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A scientific outsider: Astrid Cleve von Euler and her passion for research

(1) Introduction

By successfully defending her Ph.D thesis in botany in 1898, Astrid Cleve (b. 1875) became Sweden's first female doctor of science. She was introduced to science at an early age by her father Per Teodor Cleve, who was an acclaimed professor of chemistry, and devoted herself to continuing his work on diatoms (siliceous algae). As Sweden's foremost authority on the subject, she compiled an extensive diatom flora during the 1940s and became a titular professor in 1955.

Cleve's careerpath, however, was anything but straight. Once a Ph.D, she was rebuffed by institutionalised science and, firmly dedicated to doing research, sought other means. This paper is a result of my initial work on a Ph.D thesis on Cleve as scientist, amateur researcher and woman, and it will focus on how she pursued her passion for research.

(2) Cleve's student career

As most other girls who chose to pursue higher education in Sweden around 1900, Cleve came from an academic home.¹ Swedish women gained access to higher education in 1870, when they were given the right to sit the matriculation exam required for university studies. Initially they could only study at the medical faculty, but in 1873 all faculties except divinity were opened to female students.² Cleve's mother Alma was the third female student in Sweden and she became a writer and a teacher. She matriculated in 1873 and married professor P.T. Cleve a year later. They had three daughters, who were all tutored by their mother, as state secondary schools were still closed to girls.³

Astrid also had a physical link to the academy, as her father possessed an apartment above the chemistry laboratory while a professor at Uppsala University between 1874 and 1904. Living there with his family, his daughters literally grew up within the walls of the academy.⁴

P.T. Cleve was a liberal who actively encouraged the idea of women in the academy. In 1883, he conferred the doctor's degree on historian Ellen Fries, Sweden's first female Ph.D, and proclaimed that it was a sign of civilisation and cultural progress that women were allowed to attain higher positions in society.⁵ Proving his words in action, he made his own contribution to this progress by encouraging and supporting his daughter in her academic endeavours. In 1888, he brought her along on a research trip to Gotland, where her interest in botany was founded. Following in her father's footsteps, she was particularly eager to learn about diatoms and later chose chemistry as her second major at university.⁶

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¹ The economic and social backgrounds of Swedish female students at the end of the 19th century have been studied by Tord Rönholm in his dissertation *Kunskapens kvinnor: Sekelskiftets studentkor i mötet med den manliga universitetsvärlden* (Umeå, 1999), pp. 46–49.

² Greta Wieselgren, *Den höga tröskeln: Kampen för kvinnas rätt till ämbete* (Lund, 1969), pp. 16–17.

³ *Svenska kvinnor i offentlig verksamhet*, ed. N. S. Lundström (Uppsala, 1924), p. 75; 70 år med kiselalger, TV interview with Astrid Cleve von Euler, 31 Oct. 1961.

⁴ Astrid Cleve von Euler, "Från min barndoms och ungdoms Uppsala", in *Hågkomster och livsinytryck XVIII*, ed. Sven Thulin (Uppsala, 1937), p. 161.

⁵ Ann-Sofie Ohlander, "En utomordentlig balansakt: Kvinnliga forskarpionjärer i Norden", *Historisk tidskrift* 1987:1 (Stockholm), p. 2.

⁶ Astrid Cleve, "Äventyr i ankdam: En vetenskaplig krönika" (manuscript, 1962/1967), Uppsala University Library, p. 1 a.

After the trip to Gotland, Cleve spent ten years studying hard. She matriculated unusually young, only sixteen years old, and immediately continued her studies at Uppsala University. Her bachelor's degree was completed in 1894 and she commenced her career as a diatom expert a year later with the treatise *On Recent Freshwater Diatoms from Lule Lappmark in Sweden*, published by the Royal Swedish Academy of Sciences. In May 1898, she became Sweden's first female doctor of science, with a dissertation on the influence of living conditions on the growth of certain plants, entitled *Studier öfver några svenska växters groningstid och förstärkningsstadium*.⁷

Cleve chose to study science for her own amusement, describing herself as having a "scientific disposition". In order to pursue her interest, she desired to embark on a scientific career within the academy.⁸ Her dedication to science was also expressed in her spare time, which was mainly spent outdoors. Hiking, canoeing and biking through the Swedish countryside throughout her life, she gathered specimens and samples to examine and systematize. Her own dissertation was based on seeds gathered on a three-week trek through Lapland, and even recreational travels abroad resulted in botanical notes.

(3) Making a living

Astrid Cleve's dream of an academic career was more or less shattered when she received her dissertation grade, which was not good enough to earn her the academic title "docent". Without it, she would not be considered for employment as a lecturer at any university, a great disappointment to her and, though there is no known evidence for it, she believed that her grade had been consciously depreciated due to her gender.⁹ The year before, jurist Elsa Eschelsson had become the first Swedish woman to be awarded the title docent. After her, a full twelve female doctors passed before physicist Eva von Bahr became the second female docent in 1908.¹⁰

Lacking the coveted title, however, did not mean there were no options. Man or woman, docent or not, there were more Ph.Ds than there were available positions at the universities, and many had to find work elsewhere. Most became teachers at secondary schools, while others found employment at museums, institutes, libraries or in industry.¹¹

Cleve soon found a job as a chemistry assistant at the private Stockholm College, a position she enjoyed. Unfortunately, it did not pay sufficiently to guarantee financial security, and though she also taught chemistry at a secondary school for girls, she soon had to find different means of supporting herself.¹² In 1902 she married a colleague, German physicist Hans von Euler-Chelpin. That solved Cleve's financial problems, and even better, she could still do research as her husband's unpaid assistant.¹³ Since von Euler conducted research on organic and physical chemistry, Cleve had both the interest and skill required and the collaboration was initially successful. The couple had co-published several works by the time von Euler was appointed professor of chemistry in 1906, but then a few years of scientific silence from Cleve followed.¹⁴

⁷ Maj-Britt Florin, "Astrid Cleve von Euler", *Svensk Botanisk Tidskrift* 62 (Uppsala, 1968), p. 549. In the years 1891–95, 692 individuals matriculated in Sweden on average per year. 27 of that number were women and the students' mean age was 19.26 years. *Sveriges land och folk*, ed. Gustav Sundbärg (Stockholm, 1901), pp. 298–299, 306.

⁸ *70 år med kiselalger*.

⁹ Hanna Markusson Winkvist, *Som isolerade öar: De lagerkransade kvinnorna och akademien under 1900-talets första hälft* (Stockholm/Stehag, 2003), p. 108; Heng, "Kvinnlig jubeldoktor bonde många år: Skapar stor flora över kiselalger", *Stockholms-tidningen*, 31 Mar. 1948.

¹⁰ Markusson Winkvist, *Som isolerade öar*, p. 232.

¹¹ Markusson Winkvist, *Som isolerade öar*, p. 108; Thomas Kaiserfeld, *Vetenskap och karriär: Svenska fysiker som lektorer, akademiker och industriforskare under 1900-talets första hälft* (Lund, 1997), p. 178.

¹² *70 år med kiselalger*; Lydia Wahlström, *Trotsig och försagd* (Stockholm, 1949), p. 168.

¹³ *70 år med kiselalger*.

¹⁴ Florin, "Astrid Cleve von Euler", p. 557.

Though she wanted to conduct research and secure a place in science for herself and her husband, it is likely that Cleve's family situation forced a change of priorities in those years.¹⁵ In 1905, she experienced a great loss as her father, whom she considered her only true supporter in life, unexpectedly died.¹⁶ Meanwhile, her own family grew with five children, born between 1903 and 1910. After the last child, however, the marriage ended in a bitter divorce, finalized in 1912.¹⁷

While von Euler went on to become a Nobel Prize winner in chemistry in 1929, the divorce left Cleve in a new financially precarious position, this time with five children to care for. She could not return to her previous position at Stockholm College, so she did what many of her fellow Ph.Ds of the time did; she became a teacher. Prioritizing supporting her family did not mean that she abandoned research, however. During her marriage she continued her studies, published a series of articles on diatoms, wrote other botanical articles and conducted diatom analyses for Quaternary geologists. Furthermore, she worked as an assistant of biology at the Swedish Hydrographical-Biological Commission.¹⁸

In the summer of 1917, the forestry industry offered Cleve what the academy would not, as she was appointed director of a newly-established research laboratory in Skoghall, 300 km west of Uppsala.¹⁹ Industrial laboratories were unusual at the time, but competition, debate on the wastefulness of the forestry industry and possibly profitable by-products motivated new investments. Skoghall's research facility was built to analyse tests necessary for the general running of the works, but also to explore new uses for the vast amount of waste and find replacement products for certain materials.²⁰

Cleve embraced her new tasks energetically, initiated thorough investigations on wood and cellulose chemistry and published several articles on her findings. Though scientifically valuable, her work produced few useful alternatives for the company to make profit from, and after five years she was fired. Her scientist's view of conducting research primarily for the sake of knowledge was deemed incompatible with the industrial imperative of economic gain.²¹

No longer a research laboratory director, Cleve moved back to Uppsala and applied for a professorship in agricultural chemistry, hoping her extensive qualifications would land her the position. Again, she was rebuffed, and again, she blamed her gender. A friend of hers, a male professor in palaeontology, had a different explanation and said that she would never be hired because it was common knowledge she would keep researching anyway.²²

(4) A Quaternary geology controversy

Judging from her list of publications, he was right, at least about the latter. Cleve continuously published texts, whether she was paid to perform or not. Her publication history during her marriage is one example, a book on wood published six years after leaving the research laboratory a second, and publications on popular science a third.²³ Another example was her commitment to Quaternary geology, which resulted in many thorough texts, though in this case, Cleve's overstepping of boundaries led to protests from leading geologists.

Cleve had no formal training as a geologist, but she had conducted diatom analyses for Swedish and Finnish Quaternary geologists since before her marriage. The Quaternary period is the youngest of the Earth's geologic time periods and is presently considered to extend from 1.6–2.3 million years ago to the present. For the geologists, fossils from the salt- and fresh-water sensitive diatoms gave important information on shoreline movements and changes in land elevation essential to their research. With

¹⁵ Astrid Cleve von Euler to Gustaf Retzius, 23 Mar. 1914, Centre for History of Science at the Royal Swedish Academy of Sciences, Stockholm.

¹⁶ *70 år med kiselalger*; Hans von Euler-Chelpin, "Per Teodor Cleve", *Kungliga svenska vetenskapsakademiens årsbok 1906*, p. 209.

¹⁷ *70 år med kiselalger*; Cleve von Euler to Retzius, 23 Mar. 1914.

¹⁸ *Svenskt biografiskt lexikon* 8 (Stockholm, 1929), p. 649; Florin, "Astrid Cleve von Euler", pp. 557–558.

¹⁹ *Svenskt biografiskt lexikon* 8, p. 649.

²⁰ Bo Sundin, *Ingenjörsvetenskapens tidevarv* (Stockholm, 1981), pp. 136–137, 150–151.

²¹ Sundin, *Ingenjörsvetenskapens tidevarv*, p. 151.

²² *70 år med kiselalger*.

²³ See Cleve's bibliography in Florin, "Astrid Cleve von Euler", pp. 556–564.

time, Cleve concluded that her results were being misused and entered the geological debate with her own theories.

In 1923, Cleve published a paper based on her diatom studies and reports on various geologists' findings, in which she suggested that the Scandinavian land mass had oscillated several times during the melting of the latest land ice. According to her, the movement was activated by the diminishing weight of the ice and subsided with each oscillation, similar to a pendulum losing momentum.²⁴

The response to her paper was immediate and she was met with more or less scientifically motivated scepticism. An expert on diatoms stood against trained geologists, both sides defending their field, and neither accepting the other as fully and respectably scientific. Cleve was considered lacking in geological knowledge and accused of using other people's findings arbitrarily to reach her conclusions, while she expressed disappointment with the geologists' lack of free thinking to uncover new facts. She also failed to follow the hierarchic order within the geological community, refused to accept criticism, and presented a retooling of a theory that had already been suggested by geologists and dismissed.²⁵ Cleve stood firmly by her idea, though, and after a year of discussion within the Geological Society of Stockholm, she was shut out and the Society ceased publishing her texts.²⁶

Lack of acceptance did not stop Astrid Cleve, and she continued her geological studies. In 1927, her response to a suggestion to make a national monument of an area featuring land ice remnants was published in one of Sweden's largest daily papers. Lennart von Post and Henrik Munthe, both highly influential geologists, had studied the site, and their opinion that the environment was caused by the outflow of the Ancylus lake, a great Baltic freshwater lake, lay behind the idea. Cleve supported protecting the area, but rejected the geologists' interpretation and offered a different explanation.²⁷

Initially, her article was left uncommented, but when Munthe six months later published an article reinforcing his view, she felt obligated to defend her opinion again.²⁸ This debate occurred entirely in the daily papers, and Cleve forcefully stated that she was right and accused Munthe of trying to canonise an idea for unscientific reasons.²⁹ From there on, the debate became personal, and it is made clear that there was more than knowledge at stake, but scientific credibility and the preferential right of interpretation. Munthe called her geological work "geomythological causeries" while she insists that she has acted like a proper scientist and sought the truth in an unbiased manner, unlike her opponents.³⁰

Not all Quaternary geologists were as fierce in their criticism and many expressed the utmost regard for Cleve's diatom knowledge, but her skills as a geologist were considered spotty, particularly when arguing with highly qualified geologists.³¹ Despite the many opinions that she should leave geology to trained geologists, Cleve did not abandon the subject.

In 1929, frustrated by others' lack of interest in her education and her failure to be appointed to a post commensurate with her qualifications, she decided to become a farmer and moved house again. While farming, she also taught school and continued doing research. Fifteen years later, her age and the economic instabilities of the Second World War forced her to sell her farm, and she returned to Uppsala again.³²

²⁴ Astrid Cleve-Euler, "Försök till analys av Nordens senkvartära nivåförändringar jämte några konsekvenser", *Geologiska Föreningens i Stockholm förhandlingar* 45 (1923), pp. 23–33, 102.

²⁵ Oscillation theories had also been suggested by Swedish geologists N.O. Holst (1899) and E. Antevs (1921).

²⁶ Kristina Espmark, *Vetenskapskvinnan utanför ramarna: Astrid Cleve von Euler och viljan att forska* (Uppsala, 2005), pp. 38–45.

²⁷ Astrid Cleve von Euler, "Vad var Svea älv?", *Svenska Dagbladet*, 2 Jul. 1927.

²⁸ Henrik Munthe, "När Mälaren gick kräftgång", *Dagens Nyheter*, 11 Dec. 1927.

²⁹ Astrid Cleve von Euler, "Mytbildning kring Ancylussjön", *Svenska Dagbladet*, 11 Jan. 1928.

³⁰ Henrik Munthe, "Ancylussjön en myt? Geomytologi en ny vetenskap?", *Svenska Dagbladet*, 14 Jan. 1928; Astrid Cleve von Euler, reply to "Ancylussjön en myt?" by Munthe, 14 Jan. 1928.

³¹ Gerard De Geer to Astrid Cleve von Euler, 6 May 1929, Uppsala University Library; Sven Stolpe, *Tål ni höra mer?* (Stockholm, 1974), pp. 108–109; Maj-Britt Florin to Astrid Cleve von Euler, 23 Nov. 1947, Uppsala University Library.

³² *70 år med kiselalger.*

(5) Quaternary geology and anthropology

Cleve's commitment to Quaternary geology led to an interest in anthropology, and from 1929 until her death she published works on the human population of Scandinavia during and after the latest ice age. Though her views did not stir up the anthropologists as they did the geologists, she had difficulties publishing those as well, until *Dagsposten*, house organ of the pro-German party *Sveriges Nationella Förbund*, published two series of articles in 1949 and 1950.

Her theories on human races and their evolution and migrations in Scandinavia eventually led to a book entitled *Istider och människor i Norden (Ice Ages and Human Population in Scandinavia)*, published by the author in 1960. Here she concludes that there is a natural differentiation among humans resulting in various races, and that the relative isolation of Scandinavia has enabled "an original, anthropologically advanced population".³³

It is likely that her theories on racial biology were linked to her political views, but also to a general political and scientific interest in eugenics in Sweden at the time, manifested by the State Race Biological Institute in Uppsala, founded in 1922.³⁴ Cleve herself became politically active for the conservatives while working in industry, but disappointment with her party and a pro-German inclination oriented her toward National Socialism. In a letter to a close friend in 1944, she calls herself "a Nazi", and openly remained so until her death, much to the dismay of her family.³⁵

Though Cleve maintained a scientific stance, there is thus reason to suspect that her research outside her expert fields was more affected by personal opinion. This becomes more blatant further on, as another part of her private life seems to seep into her scientific findings: Religion. Before treating that, however, I shall go back a few years and focus on Cleve as a diatom expert.

As Sweden's most respected diatom researcher, she was asked to gather her knowledge in a diatom flora, which she began to do around 1940. It bore the title *Die Diatomeen von Schweden und Finnland* and was published in five parts between 1951 and 1955. When this crowning achievement of her scientific career was complete, Astrid Cleve was awarded two major distinctions for her contribution to science: The title of professor and the Linnaeus Award from the Royal Swedish Academy of Sciences.³⁶ However, the attention she received for her diatom expertise did not diminish her interest in Quaternary geology and anthropology.

In 1949, Cleve converted to Catholicism. Until then, there are no signs of her being particularly religious, but according to her Catholic son-in-law, Sven Stolpe, she was looking for security.³⁷ Cleve herself writes in 1958 that she has learned one thing above all, which is that life is hard and it is impossible to find true happiness. Refusing to accept that as the end of the story, she turned to seek happiness in God.³⁸

With the pamphlet *Detta är Eden: Två bilder (This is Eden: Two Pictures)*, published in 1962, Cleve claimed to have found the worldly location of the biblical Paradise. Inspired by Franz von Wendrin's books *Die Entdeckung des Paradieses* (1924) and *Die Entzifferung der Felsenbilder von Bohuslän* (1926), she suggested that a rock carving on the Swedish west coast, generally considered as originating in the Bronze Age, is actually a map from before the latest ice age, depicting the rivers of Eden. By matching the map to the northern part of Germany, as the landscape would have looked approximately 60,000 years ago, Cleve then pinpoints the exact site. The theory is more extensively discussed in an unpublished manuscript entitled "Den äldsta sannsagan" ("The Oldest True Story"), where she explains how the biblical story of Eden and the giants of Genesis are in fact true stories originating from the ice age and from a Scandinavian race moving southward as the ice spread.³⁹

³³ Astrid Cleve, *Istider och människor i Norden* (Uppsala, 1960), p. 5.

³⁴ Lennart Lundmark, "Vetenskap i rasismens tjänst", *Tvärsnitt* 24 (2002), pp. 6–9.

³⁵ Astrid Cleve von Euler to Klara Johansson, 21 Apr. 1944, National Library of Sweden, Stockholm; Sven Stolpe, *Memoarer 3: Krigstid* (Stockholm, 1976), pp. 15–16.

³⁶ *Geologiska Föreningens i Stockholm Förhandlingar* 80 (1958), p. 507.

³⁷ Stolpe, *Tål ni höra mer?*, p. 113; Stolpe, *Memoarer 3*, pp. 15–16.

³⁸ Astrid Cleve von Euler, "Religion kan inte undvaras", in *Vad livet lärt mig*, ed. Eric Leijonacker (Stockholm, 1958), pp. 63–64.

³⁹ Astrid Cleve von Euler, *Detta är Eden: Två bilder* (Uppsala, 1962); Astrid Cleve, "Den äldsta sannsagan" (manuscript), Uppsala University Library.

Using the Bible as a source for scientific facts is naturally controversial, but Cleve did not think she deviated from scientific method. She considered the story of Creation a myth, but she was convinced that it was based on facts, and could therefore be used in science. She also stressed that her results in “Den äldsta sannsagan” were based on “purely scientific starting points”.⁴⁰

During the last years of her life, Cleve revisited the old struggle with the Quaternary geologists, and published two more texts, both dedicated to the geologists of Scandinavia. One defended her oscillation theory and the other presented a new interpretation of the stages of the Yoldia sea that preceded the Ancylus lake in the Baltic.⁴¹ Neither garnered a reaction and her Quaternary geology controversy ended in a monologue. Without ever publishing again, Astrid Cleve died in 1968.

(6) Summary

The purpose of this paper was to present how Astrid Cleve von Euler pursued her passion for research. As has been shown, she constantly strove to conduct research, despite limited possibilities. Her choices mainly depended on being able to provide for herself and the possibility to do research, rather than financial convenience. It was also essential that she be published, and she turned almost anywhere to get her findings into print, no matter the scientific credibility of the publisher, or if she had to publish them on her own.

Why Cleve chose to focus on Quaternary geology and anthropology when other scientists were neither willing to discuss nor accept her findings remains an unanswered question. Her last subjects were scientifically far from her first and had little in common with institutionalised science. While she considered herself fighting for the truth, misunderstood and disregarded, the scientists she demanded recognition from stopped listening to her, and her role as a female pioneer paled in comparison with her political and racial views.

That her botanical and chemical work was well respected at the same time as her geological work was much criticised suggests that she was wrong in entirely blaming her gender for her failures. While it probably did play a part, I am inclined to believe that her home, her private tutoring and her father in particular, gave her both the confidence and the lack of social skills that made it difficult for her to play by the unspoken rules intertwined with the creation of knowledge, and thus caused problems. Cleve did not compromise, she did not respect authority and she played by her own rules. Naturally, the same characteristics might very well be what kept her going despite the obstacles, rather than giving up her dream to be a scientist.

The intensity with which she desired to be a scientist was probably also a reason why she drifted from her scientific foundations over time. Once isolated from the academy, she lost colleagues, tools, sources and methods that would have assured the science of her research, leaving her to work with whatever fragments she could access.

Despite her more questionable research, Astrid Cleve was considered Sweden’s most outstanding diatom expert, and between an Eden in Germany and microscopic algae, there is a tension that makes her a highly interesting individual to study in order to deepen our understanding about the history of science.

⁴⁰ Cleve, “Den äldsta sannsagan”.

⁴¹ Astrid Cleve, *Sista biten i puzzlet: Slutord i ett par gamla stridsfrågor om skalbankar och landvågor, Nordens geologer tillägnade* (Uppsala, 1961); Astrid Cleve, “Det tvetydiga Yoldiahavet: Ett avskedsord till Nordens geologer” (manuscript, 1965), Uppsala University Library.