

indigo

A MAGICAL DYE

It has been used in textile production, painting and medicine and its seemingly magical properties have given it a special place in folklore. **Jenny Balfour-Paul** discusses the historical, commercial and botanical aspects of the world's most valued dyestuff

Imagine a world where clothing and other textiles had no colour other than that of the raw fibre, whether beige, brown or black. Then picture the impact when prehistoric man began applying to the surface of skins such earth pigments as ochre or terracotta. These colours were a revelation to our ancestors. But consider the reaction of the first person to notice that a fibre that had come into contact with some crushed leaves that lay in a pool of urine or the leftover ash of a fire had mysteriously turned a beautiful blue?

The beauty of an oriental carpet or a Renaissance tapestry resides above all in their colours. Today, we take coloured clothing and textiles for granted, but until the mid-19th century, dyestuffs, which all came from the natural world, were rather difficult to acquire. Indigo is perhaps the most extraordinary of all the dyes provided by nature, whether from plants, insects or even shellfish.

Take the three primary colours: innumerable plants yield yellowish dyes; reds could be either vegetable

(such as madder or morinda) or animal (cochineal, kermes and lac insects). But the world's only source of natural blue dye is indigo-bearing plants which supply hues ranging from the palest sky blue to the deepest midnight blue. Combined with other dyes, indigo also furnished greens (nature, so full of green, provides no green dyes), most purples and non-corrosive blacks. Vast quantities of organic indigo were therefore produced and traded between nations well into the 20th century.

A colourful past

Indigo has an exotic history. No-one will ever know who first discovered how to manufacture indigo dye from plants, but the ingenious ancient Egyptians were 'sexing-up' plain linen mummy cloths in the third millennium BC by adding indigo-blue border stripes.

Indigo's unique chemistry makes it compatible with any type of fibre. Other dyes of antiquity, notably indigo's aristocratic cousin, shellfish purple, and those derived from the roots of the red



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madder plant, only coloured the more absorbent animal fibres, such as wool. The earliest written instruction for making blue, red and purple colours is a neo-Babylonian cuneiform tablet from the seventh century BC (currently held in the British Museum). Many archaeological textile fragments from sites all over Asia, and from South America in the same period, feature indigo, as do Iron Age textiles excavated in Europe.

The etymology of the word indigo indicates its importance in Classical times among the 'spices' traded from the East to the West, for it derives from the Greek *indikón* (Latinised *indicum*), meaning 'something Indian'. The Sanskrit for indigo, *nila*, spread eastwards into Southeast Asia and westwards via the Middle East to southern Europe and the Americas before settling into the word 'aniline', a class of modern dyes originally involving indigo.

In the Middle Ages, the production of indigo from woad leaves (*Isatis tinctoria*) for the wool industry made fortunes for European farmers and merchants.

Above: a detail depicting a group of woad dyers from a medieval stained-glass window in the Barfüsserkirche in Erfurt, Germany; **Opposite:** lengths of indigo-dyed cotton hang in a courtyard in Yemen. In the old Islamic caliphates, textiles were traditionally presented as gifts, often in the form of elaborately decorated costumes known as *tiraz*. In Yemen, these were frequently dyed with indigo and a yellow colouring known as *wars*

Jenny Balfour-Paul



Meanwhile, tropical indigo concentrate was providing a high-value, low-bulk product for camel caravans crossing the Middle East. At that time, this form of indigo was used for dyeing in Islamic territories and for paint in Europe – ‘Baghdad indigo’, named after the famous entrepôt, was used, for example, in colouring cathedrals. Tropical indigo began to oust woad after the maritime routes to India and the East Indies were opened up.

From 1600, the European East India Companies competed fiercely for indigo supplies. Later that century, European rivalry continued when plantations exploiting slavery were established in the colonies of the West Indies and America, indigo being a major crop. Modern divers have recovered indigo (still usable!) from galleons shipwrecked in the Caribbean in that period. In the early 19th century, following Europe’s loss of these colonies, Britain grabbed the lion’s share of world trade in indigo by establishing hundreds of factories in its Indian empire. Some of these survived until the 1950s. Throughout these centuries, indigo, from whatever source, was subject to protectionist legislation and caused tussles between all those with vested interests, whether farmers, merchants or governments.

The demand for indigo was insatiable because it was needed to dye every blue garment in the world. It was a practical option for workwear, hence the expression ‘blue-collar worker’. In the West, farmers’ and butchers’ smocks, Dutchmen’s trousers and service uniforms for police, army, navy (hence ‘navy blue’) and hospital staff were all dark blue. But indigo also provided the ‘royal blue’ of the aristocracy. The same dual usage applied in much of Asia, Africa and the Americas, where indigo featured widely in both everyday and ceremonial clothing and textiles.

In its undissolved state, indigo was used as a paint pigment and a medicine. Scientific analyses of artworks are revealing secrets the old masters may not have wished to be exposed, such as the practice of eking out even more

expensive lapis lazuli’s ultramarine with undercoats of indigo blue. Watercolourists loved indigo because it flowed better than mineral pigments, and illuminators of luxury manuscripts used it to protect precious vellum or parchment and to offset golden calligraphy.

As for medicine, new research suggests that ‘folk’ remedies involving indigo/woad in *Materia Medica*s, such as those of Dioscorides and Ibn al-Baytar, have scientific validity. Whether or not the ancient Britons painted their faces



Cloth image courtesy Fendler, Balgove, Paul; all other images: Jimmy Balgove, Paul

with woad indigo to frighten off Julius Caesar, indigo has been applied to the skin in many countries, for both adornment and protection, hence its popularity for tattoos. Bluebeard himself had sound reasons for dyeing his beard, since indigo repels insects as well as adding lustre and disguising grey hairs. (The armies of King Darius of Persia and the Chinese aristocracy did likewise.)

So what exactly is this wonderful and adaptable dye? Surprisingly, indigo can be produced from different species of disparate plant genera worldwide. The main plant of the tropics, *Indigofera*

tinctoria (and similar species), was adopted for colonial plantations, while *Polygonum tinctorium* was widely used in China and Japan, and other species in West Africa and elsewhere.

Woad provided Europe’s indigo-blue dye until it was usurped by stronger imported tropical indigo better suited to dyeing Indian cottons when these became fashionable. But whatever the plant source, the resulting indigo-blue dye is common to all and, uniquely among natural dyes, has the same chemical make-up.

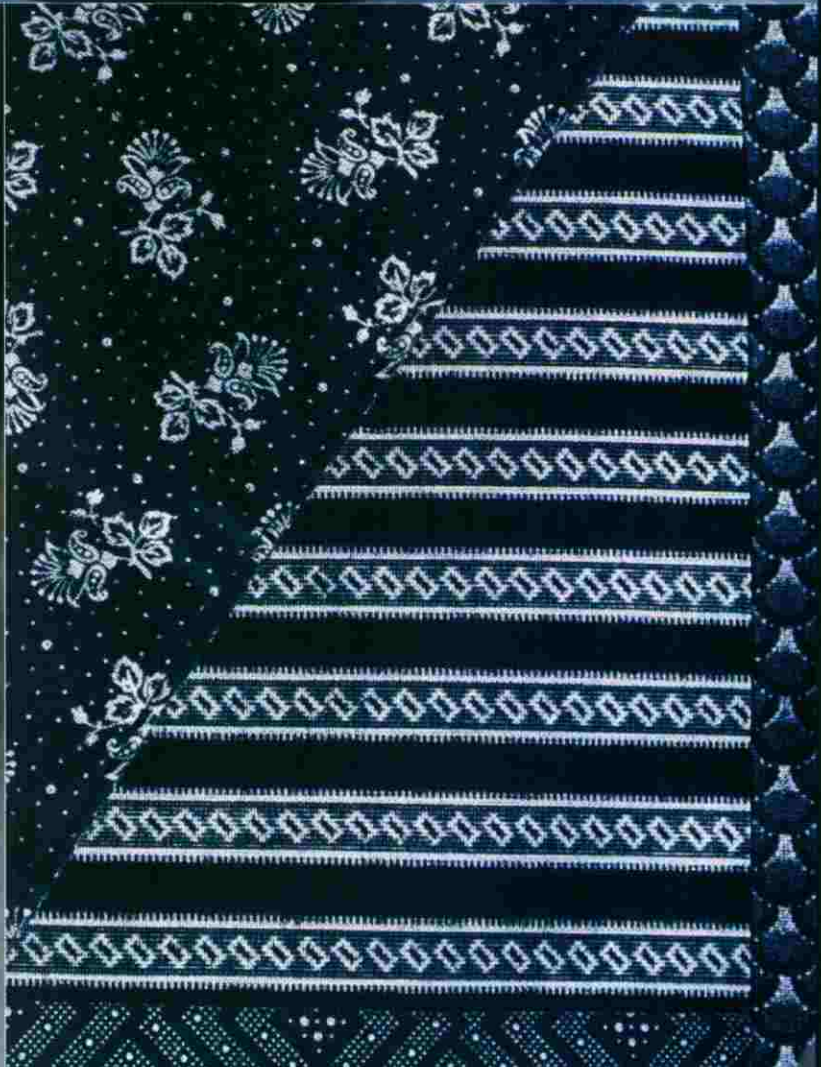
Mysterious transformations

Extracting indigo, and then dyeing with it, is akin to a conjuring trick. The precursor to the blue colour hides invisibly in the leaf of the plant until chemically transformed, either by composting the leaves for months (the traditional practice for woad and ‘Japanese indigo’) or by soaking them in water and then adding oxygen by vigorous beating. Only then does the blue colour dramatically appear. Using the second method results in the production of a blue paste that was dried into durable lumps ideal for long-distance trade.

The dyer, however, faces another problem. Indigo dyestuff is insoluble and can only dye fibres after it’s been converted to its colourless ‘reduced’ form by special bacteria. This was done by placing the indigo into a lukewarm alkaline dye vat and adding a variety of substances to feed bacteria that consumed the oxygen and allowed anaerobic indigo-reducing bacteria to thrive. Fortunately, bacteria aren’t too discriminating when it comes to food; dyers in different places have used ingredients ranging from sweet dates, wine and bananas to rotting meat and even red-ant nests. Stale urine proved a good source of alkali for the mixture.

When the dyer dyes with indigo (natural or synthetic) the cloth emerges from the vat a dull yellowish colour. This only turns blue, as if by magic, on contact with oxygen. It’s no wonder that dyers prayed to a variety of ‘indigo gods’ to make the process work. No

Above: dyers in Tunisia place indigo handprints above their vats in order to ward off evil spirits; **Opposite, clockwise from top:** dyeing a mud-resist and mordant-printed cloth in indigo in Rajasthan, India; cloth manufactured by Mycocks of Manchester until 1992 for export to South Africa, where it was known as *chwe-chwe* cloth. The patterns and designs were created by dyeing with indigo and then using a chemical discharge to give a ‘resist-printed’ appearance; a dyer from Sayeda near Sousse in Tunisia holds undyed and dyed yarns. Note how the hand has been stained by the blue dye



wonder, too, that indigo dyeing has always been the preserve of specialists who handed their secrets down the generations. The mysterious transformations that occurred within a fermentation vat also gave rise to numerous myths and legends. Commonly, the temperamental dye bath, with its strange phases of fertility, was compared (by men, of course) with the unpredictable behaviour of women.

This perplexing behaviour has also underlined the symbolic qualities of indigo-dyed cloth in many societies, especially those with no written language, where textiles have been a vital form of expression. Many dyes and colours have acquired symbolic values, but indigo's particular mysteries led to an association with significant rites of passage, especially rituals relating to death and mourning.

The strength of the dye, and subsequent surface decoration, can also transform a cloth's status; for example, a newly dyed and burnished turban or woman's face mask worn in the Sahara or southern Arabia was considered talismanic as well as decorative. Indigo's unusual dyeing qualities are also tailor-made for textile techniques such as batik, shibori and ikat. The social history of indigo-dyed clothing is rich and complex. In the case of denim jeans it has even united much of the world.

Jean genie

The earliest known representation of indigo trousers is the 'cowboy' in the Pazyryk carpet, dated to 400 BC (pictured over). In the Middle Ages we find Genoese sailors wearing coarse blue trousers known as 'gene fustian' – the derivation of the word 'jeans'. Hard-wearing blue twill was also made in Nîmes (hence 'de-nim'), and this was imported by Levi Strauss when, in 1853, he supplied 'waist overalls' to cowboys and miners during the Californian gold rush. These were later worn by US GIs in the Second World War, and from then

Top right: indigo plants are submerged into tanks in Chalatenango in northern El Salvador, where indigo production has been revived;

Right: leaves of 'Japanese indigo' floating in a pot of fresh indigo liquid. This method, which uses no chemicals, gives aquamarine and turquoise colours to silk and wool



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A detail from the Pazyryk carpet, the world's oldest known knotted wool carpet. Discovered in 1949 in the frozen tomb of a Scythian chief in the Altai Mountains of Siberia, the carpet is thought to be about 2,500 years old. Analysis of the dyes has revealed that the blues are indigo

on they were known as jeans, becoming an icon of glamour and rebellion for the youth of the post-war West. Today, denim jeans have been so wholeheartedly embraced by mainstream fashion that the annual global output is more than a billion pairs.

The early Levi's 'waist overalls' were dyed with natural indigo, but in the early 20th century, synthetic indigo hit the world market following extensive research by the German chemical company BASF. However, by this time there were many other rival synthetic blue dyes, and the indigo story could have literally faded away were it not for Levi Strauss's denim, which rescued indigo because its unusual chemistry bestows a purity of colour and desirable fading qualities not seen in other dyes. Indigo dye is built up in layers that never lose their blueness but are susceptible to


being rubbed off, causing variations that create an exceptionally lively blue, especially on the twill weave of denim, where only the warp threads are dyed.


And what of the future for natural plant indigo? Twenty years ago, it was looking bleak, its use having dwindled to remote communities in developing countries or small-scale craft dyers. But attention is returning to natural dyes, which show signs of reaching even haute couture – garments dyed with Bleu de Lectoure's woad indigo now appear on the Paris catwalks. Many factors are responsible, not least the world's heightened ecological awareness, the search for sustainable agricultural products and advances in research and application of biotechnology.

One fascinating example of the last is the identification by a group of scientists at Reading University, led by Professor Philip John, of the bacterium that works its magic in the indigo vat. This discovery, made by growing in the laboratory endospores from the sediment in a tenth-century Viking woad vat, has created the possibility of using biotechnological techniques to simplify

the extraction of indigo dye from plants. It may even lead to the use of organic dye vats on an industrial scale, thereby reducing current reliance on polluting chemicals. This research for SPINDIGO, an EU initiative, should give struggling farmers a novel cash crop.

Equally encouraging is the revival of natural indigo in countries where it was formerly associated with forced labour, for example Bangladesh, India, El Salvador and Mexico. In other countries, including Japan, South Korea and Oman, indigo is being pulled back from the brink by renewed appreciation of its commercial potential.

The indigo story may have started more than 5,000 years ago, but it is far from over. Watch this blue space. 

■ *Indigo in the Arab World* by Jenny Balfour-Paul was published by RoutledgeCurzon in 1997; *Indigo*, by the same author and published by British Museum Press, appeared in 1998, the paperback version in 2000. A major touring exhibition about indigo will be launched at the Whitworth Art Gallery, Manchester, in 2005, and Britain's first International Festival of Natural Dyes is being planned for 2005 or 2006 

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