KERMES AND COCHINEAL; WOAD AND INDIGO. REPERCUSSIONS OF THE DISCOVERY OF THE NEW WORLD IN THE WORKSHOPS OF EUROPEAN PAINTERS AND DYERS IN THE MODERN AGE

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ABSTRACT: *Kermes and woad were two of the most important colourings employed in Europe for painting and dyeing in particular from very early times. The discovery in the first half of the twentieth century of traces of kermes in the Couches-du-Rhone cave in the south of Provence (France) dates the knowledge and use of this colouring back to the Neolithic period, coinciding with the start of agriculture, the domestication of animals and the sedentarisation of man. There is similarly no doubt that woad was highly appreciated and widely employed as a colouring and pigment in all ancient Mediterranean cultures and was, indeed, commented upon by various Roman historians such as Vitruvius (1st c. BC), Pliny the Elder (1st c. BC) and Dioscorides (1st c. AD). During the Classical Period and the Middle Ages the use of these dyes was combined with others which provided the same colours in acceptable or even superior qualities, as was the case of the native indigo or the carmine that reached the port of Venice from the East. However, none of these colourings managed to eclipse the importance of kermes and woad in Europe since ancient times. This ongoing presence only became seriously threatened by the entry of cochineal carmine and indigo that started to be imported from the New World in the sixteenth century.*

KEYWORDS: colourings, kermes, woad, cochineal, indigo, Europe, America, Old World, New World, dyers, painters

1. THE PREHISPANIC ANTIQUITY OF COCHINEAL AND INDIGO

The most important dyes in America throughout antiquity were undoubtedly the cochineal carmine (*Dactylopius coccus)* and the three more common varieties of indigo in the continent (*Indigofera suffruticosa Mill; Indigofera mucrolata; Indigofera jamaicensis*),[1] the origin of which in America dates back to the second millennium BC and when indigo was already known on the Pacific seaboard and in the area now corresponding to Yucatan (Anaya, 1992:92). While the cultivation of both of these extended throughout the greater part of Mesoamerica and the Andes, there were particular regions that were more suited for their cultivation. In this regard, Oaxaca, in the high Mixteca, was one of the main producers of carmine in Mesoamerica during prehispanic times (Dahlgren, 1963: 12-13), while Guatemala, Honduras and El Salvador were the largest producers of indigo, though following the conquest in the sixteenth century the Spanish crown showed far more interest in the indigo grown in Yucatan (Ruiz, 1979: 123-130).

The importance of cochineal and indigo in the prehispanic era for dyeing, painting, ceremonial, medicinal and even cosmetic purposes explains why these were so commonly taxed in the regions producing these goods in abundance. This was the case of the Aztec city of Tenochtitlan, which benefited in Postclassical times (950/1050 AD to 16th c.) from the carmine produced in the lands of Oaxaca, and particularly that from the town of Nocheztlan, whose place-name in the Nahuatl language is represented by a cochineal insect set on a nopal cactus. These highly valued products were exchanged on both the short and long distance trade routes that had been established in Mesoamerica and the Andes area since very ancient times and thus, indigo, together with cotton, copal, liquid amber, vanilla, salt, turquoise and cocoa, was one of the goods commonly transported on the Maya trade routes (Cardós, 1975: 252). Pre-Colombian cultures tended to use this colouring mainly for dyeing and painting and it was employed to prepare the Maya blue pigment (Doménech *et al.*, 2007a; Doménech *et al.*, 2007b; Doménech *et al*, 2007c, and Doménech *et al.*, 2006), a usage which extended to various Mesoamerican cultures. Cochineal was, in turn, employed in dyeing, medicine (to lower fever, as a diuretic and as lubricating infusion to aid childbirth) (De la Cruz, 1991:81; Vázquez de Ágredos, 2007:139-140) and as food colouring where the carmine was used to colour tamales (Sahagún, 1995).[2] As a result of all these properties, cochineal and indigo became very important among the prehispanic American civilisations, though only two of these uses really attracted the eye of the Spanish reaching the New World at the end of the fifteenth century (1492), namely, their use for dyeing and painting.

For these two purposes, and particularly for the first one, cochineal and indigo were cultivated, processed and exported in large

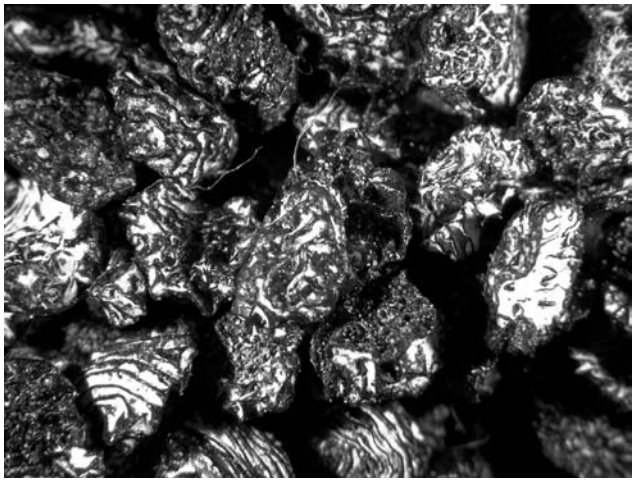

Figura 1. Cochineal carmine (*Dactylopius coccus*)

Figura 2. The plant of indigo (*Indigofera suffruticosa Mill*)

quantities to the Old World. This then led to a considerable increase in the number of plantations and the workforce required for these activities, frequently giving rise to modifications in the techniques and tools traditionally employed by these societies to obtain the colourings from cochineal and indigo in an attempt to increase production to a maximum, particularly with regards to indigo colouring.

1.1 Ancient techniques for extracting colouring from cochineal and its adulteration

The six principal techniques traditionally employed in Mesoamerica for the extraction of the main pigmentation (carminic acid) segregated by the female scale insect *Dactylopius Coccus* were: by asphyxiation in a *temazcal*,[3] steaming in bain-marie, toasting in incense burners, burning in hot water or direct fire, sun-drying and by inhalation of turpentine. As the quality of the cochineal colouring was conditioned by the method employed to kill the female insect, the selection of method proved to be one of the most important decisions in the entire process and in the pre-Colombian era the most favoured methods were that of the *temazcal* and the bain-marie (Sarabia, 1994:102 and 124), as opposed to the practice prevalent in colonial times where it was more common to kill the insects by burning in hot water or fire.[4]

Once the female cochineal had been killed it was common to sun dry the insect, particularly when it had been killed by bain-marie, and then to grind it down to a very fine powder which was frequently sold adulterated with other substances. In this manner, the chroniclers of the Indias reaching the centre of Mexico in the sixteenth century recorded the sale of four different types of cochineal carmine in the traditional markets of the region, these all being named in Nahuatl language in accordance with their origin (wild or cultivated) and purity (adulterated or fine). The names given to the carmine were: *nocheztli* (cultivated carmine), *Xalnicheztli* (wild carmine), *tlacuauctlapalli* (fine carmine) and *tlapalnextli* (adulterated carmine), and where the suffix *nextli* (lye) not only indicated its poor quality, but also revealed some of the alkaline type substances that could have been mixed in with the carmine, such as lime and ashes. The presence of these words in Nahuatl language suggests that the adulteration of carmine and other prehispanic colourings did not begin on the arrival of the Spanish in these lands, as has occasionally been claimed, but that this was a long-standing practice among these American cultures. This is further demonstrated by the fact that bye-laws had already been established in 1550 in the centre of Mexico to control the sale of good quality cochineal in the local markets, though it was not normally exported in this form to the Old World, but rather as a fine and completely dry product which could be distinguished from the others by its floury texture and the white powder coating its surface (Contreras, 1996: 30).[5]

The chroniclers of the day also recorded the dyeing and painting applications of this fine cochineal carmine during the prehispanic era, indicating that: "the purified and prepared carmine is known as *tlacuauctlapalli*, which means fine or hard carmine; and is sold in *tianguis*[6] as cakes which were bought by the *tochómitl (rabbit hair)* dyers and by painters" (Sahagún, 1995). Similarly: "This (cochineal) is found by the Mexicans on certain types of prickly pear cacti called *nopalnocheztli* […] and is used by both painters and dyers alike" (Hernández, 1942).

This double purpose of the cochineal carmine was fully employed in the Old World, while ignoring its other prehispanic uses, namely as a ceremonial and medicinal substance or as a food colorant.

1.2 Ancient and new methods of extracting dye from indigo

Indigo was the third most exported product from the New World to the Old, after cochineal and metal. This meant an enormous increase in the cultivation of this plant since prehispanic times and led to considerable changes in the indigenous system of polycultivation, while at the same time requiring the establishment of new indigo plantations which tended to be located close to markets in the interior and places allowing export, such as those established in the north and west of the Yucatan Peninsula (Pinet, 1996:160).[7] However, this was not the only change seen in the production of indigo since the arrival of the Spanish and where the canoes previously employed in pre-Colombian times for the maceration and oxidation of the plant were replaced by large textile workshops (*obrajes)* in order to produce a greater quantity of the colouring in the same period of time.

The archaeological remains of the seventeenth-century *obraje* de San Andrés in the Zapotitlán Valley (El Salvador) (Gallardo, 1997) reveals the form of these colonial structures and provides an insight into how these were organised to obtain the indigo dye from the leaves of the plant. The leaves containing the main colouring, the *indigotina*, were soaked for twenty-four hours in an alkaline water solution in several of the large vats contained in these workshops. These vats were covered with lids which were opened after this twenty-four hour period to allow the said solution, which on maceration now contained the colouring source of the *indigotina*, to pass onto other interconnected vats. The next stage of the process was performed in these second vats where the solution was stirred for twenty-four hours in order to oxidise the *indigotina* and transform this into *indoxil* which was now deposited at the bottom of the vats in the form of an emulsion or sediment, then prepared into blue cakes ready for export to Europe or sale in the traditional markets of the New World:

> The seller sets out the colours on a large basket and with each type of colour placed in a smaller basket atop of this larger basket. The colours on sale are of all types; dry colours,

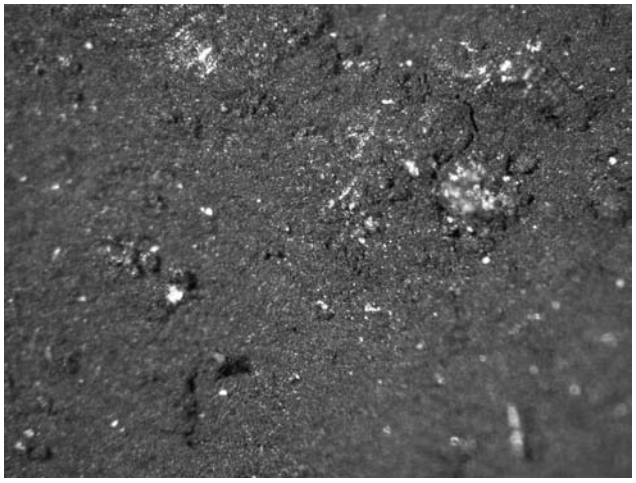

Figura 3. Blue indigo

> ground colours, carmine, light yellow, fuller's earth, wood ash, verdigris, alum and the yellow unguent called axin, *chapopotli*, mixed with this yellow unguent called *tzictli* and red ochre […] they also sell bitumen, which is like pitch, and white incense, and gallnut for dyeing, wild barley, blue cakes,[8] copperas and *margarita*" (Sahagún, 1995: 569)

In earlier prehispanic times the indigo was held in canoes and churned from the outside with instruments that served to stir the solution. However, in the colonial plant processing, the operation was performed by natives who worked from inside the vats moving around inside them to oxidize the *indigotina* and produce the precipitation of the *indoxil*. It is not surprising that this work was only performed by the indigenous population and later by the slaves brought to these lands from Africa via Cuba and Santo Domingo, as the exposure to the alkaline solution holding the colouring source of the *indigotina* could cause serious illness and even death. This explains why this activity was suddenly interrupted by the Spanish monarchy and then rapidly reinstated after calculating the serious financial losses that this would incur. In any case the extraction of indigo, together with other work such as the building of houses or the cultivation of maize fields, was one of the activities by which the indigenous population could pay the taxes imposed by the State and the Church ever since the start of colonisation as a supplement to the obligatory tax (Pinet, 1996: 147). This then irremediably gathered the population around these plantations and the work was carried out in the same way, including stirring the indigo. This process, along with all the other activities involved in the manufacture of the indigo dyestuff, conditioned its end quality which, in general terms, could be divided into three main classes:

> There are three qualities of the dyestuff which go under the names of *Flor*, *Sobresaliente* and *Corte*.[9] *Flor* refers to the indigo with a bright blue colour which when seen against the light appears very slightly iridescent. This dyestuff floats like a cork on water and when rubbed between the fingers, forms a very fine powder which may be blown away by the slightest puff of air. *Sobresaliente* only varies from *Flor* in that it has a more compact mass and subsequently sinks a little in water without completely submerging. Finally, the *Corte* has the darkest colour and is by far harder that the other classes and sinks when placed in water… These qualities are general and they are further sub-grades that are accepted by the trade in this kingdom […] (Moziño, 1797).

Among these other qualities reference should be made to the dyestuff which went under the name of *Flor tizale*, this being the most refined variety among the *Flor* group (Ruiz, 1979: 131), which explains why this was one of the varieties to reach the Old World with a certain degree of regularity.

2. THE ARRIVAL OF AMERICAN COCHINEAL AND INDIGO IN THE NEW WORLD. ECONOMIC REPERCUSSIONS AND POLITICAL-RELIGIOUS SOLUTIONS

2.1 The predecessors of cochineal and indigo in Europe: kermes and woad

The entry of American cochineal and indigo into sixteenth-century Europe did not represent the first European contact with these colourings as both had been known and employed from very early times as indeed mentioned by Vitruvius when speaking about indigo and woad in one of the chapters of his *Ten Books on Architecture*:

> One method of obtaining purple colours consists of dyeing fuller's earth with madder root and violet dye. It is also possible to obtain other colours from flowers […] Due to the scarcity of indigo, some mix Selinonte clay, or annular clay with woad – in Greek *isatin* – to obtain a colour that perfectly replaces indigo (Vitruvius, 2002: 293)

It was sufficient to precipitate a suitable proportion of a certain dye, such as woad (*Isatis Tinctoria*) on an inert substrate of fuller's earth in order to obtain a stable pigment and one suitable for artistic use. The pigment was prepared in this manner by the painters working in several ancient Mediterranean cultures from the earliest times, including the Roman culture to which Vitruvius belonged, and was similarly employed by artists in other ancient Eastern and Western civilizations, including the Maya, where the blues and greens were prepared with indigo which was precipitated in atapulgite clays, as has been confirmed since 1956 (Shepard, 1962: 565-566).

However, over and above the procedure by which lake pigments were manufactured in ancient Mediterranean cultures, there is a reference in the quote from Vitruvius that is crucial to the subject discussed in this article. From his description it may be taken that a variety of indigo grew in Europe from ancient times, but that this only grew in small quantities and hence the reason why painters had to prepare a pigment from woad and fuller's clay with optical and mechanical properties similar to indigo, though of inferior quality. This scarcity of indigo in Europe and the excellent quality of the colouring provided by it explain why so much attention was given to the matter by historians, writers and travellers, ranging from Vitruvius, Pliny the Elder and Dioscorides at the change of the era, on through Marco Polo (12th c.) and the chroniclers of the Americas (16th, 17th and 18th c.), right up to the nineteenth-century chroniclers in their descriptions of the British and French plantations in their respective colonies of India and North Africa. This scarcity also explains why the indigo grown in Europe since ancient times was a highly prized asset and one of restricted use, and that until the arrival of indigo from America in the sixteenth century, woad was the most frequent alternative and one which in the Middle Ages brought great financial benefit to France and Germany, the two main producers of woad on the continent.

With regard to the red colouring employed in Europe for dyeing and painting purposes up until the arrival of cochineal carmine from the New World, this was based on the dye extracted from the female kermes insect (*Coccus Illicis*) which grew in the kermes oaks (*Quercus coccifera*), native to the south of Italy, the south of Greece and some of its islands and in the Holm Oaks (*Quercus ilex*) so abundant in France (Donkin, 1977: 847-880). It appears that it was here that this dye began to be used in prehistory, according to what has been ascertained from the remains found in one of the caves inhabited during Neolithic times in the south of Provence, namely, the Bouches-du-Rhone cave. Its discovery and the astonishment of those coming across these ancient remains were described in the following manner:

> The fact that the use of kermes is older than the first written texts is suggested by an archaeological fragment found in a cave described as Neolithic in Bouches-du-Rhone, Provence, where remains of a toasted barley paste, meat and *K. Vermilis*

Figura 4. The Bloodwood tree or Campeche Wood (*Haematoxylum Campechianum*)

Figura 5. Achiote or West Indian saffron (*Bixa Orellana*)

> have been found, and where the use of which has not been fully explained (Donkin, 1977:859).

This red colouring from the female kermes insect was the carmine traded by the Phoenicians since the second millennium BC on the coasts of Mediterranean and so widely employed throughout Europe from this time on for the dyeing of textiles. However, this was not the only carmine known on the continent up until the arrival of American carmine in the sixteenth century, since from the Late Middle Ages, and more precisely from the start of the fourteenth century: "While Venice imported Eastern kermes, Marseilles exported kermes from the southwest of Europe" (Born, u.d.). Both of these were recommended by many essayists of the Middle Ages to adulterate various colours employed by painters, including the valuable lapis lazuli blue which could solely be imported from the only known deposit in the West, the Badakshan mines in the northeast of Afghanistan (Gettens and Stout, 1942: 165; Dolcini and Zanettin, 1999: 154; Rapp, 2002: 105). Instructions were:

> If, by chance, the lapis lazuli is poor and you have ground from that which does not turn violet, I will show you how to give it a little colour. Take a little cochineal and red sanders;[10] boil them together; but ensure that the red sanders is scratched with glass; and boil everything together with lye and a little alum and rock; when they are boiling and you see that you have a perfect vermilion colour, prior to removing the blue from the bowl (but after drying any lye on the same) add a little of this cochineal and stir everything well with your finger; and leave it for such time without drying by sun, fire or air. When it is completely dry, place it in a bag and let it rest, and it will be perfect and good. Look after it well, as it a virtue to know how to prepare it (Cennini, 1956: 53).

2.2 American cochineal and indigo in Europe. Economic consequences and political and religious consequences.

The cochineal carmine imported from the New World to Europe in the sixteenth century was also mixed with other pigments and colourings in order to brighten its colour. It was also common to adulterate this carmine and native carmine with other red dyes, though on this occasion it was more for economic rather than artistic reasons. One example of this was the rising prices of native kermes experienced in various North European countries in the mid-eighteenth century, which in France reached four and a half Francs a kilo in years of poor harvest and obliged the dyeing houses and painters to prepare the colour "medium scarlet carmine" by mixing carmine with the dye from the madder root (*Rubia Tinctoria)* (Born, u.d.).

In the second half of the sixteenth century, excessively high prices led to a shift from kermes and woad in favour of the cochineal carmine and indigo from America, and the better quality of these latter was still another reason for the eclipsing of their European alternatives. Dyers and painters began to dye their textiles and paint their canvases with the new red and blue colourings from the New World, with enormous economic repercussions for the main producers of woad (Germany and France) and kermes (Italy, Greece and France), who soon began to introduce strict measures with the intervention of the State and the Church through its most feared institution: the Holy Inquisition. In this regard, the Order issued in 1577 in Germany referred to the indigo from the New World as the "colour of the devil", among other names such as "corrosive colour", "rotten colour", "harmful colour" and "painful colour" (Buzo, 1990: 16). When using any of these labels the political and religious authorities of these countries could undoubtedly justify the punishments imposed on dyers and painters who bought colours from America, ranging from the setting of very high fines to penalties demanding the closure of their workshops (*Ibid.)*.

However, these measures were not enough to prevent these two groups from continuing to purchase and employ indigo and cochineal imported from the new territories conquered by the Spanish. This is demonstrated by the chemical results obtained over the last two decades from analysis of the base preparations employed by Italian Mannerists in their paintings where the cochineal carmine cultivated in America since prehispanic times was employed with the clear aim of brightening and strengthening the colour of their works. This was not only the case of the Italian Mannerists, as the same solution has also been detected in several of El Greco's paintings (Anaya, 1992: 91). Perhaps for this reason, that is to say, the continued interest shown by dyers and painters in purchasing these colourings from the New World in spite of the possible consequences, the strict official regulations established in these countries in the mid-sixteenth century banning these products were gradually modified and replaced by more relaxed orders which finally gave rise to the complete acceptance and admittance of these colourings. Thus, as from 1600 the dyers of Cologne could now add a little indigo to their woad in order to obtain a stronger blue, and just ten years later the dyers in Hamburg were authorized to use this dye without the need to mix it with *Isatis Tinctoria* (Buzo. 1990: 16). Almost one century later Jean-Baptiste Colbert, a minister of Louis XV, managed to ensure that French dyers enjoyed a somewhat similar situation, though in this case the indigo dye always had to contain a minimum proportion of woad.

In this way just under a century had to pass before the colourings of the Old and New World were accepted on relatively equal terms in the workshops of European painters and dyers, and particularly in the case of these latter who not only took advantage of the American indigo and cochineal carmine to provide new and brighter hues to their textiles, but who also employed other colourings that began to be im-

ported from the New World from the sixteenth century onwards. This was the case of the dyes extracted from various dye-woods, such as Brazilwood (*Haematoxylum Brasiletto*) and the Bloodwood tree or Campeche Wood (*Haematoxylum Campechianum*), very abundant in the Andes region and in the majority of the regions of ancient Mesoamerica, including the Yucatan Peninsula, from where these were exported to Europe in considerable quantities.

> Among the products that were beginning to be exploited in Yucatan with a view to trade were the precious woods of the tropical jungles such as mahogany, cedar and the dye-woods, particularly blackwood or "palo de tinte" which are found along the coast, particularly in Campeche and which may be shipped to New Spain and Castille […] (Pinet, 1996: 163).

Finally, another of the prehispanic colourings to reach the Old World and be incorporated in the palette of dyes employed to colour textiles was the achiote (*Bixa Orellana*), though by contrast with what was happening with indigo, cochineal and the dye-woods, this was not immediately exported to Europe after the Spanish Conquest but rather some time later in the seventeenth century, and was similarly included among imports from Africa and Asia. Achiote or West Indian saffron, as it was known among those chroniclers encountering this product in the local markets of the New World, was eventually and unsurprisingly included in the list of products sent from America to Europe for dyeing and even painting purposes, as native saffron had similarly been employed for this purpose since very early times and was one of the substances employed in Medieval miniatures to intensify the golden hue of gold leaf (Gonzalez, 1997: 76).

3. CONCLUSION BY WAY OF PROPOSAL

The strict regulation imposed in Europe in the mid-sixteenth century to prevent the purchase and use of indigo and cochineal carmine imported from America in replacement of woad and kermes did not extend to the seventeenth century. Very much to the contrary, from this time on the colouring exported from the New World to the Old were incorporated in the dye houses and painters' workshops together with traditional dyes in order to provide new and innovative hues to their textiles and works, which in all other aspects remained fairly close to traditional methods. Upon legalisation of the purchase and use of these new colourings, these were then sold in the same establishments supplying painters and dyers with other pigments and colourings, such as the madder root. These products were apparently sold in pharmacies, or at least this is revealed by the *taxae* or list of prices that the pharmacies in certain European countries were obliged to publish from the fifteenth century onwards, following the tradition established in Germany by Frederick II in the thirteenth century through the Edict of Salerno (Krekel y Burmester, 2003: 32-36).

With the exception of France and England, the obligation to publish the list of prices established by pharmacists for products sold in their establishments rapidly extended from Germany to other European countries and cities such as Venice, Prague, Stockholm, Copenhagen, St. Petersburg and Spain (*Ibíd.*, 33-34). These *taxae*, which are still pending study, should reveal many of the changes experienced in the sale of certain traditional colourings on the arrival of the colourings imported from the New World from the sixteenth century onwards, and serves as one of the lines of research that has recently been introduced in our project.

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NOTES

[1] Others included the *Indigofera Guatemalensis* (North, Central and South America); *Indigofera Secundiflora* (Guatemala); *Fucsia Parviflora* (Central and South America); *Jacobinia Spicigera* (Central and South America) and *Chiropetalum Lanceolatum* (Ovarlez, 2004: 65-71).

[2] The colouring obtained from the achiote shrub (*Bixa Orellana*) was used for the same purpose.

[3] The *temazcales* were steam baths built and employed by these ancient cultures.

[4] This method did not correspond to that traditionally employed in Europe since ancient times to kill the female kermes insect (*Coccus Illicis)* and which commonly resorted to vinegar baths or exposure to vinegar vapour.

[5] Fine carmine could also be found as powdered carmine, common fine carmine, extra fine carmine and green carmine.

[6] By the term *tianguis* the author is referring to the traditional markets encountered by the Spanish in these regions of central Mexico.

[7] In colonial times these plantations were called *estancias*.

[8] Our underlining.

[9] Our underlining.

[10] Our underlining.

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Versión española

TITULO: ***Kermes y cochinilla, añil e indigo. Repercusiones del descubrimiento del nuevo mundo en los talleres de los pintores y tintoreros europeos en la edad moderna***

RESUMEN: *El kermes y el pastel fueron dos de los colorantes más importantes que se utilizaron en Europa desde tiempos muy antiguos para el teñido y la pintura, en especial para el primero de ellos. El descubrimiento que se hizo en la primera mitad del siglo XX de restos de kermes en la cueva de Bouches-du-Rhone, al sur de la región de la Provenza (Francia), remontan su conocimiento y uso al Neolítico, coincidiendo con el inicio de la agricultura, de la domesticación de animales y de la sedentarización del hombre. Por su parte, no hay duda de que el pastel fue altamente valorado y utilizado como colorante y pigmento en todas las culturas del Mediterráneo antiguo, siendo varios los historiadores romanos que lo describieron en sus obras, entre ellos Vitrubio (s. I a.C), Plinio el Viejo (s. I d.C) y Dioscórides (s. I d.C). Durante la Antigüedad y la Edad Media el uso de estos tintes se combinó con otros que aportaron sus mismos colores en calidades aceptables e incluso superiores, tales como el índigo nativo o la grana que llegaba al puerto de Venecia desde Oriente. Sin embargo, ninguno de estos colorantes consiguieron eclipsar la importancia que desde antiguo tuvieron el kermes y el pastel en Europa, que sólo se vieron realmente amenazados con la entrada de la grana cochinilla y del índigo que en el siglo XVI comenzaron a importarse desde el Nuevo Mundo*

PALABRAS CLAVES: *colorantes, kermes, pastel, grana, índigo, Europa, América, Viejo Mundo, Nuevo Mundo, tintoreros, pintores*