An Overview of Photographic Processes

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Debbie Hess Norris

Goals

- Understanding component parts
- Interactions with each other
- And with the environment
- Better care & handling of the collection

Positive or Negative

Approaches to Identification

- Historical
- Contextual
- Technical

Clues to Identification: Historical/Contextual

- Photographer
- Provenance
- Image content
- Format

Private Collection

Clues to Identification: Technical

- Image quality
- Image color
- Non-image color
- Surface characteristics
- Format and presentation
- Deterioration characteristics

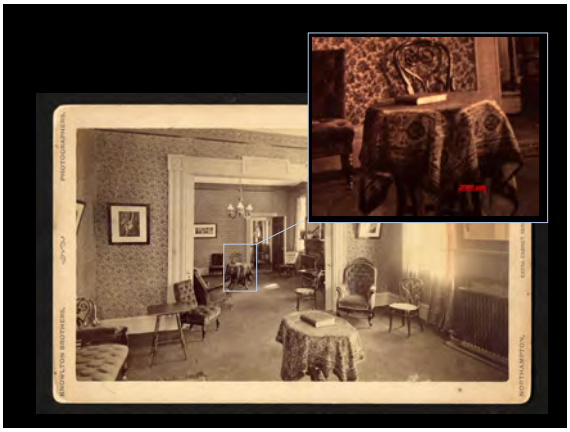
L.W. Clark (Streator, Ills): *[A little girl looking at a photo album]*
Albumen Print, Cabinet card http://www.luminous-lint.com/app/image/6975232186934130327049705 6/

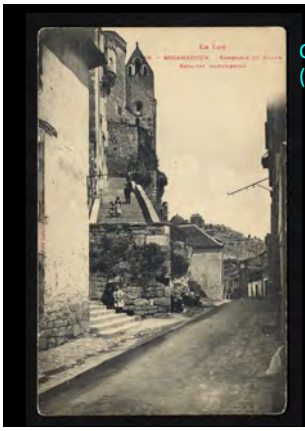
Clues to Identification: Technical

- Image quality
- Image color
- Non-image color
- Surface characteristics
- Format and presentation
- Deterioration characteristics

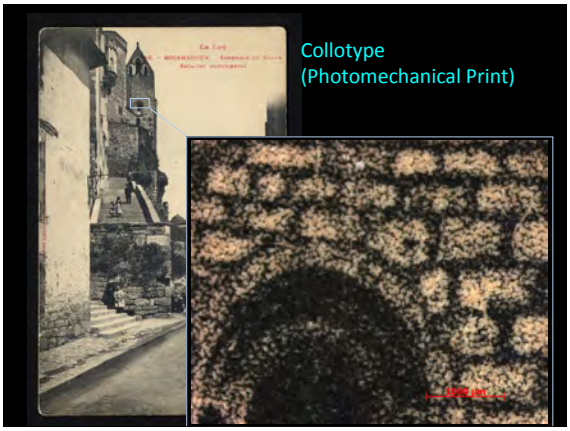
P.H. Polk, *The Bailey Children*, Silver Gelatin Photograph
Paul R. Jones Collection, University Museums, University of Delaware

True Photographs





Collotype
(Photomechanical Print)



Collotype
(Photomechanical Print)

Approximate Dating

19th Century

Approximate Dating

19th Century *or*

20th Century

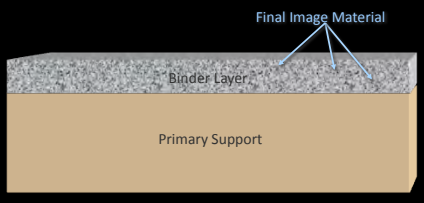
Approximate Dating

19th Century *or*

20th Century *or*

21st Century

Component Parts: Photographic Materials



Support
(paper, glass, iron, silver plated copper, plastic, textile, leather, wood and more)

Binder
(albumen, collodion, gelatin)

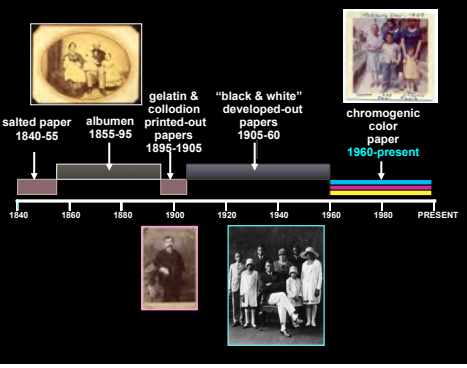
Support
(paper, glass, iron, silver plated copper, plastic, textile, leather, wood and more)

Final Image Material
(silver organic dyes, pigments, platinum, gold, iron salts)

Binder
(albumen, collodion, gelatin)

Support
(paper, glass, iron, silver plated copper, plastic, textile, leather, wood and more)

Chronology: Print Processes



Chronology of Negatives

COMMON TYPES of NEGATIVES and the DATES THEY WERE PRODUCED

Negative Type	Dates
Paper	1841 – ca. 1865
Collodion on glass	1851 – ca. 1885
Gelatin dry plate	ca. 1878 – ca. 1925
Cellulose nitrate film	ca. 1889 – ca. 1950
Cellulose acetate film	ca. 1925 – today
Polyester film	1955 – today

Maria Fernanda Valverde: *Photographic Negatives: Nature and Evolution of Processes*. 2003

Major Photographic Processes

- Salted Paper
- Albumen Prints
- Gelatin and Collodion Printed-Out Papers
- Gelatin Developed-Out Papers
- Chromogenic Color

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- Salted Paper (POP)
- Albumen Prints (POP)
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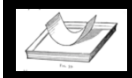
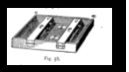
Silver Prints: Invention & Development

January 25th, 1839, Talbot showed examples of "photogenic drawings" to the Royal Photographic Society

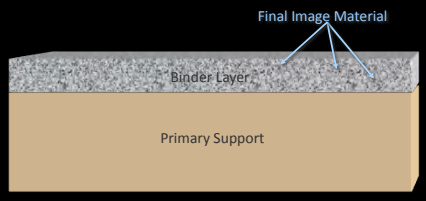


Salted Paper Prints: Coating, Sensitizing, Printing, Processing

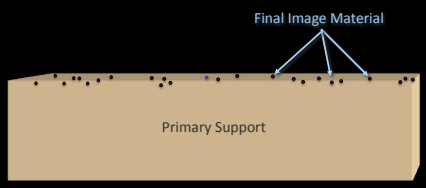


- Paper is salted (immersion, floatation, brushing) with sodium chloride (NaCl)
- silver nitrate or $AgNO_3$ brushed on (or floated on) => light sensitive silver chloride (AgCl)
- Printed out in sunlight in contact with negative or with object for photogram
- Silver image is "fixed" in sodium thiosulfate, which removes remaining light sensitive silver salts
- Print is washed and dried

Component Parts: Photographic Materials

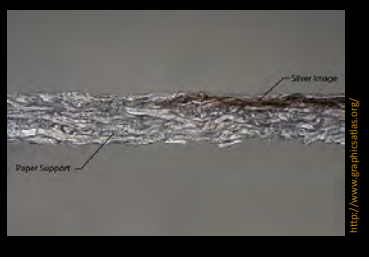


Component Parts: Photographic Materials



Salted Paper Prints

- Final Image Material: *silver metal (gold)*
- Binder: *none*
- Support: *good quality paper*



William Henry Fox Talbot, English, 1800–1877
Winter Trees, Reflected in a Pond
1841-1842
Salted paper print from paper negative
16.5 x 19.2 cm (6 1/2 x 7 9/16 in.)
2005.100.2

Edouard Baldus: [Entrance to the Port of Boulogne], 1855 Salted paper print from paper negative

Attributed to William Henry Fox Talbot, English, 1800–1877
Attributed to Nicolaas Henneman, Dutch, 1813-1898
[The Reading Establishment], 1846
Salted paper prints from paper negatives
18.6 x 22.4 cm (7 5/16 x 8 13/16 in.); 18.6 x 22.3 (7 5/16 x 8 3/4 in.)
2005.100.171

Salt Prints: Identification

- P.O.P. image color
- P.O.P. image susceptible to fading and discoloration
- Image imbedded in the paper fibers
- Continuous tone
- May be from paper negative=> less detail
- Fine detail, good tonal range possible
- Gloss or semi-gloss only if coated
- Early process

Magnification: No baryta
Paper fibers clearly visible, silver image
No binder unless coated

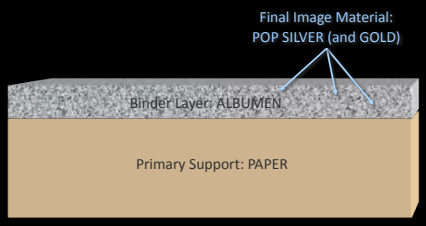
Salt Prints: Identification

http://www.graphicsatlas.org/

Albumen Prints: Coating and Sensitizing

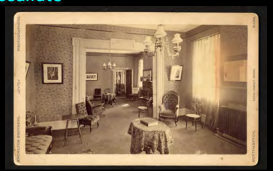
- Paper coated with albumen and ammonium or sodium chloride
- Commercially prepared papers available before 1855
- Most albumenized own papers until mid-1860' s
- Pre-sensitized papers available in 1872
- Professional photographers continued to sensitize their own papers
- Floated on silver nitrate ($AgNO_3$) to form light sensitive silver chloride (AgCl) in the albumen binder layer

Component Parts: Albumen Prints



Albumen Prints: Exposure and Processing

- Exposed in contact with a negative until image appeared (first paper negatives, then most commonly glass)
- Water wash
- Toned in gold chloride*
- Fixed in sodium thiosulfate
- Washed to remove silver thiosulfate complexes and residual thiosulfate



Albumen Prints: Yellowing of the Albumen

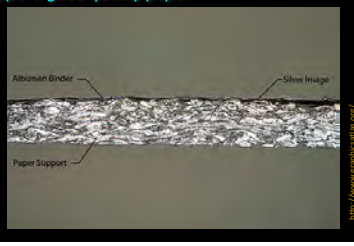
- 1850-1880 fresh albumen used
- 1880-1900 acidified, fermented albumen used for
  - smoother, glossier coating
  - less prone to yellowing (loss of glucose)

Albumen Prints: Tinting of the Albumen

- 1870-1900 much of paper tinted with analine dyes to shades of pink, purple, and blue
- 1863- first appeared on the market
- 1870-1880's very popular
- THESE DYES FADE EASILY IN THE LIGHT

Albumen Prints

- Final Image Material: *silver metal (gold)*
- Binder: *albumen*
- Support: *good quality paper*



Albumen Prints: Identification

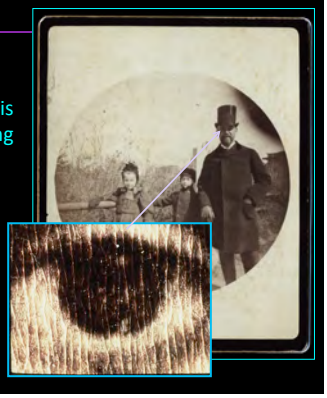
- P.O.P. image color
- P.O.P. image susceptible to fading and discoloration
- Fine detail, good tonal range
- Good detail in D-max due to self masking
- Slight gloss
- Albumen may yellow and discolor
- Albumen susceptible to cracking
- Thin paper support; often mounted

Magnification: No baryta
Paper fibers visible through binder layer

Albumen Prints: Identification

Albumen Photograph

Albumen binder layer is susceptible to cracking



Portrait Formats: Carte-de-Visites

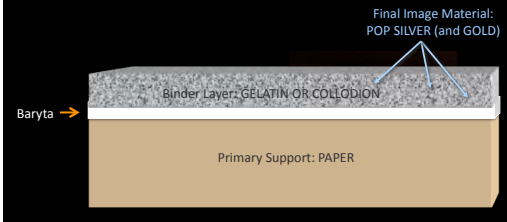
Portrait Formats: Cabinet Cards

Gelatin & Collodion P.O.P.: The Papers

- Pre-sensitized, machine made paper
- 1881- Baryta layer of barium sulfate and gelatin introduced
- For collodion prints camphor oil and glycerine added as plasticizers
- Dyes added to the baryta layer forming a pink or blue barium lake

Gelatin and Collodion P.O.P.

- Final Image Material: *silver metal (gold)*
- Binder: *gelatin or collodion*
- Support: *baryta coated paper*

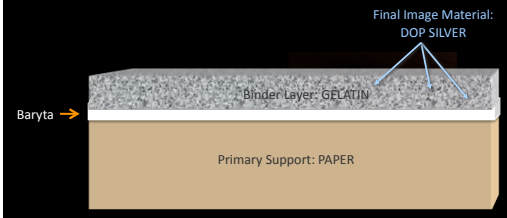


Gelatin Silver D.O.P.: Development

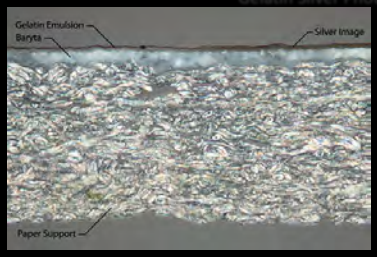
- 1900- first produced commercially
- After 1920- textured papers introduced
- Variety of weights and tonalities available
- 1968- resin coated or RC papers introduced (polyethylene plastic on either side of paper with titanium dioxide mixed in on one side)

Gelatin D.O.P.

- Final Image Material: *silver metal*
- Binder: *gelatin*
- Support: *baryta coated paper*



Gelatin Silver Photographs

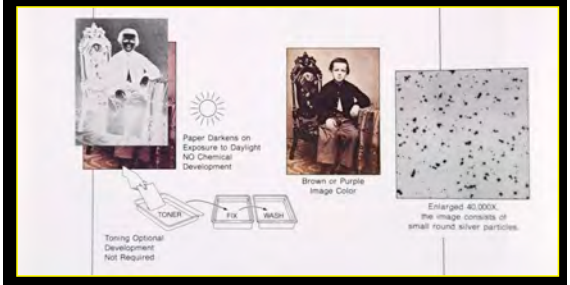


Azo postcard paper from 1911

www.graphicsatlas.com

Printed-Out Papers

Salted Paper, Albumen, Gelatin or Collodion POP

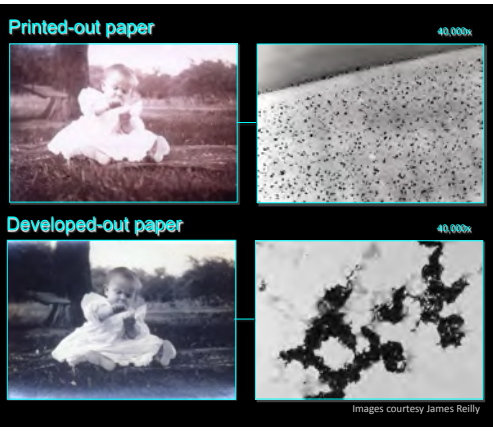


Images courtesy James Reilly

Developed-Out Papers

Gelatin Silver DOP

Images courtesy James Reilly



Images courtesy James Reilly

Silver Gelatin Developed-Out Photographs

H. Betts, Unidentified Sitters, Private Collection

P.H. Polk, *The Jackson Children*, Paul R. Jones Collection, UD Museums

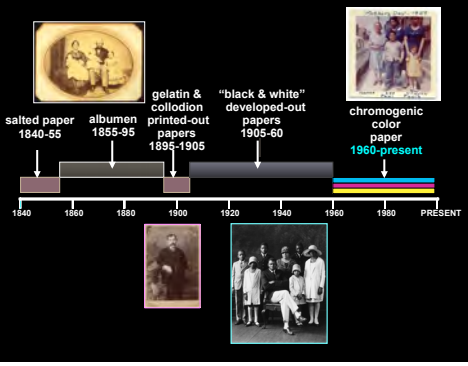
Sulfur-Toned Gelatin DOP

Silver Gelatin

- 1890's – 1960's
- Paper support coated with baryta-- many textures possible
- Neutral black & white
- Image discoloration poss.
- Silver mirroring
- Very stable if well processed and toned

Gilcrease Museum, Silver Gelatin Photograph, 4327 - 3060

Chronology: Print Processes



- Watercolor
- Dyes
- Oil paint
- Pastel
- Charcoal
- Colored pencil
- … et cetera …

Color Photography in the 19th Century

- Theory existed, but technically impossible
- Silver salts sensitive to blue light only

Louis Ducos du Hauron

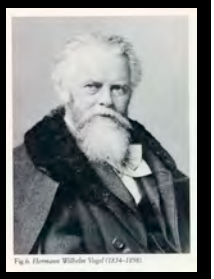
Carleton E. Watkins: *View on the Columbia, Cascades* 1867
Albumen silver print from glass negative 40.0 x 52.4 cm (15 3/4 x 20 5/8 in.)

Roger Fenton: [*Landscape with Clouds*], probably 1856
Salted paper print from glass negative

Eugène Atget: *La Château, fin Octobre, le soir, effet d'orage, vue prise du Parterre du Nord*
Albumen silver print from glass negative, Gold-toned

Color Photography in the 19th Century

- Spectral sensitizing dyes introduced by Vogel in 1873: dyes added extend sensitivity beyond the blue
- 1882 ISOCHROMATIC or ORTHOCHROMATIC plates introduced: sensitive to blue and green light



Color Photography in the 19th Century

- 1884 Vogel sensitized to orange as well as green
- Early 1890's new sensitizing dyes gave full red sensitivity
- 1906 Wratten and Wainwright of London sell PANCHROMATIC plates: sensitive to all colors equally

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Color Processes

1907-1930	Color Screen Plates
1900-1950's	3- and 4-Color Pigment Prints
1935-present	Chromogenic
1940's-1990's	Dye Imbibition or Dye Transfer
1958-present	Silver Dye Bleach
1963-present	Dye Diffusion Transfer

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Chromogenic Color

Chromogenic Color

THE MOST COMMON COLOR PROCESS of 20th Century

Chromogenic Color

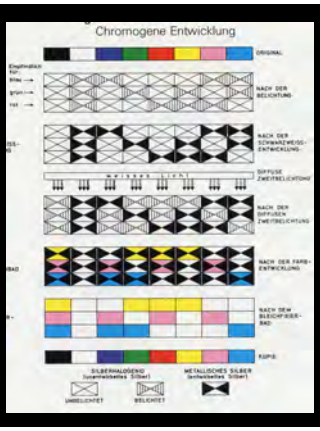
THE MOST COMMON COLOR PROCESS of 20th Century

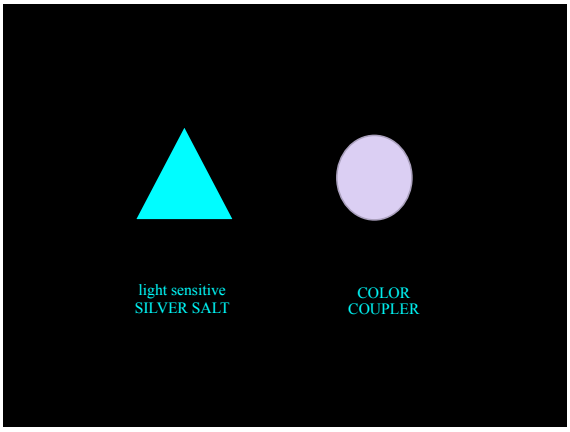
Chromogenic Color: Transparencies

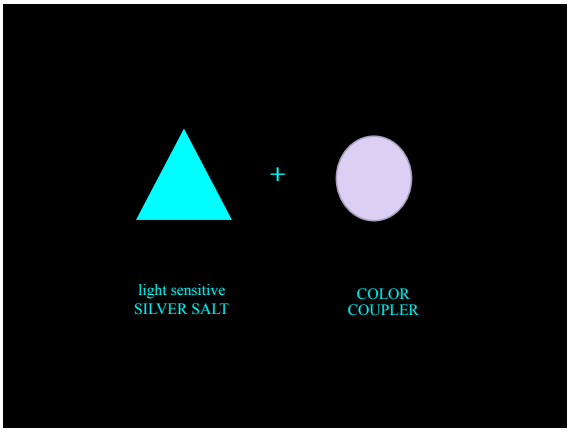
KODACHROME 1935

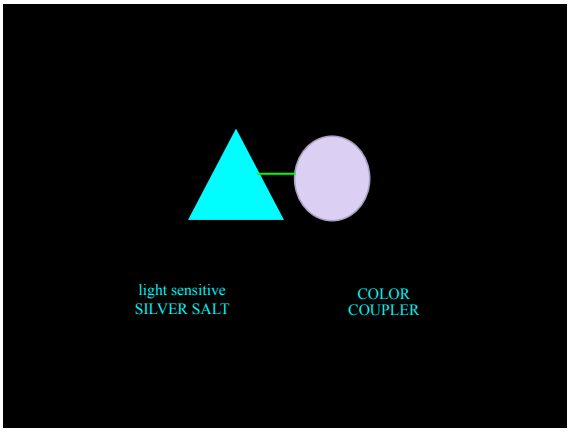
Fig.15. Leopold Mannes, left (1899–1964) and Leopold Godowsky, Jr., right (1900–1983).

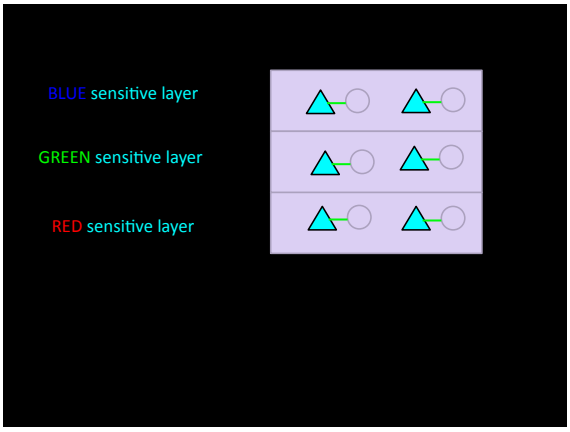
Chromogenic Color

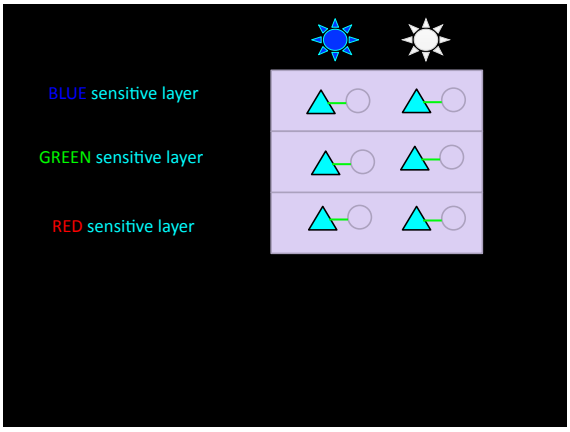


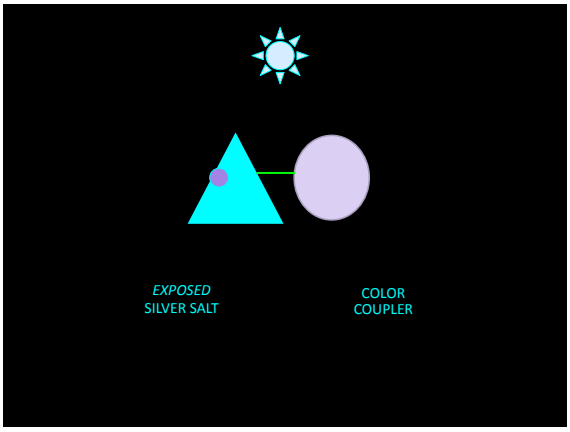


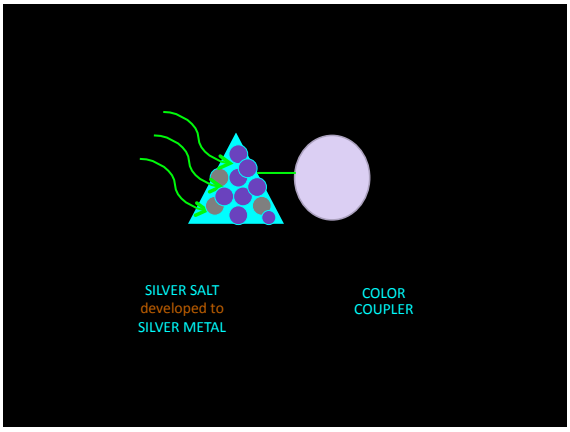


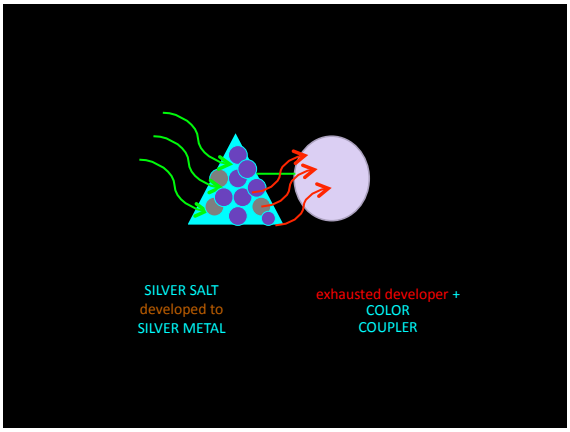


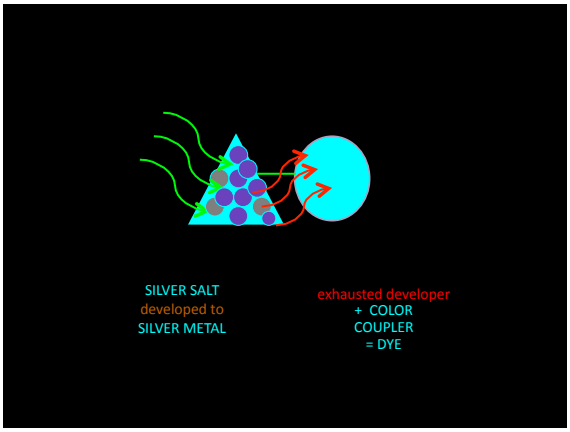




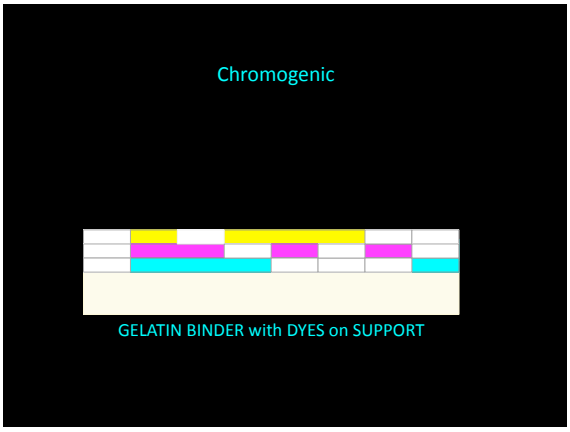

EXPOSED
SILVER SALT
COLOR
COUPLER


SILVER SALT
developed to
SILVER METAL
COLOR
COUPLER


SILVER SALT
developed to
SILVER METAL
exhausted developer +
COLOR
COUPLER


SILVER SALT
developed to
SILVER METAL
exhausted developer
+ COLOR
COUPLER
= DYE


get rid of
SILVER METAL
DYE


Chromogenic
GELATIN BINDER with DYES on SUPPORT

Chromogenic

GELATIN BINDER with DYES on SUPPORT

Chromogenic Color: Characteristics

- Yellow coupler staining, especially 1942-54
- Pre-1969: thick paper base to counteract curl of thick emulsion layers
- Post-1969: resin-coated (RC papers)

Dark stability: poor, especially pre-1980
- Cyan fades first, then yellow, leaving magenta image

Light stability: poor
- Magenta fades first, leaving greenish image
- Early RC develops cracking

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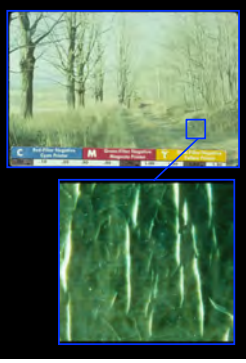

RC stabilization

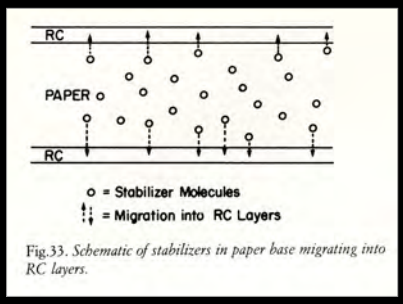

Fig.33. *Schematic of stabilizers in paper base migrating into RC layers.*

Relative Light Stabilities

Iris Ink Jet Color Prints	1.7
Polacolor 2 Prints	4.0
Kodak Ektatherm Color Prints	4.5
Canon Color Laser Copier Prints	7.8
Kodak Dye Transfer	8.0
Kodak Ektacolor Royal II	11.9
Polaroid SX-70 Time Zero Prints	12.0

Predicted years of display to reach "Home and Commercial" image-fading limits under bare bulb conditions: 12 hours per day at 450 lux (42 fc) with fluorescent lamps.
The Permanence and Care of Color Materials by Henry Wilhelm (1992).

Relative Light Stabilities

Kodak Ektacolor Plus Paper	11.7
Fujicolor "Minilab"	14.0
Ilfochrome Classic (Cibachrome II)	21.0
Fujicolor Paper Super FA Type 3	38.2
Fresson Quadrichromie Prints	100
Ultrastable Permanent Color Prints	>100
Polaroid Permanent Color Prints	>100

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