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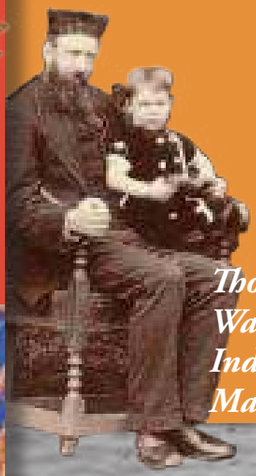
MĀRG

A Magazine of the Arts

Colours of Nature: Dyes from the Indian Subcontinent



Thomas Wardle: Indian Master-dyer

Commercial Revivals in Bangladesh

Painting with Natural Dyes

The Chemistry of Chintz

Shrinalatha Keshab with her woven shibori piece removed from the dye bath and unwrapped. Maiwa workshop, 2011.

MAIWA

With the aim of sharing knowledge of natural dyeing among experienced craftspeople, the Maiwa Foundation, an organization dedicated to the relief of poverty in rural villages by promoting economic self-sufficiency for artisans, organized a masterclass in Bengal at the end of January 2011. For a solid week, 20 artisans from throughout India and invitees from Ethiopia studied specific dye techniques and problems under the leadership of French natural dye chemist and botanist Michel Garcia.

The masterclass included breakout sessions with Catherine Ellis (author of *Woven Shibori*). On hand to facilitate were members of the Maiwa staff and special assistants Jane Stafford and Gale Anderson-Palm. Orchestrating events and overseeing the project was director of the Maiwa Foundation and owner of the Maiwa Company, Charllotte Kwon.

The class faced several real challenges. For example, some of the artisans work with ikat techniques while others work in the traditional ajrakh block-print tradition. But while ikat uses a physical resist and hence can be immersion dyed, block-printing involves premeditated calculations about thickened printed resists and dyes, and immersion mordants, tannins and dyebaths. A solution to a dyeing problem was not really a solution unless it could be incorporated into an artisan's procedure.

The class met these challenges with dedication and, sometimes, a shift in perspective. Shrinath, an ikat artisan, was under pressure from clients to achieve a jet black of the kind that was relatively easy to get with synthetic dyes. Over the course of the week it was a persistent question – how can I get this black? But as the week unfolded and techniques were shown to obtain a variety of blacks – through mordant, tannin, dye and overdye (often finishing with a strong indigo bath) – the artisans all agreed that the character of these blacks was preferable to the rather dead solid black which Shrinath had been trying to get. These shades had depth, they could be pushed in different directions to harmonize with the other colours in a piece, and, most importantly for these artisans, a natural black set their work apart from the more common synthetic dyed works.

The class never let up on the quality of the colours: "It is important that your colours are well executed in a way that makes them last as long as the cloth that they are on." This was the unwavering goal.

One of the greatest challenges of the class was language. The Maiwa organizers are English, Michel Garcia is fluent in French and English, but the attendees spoke Hindi, Bengali, Kutchi, Telugu and Ethiopian Amharic. The dyeing masterclass soon proved to be a linguistic one as well.

The masterworks exhibition at the 2011 Maiwa Textile Symposium.

At the week's conclusion the Maiwa Foundation announced the "Masterworks Challenge". Participants were to use skills, techniques or knowledge gained during the workshop to create a masterwork. A generous fixed price was offered for the completed piece that would also be part of an exhibition. In the summer months cardboard Fedex boxes began to arrive, not worthy of their contents – textiles that these artisans had worked so hard on. The pressure on working artisans to keep their studios producing is very strong. To take the studio out of production for a one-time experiment is a gamble. Maiwa was betting that the exhibition pieces would be the bridge for the artisans to implement new techniques in their own studios. It was a bet that paid handsome returns.

One box in particular caused many gasps when it was opened. It was the package that arrived from Shrinath, the ikat artisan who had asked so many times how to get a good black. The piece did indeed have black, as well as many other shades skilfully deployed on silk. The piece took centre place in the exhibition, not only because it was an exceptional textile but also because it was testament to an artisan overcoming a great hesitation in his work and producing beautiful results.

Hand-based textile techniques often face a slow and inevitable erosion in the face of the massive manufacturing power of the industrialized world. What we value most about natural colour is a quality that reveals the presence of the human hand. What we see is not only a colour, but a mark of character, uniqueness and individuality. When these aspects are coupled with skill, talent and, most importantly for craft, a deep knowledge of technique and method, the results are textiles with the power to inspire and motivate us in the same way as great music, art or writing.

Text and photographs: Tim McLaughlin

The class examines finished dye samples at the Maiwa workshop, 2011.

In keeping with Marg's commitment to supporting the arts, the thematic advertisement portfolio focuses on the initiatives taken by various organizations and individuals working in the field of culture and visual arts, design and urban renewal.

A vat of organic indigo prepared from local fruit and natural indigo.
Maiwa workshop, 2011.

A masterwork of woven shibori in natural indigo, by Bengal weaver Gautam Kumar Basak.
Maiwa workshop, 2011.

A masterwork of double ikat on silk dyed with indigo, cochineal and lac, with gold zari thread, by Shrinath Edem from Andhra Pradesh. Maiwa Textile Symposium, 2011.

Lac dyeing demonstration. Maiwa workshop, 2011.

Sophie Ahmed

Luba Hamied Children's Foundation

Lac-dyed woven shibori. Maiwa workshop, 2011.

A masterwork from the Aranya Natural Dye Unit: a quilt to which each artisan at Aranya contributed a square of cloth.
Maiwa Textile Symposium, 2011.

A masterwork bandhani piece of silk tie-dyed with henna, indigo and madder, by Jabbar Khatri from Kutch.
Maiwa Textile Symposium, 2011.

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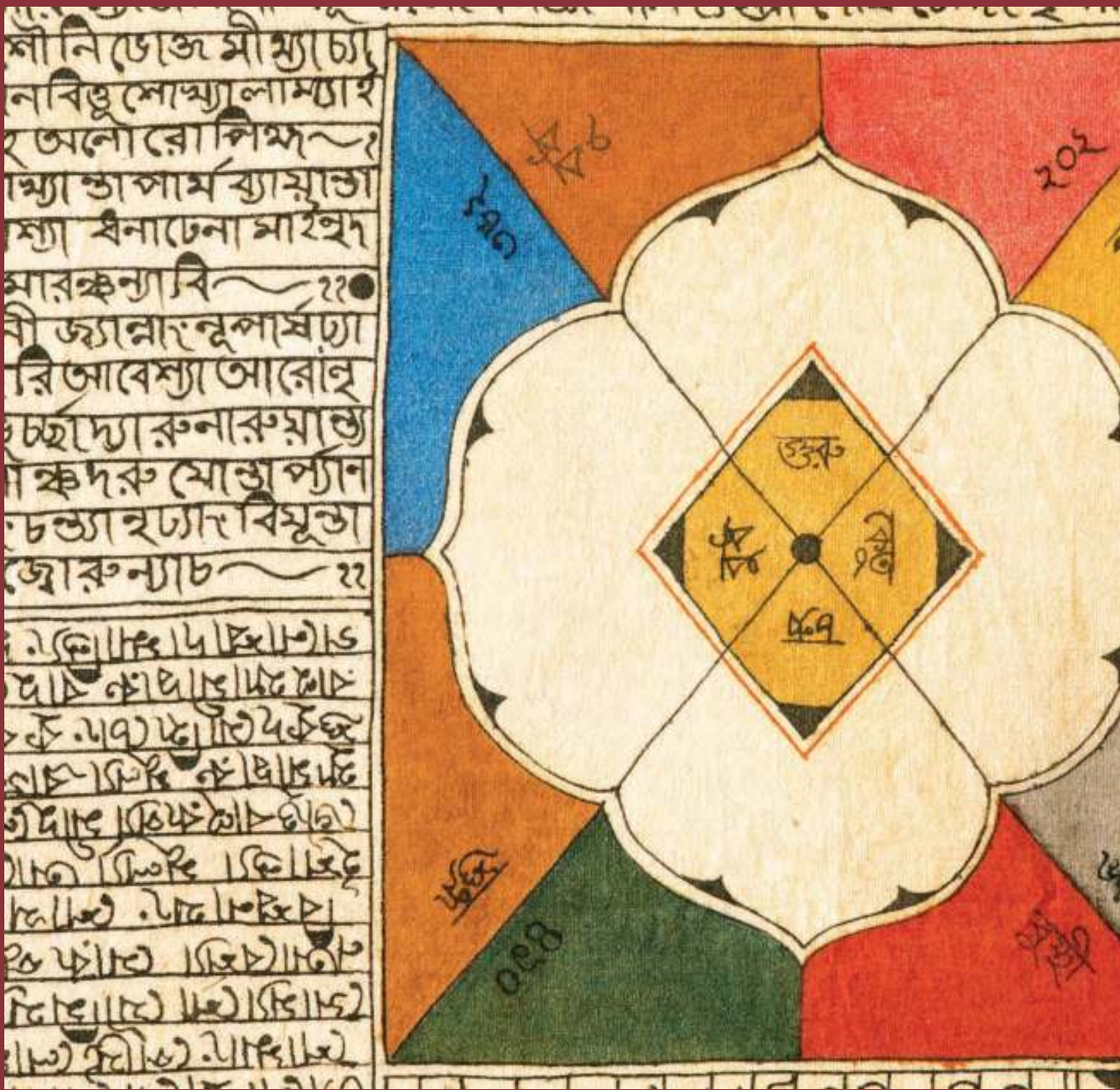
Masterworks of traditional woven woollen shawls in lac and indigo, by Shamji Vishram Vankar, from Bhujodi village, Kutch. Maiwa Textile Symposium, 2011.

A masterwork bandhani piece of silk tie-dyed with henna, indigo and madder, by Jabbar Khatri from Kutch.
Maiwa Textile Symposium, 2011.



From the *Rasi Chakra* (Horoscope) series, by Ajit Kumar Das. See caption on page 88.

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Colours of Nature: Dyes from the Indian Subcontinent

edited by Jenny Balfour-Paul

Editorial Note

Gold seems to be a recent preoccupation for the Archaeological Survey of India. The dome of the ASI protected monument of Bodhgaya, the holiest site for Buddhists, has a new gold veneer. Thanks to the generosity of Thailand's King Bhumibol Atulaya and other Thai donors about 300 kilograms of the metal were shipped in from Thailand under the surveillance of 23 of their commandoes. The gold-plating was carried out by 17 of their experts. While the structure is about 60 metres high, it is only the top 6 metres that have been covered with gold. While the government and the Buddhist community at large are grateful for the gesture, it has also come under criticism as some people feel the huge amount of money could have been put to better use. And that perhaps such opulence goes against the Buddha's principles.

More embarrassing for the Indian government, I would think, is the ASI's pursuit of gold based on a seer's dream. In October this year, a local sadhu proclaimed that he had had a dream of 1,000 tonnes of gold buried under Raja Rao Ram Baksh Singh's fort near the village of Daundiya Kheda, Uttar Pradesh. The raja, who was eventually hung by the British for his role in the 1857 rebellion, had buried it there to prevent them from acquiring it. The ASI swung into action and the digging began on October 18. Till date they have found a few glass bangles, iron nails, fragments of a miniature stone lion, terracotta beads and pottery sherds but no gold. In an age when India is presenting itself as a country moving forward, this action tends to nullify that image. Besides, how does a government agency that is visibly strapped for cash, with over 3,500 monuments and sites to protect and maintain, justify such an expense?

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This issue of *Marg* focuses on natural dyes and is based on a conference held in Kolkata in 2010 under the auspices of the NGO SUTRA. When approached by Marg, Amrita Mukerji, then Vice-President of SUTRA and the driving force behind the conference, agreed to the publication of a selection of the papers presented there with some additions. Guest-edited by Jenny Balfour-Paul, the scholar renowned for her work on indigo, this issue explores the subject of natural dyes in the subcontinent, looking at their sources and legitimacy in today's world.

Of all the natural dyes, indigo is probably the one most popular and widely used for colouring yarn and fabric as well as for painting and is known for its medicinal properties. Some consider it "mysterious" – perhaps because of the manner in which the colour reveals itself as it is exposed to oxygen. In works ranging from thangka painting to kalamkari, painters have played around with indigo's vibrant hues and various shades, as have contemporary artists. The Italian artist Francesco Clemente is known for his series of "Indigo Room" paintings created in Madras in 1983–84.[1]

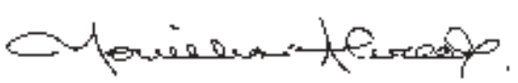
NOTE

1 "The Indigo Room (1983–84)", in Jyotindra Jain et al., *Clemente: Made in India*, Milano and New York: Charta, 2011, pp. 72–79.

On the streets in New York – once a symbol of freedom and youthful rebellion in the USA, today blue jeans are a ubiquitous item in wardrobes around the world. Photograph courtesy Jenny Balfour-Paul.

His large four-part work was executed on handmade Pondicherry paper sheets, joined together by cotton strips and dyed in indigo. At first glance it looks like a space of endless blue, but a closer look reveals an orgiastic panorama of entangled figures of men and women interspersed with figures of horses, deer, rabbits, squirrels, dogs, monkeys and goats. However, probably the most enduring and universal symbol of the use of natural dyes is the indigo-dyed denim used for blue jeans.

In a competitive economy with rising prices it is becoming increasingly hard to publish in the print medium. Marg is able to continue through the generous support of its patrons and well-wishers. In the past, special issues of *Marg* magazine have been supported by companies such as Cipla (*Crossovers: Heritage and Fusion in Goa*, December 2012) and Tata Steel (*Northeast India: The Insiders' Definition*, June 2012). This issue has been made possible through the generosity of many who are involved in the creation and revival of traditional textiles: Goodearth, Kashmir Loom, L'Affaire and SUTRA Textile Studies. As we wish all our readers the best for 2014, we sincerely hope that more supporters will come forward in the coming years.



Foreword

In the first decade of the 21st century, an astonishing discovery was made by Dr H.S. Debnath, Deputy Director of the Botanical Survey of India (BSI) in the Indian Museum, Kolkata. In a forgotten corner of the building he came across a unique 15-volume set of *Specimens of Fabrics Dyed with Indian Dyes* compiled by the famous British Victorian dyer Thomas Wardle and long since believed to be lost. It is the most comprehensive and complete documentation on this subject and was found along with one of the 20 sets compiled by John Forbes Watson in 1866 of *Textile Manufactures and Costumes of the People of India* (and the only one of the seven sets retained in India to have reappeared). Dr Debnath realized the importance of these hitherto neglected works. When news of this find reached Amrita Mukerji (then Vice-President of SUTRA) in 2009, she spread the word and it soon generated immense excitement both in India and abroad. Largely thanks to her enthusiasm, this led a year later to an international seminar in Kolkata, organized by SUTRA.

To those of us in the Crafts Council of India who work with crafts and textiles and attempt to improve the lot of the artisans who nurture traditional skills, access to India's rich textile heritage via these meticulous 19th-century records is like a journey into the past and to certain breathtaking skills the Indian subcontinent seems to have lost forever.

On behalf of the BSI, representatives of the Indian Museum and of SUTRA appealed to the Ministry of Environment and Forests for funds to enable initial conservation and digitization of the precious Wardle volumes and other rare documents. However, although a grant was given by the government for digitizing the works, which took place in 2010, expert conservation of these fragile volumes has yet to be undertaken, even though it is more urgent than ever because additional damage was done during the digitization process, which was not supervised by conservators. If action is not taken, India will lose forever the only extant document that reveals the palette of colours Indian dyers could produce with subtle combinations of dyes and mordants. It is comparable to creating a brilliant digitized image of the Taj Mahal while allowing the actual monument to disintegrate and collapse. In the case of the Wardle samples, preserving the original samples is also essential so that organic chemists can provide the in-depth scientific analysis that unlocks dyers' methods and ingredients used in the past.

The Industrial Section of the BSI, located in a red-brick heritage building next to the Indian Museum, and popular with local visitors, is also unique and worthy of conservation and preservation for its own sake and to attract international following. Among its many treasures are samples and models that demonstrate the astonishing richness of India's textile and dyeing heritage.

Kasturi Gupta Menon
Honorary President, Crafts Council of India

Only Connect

Jenny Balfour-Paul

1

Embroidered muslin "chikan" in a page from one of the John Forbes Watson 1866 sets of *Textile Manufactures and Costumes of the People of India* unearthed by Dr Himadri Debnath at the BSI Industrial Section. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Kolkata.

The desire to colour the textiles we use for our clothing and furnishing goes back millennia, to a time when prehistoric people began applying to the surface of skins or weavings such earth pigments as ochre or terracotta. Imagine the impact when someone discovered how to actually impregnate a fibre or cloth with a permanent colour. Multicoloured textiles are an unquestioned part of modern life, but until the late 19th century all dyestuffs were provided by nature – whether by plants, insects or even shellfish. Historic textiles and innumerable images in art from antiquity onwards show just how beautiful and vibrant are nature's dye colours.

In each of the world's great civilizations people discovered independently how dyes could be made from local natural resources, but it is generally acknowledged that the "home" of dyeing was the Indian subcontinent, where this art was already advanced in the Indus civilization (around 2600 BCE) and from where dyestuffs, dyed textiles and knowledge spread east and west via trade routes.

How fitting, therefore, that it was in India that an extraordinary discovery was made in 2009 that ignited great excitement among all those in the field of natural dyes.

"Only connect," wrote E.M. Forster in *Howards End*. And that's what happened when scholars, dyers, historians, conservators and botanists converged on Kolkata in February 2010, largely thanks to the determination of the remarkable Amrita Mukerji. Herself a passionate believer in connections, in 2002 she formed the not-for-profit organization named SUTRA after a Sanskrit word that literally means "connecting threads". SUTRA arose from Mukerji's desire to raise awareness in India, and particularly in her native Bengal (including the eastern part, now Bangladesh), of the incredible richness of its textile traditions, so beloved by the rest of the world.

The first SUTRA conference, held in Kolkata in 2003 and coordinated by Rosemary Crill of London's Victoria and Albert Museum, focused on the history of India's traded textiles and included an exhibition, loaned from the Tapi Collection, of fabulous textiles from the 13th century onwards, all executed in brilliant natural colours. Out of this event sprang the realization that although the subcontinent is renowned for handcrafted textiles, its textile treasures are in urgent need of preservation. This requires not just awareness but also practical training; so in 2008 SUTRA conceived, with conservators from the V&A, a seminar and workshops on conservation.

However, the planning of this event was hijacked when news reached Mukerji early in 2009 that Dr Himadri Debnath, joint director of the Botanical Survey of India (BSI) in Kolkata, had found in a forgotten corner of the building some unique long-lost 19th-century volumes of natural dye samples, along with a rare set of textile samples compiled by John Forbes Watson.

Mukerji had long been influenced, as had I, by a book, by Mattiebelle Gittinger of the Textile Museum in Washington DC, called *Master Dyers to the World*. It highlights the Indian subcontinent's extraordinary mastery of the skills of dyeing. This book heightened Mukerji's appreciation of natural dyes and realization that collective knowledge, handed down the centuries from generation to generation, was seldom recorded and much of it lost when the 20th century embraced synthetic dyes. However, it was known that

2

Signboard of the BSI at its Industrial Section, Kolkata. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Kolkata.

3

Displays at the Botanical Survey of India Industrial Section in Kolkata showing products derived from lac insects: dye, lacquerwork, shellac and the first gramophone records. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Kolkata.

Thomas Wardle, master-dyer for the great British textile craftsman and artist William Morris, had conducted assiduous research into India's raw textile materials which had resulted, incredibly, in the production of several sets of 15 volumes each, each set containing over 4,000 samples of dyed cloth as well as threads of different natural fibres. At least one set was known to have been sent to India while others remained in Britain, but none had reappeared until the BSI discovery, by coincidence in the year when scholar Brenda King had already created exhibitions in UK to mark the centenary of Wardle's death.

Excitement about these volumes led the organizers of SUTRA 2010 to divide the event already named "Raksha" – which means protection – into two parts: textile conservation now came under the banner Vastra (meaning garments), while Vriksha (meaning plants, trees and shrubs) aimed to promote awareness of natural dyes by paying particular homage to Wardle's records but also covering many other aspects of the subject. A beautiful exhibition, curated by Pramod Kumar, displayed the newly discovered BSI historic volumes and contemporary watercolour illustrations from the Roxburgh collection in the herbarium of Kolkata's Botanic Gardens, along with gorgeous textiles from old Bengal loaned from private collections. The Raksha event was opened by noted filmmaker Sandip Ray.

In recognition of the urgent need to share and disseminate knowledge of natural dyeing held by the last practitioners of the Indian subcontinent and also by researchers from other countries, as well as to encourage others to take up the cudgel and spread awareness, SUTRA will follow the success of Raksha 2010 with practical workshops on natural dyes, along the lines of those organized by Charllotte Kwon and her team at Maiwa. These will target diverse groups, including artists who might be inspired by the paintings of Ajit Das, and teachers.

Natural dyes provide an ideal model for interdisciplinary education because they span the arts and sciences and provide hands-on experiences today's children often lack. Working with natural dyes opens the eyes to the bounty and fragility of nature's colours and teaches the value of diverse histories and cultures in a homogenized world while at the same time underlining global links. The success of such teaching has been proven by the "Silk Road Connect" programme conceived at Harvard by cellist Yo Yo Ma and his Silk Road Project team (with outside partners such as myself) in 2009 and piloted, using indigo as the model, in selected schools in New York City. In the words of Ma: "Indigo presents endless possibilities for learning across various disciplines…its incredible story is a gateway to connect the personal experiences of our everyday lives (for example our own ubiquitous blue jeans) with the history, geography and culture of the whole planet." Experience and resources developed for this project could be adapted for any other natural dye and also for fibres and textiles.

Throughout the world there are encouraging commercial revivals of the ancient but still viable and sustainable art of producing dyes from nature, such as the fair-trade organization Aranya in Bangladesh, founded by the indefatigable Ruby Ghuznavi. The Indian subcontinent has a headstart, with such a richness of dyes and fibres on its doorstep and so many places to visit and collections to appreciate. Kolkata's fabulous BSI Industrial Section is one gem, with its instructive and entertaining exhibits of a kind largely lost from comparable museums such as that at Kew Gardens in London;

the Kolkata exhibits include fascinating models that illustrate fibre and dye production from start to finish – for example how a famous crimson dye and its by-product shellac, the world's first plastic, are derived from colonies of lac insects. The BSI is fortunate in having its collections championed by Kasturi Gupta Menon who works so tirelessly for the revival and preservation of handloom textiles.

This issue of *Marg* is devoted to these renowned glories of the Indian subcontinent, including intriguing stories, recounted by Bessie Cecil and Rex Cowan respectively, of chay-root dye and dyestuffs recovered from shipwrecks. However, one issue, based around papers presented at Raksha and focusing on the Indian subcontinent, can only touch on such a rich subject of significance to the whole world. More work needs to be done elsewhere in the subcontinent and in the world, studying and documenting the various traditions of dyeing with natural colours, before they are lost forever.

Just as many synthetic foodstuffs are poisoning our bodies, so the production of synthetic dyes is often toxic to the environment, whereas most natural dyes do not pollute land or water. For this reason the revival of interest in natural dyes – and not just for textiles but also for cosmetics, hair dyes, food colouring, medicines and paint – since I began my own research in the early 1980s, has been significant.

Enthusiasm for international natural dye symposia is heartening: 700 participants attended the first ISEND symposium, held in Hyderabad in 2006, organized by UNESCO and the Crafts Council of India, in cooperation with Dastkar Andhra, and coordinated by world renowned natural dye expert Dominique Cardon. More scientific and technological research is still required in order to scale up to industrial levels the sources and uses of sustainable dyes and pigments that do not damage the environment or indigenous populations.

Meanwhile, we can all do our part by taking greater consideration of nature in our choice of clothing and textiles. When it comes to the dyes that colour them it is not just a case of "Buyer Beware", but also "Buyer Be Aware". The potential is there – let us hope that producers, advertisers and consumers will in future celebrate and champion those colours derived from the natural world as if by magic.

4

Dr Himadri Debnath at the BSI Industrial Section with a rediscovered volume from Thomas Wardle's 1880s *Specimens of Fabrics Dyed with Indian Dyes*. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Kolkata.

For more than 120 years an amazing archive of over 3,500 samples of India's dyestuffs remained undiscovered in the Indian Museum, Kolkata. Over the decades the samples had been moved to various sites around the museum but were virtually unrecognized for what they were. That is until Dr H.S. Debnath of the Botanical Survey of India took the trouble to examine them in detail in 2008.

I have spent over 15 years researching the life and work of Sir Thomas Wardle of Leek, Staffordshire, England. He had thoroughly researched India's dyestuffs and silks in the 19th century, and thousands of cloth and yarn samples had been produced by him as a result. Through my years of doctoral and post-doctoral research I had searched for, but never found them. All lines of inquiry in England had turned up nothing, and I never thought they would have endured the extremes of India's climate. It was, therefore, all the more thrilling when I heard that the samples had been discovered. I received the information early in 2009, the centenary year of Thomas Wardle's death, just at a time when I was organizing a number of exhibitions to celebrate his remarkable achievements. Jenny Balfour-Paul, the internationally renowned expert on indigo, tracked me down, although we had never then met, to pass on the astonishing news that thousands of dye samples had come to light in Kolkata, as she thought I might be interested. How right she was. After many emails were sent flying across the globe about this extraordinary discovery, I was invited to take part in an exciting symposium in Kolkata in February 2010, arranged by the organization SUTRA to celebrate the find. On my first day in Kolkata I went to view the long-lost volumes of samples and met Dr Debnath to give what information I could to the Indian Museum authorities. Later I presented a paper on Thomas Wardle, the man responsible for the encyclopaedic work of producing samples of India's dyes.

Brenda King

Recalculating Colour: Thomas Wardle's Remarkable Dye Experiments

1
Thomas Wardle with ten of his children, Leek, 1878. Photograph courtesy of Staffordshire Moorlands Library and Archive Service.

Thomas Wardle (1831–1909) was born in Macclesfield, Cheshire, a noted silk town in England. His father was a master-dyer and so from birth his life was drenched with colour. His quest for the perfection of colour became a lifelong passion and linked him to eminent people such as the great English textile designer William Morris. Towards the end of the 19th century Wardle, who owned a silk dyeing and printing company, became internationally acclaimed as an expert on India's wild silks and dyestuffs. He was also a Fellow of the Royal Society of Chemists, and a geologist, musician, composer, educator and sportsman (figure 1).

Wardle was from a generation of dyers who experienced rapid and profound changes in their practice. Throughout the 19th century the English textile industry was transformed by a huge influx of mechanical printing and the use of aniline dyes. Wardle, among others, disliked the new man-made colours. They were gaudily bright with a brash, metallic sheen; moreover they were fugitive when exposed to light and not fast to washing. Seeking better results, Wardle reverted to traditional dye recipes, which had almost disappeared. Dyeing was then something of a "mystery", very little technical knowledge being recorded about traditional dye works as it was generally passed down through the generations of workers by word of mouth. Wardle, therefore, needed to consult ancient dye manuals for information. Importantly, however, he wanted to go beyond simply imitating traditional methods; he was seeking a clearer understanding of the properties of each individual dyestuff.[1] In order to do this he set up a remarkable research project at his Hencroft Works in Leek to test all the known dyes then in use in the Indian subcontinent. One important aim of this project was to give natural colours another lifespan by spreading new knowledge of these dyestuffs to extend their use in India and Europe. To develop a greater understanding of the raw materials and devise new ways of working with dyes he set out to reform the craft through science. Thanks to his skills as a dyer and ability to analyse the materials he was able to make the transition. Since traditional methods of dyeing were disappearing he had nothing to lose. He tested each dye's reaction with specific mordants and then tried out each dye recipe on different fibres using a systematic, scientific approach that had never previously been attempted. As a dye chemist his research was logical and analytical and his findings categorized. He came to new conclusions which were to have a remarkable impact on India's and England's centuries-old dyeing traditions. The results are fascinating and many of the thousands of shades he achieved still seem fresh today.

Wardle combined his dye experiments with a long-standing interest in India's tussur silk (variously spelt tassar, tussar, tussore or tassah). Even though India's dyers were highly skilled, they had never dyed tussur silk successfully. From the early 1860s Wardle experimented tirelessly in order to understand tussur's properties and challenges. Eventually he overcame a number of persistent technical problems and ultimately became an expert on India's wide range of wild silks. He then worked energetically to recommend them, publishing important technical papers which highlighted their many positive properties to an international readership. He actively encouraged French silk manufacturers to import the raw materials directly from India's silk producers. The demand for India's wild silks grew so rapidly in France that it became difficult for Indian suppliers to meet the need.

Both strands of Wardle's research intertwined when he applied the outcomes of his dye research to his new knowledge of tussur and began to dye the wild silk in permanent colours. To begin with he only achieved pale shades but with great confidence he exhibited the initial results in London in 1870. An additional London display in 1874 caught the attention of the Marquis of Salisbury, Secretary of State for India. He suggested that India's dyers would benefit from this combined knowledge. He suggested to Wardle that if they "…could be taught how to dye their tussur silk, a valuable industry would probably be created for their benefit".[2]

Wardle supported the idea but maintained he would test Indian silk only with India's indigenous dyestuffs. He refused to test tussur with the aniline dyes that were then taking increasing hold on the subcontinent. This was not simply an aesthetically motivated judgement; it simply made better economic sense if India's wild silks could be dyed with the country's numerous dyes than it would to import European dyes of either natural or artificial origin. The India Office then arranged for samples of all India's known dyestuffs and mordants to be despatched to Wardle's dye works; copious amounts arrived and storage was difficult on the small site.

The first phase of the project commenced in 1878. Throughout each hectic working day Thomas Wardle, with only one assistant, systematically tested each dye on different textile and yarn samples. As Wardle stated: "The examination necessarily occupied much time, both from the great number of the dyes collected and from experimental effort in applying them successfully to the various fibres and fabrics of wool, cotton, silk, and tussur silk."[3]

He maintained his sense of purpose over more than eight years, as almost 200 dyestuffs from India were meticulously evaluated and the findings recorded in detail. The subsequent 82-page *Report on the Dyes and Tans of India* clearly stated Wardle's aim: "…to ascertain the tinctorial powers and properties of the many and varied dyes of India".[4] As he was sent only a few specimens of tanning substances to examine, he recommended that this component of the research should continue in India to make it as comprehensive a study as possible. He was convinced that there was increased likelihood that India's tans could replace many of those then in use in Europe.

Wardle critically examined the three mordants then in regular use in India. They were sagimatti or sajimatti (also known as fuller's earth), alum and proto-sulphate of iron. He made the crucial discovery that the mordants were not as uncontaminated or as plentiful as the broader variety of metallic salts then employed in Europe, which offered more predictable results. He recognized this as the main factor which caused the widespread problems of fading experienced by European importers of India's dyed silks. His subsequent recommendations extended the choice and use of mordants in the Indian subcontinent. Although it was a significant investment of Wardle's time and expertise he considered the results were meaningful and therefore worthwhile; as predicted they extended the commercial potential of India's wild silks and dyestuffs.

Although India's rich resource of dyestuffs was well known, the precise properties of the dyes were little understood. Wardle's research project was most likely the first to subject India's dyes and wild silks to such a sustained, methodical analysis with workable results. He tested all recognized methods of dyeing to achieve the finest nuances of colour and tone. Not only were all the most common mordants and methods applied, but Wardle included successful practices known only to him and his employees. From 1878 Wardle's many public lectures and publications constantly reinforced the positive properties of India's raw materials. As he stated in his report: "I have no hesitation in affirming that these Indian dyes are well worth the attention of European dyers and printers as possessing properties distinct from, and in many cases superior to, the dyes obtained from artificial sources."[5] As a result, in 1897 *The Artist* described Thomas Wardle as the greatest living authority on the subject of textile dyeing and printing.

2

The volumes of Thomas Wardle's 1880s *Specimens of Fabric Dyed with Indian Dyes* in the Indian Museum, Kolkata. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Kolkata.

The outcomes of Wardle's research into India's raw materials produced a total of 4,100 dyed cloth and thread samples of cotton, wool, silk, eria silk and tussur silk. The samples were compiled into 15 hardbound volumes. More than one set of the volumes was produced and at least one of these was sent to India (figure 2).

It was only when I was able to view the volumes in Kolkata in 2010 that I fully comprehended the incredible task Thomas Wardle had accomplished (figure 3). This became immediately obvious when I saw the dimensions of the volumes and the ingenious presentation of the samples. Both were astonishing.

Each of the dyed cloth samples was separately mounted in a page made of two pieces of card that measured 45 x 70 centimetres, with ten samples to a page. Each page was devoted to a particular dyestuff, the name of which was handwritten across the top alongside its place of origin. The samples of cloth or yarn were clearly labelled and numbered. For example, on page 1 we can see that cochineal was tested on ten different cloth samples; there are a number of pages devoted to this dye. Totally there are 354 pages of ten samples each.

The preparation of the cloth samples alone was an ingenious, and no doubt laborious, solution and was not a method I was familiar with. Each textile sample was wrapped around a card mount, the size of a large postcard, and held in place

3

Brenda King and Dr Debnath with a Wardle volume. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Kolkata.

4

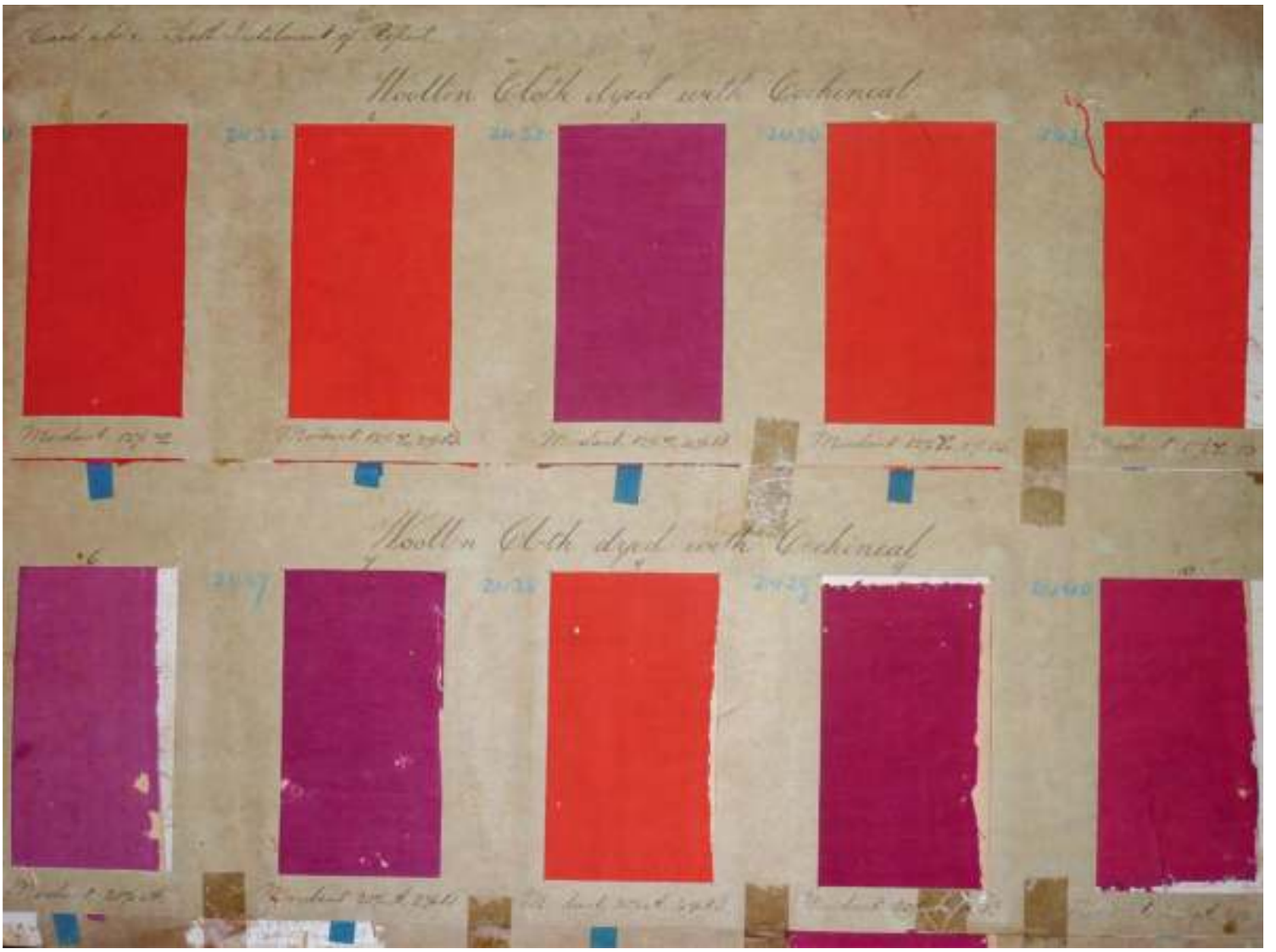
A cloth sample dyed with a mixture of turmeric and indigo. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Kolkata.

with a web of stitching on the reverse. A small tab of blue tape was stitched to the bottom of each sample to enable its easy removal from the card "sandwich" in which it was inserted (figures 4 and 5). The "sandwich" was two sheets of card with windows cut in the top layer to allow inspection of the samples. Dyed yarn samples were also mounted between similar card layers; in this case the top layer was stitched into place around the outer edges to hold the skeins in position. In one page labelled "*Ventilago maderaspatana* root bark Madras", the dyed threads are divided into two rows of skeins and grouped under four headings "Unbleached Tussur", "Bleached Tussur", "Mulberry Silk" and "Wool" (figure 6). The colours obtained from this root bark range from the palest pink through to a deep rich crimson.

Each page had a system of numbers relating to some extent to lists in Wardle's *Report on the Dyes and Tans of India*; it was clear that they were designed to be viewed together if possible. Although Wardle expressed his disappointment with the standard of this publication, because the Government of India would not fund colour images, its details are absorbing. Obviously it emphasized the unquestionable potential of India's dyestuffs, recording as it did individual raw materials and their place of origin. The botanical nomenclature was supplied to the author by the people who collected the samples from the subcontinent.[6] Charts of specific dyes were numbered to link to the pages or "cards" containing the samples. Wardle used an advanced scientific classification system. There was a great deal of cross-referencing and comment, some of which revealed a dye's aesthetic qualities. Personal descriptions scattered throughout reveal the aesthetics balancing out the scientific and unveil Wardle's ongoing passion for his craft as he gained a more profound understanding of the materials. Throughout, he describes the attractiveness of the shades achieved. For example he discusses the results he obtained when dyeing tussur silk: "They are of very great interest and beauty, and will serve to show how inexhaustible is the satisfactory range of colours that may be obtained when all the best dyestuffs of India are on the market."[7] He also states: "I have been much gratified to find how well Eria silk has behaved under the various processes with the Indian dyestuffs, many of the shades being very charming."[8]

Thomas Wardle visited India for the first time in December 1885, meeting dyers in their villages and discussing the many aspects of dyeing they had in common. He was delighted to pass on his new knowledge to the dyers he met. He also attended a conference in Calcutta (Kolkata) to speak about his research. At the end of the Introduction to his report he was able to declare: "Whilst in Calcutta my manuscript of this examination of the dyes of India, with the large series of dyed examples of silk, tussur silk, eria silk, cotton and wool, arrived, having been sent by the India Office from London, and was ordered to be printed."[9]

Wardle concluded his comprehensive report with a tribute to India's dyes: "It is unhappily but too little known in commerce how comprehensive and beautiful a range of natural dyestuffs India possesses – colours of every hue and tone and amply sufficient for all artistic and commercial requirements. …and their numbers can, by the dyer's taste and skill, be infinitely increased."



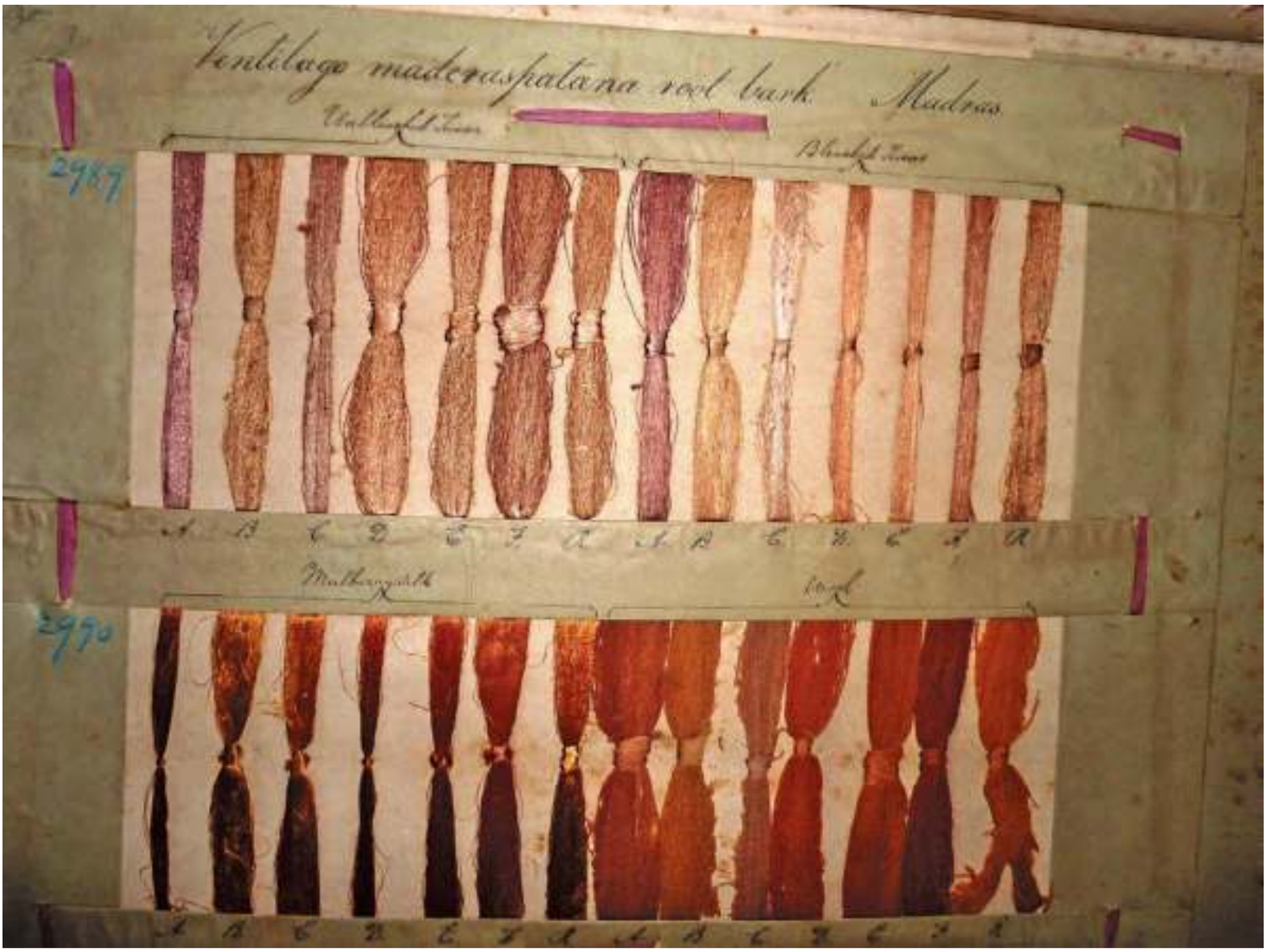
5

Woollen cloth samples dyed with cochineal. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Kolkata.

Postscript

In 2012 I travelled to India again. This time I was in Gujarat where I visited many textile practitioners. One day I arrived unannounced at the renowned workshops of the Khatris, a family that has now produced ten generations of exceptional dyers. To my amazement I was recognized and given a warm welcome by Sufiyan Ismail Khatri, a son of Dr Ismail Mohamed Khatri, who had received an honorary doctorate in 2003 from De Montfort University, Leicester, England. Sufiyan Ismail Khatri had attended the 2010 conference in Kolkata, where he had viewed the newly discovered dye samples prepared by Thomas Wardle so many decades before. He had been so inspired by the range of colours produced by Wardle that on his return to his Gujarat workshop he had tried out some new dye recipes. It is a wonderful tribute to Sir Thomas Wardle that his dye samples are now able to enthuse a new generation of dyers in India. This was just the sort of outcome he had hoped for.

NB: The search for the volumes of dye samples that were kept in Britain still continues.



6

Samples of dyed thread. Photograph: Brenda King, courtesy Botanical Survey of India, Kolkata.

NOTES

1 See Brenda King, *Dye, Print, Stitch: Textiles by Thomas and Elizabeth Wardle*, UK: Macclesfield Museum Trust, 2009, pp. 19–23.

2 Thomas Wardle (August 31, 1866), *Report on The Dyes and Tans of India,* Calcutta: Superintendent of Government Printing, India, UK: Macclesfield Museum Trust, 1887, Introduction.

3 Ibid.

4 Ibid.

5 Ibid.

6 The botanical nomenclature was examined by Surgeon-Major G. King, M.B., Superintendent at the Royal Botanical Gardens, Howrah, c. 1886–88.

7 Wardle, 1887, p. 10.

8 Ibid., p. 82.

9 Ibid., Introduction.

1

"Birth of Ganga", page from the Balakanda section of the Mysore Ramayana, 1825–30. Painted in natural colours. Photograph courtesy Ruby Ghuznavi.

Through the ages, humanity's aesthetic preferences have found expression through the creative impulses of individuals. These were not necessarily prompted by any conscious intention or external consideration, but resulted from a desire for fulfilment that went far beyond basic needs.

The human response to form, texture and colour has evolved over centuries to manifest itself with equal facility in the simple clay home of the artisan or in the architectural splendour created as homage to the Creator. The fusion of decorative arts with religious beliefs enriched the world with some of the finest arts, architecture and textiles. These have lost none of their beauty and lustre in spite of centuries of exposure to changing temperatures, dust and moisture (figure 1).

Human beings have sourced raw materials from nature for their various needs – mortar and stone for houses and monuments, fibres for clothing, clay and reed for homes and utility articles. A splendid array of colours has also been developed from plants, minerals and insects to add a magical quality to the beauty of decorative arts. Skill, natural resources and generations of artistic creativity have endowed the artisans of South Asia with a distinctive style which is highlighted in the translucent colours of manuscripts, monuments and textiles (figure 2). It is most highly developed in the magnificent range of fabrics – where a superb variety of weaves is complemented by a wide selection of dyes and prints unmatched in the history of textiles elsewhere. Today the region is seeing a revival in the use of organic dyestuffs, as evident from the survey of the scene with reference to Bangladesh.

Ruby Ghuznavi

Rangeen: Colours of Life

The madder-dyed cotton excavated at Mohenjodaro of the 3rd millennium BCE is indicative of the early history of cotton cultivation and colouring in the Indian subcontinent. In addition to exceptional proficiency in weaving, the finest skill of the Indian craftsman was dyeing and patterning fabric in brilliant fast colours. Techniques ranged from simple dyeing to the skilful manipulation of a complex range of processes – from resist- and block-printing to precise control of mordant-patterning with different combinations of dyes. Metallic salts were used as perfect binding agents in the pattern-dyeing of silk and cotton fabrics.

Indian textiles excelled in showcasing red and black – two elusive colours, made from madder and iron filings respectively. In association with other substances, these provided the base for pinks, violets and maroons. The technique for creating brilliant and lasting reds was perfected in India, and is thought to have been carried on to East Asia by Muslim traders at a later period. Mordant techniques were known in India by the 2nd millennium BCE. The pure, flawless colours used in patterning yarn-dyed and -printed cotton in India had a quality of fastness unknown in other parts of the world. Some of the earliest examples of Indian patterned textiles were excavated in Fostat in Egypt, the capital established by the Arabs after their conquests in the 7th century CE.

Indian textiles for the courts found their richest expression under the Sultanates and the Mughals. An extraordinary fineness of texture, design and colour developed within the great craft schools around the Mughal courts of Delhi and Agra and the imperial courts of Golconda. More than 300 tints were in constant use during the Mughal period, with sources as varied as madder (*Rubia tinctorum*), sappan (*Caesalpinia sappan*), lodh (*Symplocos racemosa*) and lac, saffron and pistachio, cochineal and fungus of mulberry. Indigo was much prized for the blues and greens favoured by the Muslim rulers. Royal patronage stimulated experimentation which enabled the craftsman to establish multiple substitutes for each of the primary colours – red, yellow, blue and black. They developed different shades of pink, purple and other tints, using varying combinations of dye ingredients. Names like Fakhtai, Sandali, Kafuri, Jilani, Dilbahar and Aquilquami evoke Persian and Arabian influences on the emergence of this new collection of dyes.

2

Kashmir shawl, c. 1840–60. Pashmina, or possibly a mixture of pashmina and local goat hair; warp 324.5 cm, weft 136 cm. Photograph courtesy Tapi Collection. 97.1419.

3

Cotton scarves dyed in madder, myrobalan, cutch, indigo green, raintree and indigo blue, using different mordants (except for the indigo which requires no mordant). Photograph: Ismini Samanidou.

Various products like jainamaz (prayer mats), palangposh (bedcovers), parde (drapery) and the magnificent tents reflected the roghan (red dye made from wild safflower seed oil) process of the Mughals. Kalamkaris (hand-printed or painted textiles) – especially the exquisite temple hangings – belonged to a similar genre of fine workmanship and mastery of dye colours.

Many of these fabrics swept the world markets; the most highly prized merchandise of important trade routes were the woven and printed textiles of India. The Indian craftsman's ability to respond to the tastes of a specific market enabled him to capture a large proportion of the export trade. Europe, Persia and West Asia, Armenia, Japan, Indonesia and a number of countries along the trade routes of the Arabs vied with each other for these textiles. European trade further stimulated an interest in natural dyes, so that along with textiles there was active competition for these, particularly for indigo.

What remains of interest is how the use of natural dyes was developed across continents and oceans, in societies as diverse as the Mayan Indians, the nomadic Yoruks of Turkey, the ikat weavers of Central Asia, the carpet-weavers of Persia and the traditional dyeing communities of southern India and the Gangetic delta. In the

4

Natural-dyed yarn, block-printed scarves and dyestuffs. Photograph: Ruby Ghuznavi.

flat weaves of the Turkish kilims, the aftangs or seven-colour silk ikats dyed in the abrbandi (an Uzbek term for ikat that literally means "to tie a cloud") workshops of Bokhara, and the woven and printed textiles of India, the effectiveness of the designs was reinforced by the resplendent colours of organic dyes.

Centuries of knowledge and skill were lost in less than a hundred years with the discovery of aniline dyes in 1856. Their subsequent introduction into the captive colonial markets of British India led to a rapid decline in the commercial production and use of natural dyes (figure 5). It was only a matter of time before natural dyes – especially indigo, exploited for decades by the British – were replaced by these chemical alternatives. By the time India gained Independence in 1947, the use of natural dyes had been all but eliminated there, surviving only amongst some isolated rural communities. Since then, much progress has been made in India to re-establish their use, though sadly many dyers use chemical alizarin and indigo instead of madder and natural indigo.

Historically, Bengal (today's West Bengal and Bangladesh) was famed for its woven textiles rather than for printed fabrics. In the early 19th century, Buchanan Hamilton found dyeing of yarn, rather than printing of cloth, to be the major process for the production of turbans, sashes and woven cloth. He noted turmeric, safflower, the kusum flower, polas (*frondosa* mushroom) and lobbongo (clove) among the local dye plants. In his report of the late 19th century, Dr N.N. Banerjee refers to the dyeing and weaving centres of Dacca (Dhaka), Rajshahi and Bogra. He makes special reference to the colourful fabrics of the tribal communities. Indeed, before natural dyes were reintroduced in the 1980s, the only people who used them in Bangladesh were indigenous tribes.

The movement for the revival and promotion of natural dyes in India was initiated by Kamaladevi Chattopadhyay (1903–88) in the 1970s; she was also instrumental in inspiring their revival in Bangladesh. Here the programme was initiated as a Research and Development Project of the Ministry of Industries in 1982. It had four main objectives, keeping in mind the environmental, social and economic potential of organic dyes:

– to revive plant dyes which are eco-friendly and non-pollutant,

– to re-establish a traditional craft using indigenous materials,

– to generate increased employment opportunities to maximize use of human resources,

– to carry out research and develop techniques to make natural dyes more cost-effective and commercially viable.

The initial survey showed that Bangladesh has a rich repository of dye-producing plants; however, the technical skills regarding colour extraction, fastness and range had been lost over time. During the first phase of the project well-known Indian experts K.V. Chandramouli, Toofan Rafai and Mohammad Jamil provided training in six basic shades of dyeing and block-printing. Extensive research and experimentation over the next two years with innumerable plants – flowers, fruits, leaves, seeds, sawdust and extracts – led to the successful standardization of 15 colour-fast dyes (figures 3 and 4).

In the second phase, funded by the Food and Agriculture Organization (FAO),

5

"Indigo Cultivation in Tirhoot, Bengal". A print from *The Graphic*, February 12, 1881.

6

Drying indigo extract – Nilkomol, MCC. Photograph courtesy Mennonite Central Committee, Dhaka.

the emphasis was as much on extending the colour palette and training as on undertaking measures to ensure the future availability of dyestuffs. The colour range was expanded to 30 stable dyes that, singly or as compound colours, provided almost limitless options for dyeing and block-printing. This was also the period during which extensive training workshops were conducted for dyers, weavers and craft organizations across the country. Most importantly, a collaborative project with the Ministry of Forestry ensured the inclusion of dye-producing plants in their annual afforestation programme, securing the future supply of dye sources in Bangladesh.

The most exciting event in recent years has been the successful revival of the famous Bengal indigo, after a gap of more than a hundred years. The negative history of indigo in this area thwarted all efforts to revive indigo in the 1980s. However in the '90s, the Mennonite Central Committee (MCC), an international NGO, started the cultivation and production of indigo as a pilot project with the Garos, a tribe of India's Meghalaya state and neighbouring areas of Bangladesh who did not share the same history as Bengali farmers (figure 6).

MCC received technical support for their project from India, making it a commercial success in a fairly short time. So much so that within a decade farmers in north Bangladesh, who had been cultivating indigo plants as fertilizer for years, now wanted to revert to it as a cash crop for dyes (figure 7). MCC shifted its project to the north and was followed by CARE Bangladesh's Living Blue, a community development project. Presently Bangladesh not only produces enough indigo for its domestic requirements, but also for a growing export market. Today both organizations are using local *Indigofera tinctoria*, indicating that indigo had never been lost in Bangladesh, its use only having shifted from dye to fertilizer.

Although there has seldom been any difference of opinion about the beauty and intrinsic value of natural dyes, persistent questions have been raised in national and international forums about their cost-effectiveness and commercial viability. In the

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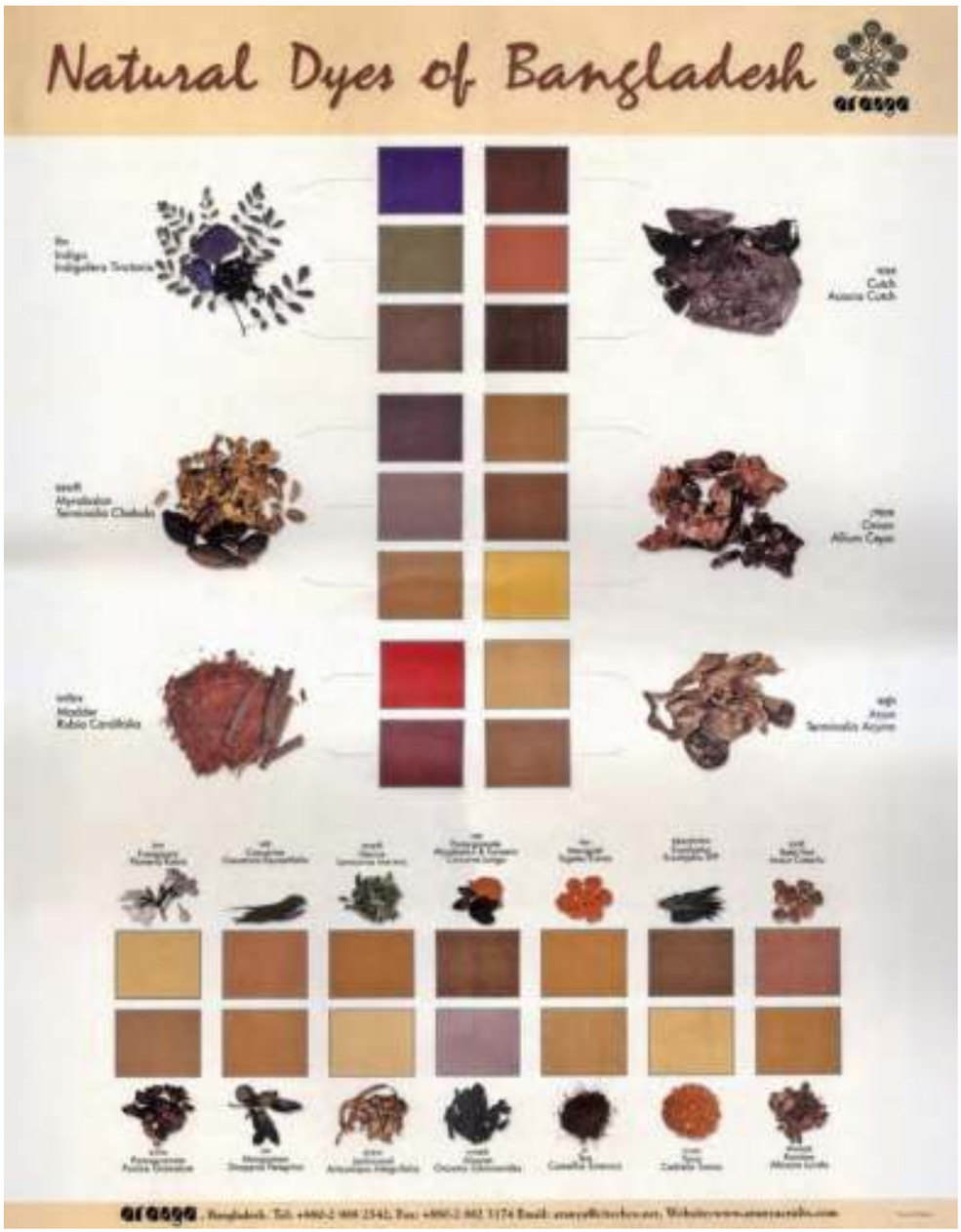
Oxidizing indigo-dyed silk yarn. Photograph: Ruby Ghuznavi.



8

Aranya's colour chart of natural dyes. Photograph: Shamsuzzaman.

'90s, a number of craft NGOs and private organizations in the region started working on the development and commercial production of natural dye textiles with Aranya, a Bangladeshi fair-trade enterprise that was at the forefront of the revival movement (figure 8).

Over the years Aranya developed new techniques to reduce fuel and labour costs without affecting the depth and fastness of the colours. It established that bright colours could be extracted from dyestuffs by boiling them for half an hour, dispelling the common belief that they required boiling for two or three hours; also that deep colours could be obtained perfectly by dyeing material in a boiled dye solution off the fire instead of on the stove. Other cost-cutting measures included sourcing dyes from waste materials like peel, leaves and petals, and extracting more than one shade from each dye solution. These measures have made natural dyes more cost-effective

and competitive today.

Another important role Aranya has played in promoting natural dyes has been through the regular training workshops it has conducted for organizations and institutions in India, Nepal, Pakistan, Malaysia, Bhutan and Turkey. These organizations in turn have held similar training programmes in their own countries.

As the lead organization in the Natural Dye Programme of the World Crafts Council – Asia Pacific Region (WCC-APR), Aranya recently hosted the first ever Training of Trainers Workshop in the region, with master-dyers and other experts from nine Asian countries attending, to share traditional and contemporary dyeing techniques, particularly the use of natural mordants. In spite of their experience and extensive knowledge, each participant learned something new. Plans are underway to organize similar workshops in the other regions of WCC-APR – especially in West Asia, where the traditional desert colours of natural dyes have been lost altogether.

Ecological concerns worldwide have generated a growing demand for organic foods, fibres and colours. As a result, there has been a resurgence of interest in natural dyes. This is reflected in the series of international workshops and conferences organized in the last decade. These events have brought together multidisciplinary participants including researchers, scientists, dye experts (traditional and contemporary), marketing specialists and others, to share the diverse wealth of knowledge and experience across the globe.

In this connection, the International Natural Dye Symposium 2006 organized jointly by UNESCO and WCC-APR and hosted by the Crafts Council of India in Hyderabad (India), and the ISEND Conference 2010 at La Rochelle (France), were outstanding events. They provided an excellent combination of informative lectures and interactive workshops conducted by some of the best practitioners in the field. These meetings provided invaluable opportunities for traditional artisans – who often work in isolated rural communities – to exchange and upgrade their skills through direct interaction with others from similar backgrounds. Though they may not share a common language, their hands speak for them. A classic example of the long-term benefits such events can provide is the fillip Bangladesh's indigo revival programme received from Dastkar India's specialized workshops, which enabled it to progress from MCC's pilot project to their successful indigo production and marketing organization, Nilkomol.

The engagement of iconic fashion designers like Vivienne Westwood, Calvin Klein and Jean Paul Gaultier in using natural-dye textiles for haute couture products has given these textiles high-profile visibility and an invaluable endorsement (figure 9). Simultaneously, a new generation of young designers, concerned with ethical and environmental issues, has been sourcing quality naturally dyed fabrics and accessories for upmarket high-street stores. International organizations have also encouraged natural dye colours for use in beauty products such as lipstick and foundation, promoted by the prestigious companies of Dior, YSL, Shahnaz and others. These developments have supported the upgrading of plant dye products from a niche market to a mainstream one, a prime objective of the natural dye movement.

The last decade has witnessed the mobilization of a worldwide movement for the

9

Local designers in Bangladesh have been working with natural dyes as seen in these block-printed saris. Photograph: Shamsuzzaman.

10

Natural-dyed silk-yarn. Photograph: Ruby Ghuznavi.

revival, development and promotion of organic dyes, and international craft networks like WCC, International Symposium and Exhibition of Natural Dyes (ISEND) and World Eco-Fibre and Textiles (WEFT) have pooled their resources to create a common platform to lobby state agencies and policy-makers. The idea is to persuade them to adopt positive measures to promote natural dyes and raise awareness of the general public about their ecological and financial merits. Some of these networks have undertaken special programmes of research and documentation on the status of natural dyes in member countries – including the availability and cost of dyestuffs, and the new dyeing techniques developed in recent years – in order to disseminate the information across borders.

While commendable progress has been made in taking natural dyes forward, it is essential to formulate sustainable strategies and programmes in order to build on the achievements so far. Only the concerted effort of all stakeholders – state entities, craft networks, institutions, artisans and practitioners – can realize the full economic, social and environmental potential of these dyes. The staying power of organic dyes will be tested by the challenge of unequal competition from synthetic dye multinationals entrenched in the furthest corners of the world today. However, the magical colour palette of natural dyes has a universal appeal that could return it to a central place in our lives again one day (figure 10).

1

"The Gopis Beseeching Krishna to Return their Clothing", detail of a page from a dispersed *Bhagavata Purana* manuscript, Delhi-Agra area, c. 1560–65. Painted in natural colours; 19.2 x 25.7 cm. © The Metropolitan Museum of Art. Image source: Art Resource, NY. 1972.260.

Indigo, colour of the Hindu god Krishna and associated with ritual and magic, is the world's most widely used and best-loved dyestuff (figure 1). It is an ingredient in paints and medicines. Indigo was exported from India to the West from antiquity and had an extraordinary impact on textiles and arts worldwide for thousands of years. From 1600 the European East India Companies competed fiercely for India's indigo, and it was in great demand for dyeing the exotic Indian fabrics that took Europe by storm. In the 19th century, Bengal became the world's main source of indigo. However, unjust production methods caused civil unrest and a "Blue Mutiny" that had widespread political ramifications, culminating in agitation at Champaran in Bihar, Gandhi's first step on the road to India's Independence. A surviving, hitherto unpublished, eyewitness account of Bengal's indigo industry in the mid-19th century lends colourful detail to the story.

Jenny Balfour-Paul

Indigo: From Bengal to Blue Jeans

One May evening in 1850, a young British indigo plantation manager called Thomas Machell sat at his desk in his isolated bungalow in the hot plains of Lower Bengal and wrote in his Journal: "Mr Crips told us stories of his experiences as a planter twenty years ago and none reflect honour on our countrymen…. I hope in the present day we are changing for the better but even now I would not like to chronicle the many grievous instances of oppression and abuse of power which I daily hear of… the consequences will fall heaviest on the destroyers of the goose that lays the golden eggs."

His words were prescient. Within a decade there would be such a violent uprising of indigo workers against their colonial overlords that India's new Viceroy, Lord Canning, would declare: "For about a week it caused me more anxiety than I had since the days of Delhi…. I felt that a shot fired in anger or fear by one foolish planter might put up every factory in flames." Canning was right to be fearful: the disastrous 1857 sepoy rebellion, commonly dubbed the "Indian Mutiny", had only recently been quelled, bringing with it transfer of rule of India from the East India Company to the British Crown. British-Indian relations were fragile; there was no foreseeing the outcome of this new rebellion erupting in Bengal, epicentre of the East India Company's former dominion.

Why was the blue dyestuff, indigo, of such importance at that time, both globally and to Bengal in particular? To understand that we need to wind back through the centuries.

2

Machell's hand-painted map of indigo estates in Bengal, 1846, from Volume 1/138 of his Journals. © The British Library Board, London.

Historical Background

Today we take coloured clothing and textiles for granted, but all dyes came from the natural world until the invention of synthetic dyes in the later 19th century. Innumerable plant and insect sources supplied yellows and reds, but the world's *only* source of natural blue dye was species of indigo-bearing plants. They supplied hues ranging from the palest sky blue to the deepest midnight, as well as such colours as greens, purples and non-corrosive blacks in combination with other dyes. With a chemistry and manufacturing process unique among natural dyes, indigo was suited to all types of fibre: it dyed "royal blue" silks of the aristocracy as well as practical linens, woollens and cottons for working people and for service uniforms (hence English terms such as "blue-collar worker" and "navy blue"). Vast quantities of organic indigo were produced and traded between nations to supply the world's textile industries.

By the time of the great Indus civilization (around 2600 BCE) indigo's chemical secret had already been discovered by Indian master-dyers and this greatly influenced indigo's global history. The Sanskrit for indigo, *nila* (meaning "dark"), which spread into Southeast Asia as well as through West Asia (where it was called *an-nil* in Arabic) to southern Europe and America, was incorporated into the word "aniline", a class of modern dyes originally involving indigo. The word indigo itself, deriving from the Greek *indikon*, "a substance from India", reflects the West's import of Indian indigo for use in Classical times (though as a pigment then, rather than as a dye).

Indigo's extraordinary molecule is contained in species of very different plant genera, but the resulting indigo-blue dye pigment is common to all, no matter which manufacturing process is used. Woad (*Isatis tinctoria*) provided Europe's ancient and medieval indigo dye but, like Japan's indigo plant (*Polygonum tinctorium*), it was traditionally processed and used as a leaf compost unsuited to intercontinental trade. In India and elsewhere, however, the dye was *extracted* from the plant's leaves, notably from certain species of *Indigofera*, Asia's main source. The chemical transformations that take place during extraction of the dye pigment from the plants seem like alchemy. The precursor to indigo's blue colour is invisible in the leaves, which have to be soaked in water to separate glucose from the "indigo-white" molecule called "indican". The leaves are then removed and oxygen is added to the water by vigorous beating. After several hours, blue foam dramatically appears on the liquid's surface, indicating the formation of indigo, sometimes referred to as "indigotin". The liquid is left to settle and excess water drained off, leaving a blue paste to dry into hard blocks of insoluble dye pigment.

This indigo dye pigment was transported East–West along the Silk Roads until Vasco da Gama discovered the maritime route to India in 1498. Indigo was the first valuable "spice" to be exported across the Indian Ocean and around the Cape of Good Hope by Portuguese traders. From 1600 the European East India Companies competed fiercely for indigo supplies because dyers were beginning to change their dye vats; European composted woad was particularly suited to woollen fibres whereas concentrated Indian indigo was ideal for dyeing the exotic Indian cottons and muslins that became all the rage in Europe.

From 1600 the Europeans also established indigo plantations in their colonies in the Caribbean, Central America and the southern states of America. These were

modelled on the Indian system, and relied on the exploitation of slave labour. In the late 18th century these indigo supplies were disrupted, due to the American Revolution (1775–83), loss of colonies, increased production of coffee and abolition of the slave trade. The West had to look elsewhere for sources of indigo, not least because so much was needed to dye the uniforms of its vast armies and navies. In the 19th century production returned East.

This is when Bengal stepped up to the indigo mark.

Indigo in Bengal in the 19th Century: An Eyewitness Account

Robert Clive conquered the vast and fertile lands of Bengal following the Battle of Plassey in 1757, establishing East India Company rule and becoming the first Governor of Bengal. Indigo was a long-established crop in north India but by the end of the century the Company was promoting Bengali indigo as a commercial product, using expertise gained in the West Indies to establish the factories. In 1802 the Company transferred control of the factories to private planters but still channelled most indigo exports through its "agency houses". So many people jumped on the bandwagon that by 1815 Bengal was exporting annually over 3,500 tons of indigo (valued then at six shillings a pound). Indigo was being produced in other parts of India such as Madras, and in other regions of Asia, notably the Dutch East Indies, but at its zenith in the 1830s and early 1840s, four-fifths of world supplies came from the hundreds of factories established by then in Bengal. Indigo manufacture had become Bengal's largest private industry, the dyestuff forming half of all exports through Calcutta. (Within a few years, however, it would fall behind raw cotton and opium, the latter being a government – i.e. Company – monopoly vital for the China trade in tea and silver.) Among the indigo industry's legacies today are ruins of former

3

Model of a Bengali indigo factory made for the British Colonial and Indian Exhibition, 1886. Department of Economic Botany, Kew Gardens. Photograph courtesy Royal Botanic Gardens, Kew.

4

Model of a Bengali indigo factory in the Department of Economic Botany, Indian Museum, Kolkata, 19th century. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Kolkata.

5

William Simpson's watercolour of an indigo factory in Bengal, 1863. © The British Library Board, London. WD1017.

plantations (including some that feature in Machell's Journals) and the more elusive, but pervasive, effect on Indian politics and society, above all in Bengal.

Among the numerous records from 19th-century Bengal, the Journals of young Thomas Machell (b. 1824) are unusual, not least in revealing empathy for the toils of the lowly working class as well as providing much detail about the indigo industry and forecasting its demise.

Between 1840 and 1856 Machell wrote extended illustrated letters to his family about his life and travels, later binding them into five journal volumes now in the British Library collection. Having first visited Calcutta when a humble midshipman in the merchant navy, Machell became embroiled in the Opium Wars of 1840–42 and made a return voyage from England to the South Seas islands of the Marquesas (transporting coal and guano), before returning to Bengal in 1845. Here he worked in indigo for several years, punctuated by two adventurous voyages when on extended leave – one from Calcutta to Alexandria by Arabian dhows and camel, the other up the Indus to Kashmir and the North-West Frontier. From 1855 he managed pioneering coffee estates in the Malabar hills and, finally, a modest company transporting goods across central India by bullock train. He died in India in 1862, aged 39.

When young Machell became an assistant to planter James Forlong in 1846 he was joining an ailing industry whose organization was complicated. Around 500 indigo planters in Lower Bengal, which produced the best quality dye, managed 143 "concerns". Each concern ran four or five "factories", which in turn had several out-factories, all with indigo-producing units (figures 2–5). A proprietor normally owned and managed just one or two concerns but notable exceptions were Hills and White and the Bengal Indigo Company. The most influential managers in Lower

Bengal, each responsible for thousands of workers and large investments in land and infrastructure, were James Forlong and Robert Larmour. The two men could hardly have differed more. Larmour was a more typical harsh master, whereas Forlong was known – and indeed sometimes criticized – for his liberal attitudes and philanthropy, which included establishing a free hospital for his workers as well as English and Bengali schools, financed by planters' subscriptions. (In 1860 *The Hindoo Patriot*'s epithet for Forlong was a "white sheep in a black flock".)

Soon after his arrival Machell witnessed the sweated labour required to process indigo from the plant. The seasonal work was carried out on a vast scale in a series of tanks (or "vats" as Machell calls them). He was fascinated by the manufacturing processes:

> At last the preparations for the great indigo manufacturing business commenced and everybody began to bestir himself. Labourers (or Coolies as we call them) came trooping into the factory, carts and boatswain were looked up in all quarters and put in order for the coming business. The vats were washed out the Chinese pumps were erected the pressing frames repaired and finally all the workmen having arrived a couple of goats were given to them with which they performed the ceremony of striking off their heads and sprinkling the blood on the Vats which were about to be opened. They then sat down and soon had the animals cut up dressed and eaten.
>
> Presently we heard the creaking and the rumbling of the hackeries, loaded with indigo plants, the shouts and songs of the drivers, the shrill cries of the women and children and the restless clanking of the Chinese pumps. The whole factory presented a scene unlike anything I had ever seen before.
>
> Women and children flung sheafs of green indigo plants into the vats which were carefully and quickly stowed by the noisy coolies the gratings spread over them and hove tight down by means of stout cross beams and iron pins and then as each vat was filled the reservoir sluice was opened and the water rushed in down narrow channels, but long before the last vat was filled the sun had disappeared in a red twilight glow…as the first streaks of dawn appeared there was a sound of wooden mallets hammering at huge wooden plugs and then a rush of orange coloured water pouring in to the lower vats. It is from this fermented Indigo juice that the dye is made by the dark skinned sons of India – the dye which may colour the purple robes of royalty or the blue coat of the charity boy, the fair forms of our northern beauties or the dark uniforms of the British soldier. This is the dye for the sailors blue jacket and labourers Sunday coat – a tide golden to those who far from here know not and care not for the toil and groanings of the thousands whose lives are spent in one long struggle of want and toil for the benefit of those who know not even of their existence.
>
> First the coolies flung out the plant from the steeping vats and then one after another dropped into the beating vats into which the golden water was let off from the steeping vats now commenced the work of the day for to and fro round and round those men up to their waists in liquid now dark green stir these pools with their sticks now they worked it into waves now it foamed like a huge washing tub

full of lather again you looked and blue streaks were seen on that lather and so they worked on now in silence now breaking out into wild chants until the water turned to a dark inky blue – now the white plate was brought and we saw how the small indigo grains had formed…it was done and the purple skinned coolies emerged at last from their redolent bath. And so it goes on until the whole manufacturing season passes away when things are all put away pumps unrigg'd Vats clean'd and the manufacturing closed for the year.

As Machell points out, the industry created "one long struggle of want and toil" for the peasants (ryots), the backbone of the industry, with little mercy shown to them either by European masters or by the local middlemen and landlords. The system was inherently corrupt. European planters were forbidden to buy or lease land around their factories, so they paid advances to the ryots via zamindars; this kept the ryots permanently in debt and compelled to grow indigo at the expense of rice. Of the oppressive hierarchy Machell wrote in 1846: "When at last you come to the Ryot you find him ground to the dust by his numerous overseers and of course the lower the overseer is the more severely he rides on the necks of the people, it is an old story with them 'a poor man over a poor man, and no pity'."

Planters employed local thugs to enforce discipline by traditional brutal means. Concerned Company officials did pass various bits of legislation to try and improve matters, but most planters were only intent on making a quick fortune. Indigo was a volatile commodity; over-speculation and the vagaries of the monsoon could cause dramatic falls in profit and more suffering for the workers.

A year after Machell's arrival the indigo industry was jolted by the collapse of Calcutta's joint British and Indian Union Bank, bringing 30 agency houses down with it in a banking crisis resembling the West's in 2008, though in Bengal the unsustainable lending was for indigo planting rather than for mortgages. Trouble brewed from then on. Both Forlong and Machell expressed reluctance to carry out orders that further increased pressure on the ryots, who were unable to recoup their advances on indigo, yet were being squeezed ever harder as the industry struggled. In the pages of his Journals Machell was forthright in his opinions: he criticized both his fellow European planters and the "Native Landlords and Landowners". He also considered native policing "rotten to the core", Britain's justice system "vile, absurd and a heartless monopoly for the employment of Company Directors sons and such like people", and Parliament's neglect of India deplorable.

The "Blue Mutiny" and its Aftermath

In 1852 near death from cholera forced Machell to leave the industry, soon after he had established a school for workers' children on his estate. The previous year he had, like Forlong, forecast trouble ahead: "It serves us right if we will tyrannise the villagers we must expect even worms to turn." And turn they did. During the 1850s the general unrest increased, exacerbated by several years of bad weather and an unpopular new Rent Act. The oppressed peasant farmers were emboldened by the recent sepoy rebellion, and by having their cause championed by liberal European magistrates and missionaries and by reforming Bengali intelligentsia and the newspaper *The Hindoo*

6

Ruins of an indigo factory near Santiniketan in Bengal, 2010. Photograph: Jenny Balfour-Paul.

Patriot. In the autumn of 1859 resentment boiled over into huge demonstrations, rioting and acts of violence. Many ryots refused advances to plant indigo, destroyed indigo fields, set factories alight and attacked their oppressors – the European planters and local zamindars (figure 6).

This indigo rebellion that followed so soon after the "Indian Mutiny" was later dubbed the "Blue Mutiny". It did not develop into more widespread violence and in 1860 an "Indigo Commission" was established to examine complaints and petitions lodged against the planting fraternity.

A further spur to the peasants' cause was the publication in 1860 of a play, *Nil Darpan*, by the Bengali writer Dinabandhu Mitra, which vilified the planters and their wives.

In 1861 a Protestant missionary called James Long – with the support of Bengal's new liberal-minded Lieutenant-Governor, Sir John Peter Grant, and his secretary W.S. Seton-Karr, former President of the Indigo Commission – commissioned a translation of *Nil Darpan* by Michael Madhusudan Dutta. It was published as *The Mirror of Indigo* in Spring 1861 and, unknown to the Lieutenant-Governor, Long sent out copies in official government envelopes. The play caused an uproar, not least among the planting community, and hit the headlines in England, turning many in Parliament against indigo planters (though some had vested interests elsewhere, notably in the rival opium trade). The planters instigated a libel suit against Long; he was briefly imprisoned and fined, but won the moral argument.

(Echoes of these Indian rebellions against Victorian colonialism are manifest today in resentments that foment and sometimes erupt when Western injustice and self-interest rides roughshod over the rights of people of other countries, notably in West Asia in recent times.)

Following the indigo rebellion many planters moved north to Bihar to make a fresh start. However, when M.K. Gandhi returned to India from South Africa, having observed there poor Indian labourers cultivating sugar, he found the indigo workers of Champaran in Bihar to be similarly downtrodden, and led them in a series of large-scale non-violent protests against tyranny. This resulted in policy reforms a year later, and began a path that led to India's Independence movement.

A few indigo factories survived in Bihar until the 1950s, though synthetic indigo had been dominating the global indigo market for decades by then. Although indigo's tainted history remains in the collective memory in Bengal and Bihar, it doesn't deter the young there from wearing their blue jeans.

Synthetic Indigo and Denim Blue

Indigo was such a valuable commercial product that a large amount of research was undertaken to synthesize it. Only after many years and at the huge cost of 18 million German marks did renowned German chemist Adolf von Baeyer (1835–1917) uncover indigo's chemical structure in 1883, earning him a Nobel Prize. In 1897 the Badische Anilin und Soda Fabrik (BASF) Company launched synthetic "Indigo pure" onto the market, half a century after synthetic alizarin had begun to replace natural madder red. Just seven years later Germany exported 8,730,000 kilograms of synthetic indigo, dramatically undermining the manufacture of organic indigo. Within 60 years in India, for example, the amount of land under indigo cultivation dwindled from 1,683,328 hectares to just 4,289.

In the 20th century indigo's story took a new turn thanks to a Bavarian called Levi Strauss who had emigrated to California in 1853. He had spotted a commercial opportunity to supply "waist overalls" to cowboys and miners during the gold rush. Originally made from an imported hard-wearing twill being made in Nîmes (hence "denim", from de Nimes), the cloth was known as gène fustian, reflecting its origins in Genoa, where it was dyed in indigo to be worn by sailors. "Jeans" (after Gènes), worn by American GIs in World War II, were subsequently adopted by filmstars and pop musicians and thus became an icon of youthful glamour and rebellion. Now embraced by mainstream fashion, denim jeans link the world; the annual global output exceeds three and a half billion pairs.

Though many chemical blue dyes are available, only indigo (whether natural or synthetic) with its unique chemistry can give denim its inimitable qualities – a purity of colour and desirable fading properties. The dye builds up in layers by repeat dippings in the dye vat, and never loses its blueness. Its susceptibility to rub-off ("stone-washing" etc.) creates variations that enliven the blues, especially on the twill weave of denim, where only the warp threads are dyed.

Organic Indigo in the 21st Century

Towards the end of the 20th century the future of natural indigo looked unpromising, since its use had dwindled to remote communities in "developing" countries, or small-scale craft dyers. But concerns about the environment have turned attention to natural dyes, indigo being the most significant.

7

Making indigo at Aranya in Dhaka, Bangladesh, 2001. Photograph courtesy Ruby Ghuznavi.

The ingredients of the synthetic indigo used by industry are toxic, just as the production of inorganic cotton is pesticide-heavy. A renewed appreciation of organic indigo's commercial potential is pulling it back from the brink in such countries as Japan, South Korea, France and Oman, and is inspiring revivals in places where it has past associations with forced labour, notably El Salvador, the Caribbean and Mexico as well as Bangladesh and India (figure 7).

Indigo-bearing *Indigofera* species were traditional inter-crops in Bengal in combination with such staples as rice, with the potential to produce both valuable blue dye and green manure. In Bangladesh the organization Aranya (now in the hands of the Bengal Foundation) has been successfully developing these since 1990, thanks to its founder Ruby Ghuznavi. Aranya has trained thousands of people to work with natural dyes and sells its naturally dyed textiles internationally in major stores.

In addition to problems with the toxicity of synthetic indigo, attention is also turning to the other ingredients of the modern chemical indigo dye vat, notably sodium dithionite that breaks down into potentially polluting sulphur compounds. In many countries promising research is being undertaken into more sustainable alternatives, such as electrochemical methods based on the biochemistry of bacterial indigo reduction.

8

Levi's 511 organic indigo jeans made by Colours of Nature and launched in 2013. Photograph courtesy Levi.com.

The fashion industry is turning the spotlight onto sustainability. Natural indigo has featured in garments on the catwalks of such couture capitals as Paris and New York. Several companies now make jeans with organic cotton and plant-derived indigo. One such, whose products are truly organic, is Colours of Nature, founded at Auroville in southern India in 1993 by Jesus Ciriza Larraona to "integrate ancient and alternative technologies". The company manufactures blue jeans from start to finish, dyeing local cotton yarn in computer controlled organic indigo fermentation dye vats, and in 2013 collaborated with Levi's to launch the first truly organic 511 jeans (figure 8).

The story of indigo has evolved over 5,000 years to connect us all, whether we wear a favourite pair of blue jeans, have ancestors who worked as forced labourers or slaves in former indigo plantations, or listen to Duke Ellington's "Mood Indigo". This makes indigo an ideal subject for educational engagement. For example in 2009–10 "Silk Road Connect", an initiative of cellist Yo Yo Ma and his Harvard-based Silk Road Project, successfully developed and piloted the use of indigo studies as an aid to engaging New York school children in the social science curriculum.

Today, India's long indigo story stretches far into the blue horizon. The country has a great role to play in the global movement towards the use of sustainable dyes in the textile and fashion industries. Bengal has the potential to once again be a major source of "green" indigo to dye a vast range of fabrics – not least the universal fashion garment, denim blue jeans.

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Also see the website www.spindigo.net

Among the most highly regarded of the numerous textile productions of the Indian subcontinent are the painted and printed cottons known as chintzes or kalamkari (literally "drawing with the pen"). They are especially admired for their vibrant lasting colours and technical virtuosity.

This particularly refined method of textile decoration, which involves many laborious stages, was precisely described by three key witnesses of the 18th century.

The first of these was Antoine de Beaulieu, a naval officer of the French Compagnie des Indes, who described all the stages of production of chintz in Pondicherry between late July 1731 and the end of January 1732. He collected samples which were bound together in a small volume on his return to France. These are now in the library of the Natural History Museum in Paris.[1]

The second witness was a French Jesuit missionary Gaston Coeurdoux, who in 1742 collated the information on cloth production that he had obtained from those of his Christian converts who were professional kalamkari painters. In 1747, he wrote an important letter in which he included information received from Pierre Poivre, a Frenchman also living in Pondicherry. In this letter he included a drawing of the "chayaver" plant used locally to manufacture red dye. In 1748, Father Coeurdoux sent to France a Mémoire by another contemporary, Paradis, on the different processes required to dye cotton cloth red, with a covering letter of additional remarks on red dyeing.[2]

In 1795 the third witness, famous Scottish botanist William Roxburgh, published his Plants of the Coast of Coromandel, *in which he described chay, used for reds and other colours, and the various dyeing processes he had observed and compared along the Coromandel Coast between Madras and Pondicherry. He explained how to use chay roots "in the manner of the painters of chintz of the region of Masulipatam". He compared techniques practised in Machilipatnam with those he had observed further south around Madras and Pondicherry.*[3]

These 18th-century sources were researched by the renowned dye chemist P.R. Schwartz in the 1950s[4] *and their information can also be compared with that provided in the 1987 book* Natural Dyeing Processes of India *by B.C. Mohanty, K.V. Chandramouli and H.D. Naik, which details the continuity and survival of techniques still used in Machilipatnam and further south in Sri Kalahasti, northwest of Madras/Chennai. Photographic illustrations accompany the technical descriptions.*[5]

Below we examine the production of traditional chintz (or "indiennes" in French) in the light of modern dye chemistry.

1–5

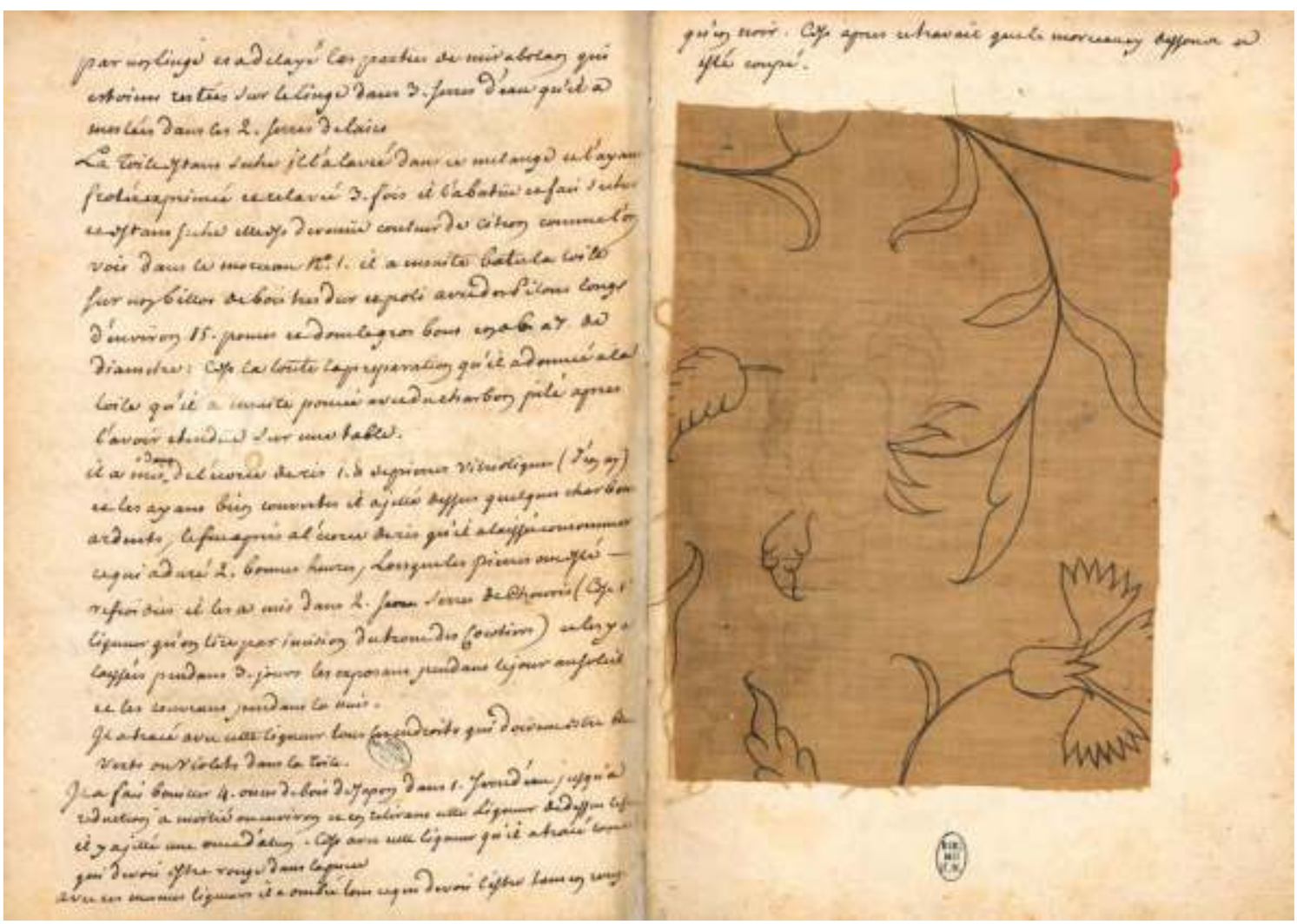
Stages in the making of a chintz as described by Captain de Beaulieu, 1731–32.

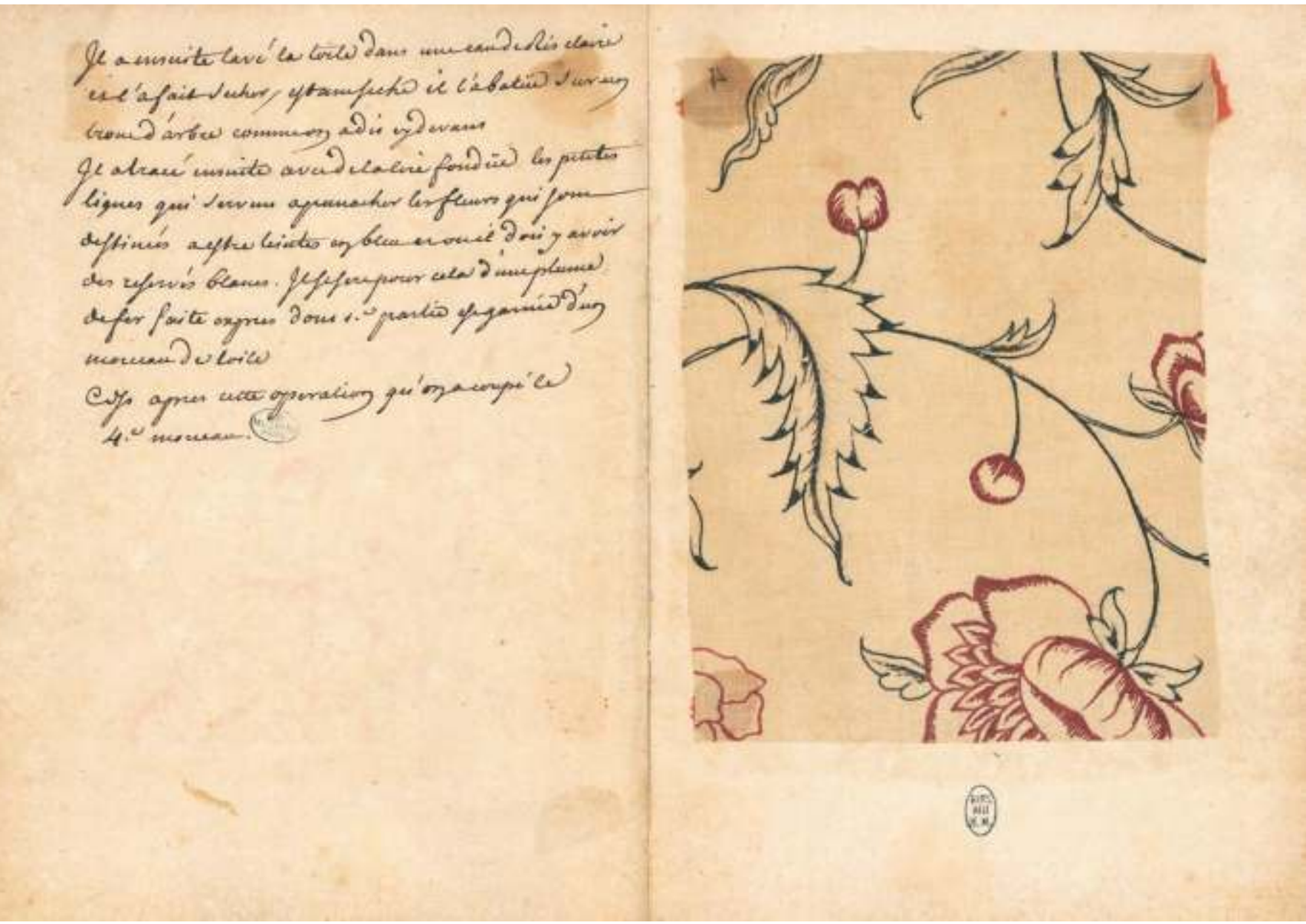
1

The first stage of the process: the cloth is boiled in a decoction of myrobalan, after which it is dried, then washed and squeezed in a bath of crushed myrobalan and buffalo milk, and beaten. The design is drawn onto the cloth with a pounce of charcoal powder through a stencil. All the lines and surfaces of the cloth that will look blue, green or purple are then painted with iron acetate (the "black mordant") and those that will be red are painted with an alum mordant dissolved in a decoction of sappan wood, to make it visible. Bibliothèque centrale du MNHN, Paris, 2013. Ms 193(1), folios 2v–3r.

Dominique Cardon

The Colours of Chintz: Empirical Knowledge of Chemistry in 18th-Century India





2

The fourth stage of the process: the cloth has been dyed in a dye bath of chay-root then washed in goat dung and water and bleached for two days by alternative dippings and drying in the sun. After a last washing in a clear rice broth and drying, the lines and parts of the design that must remain white on a blue ground are drawn with wax, using a special metal drawing tool with a cloth pad. Bibliothèque centrale du MNHN, Paris, 2013. Ms 193(1), folios 5v–6r.

We shall consider the basic stages in the preparation and dyeing of the cloth: soaking the cloth in tannins mixed with milk; painting the cloth, or in one isolated case block-printing it, with different mordants; applying dyes with the brush, usually in the following order: reds, blues and yellows. These operations are interspersed with further treatment of the cloth for applying colours – notably wax-resist, soaking again in tannins and milk, and bleaching. The operations described in the 18th-century sources, in spite of minor variations and omissions, do actually work from the point of view of chemistry and technique.

First Soak – Myrobalan and Buffalo Milk (figure 1)

Myrobalan is the dried fruit of trees of the *Terminalia* genus, of the Combretaceae family. The 18th-century sources note the local Tamil appellation "caducay" – or variations on this term – for the fruit and gall nuts of *Terminalia* trees. These are

3

The fifth stage of the process: all the ground of the cloth except the parts that must look blue or green are covered with wax, using a stick with a cloth pad on the end. The resist wax looks blue because it is reused several times after being melted, following the dipping of the cloth into the indigo vat. Bibliothèque centrale du MNHN, Paris, 2013. Ms 193(1), folios 6v–7r.

particularly rich in hydrolysable tannins. They are astringent and serve both as mordant and dye, like the gall nuts used in Europe. Red dyeing is preceded by two mordant baths, the first with myrobalan, which optimizes the subsequent mordanting with alum – however, the precise chemistry is still not fully understood.

Myrobalan is also used for dyeing; its yellow colour is due to the tannins but also to flavonoid colorants (mostly 3'-methoxy quercetin and 3',4'-dimethoxy quercetin),[6] and its hydrolysable tannins combine with iron mordant to give black.

The sugary and mucilaginous pulp of the myrobalan fruit gives an unctuous, almost viscous or rubbery consistency (unlike the gall nuts used in other countries), which means that it can be applied without running and without needing any extra thickener. When the myrobalan paste is thinned down in buffalo milk for the first soaking, the unctuous quality is increased. The complex chemical reactions that take place between tannins, the cellulose cotton fibre, casein, and the fats and sugars of milk await further

4

The sixth stage of the process: the whole cloth with its pattern of wax resist is dyed in the indigo vat. Then the wax resist is washed off in several rinses of hot water and the cloth goes through a bleaching process including repeated washings in a goat dung bath and exposure to the sun. Bibliothèque centrale du MNHN, Paris, 2013. Ms 193(1), folios 7v–8r.

research. No doubt the large amount of lipids in buffalo milk, which are oxidized when the cloth is repeatedly hung out in the sun, function like the oil (combined with tannins and alum) used elsewhere to produce "Turkey red". The calcium in the milk has recently been shown to be crucial for the formation of a red dye-mordant-cellulose complex.[7]

Repeat baths of myrobalan and buffalo milk, followed by hanging out in the sun, are essential for the mordanted zones of decoration intended to be dyed intense red, or other reddish tones. These baths, especially after the cloth has been vigorously bashed against wooden boards, form a fine layer of primer, both malleable and impermeable, which allows for great finesse and precision. This is why these baths are found at every stage of the process preceding the application by brush of mordants, wax or dyes. Roxburgh particularly emphasized the role of the milk in the mixture.[8]

Black Mordant (Kasim)

Iron acetate, in combination with myrobalan tannins, applied to cotton fibre, gives a colour-fast dye. The iron acetate is obtained by dissolving old ironwork and iron scraps from the forge in local equivalents of vinegar. (In western Europe, where wine vinegar is abundant, textile centres would share a huge communal vat of "iron liquor".)[9] It is the same chemical reaction that forms the base of most ink. Just as certain inks corrode paper, so do some black dyes affect cloth when the ingredients produce certain destructive acids. In fact, in some 18th-century Mughal textiles one can observe disintegration that exactly follows the black patterns.[10] However, iron acetate manufactured as our sources describe, combined with concentrated gall tannins such as from myrobalan, create the least corrosive blacks for the cloth.

Alum Mordant or Red Mordant (Karam or Patika Karam)

The colour of this mordant from sappan wood (*Caesalpinia sappan* L.) made it easier for 18th-century painters to see the outlines, whereas kalamkars today have no need of this colour because they print or paint the outlines in black. Our sources indicate that the 18th-century artists understood the function of sappan dye. Beaulieu observed: "one sees that the red doesn't last but merely serves as preparation for other colours".[11]

In fact the pinkish red of sappan wood, which belongs to the flavonoid chemical group, is not light-fast (though this imported dye was nevertheless used for silk dyeing in medieval Europe). Despite its fugitive nature, Coeurdoux seemed to think that sappan dye played an important role for red dyeing of painted cloths.[12]

As for alum, every civilization soon discovered that certain metallic salts had a chemical affinity with certain red dyes and made them colour-fast. When a fibre is mordanted with alum, it forms a strong chemical bond with alizarin, the main red component of madder dyes, as recent precise chemical analyses have proved.[13]

The Madders: Dyeing with Chay (figure 2)

I use the term madder for the red dye bath, as it is the term used by European dyers. But although chay (*Oldenlandia umbellata* L.) belongs to the Rubiaceae family, like the usual source of "dyer's madder" (*Rubia tinctorum* L.), it is different from all the others as it contains only one red colorant, alizarin, present in the roots both as the aglycone and in the form of glycosides. This fact in some ways explains the use of synthetic alizarin as a substitute by today's dyers at Machilipatnam. Jean Ryhiner, a calico printer in Basle (Switzerland) circa 1766, already understood the superior beauty of reds from chay compared with those from the madders whose other dye components dye the fibres along with the alizarin.[14]

Surely the remarkable intensity of Indian reds is also due to the multiple series of dye baths and mordanting which totally saturate the cloth fibres. After a chay dye bath all the cloth looks reddish brown. But it is only in the places where the kalamkar has applied alum that the colour is solidly fixed to the fibres.

Washing/Bleaching

The bleaching processes discussed in great detail in all the sources are vital from a chemical point of view. It seems that dyes mordanted with alum or iron have greater affinity with the proteins present in dung than with the cellulose of cotton, and that dung helps to eliminate the non-mordanted colours.

The ammonia produced by fermented excrement undoubtedly also plays a role in brightening colours, just as soaps and salty clays and sodas have been used to dissolve fats in the textile industries of Asia and Europe. The oxidizing that occurs during the bleaching process when cloth is repeatedly rinsed and exposed to the strong Indian sun also plays its part.

The Blues (figures 3 and 4)

The only colour-fast natural blue dye is indigo, used since the most ancient of times. It derives from "indican", the precursor to the indigo blue pigment (sometimes called "indigotin") that is present in certain plants from different botanical families. India is lucky to have several species of indigenous or cultivated *Indigofera* that are rich in indican. Unfortunately, natural indigo is rarely used today; one can understand why the dyers of Sri Kalahasti have succumbed to the temptation to use easier substitutes from elsewhere, though they are less beautiful and more fugitive.

Indigo is basically a vat dye; the blue pigment is insoluble and can only adhere to textile fibres when it is reduced to its colourless form. Traditional fermentation vats produce hydrogen in an alkaline medium. When cloth is removed from the vat and exposed to the air the reduced indigo is converted back to the insoluble blue colour. Therefore, unlike chay dyeing, every part of a textile that is immersed in a dye vat will be permanently coloured, whether or not there is mordant on the cloth.

If one tries to paint indigo from a dye vat onto selected parts of the cloth by brush, the indigo precipitates on the brush into indigo blue pigment, which is why, as Coeurdoux correctly noted, indigo painted on this way is not wash-fast. The only way that Indian dyers could retain the other colours and also dye with indigo was to apply a malleable resist of wax over all the areas not intended to be dyed blue before the cloth was immersed in the indigo dye vat. (An important European invention to get around the laborious Indian system involved adding an orpiment mixture to the indigo, which delayed precipitation long enough, by keeping the dye in its reduced state, for it to be painted or printed onto cloth.)[15]

Coeurdoux, unlike Beaulieu and Roxburgh, reported at length on the stages of indigo vat dyeing, though he failed to understand the complexities. However, it is noteworthy that dyers in Machilipatnam use the same ingredient, *Cassia tora* L. (or, in Tamil, tagttai, teleg, tabtenu or tantiymu), as their predecessors over two centuries earlier in Pondicherry. Though Coeurdoux notes that the vat's alkalinity was maintained by lime powder at Machilipatnam, Beaulieu, in another Memoir, on blue dyeing, mentions the use that continues to this day, of a mixture of lime from shells and a soda lye made from the local sandy soil (echoing the two systems used by European woad dyers).[16] He also records an indigo dyer of Pondicherry using saltpetre. This curious mention implies an additional reduction to that already provided by the use of *Cassia tora* seeds.

5

The eleventh, final stage of the process: the parts of the design that must look yellow or orange (on parts already dyed red) have been painted with a bath of turmeric and alum. Some of the parts that had been dyed red in the first dye bath of chay-root have been painted with iron acetate. Then the whole cloth is dyed in a second dye bath with chay-root. This strengthens the reds and blacks and produces purple shades on the parts painted with iron acetate. Finally, the cloth is passed through a thorough bleaching process including repeated washings in goat dung, in alkaline earth and in soap, alternating with exposure to the sun. Bibliothèque centrale du MNHN, Paris, 2013. Ms 193(1), folios 12v–13r.

The Yellows (figure 5)

Nature is full of yellow colours, yet it produces relatively few colour-fast yellow dyes.

It is not by chance that Indian dyers, from the 18th century till today, leave the application of yellow dyes to the last operation, clearly avoiding as far as possible the bleaching and sun-drying that would most affect the fragile yellows and greens (made by over-dyeing blues with yellows).

However, the yellows are well selected. Indian dyers tried to obtain the most effective yellows from those that are associated with certain tannins: pomegranate rind (noted by Coeurdoux) and myrobalan fruits and galls. However, the question of using myrobalan flowers is intriguing: they seem to be used by today's dyers and both Beaulieu and Coeurdoux talk of "fleur de cadou". However, the latter suggests that "fleur de cadou" might in fact mean myrobalan galls. Even without analysing

myrobalan flowers, one can presume that the tannins (if present in them) would be in less quantity than in the fruit or galls, and that other more fugitive yellow dye pigments are present in the flowers. Whatever is the case, the identity and significance of the use of "fleur de cadou" in the past has not been passed on to today's Indian dyers.

Conclusion

When we compare today's practices with those described in the 18th-century sources, it is obvious that there are shared and continuous technical and chemical features of Indian chintz manufacture. Indian craftsmen faced the same practical problems of transforming raw materials and adopted similar or identical solutions, though with minor variations, in the three places concerned along the Coromandel Coast. However, neither the naval officer, nor the Jesuit missionary, nor the Scottish botanist was a professional dyer. Each was simply a witness who tried to record faithfully what he saw or heard, but he may have omitted to note down some details or misunderstood the ordering of the many processes which he did not fully understand or personally witness, and sometimes the information may have been inaccurately transmitted.

What remains undeniable is the mastery of the Indian craftsmen and the beauty of the old painted textiles that have survived as testimony of their intuitive knowledge of the rules of empirical chemistry. Thousands of years of practical experimentation allowed them to select the best of the many natural mordanting and dyeing resources to be found in their surroundings and to develop the most effective means of exploiting these.

Jean Ryhiner observed that the Indian kalamkari craftsmen "have the great advantage of having plants in their environment that are more efficient for this manufacturing process than those we have in Europe. Labour is an easier matter in this country as they paint rather than print and are therefore finer artists though slower. Therefore, all other things being equal, we would not be able to compete with them because we do not have craftsmen of such high level who are also so cheap to maintain." But he considered that the more difficult conditions in which European calico printers worked, facing the same kind of chemistry, would be a powerful incitement to progress in this field: "As we are pursuing the same objectives, [inspired by the Indian craftsmen], we have greater hope of perfecting ourselves."[17] The astonishing development of industrially printed cottons in Europe in the 19th century proved him right.

NOTES

This article was translated and edited by Jenny Balfour-Paul and Bruce Wannell. For the complete text (in French) and a comparative table of the information provided by the 18th-century sources see Dominique Cardon, "Chimie empirique et savoir-faire traditionnel indien dans la teinture", in T.-N. Tchakaloff, V. Bérinstain and D. Cardon, *Indiennes et Palmapores à l'Île Bourbon au XVIIIè siècle*, Saint-Louis, La Réunion: MFMC, 1994, pp. 70–85 and appendix 2.

1. Anon., n.d., *Manière de fabriquer les toiles peintes dans l'Inde telle que M. de Beaulieu capitaine de vaisseau l'a fait exécuter devant lui à Pondichéry*, Bibliothèque Centrale du Muséum National d'Histoire Naturelle, Ms 193(1).

2. P.R. Schwartz, "Father Coeurdoux's Letters on the Technique of Indian Cotton-painting, 1742 and 1747", *The Journal of Indian Textile History*, 3, 1957.

3. William Roxburgh, *Plants of the Coast of Coromandel*, London: W. Bulmer and Co. for George Nicol, Vol. 1, 1795, cols. 1–8.

4. P.R. Schwartz, "Beaulieu's Account of the Technique of Indian Cotton-painting, c. 1734", *The Journal of Indian Textile History*, 2, 1956; Schwartz, 1957; P.R. Schwartz, "The Roxburgh Account of Indian Cotton-painting", *The Journal of Indian Textile History*, 4, 1959; P.R. Schwartz, "La fabrication des toiles peintes aux Indes au XVIIIè siècle", *Bulletin de la Société Industrielle de Mulhouse*, 4, 1957.

5. Bijoy Chandra Mohanty, K.V. Chandramouli and H.D. Naik, *Natural Dyeing Processes of India*, Ahmedabad: Calico Museum of Textiles, 1987, pp. 100–14.

6. Mammen Denni, Sandhya Bapat and Ramesh Sane, "An Investigation into Variation in Constituents in the Fruits of *Terminalia chebula* Retz. at Different Maturity Stages", *International Journal of Pharma and Bio Sciences*, 3/1, January–March 2012, pp. 416–19.

7. François Delamare and Bernard Monasse, "Le rôle de l'alun comme mordant en teinture – Une approche par la simulation numérique- Cas de la teinture de la cellulose à l'alizarine", in P. Borgard, J.-P. Brun and M. Picon (eds.), *L'Alun de Méditerranée*, Naples/Aix-en-Provence: Centre Jean Bérard/ Centre Camille Jullian, 2005, pp. 277–90.

8. Roxburgh, 1795.

9. Dominique Cardon, "Black Dyes for Wool in Mediterranean Textile Centres: An Example of the Chemical Relevance of Guild Regulations", *Dyes in History and Archaeology*, 9, 1990, pp. 8–9.

10. Patrick Soubayrol, *Effet des mordants sur la dégradation des colorants de teinture*, D.E.A. thesis in Organic Spectrochemistry, University of Paris-VI, 1992, figs. 4 and 5.

11. Beaulieu Ms. (see note 1), folio 3v.

12. Letter of January 18, 1742: "and it is in this way that the red of the different shades and nuances of this colour is made", Schwartz, 1957.

13. Dominique Cardon, *Natural Dyes: Sources, Tradition, Technology and Science*, London: Archetype Books, 2007, p. 118.

14. Jean Ryhiner, *Traité sur la fabrication et le commerce des toiles peintes*, Ms. written in Basle, Switzerland, in 1766, preserved in the Library of the Musée de l'Impression sur étoffes in Mulhouse, France, folio 47.

15. M. de Quérelles, *Traité sur les toiles peintes, dans lequel on voit la manière dont on les fabrique aux Indes, et en Europe*, Amsterdam, 1760, p. 38.

16. Quoted in ibid., pp. 36–37.

17. Ryhiner, 1766.


23. Morinda citrifolia
tinctoria. R. 918

Pramod Kumar K.G.

A Calcutta Florilegia: William Roxburgh's *Flora Indica* Drawings

> The botanical garden is beautifully situated on the banks of the Hoogly…. Dr Roxburgh obligingly allowed me to see his native artists at work, drawing some of the most rare of his botanical treasures; they are the most beautiful and correct delineations of flowers I ever saw.[1]

In February 2010, SUTRA – in partnership with the Botanical Survey of India (BSI), the Indian Museum, Kolkata, the Rabindranath Tagore Centre of the Indian Council for Cultural Relations (ICCR), Kolkata and the Victoria and Albert Museum, London – organized an event on the conservation of textiles and textile traditions. The eight-day conference consisted of seminars, workshops, exhibitions and demonstrations of traditional weaving, dyeing and patterning.

This writer was asked to curate two exhibitions to coincide with the event: Vastra – an exhibition of historic textiles from the early 17th century to contemporary examples from Bengal; and Vriksha – an exhibition of 12 original albums from the collection of the BSI being displayed for the first time. These 12 volumes included four volumes of drawings of Indian plants compiled by William Roxburgh, and prepared by Indian artists between 1794 and 1813 (figure 2). The other albums included four volumes from Thomas Wardle's *Specimens of Fabrics Dyed with Indian Dyes* (1880s) and two volumes each from the first and second series of John Forbes Watson's *Textile Manufactures and Costumes of the People of India* printed in 1866 (18 volumes with about 700 designs) and in 1873–74 (13 volumes with about 1,240 designs) respectively.

1
Painting of the *Morinda tinctoria* plant in a William Roxburgh journal. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Central Natural Herbarium (CNH), Kolkata.

2

Pramod Kumar K.G. examining a painting of the *Curcuma longa* plant in a William Roxburgh journal, with S. Girikumar and Jenny Balfour-Paul, at the Botanical Survey of India, CNH, Kolkata. Photograph courtesy Jenny Balfour-Paul.

Curating exhibitions often allows for unprecedented access to collections and archives, leading to some of life's most extraordinary experiences. A visit to the hallowed offices of the BSI and Kolkata's Central National Herbarium allowed for a rare glimpse into the life and prodigious work of Dr William Roxburgh (1751–1815), a Scottish medical doctor famed as the father of Indian botany. His office-cum-residential building, known today as Roxburgh's House, is on the west bank of Calcutta/Kolkata's Hooghly river where, from 1793 to 1814, he was the first salaried Superintendent of the Hon'ble East India Company's Botanic Garden. He founded the first herbarium in 1795.

On the death of Colonel Robert Kyd, founder of the Botanic Garden at Sibpur, Calcutta in 1793, William Roxburgh was appointed to succeed him. During Roxburgh's tenure, the garden expanded in size and exploded in terms of the number of species grown (from 300 to over 3,000). The first botanist to make a systematic study of Indian plants, Roxburgh described over 2,000 new ones, sending drawings of them to London for Sir Joseph Banks, the pioneering botanist and patron of the natural sciences who accompanied Captain James Cook on his first voyage to the Pacific Ocean (1768–71). The East India Company, under the aegis of Banks, published Roxburgh's botanical studies of the Carnatic, *The Plants of the Coast of Coromandel* (3 vols., 1795–1820). Roxburgh's other key publications include *Hortus Bengalensis* (1813–14), *Flora Indica* (edited by William Carey: Vol. 1, 1820 and Vol. 2, 1824), *Flora Indica* (2nd edition, 3 vols., edited by William Carey, 1832), *Flora*

Indica (Vol. 4: *Cryptogamous Plants* by William Griffith in the *Calcutta Journal of Natural History*, Vol. IV, 1844), and *Flora Indica* (single volume, including Vol. 4, edited by C.B. Clarke, Calcutta, 1874). His contemporaries viewed Roxburgh as "the greatest botanist since Linnaeus". The largest share of his herbarium specimens is held at the Delessert Herbarium in Geneva. Other important parts are located at the Botanic Gardens, Brussels; the Natural History Museum, London; the Royal Botanic Gardens, Kew and Edinburgh; and at the Liverpool Museum.

Thanks to the talents of several unknown Indian artists, 2,595 plant studies were produced for Roxburgh's *Flora Indica*. Sets of these drawings were distributed among various institutions such as the Royal Botanic Gardens at Kew and Edinburgh, and the British Library, Natural History Museum and Linnaean Society in London. His pioneering research into the economic potential of plant species yielding fibres, dyes, spices, medicines etc. had an immense and measurable impact on the agriculture and economy of India under the Raj.

William Roxburgh's coloured drawings are each on a plate or folio sheet of size 45 x 30 centimetres (figures 1, 3 and 4). Most are life-size, but occasionally two or three specimens are drawn on the same sheet; sometimes two folios are joined in order to depict a larger specimen. A.T. Gage, Superintendent of the Calcutta Botanic Gardens (1906–23), arranged them by family, genus and species in J.D. Hooker's *The Flora of British India* and had them bound into 35 volumes. Each plate or drawing bears the name of the species, with numbers on either side in faded pencil; on the verso is a number in ink in Roxburgh's hand. Numbers and names were rewritten on the face of each drawing before it was mounted on a thick sheet. The number on the right corresponds to the number of the species described in Roxburgh's *Flora Indica* manuscripts preserved at Kew. In addition to the name and original number, there is a set of three numbers written by Gage. According to him, the first and second numbers correspond to the family and genus numbers as listed in G. Bentham and J.D. Hooker's *Genera Plantarum*. When the same number in red is repeated for one or more drawings it means that these species were merged, and one of them was the accepted name in *The Flora of British India*.

An obsession with documenting, cataloguing and indexing India's abundant human, animal and plant life was common among the servants of the East India Company. While there was no doubt an element of passion for knowledge, it was primarily an intensive survey of assets that would subsequently inform the administration on how best to exploit the colony's natural resources. As the East India Company expanded its commercial operations and political power across India through the 18th and early 19th centuries, it had to support an enormous army and administration. Finding new plants and better understanding agricultural practices and forestry enabled the Company to administer and exploit its territories to the fullest; it was also smart economics, as the trade in exotic plants fed a sizeable market.

Documenting India's plant life was sine qua non to learning about its natural habitat, and East India Company employees such as William Roxburgh were soon identifying and commissioning local artists to record India's flora in watercolour drawings, both as part of their work and to pursue their own passion for natural history.

3

Painting of the *Indigofera tinctoria* plant in a William Roxburgh journal. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Central Natural Herbarium (CNH), Kolkata.

4

Detail of the *Curcuma longa* plant in a William Roxburgh journal. Photograph: Jenny Balfour-Paul, courtesy Botanical Survey of India, Central Natural Herbarium (CNH), Kolkata.

Although the appeal of these illustrations today is mainly aesthetic, the driving force behind their production was always scientific accuracy. The use of botanical illustrators for research has long been a practice across the Western world with the drawings being made either from pressed or living plants. One of their chief roles has been to complement taxonomic descriptions. In most cases (and as seen in the Roxburgh volumes) entire scientific plates include the plant's habit or growth form with an occasional inclusion of details of reproductive structures and features relevant to its identification (figure 5). The artists were trained to follow conventions of scientific illustration, capturing features important for identification as realistically as possible. The Indian artists had to adapt to using a very different vocabulary and style from the local or imperial Mughal painting tradition they had been trained in. Since an accurate depiction of a species could be the key to identifying and classifying it, the services of talented artists were invaluable.

The key role of artists continues, for while photography, and particularly microscopic photography, certainly helps to inform botanical work, it cannot replace the botanical illustration. A case in point would be the use of outline drawings that help distinguish elements that cannot be made out using reflected light alone. Furthermore, a sketch can be composed to display a full set of features that otherwise cannot be shown side by side on the same plane, or in nature.

After his arrival on the Coromandel Coast of south India in 1776, William Roxburgh spent 17 years there before his departure for Calcutta in 1793. While posted at Samuelcottah, Coromandel in the Madras Presidency, Roxburgh came under the influence of Johann Gerhard Konig, an eminent botanist and student of Carl Linnaeus (1707–78), the Swedish botanist who laid the foundations of binominal nomenclature. Here Roxburgh developed his first botanical plantation and went on several plant-hunting expeditions. Crucially this was where he began his collection of drawings and descriptions of plants that were to be completed by local Indian artists, which experience later helped him secure his appointment as the East India Company Naturalist in 1789. The purpose of the botanical illustrations was to show people in Europe what living plants in India looked like; this was necessary as live specimens would invariably rot on their way to Europe. Live species preserved in herbariums risked being destroyed by decay and ants in India's tropical climate. Watercolour drawings were thus an accepted substitute for herbarium specimens to help describe the new "types" represented by them.

The growing Western interest in books on flora discovered from newly accessed parts of the globe led to several publications with engravings based on these drawings. The high quality of the drawings facilitated their reproduction; Roxburgh would have been aware of this, as is evident from his personal collection of books and manuscripts, which contained similar kinds of publications.

Sadly, we do not know the name of a single Indian artist who helped create Roxburgh's monumental series of watercolour drawings of plant life in India. With the decline of the Mughal empire and the emergence of the provincial courts of north India and the Deccan, times were difficult for native Indian miniature painters and artists. Forced to travel and to seek new patrons, they found some amongst the servants

5

Painting of the *Butea superba* plant whose bark exudes ruby coloured astringent gum and whose flowers yield a yellow dye and pigment. From Roxburgh's *Drawings of Indian Plants*, Fasc. V, Kolkata: Botanical Survey of India, CNH, 1973.

of the East India Company. It necessitated learning new ways of delineation, however, as the Europeans had a different approach to perspective and aesthetics. In the Indian visual vocabulary, the importance of a detail was communicated by exaggerating it within a composition, or conversely, depicting only the detail, but in isolation and out of scale.[2] For the Europeans, fidelity to detail was paramount and directional light and consistent shadows were emphasized. The examples in the Roxburgh volumes in Kolkata clearly show the inner conflict and struggle the Indian artists underwent to create acceptable illustrations. However, their rigorous training in traditional ateliers met with high approval as they were no strangers to labour in the service of achieving perfection. The local technique of layering paint achieved a brilliant colour, and special brushes were used to create the suggestion of a pearl-like lustre and reveal the texture of leaves: technical accomplishments that were highly regarded by the colonial patrons. Roxburgh's drawings with their complement of descriptions are in most cases entire plant outlines done to size, along with enlarged dissections. In time, his Indian artists (whom he paid himself) became one of the chief attractions of the garden, with several visitors having them make copies of the drawings. These drawings are now spread across the world in several collections.

With the support of British politicians and influential scientists such as Joseph Banks, the East India Company established botanical gardens that conducted scientific experiments to assess the economic potential of various plants. The first garden opened in 1787 in Calcutta. In 1817 the Company took over the Saharunpor (Saharanpur, Uttar Pradesh) Gardens, one of the oldest gardens in India. Plants used for medicinal purposes, food crops, dyes and other commercial species were identified and grown, and then transported and sold around the world. The gardens were also used to acclimatize plants newly introduced to India. Experiments in cultivation at the Saharunpor and Calcutta Botanical Gardens turned plants such as tea and cotton into global resources that helped make the Company rich.

It is regrettable that the history of these botanic gardens, the pioneering scientists who set them up, and the plant exchange networks created are neglected areas of study despite the presence of extensive archival holdings both in India and Britain. The only significant exception to this has been a study of the life and work of Alexander Gibson at the Dapuri Gardens near Pune (formerly Poona) in western India.[3]

While Roxburgh's work in botany is well known, his influence in other fields and his larger scientific interests are less so. His work in climate theory, famine control, his meteorological diaries and articles on land-winds are yet to be completely mapped and adequately studied. Roxburgh also made several crucial contributions to the study and identification of stable dyeing methods. His awareness of the need to produce crops of economic importance is apparent in his attempt to find affordable and readily available supplies of madder dye and in his work on indigo.

His practical ideas were largely based either on the economic benefits that could accrue to the East India Company, such as his studies on dyes, sugar, pepper, spices, timber and fibre; or on the benefits they could provide for the indigenous population. Of these latter, his work on silk, on sugar production as a mode of employment, on alternative food crops to overcome famines caused by failure of the

monsoons, and the concomitant use of the River Godavari as a source of irrigation, may be cited.[4]

The numerous accolades awarded to Roxburgh testify to his reputation during his own lifetime, but are also a clear indicator of the priorities of the empire that supported his passion. Besides being elected to the Royal Society of Edinburgh in 1791 and the Linnean Society in 1974, he was twice given a Gold Medal by the Royal Society of Arts in 1805, "for his valuable communications on East-India Products", and in 1814 for the "different Products of the East Indies and their several applications to the Arts, Manufacturers, and Commerce of the United Empire".[5]

One obituary eulogized his standing in Europe by stating that "the hand of death… deprived the world of a most scientific and zealous man, who would have adorned even the chair of Linnaeus, and have added new light, had he lived, to European learning."[6] Perhaps it is time Indian researchers examine the extraordinary legacy of William Roxburgh's life's work with fresh eyes and explore further the possibilities of using India's botanical riches for the country's benefit.

ACKNOWLEDGEMENTS

The SUTRA conference and exhibitions were possible because of Amrita Mukerji's tireless efforts in insisting that William Roxburgh's albums and other material from the BSI needed to be brought to the attention of the public. Jenny Balfour-Paul enthusiastically became the de facto editor for the exhibitions while S. Girikumar safely mounted the exhibits. Ujjayini Dasgupta, Bappaditya Biswas and Chitra Sarkar along with the SUTRA team enabled a successful realization of both exhibitions. The important work of the BSI in safeguarding William Roxburgh's albums and other materials was brought home to us during interactions with Dr M. Sanjappa and Mr P. Lakshminarasimhan at the Central National Herbarium. Their enthusiasm in freely sharing important details from the BSI archives enabled me to initiate my research on this project.

NOTES

1 Maria Graham, *Journal of a Residence in India,* Edinburgh: Archibald Constable and Company, 1812, entry for November 30, 1810.

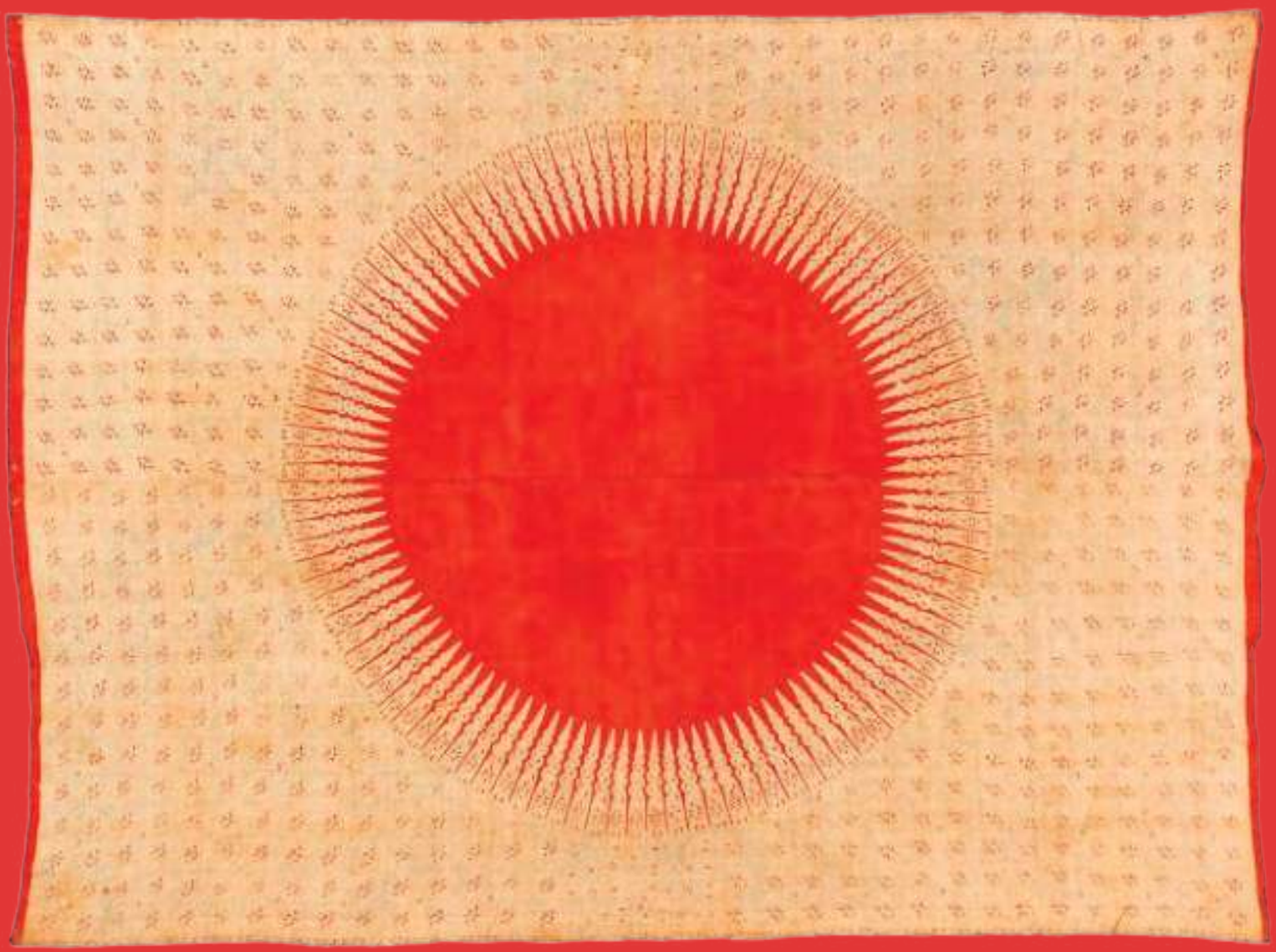
2 For an overview of Mughal paintings of flowers, see A.K. Das, "Mansur's Flower Paintings", in *Wonders of Nature: Ustad Mansur at the Mughal Court*, Mumbai: The Marg Foundation, 2012.

3 Henry Noltie, *The Dapuri Drawings: Alexander Gibson & The Bombay Botanic Garden*, Ahmedabad and Edinburgh: Mapin Publishing in association with the Royal Botanic Garden Edinburgh, 2002.

4 T.F. Robinson, "William Roxburgh (1751–1815)", The University of Edinburgh, College of Humanities and Social Science, June 2003, p. 265. http://hdl.handle.net/1842/405

5 *Transactions of the Society for the Encouragement of Arts, Manufacturers, and Commerce*, 23, 1805, p. 407 and 32, 1814, p. 207.

6 Anon., "Obituary", *Asiatic Journal and Monthly Register*, 1, 1816, pp. 28–30.

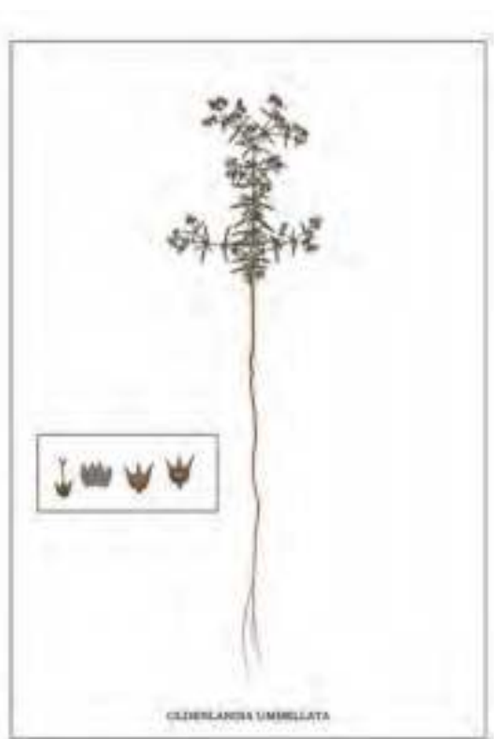


1

Textile with sunburst motif, Coromandel Coast, late 18th century (radiocarbon dated 1779–99). Cotton, resist drawn, mordant painted and dyed; 203.4 x 269.6 cm. Photograph courtesy Asian Civilisations Museum, Singapore. 2009-02135.

Bessie Cecil

Chay Red: Forgotten Dye of the Coromandel Coast



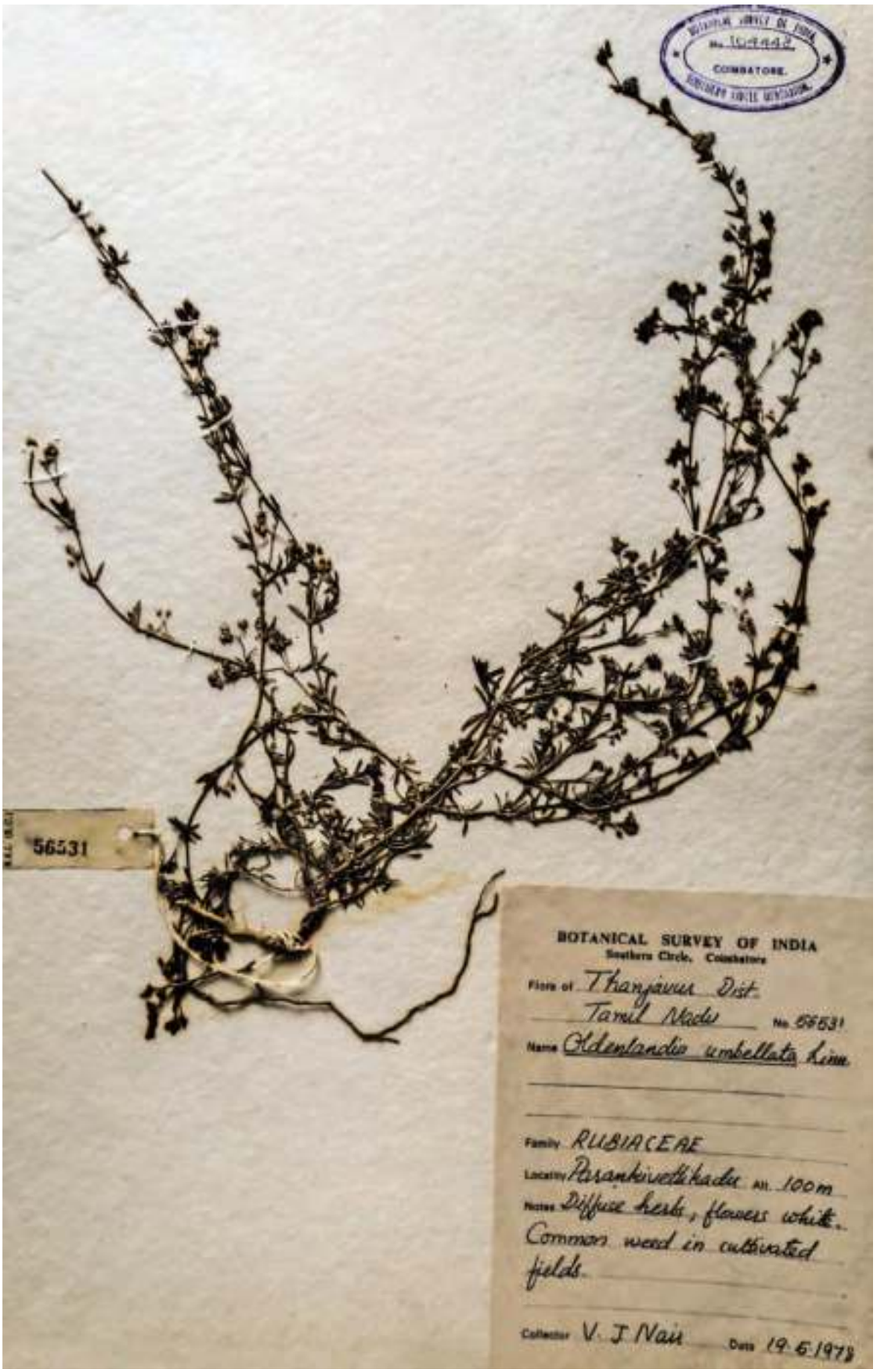
2

Illustration of *Oldenlandia umbellata* in *Plants of the Coast of Coromandel* by William Roxburgh, 1795.

The high reputation of the much sought-after cotton painted cloths of the Coromandel Coast was commonly attributed to the quality of the red dye from the root of the historic dye-yielding plant *Oldenlandia umbellata* Linn., Rubiaceae,[1] commonly known as Chay, chayaver (chaya/saya = colour, ver = root), or Indian Madder. Chay is also referred to as East Indian Madder and *Ostindischer Krapp*.[2] Chay-root produces various shades of red depending on the strength of the chemical alum that fixes dye onto fibre in a process known as mordant-dyeing. References in literature to dyeing and painting cloth with chay-root appear from the 17th to 19th century. However, extant painted textiles that were traded to Southeast Asia from the Coromandel Coast pre-date 17th-century written records. With the introduction of aniline dyes in the mid-19th century, the use and knowledge of dyeing with natural dyes declined over time.

Chay, a common biennial plant found in Burma (Myanmar), India and Ceylon (Sri Lanka), thrives on sandy soil. It grows wild, abundantly, in the Puri district of Orissa (Odisha) and in Bengal (Bangladesh and West Bengal) and was extensively cultivated on the Malabar and Coromandel Coasts. Although the plant was widespread in some parts of Bengal and Puri, it was not employed as a dye there but a considerable trade existed for chay-roots,[3] the chief market being Madras (Chennai).[4]

Chay-roots are usually about 10–12 inches long and 1/8 inch thick, somewhat straight, stiff, tough and wiry and with few or no lateral fibres (figures 2–4). When fresh, they have an orange colour; but when dried and stored, they assume a yellowish-grey hue. Boiling them in water gives a pale yellow extract, but if alkali is added a blood-red decoction is soon obtained. The colouring principles seem to reside chiefly, if not entirely, in the bark of the root.[5] The main colouring component of chay is alizarin and a distinguishing characteristic is the lack of secondary colorant on a fibre dyed in chay, though other components may be found in the dyeing liquor.[6]



3

Herbarium sample of *Oldenlandia umbellata*, Botanical Survey of India, Coimbatore. Photograph: V.R. Sai Darshan.

The cotton painted textiles of the Coromandel Coast popularly known as chintz, palampore or pintados, are finely drawn with wax resist – known in Tamil as mezhuguezhuthu (mezhugu= wax, ezhutu=writing)[7] – with a predominant use of chay red and indigo blue dyes. Extant painted textiles with chay provide fine examples of its richness and evidence of the knowledge of dyeing among the textile-producing community. Details of the processes of Coromandel Coast painted cotton textiles using chay-root dye have been described in a number of eyewitness records. There are inconsistencies in these accounts, partly due to misunderstandings of observation and partly due to regional variations of practice and of materials locally available.[8]

The primary purpose of European documentation of chay-root mordant-dyeing techniques was to emulate the methods in their respective countries; however, they never succeeded. George Watt mentions that "Chay-root rapidly deteriorates when kept in a dark place, such as the hold of a ship, whence probably the want of success that has attended at dyeing with it in Great Britain."[9] William Roxburgh wrote: "I have tried various experiments to enable me to dye red with this root (I may say two or three hundred) in a more expeditious and less troublesome way than what the natives follow, but all with no satisfactory success."[10]

William Methwold, who served as an agent for the English East India Company at Masulipatam (Masulipatnam) between 1618 and 1622, explained that this superiority derived from: "a plant which growth only in this country (Golconda), called by them Chay, which dyeth and stayeth a perfect red, with them in as great account as scarlet with us…",[11] and "…no other place affords the like colour".[12] John Irwin and Katharine Brett comment that Methwold was incorrect in saying that the chay plant grew only in Golconda as it was widely cultivated on the Madras (Coromandel) Coast. What distinguished the chay of Golconda was that in this region it grew wild on the tidal flats of the Kistna (Krishna) delta, where the estuarine soil contained a high proportion of broken or rotten shells. These were a rich source of calcium, recognized as a unique fixing agent for madder-type dyes.[13] In spite of the superior and distinctive qualities of Northern (Golconda) chay compared to Southern (Madras) chay, it is not possible to assume that all chintz with the best reds were necessarily of the Northern region. The quality of the dyestuff varies from region to region, as do the properties of water.

The chemistry of fixing chay red onto cotton was only known to the dyers of the Coromandel Coast, who were well aware that it could not be fixed on silk. Hendrick Adrian van Rheed wrote: "I have always been surprised about the beautiful colours which are produced here on the cloth with white backgrounds and have often wondered whether this could be done also in silk fabrics."[14] The study of Perkin and Hummel explains the chemistry of dyeing with chay[15] and how deep-red develops with an alkaline mordant. Cotton can withstand alkaline dyeing whereas high alkalinity will weaken or even disintegrate silk fabric. This explains why the intricately painted textiles were always of cotton and not of silk.

The origin of chay and of mordant-dyeing is currently unknown. The destructive nature of the monsoon climate has, unfortunately, erased from India nearly all material

4

Oldenlandia umbellata in the wild, Women's Christian College Campus, Chennai. Photograph: V.R. Sai Darshan.

5

Textile with cockerel motif, Coromandel Coast, c. late 16th–early 17th century. Cotton, resist drawn, mordant painted and dyed; 111.8 x 391.2 cm. Photograph courtesy Asian Civilisations Museum, Singapore. 2009-02041.

evidence of textiles preceding the 16th century. It is therefore impossible to trace the stages by which India developed the basic technique of mordant- and resist-dyeing to the sophisticated level of painting on cotton fabric.

Chay dye first attracted the special attention of A.G. Perkin[16] and J.J. Hummel during the colonial and Indian Exhibition held in London in 1886. A small sample was then obtained from George Watt who was in charge of the Economic Court and preliminary dyeing experiments indicated that it might well be worth a detailed chemical examination. Ultimately larger samples were obtained from India, through the kindness of W. Reid of Bombay, R.O. Campbell and Binny and Co. of Madras in 1893 so that exhaustive chemical analyses could be carried out.[17]

Scientific analysis of identifying chay dye on historic textiles was carried out at the Calico Museum of Textiles,[18] India in 1988, the Victoria and Albert Museum, London[19] in 1993 and the Kelsey Museum, United States[20] also in 1993. In 2011, the extant cotton painted textiles that were traded from the Coromandel Coast to Southeast Asia, now in the collection of Asian Civilisations Museum, Singapore, were also analysed and the results verify the use of chay dye (figures 1 and 5).[21]

Though the art of dyeing with chay-root declined by the end of the 19th century, research on reviving chay dye is ongoing. Extraction of dye from chay-root has been successful at laboratory level;[22] however fixing the extracted dye onto cotton cloth still remains a challenge.[23]

ACKNOWLEDGEMENTS

Amrita Mukerji, SUTRA, Kolkata, for encouraging me to write this essay on chay dye. Lynda Hillyer, Former Head of Textiles Section, Conservation Department, Victoria and Albert Museum, London, who helped getting reference material from London and Sherrie Jesulyn David, Assistant Professor, Department of Botany, Women's Christian College, Chennai, for helping in identifying a live plant of *Oldenlandia umbellata* in the wild.

NOTES

1 A.G. Perkin and J.J. Hummel, "The Colouring and Other Principles Contained in Chay Root", *Journal of Chemical Society*, LXXXVIII, 63, 1893, p. 1160.

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4 Perkin and Hummel, 1893, p. 1161.

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6 Barnes, 1993, p. 94.

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12 Letter from Masulipatam Factors dated October 25, 1634, in William Foster (ed.), *English Factories in India*, Vol. V: 1634–36, Oxford: The Clarendon Press, 1911, p. 46.

13 Irwin and Brett, 1970, p. 10.

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15 Perkin and Hummel, 1893, p. 1160.

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21 Analysis unpublished, Asian Civilisations Museum, Singapore.

22 L. Siva Ramamoorthy, Sean Mayes, Shuvra Kanta Behera, C. Rajasekaran, "Anthraquinones Dye Production Using Root Cultures of *Oldenlandia umbellata* L.", *Industrial Crops and Products*, 37, 1, 2012, p. 415.

23 Experiments in extracting the dye from the chay root and fixing the extracted dye onto cotton cloth were carried out by L. Siva Ramamoorthy in the laboratory at the Vellore Institute of Technology, Tamil Nadu, 2013.

The Revival of Natural Dyes

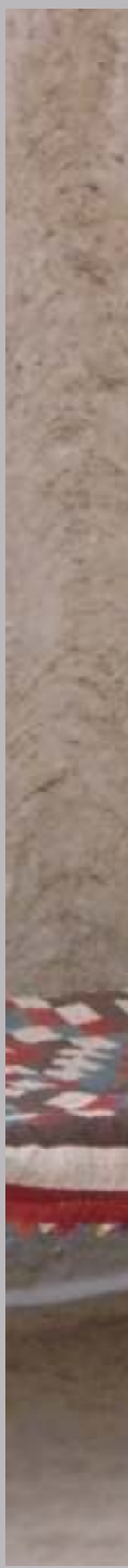
Jasleen Dhamija in Conversation with Monisha Ahmed

Jasleen Dhamija is a pioneer in the research and revival of the arts and crafts in India, more specifically the textile traditions of the country. Born in Abbotabad (now in Pakistan) in 1933, her family moved to Delhi when she was seven years old and the city has been Jasleen's home ever since.

After graduating from Miranda House, Delhi she started working with Kamaladevi Chattopadhyay for the initiation of the movement to reinvigorate the living cultural traditions of India, at the behest of India's first Prime Minister, Jawaharlal Nehru. In the wake of Independence, India was keen to revive all that the British had tried to destroy, especially the production of handloom products. Kamaladevi headed the newly formed Handloom and Handicrafts Board and Jasleen worked closely with her. During this time Jasleen travelled throughout the country meeting a range of craftspeople including weavers, dyers, printers and metalworkers amongst a host of others. The aim was to revive lost crafts, look at product development and ensure a stable and sustainable market for craftspeople. After all, this field gave employment to millions, nearly half the workforce in India. Apart from focusing on the development of the handicraft and handloom industry, Jasleen worked and researched in developing the folk and performing arts, community development and women's employment.

Jasleen has also worked extensively in Africa, Iran and Central Asia as a cultural advisor and consultant for UNDP (United Nations Development Fund). She is the author of several books on crafts and textiles, including some published by Marg – her first contribution to Marg was on embroidery and textiles in 1964, and she was also the editor of this issue. During 1964–74, she was one of Marg's Contributing Editors. She has curated several exhibitions, her most recent being "Power Cloths of the Commonwealth" for the Commonwealth Games in Melbourne (2006) and New Delhi (2010). Today, she is acknowledged internationally as a philosopher of living cultural traditions, and she writes, lectures and advises national and international organizations. Her latest appointment is as Chairman of the Committee for Handlooms Development for the 12th Five Year Plan of the Planning Commission, Government of India.

Jasleen Dhamija was the keynote speaker at SUTRA's conference on Natural Dyes, the precursor to this special issue on the subject. Monisha Ahmed, Marg's Associate Editor, engages Jasleen in a conversation specifically on natural dyes in India and her contribution to promoting this field and its future.



1

Jasleen Dhamija in a natural dyed sari from Bhagalpur, Bihar. Photograph: Monisha Ahmed, Bhuj, November 2009.

MA: India, as we well know, has a long history of natural dyes. How far back does this extend and what are some of the earliest examples?

JD: It is believed that India had mastered the art of dyeing from very ancient times, and it is also believed that this was where the resist-printing techniques originated. A Greek physician mentions the presence of patterned Indian fabrics in Samarkand in 500 BCE. The presence of dye vats at Lothal, a Harappan site, is an indicator of the knowledge of dyeing with the use of mordants. A fragment of dyed cotton was found in Harappa with vestiges of mordant dyes; it was clinging to a silver jar. Thus we have proof that dyeing cotton with permanent colours was known in India from the time of one of the earliest civilizations in the world.

MA: There has always been a certain element of secrecy and mystery associated with dyeing. Is that true, does that hamper efforts to work in the field?

JD: The art of dyeing has always been linked with alchemy, with magic, with transformation, with the mystery of the unknown. This characteristic image of dyeing is reflected in the practitioners. The dyer was an alchemist, who collected herbs, roots, scales of insects and natural minerals with which he would transform a plain cloth of cotton, wool or spun and woven silk into a myriad colours. The most mysterious of all dyes was indigo because it transformed the yarn or the fabric; it emerged from the dye pot yellowish in colour and slowly the blue developed as it was exposed to the air.

Did the image of dyer as alchemist get in the way? Well, yes and no. Success lay in realizing that dyeing was part of a cultural tradition rather than alchemy or a mere list of ingredients and their quantities. Dyeing was a serious way of life and it immersed people totally.

2

Jasleen Dhamija in conversation with Monisha Ahmed at the Sanskriti Museum, New Delhi, March 2013. Dhamija is wearing an indigo-dyed ilkali sari from Karnataka. Photograph: Tsering Wangchuk Fargo.

3

At the National Awards ceremony for master craftsmen, Jasleen Dhamija introduces the awardees to Prime Minister Indira Gandhi, New Delhi, 1969. The scheme to give National Awards to craftspeople in recognition of their work was initiated by Dhamija. Photograph courtesy Jasleen Dhamija.

MA: When you first started working in the craft sector with Kamaladevi Chattopadhyay what was the contribution you made specifically to the revival of natural dyes in the country?

JD: I started working in the area of handicrafts and handlooms with Kamaladevi Chattopadhyay in the 1950s; actually it was on November 15, 1954, a date I will never forget. One of the first projects we worked on was the revival of Indian textiles. The Handicrafts Board had set up a miniature design centre and I was asked to initiate the work for it. This involved development of handicrafts and cottage industries, community development etc.…it was all something totally new, unheard of at that time. In the West they thought of cottage industries and handicrafts as a welfare measure; for instance they saw it as destitute women being taught to embroider and knit and that kind of thing. Nobody thought of it in the way we did. Not just the revival of crafts but the revival of cultural traditions, living traditions that gave employment to thousands of people in India. We realized that the honing of skills involves not only working with the hands, but also dealing with abstract concepts and ideas, and that living cultural traditions, such as those of India, impact on the life/community and creative expression of people at multiple levels. So the initial work we did was not only to revive many of the traditions we were losing but also to make them affordable and usable for the modern-day consumer.

4

Jamil Bhai Khatri stirs his indigo vat, Kutch. It was his father Mohammad Bhai who was encouraged by Kamaladevi Chattopadhyay and Jasleen Dhamija to revive the use of natural dyes in ajrakh. Photograph: Monisha Ahmed.

MA: At the time you started working did you find natural dyes were being used or that much of the knowledge was already lost?

JD: One of the things we were losing was the use of natural dyes. Kamaladevi Chattopadhyay was a very farsighted woman and she said we must start trying to revive and collect information on natural dyes. She asked Rukmini Devi Arundale at Kalakshetra [in Chennai] to set up a Natural Dye Research Centre and to invite researchers, chemists and others to work on the science and revival of the dyes. One of the people who joined the research centre and did fantastic work was Mr K.V. Chandramouli. He made a significant contribution in India and later went to Bangladesh and started the dye research centre there. What Mr Chandramouli and the other scientists did was to collect as much information as they possibly could on natural dyes that were still known, breaking down the ingredients and the processes, and writing up the recipes.

MA: Were they able to easily find this kind of information?

JD: Yes, we slowly discovered that natural dyes were still being used in remote parts of the country where certain traditions were being maintained that demanded their use. We found traditions alive in Dharwar, Hubli and other parts of Karnataka and Maharashtra where the bride's sari had to have the warp dyed in indigo and was known as "Chandra Kali", it was a beautiful blue-black. It was considered auspicious for a bride to wear such a sari. In remote parts of the Himalaya, in the Northeast and Assam, too, natural dyes were a part of life.

The other very interesting thing was that some of the vegetable dyes, for instance indigo, are also used to make Ayurvedic medicines because of their unique properties. Since Ayurvedic medicines continued to be made at that time and texts existed, we also referred to them to find references to natural dyes that we could use.

So this was our beginning. It was a long drawn out process because first you had to find the recipe, then the ingredients had to be tested for colour-fastness, and then we had to work out how the recipes worked and what quantities we should use. It was difficult because, as you know, when you are using a natural-based material, unlike a synthetic substance, it is hard to measure accurately. There are also other variations that have to be taken into account such as the season, the soil and various other elements that are important for intensity of colour.

MA: But did you find at that time there were less natural dye practitioners than today*?*

JD: Absolutely. There were hardly any. And the few that were there were those connected with upholding certain religious or cultural practices, as I've already mentioned. Then there were those who were involved with kalamkari [hand-painted fabric] and we were also able to learn from them.

MA: Coming back to religious beliefs or cultural practices – do you think that when we stopped making natural dyes or lost some of the recipes, then we also lost those practices?

JD: Colour symbolism has always been important in India. I think practices continued even in many cases where natural dyes were replaced by synthetic dyes. But in other cases we lost the intensity of the colour and perhaps with that the meaning got diluted at times, though not always. Take red for instance – it symbolized Shakti, Power. We lost the ability to get a really bright red from vegetable dyes a long time ago. But that didn't mean the actual colour lost its meaning or significance.

So the meaning and significance remained, but not the use of natural dyes. It was quite an uphill task to revive it.

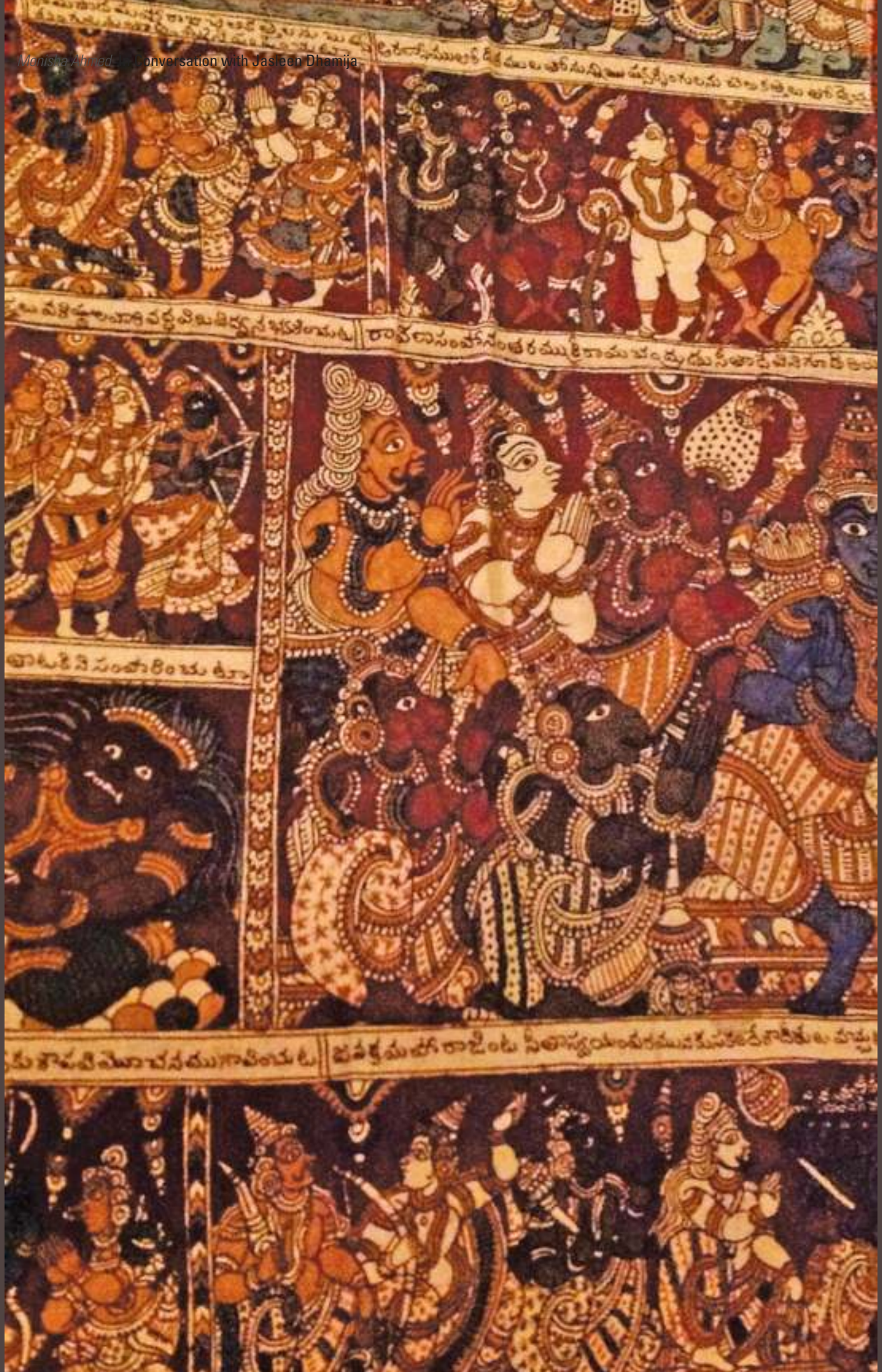
MA: Coming back to the Dye Research Centre that was set up, how successful was it?

JD: Unfortunately, in the early 1950s soon after the Handloom and Handicrafts Board was set up, Morarji Desai [then minister], at the intervention of Pupul Jayakar, divided it into two boards. Kamaladevi was appointed as Chairperson of the Handicrafts Board, and Pupul took over the Handlooms section. The Handicrafts Board found it very difficult to get funding from the government and the census did not give information on crafts. The planners had a very negative attitude to the importance of crafts. Later Kamaladevi was removed from the Chairmanship of the Handicrafts Board. And Pupul was put in charge.

Pupul did not support the revival of natural dyes. The Natural Dye Research Centre was moved out of Kalakshetra to become part of the Design Centre at Bangalore, cutbacks were made and it was marginalized. Fortunately at times bureaucracy helps, because they couldn't close it down! And then, as luck would have it, Ruby Ghuznavi decided to work on natural dyes in Bangladesh. She saw the work being done at Bangalore and was so inspired by it that she invited Chandramouli to Bangladesh and the two of them set up a training centre there. The funny thing was that designers from India went to Bangladesh to study natural dyes under Chandramouli and then came back to India where many of them started their own natural dye units. Ruby also held the first exhibition of natural dyed fabrics at the Central Cottage Industries in Delhi in 1984. This was primarily jamdani and kantha saris of Bangladesh but also included some shawls and dupattas. It was a great success and Ruby sold every piece in spite of the exorbitant import duty at that time.

5

A detail from the pallav of an indigo-dyed sari from Machilipatnam, one of the saris made by Mr Naidu. Collection: Jasleen Dhamija. Photograph: Apeni George.



MA: So a lack of interest among those in power led also to India's loss?

JD: Well yes, the attitude of various people who were then in power, such as Pupul Jayakar and Martand Singh who felt that vegetable dyes had no future and therefore it was being sentimental to try to revive them, that it was a waste of time, finances and energy.

But fortunately the momentum of the revival and the work done towards it could not be stopped. Some amount of work was done in other centres and there was hope in these places. For instance in Machilipatnam there was one Mr Naidu who ran a kalamkari cooperative society where they had preserved a very old, maybe 100-year-old, indigo pot that was used to ferment indigo. It was because of individuals such as Mr Naidu that we believed that natural dyes had a future and needed to be kept alive as far as possible. So Mr Naidu was given funding from the Handicrafts Board and encouraged to continue his work. Then there was the Bombay-based designer Nelly Sethna, who went and dug up old printing blocks which were actually based on the Isfahani patterns that used to be made in the 19th century in Iran, and used these to revive natural dyed kalamkari. That was a beginning and today the kalamkari of Machilipatnam, which is a combination of painting and printing, and uses natural dyes such as indigo and iron oxide, is widely known. And throughout Andhra Pradesh many people depend on this craft for their livelihood.

In the same way we did work in Madhya Pradesh in the 1960s. I still remember going with Kamaladevi in search of old printing houses, which was so extraordinary and exciting. We arrived late in a remote village and in the evening light we saw a huge six-foot-high clay indigo dye pot that the villagers were using. We asked them where it was from but they only said "We don't know, it has been with us for generations."

They were actually two villages known as Tarapore and Ubedpura and between them ran the river called – what a poetic name – Gandheri Gujari. And I remember Kamaladevi made the villagers bring out a charpoy and we sat and saw them working on the sand doing indigo printing for the Bhils. The design was indigo dyed with resist printing in red, yellow and green. This was applied on the thick cotton worn by the Bhils, mostly for the women to wear as long skirts. We asked the dyers to do the same printing and dyeing techniques on kosa silk because at the time in Madhya Pradesh kosa silk was being produced in large quantities but there wasn't much of a market for it. They hesitated and said "No, the silk will get spoilt." We responded, "Don't worry, you just do it." And it turned out to be a hit. The kosa silks took the colours so beautifully; they were extremely popular and cheap. The first sari was just 38 rupees. I still have my sari from that time.

So there were pockets like this throughout the country, where people were still making and using natural dyes, and we dug them out.

MA: And people were open to sharing? Because quite often one hears about dyers being very protective about their recipes and not wanting to part with them.

JD: Yes, absolutely. The success of our previous work preceded us everywhere and encouraged people. The success of the kosa saris was one story. In the same way we went to Kutch to look at the ajrakh printing. We found Mohammad Bhai was the one

6

Section of a Kalahasti kalamkari showing a scene from the *Ramayana*. Collection: Jasleen Dhamija. Photograph: Apeni George.

7

Detail from the back of an an indigo-dyed unstitched jacket from Yunan, China. Jasleen Dhamija has collected textiles from various parts of the world, besides India. Collection: Jasleen Dhamija. Photograph: Apeni George.

person who knew how to use natural dyes and we got him to experiment and work on the revival. It was another beginning for indigo blue in one of the oldest centres of printing in the world. This is where the Fostat prints came from – the Kutch region and Sindh.

So in a similar way we went and worked throughout the country, discovering old dyeing centres and setting about reviving and promoting them. We discovered individual dyers or those who still remembered recipes and encouraged them to work. In Kalahasti we found a family which used to work on kalamkari but had not produced any work for nearly 30 years and were running a shop. We encouraged them, gave them money and started a training centre – the Kalamkari Production Training Centre. I was in charge then of this programme. It was at first very difficult to persuade them because they had never taught anybody else, they only taught themselves and their children. One of them finally agreed and today hundreds of people are doing kalamkari.

MA: Would you say you were successful? In the contemporary context today, where do you see all this?

JD: We started in the early '50s, and over the years our research yielded a rich knowledge of natural dyes. Initially it never really took off in a big way. It remained

a speciality, a niche market. But things changed when in Europe they banned many of the synthetic dyes and chemical processes harmful to the environment and to the wearer because of greater awareness about the ecological impact. People realized the importance of natural dyes – for instance fabric dyed with natural indigo contains healing properties for the skin. And for the survival of the printing industry natural dyes suddenly became important again. So, I would say that today natural dyes have come into their own.

MA: But natural dyed fabric or finished products are still not so popular with the larger population, they are still sold to a more educated, aware client, aren't they? So it is still a niche market.

JD: Yes, they are still largely sold through speciality boutiques, export houses, bought by well known houses of textiles abroad as well as handicraft fairs and dastakar [craftspeople] bazaars. I suppose to make large quantities of natural dyed fabric is difficult…but there are people who are doing it. You see natural dyeing of yardage material for garments is now being processed in factories. Dye houses have been set up as an industry. People are using natural dyes and keeping methods a secret. You aren't allowed in because they are dyeing for export, both yarn as well as yardage. Recently I was invited by a confederation of weavers' cooperatives in Bengal to organize a workshop on skill training and designing as well as natural dyes. It was interesting that the factory which manufactured natural dyes came to teach the weavers so that they could set up a natural dye workshop and buy the natural dyes from them. This is an innovation from the earlier process when the dyers grew the material, collected the ingredients and then began the long drawn out process of making the dyes.

In any case, this is a changing world and a lot of innovation is happening. Fewer centres are practising block-printing since it is laborious and it takes a long time. A lot of centres have introduced screen-printing and for the uninitiated there is no difference. Some special dyers and printers have innovated by using the dyes in a way that would mix screen-printing and block-printing. They have got very interesting effects. Some of the entrepreneurs from the old printing families have become extremely successful and innovative, they are creating extraordinary effects which appear to be graphic and abstract landscapes, they are able to sell these to certain elite buyers but they also create a new dimension in the successful use of old traditions and innovation.

Kanika Mukerji

Ajit Kumar Das: Using Natural Dyes in Art

The use of natural dyes is comparatively rare in contemporary Indian art. Perhaps this is because few artists today have a thorough understanding of the ancient knowledge of dyeing with plant and mineral substances, and this is reflected in their choice of materials. While working with natural dyes might seem an intuitive choice for an artist, it requires skills carefully cultivated over a lifetime, combined with a quiet mind and monk-like dedication. Ajit Kumar Das is an artist who has committed himself to the practice of working with natural materials on cloth, breathing out a sensitive art that resonates deeply with the viewer. Experiencing works that use colours derived from barks, leaves, roots and minerals is soothing to the eyes and this elicits a response that sets Das's art apart. Like a soothsayer from another time, this unusual artist who lives in Kolkata, West Bengal makes art that subtly imparts the significance of nature, using colours, imagery and symbolism that are deeply rooted in personal meaning and experience (figure 1).

2

Padma (Lotus), by Ajit Kumar Das. Painting in dyes of pomegranate rind, myrobalan, turmeric, black, catechu, madder and indigo with alum as mordant; 124 x 105 cm. Private collection. Photograph: Michael Hsien.

1

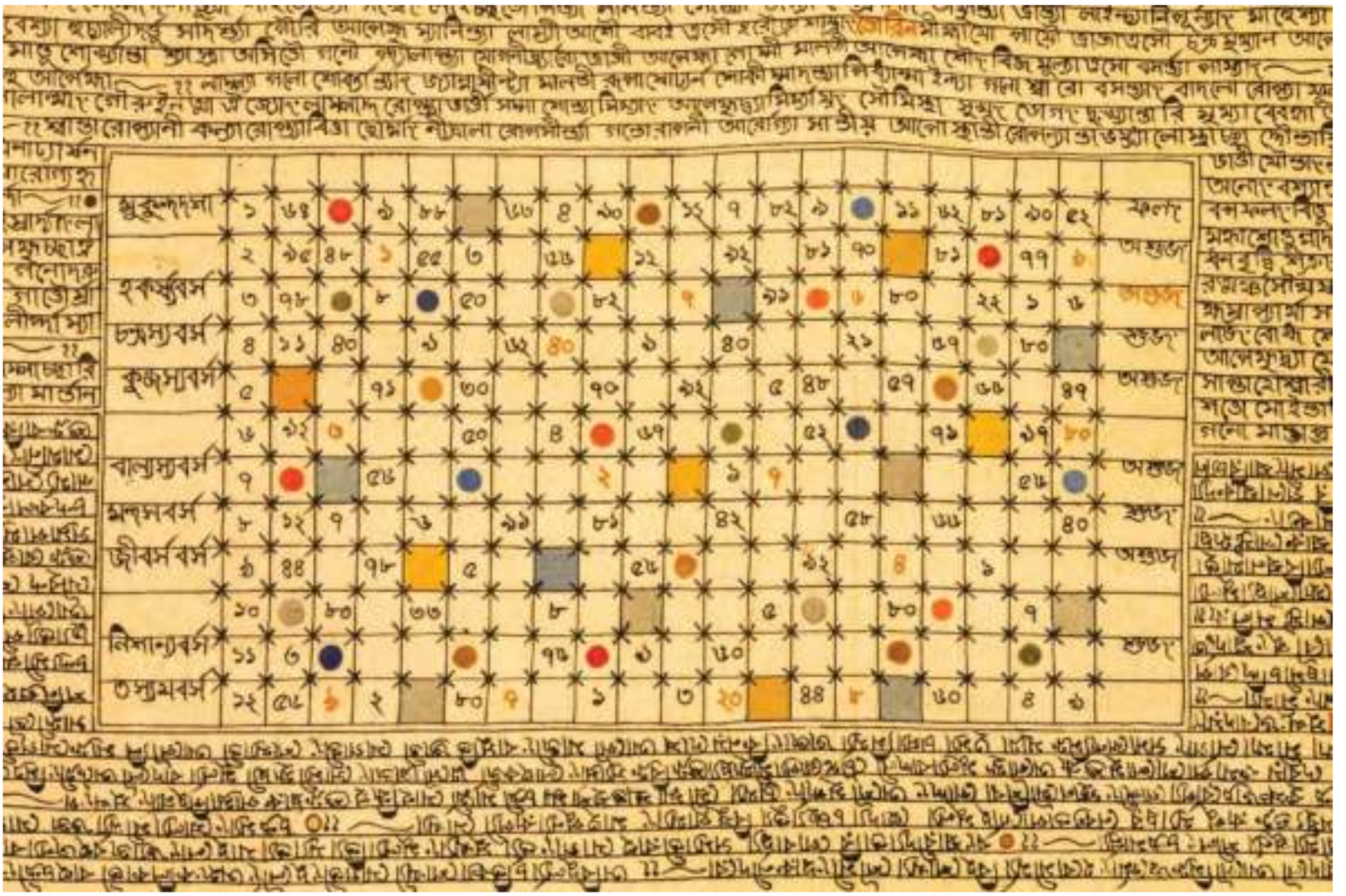
Artist Ajit Kumar Das at work. Photograph courtesy Tania Karmakar.

3 *left*

Gabhi Kunjan (Cows), by Ajit Kumar Das. Painting in dyes of pomegranate rind, myrobalan, turmeric, black, catechu, madder and indigo with alum as mordant; 178 x 129 cm. Private collection. Photograph: Michael Hsien.

4

Gabhi Kunjan (Cows), by Ajit Kumar Das. Painting in dyes of pomegranate rind, myrobalan, turmeric, black, catechu, madder and indigo with alum as mordant; 170 x 224 cm. Private collection. Photograph: Michael Hsien.



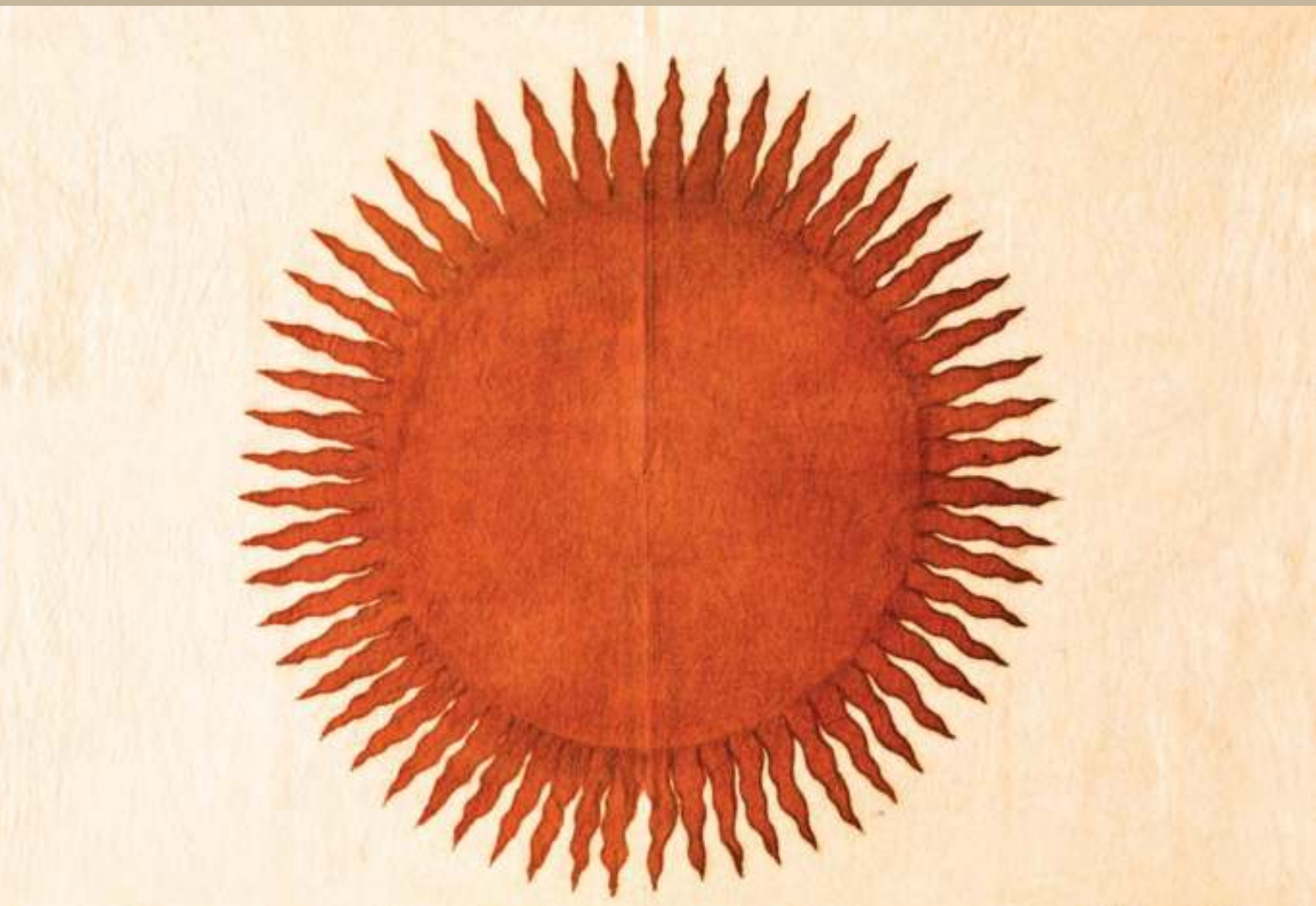
Born in 1957 into a family of dyers and washerfolk in Tripura, northeast India, Das imbibed the techniques of bleaching and dyeing from an early age. He recalls his father using annatto (*Bixa orellana*) to dye the clothes of Vaishnav ascetics a traditional orange-yellow, and he also reminisces about making his own toys from discarded bamboo sticks and clay. Circumstances grounded him and made him aware of easily available natural resources. Financial constraints meant he never finished school, since he had to earn money to help his family make ends meet. His earliest job as a printer, however, taught him skills that eventually led him to the Weavers Service Centre in Ahmedabad. Here he worked closely with the artists Tonsuk Mahicha, Gautam Vaghela and a highly skilled block-printer called Manik Lal Gajjar. During his time in Ahmedabad, Das saw pieces created for the Festival of India's series of *Viswakarma* exhibitions held in London between 1981 and 1990. The great "Tree of Life" textiles, made in Andhra Pradesh with a combination of block-printing and hand-painting in natural dyes, inspired him to paint his own versions. Artist Riten Mazumdar's approach was another important inspiration, but it was Martand Singh who first encouraged Das to think like an artist. According to Das, Singh's gentle encouragement and advice proved to be a turning point in his development into one of India's rare natural dye artists.

5

Rasi Chakra (Horoscope), by Ajit Kumar Das. Painting in dyes of pomegranate rind, myrobalan, turmeric, black, catechu, babul bark, goran bark, madder and indigo with alum as mordant; 158 x 194 cm. Private collection. Photograph: Michael Hsien.

6

Prosthor (Stone), by Ajit Kumar Das. Painting in dyes of pomegranate rind, myrobalan, turmeric, black, catechu, madder and indigo with alum as mordant; 186 x 120 cm. Private collection. Photograph: Michael Hsien.



7

Surya (Sun), by Ajit Kumar Das. Painting in dyes of myrobalan, black and madder with alum as mordant; 59 x 82 cm. Private collection. Photograph: Michael Hsien.

The palette of colours obtained directly from nature makes Das's work immediately unique and arresting. His paintings are categorized into a number of series, each interconnected in their use of colour, subject matter and spiritual significance.

Rasi Chakra (Horoscope), one of the earliest of his Astrology series, drew inspiration from the Vedic horoscope as well as Tantric religious art (figure 5). Also inspired by his own natal chart drawn up by a local astrologer, Das takes symbols and calligraphy as a starting point for these works. Another painting, *Nava-graha* (literally meaning "nine influencers" in Sanskrit), refers to the outer cosmic influences that can affect living beings on earth. Also from his earlier series is *Gabhi Kunjan* (figures 3 and 4). Reminiscent of cow images found on the pichhwais (cloth paintings) that hang in temple shrines, Das's cows are more abstract; fine black outlines and pure shades of natural colours. The cow paintings exude the simplicity with which he approaches all his work. Das pays tribute to the cow, revered as a holy animal in

India, as a kind of mother (matri); she provides mankind with essential nourishment (milk, ghee, yoghurt) as well as fuel from cowdung. In Das's *Bihakul* (Birds, figure 8) and *Mashagushti* (Fish) series, we see family representations and likewise a specific reference to "mother and child" and fertility. Their depiction is both literal and spiritual. True skill in the art of natural dyes is revealed in this collection – in the range of colours Das chooses and in his fearless attempts to represent nature's magnificent details. In the *Matri-shakti* series, Das idolizes the feminine force and combines the ideal of the mother with the expression of divine female energy (shakti) to convey ideas of procreation, fertility and creativity. The triangle (known as the yoni yantra in Tantric worship) is found in these paintings as a central motif, often placed within the womb of a fish within another fish. In most of the works in this series Das has hand-scribed words in neat Bengali script taken from religious mantras, which encircle the paintings.

A more recent addition to the collection is the *Padma* (Lotus) series. The lotus flower is a significant motif in Hindu mythology. Spiritually the unfolding petals of the lotus suggest the expansion of the soul. In one painting, unopened lotus heads placed in the lower left corner sit graphically against a background of layered lotus leaves in water, suggesting that Das is once again conveying a spiritual perspective and not a naturalistic one (figure 2). The *Prosthor* (Stones) series is Das's latest and though in keeping with spiritual concepts of family and matri shakti, reveals a marked shift from the more literal symbolism of earlier work inspired by astrological charts and tantric symbols (figure 6). Very strongly connected to the earth, in this non-representational series Das is exploring visual texture.

In his daily work with natural dyes, Das finds it impossible to exactly replicate colours. It is hard to secure a steady supply of pure dyestuffs all year round and ensure they are not contaminated by other plant material. He usually buys his dye materials from natural medicine sellers at wholesale city markets who supply the same roots and bark for healing common ailments. He grinds them into powder by hand at home, then boils them up to extract the colours. The whole process requires patience, commitment and a foraging nature, likening Das to a modern-day "hunter-gatherer". He finds the climatic conditions from January to May to be most conducive to working with natural dyes. Though not all natural dyes are colour- and light-fast, their intrinsic beauty and hues continue to inspire him to work with them.

Like his father, Das uses a cowdung and leaf-ash mixture to bleach and prepare the cloth for dyeing. The cloth has also to be soaked in pure cow's milk before Das can draw on it with his handmade kalam or pen, made from bamboo wood wrapped with jute. The cow's milk prevents the drawn lines from bleeding into the cloth and enables him to achieve the manicured script characteristic of his work.

Das first dyes the cloth with myrobalan (haritaki/*Terminalia chebula*) to give each painting a base colour. The only mordant he uses in his paintings is alum (potassium aluminium sulphate). The outlines and lines of his animal paintings are done in black – made from a mixture of iron dust, jaggery, betel leaf, mahua flower and horsegram powder that has first to ferment for 25–30 days. Pomegranate rind (*Punica granatum*) and turmeric (*Curcuma longa*) give yellow, while catechu (khoyer or katha – *Acacia*

catechu), babul bark (*Acacia nilotica*) and arjun bark (*Terminalia arjuna*) yield varying shades of brown. For orange, Das uses annatto (*Bixa orellana*) and for all shades of red (light red to maroon) as in *Surya* (Sun, figure 7) he uses Indian Madder (manjistha/ *Rubia cordifolia*). Dried indigo (*Indigofera tinctoria*) cakes provide intense blues and for unique shades of green, Das mixes indigo with turmeric or pomegranate rind.

The finished paintings are rinsed and fixed in an alum solution then given a final wash with ritha (*Sapindus mukorossi*), an indigenous soapnut that when wet lathers up like shampoo and is used by rural Indian folk even today to wash their hair.

Das's art has found a serious following wherever he has exhibited. His natural dye paintings have been collected by revered institutions around the world, including the Victoria and Albert Museum, London, the World Bank, New York and the UNDPC, New Delhi as well as numerous embassies and private collectors. One particularly fine example of a horoscope painting (*Rasi Chakra*) even became the starting point for the transformation of "Babur", a Zagat-rated contemporary Indian restaurant based in Dulwich, London. In his youth, Das exhibited at such galleries as Gallery Ganesha and Lalit Kala, New Delhi; Jehangir Art Gallery, Mumbai; Nandan Gallery, Santiniketan; and Galeries Lafayette in France. More recently Das was invited to exhibit at ISEND, an international symposium and exhibition on natural dyes held in La Rochelle, France, 2011, and at the WEFT forum in Kuching, Sarawak, 2012.

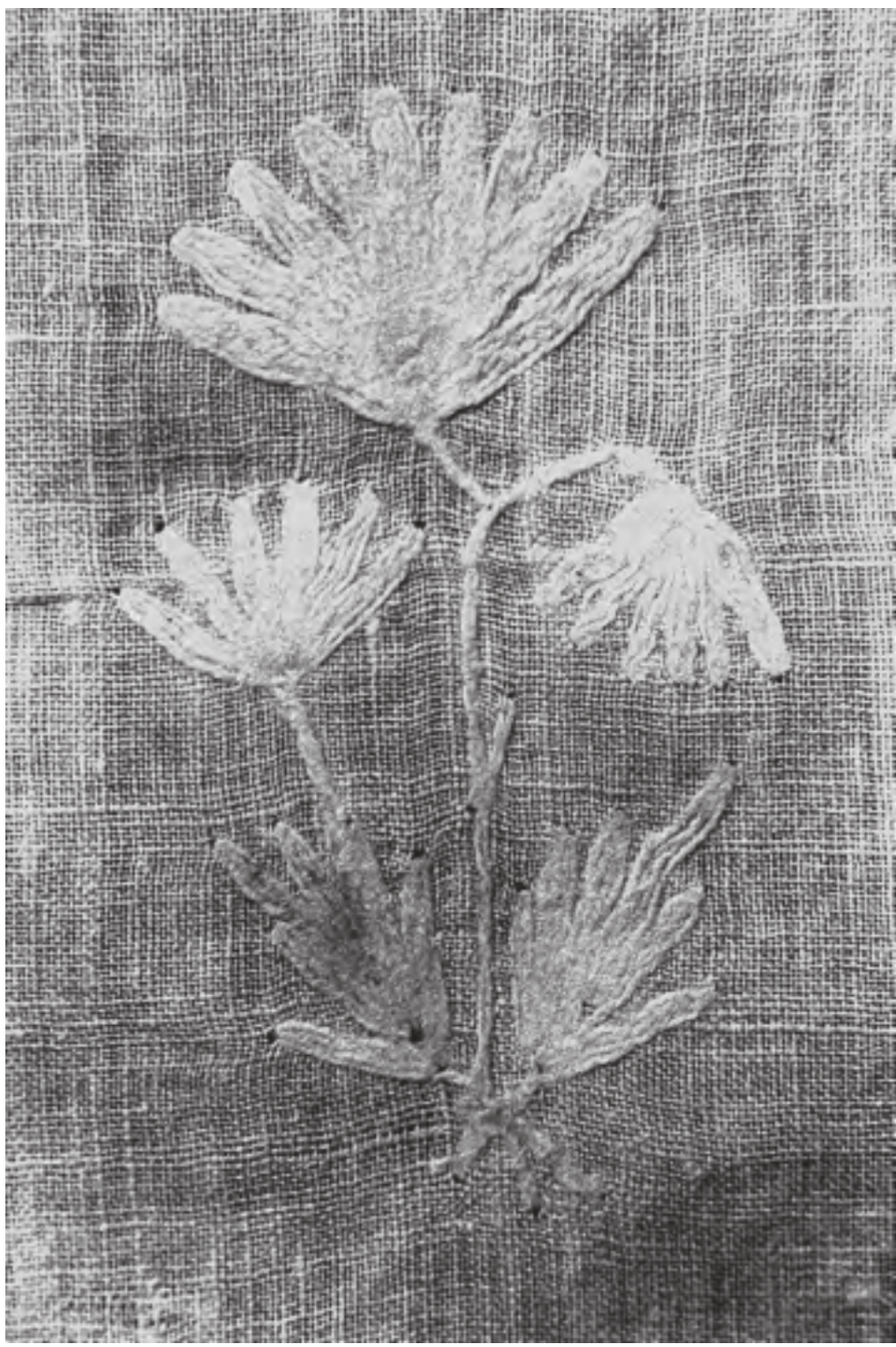
Das, however, remains a humble artist and continues to work at the Weavers Service Centre in Kolkata. On meeting him, it is apparent that he holds a reverent affection for natural dyes. Painting obsessively in the little free time his working life allows him, Das nevertheless imparts his knowledge generously to those who show interest. Today, he teaches a few people he has selected to work alongside him in his studio – this also allows further experimentation and expansion on an art he has personally nurtured, developed and made his own. He has moved into areas such as yarn dyeing and working with khadi (handspun and handwoven cotton). This results in a limited production of natural-dyed, hand-painted stoles that allows him to freely experiment with natural dyes while providing his few assistants with a much-needed livelihood. Only recently has he realized the urgent need to teach the art of natural dyeing beyond his own studio. In collaboration with SUTRA, Das has committed to various projects that will help disseminate his knowledge, including teaching the art of dyeing to a group of disadvantaged women and conducting natural dye workshops. By passing on dye methods and recipes, Das is preserving them for future generations.

8

Bihakul (Birds), by Ajit Kumar Das. Painting in dyes of pomegranate rind, myrobalan, babul bark, black and madder with alum as mordant; 72 x 50 cm. Private collection. Photograph: Michael Hsien.

Rex Cowan

Unexpected Treasures from the Sea



1

Muslin from the cargo of the *Svecia* that was wrecked in 1740. Photograph: Rex Cowan.

2

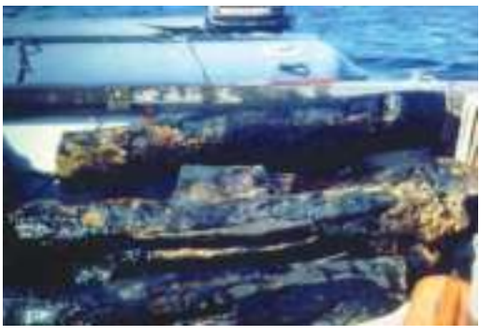
Cannons and ballast blocks from the remains of the *Svecia* (1740). Photograph: Rex Cowan.

Shipwrecks have traditionally been associated with treasure, hoards of Chinese porcelain or relics of maritime war; and with romantic and tragic tales of the loss of sailors and passengers at sea. The latter often overshadow the stories of mercantile goods. However in the last decade, historians, archaeologists and textile specialists have become increasingly interested in the discovery of dyestuffs carried as intercontinental cargo. These dyestuffs were often as valuable and sought-after as the gold and silver harvested from the Americas that fuelled the great expansions to the East. In the past no one imagined that dyestuffs might survive the trauma of a shipwreck and the disintegration processes following long immersion in salt seawater. For example, the idea that a soluble hardwood such as logwood (*Haematoxylum campechianum*) or a vegetable dyestuff like indigo (one of the most valuable of cargoes) might survive to provide a usable and even sustainable dye, was unthinkable. However, recent preparations of actual dye found in a variety of shipwrecks, and modern scientific analyses of these, have provided scientists and scholars with more information (which in turn raises more questions) about the trade, transport, packaging and scientific composition of traded dyestuffs. Expert dyers have used recovered dyestuffs to produce dye samples of high quality and variety of colour, the results of which have been aesthetically astounding.

Second only to the export of indigo from India was the trade in what has been variously called dyewood, red sandalwood, or red sanders (*Pterocarpus santalinus*). The dry deciduous forests of the Coromandel Coast, mainly in modern-day Andhra Pradesh, once hosted huge tracts of this lofty tree of durable wood whose logs were commonly traded as billets about half a metre to one metre long. In the 17th and 18th centuries Amsterdam was one of the main European centres for the manufacture of dye from this wood, which involved rasping the logs to fine sawdust. Felons in this city could choose between being sent to a filthy jail, being given a beating or being made to undertake the dirty and monotonous labour of rasping red dyewood.

It must be remembered that many of these dyestuffs had other purposes as well as colouring of textiles. Red sandalwood, for instance, was also used as a medicine, for the manufacture of musical instruments and furniture, and for burnt offerings in Hindu ceremonies.

The main discoveries of insoluble red sandalwood from India have come from the wreck sites of two East Indiamen. The *Svecia*, a heavily armed Swedish East Indiaman used by the Company mainly to trade with China, also made a few voyages to India to collect textiles and red sandalwood. In 1740 the ship was wrecked, with much loss of life, off the Scottish Orkney Island of North Ronaldsay. It carried a valuable cargo – 927 bales of Indian textiles, 18 chests of Chinese silk and, as heavy ballast to stabilize the light textile cargo, 2,000 maunds (in British India the maund was equivalent to about 37 kilograms) of *Pterocarpus santalinus*. Many of the textiles were recovered over the next two years, when bales were thrown up by the tides onto the

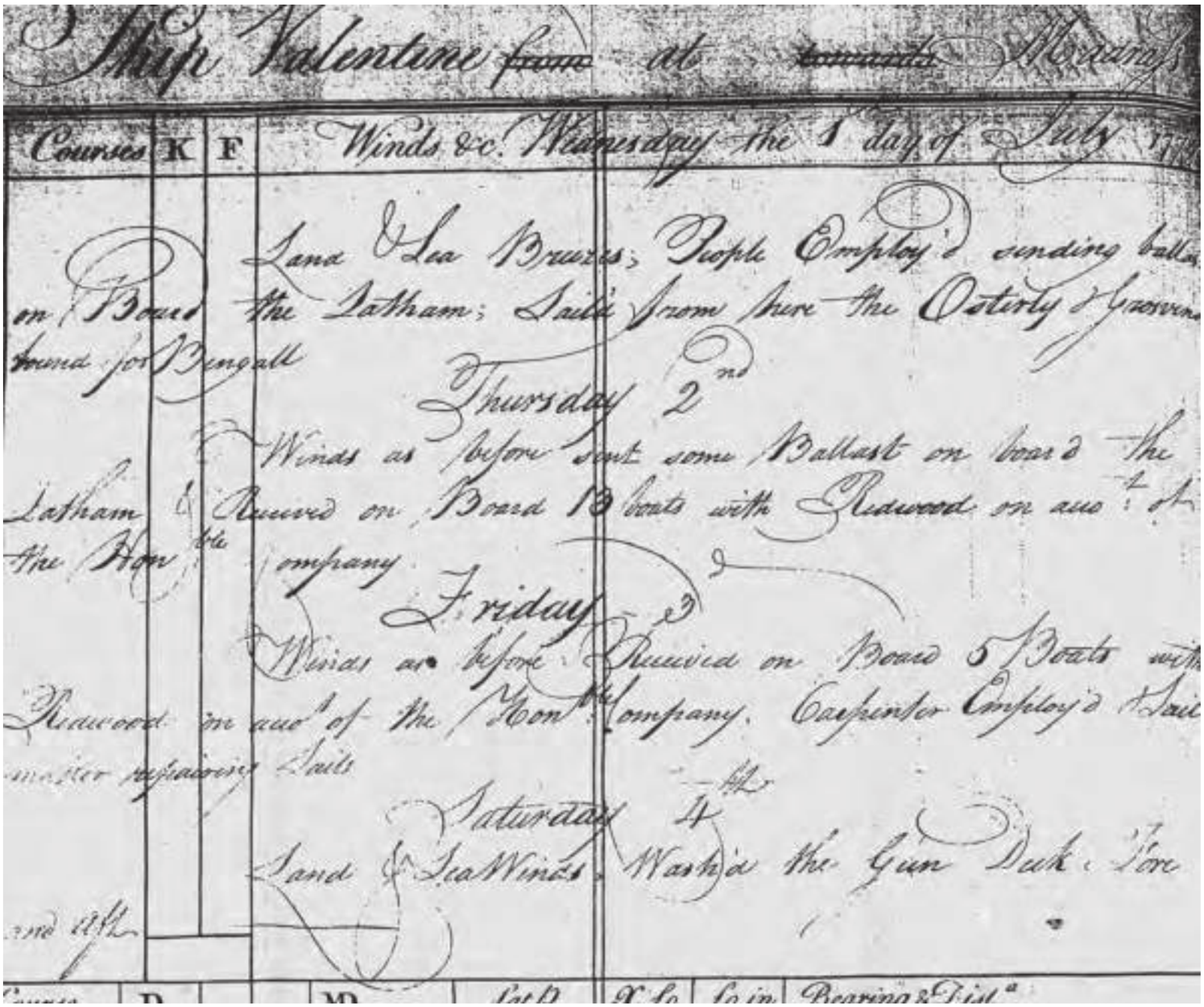


3

Billets of red sandalwood recovered by the author and his team from the wreck of the *Svecia* (1740). Photograph: Rex Cowan.

4

Samples of wool fleece dyed with red sandalwood by Margaret Tattersfield, from dyestuff recovered from the wreck of the *Svecia* (1740). Photograph: Rex Cowan.



5

Page from the logbook of the English East Indiaman *Valentine* that sank in 1778. Photograph: Richard Keen.

sandy beaches and salvaged by islanders. Some textiles were cleaned and auctioned off as "seconds" in Gothenburg, Sweden in 1742; the surviving auction catalogue lists the varieties – cottons, muslins, linens and silks – and their bargain prices. One beautiful "flower'd musline" can be seen in the Orkney Archive in Kirkwall (figure 1). In 1975 my team found the wreck and excavated it for nine years, finding, among other things, much red sandalwood in variously sized billets (figures 2–4). (The main collection of artefacts recovered by us is now in the Malmo Science and Maritime Museum in Sweden; other red sandalwood billets are in Amsterdam's Rijksmuseum and Orkney's Stromness Museum.)

The *Valentine* was a very successful trading vessel of the English East India Company, returning from India on its fourth voyage when it met a sad fate. The ship had left Madras in October 1778 and, having stopped off at Bombay and other Indian ports,

6

Indigo-encrusted coins and indigo-dyed samples from the wreck of the *Concepcion* that sank in 1641. Photograph: Jenny Balfour-Paul.

it carried a cargo of silk, saltpetre and red sandalwood. The ship's surviving logbook provides details of how the "Redwood" was ferried from Madras to the *Valentine* in small boats, and how bad weather affected the vessel's journey from St Helena in Sweden, causing a delay of several weeks (figure 5). The ship approached the Channel Islands in a strong northwesterly gale and was forced onto the treacherous Casquet reefs where it sank off the tiny island of Brecqhou. Fortunately, the crew and passengers survived. Two hundred years later in the 1970s, this wreck site was discovered by diver Richard Keen and thereafter excavated with a team of Guernsey divers directed by Keen. Divers since 1975 have carried out surveys and excavations and recovered billets and fragments of red sandalwood which have been studied by chemists and from which dye samples of excellent quality and colour range have been prepared. The amount of dyewood recovered and the smaller size of the billets seem to indicate that the vessel did not need as much paying ballast as the *Svecia*.

In the 17th century both the Dutch and the English found the export and sale of indigo from India very profitable but by the 18th century competition from mainland colonies in South and Central America and the islands of the West Indies reduced the demand for Indian indigo and exports from India to a mere trickle. The situation changed again in the 19th century owing to revolutionary conflicts in the indigo-growing countries of Central and South America.

Despite all the historical records, no actual indigo dye samples have yet been recovered from East India shipwrecks. However, a rich Spanish Plate galleon, the *Concepcion*, carrying a substantial cargo of gold and silver and 1,200 chests and bags of indigo and cochineal, sailed into the wrath of a storm in the September of 1641 and sank with all her treasure after hitting a coral reef off the island of Hispaniola (now the Dominican Republic). The wreck site was discovered in 1978 and much of the treasure has since been recovered. On one occasion, a diver, Carl Fismer, put his hand into what appeared to be a pot and pulled up a handful of silver coins encrusted with indigo (figure 6). Some of this indigo has been sampled by Jenny Balfour-Paul and found to be as effective as the indigo used today for dyeing blue jeans. Scientific analysis has also been carried out in an attempt to unlock the precise chemical composition of this extraordinary dye.

In 1771 a Dutch Baltic trader, the *Vrouw Maria*, was wrecked off the coast of Finland on its way to St Petersburg; the site was examined by the "*Vrouw Maria* Underwater Project 2009–12". On board was a valuable collection of art destined for the Russian Empress Yekaterina Alexeevna or Catherine II (1729–96), known as "Catherine the Great". But perhaps of even greater importance was the exceptional state of preservation of the cargo that originally included 1,600 kilograms of indigo in wooden barrels, and, for the red dyes, 2,300 kilograms of soluble brazilwood and almost 9,000 kilograms of madder. Indigo is mentioned in both the cargo list and the list of goods salvaged after the ship was wrecked, whereas the other dyes only appear in the cargo list. Indigo dye stained the lids of barrels in which it was packed, and samples taken in 2012 revealed an indigo leaf preserved in indigo dyestuff (the source of which remains unknown) and traces of madder root. The cargo list also includes many textiles; one intact packing crate contains a beautiful red wool fabric which analysis reveals was dyed with a combination of cochineal, madder and lichen dye known as orchil.

Wrecks of several vessels known to have been carrying indigo and other dyestuffs from India have yet to be discovered. One example is the 30-gun English East Indiaman *Albemarle*, wrecked in 1708 on the home run of her maiden voyage after three years at sea. While the East India Company directors in London were anticipating with glee the fortunes they would soon be making from the *Albemarle*'s cargo of diamonds, indigo, coffee, pepper and silks, the ship sank in an unprecedented storm off Polperro on UK's southern coast of Cornwall. Locals claimed that for weeks afterwards the waters were stained blue as the dye dispersed in turbulent seas.

All shipwreck sites, whether already discovered or still elusive, are rich storehouses of information and show that not all treasures are made of silver and gold. Historians, archaeologists and textile scholars have a vast field of discovery still awaiting their explorations.

Mark Nesbitt

Indian Dyes and Textiles at the Royal Botanic Gardens, Kew

It is not widely known that London's famous Kew Gardens holds an important collection of arts and crafts from the Asian subcontinent. This forms part of the Economic Botany Collection, founded in 1847 as the Kew Museum (figure 1). The purpose of the museum was twofold: to educate the public about botany, and to show manufacturers the full range of plant raw materials from around the world. Kew staff identified the new plant products coming in to the port of London, or sent to Kew by British officials, explorers and merchants overseas. The resulting collection, now numbering 90,000 specimens, covers all plant uses in most parts of the world.

Overall, the specimens from British India form the largest part of the collection, reflecting the importance of India to the British economy, particularly in the period after 1857. The Indian holdings were also boosted by the acquisition in 1885 of the botanical collections of the East India Company's London museum (the India Museum), including many wood specimens. From British India, Kew holds 350 dyes, about 60 textiles and about 600 samples of raw fibres such as cotton bolls. An important principle of display in the Kew Museum was the "illustrative series", showing the progression from raw material to finished product. This emphasis on showing and understanding processes is a particular strength of the collection, as is the coverage of minor as well as major useful plants.

1

A model indigo factory can be seen in the showcase on the right at Museum No. 2 at Kew, c. 1900. Photograph courtesy Royal Botanic Gardens, Kew.

Cotton and Indigo

It is not surprising that cotton and indigo dominate, given their importance to Britain's textile industry in the 19th century. This period saw much experimentation in India with introduced cottons, and the disappearance of some traditional varieties. The 60 samples of cotton (genus *Gossypium*) include the bolls of both local and American varieties of cotton, such as Juree, Gangri, Hinginghat, Egyptian, Bourbon and New Orleans. The production of textiles is represented by samples of yarn, and a remarkable portable loom collected by Sir Joseph Hooker on his Sikkim expedition of

2

Girl's jacket, donated by Mrs M.A.C. Moorat, late Inspectress of Girls Schools, Bihar. Cotton grown, spun and woven by schoolgirls, 1906; dyes with turmeric and indigo. Photograph courtesy Royal Botanic Gardens, Kew. EBC 73208.

3

"Patterned cloth of superior quality", donated by J.D. Hooker, Sikkim, 1849. Photograph courtesy Royal Botanic Gardens, Kew. EBC 65462.

4

Indigo dye cake, donated by J.J. Colman, 1852. Photograph: Jenny Balfour-Paul, courtesy Royal Botanic Gardens, Kew. EBC 60532.

1850. There are few finished textiles, including a girl's jacket from Bihar (figure 2) and dyed cotton textiles collected by Hooker in Sikkim and Bhutan (figure 3).

There are also 60 samples of indigo dye from British India. The manufacturing process is shown by the superbly detailed model from the 1886 Colonial and Indian Exhibition, now on permanent display at the *Plants+People* exhibition within Kew Gardens (see Jenny Balfour-Paul's article on Indigo, figure 3). The bulk of the specimens are of indigo cakes (figure 4), but several printing blocks from Rajasthan are also present, including three collected by Jenny Balfour-Paul in 2007.

Minor Fibres and Dyes

The 600 fibre samples are derived from a total of 230 plant species, showing the enormously wide range of plants used locally in India for fibre production. Some of these species were and are commercially important, although not on the same scale as cotton, for example jute (*Corchorus*) and ramie (*Boehmeria nivea*). Other species represent introductions to India, for example sisal and other *Agave* species from the Americas. However, the bulk are native crops and wild plants, such as madar (*Calotropis gigantea*), which yields a useful floss from the seeds and fibres from the bark (figure 5). Inner bark is often forgotten as a plant fibre, but was important throughout the tropics. Other bark fibres in the collection include banyan (*Ficus benghalensis*) and *Melochia umbellata* (a species of mallow).

5

Netting made of madar bark fibre, from Sindh, donated by H.B.E. Frere, 1850. Photograph courtesy Royal Botanic Gardens, Kew. EBC 49263.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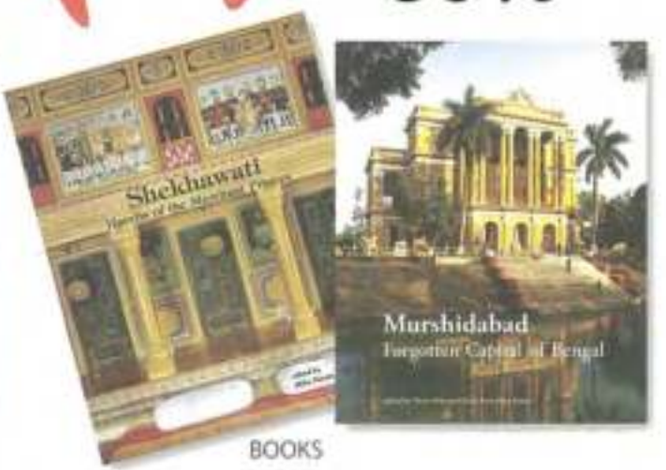

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6

Waras powdered dye (a) made from the seed pods and hairs (b) of *Flemingia grahamiana,* dyed silk (c) and dyed satin (d), donated by M.A. Lawson, Ootacamund, 1885. Photograph: Mark Nesbitt, courtesy Royal Botanic Gardens, Kew.

Dyes are a similar case: the 350 specimens are derived from about 170 species, as varied as the bark of white mangrove (*Avicennia marina*), the leaves of button tree (*Anogeissus acuminata*), the fruits of yellow myrobalan (*Terminalia chebula*) and the seed pods and hairs (whole and powdered) of waras (*Flemingia grahamiana*) along with dyed fabrics (figure 6).

Silk

Some animal products have traditionally been considered as being plant products, for example shellac, cochineal and silk, all well-represented at Kew. Four samples of wild tussar silks are present, including a box of very vivid dyed silks given by Thomas Wardle, dyer and supplier, to William Morris. The large collection of shellac specimens includes many red lac dyes.

Sources

The interest of the collection lies both in the specimens and in their provenance. The complete run of Museum Entry Books from 1847 to the current day, and the preservation of covering letters in Kew's archives, mean that the circumstances by which a specimen came to Kew can usually be investigated in detail. The collection and its associated archives are therefore an excellent resource for the study of both local uses, and of their discovery and attempted appropriation by British science and industry. Some of the sources of dyes and fibres include international exhibitions such as Amsterdam (1883), London (1886) and Paris (1900); officials such as Major Hannay in Assam or Dr Hunter in Madras; explorers such as Sir Joseph Hooker; and the current-day researcher on dyes, Jenny Balfour-Paul.

Using the Economic Botany Collection

The Economic Botany Collection is now mainly housed in a research store at Kew, although 500 specimens are on display in the Gardens. The collection was databased in the 1980s, and this is available online, with digital images of selected specimens. The collection can be visited by appointment. Some letters in Kew's Archives have been digitized, but most of those relevant to useful plants are housed in the Miscellaneous Reports series, which have not yet been digitized or indexed.

Economic Botany Collection website http://www.kew.org/collections/ecbot/
Collection database http://apps.kew.org/ecbot/search

Books Received

1

Prince Alexei Saltykov's Journeys Across India. St Petersburg: Russian Museum and Palace Editions, 2012. 204 pages, illustrated throughout. Price not mentioned.

2

The Fantastic Beings of Ancient India (From 2500 B.C. to the VIth Cent. A.D.) Vol. I, by Dr. ZHU Xintian. Mumbai: Edition Franco-Indian Research, 2012. 252 pages, illustrated throughout. £ 80.

3

Clemente: Made in India, by Jyotindra Jain. Milano and New York: Charta Ltd., 2011. 240 pages, 344 illustrations in colour. US$ 45.

4

Textiles and Dress of Gujarat, by Eiluned Edwards. Ahmedabad: V&A Publishing in association with Mapin Publishing, 2011. 248 pages, 243 colour photographs, 3 maps and 18 line drawings.

Contributors

Jenny Balfour-Paul, writer, artist, curator, international lecturer and intrepid traveller, is an Honorary Research Fellow at Exeter University, a Fellow of The Royal Geographical Society, the Royal Asiatic Society and the Explorers Club, President of the UK Association of Guilds of Weavers, Spinners and Dyers, and also partner in Harvard's "Silk Road Connect". She was consultant for the Whitworth Art Gallery's 2007 UK touring exhibition *Indigo: A Blue to Dye For* and for the American 2011 documentary *Blue Alchemy: Stories of Indigo*. Author of two books on indigo and numerous other writings, her forthcoming book relates her adventures with Victorian traveller and indigo planter Thomas Machell.

Brenda King, an independent researcher and curator, is Chair of The Textile Society, UK. Her forthcoming book *Stitch and Stone: A History of the Leek Embroidery Society* features Thomas and Elizabeth Wardle. Their embroidery was famous for using Indian wild silks, designs and dyestuffs and for its importance to the English Arts and Crafts Movement.

Ruby Ghuznavi has revived natural dyes in Bangladesh and is the Executive Chairman of Aranya. She is a founder member, past President and Executive Committee member of the National Crafts Council of Bangladesh, an Honorary Member of the World Crafts Council, Chairperson of WCC-AsiaPacific Region's National Dye Programme and Founder Trustee of Transparency International Bangladesh. She is also trustee of the Bengal Foundation and a core member of Naripokkho, a women's activist organization. Her publications include *Naksha*, *Rangeen*, and articles in national and international journals.

Dominique Cardon is Emerita Scientific Researcher at the National Centre of Scientific Research (CNRS), Lyons, France. Her research themes are the history and archaeology of textile production and dyeing. One of her books on natural dyes was awarded an "Art and Science of Colour Prize" of the L'Oréal Foundation in 2003. She received the UNESCO Medal "Thinking and Building Peace" in 2006 for the scientific direction of international symposiums on natural dyes in India, Korea and France, and the Silver Medal of CNRS in 2011.

Pramod Kumar K.G. is the Managing Director of Eka Archiving Services, New Delhi. He established the Anokhi Museum of Hand Printing, Amber, and instituted the Jaipur Literature Festival. Currently he is the Consulting Editor from India for the journal *Textiles Asia* and has authored *Posing for Posterity – Royal Indian Portraits* (2012).

Bessie Cecil is an alumnus of the Government College of Fine Arts, and has obtained a PhD in Textile Design and Textile Conservation from the University of Madras. She has been a Fulbright Doctoral and Professional Fellow at Florida State University, Tallahassee, USA, Visiting Fellow at the Victoria and Albert Museum, London (on a Nehru Fellowship) and Research Fellow at the Asian Civilisations Museum, Singapore.

Monisha Ahmed is an independent researcher. Her doctoral thesis from Oxford University developed into the book *Living Fabric: Weaving among the Nomads of Ladakh Himalaya* (2002). She is the author of several articles on the material culture of Ladakh, as well as Indian textiles. She co-edited with Clare Harris *Ladakh – Culture at the Crossroads* (2005) and co-authored with Janet Rizvi *Pashmina – The Kashmir Shawl and Beyond* (2009), both for Marg. She is the co-founder and Executive Director of LAMO (Ladakh Arts and Media Organisation) and Associate Editor, *Marg* in Mumbai.

Kanika Mukerji, alias Bowerbird, is a closet poet, photographer and textile lover rolled into one. A background in art (Western Michigan University, Michigan, USA) and textiles (Central Saint Martins College of Art and Design, London) informs her work at utsa collective, but of late, a rekindled interest in travel photography takes this wanderer places. At present, she is also a committee member with SUTRA, a Kolkata-based NGO dedicated to the preservation of India's textile heritage.

Rex Cowan is a former Fulbright Scholar and practising lawyer, now wreck hunter specializing in those of the East India Companies belonging to the English, Dutch and Swedes of the 17th and 18th centuries. He is also a writer and broadcaster whose work has received recognition and awards. For 22 years he was a member of HM Government's Advisory Committee on Historic Wrecks. In 1992 the Queen of the Netherlands knighted him for his services to Dutch Maritime History. It was as a result of his discovery of the wreck of the Swedish East Indiaman *Svecia* with its large cargo of dyewood that he became interested in the various dyestuffs aboard shipwrecks around the world.

Mark Nesbitt is Curator of the Economic Botany Collection at the Royal Botanic Gardens, Kew, London. With a background in botany and archaeology, his research interests are in 19th-century colonial botany, particularly medicines and fibres.

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KUTCH - *GHAGRA*, of Chinese silk in fuchsia - embroidered with "ari or mochi kaam" this was done in the 18th & 19th century under royal patronage. The male members of this community were involved in the task. "Ari" was the particular tool used for this fine embroidery.

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Miss Sonal Natwarbhai, from the Virpura Village in Sanand, Gujarat. Sonal used to sit on the floor and study. Today she and more than 250 other students benefit from the classroom facility upgradation initiative of Tata Motors. The Company has a holistic approach to improving the access to and quality of education. The company supplements its infrastructural support to schools with training of teachers and extra-curricular activities or students.

Mr. Sujit Soren of Gopalpur village in East Singhbhum district of Jharkhand. He was the first in the village to adopt water conservation techniques of the Gram Vikas Kendra society of Tata Motors. Today, the village boasts of perennial irrigation for about 100 acres and about 10,000 fruit and timber generating trees.

Mrs. Rohini Bhanudas Wadekar of Pune in Maharashtra. A widow with three children, she was trained to become self-dependent with technical skills by Tata Motors' Grihini Social Welfare Society.

Mr. Vinod Pachpute of Vasuli village in Pune district of Maharashtra. A diploma holder in mechanical engineering, he is also a trustee and an alumni of the Bhamchandra High School in the village – the only one in the vicinity covering seven villages. Tata Motors helped set up the school and continues to support it. About 600 students have passed through its portals till date.

Mr. Jowahar Ram Paswan of Baranimdih Mohalla of Chaibasa district in Jharkhand. Today, he is an employee of Nav Jagrat Manav Samaj. It became possible when the Nav Jagrat Manav Samaj, supported by Tata Motors, intervened to manage his leprosy and found him a job with a permanent income. Today, Mr. Paswan intervenes to bring comfort to others.

Mr. Man Singh Murmu of Baijnathdih village in East Singhbhum district of Jharkhand. With mostly infertile land holdings, Mr. Murmu and other residents found meeting both ends difficult. Tata Motors helped him lead change by beginning a tree plantation drive. Today, Baijnathdih has a forest of income-generating trees, and a Forest Protection Group to nurture its economic turnaround.

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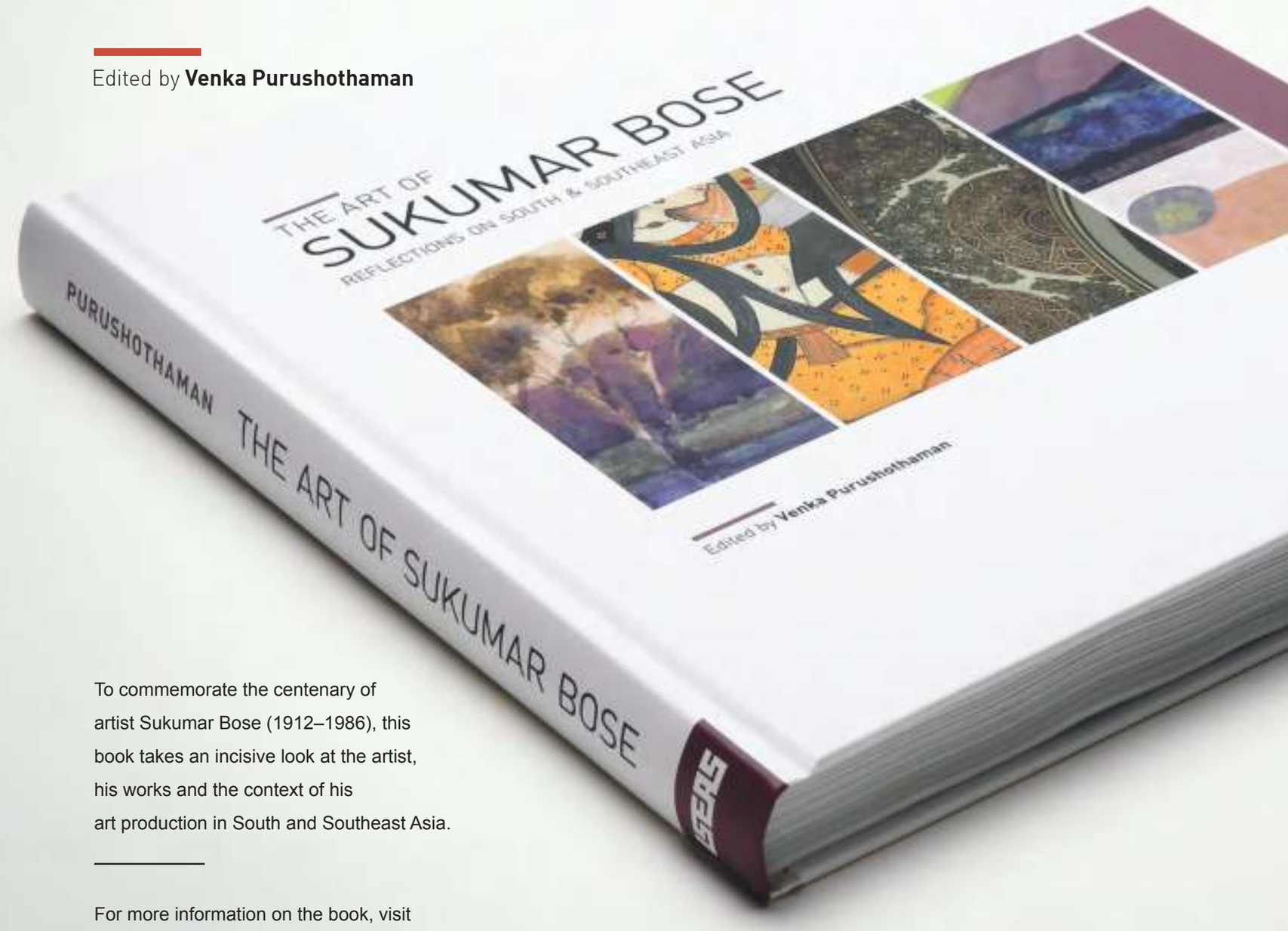

To commemorate the centenary of artist Sukumar Bose (1912–1986), this book takes an incisive look at the artist, his works and the context of his art production in South and Southeast Asia.

For more information on the book, visit
www.iseas.edu.sg/publication/1844
For more information on the artist, visit
www.sukumarbose.org

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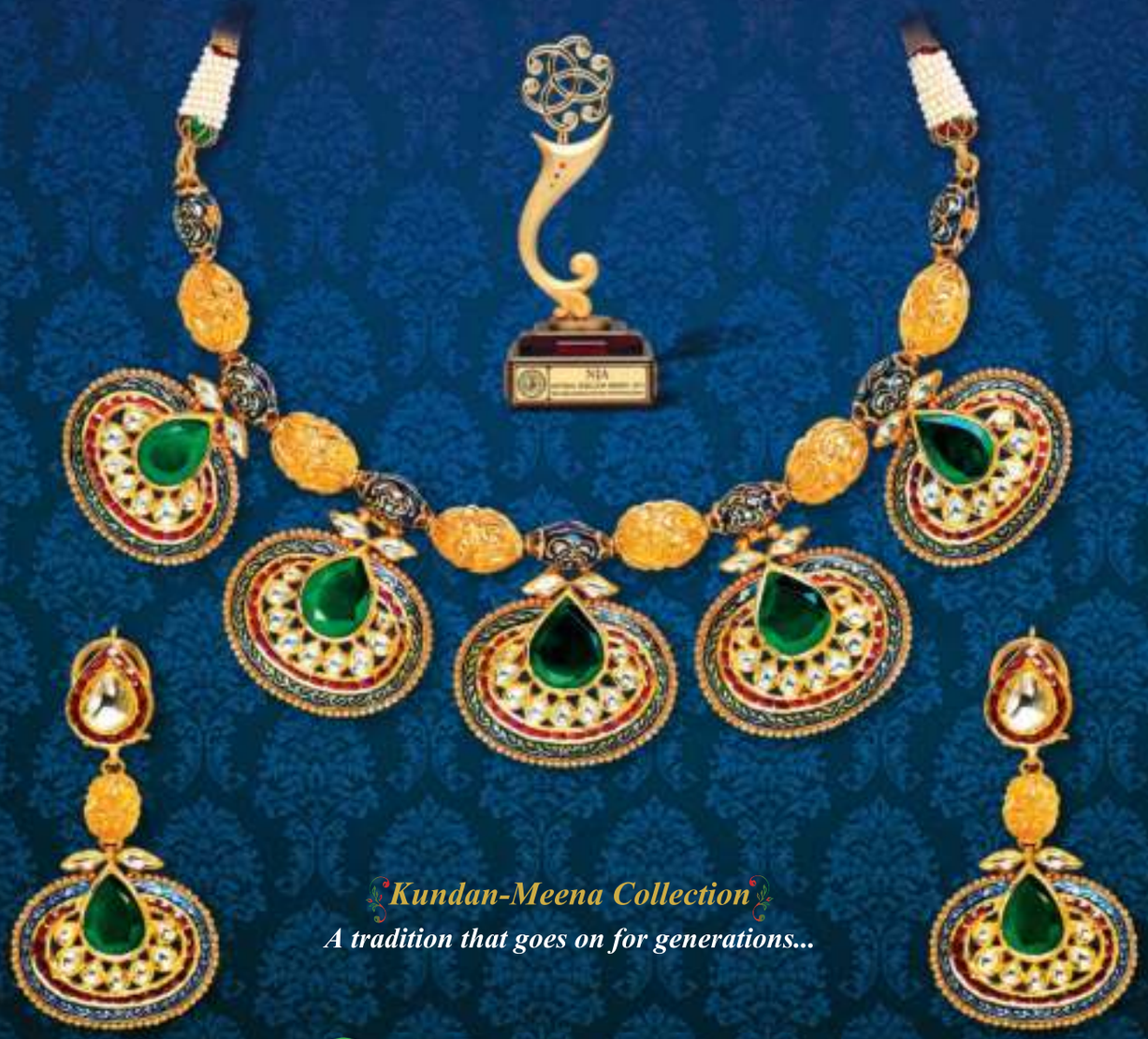

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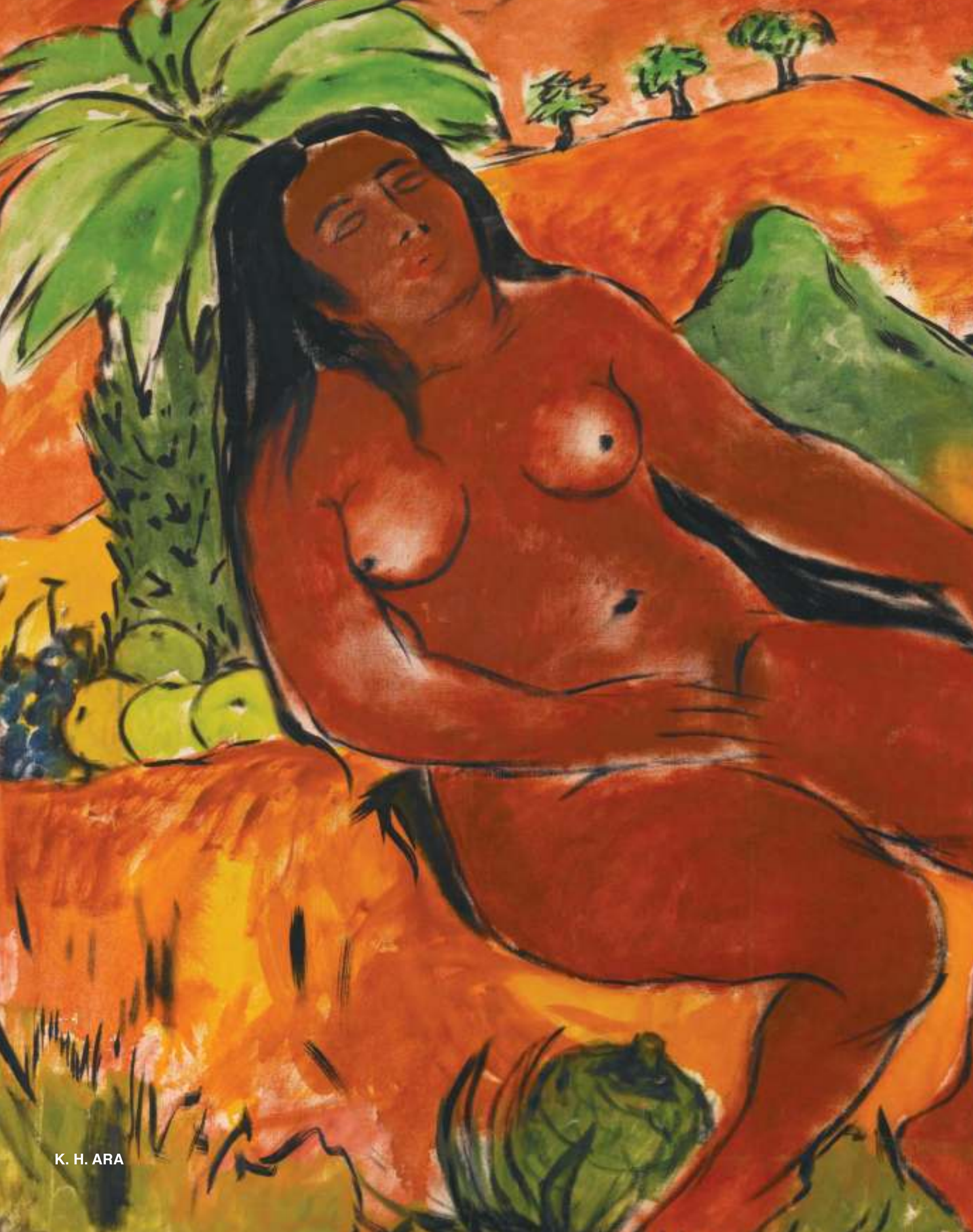
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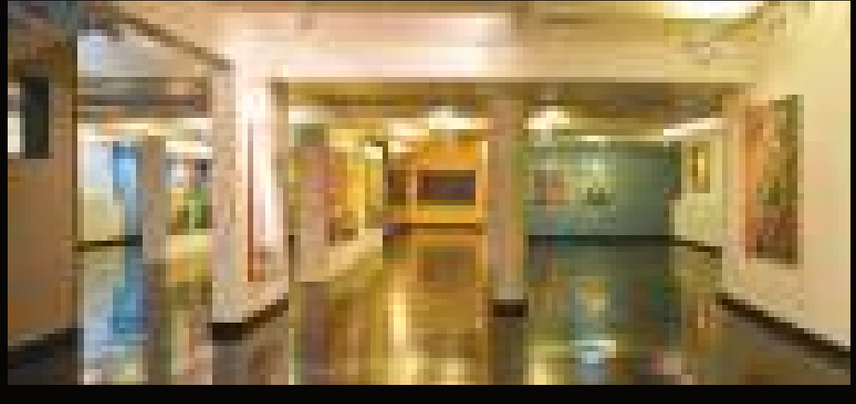

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Gopal Prasad Sharma, Gangaur Procession, 28 x 41

Harsha Biswajit- Migration - inkjetprint on hahnemuhle fine art 300 gsm archival paper - size variable - 2012

India Art Festival : Third Edition at Nehru Centre, Mumbai, India

After the grand success of second edition of India Art Festival at MMRDA ground, Bandra Kurla Complex, Mumbai, the third edition of India Art festival is scheduled from 19 to 22, December 2013 at Nehru Centre, Worli, Mumbai. In the third edition, the general exhibition section in which all major art galleries participate will be created at the ground floor, where as artists' pavilion will be put up at the second floor of Nehru Centre. The highlights of the third edition of India Art Festival, apart from 35 participating art galleries and more than 500 participating artists, include the 'Public Art Space' curated by Veerangana Kumari Solanki and 'IAF Conversations' programmed by Ranjit Hoskote. In the public art space, major art galleries from Mumbai & Delhi like Sakshi gallery, The Guild, Exhibit 320, Latitude 28, and Art Alive Gallery along with others are participating.

The decision to move venue of the third edition of India Art Festival to Nehru Centre is mainly attributed to the costly logistics associated with mounting the art festival in the open ground, as real estate, open spaces and correlated infrastructures are costly in Mumbai compare to Delhi. As Art market is affected due to economic slowdown, exhibitors hesitate to pay higher booth rent to meet this costly logistics in the open ground art festival. The organisers found the best way to sustain this movement at Nehru Centre with controlled quality and scale. This is the only art fair in the Asian subcontinent in which art galleries and individual artists come under the one roof. Nehru centre has few constrains like space limitation but it has benefits like strategic location close to south Mumbai.

The major art galleries participating in the India Art Festival 2013 includes The Gallery of Gnani arts, Singapore, Gallery Art and Soul, Gallery Beyond, Tao Art Gallery, Ma Passion, Vardhanman Art Gallery, J. S. Art Gallery, Studio 3, Kol Kali Bay, Khussh Gallery, Art Gate, Art Desh - The Studio, International Creative Art Center, Sakshi Gallery, The Guild, Alok Art Foundation, Art Gold, Impression art Gallery (all Mumbai), Art Konsult, Art Alive Gallery, Gallery Pioneer, Exhibit 320, Latitude 28, Pearl Art Gallery, Gallery Ruki, Lavanya Art Gallery, Karma Art Gallery, Shreyash Art Gallery, Art & Aesthetics (all New Delhi), Forum Art Gallery (Chennai), Galerie Sara Arakkal (Bangalore), Art Alinda (Kolkata) and India House Art Gallery (Pune).

The IAF conversations, a two-day conference programmed by Ranjit Hoskote, held every year as a collateral event makes art festival an interactive experience for the visitors. The interesting panel discussion for artists this year is based on the processes, by which artists can be groomed, mentored and their work championed. The speakers enlightening artists on this important aspect are experts like Pheroza Godrej, Arundhati Ghosh and Mortimer Chatterjee. The other speakers addressing the urgencies that confront art world include Reena Kallat, Kamini Sawhney, Anuradha Parikh, Matthieu Foss, Nancy Adajania, Mustansir Dalvi, Prof.Manisha Patil, Suresh Jayaram, Kaiwan Mehta, Sudhir Patwardhan, Gieve Patel, Dilip Ranade, Zasha Colah, Sumesh Sharma and others.

In the third edition of India Art Festival, all Indian Master Painters represented by 35 art galleries will showcase their works with young & upcoming artists from fifty different cities. Individual artists from Spain, fifteen Indian states are participating in the third edition of India Art Festival. Kalavishkar, the organizing institute also presents IAF award to a selected artist by judges panel.

India Art Festival is greatly contributing to the growth of art patronage in the western India and it is supported by almost all the constituents of art market who understand the basic role of art fairs.

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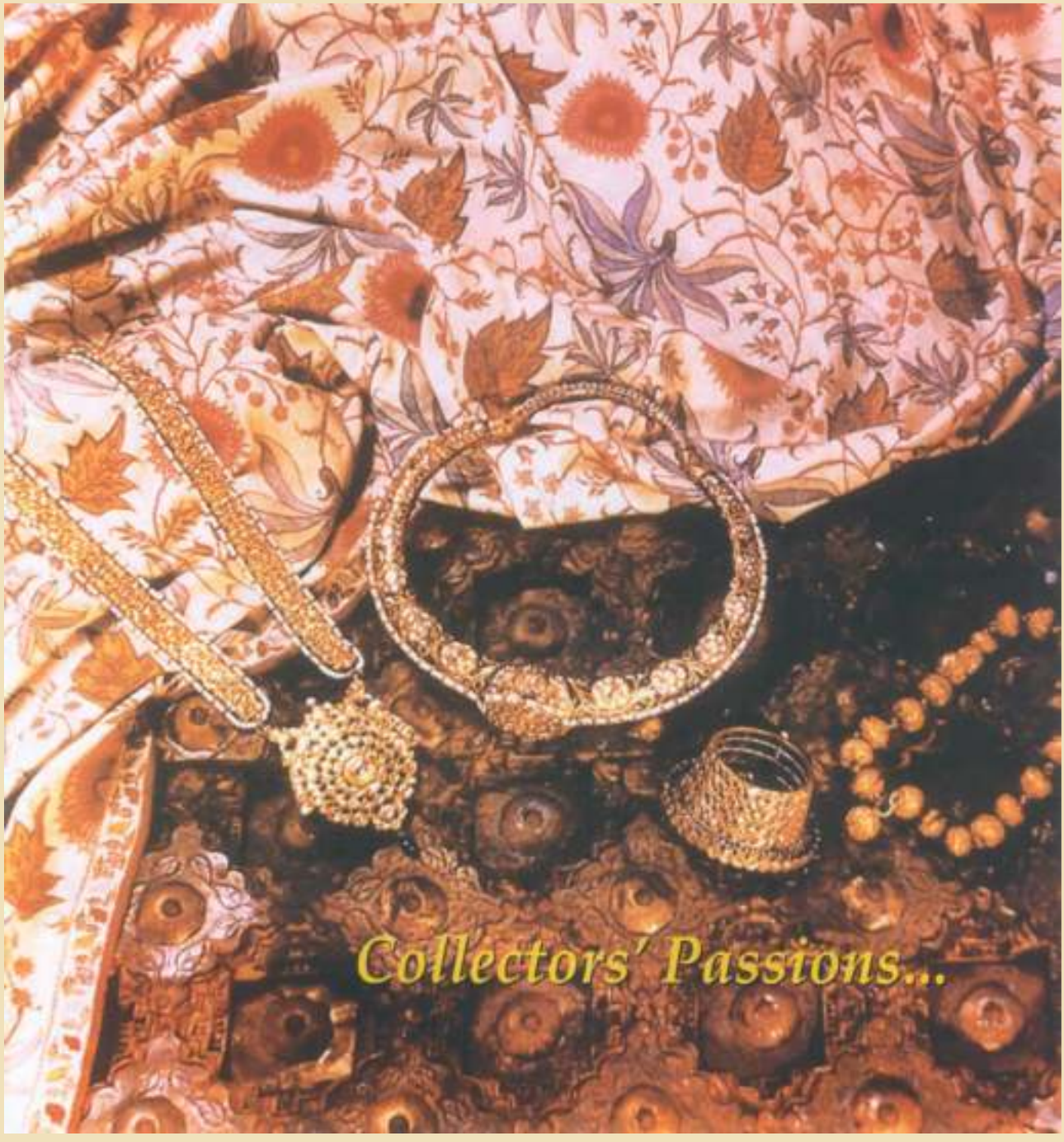

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Dolly Dutta, Title: TV watcher, Acrylic on canvas,Size:30x40 inch.

Tarun Maity, Title: "I am Vegetarian" Bronze, 24x40x26 inch.

Suvajit Samanta, Title: Save Nature, Wood, Brass & Aluminium, 27x12x24 inch.

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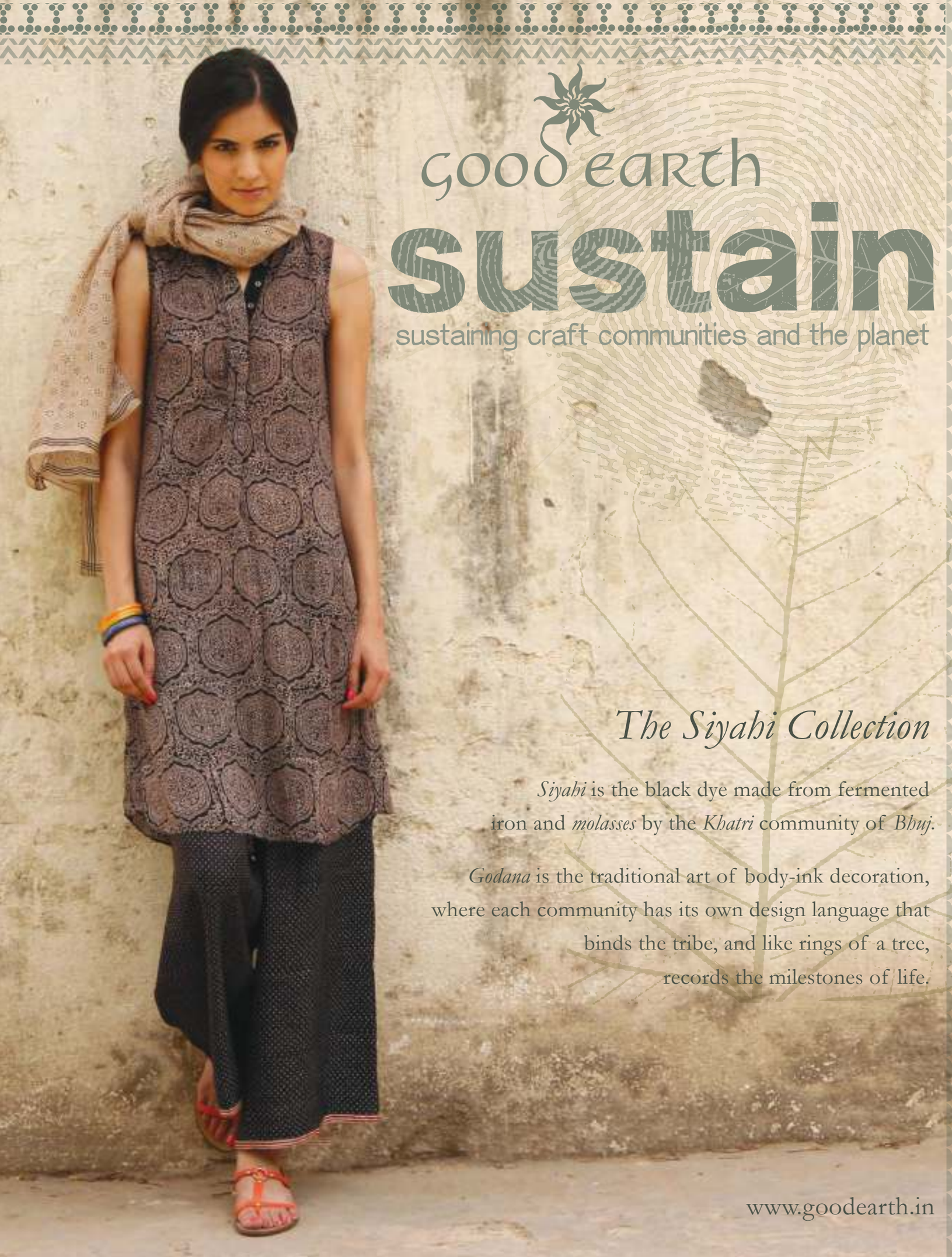
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To view the entire Speakers' Forum Schedule, please visit our website: **www.indiaartfair.in**.

Some of the Speakers at India Art Fair 2014 are as follows:

Bharti Kher
Artist, New Delhi

Budi Tek
Entrepreneur, Art Philanthropist, and Collector, China

Chris Dercon
Director Tate Modern, London

Dayanita Singh
Artist, New Delhi

Gayatri Sinha
Art Critic and Curator, New Delhi

Homi Bhabha
Critical Theorist and Anne F. Rothenberg Director of the Humanities Centre at Harvard University

Jean De Loisy
Director, Palais de Tokyo, Paris

Jeebesh Bagchi
Member RAQS Media Collective, New Delhi

Li Bing
Collector, Beijing He Jing Yuan Art Museum Owner and Convenor, China

Peter Fischli
Artist, Switzerland

Philip Dodd
Chairman, Made in China

Rajiv Savara
Art Collector & Chairman G&T Oilfield and Offshore Services Pvt. Ltd. Chairman of the Board & Founder Trustee: The Savara Foundation for the Arts, New Delhi

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