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Papir

Ordet stammer fra det gresk-latinske "papyrus".

Papir, blekk og trykking uten og med løse typer er alle kinesiske oppfinnelser. Tradisjonelt har oppfinnelsen av papiret blitt tilskrevet en høy kinesisk funksjonær ved navn Ts'ai Lun (eller Louen), og oppfinnelsen skal ha foregått år 105 e.Kr. Det kinesiske papiret på den tiden ble slipt forsiktig med en stein for å få det til å ligne på pergament (som var et mer kostbart materiale) (Fontaine 1994 s. 13). Papir var inntil en tiendedel billigere å produsere enn pergament, kunne produseres raskere og i større mengder (Barbier 2000 s. 60). Dessuten var det enklere å trykke tekster på papir enn på pergament (s. 60).

"Papiret ble kjent i år 105 e.Kr., da Ts'ai Lun fortalte den kinesiske keiseren om den nye oppfinnelsen." (Krensky og Christensen 1997; upaginert bok) En fransk forsker hevder at Lun var evnukk og at han informerte den kinesiske keiseren om at det var oppfunnet et skrivemateriale lagd av bark fra morbærtreet (Étiemble 1973 s. 49). Dette var en type papir. Andre typer papir hadde allerede blitt produsert i Kina i ca. hundre år (Étiemble 1973 s. 61). Andre kilder hevder at Ts'ai Lun bare forbedret en teknikk som allerede hadde eksistert i Kina i minst tre hundre år (Biasi og Douplitzky 1999 s. 14).

"According to Chinese records paper was invented bu Cai Lun, a eunuch at the court of the Han Emperor Wu Di, in the year 105 AD. In actual fact Cai Lun seems to have been more of a supervisor than an inventor (he was charged with collecting information and reporting to various experiments in paper-making that were taking place in China) and the invention of paper was in all likelihood the outcome of an evolutionary process based to no small extent on the knowledge of making silk 'paper'. Cai Lun's paper had the advantage of being considerably cheaper than silk, having been made, according to contemporary records, from tree bark, fish-nets and old rags; botanists who have examined the earliest available (2nd century AD) paper fragments pronounce it a mixture of raw fibres (mulberry, laurel and Chinese grass) and rags." (Gaur 1987 s. 44-45)

I Kina i "the +3rd century, under the leadership of its curator Hsün Hsü, the Imperial Library copied bamboo books onto paper. Paper had been invented in or before the -2nd century, but was not used for writing until early in the +1st century. It was a cheap writing material: a single worker could make two thousand sheets of paper in a single day. (Compare the cost of one day's wages to the value of the two hundred animals whose skins were required to make one parchment or vellum codex in Europa.)" (Lerner 2002 s. 54)

"Paper was not invented specifically for writing. "It was extensively used in China in the fine and decorative arts, at ceremonies and festivals, for business transactions and records, monetary credit and exchange, personal attire, household furnishings, sanitary and medical purposes, recreations and entertainments and so on" (Tsien Tsuen-Hsuin, *Science and Civilisation in China*, V, pt. 1: *Paper and Printing* [1985] 2)." (http://www.historyofinformation.com/; lesedato 30.03.12) I Japan har papir blitt framstilt på forskjellige måter til bruk i masker, drager, dukker, origami (papirbrettingskunst) osv.

"[T]he Chinese made constant improvements in paper, which was a valuable commodity. Its use spread to Korea, Vietnam, and Japan, then throughout the Orient. It reached the Arab world, apparently with men of the Caliph of Baghdad acting as intermediaries after they had been imprisoned by the Chinese and had learned the secrets of the fabrication of paper from their captors (early eighth century). Gradually Baghdad, Persia, Armenia, and Syria became active centers for manufacturing and exporting paper, and the Byzantines began to write their books on Syro-Iranian paper starting in the eighth century" (Martin 1995 s. 52).

I Kina på 1000-tallet "[t]o prevent the loss of Imperial Library books, they were copied onto special paper, making stolen copies readily identifiable and thus unsalable." (Lerner 2002 s. 60)

"One cannot separate the history of the techniques whose invention is attributed to Gutenberg from the history of the inventions that preceded or accompanied those same technological advances and whose origin raises closely related questions. The first of these technologies is paper. Invented in China and adopted by the Arabs in the eighth century, paper spread with Islam between the ninth and the eleventh centuries along the southern shores of the Mediterranean. Paper penetrated into Muslim Spain by way of Cordoba and Toledo. Játiva, near Valencia, became an active production site at least by the twelfth century. Catalonia, an industrial region with relations with Italy, became an important center for the export of paper. […] Around 1210 Arabic paper was imitated near Genoa, but it was above all in Fabriano that Western papermaking techniques were developed." (Martin 1995 s. 207-208)

"In 751, the art of papermaking was introduced from China into Samarkand, whence it soon spread across the Islamic world. A paper mill existed in Baghdad by

794, but it was in Egypt that the paper industry most flourished, its raw material the linen from that country's extensive flax culture. The resulting abundance of paper lowered the price of books throughout Islam, and the bookshops that arose in every Arab city served as the nuclei for a lively literary culture." (Lerner 2002 s. 69)

"In 751 AD the Muslim governor of Samarkand took captive a large number of Chinese prisoners, some of the adept in the art of paper-making. According to one version those men voluntarily set up paper-making shops in Samarkand; another version claims that they betrayed their secret only under torture. For the next hundred years or so Samarkand paper (which used linen rags instead of mulberry bark) was as highly priced an export article as Chinese paper, but the social and religious structure of Islam is averse to localized exclusiveness and soon paper was being made in the Middle East; Baghdad, Damascus, Tiberius, Hamah, Tripoli and later Cairo became important manufacturing centres. In the 12th century the Arabs introduced paper to Spain and Sicily, and a century later to India. Rags remained the most important ingredient; in the laws of Alfonso X of Spain (1236 AD) paper is referred to, rather fittingly, as *pagamino de paño* (cloth parchment). In 1492 the Muslims lost Spain and the art of paper-making passed into the hands of less skilled Christian craftsmen. Almost immediately the quality of paper declined. During the following centuries paper established itself firmly in the Western world. In 1338 a paper-producing factory was established in France (Troyes); in 1390 paper-making reached Germany (Nuremberg), in 1498 Austria (Wiener-Neustadt) and in 1690 America (Germantown near Philadelphia). Until the 19th century the manufacturing process remained basically the same; then, for economic reasons (the spread of general education caused an increase in demand), wood was introduced as a substitute for rags. This guaranteed supplies of paper but irrevocably diminished its quality, durability and appearance." (Gaur 1987 s. 46-47)

Bokpapir er "paper suitable for printing books, pamphlets, periodicals, catalogs, etc., as opposed to various other grades (newsprint, tissue paper, wallpaper, wrapping paper, etc.). Book papers vary in content, color, finish, opacity, weight, and permanence. For books that are to be retained indefinitely in the collection, librarians prefer permanent papers, acid-free and of high rag content." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

Mye papir lages av gran. Stammen i grantreet deles inn i toppen, midten og rotstokken, og hver av disse gir ulik papirkvalitet. Toppen brukes bl.a. til mykt tørkepapir som har god oppsugingsevne. Midtdelen av grantrestammen brukes i stor grad til trykkepapir (fiberveggene her er tynne og klapper lett sammen og binder seg til hverandre, som gir jevnt papir). Den nederste delen av stammen (rotstokken) har kraftige fibre som brukes til bl.a. papp.

Det har blitt anslått at det i de gamle papirmøllene trengtes 200.000 liter vann for å produsere 300 kilo papir i timen, dvs. nesten 700 liter vann per kilo papir (Febvre

og Martin 1999 s. 46). Slike papirmøller krevde svært rent vann (Robin 2003 s. 8-9).

"European paper-making techniques were very similar to those the Chinese had developed more than a thousand years before, although small improvements were gradually introduced. Instead of using grass or horsehair for the mesh of the frames, fine copper wire was soldered together to make a sieve. The wires created a visual effect: after the water has drained through the mesh the fibres tend to lie more thickly in the trough between the strands of wire, leaving an almost "bald" patch on the highest point of the rounded wire. When dried, the paper is more transparent where it is thinnest, and these white stripes which we still sometimes see in paper are called "laid" lines. Advantage was taken of the effect to identify different paper-makers by creating personal symbols in the paper, known as watermarks. The design was soldered in a continuous thread on top of the wire mesh, so that the emblem would be revealed along with the other wire marks when the finished paper was held up to the light." (Jackson 1981 s. 116-117)

I perioder uten tilgang på billig papir var det vanlig med tettskrevne sider, uten markering av kapitler og avsnitt, og med en rekke forkortelser (Febvre og Martin 1999 s. 129).

Betegnelsene nedenfor er hentet fra Stein Davidsens *Grafisk håndbok* (1995) og Audun Nystuen m.fl.s *Bok om boken: En grafisk kokebok for deg som arbeider med bøker* (2008):

- absorpsjon: Papirets evne til å trekke til seg (absorbere) farge, fuktighet og lignende.

- adhesjon: Festeevne, f.eks. om trykkfarge.

- hygroskop: Også kalt hygrometer. Et instrument til å måle luftfuktighet, og som kan stikkes inn mellom papirark for å måle papirets fuktighet.

- japanpapir: Fint, tynt, rent cellulose- og bladfiberholdig papir (fra morbærtrær).

- kapillærer: "Porer" i papiroverflaten. Hvis det er mange kapillærer, blir det høy oppsugingskraft, som gir gode rasterpunkter (punkter i et bilde) og bra fargetørking.

- lugging: Skade ved trykking som oppstår ved at fargen eller gummiduken rykker løs partikler fra papiroverflaten.

- lus: Partikler fra papiroverflaten som ved trykking fester seg til trykkplaten, gummiduken eller fargen, og danner små, hvite prikker på trykket. Partikler fra

fargen kan gi fargete prikker med hvite kanter. Det kan også skyldes at biter av inntørket farge har kommet med på fargevalsene i trykkingen.

- matt papir: Papirkvalitet der lyset spres når det treffer papiroverflaten. Det er vanligvis lesevennlig.

- meldliming: Metode for å gjøre papir vannavstøtende.

- opasitet: Fra latin "opacus" = mørkt. Mål på ugjennomskinneligheten i papiret. Jo høyere verdi, desto bedre opasitet.

- pergamentpapir: For å gi papiret stor våtstyrke kan det pergamenteres. Det gjøres ved å lede papirbanen gjennom et bad av 65-70 % svovelsyre. Da oppstår det klisterlignende forbindelser slik at papiret mister sin sugeevne og får en vannfast hinne. Olje og fettstoff kan ikke trenge igjennom dette papiret, og det brukes f.eks. til emballasje for margarin og smør.

- pergamyn: Spesialbehandlet papir som hindrer gjennomslag av fett.

- plastpapir: Et syntetisk, papirlignende materiale som tåler vann, fett og noen syrer; kan behandles som papir under trykkingen.

- pregekalander: Etterbehandling av papiret, f.eks. for å gi det en spesiell struktur i overflaten (lerretspreg, hamret struktur, eggeskallstruktur osv.). Papiret kjøres mellom to valser, den ene en stålvalse med inngravert mønster, den andre en papirkledt valse som får sitt mønster fra stålvalsen. Det første virker som en patrise, den andre som matrise. Preget kan være både én- og tosidig. Pregingen gjør at trykket ikke blir så ømfintlig for fingermerker og lignende.

- preging: Trykking der trykkbildet står i relieff (opphøyd eller nedpresset).

- returpapir: Avfallspapir, dvs. makulatur fra trykksakproduksjon, aviser osv. Resirkuleres og brukes hovedsakelig som innpakningspapir, til kartonger, avispapir og lignende.

- røsj papiroppmaling: Cellulosefibrene i papirmassen blir kuttet opp. Dette gir et mykt, porøst papir med god sugeevne og god opasitet, men med dårlig styrke.

- råkant: Den ujevne kanten på bøttepapir; revet kant.

- sandfanger: En del av papirmaskinen som sørger for å fange opp sandkorn og andre partikler fra papirmassen.

- satinert papir: Papir som er glatt på begge sider.

- silkepapir: Tynne, myke papirsorter som i middelalderen ble framstilt i Orienten, spesielt i Bagdad-området. Råmaterialet er lin, og det kan være satinert eller matt.

- sulfatmetoden: Kjemisk framstillingsmåte for papir der papirmassen blir kokt i natronlut, soda og natriumssulfid (alkalisk). Prosessen kan føre til illeluktende lukt ("masselukt"). Ved denne metoden blir nesten alt lignin oppløst, og det oppstår trefri og ubleket masse.

- sulfittmetoden: Kjemisk framstillingsmåte der papirmassen kokes i svovelsyre, kalsiumsulfit eller magnesiumbisulfitt i vann (surt). Denne metoden gir trefri og ubleket masse. Nesten alt lignin blir oppløst.

- trekkstyrke: Største trekk-kraft et papir tåler før det revner/brister.

- trykkpapir: Det finnes en rekke varianter av slike papir – treholdige, trefri, matter og satinerte. I tillegg finnes det bestrøkne overflater, matte og blanke, og ulike farger og preg. Ulike trykkmetoder stiller spesielle krav til papirkvaliteten. Dette gjelder også den bruken som trykksaken er beregnet for.

- vannmerke: Merke eller tekst i papirbanen som dannes ved at en metalltråd er sydd på en av tørkedukene i papirpressen.

- velinpapir (eller vellum-papir): Hvitt, gjennomskinnelig pergament-lignende papir med fløyelsaktig overflate, satinert og godt limt.

"One of the most important skills in making paper by hand is to achieve a regular integration of the fibres, so as to give the sheet an even tearing strength; and this was done by shaking the watery pulp within the frame as it was scooped from the vat. Machines have never fully been able to simulate this skill, and modern papers will tear much more easily in one direction than the other – particularly cheaper papers such as newsprint. The tiny fibres, floating in the water as it is spewed out on to the moving belt of wire mesh in a modern paper-making machine, tend naturally to follow the direction of the flow like logs on a river, rather than interlocking equally in all directions. Machine-made papers thus "split" more easily if they are folded in the direction of the fibres, known as the "grain". Grain is an important factor in the manufacture of books, because paper folds (as well as tears) more easily with it than against it. A book bound with the paper grain running horizontally will be less pleasant to handle, because the pages will stand up stiffly rather than lying and folding easily." (Jackson 1981 s. 117)

Det engelske ordet "grain" betegner, "[i]n a sheet of machine-made paper or board, the direction in which most of the fibers lie, determined by forward movement of the papermaking machine in manufacture. Books are printed with the grain parallel to the spine because paper bends more readily with the grain than against it. One way to determine the grain in a sheet of paper is to do a tear test – paper tears more

cleanly with the grain than across it. There is little or no grain in a sheet of handmade paper. Woven material used as covering material in bookbinding also has grain – as a general rule, the warp threads run parallel to the spine." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

Uttrykket "against the grain" er "A popular expression meaning "contrary to natural inclination" originally used in the printing trade to refer to machine-made paper folded across the grain of its fibers. In book production, sheets are printed with the grain running from top to bottom of the leaves, allowing them to flex easily lengthwise after they are bound. When folded with the grain, paper tears easily and cleanly along the fold. When folded across the grain, it cracks and leaves a ragged edge when torn." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

En leser på 1700-tallet kjente på papiret i en bok som skulle kjøpes for å vurdere bl.a. papirets vekt og elastisitet (Chartier 2003 s. 174).

På 1700- og 1800-tallet hendte det at bøker ble trykket på papir i ulike farger, som delvis skulle samsvare med innholdet i tekstene. Dette gjaldt blant annet den østerrikske forfatteren Ignaz Franz Castellis *Fortellinger om alle farger* (1839-40) (Rehm 1991 s. 70).

Ulike typer papir har blitt brukt rundt om i verden lenge før papir ble brukt i Europa. Et eksempel: "Natives of pre-Columbian Mesoamerica manufactured Amatl (Nahuatl: āmatl, Spanish: amate or papel amate) during the first millenium BCE. This was a form of paper made by boiling the inner bark of several species of trees, particularly fig trees (genus Ficus) such as F. cotinifolia and F. padifolia. The resulting fibrous material was pounded with a stone to produce a stretchy and somewhat delicate paper, colored light brown with corrugated lines." (http://www.historyofinformation.com/; lesedato 30.03.12)

År 751 e.Kr. tok noen arabere til fange en gruppe kinesere som viste seg å beherske kunsten å lage papir, og i løpet av noen år ble Samarkand et viktig produksjonssted. Samarkand egnet seg også godt som handelssted, siden byen ligger langs den såkalte "Silkeveien" mellom Vesten og Kina (Biasi og Douplitzky 1999 s. 14). I middelalderen ble det også eksportert papir fra Konstantinopel og fra Nord-Afrika til Europa via Sicilia (Biasi og Douplitzky 1999 s. 99). En av grunnene til den kristne kirkens skepsis til det nye skrivematerialet var at det var et arabisk/muslimsk produkt. Dessuten var det mindre solid enn pergament: lettere å rive og brenne, det fikk større skade ved fukt, i det hele tatt framsto papir som svært skrøpelig i sammenligning med pergament (Biasi og Douplitzky 1999 s. 99).

"In 751 AD the Moslem governor of Samarkand is reported to have taken Chinese prisoners, some of whom were skilled paper-makers. According to one version of the story these men set up paper-making shops in the city; but another version

claims that they betrayed their secret only under torture. Gradually a knowledge of paper-making techniques spread to other Islamic cities, and its use began to displace parchment for religious texts. Good quality raw materials for the pulp were always in short supply, however, and in eleventh-century Egypt even the linen wrappings from the graves of embalmed corpses were robbed, and sold to paper factories. By the twelfth century the Arabs had introduced paper to Spain and Sicily, where rags still formed such an important ingredient in the making of pulp that the laws of Alphonso X of Spain in 1236 described the paper as "cloth parchment"." (Jackson 1981 s. 116)

"In AD 751 there was fighting on the borders of China, and some Chinese paper-makers were taken prisoner. Their captors were Muslim. The whole Muslim world rapidly adopted paper as a writing material. Damascus became the centre of paper making and later made enough to be able to export to Christian Europe. [...] When paper first arrived, about the 12th Century, the church refused to use it because it had been made by Muslims – the enemies of the Christian Church." (Clark 1987 s. 26-27) I fem hundre år forble produksjonsmåten en arabisk hemmelighet, for deretter å spre seg til via Bysants, Spania og Italia nordover i Europa.

"Chinese Prisoners of War Convey Papermaking Techniques to the Arabs. 751. Chinese Tang forces were defeated by Arabs at the battle of Battle of the Talas River, near Samarkand, and lost control of the Silk Road through Central Asia. Chinese prisoners of war taken at the battle of Talas conveyed papermaking techniques to the Arabs. […] Papermaking was established in Baghdad. By 750 it had reached Damascus and Cairo on its way westward from China. […] The Oldest Surviving Manuscript on Arabic Paper. Circa 825. "The oldest surviving manuscript written on Syrian paper is a Greek text, in the Vatican, of miscellaneous teachings of the church fathers, Doctrina patrum. On the basis of the script, the manuscript has been ascribed to Damascus in the early ninth century. The yellowish brown paper is remarkably smooth and even, despite the occasional clumps of fiber. The sheets, though flexible and soft, vary in thickness from one to another, suggesting that quality control was still a problem. The distinctive page size (10 by 6 inches: 26 x 15 centimeters) and narrow format of the manuscript show not that paper makers used molds of that size but that the paper sheets were trimmed, probably to imitate the standard format of books written on papyrus" (Bloom, *Paper Before Print. The History and Impact of Paper in the Islamic World* [2001] 58 and figure 25)." (http://www.historyofinformation.com/; lesedato 30.03.12)

"The Oldest Complete Dated Book in Arabic Written on Paper. 848. "The oldest dated complete book in Arabic copied on paper that we know is a manuscript dating to 848, recently discovered by accident in the regional library of Alexandria, Egypt; it awaits complete publication" (Bloom, *Paper Before Print. The History and Impact of Paper in the Islamic World* [2001] 58). […] The Oldest Arabic Manuscript on Arabic Paper Preserved in Europe. November – December 867. The

second oldest surviving Arabic book on Arabic paper, and the earliest Arabic manuscript on paper preserved in Europe "is generally believed to be a fragmentary copy of Abu Ubayd's work on unusual terms in the traditions of the Prophet dated Dhu'l-Qada 252, November – December 967 and preserved in Leiden University Library (Legatum Warnerianum). It bears no indication of where it was copied. The opaque stiff paper has turned dark brown and has a tendency to split along the edges. […] This tendency for the pages to split is actually a result of delamination, a condition seen in many early papers, such as the Vatican manuscript (Doctrina partum). When the pulp was not sufficiently beaten, the outer layers of the cellulose fibers did not detach and form physical and chemical bonds with adjacent microfibrils, and the resulting paper has weak internal cohension. The condition was exacerbated when the paper was given a hard surface with the application of size. The weaker interior splits easily in two, revealing a rough, woolly and feltlike inner surface" (Bloom, *Paper Before Print. The History and Impact of Paper in the Islamic World* [2001] 59-60 and figure 27)." (http://www.historyofinformation.com/; lesedato 30.03.12)

"The adoption and subsequent introduction to the West of Chinese paper manufacture was Islam's most important contribution to the evolution of the book. Although Muslims also wrote books on papyrus and parchment, they were importing Chinese paper, which had been introduced to the Arab world by the seventh century or perhaps earlier. Chinese prisoners of war built the first Muslim paper mill in Samarkand soon after 751, the date of their capture, and in 794 a mill was built in Baghdad. Subsequently Damascus became a papermaking center, as did Fez in Morocco, probably by the tenth century. Paper gradually replaced papyrus in Islam, and by the middle of the tenth century it had totally displaced papyrus for writing. Another century was to pass before papermaking was introduced into Spain, its first appearance in the West." (Kilgour 1998 s. 59)

"From Sicily the art of paper-making spread to Italy, and Italian craftsmen established it elsewhere in Europe. By 1276 there was paper production at Fabriano, near Ancona; within the next century mills using water-driven hammers to macerate the rotted cotton and linen fibres had been set up all over northern Italy; and soon there were similar mills in Germany and France. By the early fifteenth century even peasants were able to afford linen clothes, and for the first time there was no shortage of linen and cloth rags." (Jackson 1981 s. 116)

"Dard Hunter, doyen of the history of papermaking, discussed three important Islamic innovations in paper manufacture: (1) the invention of the modern laid-wires and chain-wires mold; (2) the use of linen rags for pulp; and (3) the trip-hammering of rags to produce pulp. Hunter viewed the mold as "the first real step in papermaking, as it enabled the artisan to form sheets continually upon the same mold," and pointed out that "even the most modern paper-machine employs precisely the same principles." The Muslims used linen rags for papermaking in place of the mulberry bark used by the Chinese but unavailable in Islam. They also

replaced hand-beating of pulp with laborsaving trip-hammering. For this procedure a heavy hammer was attached to a long horizontal wooden beam pivoted near the hammer, and a man or boy standing on the end distant from the hammer raised the hammer by his weight; when he removed his weight, most likely by raising himself using an overhead bar, the hammer crashed down on the rags and pulp. In the eleventh century a paper mill was built at Jativa, in Spain, that was probably driven by a waterwheel, thereby eliminating human work from the stamping process." (Kilgour 1998 s. 59)

Midt på 1100-tallet fortalte araberen al-Idrisi at det fantes papirmøller i Valencia i det østlige Spania, og at papiret som ble produsert der var en eksportartikkel både til Europa og til Orienten (Biasi og Douplitzky 1999 s. 99). Den arabiske geografen Muhammad ibn Muhammad al-Idrisi (1100-1165) skrev om "The First Paper Mill in Al-Andalus (1150), […] of the Spanish city of Xátiva (now Játiva or S. Felipe de Játiva): "Paper is there manufactured, such as cannot be found anywhere else in the cilvilized world, and is sent to the East and to the West" (Hunter, *Papermaking: The History and Technique of an Ancient Craft*, 2nd ed [1947] 473)." (http://www.historyofinformation.com/; lesedato 30.03.12) Området for disse første møllene omfatter både Valencia og Toledo i Spania (Raible 2006 s. 131). De spanske araberne hadde monopol på denne produksjonen i Europa, og dette varte til ut på 1200-tallet, da araberne begynte å miste sitt sterke feste i Spania på grunn av en kristen "gjenerobring" ("Reconquista"). Dermed fikk de kristne kunnskaper om produksjonsmåten, og det er mulig at de første franske papirmøllene oppstod i Sør-Frankrike allerede på slutten av 1100-tallet (Biasi og Douplitzky 1999 s. 99).

"ln 1074 one Abū Masaifa established the first European paper mill, at Jativa, in eastern Spain, south of the Jucar River and about twenty miles inland from the Mediterranean Sea. It must have been a good-sized mill, for it had thirty workers. It was located outside the town on a canal and presumably was driven by a water wheel. Sometime before 1148, a Muslim traveler, Idrisi, visited Jativa and described the paper manufactured there as being superior to that found anywhere else in the "universe," and learned that it was being exported to the East and West, as he put it. In 1238 Valencia fell to Christendom when the forces of James I of Aragon captured it, but the mill continued to be operated by Muslims and Jews. The next European mill was established about 1270 at Fabriano near Rome, to be quickly joined by others in the same vicinity; one is still operational and is a museum. The mill Richard-de-Bas at Ambert d'Auvergne dates from 1326 and was "one of the first mills to see the light of day in France"; it too is still operational and is also a museum. Waterwheels drive both mills. The first German mill, at Nuremberg, was established in 1390; the first English mill was established in 1490, more than two centuries after the Fabriano mill. This extraordinarily slow advance across Europe reveals that paper was not in great demand. For single-copy manuscript book production the only advantage paper had over parchment was that it cost less. However, fourteenth-century paper was fragile, had a rough surface,

“drank” the water-based ink, and was not hospitable to the pigments of illuminators.” (Kilgour 1998 s. 79)

“Papermaking Reaches the Moorish Parts of Spain. Circa 1100-1151. Through the Arab conquest of North Africa and Southern Spain, papermaking first reached the Moorish parts of Spain (Al-Andalus) in the 12th century. A paper mill is recorded at Fez (Fes) in Morocco in 1100, and the first paper mill on the Spanish mainland is recorded at Xàtiva, near Valencia, which was still under Arab rule, in 1151. “Paper seems to have advanced less rapidly in Europe than it had advanced either in China or in the Arabic world. The European parchment with which paper had to compete was a far better writing material than either bamboo slips or papyrus. Furthermore, there were few in Europe who read, and the demand for a cheaper writing material, until the advent of printing, was small. While it was the coming of paper that made the invention of printing possible, it was the invention of printing that made the use of paper general. After Europe began to print, first from blocks and then from type, paper quickly took its place as the one material for writing as well as for printing, though, strange to say, the first paper mill in England was not set up until seventeen years after Caxton began to print at Westminster” (Carter, *Invention of Printing in China* 2nd ed [1955] 137-38).” (http://www.historyofinformation.com/; lesedato 30.03.12)

En av de første papirmøllene i Europa “was set up at Fabriano in Italy in 1276, and it was soon followed by mills at Bologna in 1293, Troyes in 1348 and Nuremberg in 1393. Even the church began to use paper for less important documents.” (Clark 1987 s. 27) Tyskeren Ulman Stromer fikk hjelp av papirprodusenter fra Milano til å etablere en papirmølle i Nürnberg i 1390 (Biasi og Douplitzky 1999 s. 100). Allerede på 1200-tallet ble det italienske papiret produsert på en mekanisert måte, dvs. i en effektiv, teknisk produksjon, ganske annerledes enn de metodene som araberne brukte (Biasi og Douplitzky 1999 s. 99).

“In Germany, Nuremberg, with its *Gleissmühle* founded in 1390 by the merchant Ulman Stromer, was probably the first location at which paper was made. Stromer acquired his knowledge of paper production on business journeys to Lombardy. Further centres of papermaking grew up in towns experiencing economic and cultural growth such as Ravensburg, Augsburg or Reutlingen. […] At that time in Europe, paper and parchment were considered equivalent, the latter still being in use, although eight times as expensive as paper. […] Around 1450, there were an estimated ten mills in Germany, around the year 1500 sixty, and around 1600 approximately 190. […] The oldest locations of the book trade, such as Frankfurt and Leipzig, were at the same time the sites of paper trade fairs. It was no exception for important printers or publishers to run their own paper mills: thus the *Gengenbach* mill belonged to the Frankfurt printer Christian Egenolff, and mills in Nuremberg and Ravensburg were in the possession of the bookseller family Endter. Similarly, paper mills had several publishers as regular customers, as paper was also produced on commission. A region with a history of success with paper and art

since 1576, when the first paper mill was founded at Krauthaüsen, near Düren, is situated between Cologne and Aachen in North Rhine-Westphalia. A link to the railway line from Cologne to Aachen in 1841 favoured the development of this district into an industrial location. The paper industry there – with firms such as *Sihl*, *Zanders*, *Schoellershammer*, and also *Voith-Sulzer* paper machines, which have partly specialised in fringe areas – has enjoyed international recognition up to the present day." (Weber 2007 s. 58)

Møllene ble bygd ved elver og ofte styrt som familiebedrifter, samtidig som de reelle eierne ofte var handelsmenn i byer i nærheten. Det var disse handelsmennene som både skaffet tekstilråstoffene og senere drev handel med sluttproduktet (Biasi og Douplitzky 1999 s. 100). Middelalder-universitetene hadde stort behov for skrivemateriale, og dermed også for papir. Det er grunnen til at papirprodusenter etablerte seg utenfor Paris midt på 1300-tallet (Essonnes i 1354-55 og Saint-Cloud i 1376) (Biasi og Douplitzky 1999 s. 100). Det var fra 1300-tallet av at papiret begynte å utkonkurrere pergamentet som skrivemateriale. Men pergamentet ble uansett brukt i lang tid etter dette til traktater, spesielt viktige offentlige tekster og lignende (Blasselle 1998a s. 18).

"The Earliest Extant Document from Europe Written on Paper. 1109. […] Possibly written on paper manufactured in Europe, comes from the chancellery of the Norman kings who had occupied the island of Sicily. It is an order in Greek and Arabic concerning a salt mine near Castro Giovanni issued by the countess Adelasia, first wife of Roger I of Sicily. The document is preserved in the state archives at Palermo." (Levey, "Mediaeval Arabic Bookmaking and its Relation to Early Chemistry and Pharmacology," *Transactions of the American Philosophical Society*, new series, Vol. 52, part 4 [1962] 10; her sitert fra http://www. historyofinformation.com/; lesedato 30.03.12)

"The First Use of Paper in Italy. 1154. "First use of paper in Italy, in the form of a register written by Giovanni Scriba, dated 1154-1166. It is thought that this particular paper had been imported from the East. No other specimens of paper are found in Italy until 1276, the date of the first mention of the Fabriano paper mills" (Hunter, *Papermaking: The History and Technique of an Ancient Craft*, 2nd ed [1947] 473). […] Paper may have first been manufactured in Fabriano because of its proximity to Ancona, a port which enjoyed extensive trade with the Arab world." (http://www.historyofinformation.com/; lesedato 30.03.12)

Fra 1200-tallet ble ikke klutepapir lenger lagd av ull, men av lin og hamp (Barbier 2000 s. 60). På 1200-tallet ble det vanlig i Europa å lage klær og andre tekstiler av lin, og dyrkingen av linplanter gjorde det også enklere å skaffe råstoff til papirmøllene (Biasi og Douplitzky 1999 s. 14). Linfiber egnet seg godt til å lage papir. Lin var det vanligste råstoffet i den første tiden med papirproduksjon i Europa.

I Nürnberg drev dynastiet Stromayr papirmøller (Barbier 2000 s. 60). Tre personer i denne slekten var Peter, Andreas og Ulman Stromayr.

"Decisive for the outstanding quality of the fourty-two-line Gutenberg Bible, apart from the printing, was the high-quality paper that served as medium. The surface coating was of animal glue, a decoction of boiled rabbit skin and bones, and the paper was beaten subsequently with a mallet; this resulted in a silky matte, smooth surface and a good reception of the ink and pigments." (Weber 2007 s. 85)

"The First Comprehensive Treatise on Papermaking. 1761. Astronomer and writer Joseph Jérôme Lefrançois de Lalande published *L'Art de faire le papier* in volume 4 of the series *Descriptions des arts et métiers* published by the Académie royale des Sciences. Papermaking, a craft which had arrived in Europe earlier than printing, and had been passed down as trade secrets through apprenticeship for even longer, was later than printing in having a comprehensive manual published. The first comprehensive printing and typesetting manual had been published by printer Joseph Moxon roughly eighty years before de Lalande's, in 1683-84. By the mid-eighteenth century several other printing manuals – most notably that of Fertel – had been published. However, since literacy was not required for tasks in papermaking it is probable that many papermakers were illiterate, in contrast to printers, who had to be literate. Thus it may be appropriate that this first detailed treatise was written not by a professional papermaker but by a scientist and astronomer. Its publication in a handsomely and expensively printed scientific series would suggest that it was intended not necessarily for papermakers themselves, but for students of technology, or entrepeneurs who might enter the papermaking industry." (Hunter, *The Literature of Papermaking 1390-1800*, 1925 s. 33; her sitert fra http://www.historyofinformation.com/; lesedato 30.03.12)

"De Lalande's work comprised 150 folio pages illustrated with 14 large engravings, describing the process of papermaking. Fundamental elements of the process were (1) Selection of raw material, i.e. rags. High quality white paper depended on using high quality white rags. (2) Conversion of rags into pulp (or "stuff"). When de Lalande published this process was done by a washer/beater "engine" propelled by water power. (3) Sheet-making and consolidation. (4) Sizing. (5) Sorting, Finishing and Packing. […] A very careful and accurate observer, de Lalande consulted with numerous professional papermakers in different regions of France in order to write his treatise. The work covers all aspects of the trade, including the design and construction of buildings, the design of machinery and equipment, and the economics of the business, plus a glossary of terms of the trade. De LaLande's work was translated into German along with the rest of the *Descriptions des arts et métiers* series, from 1762-75. A Dutch translation of de Lalande's treatise appeared separately in 1792. The work was first translated into English by Richard MacIntrye Atkinson more than 200 years after its original publication, in a splendid full-size edition limited to 405 leatherbound copies in 1976. By this time the text was chiefly of interest to paper historians or hand-made

papermakers. The English translation, published by The Ashling Press, Mountcashel Castle, Kilmurry, Sixmilebridge, Co. Clare, Ireland, included all the plates printed on blue hand-made paper made by Ashling Papermakers." (Hunter, *The Literature of Papermaking 1390-1800*, 1925 s. 33; her sitert fra http://www. historyofinformation.com/; lesedato 30.03.12)

"German pastor, botanist, mycologist, entomologist, ornithologist and inventor Jacob Christian Schäffer published *Versuche und Muster ohne alle Lumpen oder doch mit enem geringen Zusatze derselben Papier zu machen* in six volumes, Regensburg, 1765-71, in which he documented his experiments with new papermaking materials, and included actual specimens of paper made with each. Because his experiments were conducted prior to the discovery of bleach by Scheele, Berthollet and others, all of Schäffer's samples show the tint of the original material from which they were made. Schäffer's book also probably includes the first documented sample of paper produced from wood pulp – not surprising because Schäffer, an entomologist, studied the production of wood pulp paper by wasps: "In most of the examples about one-fifth part cotton rags were added to the pulp to help bind the fibres together. A number of the specimens are sized and nearly all have been printed upon. It is curious to note one of the first specimens shown in Schaeffer's books was made from wasps' nests – for it was not the wasp, himself, the first papermaker, or was it the frog who was the original fabricator of paper? The wasp made his nest of wood fibre cleverly felted together exactly as paper is constructed, while the frog made a peculiar kind of spittle on the surface of ponds which became well-felted paper after drying naturally in the sun" (Hunter, *The Literature of Papermaking 1390-1800* [1925] 34-36.) Writing in 1925, Dard Hunter described Schäffer's set of books as "the most interesting and rarest work on the subject of paper ever published," and stated that complete copies with all of the 82 original paper specimens were extremely difficult to find." (http://www. historyofinformation.com/; lesedato 30.03.12) Schäffer testet fra 1765 og framover ut papirproduksjon av blant annet humle, mais og furukongler (Biasi og Douplitzky 1999 s. 150). Det går an å lage papir av fibrene i hvete, bygg, rug og ris (Biasi og Douplitzky 1999 s. 187).

Den maskinen som avløste den kostbare og tidkrevende framstillingen av håndlaget papir, ble oppfunnet av franskmannen Nicolas-Louis Robert i 1798, oppfunnet på papirmøllen i Essonnes i Frankrike. Robert tok sitt patent med til England, og der kom de første maskinene i drift i 1803. På denne maskinen kunne det produseres opptil 450 kg per dag, ti ganger mer enn før (Davidsen 1995 s. 243). Roberts maskin lagde papir som kunne være en sammenhengende rull, ikke som løse ark (Fontaine 1994 s. 104). Arbeidet med maskinen hadde pågått siden 1795, men var først tre år senere han fikk et 15 års patent på den (Biasi og Douplitzky 1999 s. 146)

"On the eve of the French Revolution demand for paper was growing, and a bookkeeper for Diderot, Nicolas-Louis Robert, invented the first machine that

produced paper in continuous sheets. This machine was later powered by a steam boiler, but the production of continuous-sheet paper spread only slowly, following demand in the early nineteenth century." (Martin 1995 s. 210)

Engelskmannen Henry Fourdrinier "tok i 1806 patent på en papirmaskin med kontinuerlig papirbane." (Hesselberg-Wang 2009c)

"Machine-made paper by the Fourdrinier process did not come into being until the early nineteenth century. They had other problems, nonetheless, since they were often forced to print on paper of uneven thickness and differing weight and size. A newly-formed sheet of moist rag paper in its frame can weigh several pounds, but when dry it weighs only as many ounces. Paper-makers found it hard to judge accurately the rate of evaporation and the potential weight of different pulp constituents, so the manufacture of uniform sheets for printing remained extremely difficult until the onset of the machine age. [...] The cheapness of paper encouraged easy and ephemeral writing, and it made the printing of books in quantity a practicable possibility for the first time." (Jackson 1981 s. 117)

I antologien *Bookish Histories. Books: Literature, and Commercial Modernity, 1700-1900* (2009; redigert av Ina Ferris og Paul Keen) skriver Leah Price i artikkelen "Getting the Reading Out of It: Paper Recycling in Mayhew's London" om "how printed text becomes transformed into pages of paper for wrapping things in. Taking as her starting point Henry Mayhew's encyclopedic account of the uses to which paper is put in *London Labour and the London Poor* (1851) – part of his interest in the resale trade – she situates books within a world where virtually everything is reissued in one way or another." (http://www.palgraveconnect.com/pc/doifinder/view/10.1057/9780230244801; lesedato 13.05.15)

År 1800 var antakelig Europas papirproduksjon på ca. 100.000 tonn. Noen årtier senere kom industrialiseringen av papirproduksjonen, og i år 1900 var verdensdelens papirproduksjon på over seks millioner tonn. I 1970 var den på 104 millioner tonn, og halvparten ble brukt til aviser, bøker, tidsskrifter og andre trykte tekster, samt skrivepapir.

I 1921 skrev en norsk avis: "Gyldendalske forlag har i disse dage sendt ud de sidste bind af Jonas Lies samlede digterverker. Dermed har publikum nu faaet Bjørnsons, Ibsens, Kiellands og Lies verker i standardudgave. Det lyder enkelt og ligetil, men hvis man ser nærmere paa, hvad de samme forfattere i årenes løb har slugt af papir og arbeide, vil man forstaa, at det ikke er saa letvint og ligetil, som det ser ud. De fire forfattere sendte ud ikke mindre end 107 bøger, og allerede i 1898 begyndte Gyldendalske udgivelsen af de første folkeudgaver. Ialt har Gyldendalske fra 1861 til og med 1920 sendt ud 3.370.429 bind omfattende ialt 75.609.137 ark af Ibsens, Bjørnsons, Kiellands og Lies verker. Papirforbruget er saa stort, at hvis man skulde transportere dette papir paa engang, maatte man benytte 302 ti-tons godsvogne for at faa alt med. For at fremstille alt dette papir maatte en stor moderne papirmaskin

gaa med kontinuerlig drift dag og nat i et helt aar." (sitert fra *Aftenpostens* magasin *Historie* nr. 4 i 2021 s. 33)

"Paper was first made in England in 1494, by John Tate in Hertfordshire; previously it had been imported. At the time, English paper was of poor quality. It was mainly brownish in colour, as the proper way to break rags down into paper pulp was not yet known." (Weber 2007 s. 62)

"Paper was originally made in sheets by hand, [i England] mainly in Kent, Hertfordshire and Buckinghamshire, to supply the printing shops of London. By the time of the Industrial Revolution, mechanised methods of paper making were being developed to keep up with the ever increasing demands of the printing industry. Paper making, regardless of scale, involves making a dilute suspension of fibres in water and allowing this suspension to drain through a wire screen so that a mat of randomly interwoven fibres is laid down. Water is removed by pressing and drying the fibres to make paper. A watermark is made by creating a design into the wire screen. Nicholas Louis Robert of Essonnes, France, developed the first continuous paper making machine, whilst working for the French paper mill, Leger Didot, in around 1799. After quarrelling with his employers over the ownership of his invention, he decided to develop it further in England. However, due to the political situation between England and France at the time, he sent his English brother-in-law, John Gamble. He, through a chain of acquaintances, was introduced to the brothers Henry and Sealy Fourdrinier, stationers of London, who agreed to finance the project. Gamble was granted a patent for the machine in October 1801 and, with the assistance of the skilled and ingenious mechanic, Bryan Donkin, an improved version was installed in Frogmore, Hertfordshire in 1803. Further developments followed, with the Fourdrinier brothers installing the new machinery at their own paper mills. However, it wasn't until the 1830s that these were in general use and the process of paper making became industrialised." (Velma Dinkley i http://ftfmagazine.lewcock.net/; lesedato 09.01.13) Brødrene Fourdriniers maskin ble tatt i bruk i Sorel-Moussel i Frankrike i 1816 (Barbier 2000 s. 210). Det var en landsby der det tidlig ble etablert en papirfabrikk.

"The First Paper-Making Machine. 1798. French soldier and mechanical engineer Louis-Nicolas Robert invented the first paper-making machine. After completing his military career, in 1790 Robert became an indentured clerk at one of the Didot family's Paris publishing houses. First working under Saint-Léger Didot as a clerk, he later switched to a position as "inspector of personnel" at Pierre-François Didot's hand paper-making factory in Corbeil-Essonnes in the suburbs of Paris. This establishment had a history dating back to 1355 and supplied paper to the Ministry of Finance for currency manufacture. Both Robert and Didot grew impatient with the quarrelling workers, vatmen, couchers, and laymen, so Robert was motivated to find a way to mechanize the labor-intensive process of making paper by hand. Prior to 1798, paper was made one sheet at a time, by dipping a rectangular frame or mould with a screen bottom into a vat of pulp. The frame was removed from the

vat, and the water was pressed out of the pulp. The remaining pulp was allowed to dry; the frame could not be re-used until the previous sheet of paper was removed from it. Robert's construction had a moving screen belt that would receive a continuous flow of stock and deliver an unbroken sheet of wet paper to a pair of squeeze rolls. As the continuous strip of wet paper came off the machine it was manually hung over a series of cables or bars to dry. This continuous, unbroken sheet of paper later had to be cut. Robert applied for a French patent for his machine on September 9, 1798; it was granted in 1799. However, because of disagreements between Robert and his partners, St. Leger and François Didot, and also because of financial disruptions caused by the French Revolution, François Didot attempted to have it developed in England, sending his English brother-in-law, John Gamble, to London to develop the technology." (http://www.historyofinformation.com/; lesedato 30.03.12) I 1799 begynte den mekaniske papirproduksjonen (Franzmann, Hasemann og Löffler 1999 s. 39).

"One technological advance inexorably followed another, working to eliminate bottlenecks and to increase the rate of production of texts. The first problem was to find a paper supply adequate to growing demands that an increased use of writing prompted. In the eighteenth century wide use of the cylindrical paper mill and the appearance of wove paper signaled a new departure. Around 1789, Nicolas-Louis Robert, an engineer and printer who worked with Pierre-François Didot in his paper works at Essonnes, had an idea for a procedure for producing paper much more rapidly than with the traditional vat. In that same year Robert took out a patent for a machine that would produce paper in a continuous strip that could be rolled onto a drum as it emerged. In 1801, Didot Saint-Léger, Pierre-François Didot's son, set up business in England with his brother-in-law, John Gamble, who took out a patent in the same year for an enormous paper-making machine 3.70 meters wide and 13.70 meters long. The two men began to manufacture their machines in 1805, and in 1814 they started making similar machines in France. What was innovative about their machines was not so much that they produced paper in a continuous web (in fact, some machines produced sheets) as that the various stages of paper manufacturing were gradually incorporated into a single piece of machinery. This gave an infinitely higher rate of production than with traditional procedures, and it enabled the manufacturer to replace a specialized and traditionally restive personnel with a small number of mechanics and an unskilled work force of women and children. […] In 1844 a Saxon master weaver, Gottfried Keller, created a machine for grinding down logs to make what is called "groundwood" or "mechanical pulp." He ceded his patent to Heinrich Völter, the director of a paperworks in Bautzen, who improved the procedure with the aid of a mechanic named Voith. At this stage, however, wood was no more than a promising complement to other materials; it became the dominant material only when ways were found to separate the fibers by slicing the wood with the grain and to "cook" the pulp by breaking it down chemically. When this became possible around 1860, the Western world could think that its supply of raw materials was inexhaustible. Paper production

increased sixfold in Germany and fourfold in France between 1875 and 1908." (Martin 1995 s. 401-402)

På 1700-tallet utgjorde prisen på papir minst 50 % av omkostningene for å produsere en bok (Chartier 2003 s. 174). "De nye maskinene skapte fullstendig kaos på det på forhånd knappe råstoffmarkedet. Mot slutten av 1700-tallet ble situasjonen akutt. Man eksperimenterte med alle slags fibre fra sjøgress og bark til potetskrell. På jakt etter nye råstoffkilder fant man, bl.a. ved å studere vepsebol, at et papirlignende materiale kunne fremstilles av trevirke. I 1840 tok Friedrich Gottlob ut patent på slip-prosess, en maskin som malte trestammer til papirråstoff. Grunnlaget for moderne papirindustri var lagt. Rundt midten av det 19. århundre hadde man funnet frem til to prinsipielle metoder: mekanisk og kjemisk fremstilling." (Hesselberg-Wang 2009c)

Mangelen på papir førte til eksperimentering. I 1719 skrev Réaumur til det franske vitenskapsakademiet at det kunne være mulig å lage papir av trevirke. I 1727-1730 fikk tyskeren Franz Ernst Brückmann trykket noen eksemplarer av et naturvitenskapelig verk han selv hadde skrevet, og denne utgaven var på papir lagd av cellulose (Febvre og Martin 1999 s. 49). På begynnelsen av 1800-tallet "supplies of rags were no longer sufficient. As early as the eighteenth century people had experimented with using various sorts of vegetable pulp to make paper, and in the nineteenth century a number of substances – straw, alfalfa, wood – were tried as substitutes for rags." (Martin 1995 s. 402) Først på 1860-tallet slo bruk av cellulosepapir igjennom til bruk i aviser (Febvre og Martin 1999 s. 49).

Den britiske forleggeren Edward Lloyd var på 1840-tallet "one of the first publishers to introduce Hoe's American printing presses into England – thereby speeding up his production process – and as his fortune grew he established his own paper-making plant in Kent and leased 100,000 acres of land in Algeria for growing esparto grass for the improvement of paper-making." (Haining 1975 s. 31-32)

Hovedråstoffet for celluloseproduksjon i Norge har vært grantre. Store mengder trefliser av gran blir kokt og ofte tilsatt kjemikalier. Denne massen blir til cellulose. Forskjellige fyllstoff kan øke tetthetsgraden og ugjennomskinneligheten til det papiret som produseres fra massen. Limstoff binder fibrene sammen og øker dermed papirets styrke. Vannet må fjernes fra massen før det kan helles ut i et tynt lag, presses og tørkes, før det etter hvert kan rulles opp i store ruller. Da har fiberretningen blitt orientert mest mulig slik at papiret skal kunne brettes uten å brekke. Det kan lages papir med ulike egenskaper, f.eks. med ru eller glatt overfalte, eller med matt eller blank overflate. Bulk betegner hvor tykt papiret er (f.eks. har trekkpapir god bulk og bibelpapir svak bulk).

"The First Patent for Paper Recycling. […] On April 28, 1800 English papermaker Matthias Koops was granted English patent no. 2392 for Extracting Ink from Paper

and Converting such Paper into Pulp. Within the patent Koops described his process as "An invention made by me of extracting printing and writing ink from printed and written paper, and converting the paper from which the ink is extracted into pulp, and making thereof paper fit for writing, printing, and other purposes." This was the first patented process for recycling paper, and it is also possibly the first patent received for a recycling process that was – much later – widely used. Koops's patent was first published in print in London in 1856. Prior to this time English patents were recorded only on the Patent Rolls and were not published in print until the Patent Law Amendment Act of 1852 proposed that an Office of the Commissioners of Patents be set up. Under its first Superintendent of Specifications, Bennet Woodcroft, the Office published newly deposited specifications, and also all earlier patents beginning in 1617. Hunter, *The Literature of Papermaking 1390-1800* (1925) 48. Hunter, *Papermaking: The History and Technique of an Ancient Craft* (1947) 333; see also 332-35." (http://www.historyofinformation.com/; lesedato 30.03.12)

Klutesamlere gikk fra hus til hus og betalte for stoffrester, filler og brukte klær (Biasi og Douplitzky 1999 s. 109). Disse tekstilene måtte renses for all skitt før de kunne brukes i produksjonen (Biasi og Douplitzky 1999 s. 112). Først på 1700-tallet ble det vanlig å rense papirmassen med klor og i andre kjemiske prosesser (Biasi og Douplitzky 1999 s. 146). Fra 1787 gjorde bruk av klor det mulig å framstille hvitere papir enn tidligere (Barbier 2000 s. 210).

Såkalt vellum-papir ble oppfunnet av John Baskerville i Birmingham i 1750. Papiret ble kalt dette fordi det lignet på svært fint pergament, dvs. vellum. Baskerville trykket en utgave av Vergils i 1757 på vellum-papir (Fontaine 1994 s. 96-97).

"Englishman and a former writing master, John Baskerville, worked with John Wattman to invent wove paper, using forms lined with fine metal mesh to produce a paper that gave new brilliance to luxury print jobs." (Martin 1995 s. 328)

"Norges første papirmølle het Bentse brug og ble etablert i Christiania i 1695." (Hesselberg-Wang 2009c)

"Inntil det 19. århundre var det bare cellulosefibre fra bomull og lin som ble brukt til papirfremstilling i Vesten. Bomull og lin inneholder ca. 90 % cellulose. Fibrene fikk man fra tøyfiller. Kort beskrevet ble fibrene kokt med pottaske eller kalsiumkarbonat, sterkt alkaliske stoffer som nøytraliserte eventuelle syrer. Rester av disse stoffene i papiret virket senere som buffer, dvs. at de beskyttet fibrene mot syreangrep. For å frigjøre fibrene ble fillene tilsatt mye vann og stampet i et hammerverk. Resultatet ble en tynn fibervelling, som ble helt over i en stor bøtte (derav navnet bøttepapir). Vellingen ble øst opp i en spesiell papir-form, som var laget av messing eller bronse. Bunnen i formen var en finmasket duk som slapp vannet gjennom, men holdt fibrene tilbake. Fra slutten av 1200-tallet ble den

finmaskede duken gjerne utstyrt med et filigranmønster som dannet vannmerke i arket. Arkene ble presset mellom filt for å fjerne mer vann og deretter hengt opp til tørk." (Hesselberg-Wang 2009c) "I siste halvpart av det 17. århundre utvikles hollenderen, en maskin til å løse opp fibrene i fillene. Den erstattet det gamle stampeverket." (Hesselberg-Wang 2009c)

Det var i 1840 at en teknikk for å knuse treverk til en bløt masse ble oppfunnet, noe som gjorde det mulig å lage papir av treverk (Fontaine 1994 s. 104). Først i 1843 begynte bruken av treverk/cellulose som etter hvert erstattet klutepapiret (Franzmann, Hasemann og Löffler 1999 s. 39). "The invention of mechanical wood pulp in 1843 was followed in 1854 by the development of soda cellulose, which made it possible to produce paper in almost unlimited quantities. The Fourdrinier paper machine was also further developed, to be able to produce higher quality paper, more efficiently." (Weber 2007 s. 88)

"Den vesentlige bestanddel i papir er cellulose. Cellulosefibre er et av naturens viktigste byggematerialer. Vi finner det i alle slags plantevekster, fra det minste gresstrå til store trær. Cellulose er en polymer, dvs. at den danner lange molekylkjeder som består av et stort antall små, identiske enheter, monomerer. Monomeren er et sukker kalt cellobiose, som igjen består av to glykosemolekyler. Vi kan tenke oss at hvert glykosemolekyl danner en ring og at cellulosepolymeren består av mange ringer hektet til hverandre i lange kjeder. Fra hver ring stikker det ut hydroksylgrupper, som består av et oksygenatom og et hydrogenatom. Det som er viktig i bruken av cellulose til papirfremstilling, er at vannmolekylene kan danne broer mellom de lange cellulosemolekyl-kjedene. Når våte cellulosefibre tørkes, dannes et solid og sammenhengende papirark." (Hesselberg-Wang 2009c)

"Papermaking from Wood Pulp Rediscovered & Industrialized. October 26, 1844 - August 1845. Though Matthias Koops in England produced paper from wood pulp as early as 1801, credit for the discovery of the industrial process for making wood pulp paper is generally given to the German machinist and inventor Friedrich Gottlob [eller Gottlieb] Keller, and to the Canadian poet and inventor Charles Fenerty, both of whom appear to have independently announced the discovery of similar processes in 1844. However, neither Fenerty nor Keller exploited the process; that was accomplished by the German industrialists, Heinrich Voelter, and Johann Matthäus Voith. Fenerty began experimenting with wood pulp around 1838. On October 26, 1844 he took a sample of his paper to the leading newspaper in Halifax, Nova Scotia, the Acadian Recorder. […] [Keller] sold his process to a paper specialist Heinrich Voelter, and in August, 1845 both Keller and Voelter received a German patent, which reverted entirely to Voelter, and Keller became unemployed. In 1848 industrialist Johann Matthäus Voith began working with Voelter to develop means of mass producing paper by wood pulp processing, and by 1852 Voelter was selling numerous wood-grinding machines for the papermaking process, and producing wood pulp paper at his mill in Heidenheim. Voith continued to improve the process, and in 1859 he created the first Raffineur,

a machine that refined the raw wood pulp and significantly improved the quality of paper products. Voelter and Voith's business continues today as a division of the German industrial company Voith AG." (http://www.historyofinformation.com/; lesedato 30.03.12) Under verdensutstillingen i 1867 i Paris presenterte Voelter en maskin som produserte papir på sitt tilmålte utstillingsområde (Biasi og Douplitzky 1999 s. 150).

Fransk-tyske Louis Piette så behov for et fagtidsskrift, og startet i 1854 *Tidsskrift for papirprodusenter* som skulle informere om tekniske finesser, støtte videre undersøkelser innen papirindustrien og utveksle erfaringer. Tidsskriftet ble utgitt på papir lagd av en lang rekke råvarer, bl.a. bregnebusker og gress (Biasi og Douplitzky 1999 s. 150).

"The Sulfite Pulping Process for Manufacturing Paper. 1866. American soldier and inventor Benjamin Chew Tilghman developed the sulfite pulping process for the manufacture of paper from wood pulp, receiving the US patent on the use of calcium bisulfite, Ca(HSO3)2, to pulp wood in 1867. The first mill using this process was built in Bergvik, Sweden in 1874. It used magnesium as the counter ion and was based on work by Swedish chemical engineer Carl Daniel Ekman. Throughout the 19th century it was increasingly necessary to find workable substitutes for scarce linen rags, the supply of which could not possibly keep up with the growing demands for paper. While the production of paper from wood pulp enabled greatly increased production, the bleaching agents used in this new process reduced the longevity of paper. The pulping, bleaching, and sizing processes generated hydrochloric and sulfuric acids, which over time resulted in brittleness and deterioration of paper, and the possible loss of information." (http://www.historyofinformation.com/; lesedato 30.03.12)

"Inntil ca. 1800 foregikk bleking i solen. Kjemiske blekemidler som klor ble ikke tatt i bruk før 1780. Klor har siden vært benyttet inntil for få år siden, da det av miljøhensyn er blitt erstattet av andre og lettere nedbrytbare forbindelser. Papiret måtte limes for å være godt egnet som skrivemateriale. Arkene ble trukket gjennom limbad, inntil ca. 1800 ble som regel pergamentlim/gelatin benyttet. Moritz Friedrich Illig tok rundt 1800 i bruk harpikslim og tilsatte alun, dvs. aluminiumsulfat, for å gjøre lim-prosessen mer effektiv. Aluminiumsulfat reagerer med vann (som vi vet er til stede i papiret) og danner svovelsyre. Syre virker som en saks som klipper over de lange cellulosekjedene og forårsaker at papiret mister styrke og blir sprøtt. Denne form for nedbrytning betegnes som depolymerisasjon og angis i grader. Dessverre har tilsetning av aluminiumsulfat i limprosessen for å oppnå vann- og blekkfast papir vært dominerende inntil for få år siden." (Hesselberg-Wang 2009c)

"Under fremstillingen av håndlaget papir vil papirmakeren bevege papirformen slik at fibervellingen fordeles jevnt utover duken. Fibrene havner hulter til bulter uten noe spesielt system. I papirmaskinen derimot vil fibrene p.g.a. vannflommen ha en

tendens til å orientere seg i maskinens kjøreretning. Fiberretningen har meget stor betydning ved falsing av ark [dvs. bretting] og er avgjørende for kvaliteten på bøker." (Hesselberg-Wang 2009c)

Det har blitt kalkulert at det i 1730-årene var behov for 2.900 tonn papir årlig i England, mens behovet i 1795 hadde steget til 11.600 tonn (Barbier 2000 s. 210). I årene 1861-1900 ble den britiske papirproduksjonen nesten sjudoblet, fra 96 tusen tonn til 648 tusen tonn (Biasi og Douplitzky 1999 s. 151). Midt på 1800-tallet var behovet for papir i Tyskland til aviser, tidsskrifter og kalendere tre ganger så stort som behovet for papir til bøker (Wilke 2000 s. 158). På slutten av 1900-tallet ble ca. 85 % av alt papir i verden lagd av cellulose fra trær, det øvrige lagd av bomull, lin etc. (Biasi og Douplitzky 1999 s. 187).

Mesteparten av papiret lagd i perioden 1800-1985 er svært syreholdig, og trenger kalde og tørre magasiner for å kunne bevares lenge. Magasinene bør helst ha lave CO^2-utslipp. Syreholdig papir har ellers relativ kort holdbarhet. Det blir gult og kan lett gå i biter. Papir utsettes også for syre fra hender som tar i papiret og fra forurenset luft (Biasi og Douplitzky 1999 s. 225).

Bomullsfibre er omtrent ti ganger så lange som fibrene i trær (Biasi og Douplitzky 1999 s. 187). "The Questionable Quality of Paper. […] In his annual report for 1898 Librarian of Congress John Russell Young commented on the "questionable quality of the paper upon which so much of the Library material is printed." Referring to the wood pulp paper that is inferior to paper previously made from linen rags, Young warned that many of the works coming into the Library "threaten in a few years to crumble into a waste heap, with no value as record." " (http://www.historyofinformation.com/; lesedato 30.03.12)

Syrens langsomme destruksjonsprosess kalles papirets "slow fire" (Biasi og Douplitzky 1999 s. 225). "Scholars, archivists and preservationists assembled here to discuss the slow deterioration of books and paper archives at libraries around the world. A montage of crumbling books, the "slow fire" of the acidic paper on which most modern books and newsprint are printed, gives grim evidence of what Library of Congress deputy librarian William Welsh calls "embrittlement," the inexorable decay of paper, crumbling to the touch like dry, autumn leaves. He believes that fully one-quarter of the then 13 million documents in the collection are in severe danger. More than 77,000 additional ones per year are also in jeopardy. Even worse, this is an international phenomenon. An irony is that the older the document, the more likely it is to be well preserved. Until 150 years ago, most books and papers were rag rather than wood pulp based and were acid free, PH neutral or safely alkaline. It is not so much the deep historic record of man that is at risk (though that as well) but the more recent record of modernity. It is not so much the valuable papers of our culture that are being lost; it is the contracts, court records, pulp fiction, magazines and newspapers that are most at risk."

(http://www.theasc.com/; lesedato 04.04.12) Det syreholdige papiret gulner, blir mindre bøyelig og smuldrer opp (Biasi og Douplitzky 1999 s. 225).

En gruppe kjemiske stoff kalt "alkalier" er "[s]ubstances with a pH exceeding 7.0 (neutral), for example, calcium carbonate or magnesium carbonate added to paper in manufacture as a reserve or buffer to neutralize any acids that might develop with age. Alkaline substances are also used in the deacidification of materials made from acid paper or board. The opposite of acidic." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

"Acid paper" er papir "that has a pH value less than 7.0 (neutral). The primary source of acid in paper is lignin, an organic substance contained in untreated wood pulp, but acid can also develop from the addition of certain types of sizing or from residual chlorine used in bleaching. It can also be introduced by acid migration or atmospheric pollution (sulfur dioxide). Because acidity weakens the cellulose in plant fiber, it can cause paper, board, and cloth to yellow and become brittle over time, making it an important factor in the preservation of printed materials. To ensure durability, publishers are encouraged to use acid-free permanent paper in printing trade books. Buffering helps neutralize acids that develop after manufacture. Acid can be removed from fiber-based materials by an expensive process called deacidification. " (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

"Buffered paper" er "[p]rinting paper to which an alkaline substance, such as calcium carbonate or magnesium carbonate, is added in manufacture to neutralize any acid produced internally as a result of aging or introduced by acid migration or exposure to atmospheric pollution." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05) Tilsvarende defineres "buffering" slik: "In papermaking, the addition of an alkaline substance such as calcium carbonate or magnesium carbonate to the pulped fiber to neutralize any acid that may develop as paper ages or that is introduced through acid migration or exposure to atmospheric pollution. Extent of buffering is indicated as a percentage of the paper weight, usually no more than 2 to 3 percent." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

"Esparto" er en papirtype "named after a coarse, short-fibered grass grown in the Mediterranean region that, when mixed with chemical wood pulp, produces the bulk and smooth finish suitable for printing fine-quality books and plates" (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05).

"Glassine" er en type "thin, dense, translucent glazed paper sometimes used to protect the covers of new books. Also used for panels in window-envelopes and as wrapping material because it is resistant to the passage of air, water, grease, etc." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

“Cover paper” er “[h]eavier grades of paper used for the outer cover of pamphlets, trade catalogs, and paperback books. Also, any paper used to cover the outer surface of the boards of a book bound in hardcover. Available in a wide range of colors, cover papers often have a finish designed for durability or to enhance marketability.” (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

Såkalt “coated paper” er papir der “a thin layer of mineral, wax, resin, plastic, or emulsion has been applied, either in the papermaking machine prior to drying and finishing or by a separate coating machine after manufacture (some papers are double-coated using both methods). Coated papers are used to print posters, wall calendars, dust jackets, magazine and catalog covers, and other materials in which detailed visual elements predominate (art books, exhibition catalogs, coffee table books, etc.). The finish can be glossy or dull. Also known as art papers.” (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

Betegnelsen “eggshell” brukes om en “smooth, slightly pitted finish given to uncoated paper or board that produces a soft, nonglossy surface resembling the shell of a bird’s egg. Most antique papers have this type of finish.” (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

“Glossy”: “A finish in which the surface of paper or board is given a smooth, shiny coat of varnish to enhance the appearance of visual material (illustrations, posters, etc.). Most magazines are printed on glossy paper to attract readership, as are dust jackets to heighten the sales appeal of new books. In publishing, the term also refers to a photograph printed on smooth, shiny paper, the format preferred by printers in reproduction work.” (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

“Foxing” er “[r]eddish-brown or yellowish spots resembling freckles on the paper of old documents (books, prints, etc.), a condition probably caused by fungus and/or a chemical reaction under humid conditions. Particularly common in paper made by machine in the late 18th and 19th centuries, foxing can vary in extent from barely visible to ruinous. Although the cause (or causes) are not fully understood, the fact that foxing often begins near the edge of a leaf or sheet and spreads inward suggests that exposure to the atmosphere may play an important role. In some types of documents, foxing can be reduced or eliminated by a technique called washing, but preservationists proceed with caution because some methods can cause further damage.” (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

“Deckle edges” er “[t]he uneven or feathered edge of a sheet of handmade paper, created by the flow of liquefied fibrous stock between the frame (deckle) and sieve of the mould used in manufacture. The same effect is achieved in machine-made paper by exposing the edge to a jet of air or water. In quality bookbinding, deckle edges are considered tasteful, but since books tend to collect dust when stored on

an open shelf, and rough edges are difficult to clean, the feature is not practical." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

"Fold endurance" har vært et "measure of the strength of a grade of paper, based on the number of times a sheet can be folded in both directions along the same fold line before the fibers detach at the crease, usually tested mechanically. Fold endurance was dropped as a criterion in the 1992 revision of the ANSI/NISO Z39.48 standard for permanence of paper." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

"The term 'double fold' refers to the test used by many librarians and preservation administrators to determine the brittleness and 'usability' of paper. The test consists of folding down the corner of a page of a book or newspaper, then folding it back in the opposite direction – one double fold. The action is then repeated until the paper breaks or is about to break. The more folds the page can withstand, the more durable it is. (In the late 1960s, preservation founding father William Barrow was fond of using a machine-run fold tester to back up his claims about the number of endangered books.) This experiment was used by library officials to identify their institution's brittle books, and, in some case, to justify withdrawing items from the shelves or replacing them with another format (most often microfilm)." (http://www.historyofinformation.com/; lesedato 30.03.12)

"The boards and paper in a finished book may cockle if heat is applied following exposure to excessive moisture. The condition can be prevented by controlling temperature and relative humidity in storage. The parchment and vellum used as a writing surface in medieval manuscripts is also susceptible to cockling because it is made from membrane" (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05).

Det er utviklet teknikker for å av-syre papir, dvs. å fjerne de syrene som tærer på cellulosen. En teknikk er å legge bøkene med syreholdig papir i en slags vaskemaskin-trommel med kjemikaler som fjerner syrene. Etterpå tørkes bøkene i en slags mikrobølgeovn (Zimmer 2000 s. 171). Det tyske firmaet Battelle hadde rundt år 2000 utviklet en teknikk som gjorde tørking unødvendig. Battelles maskiner ble plassert i kjelleren i Det tyske bibliotek i Leipzig og hadde kapasitet til å avsyre 200 000 bøker i året (Zimmer 2000 s. 171). Avsyringen reparerer imidlertid ingen skader på papiret som allerede har oppstått.

"Computers Have Not Caused a Reduction in Paper Usage or Printing. […] In 1999 it required about 756,000,000 trees to produce the world's annual paper supply. "The UNESCO Statistical Handbook for 1999 estimates that paper production provides 1,510 sheets of paper per inhabitant of the world on average, although in fact the inhabitants of North America consume 11,916 sheets of paper each (24 reams), and inhabitants of the European Union consume 7,280 sheets of paper annually (15 reams), according to the ENST report. At least half of this paper is

used in printers and copiers to produce office documents." Thus computers have not reduced paper usage; if anything, because nearly everyone who owns a personal computer also owns a printer, and more and more people acquire computers every year, the amount of printing being done continues to increase." (http://www.historyofinformation.com/; lesedato 30.03.12)

"Research on Paper Though Time by a University of Iowa team led by Timothy Barrett, director of papermaking facilities at the UI Center for the Book, showed that the earliest paper tended to be the most durable over time because of high qualities of gelatin and calcium in its manufacture. Over three years the team analyzed 1,578 historical papers made between the 14th and the 19th centuries. Barrett and his colleagues devised methods to determine their chemical composition without requiring a sample to be destroyed in the process, which had limited past research. […] Barrett says one possible explanation for the higher quality of the paper in the older samples is that papermakers at the time were attempting to compete with parchment, a tough enduring material normally made from animal skins. In doing so, they made their papers thick and white and dipped the finished sheets into a dilute warm gelatin solution to toughen it. "Calcium compounds were used in making parchment, and they were also used in making paper," Barrett says. "Turns out they helped prevent the paper from becoming acidic, adding a lot to its longevity." " (http://www.historyofinformation.com/; lesedato 30.03.12)

"All over the world, people use paper every day. From eco-friendly food packaging to recyclable newspapers and magazines, to office paper, printing paper and tissue paper, most people can't get through the day without it. Paper makes our world better. And when we make the right paper choices, we get the chance to return the favor. So, why is it that so many people seem to have turned on paper? Through misleading environmental claims like deforestation, excessive energy consumption and crowded landfill sites, it's been the source of recent bad publicity. However, with a little more information, it soon becomes clear that paper isn't the cause of environmental destruction. In fact, it just may offer a solution. So we decided to clear up the confusion and turn a page in the way people see paper. Below are a few key reasons why paper is good – and why the right paper is even better. For starters, making paper doesn't destroy forests. In fact, the forest products industry plants more than 1.7 million trees per day. When you think about it, it just makes sense. After all, if we don't ensure a steady supply of raw materials, how can we continue to provide the products that so many people rely on to communicate and store information each and every day? That's why, for every tree we harvest, several more are planted or naturally regenerated in its place. And it's not just about sustaining paper. It's also about sustaining forest life. […] Paper is portable, secure, consistent and permanent. It's 100% recyclable. And the people who make it have made great strides in reducing overall energy consumption and protecting natural forests. Maybe that's why there are nearly 750 million acres of forests in the U.S. – about the same as 100 years ago. Additionally, annual net growth of U.S.

forests is 36 percent higher than the volume of annual tree removals, and total forest cover in the U.S. and Canada has basically remained the same from 1990 to 2005. By planting new seedlings, we help rid the atmosphere of carbon dioxide, and replace it with fresh oxygen. As young trees grow, they absorb CO2 from the atmosphere. […] Paper has often been accused of taking up excessive landfill space. However, thanks to the success of neighborhood curbside recycling programs, increased community awareness and individual activism, recycling rates are now at an all-time high. In 2009, over 63 percent of the paper consumed in the U.S. was recovered for recycling. To put it in perspective, the recovery rate for metal is 36 percent; glass is 22 percent; and plastic is only 7 percent." (http://www.paperbecause.com/Paper-is-Sustainable/Paper-is-Not-Bad; lesedato 27.10.10)

"Publishers have been printing selected manuscripts on recycled paper since the late 1990s. Yet it was J. K. Rowling's *Harry Potter and the Deathly Hallows* that took eco-friendly publishing to a whole new level. When the book was released in 2007, it was printed on recycled paper in sixteen countries, including in Canada, where publisher Rainforest has been printing the *Harry Potter* series on "green" paper since 2003. Scholastic, the series' U.S. publisher, agreed to print the first 12 million copies of the *Deathly Hallows* on paper made from at least 30 percent post-consumer waste fiber. In addition, the 100,000 deluxe editions were printed on 100 percent recycled paper. According to a report from the Canadian organization Markets Initiative, which works with book publishers to shift their titles onto eco-friendly papers, the English-language editions of this book will save more than 197,000 trees, an area 2.5 times the size of Central Park. The efforts of Rainforest, Scholastic, and other *Harry Potter* publishers around the world have set a precedent in the book industry. An estimated 300 publishers have since announced plans to increase the number of books they print on eco-friendly papers, while dozens of printers have begun to stock recycled paper." (Turow 2009 s. 276)

Papir lagd av bomullsfibre brukes i blant annet pengesedler og bibler (Biasi og Douplitzky 1999 s. 187). I Norge har Bibelen i moderne tid ofte blitt trykt på tynt, syrefritt papir. Dette papiret er langt mer varig enn vanlig papir. "Alt såkalt syrefritt og syrenøytralt papir er syrefritt/nøytralt når det kommer fra fabrikken. Men alt papir vil kunne trekke til seg syre […]. Har papiret ligget fremme, eksponert for luft og lys, så har det hatt anledning til å trekke til seg ganske mye syre. […] Ellers så er både sedler og frimerker syrefrie." (http://www.kameraregisteret.no/; lesedato 03.04.12) "I løpet av siste halvdel av 1800-tallet fant man frem til to metoder for å fjerne lignin og harpikser fra tremassen, slik at man fikk en ren cellulose. Denne rensede, bleknede massen kalles kjemisk masse og det er denne som nesten alt kvalitetspapir i dag lages av. Papir som er laget av ren cellulose er av høy kvalitet og har lang levetid. Men det forutsetter at limet som er blandet i massen er syrenøytralt. Ikke før 1980-tallet kan vi snakke om en full omstilling av produksjonsprosessen av kvalitetspapir, der man gikk over til syrenøytrale limtyper. Når vi bruker uttrykket "syrefritt papir", snakker vi om papir som ikke

inneholder mekanisk masse, dvs. urensede trefibere. For at et papir skal kunne kalles "syrefritt", er det ikke nok at det ikke inneholder mekanisk masse. Det må også være nøytralt limt. Et syrefritt papir skal ha en pH på 7 eller mer." (http:// www.rammehjornet.no/; lesedato 03.04.12)

Såkalt "bibelpapir" er "strong, thin, opaque printing paper made from new cotton or linen rags, or from flax fiber, used to reduce the bulk of large volumes such as dictionaries, encyclopedias, bibles, and prayer books that would otherwise be too thick for easy handling. Sometimes used synonymously with India paper."

Det italienske "Istituto Centrale per il Restauro e la Conservazione del Patrimonio Archivistico e Librario […] restaurerer og konserverer bøker og arkivmateriale […] Det er hundrevis av verker – bøker, pergamenter, manuskripter og tegninger – som hvert år havner under konservatorenes mikroskoper og forstørrelsesglass på "bokhospitalet". De er i elendig forfatning enten de er fortært av tidens tann, vann, bakterier, insekter og mus eller er blitt flammenes eller krigens rov. […] Etter den siste flommen i Toscana ba de lokale myndighetene oss om hjelp til å redde de oversvømmede arkivene. Vi rådet dem til å fryse bøkene. Det hindrer at blekket flyter utover og at mikroorganismer formerer seg. Deretter lar man det frosne vannet fordampe for å unngå vannskade […] Instituttet har også et museum som er fylt med bøker som livet har fart hardt med. En bok er gjennomboret av et knyttnevestort hull etter termittangrep. En annen er full av kulehull som stammer fra slaget ved Monte Cassino under annen verdenskrig." (*A-magasinet* 10. august 2012 s. 42-45)

"Hvert år bruker den amerikanske bokindustrien noe slikt som 30 millioner trær. […] En undersøkelse i regi av britiske HarperCollins viste at 84 prosent av britiske bokkjøpere ville kjøpe en bok laget av gjenvinningspapir hvis de kunne, fremfor av normalt papir – og en tredjedel av dem var villig til å betale mer for slike miljøvennlige bøker." (*Aftenposten* 5. juli 2009 s. 12)

Den franske forfatteren Jean Genet skrev sin debutroman *Vår Frue med blomster* (1942-43) på toalettpapir mens han satt i fengsel. Manuset ble funnet og fjernet, men Genet skrev det på nytt (Millett 1993 s. 191). Toalettpapir i fengsler har vanligvis vært hardere/stivere enn det toalettpapiret som kjøpes i vanlige butikker. Den amerikanske forfatteren Kate Millett har fortalt at hun så et lite stykke toalettpapir som det stod fem hundre ord på, skrevet av en irsk fange og smuglet ut av Armaugh-fengslet i Nord-Irland (Millett 1993 s. 191).

"When I read an old book, I hold its pages up to the light and often find among the fibers of the paper little circles made by drops from the hand of the vatman as he made the sheet – or bits of shirts and petticoats that failed to be ground up adequately during the preparation of the pulp. I once found a fingerprint of a pressman enclosed in the binding of an eighteenth-century *Encyclopédie* – testimony to tricks in the trade of printers, who sometimes spread too much ink on

the type in order to make it easier to get an impression by pulling the bar of the press." (Darnton 2008)

"Å løfte en treform opp fra karet, er tungt, og selv den sterkeste papirformer klarte ikke å lage et jevnt papir på rammer som var større enn ca. 80 x 55 cm. Behovet for større formater førte til oppfinnelsen av den løpende viren, som ble oppfunnet av franskmannen Nicholas-Louis Robert i 1799. Med visse forbedringer ble denne papirmaskinen satt i produksjon i begynnelsen av 1800-årene, og den ble kalt en Fourdrinier, etter brødrene Fourdrinier, som hadde forbedret Roberts opprinnelige patent. Størrelsen og kapasiteten har naturligvis endret seg, men i prinsippet er det den samme maskinen som brukes i dagens papirproduksjon!

Fourdrinier-maskinen bestod av en duk, en vire, som ble drevet rundt og rundt av hjul. Duken gikk gjennom karet med fibermasse, og massen festet seg på duken. Massen ble mekanisk rystet jevnt utover duken, og deretter ført gjennom valser som presset ut vannet. De første maskinene var halvmekaniske, slik at arbeidere kuttet til det halvvåte papiret, etterlimte og tørket det, men etterhvert ble også disse delene av produksjonen gjort maskinelt. Papirduken gikk gjennom en beholder med lim, og avslutningsvis ble papirbanen ført gjennom en rekke valser for tørking og glitting av overflaten.

[…]

Etterspørselen etter papir økte stadig. Fra 1700-tallet ble mangelen på råstoff et problem som vokste i takt med papiretterspørselen. Det ble innført forbud mot eksport av kluter, og det var strenge bøter for ikke å levere filler og kluter til klutesamleren. Det ble eksperimentert med andre typer plantefibre; strå, gress, bark fra ulike trær, potetplante (!), løvetann, osv.

Naturvitenskapsmannen René Antoine Ferchault de Réaumur var den første som i 1719 kom i tanker om å bruke trefiber som råstoff for papir.

[…]

Trefibre inneholder harpikser og et stoff som heter lignin. Dette stoffet ligger mellom cellene i treet som et slags lim, og gir treet fleksibilitet og styrke. Ligninet løses ikke i vann, og det danner kjemiske forbindelser som gjør papiret gult og sprøtt.

Harpiks ble tatt i bruk som overflatelim for papir fra første halvdel av 1800-tallet. Det billige harpikslimet kunne tilsettes direkte i papirmassen, og slik unngikk man den tidkrevende prosessen med gelatinliming. Man fant snart ut at ved å tilsette alun kunne man spare inn på limmengden, fordi harpikslimet da spredte seg jevnere i papirmassen.

Kombinasjonen av harpiks, alun og lignin i urensede trefibre var en katastrofe for papiret. Alunet, som inneholder svovel, dannet lett svovelsyre, som angrep papirfibrene. Ligninet får papiret til å gulne og bli sprøtt. Resultatet var et papir som etter kort tid ble så nedbrutt at det knapt kunne håndteres.

Ubleket tremasse, såkalt mekanisk masse, brukes idag i produksjonen av avispapir, og det er innholdet av lignin som gjør at avisen gulner allerede etter noen timer i solen.

[…]

Man forsto snart at en av årsakene til at det nye papiret gulnet, var innholdet av lignin og harpikser i trefibrene, og det ble derfor lett etter en måte å rense fibermassen på. De uønskede komponentene var ikke vannløselige, men var løselige i sterk alkali og sterk syre. I løpet av siste halvdel av 1800-tallet utviklet det seg to rensemetoder:

- sulfatprosessen, der tremassen ble kokt under trykk med sterk alkali (kaustisk soda), og

- sulfitprosessen, der tremassen ble kokt under trykk med sterk syre (svovelsyre).

Sulfitprosessen ga en cellulosemasse som lot seg bleke, og denne rensemetoden ble tidlig den dominerende. Sulfatprosessen ga sterkere fibre, som var vanskelige å bleke, og denne prosessen ble derfor brukt hovedsakelig til produksjon av kraftpapir. I norsk papirproduksjon idag er det sulfatprosessen som brukes, med unntak av Borregaard, som produserer sulfitpapir. Den rensede tremassen kalles kjemisk masse, og består av ren cellulose.

Den kjemiske massen er ren cellulose, og papirene laget av dette fibermaterialet burde i prinsippet være av høy kvalitet og ha en lang levetid. Likevel ser vi at mye av det papiret som ble produsert frem til 1970-årene er av meget dårlig kvalitet. Dette skyldes først og fremst limet, som gjennom det meste av 1900-tallet fortsatte å være harpiks/alunlim. Limet var billig, prosessen var enkel, og en omstilling av produksjonen var svært kostbar. Dessuten hadde man lenge ikke noe konkurranse-dyktig alternativ til harpikslimet. Først fra 1980-årene kan vi snakke om en full omstilling av produksjonsprosessen av kvalitetspapir, der man gikk over til syrenøytrale limtyper." (papirkonservator Kari Greve i http://www.nbbs.no/papir.htm; lesedato 07.01.13)

"Woodpulp magazines, later shortened to "pulps" in the lingo of the trade, got their name from the cheap paper on which they were printed, of such dubious quality that readers often found splinters pressed into the pages." (Fugate og Fugate 1980 s. 41)

Sand har helt fram til slutten av 1800-tallet blitt brukt for å suge opp blekk, altså til da trekkpapir ble oppfunnet. En arbeider ved en britisk papirfabrikk glemte å limstryke skrivepapiret han skulle lage (limstrykingen gikk ut på behandle papiret med en klebrig oppløsning for å gi det en glatt overflate). Fabrikkeieren tok dette papiret for å bruke det til kladdepapir på sitt kontor, men blekket fra hans fyllepenn ble sugd opp i papiret, og slik fikk han ideen til å produsere trekkpapir. "My 6″ x 3″ blotting paper has been in use for at least four years. It is very heavy paper and resides in my daily journal between the most recent passage and the facing page. It serves as a bookmark plus I never have to wait for ink to dry, handy when you think about what gets written in a journal. Should someone walk up behind me, I can slam the book shut instantly without fearing a mess when I return. Two disasters averted! […] The blotter makes the writing tidy and as close to instant drying as this nib will ever get. As if collecting ink and pens wasn't engrossing enough, there are collectors of rocker blotters and even those who collect blotting paper. To be sure there are some gorgeous antique ones that turn up now and again." (anonym blogger sitert fra https://inkophile.wordpress.com/2010/12/27/the-ink-blotter-a-dirty-little-secret/; lesedato 06.02.15)

"A few extremists [på 1700-tallet] took to reading-as-digestion literally: thus the case of a woman in Hampshire, England, who "ate a New Testament, day by day and leaf by leaf, between to sides of bread and butter, as a remedy for fits." [...] On eating the New Testament and other ritualistic uses of books, see David Cressy, "Book Totems in Seventeenth-Century England and New England," *The Journal of Library History* 21 (1986): 99." (Towheed, Crone og Halsey 2011 s. 30 og 34)

"Vårt Land forteller om Bibelselskapets nye nytestamente som tar i bruk et patentert, syntetisk papir, og er innbundet med vannfast lim, slik at både boksider, omslag og innbinding tåler vann. […] Den amerikanske patentinnehaveren på mirakelmaterialet Durabooks™ rettet seg mot andre segmenter, da de tidlig i forrige tiår lanserte nyvinningen" (*Morgenbladet* 18.–24. juni 2010 s. 34).

Såkalte "contraries" er "[i]mpurities in the rag, waste paper, or other fibrous material from which paper is made, usually bits of wool, feathers, or twine, or hard materials such as metal staples, bone, or plastic that must be removed in the papermaking process to maintain quality of product. Contraries occasionally show as blemishes in a sheet of finished paper." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

På engelsk er "dandy roll" en "cylinder that exerts pressure in mechanized papermaking, smoothing the surface and creating designs such as the watermark, countermark, and the lines characteristic of laid and wove paper." (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

Klevfos Cellulose & Papirfabrikk ble startet i 1888 ved Løten, øst for Hamar. Den brant ned i 1909, men ble bygd opp igjen og var i drift fram til 1976. I dag er fabrikken et kulturminne.

"Du har kanskje sett dem i bøker du har lest – de grønne logoene med stiliserte trær i ulike fasonger. Sertifikatene har navn som FSC og PEFC, og skal forsikre leseren om at bøkene er trykket på papir fra bærekraftig skogbruk. Men kan vi stole på det? Nei, mener Regnskogfondet. […] Forleggerforeningen laget i fjor en veileder for ansvarlig anskaffelse av papir med innspill fra Regnskogfondet. Arbeidet ble satt i gang etter at fondet i 2015 og 2016 fant regnskogfiber i en rekke norske bøker trykket i Kina. Veilederen er en guide til hvordan forlag kan minske risikoen for å bruke trevirke fra såkalt kontroversielle kilder. […] Det ideelle ville være å bruke mest mulig resirkulert papir. […] I tillegg er Cappelen Damm medlem i Preps, som eneste norske forlag. Det gir tilgang på en database over ulike papirkvaliteter og hvor de kommer fra. [...] De norske bøkene som Regnskogfondet fant regnskog-fibre i, kom fra Kina. Disse bøkene er ofte trykket i samproduksjon med et utenlandsk forlag. Cappelen Damm foretar stikkprøver hvert år av tilfeldig utvalgte titler [...] Da sendes bøkene til et laboratorium i England, som analyserer hvor fibrene kommer fra. Så langt er det ikke funnet regnskogfiber i noen av bøkene [...] Opp mot 97 prosent av Cappelen Damms egenproduksjon er laget med sertifisert papir. Trevirket kommer hovedsakelig fra Norden og fra eukalyptusplantasjer i Brasil." (*Klassekampen* 21. november 2020 s. 50-51)

"Målet for norske forlag er å unngå uakseptable papirkvalitetar. Men spørsmålet er i kor stor grad vi greier å sikre dette, seier Heidi Austlid i Forleggerforeningen. […] - Vi har utarbeida ein rettleiar som skal hjelpe forlaga til å velje gode materialar til trykking av bøker. I den er det fyrst og fremst fokus på å sikre at ikkje papir har fibrar frå tropisk regnskog, men den er like aktuell i høve til utryddingstrua naturskog i Sverige og Noreg. […] Forfattarane kjem til å etterspørje ein berekraftig bokproduksjon, og etterkvart vil kundane som kjøper bøker det også." (*Morgenbladet* 26. mars–8. april 2021 s. 57)

"Ein av få norske forfattarar som kan vere sikker på at boka hans ikkje bidreg til å øydelegge gammalskogen, er Thomas Horne, som i fjor vann Brageprisen for *Den store klimaguiden*. Dei svært taktile boksidene i denne er laga av avfall frå landbruket. - Det gir ein dobbel klimaeffekt, ved at landbruksavfall som ikkje kan komposterast blir til papir i staden for å brennast. Ein unngår avskoging, og ein unngår CO_2-utslepp, seier Horne, som synest det var heilt sjølvsagt at han og designaren Eivind Stoud Platou jobba for at forlaget valde ein så klimavennleg produksjon som mogleg, når han hadde skrive ei bok om dette emnet. Størstedelen av klimaavtrykket til ei bok kjem frå papiret, og derfor er spørsmålet om klimapåverknaden til skogsindustrien særleg viktig for forfattarar. Svara på det spørsmålet er kompliserte, men at skogsindustrien liksom skal vere klimanøytral, vil ikkje Horne vere med på. - I den boreale skogen vi har, som er del av eit belte som strekker seg over heile den nordlege halvkula, er 80 % av karbonet lagra i

jordsmonnet, i enorme underjordiske nettverk av sopp og ulike former for mikroliv. Det tek 30 til 60 år før eit nyplanta tre kan binde opp like mykje karbon som det ein hogde, det er tid vi ikkje har, viss vi skal bremse klimaendringane. […] - Forfattarar er overraskande lite opptekne av kvar papiret i bøkene deira kjem frå. Det er forlaget og designarane som bryr seg om papir, men eg har inntrykk av at omsyn til klima og miljø kjem ganske langt ned på lista. Vi bør vere klarare i krava våre til forlaget, og søke ein mest mogleg klima- og miljøvennleg produksjon." (*Morgenbladet* 26. mars–8. april 2021 s. 56-57)

Papirkunstneren Karen Bit Vejles "uttrykksform, psaligrafi, betyr bokstavelig talt kunsten å tegne eller male med saks. Hun åpnet sin første utstilling på Nordenfjeldske Kunstindustrimuseum i Trondheim i 2008, og i løpet av få år har hun vist arbeidene sine flere steder i Skandinavia, i USA og Kina. Hennes kunstneriske arbeid spenner fra vandreutstillingen "Scissors for Brush" til bestillingsverk for UD og flere anerkjente internasjonale selskaper, som for eksempel Hermes og Georg Jensen. Karen Bit Vejle forteller magiske historier med sin saks. Hun lytter alltid til musikk mens hun klipper, og det er ofte mye humor i hennes billedunivers. Humor og evnen til å se gleden i de små tingene. Like ofte ligger det en dyp seriøsitet og temaer som skaper engasjement og refleksjon. I motsetning til nesten alt annet i dagens samfunn, er psaligrafi en langsom aktivitet. Det tar tid å mestre, planlegge og utføre. Vejles arbeider er formet fra et stort sammenhengende ark, og klippes med kun en liten saks. Hvert enkelt sakseklipp er nøye planlagt, ettersom selv den minste feil kan ha fatale konsekvenser for sluttresultatet. Dette er en langsom kunst som krever nesten pinsom tålmodighet og dyp konsentrasjon." (https://www.fineart.no/kunstner/bit-vejle; lesedato 20.11.20)

Klutepapir

Også kalt "bøttepapir". Klutepapir/bøttepapir (også kalt "büttenpapir" og "håndpapir") er en type kluteholdig papir, "ofte håndlaget og med vannmerke. Kan også være med råkant til en eller flere sider. Har navn etter trekaret eller bøtten som man dyppet i papirmassen. I Europa ble papiret i begynnelsen laget av kluter (filler), fortrinnsvis av bomull og lin. Klutene ble levert på papirmøllen, der de ble renset og lagt i kummer til gjæring. Etterpå ble de banket til fibermasse i stampemøller. Massen ble overført til store kar, "bütten" = bøtte, og tilsatt mer vann. En treramme med virebunn ble dyppet i massen, og når den ble løftet, rant vannet ut gjennom viren (nettingen) i bunnen. Formen ble rystet slik at papirfibrene ble sammenfiltret. Papir og filt ble skiftevis lagt opp til en stabel på 260 ark, etter franske mål ½ ris, som ble presset. Diderot forteller at et godt arbeidslag på en 16 timers dag kunne framstille 4160 ark. Det største problemet var å få ensartet tykkelse på papiret." (Nystuen m.fl. 2008 s. 73)

Fra 1400-tallet til 1700-tallet i Frankrike var klutepapir av god kvalitet en stor utgiftspost for boktrykkerne, større enn betalingen for arbeidet med selve trykkingen (Febvre og Martin 1999 s. 172).

“Inntil det 19. århundre var det bare cellulosefibre fra bomull og lin som ble brukt til papirfremstilling i Vesten. Bomull og lin inneholder ca. 90 % cellulose. Fibrene fikk man fra tøyfiller. Kort beskrevet ble fibrene kokt med pottaske eller kalsiumkarbonat, sterkt alkaliske stoffer som nøytraliserte eventuelle syrer. Rester av disse stoffene i papiret virket senere som buffer, dvs. at de beskyttet fibrene mot syreangrep. For å frigjøre fibrene ble fillene tilsatt mye vann og stampet i et hammerverk. Resultatet ble en tynn fibervelling, som ble helt over i en stor bøtte (derav navnet bøttepapir). Vellingen ble øst opp i en spesiell papir-form, som var laget av messing eller bronse. Bunnen i formen var en finmasket duk som slapp vannet gjennom, men holdt fibrene tilbake. Fra slutten av 1200-tallet ble den finmaskede duken gjerne utstyrt med et filigranmønster som dannet vannmerke i arket. Arkene ble presset mellom filt for å fjerne mer vann og deretter hengt opp til tørk.” (Hesselberg-Wang 2009c)

“I siste halvpart av det 17. århundre utvikles hollenderen, en maskin til å løse opp fibrene i fillene. Den erstattet det gamle stampeverket.” (Hesselberg-Wang 2009c)

Vannmerke

Et merke som er gjennomsiktig som vann, men synlig i et papirark. Et emblem eller annet merk lagd i selve papirstrukturen i et ark, og spesielt synlig hvis papiret holdes mot lyset. Brukes til å markere hvem som har produsert papiret e.l., og kan dermed brukes til tidfesting av når bøker ble produsert.

Vannmerker stammer fra perioden da papir ble håndlagd, ark for ark. Merkene ble lagd ved at en form lagd av en metalltråd ble lagt nederst i den formen som den våte papirmassen deretter ble fylt i. Papiret ble litt tynnere der formen ble synlig i det ferdige papiret.

“A paper mill was driven by waterpower. The waterwheel operated a number of heavy beaters that tore up the raw material – linen and cotton rags, cordage, etc. – under water and mashed it to a thin pulp, which was then poured into a vat. A frame made of wood with brass wires stretched across it was dipped into the vat and on this frame the paper sheet was formed. The brass wires in the frame left lines in the paper that were plainly visible when it was held up to the light, and the idea soon developed of bending some of the wires to form various designs. These so-called watermarks could contain the initials or the name of the papermaker. The oldest known watermark dates from 1282.” (Katz 1995 s. 180)

“In dealing with paper containing watermarks, one finds oneself in a highly varied world of shapes and forms. Signs and symbols appear, brightly visible, which reach the optimum of pictorial language and expressive power only with light shining through the paper. In the Western tradition of papermaking, paper was made on laid-wire screens, later woven screens on rigid wooden frames with fine bronze rods sewn or soldered onto the screen. The watermarks come about during the

actual process of dipping, and are information contained in the texture of the paper itself, which mark the product and give information as to its origin and cultural context. In Asian papermaking (dipping processes), traditional watermarks were only used in banknotes – in Japan, for instance, for the first time during the Edo Period (1615-1868) in state bank-notes – or in papers used for writing special poems." (Weber 2007 s. 89)

"A quite different technology of the 'watermark', purely decorative in character, developed in Asia, above all in Japan, the so-called *Rakushi* lace paper, also known as *mizutamashi*. The valuable, longfibred mulberry bush paper kozo is particularly well suited to this process. In accordance with the principle that a drop of water in a wet paper sheet displaces the fibres, leaving traces, decorative water jet signs are made. Overall patterns arranged rhythmically are made by laying a stencil of metal or plastic on the dipped, uncouched and unpressed sheet of paper. The unprotected points in the fibre are manipulated by the water jet; each drop leaves a fine, circular structure, and the fibres shape themselves into parts of the surface which are denser yet more transparent. If no stencil is laid on, the water jet forms many small transparent spots strewn across the sheet." (Weber 2007 s. 90)

"Mens papiret oprindelig var en kinesisk opfindelse, er vandmærket en europæisk. De første vandmærker dukkede op i italiensk produceret papir i 1282. De hidrører fra et mønster formet af metaltråd og syet (senere loddet) til bunden af papirformen, hvor det ligesom kædelinjerne har fortrængt noget af papirmassen og gjort det færdige papir tyndere. Vandmærkerne var først og fremmest bomærker, der skulle identificere papirets oprindelse og sikre mod efterligninger. I alle de århundreder, hvor bogtrykkerkunsten har været kendt, var hovedreglen for placeringen af et vandmærke, at det blev anbragt i midten af det hele arks ene halvdel, således at det, når arket foldedes til to folioblade, kom til at befinde sig midt i det ene blad. Papir med sådanne enkeltmærker blev fremstillet helt ind i 1700-tallets første halvdel. Afvigende placeringer forekom, men begrænset både historisk og regionalt." (Kondrup 2011 s. 351)

"The earliest preserved watermark, a Greek cross in a paper made around 1282 in Bologna, is a trademark intended to protect the workshop from imitations. Such wire drawings are first documented in the dissertation of the monk Theophilius Presbyter in *De diversis artibus* around 1100 in north-western Germany. The legal aspects with relation to these trademarks were recorded by the Italian scholar Bartolus de Sassoferrato (1314-1357) in his *Tractatus de insignis et armis*: 'And so we see that each sheet of paper has its sign, which indicates which workshop or paper mill it comes from. According to the law, then, in all cases the sign remains the property of him who also owns the mill.' Watermarks developed into a complex pictorial language. Geometrical forms were replaced by symbols of everyday culture, or by the names of persons, place-names or heraldic elements." (Weber 2007 s. 89-90)

Vannmerket kan være enten tynnere eller tykkere enn resten av arket, men noen ganger lages det også "uekte" vannmerker med en transparent fettfarge som trykkes på arket (Kautter og Kraeft 1995 s. 209).

"Vannmerker er bokstaver eller symboler i papiret som er synlige når man holder papiret opp mot lyset. Disse ble laget ved å feste kobbertråder til duken i papirformen. Når papirmassen legger seg på duken, blir det liggende et tynnere lag over kobbertrådene enn over resten av duken, og vannmerket blir dermed synlig i gjennomlys. Vannmerkene var fra tidlig av et kjennetegn for den enkelte mølle. Etterhvert kopierte møllene spesielt fine vannmerker fra hverandre, slik at samme vannmerke kunne bli brukt med en uendelighet av variasjoner av en lang rekke møller over et tidsrom på flere hundre år." (papirkonservator Kari Greve i http:// www.nbbs.no/papir.htm; lesedato 07.01.13)

"For å frigjøre fibrene ble fillene [som skulle brukes til å lage klutepapir] tilsatt mye vann og stampet i et hammerverk. Resultatet ble en tynn fibervelling, som ble helt over i en stor bøtte (derav navnet bøttepapir). Vellingen ble øst opp i en spesiell papir-form, som var laget av messing eller bronse. Bunnen i formen var en finmasket duk som slapp vannet gjennom, men holdt fibrene tilbake. Fra slutten av 1200-tallet ble den finmaskede duken gjerne utstyrt med et filigranmønster som dannet vannmerke i arket. Arkene ble presset mellom filt for å fjerne mer vann og deretter hengt opp til tørk." (Hesselberg-Wang 2009c)

Ulike papirmøller hadde fra 1600-tallet egne vannmerker.

"Among the aristocracy, politicians and businessmen, paper bearing their own portrait as a watermark was very popular. Light- and shadow portraits in banknotes or overall shadow patterns in bonds increased the identifiability of the documents, and went down in history as a guarantee of security." (Weber 2007 s. 90)

"Vandmærkernes motiver skiftede med tiden (heldigvis!). I bogtrykkerkunstens århundreder har man haft en forkærlighed for våbenskjolde (rigsvåben, provins- eller byvåben, familievåben) samt en række genkommende motiver: narrehuen, bikuben, posthornet, trekløveren, den franske lilje, løven m.fl. I dansk papir har man været glad for kongemonogrammer. Da vandmærkerne ikke i længden ydede den ønskede beskyttelse mod efterligning, men selv blev efterlignet, begyndte man omkring 1600 at anbringe et sekundært, mindre mærke – "bimærket" – i tilknytning til hovedvandmærket. Dette bimærke bestod af mystiske tegn eller små bogstaver, som skulle være svære at efterligne, og fra nu af var det bimærkerne, der identificerede papiret som produkt fra en bestemt mølle. Hovedvandærkerne blev i stigende grad betegnelser for bestemte papirformater (fx det meget brugte bikubeformat, 36,5 x 46 cm). […] Andre hyppigt brugte formater var Propatria (34 x 42 cm), Lille median (40,5 x 51,5 cm) og Stor median (46,5 x 59 cm). […] I Frankrig befalede myndighederne i 1688, at papirmagerne skulle bruge deres initialer" (Kondrup 2011 s. 351).

Et “countermark” er “[a] smaller, secondary watermark on antique papers, usually located in the center or lower center of the half-sheet opposite the watermark, indicating the name of the papermaker and sometimes the date and place of hand manufacture.” (Joan M. Reitz i http://lu.com/odlis/odlis_c.cfm; lesedato 30.08.05)

“Since the cost of watermark paper is relatively high and the awareness of corporate identity as well as security thinking have changed during the 20th century, the watermarks have been replaced by fluorescent fibre, embossed signs or other kinds of symbol.” (Weber 2007 s. 90)

Det har blitt utviklet teknikker for å lage “digitale vannmerker” som kan avsløre hva som er original og hva som er kopi av et digitalt dokument (Zimmer 2000 s. 149). Vannmerket skal hindre at kopien blir en eksakt, uatskillelig kloning av originalen.

Litteraturliste (for hele leksikonet): https://www.litteraturogmedieleksikon.no/gallery/litteraturliste.pdf

Alle artiklene i leksikonet er tilgjengelig på https://www.litteraturogmedieleksikon.no