A Methodology For Dating Photographs Relative to 1950.

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Michael Mattis posed a problem. He wanted dates on a group of silver-based, black and white photographs. The problem was that he wanted this work to be grounded in objective fact. He was asking for a dating methodology based on an empirical assessment of the photographic print. I didn't have one.

This was the beginning of the ongoing project that I am speaking of today.

He already knew I could give him some general ideas based on subjective criteria.

Notes on talk presented at the AIPAD Symposium: *Identifying Photographic Paper and Process*, Metropolitan Museum of Art, New York, July 8, 2001.

Qualitative criteria for dating

Physical deterioration

Abrasions, creases, losses, tears…

Unknown photographer, ca. 1910

My set of subjective criteria is the same one everyone in this room uses everyday when we look at prints.

Things like physical deterioration, like the creases and losses on this gelatin silver print from around 1910…

Qualitative criteria for dating

Chemical deterioration

Highlight yellowing, image fading, silver mirroring…

Unknown photographer, *Cotton Factory Arequipa, Peru*, ca. 1935

… or chemical deterioration, like the highlight yellowing and silver mirroring on this print from the mid 1930's…

Qualitative criteria

Image content

Charles M. Conlon, *Jack Chesbro at Huntington Grounds*, 1909

…or dating can be based on image content.

This is Jack Chesbro in a Red Sox uniform posed in the Huntington Grounds in Boston photographed by Charles Conlon. This information gives us the date of the photograph since The Huntington Grounds were replaced by Fenway Park in 1912, but better yet, Chesbro only pitched one game for the Red Sox and that was in 1909.

Qualitative criteria

Provenance

Unknown photographer, *Worcester County High School All Star Baseball Team,* 1958

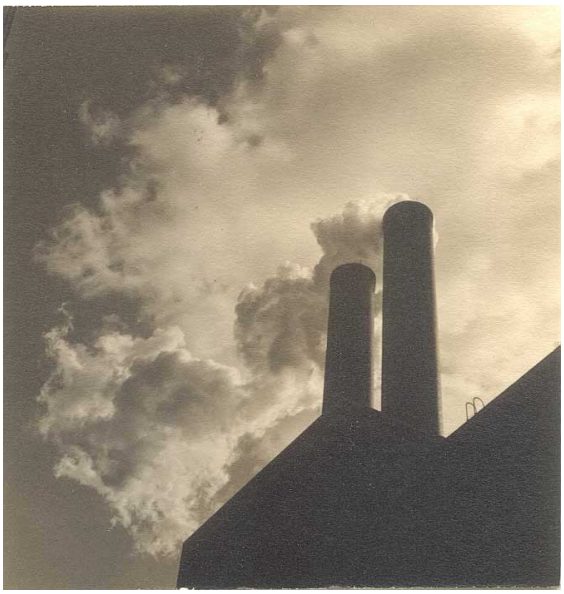
Sticking with baseball for a minute, here is an example of dating based on image content but also on provenance.

This is may father. I know this photograph is old since he is old (not that old, really). But also, from the standpoint of provenance, he gave this to me and when he did he told me it is his original print from 1958 and not a later copy. I trust my father, I have no reason to doubt him, so I believe this print is genuinely from the late fifties.

Qualitative criteria

"Look and feel"

– Image tone, tonal range, contrast, aesthetics…



Buckingham, *Smokestacks*, 1940

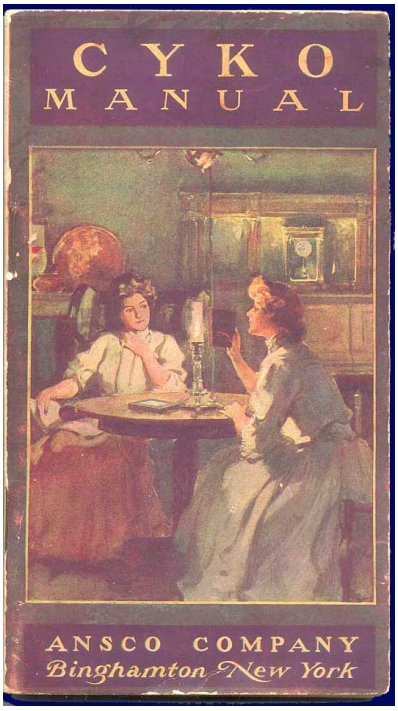
Then lastly there are the somewhat ineffable "look and feel" characteristics.

This photograph is dated 1940. Maybe the overall warmth of the image tone or the composition, somewhat reminiscent of Charles Sheeler's work in the late 1920's lend more credibility to this date.

We all have our own set of qualitative markers that are useful for dating a print, but what about empirical, hard, non-subjective criteria? That is much tougher problem.

A stable medium

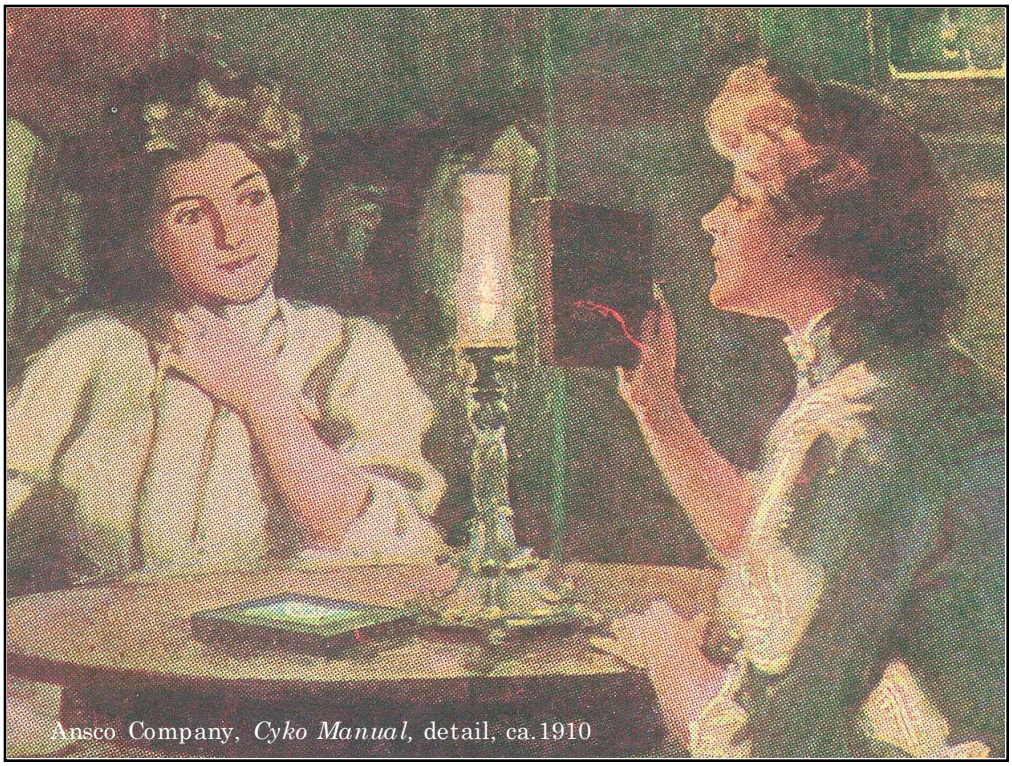
- Materials and techniques for making a silver print have not changed substantially in over 100 years.



Ansco Company, *Cyko Manual*, ca.1910

One of the reasons it is a tough problem is that gelatin silver developing out paper has changed very little for over 100 years.

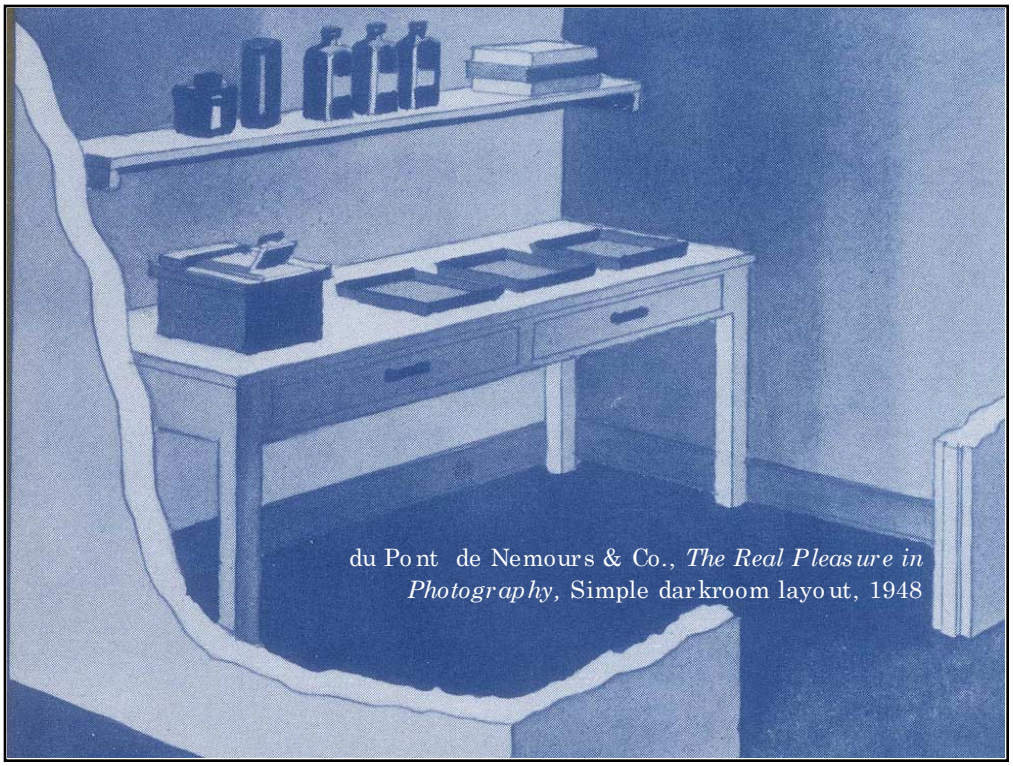
Here is a manual for Ansco's CYKO paper from 1910. It presents instructions for making prints using this long gone brand of so called "gaslight paper." The processing instructions in this pamphlet are seemingly ageless as they are nearly identical to instructions you would find in a photography 101 course taught today.



Ansco Company, *Cyko Manual,* detail, ca. 1910

Here is a detail of the cover. She is making a contact print, exposing the CYKO paper using a printing frame. It looks like she is using an oil lamp and, based on the manual, her exposure time should be a leisurely 40 seconds.

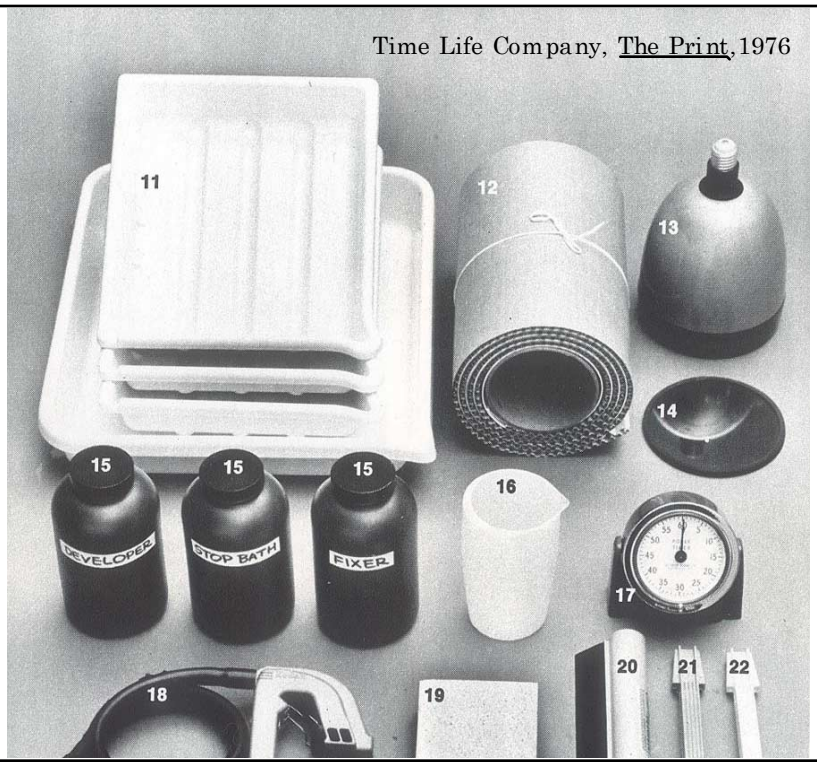
If she was using a gas lamp, her exposure time would be about 20 seconds or so giving you a good reading on the relative intensities of gas lamps and oil lamps at the turn of the century.



du Pont de Nemours & Co., *The Real Pleasure in Photography,* Simple darkroom layout, 1948

Her next move would be to remove the paper from the printing frame and develop the latent image. Her darkroom would have been laid out almost identically to this depiction from 1948. Here are the three essential trays for the three essential processing chemicals: developer, stop bath and fix.

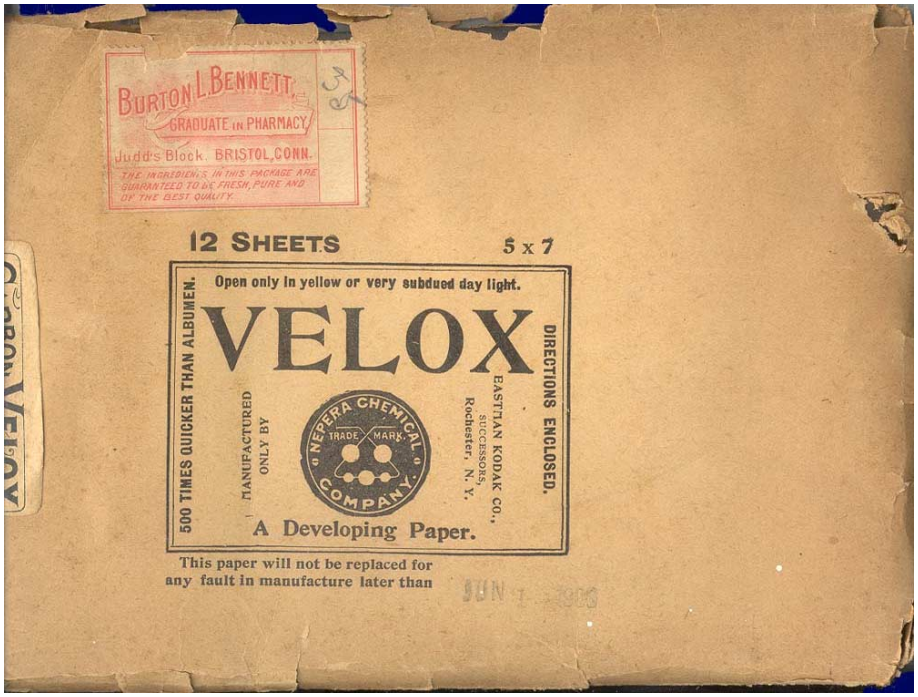
(Instead of a printing frame and gaslight, here we see a new fangled contact printer that uses an electric light.)



This is an illustration from the Time Life photography series from 1976. It shows the essential materials for making a black and white print. We have a few new elements, like fancy timers and siphons for tray washing, but the three essential chemicals, developer, stop bath and fix are still present.

The point here is that our photographer from 1910 would be able to walk into a darkroom today and using materials and equipment just like these immediately begin making prints.

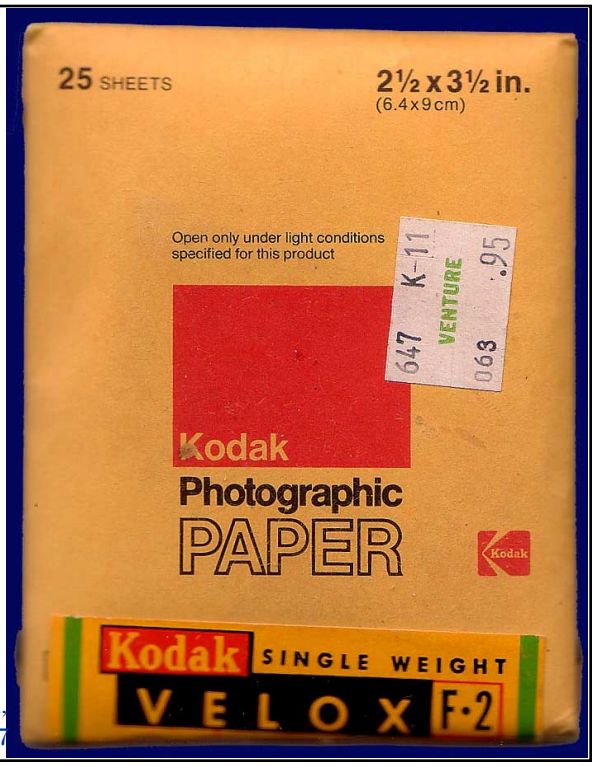
Things have not changed that much.



Eastman Kodak Company, Velox, expired June, 1908

Another way of making the same point:

This is a package of Velox paper, dating from 1908. Like Cyko, Velox was one of the first so called "gaslight" papers. This term was used in the early part of the century and refers to silver prints made by development. It is precisely the same type of paper the photographer from 1910 used and very much the same as the papers available today. So much so that the Velox brand…



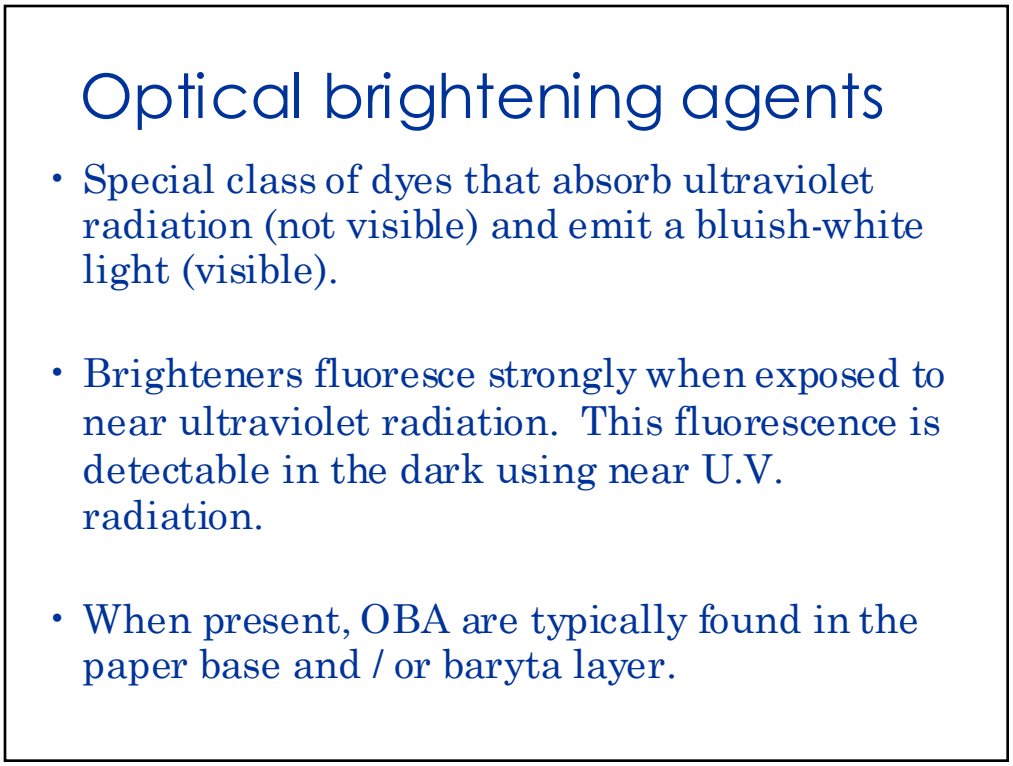
Eastman Kodak Company, Velox, expired June, 1977

…persisted well into the 1980's and possibly later. Just as the photographer from 1910 would be at home in a contemporary darkroom, she would have been likewise capable of using this paper from 1977.

So, herein lies the context for the problem of empirically dating 20th century photographic papers: As a medium, gelatin silver developing out papers have outwardly changed very little over the past century.

However, upon close evaluation some differences do emerge over time, as I found out through my own research and through collaboration with Val Baas and Walter Rantanen, both of whom are on the program this morning.

These differences can be used to objectively date paper.



The first part of the dating methodology that emerged deals with the presence of optical brightening agents (OBA).

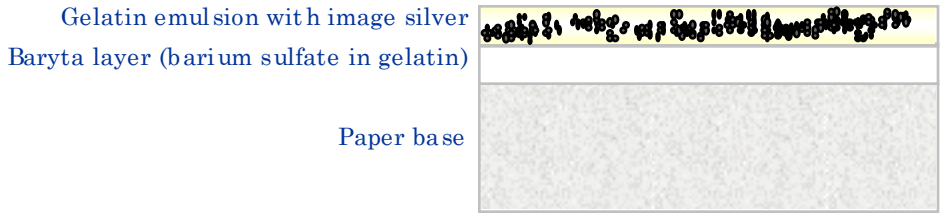
Optical brightening agents are chemical compounds that absorb ultraviolet radiation (which we can not see) and emit visible light. For the manufacturers of photographic paper, optical brighteners are a convenient way to make highlights appear brighter and whiter.

Whiter and brighter paper is achieved through the fluorescence of the brighteners when exposed to near ultraviolet radiation. Such U.V. is plentiful in sunlight and in many fluorescent lights.

When present, brighteners usually (but not always) appear in the baryta layer and / or the paper base.

Optical brightening agents

Cross section, gelatin silver developing out print



–When present, brighteners will usually appear in paper base and the baryta layer.

–Seldom do brighteners appear in the emulsion though this is possible through various mechanisms.

It occurs to me that perhaps not everyone knows what I mean by baryta layer.

Here is a cross section diagram of a gelatin silver print. The baryta is the middle layer, between the paper base and the emulsion. The purpose of this white-pigmented layer is to coat the paper, thereby diminishing the influence of the paper texture on the print and to give highlights a clean, white appearance.

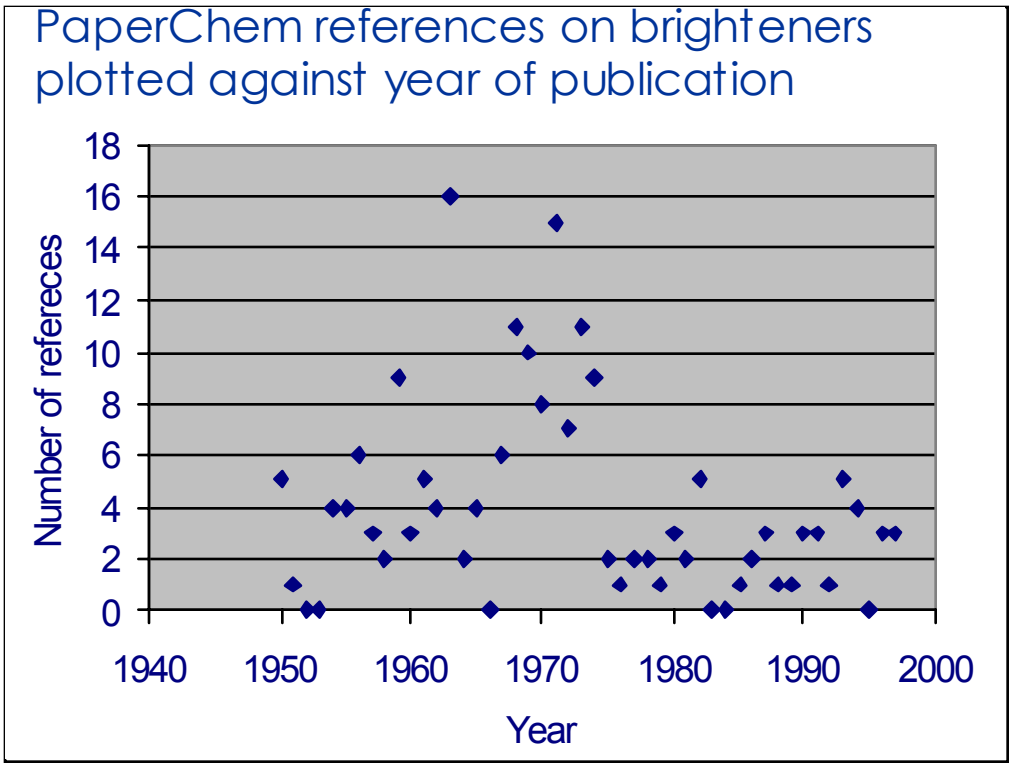
So, when present, optical brightening agents are usually, but not always, limited to the paper base and / or the baryta layer.

OBA: A Brief History

- 1920's - First experiments with naturally occurring fluorescent materials.
- 1934 – The English firm Imperial Chemical Industries prepares first synthetic brightening agent.
- 1943 - CIBA produces brighteners based on stilbene derivatives that have broad application for use with cellulose-based materials.
- Early to mid 1950's - Photography manufacturers first propose use of brighteners
- Mid to late 1950's - First photographic papers with brighteners appear.
- Early mid 1970's - Manufactures dramatically increase amount of OBA in paper base and baryta.

In terms of papermaking technology, brighteners began to be available in the mid-1940's when synthetic compounds with a high affinity for, and compatibility with, cellulose-based materials began to emerge.

Skipping to the fourth bulleted point, the evidence that manufacturers of photographic paper began incorporating OBA in the mid to late 1950's is very strong. The proof for this assertion is based on a great deal of original research by Val Baas, with some supporting evidence that I developed. I will leave the heavy lifting on the chronology to Val.



However, nobody enjoys making an audience suffer with graphs more than I do. And I know Val would never stoop to this. So, here we go.

Actually this chart makes a pretty useful and simple point. I commissioned a comprehensive literature search going back to 1930 on brighteners through the Institute of Paper Science and Technology. The chart plots the number of articles found in the papermaking literature for a given year. We see that the number of articles rises rapidly from zero in 1949 to five 1950 and really peaks in the early 1970's. If you plotted a regression of these data, you get a nice bell shaped curve, starting in 1950 and peaking in the 70's, key periods for the incorporation of brighteners in photographs.

Use of Fiber Identification for Dating

- Cotton and flax from rag appear to be the main sources for photographic papers made up to the 1910's to 1920's.
- Starting probably in the 1910's, sulfite wood pulp is used. Sulfite pulp alone is used almost exclusively by the 1930's into the 1960's. Sulfite pulp predominates in photographic papers made to the present time.
- Starting in the late 1950's or early 1960's hardwood kraft pulp (sulfate process) appears in small quantities in photographic papers. Hardwood kraft pulp generally appears in small proportions mixed with sulfite pulp.
- Presence of hardwood kraft has never been observed prior to late 1950's in photographic bases.

After brighteners, the next characteristic that can be used to distinguish a post-1955 print is the presence of hardwood kraft papermaking fiber.

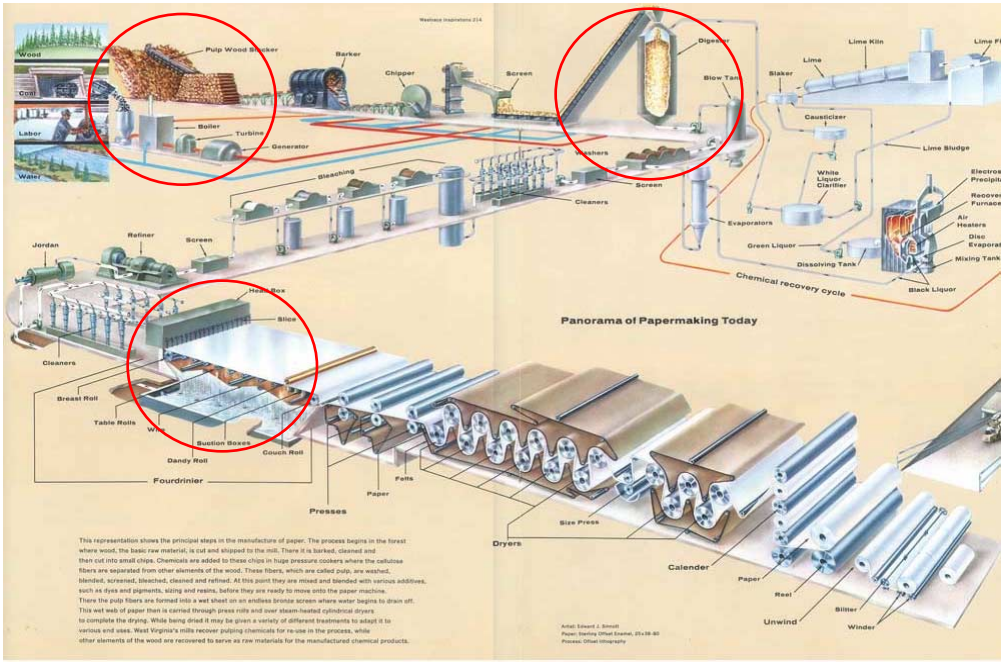
Prior to the mid fifties, a variety of papermaking fibers were used for photographic papers. Walter will cover this terrain so I can afford to be brief. Let's skip to the last two bulleted points, since these are key for dating.

Starting in the late 1950's or early 1960's a particular type of papermaking fiber, known as "hardwood kraft," appears in small quantities in photographic papers. Presence of hardwood kraft has never been observed prior to late the 1950's.

As Walter will explain, there are lots of nuances to this type of analysis and we are not limited to dating papers through the presence of hardwood kraft alone. However, hardwood kraft is key from the standpoint of determining whether a paper was made post 1950.

Papermaking

Westvaco, *Inspirations 214*, 1960

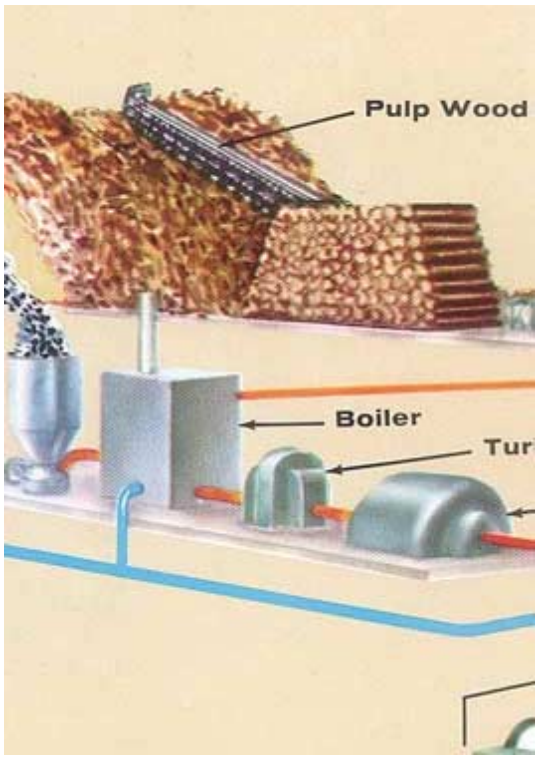


I realize that papermaking terms like "hardwood kraft" are alien to virtually everyone in the audience, so I want to take a minute and attempt to make this semi abstract terminology a little more concrete.

Here is schematic diagram illustrating the papermaking process, starting here with trees, then moving along to a finished product here.

I've circled in red three zones of particular significance.

Hardwood or softwood refers to the species of tree.

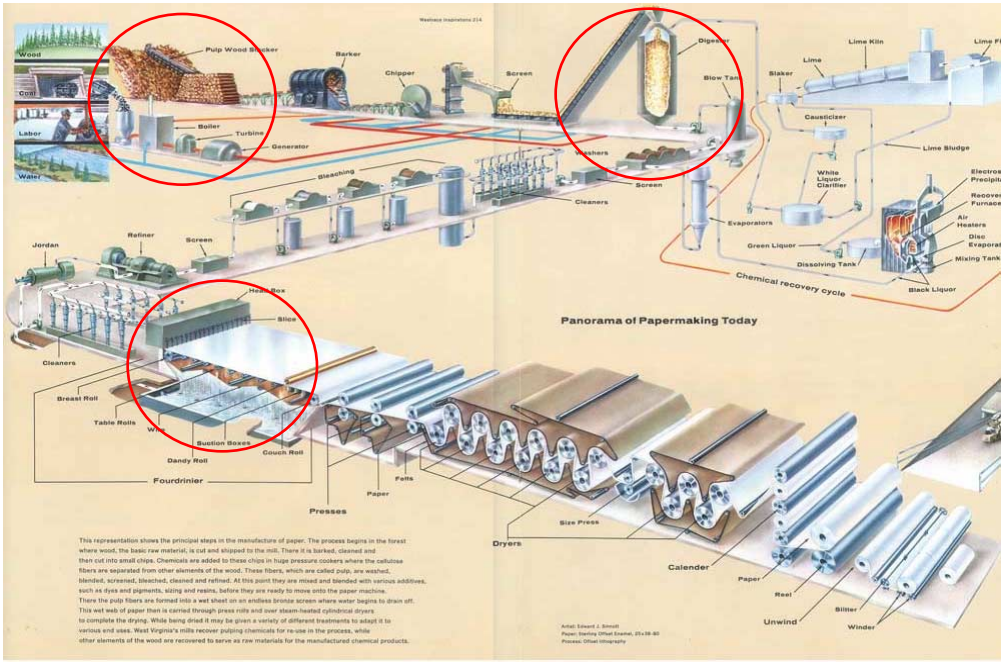


Westvaco, *Inspirations 214*, 1960

Here in the first zone trees are harvested. The trees are roughly sorted by species with the major demarcation between hardwoods and softwoods. In general, hardwood species are less desirable than softwoods for high quality paper such as photographic paper since they require more processing to achieve a similar level of quality.

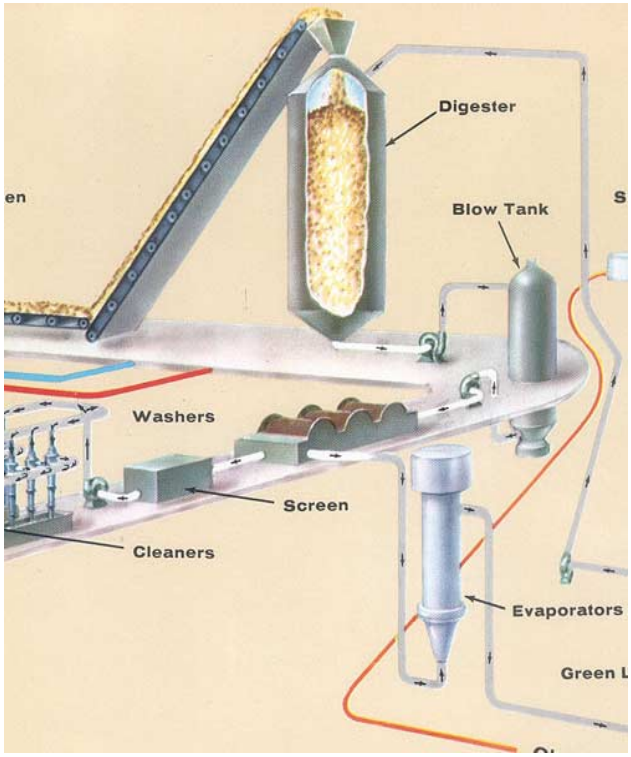
Papermaking

Westvaco, *Inspirations 214*, 1960



The next important zone is where the wood is physically and chemically converted into pulp.

The term "kraft" refers to the chemistry of the conversion process from wood to pulp.

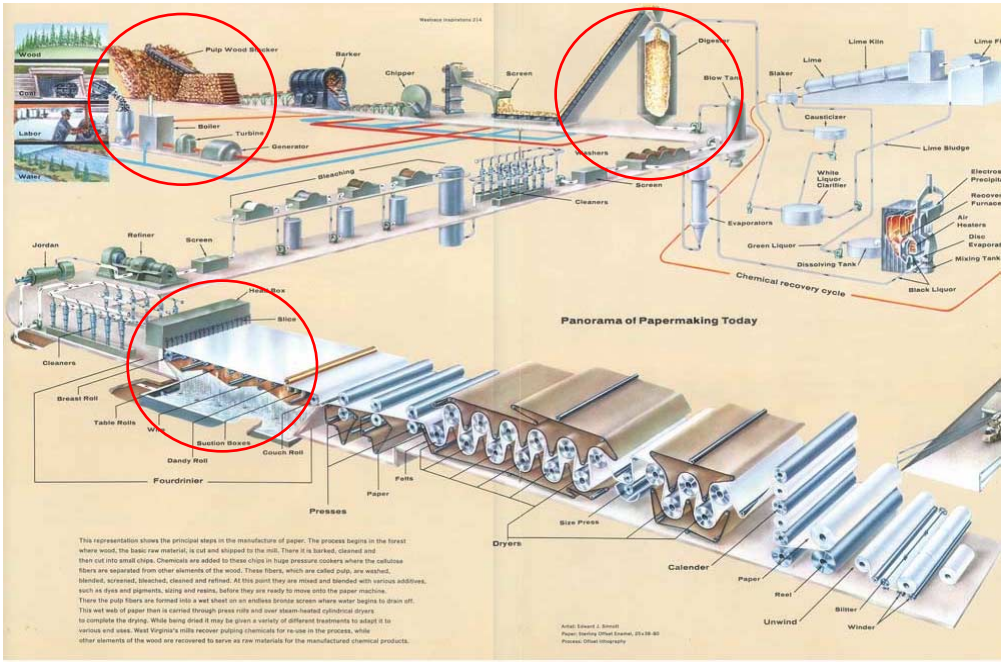


Westvaco, *Inspirations 214*, 1960

Here is where the distinctions between the kraft process and other processes are made based on the type of chemistry used to convert the chipped wood into papermaking material.

Papermaking

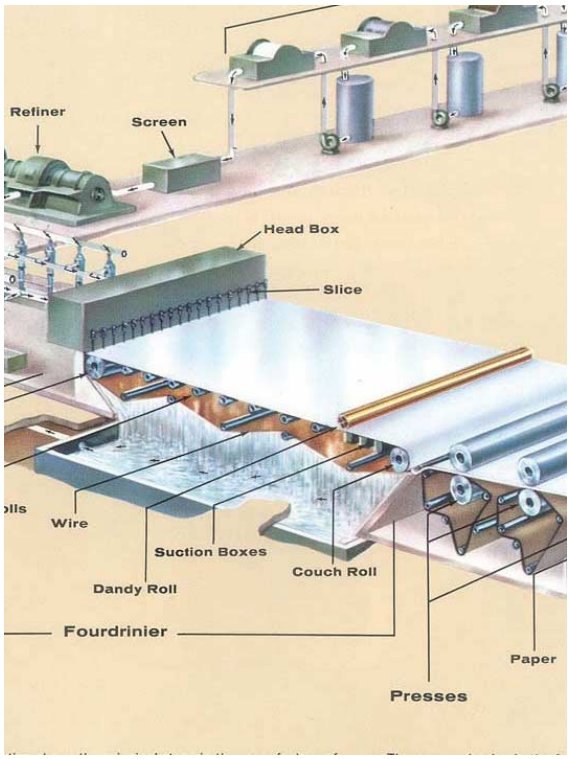
Westvaco, *Inspirations 214*, 1960



So now when you hear "softwood sulfite" or especially "hardwood kraft," you know these terms refer to the type of wood, (hardwood or softwood) and method for chemical processing (sulfite or kraft).

On to the next key zone…

Brighteners are typically added to paper pulp in the head box of the Fourdrinier machine.

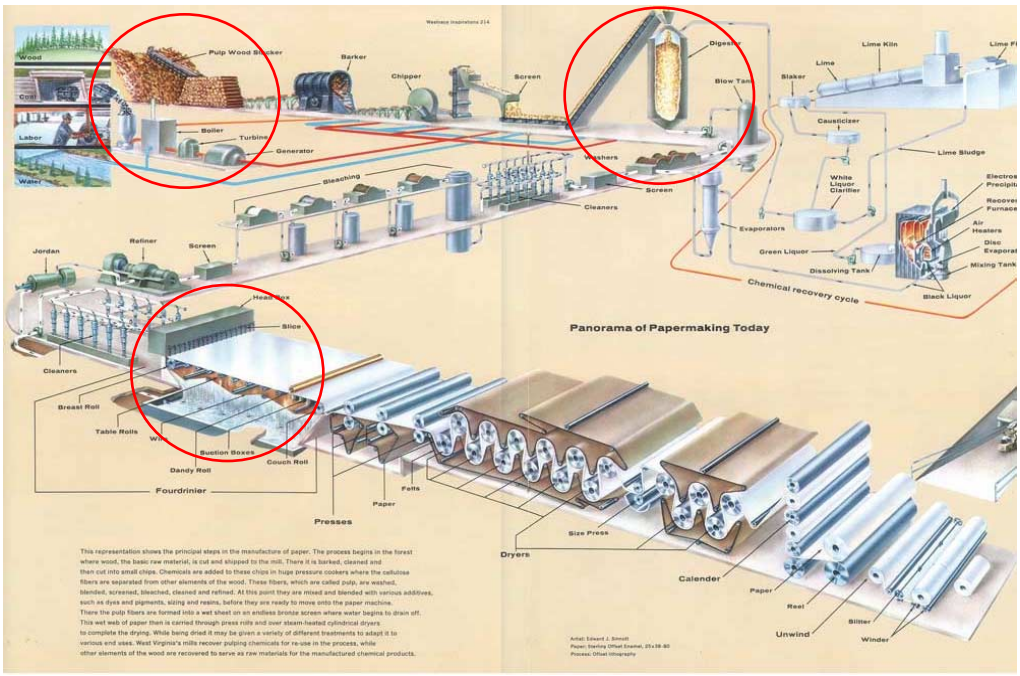


Westvaco, *Inspirations 214*, 1960

In this zone we are actually making paper. This is a view of a Fourdrinier machine. The purpose of the Foudrinier is to take the pulp and deposit it on a continuously moving mesh belt. Water drains from the pulp and the newly formed sheet of paper is pressed. The pulp is deposited on the belt from the head box. It is in the head box that optical brightening agents and others types of materials like sizing agents and wet strength agents can be added to the pulp.

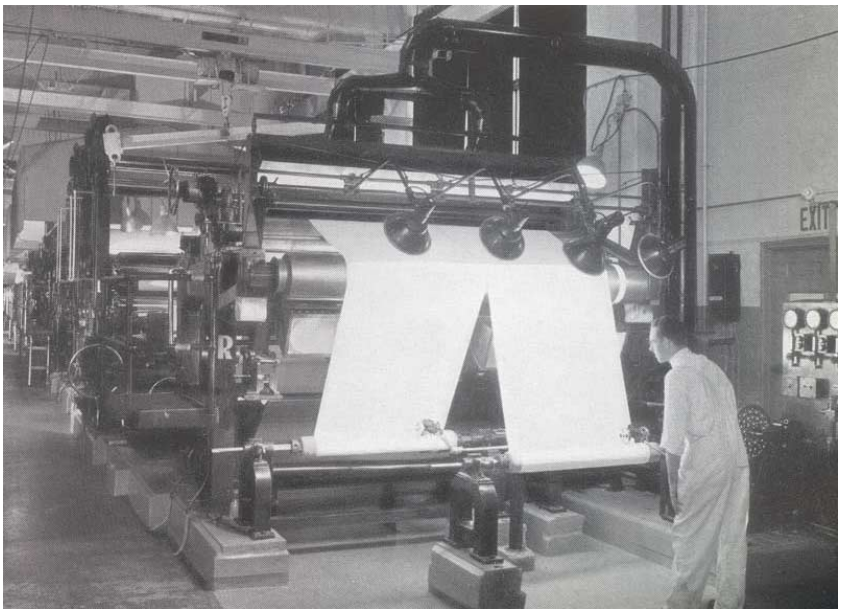
Papermaking

Weatvaco, *Inspirations 214*, 1960



From the Fourdrinier, the paper goes through several drying and pressing steps until it is finally rolled at the end of the process.

"Dry end" of a Kodak Fourdrinier machine.

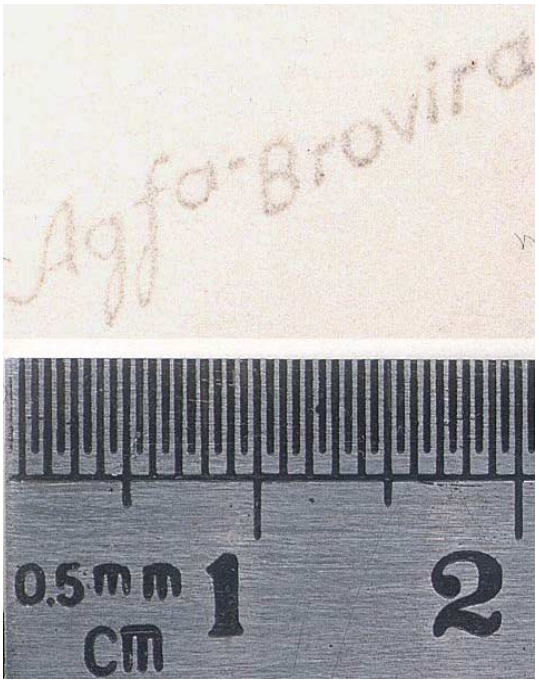


Eastman Kodak Company, *Kodak Photographic Papers*, 1941

Here is the dry end of a Kodak Fourdrinier machine from around 1941. At one point Eastman Kodak had close to a dozen such machines in almost continuous operation. Today, most Kodak paper stock is purchased from outside vendors.

Manufacturer Markings - Agfa

- For existing products, Agfa used a two-part logo (manufacturer name "Agfa" and the product name, i.e. "Brovira") up to mid 1950's.



Back printing from Agfa Brovira, Semi matte 112, ca. 1938

Another way to determine to date of a photograph might be an assessment of manufacturer markings. If present, these markings will appear on the reverse of a photographic paper. This method is very limited since major companies like Kodak, Dupont, and Ansco rarely, if ever, marked their papers.

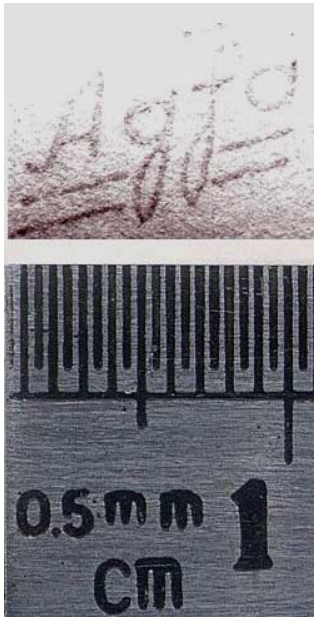
However, one company, Agfa, consistently marked its papers and these markings can be very useful for dating the papers pre- or post- the mid 1950's.

Prior to the mid 1950's Agfa used a two part logo (manufacturer name "Agfa" and the brand name, i.e. "Brovira"). After the mid-fifties, Agfa dropped the brand name. Therefore, if you have a paper with a two part Agfa logo it was produced before the mid 1950's.

Illustrated is a two part logo, typical of that used before the mid 1950's. This one dates from the late 1930's.

Manufacturer Markings - Agfa

- For new products introduced after 1945, and for existing products produced after the mid 1950's, Agfa used a one-part logo ("Agfa" alone).
- Throughout the 20th C. Agfa also produced brands of paper without a logo.



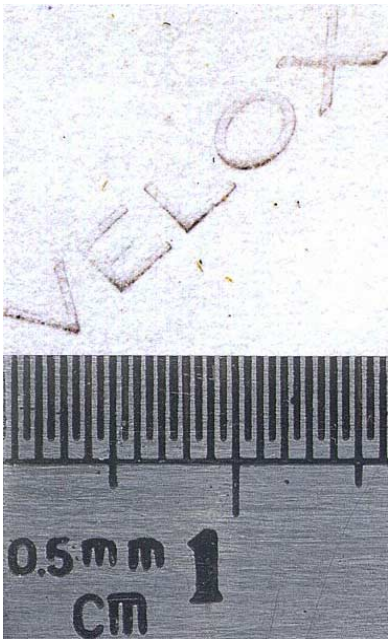
Back printing from Agfa Brovira, BW 111, ca.1960

For new products introduced after 1945, and for existing products produced after the mid-1950's, Agfa used a 1 part logo ("Agfa" alone). Illustrated is a one part logo, typical of that used after the mid-fifties. This one dates from 1960.

One small catch is that throughout the 20th C. Agfa also produced brands of paper without a logo.

Manufacturer Markings - KODAK

- Kodak Velox papers were unmarked until sometime between the early 1920's to the early 1940's.
- By early the 1940's, Kodak Velox papers were marked with the single word "VELOX".



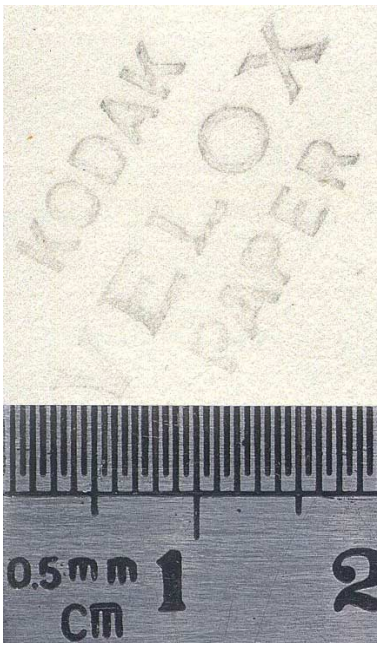
Back printing from Kodak Velox, F1, 1943.

As I mentioned, Kodak generally did not mark its papers. One exception is the Velox brand that we talked about a few minutes ago. Kodak Velox papers were unmarked until sometime between the early 1920's to the early 1940's.

By early the 1940's, however, Kodak marked these papers with the single word "VELOX." Shown is such a marking from a 1943 Velox paper.

Manufacturer Markings - KODAK

- By early the mid 1950's, Velox papers used a three word logo "Kodak / Velox / Paper."
- This logo persisted until through the 1960's and possibly later…



Back printing from Kodak Velox, F1, 1956.

By early the mid-1950's, Velox papers used a three word logo "Kodak / Velox / Paper." Illustrated is an example from 1956.

This logo persisted through the 1960's and possibly later.

Important Caveats

- Methodology is dependent on "red flags" being present. If O.B.A.'s or hardwood kraft fibers are present then manufacture date is post-1950-5.
- If O.B.A.'s or hardwood kraft fibers are not present, then results are inconclusive.
- Only determines date of paper manufacture, not actual printing date.
- O.B.A.'s fade in light. They can be washed out in ordinary processing and they can be deliberately extinguished.

To summarize: Photographic papers can be dated pre or post the mid 1950's by looking for

•optical brightening agents and,

•hardwood kraft papermaking fiber

If these factors are present, then it is safe to conclude that the photographic paper was made post 1955 or thereabouts.

•Also, date can sometimes be determined through manufacturer markings.

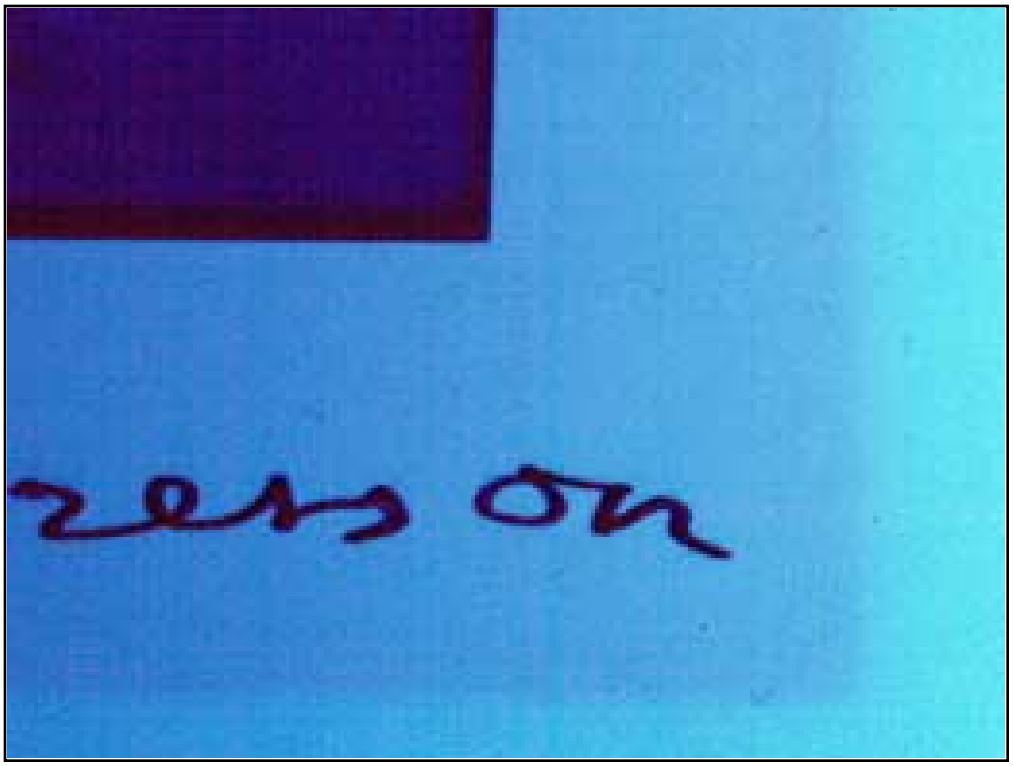
This methodology comes with certain caveats:

•The methodology is dependent on "Red Flags" being present. If O.B.A.'s or hardwood kraft fibers are present, then manufacture date is post-1950-5.

•However, if O.B.A.'s or hardwood kraft fibers are not present, then the results are inconclusive, since papers are made up to the present day that do not incorporate OBA or hardwood kraft.

•The methodology only determines date of paper manufacture, not actual printing date.

•O.B.A.'s fade in light. They can be washed out in ordinary processing and they can be deliberately extinguished.



Shown is a detail of Henri Cartier-Bresson, Rue Mouffetard, Paris, 1954 (printed later), photographed using ultraviolet radiation. Brighteners have faded in areas exposed by the mat and remain intact in passages covered by the mat.

Future Work

- This methodology is merely the beginning. Dating prints is only one of potentially many applications.

- Future work should include the compilation of reference collections of photographic materials to serve as a basis for research and comparative analysis.

This methodology is only the beginning. New tools, like the ones Klaus Pollmeier and Tania Passafiume will discuss, hold a great deal of potential. We also know that there are other paper components that will be useful in dating. For instance we know that the wet strength agent melamine formaldehyde was used in papers extensively following the 1940's but never prior.

It is my contention that our future work depends on the creation of reference collections of photographic materials to serve as a basis for research and comparative analysis. I think this is a critical need.

The creation of such a reference collection, in many ways, was really the beginning of contemporary art conservation practice in the US.

In 1928 Edward W. Forbes, Director of Harvard University's Fogg Art Museum, established the Department for Technical Studies. This was the first department for scientific research in conservation and the study of artists materials and techniques in an American museum. This department played a key role in establishing conservation science as a new academic discipline in the United States. What Forbes realized was that all interpretive analysis on a work of art needs to be grounded in an understanding of materials. Forbes knew that without this grounding in materials and techniques, analysis of a work of art is unmoored, lacking a meaningful tie to the point of artistic creation.

I think experience tells everyone in this room that if this is true for paintings, it is also true for photographs. We owe it to ourselves and to our medium to work toward a better understanding of the materials and techniques of the photographer.