University of Glasgow

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Researching and Identifying Palette of Pigments used in 18th- and 19th-century Indian Botanical Drawings

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Introduction:

Claire Bank's PhD research project explores the important contributions made by late 18th and early 19th century Indian artists to the field of botanical science. The main aim of this placement is to provide Claire with sufficient reference information to address the relationship between drawing on paper and painting techniques and material sources by creating an updated catalogue of historical pigment Raman Peaks and preparing a set of reference pigment lists suitable for 18th/19th C botanical drawings. The results of the placement found that the research and identification of palette pigments used in 18th/19th century Indian botanical drawings was effective in determining the recipes of pigments used by Indian artists of the time and led to a better understanding of the context for painting techniques and materials on paper.

Creating the List:

Previous to pigment selection, I firstly reviewed research on identifying pigment categories used in 18th century botanical drawings, created an initial reference list of 18th century pigment sources based on the Raman spectroscopic data available in the literature, and then filtered out the current list of pigments provided by Dr Garside and Dr Richter. The results of these two screenings were combined and added to the latest research sources to create a new list of pigments suitable for this research, ensuring that the sources used subsequently were fully referenced (fig.1).

Fig.2 pigments collections used for paint trials. ©Mengwei Liu

List 2 18th/19thC pigments used for Indian company drawings

PIGMENT/Laserwavelength	Chemical Formula	Source	Origin	Date	Notes
REDS					
Carmine/cochineal	C22H20O13	Kremer Pigments			
Brazilwood		Kremer Pigments			
Madder lake	C14H8O4, C14H8O5	Pigment reconstructions, Mark Richter			
Caput Mortuum		Enzinger Pigments (M.Richter)			
Vermillion	mercury(II) sulfide, HgS	L Cornelissen & Son			
Cinnabar		M Richter, pigment colle Japan			
Red lead		Enzinger Pigments (M.Richter)			
Haematite	iron(III) oxide chromophore (Fe2O3 + clay + silica)	Kremer Pigments			
Red ochre		Enzinger Pigments (M.Richter)			
Browns					
Brown ochre		Enzinger Pigments (M Richter)			
Burnt umber		Enzinger Pigments (M Richter)			
Raw umber		Enzinger Pigments (M Richter)			
Burnt Siena		Enzinger Pigments (M Richter)			
Raw siena		Enzinger Pigments (M Richter)			
Bistre		Enzinger Pigments (M Richter)			
Kassel earth		Enzinger Pigments (M Richter)			
Black					
Bone black		Kremer Pigments			
Lamp black	carbon, C	Enzinger Pigments (M Richter)			
Vine black		Enzinger Pigments (M Richter)			
Charcoal		Enzinger Pigments (M Richter)			
Blues					
Indigo		L Cornelissen & Son			
Prussian blue	iron(III) hexa-cyanoferrate(II) Fe4[Fe(CN)6]3.14-16H2O	Enzinger Pigments (M Richter)			
Ultramarine (lapislazuli)		Kremer Pigments	Afghanistan		
Smalt	cobalt(II) silicate CoO.nSiO2	Enzinger Pigments (M Richter)			
Blue verditer(Bremer blan)		Kremer Pigments			
Azurite	2CuCO3-Cu(OH)2	Kremer Pigments			
Greens					
Verdigris (basic)		Pigment reconstruction, Mark Richter			The pigment was produced in 1998
Malachite	basic copper(II) carbonate CuCO3.Cu(OH)2	L Cornelissen & Son			
Chrysocolla (Cedar green)		Kremer Pigments			
Sap green		Pigment reconstructions, Mark Richter			
Terre verte/Green earth（Bohemian)	Variations on K[(AlIII,FeIII)(FeII,MgII)],(AlSi3,Si4) O10(OH)2	Enzinger Pigments (M Richter)			
Yellows					
Yellow lake (buckthorn)		Pigment reconstructions, Mark Richter			Paint trial made in 1996
Yellow ochre	Iron(III) oxide hydrate, Fe2O3 H2O + clay + silica	Enzinger Pigments (M.Richter)			
Gamboge	Gambogic acid, C38H44O8	Pigment reconstructions, Mark Richter			
Realgar	arsenic(II) sulfide, As4S4	Kremer Pigments			
Orpiment, King's yellow	Arsenic(III) sulfide, As2S3	Kremer Pigments			
Litharge (massicot lead yellow)	tetragonal lead(II) oxide, PbO	Kremer Pigments			
Turmeric		Pigment reconstructions, Mark Richter			Paint trial made in 1996
Saffron		Pigment reconstructions, Mark Richter			Paint trial made in 1996
Naples yellow	lead(II) antimonate Pb2Sb2O7	Enzinger Pigments (M.Richter)			
Indian yellow	magnesium salt of euxanthic acid MgC19H16O11.5H2O	Pigment collection, Graeme Cannon (2018)			
White					
Calcite	CaCO3	Enzinger Pigments (M.Richter)			
Gypsum	CaSO4-2H2O	Enzinger Pigments (M.Richter)			
Lead white	Basic lead(II) carbonate, 2Pb CO3 Pb(OH)2	Enzinger Pigments (M.Richter)			

Fig.1 18th/19thC Pigments pertaining to Indian Company drawing list. ©Mengwei Liu

Paint Trials:

Paint trials were prepared in the Kelvin Centre using the selected pigments. I conducted paint trials, producing samples of 18th/19th C pigments on paper from a variety of sources in the Kelvin Centre (fig.2). I used whole egg as a binder with pigment to grind and then applied evenly with a brush to the historical paper (fig.3). After a number of attempts, I have found that eggs as binder diluted very effectively the paints which I produced, which is why I only used half a drop. Also, some red and yellow organic lake pigments need to be ground (fig.4), if the pigment is applied to the paper in a lumpy state, it may not have been ground enough and I had to wait for it to dry before applying another layer. In order for the pigment to be better analysed by Raman spectroscopy, it should not be applied too thinly or else the quality of the Raman spectra will be affected due to the interference of the paper. The paint should be thick, but not too thick, as the paint may flake off the paper after drying.

Fig.3 paint trials. ©Mengwei Liu

Results:

During the process of experimentation, it was found that different pigments behaved differently with the egg binder, if other pigments only require half a drop to dilute and apply well, black pigments such as charcoal are difficult to blend with egg and usually require two drops of binder. In addition, the pigment survey also revealed the use of the pigment Indian yellow, a yellow organic pigment produced in India between the 15th and 20th C It consists of magnesium euxanthate, originally made from the urine of cows specialising in eating mango leaves, with the washed powdered material appearing a transparent golden-yellow colour, due to its high price, it was often adulterated with inorganic yellow pigment. As mango leaves are harmful to cattle, the production of Indian Yellow was banned. Indian Yellow pigments available on the market usually contain synthetic coal tar derivatives, and can be distinguished from the genuine Indian Yellow by exposure to long-wave ultraviolet light.

Fig.4 pigment grinding. ©Mengwei Liu

Conclusion:

An in-depth study of the pigment palette used in 18th/19th C Indian botanical drawings through reading literature, creating pigment lists and paint trials has been undertaken, and this work has not only provided a solid foundation of knowledge for Claire Banks, but has also provided a specific and invaluable referential experience for understanding historical pigment recipes used in 18th/19th C drawings on paper.

Bibliography:
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