anning of Lyme Regis.* Sherrens Printing, Weymouth, England.

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

_____, Benamy, E., Daeschler, E.B., Spamer, E.E., and Bogan, A.E., 2000. Etheldred Bennett of Wiltshire, England, the first lady geologist-her fossil collection in the Academy of Natural Sciences of Philadelphia, and the rediscovery of "lost" specimens of Jurassic Trigoniidae (Mollusca: Bivalvia) with their soft anatomy preserved. *Proceedings of the Academy of Natural Sciences of Philadelphia,* v. 150, p. 59-123.

Walker, S.M. and Saroff, P.V., 2007. *Mary Anning: Fossil Hunter.* First Avenue Editions.

Wellnhofer, P., 1991. *The Illustrated Encyclopedia of Pterosaurs*. Salamander Books, Baltimore, MD.

Whewell, W.W., 1834. Review of On the Connexion of the Physical Sciences. *Quarterly Review,* v. 51, p. 54-68.

Wyse Jackson, P.N., 2004. Thomas Hawkins, Lord Cole, William Sollas and all: casts of Lower Jurassic marine reptiles in the Geological Museum, Trinity College, Dublin, Ireland. *The Geological Curator*, v. 8, p. 11-18.

> "Notwithstanding all the dreams of theorists, there is a sex in minds. One of the characteristics of the female intellect is a clearness of perception. …when women are philosophers, they are likely to be lucid ones; …when they extend the range of their speculative views, there will be a peculiar illumination thrown over the prospect."
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> William Whewell, 1834