Patterns of Culture
Techniques of Decoration and Coloration

by M. A. Hann

Title: Patterns of Culture - Techniques of Decoration and Coloration
Author: M. A. Hann
Foreword: D. Holdcroft

Ars Textrina no.35, a monograph in the Ars Textrina series, published in association with the University of Leeds International Textiles Archive (ULITA) as an accompaniment to the exhibition 'Patterns of Culture - Techniques of Decoration and Coloration'.

ISBN: 0-9549640-0-4

Acknowledgements
The organisation of the exhibition, to which this monograph is an accompaniment, was facilitated by the endeavours of Mr J. A. Smith, Mr P. Lawson, Ms B. Thomas and Ms A. Chu. Thanks are also due to Mr I. S. Moxon for reading various proofs of the monograph and for discussions relating to aspects of its contents. The author accepts responsibility for errors or omissions.

Foreword
The exhibition 'Patterns of Culture - Techniques of Decoration and Coloration' focuses on a particular aspect of decorated textiles: techniques of coloration and patterning, particularly resist dyeing (including tie-and-dye, ikat and batik) as well as printing with the assistance of blocks and stencils. The monograph is published to accompany the exhibition with the same title; the latter includes textiles from India, Pakistan, Indonesia, Malaysia, Japan and West Africa.
D. Holdcroft (Chairman of the ULITA Committee)

Price of the monograph: £5.00. All proceeds to ULITA

Contents

1. Introduction

The concern of this monograph is with certain types of decoration on textiles, produced by the application of dyes in association with other materials. This includes direct printing, using blocks or stencils, and the various resist-dyeing techniques. Direct printing involves the application of colour directly on to the fabric surface, in one process, and does not involve secondary or intermediate processes before the development of the coloured design. The term resist dyeing refers to a wide range of techniques used to decorate textiles by selectively dyeing areas on a yarn or fabric's surface. This selective dyeing is facilitated by folding or knotting, the use of stencils or shields, wrapping thread (or similar material) round folded fabric or hanks of yarn, stitching thread into fabric and drawing it tight, or applying resist materials such as wax or paste to the fabric's surface. Three general categories can be identified: batik, ikat and tie-and-dye. Variants are found worldwide and have been used to decorate fabrics throughout much of recorded textile history. The objectives of this monograph are to identify and explain various hand-printing and resist-dyeing techniques and their variations.

2. Block / Stencil Printing

Printing on cloth involves the use of carved wooden blocks or cut-paper stencils to impart a pattern or other design to the cloth's surface. The number of blocks or stencils used in a design depends generally on the number of intended colours; it is the norm to use one block or stencil per colour for each repeating unit of the design. For example a four-colour all-over repeating field pattern with an associated four-colour border pattern would require four blocks or four stencils for the field design and four blocks or stencils for the associated border design. Differentiation can be made between direct printing, resist printing, mordant printing and discharge printing. With direct printing, thickened dyestuff is applied directly to the cloth's surface by an engraved wooden block or cut stencil. Resist printing involves the application of a material such as hot wax, some form of clay-based resin mixture or rice paste to the fabric surface, with the intention of subsequently preventing the dye of the dye bath from reaching the surface where the resisting material has been applied. Mordant printing is also used in association with a dye bath and involves printing first with a mordant (a substance which assists dye uptake). On submersion in the dye bath, the dye will attach to those areas where the mordant has been printed. With discharge printing, colour is removed from the cloth through the action of a discharge agent. Each of the four techniques is described below.

2.1 Direct Printing

Today, hand-block printing directly on to cloth is still practised in India, Pakistan and several other parts of Asia. Blocks are generally of wood (with teak a preference) and are of a size to allow easy manipulation by hand, with a maximum length or breadth dimension of around 30 centimetres and a depth of around 10 centimetres, although blocks are often much smaller. The process of producing a single block involves carving and drilling and may take between three days and ten days depending on the intricacy of the design and its dimensions [Sreenivasam, 1989, p. 30]. The block is finished by attaching a handle to its back and is ready for printing after several weeks of soaking in oil (apparently this ensures that the block will not absorb water during the printing process) [Sreenivasam, 1989, p. 30].

Stencils (known in Japan as katagami) were traditionally cut from mulberry paper and consisted of several layers between each of which was inserted a fine net of human hairs which gave stability during use; this arrangement of paper and hair was the precursor to silk-screen printing with the hair replaced initially by silk and the whole arrangement being attached to a frame.

Prior to printing, the cloth (often referred to as the print base) undergoes various preparatory washing and bleaching processes to ensure absorbency during printing or dyeing. Typically, in a small-scale domestic set-up, printing is done on a long, low table. The surface is covered with thick layers of woollen blankets and heavy cotton cloth. Over this, a damp cloth may be spread to ensure that the cloth being printed does not slip [Sreenivasam, 1989, p. 30]. Dyes, thickened with gum-arabic, are poured into deep trays which contain some form of sponge-type pad to ensure that only a limited amount of dye is taken up by the block. The border of the textile is generally printed first and then the central field. Generally, a single-colour design is printed using one block for the border and one for the central field. Occasionally, a connecting corner block, which will have a ninety-degree turn, may be used. In multi-coloured designs, an outline block is used first and other blocks, one for each colour, are used to build up the details of the design.

2.2 Resist Printing

Resist printing involves placing a barrier (the so-called resist) on areas of the cloth to prevent dye penetration. The resist is printed by block or stencil on the surface of the cloth, in certain predetermined areas. On being immersed in a dye bath, the cloth will take up dye in those areas not covered by the resist material. The background or original colour of the cloth is thus preserved. Typical resists include bees wax, clay, mud, or rice paste. Wax resists are associated with producers in many parts of Asia, especially Indonesia. Rice-paste resists are typical of Japan and parts of South China, and are used in association with a stencil; a spatula is employed to rub resist paste into those parts of the fabric not covered by the stencil. Subsequently, the fabric is dyed, the dye taking to the areas not covered by the resisting paste. After drying, the paste is washed out to expose the undyed areas. Mud or clay resists are associated with India, especially Gujarat, Rajasthan and Madhya Pradesh. The technique is reputed to have origins in the subcontinent dating back around two

thousand years [Streenivasam, 1989, p. 31]. Streenivasam commented on the constituent materials used in a mud resist:

> ...a mixture of clay or mud which has been aged for a year, lime powder which keeps the mixture from cracking, gum (such as gum-arabic) resin and water. Generally, a small amount of jaggery (molasses-like substance) castor oil and perhaps a few drops of liquid soap are added so that the resist will not wash off in the dyeing.
>
> [Streenivasam, 1989, p. 31]

2.3 Mordant Printing

In most cases, the use of a fixative, generally known as a mordant, is necessary to ensure that the dye adheres to the constituent fibres of the cloth and remains fast in everyday use. The use of mordants is regarded as a positive process, because the dye adheres only to the areas treated. Generally, mordants are metallic oxides which combine with the dye and allow it to bind with the fibre. An example of a traditional mordant used in India and elsewhere is alum, which when used with madder produces a range of reds [Guy, 1998, p. 22]. A particularly comprehensive review of alum and its use historically was provided by Singer [1948].

When a mordant is applied to specific areas of the cloth, by either wooden block or stencil, those areas will take up the dye. Decoration on a cloth may be facilitated totally through the use of mordants. Often, however, the application of mordants is combined with other printing techniques, such as resist methods and direct-dye application. The so-called ajrak textiles are an important example. These textiles are associated with Sindh province in Pakistan and with the Kutch region in Gujarat (India). The process of their production involves a combination of mud or clay resist and mordant printing, together with dye baths of indigo[1] for blue and madder for red [Sreenivasam, 1989, p. 19]. The mud or clay resists the dyestuffs and the mordant allows the dyestuff to attach to the cloth. The process is described further in subsection 3.3 below. A reasonably detailed description of mordanting is given by Gittinger [1982, pp. 19-21].

[1]Indigo dyeing is historically of great importance worldwide and is closely associated with the techniques explained in this monograph. In order to be effective as a dye, indigo undergoes an altered state (known as reduction) and, as it is transformed back to its original state (through oxidation), it attaches itself to the surface of the fibres. Haller commented: “Reducing agents convert the dyestuff in an alkaline medium to indigo white, but it can be regenerated by oxygen. The double process of reduction and subsequent oxidation is the principle underlying all indigo dyeing” [Haller, CIBA Review, 1951, no 85, p. 3075].

2.4 Discharge Printing

With discharge printing, a discharge agent may be stencilled or block-printed on to a dyed fabric; this agent detaches the colour from the printed areas and can be washed out with the colour. Discharge printing thus relies on completely dyeing a piece of fabric and, after drying, printing it with a paste which will have the effect of removing the dye from the printed areas. In the context of discharge printing of indigo, Haller commented:

> It was comparatively recently late in the history of dyeing that textile printers proceeded to produce white and coloured patterns after dyeing the fabric with indigo dye with the aid of a discharging agent.
>
> [Haller, 1951]

The technique is thus of relatively recent origin and was developed as a viable industrial process through the endeavours of scientists such as Camille Koechlin, John Mercer and Jean-François Persoz during the nineteenth century [Haller, 1951].

Discharge printing is also used by craft printers today, and is occasionally combined with other techniques. The technique has an effect similar to that of certain types of resist printing. It is worth noting that various craftworkers consulted by the author confirmed that the use of discharge techniques will generally give a strictly defined "hard edge" whereas dyeing with wax resist will give a much "softer edge". Also, resists (such as wax) can protect dyed areas whereas the use of discharge agents will not protect a base colour but instead will remove it. Different concentrations of discharge paste can remove proportionately equivalent amounts of dye and can be used therefore to introduce various shading effects.

2.5 Possible Origins

Schaefer commented that, although the earliest printed textile known to textile historians was less than two thousand years old, historical tradition and surmise ascribed knowledge of textile printing to more ancient times [Schaefer, 1939]. The Greek historian Herodotus, writing in the 5th century BCE, reported that the people of the Caucasus painted animal figures on their clothes by means of a pigment extracted from leaves:

It is also said that there are trees here of which the leaves when crushed and mixed with water produce a dye with which the natives paint figures on their clothes, and the dye is so permanent that the designs never wash out but last as long as the material does, as if they had been woven into it when it was first made...

[Herodotus, tr. de Sélincourt, 1996, p. 80]

The comment on the permanency of the colour denotes a sophisticated knowledge of dyeing processes on the part of the practitioners, manifested through the apparent fastness of the colours applied.

Schaefer observed that cotton fabric was being printed in India during the fourth century BCE, and such cottons were exported to China in 140 BCE [Schaefer, 1939, p. 914]. A view widely expressed in the literature concerned with the subject is that India (including present-day Pakistan) is the source for the earliest techniques of dyeing and printing. Important discoveries at an Indus Valley site, associated with the ancient culture of Mohenjodaro, have confirmed the use of madder as a colorant for cotton some four and a half thousand years ago [Wheeler, 1953, p. 63]. It appears that, although knowledge of cotton cultivation spread far beyond India, supremacy in cotton dyeing and, in particular, the use of mordants to fix the dye to the fibres, remained largely the preserve of the Indians until the widespread use of synthetic dyes in the late-nineteenth century [Askari and Crill, 1996, p. 9].

Products resultant from knowledge of dyeing and early forms of printing were traded westwards to the Persian empire, which included Mesopotamia (from 539 BCE) and Egypt (from *c*.525 BCE). Subsequently, Egyptian trade with India was particularly active in the half century following Alexander's death. The Ptolemies went on until 30 BC (323 until 181 BCE) [Schaefer, 1939, p. 915]. It appears also that both the Greeks and Romans had knowledge of printed textiles. Schaefer commented:

At that time the Egyptians extended their trade as far as the east coast of the mainland of India, and even sailed up the Ganges as far as Palibothra. Greeks and Romans possessed patterned fabrics, and the Greek geographer Strabo... [63 BCE to 20 CE] mentions printed textiles from India.

[Schaefer, 1939, p. 915]

In the debate on the early history of coloration of textiles, reference is often made to a passage from Pliny the Elder (23-79 CE):

In Egypt they also colour cloth by an exceptionally remarkable kind of process. They first thoroughly rub white fabrics and then smear them not with colours but chemicals that absorb colour. When this has been done, the fabrics show no sign of the treatment, but after being plunged into a cauldron of boiling dye they are drawn out a moment later dyed. And the remarkable thing is that, although the cauldron contains only one colour, it produces a series of different colours in the fabric, the hue changing with the quality of the chemical employed, and it cannot afterwards be washed out. Thus the cauldron which, if dyed fabrics were put into it, would undoubtedly blend the colours together, produces several colours out of one, and dyes the material in the process of being boiled; and the dress fabrics when submitted to the heat become stronger for wear than they would be if not so heated.

[Pliny, tr. Rackham, 1952, p. 371]

This passage has been interpreted in various ways, and has been debated in several texts [see, for example, Schaefer, 1939, p. 915; König, 1978, pp. 106 - 109; Healy 1999, pp. 193 - 195].[2] The phrase "smear them not with colours but chemicals that absorb colour" suggests the application of a colourless paste which acts as a mordant or, if consideration is taken of subsequent phrases, the application of more than one type of colourless paste, each type with a different constituent mordant. Application may well have been by carved wooden blocks, a technique which was apparently well developed by Pliny's time [Schaefer, 1939, pp. 914-915]. The application of more that one mordant would be an efficient means to facilitate the development of different colours from the same dye bath. For example, depending on the type of mordant used, a dye bath of madder could produce a range of colours from browns to reds and pinks. Thus if two, or possibility more, mordants were applied using wooden blocks, the resultant fabric could take up the requisite number of colours (or, more likely, different shades of one colour) in addition to retaining the original background white to which no mordants were applied. Pliny's final comment in the paragraph presented above states that the resultant coloured fabric became "stronger for wear" than if not heated. The author is unable to discover a reason why the fabric should acquire improved tensile properties due to being boiled in a dye bath. However the application of heat may well have enhanced the action of the mordant and/or attached the dye more strongly to the fibres. The resultant coloured fabric would thus not fade during wear to the degree likely if the dyestuff was not firmly fixed to the constituent fibres.

[2]The author is indebted to Mr. I.S. Moxon, the classicist, for translating, interpreting and debating various texts, and to Drs K. Beverley and R. Blackburn for discussions relating to dye chemistry and, in particular, the use of mordants.

One of the most important archaeological sites associated with printed textiles is the burial field of Achmin, in Upper Egypt. Here, the ancient Egyptian custom of burying possessions with the dead, and the exceedingly dry soil conditions prevailing in the region, have resulted in a wide range of textile finds being unearthed in a rare state of preservation. The earliest specimen from this site is a child's tunic, reputed to date from the fourth century CE, with a simple block pattern. Schaefer insists that "the technique was that of ...wax print", and the decoration of the item was by a resist-dyeing procedure [Schaefer, 1939, p. 915]. Further proof that textile printing was practised in Egypt in the fourth century CE is in the form of a printer's block, again found at Achmin. It consists of a cylindrical piece of wood about five or six centimetres in length and slightly less in diameter with an engraved motif at either end. Schaefer does however note that the block may have been used to print embroidery outlines [Schaefer, 1939, p. 917].

Recent evidence suggests that textile printing in China is of great antiquity [see, for example, Hann, 2004, pp. 16-17]. On the basis of the highly developed nature of a number of printed fabrics found in a Han dynasty (206 BCE–220 CE) tomb, archaeologists had surmised that the origin and early stages of the development of textile printing in China may have dated to sometime before the Han dynasty. There was no direct evidence to support this claim until 1979, when several fragments of monochromatic-printed hemp fabrics were found in a group of cave burials at Gueixi in Jianxi province [Chen and Liu, 1980, p. 15]. A carbon-14 dating equivalent to 2,595 years (± 75 years) ago has been published [Chen and Liu, 1980, p. 15]; so the printed hemp fabrics predate the oldest Egyptian example by at least eight hundred years. The printed fragments were not substantial enough to determine the pattern repeat or the precise means of production. However, quite remarkably, two wooden squeegees were also found in the proximity of the fabrics, which indicate the possibility of a stencil-type printing technique as opposed to a block-printing technique [Zhong and Hann, 1989]. It appears that this discovery provides the earliest dated evidence of stencil printing, not only in China but, it seems, worldwide. It should be stressed that it is highly unlikely that the printed hemp textiles mentioned above were produced elsewhere and traded into China. First, they are dated before the Han Dynasty, the great epoch of Chinese trade with countries to the west along the so-

called Silk Route [Hann, 2004, pp. 18–19], and, second, they were found associated with the two wooden squeegees suggesting home production, as it is doubtful that squeegees were objects of trade.

An early printed textile, dated to the sixth century CE, was found in the tomb of Saint Caesarius of Arles (502–543 CE) [Schaefer, 1939, p. 917]. This textile is generally considered as the "...oldest European textile print" [Schaefer, 1939, p. 917], although it may well have been imported after production in India or possibly Egypt. According to Schaefer the pattern consists of "...simple dot, ring, and circle motifs, which are reserved white on the blue fabric", thus suggesting an indigo resist design [Schaefer, 1939, p. 917].

The scholarly endeavours of R. Barnes (Department of Eastern Art at the Ashmolean Museum) have done much to advance knowledge of the history of printed textiles. The Newberry Collection held at the Ashmolean includes 1,225 pieces of Indian origin, found at Fostat. The majority of these are block-printed cotton textiles, all traded to Egypt from India (probably Gujarat, and maybe Rajasthan as well as Sind) "... initially as part of the medieval pre-European Indian Ocean trade" [Barnes, 1992]. They are thus amongst the earliest surviving examples of their type and are evidence of the economic exchange that linked India with the Near East. Barnes explained that the textiles could be classified into three groups: those which were coloured using indigo; those of various shades of red on white, indicating mordant printing using a madder dye bath; those which were coloured using combinations of indigo and madder [Barnes, 1992]. Archaeological excavations at the Egyptian Red Sea port of Quseir al-Qadim (used as a trading port in Roman times and again in the thirteenth and early-fourteenth century CE) have yielded sixty-eight fragments. These thirteenth- and early-fourteenth-century CE cotton fragments seemingly bear a direct relationship (in terms of both decorative style and technique of production) to the Newberry Fostat textiles documented by Barnes. It is believed that many of the items in both collections have a common source and period of manufacture [Barnes, 1992; http://www.Isa.umich.edu/kelsey/galleries/exhibits (accessed 20.12.2004)].

3. Wax- / Paste-Resist Techniques - Regional Variants

The word batik is used to refer to wax- (or sometimes paste-) resist patterning techniques and the resultant textile products. The derivation is apparently from the Javanese ambitik meaning to mark with small dots [Steinmann, 1947]. The process, as it is practised in many parts of the world, involves the application of hot molten wax to selected areas on the fabric's surface. On solidification of the wax, the fabric is immersed in a dye bath. The wax acts as a barrier to the dye and take-up only occurs in the unwaxed areas of the fabric.

Wax may be applied by one of several methods, using various implements. Most common is the Javanese canting (pronounced tjanting), an implement consisting of a small vessel of thin copper (which holds the molten wax) with one or more spouts (through which the molten wax flows) and a handle of reed or bamboo. The equivalent Indian implement is known as a kalam. This consists of a handle of wood attached to a short pointed metallic rod around which a wad of fibre is wound; in this case the wad of fibre holds the molten wax which in turn is allowed to flow, via the tip of the metallic rod, on to the surface of the cloth. Wax, or other forms of resist, may also be applied using blocks of various kinds as well as stencils. In the production of monochromatic batiks, the resist is applied once only prior to one dye-bath treatment. With polychromatic batiks, more than one dyeing takes place together with an equivalent number of resist applications. Subsequent to dyeing, the resist is removed either by scraping, especially when brittle waxes have been used, or by boiling.

Occasionally batiks show a peculiar veining effect, caused if a brittle wax mixture is used which, on cracking during immersion in the dye bath, permits dye to penetrate through to the fabric's surface. Although this cracking effect is popularly associated with batik products the world over, and is typically evident on screen-printed imitations, it is generally not pronounced on the higher-quality batiks (such as the finer qualities produced in central Java). Often, especially in cases where the batik is destined for a tourist market, the cracking effect is encouraged deliberately.

Generally, machine-woven cotton fabrics are used since these allow finer graphic detail than can be achieved using coarser hand-woven fabrics. The traditional use of batik, particularly in Asia, is in festive or ceremonial dress. In recent times the fabric has been made up into various western-style apparel items including men's shirts and women's dresses, blouses and skirts. Whilst batik has developed as a craft in many parts of Asia, Africa and Europe, it is probably in Java, one of the principal islands of the Indonesian archipelago, where the product has reached its highest level of aesthetic excellence. Some of the more important regional variants in the process and the resultant products are outlined below.

3.1 Indonesia

The principal areas of production included the areas in and around the central Javanese sultanates of Surakarta (Solo) and Yogyakarta (Yogya), the coastal areas of Cirebon, Indramayu, Pekalongan and Lasem, and the areas in and around Garut in West Java. Surakarta and Yogyakarta were the locations of the two powerful sultanates or principalities; each sultanate had its own Kraton or court which, in addition to being the residence of the local sultan and his extended family, also acted as a seat of government, religion and culture. Many traditional batiks were associated with the sultanates and, since Dutch colonial times, these have been known as Vorstenlanden batiks [Hann and Thomson, 1993, p.7]. In terms of colour and patterning, these batiks differed from batiks produced elsewhere in Java or other parts of Indonesia. Batiks produced elsewhere are known collectively as pesisir or coastal batiks [Djoemena, 1986, p. 8].

Colour combinations such as blue and white, red and white, red and blue, and red, blue and green were common on pesisir batiks but not on Vorstenlanden batiks [Djoemena, 1986, p. 9]. Further to this, shades of colours on pesisir batiks varied greatly depending on the workshop and its location. For example, the red on Indramayu batiks is generally not as bright as the red on Pekalongan batiks [Djoemena, 1986, p. 9]. Vorstenlanden batiks exhibit a rather more restrained palette of colours: rich browns, indigo blue, cream, white and black predominate [Djoemena, 1986, p. 8].

Pesisir batiks show naturalistic compositions and include floral, animal

and maritime themes. Vorstenlanden batiks depict motifs and patterns which are considered to reflect Hindu-Javanese culture and include a small number of forbidden or larangan designs (from larang to forbid [Kramer and Koen, 1993, p. 392]) which were restricted in use to members of the Kraton. [Djoemena, 1986, p. 12]. Commenting on the iconography of these Central Javanese batiks, Haake pointed out that they retain much information relating to the ancient beliefs and religious philosophy of the Javanese people [Haake, 1989]. Batiks from the coastal regions of the north, on the other hand, show the acceptance of Chinese and European motifs and compositions [Hann and Thomson, 1993, p. 8]. Some of the more common motifs and patterns, which assist in the identification of the location of production (and occasionally the method of production), are identified below.

A common batik design associated with Java is the tampal (meaning patch or plaster [Kramer and Koen, 1993, p. 489]) pattern. Traditionally identified as typical of Surakarta, Yogyakarta, Pekalongan and Cirebon, this pattern comprises a design field which is divided by a network of regular (or sometimes irregular) shapes with each filled by either a repeating pattern or else by a symmetrical or asymmetrical motif. The tampal pattern may have its origin in the patched clothing worn by Buddhist monks as an outward expression of poverty [Hann and Thomson, 1993, p. 8]. Another dominant pattern type, typically found on batiks from Surakarta and Yogyakarta, is the so-called parang (meaning dagger or chopper [Kramer and Koen, 1993, p. 424]) pattern. Varieties within this pattern class were larangan designs and were restricted in use to the high-ranking members of the Kraton [Djoemena, 1986, p. 12]. These patterns thus acted as insignia of social standing within Javanese society. Motifs of Chinese origin include the Chinese unicorn and phoenix, pairs of fish, cloud motifs, banji (swastika-shaped patterns) and a wide range of floral decoration probably sourced from imported Chinese ceramics [Hann and Thomson, 1993, p. 8].

Occasionally variations or developments in technique extended the range of decorative possibilities. For example a common characteristic of traditional Indramayu batik designs was the use of a coarse stipple effect as space filling or as a background between dominant motifs. This effect was achieved by a comb-like implement, with fine needles as teeth,

which was used to produce tiny openings in the solidified wax through which the dye could readily penetrate when the cloth was immersed in the dye bath [Djoemena, 1986, p. 43].

3.2 Japan

In Japan, rice paste was employed rather than wax to resist the penetration of dyestuff through to the fabric. These techniques seemingly evolved from twelfth-century CE Chinese in-fa-pu methods [Anon., *CIBA Review*, 1967/4]. Glutinous rice and rice bran were boiled and mashed to form a resist paste. Application was by tube or stencil. With the former method, the paste was squeezed directly on to the fabric's surface from a tube, and with the latter method the resist paste was applied to those areas of a fabric surface not covered by a stencil. When the paste was dry the fabric was dyed and the paste subsequently removed by washing off. The application of resist paste by tube was commonly used in the Tohoku area of north-eastern Japan to produce designs on women's ceremonial head-dresses [Anon., *CIBA Review,* 1967/4]. Elsewhere in Japan a free-hand method, involving paste from a tube, was used in the dyeing of large-scale family crests or trademarks [Anon., *CIBA Review*, 1967/4]. When stencils (katagami) were to be used, the paste was applied with a spatula into those parts of the fabric not covered by the stencil. When the paste was dry the fabric was immersed in a dye bath and the paste subsequently washed off [Anon., *CIBA Review*, 1967/4]. The so-called dye-pouring (chusen) technique also relied on the use of stencils. In this case the resist paste was applied by stencil to a piece of fabric which when dry was folded several times, each fold corresponding in dimensions to the size of the stencil. Dye was then poured on to the upper layer of the fabric (i.e. the area to which the resist paste had been applied), allowed to seep down through the folded fabric and to colour those areas not directly below the pasted areas on the top layer [Anon., *CIBA Review*, 1967/4].

In Japan, stencils were used in combination with other techniques. Various ornamental effects were achieved when combined with direct-printing or free-hand drawing techniques. The name yuzen designates a method of decorating fabrics which combines various printing and dyeing operations with free-hand addition of details [Anon., *CIBA Review*, 1967/4]. Stencils were used to print motifs directly in one or more colours. Printed motifs were further enhanced by hand painting, and were then covered with a

resist paste. The background colour was then applied using a squeegee [Anon., *CIBA Review*, 1967/4].

3.3 India and Pakistan

Indigo resist dyeing, using beeswax in conjunction with various mordant-dyeing techniques, was used to produce the so-called kalamkaris of the Coromondel coast of India. These textiles were traded in many parts of Asia and were brought to Europe in the eighteenth century where they acted as a stimulus to developments in dyeing chemistry and printing techniques.

Both painting and block-printing were employed in resist patterning. Molten wax or moist mud was simply applied to those areas not intended to be dyed. Indigo dyeing, in particular, was traditionally achieved in Indian cotton cloths by a resist method. In the southern states of Andhra Pradesh and Tamilnadu, the resist agent used was wax, and in Gujarat, Rajasthan and Madhya Pradesh mud was used. After printing or painting, the fabric was immersed in a dye bath. The depth and intensity of the resultant colour depended on the concentration of the dye, the duration in the dye bath and the number of immersions in the dye bath [Guy, 1998, p. 23]. Ultimately, the colour developed through oxidation, which began after removal of the cloth from the dye bath. As observed by Guy, more complex procedures, involving double dyeing to achieve a third colour (such as yellow on blue to produce green), were occasionally used [Guy, 1998, pp. 34-37].

Ajrak printing, which is associated with Sindh province in Pakistan and with the Kutch region in Gujarat, used a combination of mud or clay resist and mordant printing, and immersion in dye baths of indigo blue and madder red [Sreenivasam, 1989, p. 19]. The mud or clay resisted the dyestuff and the mordant attracted it. Typical designs are composed of a central field of squares, diamonds and star-shaped motifs, bordered by several rows of larger diamond shapes interspersed with rows of stylised flowers. Historical records are limited, but there is evidence of trade in similarly produced cottons from the north-west of India to Egypt and the Mediterranean initiated via the trade routes of the Indian Ocean [Askari and Crill, 1997, p. 59]. The Newberry textiles (held at the Ashmolean Museum), found at Fostat outside Cairo in the late-nineteenth century, are

an important collection which includes block-printed textiles, produced using resists or mordants, or combinations of both [Askari and Crill., 1997, p. 59]. These were exported from India, principally from Gujarat. An ajrak is a rectangular cotton textile, traditionally worn by men as a shoulder mantle, shawl or turban. The most important ajrak-producing areas in Sind were Karachi, Thatta, Jerruck and Hyderabad [Askari and Crill, 1997, p. 59]. Askari and Crill [1997, p. 59] observed that the term ajrak may have been derived etymologically from the Arabic word for blue. Dominant colours in ajraks are shades of blue and red (indigo and madder being the relevant dyes respectively) with some white retained and black used as outlines. Ajraks were traditionally printed on both sides. Askari and Crill, commenting on the typical design composition of an ajrak, observed:

> The end borders are referred as the paland and invariably consist of two borders of medallions and fluted arches (mihrabs) on short pillars, separated by a triple white stripe or naro. The side borders, however, vary in number and pattern, each with its own wat or subsidiary borders. The wat usually contains small, stylised flowers on a continuous vine with leaves, and the simpler ajrak may sometimes have only a single wat along its sides. Ajraks are generally distinguished by the pattern on the central field and the configuration of the side borders.
>
> [Askari and Crill, 1997, p. 61]

At least ten clear stages were required in the production of the traditional ajrak. Each is identified and described briefly below. In the first stage, five-metre lengths of cotton fabric were repeatedly washed and immersed in a solution of ground tamarisk seeds, molasses, oil and water to help soften the fabric and to rid it of starch. Printing proceeded in three stages using wooden blocks. A resist was applied to mark the white outlines and the stylised flowers of the pattern. Next a mordant was applied to the areas intended ultimately as black outlines. A resist and mordant mix was then applied to all areas not to be dyed blue. The cloth, in wet state, was sprinkled with powdered cow dung or ground rice bran on both sides to fix the resists. The fabric was then allowed to dry. Dyeing began after the dry fabric had been finely pleated and immersed in a cold indigo dye bath. On removal from the dye bath, the fabric was washed to reveal grey areas (where the red dye would be allowed to develop) as well as the resisted white areas. Madder-red dyeing followed in a hot dye bath, which allowed the red areas and the black outlines to develop. The cloth was then cooled and soaked in a mixture of camel dung and water. An

intensive phase of soaking in water and beating on stone slabs followed before the cloth was spread in the sun to dry. The final stage in dyeing was preceded by printing a resist on all area except those area that had already been dyed blue (following the first stage of dyeing). This second indigo stage had the function of intensifying the blue colour obtained earlier.

3.4 Further Distribution

In 1947 Steinmann presented a discussion on the possible origin and spread of batik and similar resist techniques [Steinmann, 1947]. Although he failed to present a definitive answer relating to the question of origin and diffusion, he none the less succeeded in identifying the widespread use of the technique and in assembling evidence of its early use. He identified the antiquity of the technique in Japan, South China, India, East Turkestan and parts of West Africa. Amongst the oldest batik fabrics, identified by Steinmann, were the screens held in the Imperial Treasury (known as the Shôsôin, in Nara, Japan), suggesting that the technique may have been known in Japan during the Tempyo or Nara period (710 –794 CE), although it was suggested by Steinmann that these items were produced by Chinese artisans [Steinmann, 1947]. To support his discussion, he identified several Japanese scholars who agreed that wax-resist printing, so common in eighth-century Japan, had been introduced into that country from China" [Steinmann, 1947]. Production in China does not however appear to have been widespread at any stage. Probably the most notable batik-type textiles produced within China's current geographical boundaries were crafted by the non-Chinese Miao, a tribal people settled in recent centuries across several provinces in South China. The Miao used an implement consisting of a metal tube attached to a bamboo handle to apply wax to cotton fabrics [Steinmann, 1947].

According to Steinmann [1947] South Indian batik production reached its peak in the seventeenth and eighteenth centuries, with exports to Java, Sumatra and elsewhere. It appears that these Indian textiles were produced using combinations of resists and mordants, applied by blocks and freehand using a kalam (mentioned previously). The most westerly part of Asia where resist-patterned textiles were produced was Bokhara (in Turkestan). These patterned textiles were described by Steinmann as

Ikat, silk, 20th-Century India.

Batik, cotton, 20th-Century Java.

Bandhani, cotton, 20th-Century Gujarat.

Ikat, silk, 20th-Century Gujarat.

Batik, cotton, 20th-Century Java.

Adire, cotton, 20th-Century West Africa.

Resist-printed and dyed cotton, 20th-Century India.

Ajrak, cotton, 20th-Century Pakistan.

dress designs "...in blue and white and square handkerchiefs of silk with simple patterning... often with a border of Arabic lettering" [Steinmann, 1947, p. 2105]. It has not been ascertained how far these designs were influenced by designs from China, since during the Tang dynasty (620-907 CE), when Chinese artisans seemingly first came to know of batik, the Chinese Empire extended westwards as far as East Turkestan [Steinmann, 1947, p. 2106].

Starch-resist, indigo-dyed cloths were produced by the Yoruba of West Africa and were known as adire eleko. Designs are composed in a structure of squares and rectangles. Motifs within the structure include leaves, plants, various animals and representations of other natural and man-made objects. Extensive details were given by Picton and Mack [1991, pp. 147-168].

Batik is practised widely by modern craftworkers in Europe. Wax is the most common choice of resist. A variety of implements may be used, but to achieve fine lines a Javanese-style canting is best employed. The wax must be applied in its molten state and should therefore be heated and kept to a working temperature of around eighty degrees Celsius. When the wax is too hot it has the tendency to spread too rapidly and when too cool it tends to solidify too quickly; clarity of design is lost in each case. With a monochromatic design, the fabric can be dyed soon after the wax has set. With polychromatic pieces the wax is applied in successive layers, each after a dyeing. It is important to use cold-temperature dyes; cold-water-reactive dyes are particularly suitable for both cotton and silk fabrics. It is important to keep the fabric, once waxed, as flat as possible during the dyeing process; otherwise the wax may crack and allow the penetration of dye. Once dyeing has taken place the wax needs to be removed. This can be done by plunging the fabric into boiling water or by ironing the fabric between layers of absorbent paper. Various starches and gums can be used as alternatives to wax. A simple flour-and-gum-arabic paste performs very successfully, if used with block-or screen-printing techniques. Cassava paste is more glutinous and is traditionally hand-painted or stencilled on to the cloth, as it tends to be too sticky to be successfully printed by screen or by block. Japanese rice paste can be stencilled, applied with a fine wooden spatula or trailed across the fabric's surface with a tube. Cut stencils need to be stiff; oiled manila

card or thin plastic are adequate. Paste can be applied using stiff paint brushes, pieces of card or thin strips of wood. Where a cracked effect is desirable, dextrin makes a successful resist and, when used warm, can be painted, block-or screen-printed on to most common fabric types. Once dyeing is completed it is necessary to remove any traces of starch by boiling the fabric in hot soapy water.

4. Ikat Techniques - Regional Variants

The word ikat is derived from the Malay (or Indonesian) word mengikat meaning to tie [Kramer and Koen, 1993, p. 265]. The ikat process is a resist-dyeing process, which involves the binding of sections of warp and/or weft threads with dye-resistant material (such as strips of palm leaf) prior to fabric construction. On immersion in a dye bath, the uncovered areas of the threads take up the dye. Further colours can be obtained by rearranging the resist-protected areas prior to further dye-bath treatment. On completion of dyeing, the resist material is removed and the threads are carefully arranged before weaving. The resist may be applied to the warp, the weft, or both sets of threads. The resultant products are referred to as warp-ikat, weft-ikat, and either double-ikat or compound-ikat respectively. In warp-ikat, only the warp threads are patterned. In weft-ikat, only the weft threads are patterned. In compound-ikat both warp and weft threads are patterned, each set producing an independent design not reliant on the other. In double-ikat, both sets of threads are patterned and overlap in the final woven design. As pointed out by Weiner:

> Double-ikat is the most difficult to design and weave because the dyed and undyed portions must line up to form an intricate pattern.
>
> [Weiner, 1992]

In order to enhance the clarity of an ikat motif or pattern the decorated yarns should be allowed to dominate within the final woven cloth. Larsen observed:

> Whereas most ikats are plain woven, almost all warp-ikats are cloths in which the warp yarn dominates the weft because it is either heavier or more densely crammed. The inverse is true of weft-ikat. Double-ikats tend to be woven in a balanced plain-weave.
>
> [Larsen, 1976, p. 29]

A typical visual characteristic of an ikat-type cloth is a feather-like effect which is caused by the colour in the dye bath bleeding under the resisting material, and by the slight movement of threads caused by the strains imposed by the weaving process.

The constituent fibres of yarns used for ikat production vary depending

upon the location of production and the nature of the fibres readily available. Historically these have included: cotton, silk, ramie, hemp, banana fibres, and some other plant fibres. The nature of ikat production in Indonesia, India and Japan and other important producing locations is discussed below.

4.1 Indonesia

In Indonesia ikats were considered to possess a myriad of ritualistic, ceremonial and spiritual functions. Referring principally to warp-ikats, Warming and Gaworski commented that they:

> ...have a ritual and spiritual value that extends beyond the mere physical object. Textiles are required for ceremonies, but not just as traditional dress for the participants. The cloths themselves are a necessary part of the ritual. Warp-ikat cloths act as burial shrouds, as part of the exchange of gifts before marriage, and as a way of preserving local history and legends.
>
> [Warming and Gaworski, 1981, p. 79]

This close relationship between textiles and culture extends to a time when many of the island peoples came into contact with a bronze-using culture originating in what is now the northern part of Vietnam [Warming and Gaworski, 1981, p. 54]. This Dong-Son culture, as it is known, was the source of certain styles of decoration which combined with indigenous symbols and motifs to provide the extensive range of designs evident in the warp-ikats produced in Indonesia in the past few hundred years.

Variations of the technique were widespread across the archipelago. The best-known cotton warp-ikats are those of East Sumba. Other important locations are Sulawesi, Timor, Sawu and Rote. Weft-ikat production was less extensive and was evident in parts of Sumatra, East Java, Sulawesi and Bali [Kartiwa, 1987, p. x]. Among the most exquisite weft-ikats are those from the Palembang region (South Sumatra). Double-ikat patterned cloths were made in Tenganan, a village located in the east of the island of Bali [Warming and Gaworski, 1981, p. 108]. A range of weft-ikats was also produced on Bali. Some of the more important regional variations in technique and decoration are identified below.

Cotton warp-ikats from East Sumba are known as hinggi, and were worn by men as waist and shoulder cloths. They were much valued as ritual and prestige objects. The principal compositional characteristic is

a series of horizontal bands, three to eleven in number, containing a great variety of motifs derived from the realms of legend, sacred rite and such diverse foreign sources as Chinese porcelains or Dutch coins [Larsen, 1976, p. 150]. Probably the most common motif is the horse, its use in ikat decoration being a reflection of its past status in Sumbanese daily life as a measure of wealth [Warming and Gaworski, 1981, p. 81]. Another prominent motif is the so-called skull tree, a reminder of past ritualistic head hunting. Other common motifs include the shrimp, the snake, the Chinese dragon (believed to be adapted from imported Chinese ceramics), the rooster, standing human figure, deer, monkey, lizard, crocodile, fish, insect, sea horse, cockatoo and various other birds [Hann and Thomson, 1993, p. 12].

Cotton warp-ikats were produced by the Toradja people of central Sulawesi. These invariably depict large-scale geometric patterns in blue, white and black against a dominant red background. The geometry of the Toradja ikats has been interpreted as human figures in schematic form and has, on occasions, been considered to resemble some patterns produced by native North Americans. [Jager Gerlings, 1952, pp. 110-111; Larsen, 1976, p. 149].

As pointed out by Kartiwa, trade in Timor cloths outside the area was long-standing, especially to non-weaving areas such as Irian Jaya [Kartiwa, 1987, p. 80]. Supplementary-weft decoration is often used in conjunction with warp-ikat. Brilliant red bands and stripes or large-scale blue ikat patterns are typical. Motifs include various birds, horses, lizards and human figures. As pointed out by Gittinger, subtle variations in decoration and technique, including tonal qualities of colour and variations in band width, were apparent from area to area within Timor, but these variations were barely perceptible to the vast majority of outsiders [Gittinger, 1985, p. 175].

The most important characteristic of the cotton warp-ikats produced on Sawu island was that their designs denoted membership in a female-aligned clan system that controlled life-crisis rituals [Hann and Thomson, 1993, p. 12]. Delicate white geometric and floral motifs against a dark blue or black background are the principal decorative feature [Warming

and Gaworski, 1981, p. 83]. Motifs were taken from Portuguese, Dutch and other European sources [Hann and Thomson, 1993, p. 12].

The inhabitants of the island of Rote came into early contact with Europeans during the seventeenth century with the arrival of the Portuguese, who brought with them exquisitely designed Indian double-ikat cloths (known as patola) to exchange for spices. It should be noted that, contrary to the impression given in many of the standard texts on the subject, Indian cloths were traded extensively in Asia before the arrival of Europeans [Guy, 1998]. In spite of the point of first trade contact, the influence of Indian patola-cloth design can be detected in the design of Rotenese warp-ikats, in particular through the use of various octagon-shaped floral motifs, known as the black motif in Rote and as the jelamprang motif elsewhere in Indonesia [Gittinger, 1985, p. 185].

In the western part of Flores, textile patterning was traditionally through the use of songket weaving (a supplementary-weft patterning technique). Elsewhere on the island warp-ikat patterned textiles were produced. A wide range of sources of patterning can be identified. In the isolated central region, the ikats produced by the Ngada are generally blue-black in colouring and show simple triangular, square and zigzag shapes, revealing very little influence from outside sources [Gittinger, 1985, pp. 168-169]. Substantial foreign influence is evident in the textiles produced elsewhere across the island. In some cases European designs were adapted, or compositional arrangements typical of Sumba were imitated [Gittinger, 1985, p. 169]. The design of Indian patola cloths has had a major impact.

The Batak people of North Sumatra produced cotton warp-ikats with simple arrowhead effects or diamond shapes, in white against a single background colour. Among the most exquisite weft-ikats are those from the Palembang region. In terms of design, these ikats show a bewilderingly wide-ranging iconography. Motifs include complex arrangements of ship and mountain images, snakes, decorative floral and arabesque forms, as well as various geometric patterns [Gittinger, 1985, p. 103]. The most renowned of Bali's textiles are the double-ikat patterned cloths made in Tenganan, a village located in the east of the island. These cloths, which are known as gringsing, show a range of stylised floral and geometric

motifs as well as various human figures. The style of the human figures has been compared to thirteenth- and fourteenth-century temple decoration in central Java, thus suggesting that similarly patterned textiles may have been produced in Java in the past [Gittinger, 1985, p. 149]. A range of weft-ikats was also produced in Bali, showing not only geometric and floral compositions, but also various figural scenes drawn from Hindu mythology.

4.2 India

Most renowned of the resist-dyed cloths from India are the double-ikat silks from Gujarat and Orissa. Known as patola in Gujarat and as banha in Orissa, these cloths were extensively traded throughout much of South-East Asia, initially through the activities of Indian, Arab and Chinese traders and, from the seventeenth century onwards, Portuguese, British and Dutch merchants who used them as exchange goods for precious spices such as nutmeg, mace, cloves and pepper [Sreenivasam, 1989, pp. 11 and 35]. According to Weiner, patola were used as temple hangings, bridal gifts and shrouds, and were worn at court appearances, classical dance events, weddings and funerals [Weiner, 1992]. Not surprisingly, in coastal Indian towns such as Orissa, ikat designs were inspired by the sea and included various sea animals and fish. Flowers and stripes were also common and arrowhead-type effects were in widespread use on the borders of saris [Weiner, 1992]. In South India, lotus blossoms, four-petalled flowers and swastika-type designs, as well as stylised peacocks, parrots, lions and elephants, were common [Weiner, 1992]. Checks and squares containing small motifs were also used. Ikats from Gujarat commonly depicted diamonds and rosettes.

Patola were traditionally used as ceremonial saris in Gujarat, and the major producers were located in Patan, Ahmedabad, Cambay and Surat [Guy, 1998, p. 26]. Guy observed that the techniques of single- and double-ikat were also practised on the Coromandel coast, in Orissa and Andhra Pradesh, where cotton was used as well as silk [Guy, 1998, pp. 26-27]. The word patola (with singular patolu) appeared in various forms as early as the fourteenth century CE in India and in accounts of early-sixteenth-century European commentators. The latter documents are reviewed by Guy [1998, p. 26].

4.3 Japan

Kasuri is a Japanese term used to denote ikat-type fabrics produced by one of a number of yarn-resist-dyeing techniques. It is important to note that all four types of ikat (warp-, weft-, compound- and double-ikat) were produced in Japan [Weiner, 1992]. In an important article published in the *CIBA Review* in 1967 eight methods, used in Japan, for producing kasuri and kasuri-type fabrics were identified. Each is described briefly below.

The first listed method followed the familiar procedures associated with conventional ikat produced elsewhere, especially in Indonesia. Simply, thread was wound tightly around those portions of the warp or weft yarns which were intended to resist the dye. Dye would take to the areas not covered with the resist. After drying, ties were removed and weaving commenced [Anon., *CIBA Review*, 1967/4].

The fine dotted patterns associated with the silk kasuri of Amamioshima and the ramie kasuri of Miyako were produced by weaving weft yarns with thick cotton warps into a plain-woven fabric which was piece-dyed and then taken apart. The weft yarns, which remained undyed in those areas covered with warp threads, were subsequently woven with new warps into the final fabric [Anon., *CIBA Review*, 1967/4].

A technique used for producing hemp kasuri from Omi and Echigo, the silk kasuri from Yonezawa and the cotton kasuri from Yamato, entails pressing yarns between two boards engraved in high relief ; on immersion in a dye bath, the dye takes only to the areas not under pressure [Anon., *CIBA Review*, 1967/4].

With one listed method, dye was simply rubbed into sections of yarn using a thin stick. When the dye had dried, the yarn was assembled as warp or weft, and woven. A dye bath was not therefore required [Anon., *CIBA Review*, 1967/4].

Another method listed simply involved dipping a portion of a skein of yarn in a dye bath. When the yarn was dried, and the warp or weft assembled, weaving proceeded. A hazy effect resulted; such fabrics were known as fukiyose or drifting kasuri [Anon., *CIBA Review*, 1967/4].

A further variation for producing a kasuri-type fabric involved weaving a fabric with temporary weft threads and then printing this fabric with a multi-coloured figured design. Subsequently, the fabric was taken apart and the partially dyed warp threads woven again with new undyed weft yarns to produce the final product [Anon., *CIBA Review*, 1967/4].

Woven imitations of kasuri fabrics were produced using solid-colour yarns. Presumably one colour was used for the areas supposedly resisted and the other colour for the supposedly dyed areas. The resultant fabrics were known as ukiori kasuri, although they were imitations [Anon., *CIBA Review*, 1967/4]. A further imitation was produced by printing on solid-colour piece-dyed fabrics [Anon., *CIBA Review*, 1967/4].

Kasuri fabrics were employed often in the production of futons (i.e. thickly padded cotton quilts or mattresses). Various plant and animal motifs as well as a wide range of geometrical motifs were used [Langewis, 1967, pp. 33-37].

4.4 Further Distribution

In 1992, Weiner reported that warp-, weft- and compound-ikats were woven in Guatemala and Mexico. Warp-ikats were produced in Ecuador, Colombia, Peru, Bolivia, Argentina and Chile. In El Salvador and Honduras, weft-ikats were woven. Typically, in most of these areas, the resultant cloth had an amazingly wide range of end uses, including skirts, shawls, ponchos, blouses, aprons, sashes, jackets, trousers, blankets and hammocks [Weiner,1992]. Weiner commented that the majority of designs were "...bright, multi-coloured ikat stripes mixed with plain stripes or ikat plaids" [Weiner, 1992]. Motifs included fish, birds, pumas, the human form and mythological characters [Weiner, 1992].

The tribal peoples of Hainan (China) produced ikat using wax as a resist [Weiner, 1992]. Other than this, it seems that there was no other ikat production in China. The technique was at some time used in much of West Africa by, for example, the Hausa, the Yoruba, the Northern Edo and the Ewe of Ghana, all of whom used ikat-dyed yarn in warp-stripe patterns [Picton and Mack, 1991, p. 38]. The most elaborate use of the ikat technique in Africa was amongst some Sakalava groups in western Madagasar [Picton and Mack, 1991, p. 38].

5. Tie-and-Dye Techniques - Regional Variants

Tie-and-dye, when used in its basic form, is a relatively straightforward means of decorating textiles. Pieces of cloth are wrapped and tied tightly with yarn or string so that dye will only penetrate to the unbound areas of the cloth. In Indonesia the technique is known as plangi / pelangi and in the Indian subcontinent the terms bandhani (from band meaning to bind) and chundri (meaning to gather into fine pleats) are used. In Japan the term shibori (derived from shiboru, meaning to wring, squeeze, or press) refers to both the process and the product. Among the Yoruba people of Nigeria the technique is known as adire. Probably the simplest form of decoration achieved using the technique is a light circle against a dyed background, as found on fabrics from the Indian subcontinent, parts of North and West Africa, Japan and parts of South-East Asia. These designs are produced by using the fingertips or nails to pull up small portions of the fabric and by tying firmly these bunched areas with waxed yarn or similar material. After dyeing, these tied portions are untied to reveal undyed areas of greater or lesser size. Alternatively the elevated areas may be tied at their bases with the upper parts left free; after dyeing, ring-shaped undyed areas will result. On occasions, small pebbles, glass beads, grains of rice, or seeds, are tied into the fabric bunches; such additions may enhance the regularity of design in the resultant dyed fabric.

When thin fabrics are being decorated, the lengthy work of tying can be shortened by folding the fabric and tying two or more layers at a time. Folding twice can thus give four layers of cloth. It has been observed that simultaneous treatment of several fabrics was encountered in India (especially Rajasthan) as well as Indonesia and Japan [Bühler, 1954].

The vast majority of tie-and-dye products necessitates only one dyeing operation. Where this is the case, one set of ties is made and the cloth is placed in the dye bath once only. Patterns are thus reserved in the natural colour of the fabric against a one-colour background. Multi-coloured tie-and-dye products are not as common and necessitate the use of more than one dye bath. Each new dye bath requires the fresh tying of resists.

5.1 India and Pakistan

The craft was widespread throughout India. Six key areas of historic importance can be identified: Rajasthan, Gujarat, Maharashtra, Tamil Nadu, Andra Pradesh, Madhya Pradesh [Westfall and Desai, 1987]. The technique was also in use in parts of Pakistan, especially in the Punjab. The simplest Indian bandhani or Pakistani chundri cloths show round or diamond-shaped patches of a few centimetres width distributed evenly over a dyed ground. One of three means for creating outlines on the fabric, to guide the artisan tying the ties, was employed. The first of these involved the use of a stencil motif in which chalk was sprinkled over the holes to transfer the form of the motif on to the fabric [Westfall and Desai, 1987]. In a second method, an engraved wooden block was used to stamp geru (a red-coloured clay liquid) in the form of the desired design. In the third method, the dampened fabric was placed over a block of wood that had the points of nails protruding in the form of a design. Tiny portions of the fabric held on each nail were pinched and tied with waxed thread. A circular spot was thus reserved from the dye of the dye bath. If each portion of the fabric was tied at the base of the protruding nail only, a ring-shaped area was reserved from the dye [Else, 1988].

Each region has its characteristic colours and designs. Bühler, a renowned authority on resist-dyeing techniques of various kinds, remarked that the finer categories of Indian plangi fabrics were referred to by different names depending on the nature of the process by which they were created [Buhler, 1954]. Many of these terms are still in use today. In Gujarat, for example, red fabrics with scattered figures or patches of white, yellow and green were known as chunri or chundri, and cloths with a white undyed central area and red margins with tendril-like forms in white, yellow and green were known as panetar or paneter [Bühler, 1954]. Fulwadi cloths were red and divided by yellow dots into lozenge-shaped panels filled with several large reserved areas of white and green, and gharchola cloths were of the same colour scheme, and had oblong-shaped panels with figurative motifs showing humans or animals [Bühler, 1954]. Typical of Rajasthan are tie-dyed fabrics with zigzag designs, wavy lines, leaf shapes, crosses and various other simple figures [Buhler, 1954]. More complex resist-patterned fabrics are also produced in Rajasthan, and these depict minutely worked outlines of various leaf and floral motifs, and animals or human figures [Bühler, 1954].

Throughout much of the Indian subcontinent, the technique is still widely used, particularly in rural areas. Saris, shawls and turbans are typical end uses. Bühler observed that exports from Rajasthan to other parts of the Indian subcontinent were, at one time, considerable. The resist materials were not normally removed prior to the sale of the resist-dyed fabric. This enabled prospective purchasers to distinguish between genuine hand-crafted items and factory-made imitations [Bühler, 1954]. The laharia or wrap-resist-dyed cloths of Rajasthan were used for turban cloths and for saris. These cloths were prepared by rolling the fabric lengthways in rope form and twisting it with one or more strong cotton cords. After several rope forms had been twisted and tied with cords, they were immersed in a dye bath. Each successive colour required the adjusting or removal of the cord resist [Sreenivasam, 1989, p. 35].

5.2 Indonesia

In Indonesia the principal producing regions were Sumatra (particularly the area in and around Palembang), Java, Lombok and Bali. Often silk, rather than cotton fabric, was used. In Sumatra and Java, the dominant background colour to fabrics was generally red or reddish purple and the resisted areas took the form of circles, rings, lozenges, or more complex motifs [Buhler, 1954]. Plangi fabrics were used as shawls, sashes, and sarongs as well as wall hangings [Buhler, 1954].

A variant of the plangi technique, known as tritik (in Indonesia), relies on the use of stitch work. A length of strong thread is sewn into the fabric using a series of short stitches. The thread is subsequently drawn tight and close-packed folds form in the fabric. On immersion in the dye bath, the dye will be unable to penetrate to the tightest-drawn portions of the fabric and will penetrate sparingly to the close-packed folds. These stitched resists were occasionally combined with the more simple tying technique outlined above; examples include the so-called kain-kembangan cloths of central Java, which have tritik-patterned borders. The red silk plangi cloths of Palembang (South Sumatra) are probably the most outstanding of those produced in Indonesia. The compositional layout of these cloths is very similar to that of the so-called patola double-ikat cloths of Gujarat [Hann and Thomson, 1993, p. 16]. Bühler observed that loosely woven Chinese silks were often used for plangi products in Palembang (Sumatra) and in the eastern part of Java. Three fabrics, each folded twice, were on

occasions tied with resists simultaneously. A piece of work was therefore composed of twelve layers of fabric held in place by loose stitches along the edges [Bühler, 1954].

5.3 Japan

In Japan the technique is known as shibori and was particularly popular during the eighteenth century. Combinations with other resist-dyeing techniques as well as embroidery were not uncommon. The technique was deemed to be best suited for use with soft pliable fabrics and was seemingly first used on silk and then, in the sixteenth century and onwards, for cotton [Anon., *CIBA Review*, 1967/4]. Certain regions or towns became associated with particular varieties of shibori fabric. The kyo shibori from Kyoto are renowned as elegant designs on silk, and cotton shibori designs from Arimatsu and Narumi have been prized since the sixteenth century [Anon., *CIBA Review*, 1967/4]. The production of Japanese shibori fabrics was generally very labour intensive and, as a result, a whole kimono made from intricate shibori designs was very expensive and beyond the spending power of the majority of Japanese. Coverlets, wraps and men's waistbands, decorated by using simple designs, were common [Anon., *CIBA Review*, 1967/4].

One of the rarest forms of resist dyeing is "clamped resist", known in Japan as itajime. The resultant soft ghostly images are found with no other resist or printing technique. Clamped resists do not require the use of pastes, waxes or bindings, but instead involve folding cloth in two or more directions and clamping it between boards or sticks. The clamped-resist technique seemingly fell into disuse in Japan by the twelfth century CE but was revived during the nineteenth century in a simplified form. In 1837 Tomoshicihi Miura, in Yamato near Nara, adapted the method to the resist-dyeing of warp and weft threads in the production of ikat-type designs [Leighton-White, 1994]. With this technique (known as the itajimi-kasuri) yarns were passed between two boards engraved in high relief and, when immersed in a dye bath, the dye was unable to penetrate to the areas under pressure [Anon., *CIBA Review*, 1967/4].

5.4 Further Distribution

The technique was widespread in many other parts of Asia, and its use has been noted in Cambodia, Myanmar, Thailand and Indonesia [Bühler,

1954]. In China, the technique was generally associated with rural people in the south, particularly in Szechwan and Yunnan provinces, where it was used in association with intricate stitching and folding techniques to produce blue and white designs on cotton. Motifs included fish, flowers, birds and butterflies and lion-type animal motifs. Curtains, bedcovers, and clothing for children were the principal end uses [Bühler, 1954].

Tie-and-dye-type fabrics were produced in many parts of Africa; the adire oniko cloths produced by the Yoruba of Nigeria are probably the most notable. These fabrics were produced by tying and stitching using raffia. Resist-dyed fabrics with designs composed of large or small circles were found throughout much of West Africa, and production of these was particularly common among the Yoruba as well as the peoples of Senegal and Gambia [Picton and Mack, 1991, p. 148]. In Morocco, Algeria, Tunisia and Libya simple ring designs, using single-colour resist-dyeing on woollen fabrics, were common [Bühler, 1954]. In Gambia and Senegal a marbled effect was produced by crumpling the fabric and binding it loosely before immersion in a dye bath [Picton and Mack, 1991, p. 150]. In Senegal, Gambia and Sierra Leone, strips of cloth were folded into several narrow pleats and bound together to create a cross-hatched effect [Picton and Mack, 1991, p. 152]. In Senegal, geometric patterns were embroidered on cloths which, after dyeing, were unpicked to reveal very finely rendered designs against the dyed background [Picton and Mack, 1991, p. 152].

Bühler noted the production of plangi fabrics in Persia, Syria, Cyprus and Chinese Kashgar, and in addition provided a comprehensive two-page table showing the distribution worldwide, noting the material used and the characteristics of the technique employed [Bühler 1954]. He noted further that the earliest traces of plangi in the continent of America dated to pre-Columbian times, with Peruvian fragments from the first millennium (CE). He also made reference to the existence of pictorial evidence showing familiarity with the technique in Mexico, prior to the arrival of the Spanish. Other tie-and-dye districts in the Americas were located geographically within the sphere of influence of either Peru or Mexico [Bühler, 1954].

From the viewpoint of the modern craft worker bound resists are probably

the simplest form of patterned textiles. Horizontal, vertical or diagonal stripes can be achieved by pleating or rolling the fabric tightly and then binding sections to stop the penetration of the dye. A chequered effect can be produced if the fabric is rolled, tied and dyed in two directions each at ninety degrees to the other. The most common bound resist is when the fabric is pulled into a central position and bound in sections down its length thus producing circles in the final design. Interesting additional patterning can be produced by further binding. The size of each circle can vary from one millimetre in diameter to one metre depending upon how much fabric is pulled up. With bound resists the choice of binding material is of great importance, as it is necessary to ensure that the ties are tight and that the dye will not penetrate underneath. After dyeing it is important to rinse and dry the fabric thoroughly before it is untied, otherwise excess dye will bleed into the design. Using different dyes and fabrics, while employing the same basic technique, can yield amazingly wide variations in final design.

Stitched resists require strong thread. Lengths of fabric are often folded into layers and then stitched to achieve mirror images of motifs. Once the stitching has been completed the threads are pulled up tightly until the cloth forms closely-packed pleats. Threads in the corrugations of the fabric are largely protected from the dye.

Pleating of cloth can be done by hand or by using a machine known as a princess pleater. Hand-pleated cloth tends to be slightly irregular. Fabrics can be pleated in weft or warp directions and the pleats are often secured by a tacking thread. Crisper pleats can be achieved by using a domestic iron to press the edges of the fabric.

6. In Conclusion

Resist-dyeing techniques have been practised worldwide and, in their simplest forms, were probably the first means of decorating textile fabrics. Knowledge of such techniques, although they are remote in historical origin, should not be restricted to the anthropologist, archaeologist or historian, for such knowledge can form the basis from which to derive or develop a wide spectrum of aesthetic effects of great value to the modern designer. Many of the techniques described above are still practised today and have spread beyond their traditional homelands to be used by craftspeople in Europe and North America. Resist-dyeing techniques require high levels of skill and are exceedingly labour intensive. In terms of the mass-market production of the twenty-first century, these techniques offer no real potential as competitors for more technologically advanced screen- and digital-printing techniques. However, in more specialised, niche, couture-type markets, there is always the demand for the unique, exclusive, one-off, designed item. Beyond this, there is still much of value to the modern designer. Experimentation with these techniques, within a modern studio environment, offers potential in the realms of design and product development, and as a complement to the numerous innovations in computer-aided design.

References

Anon. (1954). Plangi - Tie and Dye Work, *CIBA Review,* no.104, pp.3726-3752.

Anon. (1967). Japanese Resist-dyeing Techniques, *CIBA Review*, 1967/4, pp.2-29.

Askari, N. And Crill, R. (1997). *Colours of the Indus. Costume and Textiles of Pakistan*, Merrell Holberton Publishers, London, in association with the Victoria and Albert Museum.

Barnes, R.(1992). Fragments of Splendour. Indian Resist-dyed Textiles from the P. E. Newberry Collection in the Ashmolean Museum, *The Ashmolean*, no.22 (Spring/ Summer) 3pp.

Bilgrami, N. (1990). *Sindh Jo Ajrak*, Department of Culture and Tourism, Government of Sindh, Pakistan (ISBN 969-8100-00-8).

Bühler, A. (1942). Ikats, *CIBA Review,* no.44, pp.1586-1611.

Bühler, A. (1951). Indigo Dyeing among Primitive Races, *CIBA Review*, no.85, pp.3088 - 3091.

Bühler, A. (1954). Plangi - Tie and Dye Work, *CIBA Review*, no.104, pp.326-3752.

Chen, Y. and Liu, S. (1980). The Excavation Bulletin of Gureixi cave Burials in Jianxi Province, *Wenwu* (Cultural Relics), No. 11, p.15.

Djoemena, N. S.(1986). *Batik: Its Mystery and Meaning*, Penerbit Djambatan, Jakarta.

Else, J. (1988). A Composite of Indian Textiles: Tradition and Technology, *Ars Textrina*, vol.x, pp.71-84.

Gillow, J. and Dawson, B. (1992). *Traditional Indonesian Textiles*, Thames and Hudson, London.

Gittinger, M. (1982). *Master Dyers to the World. Techniques and Trade in Early Indian Dyed Cotton Textiles*, Textile Museum, Washington.

Gittinger, M. (1985). *Splendid Symbols. Textiles and Tradition in Indonesia*, Oxford University Press, Singapore.

Guy, J. (1998). *Woven Cargoes. Indian Textiles in the East*, Thames and Hudson, London.

Haake, A.(1989). The Role of Symmetry in Javanese Batik Patterns in I. Hargittai (ed.) *Symmetry2: Unifying Human Understanding*, Pergamon, New York, pp.815-826.

Haller, R. (1951). Indigo, *CIBA Review*, no.85, pp.3072-3087.

Hann, M. A. (1992). Unity in Diversity: The Batiks of Java, *Ars Textrina*, vol.XVIII, pp.157 - 170.

Hann, M. A.(2004). *Dragons, Unicorns and Phoenixes - Origin and Continuity of Technique and Motif*, the University Gallery Leeds (ISBN 1-874331-32-4).

Hann, M. A. and Thomson, G. M. (1993). *Unity in Diversity. The Textiles of Indonesia*, The Gallery, University of Leeds.

Healy, J. F. (1999). *Pliny the Elder on Science and Technology,* Oxford OUP.

Herodotus **(1996 trans.)** de Sélincourt, A., with introductory matter and notes by Marincola, J., Penguin, London.

Jager Gerlings, J. H.(1952). *Sprekende Weefsels*, Koninklijk Instituut voor de Tropen, Amsterdam, 1952.

Kartiwa, S. (1987). *Indonesian Ikats*, Penerbit Djambatan, Jakarta.

Kramer, A. L. N. And Koen, W. (1987). *Tuttle's Concise Indonesian Dictionary*, Charles Tuttle Company, Rutland, Vermont.

Langewis, J. (1967). Kasuri Motif Symbolism, *CIBA Review*, 1967/4, pp.33-37.

Larsen, J. L. (1976). *The Dyers Art. Ikat, Batik and Plangi*, Van Nostrand Reinhold, New York.

Leighton-White, S. (1994). Japanese Resist Dyeing *Textile Society*, vol. 21.

Picton, J. and Mack, J. (1991). *African Textiles*, second edition, British Museum Publications, London.

Plinius Secundus **(1978 trans.)** *Naturkunde*, lateinisch - deutsch Buch 35 Farben Malerei Plastik ed. and tr. König, R' and Winkler, G., Heimeran Verlag, Munich.

Pliny (1952 trans.). *Natural History*, vol.9, Rackham, H. (trans.), Heinman, London.

Schaefer, G. (1939). The Earliest Specimens of Cloth Printing, *CIBA Review*, no.26, pp.914-920.

Singer, C. (1948). *The Earliest Chemical Industry: an essay in the historical relations of economics and technology illustrated by the alum trade*, Folio Society, London.

Sreenivasam, E. (1989). *The Textiles of India: A Living History*, Octagon Center for the Arts, Ames, Iowa.

Steinmann, A. (1942). The Patterning of Ikats, *CIBA Review*, no. 44, pp.1612-1618.

Steinmann, A. (1947). Batiks, *CIBA Review*, no. 58, July 1947, pp.2090-2123.

Vetterli, W.A. (1951). The History of Indigo, *CIBA Review*, no.85, pp.3066-3071.

Warming, W. and Gaworski (1981). *The World of Indonesian Textiles*, Serindia Publications, London, 1981.

Weiner, Y. (1992). The Indian Origin of Ikat, *Ars Textrina*, vol.17, pp.57-85.

Westfall, C. D. And Desai, D. (1987). Bandhani (Tie Dye), *Ars Textrina*, vol.VIII, pp.19-28.

Wheeler, M. (1953). *The Indus Civilisation* supplementary volume to *Cambridge History of India*, (cited by Askari, N. And Crill, R., *Colours of the Indus. Costume and Textiles of Pakisan*, Merrell Holberton Publishers, London, 1997).

Zhong, H. and Hann, M. A. (1989). Textile Manufacture in China During the Period of the Warring States (475-221 BC), *Journal of the Textile Institute*, vol.80, no.3, pp.403-413.

ULITA