

APPEAR Glossary (3/5/2020)

Animal glue – a collagen-based adhesive made by boiling animal skin, bones, or tendons in water. The proteinaceous glue is used as a binding medium that is mixed with pigments for painting; it can also be used for sizing or sealing wood, for applying gilding, and for joining or bonding. Glues can be made from many types of animals including cow, rabbit, horse, or fish.

Antinoöpolis – an ancient Roman city south of Cairo and the Fayum basin, on the east bank of the Nile. The mummy portraits believed to have been discovered at this site exhibit a characteristic austere style and the wooden panels a unique stepped shape. The city was founded in AD 130 when the Emperor Hadrian named it in honor of Antinoüs, his lover who drowned in the Nile.

Antonine period (AD 138–192) – the era that encompasses the reigns of the emperors Antoninus Pius (AD 138–161), Marcus Aurelius (AD 168–180), and Commodus (AD 180–192). In the Antonine period provincial elite populations flourished. The distinctive, Hellenized hairstyles of members of the imperial court were seen on coins and in widely disseminated portraits, largely of stone and bronze. For women, a bun of braids coiled at the crown of the head and gradually draped to the nape of the neck; men adopted a bearded appearance with long, tousled hair. These closely imitated, specific hairstyles help scholars propose a rough chronology of Roman portraiture and art.

Balteus – a sword strap, typically depicted on painted portraits as a diagonal red band, sometimes with gold or silver studs, worn over the tunic. Its presence suggests that the deceased was in the military.

Beeswax – a natural wax produced by honeybees (*Apis sp.*) that is primarily composed of esters of various fatty acids and long-chain alcohols. Egyptians used beeswax for the mummification process, to retain the permanency of wig curls, in cosmetics, and to create painted portraits (encaustic).

Binding media – organic materials that hold pigments together, enabling them to be applied as a cohesive film. Ancient binding media are based on natural materials, including wax, plant gums, and proteins, such as animal glues. The physical properties of the medium strongly influence the handling and visual characteristics of the paint.

Bulla (pl. *bullae*) – a type of amulet, similar to a locket, worn around the neck of a boy. An indication of free birth, a bulla was used for protection as well as an official status symbol.

Calcium carbonate (chalk, lime, calcite) – a chemical compound used to create a stable white pigment with limited hiding power (opacity); this pigment is used to make grounds (preparation layers) for painting. Chemical formula: CaCO_3

Carbon black – a pigment made by charring wood or other organic materials in a reducing environment (a restricted air supply). It is also known as vine black (charred, desiccated grape vines and stems) or lamp black (soot collected from oil lamps). Infrared imaging can be used to



reveal artists' sketches and underdrawings made in carbon black that may not otherwise be visible beneath the painted layer, due to the pigment's tendency to absorb infrared radiation.

Cauterium (cautarium) – similar to a spatula or a palette knife, a metal tool that, after being heated, was used to blend the wax colors in encaustic painting.

Cestrum – a pointed graver, possibly metal, used for adding incised details in encaustic. The cestrum would have been heated and used to draw into wax.

Chiton (tunic) – a simple garment that covered the upper body, starting at the shoulders and ending at a length somewhere between the hips and the ankles. The English word *chiton* originates from the Latin *chiton*, which means “mollusk,” that, in turn, is derived from the Greek word *khitōn*, meaning “tunic.” The tunic was a basic garment worn by both men and women in ancient Rome. Citizens and noncitizens alike wore chitons (usually white for men and red for women). Citizens might wear a chiton under the toga, especially on formal occasions. The length of the garment and the presence or lack of stripes (*clavi*), as well as their width and ornamentation, indicated the wearer’s status in Roman society.

Cinnabar – an orange-red pigment with excellent hiding power (opacity) and good permanence. It has been used from antiquity to the present. Chemical formula: Mercuric sulfide, HgS

Clavus (pl. *clavi*) – In Rome some *clavi* of specific width and/or color distinguished members of a particular rank or status, but the significance of the *clavus* in an Egyptian context remains undetermined.

Consolidate – to strengthen or stabilize a material by adding another impregnating material, such as an adhesive (consolidant). For example: *The paint on the surface was consolidated using gelatin.*

Earth pigments – naturally occurring minerals that contain metal oxides, principally iron and manganese, and that have been used since prehistoric times as pigments. The primary types are ochre, sienna, and umber.

Egyptian blue (cuprorivaite) – a pigment that was manufactured and used by Egyptians possibly as early as 3100 BC. Considered to be the first synthetic pigment, Egyptian blue was made by mixing a calcium and copper compound with silica/quartz and a flux; heating the mixture to a very high temperature (900°C); and then grinding the glassy product to a powder. Chemical formula: Calcium copper silicate, $\text{CaCuSi}_4\text{O}_{10}$ or $\text{CaOCuO}(\text{SiO}_2)_4$

El-Hibeh (el Hiba) – an archaeological site on the east bank of the Nile, south of Cairo. Remains at the site date from the late Pharaonic, Greco-Roman, Coptic, and early Islamic periods—approximately 1100 BC to roughly AD 700.

ELISA (enzyme-linked immunosorbent assay) – an analytical technique that employs antibodies to identify proteins in binding media such as animal glue, egg, and milk, as well as

polysaccharides in plant gums. ELISA can also characterize the biological source of the protein (e.g., rabbit-skin glue vs. fish glue).

Encaustic – A wax-based painting technique. From the Greek word *enkaustikos* (“burned in”), the term in its most literal sense refers to the use of molten beeswax combined with pigments; once solidified, the paint can be further manipulated by the use of heated tools. The term is often used in a more general sense to describe any painting technique in which wax is the major component of the medium.

er-Rubayat (er Rubayyat, er Rubiyat, er Rubayet, el Rubiyat) – an archaeological site on the west bank of the Nile within the Fayum basin, also known as the cemetery near ancient Philadelphia. This location is where many portraits acquired by the Viennese art dealer Theodor Graf were found.

Flavian period (AD 69–96) – the era that encompasses the reigns of Vespasian (AD 69–79) and his sons Titus (AD 79–81) and Domitian (AD 81–96). Although Vespasian encouraged a return to traditional Roman values of austere modesty, the rule of Domitian saw new levels of extravagance, especially in the dress and coiffure of imperial women. As imperial fashions became known through the dissemination of coins and sculptured busts and statues, the elaborate hairstyles were imitated, with tiers of curls requiring hairpieces to achieve the required height and mitered shape above the brow; men copied the look of balding emperors Vespasian and Titus.

False-color infrared (FCIR) / infrared-reflected false color (IRRFC) – images created through digital post-processing by combining visible and near-infrared images. The false colors produced can help in characterizing materials or in distinguishing between visually similar substances.

False-color ultraviolet (FCUV) / ultraviolet-reflected false color (UVRFC) – images created through digital post-processing by combining visible and ultraviolet reflectance (UVR) images. The false colors produced can help in characterizing materials or in distinguishing between visually similar substances.

Fayum (Faiyum, El Faiyûm, Al-Fayoum, Fayyum) – a fertile desert basin immediately to the west of the Nile River, south of Cairo. Roman mummies were discovered there in several ancient cemeteries and archaeological sites, including Hawara and er-Rubayat. The Fayum was a very prosperous region and a vibrant cultural center during the Greco-Roman and Roman periods.

Fiber optics reflectance spectroscopy (FORS) – an analytical technique for identifying pigments and dyestuffs. This technique uses two fiber optics: one to expose the sample to light and the other to collect a diagnostic reflectance spectrum.

Fibula – a decorative pin or brooch, usually made of metal such as bronze, silver, or gold, used to gather and secure the folds of a garment.

Fourier transform infrared spectroscopy (FTIR) – an analytical method used for the characterization and identification of organic and some inorganic materials, based on the excitation of specific vibrational modes of functional groups in the infrared region.

Galena – a natural mineral form of lead sulfide used as a gray/black pigment and as a cosmetic in antiquity. Chemical formula: PbS

Garland – a floral necklace used in religious rituals and for festive occasions. The Egyptians placed garlands on their mummies as a sign of celebration in entering the afterlife; this practice developed at the beginning of the New Kingdom and continued into the Roman period. The rose was specifically associated with the goddess Isis.

Gas chromatography/mass spectrometry (GC/MS) – an analytical technique used for the precise identification of organic binding materials such as oils, waxes, resins, and gums. The instrument separates complex mixtures of organic compounds using a capillary column housed in a temperature-controlled oven and, in combination with the mass spectrometer, can facilitate identification and quantitation of the various components.

Gilding – a term that describes the various decorative techniques for applying a very thin layer of gold leaf or gold powder to a solid surface such as wood, stone, or metal to give the appearance of being made of solid gold. Gold leaf, typically between 18 and 22 karats, is hammered into extremely thin sheets (leaves), or ground into a powder, and then applied with an adhesive.

Green earth (terre verte) – a naturally occurring Fe, Mg, Al, K hydrosilicate mineral pigment colored by glauconite or celadonite, with other associated minerals.

Ground (preparation layer) – a primary layer applied to a substrate to form a smooth surface on which to paint. Typically, ground layers were composed of a white material such as gypsum, although they can range in color and composition.

Gum – a water-soluble, polysaccharide exudate obtained from various woody plants or other natural sources and used as a binder for pigments. Gum arabic was the most commonly used plant binder in antiquity.

Gypsum (calcium sulfate dihydrate) - a soft sulfate-based mineral found in nature. Often mixed with water to form plaster, it is used in the preparation of substrates, such as wood panels for painting. Also used as a white pigment, gypsum was identified in Tutankhamen's paint box. Chemical formula: CaSO₄·2H₂O

Hadrianic period (AD 117–138) – the era that encompasses the reign of Hadrian, who was known for his interest in Greek culture. The visual legacy in the portraiture of this period is exemplified in the Hellenization of male features (a short Greek beard reminiscent of that of the Athenian general and politician Pericles, and a full head of curly hair) and the classicization of female features (modest clothing and coiffures made of braids wrapped around the head).



Hawara - a Roman site in Egypt located in the Fayum basin. The necropolis at this site is well known for the systematic and well-documented excavations by British Egyptologist Sir Flinders Petrie.

Himation (*pallium* in Latin) – a mantle worn by both men and women in the Greek world. It consisted of a square piece of cloth worn over the shoulder (typically the left), with the excess cloth draped over to the opposite shoulder. (See *pallium*.)

Horus lock – a distinctive Egyptian hairstyle depicted on the gods Horus/Harpocrates and also worn by children (typically male) and sometimes by adult males. It appears as a single lock of hair (a sign of youth) on the right side of the head, above the ear.

Hyperspectral imaging – a scanning technique that records and processes hundreds of images of the same spatial area at a series of different wavelengths across the electromagnetic spectrum. Spectral data obtained for each pixel in the area can help detect or characterize materials present.

Indigo – a natural blue dye derived from the plant *Indigofera tinctoria* and related species growing in the Mediterranean, India, and Asia, among other locations. It is believed that originally the dye woad (*Isatis tinctoria*), rather than indigo, was used in antiquity. Chemical formula: C₁₆H₁₀N₂O₂

Infrared reflectography (IRR) – an imaging technique in which an object is irradiated with short-wave infrared radiation (SWIR; 1000–3000 nm). A specialized infrared-sensitive digital camera detects and captures the contrast between materials that reflect the infrared, such as lead white, and those that absorb it, such as carbon-containing pigments. Because infrared is of longer wavelength than visible light, some low-absorbing materials may also allow the infrared to be transmitted through them, revealing hidden underdrawings, artist's modifications and methodology, or modern interventions.

Iron oxide pigments (hematite, ochres, sienna, umber) – also referred to as *earth pigments* and made from minerals containing oxides and hydroxides of iron, iron oxide pigments can occur in many different colors, such as yellow, orange, red, brown, and black. Approximately sixteen known iron oxides and oxyhydroxides were widely sourced and processed (calcined) for use as pigments.

Julio-Claudian period (27 BC–AD 68) – the era that saw the establishment of imperial rule at Rome by five successive members of a single family: Augustus (27 BC–AD 14); Tiberius (AD 14–38); Gaius, often known as Caligula (AD 38–41); Claudius (AD 41–54); and Nero (AD 54–68). Augustus developed a clean-shaven look of somewhat short, neatly cut hair with a fringe of locks above the brow. Later Julio-Claudian court hairstyles were longer and more elaborate, with coiled corkscrew ringlets in front of the ears and tightly wound curls around the face. Wealthy provincial men and women imitated Roman imperial court style, which was rigorously disseminated across the empire, notably on coins and in portraits in many media.

Kermes – an insect-derived ancient red dye/colorant and source of the word *crimson*. Early Egyptians made this red dye from the dried bodies of a female wingless scale insect—either



Kermes ilices or *Kermes vermilio*, both of which live on certain species of Mediterranean oaks and produce a powerful, permanent scarlet dye and organic colorant. Chemical formula: kermesic and flavokermesic acid, $C_{16}H_{10}O_8$

Lake – a pigment manufactured by precipitating a dye onto an inorganic substrate/mordant (such as the metallic ions aluminum or calcium).

Lead soaps – a product created by the saponification of an oil (such as a drying oil, which hardens due to oxidation) promoted by a lead-based pigment, such as lead oxide. The soaps formed by interaction between fatty acids in the oil and lead ions from the pigment can manifest as insoluble white aggregates within the paint layer or as a white haze (efflorescence) on the surface.

Lead white – a white pigment, both found as a naturally occurring mineral known as hydrocerussite and produced synthetically by exposing metallic lead to an acid (e.g., vinegar). Lead white has been widely used in antiquity and in Egypt since around 400 BC. Chemical formula: Basic lead (II) carbonate, $2PbCO_3 \cdot Pb(OH)_2$

Linen (flax) – a textile derived from the flax fiber, commonly used in but not originally native to Egypt, dating back to the Neolithic period (about 4000 BC). Two types of flax were cultivated in Predynastic Egypt: *Linum bienne* (synonym *Linum angustifolium*) and *Linum usitatissimum*. To produce linen thread, flax was dried, retted (soaked), beaten to separate the bast fibers from the stems, spliced, and spun. Although rarely done, linen thread could then be dyed (using ochre or organic colorants) before being woven into cloth. Women, men, and children were involved in linen production, but weaving is most closely associated with women. Linen cloth was very valuable and sometimes used as currency. Egyptian mummies were wrapped in linen because it symbolized wealth, light, and purity.

Liquid chromatography with diode array detection and mass spectrometry (LC/DAD/MS) – many natural dyes consist of more than one chemical compound, and LC is a technique by which the compounds can be separated and then individually identified by DAD and MS detectors.

Madder – a dyestuff derived from the root of the madder plant (*Rubia tinctorum*), which is native to the eastern Mediterranean and Persia. Likely introduced to Egypt by the Greeks or Romans, madder was used throughout antiquity for coloring textiles and as a pigment. Chemical formula: Alizarin (1,2-dihydroxyanthraquinone), Purpurin (1,2,4-trihydroxyanthraquinone)

Malachite – a mineral used as a pigment of varying green hues. It has moderate permanency and is sensitive to acids and heat. Found on Egyptian tomb paintings, malachite is perhaps one of the oldest known green pigments. Chemical formula: Basic copper (II) carbonate, $Cu_2CO_3 \cdot Cu(OH)_2$

Modified wax – beeswax that has been modified by the addition of other materials, such as resin, glue, or oil, or that has been treated with an alkali to make it water soluble, thus paintable cold. Some scholars have proposed that wax was modified in some way for use as a paint medium in ancient Egypt.



Multispectral imaging (MSI) / multiband imaging (MBI) – the creation of a series of images, each recording reflectance within a different limited range of wavelengths. This process involves using a series of band-pass camera filters or a set of narrow-band illumination sources; thus, it records variations in the absorption of materials at different wavelengths. Comparing or combining these images can help to characterize materials or to distinguish between materials that may appear similar.

Multiband reflectance subtraction imaging (MBR) – a digital post-processing technique that subtracts a near-infrared image from a visible light image, thus enabling the characterization of certain materials, specifically indigo.

Orpiment – an orange-yellow pigment with large particles and a glittering quality used to imitate gold. Sourced from the Red Sea and Asia Minor, orpiment, mentioned by Pliny and Vitruvius and also noted in Egyptian works of the Pharaonic period, was widely traded by the Romans. Chemical formula: Arsenic trisulfide, As_2S_3

Panel – painting supports made from various woods, including, lime, sycomore fig, and cedar of Lebanon, among others. The shape of the upper portion of mummy portrait panels may indicate the cemetery in which the mummy was buried: stepped panels are associated with Antinoöpolis, round-topped panels with Hawara, and angled panels with er-Rubayat.

Pallium – a large, draped rectangular cloth, worn as a cloak or mantle with no undergarment, often associated with Greek intellectual activities. To the Romans, the pallium was a distinctly Greek form of dress, and so it was worn only in specific contexts. (See *himation*.)

Pastiche – artworks that incorporate several different styles or are composed of parts drawn from a variety of sources (e.g., a complete panel that is made of two or more panels).

Penicillum – a paintbrush with bristles made from plant fibers or animal hair.

Photometric stereo imaging – a computational imaging technique that separates color from shape data to generate a high-resolution composite image that estimates surface topography.

Pigment – a colorant either derived from natural sources—mineral, plant, or insect—or produced synthetically. Typically, pigments are crushed into a fine powder and mixed with a binder, resulting in a suspension that becomes insoluble when dry; a dye produces a lake pigment when attached to an inorganic substrate or mordant.

Plant resin – a water-insoluble exudate obtained from one of several plants, particularly coniferous trees such as pine, cedar, or fir. Composed of chemical compounds known as terpenes, plant resins are used for the production of varnishes and adhesives and for mummification processes. Many resins have an aromatic quality that also acts as a preservative (biocide).

Polarized light microscopy (PLM) – optical microscopy that utilizes polarized light to study the structure and composition of materials. Particles (of pigments, for example) may be characterized by their appearance and by observing their isotropic and anisotropic characteristics based on their crystallographic structure.



Polychrome – the application of multiple colors to an object to produce a decorative effect.

Provenance – the ownership history of an artifact.

Provenience – the geographic origin of an artifact.

Punic wax – beeswax prepared in a certain way, as described by both Pliny and Dioscorides. The precise nature and composition of Punic wax has been much debated, with the source texts variously interpreted as describing the preparation of a purified or clarified beeswax, or one that has been partially or completely saponified by the addition of an alkali. In the latter case the product is presumed by some to be water miscible and amenable to application in a cold state.

Radiocarbon dating – a scientific method for dating organic materials or an object containing organic materials.

Raking light – illumination of an object by a light source positioned at an oblique angle or almost parallel to the object's surface. It is used to provide information about the surface topography.

Raman spectroscopy – an analytical technique used to observe the vibrational, rotational, and other low-frequency molecular modes of a material. When excited by monochromatic light (visible, near infrared, or near ultraviolet) from a laser beam, the collected inelastic scattered light collected with a spectrometer produces spectra that are specific to the chemical bonds and symmetry of specific molecules. Comparing reference spectral databases allows for the identification of materials.

Realgar – closely related to orpiment, a red-orange pigment that was widely traded in the Roman Empire and used throughout ancient Egypt and Mesopotamia. Pararealgar is formed when realgar is exposed to light (degradation); it has the same elemental composition but different crystalline structure. Chemical formula: Arsenic sulfide, As₄S₄

Red lead (minium) – a bright red-orange pigment that was one of the first to be synthetically produced. It is also referred to as *minium*, the naturally occurring pigment named after the river Minius, located in northwest Spain. Chemical formula: Lead (II, IV)-oxide Pb₃O₄

Red ochre – a brownish-red earth pigment that contains anhydrous iron oxide, or hematite (from the Greek *hema*, meaning “blood”). Used since prehistory as pigments, ochres may vary widely in shades and transparency. Composition: Anhydrous iron (III)-oxide, Fe₂O₃

Reflectance transformation imaging (RTI) – a computational imaging technique that reveals surface topography, details, and textures, thus enabling the study of tool and brush marks, etc. RTI produces a polynomial texture map, or pseudo-three-dimensional image, of an object or surface. The light source is positioned at a constant radius from the subject at different angles (i.e., raking light) to create a hemisphere of positions and the image captures acquired from a fixed camera position during each light movement. The final processed file determines all possible light positions within the virtual hemisphere.

Reflected near-infrared (NIR) photography – an imaging technique that records radiation responses in the near-infrared region (700–1100 nm), thus capturing the contrast between



materials that reflect the infrared and those that absorb it, such as carbon-containing pigments. Because infrared is of longer wavelength than visible light, some low-absorbing materials may also allow the infrared to be transmitted through them, revealing hidden underdrawings, artist's modifications and methodology, or modern interventions.

Sagum – a long, dark-colored (red, blue, or purple) outer cloak worn by Roman soldiers. The sagum was fastened on the shoulder with a fibula (brooch).

Scanning electron microscopy and energy dispersive X-ray spectroscopy (SEM-EDS / EDX) – an electron microscope that images the surface of a sample by scanning it with a high-energy beam of electrons. The interaction between the electrons and the constituent atoms at the sample's surface reveals topography and elemental composition.

Severan period (AD 193–235) – an era characterized by, among other things, a fashion for short military beards and hair cropped close to the head for men and center-parted and pulled-back hair for women. These distinctive styles help scholars to propose a rough chronology of Roman portraiture and art, as images with these coiffures appear on dated materials such as coins and busts.

Shroud – a cloth used to cover or protect another object. The term is most often used to refer to a cloth that covers or envelops a corpse. Many mummy shrouds were painted before being placed over the mummy's head or enveloping the entire body.

Specular light – light that behaves as in a mirror; that is, a ray of incoming light (incident ray) that strikes a surface and is reflected back in a single outgoing direction.

Stucco – a fine plaster made of either gypsum or calcite that is used for coating surfaces or that is molded into decorative shapes. The mixture is applied wet and shaped/molded; it is typically painted after drying. Funerary masks made of stucco are found in Egypt from the First Dynasty to the first century AD.

Tempera – in the context of ancient art, this term generally refers to a fast-drying, water-miscible painting medium such as animal glue or plant gum. The term *tempera* originates from the Latin *temperare* (“combining, blending”).

Trajanic period (AD 98–117) – the era that corresponds to the reign of Trajan. This period is exemplified by a distinctive women's hairstyle consisting of a “nest” of braids placed at the back of the head and rolls of curls arranged into a tall diadem (crown or headpiece) towering over the forehead. These distinguishing styles help scholars to propose a rough chronology of Roman portraiture and art, as images with these coiffures appear on dated materials such as coins and busts.

Tunic – See *chiton*.

Ultraviolet-induced visible fluorescence (UVF) / UV-visible fluorescence / Ultraviolet-induced visible luminescence (UVL) (historically UV/VisFL) – an imaging technique and diagnostic examination method, based on characteristic responses of materials to ultraviolet (UV) radiation (185–400 nm) in the form of fluorescence, in which radiant energy in the UV



region is absorbed and then reemitted as lower-energy visible light. The fluorescences revealed by the technique are used to assist in the general characterization or differentiation of materials—such as pigments, coatings, binders, and adhesives—and to diagnose the condition of an object (e.g., to detect restorations). The term *luminescence* also encompasses the possibility of a phosphorescent response to UV radiation in which there is a delay in the reemission of the absorbed energy by some materials, so that emission might even continue for a period after the UV excitation source is turned off. Because fluorescence is by far the dominant phenomenon being observed and documented, the term *fluorescence* has historically been used in describing this technique in conservation (as well as in medicine, nondestructive testing, and forensics); however, *luminescence* is an equally appropriate descriptor.

Ultraviolet reflectance or ultraviolet reflected (UVR) imaging / reflected ultraviolet (RUV) imaging – an imaging technique that records variations in reflection and absorption of ultraviolet (UV) radiation by the surface of a subject. This imaging technique primarily aids in the characterization or differentiation of materials. Also because UV radiation exhibits very limited surface penetration, the technique can also help in characterizing surface sheen.

Umbers (raw and burnt umber) – natural earth pigments containing iron and manganese oxides and hydroxides. Used throughout history as earth tone pigments, umbers range in color from cream to brown, depending on the amount of iron and manganese present. Chemical formula: Iron (III)-oxide, partly hydrated + manganese oxide, $\text{Fe}_2\text{O}_3 \cdot (\text{H}_2\text{O}) + \text{MnO}_2 \cdot (\text{n H}_2\text{O})$

Visible-induced infrared luminescence / visible-induced luminescence (VIL) – an imaging technique in which visible light is used to induce the emission of infrared radiation (primarily in the near-infrared [NIR] region [700–1100 nm]) by certain materials. It has been used to identify historical blue pigments (principally Egyptian blue, Han blue, and Han purple) as well as many cadmium pigments and some natural dyes. These materials may show a very strong IR emission when excited by visible light. The set-up for this type of imaging requires an excitation source emitting only visible light with no IR component, an imager with sensitivity to NIR (such as an IR-modified digital camera), and a lens filter that absorbs all visible light and transmits NIR.

Visible-induced visible luminescence (VIVL) – a method of recording a photo-induced emission of light in the visible region (500–700 nm) when the object is illuminated within a narrow band of visible light of higher energy (400–500 nm). The technique involves careful control of the spectra of the illuminating excitation source and imager lens filtration to limit the spectrum recorded only to the lower energy band of visible light.

Wreath – an assortment of flowers, leaves, fruits, twigs, or other materials constructed to resemble a loop. Typically worn on the head in ceremonial events, wreaths have much history and symbolism associated with them. In the Greco-Roman world, wreaths were used as an adornment that could represent a person’s occupation, rank, achievements, and status.

X-radiography – an imaging technique used to reveal the internal structure of an object by using X-rays to record variations in the densities of its constituent materials. X-rays are transmitted, absorbed, or scattered in varying degrees by the materials present; the radiation that passes through the object is then captured on photographic film or a digital receptor placed behind the



subject, thereby creating the radiograph. Dense materials and/or those containing elements of high atomic number, such as metal and lead white paint, strongly absorb X-rays and will appear white or light in tone; less dense materials, such as wood or other organic matter, readily transmit radiation and appear dark in the resulting image.

X-ray diffraction (XRD) – an analytical method used to examine the crystallographic structure, composition, and physical properties of materials, such as mineral pigments.

X-ray fluorescence (XRF) and portable X-ray fluorescence (pXRF) spectroscopy – a technique used for nondestructive elemental analyses of inorganic materials, utilizing a focused beam of X-rays to excite the atoms on the surface of an artwork and measuring the emitted energy. These emissions provide characteristic fingerprints of the elements contained in the sampled area, allowing researchers to formulate hypotheses about the compounds contained therein.

Yellow ochre – a naturally occurring mineral consisting of silica and clay. Its yellow color is attributed to the mineral goethite. Found throughout the world, yellow ochre has many shades and hues. Chemical formula: Iron oxyhydroxide, FeO(OH)