journal of Geoethics and social Geosciences

Journal of Geoethics and Social Geosciences, 03, Special Issue, 2025; doi:10.13127/jgsg-90

Learning from five pioneer women in Geosciences: a long-lasting story

Rosa Anna Fregola, Patrizia Maiorano, Francesca Micheletti, Luisa Sabato and Martina Zucchi*

Department of Earth and Geoenvironmental Sciences, University of Bari Aldo Moro, Italy

Article history: received August 5, 2025; accepted October 21, 2025; published October 27, 2025

Abstract

This article is a first product compiling the results of dissemination activities conducted within the group "Women in Geosciences" at the Department of Earth and Geoenvironmental Sciences, University of Bari, aimed primarily at involving young students. It collects the individual stories of five female geoscientists from different countries, covering a wide time span (17th to 20th century), working in different fields of study (mineralogy, palaeontology, geology, marine geology, petrography). Martine de Bertereau, Mary Anning, Maria Matilda Ogilvie Gordon, Maria Vasilyevna Klenova and Oplinia Hieke explored mines, mountains, beaches, and oceans, while collecting and studying minerals, fossils, and rocks. In many cases, their activity resulted in economic and cultural improvements that initially benefited small groups and then entire communities. The common thread linking all these stories concerns the numerous obstacles and prejudices these women have had to face due to the persistent gender imbalance in Earth Sciences. Despite their intense research activity, some of them are remembered mainly as wives or disciples of famous male scientists and explorers. Some remained in the shadows because their scientific achievements were mainly attributed to well-known men, while others only gained recognition later. All of them are a great source of inspiration for their perseverance and contributions to the development of Geology as a Science. Learning from these pioneers should motivate younger women into Geosciences and help to understand which prejudices have been overcome and what still needs to be achieved.

Keywords: Pioneer, Women, Geoscientists, Gender bias.

1. Introduction

As a general matter of fact, women scientists were written out of history (Dominus, 2019), and this statement is also true for those working in the field of Geosciences. The science historian Margaret Rossiter's career focuses on bringing to light the unknown or forgotten stories of women scientists. According to Rossiter (1982), their invisibility, even for the most experienced historians, is due to a deliberate concealment of the women's role in the history of science. In honour of Matilda Joslyn Gage (1826-1898), who first described this phenomenon (Gage, 1883), Rossiter coined the term "Matilda effect" to refer to the intentional failure to acknowledge the achievements and merits of female scientists, which are instead attributed to their male colleagues (Rossiter, 1993).

The memory of pioneering female geoscientists and their role in the history of Earth Sciences have been reclaimed, especially for those who lived and worked in the 19th and 20th centuries: research conducted by science historians has shown that the number of female geoscientists active during that period was much higher than previously thought (e.g., Burek and Higgs, 2007; Vincent, 2020). Obviously, the further back one goes in time, the more difficult it is to retrieve historical information, and this is undoubtedly one of the reasons why the historical record of female geoscientists from earlier periods is limited to a smaller number of figures. This article is part of the dissemination activities (seminars, conferences, videos, double interviews, educational outreach, and school orientation programs) that, starting in the year 2019, have been conducted by the "Women in Geosciences" group at the Department of Earth and Geoenvironmental Sciences, University of Bari, Italy. The stories of five pioneering female geoscientists, from very different geographical, temporal, cultural and scientific backgrounds, are collected here to further motivate girls to pursue scientific careers in the Earth Sciences, providing them with food for thought and examples to follow.

Aware that the list of female geoscientists does not end with these, the authors of this paper have chosen them because of the broad affinity of their scientific fields of research with their own. Hence, the following sections explore lives and contributions of Martine de Bertereau (1590?-1643?; mineralogist and mining engineer), Mary Anning (1799-1847; fossil hunter and pioneer palaeontologist), Maria Matilda Ogilvie Gordon (1864-1939; sedimentary geologist), Maria Vasilyevna Klenova (1898-1976; marine geologist) and Oplinia Hieke (1915-2006; petrographer), who carried out their scientific work across different centuries, from the 17th to the 20th, and in different geographical areas, from Europe to Russia (Fregola et al., 2024). Their stories are presented below, also highlighting similarities and differences. The comparison reveals the enormous efforts that some of these women, at least

those who worked furthest back in time, had to make to overcome prejudices and obstacles of pursuing a career in a field that, at least in the past, was considered male-dominated. Far from discouraging young women from chasing such careers, these considerations are intended to raise awareness of the great work done by pioneering female geoscientists, which has undoubtedly, at least in part, paved the way for new generations.

2. Five female geoscientists: stories and "glories"

For each of the five female geoscientists (Figure 1), the following sub-sections provide some biographical notes, the subject of their study, their main achievements and the difficulties encountered (if any), in relation to the historical and geographical context in which they worked.

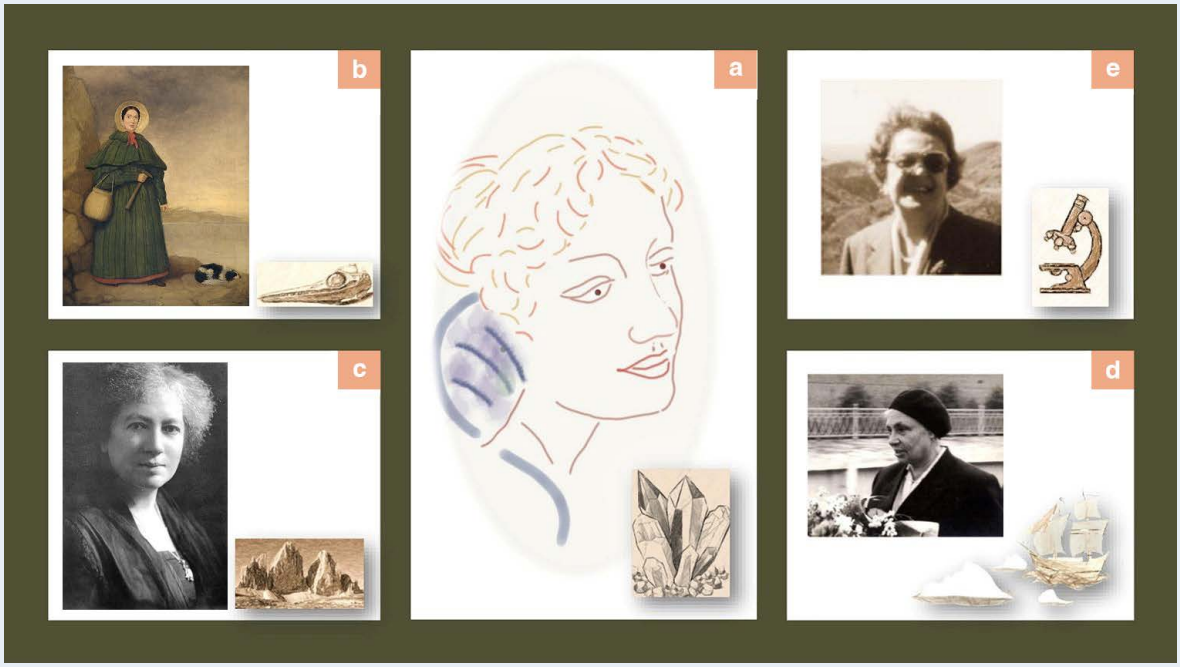


Figure 1. *Pictures and drawings of the five female geoscientists: a) Martine de Bertereau (artistic illustration, credits: Rosa Anna Fregola); b) Mary Anning (portrait's credits: https://it.wikipedia.org/wiki/Mary_Anning, public domain, accessed 20 October 2025); c) Maria Matilda Ogilvie Gordon (photo's credits: Bressan, 2011; Argentieri, 2013); d) Maria Vasilyevna Klenova (photo's credits: Shirshov Institute of Oceanology, RAS); e) Oplinia Hieke (photo's credits: modified after de Ceglia, 2007).*

2.1 Martine de Bertereau (1590?-1643?): a pioneering French mineralogist and mining engineer

> "*Plusieurs voyant au frontispice de ce discours le nom de ma qualité, me jugeront à mêmes temps plutôt capable de l'économie d'une maison, et des délicatesses accoustumées au sexe, que capable de faire percer, et creuser des montagnes, et très exactement juger les grands trésors, et bénédictions, enfermez et cachez dans icelles* […]" ("*Many who see the name of my quality at the beginning of this speech will judge me to be more capable of managing a household and attending to the delicacies customary to my sex than of piercing and digging through mountains and accurately judging the great treasures and blessings enclosed and hidden within them* […]"; de Bertereau, 1632).

2.1.1. Biographical notes, mining explorations and historical context

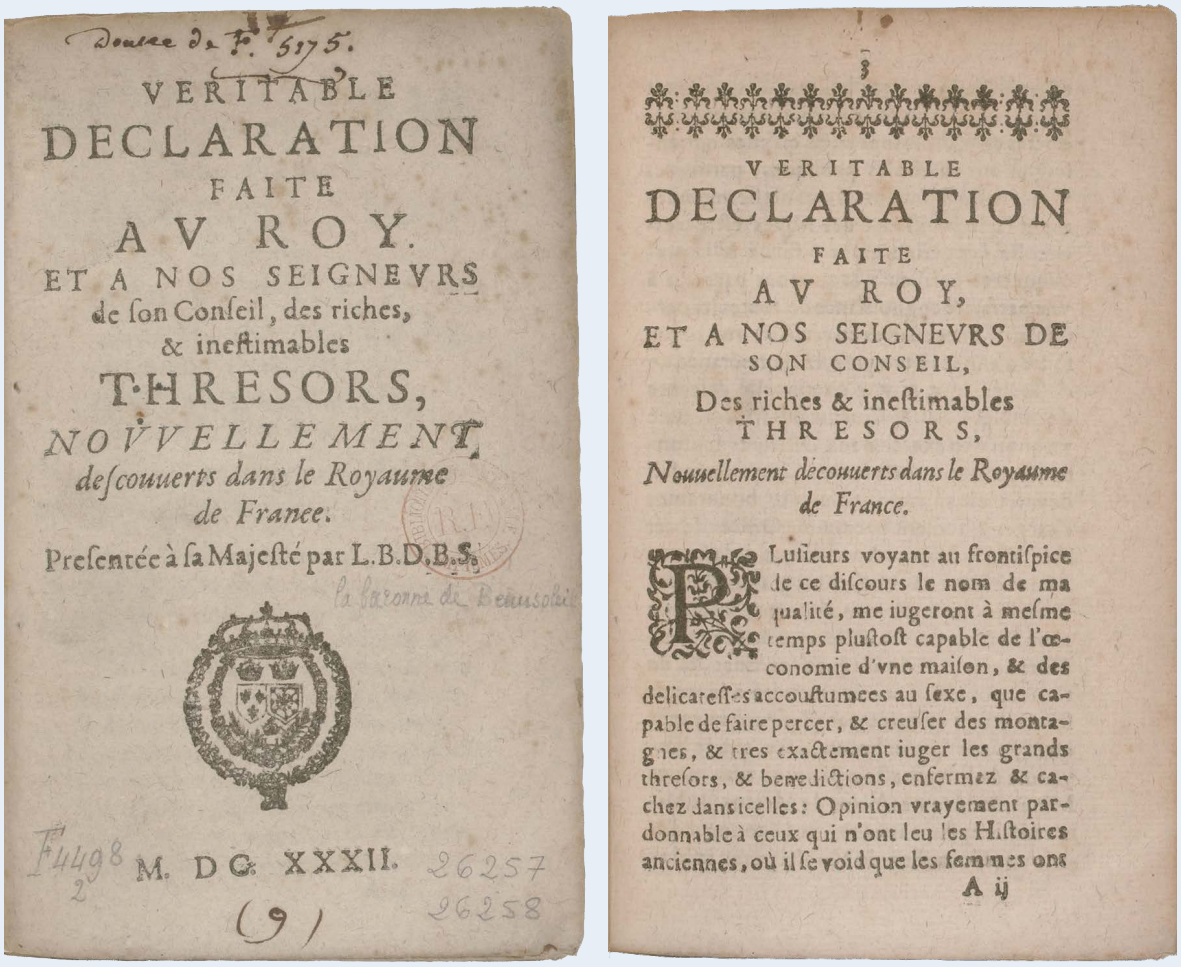
Martine was a cultured and educated woman born around 1590 (Chermette, 1985) into a noble French family of mining engineers, thanks to which she was initiated into the science of mining. In addition to French, she spoke Italian, German, English and Spanish, and knew Latin and Hebrew. Martine married in 1610 to Jean du Chastelet, Baron de Beausoleil and Offenbach, born around 1578 in the Netherlands. Her husband was a mineralogist and one of the first mining engineers in Europe, who arrived in France after 1601, at the invitation of his compatriot Pierre de Beringhen, Comptroller General of the Mines of France, during the reign of Henry IV. Until that time, the exploitation of French mines had long since stopped, by the end of the 15th century. Martine and Jean had at least three (Chermette, 1985), possibly up to five or six (Kenny, 2024) children, the eldest of whom was named Hercules, and the youngest, Anne, was born around 1630 (Chermette, 1985). After their marriage, between 1610 and 1626, the couple's shared passion for mining led them to conduct numerous explorations in France and other parts of the world (Germany, Hungary, Bohemia, Moravia, Poland, Silesia, Sweden, Tyrol, Spain, Scotland, England, Peru), to find new mineral deposits. In 1626, Baron de Beausoleil obtained a commission from the Superintendent of the Mines of France authorising them to "travel to the provinces of France, to open mines, make assays and give faithful advice, before deciding what would be appropriate for His Majesty's affairs" (Chermette, 1985). At that time, the King of France was Louis XIII, who ascended the throne when he was just nine years old, in 1610, on the death of his father, Henry IV, and reigned until 1643. In 1626, his reign was characterised by the influence of Cardinal de Richelieu, who

became his main advisor and minister. In their exploration activities in Languedoc and Brittany, Martine and Jean were accompanied by a large team of 50 German and 10 Hungarian miners, and equipped with various astrological instruments, such as the divining rods described by Agricola, the father of Mineralogy (Bauer, 1556). Precisely the use of this type of instrumentation for mining research, although in vogue in Martine's time (Kölbl-Ebert, 2009; Valderrama and Pérez-Pariente, 2012), earned the couple the dislike of the authorities and was used by their detractors as a pretext to denigrate their activities and accuse them of magic and witchcraft. In particular, the Beausoleils' odd procedures had attracted the attention of the provincial rector of the Duchy of Brittany, Latouche Grippe, who, in 1627, confiscated various possessions in Martine's home at Morlaix, in Brittany, including mineral samples, instruments, records of the places where the mines had been reported, as well as gold, silver, rings and precious stones (Chermette, 1985). This episode prompted the couple to leave for Germany a year or two later; then they returned to France around 1630 (Kenny, 2024).

2.1.2. Results achieved, written works and lack of recognition

Indeed, Martine and Jean succeeded through their expeditions and research in discovering many new mineral deposits and often financed their ventures at their own expense. Nevertheless, their work, once appreciated and supported by King Henry IV, was later not duly recognized in the time of Cardinal de Richelieu. It was to the latter that Martine addressed the plea contained in her book "La Restitution de Pluton à Monseigneur l'Eminentissime Cardinal de Richelieu" (de Bertereau, 1640), with the aim of obtaining fair compensation in return for their work. In this paper the Baroness listed more than 150 metal deposits in France and claimed the £300,000 that she and her husband had spent in France, as well as the granting of certain concessions. Unfortunately, her plea did not yield the expected result and, on the contrary, in 1640 the Cardinal ordered them to be imprisoned under the pretext and accusation of using witchcraft tools in their mining explorations. According to most literary sources, both spouses died in prison, separated and in absolute poverty: the Baron at the Bastille in 1645, while Martine at Vincennes in 1643, where she was imprisoned with her youngest daughter Anne, to whom Martine taught Latin and mining (Chermette, 1985). The eldest son Hercules, to whom his parents had entrusted the supervision of their interests in Hungary, was also arrested and imprisoned in the Bastille, but was not long in being released. Historical records of both Martine's dates of birth and death are not certain. Indeed, according to some authors, Martine did not die in prison and would survive until 1668 (Kenny, 2024).

Interestingly, even in relatively recent times, Martine has been remembered as the traveling companion and "secretary" of her husband, the Baron, "capable of writing memoirs on the most diverse and serious topics with real talent" (Chermette, 1985). Indeed, Martine left us three written works: i) "Diorismus verae Philosophiae de materia prima lapidis" (de Bertereau, 1627); ii) "Véritable declaration faite au Roy et à nos seigneurs de son Conseil des riches et inestimables trésors nouvellement découverts dans le Royaume de France" (de Bertereau, 1632), a book on mineralogical statistics in France (Figure 2); iii) the above mentioned "La Restitution de Pluton" (de Bertereau, 1640).



VERITABLE
DECLARATION
FAITE
AV ROY.
ET A NOS SEIGNEVRS
de ſon Conſeil, des riches,
& inеſtimables
THRESORS,
NOVVELLEMENT
deſcouuerts dans le Royaume
de France.
Preſentée à ſa Majeſté par L.B.D.B.S.

M. DC. XXXII.

VERITABLE
DECLARATION
FAITE
AV ROY,
ET A NOS SEIGNEVRS DE
SON CONSEIL,
Des riches & inеſtimables
THRESORS,
Nouuellement découuerts dans le Royaume
de France.

Plusieurs voyant au frontiſpice de ce diſcours le nom de ma qualité, me iugeront à meſme temps pluſtoſt capable de l'œconomie d'vne maiſon, & des delicateſſes accouſtumees au ſexe, que capable de faire percer, & creuſer des montagnes, & tres exactement iuger les grands threſors, & benedictions, enfermez & cachez dans icelles: Opinion vrayement pardonnable à ceux qui n'ont leu les Hiſtoires anciennes, où il ſe void que les femmes ont

A ij

Figure 2. *Title page and first page of Véritable declaration (Martine de Bertereau, 1632; credits: https://gallica.bnf.fr/, accessed 20 October 2025/Bibliothèque nationale de France, open access).*

In her writings (de Bertereau, 1632; 1640), which would represent examples of "self-writing" used to claim their role and expertise (Kenny, 2024), Martine challenges the gender conventions of the time, claiming an active and competent role in the male-dominated field of mining engineering. According to Kenny (2024), Martine's self-presentation would be a means of gaining social, economic, and legal recognition, but also a source of controversy and doubt. Anyway, wanting to rely on her own writings, the figure of Martine is that of an enterprising and courageous mining explorer also capable of descending into the depths of the Earth, exploring the underground mine shafts. Indeed, in "La Restitution de Pluton", Martine herself also mentions her descent into the depths of the mines of Peru: "having descended into the shafts and caverns of the mines (although frightening in depth) such as the gold and silver mines of Potozi, in the Kingdom of Peru, whose caves are called by the Spaniards 'Esperanza de la Muerte' […]" (de Bertereau, 1640).

2.1.3. An inventory of French mines later exploited

Martine reported an inventory of the mineral deposits of France (de Bertereau, 1632, 1640), whose existence was later verified. Some of them were actually exploited, among which (Chermette, 1985): an amethyst mine in Pégu, Auvergne, exploited by the Spanish in the 17th century; an antimony mine near Langeac and Brioude, explored in the 19th century; a mine of garnets, rubies, hyacinths and opals along the Lou Riou Pegoulou in Espaly, still known in the 20th century; a gold mine in Auriau Mountain, in Dauphiné, most likely Auris above Bourg d'Oisans, where the existence of gold was actually noted in the 18th and 19th centuries; a silver-lead mine at Saint-Julien, in Forez, exploited in the 17th century; an amethyst mine near the town of Lannion, Brittany, whose existence was later confirmed; the Pont-Péan lead (galena) mine in Brittany, also containing silver, vitriol, sulphur, zinc, mercury, and arsenic, whose exploitation was attributed to the Société des Mines de Bretagne in 1731 (Gobet, 1779). Mining activities in the Pont-Péan galena mine, whose discovery is traced back to 1627 by Martine and Jean de Beausoleil, continued until the 20th century (Chermette, 1985; Association Galène, 2025; Cudennec, 2025). Indeed, judging from the list of deposits discovered by Martine and Jean that were later actually exploited, especially in Brittany (Descoqs, 1920), the results of their mining research proved useful long after their deaths, despite the original research tools used.

2.2 Mary Anning (1799-1847): a pioneering fossil hunter and palaeontologist in a changing world

> "*I began frequenting the beaches more and more, though at the time few women took an interest in fossils. It was seen as an unladylike pursuit, dirty and mysterious*" (Chevalier, 2010).

2.2.1. Historical and scientific background

Born in England at the end of the 18th century into a poor family, Mary Anning lived through the transition between the Georgian and the early Victorian periods, a time of great scientific, economic, and technological transformation. Geology and palaeontology were emerging as new scientific disciplines, while theories on the evolution of species, later developed by Charles Darwin, would not appear until several decades later. In the 19th century, topics such as the concept of geological time were beginning to capture the interest of scientists, and the fossil remains of previously unknown creatures were increasingly considered fundamental to understanding the evolution of our planet. In this context, the story of Mary Anning is that of a tenacious fossil hunter who, thanks to her extraordinary discoveries, made profound contributions to the active male-dominated scientific debate going on about the transformation of species, the diversity of life in the Mesozoic, and the scale of the geological time.

2.2.2. Female fossil hunter at Lyme Regis: a "divine" talent

From an early age, Mary Anning accompanied her father Richard, a carpenter, in collecting fossils along the cliffs of Lyme Regis, a quiet seaside town in southern England. These fossils were sold as curiosities to passing tourists. After her father's death, Mary, then only eleven years old, continued the activity which had become essential for her family's livelihood. The cliffs of Lyme Regis turned out to be an ideal site for fossil hunting. There, the Blue Lias formation emerges, a Jurassic geological unit, rich in exceptionally well-preserved fossils, true chapters in the storybook of the Earth life. In Victorian England, it was highly unusual for a young woman to climb the steep and dangerous cliffs of Dorset after storms, break rocks with a hammer, expose strange, still poorly understood objects, reconstruct them, and create detailed drawings and descriptions. Her talent was so astonishing

that someone attributed it to divine favour. This is what Lady Harriet Silvester, an English noblewoman who visited Mary Anning in 1824, wrote about her, clearly astonished that a young woman of modest origins could possess such expertise in the sciences: "*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, 1967).

2.2.3. Discovering extraordinary creatures, science, and later acknowledgements

Challenging all the social conventions of her time and guided by an exceptional intellectual curiosity, Mary Anning studied texts on anatomy and geology, read scientific articles, and over time had the opportunity to discuss her discoveries with leading scientists who travelled to Lyme Regis to consult her and examine her specimens. Although she remained outside official scientific institutions, she gradually earned the respect and friendship of prominent geologists and palaeontologists such as William Buckland (1784-1856) and Henry De la Beche (1796-1855).
Mary Anning's work was not documented in scientific papers in the modern academic sense. Her only formal scientific contribution published under her own name appeared in 1839 in the *Magazine of Natural History*. It is an excerpt from a letter (Anning, 1839) she sent to Edward Charlesworth, a member of the Geological Society of London, in response to his request for information following debates raised by his paper *"On the Fossil Remains of a Species of Hybodus from Lyme Regis"* (Charlesworth, 1839). It is therefore difficult to compile a complete catalogue of Mary Anning's discoveries, especially considering that the fossils she extracted were often attributed to the male scientists who wrote articles about them and built their careers upon Mary's findings. Some of her most important discoveries, particularly those of the extraordinary marine reptiles, are now housed in the galleries of the Natural History Museum in London. Among her most significant discoveries was the remarkable skeleton of an ichthyosaur, found with her brother Joseph, the first specimen of its kind to attract scientific attention, now known as *Temnodontosaurus platyodon*. Equally astonishing was her discovery in 1823 of an incredible marine

reptile, nearly 3 metres long, with a tiny head, an extremely long neck, and an unusually large number of vertebrae (Figure 3). The finding was so unusual that even Georges Cuvier, the father of modern palaeontology, initially believed it to be a fraud. It was the first almost complete specimen of a plesiosaur: *Plesiosaurus dolichodeirus*, cited by Buckland (1836) as one of geology's most important contributions to comparative anatomy. This was not her only finding of a plesiosaur species, since she also discovered the first specimen of *Plesiosaurus macrocephalus*, initially named by Buckland (1836), and later formally described by Owen (1840).

In 1828, Mary Anning also found the first British fossil specimen of a flying reptile, later described by Buckland (1829a) as *Pterodactylus macronyx*, today known as *Dimorphodon macronyx*. Buckland described it as a monster unlike anything previously known on Earth. This time, at last, Mary Anning was credited with the discovery.

Mary Anning also made significant contributions to invertebrate palaeontology, notably through her discovery of fossil belemnites with preserved anterior sheaths and ink sacs. Her friend Elizabeth Philpot (1780-1857) managed to rehydrate fossil ink and use it as pigment for scientific illustrations and artwork. Mary also discovered what we now call coprolites, fossilized faeces. She correctly interpreted them as such after finding them in the abdominal regions of ichthyosaur skeletons. These remains were officially named and described by Buckland (1829b) and presented to the Geological Society of London. Mary Anning discoveries inspired several artworks, including the famous watercolour *Duria Antiquior* by the geologist Henry De la Beche, which featured ichthyosaurs, plesiosaurs, and pterosaurs in a prehistoric scene, the first pictorial reconstruction of ancient life based on fossil evidence. De la Beche sold prints of the painting to raise funds for Mary in her later years.

Mary Anning died in 1847 of breast cancer. Upon her death, her friend Henry De la Beche, then President of the Geological Society of London, wrote an obituary for her in the *Quarterly Journal of the Geological Society*, even though she had never been, and could not have been, a member of the Society. Few species and even a new genus of marine reptile, *Anningasaura*, described by Vincent and Benson (2012), have been named in her honour. Although Mary Anning received little recognition during her lifetime, much has been written about her life in the decades after her dead. Publications continue to appear (i.e., Cofano and De Ceglie, 2025a,b) for both academic and general audiences, including adults and young people. She is now celebrated as "*the greatest fossilist the world ever knew*" (Torrens, 1995) or the "*Princess of Palaeontology*" and "*Geological Lioness*" (Davis, 2012). In 2010 the Royal Society included her among the ten British women who most influenced the history of science, 200 years after her birth. In Lyme Regis, a museum dedicated to her now stands on the site of her home and fossil shop. The museum offers

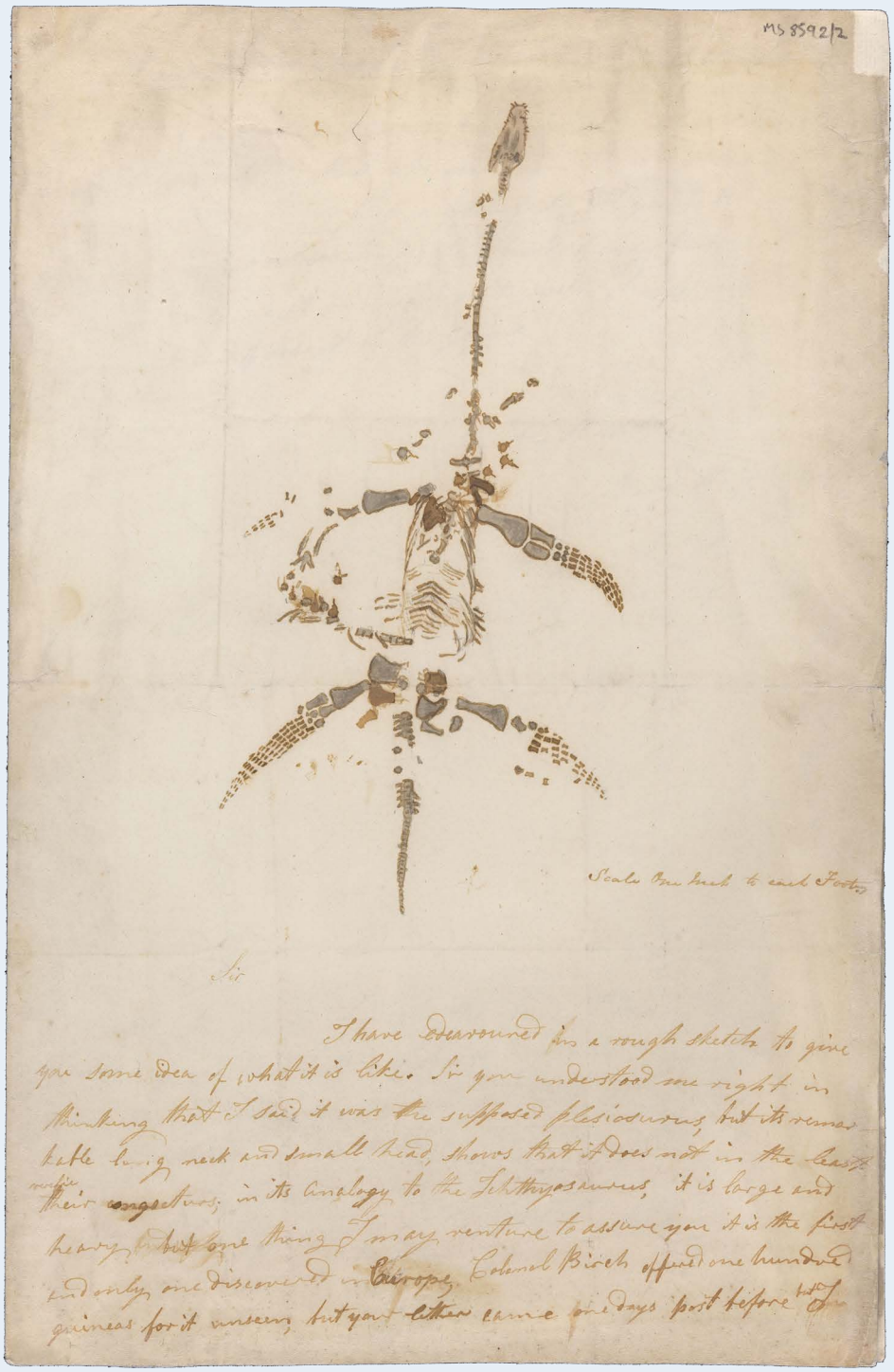


Figure 3. *Autograph letter from Mary Anning concerning the discovery of plesiosaurus (December 26th, 1823). Wellcome Collection. https://wellcomecollection.org/works/b9f2fgjg, accessed 20 October 2025).*

guided tours retracing her footsteps along the beaches and cliffs of the Jurassic Coast, now a UNESCO World Heritage Site.

2.3 Maria Matilda Ogilvie Gordon (1864-1939): a geologist – the lady of the Dolomites

2.3.1. Biographical and educational notes

Maria Matilda (known as May) was born in Monymusk, Aberdeenshire, Scotland, on 30 April 1864 to a wealthy family (Creese, 1996; Burek, 2005; Wachtler and Burek, 2007; Bressan, 2011; Argentieri, 2020). The eldest of eight children, most of whom went on to have successful careers, she received an excellent education and soon demonstrated exceptional talent, becoming the top student at the Merchant Company Schools Ladies College in Edinburgh. She began to cultivate a passion for science and natural history in 1881, while spending her holidays at the family's country house, thanks to her explorations in the Highlands with her brother Francis, who would later become a geologist. After one year spent at the Royal Academy of Music in London, where she demonstrated an exceptional talent as a pianist, she decided to change her way. In 1890, she graduated with a bachelor's degree in science from University College London, specialising in geology, botany, and zoology. She then decided to move to Germany to continue her university studies. However, after being denied admission to classes at the University of Berlin because she was a woman, she attended the University of Munich, even though she was not officially enrolled, where palaeontologist Karl Von Zittel (1839-1904) and zoologist Richard von Hertwig (1850-1937) allowed her to conduct research in their laboratories. Despite further rejections at university, her resourcefulness enabled her to get in touch with scientists who shared her passion for studying corals. The decisive turning point in May's career came in July 1891, when she received an invitation from Baroness Irmgard (1853-1919) and Baron Ferdinand (1833-1905) von Richthofen to accompany them on a long trip to the Dolomites. The Baron was a geologist who, decades earlier, had discovered that the Dolomites were largely made up of fossilised coral reefs.

2.3.2. Mapping mountains and breaking barriers

Maria Matilda was fascinated by the Dolomites and learned to climb them with the help of a mountain guide. Baron von Richthofen encouraged May to become

a geologist. Without anyone's guidance, she began mapping the San Cassiano area, staying in Corvara in Val Badia, a region that at the time had neither roads nor inns. Despite these difficulties, she worked with tenacity and passion, producing magnificent geological maps (Figure 4), and developing robust structural models, while collecting and cataloguing numerous species of molluscs, corals, and sponges. The first part of her research findings was published by the Austrian Geological Survey, Geological Magazine, Quarterly Journal of the Geological Society of London, and Edinburgh Geological Society. Diagrams and drawings accompanied her writings, including references to distant sites, resulting in an excellent work of "modern" stratigraphic correlation. Thanks to her studies, she was the first woman ever to receive the titles of Doctor of Science (University of London, 1893) and Doctor of Philosophy (University of Munich, 1900).

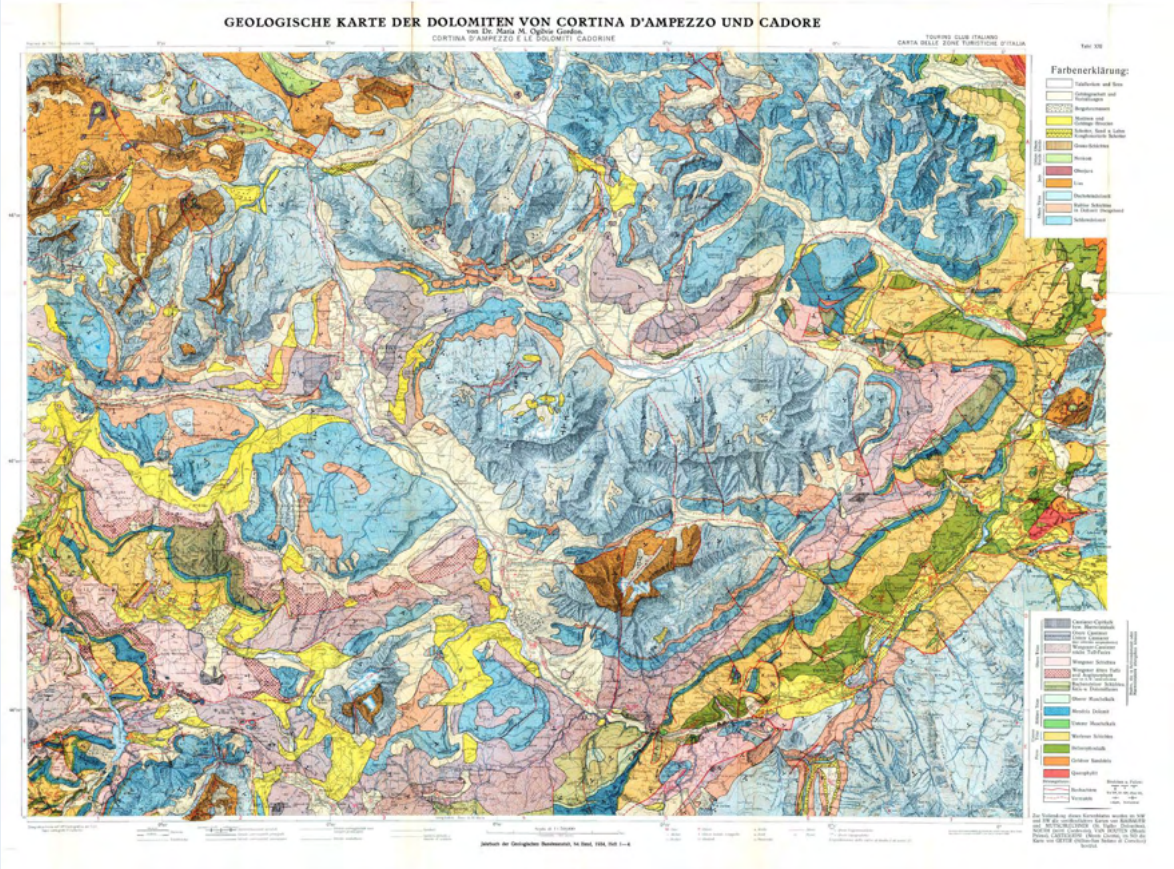


Figure 4. *Geological map of the Dolomites of Cortina d'Ampezzo and Cadore (Ogilvie Gordon, 1934).*

After marrying Doctor John Gordon in 1895, with whom she had four children, Maria Matilda continued to study the Dolomites, even managing to involve her husband in her explorations. May also became an activist in the Liberal Party and fought for women's emancipation internationally, even after she was widowed in 1919. At the beginning of the 20th century, Maria Ogilvie Gordon's geological studies had advanced to such an extent that the time had come to publish a general description of the geology of the Dolomites (Ogilvie Gordon, 1900). She proposed a new theory on their formation which, being well supported by data, was accepted by the scientific community. Over the next few years, she handwrote hundreds of pages in English, even though she intended to publish her work in German and drew an extremely detailed geological map. She sent everything to August Rothpletz (1853-1918), director of the Palaeontological Institute at the University of Munich. He had previously considered her unsuitable for research, but changed his mind and developed a relationship of mutual respect with her.
In 1914, the First World War broke out and everything stopped. Maria was involved in social work, especially in hospitals, and she had little time left for geology. In those years, both her husband and August Rothpletz died, and her manuscript was lost. Maria did not give up and returned to the Dolomites. With tenacity, she reviewed the notes she had kept, reconstructing the entire manuscript. In 1927, she published her most important scientific work in Austria, a 400-page book on the geology of the Dolomites (Ogilvie Gordon, 1927). Maria Matilda also produced the first tourist guides to the Dolomites, aimed at a non-expert audience, anticipating the advent of geotourism by almost a century, and seeking to bring geology to a wider audience (e.g., Ogilvie Gordon, 1928).

2.3.3. Beyond geology and later honours

Meanwhile, she continued her social activities. Among her many achievements in this field, she was appointed the first female justice of the peace at the London Court. Thanks to her commitment to women's welfare, she was also the first woman to receive the honour of Dame Commander of the Order of the British Empire from King George V.
She published over 35 highly valuable scientific papers, but her contributions were only recognized much later. In 1931, she became an honorary member of the Geological Society of Vienna; in 1932, she received the prestigious Lyell Medal from the Geological Society of London. Maria Matilda died at her home in Regent's Park on 24 June 1939. Bailey (1939) wrote: "*with her passing, we have lost a pioneer in promoting women's participation in education and scientific research*". Very recently,

in 2000, a new genus of Triassic fern was named in her honour (*Gordonopteris lorigae*). In 2021, NASA named a crater on Mars after May, calling it Maria Gordon Notch, in recognition of her work in the field of geology.

2.4 Maria Vasilyevna Klenova (1898-1976): the mother of marine geology

2.4.1. Biography and education

Maria Klenova was a Russian marine geologist, born on 12 August 1898 in Irkutsk, Central Siberia, into the family of the exiled land surveyor Vasilij D. Klenov (Barash, 2019; Puminov, 2025; Shirshov, 2025). Maria was inseparable from her sister Elena; their mother, Raisa Naumovna, was a nurse, while their father was a labourer and had served a sentence of hard labour for participating in revolutionary activities. Maria Klenova maintained the family's militant "proletarian" attitude and belief in the class struggle. She graduated from high school in Ekaterinburg. She began studying medicine, first in Moscow and then in Siberia, where she moved in 1917 due to the Russian Revolution. In 1918, she completed courses in typing and shorthand in Ekaterinburg.
Despite her early academic studies in medicine, Maria Klenova later showed a keen interest in natural sciences and geology. The decisive turning point in her life was her meeting with the great polar explorer Fridtjof Nansen, a Norwegian scientist considered the founder of physical oceanography (Barash, 2019). Nansen visited Russia several times, giving lectures which Maria Klenova probably attended. After this event, Maria Klenova moved from Tomsk University (Siberia) to Moscow State University, graduating in mineralogy and petrography of sedimentary rocks in 1924. In the same year, she entered the postgraduate programme, preparing her thesis "*Towards the Lithology of the Barents Sea*" (1926), under the supervision of Yakov Vladimirovich Samoilov (1870-1925), first, and Vladimir Ivanovič Vernadsky (1863-1945), later.

2.4.2. A life spent studying marine geology aboard ships

Her scientific career began immediately and, in 1925, she undertook her first expedition in the vessel Perseus, the inaugural Soviet research ship affiliated with the Floating Marine Research Institute, with which she would continue to navigate for the following ten years. Ivan Mesyatsev (1855-1940), the director of the Soviet

Oceanographic Institute, allowed Maria Klenova and other female scientists to board the Perseus, despite the prohibitions that women faced during that historical period, since he was a strong supporter of gender equality. At the end of 1920s, Maria Klenova was the most experienced crew member of the State Oceanographic Institute. In 1930, Maria Klenova became the head of the Marine Geology Laboratory, where she studied the lithology, mineralogy, and geochemistry of sediments. Under her supervision, a unified methodology for processing samples was developed and implemented, establishing guidelines. In 1937, Maria Klenova was awarded the title of Doctor of Geological and Mineralogical Sciences based on her works, without having to defend any thesis, and was confirmed as a professor of Marine Geology (Barash, 2019). Under her guidance, nearly 200 special maps were compiled for the Navy during the war (1941-1944), and for this reason she was awarded the Order of the Red Labour Flag. From 1945 to 1953, Klenova participated in the compilation of maps and the publication of the Naval Atlas. Her research also focused on the Arctic mapping (Zonn et al., 2017; Barash, 2019). One of her most significant contributions was the first bathymetric map of the Barents Sea (Klenova, 1948; Figure 5).

Maria Klenova was an enthusiastic researcher with a profound passion for marine geology and harboured an aspiration to conduct research in Antarctica. She attempted to join the first Soviet expedition several times but was unsuccessful due to an unofficial policy prohibiting the inclusion of women. Only the support of a high-ranking Soviet official permitted her to participate in the Antarctic expedition (1955-1956) on board of Lena and Ob ships. Maria Klenova's unwavering commitment to scientific exploration was evident throughout her career. Her data collection and interpretation significantly enhanced scientific understanding of glacial and post-glacial processes in polar regions. Furthermore, she produced noteworthy bathymetric maps that were subsequently used in the first Soviet Antarctic atlas. In addition to expeditions, she conducted research at the Soviet Mirny station on the Queen Mary Coast where she worked for several weeks, becoming the first Soviet female scientist to work onshore in Antarctica. On her return to the USSR (Union of Soviet Socialist Republics), she also became the first female scientist to land on Macquarie Island.

After 1955, Klenova and her team moved to the Institute of Oceanology of the USSR Academy of Sciences, where she directed the Geological Research Cabinet of the Department of Marine Geology (Barash, 2019). Her husband was the geologist Leonid Vasilyevich Pustovalov (1902-1970), who had graduated from Moscow State University at the same time as she did, and had worked for the first few years under the supervision of Y.V. Samoilov. In 1953, he became a corresponding member of the USSR Academy of Sciences. Her work in both polar regions, rare for any scientist of the time and exceptional for a woman, secured her a place among the pioneers of marine geology.

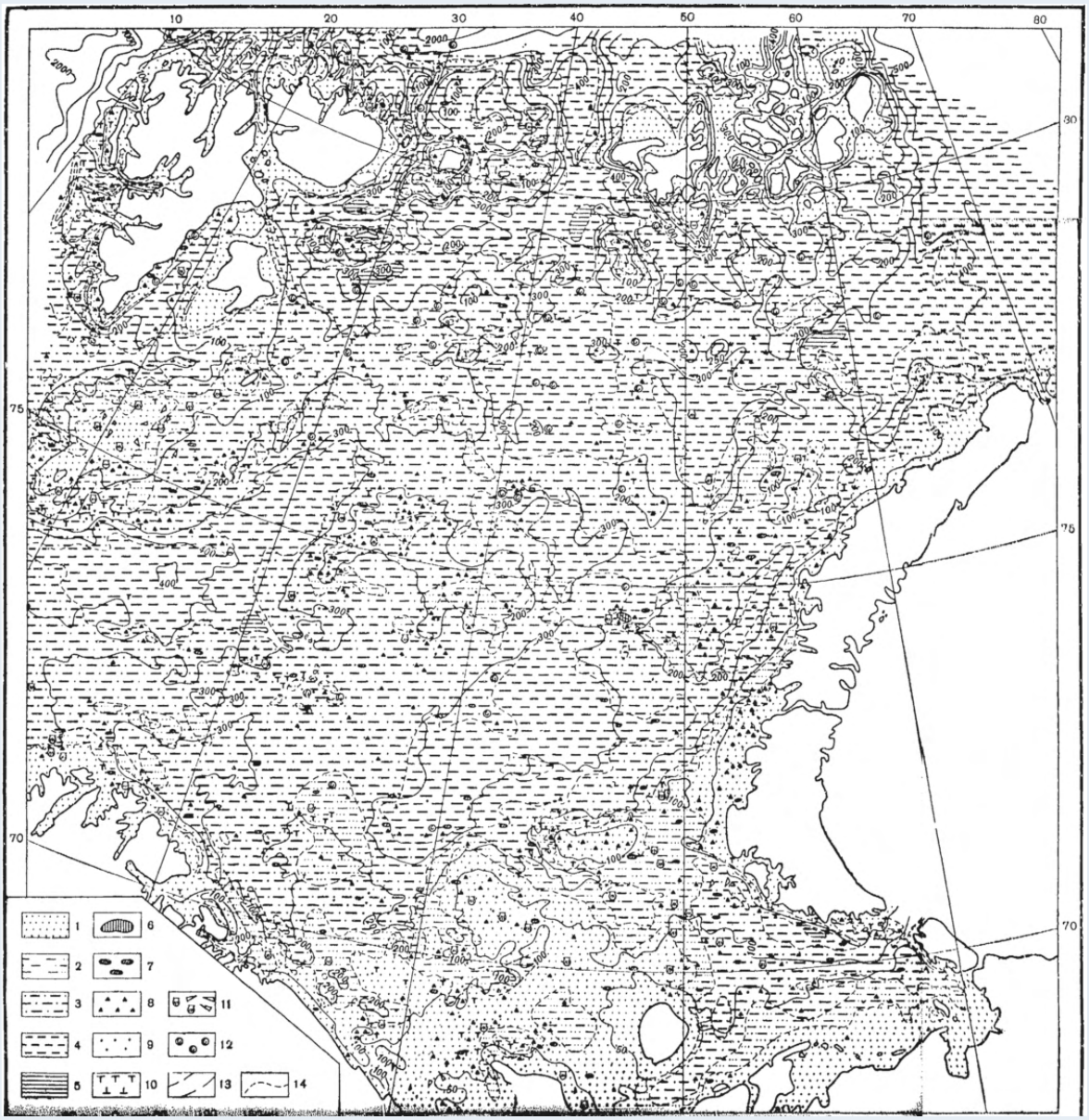


Figure 5. *A bathymetric map of the Barents Sea (Klenova, 1948).*

2.4.3. Main scientific achievements and honours

Maria Klenova published *Geology of the Sea* (Klenova, 1948), one of the earliest comprehensive Soviet texts on marine geology, synthesizing several years of field data and theoretical analysis, which served as a fundamental reference textbook for generations of Soviet geologists and oceanographers. This book was written in the late 1930s, but its publication was delayed until 1948 due to the Second World War. An interesting anecdote is associated with the publication of this book: in the same year, the renowned American scientist Francis Parker Shepard published a similar work and acknowledged Klenova's precedence in the preface: "*It always happens that someone raises the flag before you*". Maria also published *Geology of the Barents Sea* (Klenova, 1960), and *Geology of the Atlantic Ocean* (Klenova, 1975). In recognition of her significant contributions to marine geology, several discoveries have been named in her honour, including the *Klenova Valley* near the North Pole, the *Klenova Seamount* off the coast of Brazil, the *Klenova Peak* in Antarctica, a mountain on the coast of Russkaya Gavan Bay on Novaya Zemlya Island, and the training and production vessel *Professor Klenova* (in service from 1979 to 2004). Furthermore, her legacy is perpetuated through the *Klenova Crater* on Venus. Throughout her career, Klenova was duly recognized by the Soviet state for her distinguished scientific achievements. She received numerous prestigious honours, including the Order of the Red Banner of Labour and several medals awarded by the Academy of Sciences. She was an active member of several scientific committees, including those involved with the Soviet contributions to international research projects. Her work contributed to the Soviet Union's strategic use of marine science for both economic development (e.g., offshore resource exploration) and geopolitical strategy during the Cold War.

2.5 Oplinia Hieke (1915-2006): a petrographer and volcanologist of the twentieth century

2.5.1. Biographical notes and education

Oplinia Hieke was born on 28 July 1915 in Palmanova, Italy. Her father ran a photography studio in Udine, where her mother helped him. She attended university in Padua, earning two degrees: one in Natural Sciences in 1938, and another in Chemistry in 1941 (Focaccia, 2025). Her academic background, straddling the fields of chemistry and geology, laid the foundations for her pioneering contributions to the Geosciences. At the University of Padua, Oplinia met Michelangelo Merlin and married him in 1946.

Between 1939 and 1960, Oplinia held the position of assistant professor of mineralogy at the Institute of Geology at the University of Padua. During this period, she developed her scientific method, characterised by precision, originality, and an unconditional dedication to research. Her work contributed to the advancement of mineralogical studies in Italy, at a time when female scientists were still rare in this field.
In 1965, Oplinia Hieke joined her husband at the University of Bari, where he was professor of physics since 1958, and she became a professor of petrography. Here she began a period of exceptional academic and scientific activity. During her tenure, she introduced an innovative and highly effective approach to teaching and research, and founded numerous research laboratories, contributing to a significant improvement in scientific research in the field of petrography at the University of Bari. Furthermore, Oplinia Hieke played a pivotal role in training a new generation of Italian petrographers. Her influence as an educator was profound, with students and colleagues consistently praising her intellectual rigor, her enthusiasm for teaching, and her dedication to advancement of scientific knowledge (de Ceglia, 2007). In 1973, Oplinia Hieke moved to the University of Venice, where she taught mineralogy and continued her research at the Faculty of Industrial Chemistry. She died in Padua on 4 May 2006.

2.5.2. An interdisciplinary research approach, collaborations, and mentoring

Her scholarly interests were diverse and encompassed several subfields within the Geosciences, including: i) petrography of crystalline complexes, focusing on regions such as Gran Paradiso and Calabria; ii) volcanology, with field research conducted in Eastern Africa, in the Vulture area, southern Italy (Hieke Merlin, 1967; Figure 6), and the Euganean Hills, northern Italy; iii) sediment characterisation and contaminant interactions, particularly in the Venetian Lagoon, the northern Adriatic Sea, the Po Delta, and the mouth of the Adige River; iv) paleoclimatic reconstructions of the recent Quaternary, including investigations in Antarctica (Hieke Merlin et al., 1989).
Her ability to integrate geochemical, petrographic, and environmental data has enabled her to address both local and global scientific issues. This interdisciplinary approach, straddling earth and environmental sciences, has allowed Oplinia Hieke to contribute significantly to the understanding of earth systems. Her colleagues and students remember her as a person of remarkable organizational skills, extraordinary integrity, intellectual coherence, and compassion (de Ceglia, 2007). Such qualities have been fundamental to her ability to foster collaborations with both Italian and international research groups. She was widely appreciated also for her ability to instil

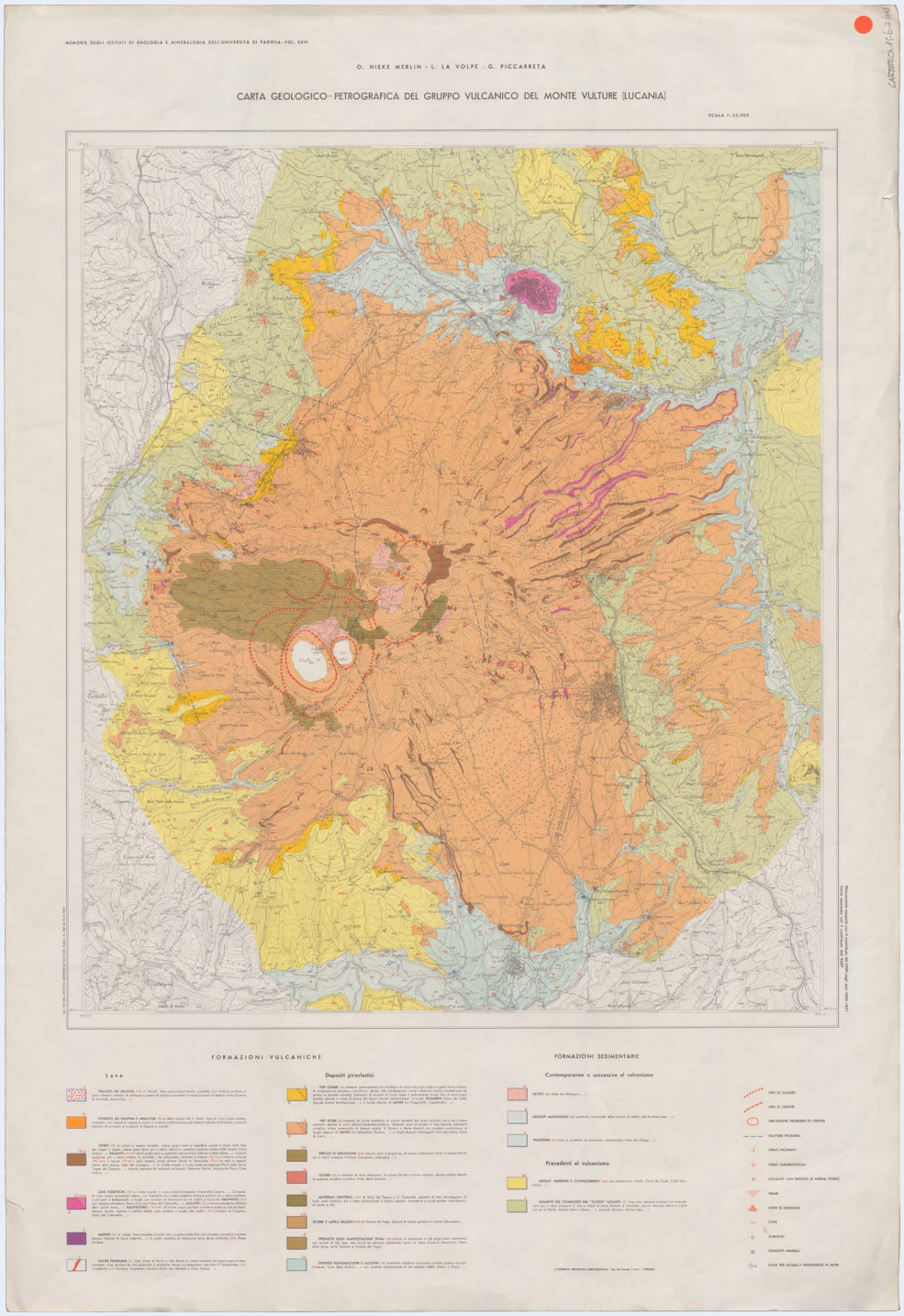


Figure 6. *Geological-petrographic map of the Monte Vulture volcanic group (Hieke Merlin, 1967).*

a passion for scientific research in those she mentored, nurturing their curiosity, and fostering an environment of rigorous scholarship. Oplinia Hieke's legacy endures in the academic institutions she shaped, the scholars she mentored, and her significant contributions to the fields of petrology, volcanology, and environmental geoscience.

2.5.3. The Merlin Collection

In addition to her extensive scientific achievements, Oplinia Hieke was closely associated with the Merlin Collection, a private assemblage of 138 artifacts primarily consisting of Greek, Italic, and local ceramic works, collected by Oplinia and her husband. The collection also includes a smaller number of bronzes, glass objects, coins, and items from prehistoric and protohistoric contexts (Menegazzi, 2013; 2020). The earliest documentation of the collection dates to 1970, when Michelangelo Merlin formally reported its existence to the Provincial Archaeological Museum of Bari. In late 1971, the Italian Ministry of Public Education officially recognized the collection for its exceptional artistic and archaeological value. When Hieke relocated to Venice in 1973, the collection was transferred as well, ultimately reaching its destination in Padua in 1983. Following Hieke's passing in May 2006, the Board of Directors of the University of Padua announced that she had bequeathed the entire collection to the university. Her generous donation is now permanently housed in the galleries of the Museum of Archaeological and Artistic Sciences. This final act of cultural patronage reflects Hieke's enduring commitment to the advancement of knowledge, not only in the geological sciences but also in the broader realm of human history and material culture. The Merlin Collection stands today as a testament to her vision of science and education as deeply interconnected, transcending disciplinary boundaries.

3. Discussion and conclusion

Despite the wide geographical, temporal, and cultural gaps that separate these five geoscientists, in addition to their differences, we can also outline some common features.

Martine de Bertereau was born into an aristocratic and economically well-to-do family of mining heritage and married a noble and famous mining engineer. She was able to take advantage of her status, both in terms of education and economic resources needed for the mining research she conducted with her husband. In contrast,

Mary Anning was born into a poor family and received no formal scientific education. Like Martine de Bertereau, Maria Matilda Ogilvie was born into a wealthy family that enabled her to receive an excellent university education, although she (as well as Martine and Mary Anning) never pursued an academic career.

Mary Anning did not publish the results of her findings, many of which were instead "exploited" and published by male scientists without hardly giving Mary due recognition. On the contrary, despite living in an earlier time, Martine managed to publish the results of her discoveries. Her works were intended to leave a written account of all the mineral deposits in France and to obtain financial recognition for herself and her husband.

Some of these pioneers were women of science ahead of their time in their respective countries, such as Martine in 17th century France, when mining research was not yet widely recognised and appreciated, and the figure of a female mining engineer was an absolute rarity. Mary Anning collected fossils in the first half of the 19th century England, when palaeontology was taking its first steps as an independent discipline, and it was highly unlikely to conceive of a young woman hunting for fossils on the beach. Despite very limited financial and educational resources, Mary Anning succeeded in discovering extraordinary fossil specimens, and can rightfully be regarded as a pioneer of modern palaeontology. In the second half of the 19th century, Maria Matilda Gordon engaged in an activity, geological surveying, that is still often considered a male prerogative, and that was very difficult for a woman to undertake alone. She worked without a geological guide, and over time earned the appreciation of eminent scientists.

Being women, these pioneers encountered various prejudices and obstacles. In particular, Martine de Bertereau has been remembered as the travelling companion and secretary of her husband, the mining engineer Baron de Beausoleil, and as the editor of the memoirs of their mining explorations. Her resourcefulness and courage in tackling typically male ventures, particularly in the 17th century customs, were not appreciated and, on the contrary, she was denigrated and accused of witchcraft, based on the alchemical methods employed in their explorations. Despite Mary Anning's name and discoveries being mentioned on several occasions at meetings of the Geological Society of London, she was not permitted to attend any of them, even as an auditor, because she was a woman. It's worth noting that the Geological Society did not admit women as members until 1919, nearly 100 years after its founding. Similarly, Maria Matilda Ogilvie was denied admission to courses at the University of Berlin because she was a woman. Despite this, she succeeded in the research field of geology. Her research remained in the shadow for a long time because she never held an academic position, but always worked independently.

Although little is known about Maria Klenova's family background, the available biographical documentation suggests that she came from a middle-class family that allowed her to receive an academic education. Throughout her career, she was a passionate and insightful researcher who remained true to the ideals of the 1920s, rejecting social and scientific views that conflicted with her own beliefs. At the same time, she demonstrated teaching perseverance, integrity, respect, and tolerance towards her colleagues, encouraging their scientific development. Her determination and profound knowledge of marine geology set an example for many women in a time of great historical change, marked by the decline of imperial Russia, the collapse of the tsarist autocracy, the First World War, the Russian Revolution (1917), and the subsequent civil war (1918-1922). Despite the highly ideological nature of Stalinist and post-Stalinist science, when research was often closely monitored for political reasons, Klenova succeeded in maintaining her influence within the academic community.

One notable common element among our pioneers is that no less than four out of five were married to male scientists working in the same (Martine de Bertereau, Maria Klenova) or a different (Maria Matilda Ogilvie Gordon and Oplinia Hieke) scientific field. Often their husbands have been supporting figures in their scientific research, either directly, as fellow researchers (e.g., Martine), or by spurring and motivating their wives to persevere in their work (e.g., Maria Matilda). Among the five, Mary Anning had no husband and acted independently, relying on the friendship and collaboration of many other women (Cofano and De Ceglie, 2025a). Moving forward in time to almost the present day, Oplinia Hieke lived and worked primarily in the second half of the 20th century, so that her path might have been easier than that of female scientists of the past. She grew up in a middle-class family in northern Italy, a region where women generally held a more prominent role than in the South of the country. Nevertheless, her birth surname, Hieke, has always been associated with that of her husband, Merlin, even in scientific publications, as indeed was the custom among female scientists of her generation. This is also the case with Maria Matilda, who is usually remembered and recognized by her husband's surname, Gordon, instead of her birth surname, Ogilvie.

These women, who succeeded in balancing research, family, and social commitments, can be considered role models for young women aiming at pursuing a career in Earth Sciences. Nowadays, women are still in the minority in the scientific field, and there is still a long way to go. The first prejudice to overcome is the belief that women are less suited than men for STEM disciplines (Science, Technology, Engineering, and Mathematics). In fact, according to a recent report by the MUR (2024), only 39.2% of STEM students in Italy are women, compared to 60.8% men. Although women earn over 42% of PhDs in Italy (men account for 58%), the gender gap widens

progressively throughout academic careers, increasing as top positions are reached: among full professors, there are only 37 women for every 100 men.

The stories of the five women described in this article should not be considered exceptional cases, but rather those of women gifted with the talent of a firm belief in their own abilities. Their experiences demonstrate that Science is genderless and should encourage young people to pursue a scientific career.

Acknowledgements. The authors would like to thank the JGSG Associate Editor, Giuseppe di Capua, for handling the manuscript, and the reviewers, Daniela Ruberti and Marco Pantaloni, for their helpful comments and suggestions.

References

Anning M., (1839). Note on the supposed frontal spine in the genus Hydobus. The Magazine of Natural History, conducted by Edward Charlesworth, Longmans, London, 3, 605. https://www.biodiversitylibrary.org/item/19444#page/641/mode/1up (accessed 20 October 2025).

Argentieri A., (2020). La Dama delle Dolomiti. Maria Matilda Ogilvie Gordon (1864-1939). Geologia e emancipazione femminile in Europa fra il XIX e il XX Secolo. Geologicamente, 2, 75-76. https://www.geologicamente.it/267/geologicamente-numero-2.html (accessed 20 October 2025).

Bailey E.B., (1939). Maria Ogilvie Gordon, D.B.E., Nature, 144, 142-143. https://doi.org/10.1038/144142a0.

Barash M.S., (2019). Maria Vasilyevna Klenova: Science and Life. ИСТОРИЯ НАУКИ. ОКЕАНОЛОГИЯ (History of Sciences). Retrieved from https://www.researchgate.net/publication/335602862_Maria_Vasilyevna_Klenova_Science_and_Life (accessed 20 October 2025).

Bauer G., (1556). De Re Metallica, libri XII. Basel, Switzerland.

Bonatti E., and Crane K., (2012) Oceanography and women: Early challenges. Oceanography, 25(4), 32-39. https://doi.org/10.5670/oceanog.2012.103.

Buckland W., (1829a). XI.-On the Discovery of a New Species of Pterodactyle in the Lias at Lyme Regis. Transactions of the Geological Society of London, 3(1), 217-222. https://doi.org/10.1144/transgslb.3.1.217.

Buckland W., (1829b). XII.-On the Discovery of Coprolites, or Fossil Fæces, in the Lias at Lyme Regis, and in other Formations. Transactions of the Geological Society of London, 3(1), 223-236. https://doi.org/10.1144/transgslb.3.1.223.

Buckland W., (1836). Geology & Mineralogy, Considered with Reference to Natural Theology, Volume I.

Burek C.V., (2005). Who were they? The lives of geologists. 5. Dame Maria Matilda Ogilvie Gordon – A Britisher – and a woman at that (1864-1939). Teaching Earth Science, 30(4), 42-44. Retrieved from https://www.researchgate.net/publication/30067619_Dame_Maria_Matilda_Ogilvie_Gordon_A_Britisher_and_a_woman_at_that_1864-1939 (accessed 20 October 2025).

Burek C.V., and Higgs B., (2007). The Role of Women in the History of Geology. Geological Society, London, Special Publications, 281. https://doi.org/10.1144/SP281.0.

Charlesworth E., (1839). On the fossil remains of a species of Hybodus, from Lyme Regis. The Magazine of Natural History, 3, 242-248. Retrieved from https://www.biodiversitylibrary.org/item/310741#page/10/mode/1up (accessed 20 October 2025).

Chermette A., (1985). Martine de Bertereau (1590-1643), une femme ingénieur des mines au XVIIe siècle. Bulletin mensuel de la Société linnéenne de Lyon, 54(10), 69-80. https://www.persee.fr/doc/linly_0366-1326_1985_num_54_10_10720 (accessed 20 October 2025).

Chevalier T., (2010). Remarkable Creatures: A Novel. Penguin.

Cofano A., and De Ceglie R., (2025a). Fossils, drawings and letters. Women's contribution to the development of early 19th century geosciences. Rendiconti Online della Società Geologica Italiana, 66, 2-14. https://doi.org/10.3301/ROL.2025.08.

Cofano A., and De Ceglie R., (2025b). Monsters and dragons of the past: the ichthyosaur of Mary Anning. Journal of Geoethics and Social Geosciences, 3(Special Issue), 1-25. https://doi.org/10.13127/jgsg-83.

Creese M.R.S., (1996). Maria Ogilvie Gordon (1864-1939). Earth Sciences History, 15(1), 68-75. https://doi.org/10.17704/eshi.15.1.u422363m32632kg8.

Davis L.E., (2012). Mary Anning: Princess of Palaeontology and Geological Lioness. The Compass: Earth Science Journal of Sigma Gamma Epsilon, 84(1), 57-88. https://doi.org/10.62879/c20182498.

de Bertereau M., (1627). Diorismus verae Philosophiae de materia prima lapidis. Jean Martel Publisher, Béziers, France. Retrieved from https://archive.org/details/bub_gb_QMRMzj-1_2EC/page/n7/mode/2up (accessed 20 October 2025).

de Bertereau M., (1632). Véritable declaration faite au Roy et à nos seigneurs de son Conseil des riches et inestimables trésors nouvellement découverts dans le Royaume de France. Paris, France. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k15113853 (accessed 20 October 2025).

de Bertereau M., (1640). La Restitution de Pluton, à Monseigneur l'Eminentissime Cardinal de Richelieu. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k325771d (accessed 20 October 2025).

de Ceglia F.P., (2007). Scienziati di Puglia. Secoli V aC-XXI dC. Bari, Mario Adda Editore, pp. 589-591.

Descoqs A., (1920). La Bretagne minière et les prospections du Baron et de la Baronne de Beausoleil au XVII[e] siècle. Bulletin de la Société géologique et minéralogique de Bretagne, 1(4), 227-239. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k9691010f?rk=21459;2 (accessed 20 October 2025).

Fregola R.A., Maiorano P., Micheletti F., Sabato L., and Zucchi M., (2024). Learning from the pioneer women in Geosciences. ABSTRACT BOOK – Congresso congiunto SGI-SIMP "Geology for a sustainable management of our Planet", Bari, 2-5 September 2024, 803. https://doi.org/10.3301/ABSGI.2024.02.

Gage M.J., (1883). Woman as an inventor. The North American Review, 136(318), 478-489. Retrieved from https://ccdl.claremont.edu/digital/collection/p15831coll7/id/940 (accessed 20 October 2025).

Gobet N., (1779). Les anciens minéralogistes du royaume de France, 1, 259-451. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k86258x/ (accessed 20 October 2025).

Hieke Merlin O., (1967). I prodotti vulcanici del Monte Vulture (Lucania). Memorie degli Istituti di Geologia e Mineralogia dell'Università di Padova, 26(7), 1-70. Retrieved from https://phaidra.cab.unipd.it/view/o:450000 (accessed 20 October 2025).

Hieke Merlin O., Longo Salvador G., Menegazzo Vitturi L., Molinaroli E., Pistolato M. et al. (1989). Major element geochemistry of sediments from the Ross Sea, Antarctica. Bollettino di Oceanologia Teorica ed Applicata, 7, 83-96.

Kenny N., (2024). «Que la France me recognoisse ce que je suis»: mais qui étaient au juste Jean du Chastelet et Martine de Bertereau, baron et baronne de Beausoleil? In Desarbres P.-V., Ferrer V., and Tarrête A., (Eds.), L'écriture de soi à la Renaissance. Proceedings of the Conference «L'Écriture de soi à la Renaissance», 6[th]-7[th] April 2023, Paris, France. Retrieved from https://ora.ox.ac.uk/objects/uuid:3dcdfd63-f624-4829-9a5a-59ced9a6952d (accessed 20 October 2025).

Klenova M.V., (1948). Geology of the Sea (Geologiya morya). Uchpedgiz, Moscow.

Klenova M.V., (1960). Geology of the Barents Sea, Academy of Sciences USSR.

Klenova M.V., (1975). The Geology of the Atlantic Ocean. Moscow: Science.

Kölbl-Ebert M., (2009). How to Find Water: The State of the Art in the Early Seventeenth Century, Deduced From Writings of Martine de Bertereau (1632 and 1640). Earth Sciences History, 28(2), 204-218. https://doi.org/10.17704/eshi.28.2.3675823j24h9uv9r.

Menegazzi A., (2013). La Collezione dei coniugi Michelangelo Merlin e Oplinia Hieke: da raccolta privata a museo pubblico: nota preliminare. Eidola: International Journal of Ancient Art History, 10, 31-40.

MUR – Ministero dell'Università e della Ricerca (2024). Focus "Le carriere femminili in ambito accademico. Elaborazioni su banche dati MUR, DGPSS, Ufficio VI, Servizio

Statistico. https://ustat.mur.gov.it/media/1276/focus_carrierefemminili_universit%C3%A0_marzo2024.pdf (accessed 20 October 2025).

Ogilvie Gordon M.M., (1900). The Origin of Land-Forms through Crust-Torsion. The Geographical Journal, 16 (4), 457-469. https://doi.org/10.2307/1774327.

Ogilvie Gordon M.M., (1927). The Gröden, Fassa and Enneberg areas in the South Tyrolean Dolomites. Geologische Beschreibung mit besonderer Berü cksichtigung der Ueberschiebungscheinungen. Abhandlungen der Geologischen Bundesanstalt Wien, 24(1,2). Retrieved from https://phaidra.univie.ac.at/detail/o:1374254 (accessed 20 October 2025).

Ogilvie Gordon M.M., (1928). Guide for Geological Tours in the South Tyrolean Dolomites. L. Waldmann, Erlä ut Exkurs. Deutsche Geol. Ges. Wien.

Ogilvie Gordon M.M., (1934). Geologie von Cortina d'Ampezzo und Cadore. Jahrbuch der Geologischen Bundesanstalt, 84(1-4), 59-215. Retrieved from https://opac.geologie.ac.at/ais312/dokumente/JB0841_059_A.pdf (accessed 20 October 2025).

Owen R., (1840). A description of a specimen of the Plesiosaurus macrocephalus, Conybeare, in the collection of Viscount Cole, M.P., D.C.L., F.G.S., &c. Transactions of the Geological Society, London, 5, 515-535. https://doi.org/10.1144/transgslb.5.3.515.

Rossiter M.W., (1982). Women Scientists in America. Volume 1: Struggles and Strategies to 1940. Johns Hopkins University Press.

Rossiter M.W., (1993). The Matthew Matilda Effect in Science. Social Studies of Science, 23(2). https://doi.org/10.1177/030631293023002004.

Torrens H., (1995). Mary Anning (1799-1847) of Lyme; 'the greatest fossilist the world ever knew'. The British Journal for the History of Science, 28(3), 257-284. https://doi.org/10.1017/S0007087400033161.

Valderrama I.M.P., and Pérez-Pariente J., (2012). Alchemy at the service of mining technology in seventeenth-century Europe, according to the works of Martine de Bertereau and Jean du Chastelet. Bulletin for the History of Chemistry, 37(1), 1-13. Retrieved from https://www.ideals.illinois.edu/items/134893 (accessed 20 October 2025).

Vincent A., (2020). Reclaiming the memory of pioneer female geologists 1800-1929. Advances in Geosciences, 53, 129-154. https://doi.org/10.5194/adgeo-53-129-2020.

Vincent P., and Benson R.B.J., (2012). *Anningasaura*, a basal plesiosaurian (Reptilia, Plesiosauria) from the Lower Jurassic of Lyme Regis, United Kingdom. Journal of Vertebrate Paleontology, 32(5), 1049-1063. https://doi.org/10.1080/02724634.2012.686467.

Wachtler M., and Burek C.V., (2007). Maria Matilda Ogilvie Gordon (1864-1939): a Scottish researcher in the Alps. Geological Society, London, Special Publication, 281, pp. 305-317. https://doi.org/10.1144/SP281.20.

Welch E., (1967). Lady Silvester's tour through Devonshire in 1824. Devon and Cornwall Notes and Queries, 30, 313.

Zonn I.S., Kostianoy A.G., Semenov A.V. (2017). Klenova, Mariya Vasilievna (1898-1976). In The Western Arctic Seas Encyclopedia. Encyclopedia of Seas. Springer, Cham. https://doi.org/10.1007/978-3-319-25582-8_110049.

Sitography

Argentieri A., (2013). La dama delle Dolomiti: Maria Matilda Ogilvie Gordon (1864-1939) – Geologia e emancipazione femminile in Europa tra il XIX e il XX secolo. https://www.geoitaliani.it/2013/04/la-dama-delle-dolomiti-maria-matilda.html (accessed 20 October 2025).

Association Galène de sauvegarde du patrimoine minier de Pont-Péan Website. Histoire de la mine de Pont-Péan de la découverte à l'arrêt de l'exploitation: https://www.galene.fr/index.php?frame=histoire (accessed 20 October 2025).

Bressan D., (2011). A women geoscientist in the Dolomites: Maria Matilda Ogilvie Gordon. http://historyofgeology.fieldofscience.com/2011/06/women-geoscientist-in-dolomites-maria.html (accessed 20 October 2025).

Cudennec J.P., Pont-péan au fil du temps: http://envor2004.free.fr/crbst_1.html (accessed 20 October 2025).

Dominus S., (2019). Women Scientists Were Written Out of History. It's Margaret Rossiter's Lifelong Mission to Fix That. Women in Science, Smithsonian Magazine: https://www.smithsonianmag.com/science-nature/unheralded-women-scientists-finally-getting-their-due-180973082/ (accessed 20 October 2025).

Focaccia M., Scienza a Due Voci. Le donne nella scienza italiana dal Settecento al Novecento. Hieke Merlin Oplinia: https://scienzaa2voci.unibo.it/biografie/77-hieke-merlin-oplinia (accessed 20 October 2025).

Menegazzi A., (2020). Giornata Internazionale della donna 2020. Dalla storia della terra ai vasi greci: Oplinia Hieke collezionista di antichità. Centro per i Musei Università di Padova: https://www.musei.unipd.it/it/museo-scienze-archeologiche-darte-giornata-internazionale-donne-2020 (accessed 20 October 2025).

Puminov A., (2025). Первопроходец морских глубин. https://www.peoples.ru/science/geologist/maria_klenova/ (accessed 20 October 2025).

Shirshov Institute of Oceanology of Russian Academy of Sciences. https://ocean.ru/en/ (accessed 20 October 2025).

*Corresponding author: **Rosa Anna Fregola**

e-mail: rosaanna.fregola@uniba.it