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Digitizing Glass Plate Negatives and lantern slides

[1]Marian Ragaa, [2]Wafika. Wahba, [3]Mohammed Marouf,
[4]Yehia Osman Al Naquarty

[1]Researcher in El-Minya Government
[2]Conservation Department, Faculty of Archaeology, Cairo University, El-Gamaa St., 12613, Giza, Egypt,
[3]Conservation Department, Faculty of Archaeology, Sohag University, El-Gamaa St., Sohag, Egypt,
[4]Conservation Department, Faculty of Fine Arts, El-Minya University, El-Gamaa St., El-Minya, Egypt .

Abstract: **In general, most of the materials and methods used for conservation treatments are initially designed for application in other fields and then adapted by restorers for their specific purposes , This research aims to shed light primarily on digitization which is important for the preservation of the original glass archival material old fragile glass plate negatives and lantern slides Which is in danger of damage or loss , therefore it must be preserved by modern technology as digitization to change our perspective on collections of photographs , office services and strategic planning for them , The research deals with the importance of the process of Digitization as one of the ways to preserve and maintain the monuments and the definition of glass slides and types starting from the historical glance about them and their invention as one of the stages of the development of photography in the middle of the nineteenth century and its use even during the first quarter of the twentieth century and the definition of Projector Lantern Slides and their relationship to photo glass scalable also deals with how to use the scanner to digitize glass pieces and make copies for trading between users and how to store glass Slides and recommendations to be made for digitization, preservation and storage.**

Keywords: **digitization, negatives, glass, slices, projector.**

1. INTRODUCTION

Despite similarities in terms of image substance and processing methods, photographic negatives are made from different materials depending on their type of process and time period. Therefore, not all negatives are equal, nor do they behave the same over time. The lifespan of different types of negatives is determined by the least chemically stable of their components, which varies from one process to another. For example, negatives on glass supports may suffer from the symptoms and manifestations of glass decomposition, whereas negatives on plastic supports will show signs of degradation related to the inherent instability of the polymers employed in creating the plastic supports .The conservation problems posed by negative collections are not just related to their material condition, but to other factors as well, such as the sheer quantity of negatives, accessibility to the collection and negative storage requirements Nevertheless, understanding the chemical and physical properties of each type of negative, as well as the kind of processing they may have undergone, is the first step towards preservation , Before the film era and way before the digital era, photographic emulsions were made on glass supports, known as glass plate negatives.

Digitization is the transformation of analog information (from whatever form and from whatever support) to digital code. Manuscripts, books, bars, paintings, magnetic media, CDs, discs, audio and video recordings and photographic materials' which are important for the preservation of the original archival material that is in danger of damage or loss or for the

purpose of digital treatment to reach the best Results without changing or compromising the original . (1) The Digitization doesn't mean the substitution of the original material or its disposal and the destruction of the original, but its conversion to the digital state to keep the content as much as possible . (2)

Digitization, digitalization and digital transformation are three terms , Digitization and digitalization are two conceptual terms that are closely associated and often used interchangeably in a broad range of literatures. There is analytical value in explicitly making a clear distinction between these two terms.(3) Digitization is used in many contexts it is very often confounded and/or interchangeably used with digitalization.

DIGITIZATION: CONVERTING FROM ANALOG TO DIGITAL FORMAT is creating a digital (bits and bytes) version of analog/physical things such as paper documents, microfilm images, photographs, sounds and more ,So, it's simply converting and/or representing something non-digital into a digital format which then can be used by a computing system for numerous possible reasons.(4) The second term is **DIGITALIZATION:AUTOMATING BUSINESS PROCESSES** is Often used interchangeably with digitization as mentioned (and with digital transformation too) its means turning interactions, communications, business functions and business models into (more) digital ones which often boils down to a mix of digital and physical as in Omni channel customer service, integrated marketing or smart manufacturing with a mix of autonomous, semi-autonomous and manual operations .

The third **Term DIGITAL TRANSFORMATION: CREATING A DIGITAL COMPANY Digitalization** does not result in digital transformation. Digital transformation is about doing things differently-creating a completely new business model by using modern information and computer technologies .(5) it mean the transformation of business activities, processes, products, and models to fully leverage the opportunities of digital technologies. The main goal is to improve efficiency, manage risk or discover new monetisation opportunities. Digital transformation is doing things in a new (digital) way. (6)

The Preservation Committee of the Canadian Council of Archives supports the following principles as a guide to the development of digitization Programs in archives.

1. Digitization encourages preservation by limiting the handling of original records.

2. Digitization is, above all, part of an access strategy.

3. The process of digitization must not place original records at risk of damage from handling or use.

4. The establishment of a digitization service must not violate the physical or intellectual rights (property rights, copyright or privacy) of persons.

5. Digitization must strive to preserve to the greatest extent possible the authenticity and integrity of the original information. Digital enhancements may be performed on copies to improve access, but an "authentic" unaltered version (the original analog document or a digital version) must always be kept**.** (7)

Photographic negatives Photographic negatives are unique camera images used as masters for the production of multiple positive prints. Generated at the real scene, negative images are primary sources of visual information and represent half of the step towards the creation of the photographic print , The processes for producing negatives, as well as the supports on which they were created and the transparent medium (i.e., binder) that holds the light-sensitive salts that form the image after processing, have changed over the years.

(1) Digitization and Archives, CANADIAN Council of Archives Preservation Committee , Retrieved from October 2002, p 1.
(2) Digitization, digitalization and digital transformation: the differences ,Retrieved from 22/2/2018
(3) Scott Brennen and Daniel Kreiss , Digitalization and Digitization , September 8, 2014 , Retrieved from 22/2/2018 .
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The difference between black and white image negatives and colors

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

the negatives most commonly found in photographic archives and the dates they were produced

A black & white negative image is made up of fine silver particles (color negative images are made up of color dyes) embedded in a thin transparent layer called the binder. Together, the binder and the image substance form a single coat, which is often called the emulsion, on a transparent or translucent firm support (e.g., paper, glass, film, etc.). During fixing (i.e., transforming all of the silver halide crystals that were not exposed to light into a water-soluble compound that can be washed away), the negative image is stabilized and will not change upon further exposure to light and, if processed properly, will remain unchanged under ordinary environmental conditions. This allows for the printing of positive images (positives) from the negative over a long period of time.[(1)]

Color negative images are composed of chromogenic dyes (cyan, magenta, yellow) that form during development of the negative image around the exposed silver-halide crystals, which become filamentary silver particles after development. The filamentary silver particles are removed later during one of the color negative processing steps (called bleaching) leaving just the dyes.

In contrast to the creation of the negative image, early positive prints were obtained entirely through exposure to sunlight—without the aid of a chemical agent—until the turn of the 20th century when photographic papers for creating developed-out prints (which require the aid of a chemical agent) were commercialized.

Despite similarities in terms of image substance and processing methods, photographic negatives are made from different materials depending on their type of process and time period. Therefore, not all negatives are equal, nor do they behave the same over time. The lifespan of different types of negatives is determined by the least chemically stable of their components, which varies from one process to another. For example, negatives on glass supports may suffer from the symptoms and manifestations of glass decomposition, whereas negatives on plastic supports will show signs of degradation related to the inherent instability of the polymers employed in creating the plastic supports .

Nevertheless, understanding the chemical and physical properties of each type of negative, as well as the kind of processing they may have undergone, is the first step towards preservation.

Three types of glass plate negatives exist Albumen Glass Negative 1847 – 1860

in 1847 Claude Félix Abel Niépce de Saint-Victor developed the first feasible glass process in the form of albumen glass plate negatives. Although, because of its transparency, the images are sharper than the paper negatives used at the time, the process is laborious, specifically requiring a very long time for exposure and development , An albumen negative is comprised of an albumen and silver emulsion on a glass support. The image tone ranges from ocher-orange to olive green. Emulsion will appear creamy in dark areas. The image resolution is relatively sharp. Albumen negatives were typically made with thick, irregularly sized rough-cut glass. Corners may not be coated with emulsion.

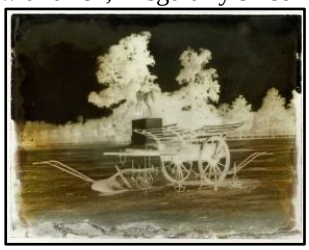

Figure (1) Albumen glass negative: Agricultural Instruments [Landbouwinstrumenten], attributed to Claude-Marie Ferrier, 1851- copied from psap.library.illinois.edu

Identification of Albumen Glass Negative

An albumen negative is comprised of an albumen and silver emulsion on a glass support. The image tone ranges from ocher-orange to olive green. Emulsion will appear creamy in dark areas. The image resolution is relatively sharp. Albumen negatives were typically made with thick, irregularly sized rough-cut glass. Corners may not be coated with emulsion. [(2)]

(1) Maria Fernanda Valverde , Photographic Negatives: Nature and Evolution of Processes, 2nd edition © 2005 Advanced Residency Program in Photograph Conservation, sponsored by the Andrew W. Mellon Foundation George Eastman House, mage Permanence Institute Photography by Douglas Manchee,p 4

(2) Negatives, Preservation Self-Assessment Program by institute of museum and library servicesUniversity of Illinois at Urbana-Champaign 2007.

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CollodIon glass Plate negatIves

The collodion glass plate negative process is a monochrome silver process invented by the Englishman Frederick Scott Archer in 1851, which was widely used until the 1880s. . [1]

The collodion used to produce photographic negatives on glass is obtained by dissolving cellulose nitrate – a chemical product developed by the Swiss chemist Christian Frédéric Schönbein – in alcohol and ether , In addition, exposure times were shorter than those for the daguerreotype or calotype, ranging from a few seconds to a few minutes, depending on the amount of light available. Finished negatives were usually used to produce albumen prints, although salt prints were sometimes made during the 1850s and early 1860s.[2]

Figure (2) Collodion on glass negative (laterally reversed ,right, with positive image left. Mathew B. Brady (American, 1823-1918). ANNIE LEWIS, ca. 1868. 20.3 x 25.4 , cm (8 x 10 in.). George Eastman House Collection. Photographic Negatives: Nature and Evolution of Processes, 2nd edition © 2005 Advanced Residency Program in Photograph Conservation

The advent of the glass plate negative resulted in an increased interest in photography. Do-it-yourself manuals cropped up during the 1860s and assisted both the amateur and professional photography in the creation of glass plate photographs. In 1864 John Towler published The Silver Sunbeam and, in it the outlined the new photographic process in just ten easy steps . Towler stated that "the operation of taking a collodion positive on glass consists of the following subdivisions"

1. Preparing the glass plate.
2. Coating the prepared plate with collodion.
3. Sensitizing the plate.
4. Exposing the prepared plate in the camera.
5. Developing the picture.
6. Fixing the image.
7. Drying the plate.
8. Remove any particles which may be settled on the plate.
9. Flow the plate with the "purest and most transparent crystal varnish, precisely in the same manner as the plate was covered with collodion" (Towler, 1864, n.p.).
10. Apply a dark background to the plate in the form of black velvet or paper.[3]

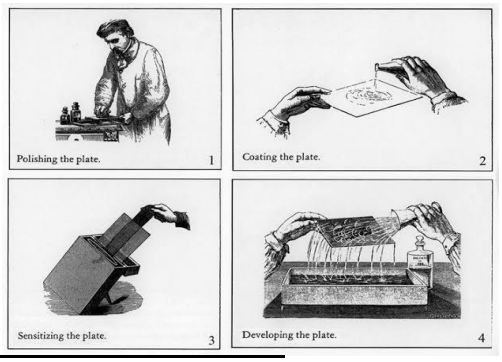

Figure (3) Wet-collodion process photography - Art history Glossary

(1) Visual glossary of photographic techniques © ARCP / Mairie de Paris, 2013
(2) article about Understanding the wet collodion process , © 2020 Khan Academy.
(1) Vail, S. (October 2002). Glass plate negatives. The Scream Online: A Magazine for Art, Photography, Literature ,p1-2 , Retrieved from May 17, 2005,

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Frederick Scott Archer's [1] wet plate negative was produced by spreading a glass plate with collodion, a flammable liquid made of cellulose nitrate and ether. The glass plate was then placed into a bath of silver nitrate which turned the collodion into a photosensitive silver iodide [2] The wet plate was then exposed in a camera. The photographer then had approximately five minutes to complete the exposure before the wet plate dried. The exposed plate was then protected with a coat of varnish The wet plate negative was in use from the early 1850s until the late 1880s, before being almost completely replaced by the more convenient dry plate negative process.[3]

Richard Daintree [4] Born in England in 1832, he was geologist, photographer and international promoter of Queensland, Australia, At this time photography was a complex activity. Pictures had to be taken using the wet collodion process, in which wet plates were exposed and then developed immediately. As many of Daintree's photographs were taken outdoors, this meant using a portable darkroom. The resulting images were very different to the highly posed studio portraits that characterised photography at this time. in 1868 Daintree successfully sought employment as the first government geologist for northern Queensland , In doing this he created a valuable photographic record of life on the Cape River diggings , In 1870 the Queensland government asked Daintree to put together an exhibition of photographs and mineral specimens for the 1871 Exhibition of Art and Industry in London. Unfortunately Daintree's mineral samples were lost in a shipwreck on the way to London, and Daintree had to create an exhibition using his photographs and maps and called the Sun Pictures of Victoria collection.

Figure (4) Richard Daintre " Morning – going to work " glass plates negatives by Copied from National Museum Australia


(5)

Identification of CollodIon glass Plate negatIves

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.[6]

(1) Frederick Scott Archer (1813 – 1 May 1857) invented the photographic collodion process which preceded the modern gelatin emulsion. He was born in England and is remembered mainly for this single achievement which greatly increased the accessibility of photography for the general public.
(1) Vail, S. (October 2002). Glass plate negatives. The Scream Online: A Magazine for Art, Photography, Literature, p1. Retrieved SEP 9, 2017.
(2) Hendricks, K. B. (1992). Warning signs: when photographs need conservation. In Conservation concerns: a guide for collectors and curators. Washington, DC: Smithsonian Institution Press.pp48-49.
(4) Article about Richard Daintree RETRIEVED DEC21,2019https://www.sbs.com.au/gold/story.php?storyid=105
(5) National Museum Australia Retrieved 26-11-2017 .
(6) Maria Fernanda Valverde , Photographic Negatives 20005,p 12

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GelatIn dry Plate negatIves ca. 1878 – ca. 1925

The replacement of collodion with gelatin binder was a major and far-reaching technical innovation in the history of photography. Gelatin changed all aspects of photographic technology and quickly became the dominant medium after the introduction of the dry plate process.

Fig (5) Gelatin glass negative alongside silver gelatin print. Image courtesy of Image Permanence Institute, Graphics Atlas.

Gelatin dry plates were the first photographic negative [1] materials that were manufactured and mass produced. Photography became faster, easier and the need for a portable darkroom was eliminated. The materials also had a shelf life of several months. This made photography much more accessible, allowing more people to become amateur photographers, which in turn increased demand for manufactured photographic papers. This marked the birth of the modern photographic industry. Gelatin dry plate negatives were exclusively used to print all photographic printing processes used between the 1880s and 1890s and was used into the 1920s. Printing processes included: gelatin and collodion POP, matte collodion, silver gelatin DOP, platinum and carbon.

During the 1890s, improvements in gelatin glass plate technology made possible the creation of orthochromatic emulsions with extended sensitivity into the green and yellow wavelengths of the spectrum. The adsorption of cyanine dyes to the surface of the silver halide crystals provided them with light-sensitivity to these and other wavelengths26 (other than red) and, by 1906, panchromatic plates (sensitive to the full visible spectrum) were already available.[2]

The negative process consisted of the following steps:

1. Pour the plate
2. Expose
3. Develop
4. Fix
5. Wash
6. Intensify (optional)
7. Varnish (optional)

Identification

Gelatin dry plates are very common. Most negative images show a gray or black image color. Rarely, one will find a physically developed negative image that will be gray or tan in hue. Gelatin glass plates are recognized by their machine characteristics , such as:

• Even coating of the gelatin layer across the entire surface of the glass.

• Relatively thin, smooth support of standard thickness.

• Most glass supports were 2 to 3 mm thick (thinner than handmade glass).

Although most gelatin glass plates were machine-coated, during the 1870s they were still coated by hand.

The Lantern Slides The definition of the Society of American Archivists (SAA) states that a magic lantern slide is “a transparent image on glass, approximately 3.5 x 4 inches, that is intended to be viewed by projection.” Some “lantern slides may have images that are hand-painted, printed or photographed.”

Figure (6) the photographic glass plate and the cover glass is bound with four strips of paper tape around the edges that overlap along the corners at a 90 degree angle. This photo copied from TREATMENT OF ALFRED STIEGLITZ’S LANTERN SLIDES p3.

(1)

(1) Graphics Atlas is a web-based resource created by ©2020 Image Permanence Institute (IPI).
(2) Maria Fernanda Valverde , Photographic Negatives 20005,p15

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Magic lantern slide technology actually predates the invention of modern photography. Originally, glass slides made from drawings or paintings were held up by a device, then backlit by a candle or lantern, then projected on a wall , Eventually, photographers began printing color positive images on glass slides and projecting them through one of these. (Basically, a concave mirror sits behind a light source and focuses the luminance through a small, square plate of glass and out the hole-thing). Some photographers even hand-painted their lantern slides for maximum artistic effect.[(2)]

Figure (7) Early drawing of a magic lantern in use from Zahn's Oculus Artificialis Teledioptricus Sive Telescopium (1702). Rakow Library collection

Often called a "stereopticon show," Magic lantern shows were the combination of projected images, live narration, and live music that preceded the movies. They were incredibly popular 100 years ago.

By the 19th century, the magic lantern was used in theaters, churches, fraternal lodges, and at home by adults and children. In 1895 there were between 30,000 and 60,000 lantern showmen in the United States, giving between 75,000 and 150,000 performances a year. That means there would have been several shows a week.

Decalcomania or Chromolitho Slides

By the difficult term Decalcomania we describe the technique of transferring pictures from specially prepared paper to surfaces such as glass, china, pottery etc. In the world of magic lanterns we specifically mean the application of this process while making a lantern slide by transferring an image to a square or oblong piece of glass. The technique was used by professional slide makers, but enjoyed a vogue among amateurs too. Images were printed in colors by the chromo-litho principle, and then transfered to glass. Porous paper was coated with a solution of starch, albumen and glycerin. The colored pictures were printed, details first, background last, and then finished by a coat of glue. [(3)]

continuing in a greatly reduced way through World War II , From the 1950s, the projected image turned to 35mm slides used for personal and business uses with projectors such as the Kodak Carousel. As late as the 1980s, office slide printers allowed business people to create colour digital slides for presentations. This faded out with the advent of the digital video projector in the late 1980s and early 1990s . [(4)]

Digitizing Glass Plate Negatives and lantern slides Digitizing Glass Plate Negatives (GPN) is sometimes seen as difficult. The digitization of both the negatives glass , the fragile ones and the Lantern slides need the hands of his trainer and expert in dealing with glass surfaces and aware of the challenges in dealing with all that is unique. .

Steps of Digitizing (GPN) Scanning

For the process of scanning the glass plate photographs, the equipment available to me was an Epson Perfection V700 Photo scanner, and for what I needed it worked seamlessly. The most important feature in any scanner you use is the ability to remove the inner cover to reveal a built-in transparency unit. The scanner needs to be able to capture the light that goes through the glass plate to capture the image.

Figure (8) Epson Perfection V700 Photo scanner copied from https://www.dublincity.ie/

(1) ROSINA HERRERA , TREATMENT OF ALFRED STIEGLITZ'S LANTERN SLIDES , Topics in Photographic Preservation, Volume Thirteen (2009) , p3
(2) Wilderness Lantern Slides , images from the American Alpine Club photo library , Reterved from 21-2-2020 https://huckberry.com/journal/posts/wilderness-lantern-slides
(3) http://www.magiclanternsociety.org/about-magic-lanterns/lantern-slides/
(4) Article about cleaning and scanning lantern slides , Retrieved from 27-4-2019 http://artifactphoto.ca/cleaning-and-scanning-lantern-slides/

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The next step is to clean the glass flatbed of the scanner; any large particles or smudges could appear on the scanned image. These particles could also scratch and damage the glass plate.

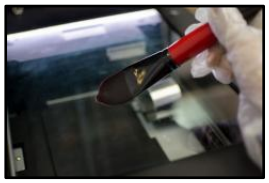

Figure (9) clean the glass flatbed of the scanner https://www.dublincity.ie/

It is also necessary to clean the glass plates themselves. Depending on age and what conditions they have been kept in, they may have dirt and smudges on them that can affect the image quality. I started with a dust free brush and lightly dusted the glass and emulsion side of the glass plate. It is particularly import to be gentle with the emulsion side (the less shinny of the two sides) because this is what is holding the im age to the glass plate.

Figure (10) clean the glass plates copied https://www.dublincity.ie/

With the glass side of the plate I used a bit more pressure to clean the slide; I found that using a Q-tip or cotton bud and sometimes a little bit of moisture works wonders on cleaning light smudges of dirt.

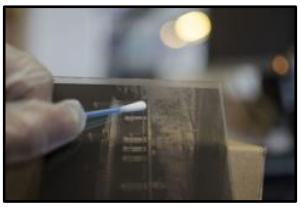

Figure (11) clean the glass plates copied https://www.dublincity.ie/

The next step was to very gently place the glass plate on the glass of the scanner with the emulsion side down; I found this technique worked best for me. I tried a few different techniques, such as using film holders and area guides to hold the glass plate away from the surface of the scanner. However, I found this made the scanned images much lower in detail and quality. I also experimented using Mylar (a thin plastic sheet) to protect the glass plate and glass flatbed from scratching each other; however, I found that this creates Newton's rings (swirly lines that can appear when two transparent things are on top of one another). I found being gentle and cleaning both glass surfaces for dust particles would prevent any scratching of glass**.**

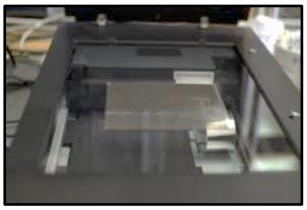

Figure (12) clean the glass plates copied https://www.dublincity.ie/

Newton's rings

When the glass of the slide is in direct contact with the scanner glass, Newton's rings are likely to form on the surface, as in the example below. **Newton's rings** occur when light is reflected between the glass plate and scanner surface. The only way to eliminate this is by moving the two surfaces apart or by using anti-Newton's ring glass on the scanner. To separate the two surfaces a simple thin card matte can be used. However, this may introduce further depth of field issues and a close inspection of the resulting scan is required to determine whether the slide image is in critical focus. [1]

Following these preparatory steps I finally began scanning the glass plate photographs. I used Adobe Photoshop to access my scanner settings and touch up the scanned image; under file and import I accessed my Epson V700 scanner settings. I

1 SHINGO ISHIKAWA AND DARREN WEINERT , https://www.nfsa.gov.au/latest/glass-cinema-slides-3

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used professional mode to access the settings where I can control document type, image type, and any adjustments I may need to make, I tried to leave the image as close to its original form as possible. However, to see the image fully, sometimes certain areas need to be lightened, darkened, or given just a bit more contrast. Another problem with scanning glass plates is coming across a broken plate. I found that, with some handy Photoshop skills, the cracks can be edited to show the image in its original quality .

The practical side of the application is on the glass negatives of the Egyptian Museum, and the previous steps were applied and the use of tools such as brushes and hand blowers and the results as shown in the following form: -

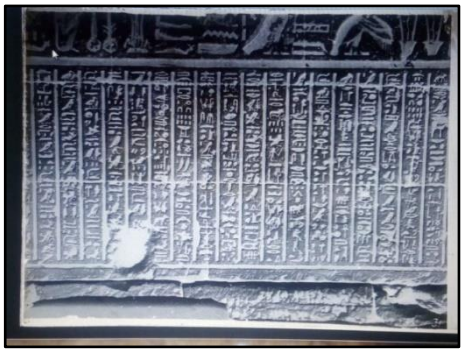

Figure (12) digitized the glass plate from the Egyption museum collection

Figure (13) digitized the glass plate from the Egyption museum collection

2. CONCLUSIONS

Glass plate negatives were the first mass-produced, ready-to-use film made available to photographers. While a glass plate negative can be fairly durable and resistant to changes in temperature and humidity, it is important to follow certain guidelines for storage and handling to ensure their preservation.

- Always handle plates with two hands by the opposite edges, not the corners.
- Wear gloves when handling glass plates to avoid leaving fingerprints on the glass or oils on the emulsion. Some recommend lint-free cotton; others recommend a synthetic glove, such as nitrile, to avoid slippage and snags.
- Place the glass plate, emulsion side up, in a four-flap buffered enclosure. (Label the enclosure before placing the negative inside.)
- Store glass plates vertically on their long side in an acid- and lignin-free buffered storage box.
- Make sure that plates are not rubbing against each other and do not fill the box too tightly.
- Use stiffeners made out of folder stock to separate individual negatives.
- Label each box with contents and mark "Heavy" and "Glass Negatives: Handle with Care" on the label. This will warn everyone to be careful when lifting the box off a shelf.

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