



# **Negativos de vidrio**

Línea del tiempo

Negativos con aglutinante de albúmina 1847-1855

Negativos de colodión húmedo 1851-1880

Negativos con aglutinante de gelatina 1880-1950

Ambrotipos 1850-1880

Vistas de linterna mágica

Autocrómos 1907-1930

Antecedente inmediato

Vistas de linterna mágica pre fotográficas





# **Alcances del curso**

Fabricación del vidrio

Estatigrafía de negativos de vidrio

Físico química general de los materiales constitutivos

Identificación

Conservación y estabilización

○ Caracterización de deterioros

Almacenamiento y parámetros de resguardo a largo  
plazo





# Usos y Fabricación

**del vidrio**









**Fabricación del**

# Vidrio

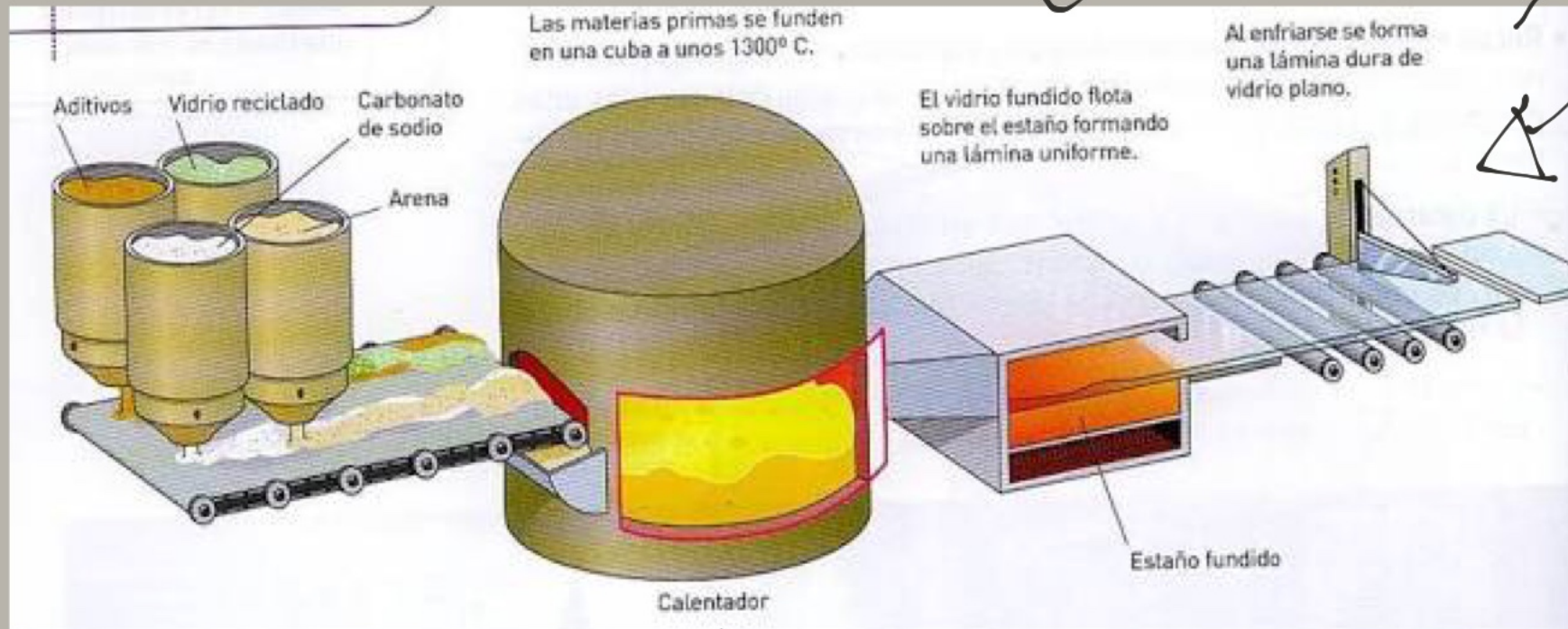


materia prima

horno

Laminación  
Formación

Enfriamiento  
Dureza



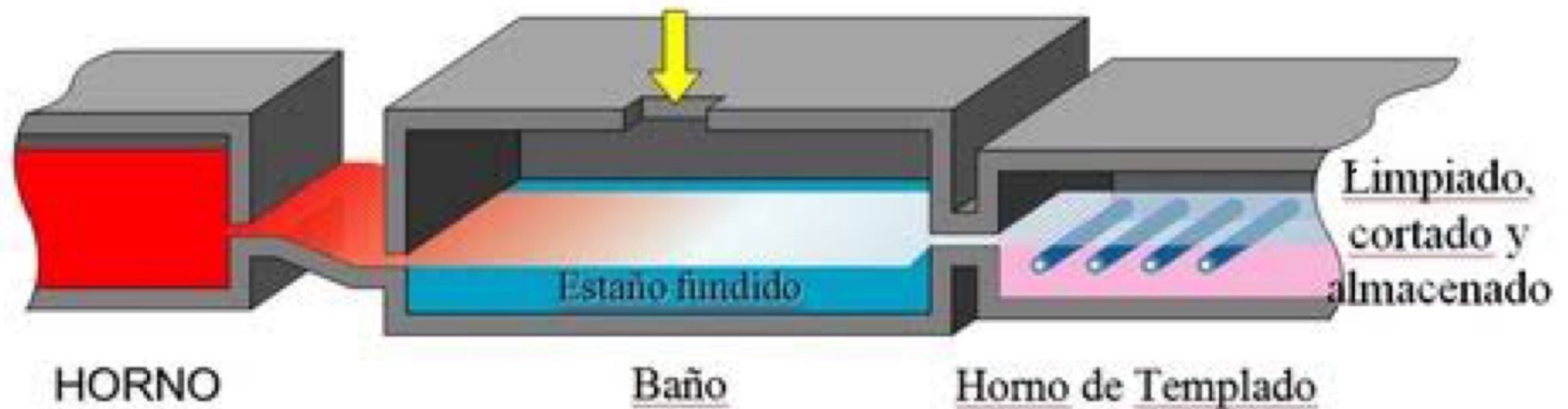
Estano

Estano

Arena, bicarbonato  
sódico, cal, sulfato  
sódico y dolomitas son  
fundidas a  $1600^{\circ}\text{C}$

Vertido en un baño de  
estaño fudido a  $1100^{\circ}\text{C}$   
Atmosfera controlada

El vidrio está fabricado  
y es sacado a  $600^{\circ}\text{C}$  y  
templado







**Procesos sobre soporte de  
vidrio / aglutinante**



Colodión

Albúmina

Gelatina



**Las placas fotográficas placas  
húmedas de colodión y placas**

**secas de gelatina**









# Negativos albúmina 1847-1855



**Colodión húmedo 1851-1880**

**Gelatina y plata 1880-1950,  
placas astronómicas 1980**

Ambrotipos 1850-1880

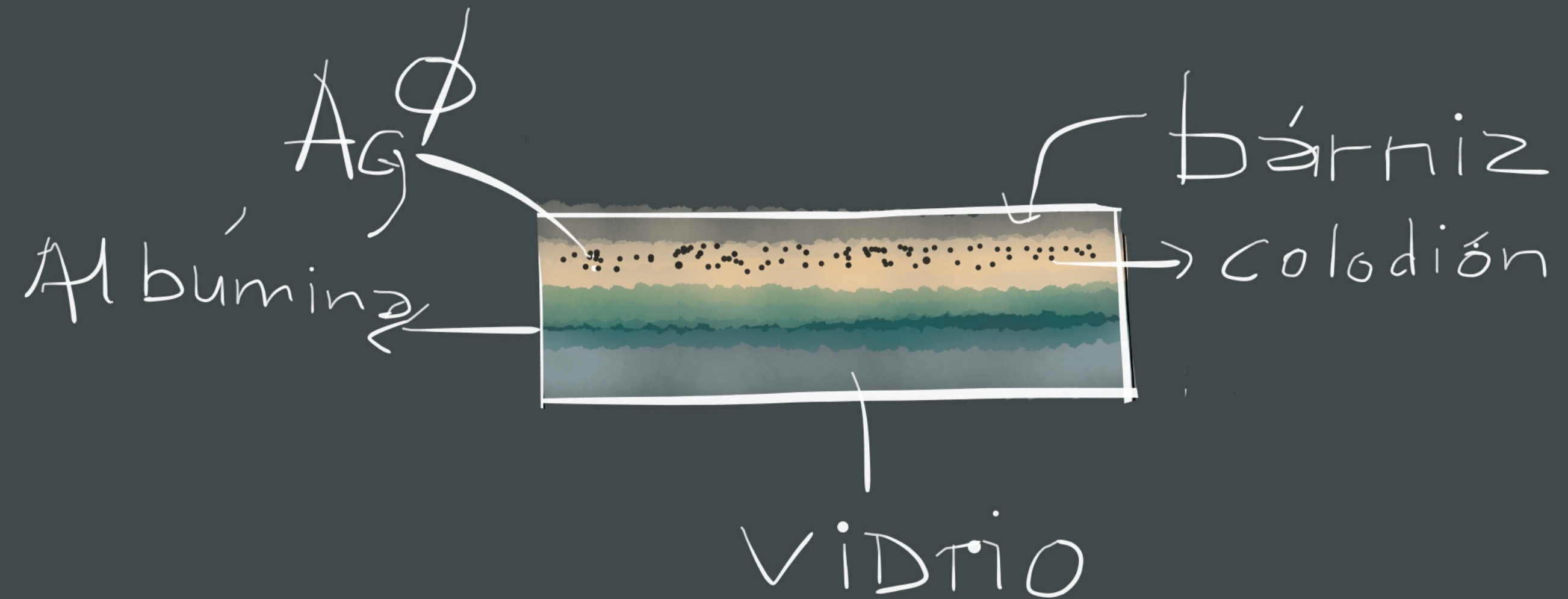
Cristal uim Vistas de linterna mágica

Autocromos 1907-1930

**1851:** Frederick Scott Archer, a sculptor in London, improves photographic resolution by spreading a mixture of collodion (nitrated cotton dissolved in ether and alcohol) and chemicals on sheets of glass. Wet plate collodion photography was much cheaper than daguerreotypes, the negative/positive process permitted unlimited reproductions, and the process was published but not patented.



# Negativo Colodión húmedo





## COLLODION GLASS PLATE NEGATIVES

1851 – ca. 1885

### ■ Background

The adoption of glass as a negative support in the mid-nineteenth century marked the beginning of a new era in negative technology characterized by sharper negatives and more detailed positive prints than those created through the paper negative processes.

The problem of getting the silver salts to bind (adhere) to a glass support was first solved by Abel Niepce de Saint Victor in 1848, with the introduction of the albumen on glass process. However, the glass support did not become dominant until 1851 when Frederick Scott Archer introduced the much faster collodion on glass formula, which used collodion as the image binder.

The collodion-on-glass negative process was also known as *wet plate*. This term derived from the necessity of exposing and processing the glass plate while it was still damp with the sensitizing chemistry to achieve optimum exposure speed. Because the poured plates had to stay wet throughout the entire process, collodion-on-glass negatives required a mobile darkroom that limited their ease of use outside of studio photography.

The wet plate process was practiced worldwide and negatives of this kind are found in most archives with 19<sup>th</sup>-century holdings; many of them are studio portraits.



## Colodión Húmedo

Antecedente negativos de albúmina sobre vidrio 1848

Abel Victor Niepce de San Victor

Colodión Frederick Scot Archer 1851

Placa húmeda/wet plate



ed extremely sharp and detailed negative images. Typical collodion nega-  
when viewed against a dark background. They often have a dull, milky-tan  
flected light.

p of silver particles deposited on the surface and suspended immediately  
odion binder.

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ht.

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es by

e neutral in color.

wet plate negatives were routinely retouched with graphite, especially on the  
retouched needed to be prepared by abrading the varnish overcoat to give  
hold the graphite. Red or yellow oxide pigments with a binder, or paper,

### THE EFFECT of PROCESSING on WET PLATE IMAGES

| Processing Step | Solution        | Effect                             |
|-----------------|-----------------|------------------------------------|
| Development     | Pyrogallic acid | Darker, more burnt-umber in color  |
|                 | Ferrous sulfate | Lighter, less burnt-umber in color |
| Fixing          | Hypo            | Darker image color (brownish gray) |
|                 | Cyanide         | Lighter image color (milky-tan)    |



chives with 19<sup>th</sup>-century holdings; many of them are studio portraits.

## ■ Process

The collodion binder was made by modifying cellulose found in *cotton linters* with nitric acid, a process called *nitration*. The resulting nitrocellulose was dissolved in alcohol and ether to produce a viscous liquid called collodion.

Ten steps were necessary to create a negative image using the wet plate process:

1. Clean the glass
2. Iodize the collodion
3. Pour the collodion on the plate
4. Sensitize the collodion
5. Expose
6. Develop
7. Fix
8. Wash
9. Intensify (optional)
10. Protect

### *Step 1: Clean the glass*

First the glass plate was cleaned with a mixture of alcohol and pumice or a mixture of thin powder such as Tripoli, rouge or calcined lamp black.<sup>6</sup>

### *Step 2: Iodize the collodion*

The wet plate process required iodizing the collodion to introduce halide by adding calcium

Collodion on glass negative (laterally reversed image of Mathew B. Brady (American, 1823-1918). 10 x 12.5 cm (8 x 10 in.). George Eastman House Collection.

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- |                                    |                         |
|------------------------------------|-------------------------|
| 1. Clean the glass                 | 6. Develop              |
| 2. Iodize the collodion            | 7. Fix                  |
| 3. Pour the collodion on the plate | 8. Wash                 |
| 4. Sensitize the collodion         | 9. Intensify (optional) |
| 5. Expose                          | 10. Protect             |

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*Step 2: Iodize the collodion*

The wet plate process required iodizing the collodion to introduce halide by adding cadmium or potassium

## ■ Stability/Deterioration

Collodion negatives are relatively stable. The following factors can turn them less stable and more difficult to preserve:

- Original glass composition (excess alkali)
- Lack of a varnish overcoat
- Improper cleaning of the glass support (before pouring the collodion on the plate)
- Improper storage of the negatives

In general, the chemical composition of the glass is the most important factor relating to the stability of collodion plates. Some glass employed during the collodion era had a high proportion of potassium oxide<sup>16,17</sup> and was subject to chemical decay. This type of deterioration, called “weeping glass”, causes softening of the binder and varnish and the loss of adherence to the glass.

The presence of a varnish overcoat is also essential for wet plate negative preservation; collodion negatives are extremely fragile, easily abraded and oxidized. *Silver mirroring*—metallic deposit on the surface of the binder—is a common sign of image oxidation.

Occasionally, collodion glass plates exhibit “emulsion frilling” (the binder peeling away

## **Problemática de preservación**

Composición original del vidrio exceso de partículas



con base /contenidos alcalinos

Ausencia de barniz protector lado emulsión

Limpieza precaria antes de emulsionar la placa

Almacenamiento y manipulación precario

## **los negativos de colodión húmedo son relativamente estables**

El foco de inestabilidad es la composición del vidrio/ soporte

La presencia de altos volúmenes de óxido de potasio usado en la fabricación del vidrio en el siglo XIX es un vector importante

La causa de deterioro final es la aparición de vidrio llorado, la causa eficiente es desprendimiento de la emulsión y por lo tanto del barniz, así como la separación del aglutinante con el elemento que forma la imagen.

A nivel del elemento que forma la imagen, la oxidación

de la plata metálica se manifiesta como un espejo azul,

Perdida densidad

or “weeping glass”, causes softening of the binder and varnish and the loss of adherence of the collodion to the glass.

The presence of a varnish overcoat is also essential for wet plate negative preservation; unvarnished collodion negatives are extremely fragile, easily abraded and oxidized. *Silver mirroring*—a blue-purplish metallic deposit on the surface of the binder—is a common sign of image oxidation.

Occasionally, collodion glass plates exhibit “emulsion frilling” (the binder peeling away from the glass), which occurred early in the history of this type of negative due to improper cleaning of the glass support before coating it with the collodion.<sup>18</sup>

### ■ Storage

When an unstable glass plate is stored under high relative humidity conditions, the surface of the glass develops a highly alkaline hydrated layer that adversely affects the silver image, the binder, and the varnish. These glass corrosion deposits appear as moist droplets in conditions of high relative humidity and form crystals when stored at low relative humidity.<sup>19</sup>

Collodion glass plates need to be stored at a cool to moderate temperature (below 18°C) and at 30% to 40% relative humidity. A relative humidity of less than 40% is critical to protect them from the effects of

## Almacenamiento de placas sobre vidrio de colodión



# húmedo

En ambientes de alta humedad el vidrio desarrolla una fina capa de Alkalís hidratados que afectan

- ☐ a la plata metálica que forma la imagen
- ☐ Al aglutinante
- ☐ Al barniz

Los depósitos de corrosión del vidrio aparecen como gotas de rocío en condiciones de alta humedad y forman cristales cuando baja la humedad

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Collodion glass plates need to be stored at a cool to moderate temperature (below 18°C) and at 30% to 40% relative humidity. A relative humidity of less than 40% is critical to protect them from the effects of glass corrosion such as alkali leaching.<sup>20</sup> However, storage of chemically unstable glass at low relative humidity (below 30%) is not recommended because may it cause dehydration of the glass surface.<sup>21</sup>

### ■ Identification

To identify wet plate negatives place the negative against a dark background and the image will appear as a positive.

In addition, since these negatives were entirely handmade (unlike the machine-made gelatin dry plate negatives to follow), they also are identified by manufacturing irregularities such as:

- Rough-cut edges of the glass support
- Thickness of the glass (machine-made glass is usually thinner)
- The glass may not be perfectly square
- Uneven surface of the glass support
- Uneven surface of the varnish overcoat
- Uneven edges of collodion binder and varnish layers
- Uncoated corner (where the plate had been held during coating)

As the industrial era began glass became more standardized, more stable, less expensive, and more readily available.

## **Almacenaje colodión húmedo sobre placas de vidrio**



**Temperatura fresca a  
moderada**

**18 Grados Celsius no más 40%  
humedad relativa para evitar  
la corrosión**

Las placas inestables no deben almacenarse a menos  
de 30 % de humedad relativa para evitar  
deshidratación del vidrio y lixiviación alcalina

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## 8 claves identificación de placas húmedas de colodión

1 un negativo de colodión sobre un fondo negro se visualiza como un positivo

2 hay una o varias esquinas sin emulsion

3 la placa no está cortada a escuadra

4 el grosor de la placa varía

5 superficie no homogenea

6 capa de barniz no homogenea

7 esquinas disparejas

8 barniz y emulsión no son homogéneos en esquinas y orillas



**Anti-halo layer:** A dark layer at the back of a glass or plastic support that absorbs light during exposure to prevent it from bouncing back and creating a halo effect.

**Binder:** Thin, transparent layer containing the image substance.

**Calotype:** Paper negative process introduced by Henry Fox Talbot in 1841.

**Celluloid:** A plastic made of cellulose nitrate with a plasticizer such as camphor.

**Cellulose ester:** Plastic produced by modifying cellulose chains through a process called esterification.

**Chemical development:** The chemical reduction of silver-halide crystals into metallic silver particles called filamentary silver. It is different from physical development in that all the image-forming material is present in the binder and no silver is added by the developing solution. Every negative type except collodion and paper negatives were/are created using chemical development.

**Chemical reducing agent:** Element or compound with a strong tendency to give electrons in a redox (reduction oxidation) reaction and thereby becomes oxidized.

**Cockling:** Planar deformation or buckling.

**Collodion:** Cellulose nitrate lacquer, a viscous liquid made by dissolving nitrated cotton in alcohol and ether.

**Cotton linters:** Short fibers that stick to the hull of the cottonseed after the long fibers (used in making cloth) have been removed.

**Developed-out image:** An image that is created through exposure and chemical development.

**Developer:** Chemical reducing agent that magnifies the reaction started by the exposure of the silver-halide crystals to light and produces a strong image from the otherwise invisible or latent image.

**Developed-out images:** Negatives or positive prints produced through exposure and development of a latent image with a chemical agent.

**Developing-out photographic papers:** Papers on which a negative is exposed but the image remains latent until it is made visible by chemical development.

**Dry plate:** A glass plate negative containing a silver image on a gelatin binder.

**Emulsion:** A suspension of light-sensitive silver halide salts in a viscous medium (e.g., a gelatin solution) forming a coating on photographic plates, film, or paper.

**Filamentary silver:** Opaque silver particles that result from the exposure and chemical development of light-sensitive silver-halide crystals.

**Fix:** Transform all silver-halide crystals that were not exposed

to light.

**Latent image:** A change caused by light during the exposure of a light-sensitive silver halide crystal, which is then magnified by the developer and leads to the chemical reduction of the entire crystal.

**Nitration:** Introduction of nitro groups into the cellulose chain through an esterification process with nitrate and sulfuric acid.

**Physical development:** Development with a developing solution (i.e., chemical reducing agent) that contains excess silver ions, which add opacity to the image. Silver particles produced through physical development are slightly different in shape and size from those produced by chemical development. Collodion and paper negatives were produced using physical development.

**Plasticizer:** A compound made of molecules of smaller size than a polymer, which are added to the polymer during the manufacture of a plastic material to provide flexibility.

**Polymer:** A large molecule made of smaller units called monomers.

**Positive prints:** Images showing correct, not inverted, tonal values.

**Print by contact:** To print not through enlargement, but by placing the negative directly in contact with the light-sensitive paper and exposing it to light.

**Printed-out positives:** Images produced entirely through exposure to sunlight, or an ultraviolet-rich source, without the aid of a chemical reducing agent. These positives were contact printed and have a reddish or purplish-brown hue with subtle details in the dark areas.

**Printing-out papers:** Papers on which a negative is overlaid and exposed to sunlight until the image is fully visible.

**Sensitizing:** Formation of the light-sensitive silver halide crystals.

**Silver mirroring:** Chemical deterioration of the silver image that leads to the formation of bluish silver deposits on the surface of the binder.

**Subbing layer:** An extremely thin, transparent layer that adheres the binder to the negative support.

**Support:** Firm or flexible material, which is optimally transparent or translucent (e.g., paper, glass, cellulose nitrate, cellulose acetate, polyester), that acts as a base for the image-binder layer of the negative.

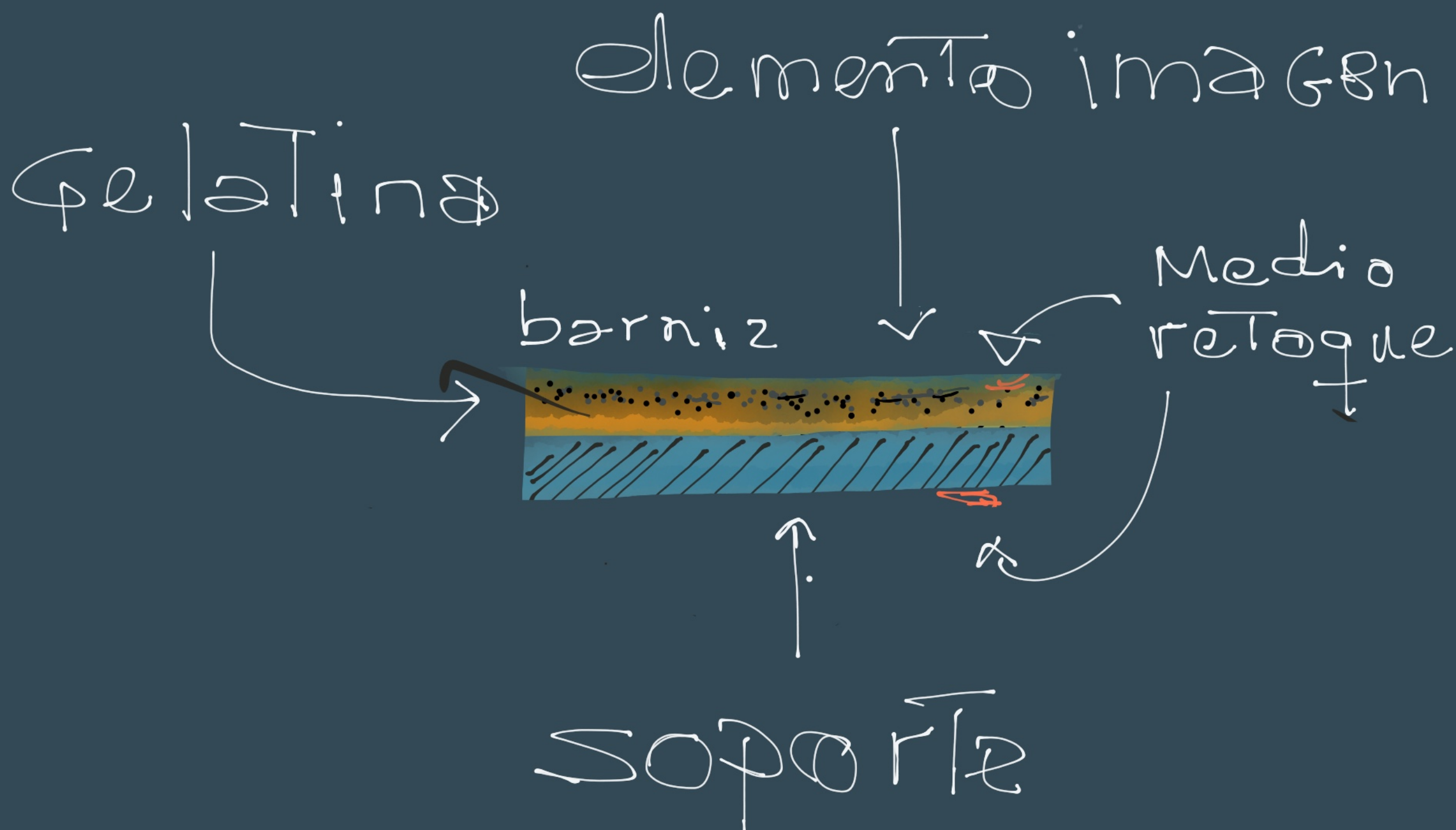
**Velox/gaslight paper:** Photographic paper used by amateurs. This slow developing-out paper could be printed by exposure to gaslight.

**Wet plate:** A glass plate containing a silver image in a collodion binder.

# Glosario

**1871:** Richard Leach Maddox, an English doctor, proposes the use of an emulsion of gelatin and silver bromide on a glass plate, the "dry plate" process.





**Conservación de**



# **negativos de vidro**

## **Estatigrafía**



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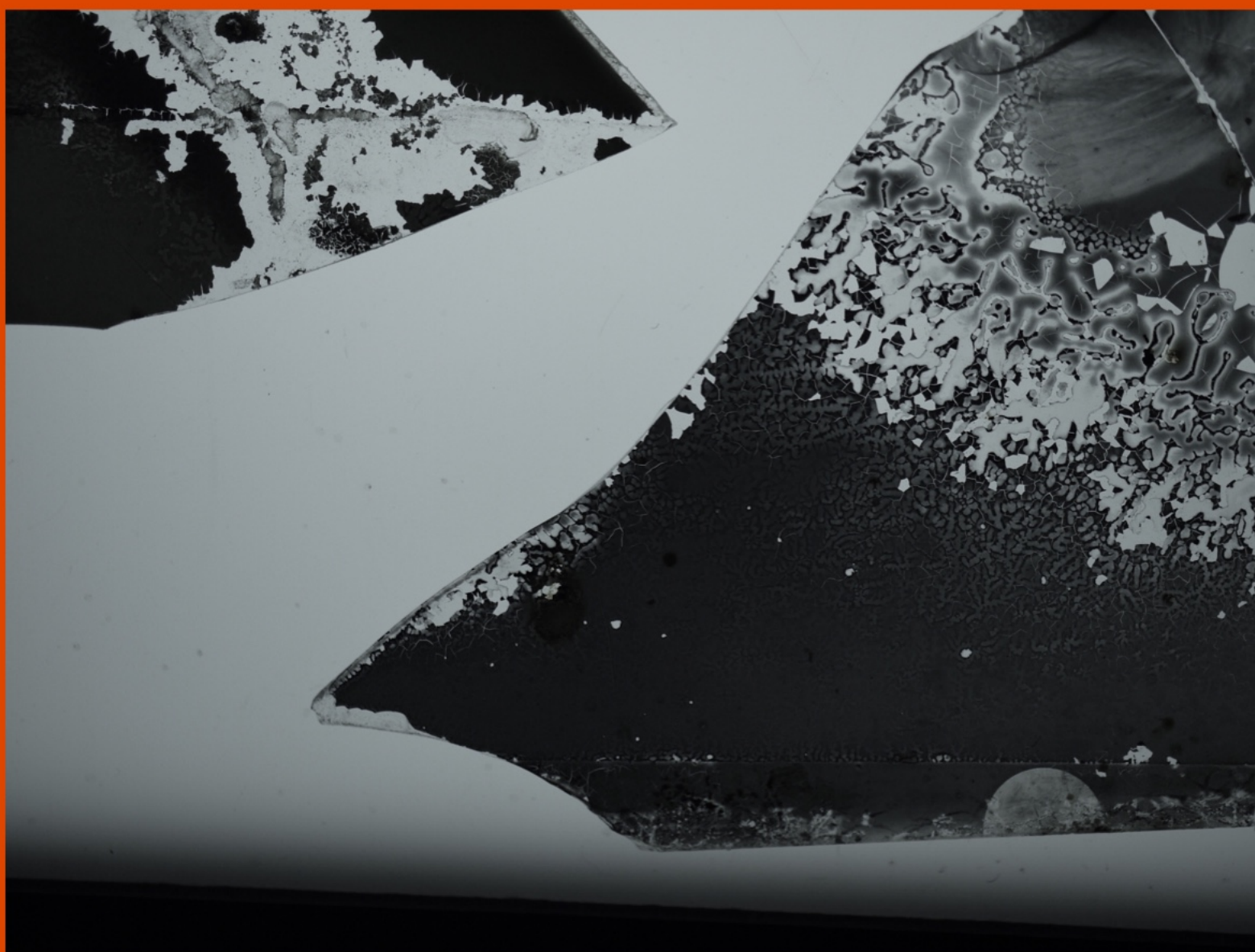






[https://drive.google.com/  
open?](https://drive.google.com/open?)

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# **Fotografías sobre vidrio**

## **Inestabilidad**



# Fragilidad

No es tan estable como aparenta

Friabilidad: se rompe, se fractura, se pica, se es sensible a la abrasión, se raya

Es inestable químicamente

Lixiviación del vidrio es frecuente.

Arrastra la exfoliación de la emulsión y la destrucción de la imagen

Interfiere con la emulsión y con la capa de barniz

Se reportan vidrios deteriorados y fuertemente afectados

Placas de vidrio con histéresis con la emulsión

Posible intervención sobre negativos de vidrio



**Negativos de plata gelatina  
sobre vidrio**

Producción industrial 1880

Mejora la calidad del vidrio en. O comparación con el vidrio usado para el colodión húmedo

Mejoras: menos defectos de fabricación menos burbujas

Aristas mejor acabadas

Mejor estado físico

Negativos tempranos de gelatina fueron barnizados

Deterioro frecuente : química del vidrio





**Vidrios rotos proceso de  
estabilizacion**

Sobre un soporte auxiliar de vidrio reagrupar los fragmentos para unirlos

Entre cada uno de los fragmentos colocar una separación de cartulina libre de ácido

En caso de emulsión exfoliada evitar desgarramiento

# **Lixiviación del vidrio**

Remoción de componentes del vidrio solubles en agua

Resultante en pérdida de transparencia

Formación de depósitos alcalinos en la superficie

Perdida del acabado liso del vidrio, presentará una superficie áspera

Hay varios grados de lixiviación

Es un proceso lento y oculto

Se cataliza rápidamente por factores externos



# Lixiviación del vidrio

Lixívia = blanqueador

Remoción de compuestos solubles del vidrio en agua

Perdida de transparencia

Formación de deposiciones alcalinas

La superficie pierde el acabado y se torna áspera

La lixiviación tiene diferentes grados de avance

Es un proceso silencioso y asintomático

Se cataliza en presencia de factores externos

Stephen Koobs define cinco niveles de deterioro por lixiviación

# Primer nivel se remueve con limpieza

- ☐ El quinto nivel es definido por la disgregación de la estructura del vidrio
- ☐ y la pérdida total del objeto

# Factores de deterioro del vidrio

Composición química del vidrio

Valores de humedad relativa

Influencia de imagen de plata



# Composición química del vidrio

Sílice dióxido de silicio aproximado 70%

Estabilizantes: óxido de calcio, magnesio, aluminio, 5-15%

Fundentes -para formar la malla del silicio- sales alcalinas óxidos de sodio y de potasio 12-20%

Aquí la causa material del deterioro: si la presencia de esto es alta, son altamente higroscópicos

Forman una capa hidratante en la superficie del vidrio

Son solubles y susceptibles de ser removidos por acción de más agua y extraídos laxivación

Detección vidrio lechoso

Formación de micro cráteres remoción de materialidad

Depósitos alcalinos expulsan emulsión de gelatina

# Conclusiones, hasta aquí

No todos los vidrios son inestables de forma regular

Un volumen elevado de sales alcalinas son factor de inestabilidad

Óxidos de sodio o de potasio tienen la función de bajar el punto de fusión, para una más fácil fabricación

Se reportan muchos casos en que los vidrios han resistido exitosamente condiciones adversas

La composición del vidrio es un factor que no podemos controlar



**Negativo virado**









**Exfoliación de la**

# emulsión perimetral

Ganancia de densidad por deterioro del vidrio  
lixiviación





**Exfoliación**



**perimetral**



# Residual químico

Mancha amarilla a marrón

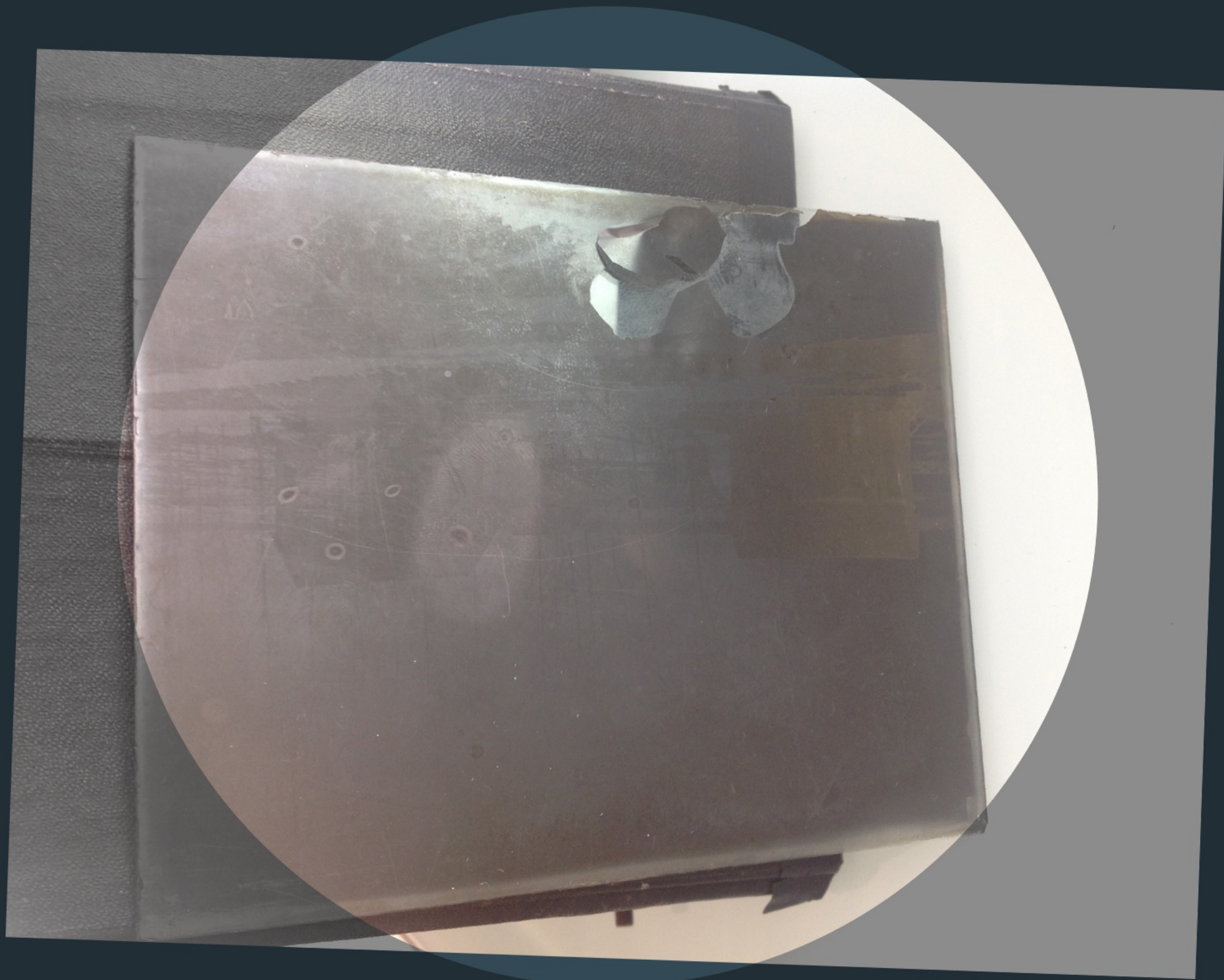




# **Corrosión de la plata**

Efecto espejeo de la plata































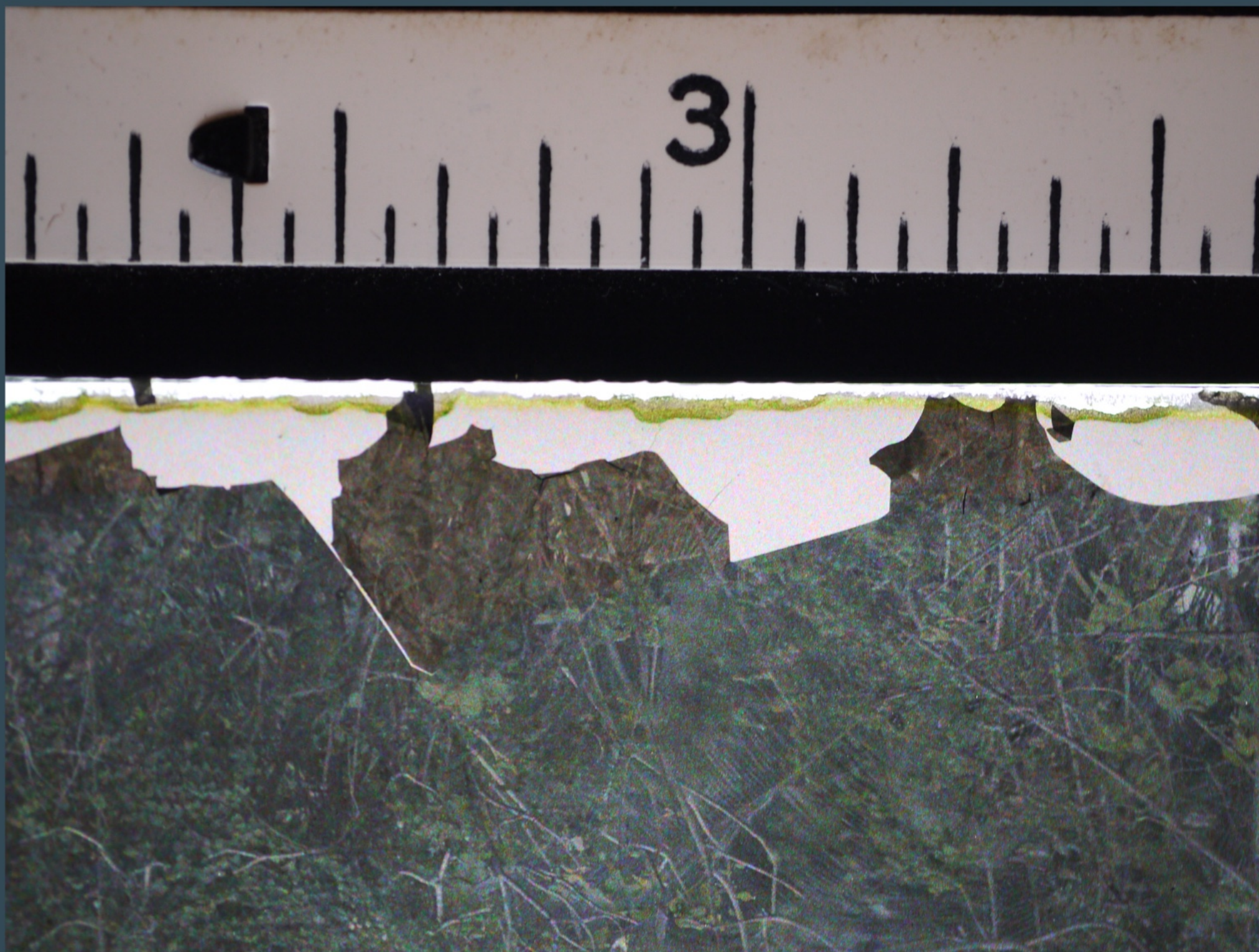
**Vidrio en deterioro**



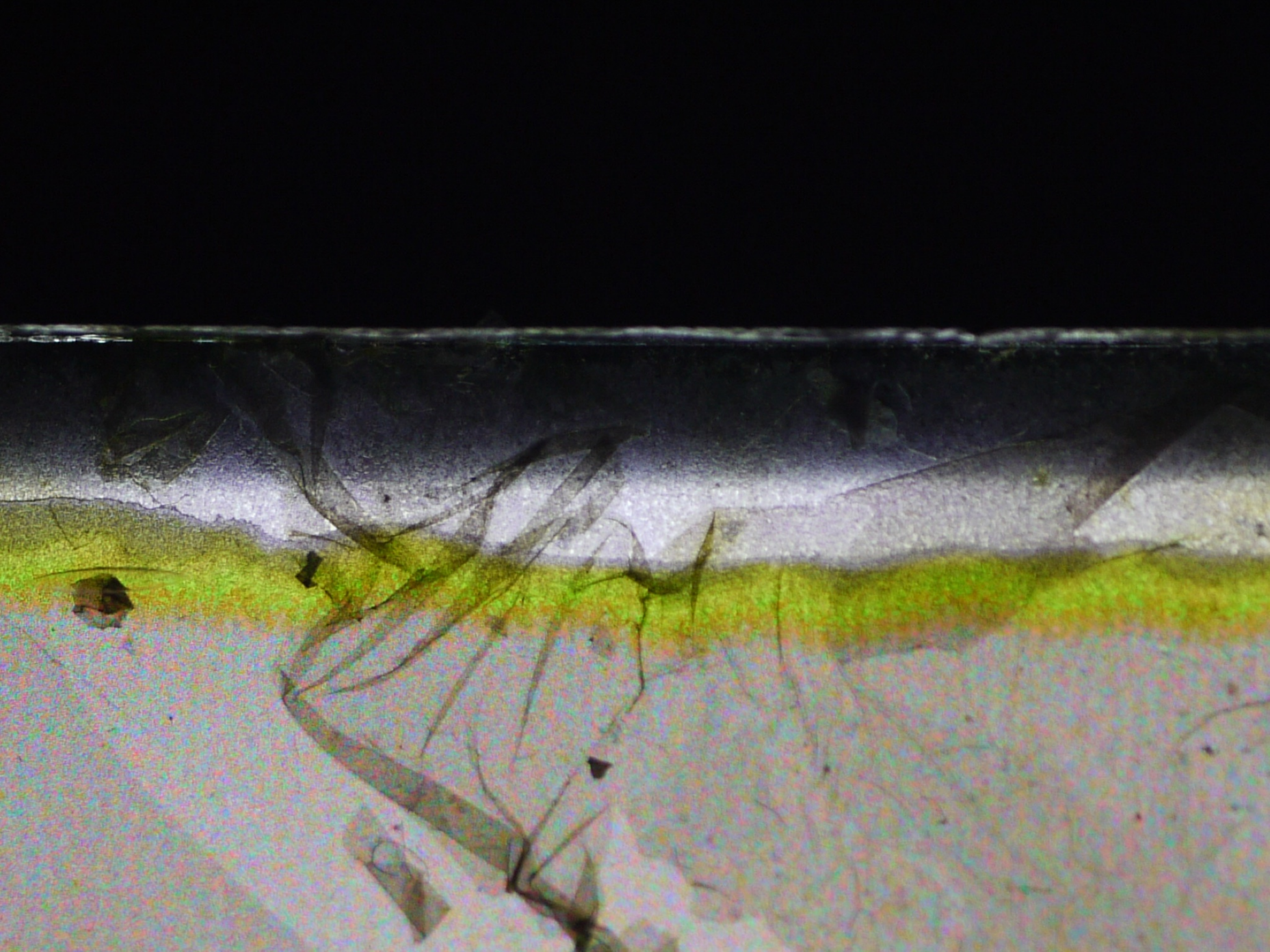


**Autocrómo**





















**Deterioro por activación del  
mercurio usado como**

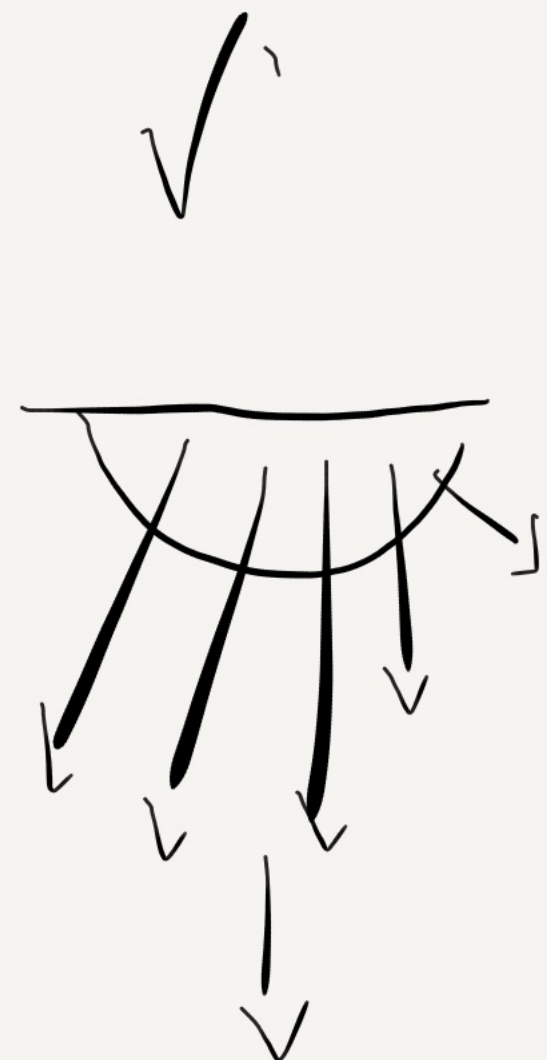
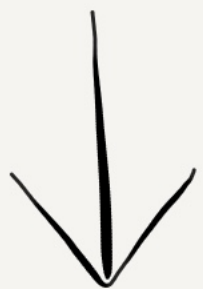


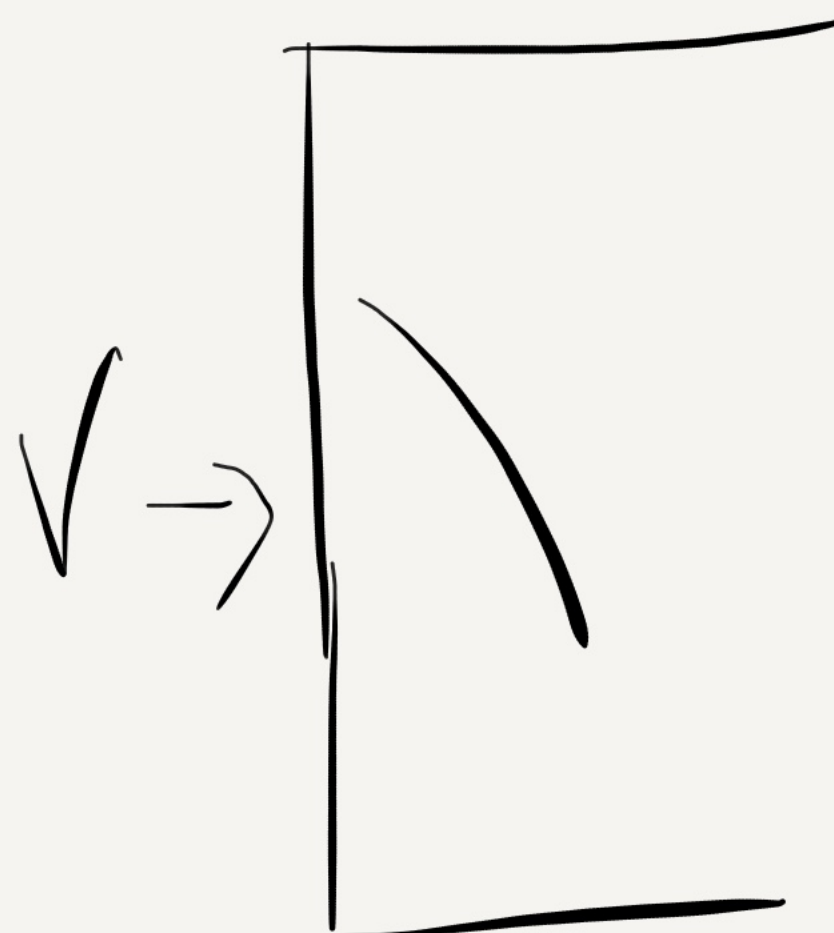
**intensificador.**

**intensific**

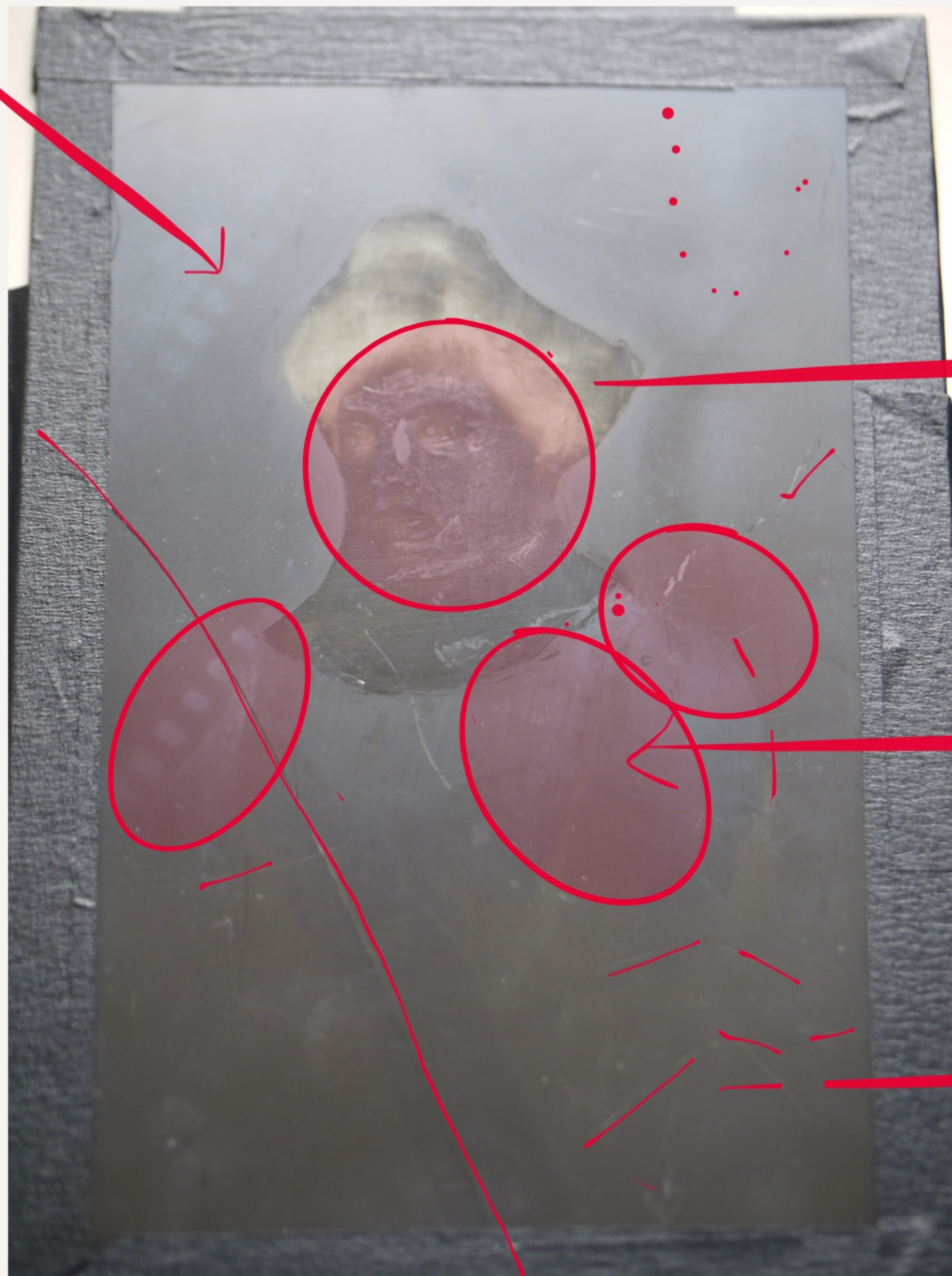








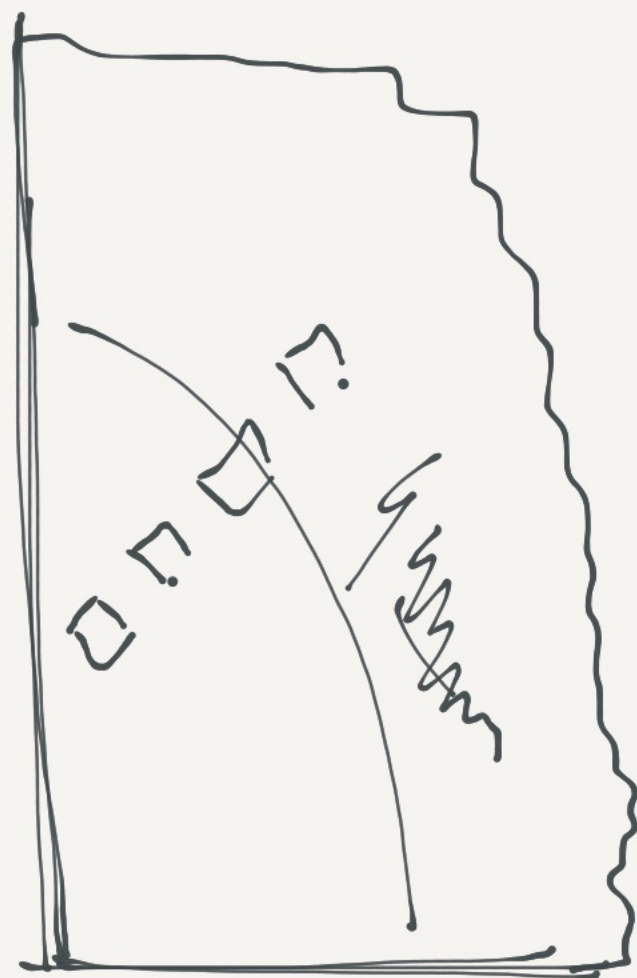




R

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**Negativo copia**



No 5







# **Fin**

**haluro.osorio@gmail.com**

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