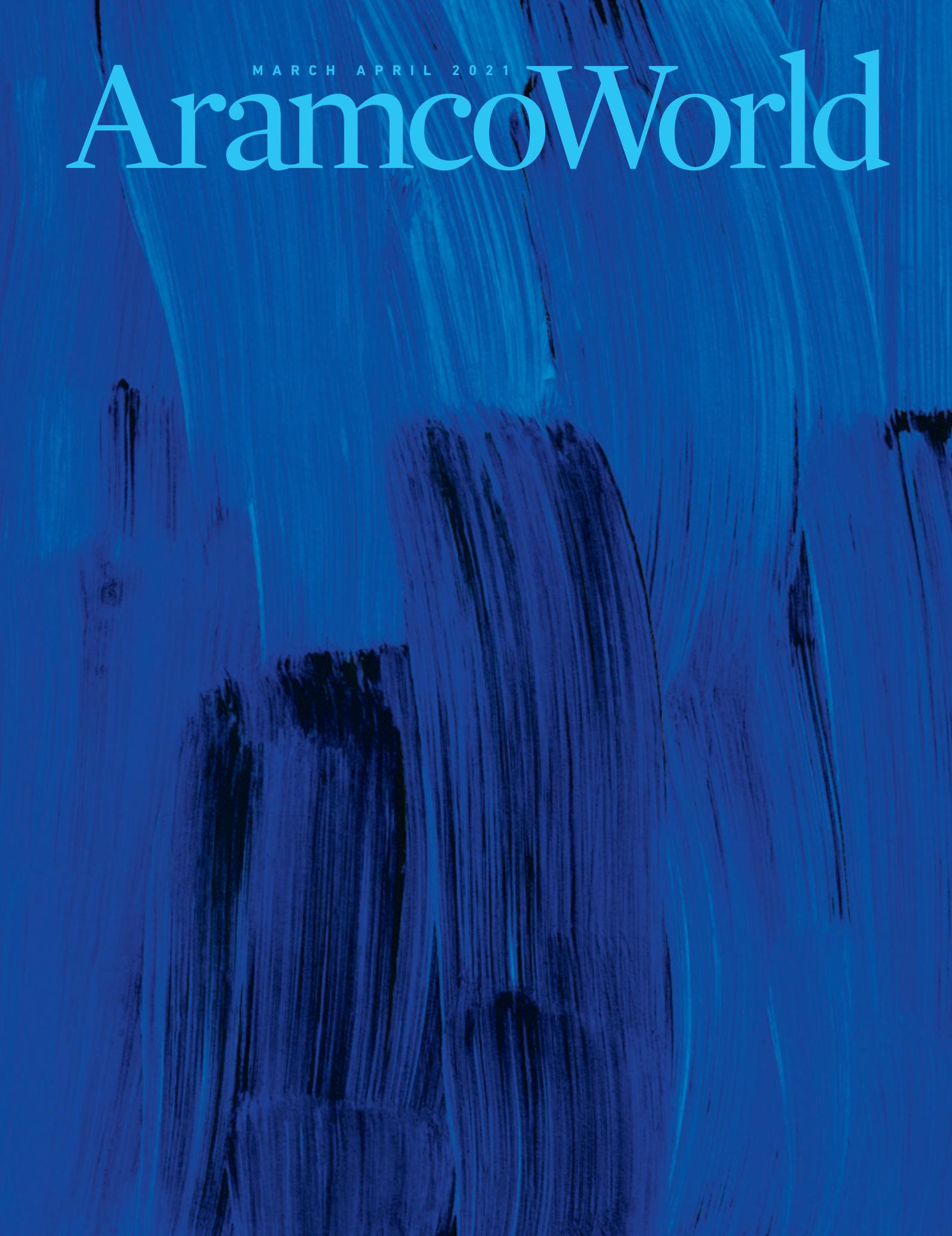
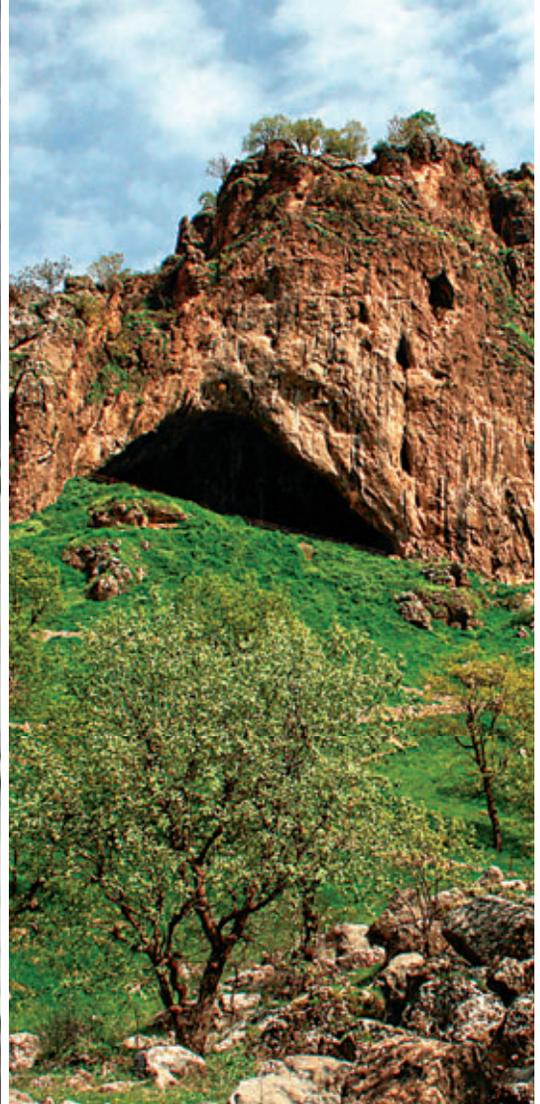
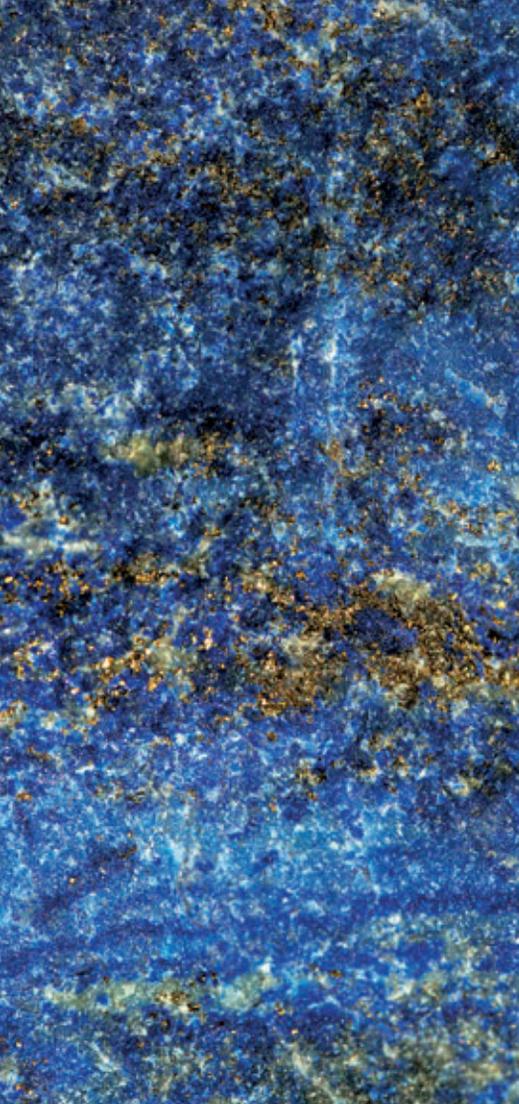


MARCH APRIL 2021

AramcoWorld





6 The Quest for Blue

Written by Tom Verde

Rare in nature and difficult to extract from minerals, blue eluded artisans for centuries until Egyptians invented the world's first synthetic pigment. Formulas for blues from cobalt and indigo followed, and the results have delighted our eyes and evoked the sacred, the royal, the opulent and the mysterious ever since. And the quest is not over.

16 Uncle Sam's Camel Captain

Written by Steve Brown

As a young man in Ottoman Turkey, Hadji Ali became an expert camel handler. In 1857 he accepted the US Army's offer to assist its deployment of camels in the southwestern deserts, where his name was Americanized to "Hi Jolly." His skills proved valuable, and yet he died penniless. Today his memory endures in legend as much as in fact—and on one miniature pyramid in Arizona.

20 Shanidar Cave Yields New Signs of Neanderthal Emotions

Written by Graham Chandler

Traces of flowers in a Neanderthal grave found 45 years ago in northern Iraq led to a theory that even the earliest humans may have expressed emotions in ritual. In 2016 archeologists returned: Could new finds lend support to the theory, or not?

 2 FIRSTLOOK

 4 FLAVORS

 38 REVIEWS

AramcoWorld

MARCH / APRIL 2021 | VOL. 72, NO. 2

We distribute *AramcoWorld* in print and online to increase cross-cultural understanding by broadening knowledge of the histories, cultures and geography of the Arab and Muslim worlds and their global connections.

aramcoworld.com



FRONT COVER Time was when textured blue brushwork like this might have cost a royal sum. Though invented in Egypt 5,000 years ago, synthetic blues were not widely available until the 18th and 19th centuries. Art by Kseniya Kurbatova.

BACK COVER Along the bowsprit of the 52-meter charter pinisi schooner *Amandira*, crewmen tend the boat's trio of jib sails. The arrangement of the rigging that supports the jibs as well as the boat's two masts, mainsails and topsails gave the *pinisi* its name. Photo courtesy of Aman.



26 Pinisi Boats Sail into the Future

Written by **Tristan Rutherford**

Masterpieces of a wooden-boat tradition from the center of the 5,200-kilometer-wide Indonesian archipelago, *pinisi* schooners are both unique and related to the Arab dhows and European sailing ships that preceded them on the waters that link the region's thousands of islands. Using memory, not blueprints, *pinisi* shipwrights build each boat by hand, from motorized cargo carriers to luxury sailing yachts. So distinctive are *pinisi* that in 2017 the UN inscribed them on its Representative List of the Intangible Cultural Heritage of Humanity. To see how they are built, the shipyards in the town of Tanah Beru in South Sulawesi are a good place to start: Look for tall wooden masts, and listen for the pounding of wood as hand-hewn timbers get pegged into a hull without using a single nail.

34 Spice Migrations: Pepper

Written by **Jeff Koehler**
Art by **Linda Dalal Sawaya**

It is the most common spice on tables around the world today, and for centuries, growing and trading the round corncobs of *Piper nigrum*—black pepper—created wealth, from pepper's monsoon-watered origins in India to all of Asia, East Africa and Mediterranean Europe.

 **40 EVENTS**  **Online LEARNING CENTER**

Publisher: Aramco Americas | President and CEO: Nabeel I. AlAfaieg | Director, Public Affairs: Alma S. Kombargi | Editor: Richard Doughty |
Managing Editor: Jennifer Mathlouthi | Assistant Editor: Alva Robinson | Digital Media Editor: Johnny Hanson | Administration: Sarah Miller |
Print design: Graphic Engine Design | Printing: RR Donnelley / Wetmore | Web design: eSiteful Corporation | Mobile design: Herring Design

Subscriptions: www.aramcoworld.com | Editorial: editor@aramcoamericas.com

Mail: *AramcoWorld*, Post Office Box 2106, Houston, Texas 77252-2106, USA

ISSN: 1530-5821





FIRSTLOOK

My Grandmother's *Tlaba*

Photograph by
Nada Harib

In my hometown of Yefren, about 200 kilometers southwest of Tripoli, Libya, in the Nafusa mountains, my cousin Mira wears our grandmother's *tlaba* (wool garment) to connect to her family roots. The photo is part of a documentary project I started to depict Amazigh women from Libya.

As a Libyan woman, I care about women in Libya. And because I am Amazigh, a term for the indigenous Berber "free people" of North Africa, I am drawn to photographing my own unique culture.

Our country is rich with stories written in art, in architecture, and in diverse traditions and languages. Focusing on the lives of women is challenging, yet I dream of taking more photos of them, more photos of us, while capturing the beauty and reality of Libya and highlighting life, as it is, in all its shades.

Linguistically speaking, Amazigh is a feminine word. Historically, Amazigh women were queens and held respected positions and leadership roles throughout North Africa.

Amazigh traditions differ from culture to culture. In Yefren, the *tlaba* played a specifically significant role. My mom told me how my grandmother wove her *tlaba* from their own sheep. Traditionally it was worn on every important occasion throughout the year, winter and summer, from wedding celebrations to childbirth and somber times of mourning at funerals. *Tlaba* is a lifestyle; the patterns are not just intersecting threads, but strands interweaving life and death, present and past, nature and earth.

Working on projects in my own country and being able to go farther than I used to go allow me to have new perspectives, and I was able to push through barriers of fear and challenges. It helps me tell stories that are beyond the stereotypical images of Libya.

—Nada Harib

 @nada_harib, www.nadaharib.com







FLAVORS

Spicy Bean Soup

Recipe by
Troth Wells

Photograph courtesy
Kam & Co. Denmark

While I was staying in Marrakesh, the *diffa*, or feast, comprising many courses was served one night.

There were several meat dishes, so I asked if I could eat only non-meat ones. They were happy for that and charged very little—perhaps because the meat dishes were the centerpiece. This bean soup, *harira*, is often made with lamb, but this is a meatless version. I sometimes add peas or other veg to use them up.

(Serves 6)

1 onion, chopped	2 tablespoons cilantro/coriander, chopped
1 can garbanzos/chickpeas	2 tablespoon parsley, chopped
1 can white kidney or borlotti beans	1 lemon, juiced
1 can tomatoes	2 quarts / 2 liters stock
½ teaspoon saffron threads	½ cup / 100 grams rice
½ teaspoon cinnamon	1 tablespoon flour
¼ green chili, deseeded and chopped or ¼ teaspoon chili powder	Oil
	Salt and pepper

Using a saucepan, gently fry the onion and then add the garbanzos/chickpeas, beans, tomatoes, saffron, cinnamon and chili/powder.

Then put in one tablespoon of the parsley plus the cilantro/coriander, the lemon juice and seasoning. Stir well and cook for 5 minutes.

Now power in the stock and then add the rice. Stir well and boil for 10 to 15 minutes until the rice is soft.

While that is cooking, mix the flour with a little water to make a roux and stir this into the soup.

Adjust the seasonings and cook for a further 15 minutes, stirring from time to time. Serve with the remaining parsley on top.

Reprinted with permission from
One World Vegetarian Cookbook
Troth Wells
2019, Interlink Books,
978-1-56656-834-0, \$35 hb,
www.interlinkbooks.com.

Troth Wells is an Oxford-based food writer and cookbook author. She has written several cookbooks, including most recently *One World Vegetarian Cookbook*, *Global Vegetarian Cooking: Quick and Easy Recipes from Around the World*, and *Small Planet, Small Plates: Earth-Friendly Vegetarian Recipes*, all published by Interlink Books.



THE QUEST FOR BLUE



WRITTEN BY TOM VERDE

It's easy to think of blue as a naturally pervasive color. It's all around us in clear skies and bodies of water. Yet elsewhere blue appears infrequently, coloring only a handful of minerals and less than 10 percent of flowering plants. Even the feathers of birds, from blue jays to bluebirds, are not truly blue but the result of a biologically sophisticated trick of the eye. The scarcity of blue in the natural world has, for much of history, made it hard to reproduce.

"Other colors were made from natural materials that you perhaps processed, but blue as a pigment didn't already exist and had to be created," says Mark Pollard, professor of archeological science at Oxford University.

The earliest humans could pick up chunks of red or yellow ochre or white chalk and use them almost like crayons, and black could be found at the end of every burnt stick. But the transformation of natural materials into the color blue, Pollard explains, required considerable effort and ingenuity.

The quest to unlock the secret of that transformation dates back millennia and spans cultures and civilizations, from Bronze Age Central Asia to early imperial China, from medieval Venice to the modern Maghrib (Islamic North Africa).

The breakthrough came more than 5,000 years ago along the banks of the Nile when early Egyptian chemists first brought the color of the sky down to earth.

EGYPTIAN BLUE

$\text{CaCuSi}_4\text{O}_{10}$

PANTONE®
2746C
Egyptian Blue

THE FIRST BLUE

“[T]he fields are caused to grow, the fields are made blue, everything alongside the earth is caused to come into being,” reads a hieroglyphic inscription from the third-century-BCE temple of Horus at Edfu, referring to how the annual floodwaters of the Nile nourished the fields. A source of inspiration and worship, blue was also the color of the cosmos, fertility, sustenance and rebirth, according to Lorelei Corcoran, professor of Egyptian art and archeology at the University of Memphis and a translator of the Edfu text. Additionally, the shimmering interplay of sun and sky embodied the spark of life itself, Corcoran explains.

“Blue isn’t immediately a color one would associate with the

sun. We usually think of yellow or red,” she says. “But if you look at the headdress that the ancient Egyptian kings wore, at the mask of Tutankhamun for example, you see it’s made out of blue and gold stripes, and it’s been suggested that represents the rays of the sun breaking through the heavens.”

The Egyptian name for the blue they used transliterates phonetically as *hsbd iryt*, which means “artificial lapis lazuli.” The name reflected the high regard for the semiprecious gemstone that, together with cobalt, azurite, turquoise and indigo, was one of several sources of blue-hued raw materials Egyptian craftsmen used in pigments, amulets, beads, jewelry, scarabs, statuary and textiles.

Still, these raw materials had their limitations.

Lapis lazuli was rare and wildly expensive. Mined from a single valley in northeast Afghanistan, a shipment of the gemstone took three years to arrive in Egypt. Cobalt, from the much closer western desert of Egypt, proved most useful in glassmaking and, briefly during the Amarna period (1365–1345 BCE), to decorate

pottery. Azurite could be found in the Sinai Peninsula and Egypt’s eastern desert, but it was difficult to carve, and it produced pigments closer to green than blue. Turquoise could also

*Of all the colors
on a painter’s
palette, the most
elusive have
been blues.*

Using blue to represent the heavens, Egyptian artists of the first century BCE produced ceiling reliefs in the Hathor Temple in Qena, Egypt, that depict the zodiac. **OPPOSITE** Five thousand years after its invention, Egyptian Blue remains a distinct color, shown here as powdered pigment. The Greeks called it *kyanos*, from which English took *cyan*.



MIKHAIL KOKHANCHIKOV / ALAMY; OPPOSITE: ERIC LUBRICK / INDIANAPOLIS MUSEUM OF ART



LEFT Only 9 centimeters tall, this juglet was shaped and fired between 1750 and 1640 BCE using Egyptian Blue. The color's intensity could be varied by changing the proportions in its formula, with results from the saturated, lazurite-like tones that led Egyptians to name their color *hsbd iryt*, "artificial lapis lazuli," to delicate pastels. Roughly during the same era, ceramists figured out how to use powdered silica, quartz and other locally available agents to produce a brilliantly glazed blue ceramic that became known as faience, which remains glossy on both of these hippopotamus statuettes, **ABOVE**. Egyptians of the time regarded hippos as the deadliest inhabitants of the Nile, and the larger one—affectionately named William by the Metropolitan Museum of Art in New York—is among the finest examples of many faience animals that have been found in Egyptian tombs. (The smaller hippo is a bit older, from 1810-1700 BCE.) Both are decorated with designs of marsh plants, and on "William," the lotus appears prominently.

be found in the southwestern reaches of the Sinai, but it was rare and thus expensive. Indigo, meanwhile, had to come from far-off India.

Thus faced with the need for an affordable and readily available blue, the Egyptians invented the world's first synthetic pigment: Egyptian blue.

Chemically known as calcium copper silicate, the recipe called for mixing chalk or limestone with a copper-rich mineral, typically malachite, together with silica-rich sand and an alkali to fuse it all together. When fired at extremely high temperatures the result was a blue, opaque, glass-like compound ceramic. When ground to powder and mixed with a binder such as oil, it produced enduring paints that could be varied in intensity from a deep, rich lapis-like shade to lighter, pastel ones, all depending on how finely it was ground.

Corcoran's research shows that Egyptian blue made its debut near the beginning of pharaonic times, around 3250 BCE. With their formula, Egyptians were able to use it on everything from walls and ceilings of temples and tombs to funeral masks and illuminated hieroglyphic texts.

Egyptian ceramists also found that by using a similar method they could produce objects self-coated in a brilliant blue glaze by firing a pasty combination of silica (either sand or crushed quartz) with small amounts of sodium, calcium and water. (Some scholars maintain that Mesopotamians may have developed this technique as early as the fifth millennium BCE and passed it on to the Egyptians.)

The result of this process was faience, which due to the soft composition of the base paste, proved most useful for small jewelry and decorative objects. The sheer difficulty of the process is a testament to the Egyptian fondness for blue and the persistence of

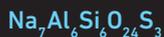
experimentation that the color demanded.

"It's only in the last century or so that we have an understanding of how faience was actually made," says potter Amy Waller, who mimics Egyptian techniques to produce modern versions of faience in her studio in Bakersville, North Carolina. The recipe for Egyptian blue spread to Mesopotamia and the Aegean region around 2500 BCE. The Greeks named it *kyanos*, the root of the English word *cyan*. Traces of the pigment have been detected on the Parthenon, built during the fifth century BCE. To the Romans, it was *caeruleus* (in English, *cerulean*), meaning sky-blue, a favorite color for the villa walls of the well-to-do. It was a Roman who preserved the knowledge of how to make Egyptian blue: In his wide-ranging first-century-CE work, *De Architectura*, military engineer and architect Vitruvius recorded the color's ingredients and a detailed discussion of its manufacture.

While some say Egyptian blue died out with the Romans, art historians have detected the pigment on the walls and statues of medieval churches and abbeys from northern Italy to the British Isles. In 2011 a team of Belgian and Danish researchers, using high-tech optical equipment, discovered the use of Egyptian blue by Renaissance artist Giovanni Battista Benvenuto in a painting of the Christian Saint Margaret in 1524.

The team's analysis also revealed the presence of another blue mingled with the Egyptian blue of Margaret's cloak: ultramarine, a deep blue pigment made from lapis lazuli. Why Benvenuto mixed the two paints is uncertain: Was he aiming to produce a particularly precise shade? Or was he stretching his supply of ultramarine—the costliest, rarest, most-celebrated and sought-after pigment of the day?

ULTRAMARINE



PANTONE®
17-4037 TCX
Ultramarine

COLOR FROM BEYOND THE SEA

If Benvenuto was indeed being parsimonious with ultramarine, it was with good reason. It was costly: 100 florins for barely a pound (the equivalent of \$228 an ounce today), as fellow artist Albrecht Dürer grumbled in 1508. Just a few years earlier, Michelangelo left a painting permanently unfinished in Rome because he couldn't get his hands on enough ultramarine. Dutch painter Johannes Vermeer died broke in 1675 in part because of his lavish use of the pigment in many of his famous paintings, such as the "Girl with a Pearl Earring" and "Woman in Blue Reading a Letter."

Ultramarine was expensive because lapis lazuli was no more readily available in Benvenuto's or Vermeer's day than it was in pharaonic Egypt. It still had to travel from a single source in Afghanistan's Sar-i-Sang Valley where it had been extracted in the same way since the seventh millennium BCE, or the Bronze Age: by heating the walls and ceilings of mine shafts with fire and dousing them with ice-cold river water to crack open veins of the gemstone. (Today miners use dynamite, but soot from centuries-old fires can still be seen in the shafts, and though lapis can be found in other locations globally, none are of comparable quality or as bountiful.)

The name of the gemstone comes from the Latin *lapis* (stone) and *lazulum*, from the Arabic *gizr al-lazaward* (the root of azure), itself a loan word from the Persian name for the mineral, *lajvard*. Yet the name by which its derivative pigment came to be known among Italian and other painters and merchants in the 14th and 15th centuries reflected its enticingly distant origin: *ultramarinus*, "beyond the sea."

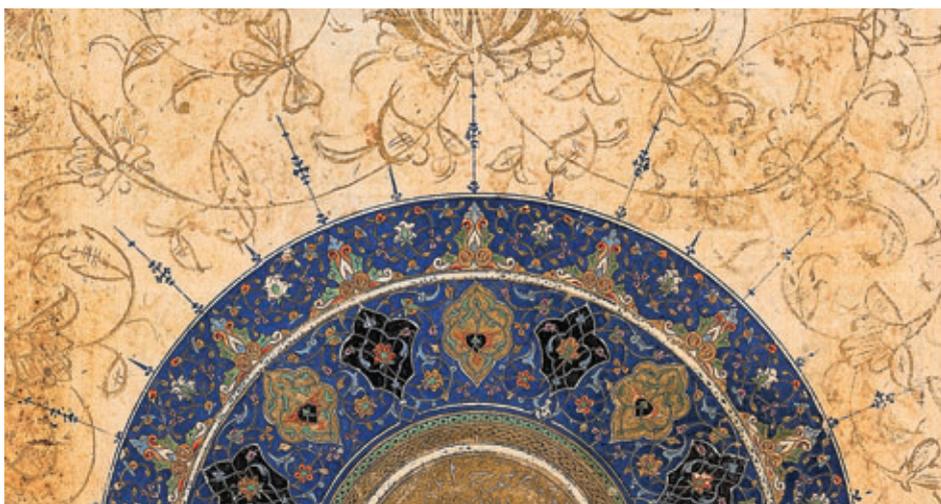
TOP In this detail from a late-15th-century-CE illuminated manuscript from Herat, now in Afghanistan, a young man picks up a rock that is likely meant to be lapis lazuli. The painting uses ultramarine derived from crushed lapis lazuli, and Afghanistan is the world's leading source of the semiprecious mineral. **RIGHT** A detail from the frontispiece of the same manuscript shows extensive use of ultramarine. Scarcity, together with the daunting difficulty of producing paint from the mineral, kept the price of ultramarine ultra high.

"Ultramarine blue is a color illustrious, beautiful, and most perfect, beyond all the other colors," wrote Italian craftsman Cennino Cennini in his *Il libro dell'arte* (*The Craftsman's Handbook*, c. 1390). In the book Cennini also left a detailed description of another reason ultramarine was so costly—its production.

Separating lazurite, the blue mineral, from its surrounding material began with grinding the gemstone to a powder. This was mixed with resins into a paste, heated to a putty, then soaked and kneaded in a basin of alkaline solution for days before yielding a paltry amount of the rich blue, bordering-on-purple pigment, which settled in the bottom of the basin.

Prior to its arrival in Western Europe, isolated examples of lapis as a pigment pop up here and there: in a 16th-century-BCE statue of an Egyptian queen and on 13th-century-BCE plaster wall fragments from Mycenaean Greece. During the fourth through the eighth century CE, it appeared in Central Asia, in cave paintings along the Silk Road, in Turkic parts of western China, and in the robes and wall paintings of the great, recently destroyed sixth-century-CE Buddha statues in the Bamiyan Valley in Afghanistan.

While Cennini's is the oldest European recipe for ultramarine, a considerably earlier mention of the process in an Arabic treatise ascribed to the ninth-century-CE "father of chemistry," Jabir ibn



Hayyan. Further written evidence that purifying lapis was already known in the Middle and Near East is the mid-13th-century book on gemmology, *Azhar al-afkar fi djawahir al-ahdjar* (*Best Thoughts on the Best of Stones*) by Berber polymath Ahmad al-Tifashi. In his chapter on lapis, al-Tifashi recommends mixing “powdered lapis” with resins “into a dough” and manipulating the batch in water “until its essence will come out.”

Around the same time, Georgia-born Hobays Teflisi also included a method for rendering pigment from lapis in his *Bayan al-shena'at*, a work that offered practical information on alchemy, jewelry, coloring crystals and glass.

Arab alchemists, however, were more interested in the pharmacological virtues of ground lapis, which they prescribed to treat heart palpitations and melancholy, among other ailments, as well as using it to make ink. Miniaturists and manuscript illustrators, many in Persia, used ultramarine to decorate texts, including editions of the royally commissioned *Shahnama* (*Book of Kings*).

Such evidence prompted late art historian Daniel V. Thompson, author of *The Materials and Techniques of Medieval Painting* (Dover, 1956), to speculate that “the invention of the method” of transforming lapis into a pigment “may well be a product of Moorish ingenuity, and it may even have been from some Arabian source that Europe before the 13th century obtained its ultramarine azure.”

Once it did, Europe couldn't get enough of it despite the price. Monks used it to illuminate sacred texts while kings and princes, like their Persian counterparts, paid princely sums to commission elaborately illustrated books showcasing the pigment, such as the famed, 15th-century *Très Riches Heures du Duc de Berry* (*The Very Rich Hours of the Duke of Berry*). Because of its exorbitant cost as well as its chromatic proximity to royal purple, ultramarine also became the favored shade of Christian artists depicting the robes of Mary, mother of Jesus, in medieval and Renaissance paintings, symbolizing Mary's elevated status. Artists of the day had clauses written into their contracts that patrons had to pay extra for supplies of ultramarine while some required travel expenses for trips to Venice to obtain them.

In the early 19th century, European chemists, mimicking their pharaonic Egyptian predecessors, mixed china clay, soda,



Ultramarine was also often used together with gold-leaf paint to illuminate manuscript editions of the Qur'an, such as this Ottoman copy. It dates from the same 17th century as the Dutch painter Johannes Vermeer's famous “Girl with a Pearl Earring,” in which he used copious amounts of ultramarine in her headscarf. Vermeer died broke, in part due to his liberal expenditures on the world's most costly color.



charcoal, quartz and sulphur to produce an affordable, synthetic ultramarine. Artists grouched that the copycat color lacked the dimensional depth of true ultramarine, but they couldn't argue with a price that was 2,500 times less than ultramarine from lapis lazuli. As ever, the business of blue played a major role in its use, production, procurement and prestige. And by then one of the most profitable businesses of blue was porcelain, thanks to cobalt.

COBALT BLUE



PANTONE®
2738 C
Cobalt Blue

BLUE MEETS WHITE

Enumerating the virtues of a 15th-century porcelain cup in his catalog of Ming dynasty ceramics, 16th-century artist and calligrapher Xian Yuanpian remarked, “The glaze is of a uniform translucent white, like mutton-fat or fine jade ... and the blue so pure and brilliant as to dazzle the eyes, being painted with Muslim blue.”

So-called “Muslim blue” was blue made from Persian cobalt, a mineral known to be imported to China during the first quarter of the 13th century CE, perhaps earlier. Its Chinese name, *huihui qing*, clearly identified the pigment as “a product of foreign lands,” as bureaucrats of the day described it: *Huihui* was the common Chinese term for Muslims during the Ming Dynasty, from 1368 to 1644 CE, into the Qing Dynasty, which lasted from 1644 to 1912. Today, most Chinese-speaking Muslims in China still identify as Hui.

By the Ming dynasty, cobalt, as a pigment, had been used in some wall paintings and statuary in China and as far west as Turkey in a 14th-century-CE Byzantine church mural in Istanbul. But it was use in tough yet translucent porcelain—an invention dating to the Han Dynasty (22 CE–250 CE)—that popularized cobalt-based blue on an international scale. Indeed, its prominence in porcelain’s most familiar color scheme, blue and white, was the product of centuries of cultural and commercial interchange among China and Islamic lands.

“There was this exchange going on between materials, technology and design,” says archeological scientist Pollard.

The earliest-known examples of blue-and-white pottery in

China date to the late Tang Dynasty (618 CE–907 CE) with production centers in the region of Gongyi City (now Gongxian) in central China’s Henan province. The color scheme enjoyed a brief popularity, then disappeared in China for the next five centuries. Whether the source of Tang cobalt was local or imported remains an open question. What is certain is that by the ninth century CE, potters in the Iraqi port city of Basra—a center of Abbasid culture and commerce—had been exposed, via Silk Road trade, to Chinese ceramics. Though they didn’t have the technical know-how to reproduce porcelain (a well-guarded secret), Muslim potters were able to approximate the creamy white sheen of Gongxian ware, which they embellished with delicate, cobalt-blue floral designs and Arabic lettering.

The source of Abbasid-era cobalt as a raw material also remains uncertain. But by the early 14th century CE, the major Middle Eastern location of the world’s finest, inky-blue cobalt was widely known to be Qamsar, a village in the mountains around Kashan, in central Iran’s Karkas Mountains. “[P]eople there claim it was discovered by the prophet Sulaiman,” wrote the Persian historian Abu’l-Qasim Kashani in his 1301 CE treatise on ceramics. The legend of its discovery, Kashani noted, prompted craftsmen to refer to Qamsar cobalt as *Sulaimani*, a name that came to be reflected in another Chinese term for Muslim blue: *su-ma-li* or *su-ma-ni*. Scholars suggest that *su-ma-li* may also be a Chinese transliteration of the Arabic word *samawi* (sky-colored).

Less laborious to process than lapis, raw cobalt was washed and crushed to obtain the pure ore. This was mixed with an organic binding agent and formed into easily transportable cakes. These, when melted together with potash and borax, hardened into a glass called smalt that was ground into a powder to make pigment. In either cake form or as smalt, cobalt made its way east along the Silk Road and by sea to the Fujian province city of Quanzhou, China’s principal port for foreign trade from the 11th through the 14th century. There it fetched high prices: two catties (a little over two and half pounds) equaling the value of one roll of fine silk, per imperial decree. To conserve the pigment, craftsmen

LEFT Imitating the glass lamps of mosques, this 16th-century-CE ceramic vase was made in Iznik, Turkey, using cobalt for both the fine swirls and the calligraphy. **LOWER, CENTER** Painted in vivid cobalt, this Yuan Dynasty pot was made in the 14th century, when porcelain was among China’s leading exports. **LOWER, RIGHT** The raw material of cobalt paint and glaze is potassium cobalt silicate, or smalt, shown here in a bottle dated to the 17th or 18th century.





The vaulted ceiling, domes, columns and walls of the Sultan Ahmed Mosque, or “Blue Mosque,” in Istanbul, Turkey, are covered with some 20,000 hand-painted ceramic tiles that feature more than 50 designs. The tiles were produced in Iznik, which at the time of the mosque’s construction, between 1609 and 1616, had become the leading ceramics center of Ottoman Turkey. **RIGHT** In the mid-1870s, French painter Pierre-Auguste Renoir used cobalt blue heavily in “*La Première Sortie*” (“The First Outing”), showing a young woman at the theater.

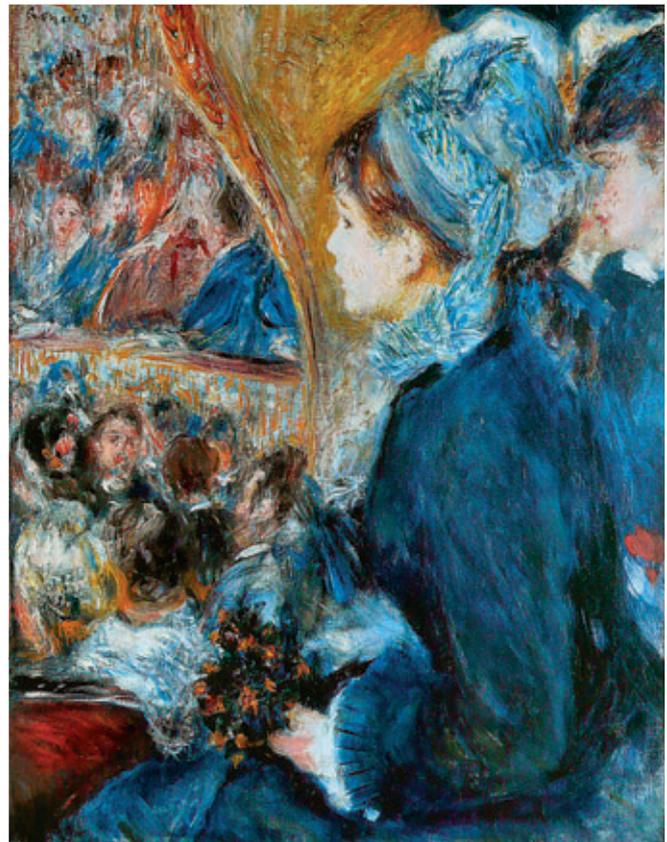
in the southern city of Jingdezhen, China’s porcelain capital, blended Persian smalt with locally obtained cobalt to produce huihui qing, with which they decorated a wide variety of porcelain objects. Most of these were destined for markets back in the Middle East, as the Chinese preferred solid colors and were not especially fond of mixed blue-and-white patterns.

“It was never really Chinese and only became an adopted taste,” Pollard says.

The driving force behind the adoption were wealthy Muslim merchants living in Quanzhou who controlled much of the export, marketing and even manufacture of Chinese blue-and-white porcelain targeted to serve almost exclusively an Islamic market. Jingdezhen potters responded by creating blue-and-white plates, bowls, jars and other fine-porcelain objects featuring Islamic-inspired floral and geometric designs. Some, unschooled in the language, attempted to imitate Arabic lettering, with mixed results.

Even though the Hongwu Emperor, founder of the Ming Dynasty and ruler of China from 1368 to 1398 CE, abruptly shut down overseas trade (he favored agriculture as the country’s economic cornerstone), the foreign taste for porcelain was too lucrative to abandon. In 1383 China exported some 19,000 pieces as diplomatic gifts to Muslim rulers, according to Ming court records. Once Hongwu’s son Yongle lifted the trade ban upon his accession in 1403, blue-and-white porcelain once more “comprised the bulk of [China’s] export trade in ceramics,” according to ceramics historian Robert Finlay.

The color combination “went on to triumph far and wide, reshaping (and sometimes destroying) pottery traditions in virtually



every society it touched, from the Philippines to Portugal,” Finlay wrote in *Pilgrim Art: Cultures of Porcelain in World History* (University of California Press, 2010).

This stylistic juggernaut rolled through Islamic Spain, where blue and white strongly influenced al-Andalus’ intricate *azulejo* tilework: *azul* means “blue” in Spanish. Renaissance Italy’s colorful Maiolica tradition, French faience, Dutch Delft, Danish Royal Copenhagen, English blue-and-white wares and, across

the Atlantic, American Currier & Ives designs—and more—all descended from China's blue-and-white cobalt porcelain.

On its way west, blue and white porcelain passed through the busy trading city of Iznik in western Anatolia. There, its style was reinvented during the 15th and 16th centuries by Ottoman potters who took their cue from Chinese blue and white while adding decorative flourishes of their own: intricately interlaced, spiralling floral and geometric designs as well as additional colors such as turquoise (from the French for “Turkish”), emerald green and clay-colored bole red.

These ornate polychromatic patterns came to characterize what became synonymous with the city, Iznik pottery. Yet blue remained a predominant, foundational color. From the lavish walls of Istanbul's Topkapı Palace to the stunning interior of the nearby, early-17th-century Blue Mosque, Iznik ceramics flourished under the patronage of Ottoman sultans, especially Suleiman the Magnificent (1494-1566). While certainly a display of earthly wealth and power, the prominence of blue Iznik tiles served to transcend the secular, according to Idries Trevathan, author of *Colour, Light and Wonder in Islamic Art* (Saqi Books, 2020) and curator of Islamic art and culture at Saudi Arabia's King Abdulaziz Center for World Culture.

“The vast expanse of tiles decorating every surface of blue-tiled mosques,” he says, evokes “blossoms and flowers strewn on dark-blue meadows, or even a dark-blue background and inner field suggesting the depths of the sky covered in stars. Thus, the design simultaneously evokes the flowers of paradise and the stars in the heavens,” Trevathan says.

This symbolism reflects the linguistic roots of the Arabic word for blue, *‘azraq*, which originally meant a glittering or gleaming point, such as a star. The concept, says Trevathan, conveyed “a sense of brightness combined with movement.”

Or dazzle, as Xian Yuanpian observed.

Blue's shimmer and intensity, in fact, have always drawn attention, inspiring a global industry and impacting the apparel of kings and common men alike.



TRUE BLUE

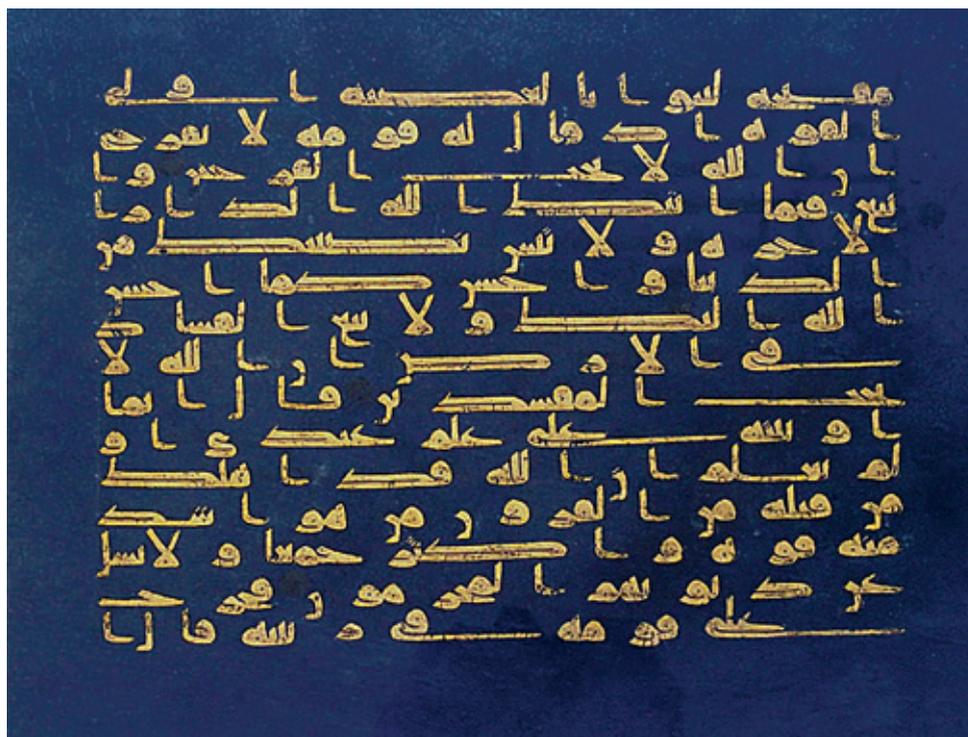
Beginning in the 16th century, all across Europe, those with financial stakes in the production of blue dye made from the scrawny flowering plant called woad launched an aggressive smear campaign against its new competition, indigo, one of the many goods flooding into Europe thanks to the expansion of trade with Asia during centuries of colonialism.

Officials in Dresden claimed in 1650 to have “clear proof that indigo not only readily loses its colour, but also corrodes clothes and other fabrics.” In Nuremberg, dyers were forced to swear not to use “the devil's dye,” as German Emperor Ferdinand III deemed indigo in 1654. In England Queen Elizabeth I decreed the

dye poisonous and banned its use throughout the realm under threat of prison. The French government took it a step further: the penalty for dyers caught using indigo was death.

None of these charges were true.

In fact, indigo derived from the native Indian plant *Indigofera tinctoria* produced the most-colorfast, most-intensely blue dye in the history of textiles.



Indigo dyed the estimated 600 parchment folios of one of the most renowned copies of the Qur'an ever produced: The so-called “Blue Qur'an,” which dates to the late ninth and 10th centuries in Tunisia, where calligraphers used gold leaf.

“It can't lose its blueness. It's the only dye that has that quality,” says Jenny Balfour-Paul, honorary senior research fellow at the University of Exeter's Institute of Arab and Islamic Studies and author of several books on indigo, including *Indigo in the Arab World* (Routledge, 1996).

Indeed some of the world's oldest-known indigo textiles, such as the blue borders of linen on clothes found with Egyptian mummies, dyed more than 4,000 years ago, retain color.

Greeks and Romans coveted indigo as a luxury and shipped it to Egypt and the Mediterranean by way of the Indian Ocean.

The word *indigo* derives from the Greek *indikón*, which was Latinized as *indicum*, pinpointing the product's geographic origins.

The chemical compound, known as a precursor, responsible for indigo's intensity is indican, present in all members of the botanical genus *indigofera*. Woad contains far less of its own blue-producing precursor, thus requiring far greater amounts of the plant to process than Indian indigo. The recipe for extracting the colorant from either species

requires fermenting the leaves in an alkaline solution to chemically transform the precursor to a blue dye that reveals itself through oxidization, via repeated dunking of the dyed material. After each immersion, the material, which starts out yellow, becomes increasingly blue as it is exposed to air.

During the Umayyad era from the mid-seventh to mid-eighth century CE, much of the indigo trade was in the hands of Arab merchants who ultimately helped spread the popularity and cultivation of indigo from Kabul west to the Levant and across North Africa to Sub-Saharan Africa, all in the wake of the spread of Islam.

By the 14th century CE, Baghdad became the most famous and active center for the best indigo, most of which likely came from Kabul and Kirman in southeast Persia, according to Balfour-Paul. Even though it cost up to three and four times as much as indigo from other sources, *endego fino de Baghdad*, as Italian merchants referred to it, was "best of all," in

By the 14th century, Baghdad had become famous for the best indigo.

the words of one 14th-century-CE Catalan trader.

Owing to its prestige, indigo blue became the color of European royalty, especially the French, who adopted it for robes and heraldry.

"Even King Arthur, the most important legendary king invented by the medieval imagination, was not only depicted wearing blue from the middle of the 13th century on, but was also shown carrying a shield 'd'azur à trois couronnes d'or' (of a blue field and

three gold crowns), the same colors as in the arms of the king of France," observed historian Michel Pastoureau in *Blue: The History of a Color* (Princeton University Press, 2001).

In the Arab world, indigo blue was held in similar high regard, particularly when applied to cloth that was worked and beaten to a sheen.

"The shinier it is, the more prestigious it is," says Balfour-Paul, citing the iconic, electric-blue robes and headdresses of North Africa's Tuaregs as but one example of indigo blue's widespread cachet in the Muslim world. Many historic Western travelers to the Arabian Peninsula noticed both its cultivation and popularity.

In his 1830 *Notes on the Bedouins and Wahabys*, Johann Ludwig Burkhart remarked that blue was the "universal" favorite color for Bedouin clothing "in all the tribes north of Mekka," while 18th-century German explorer Carsten Niebuhr noted in his 1792 *Travels Through Arabia and Other Countries in the East* that



NEW BLUE

YInMn Blue, or "MasBlue" as it is commonly referred to at Oregon State University (OSU), was discovered in 2009, when OSU student Andrew Smith was exploring the electronic properties of manganese oxide by heating it to approximately 1200 degrees Celsius (~2000 °F). Instead of a new, high-efficiency electronic material, what emerged from the furnace was a brilliant blue compound—a blue that OSU distinguished professor Mas Subramanian knew immediately was a research breakthrough.

"If I hadn't come from an industry research background—DuPont has

a division that developed pigments and obviously they are used in paint and many other things—I would not have known this was highly unusual, a discovery with strong commercial potential," he says.

The pigment contains the elements Yttrium, Indium, Manganese and Oxygen. Blue pigments dating back

millennia have been notoriously unstable—many fade easily and contain toxic materials. The fact that this pigment was synthesized at such high temperatures signaled to Subramanian that this new compound was extremely stable, a property long sought in a blue pigment, he says.

In May 2012, the Subramanian team received a US patent and began rigorous testing of the pigment. They concluded that the increased UV absorbance and stability in outdoor weathering and heat-buildup tests demonstrate that YInMn blue is superior to cobalt blue. In addition the high solar reflectance (compared to similarly colored pigments) indicates that this "cool pigment" can find use in a variety of exterior applications by reducing surface temperatures, cooling costs and energy consumption.

—Oregon State University
Department of Chemistry



Indigo-dyed robes, such as this one worn in Morocco, **ABOVE**, are characteristic of Tuareg peoples, a loose confederation of Amazigh (Berber) tribes of Northwestern Africa. **RIGHT** In Gujarat, India, a contemporary dye master works a textile in a vat of indigo. Over the centuries, indigo's unique colorfastness made it a favorite for heavy-use attire such as military uniforms, industrial work coveralls, and pants first made with American cowboys in mind—blue jeans.

the “indigo shrub ... is cultivated through all Arabia, blue being the favorite color of the Arabians.”

This favorability extended beyond fashion. Whereas red is associated with heat, blue connotes the opposite, and “was widely used for cooling feverish conditions,” notes Balfour-Paul. In his 13th-century-CE pharmacopoeia, *Compendium on Simple Medicaments and Foods*, Arab botanist Ibn al-Baytar catalogs a long list of medicinal uses for indigo, based on its cooling properties, Balfour-Paul points out. Even well into modern times, among tribal peoples of the southern Arabian Peninsula, indigo remained a component of traditional folk medicine, applied to the skin, for example, as an insecticide.

Culturally in Islam, blue's prestige extended to sacred uses too during the Middle Ages. Today one of the most stunning examples is the renowned Blue Qur'an, with its gold-leaf calligraphy inscribed on indigo-dyed parchment, produced in either Spain or Tunisia sometime in the late ninth or early 10th century CE, as scholarly opinions differ. The color scheme, says art historian Maria Sardi, was likely inspired by earlier court documents in circulation among Muslim and Christian rulers of the day.

“When the Byzantine emperor sent diplomatic correspondence to the Sultan, he wrote with gold on blue parchment, which was very impressive to the Muslims,” says Sardi, who has also studied the Mamluks' fondness for blue and gold in their decorative arts, clothing, and regalia.

The Arab monopoly on indigo ended, as it did with spices and much of the maritime Silk Road trade, in 1498, when the Portuguese explorer Vasco da Gama rounded Africa's Cape of Good Hope and opened the way for Europe to have a direct channel to the East. Even as the Arab dominance in the indigo trade eroded, Western demand only increased and eventually overcame the attempts to suppress it.

Its adoption in two major markets turned the tide: the military and industry. Indigo's durability made it the dye of choice for



hardy uniforms of wool and cotton, be they those of soldiers in the ranks, sailors at sea, or workers in the field or factory. (Think “navy blue” and “blue collar.”)

These last two cohorts were beneficiaries of one last durable legacy of the Arab world's indigo trade. As Balfour-Paul has chronicled, during the early Islamic era, a sturdy Egyptian cloth known as fustian (named for Fustat, the city that preceded Cairo) was imported to Italy. Imitating the cloth, Genoese weavers produced their own version, known as Gene fustian, which they dyed indigo blue. As Gene fustian's popularity grew, its name was abbreviated to Gene and, as legend has it, eventually to *blue jeans*, perhaps the most globally popular innovation in the modern history of fashion. 🌐



Tom Verde (tomverde.pressfolios.com) is a senior contributor to *AramcoWorld*. Like the majority of those who responded to a 2015 global survey, his favorite color is blue.



Related articles at aramcoworld.com

Lapis lazuli: Mar / Apr 2013

Murex purple: Jul / Aug 2006

Uncle Sam's Camel Captain

Written by STEVE BROWN

On a bitterly cold December night in 1902, one of Arizona's blinding dust storms howled across the Sonoran Desert. In a ramshackle saloon in the town of Quartzsite, an old prospector spun his story. To most of his audience, it must have seemed like another tall tale, this one about a beast the prospector claimed he saw outside town with a tongue that glowed like a flame.

As he spoke, one of the older men paid close attention. To his ears the so-called beast sounded like nothing more than a camel, and he didn't buy the part about the glowing tongue. He asked the prospector where the encounter had occurred, rose from his seat and bid those in the saloon farewell. It was the last time the man known as Hi Jolly was seen alive—or so the legend goes.

Days later the story concludes with Hi Jolly discovered half-buried in the blown sand, one arm wrapped around the neck of a camel, both having perished in the storm. The legend even adds a trace of a smile to his face, because Hi Jolly had found an old friend.

Laden with two wooden barrels of water during a June 1859 US Army camel corps expedition in Southwest Texas, a camel slipped on the smooth rock, and its fall broke one of the precious barrels. The incident was illustrated by artist Thomas Lovell, who included Hi Jolly in the scene, just above the fallen camel's head.



It's not likely Hi Jolly really died this way, and historically speaking, we know only that Hi Jolly passed away on or near December 16, 1902, in Quartzsite, a tiny town in Western Arizona. We also know that, although he died destitute and separated from his family, his real-life exploits have caught the eyes and captured the imaginations of historians, songwriters, TV producers and Hollywood filmmakers. Like the audience in the apocryphal saloon, all have been drawn in by his story, a uniquely American larger-than-life tale of frontier adventures and contradictions.

He was born around 1828 and named Philip Tedro by his mother, who was Greek, and his father, who was Syrian. They lived in Smyrna (now Izmir), a city on the Aegean Sea in Ottoman Turkey. As a young man Philip's spiritual path led him to become a Muslim, and he adopted the name Ali. He made Hajj, the pilgrimage to Makkah, after which he took the title "Hadji"—one who has performed Hajj—and he went as Hadji Ali. By profession, he was an adept camel driver and breeder.

In 1856 a US diplomat named Gwinn Harris Heap arrived in Smyrna carrying funds to purchase several dozen camels for the US Army under the direction of then-Secretary of War Jefferson Davis. The army planned to deploy the camels as long-range pack animals in the desert territories acquired from Mexico.

One of the two known photographs of Hi Jolly is this portrait made in 1880 for his marriage to Gertrudis Serna. That was also the year that, at age 52, he became a US citizen under his given name, Philip Tedro.



Like many immigrants, Hi Jolly adapted his name and identity to his circumstances—in his case, helping blaze settler trails only to watch railroads make them obsolete.

Among eight men hired in Smyrna to help with the task was Hadji Ali. He traveled into the interior of Turkey to help purchase 33 camels, which were loaded on board the *USS Supply* and sent to Texas. The next year the army came back for more, and this time Hadji Ali was hired as a full-time handler. In Texas he marched 41 camels inland to Camp Verde in the hills west of San Antonio, where they joined up with the camels that had arrived the year before. The Texans had a hard time pronouncing "Hadji Ali," and when they localized his name to "Hi Jolly," it stuck.

Novelist Téa Obreht, who included a character based on Hi Jolly in her 2019 *Inland*, remarked that he "haunted me: an Ottoman subject caught between his old empire and his new one, not quite belonging anywhere; the warden of creatures that were utterly pedestrian to him, but a source of endless fascination to everyone who encountered them."

His first expedition with what is unofficially known as the US Army's "camel corps," took Hi Jolly deep into the frontier with 25 camels hauling supplies for Lieutenant Edward Beale's survey of a 1,600-kilometer wagon road from Fort Defiance in the New Mexico Territory to the Colorado River. The expedition proved a success, in part thanks to the camels. Beale's road became a well-worn trail for westward migration in the 1860s and 1870s. Later the Santa Fe Railway, and America's iconic Route 66, would follow Beale's path.

Hi Jolly and the other camel drivers do not appear to have been particularly well-treated in the army. He and several other camel drivers went on strike at least once over a lack of pay. Their quarters were not in the barracks with the troops but in a shed at the back of the camel barn.

In 1860 the army experimented with its camels to create an express messenger service between Los Angeles and Fort Mojave on the Colorado River. The initial run saw Hi Jolly riding the camels hard and fast, like a rider for the Pony Express. One camel died from exhaustion.

After that Hi Jolly was transferred to care for the camels the army had moved to Fort Tejon in Southern California. From there he led another nearly fatal expedition, this one to survey the northern Mojave Desert and Death Valley: The camels were credited with saving the lives of the men.

The army moved the camels again, to Camp Latham, closer to Los Angeles, in another attempt at using them for express mail service. This time the route would cover some 450 kilometers from San Pedro, California, to Yuma, Arizona. Once again army command chose Hi Jolly to ride the first run, but it all too quickly ended in tragedy: The camel died after only 100 kilometers.

The Civil War in 1861 brought the camel corps experiment to an end. Former Secretary of War Jefferson Davis became a senator from Mississippi and then president of the Confederacy. In Texas the army surrendered Camp Verde to the secessionists, retook it four years later and in 1869 abandoned it. Today it is a small town where a historical marker commemorates the fort's role in the camel corps, and a plaque, featuring a camel, hangs on the wall of its post office.





An army camel stands near the center in this detail in a photograph taken in 1863 at Fort Tejon, California. The image was made during a geological survey of Southern California, where many of the camels were moved after the onset of the Civil War in 1861. From there, the camels transported supplies between army installations and towns until the “camel experiment” was disbanded in 1881.

Hi Jolly left the army in 1870, and he continued to work with other pack animals. He also was, it seemed, something of a raconteur. *The Arizona Republic* wrote this about a moment of political theater in 1871:

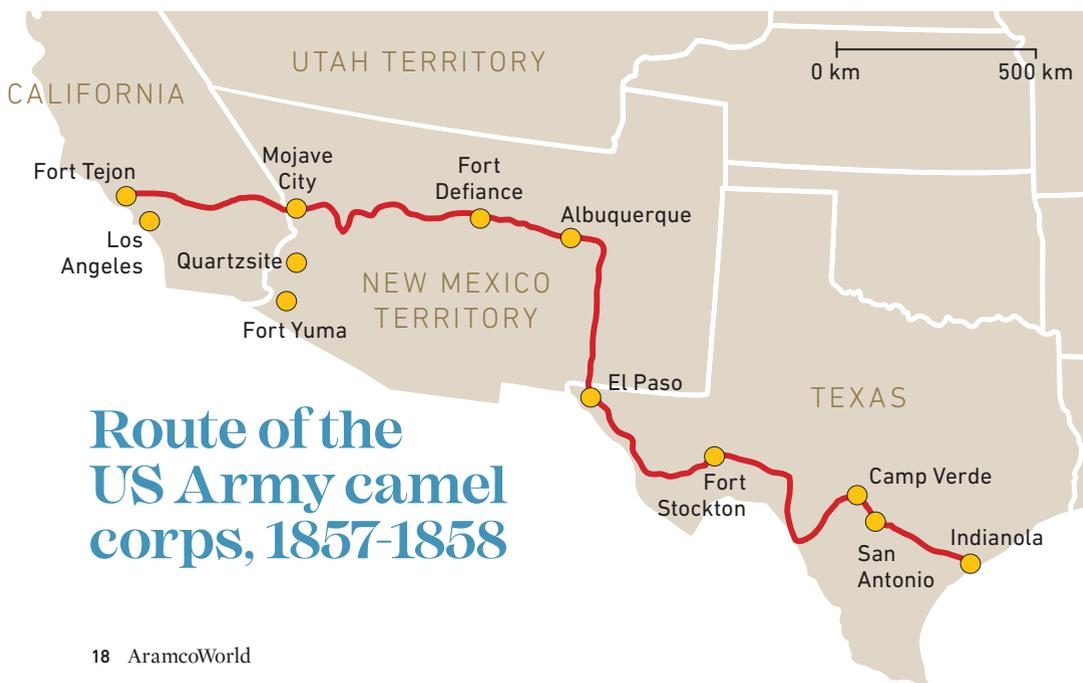
Jolly was in Los Angeles during the Franco-Prussian War and when the news of the downfall of Paris reached that place the Germans of the city held a big picnic a short distance out of town. Jolly was a sympathizer of the French cause and the jollification of the Germans greatly enraged him. He hitched up a couple of the old camels to a government wagon and with several wild whoops dashed into the midst of the merrymakers, causing great consternation and a general stampede of men and teams.

Reporting the same incident, *The Los Angeles Herald* described him as the “man who enjoys the happy distinction of being Uncle Sam’s camel-tamer” and who “relates anecdotes with a cleverness that would make Mark Twain jealous.”

When the army quit using camels, Hi Jolly obtained a handful of them to start a private freight service between the Colorado River and mines in Arizona, as well as a camel express service between San Diego and El Paso. One traveler described him bringing water to stagecoach stops on the backs of 25 camels and selling it to travelers. But his business faltered, and he released his camels into the wild near Gila Bend, Arizona. Accounts of the period say he was known as generous and friendly, and mention of “kneeling and fasting” indicates that he likely remained a largely observant Muslim.

In 1880 Hi Jolly became an American citizen, and he married Getrudis (Gertrude) Serna in Tucson. In doing so he reverted to his birth name, Philip Tedro, most likely to avoid tension with his bride’s Catholic family. Today, the couple’s wedding photograph (see p. 17) remains one of the only known photos of Hi Jolly.

Not long after the couple’s daughters Amelia and Minnie were born, he left in 1885 to run pack mules for Brigadier General George Crook’s campaign against Geronimo, the leader of the Chiricahua bands of the Apache tribe.



Route of the US Army camel corps, 1857-1858



A historical marker and a pyramid-shaped memorial in Quartzsite, Arizona, keep alive the memory of Hi Jolly, who is described on the monument's epitaph as "Cameldriver-Packer-Scout-Over thirty years a faithful aid to the US Government."

Afterward, he returned to prospecting.

In 1891 Hi Jolly and Gertrudis had a son, Fernando Serna Tedro. Census records from 1910 place Gertrudis and all three children in Tucson, and they list Fernando's occupation as carpenter. Records from the 1920 census show Fernando residing in Los Angeles County with his sister Amelia and her husband, and no occupation or spouse is listed. No further records of him or his sisters are known.

In 1898 Hi Jolly returned one last time to Tucson. In deteriorating health, he asked to see Gertrudis and the children, and he begged Gertrudis to take him back. She refused.

Hi Jolly returned alone to Quartzsite, at that time a town of about 20 hardy souls. The US government rejected his petition for a small military pension despite support from Arizona's Territorial Delegate to Congress, Mark Smith. When Hi Jolly died on or around December 16, 1902, a small funeral was held, and neighbors erected a wooden grave marker.

Although the legend of Hi Jolly dying while embracing one of his long-lost camels is almost certainly pure folklore, in 1935 the Arizona Highway Department actually interred, in a stone memorial to him in the shape of a pyramid with a camel on top, the ashes of Topsy, the last of the government's camels. The pyramid now stands at the center of a Quartzsite cemetery, where it remains a historic site and tourist attraction.

The story of Hi Jolly and the US Army's camel corps reached beyond the Southwest. There was a folk song written about Hi Jolly in 1962; a children's book appeared in 1959; and his character was written into at least two Hollywood movies, *Southwest Passage* in 1954 and *Hawmps!*, a comedy about the camel corps, in 1976. On television his character appeared in a 1957 episode of the classic series *Death Valley Days* as well an episode of the series *Maverick*. In Turkey, filmmaker Mert Türkoğlu produced *Haci Ali* in 2018 as "a documentary of an Ottoman soldier who came to the United States as an immigrant."

Leading Arab American journalist and Air Force veteran Ray Hanania included Hadji Ali in an online commemorative listing of Arab American military veterans. Hadji Ali—Hanania listed him under his original chosen name—"is one example of how Arab immigrants to America played many different roles in supporting our new adopted country, especially serving active duty in the US military," Hanania says.

Today the spirit of Hi Jolly and the US Army's camel corps lives most vividly on a small farm near Waco, Texas, not far from the original Camp Verde. Doug Baum, founder of the modern-day Texas Camel Corps, keeps nine camels that he trots into regional educational programs, backcountry camel treks, historical re-enactments, fairs, parades and even the occasional feature film appearance, such as when they joined Martin Sheen in 1999 in *A Texas Funeral*, all with references to the historical camel corps.

Baum is fascinated with the story of the army's camel handlers and journeys, and he has reviewed the original

journals of Beale and his contemporaries.

"Hi Jolly in so many ways represents every one of us," Baum says. "He's an immigrant, like most Americans. His story resonates with all of us because it is our story." 🌐

Old-timers out in Arizona Tell you that it's true You can see Hi Jolly's ghost a-travelin' still When the desert moon is bright He comes ridin' through the night Leadin' four and twenty camels 'cross the hill.

—"Hi Jolly, the Camel Driver," by Randy Sparks, recorded by the New Christy Minstrels, 1962 ©Cherrybell Music Company



Steve Brown is a journalist and historian based in the Mojave Desert, not far from the route Hi Jolly first took across California. He has encountered many strange things in the desert, but no camels—not yet.



Related articles at aramcoworld.com

Camel history: Nov / Dec 2018

Camel corps: May / June 2002

SHANIDAR CAVE Yields New Signs of Neanderthal Emotions

Written by
**GRAHAM
CHANDLER**



With the findings of flowers in association with [a gravesite of] Neanderthals, we are brought suddenly to the realization that the universality of mankind and the love of beauty go beyond the boundary of our own species.

—Ralph Solecki, *Shanidar: the First Flower People*, 1971

Forty-five years after archeologist Ralph Solecki wrote those words, “it was in late spring and abominably hot,” recalls archeologist Graeme Barker of the 2016 excavation season at Shanidar Cave, 100 kilometers northeast of Mosul in the foothills of the Baradost Mountains in the Kurdish region of northern Iraq. The surrounding foothills were dry and dusty because shepherds had grazed their flocks especially heavily that year. Barker, who was 69 at the time and is Emeritus Disney Professor of Archaeology at the University of Cambridge, explains that this reduced the grass and flower samples he and his team hoped might help settle one of the most intriguing questions about

our closest evolutionary relatives: Did Neanderthals think and feel like we do?

The question goes back to the late 1950s, when archeologist Ralph Solecki of Columbia University excavated at Shanidar the remains of 10 Neanderthal men, women and children who had lived an estimated 60,000 years ago. Particularly compelling were remains found with significant quantities of pollen from those brightly colored flowers that would prove scarce to Barker. Solecki’s team named the remains Shanidar 4. The pollen analysis showed traces of hyacinth, bachelor’s button and hollyhock, all hypothesized to have been woven into the branches of a pine-like shrub and placed with the body. The discovery

Fenced to protect excavations that since the 1950s have yielded remains of at least 10 Neanderthals, Shanidar Cave lies in the foothills of the Baradost Mountains in Kurdish-controlled northern Iraq. One of the discoveries, unearthed in 2016 and designated Shanidar Z by archeologist Graeme Barker, includes enough skull remains that the profile of the deceased, believed to be a middle-aged adult, can be seen facing to the right in the **INSET, ABOVE**. The body appears to have been deliberately arranged with a flat stone under its head, adding to evidence that Neanderthals buried their dead deliberately and even with ritual.





Inside Shanidar Cave, blue tarpaulins cover parts of trenches started by Ralph Solecki and furthered recently by Graeme Barker and his team from Cambridge University. “We thought with luck we’d be able to find the locations where they had found Neanderthals in the 1950s, to see if we could date the surrounding sediments,” says Barker. “We didn’t expect to find any Neanderthal bones.” Shanidar Z, whose ribs and spine appear partially excavated **ABOVE**, proved a significant discovery for the Cambridge team. **LOWER** Cambridge anthropologist Emma Pomeroy in the trench during the 2016 dig.

led Solecki to introduce the theory that if Neanderthals could express lamentation of death, then perhaps they were capable of far more too. The act of grieving or paying respect to the dead, as well as the participation in some type of death memorial ritual, suggested to Solecki that Neanderthals possessed compassion.

This took the first swing in what has become a steady tearing down of the brutish “caveman” stereotype that had been dominant over the century since *homo neanderthalensis* was first classified scientifically in 1856. Evidence continues to support understanding that Neanderthal populations inhabited southern Europe and western and south-central Asia from roughly 400,000 to 40,000 years ago, and that they overlapped with early *homo sapiens*—us. The “bad press” for Neanderthals, as Barker calls it, persisted until Solecki’s excavation. If Neanderthals possessed compassion enough to arrange and place flowers in the grave, then did they also possess other complex abilities, such as learning, communication, awareness, ritual and even belief systems?

Solecki found further evidence for this in another male skeleton that they named Shanidar I. Forensics indicated Shanidar I not only lived a long life for his time—around 40 years—but also survived a traumatic head injury at some earlier age as well as perhaps other physical injuries as a child that likely incapacitated him to some degree. Solecki noted the healed wounds of Shanidar I suggested that Neanderthals may have cared for their sick or disabled.

However, Solecki’s interpretation of the pollens was contested, due to what critics called insufficient safeguards against contamination as well as Solecki’s lack of comparison samples from surrounding deposits. As intriguing as it was, it could not be

regarded as proof. Yet the implications were profound and tantalizing enough to trigger a decades-long avalanche of research in archeology and anthropology. Barker is but one of many spurred on by Solecki, aided now by sophisticated new techniques like DNA analysis.

In 2011 the Kurdistan Regional Government invited Barker to come to Shanidar and reexamine Solecki’s findings. It is the first such invitation issued since 1960.

“I could hardly believe it,” Barker says, remembering the excitement. (Barker later notes that Solecki, long retired, had been





ABOVE, LEFT In June 1953, while a member of his team gingerly uncovers bones of a Neanderthal child, Ralph Solecki makes notes of the first Neanderthal discoveries in Shanidar Cave. **RIGHT** Close to Solecki's excavation, Barker holds a block of soil that will be analyzed using micromorphology techniques not known in the 1950s. Behind him, Neanderthal bone remains can be seen protruding out of the soil.

“enormously supportive.” Solecki passed away in 2019.)

Five years later, in 2016, Barker led a team of specialists to reopen Solecki's 14-meter-deep trench and examine the soils using advanced techniques of micromorphology and more.

“What we were hoping was simply to expose the different locations where Solecki found the Neanderthals, date them and get information about climate and how they were living using methods not available to him,” Barker says. “So we'd end up with a good chronology of when they were there and how they were behaving.”



They found more than they expected.

“As we got down into the intact stratified deposits, we found some clearly articulated limb bones,” he says, explaining how they gingerly used trowels and brushes to expose the bones of the body they named Shanidar Z. It soon became clear this was, like Shanidar 4, likely an intentional Neanderthal burial. The body had been placed on its back with its head and shoulders raised on a triangular stone. The head was turned slightly to its left and set to rest on the closed left hand as if in a dreamy sleep.

“The hand and the stone look as if they were placed there,” says Barker. “It's not one of the stones from the sort of rockfall that's below and around and above.”

Barker also notes the micromorphology sections “clearly show that the body is in a location that has been partly changed by people. It is in some kind of scoop that is suggestive of an intentional burial.”

The micromorphology slides also showed evidence of pollen. How it came to be there and whether it is pollen of flowers or other vegetation is not yet conclusive, he says, but “the cumulative evidence is looking more and more like the undeniable evidence for a deliberate burial associated with ritual behavior.”

This is significant because it shifts our understanding of the grave closer to an example of what archeologists call “mortuary behavior.”

This takes place when people do not merely bury a body but perform rituals around it—like nearly all modern cultures do today.

As significant as they may turn out to be, Barker's findings are far from isolated.

Among the research that Solecki's hypotheses helped launch, four stand out, and all have added supporting evidence.



An artist's impression of a Neanderthal burial at Shanidar Cave, **ABOVE**, draws on the finds of Solecki and Barker to show a community gathering and laying flowers around the body of the deceased. **LEFT** A visitor to the exhibition "Cambio de Imagen" (Change of Image) at the Museum of Human Evolution in Burgos, Spain, looks on a model of the face of a Neanderthal man.



Neanderthals prepared some foods.

Robert Power, a research associate at Ludwig-Maximilians University in Munich focuses on diet of hunter-gatherer and early farming societies. He analyzed the residue and calculus on the teeth of Neanderthals. In addition to being predominantly carnivorous, "they clearly used plants such as chamomile, yarrow and others for flavor and for medication," he says. And it wasn't always just "gathering" either: They enjoyed foods such as olives, he says, that required processing to be palatable.

Neanderthals embraced technology.

And it was more than spears and stone axes, says Bruce Hardy, professor of anthropology at Kenyon College, who studies Neanderthals and human ecology. Since 2006 he has been excavating Neanderthal occupation levels at the Abri du Maras site in a valley near the Ardeche River in France. The site is rich in stone tools, and some show, under a microscope, tiny fibers

stuck to them. Though it was originally unclear at first what the fibers had been, one day Hardy noticed that attached to one of the items was something larger: distinct bundles of fibers in three-ply cord about 6 millimeters long. It dated to between 41,000 and 52,000 years ago.

Cheers broke out in the lab, Hardy recalls of the moment of discovery.

"When I found this piece with all those twists, we knew we were really on to something, because cordage is not as simple as it looks," he says. "It takes a good bit of imagination and mathematical understanding."

Bast, or layers of inner tree bark, likely from conifers, are fibers that are first S-twisted to form yarn, he explains. Then the yarns are Z-twisted in the opposite direction, which prevents unravelling, to form a strand or cord. Hardy explains that as the multiple cords are twisted to form a rope, and the ropes interlaced to form knots, the methods suggest broader technologies: bags, mats, nets, fabric, baskets, structures, snares and even watercraft.

"There's no reason to think Neanderthals are cognitively any different than we are," says Hardy. Because the Abri du Maras cord was a rare perishable material, "if we look more carefully—in particular, microscopically—in the sediments and on tools we are going to find they were doing more."

**Neanderthals
"clearly used plants
such as chamomile,
yarrow and others
for flavor and for
medication."**

—ROBERT POWER

Neanderthals made art.

Paul Pettitt, professor of archeology at Durham University in the UK, specializes in paleolithic art. In 2015 he took a team to three cave sites in Spain to analyze samples of more than 1,000 red-and-black paintings and engravings on the walls. He

noted the differences in craft techniques and tools, including hand stencils and handprints, geometric shapes as well as figurative representations of horses, deer, birds and more. He took particular note of three images: a red linear motif in La Pasiega in northern Spain, a stencil of a hand in Maltravieso in west-central Spain, and red-painted stalactites and stalagmites in the Cave of Ardales in southern Spain.

Pettitt and his team dated the art to more than 64,000 years, which predates the arrival of modern humans in Europe by at least 20,000 years. The inescapable implication is that the artists must have been Neanderthals.

Others, however, have challenged Pettitt's use of standard Uranium-Thorium (U-Th) dating and maintained the necessity of using other methods too. But Pettitt stands by his results. "We actually sample in the paint itself, and when we have exposed the pigment underneath, we stop."

"It's not surprising they would create the first hand stencils or the rectangle of overlapping finger dots," Pettitt says. "They wanted to leave a mark of their body on the external landscape."

The idea that Neanderthals likely were able to sketch on walls further contributes to understanding their cognitive abilities.

"The overwhelming majority of cave art remains undated," Pettitt says.

Neanderthals could be attractive.

One of the perennial questions about Neanderthal behavior is whether they interbred with modern humans, seeing as the two species shared large swaths of territory, including the region around Shanidar, for more than 10,000 years. It is also the one major question science has largely settled.

"What the earliest claims were for interbreeding is a lot of people had thought it possible, if not probable," says Greger Larson, director of palaeogenomics and bioarchaeology research at Oxford University's School of Archaeology.

Larson notes when the first Neanderthal genome was published in 1997, it showed non-African populations with Neanderthal DNA mixed together.

"Then as more Neanderthal DNA was reported, it showed that admixture was pretty common," he says, noting in people today the amount varies from less than one percent to more than two percent depending on heritage.

"Neanderthals and humans are so closely related they are as similar as wolves and coyotes," he says. "And we know that those species can readily hybridize."

From his work in France, Hardy has also theorized on interbreeding.

"To think of something as closely related to us as Neanderthals are, to think that they don't have symbolic thought when ultimately we are seeing through DNA evidence that they are interbreeding with modern humans' ancestors—it doesn't make any sense," Hardy says. "Why are we going to interbreed with something incapable of symbolic thought?"

Hardy reckons the shared DNA and evidence of interbreeding suggest something further.

"Neanderthals and humans are so closely related they are as similar as wolves and coyotes ... and we know that those species can readily hybridize."

—GREGER LARSON

"At some level we're not really talking about an extinction," he says. "We're talking about an assimilation, where part of the Neanderthal genome is brought into the modern human."

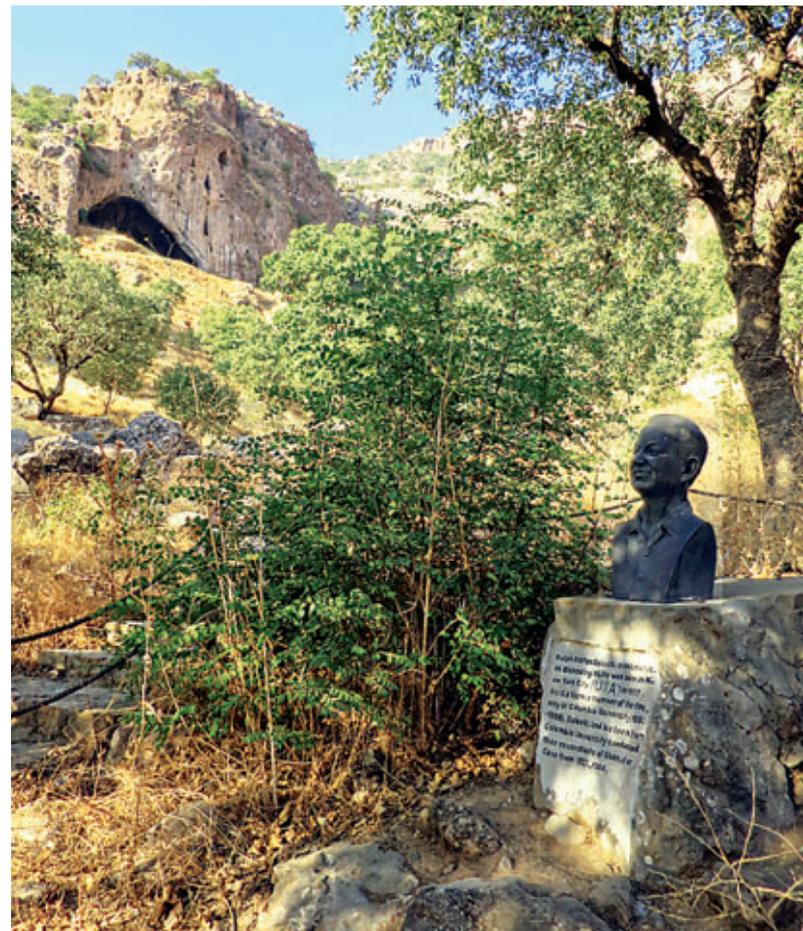
Or as Larson puts it, if Neanderthals were alive today, they could blend in aboard a bus in any city, particularly in Europe or West Asia.

The discoveries at Shanidar Cave and elsewhere add that not only would the Neanderthals blend in, but any one of them might give up a seat for a less able

passenger. Or hold the door.

Barker hopes Shanidar Cave will continue to reveal more answers. Every scrape of the trowel, every swish of the brush, every microscopic soil analysis promises clues to come. 🌐

Honoring the contributions of Solecki to the growing body of science surrounding the lives of Neanderthals, a bust of Solecki stands in a grove that opens north toward Shanidar Cave.



Writer **Graham Chandler** focuses on topics in archeology, aviation and energy. He received his doctorate in archeology from the University of London and lives in Calgary, Alberta.



Related articles at aramcoworld.com

Agricultural revolution: Nov / Dec 2014; Mar / Apr 2009
Ksar Aqil, Lebanon: Sep/Oct 2012





PINISI BOATS



SAIL INTO THE FUTURE

WRITTEN BY
**TRISTAN
RUTHERFORD**

From the shipyards that line Tanah Beru's beachfront, the masts of great wooden sailboats rise to palm-tree heights. Closer to the sands, shipwrights wield saws and adzes to sculp 40-meter hulls made of massive timbers bent into shape over open fires and assembled with dovetails, pegs and other joinery—no nails. As much as the art of *pinisi* boatbuilding here in South Sulawesi, Indonesia, may look timeless, it is a craft very much of the present, one that is finding new and promising markets for floating masterpieces.



A craftsman scrapes sawdust where ribs meet hull planks on a *pinisi* boat under construction in Tanah Beru, where Haji Abdul Wahab, **RIGHT**, has been building the iconic Indonesian schooners for more than 30 years.

No blueprints exist for *pinisi* sailboats, and the name *pinisi* was first used more than a century ago to refer to the type of rigging they used, though more recently it has come to refer generically to the boat itself. All the designs, says Tanah Beru master boat-builder Haji Abdul Wahab, are in the heads of *pinisi* shipwrights.

“The people around Tanah Beru in South Sulawesi are boatbuilders,” he explains, where *pinisi* still transport goods around Indonesia.

They remain workhorse vessels in a country whose 6,000 inhabited islands are often accessible solely by boat. Agile and economical to operate, *pinisi* slip easily in and out of small harbors. The country stretches more than 5,200 kilometers from Banda Aceh, in the Bay of Bengal, east to the province of West Papua, off the island of New Guinea, a distance comparable to Dublin to Makkah, or Los Angeles to New York. By the 1970s Indonesia’s 1,000 *pinisi* comprised the world’s largest sailing fleet. The goods they transported included timber, sugar, rice, bags of cement and much more.

This means that in its coastal towns, sailing is in South Sulawesi’s geographical and cultural DNA. The shipyards of Tanah Beru lure children to play inside *pinisi* hulls after school. Teens seek out builders to learn crafts such as wooden “tree nails” and skills such as working a two-person saw. Aspiring shipwrights apprentice here.

The majority of *pinisi* have been built in South Sulawesi by



craftsmen like Haji Abdul Wahab, who is also founder of his own *pinisi*-building company, Pinisi Ara. Making the trade possible is the nearby availability of what is reputed to be the best boat-building wood in the world: Bornean ironwood, *Eusideroxylon zwageri*. Heavier than water by volume yet easy to work, it doesn’t rot, and Teredo worms, the burrowing clam that has driven sailors

to despair for millennia, don't eat it. Yet Bornean ironwood only grows in lowland forests where rainfall is extreme (it needs six times as much rain as falls in London). Some climax forest trees rise to 50 meters and reach 1,000 years old; however, overharvesting has earned the species a "vulnerable" status from the International Union for Conservation of Nature, and its export is restricted by the Indonesian government.

South Sulawesi's position in the center of the Indonesian archipelago also sets pinisi ship design in motion. The island sits among Borneo, Bali, Java (where most Indonesians live), Papua and the Spice Islands of the Moluccas. Since the 16th century, residents of Sulawesi witnessed two-mast Portuguese and Dutch trading ships transporting nutmeg, black pepper, cloves and other spices from the Moluccas. This design is generally believed to have inspired the twin pinisi masts today, according to South Sulawesi shipwrights, whose expertise flows from the archipelago's practical, oral tradition, not written histories or how-to guides.

The sailing rig that hangs from the two masts, to which the term pinisi technically refers, gradually evolved to become the ship's majestic, seven-sail spectacle. That's three stacked jib sails billowing out front from a long, spear-like bowsprit, two expansive, main gaff sails and, above each gaff, a topsail. As the Dutch colonial empire fell into decline, locally run pinisi absorbed some of the trading business. By following westerly winds for six

months, long-distance pinisi carried dried fish, cloth and Borneo timber as far as Vietnam, Java and Sumatra. Easterlies then pushed the boats back through the archipelago, laden with other goods for home. Other pinisi did regional work, including fishing and collecting sea cucumbers, as well as trading with Australia to the south.

So important to Indonesian identity is the pinisi that in 2017 the United Nations Educational, Scientific and Cultural Organization (UNESCO) inscribed "Indonesia Pinisi, or the Art of Boatbuilding in South Sulawesi" on its Representative List of the Intangible Cultural Heritage of Humanity. UNESCO notes the "construction and deployment of such vessels stand in the millennia-long tradition of Austronesian boatbuilding and navigation," which is notable for the first technologies for fast ocean travel,

RIGHT Haji Abdul Wahab presides over an *annatta* ceremony, marking the commencement of a new pinisi boat completion. The ceremony usually includes a social gathering marked by singing, feasting and prayers to correspond with the boat's maiden voyage. **LOWER** Timber dowels hold inner ribs to hull planks during construction.



TOP AND OPPOSITE, LOWER: COURTESY HAJI ABDUL WAHAB; LOWER: PETER PTSCHELINZEW / ALAMY; OPPOSITE, TOP: YUSUF WAHIL / AFP VIA GETTY IMAGES; PREVIOUS SPREAD: YUSUF WAHIL / AFP VIA GETTY IMAGES



Pinisi were exclusively sailboats until the 1980s. Since then, motorized pinisi, such as these in Jakarta, have joined what remains one of the world's largest sailing fleets. Both types of pinisi carry cargo to ports throughout the more than 6,000 inhabited islands of Indonesia and across Southeast Asia.

such as outriggers and multihull vessels. The pinisi is also featured on Indonesia's benchmark 100 Rupiah currency note.

The UNESCO recognition was good for business too, says Haji Abdul Wahab. "After pinisi entered the protection of UNESCO, many local people were interested in making ships," he explains, noting about 70 percent of the people in the Tanah Beru area make their livings from boatbuilding and navigation. "The Sulawesi people are very happy with the making of pinisi because it really helps the community's economy and also absorbs more local workers," although he notes that last year "trade ebbed very much," due to the COVID-19 pandemic.

It was during the 1980s that the tradition of pinisi design experienced its most dramatic change. "Advanced technology was used in the building of our ships for the first time," remembers Haji Abdul Wahab. That meant adding a motor.

Stimulus loans from the International Monetary Fund at the time allowed Indonesia's pinisi transport fleet to develop Kapal Layar Mesin (KLM), literally "engine sailing boats," that could turn on power when faced with strong headwinds. The boats grew larger and wider, the better to accommodate more cargo: tins of beef, house tiles, ready-made garments, motorcycles. Some KLM pinisi designs dispensed with sails altogether. As goods moved more rapidly and life became quicker, Indonesia's boat-related economies

prospered. The only G20 member state in Southeast Asia, Indonesia is forecasted to be a top-10 global economy by 2030.

The KLM pinisi, however, also wore out quickly. Instead of working in tandem with the wind like the sail-only vessels, KLM hulls became strained from motoring into heavy weather. Some boatbuilders blamed the ill fortunes on the KLM-builders' short-cutting and even ignoring traditional local rituals that marked the stages of building each sailing pinisi, milestone ceremonies

like those observed for a child growing up. For example, the laying of the keel would signify conception, and a vessel's launch would represent birth, celebrated sometimes with a feast of rice cakes, boiled eggs, and bananas steamed with condensed milk. The building of a ship often included prayers, incense and a traditional pouring of tea over the wooden hull. Finally, a maiden voyage would signify a parent preparing a child

In the late 1990s, the global superyacht industry discovered the pinisi.

for the wider world.

The actual reasons for the shorter lifespans for KLM pinisi shorter lifespans may have yet another practical cause in addition to headwinds. As the island's boatbuilding industry used up premium timber, shorter planks of lesser woods were used on the ever-larger boats. Still KLM pinisi design thrives.

Two decades ago, as global tourism increased, the superyacht industry discovered that a 50-meter, hand-built yacht could be



Resting at anchor in Bali, the 33-meter, 24-passenger Cheng Ho is one of many relatively new pinisi offering live-aboard diving and sailing in waters open only to boats built and registered in Indonesia.

commissioned in South Sulawesi for one-fifth the cost of what would typically cost around \$25 million elsewhere. The pinisi market blossomed further when some of the most elite global yachters realized that Indonesia's maritime registry was a closed one. This meant that if they wanted to cruise in the world's most biodiverse waters—such as Raja Ampat, which hosts 1,000 species of fish and 500 species of coral, 10 times more than the Caribbean—they would need to build their own yachts in shipyards like those in Tanah Beru.

This drew attention also from international naval architects like Michael Kasten, who in 2001 received a call “out of the blue” from Bali. The voice on the other end asked, “Do you know anything about pinisi boats?” The caller wanted to know if Kasten could design a vessel similar to those in South Sulawesi that would include technology like GPS navigation and a scuba diving room. Kasten printed off some blueprints from a Computer Assisted Design (CAD) program and flew to South Sulawesi, where he met Haji Abdul Wahab.

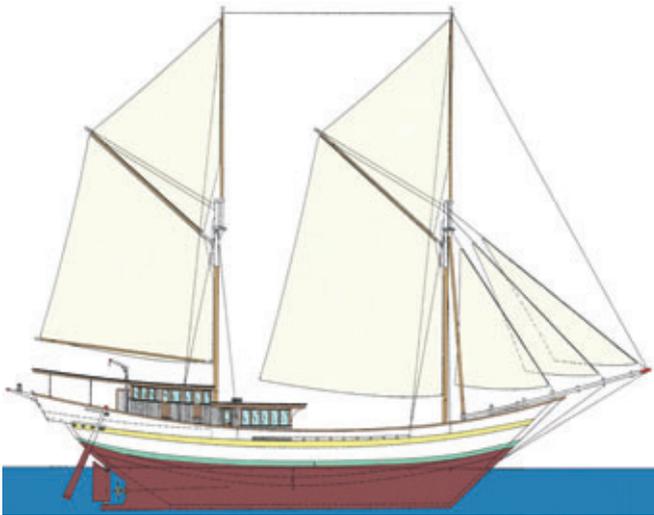
“At first I laid out lots of blueprints,” he recalls. “This made [Haji Abdul Wahab], who was to build the pinisi, a little bit reluctant. So, through an interpreter”—a necessity in a nation with 700 languages—“I said, ‘Please tell the Haji I’m not here to tell him how to build a boat, I’m here to learn at the Haji school of boatbuilding.’ Then he

jumped up and said, ‘Let’s go!’”

“Let’s go!” meant an overnight ferry to Borneo, the world’s third-largest island, northwest of Sulawesi. There, said Haji Abdul Wahab, Kasten’s pinisi would be constructed by South Sulawesi



OPPOSITE: GRANT ROONEY PREMIUM / ALAMY; ABOVE: EDMUND LOWE / ALAMY



Built in Borneo by shipwrights from Tanah Beru, the 36-meter *Silolona* was, like all traditional pinisi, crafted by hand without formal blueprints. Its two-mast, seven-sail design, **LEFT**, is typical of the traditional sail arrangement from which the Indonesian name *pinisi* derives.

dimensions, created in 1867 by the Lloyd’s group of insurance brokers, have evolved to help ensure that large wooden boats are as seaworthy as possible.

The Sulawesi builders, however, used no such plans. Yet after tabulating the measurements, Kasten realized “they were exactly the same [as German Lloyd’s specifications], within a centimeter. It made the hair on the back of my neck stand on end.”

It was, he says, as if “the ocean has taught two boatbuilding traditions, on opposite sides of the world, [with] the same lessons in how to construct a seaworthy boat.” In his case the result was the 36-meter *Silolona*, built also using the traditional poetic-whimsical naming conventions for her parts: Central beams are *naga-naga*, or dragons; the curvaceous keels are *pisang-pisang*, or bananas. And so on.

With no mechanical launch tools, it took 10 days to haul *Silolona* into the water where, after fitting out with engine, plumbing, paint and electronics, “we did a homecoming voyage back to the beach” near Tanah Beru, says Kasten, who has since designed several more pinisi, all marrying old and new technologies from the wooden joinery and the billow of the sails to the Wi-Fi, GPS and optional engine. His boats include *Amandira*, named for the luxury hotel group Aman, which hosts an onboard diving center and a spa.

craftspeople working close to the stocks of ironwood. The boatyard was sited at the Borneo port of Sangkulirang, along the Makassar Strait, almost bang on the equator, beside a river that flowed from the forests.

In Sangkulirang Kasten saw how Indonesian tradition differed from his own practice in the US, which involved 3D computer designs with exact measurements for each and every wood cut. “I wanted to make our boat compliant to German Lloyd’s specifications,” explains Kasten. These standardized sets of structural



As part of the opening ceremonies of 2018 Asian Games, which hosted some 11,000 athletes from 45 Asian countries, a pinisi sailed the Games' official flame to Tanah Beru, where along the beachfront shipyards, **LOWER**, another pinisi takes shape.



Like Haji Abdul Wahab, Kasten has come to view pinisi design as “not a fixed thing” but rather a globally influenced structure for an increasingly globalized boat. The Portuguese sailed to Indonesia and both gave and borrowed from the pinisi tradition, as did Arabs who sailed dhows into the region starting in the 15th century. All, he says, have more similarities than differences.

After more than 30 years building pinisi, Haji Abdul Wahab says he is pleased to think about the boats' growth and renown, and that today they still are sailed as far as Thailand, Borneo and Papua, as in times past.

The symbol of Indonesian marine heritage has picked up a good wind forward.

“Pinisi shipbuilding will always exist and develop,” he says. “It will be maintained to remain traditional by applying modern technology in it.” 🌐

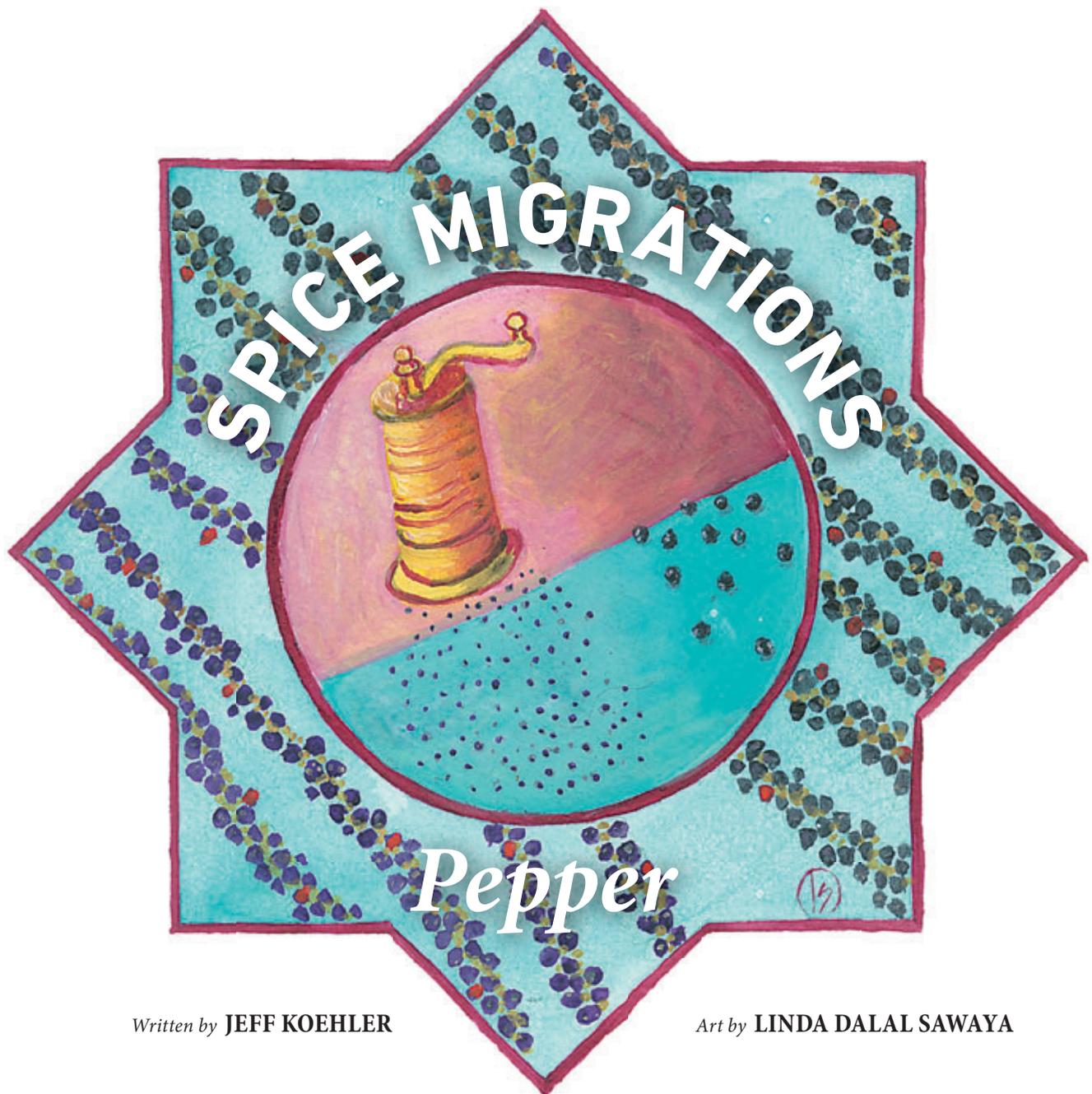


Tristan Rutherford (tristansurmer@gmail.com) learned to sail on his father's sailboat *Aeolus* as they cruised England's south coast for weeks at a time. Now a travel and yachting writer and winner of six journalism awards, his work hack is to charter bareboat yachts in the Aegean and then take a swim after completing the day's assignments on board.



Related articles at aramcoworld.com

Dhows: May / Jun 2012, Mar / Apr 2010, May / Jun 1999



Written by **JEFF KOEHLER**

Art by **LINDA DALAL SAWAYA**

This is pepper country, the Moroccan traveler Ibn Battuta declared of Malabar, India's southwest coast along the Arabian Sea. Admiring the tropical forests and hills made bountiful by monsoon rains, there was "not a span of ground or more but is cultivated," he observed. "Every man has his own separate orchard," and these extend down the coast for the distance of "a two-month march" (about 400 kilometers).

Among the many ports in Malabar he visited in the 14th century, thee "flourishing and much-frequented" Kozhikode, known then as Qaliquit (and later Calicut), today in the state of Kerala, stood out. In its harbor, he wrote, "gather merchants from all quarters," such as China, Java and Sri Lanka to the east and the Maldives, Yemen and Persia to the west.

Many of them traded in spices—especially cloves, nutmeg and cinnamon from further east and cardamom, ginger and

cassia from Malabar itself. But one spice was king, anchor of the city's success: *Piper nigrum*—black pepper.

Black pepper was then the most widely used spice in the world, and it still is, says spice writer and *Times of India* food critic Marryam H. Reshii. "You'd be hard pressed to find a single family around the globe whose kitchen or dining room dresser does *not* have black pepper," she says. So commonplace is pepper that it frequently regarded as unassuming and humble. That's



deceiving. “Modest appearance notwithstanding,” she says, the spice that “has led world history for much of the last millennium is a giant.”

Piper nigrum is native to India’s Western Ghats mountain range. In the shady, steamy heat of its forests, and on Malabar’s coastal plain and neighboring hills, pepper thrives. Ibn Battuta described the pepper trees as looking a lot like grape vines. “They are planted alongside coco-palms and climb up them in the same way that vines climb,” bearing dozens of peppercorns on each single, slender spike.

As soon as one or two of the berries turn red, the whole spike is harvested, generally in autumn. Workers separate the berries between their hands or even their feet, and they spread them out in low piles on coconut mats or large patios. There they dry in the sun, and workers rake them from time to time until, as Ibn Battuta wrote, “they are thoroughly dried and become black.”

The process is essentially similar today, says Australian spice trader Ian Hemphill. “When fresh, green peppercorns are dried in the sun, a naturally occurring enzyme in the skin turns the berries black and creates a highly aromatic oil that gives black pepper its distinctive aroma and flavor,” he says. “The taste is warm, and the flavor full-bodied, round.” And hot, in a clean, sharp way, thanks to piperine, the active ingredient in the white heart of the peppercorn.

“Black pepper drying in the sun is one of the distinctive sights of Kerala’s countryside,” Reshii described in *The Flavours of Spice*. She recalled how as a child in Kochi, south of Kozhikode along the coast, she could see men “raking tons of pepper set out to dry on coconut-leaf mats.”

She adds that at any table in Kerala, there is no avoiding pepper: “It is the one state where the sting of black pepper will catch you at the breakfast table in your *idli* steamed rice cake, in the incendiary chutney served with your fragrant lamb biryani at lunch and during the tea-time snack of banana chips sprinkled with black pepper,” she says. And if you manage to avoid it during dinner, it’s a deep mystery. “Its fragrance and tingling heat will grab your attention even if there are just one or two peppercorns sprinkled over your food.”

Pepper is endowed with more talents than simple taste. “The oils in black



Banana-Pepper Rounds

This simple South India treat is an easy-to-make, family-friendly snack or dessert. Slices of ripe banana are dipped in a smooth batter of whisked egg and sugar, then dropped into hot oil and lightly fried. They’re served hot, topped with finely ground black pepper, which gives a wonderful combination of sweet and hot flavors. The recipe is adapted from *Mangoes & Curry Leaves: Culinary Travels Through the Great Subcontinent*, by Naomi Duguid and Jeffrey Alford (Artisan, 2005). —JEFF KOEHLER

Serves 4–6

1 large egg	½ to 1 cup / 120 to 250 ml coconut oil or peanut oil	finely ground black pepper to taste
¼ cup / 50 grams sugar		

Crack the egg into a medium bowl and whisk in the sugar. The batter will be runny and thin, so keep whisking patiently, up to 5 minutes, until it thickens and you can see small bubbles. Set aside.

In a medium-size heavy skillet, heat just over 1.25 centimeters (½ inch) of coconut or peanut oil over medium-high heat. (Vegetable or canola oil works, too.) Line two plates with paper towels. Have a slotted spoon ready.

Peel the bananas and slice them crosswise into rounds just under 1.25 centimeters (½ inch) thick. You can slice them thinner if the bananas are quite firm.

Whisk the egg-sugar mixture briefly again. Pick up one banana round between your thumb and forefinger, drag it through the batter, and immediately and very carefully drop it into the hot oil. Repeat with about 10 more banana slices. The batter browns quickly, so start turning the slices over carefully with the slotted spoon. When they are done, lift out of the oil, let drain for a moment, and then place on the paper towel-lined plates. Repeat with the remaining banana slices and batter, whisking the batter again frequently.

Transfer the rounds to a serving platter or plates. Grind pepper over them generously. Serve immediately, while still hot.

pepper create an appetite stimulant,” says Hemphill, who is also author of the authoritative *Spice & Herb Bible* (Robert Rose, 2014). Pepper’s aromas make us salivate in anticipation, and as its pungency warms the tongue, it also chemically activates our gastric juices.

Long before Ibn Battuta, pepper was one of the earliest and most-important commodities sold to southern Asia and the lands around the Mediterranean. While the Romans

were not first to use pepper in cooking, they were first to do so

with regularity, according to Jack Turner, author of *Spice: The History of a Temptation* (Knopf, 2004). Among the 468 Roman recipes compiled in the first-century-CE collection *Apicius*, 349 call for pepper.

During the Middle Ages, pepper continued to travel west across the Arabian Sea and north through the Levant, often ending up in Constantinople. Some also went to Jiddah and overland to Makkah, Madinah and beyond, and more continued onward still to Cairo, Alexandria and the greater Mediterranean.

When the physician ‘Abd al-Latif al-Baghdadi visited Egypt in the 13th century, he observed how Egyptians used black pepper, cinnamon and coriander in sweet chicken dishes. The 14th-century Egyptian cookbook *Kanz al-fawa'id fi tanwi al-mawa'id*, (*Treasure Trove of Benefits and Variety at the Table*) backs up his observation, asserting that *filfil* (pepper) “is added to all the main dishes and it is indeed the spice to use.”

But there were yet larger markets than these for pepper both domestically, within India itself, and around Asia, especially in China. In 1320, just 22 years before Ibn Battuta’s visit to Malabar, Marco Polo wrote: “I assure you that for one shipload of pepper that goes to Alexandria or elsewhere, destined for Christendom, there come a hundred such, aye and more too, to this haven of Zayton,” which is now called Quanzhou.

Even Ibn Battuta, arriving in Qaliquat, made passing note of 13 Chinese vessels at anchor. While Polo may have exaggerated, says Michael Krondl, author of *The Taste of Conquest* (Ballantine Books, 2007), in 1500 China consumed three-fourths of the global pepper supply. Thus, it is an irony of history, Krondl maintains, that the relatively smaller volumes of spices that went west ultimately had an outsize impact on world affairs. “That minority trade in Europe motivated a trade system that did in fact lead to globalization and colonization,” he says.

This began when Portuguese mariner Vasco da Gama reached India by sailing around Africa at the end of the 15th century. His exploratory visit was followed by a Portuguese fleet of 13 ships outfitted with cannons and crewed by more than 1,000 sailors who arrived in Qaliquat demanding exclusive access to the region’s resources—pepper chief among them. When they were

rebuffed, says Manu Pillai, a Kerala-born historian and author, “the Portuguese took their business to Cochin [Kochi] instead—helping that port grow as the Arabs had helped Calicut—and began centuries of war” that broke both Indian and Arab control of trade for more than four centuries.

While pepper remains king of the world’s spice racks, India is today far from its largest grower. Pepper had spread long before

Marco Polo, Ibn Battuta and Vasco da Gama saw it, and in their times Malabar produced about two-thirds of the world’s total. Siam (Thailand), Sumatra and Java (both now in Indonesia) grew substantial, competing amounts.

Today, Vietnam, Brazil and Indonesia produce more than 60 percent of the world’s pepper. And as pepper plants have proliferated, so too the aromas and various pungencies of the peppercorns have shifted depending on soil and climate conditions.

For example, says Hemphill, “Vietnamese has a somewhat lemon-like profile, and to me, Indonesian is a little earthy and not as fragrant as Malabar.” Experts generally agree that the south of India still produces the world’s most flavorful pepper. “I am often of the belief that the best spice is the one that comes from its country of origin,” Hemphill says. “As pepper is native to the south of India, and was traded from the Malabar Coast, I find Malabar Garbled number 1 [the highest grade of pepper] the most original.”

According to Reshii, this is perhaps to be expected: The hills of Malabar are drenched by the monsoon at exactly the moment the flower develops into the spice, she says, lending the region’s peppercorns their unique potency. Such conditions and traits cannot be duplicated, not even elsewhere in Kerala, she maintains. “I ask for Malabar Garbled Extra Bold,” she adds. “All I need to do is inhale the fragrance, and I can tell if it is what I am looking for.” ☺



Jeff Koehler is a James Beard and IACP award-winning author based in Barcelona. His most recent books are *Where the Wild Coffee Grows* (a *New York Times Book Review* “Editor’s Choice”) and *Darjeeling: A History of the World’s Greatest Tea* (“hard to put down”—*The Guardian*, paperback of the week). His writing has appeared in the *Washington Post*, NPR, *Wall Street Journal*, *Saveur*, *Food & Wine*, *Times Literary Supplement*, *South China Morning Post*, and many other publications. Follow him on Instagram @jeff_koehler. **Linda Dalal Sawaya** (www.lindasawaya.com; @lindasawayaART) is a Lebanese American artist, illustrator, ceramicist, writer, teacher, gardener and cook in Portland, Oregon. Her 1997 cover story, “Memories of a Lebanese Garden,” highlighted her illustrated cookbook tribute to her mother, *Alice’s Kitchen: Traditional Lebanese Cooking*. She exhibits regularly throughout the US, and she is listed in the *Encyclopedia of Arab American Artists*.





REVIEWS

Without endorsing the views of authors, the editors encourage reading as a path to greater understanding.

Search book, music and video reviews, 1993–present, at aramcoworld.com

“The stories of these 25 women of the Middle East are here to inspire you. Achieving our goals might be hard sometimes but that’s why we need positive role models to guide us.” —Wafa’ Tarnowska



Amazing Women of the Middle East: 25 Stories from Ancient Times to Present Day

Wafa’ Tarnowska, 2020, Crocodile Books, 978-1-62371-870-1, \$19.95 hb.

Writer, translator and storyteller Wafa’ Tarnowska’s portraits of 25 pioneering women date from the era of Egyptian Queen Nefertiti (1370–1330 BCE) to contemporary scientists, pilots, architects and astronauts, among others. Her book offers young readers long-overdue role models from the Middle East. Written in a charming, conversational style, Tarnowska’s profiles are educational and empowering. Beginning with the stories of Nefertiti, the Queen of Sheba, Cleopatra and Sheherazade, she travels across centuries to write about an array of accomplished women. An Egyptian writer, poet and social activist, May Ziadeh (1886–1941) was among the first to discuss feminism and women’s rights during weekly gatherings at her Cairo home. Pilot Maha al Balushi (b. 1986) fulfilled her childhood dream when she became the first woman to fly for Oman Air, her country’s national airline. Tarnowska’s carefully chosen and beautifully illustrated profiles inspire and challenge stereotypes about women in the Middle East.

—PINEY KESTING



Baikonur: Vestiges of the Soviet Space Programme

By Jonk. 2019, Jonglez Publishing, 978-2-36195-377-5, \$39.95 hb.

Secreted away on the silent steppe of southern Kazakhstan, the Baikonur Cosmodrome has played an outsized role in the history of human civilization. This was the earthly departure point for Sputnik, the first artificial satellite; for Yuri Gagarin and Valentina Tereshkova, the first man and woman in space; and for Luna 9, the first spacecraft to land on the moon. The facility, now loaned to the Russian Federation for \$115 million a year, is under tight security, yet in 2018 it was infiltrated by photographer Jonathan Jimenez, nom de guerre Jonk, who spent three days shooting derelict Ptichka space shuttles in an abandoned hangar. Jonk’s spectacular images of the space-race relics went viral, and in this volume he supplements his photographic documentation with a suspenseful account of how he and three friends, armed with thermal imaging goggles and 22 kilograms of photo gear, were able to trespass “the world’s most important urban exploration site.”

—DENNIS KEEN



Building the Caliphate: Construction, Destruction, and Sectarian Identity in Early Fatimid Architecture

Jennifer A. Pruitt.

2020, Yale UP, 978-0-30024-682-7, \$65 hb

The optimism that from chaos comes order could summarize the architectural legacies of the Fatimid dynasty, which founded Cairo in 969 CE and dominated the Mediterranean for most of the 10th–12th century. Although the dynasty’s sixth caliph, al-Hakim, fomented 25 years of conflicts with the destruction of many of Jerusalem’s holy structures, the Cairo mosque that bears his name features highly stylized minarets that are also the city’s oldest “masterworks of Islamic stone carving,” writes Pruitt, a professor of Islamic art history. It fell to al-Hakim’s son and successor, al-Zahir, to sponsor the rebuilding of Jerusalem, including restorations of the Dome of the Rock and al-Aqsa Mosque, “thereby changing the status of the city in Islamic thought.”

—TOM VERDE



Caught in a Whirlwind: A Cultural History of Ottoman Baghdad as Reflected in Illustrated Manuscripts

Melis Taner. 2020, Brill, 978-9-00441-269-9, \$154 hb.

Caught in a Whirlwind describes the short decade of relative peace following the Treaty of Constantinople in 1590 between the warring Safavid Persians, led by Abbas the Great, and the Sunni Muslim Ottoman Empire, led by Sultan Ahmed I. Located in the disputed Mesopotamian and Southern Caucasus territory, Baghdad became the site of bitter conflict. Melis Taner observes some of the manuscripts created during this short decade of intense creativity. Like an academic detective, she considers what individual manuscripts reveal about the two empires’ heated rivalry, the creativity of individual artists, and the visual culture and patronage at the time. Taner’s mastery of her subject as well as the detail and artistry of the illuminations provide tremendous insight into a rare period of creativity under pressure.

—SOPHIE KAZAN



Islam, Science Fiction and Extraterrestrial Life: The Culture of Astrobiology in the Muslim World

Jörg Matthias Determann. 2020, I.B. Tauris,

978-0-75560-127-1, \$115 hb.

This is a rare excursion into a little-explored region of Islamic culture: Muslim perceptions of life on worlds beyond Earth. This historical study focuses on literature and films from the 19th to 21st century in Muslim countries. The author delves into the writings and media of the Arab and Muslim world, examining authors like Azrul Jaini, Ibne Safi, Muhammed Zafar Iqbal, Nehad Sherif and Eliza Handayani. Most readers of the West will be riveted by the imaginative and futuristic explorations of possible extraterrestrial life in the universe by Muslim writers and filmmakers. The work assesses articles, short stories and novels before moving on to film. It looks at the Islamic perspective on unidentified flying objects, or UFOs. The book also explores Middle Eastern echoes in Western science fiction—such as the 1902 movie by French artist Georges Méliès, *A Trip to the Moon*, whose moonscapes were influenced by his longstanding interest in the “magical” cultures of Egypt.

—ROBERT W. LEBLING



Mosques: Islamic Architecture in Europe

Ahmed Eckhard Krausen. 2020, ATS Consulting, 978-8-39575-950-5, €25 hb.

Ahmed Krausen's *Mosques: Islamic Architecture in Europe* is a delightful picture book that highlights the best parts of his photographic exhibition of the same name. In addition to the beautiful, exquisite glimpses of mosques across the continent, guest writers discuss the nuances of Arabic and Islamic influences in European society. It is interesting how Krausen arranged the book with English and Polish versions of everything, from the photo captions to the contributing essays themselves. This book is perfect for light reading on winter days or setting out as a coffee-table book. *Mosques* is also an excellent gift idea to for the architecture enthusiast or history buff in your life. Krausen's latest publication bridges the gap between the European mainstream's vision of Muslims and Islam with their real-life subtleties and diversity. When flipping through its pages, readers will find that there is more that unites Europeans than what divides them.

—MARINA ALI



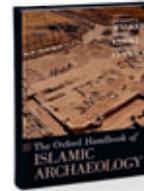
Nomads Land: The Kazakhstan Project

Dieter Seitz. 2017, Hatje Cantz,

978-3-77574-3636-1, €40.00 hb.

Since the dissolution of the Soviet Union in 1991, the Central Asian republic of Kazakhstan has undergone a profound transformation. Physical relics of that bygone era have largely been left to the gnawing of time, as new symbols of prosperity, seeded by the country's vast mineral wealth, have arisen in their stead. The German photographer Dieter Seitz has been especially attuned to the uncanny contradictions that these dramatic changes have wrought. In this album of more than a hundred of his photographs, “continuity, decay and change in a post-socialist society” are made visible in provocative compositions: glistening office towers rise above trash bins, a middle-class family poses with a wolf pelt on the wall, and plastic horses race in front of an opulent opera house. The collection is a melancholic yet honest portrayal of a nation whose visage of a nomadic past has been seemingly and irreconcilably lost, yet whose future seems at once promising and beguilingly uncertain.

—DENNIS KEEN



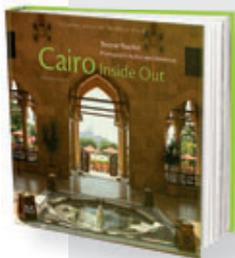
The Oxford Handbook of Islamic Archaeology

Edited by Bethany Walker; Timothy Insoll and Corisande Fenwick, eds.

2020, Oxford University Press, 978-0-19998-787-0, \$175 hb.

The wider, historic Islamic world—from West Africa to Southeast Asia—is canvassed in this overview of its archeologic past, broken down by individual regions (Arabia and the Gulf, Central Asia, the Sahara, etc.). Chronologically, the chapters, penned by various experts, extend from “medieval to modern,” commencing with the Islamic conquest of the Levant in the seventh century CE and extending up to the 21st century. Rich in history, each chapter discusses major finds and how they inform our understanding of Islam's impact on such dynamics as architecture, trade, material culture, rural versus urban society and more. In the discussion of Syria's early Islamic past, we learn that under the Abbasids, mosques began to be “characterized by their large dimension and belong to a Mesopotamian tradition.” An exceptionally informative reference work for the scholar and lay reader alike.

—TOM VERDE



Cairo Inside Out: Expanded Edition

Trevor Naylor, Doriana Dimitrova, ph. 2019, AUC Press, 978-9-77416-922-9, \$24.95 pb.

In *Cairo Inside Out*, author Trevor Naylor offers respite in the Egyptian capital's architectural past, evoking the in-between places that anchor experiences in a metropolis marked by frenetic development and overlapping historical identities. It's part coffee-table book and part city guide, with vivid color photos capturing light-filled foyers, Nile houseboats, elevated vistas, grand hotels and storied cafes. The “inside-out” framing situates the reader within the walls of landmarks like the Cafe Riche, Hotel Windsor and Ibn Tulun Mosque. Naylor's historical commentary and practical advice on how to sail on a *felucca* or haggle in the alleyways of Khan al-Khalili complement the experiential quality in Doriana Dimitrova's photography, captured over a year. Even the most cursory read inspires and equips prospective visitors. For Naylor, Cairo is a city not to be explored only for its current charms, but to be experienced by way of time travel to earlier points in its 1,000-year history, with buildings rather than people serving as his main cultural touchstones.

—J. TREVOR WILLIAMS



Cairo Since 1900: An Architectural Guide

Mohamed Elshahed. 2019, AUC Press, 978-9-77416-869-7, \$39.95 pb.

Author Mohamed Elshahed argues that modernism, the clean-lined, functional architectural style prevalent in the 20th century, was institutionally forgotten in Egypt amid a flurry of state-led building projects after the revolution of 1952 and now faces the threat of erasure. Structures less than a century old fail to qualify for heritage status, leaving many in disrepair and subject to demolition to make way for buildings that “lack any architectural point of view.” Elshahed counteracts the city's selective amnesia by cataloging the legacy of groundbreaking professionals who shaped the cityscape mainly from the 1920s onward. This compendium offers written profiles, historical photographs and renderings of 226 Cairo structures, mapped and grouped by neighborhood. The listings, some supplemented with floor plans and elevations newly drawn by Elshahed's team, focus on modernist buildings but also reference a variety of architectural styles from Mamluk to Art-Deco apartments and Neo-Baroque department stores, as well as eclectic buildings that combine various traditions in one design.

—J. TREVOR WILLIAMS



EVENTS

Highlights from aramcoworld.com

Please verify a venue's
schedule before visiting.

Suspect Objects Suspect Subjects highlights and responds to the social challenges facing Muslim communities in the UK and around the world, addressing themes of government policy and monitoring, controlled identities and the cause and effect on individuals and subsequent impact on mental health. The artworks, all by British-born artist Faisal Hussain, target and immerse the viewer to echo aggressions that surround Muslim communities, playing on the navigation of our reality and memory. The Brunei Gallery, **London**, through March 20.

Shuruq Harb. The Jump. Set within the tectonic rift of the Jordan Valley and weaving multiple storylines joined through a robotic narrator, *The Jump* explores the psychological terrains of leaping into the void. Palestinian artist and filmmaker Shuruq Harb looks at the possibility of storytelling through fragmentation, viewing it as a technical condition of our contemporary era—the way we navigate our lives virtually online through our devices and our condition of short attention spans. Fundació Antoni Tàpies, **Barcelona**, through March 28.

CURRENT / APRIL

Zarina Bhimji: Black Pocket. For over 30 years, London-based Ugandan Asian photographer Zarina Bhimji has staged inquiry into image, object, sound and language as she's searched

for the universal in both its literal and abstract manifestations. The exhibit features the artist's early exploration into forms of knowledge as well as her later exploration of architecture and landscape as arbiters of complex experience and emotion. Al Mureijah Art Spaces, **Sharjah, UAE**, through April 10.

CURRENT / JUNE

Zarah Hussain: Breath explores the universal sanctity and necessity of breathing, mining Hussain's own reflections and experiences as she integrates the personal stories of members from her community who have, in some way, experienced the physical trauma of losing their breath or its transformative healing power. Produced in London while the artist was under lockdown due to COVID-19, the works on display utilize the principles of mathematics and geometry to activate our awareness and deeper connection to breath. Peabody Essex Museum, **Salem, Massachusetts**, through June 20.

CURRENT / JULY

not in, of, along, or relating to a line focuses on how nine artists and art collectives explore how identities and histories are created, transformed or invented using digital technologies to narrate, alter, augment or invent their identities. The artists appropriate technologies to variously pursue each of these

strategies. NYU **Abu Dhabi** Art Gallery, through July 10.

CURRENT / AUGUST

Reflections: Contemporary Art of the Middle East and North Africa features over 100 works on paper that celebrate over a decade of collecting contemporary art of the Middle East and North Africa. The exhibit weaves together a rich tapestry of expression from artists born in or connected to the regions and who reflect on their own societies. British Museum, **London**, through August 15.

ONGOING

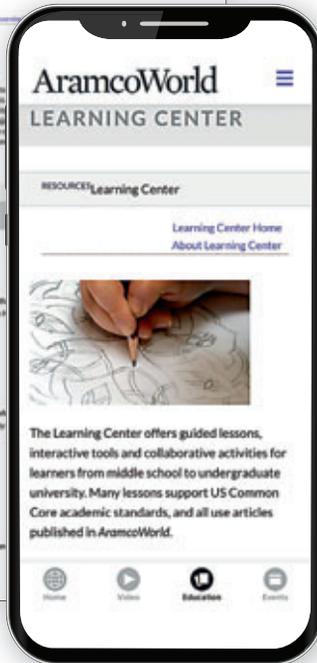
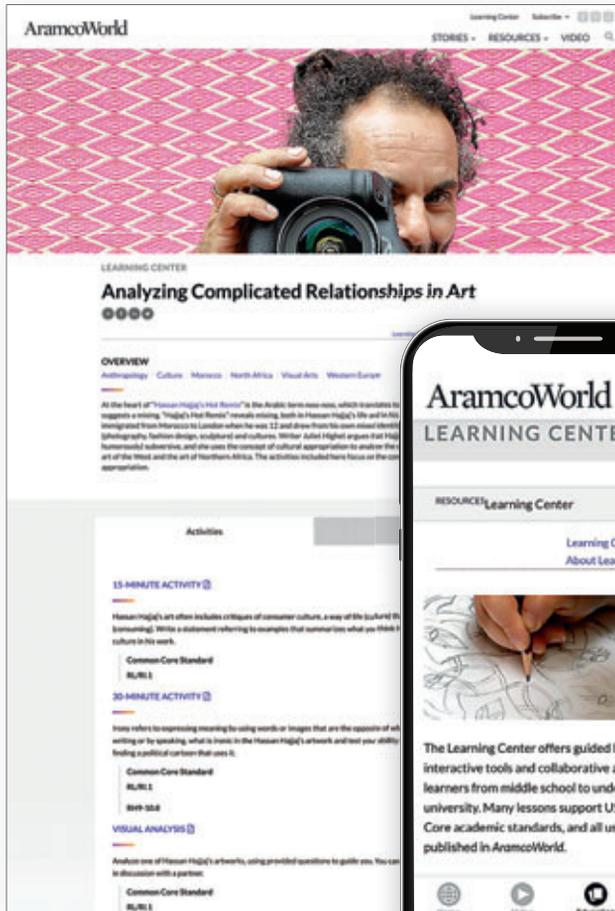
Outlands presents a collection of landscape and portraiture works that explore remote locations and rural outposts in China and the Arctic Circle by Dubai-based photographer Mohammad Kamal. The series captures the intersection of the natural world and human presence, spanning fishing villages, rugged mountain ranges, ice caves and minority communities. Kamal's portraits allow for an intimate examination of the lives of the elders in their own homes. The Empty Quarter, **online**.

Readers are welcome to submit event information for possible inclusion to proposals@aramcoamericas.com, subject line "Events."



Oman: The Land of Frankincense presents finds from archaeological excavations carried out in the Sultanate of Oman over the past 50 years, with treasures dating from the third to first millennium BCE. The exhibition includes metal artifacts, stone *mijmars* (incense burners), an Indus seal bearing an inscription and a stone countenance from a temple of Sin, the god of the moon. The objects tell how the region played a significant role as a center for the spread and propagation of cultural processes. The interests of Mesopotamian and Indus civilizations intersected, and encounters with them led to fusions with local cultures. Four themes run through the exhibit. The first is devoted to Magan, the oldest-known civilization on the territory of Oman. The second shows the legendary land of frankincense, to which four UNESCO World Heritage sites belong. The third and fourth connect with the Iron Age and highlight the snake cults that existed in the Arabia Peninsula long before the transition to monotheism. The State Hermitage Museum, **Saint Petersburg**, through December 12, 2022.

Vessel of soft stone, 1200 to 800 BCE, Diba.



Lessons Activities Resources Ideas

Discover more
with our expanded
Learning Center

aramcoworld.com
and on our app



Follow us on Facebook, Instagram.



Download our free mobile app.

AramcoWorld is published bimonthly in print, web and mobile editions, and an email newsletter is published biweekly. Two-year (12-issue) renewable subscriptions to the print edition are available without charge to a limited number of readers worldwide.

To subscribe to the email newsletter: aramcoworld.com → Subscription Services → Newsletter.

To subscribe to the print edition: aramcoworld.com → Subscription Services → Print Edition.

For residents of Saudi Arabia, all requests for subscriptions, changes of address and renewals must be sent by postal mail to Public Relations, Saudi Aramco, Box 5000, Dhahran 31311, Saudi Arabia.

Change of address: aramcoworld.com → Subscription Services → Print Edition. Have your mailing label with you in order to enter your alphanumeric Subscriber Account Number.

Back issues, from 1960 onward, can be read in full online and downloaded from aramcoworld.com.

Article Proposals: aramcoworld.com → About → Guidelines for Contributors.

Permissions:

Texts of articles may be reprinted without specific permission provided that the text be neither edited nor abridged, that the magazine and author be credited, and that a copy of the reprinted article or a link to it be provided to the editors.

Photographs and illustrations: Much of our photo archive is available on our website. Image licensing for approved uses is royalty-free.

No spam: Contact us with confidence. You will receive no unsolicited marketing email or postal mail as a result of your subscription or inquiry.

Privacy: aramcoworld.com → About → Privacy Policy

AramcoWorld (ISSN 1530-5821) is published bimonthly by Aramco Americas, Two Allen Center, 1200 Smith Street, Houston TX 77002, USA.

Copyright © 2021 by Aramco Americas. Volume 72, Number 2. Periodicals postage paid at Houston, Texas, and at additional mailing offices.

POSTMASTER: Send address changes to *AramcoWorld*, Box 2106, Houston, Texas 77252-2106.

