The introduction of lithography in Sweden

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In the history of printing, only two graphic inventions can really be linked to individuals. The first was moveable type book printing, invented by Johannes Gutenberg in Mainz in the 1460s, and the other was chemical printing – lithography - which was invented by Alois Senefelder in Munich around 1798. Gutenberg's invention was more or less a complete process, while Senefelder's invention was what could be called an open process, a process underlying the development of printing ever since 1800, including the techniques and methods of photography, photolithography, offset printing and electron beam lithography. The latter is used to produce computer chips.

The invention of chemical printing is interesting for several reasons. Its origins are relatively straight-forward; its inventor Alois Senefelder is known, as are the circumstances in which the invention was developed. The fairly simple technical process, together with its usefulness, meant that the invention was accepted fast, not to say very fast. Lithography was more or less immediately adopted for printing sheet music, illustrations, information material, job prints and maps. Practically all products in the printing business could be printed lithographically. The phases and participants in this innovative process are easy to trace. The innovative process began when Alois Senefelder asked himself if there was an affordable way for him to print his plays. Other innovators got involved at an early stage, improving and elaborating on Senefelder's methods. This development is still going on.

The principle of lithography is apparently simple. Oil attracts oil but repels water. A lithographic stone is dampened with water and printing ink is applied. The ink adheres to the surfaces that will form the printed image, while being repelled by the other surfaces. It's like magic!

HOW DOES THE LITHOGRAPHIC PRINCIPLE WORK?

The lithographic principle is based on chemical characteristics such as surface tension, polarity, hydrophobia and hydrophilia. Hydrophobic molecules repel water, while hydrophilic molecules retain it. The lithographic medium uses fatty acids that consist of long molecular chains. One end is hydrophilic, water-retaining, and adheres energetically to the stone surface, which is coated with a thin film of water even when dry. The other end is hydrophobic. In other words, the

fat molecules adhere with one end to the stone, while the other end repels water, or attracts printing ink. This is the heart of the lithographic principle. Senefelder understood the importance of getting the lithographic medium to adhere to the stone so that it was not worn off by repeated printing. The magic substance that made this possible was gum arabic. The effect of gum arabic is divided into hydrophobic and hydrophilic zones. Applied on limestone, gum arabic stabilises the stone particles. The hydrophilic arabic acid attracts the moisture of the water, which is absorbed between the particles. Thanks to its hydrophilic properties the oily lithographic medium is also emulsified and absorbed and thus retained in the stone pores.

LIMESTONE FROM SOLNHOFEN

Due to the growing demand for cost-effective production methods for printed material, many innovative people were engaged in finding various ways of improving the printing process. Four people were engaged independently of one another on limestone from Solnhofen: the pastor Simon Schmid, the author and all-rounder Alois Senefelder, the copper plate printer Michael Mettenleiter, and, lastly, the former theology student Franz Anton Niedermayer in Bavaria. These four also involved many others in their respective processes, people who in turn helped to develop the lithographic technique. Publishers and book and music sellers saw the earning potential that lay in improving the printing of their products.

TEN STEPS IN THE INVENTION OF LITHOGRAPHY

Chemical printing was invented sometime in the autumn/winter of 1797-1798. 1798 has been established as the official birth year. The inventor Alois Senefelder was born in Prague in 1771. His father was an actor there, and in 1778, he was employed at the Prince-Elector's Court Theatre in Munich. Alois had five brothers and three sisters. His youngest brother died in childhood, while the others, Theobald, Georg, Karl and Clemens were all drawn into Alois' lithographic activities. In the autumn of 1783, Alois Senefelder was enrolled at the Prince-Elector's school in Munich and moved on in 1787 to the lyceum. His preserved graduate diploma shows that he was one of the top students there. In 1789, Alois Senefelder won a scholarship to study law at the University of Ingolstadt. He spent his holidays with the family in Munich and managed to get his own plays, including *Connoisseur of Girls* and *Mathilde von Altenstein* both performed and printed. His father died in 1792, at the mere age of 48, leaving Alois' mother Catharina

Senefelder the sole provider for eight under-aged children. As the oldest son, Alois Senefelder was forced to give up his studies to support his family. This is when the history of lithography began.

The young Senefelder appears to have had a restless spirit. Although his studies would have qualified him for a post as an office clerk or similar profession, he seems to have devoted himself to a great many things alongside his law studies. The primary source of information on the early history of lithography is a book published by Senefelder in 1818, with the German title *Vollständiges Lehrbuch der Steindruckerei*, which suggests that he was interested in both chemistry and mechanics as a student. He had also, as mentioned, written plays. After a failed attempt at acting, he decided to devote himself to writing. It was hard for him, however, to get his plays printed.

It is not entirely easy to reconstruct the development of his innovation based on Senefelder's account in *Lehrbuch*, but on the whole, it proceeded as follows:

His innovation can be divided into ten steps. The first was when Alois Senefelder decided to print his own plays. Step 2 involved engraving types in steel and knocking them into a boxwood block. This would give the letters the appearance of lead types. Step 3 was to produce stereotype plates using these types. Step 4 involved learning to write backwards on copper before etching. During that process, Senefelder succeeded in producing a satisfactory correcting ink made of three parts wax and one part tallow soap, or soft soap, with the addition of carbon black and rainwater. This was when the development of chemical printing began in earnest. Step 5 required him to appropriate all the pewter plates of the household, but the result was unsatisfactory. Instead, he went on to step 6, using a limestone slab from Solnhofen in the Jurassic mountains of Bavaria. An application of sulphuric acid produced a polishable plaster surface. He rolled the surface with a mixture of thin linseed oil varnish with added Frankfurter pigment and tartar that he could write in. Senefelder had thus developed a method for making stone etchings. The seventh step on the way was when he wrote on a stone with his correction ink made of soft soap and wax before etching it with nitric acid. It worked! The acid etched less than a millimetre into the stone surface. In this way, Senefelder had produced a relief-print stone and printed using a modified copperplate press. He began receiving orders and formed a partnership with the musician and composer Franz Gleissner. For the sheet music of a song about the great fire in the village of Neuötting he designed a small vignette. This is considered to be the first printed lithographic illustration.

Writing backwards was difficult. In step 8, Senefelder developed an ink that could be transferred directly from paper to stone without the

need for any subsequent processing. This was the advent of transfer paper. Using this method he transferred an image from an aquatint of the head of Christ. This illustration is considered to be the first lithographic overprint.

Senefelder never specified which was the first image to be printed using the chemical process. It could well have been this one. The small vignette for the fire of Neuötting may also have been a chemical print. But the process was far from finalised. The ninth and crucial step was to prepare a stone with a solution of gum arabic and diluted nitric acid after writing on the stone. The printing ink was repelled by the unwritten surface, while being retained by the ink writing. Thus, chemical printing – lithography – had been invented.

The limestone slabs easily cracked if a regular copperplate press was used for printing. Senefelder, who had taken an interest in solving mechanical problems, simply devised a new form of press for the lithographic process, where the pressure on the printing surface was applied via a long bar attached at the upper end by a hinge and ending in an ink distributor, an obliquely mounted leather-clad hardwood board. The lithographic stone is placed in a wood frame fixed to the underlying bed. The idea was derived from one of his first attempts, where he had made a print using a cloth-covered board that was pulled across the printing sheet.

The entire development of his innovation was based on materials and techniques that were readily available, either in the domestic environment or in the printing houses that Senefelder had grown familiar with when printing his first plays.

THE INVENTION SPREADS

In 1799, Senefelder and Gleissner were granted privileges for all of Bavaria for 15 years. Initially, the school system and music business were particularly interested in the new printing method. In that first year, the company was visited by music publisher Johan Anton André from Offenbach outside Frankfurt am Main. He was returning from Vienna, where he had bought Mozart’s estate from his widow Constanze. He now bought Senefelder’s invention for his music printing business in Offenbach. Senefelder and Gleissner came with him and set up a lithographic printing house.

André had great plans and dispatched his brother Philip and Senefelder to London in 1801 to get a British patent. This was approved after seven months. Philip André kept Senefelder more or less under lock and key throughout the waiting time, to prevent him from revealing the secret of lithography to outsiders. Meanwhile, he conducted chemical

experiments. Philip André had also conceived the idea of printing and publishing lithographic illustrations. In 1803, he began publishing the album *Specimens of Polyautography* with contributions from artists working in Britain, including Benjamin West and Sergel's friend Heinrich Füssli.

After the London sojourn, Senefelder went to Vienna to introduce lithography there. He was granted a privilege and named his printing house Kaiserliche und Königliche privilegierte chemische Druckerei. The venture was unsuccessful, however, partly due to the war but also to Senefelder's lack of management skills.

In Munich, Alois Senefelder's brothers continued to run their lithographic business. Despite Senefelder's privilege, they sold the technology to a weekend college for further training of craftsmen and artists. The new printing house was given the grand name of Die Lithographische Kunstanstalt bei der männlichen Feiertagsschule. The artistic director was Hermann Mitterer, the first to develop Senefelder's invention by improving the lithographic printing press. He attached the mobile reamer of Senefelder's litho press in a fixed position. Instead, the print plate could be moved under the reamer with a cross wheel or winch. According to Senefelder, this was the most significant improvement of chemical printing made by anyone else. With the monthly publication of portfolios of six lithographic images, which Mitterer started in 1805, lithography was developed into a mature printing technique by the contributing artists.

Johann Anton André in Offenbach had a cousin named François Johannot, who, inspired by the British art lithographies, began printing illustrations. One of the earliest masterpieces was a *Romantic Landscape* by Matthias Koch from 1802, in lithographic crayon.

Wilhelm Reuter in Berlin was another artist who was attracted by the potential of lithography in the early days. His earliest known lithographies date from 1801. In Paris in 1803, he saw a few examples from *Specimens of Polyautography* and became even more enthusiastic. On his way back to Berlin, he met Johannot and decided to produce art prints. Johannot sent two lithographic stones to Reuter in Berlin, one polished and the other grainy. In a letter dated July 1803, he gave Reuter instructions on how to proceed. In 1804, Reuter invited a few leading artists in Berlin to contribute work to *Polyautographische Zeichnungen vorzüglicher Berliner Künstler*. This publication continued until 1808.

Probably the first article in German about the newly-invented lithographic method was about the lithographer Franz Anton Niedermayr in Regensburg. The headline was "Neuer Notendruck und

Vervielfältigung von Handzeichnungen" and it was published in 1803 in Gotha. On 9 July that year, a Swedish translation was published in Stockholms Posten, under the heading "Ny uppfinning" (New invention).

Johannot's printing house in Offenbach was described by the German museum director Gotthelf Fischer. His observations were published in an article with the heading "Ein Wort über Polyautographie", published in Leipzig in 1804. The same year, Stockholms Posten published a few summaries of Fischer's articles.

The summaries in Stockholms Posten were printed anonymously according to common practice at the time, but it is likely that they were written by a person in Stockholm, Ulric Emmanuel Mannerhjerta. After a short military career, he had moved to Stockholm, where he ran a music shop from 1803, Musikaliska Magazinet, an agent for Musikverlag Johann André in Offenbach. In 1804, Mannerhjerta went on a long journey in Europe to buy sheet music for Musikaliska Magazinet. It was on this journey that Mannerhjerta became acquainted with lithography as a printing method for music. In 1809, Mannerhjerta applied for permission to print sheet music.

However, the war councillor Olof Åhlström held an exclusive privilege for printing music since 1788. Åhlström had probably got wind of the progress of lithography from the same source as Stockholms Posten in 1803 and wasted no time in applying secretly for a renewal of his privilege. He succeeded in getting this before Stockholms Posten had published its article. His privilege was extended to 1823.

Olof Åhlström was originally an organist and composer and had been Crown Prince Gustav (IV) Adolf's music instructor. He was elected into the royal Academy of Music in 1785. In 1779, he had secured a post in Krigskollegium (the War Office) and eventually became a war councillor. To protect his business, Åhlström protested against Mannerhjerta's application, and succeeded in preventing the introduction of lithographic printing in Sweden until 1818. Mannerhjerta's application was not rejected but simply disappeared, despite some positive reactions within the bureaucracy. Finally, in 1818, it was approved, mainly thanks to the intervention of Crown Prince Charles John.

Handelstidningen published three articles on lithography in 1818, summarising a book on lithography that had been published earlier that year by Gottlob Heinrich Rapp, a merchant in Stuttgart. Concerned that there were no reliable descriptions of the new lithographic printing process, he wrote one himself – Das Geheimnis der Steindruck.

In Stockholm there was a group who were interested in lithography, who met in the home of the mining counsellor Gustaf Broling, where they conducted experiments with what was generally called stone printing. The Nationalmuseum in Stockholm has a caricature of Crown Prince Charles John with a note in brown ink: "One of the first Stone Prints in Sweden, drawn ex tempore by former Lieut. Söderberg on Marble at G.B." G.B stands for Gustaf Broling. He was a trained engraver. It is fairly understandable that a mining counsellor should take an interest in lithography. The other members of the lithography circle were Ulric Emmanuel Mannerhjerta, Lieutenant Söderberg, Count Carl Edvard Gyldenstolpe and the publisher and printer Per Adolf Granberg.

The newspaper Inrikes Tidningar wrote about their experiments in an article on "Lithographi" on 18 June, 1813, alongside the announcement of a six-week armistice from the military headquarters in Stralsund. In addition to an outline of the lithographic process, the article contained a bibliography. It also called for suggestions of Swedish stone that would be suitable for lithographic printing.

However, the lithography group was not sufficiently established on the art scene in order to promote its cause, and Åhström still had his privilege to print music using obsolete methods.

Instead, lithographic printing was introduced in Sweden thanks to a royal initiative. The road from Munich went via Berlin and Copenhagen. In Berlin, a resourceful officer, Major von Reiche, had founded a lithographic institute with the royal departments as its customers. By 1818, it had already been incorporated with the German general staff, and in 1820 it was renamed "Königlich Lithographisches Institut am Kriegsministerio". Von Reiche also ran a lithographic training institute.

During the Prussian war against Napoleon, Major von Reiche had led a volunteer rifle battalion. The Swedish army under Crown Prince Charles John had also taken part in the battle.. This must have somehow prompted Charles John's right hand man Louis De Camps to summon the lithographers Ludwig Fehr and Carl Müller from Berlin. They arrived in Stockholm from Copenhagen in late December 1817. Fehr and Müller officially started their printing house in April 1818. Fehr left after only a year, and later opened a lithographic printing house in Christiania, as Oslo was called in those days.

One person who was prepared for the arrival of the new lithographers was Fredrik Boije af Gennäs, who had started a publication, *Konst- och nyhetsmagasin för medborgare av alla klasser*, in 1818, also called Boijes Magasin. This periodical was published in Stockholm in 1818-1844 and featured regular fashion reports from the major European cities. The illustrations in the first three years were lithographic prints,

by Fehr & Müller the first year and by Carl Müller from 1819. After 1823, when the publication was renamed *Magasin för Konst och Mode*, it again included lithographic prints.

But Boije and his readers did not consider the quality of the lithographic prints to be satisfactory. It was more expensive for Boije to use lithography than to etch the illustrations himself. Most fashion illustrations were made by Fredrik Boije, initially using lithographic ink, and later as watercoloured line etchings. If we study the lithographies carefully in side lighting, we can see marks after the stone edges. These are often very uneven, suggesting that the printers have reused stones that had cracked while making previous prints. Occasionally the print is uneven. Fehr & Müller obviously had problems printing larger editions.

After Fehr's departure from Stockholm, Carl Müller was the sole proprietor of the printing house. He continued the business, with prolific publishing of music, newspaper supplements and art lithography. His skills improved constantly, which may have contributed to making Carl Müller Stockholm's most successful lithographic printer. In 1819, he published six lithographic views of Stockholm, drawn by Fredrik Emmanuel Werner.

After five years, in 1823, Fredrik Boije changed the name of his magazine again, from *Konst- och Nyhetsmagasin för medborgare af alla klasser* to *Magasin för Konst, Nyheter och Moder*. In the new series, Boije resumed publishing lithographies printed by Carl Müller, for instance a floating bath house designed by the architect Fredrik Blom.

Müller developed his printing operation to produce increasingly advanced products. He began experimenting with zinc lithography, i.e. replacing the limestone slabs with zinc plates. He had been printing maps for the military from an early date. In 1830, Müller applied for a loan from a manufacturing fund for innovative development. His application mentions that he studied and worked in Munich for Alois Senefelder, and later at Major von Reiches lithographic institute in Berlin. From there, he was summoned to Sweden by General De Camps to establish a lithographic printing house in Stockholm together with Ludwig Fehr. With assistance from friends he was able to take over the printing house in 1819 and introduce improvements, especially with regard to zinc lithography, where zinc alloy plates are used instead of limestone slabs. Müller needed to invest in a rolling mill to produce zinc plates, and a press, and therefore needed to borrow 4,000 Riksdaler Banko. He had letters of recommendation from Fredrik Boije and General Johan Peter Lefrén, known as a military theorist and successcul amateur printer. *Magasin för Konst, Nyheter och Moder*, No 5, 1830, published *Ett landskap, aftryck ifrån Zinkplåt*, a landscape printed from a

zinc plate by Carl Müller. This picture was probably the first zinc lithography published in Sweden.

And this is when the greatest mystery in Swedish lithographic history took place. On 23 October, 1830, Müller went to Motala to order a new press for printing zink plates from Motala Verkstad. He was due back in Stockholm within eight or ten days. But he never returned. It was assumed that he fled, but the fact that he had not collected the loan before his departure would belie this. Another explanation is that Müller had an accident. After his disappearance, Carl Müller's widow inherited the business and continued to operate it for a few years.

If Carl Müller had been able to pursue his activities, his printing house would probably have become the leading lithographic business for many years. Instead, others took over, including Carl von Schéele, Johan Petter Gjötström and Johan Magnusson, the latter two in the company Gjötström & Magnusson.

Invented in Germany in 1798, lithography was rapidly developed by the printing houses operated by Hermann Mitterer and Alois Senefelder in Munich even before 1810. The process then spread fairly quickly throughout Germany. But it was long before it won a foothold in the rest of Europe, largely due to the Napoleonic wars. After 1815, however, lithography was developed mainly in France and the UK. Thus, even though it took until 1818 for lithographic printing to reach Sweden, this was by no means a long wait. After all, it had only been invented 20 years earlier.

Translation: Gabriella Berggren