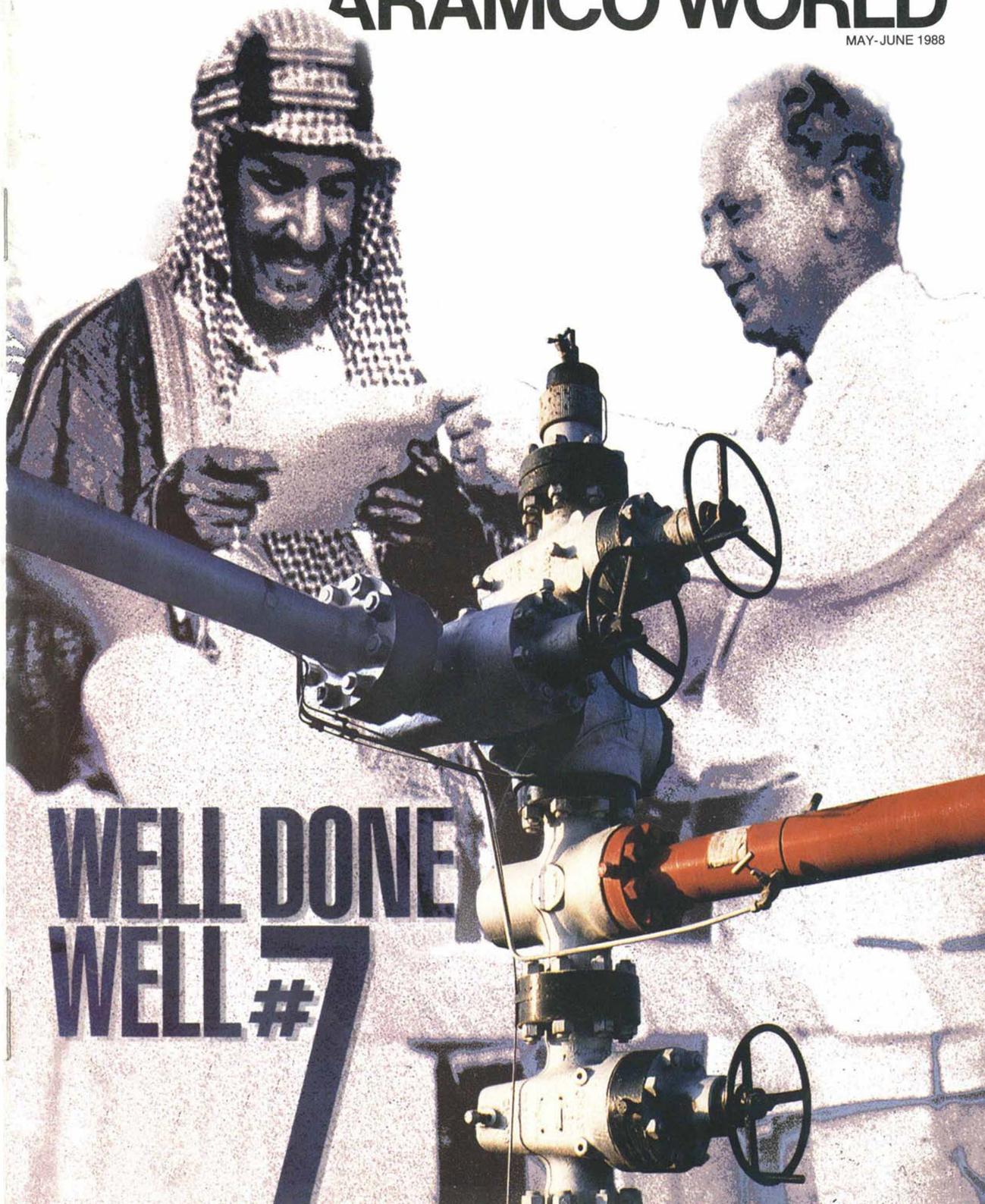
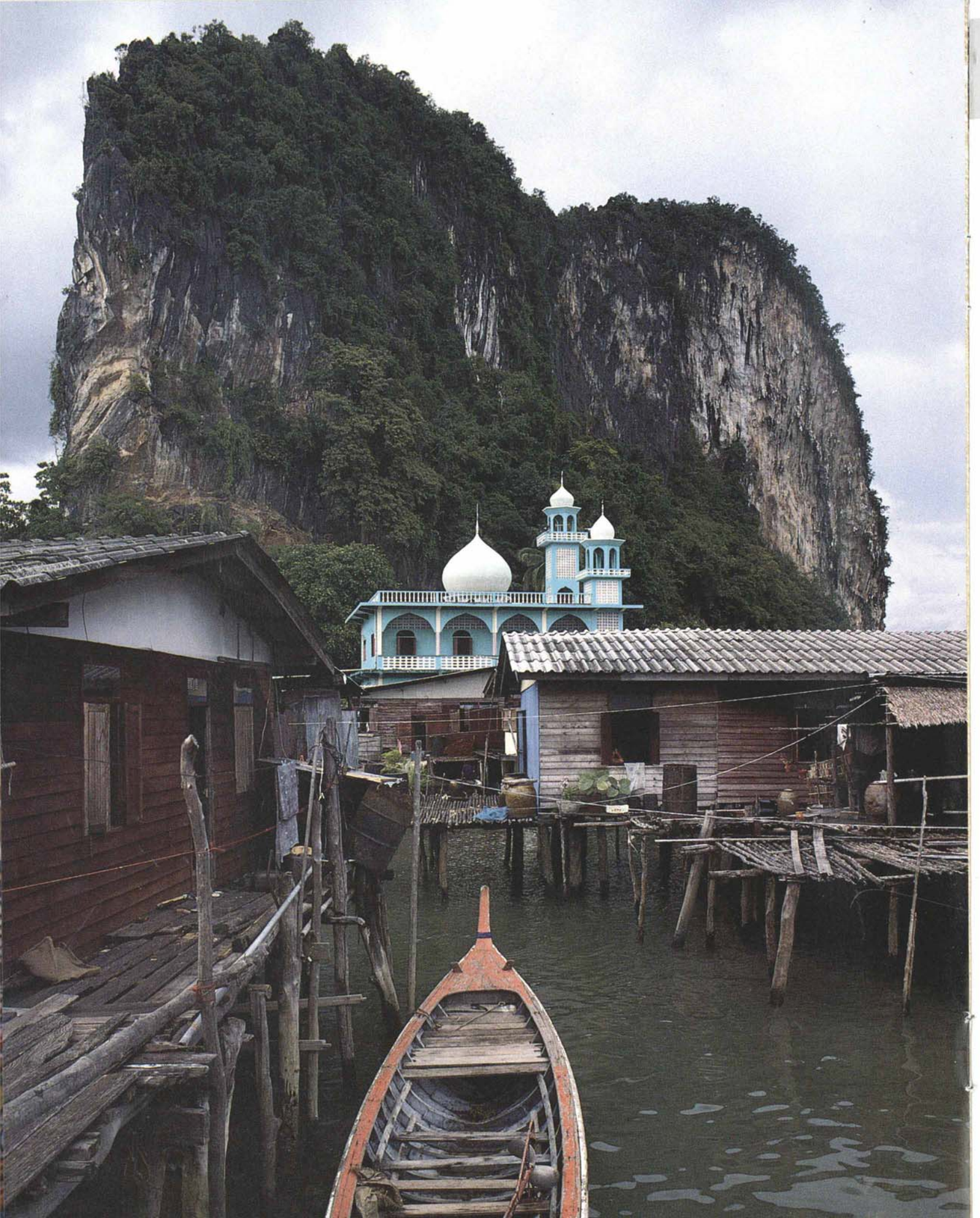
ARAMCO WORLD
P.O. BOX 3725
ESCONDIDO, CALIFORNIA 92025-0925
FORWARDING & RETURN POSTAGE
GUARANTEED
ADDRESS CORRECTION REQUESTED

ARAMCO WORLD
MAY-JUNE 1988



WELL DONE WELL #7



Published by Aramco, a Corporation, Suite 1200, 1667 K Street, N.W. Washington, D.C. 20006

John J. Kelberer
CHAIRMAN OF THE BOARD AND CHIEF EXECUTIVE OFFICER

Ali I. Naimi
PRESIDENT

F. M. al-Bassam
VICE PRESIDENT PUBLIC AFFAIRS

Ismail I. Nawwab
GENERAL MANAGER PUBLIC AFFAIRS

Robert Arndt
EDITOR

George Smalley
ASSISTANT EDITOR

DESIGN & PRODUCTION
Scurr, Barnes & Keenan Ltd

PRINTED IN THE USA
Shenandoah Valley Press

Aramco World is distributed without charge to a limited number of readers with an interest in Aramco, the oil industry, or the history, culture, geography and economy of the Middle East.

Editorial correspondence should be addressed to
The Editor, M.S. 1107,
Aramco Services Company,
Post Office Box 2106,
Houston, Texas 77252-2106, USA
Requests for subscriptions and changes of address should be sent to
Aramco World, Box 3725,
Escondido, Calfornia 92025-0925

Cover: On May 1, 1938, King 'Abd al-'Aziz Al Sa'ud turned a valve to load the first Saudi crude oil onto a tanker at Ras Tanura. In ceremonies that day, the king read congratulatory telegrams handed him by Floyd Ohliger (right), Dhahran manager in residence. In foreground is the wellhead of Dammam No. Seven, still productive today. Back cover: Decorated prow of a fishing boat in southern Thailand shows plant forms and mythical birds. Photo: Nik Wheeler.

◀ Firmly founded on a coastal cliff, the Koh Pan Yi mosque symbolizes the strength of Islam on the Malay Peninsula.

ARAMCO WORLD

VOL.39 NO.3 PUBLISHED BI-MONTHLY MAY-JUNE 1988


SIMARSKI


NORTON


LAWTON

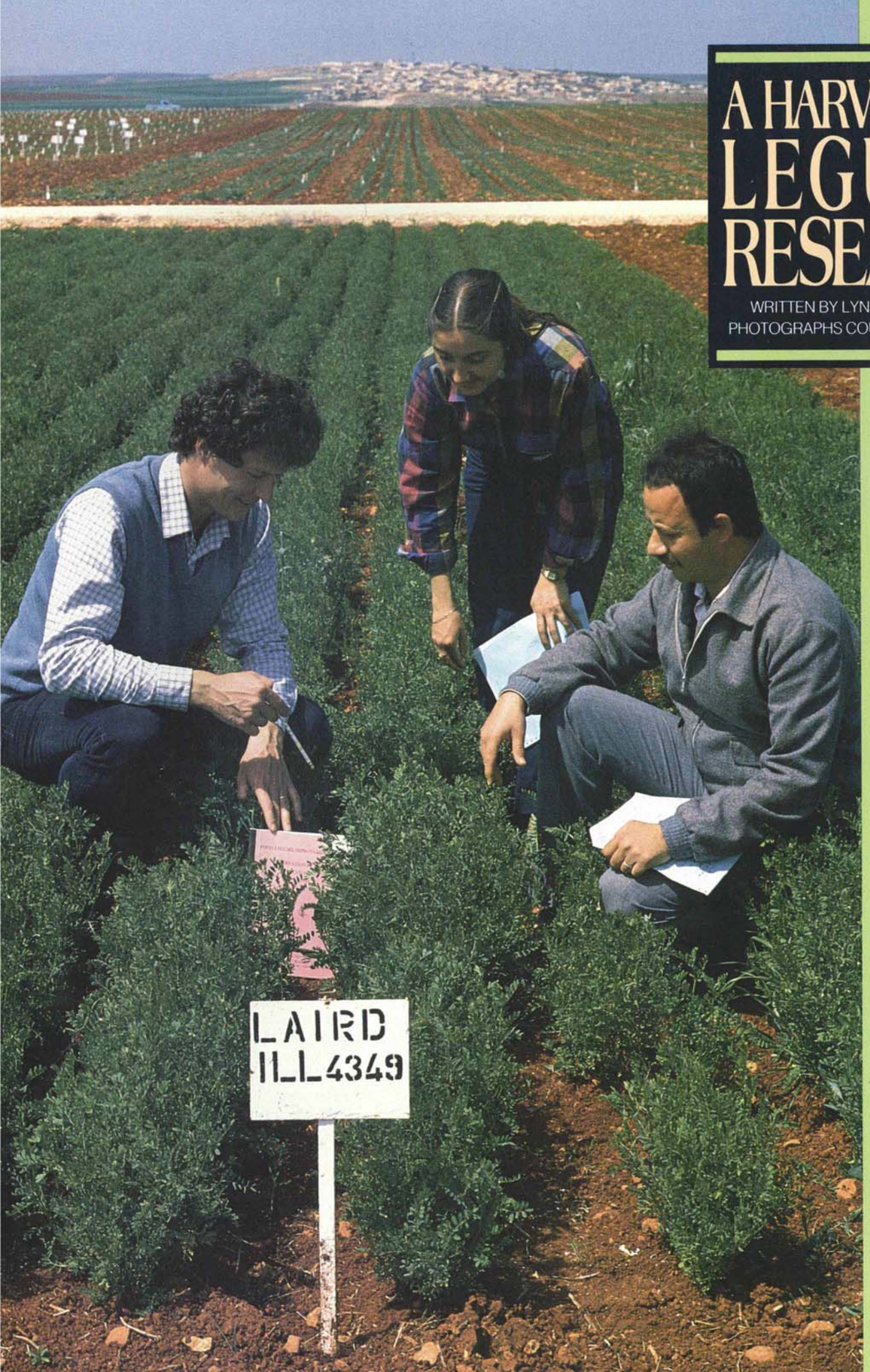

TRACY

ANDREWS


HILDEN

A HARVEST OF LEGUME RESEARCH

WRITTEN BY LYNN TEO SIMARSKI
PHOTOGRAPHS COURTESY OF ICARDA



Taller lentil plants (left and lower right) and shorter faba beans (upper right) produce larger harvests for Middle Eastern farmers.

ICARDA

Even before Esau sold his birthright to Jacob for a bowl of red-lentil pottage, legumes – plants of the pea family – have provided important staple foods in the Middle East and North Africa. Today, legumes are the basic ingredients of such staff-of-life dishes as the Egyptian laborer's breakfast dish of *ful mudammas*, the Yemeni farmer's bowl of *shurbat adas*, the Syrian city-dweller's scoop of *hummus bi tahinah*, and the Turkish movie-goer's bag of toasted *leblebi*.

Of the more than 14,000 species of legumes, including important fodder plants like alfalfa, three species account for two-thirds of the legumes produced today for human consumption in the Middle East and North Africa. They are faba beans (*Vicia faba*), lentils (*Lens culinaris*), and chickpeas (*Cicer arietinum*). Only cereal production surpasses "the big three" in the region's rainfed agriculture.

Legumes, also known as pulses, confer special dietary and agricultural benefits that make them particularly valuable. Nonetheless, modern agricultural research has long bypassed them in favor of breeding new types of wheat and other crops. Unimproved local varieties of legumes suffered from low yields and unstable harvests, and in recent times the farmers of the Middle East began to abandon them for more dependable crops that had profited from scientific improvement.

But now the International Center for Agricultural Research in the Dry Areas (ICARDA), headquartered in Aleppo, Syria, is attempting to reverse the outlook for legumes, as part of its mission to improve the region's production of basic food crops.

Agricultural scientists such as those at ICARDA use crop plants' genes – the blueprints of inherited traits – to produce better plants for farmers. They often utilize "landraces" of crops, the unimproved local strains that farmers have cultivated for centuries, as a starting point, identifying plants that show desirable characteristics, such as tallness, abundant pods, or resistance to some insect pest. Then, they cross different plants with each other to produce, over time, a new variety with all the desirable traits.

Local scientists from Morocco to Pakistan then test ICARDA crop lines under a wide array of local conditions, breeding for their particular environment. It is the task of national research and extension programs to refine the new crop lines – and ICARDA's new technologies – and disseminate them to farmers.

A prime reason legumes have played a vital role in the region's traditional farming systems is their ability to take nitrogen directly from the atmosphere and "fix" it in a form plants can use. Because legumes leave surplus nitrogen behind in the soil to nourish subsequent crops such as corn and wheat, they save the farmer the cost of artificial nitrogen fertilizer.

Once in the pot, legumes are rich in fiber and contain two to four times the protein of cereals – hence their nickname, "the poor man's meat." Legumes and cereals eaten together supply complementary amino acids – the building blocks of protein – thus providing better nourishment than if either type of food were eaten alone. Traditional diets the world over mix grains and pulses – rice and soy in Japan, corn and beans in Mexico, rice and lentils in the Middle Eastern dish *mujaddarah*.

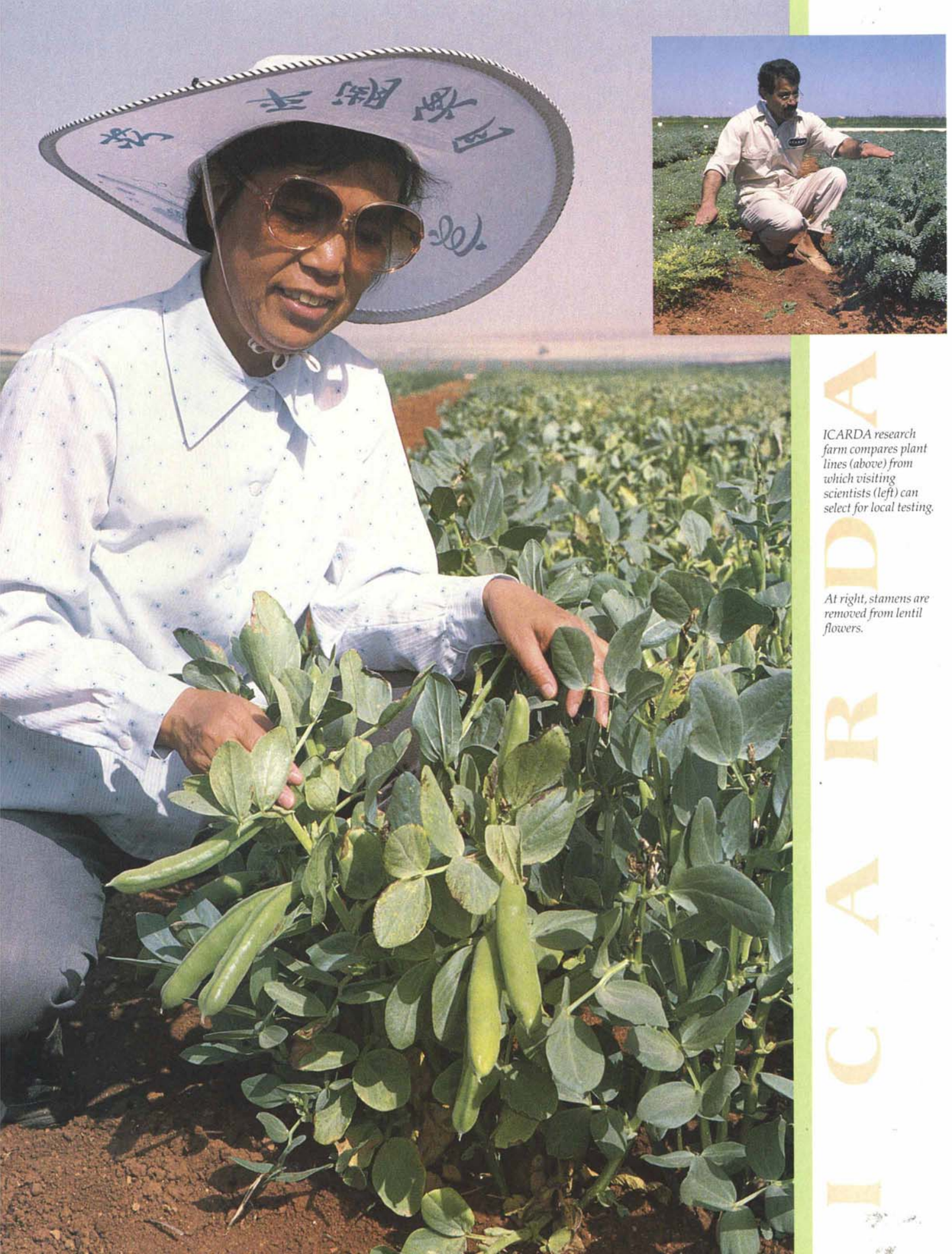
Ancient sources confirm that the "big three" legumes, which were first domesticated in the Middle East, have been eaten for millennia. Faba beans, which originated in west or central Asia, are mentioned in Hittite texts and the Bible; Ramses II of ancient Egypt is known to have offered 11,998 jars of beans to the god of the Nile.

The dominant food legume in North Africa today, faba beans supply the main ingredient of *ful mudammas*, Egypt's national dish, which is also served with tomatoes, onion, olive oil, lemon, and hard-boiled eggs. Faba beans are also used in a Levantine salad and to "decorate" North African couscous – another nutritious grain-legume combination.

Through careful breeding, ICARDA is transforming the faba bean. The goal is a new plant variety that is easier to grow. Harvests from traditional varieties are undependable, partly because the plant relies on outside pollinators to fertilize it. "The population of pollinating insects, such as bees, can vary," says Dr. Mohan Saxena, head of ICARDA's food legume research, "and without insects, there may be no pod set." Faba bean lines were discovered that can naturally fertilize themselves – a characteristic that was bred into ICARDA's new plants. Other lines contributed genetic traits for stable – and higher – yields. "The new plant lines are being distributed to different countries to test under local conditions," Saxena says.

Tall, traditional faba beans also have an architectural fault: they tend to lodge, or fall over, in the field, making harvest difficult. In most of the region, the plants are cut or pulled out by hand. ICARDA's scientists are developing faba bean plants almost 50 percent shorter that stay erect. Unlike old types, the stalks of the new plants end in a flower. More of the plant's energy is thus channeled into developing seeds instead of unproductive foliage.

Other plants have been bred with an independent vascular supply – an individual nutritional pipeline – to each flower pod. "Normally, the supply to all the flowers is interconnected," says Saxena, "and older and younger flowers compete for the plant's nutrients. If each flower has its own supply, more pods will form, and they will mature more uniformly."



ICARDA research farm compares plant lines (above) from which visiting scientists (left) can select for local testing.

At right, stamens are removed from lentil flowers.

ICARDA

The acid test of a new plant line, of course, is performance in farmers' fields. ICARDA has joined with national scientists in the Nile Valley Project to improve faba bean production in Egypt, Sudan, and Ethiopia. Profitably exported from the area in the early decades of this century, the crop must now be imported at twice the cost of local production. But the cooperating countries are beginning to reverse this trend: In Egypt's Mina Governorate, for instance, farmers have achieved 10- to 20-percent yield increases with new techniques and varieties. Project scientists also developed "Giza 402," the first commercial faba bean variety to resist the devastating parasitic weed *Orobanche*, which can wipe out entire fields. The new variety is now grown on about 4,000 hectares (15,000 acres) in Egypt.

In irrigation schemes in southern Sudan, where faba beans were traditionally not grown, "the project demonstrated that faba bean is the most profitable winter season crop available," says Saxena. "These schemes have a fallow or rest season which can be replaced by a legume. Faba beans used this way could provide a surplus for export and generate foreign exchange."

Lentils are just as venerable in the Middle East, which presently grows one-third of the world's crop. On land now submerged beneath Syria's Lake Assad, archaeologists found the oldest remains of lentils from about 8000 BC, while lentil paste was discovered in Egyptian tombs of Thebes that date from about 2300 BC. Lentils have long been a staple food especially for the poor: There is an ancient Greek saying about a *nouveau riche* gentleman who "doesn't like lentils anymore."

Today, virtually every region, every group in the Middle East seems to have its own characteristic recipe for lentil soup. Tess Mallos' *Complete Middle East Cookbook* includes a Levantine lentil soup with silverbeet, an Armenian soup based on lamb stock, a sour Cypriot version with vinegar, a highly-spiced Gulf recipe with tomatoes and limes, an Egyptian soup with chicken or meat stock, cumin, and lemon, and a Yemeni soup flavored with garlic, tomatoes, and coriander leaf. Lentils, along with chickpeas and lamb, are also added to *harira*, a North African stew, while Egyptian *koushari*, a traditional Coptic "fasting" dish for meatless meals, combines lentils, noodles, and rice.

"Mechanizing the lentil harvest, particularly the step of pulling plants from the ground by hand, is widely recognized as the crop's major problem," explains Dr. Willie Erskine, lentil breeder at ICARDA. "The lentil pods open up when they're left too long on the ground, so there's a 'time window' – about four to seven days – when the crop must be harvested, or lost." During this period, the scarcity and high cost of labor hit small farmers hardest.

Major lentil-growing countries recently sent 36 scientists to ICARDA for demonstrations of improved plants, growing techniques, and machinery. They saw new lentils more amenable to machine harvest – plants less prone to lodging, with pods that do not shatter in the field and lose their seeds before harvest. Ethiopia and Tunisia have released such varieties – derived from ICARDA lines – to their farmers for commercial growing, and Syria plans to do likewise.

Among new machines developed at ICARDA to suit local farmers' special needs is a lentil puller that ensures harvest of the plants' straw as well as the seeds. Lentil straw supplies nourishing feed for sheep, sometimes bringing the Middle Eastern farmer a greater profit than the seeds, especially in very dry seasons.

As for chickpeas, the oldest remains, from 7,500 years ago, were found near Burdur in western Turkey. An Egyptian papyrus text lists the seeds as 'falcon-face,' after their beaked shape. Crushed chickpeas, along with onion juice and honey, comprise an old aphrodisiac recipe recorded in Lorna Hawtin's *Chickpea Cookbook*. Boiled chickpeas were advertised on the streets of old Damascus with the reverent cry, "O you on the boil, seven servants have prepared you!" – underlining the care with which they were prepared (See *Aramco World*, September-October 1971).

Now accounting for the largest share of the region's legume production, chickpeas figure in some famous Middle Eastern dishes, particularly nutritious snacks. They are roasted and sold in nut shops, deep-fried with other vegetables in balls called *falafal*, or blended into *hummus bi tahinah*. In the Armenian Lenten dish *topig*, packets of an elaborate chickpea dough are stuffed with onions, spices and *tahinah*.

ICARDA concentrates on "kabuli" chickpeas – the large-seeded buff-colored types eaten in Arab countries and elsewhere – and has scored some dramatic advances. Studies showed that two obstacles – frost, and a fungal disease called *Ascochyta* blight – traditionally prevented farmers from planting in winter and kept yields low. They sowed the crop in spring to avoid the wet windy weather that fostered epidemics of the blight. But 15 new blight- and frost-resistant ICARDA varieties surmount these problems. Dr. K. B. Singh, a chickpea breeder at ICARDA, points out that the new chickpeas bred to be planted in winter yield up to twice as much as the old spring-sown types, because earlier sowing allows the plants to exploit the entire rainy season.

The future for legumes – and for the farmers who grow them in the Middle East – is clearly brighter than it was some 15 years ago, when only two scientists were conducting fulltime research on legumes in the entire region. Now, a research network spans the area, with ICARDA at the hub. More than 250 local scientists, trained in legume research at the Center, spearhead national programs that did not even exist a few years ago. Network members exchange visits and stay in touch through ICARDA's legume information services, including the technical newsletters *Lens*, on lentils, and *Fabis*, on faba beans.

Crop seeds, with their precious genetic variation, also flow through the research network's conduits. At its Aleppo research farm, ICARDA shelters a priceless stock of legume seeds, along with those of other important Middle Eastern and North African crops. The Center's expeditions have sought local races of crops from Syria, Jordan, Iraq, Turkey, Lebanon, and Morocco. According to Saxena, ICARDA's holding of more than 3,000 types of faba beans and 5,800 lentil types are the world's largest collection; the Center's approximately 6,000 large-seeded chickpeas are duplicated at a sister center in India.

Much of this genetic heritage is "active" – that is, it is sent all over the region each year for use in breeding programs. Part of the collection is left sealed for breeders of the future, who will be able to draw upon it for legume genes that resist some insect or pest yet unknown – ensuring that crops with such ancient pedigrees will continue to provide harvests for the Middle East's – and the world's–burgeoning population.

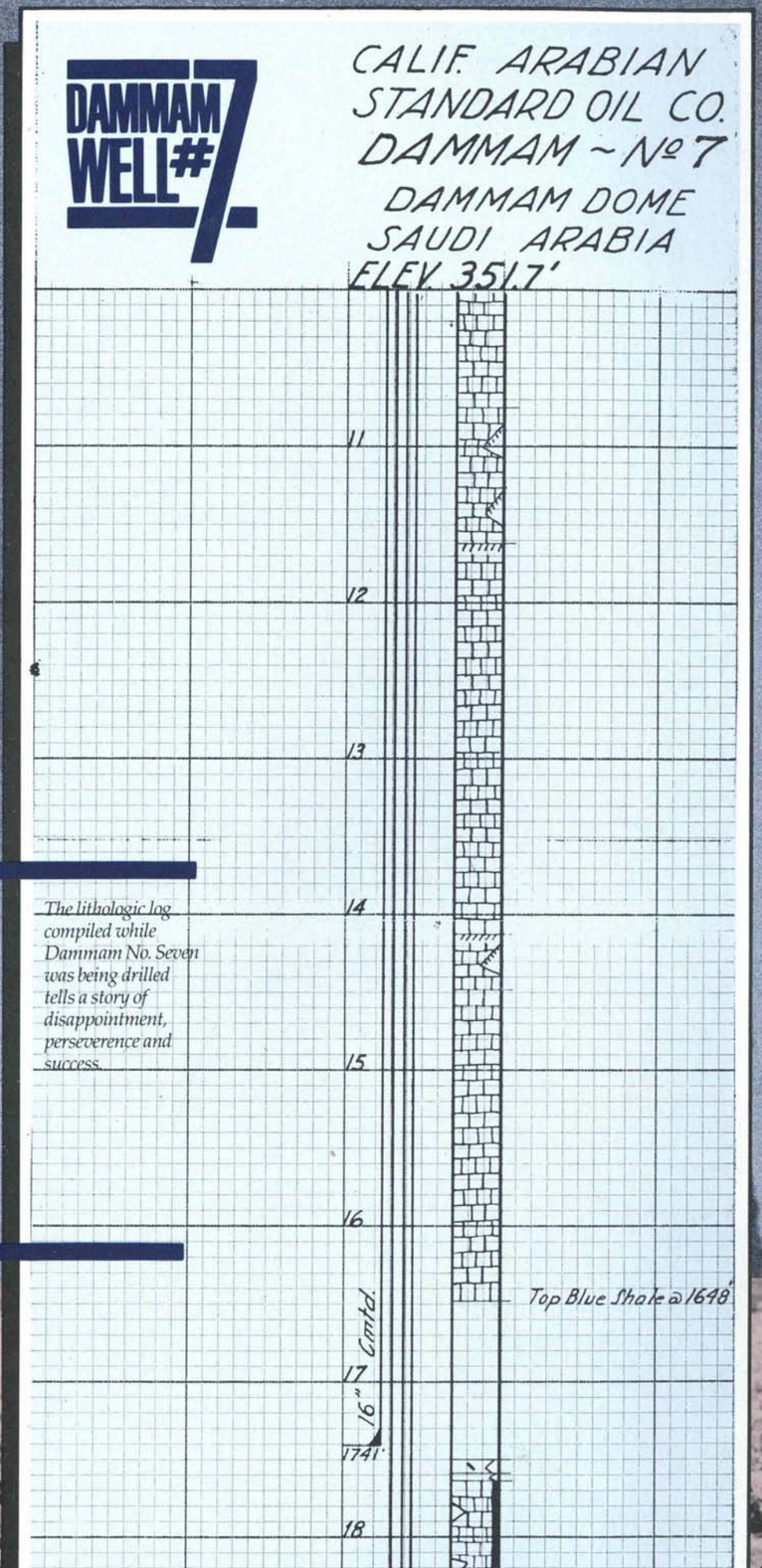
Lynn Teo Simarski, a free-lance writer specializing in the Middle East, was ICARDA's staff science writer during her two-year residence in Aleppo.

Less than 200 feet separated failure from success

WELL DONE WELL #7

WRITTEN BY MARY NORTON

In early March 1938, nine-tenths of a mile (1,440 meters) underground, a deep-test well in Saudi Arabia's Eastern Province struck oil. That moment ended one era and began another.



The lithologic log compiled while Dammam No. Seven was being drilled tells a story of disappointment, perseverence and success.

The oil-bearing rock was in a layer that geologists had dubbed the Arab Zone. The well, drilled into the geological formation they called the Dammam Dome, capped a quest that had lasted nearly five years. It made possible the commercial development of oil in Saudi Arabia, and all that flowed from that: Prosperity for the kingdom's people, resources with which to build the country's future, and strength to make its moderating voice heard in international affairs. The find also set Aramco firmly on course toward becoming the world's largest oil-producing company.

The discovery well's name, determined months before, could not have been more prosaic: Dammam No. 7. Yet, of all the thousands of wells drilled in Saudi Arabia since, "Lucky No. 7," as it came to be called, is the mascot, the symbol of first success. This year marks the 50th anniversary of Dammam No. 7, the 50th anniversary of the discovery of oil in the Kingdom, and the 50th year of continuous oil production by Aramco.

Dammam No. 7 stands on a hill named Jabal Dhahran – the surface expression of the Dammam Dome – near a cluster of peaks called Umm al-Rus. Today, Aramco's gleaming high-tech Exploration and Petroleum Engineering Center (EXPEC) lies just up the road, and the company's headquarters community of Dhahran just beyond. The town, green and comfortable, is far different from the drilling camp it once was, and the silicone-chip and stainless-steel technology of EXPEC is light-years beyond that of the 1930's; nonetheless, Aramco has never lost sight of its geological roots.

Those roots date back to May 1933, when the original oil concession agreement was signed. The search for oil began the following fall, on September 23, when American geologists Bert Miller and Krug

Henry crossed to the Saudi mainland from Bahrain. They landed at the sleepy coastal village of Jubail, about 105 kilometers (65 miles) north of the Dammam Dome, and that same day journeyed by car and camel to look over Jabal Berri, some 11 kilometers (seven miles) to the south.

What they experienced on their return was only a mirage but seems, in hindsight, to have been something more. They looked across a great salt flat and suddenly, as Wallace Stegner tells the story in *Discovery!*, "the solid earth veered before their eyes, the intense light flawed and changed, and unknown Arabia grinned at them – a sudden distorted grin – as the ring of the horizon boiled and floated ....The pearling town of Jubail, which they knew had only a thousand or so people, threw up a skyline like New York's, a vision of cloud-capped towers and ... palaces."

The mirage proved to be less a desert delusion than an uncanny look into the future. Jubail today is a sprawling industrial city whose towers, stacks and minarets form a striking skyline against the coastal plain and whose factories and refineries are fed and fueled with hydrocarbons produced by Aramco. And elsewhere in the Kingdom – in Makkah and Medina, Riyadh, Jiddah, Yanbu', Abha, Taif, Hofuf, Dammam and in countless other cities and towns – developments have taken place on a scale of such magnitude and in so compressed a timespan that even those who have witnessed them are often incredulous.

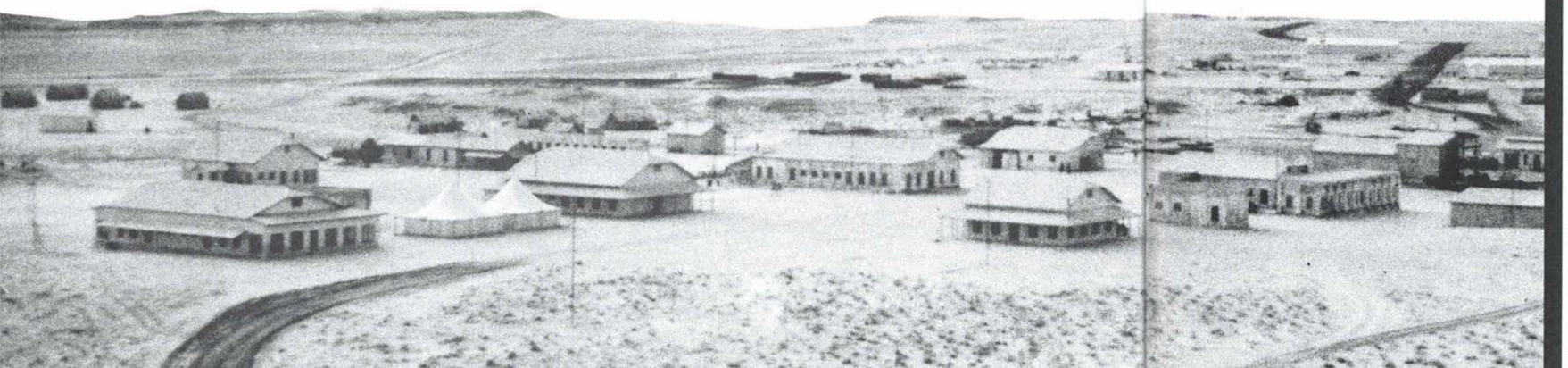
The wellspring of these achievements was Dammam No. 7: Testing the discovery, it flowed 1,585 barrels a day on March 4, 3,690 barrels on March 7, 2,130 nine days later, 3,732 five days after that, 3,810 the next day, and so on until the head office cabled that they saw no reason to continue the test. Dammam No. 2 and Dammam No. 4 were also deepened to the Arab Zone and they too proved good producers. Jubilation reverberated from Dammam Camp to Riyadh and San Francisco, where CASOC, the California Arabian Standard Oil Company formed for the Arabian venture, joined in celebrating the victory.

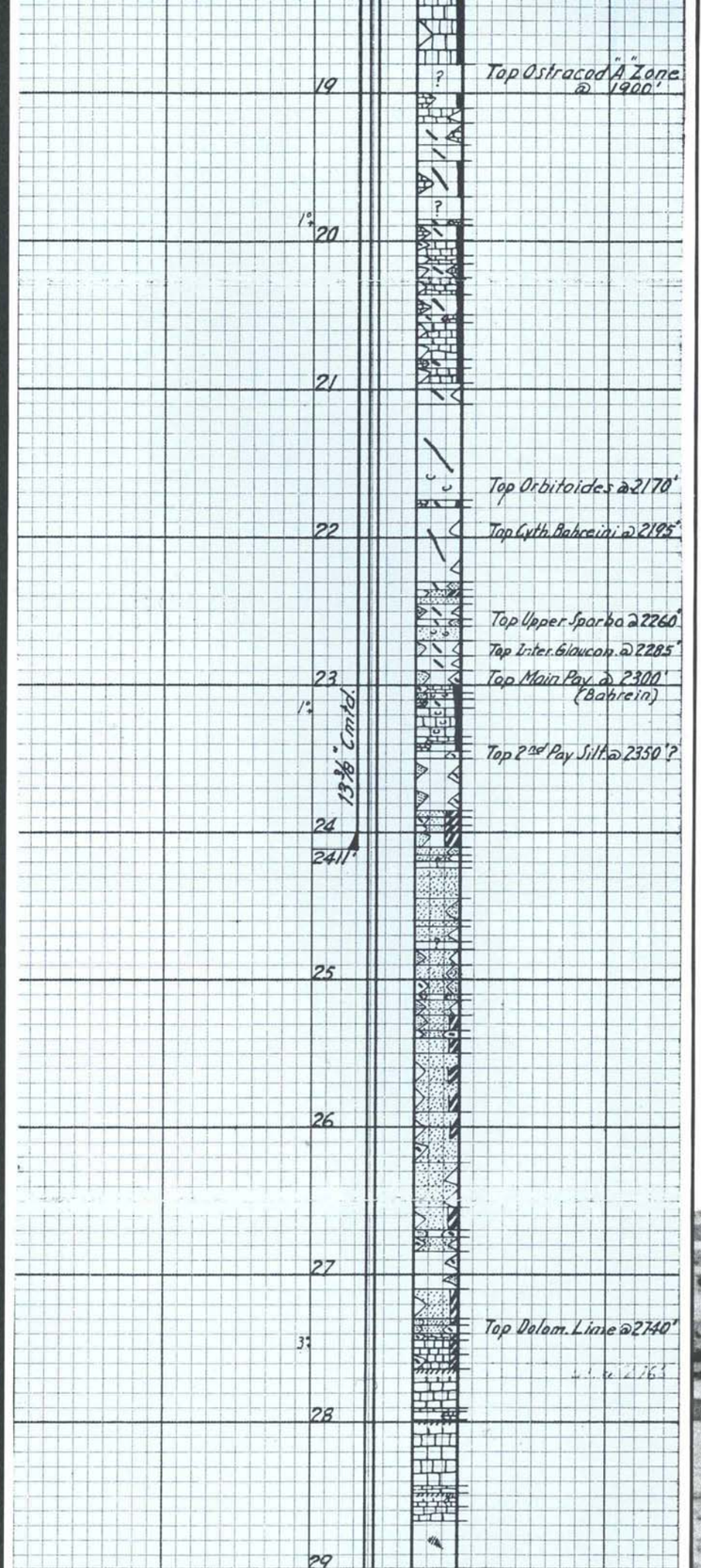
Saudi Arabia's King 'Abd al-'Aziz Al Sa'ud, hopeful but not sanguine, had given all possible cooperation to the venture, and not long after October 1938, when the presence of oil in commercial quantities was officially declared, plans began to unfold for his visit to al-Hasa, as the Eastern Province was then known.

In the spring of 1939, the king and his retinue moved east from Riyadh in a caravan of 2,000 people in 500 cars, across the red sands of the Dahna and along desert tracks to a place near the oil camp, officially named Dhahran only 10 weeks before. In an atmosphere of conviviality, the visitors set up a city of 350 white tents within view of the camp for festivities which included inspections, banquets, receptions and boat rides in the Gulf.

The timing of the visit coincided with the completion of a 69-kilometer (43-mile) pipeline from the Dammam oil field to the port of Ras Tanura, where the tanker *D.G. Scofield* lay waiting. On the last day of celebrations, Stegner recounts, King 'Abd al-'Aziz Al Sa'ud unhesitatingly "reached out the enormous hand with which he had created and held together his kingdom in the first place, and turned the valve on the line through which the wealth, power and responsibilities of the industrial 20th century would flow into Saudi Arabia. It was May 1, 1939. No representative of the United States was present, even as an observer. The United States had not yet accredited any representative to Saudi Arabia."

What people knew at the time was truly cause for celebration: Oil had been found and was being produced. What they did not know was that the Dammam Field would become but one bead in a whole necklace of discoveries by Aramco – 52 oil fields in all, including Ghawar, the world's largest onshore field, and Safaniya, the world's largest offshore field.





Spreading out to explore distant corners of the million-square-kilometer (385,000-square-mile) concession area, the pioneering geologists could not have imagined that one-fourth of all the world's oil lay beneath their feet. Nor could they have envisioned that the Kingdom's recoverable oil reserves would one day run to 167 billion barrels – more by far than in any other nation on earth – or that recoverable natural gas reserves would surpass 135 trillion cubic feet. To them, any oil at all amounted almost to a windfall, and gas was just a nuisance.

Neither could the first Saudi and American drillers have imagined, even after they struck oil, that Dammam No. 7 would be capable of producing not for months or years but for several decades into the future, or that this one well would pour out more than 32 million barrels of oil. And the planners and engineers of the company's early days surely did not dream that Aramco's daily crude-oil production would ever approach 10 million barrels a day, as it did in 1982, or that cumulative production would exceed 53 billion barrels of crude oil and 1.6 billion barrels of natural gas liquids, as it did last year.

Indeed, little about Aramco today was within the conception of the company's pioneers. Aramco now has 43,000 employees, about 550 wells in production, 20,500 kilometers (12,733 miles) of flowlines and pipelines and more than 60 gas-oil separator plants. Gas is no longer a dangerous nuisance, but an important product: There is an extensive gas-gathering system whose three main processing plants can handle four to five billion cubic feet per day of raw natural gas, and the company operates two large fractionation plants for natural gas liquids – as well as three oil terminals, two liquefied petroleum gas terminals and a good-sized refinery.

Nonetheless, back in 1938, there were hopes and hints that something great might come to pass. Even before the concession agreement between Saudi Arabia and Standard Oil of California was signed on May 29, 1933, geologist Fred Davies, who worked for SOCAL on Bahrain, looked across the Gulf at the limestone silhouette of Jabal Dhahran and noted its resemblance to Jabal Dukhan in Bahrain, where oil had been discovered in 1932.

It was not surprising, then, that Bert Miller and Krug Henry should examine those rugged hills within a week of their arrival at Jubail. "We got on one of the beds and drove around it," Miller would later relate, "and we knew then, in just a few minutes, it was like a copy of Bahrain Island." After surface mapping and aerial reconnaissance, and though exploration parties were working intensively in other locations, the Dammam Dome remained the best bet, and Miller recommended that the search for oil should begin there. The hope was that they would find oil at the same depths as on Bahrain – in the 600-meter (2,000-foot) range known as the "Bahrain Zone."

The wildcatters – drillers, rigbuilders, and construction men who came over from Bahrain in the fall of 1934 – were men like the geologists in their light-hearted affection for challenge, their stamina, and their undaunted – and well-founded – belief in their own abilities. Every one of them, Stegner wrote, had "been knocking about the world for years."

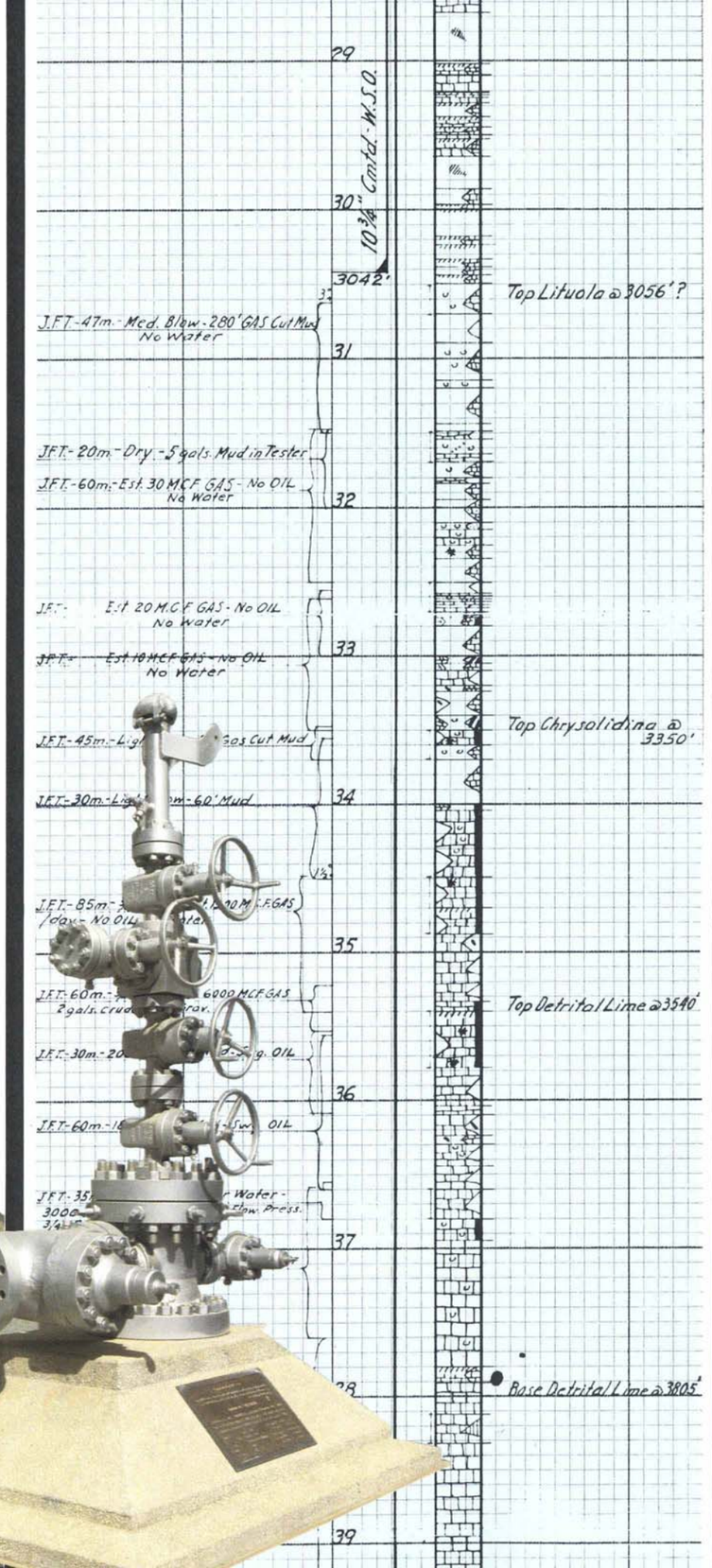
Still, the Dammam Dome tested them. An early edition of the *Aramco Handbook* states that "not only the drilling rig and equipment, but every item of lumber, hardware, plumbing and steel needed to create and supply living quarters, pipe for water, transportation equipment and spare parts, food and personal requirements had to be brought over in a supply line reaching from the United States." In addition, water wells had to be drilled, roads built and power provided where none of these things existed.

With the help of Saudi recruits, for whom drilling – and indeed the very notion of scheduled shift work – was entirely new, Dammam No. 1 was spudded in on April 30, 1935, using an old cable-tool rig. The obelisk-shaped derrick, the area's tallest structure, looked out over desolate terrain that was hardly softened by distant black Bedouin tents. After seven months of sputtering between hope and disappointment, the well produced a strong flow of gas and shows of oil just short of 700 meters down (2,300 feet) – but an equipment breakdown forced the crew to kill the well and later plug it with cement.

The drillers rigged up Dammam No. 2 the same day.

No. 2 was almost too good to be true. Spudding in on February 8, 1936, the crew had drilled to a depth of 663 meters (2,175 feet) by May 11. This was the targeted Bahrain Zone, and from it came a flow of 335 barrels of oil a day when the well was tested in June. A week later, after acid treatment, it flowed at the equivalent of 3,840 barrels a day, just like that.

The news was what CASOC had wanted – and needed – to hear. Back from San Francisco came instructions to put down Dammam Nos. 3, 4, 5 and 6. Contrary to the cautious industry practice of awaiting proof of field size and commercial viability before establishing a permanent camp, CASOC cabled Davies in June to expect a shipment of air-conditioned family cottages, as well as several bachelor housing units. And for good measure, word came in July to prepare Dammam No. 7 as a deep-test well.



More work meant more men and more material, and soon there was more of all three than the camp could handle. By the end of 1936, the number of American employees in the field had risen from 26 to 62, and 1,076 Saudis had joined the strange new enterprise. About that time, however, things out by the drilling rigs started to turn sour.

Dammam No. 1, drilled to below 975 meters (3,200 feet), proved a loser. No. 2 "went wet" and started producing eight or nine times more water than oil. Dammam No. 3 had a flow of no more than 100 barrels of heavy oil a day, with 15 percent water. No. 4 was dry as a bone. No. 5 had no production either. A wildcat well at al-Alat, a prospect 20 miles northwest, was a bust all the way down to 1,380 meters (4,530 feet). Dammam No. 6, drilled in early 1937, showed only a little oil mixed with water.

On December 7, 1936, the wildcatters had spudded in the deep-test well, No. 7. The other wells had been disappointing, but when it came to trouble, Dammam No. 7 proved to be in a class by itself.

There were delays and stoppages. Drill pipe stuck. Rotary chains broke. Bits were lost down the hole and had to be fished out, and walls caved in. As the steam-driven rotary rig ground toward the Bahrain Zone, the results remained the same: No oil. No oil.

Ten long months later, on October 16, 1937, at 1,097 meters (3,600 feet), the drillers saw the first sign: two gallons of oil in a flow of mud cut with belches of gas. Then, on the last day of the year, control equipment failed and the well blew out. After drilling 1,382 meters (4,534 feet) into their best prospect, the CASOC crews hadn't found enough oil to fill the crankcases of their own trucks.

The optimism of 18 months before began to look foolish, and a somber mood descended on SOCAL's management. Sides were chosen, fingers were pointed and hard questions were raised about the future of a venture that had cost millions and proved nothing.

Chief geologist Max Steineke, who knew more about Saudi Arabia's geology than anyone, was called to San Francisco early in 1938. Since his arrival at Jubail in late 1934, the insatiably curious and energetic Steineke had ranged far and wide in the concession area and had recently crossed Arabia to Jiddah and back, hunting fossils, observing rocks and dips, synclines and anticlines. On his return, he wrote a seminal paper on Saudi Arabia's geology.

Waiting to hear his opinion were men who had gone far out on a limb in the expectation that oil would by now be found. Some could already hear, in their minds' ears, the wrath of their stockholders, and were more than ready to pull out of the Saudi Arabian venture altogether.

But Steineke had never wavered in his belief that oil lay beneath Saudi Arabia's stratigraphy, and now he stood his ground. Still unable to prove his hypothesis, he fell back on his formidable knowledge, intuition and optimism.

He was dramatically vindicated. In the first week of March, 1938, while Steineke was still arguing his case in San Francisco, Dammam No. 7 found what it was looking for at a depth of 1,440 meters (4,727 feet) – less than 60 meters (200 feet) farther down. When Dammam Nos. 2 and 4 confirmed the find, Dammam Field was declared a commercial producer.

What followed, in the 50 years since then, has been one of the classic national and corporate success stories. Saudi Arabia prospered, Aramco grew, and the Saudi-American partnership became a model of the fruitful transfer of technology and of cross-cultural cooperation. But the success was not automatic: It was earned, every day, over and over again in the following years, and much of it was attributable to the character of the men, Saudis and Americans, who dealt honestly and forthrightly with each other and with the novel and less dramatic difficulties of the post-pioneer period.

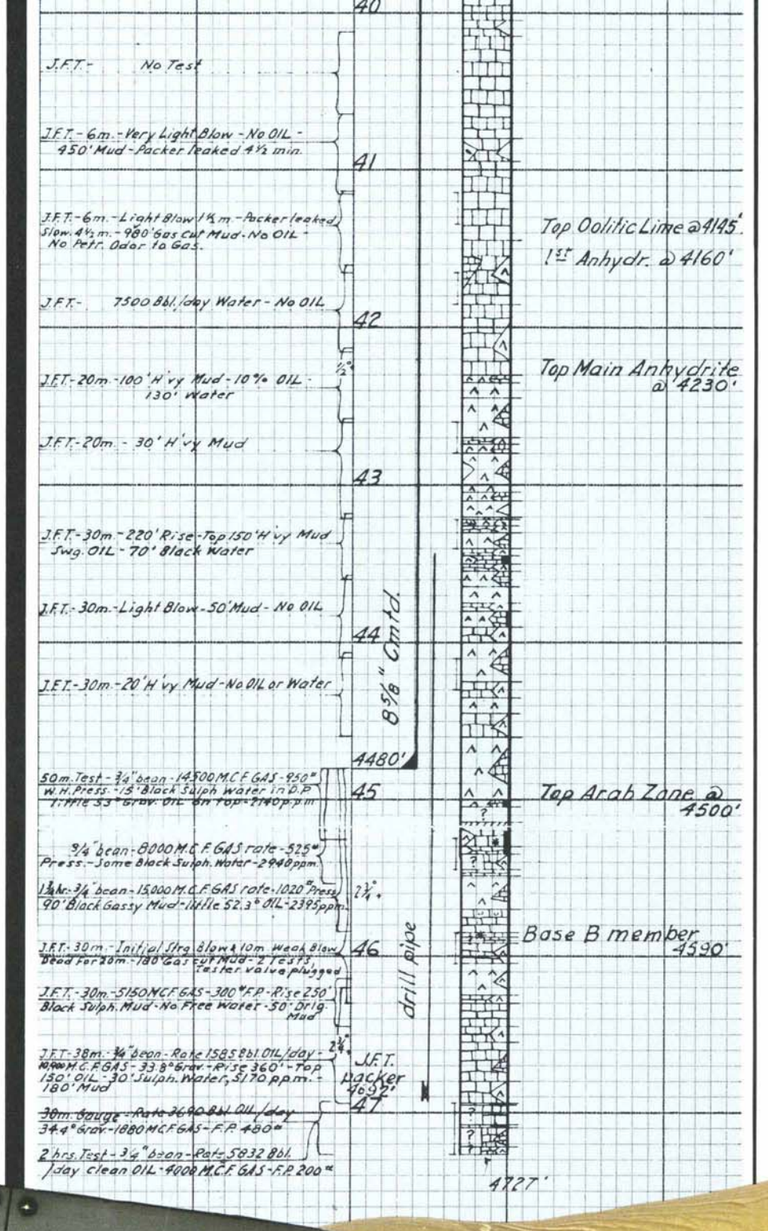
Despite their roving instincts, many of the first American employees in Saudi Arabia stayed on and grew with the company. Fred Davies and Tom Barger, a junior geologist who arrived in 1937, each became chairman of the board of Aramco. Floyd Ohliger, a young petroleum engineer who arrived in 1935, supervised the construction of the al-Khobar pier and later dealt with King 'Abd al 'Aziz on company matters, retired as a vice president in 1957. Max Steineke had "at least a finger" in the discovery of every oil field in Saudi Arabia until his death in 1952. And some of the wildcatters stayed, too, like Bill Eltiste. His Aramco-sponsored efforts to help interested local Saudis get started in business led to a new class of Saudi entrepreneurs and a vastly improved and diversified local economy in the Eastern Province.

And how has the well near Umm al-Rus – the stubborn well that started all this – fared over the years? From rambunctious beginnings, Dammam No. 7 quickly settled down to become a model of good behavior. During World War II it added its share to the 12,000 to 15,000 barrels a day piped from the Dammam Field to al-Khobar and shipped by barge to Bahrain. It was shut in for a few weeks in 1950, when 600,000 barrels of oil a day were flowing from the Abqaiq and Qatif Fields, and the Abu Hadriya, Ghawar and Fadhili Fields had been discovered, and then it was back on line for most of the next 25 years.

In 1975, Dammam No. 7's wellhead – the above-ground assemblage of valves and flanges – got a new coat of aluminum paint. By that time, a plaque had been erected near the base of the well-head that brought some attention from visitors and residents interested in making rubbings of the inscription.

In 1982, after 45 years of nearly continuous output, Dammam No. 7 was taken out of production because of slack demand. However, the well is still capable of turning out about 1,800 barrels a day – and, as always, without a pump. And recently, "the mother of wells" produced what one might call a new child of sorts. No. 7's second wellhead, which had been in use from 1952 until 1978, was refurbished and mounted on a pedestal at EXPEC's entranceway as a symbol of the Aramco enterprise. The monument is a vivid reminder to all who pass by of how, on a nearby hill, Dammam No. 7 launched Saudi Arabia's petroleum industry 50 years ago.

Mary Norton, a veteran contributor to Aramco World, *has lived in Saudi Arabia since 1958.*

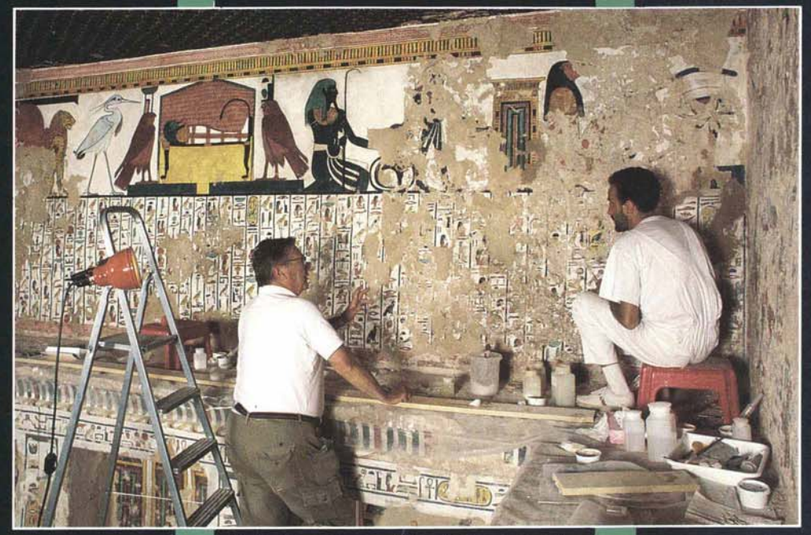


NEFERTARI

RAMESSIDE RENAISSANCE RESTORED

WRITTEN BY JOHN LAWTON
PHOTOGRAPHED BY TOR EIGELAND

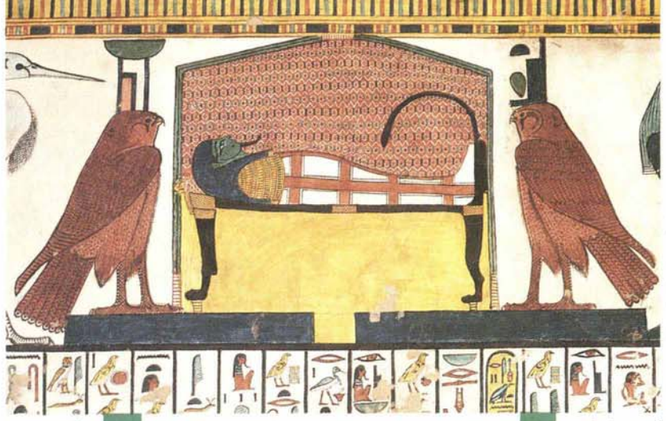
BY COURTESY OF THE
EGYPTIAN ANTIQUITIES ORGANIZATION



Paolo Mora, above, and his wife Laura, opposite page, supervise restoration of damaged paintings in Nefertari's tomb.

The 3,200-year-old wall paintings of the tomb of Queen Nefertari at Thebes – regarded by Egyptologists as the finest of the pharaonic age – are being prepared for public viewing for the first time in 50 years.

In March of this year, exceptionally, *Aramco World* was granted permission by the Egyptian Antiquities Organization not only to visit the tomb but also to photograph the elaborate, painstaking and highly technical restoration work going on inside.



Above: A restored painting in the outer chamber of Nefertari's tomb. Below: left, a reasonably preserved detail and, right, Giuseppe Giordano working on a badly damaged one. Opposite page: Queen Nefertari with the god Horus.

Because of the paintings' precarious condition – the result of rainwater seepage and rock salt crystalization, as well as humidity from the breath and bodies of tourists – the tomb has remained closed since 1939 to ward off further deterioration. Apart from the archeologists and scientists working inside, only the occasional VIP has been allowed a glimpse of its splendid decoration until now.

"No tomb in the whole of Egypt is comparable in artistic superiority and fascination" to that of Nefertari, says Gamal Moukhtar, a former director of the Antiquities Organization. "The splendid paintings reflect the genius and skill of the artists and draftsmen working during the Ramesside artistic renaissance."

Art developed on two levels under the Ramesside pharaohs of the 13th century BC. Besides excellence of technical execution and subtlety of craftsmanship, artists also strove for decorative perfection – and nowhere more so than in the underground tombs in the Valleys of the Kings and Queens at Thebes, site of modern-day Luxor.

These artists experimented as well with new painting techniques in the modeling of figures, using shading in their pigments – in effect showing highlight and shadow areas – to give a certain three-dimensional quality to faces and arms.

In the slim figure, delicate profile and elegant posture of Queen Nefertari – her name means "most beautiful of them all" – the artists of her day had a perfect subject, as well as a good excuse for extravagance: Nefertari attained a unique position among Egyptian queens. Favorite wife of Ramses II, she played an unparalleled role in foreign affairs and is the only wife of a pharaoh to be depicted on the facade of a temple – at Abu Simbel. Her tomb is thus a riot of rich and brilliant color, with vivid depiction of over 100 figures and reams of diverse hieroglyphics chronicling her active life.

And because the poor-quality limestone from which her tomb was hewn was not suited to the finest carving, craftsmen developed a special technique: They covered the rough rock surface with plaster into which the reliefs were cut, producing a smoothness of artistic expression rarely matched in other tombs.

Yet it is this very technique that threatens the continued existence of the wonderful works of art that it made possible. Rainwater seeped from the surface through the badly fractured rock surrounding the tomb, dissolving sodium chloride from the rock. Whenever the water dried, the salt crystallized behind the plaster layer, pushing the paintings off the wall.

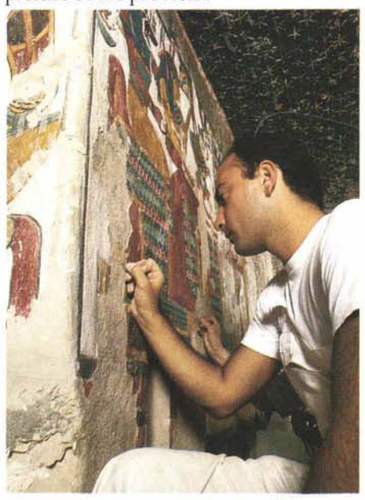
When Italian archeologist Ernesto Schiaparelli discovered the tomb in 1904, its paintings were already seriously damaged by water and salt. Further damage was caused by the humidity created by sight-seers, and visitors touched, scratched and even chipped the paintings. Eventually, just before the outbreak of World War II, the tomb was closed to the public.

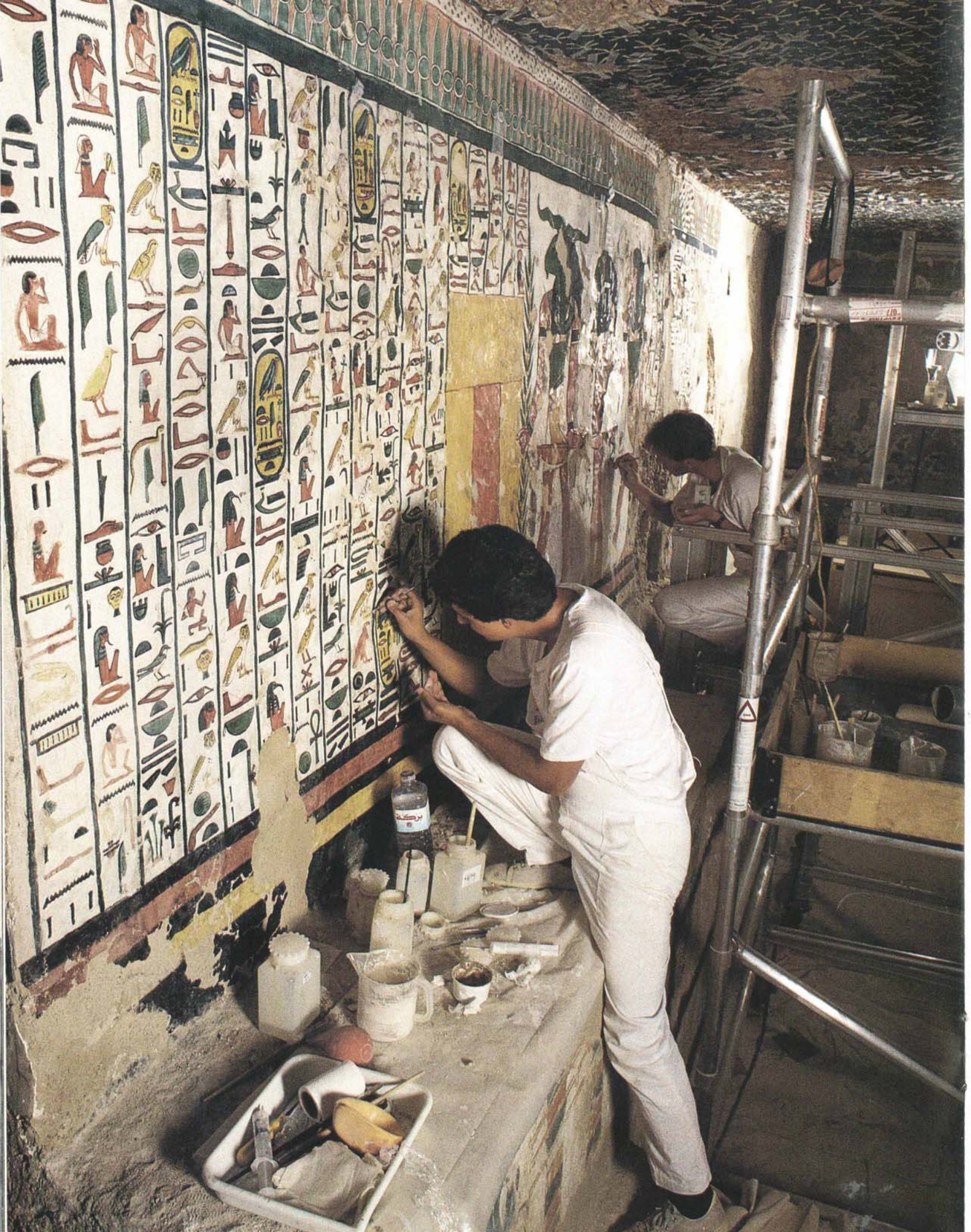
Between 1934 and 1977 various well-intentioned but unsuccessful restoration attempts were made. Some even aggravated the problem: Cement used to hold the plaster in place itself contained more water and salt, which further loosened the hold of the paint and plaster layer on the rock. Attempts to wipe the paintings clean smudged some of them instead; efforts to restore others proved to be clumsy and unsightly.

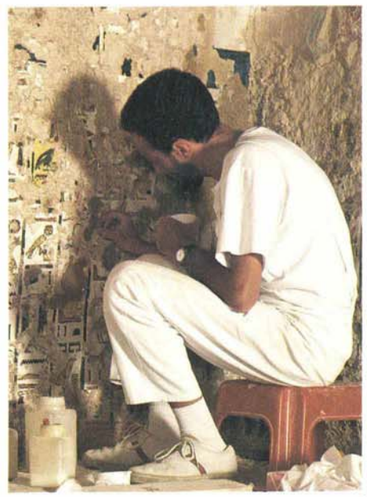
Eventually the Egyptian Antiquities Organization realized that the only way to save the paintings was to treat the entire tomb scientifically. But the Egyptian government, beset by serious economic and social problems, could not afford a large-scale project.

It was the Getty Conservation Institute of Los Angeles – one of the institutional heirs of the Getty oil fortune – that finally came forward with the cash. The Institute, says Special Projects Director Miguel Angel Corzo, has a shared interest with the Antiquities Organization in "conserving cultural property of world importance."

In 1986, all 520 square meters (5,600 square feet) of the tomb's remaining paintings – over a third of the original area had already been forever obliterated – were photographed, and 200 tables pinpointing areas of decay were drawn up to provide a comprehensive picture of the problem.







Left: Adriano Luzi works in a cramped corner of Nefertari's tomb. Right: Lotfi Khaled injects acrylic resin to consolidate crumbling plaster and, opposite page, works with Stephen Rickerby in the burial chamber.

And in 1987, over 12,000 pieces of gauze and "Japanese paper" – a tough tissue handmade from mulberry bark – were carefully glued all over the tomb walls and ceilings as a kind of Band-Aid, to hold sagging plaster and flaking paint temporarily in place.

Meanwhile, geologists probed the drainage pattern in the rock around the tomb, with a view to diverting future rainwater from it. Fortunately, because of its elevation, the Valley of the Queens is *not* threatened by rising groundwater caused by Lake Nasser, behind the Aswan High Dam – a serious problem for many lower-lying monuments in the Nile Valley.

Restoration work began in earnest in February of this year, when a multinational team of mural conservationists, led by Italian Paolo Mora and his wife, Laura, tackled those areas of the tomb that were in most urgent need of preservation work.

Worst damaged were the paintings on the walls of the tomb's two complexes of rooms, and in the descending corridor connecting them. Murals in the outer chamber, depicting the earthly life of Nefertari and her adoration of gods and goddesses worshipped in phararonic times, were cracked and flaking badly.

Paintings on the walls of the corridor between the outer hall and the main burial chamber portray Nefertari's passage from the earthly life to the sepulchral sphere below. They were discolored with dirt rubbed from the hands of visitors descending the stairway. And in the 10.4- by 8.45-meter (34- by 28-foot) burial chamber itself, and in its three small anterooms, the pictorial theme follows the various burial stages; there, large pieces of richly-painted plaster were literally hanging from the walls. "Everything," says Laura Mora, "was confusion."

Yet there were bright spots. The best preserved parts of the tomb were the magnificent midnight-blue ceiling, covered with thousands of yellow stars, and the four pillars, decorated with paintings of various deities, supporting the roof of the burial chamber.

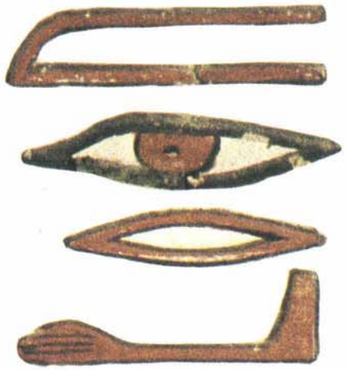
Here – out of reach of human hands and hardly affected by rainwater – the natural, mineral-based colors applied 32 centuries ago shine almost as brilliantly as if they had been painted yesterday. Even individual brushstrokes are visible, and color still blossoms in painted cheeks.

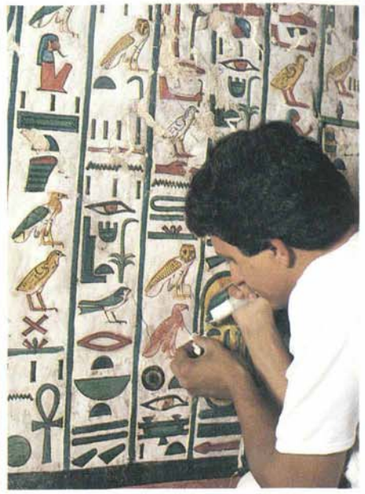
"Man and water are always the cause of the damage," said Paolo Mora, carefully touching away with acetone the crudely applied, ill-matching paint used in earlier conservation efforts. "We believe in restoration, not alteration."

Dust and dirt, he explains, should not be removed by wiping: Though the natural pigments used by pharaonic artists do not fade, they can be smudged. Mora blows the dirt away with a low-pressure air gun.

This is just one of the tricks the Moras have learned during their combined total of nearly 100 years as teachers and restorers at the Instituto Centrale del Restauro in Rome. "We are well trained," says Paolo, "because we have lots of ancient monuments of our own in Italy."

All the other members of the team – four Italians, two Egyptians and a Briton – are under 30. For while the Moras have the experience, "young people," says Paolo, "have steady hands, good eyesight and lots of patience."





They need them. Adriano Luzi works crouched in the glare of spotlights in a cramped corner of the tomb six hours a day, six days a week for the duration of the two-month annual Luxor archeological "season." Restoration work, he says, "is long and difficult, because everything is very fragile."

It does, however, have its compensations. One who feels them especially strongly, particularly working in Nefertari's tomb, is Lotfi Khaled, a 26-year-old graduate of Cairo University's Faculty of Archeology. "Being Egyptian," he said, "I get a real good feeling working here. And my friends are *very* jealous."

Dressed completely in aseptic white and working in isolated pools of brilliant light throughout the tomb, restorers were applying the best technical methods known today with the minute attention to detail their work demands. Khaled and Briton Stephen Rickerby, of London's Courtauld Institute of Art, were fixing flaking plaster by injecting an acrylic resin emulsion behind it and gingerly pushing it back onto the wall.

On the other side of the burial chamber, more Italian restorers were reattaching sections of richly-painted plaster to the wall with gypsum. The pieces had been removed so that cement used in earlier restoration could be cleaned from the wall behind them.

The tomb is hot and airless and full of dust and sickening chemical smells, but no one complains. Signs hung prominently on the forest of scaffolding that clutters the tomb sum up the team's attitude. They read: "No problem."

And if, in fact, all goes well, Paolo Mora hopes to complete the restoration of the tomb in four years' time.

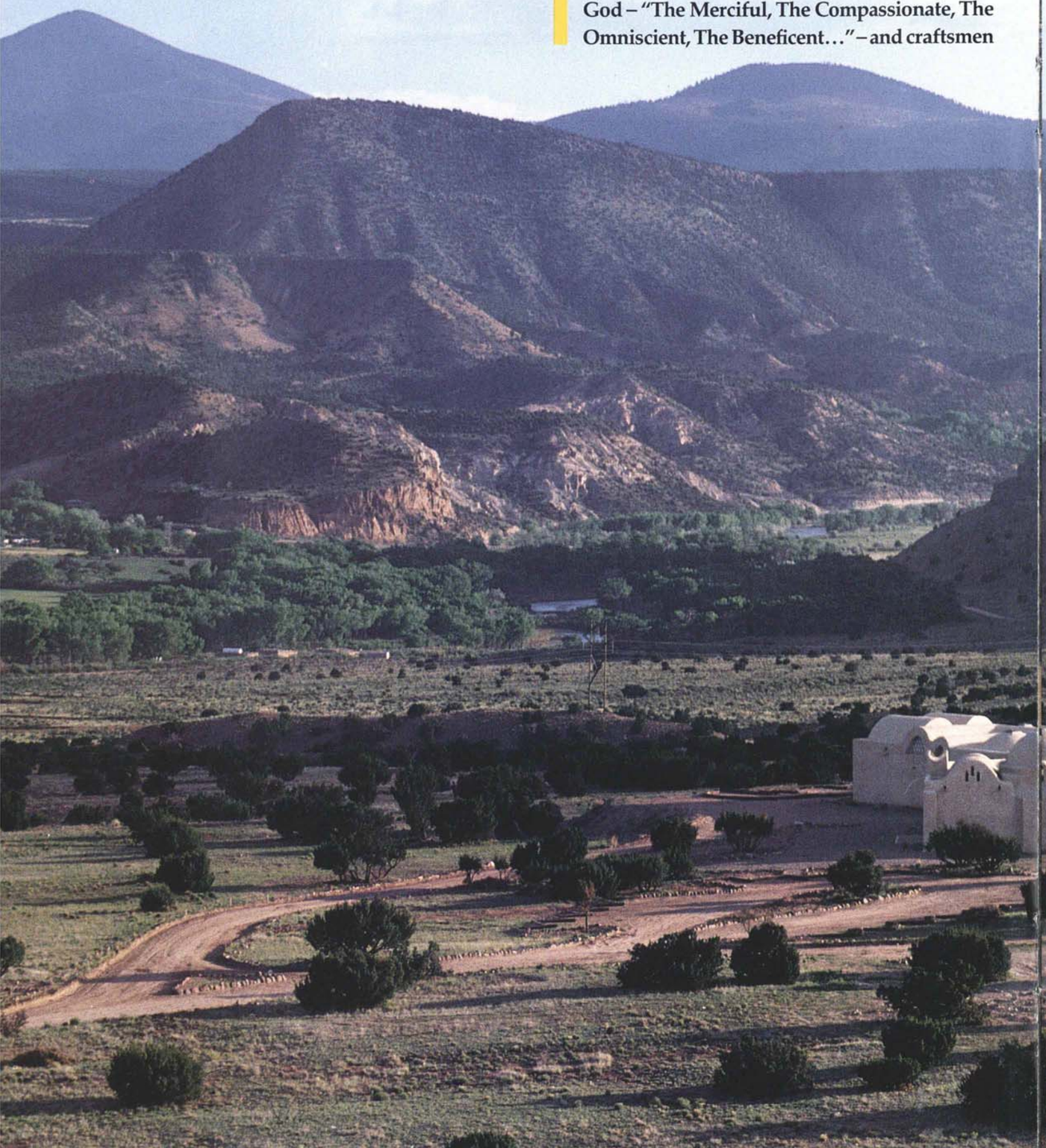
John Lawton is a contributing editor of Aramco World.

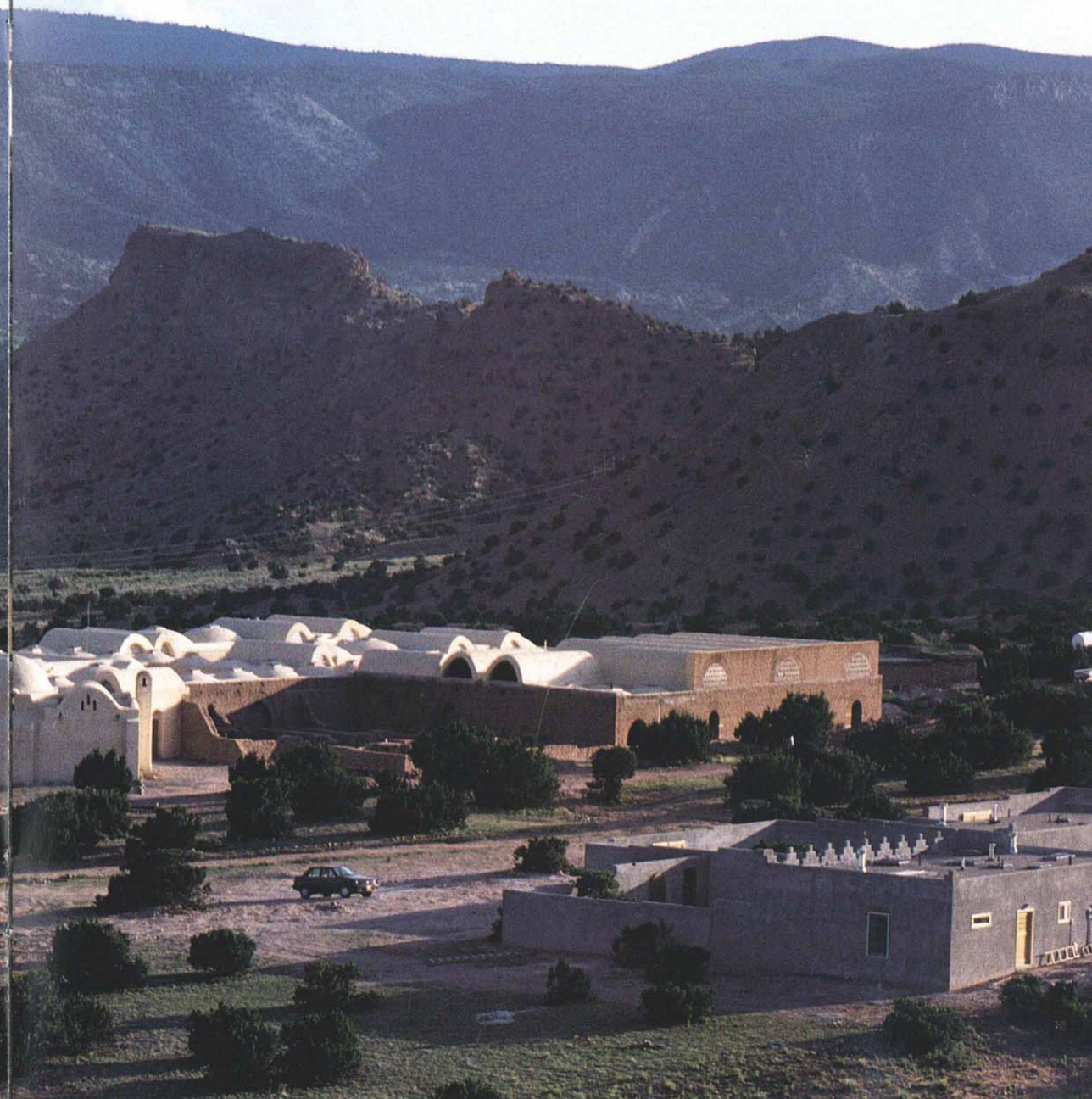
DAR AL-ISLAM
The Code and the Calling

WRITTEN AND PHOTOGRAPHED BY WILLIAM TRACY

The cream-colored mosque and school nestle in a semicircle of arid hills on a juniper-studded plateau. Beyond is a vista of snowcapped mountains. Boys and girls begin their school day with a recitation of the most beautiful 99 names of God – "The Merciful, The Compassionate, The Omniscient, The Beneficent…" – and craftsmen shaping adobe walls and barrel vaults pause in their labor to pray together beneath a completed dome. It might be a scene in the highlands of Morocco, Syria, Yemen or Afghanistan.

In fact, this is Dar al-Islam, a growing community of American Muslims in Abiquiu, New Mexico – in the heart of the American West.





DAR AL-ISLAM

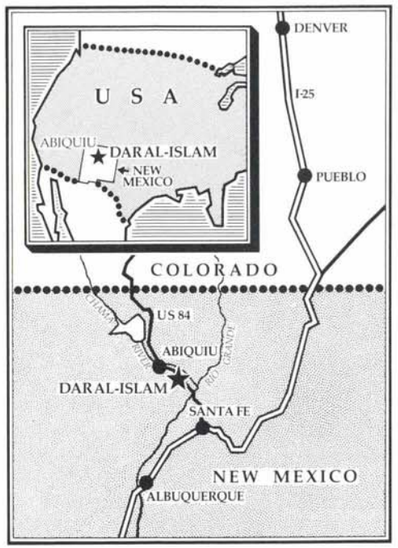
Community life at Dar al-Islam takes place under hand-built adobe domes (background photo). Clockwise from top, practicing weaving in handicrafts class; eating lunch in the elementary school; praying in the community's mosque; planing a wooden door.

Dar al-Islam, the Abode of the Faithful, was incorporated as a nonprofit religious and educational foundation in 1980, on the first day of the year 1400 of the Muslim *hijri* calendar. It is the first Islamic village in the United States. Planned as the eventual home of 150 families, it is home already to more than 30. The adult American-born among them have come to Islam from sister monotheistic traditions, Christian and Jewish, or in some cases from agnosticism, after years of searching for something they felt they had been missing. For them the Muslim faith resolved unanswered questions; they may have first encountered or embraced it in places as diverse as England, Morocco, Egypt or Saudi Arabia. The community has also welcomed a number of non-American Muslims from Canada, Ireland, Holland and Belgium, from Turkey, Syria, Jordan and Iraq.

Abdullah Nuridin Durkee is director of the foundation and one of its three cofounders. Born a Roman Catholic in upstate New York, Durkee embraced Islam in 1971 while in Jerusalem writing a book on monotheism. Later he and his wife Nura journeyed to Makkah in Saudi Arabia to study Arabic and Islamic law at Umm al-Qura University. In a chance encounter in the Sacred Mosque one night in 1978, Durkee met a Saudi businessman and pipe manufacturer named Sahl Kabbani who knew and admired the United States and Americans from the years after World War II, when he had earned his engineering degree at Worcester Polytechnic Institute in Massachusetts. During the two men's serendipitous meeting near the Ka'ba, the idea of Dar al-Islam was born.

The idea was to establish a community in the United States whose members could live a fully Islamic way of life. Dar al-Islam would be a place where American Muslims could engage in life's daily transactions according to their beliefs: the *deen*, or code of Islam. And in manifesting their faith, they would bear witness of Islam to others: the *da'wa*, or calling.

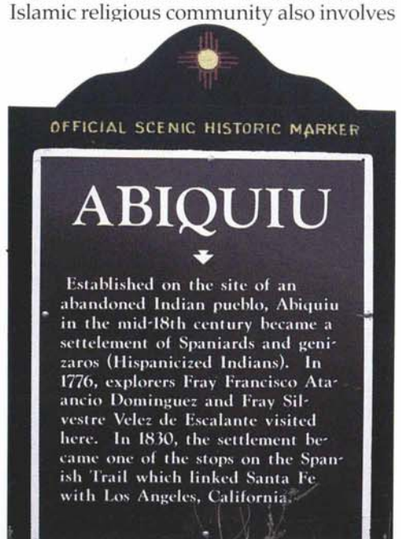
Islam defines not only the individual's relationship with God, but all aspects of individual and community life. Thus, when he talks about Dar al-Islam, Durkee likes to use the metaphor of a table supported by four legs. In Islam, worship and education represent but one of the legs of the table. A second, no less important, is the creation of housing, neighborhoods and communities. In American cities, where they are a small minority, Muslims find themselves isolated from one another, their spiritual lives often reduced to attending a weekly religious service. Until



now, the response to that isolation has been construction of additional places of worship, establishing mosques in cities and university towns throughout the country. Durkee believes, however, that while such centers do also serve educational and social functions, they inevitably focus on the more limited goal of helping American Muslims maintain their religious identity. The concept of *deen* includes the daily relationships and interactions among Muslims, a closeness to one's family and caring for neighbors.

The third leg of the table, important to any endeavor in the real world, is business: Spiritual life does not function in a vacuum, and Islamic business practices and principles (See *Aramco World*, May-June 1987) are an important part of daily interactions among Muslims.

The fourth leg is nourishment. Aside from the universal need to eat, food in an Islamic religious community also involves



certain dietary practices that are sometimes difficult to follow in North America, especially in terms of the selection and preparation of meat.

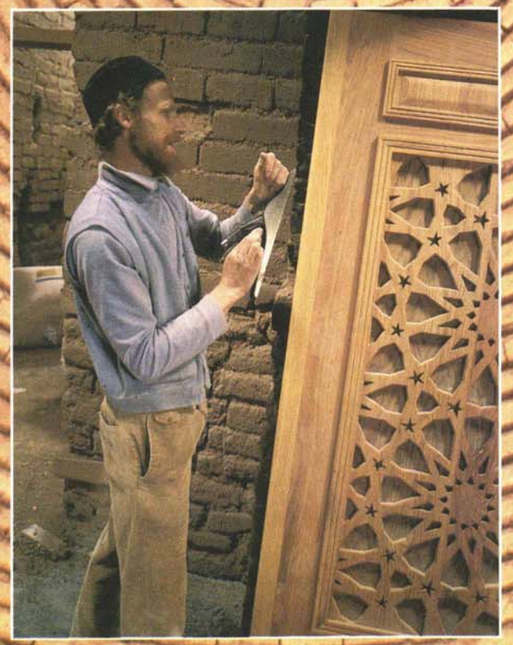
As four legs support the table, Durkee concludes, an Islamic code of life requires a broad base. Therefore a meaningful American project had to reach beyond the provision of a place to pray or a cultural center. It had to deal with all of life's transactions, the real-life problems Muslim families face in all four areas: worship and schooling, community, business and agriculture.

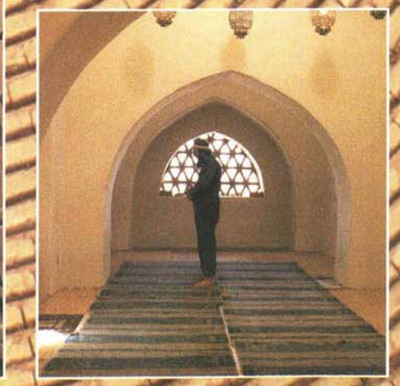
Nura Durkee makes another point. The purpose of the project was not to create an isolated, fully self-sufficient community, a ghetto for a self-conscious minority. While creating space in which Muslim families could practice *deen*, they should not forget that they lived, after all, within a larger world. Carrying out *da'wa* was an important concern too. They would make every effort to present an Islamic example in America, to interact with and earn the respect of their fellow Americans. And finally, Dar al-Islam would also serve as a base and a retreat for the broader Islamic community of students and travelers in the United States.

All these factors were considered when Dar al-Islam was conceived. The search for the right location in America was made possible by another serendipitous meeting in Makkah, several months after that of Nuridin Durkee with Sahl Kabbani.

One night in 1979, during the fasting month of Ramadan, Nura Durkee was also praying in the enclosure of the Sacred Mosque and was also recognized as an American Muslim by a stranger who spoke to her. The woman was Princess Muthie bint Khaled, a daughter of Saudi Arabia's then King, the late Khaled ibn 'Abd al-'Aziz. She had heard of the Durkees' idea of creating a Muslim community in America, and she offered her help. They used an initial gift from the princess to begin the search.

The Durkees knew that they would need space: a very large piece of land at a relatively low cost. This ruled out the crowded metropolitan areas of the east and west coasts, which were less than ideal in any case because of their hectic pace and material distractions. The Durkees were familiar with the American Southwest and attracted by its climate and its scenic grandeur, with both open space and openness to diversity. They wanted to be within reach of a city, whose economy and resources would be especially useful in the initial stages – but not so close that city sophistication or demands would hinder contemplation and concentration on religious and educational goals.





At Abiquiu, in sparsely populated north-central New Mexico's mile-high Rio Arriba County, the Durkees found what they were searching for: a 3,450-hectare (8,500-acre) ranch composed of rugged, empty back country, a flat-topped mesa and a verdant, flat-bottomed valley bisected by the fast-flowing Chama River. A highway fronts the property and separates it from the village of Abiquiu on the south side of the river, providing the community's connection to the larger world. As the Chama rushes to meet the Rio Grande, its passage through the hills opens a line of sight to the lofty Sangre de Cristo range, whose peaks soar 4,000 meters (13,000 feet) into the desert air.

Along the two rivers there are villages, some Indian, with their nature-centered traditions, some Hispanic and thus mostly Roman Catholic, others Anglo-American, most often Protestant. As much as any place in the United States, northern New Mexico is tri-cultural, and these highlands seem to welcome diversity in the common search for life's meaning. There is a Sikh community in nearby Espanola; Ghost Ranch, a Presbyterian-affiliated retreat established on artist Georgia O'Keefe's former property, is just up the road; Abiquiu itself, settled by Spaniards and Hispanicized Indians in the mid-1700's, is 99 percent Catholic. In this setting, Dar al-Islam, a community of Muslims, would be just another village along the river, able to coexist in the tolerance and mutual respect that are features of both America at its best and of the golden periods of Islam.

The selection of a New Mexican site also closed a circle, in a historical sense. The Spanish who first settled here in 1610 – only Florida and Virginia had European settlers earlier – brought with them the influence of the Arab kingdoms of Andalusia. The last of these, Granada, had succumbed to the *reconquista* only in 1492, hardly more than a century before. The first Muslim known to have lived in New Mexico was a Moor named Estevan who accompanied Friar Marcos de Niza, the first Spaniard to explore America's Southwest. Many Spanish words still in use in New Mexico, and many local place names, have Arabic roots. The name of the town of Alcalde, about 24 kilometers (15 miles) from Abiquiu, recalls the title of certain Spanish colonial administrators, one derived from the Arabic *al qadi*, the judge (See *Aramco World*, November-December 1976). The sophisticated local system of allocating irrigation water from the Chama also has its origins in Muslim Spain and the Arab East. So when Dar al-Islam came to Abiquiu, it did seem to find a welcoming environment.

In Saudi Arabia, meanwhile, Princess Muthie bint Khaled had interested her four sisters in the Dar al-Islam project and they continued to contribute as a family, enough at first to establish the legal foundation, buy the first 450 hectares (1,100 acres) of land, build a mosque, or *masjid*, and begin the construction of a school, or *madrasa*. Later the princesses' father made a substantial donation, enough to complete more than half of the school and to purchase the remaining 3,000 hectares (7,400 acres) of the ranch. With the land came the main ranch house – an adobe hacienda – and a number of workers' houses, barns and corrals.

Along with Sahl Kabbani and Nuridin Durkee, Dr. Abdullah Naseef, then rector of King Abdul Aziz University in Jiddah, now Secretary General of the Riyadh-based World Muslim League, joined in cofounding Dar al-Islam. Other members of the foundation's board were chosen from among Muslim educators and patrons in the United States, Saudi Arabia, Bahrain, Egypt and Morocco. The foundation, as a nonprofit organization, supervises three areas: the mosque and school, lands and housing, and an Institute of Traditional Islamic Studies.

To design the *masjid* and *madrasa*, Dar al-Islam chose Egyptian architect Hassan Fathy, a man venerated worldwide for his life-long commitment to vernacular architecture and his mastery of traditional adobe construction. Though then already in his 80's, Fathy came to Abiquiu himself to oversee construction, and brought with him two Nubian craftsmen to instruct local workers in adobe techniques. The mosque was built first, except for the still unfunded minaret. The largest part of the connecting school building was also completed; construction continues on a kitchen and cafeteria, arts and crafts rooms, and a language laboratory.

Studies indicate that as many as 80 percent of the children of Muslim families that immigrate into the American melting pot eventually leave Islam. An important goal of Dar al-Islam's school, therefore, is not only to teach the community's children but also to train teachers and develop an Islamic curriculum. Eventually the foundation hopes to have a boarding school – the last major building designed by Fathy – to serve the children of Muslim families whose professional lives keep them elsewhere in the country.

Egyptian-born Ahmed El-Helou, the school's director, came to Dar al-Islam with years of experience teaching Muslim children in Holland. In 1986-1987 he oversaw a staff of six qualified full-time teachers and an enrollment of 44 children. Except for matters fixed by state law – such as the number of school days per year – El-Helou and his staff are free to tailor the school to the community's needs. Thus, boys and girls study together through the early elementary years and are separated after the age of 10. In some subjects, the school has chosen the same texts used in New Mexico's public schools, but El-Helou and his curriculum coordinator, Dr. Ali Malik, also make sure to give the children a solid grounding in Islamic values, as well as classes in Arabic and the Qur'an.

"Most young people grow up to believe they must compromise between their idealism and the reality of the world," El-Helou says. "But as the Prophet showed us, it *is* possible to live the ideal, by following God's word. Dar al-Islam provides a place to learn this while isolated from outside pressures. The pressures of one's own ego cannot be escaped, but we can prepare ourselves to deal with them."

As to the community's land and housing – the foundation's second area of concern – the first task was to renovate the existing houses, set beneath towering cottonwoods, facing south across pastureland. Four new houses for settlers were also built along the northern bank of the Chama, each with a solar-heated glass porch and its own vegetable garden. In anticipation of a gradually increasing population, the foundation has prepared a master plan for the plateau area surrounding the mosque and school. Already three houses with walled courtyards have been built there; each represents space for another family in the community and additional students to sustain and support the school. For now, too, some settlers rent houses in the village of Abiquiu.

The wild back country and the irrigated land along the river is leased to neighboring ranchers for the present, but the foundation's long-range plans call for

A Blessed 'Id

It is Wednesday, and it is the last day of Ramadan, the month of fasting. Perhaps.

The children at the Dar al-Islam Islamic School are excited because tomorrow may be the 'Id al-Fitr, *the holiday of breaking the fast – a special holiday in the Muslim lunar calendar. But no one will know for sure unless the new moon is actually sighted this evening.*

If someone does see the moon, there will be no school tomorrow; all the families of Dar al-Islam will gather outside the mosque for communal prayers in the morning. There will be a community picnic in the afternoon, and gifts for all the children.

The older ones have been fasting with their parents and the other groups, from dawn to sunset, for the past 29 days. The younger children have fasted as they could, some for half of the days, others for only three or four. (The obligation to fast during Ramadan is relaxed for travelers, the sick and the young.) To encourage them, their teachers have put a star beside their names for every day they succeeded. Three-year-old Yaseen is very proud: Today he has fasted, he says with a shy grin, from breakfast until he ate a sandwich – at lunch.

Just before sunset several of the men drive from the village of Abiquiu to the big dam and lake a few kilometers upstream, where they can have a clearer view of the horizon. The evening sky is radiant and red, but there are scattered low clouds above the cliffs. No one can spot a faint, thin crescent so soon after sunset.

At Dar al-Islam, someone has received a telephone call from friends in Saudi Arabia. The new moon has been sighted there! In houses along the river and others across the valley in Abiquiu there is discussion about waiting until the moon appears here. Neighbors telephone each other to ask for news. Then one family receives a call from a Muslim friend in Georgia, another from friends in California; then comes a call from Washington state. The word spreads. The new moon has been seen in America too!

Early Thursday morning about 90 people, men, women and children, gather in their holiday best among the juniper trees outside the mosque. The women wear long colorful skirts and cover their heads with scarves; the men wear tunics over trousers, or floor-length robes with caps or turbans. Several visitors, invited by telephone, have driven to Dar al-Islam from Taos or Santa Fe, and a group of families comes from Abiquiu in the big yellow school bus. Everyone is welcomed with the greeting, " 'Id mubarak!" *– blessed* 'id. *Two rows of mats and carpets spread across the dusty earth, for the men and boys in front and for the women, girls and small children some distance behind them, all facing toward distant Makkah.*

Ahmed El-Helou, the school director, stands before those assembled and reminds them that they are part of the world-wide Islamic community. All over the globe, Muslims have been fasting together as they are now joined together in celebration. They are united, he says, high and low, men and women, all colors and classes. Then he leads them in prayer.

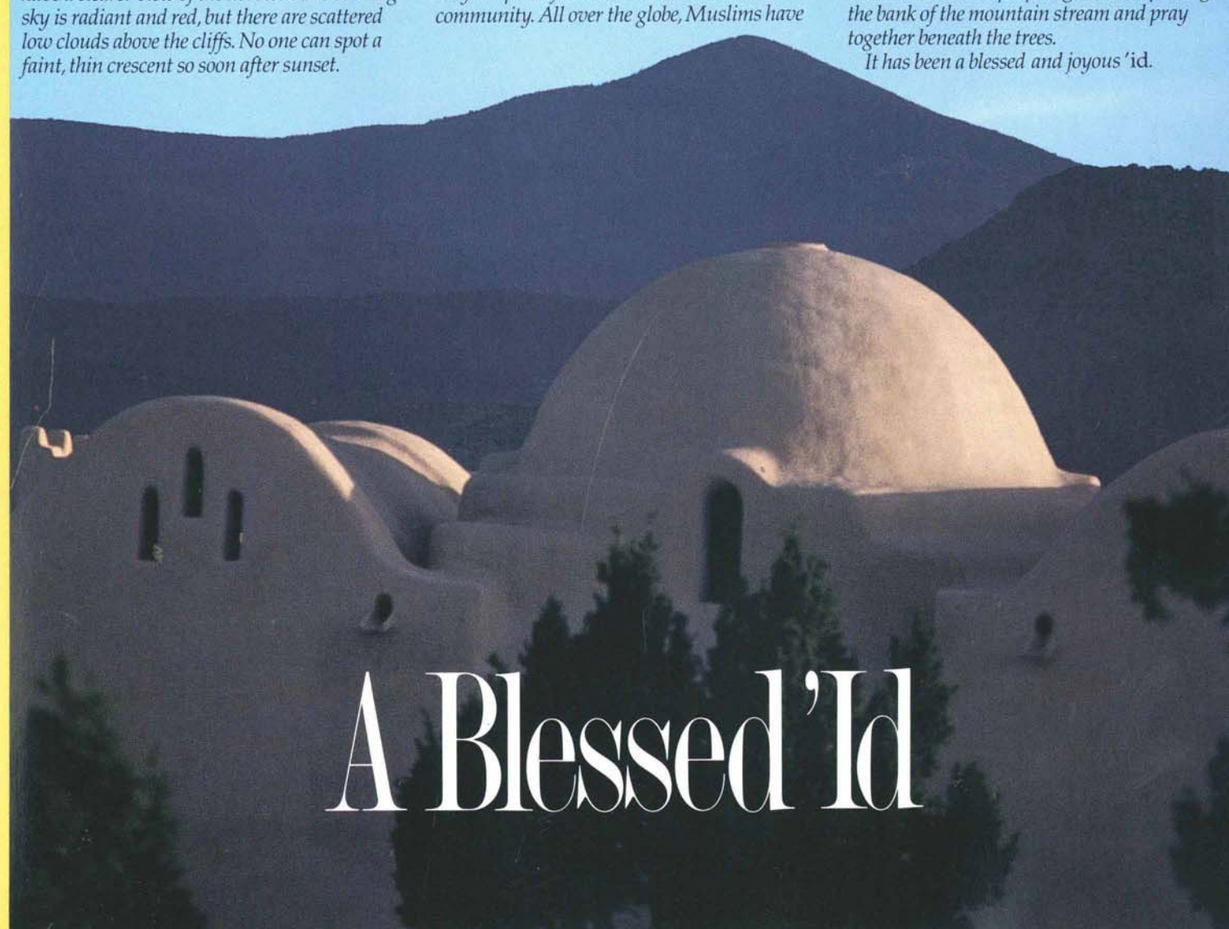
In the afternoon many families drive to a picnic ground in the Carson National Forest. An icy stream rushes beneath pines, spruce and fir beside the meadow. The yellow bus is parked amid cars and pickups. Some men and boys play volleyball; an older boy takes a chilly dip to retrieve a stray ball. One man gathers dandelions for tea, another sits quietly on the grass and reads. Three families have brought lambs to share, and a group of men grill them over a bed of coals. Dark clouds race overhead, drop a few sprinkles and pass.

The picnic is a feast from East and West: There are stuffed grape leaves, couscous, spinach pastries, eggplant, pita bread, dates, rice pudding, baklava and crescent-shaped cookies, as well as potato salad and watermelon.

After the meal there are games of badminton and stickball, and the children show each other their new toys. Nine-year-old Samia is very happy: She was the youngest of all the children to have fasted every single day, and the school director has given each child a quarter for every day he or she was able to fast. Samia has over seven dollars!

As the sun sets, people again line up along the bank of the mountain stream and pray together beneath the trees.

It has been a blessed and joyous 'id.

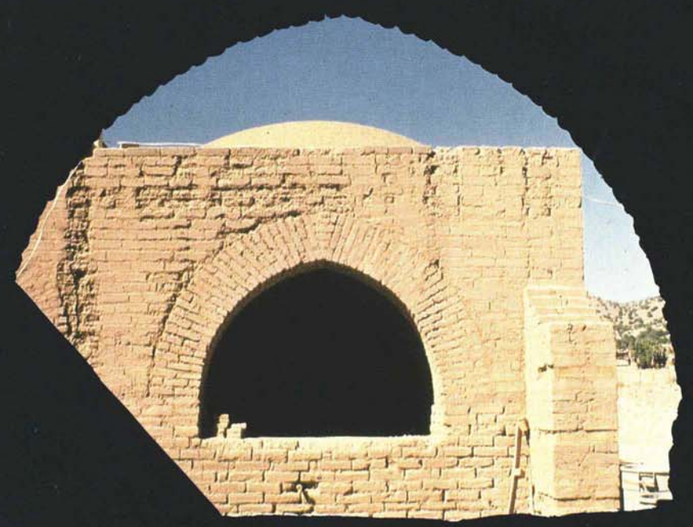


DAR AL-ISLAM

In Islamia's offices (below), children's books take shape under the eyes of publisher McCabe, center, and editor Spiker, while new buildings rise (bottom) to house other community activities. At left, children perch in a window embrasure that looks out over New Mexico's landscape. Opposite, Dar al-Islam cofounders Abdullah Nuridin Durkee and Nura Durkee and their two children.


PAMELA ROBERSON


RAMONA STORM


RAMONA STORM

developing a nursery for native trees and shrubs, a herb farm, a fish hatchery, feedlots for cattle and perhaps an Arabian-horse ranch.

The Institute of Traditional Islamic Studies was conceived as an advanced educational institute where graduate students could learn about Islam from Muslims in an Islamic context. The ranch's old adobe hacienda is the venue for a variety of programs and seminars. In the summer of 1986 it hosted a training workshop for teachers in Muslim schools, cosponsored by the World Muslim League in Riyadh. The next year, the University of Florida cosponsored a seminar on Islamic communities for architects interested in traditional architecture. Another seminar in 1987 was devoted to the development of an integrated curriculum, from language to science, in an Islamic perspective.

"Secular studies teach us the facts of known phenomena," one Muslim mother and teacher said, "but they fail to emphasize responsibility. Muslims are enjoined to be caretakers of the world, to work with it, not to destroy it. We are only visitors here. It's not unlike the Christian idea of stewardship. We want to teach our children this view – especially on this land: ecology, planting, increasing fertility."

"Science is not God," Dr. Malik says. "But it does give us a sense of the greatness of God. Everything leads us toward our Creator."

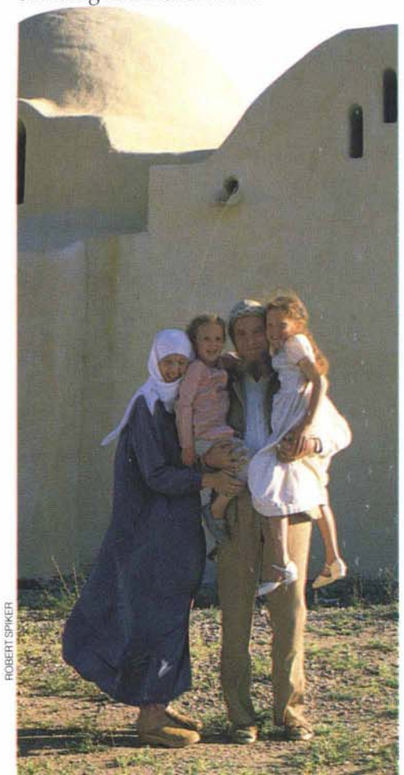
As a religious and educational foundation, Dar al-Islam cannot engage in profit-making activities. And yet, to exist as a community in a remote location it was necessary to encourage small business ventures and create jobs. To help with this dilemma, trustee Sahl Kabbani established the Crescent Leasing and Development Company. Crescent leased a portion of the land fronting on the highway and there built an inn, restaurant, gift shop and automobile body shop and garage.

Another company, Al-Manjara (The Builders), a licensed contractor, leases space from Dar al-Islam and carries out major construction for the foundation and for individuals in the community, as well as projects for clients as far away as Santa Fe and Albuquerque. Woodworker Benyameen van Hattum, born in Holland, has handcrafted doors and other furnishings for the mosque and school, many pieces based on traditional Islamic patterns.

Islamia Incorporated is another private company, established by an Egyptian businessman to develop prototypes for a series of 12 English-language readers for children through the sixth grade. In Islamia's offices, rented from the foundation, Irish-born Muhammed Abdul Bari' McCabe and American editor and graphic designer Abu'l Qasim Spiker are creating books which they hope will be of value to Islamic schools in the West and to families for home use – and which will also serve as tools for teaching English to children in the Muslim East.

The series, "Islamic Perspectives," incorporates such basic values as honesty and respect for parents and elders. One reader is called *Helping at the Farm*. "Note the use of the word 'helping' as opposed to 'visiting,'" Spiker says. "Our purpose is not to shut children into a bubble, but to provide them the values which will enable them to discriminate for themselves what is important."

Dar al-Islam has never accepted financial assistance from a government. All donations have come from individuals, because the foundation is seen as a trust of the world community of Muslims. "Traditionally, the heart of the Islamic world has supported Muslim projects on the far frontiers," Nura Durkee says. "Each Muslim community in America has its own projects and needs, so we are reluctant to turn to them for help. People in Egypt are not generally wealthy, but they value Islam immensely and understand what it is to try to live on little. Once in Cairo, I was handed a stack of crumpled piaster notes, about 13 dollars, by two little old ladies all dressed in black. I was in tears. One knows that such a gift comes with great understanding and a lot of heart."


ROBERT SPIKER

The foundation continues to receive donations from many individuals in Egypt, in the various Gulf countries, in Saudi Arabia – where members of several Ladies' Benevolent Societies have been particularly active – and from elsewhere in the Middle East. *Zaqat*, the Muslim concept of organized and obligatory charity, has been a blessing to the foundation.

Yet Dar al-Islam exists also in a peculiarly American tradition. The construction, amid democracy's diversity, of a community designed to suit the principles of a particular group of people is not an uncommon event in American history. In this sense Dar al-Islam follows in the path worn by the 17th-century Quakers and such 18th- and 19th-century American communities as the Shakers in New York, the Amanites of Iowa and the Hutterites of South Dakota. Brook Farm in Massachusetts and New Harmony in Indiana were other early communities built on principles, whose members strove to live just and honest lives in the company of like-minded people.

In many other ways, however, Dar al-Islam is quite different from these American predecessors, not least because it does not stand alone: It is part of the vast world community of Islam.

Nonetheless, Dar al-Islam is still a community of American Muslims, connected in its special way to mainstream America. Local people from Abiquiu are hired to work alongside Dar al-Islam's Muslims; Muslims patronize Abiquiu businesses and rent houses in the village. The foundation supports the Abiquiu fire department and contributes to the local Head Start program. Students from surrounding areas and visitors from across the nation drive up the dirt road to admire the adobe mosque on the plateau above the Chama and think about why it is there. Many record their thoughts in the guest book, whose pages are filled with words such as "peaceful," "serene" and "spiritual." "A beautiful house of God," one family from Albuquerque wrote recently, and another visitor added, "God bless you."

Compassion and love are values held in common by Americans of many faiths. In Islam, living in harmony and being good neighbors is part of practicing *deen* and carrying out *da'wa*.

"My point of view is that they are bringing in a lot of family tradition, unity and respect for human institutions." The speaker is Father Milan Garcia of the St. Thomas Church in Abiquiu. "This is a good thing for northern New Mexico."

William Tracy, a lecturer on Islam and Middle Eastern affairs, is a former assistant editor of Aramco World *and remains a frequent contributor.*

MUSLIMS · IN · SOUTHERN · THAILAND

FROM · BUNGA · MAS · TO MINARETS

WRITTEN BY JOHN ANDREWS
PHOTOGRAPHED BY NIK WHEELER

The intersecting calls of the muezzins pierce the sweltering equatorial air as Ahmad Abdurrahman, imam of Narathiwat's central mosque, arrives on a racketing and underpowered moped to lead the noon prayer. "We're 80 percent Muslim here," he says, with an engaging smile.

Climb to the top of the minaret of Abdurrahman's modern, almost futuristic, mosque and he will show you a stunning view: palm-fringed beaches running along the South China Sea, wooden fishing boats moored in jostling huddles in the creek and lush plantations of oil palms and rubber trees that stretch to a mountainous horizon.

This is Thailand, and it looks like paradise – complete with a serpent named poverty.

"My father was a shaykh in the mosque and wanted me to study Islam."

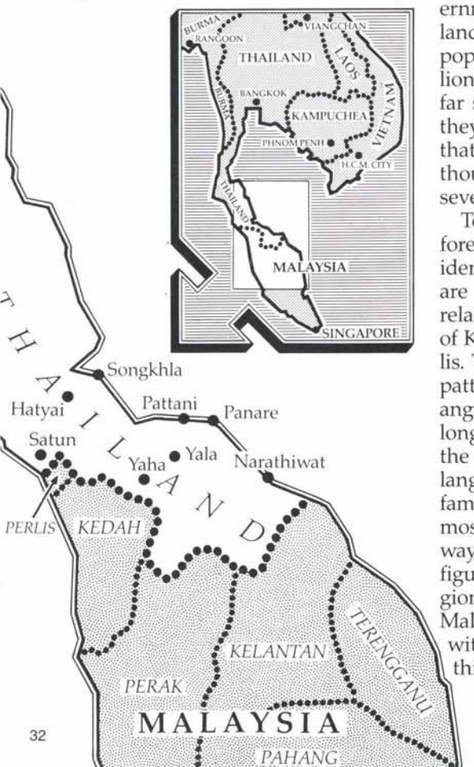
Economic growth, however robust, has a hard time eradicating the country's rural poverty and urban squalor, particularly here in Thailand's deep south. Narathiwat is only 840 kilometers (520 miles) as the crow flies from the capital Bangkok – but it might as well lie in another country in terms of race, religion, culture and even language.

"The Muslims are the poorest people in Thailand," imam Ahmad says. "We need government assistance." Eighty kilometers (50 miles) to the northwest, Chamnong Koomrak, governor of Pattani province, replies, "We're trying.... Our budget is growing by 10 percent a year. We give special privileges to Muslims to enter university and we want to develop the south, in fisheries, food-processing and tourism."

The truth is that there are few shortcuts to development anywhere. Both the government in Bangkok and the Muslim electorate in Thailand's southern provinces of Pattani, Satun, Narathiwat and Yala know that the key to prosperity is education. For the authorities, that means instruction in the Thai language. The people of the south agree – but they intend at the same time to preserve their religion and their culture.

The result is a fascinating renaissance of Muslim awareness spreading across the narrow, elongated arm of land that reaches down from the body of Buddhist Thailand in the north to the Muslim nation of Malaysia in the south. You see it everywhere, from the simple yet elegant central mosque in Pattani to the corrugated-iron mosques of the fishing villages along the eastern coast. You see it, too, among the 1,700 students who cram the classrooms of Narathiwat's Islamic Foundation for Education, built 20 years ago with a donation from the late King Faysal of Saudi Arabia. And you sense it in the faces of the tiny children learning Arabic from Jitsom bint Salih in a one-room *madrasa*, or Qur'anic school, in the sand-swept coastal hamlet of Ban Budi.

Muslim schoolgirls at Laem Pho elementary school. Opposite page, Pattani's new central mosque and (inset) a young worshipper.



So who are these Thai Muslims? To government statisticians they are one of Thailand's minorities, perhaps four percent of a population now numbering about 55 million, overwhelmingly concentrated in the far south. To their Buddhist compatriots they are known as *khaek*, a word that means "visitor" in the Thai language – though the Muslims came to the region several centuries before the Thais.

To any real visitor, however – a *farang* or foreigner from overseas – the ethnic identity of the Muslims is obvious: They are Malay, just like their neighbors and relatives in the northern Malaysian states of Kedah, Kelantan, Terengganu and Perlis. The two groups dress the same way: patterned sarong and white skullcap or angular black *songkok* hat for the men, long-sleeved dress and *dawa* head-scarf for the women. They speak the same Malay language, although many of the fishing families have a dialect all their own. And, most of all, they worship God in the same way, recoiling from the ornamented figures of Buddhism, Thailand's state religion. The fact that they bear Thai, not Malaysian, citizenship has nothing to do with cultural affinity– but it has everything to do with the politics of the past.

The Malays originated on the island of Borneo, now divided between Malaysia's Sabah and Sarawak and Indonesia's Kalimantan. About 1,500 years ago they began an expansion that took them south and west through the islands of Indonesia and northward to the Philippines and the Malay Peninsula. Meanwhile, the Thais – originating perhaps in southeastern China – were expanding southward in competition with peoples like the Shans, Mons and the Khmers of today's Kampuchea. The inevitable meeting of Thai and Malay came around the beginning of the 13th century.

But this meeting was not a clash of nations in any modern sense. Southeast Asia nearly 800 years ago was a shifting patchwork of kingdoms, each vying for tribute and influence but not necessarily for conquest. The Siamese, as the Thais used to be known, had one kingdom – but so did the Khmers, while to the south there were the kingdoms of Majahapit and Langchia. Just as the medieval Arab historian Ibn Khaldun theorized, when a state was vigorous, it expanded in territory and influence at the expense of weaker states – until the weak in turn became strong and led a fresh cycle of change.

Today's Muslim provinces of southern Thailand are the descendants of Malay kingdoms that in the Middle Ages paid tribute – in the form of *bunga mas*, or ornamental flowers of gold and silver – to the king of Siam. The payment of flowers showed a degree of loyalty to the king, and dependence on his protection against rival forces. It hardly mattered that the Siamese were purveyors of the region's Buddhist and Hindu tradition, while the Malays were 14th-century converts to Islam. What was at stake was power, not culture.

Yet it is the cultural difference between Thailand's Buddhist majority and Muslim minority that has imbued the south with its distinct flavor. This has survived the centuries, from the days when flowers were given as tribute to the modern era of representation – by a handful of Muslim deputies – in Thailand's National Assembly in Bangkok.

The mosque and the *pondok*, a religious boarding school for young Muslims, were the reason the culture survived. They still are, though the *pondok* is fast disappearing in favor of the *madrasa*, which receives government help in return for teaching secular subjects, including the Thai language, alongside the religious curriculum.

Turn off the main highway between Pattani and Narathiwat, go a kilometer or so along a mud road between glistening, luminous-green rice paddies, and you come to the Telok Manok mosque, built more than 300 years ago. Only a small minaret reminds you of Islam's Arabian origins; otherwise, the building, with walls and floor of heavy wood and roof of small, scalloped red tiles, is more reminiscent of an Indonesian longhouse.

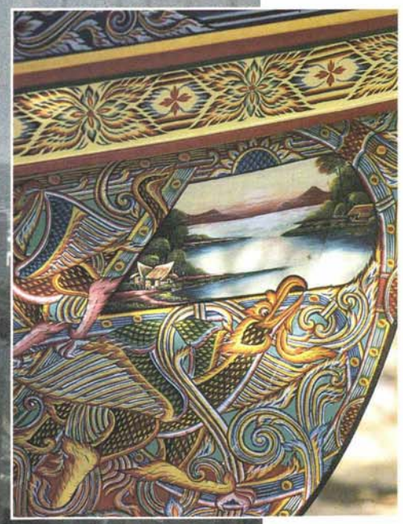
The Telok Manok mosque is part of an Islamic tradition that remains real for almost all Thai Muslims. Late on a rain-swept afternoon, we met young men there who were making a form of pilgrimage to the region's oldest mosque. Muhammad Said and Muhammad Hashim had both come from their homes in the Malaysian state of Perak. They were visiting their Thai friends, Muhammad Bidi Talodin and his cousin Ramli Talodin. We conversed in neither Thai nor Malay but in Arabic: Muhammad Bidi learned the language as a student in Benghazi, Libya, and 30-year-old Ramli had spent four years in Kuwait and six in Riyadh, Saudi Arabia, where he graduated with a degree in education. Now he teaches at the Islamic Foundation school in Narathiwat, keeping both tradition and culture alive.

Ramli and his colleagues use Arabic, as well as Malay, to promote the faith and its teachings. That may seem obvious: All good Muslims are supposed to be able to read the Qur'an in Arabic. But contrast it with Malaysia: In that country, where Islam is the state religion, most people now have difficulty reading the *jawi*, or Arabic, script because the written Malay language has been romanized. The Muslims of Thailand, however, invariably use the Arabic script when writing their language, be it in the mosque or outside.

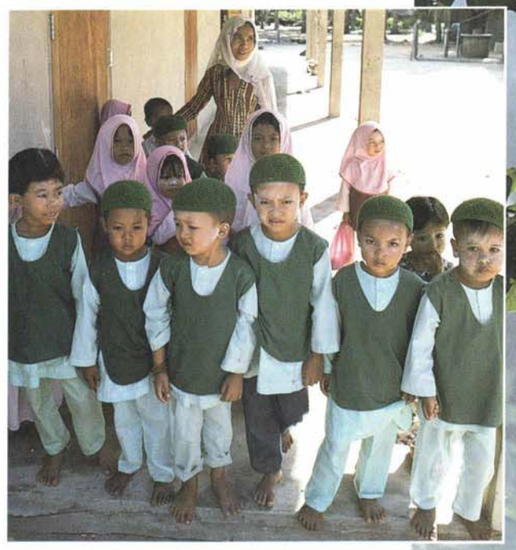
For preserving and strengthening the use of Arabic, the Muslims of Thailand can thank their brethren in the Arab world. Since the mid-1970's, the countries of the Arabian Peninsula – especially Saudi Arabia, Kuwait and Qatar – have offered scholarships to Thai Muslims to pursue both religious and secular studies in the Middle East. Though there are only about half a dozen scholarships a year to any one country, their impact is enormous. Few Thai Muslims speak the national language well enough to enter a Thai university, so the chance to pursue advanced studies in an Arab country is a real boon. At the Narathiwat school, over 50 of the staff are graduates of universities in the Arab world. Fuad Tayyib, now aged 30, studied mathematics at Riyadh University; Nasir al-Din Hamid majored in Islamic studies in Kuwait; Hassan Hajj Ahmad is an alumnus of a high school in Kuwait and of the University of Qatar.

And there is even a chance to go to the most famous center of Islamic learning, al-Azhar University in Cairo. 'Umar Tayyib, the director of the Narathiwat school, says proudly, "Next year we should have three students at al-Azhar." And when they return? Naturally they will pass on their learning, just like the Narathiwat imam, Ahmad Abdurrahman. He went to Makkah to live at the age of 10 – "because my father was a shaykh in the mosque and wanted me to study Islam" – and then studied at al-Azhar in the 1960's and 1970's.

By now, enough students have returned from the Arab world to constitute a nucleus of Arabic-language teacher training in Thailand itself. Jitsom bint Salih, for example, teaches the children of her poor fishing village the Arabic that she learned not in the Middle East but in the Islamic Institute in Pattani – and the slogan on the wall of her tiny schoolroom proclaims in Arabic, "Teach the people what they do not know."



Thatched-roof houses on stilts make up the village of Koh Pan Yi, whose inhabitants fish from elaborately painted kolae *boats (above). At right, village boys.*



A Muslim education is available to boys and girls through secondary school in southern Thailand.

But we are leaping over the centuries. What happened between the days of *bunga mas* and the modern era? The answer is two-fold: First, Islam grew deep roots in the region; and second, the European powers arrived in Southeast Asia. Both factors were troublesome complications for successive Siamese monarchs.

Islam arrived in the wake of commerce. Muslim traders from the Middle East and India brought their religion with them as they sailed to Southeast Asia in search of spices and other riches. By the early 17th century Pattani had established itself as the center of Islamic learning in the Malay Peninsula. For the next 200 years and more Pattani produced scholars who not only translated Arabic texts for Malay readers but who also wrote their own religious works. Daud ibn Abdullah ibn Idris al-Fatani, for example, was a theologian whose expertise in *fiqh*, or jurisprudence, was recognized even in Makkah.

But the stronger Islam became in the region, the more its adherents identified not with the distant king of Siam but with their coreligionists in the Malay states to the south. The result was a series of uprisings, encouraged in part by the insensitivity of the Siamese bureaucrats to Muslim custom. By 1890 a Muslim writer described the officials who came to diminish the power of the traditional rulers and of the *'ulama*, the religious leaders who advised them, as "the leeches and parasites of the state."

The 300-year-old Telok Manok mosque represents Islam's deep roots in the region. Below, a teacher at the Islamic Foundation for Education in Narathiwat.

Such tensions, leading at one point to the exile of the ruler of Pattani, also reflected international conflicts. By the 16th century, Europe's colonial powers were competing for the land and resources of Southeast Asia. At first, the Siamese were pressed to grant trading concessions – to the Dutch, for example, giving them a monopoly over part of the country's external trade, and to the Portuguese to trade with certain Malay states. But soon Siam's independence was at stake. The French were approaching from their new domain in Laos and other parts of Indochina; the British were threatening to encroach both from India in the west and from Singapore and the Malay Peninsula in the south.

By the beginning of this century the reformer King Chulalongkorn desperately needed some formula to stop his domain being nibbled away by the rival ambitions of the French, British, Russians, Germans and even Turks. The answer was the Anglo-Siamese Agreement of 1909: The King formally ceded tributary rights to four of Siam's southernmost Muslim provinces – Kedah, Terengganu, Kelantan and Perlis – to Britain in exchange for Britain's recognition of Siamese sovereignty over Pattani and the principalities surrounding it. It was a clever move for both parties: By sacrificing part of their traditional authority, the Siamese won the implicit protection of the British, who for their part could enjoy the plantation riches of northern Malaya while keeping Siam as a neutral buffer state between British India and French Indochina.

The only problem was that the agreement left many Muslims north of the new border to co-exist with a Buddhist majority with which they had little mutual sympathy. This juxtaposition led to the emergence, in the last 40 years, of various movements seeking Muslim independence from Thai rule.

Fortunately, governments can learn from their mistakes, and King Chulalongkorn's conciliatory instructions to his ministers three-quarters of a century ago have been recalled: "We regard [Islam] as a religion for those people in that part of the country." Muslim wishes have been heard and Muslims' circumstances have improved. Each Muslim province now has a central mosque built with government funds – to the tune of $1 million in the case of Ahmad Abdurrahman's mosque in Narathiwat. In Pattani, Governor Chamnong says, "Everyone is free to worship in his own way – but we want every Muslim to speak Thai. They are people of this country, and Thai is the official language." But that does not have to mean losing the culture of Islam, the governor adds: "We're trying to open a new faculty at the university in Islamic studies, so that the people don't have to go to Cairo."

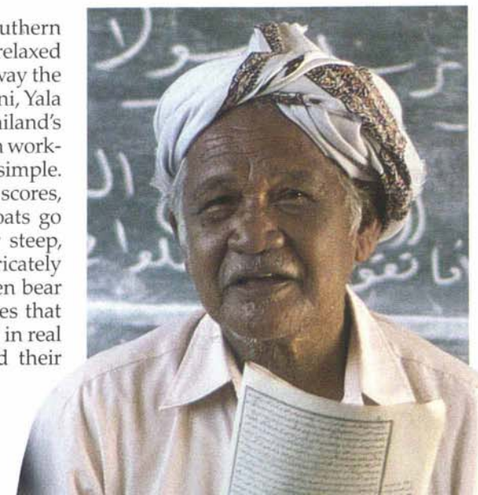
In the meantime, life in the southern provinces goes on with the relaxed rhythm imposed by nature. Take away the small businessmen of Hatyai, Pattani, Yala and Narathiwat and most of Thailand's Muslims are rice farmers, plantation workers or fishermen. Life is hard, but simple. From fishing villages like Panare scores, even hundreds, of *kolae* fishing boats go out with the tide each day. Their steep, pointed prows are a mass of intricately painted curls; sterns and sides often bear beautiful paintings of Alpine scenes that none of the fishermen will ever see in real life. In the fields, the farmers and their families toil over the rice plants.

To the visiting *farang*, the scenes are a delightful passport to an era urbanized man has left behind. For the Thai Muslims entertainment is still a communal enjoyment. The fishing families huddle around a shared television. In villages like Chana, the inhabitants gather in the early morning to raise dozens of caged doves aloft on six-meter (20-foot) metal poles. The doves burst into songs that are judged for pitch, melody and volume. An outsider can hardly tell even from which direction the dove song is coming – but the owners can, and a bird that wins a major competition can end up being worth $12,000.

Will it stay this way forever? Perhaps not. Development, although slow, will bring cars to replace the ubiquitous mopeds. The potential of the valuable tin deposits in the hills is bound to force change. Fishermen will leave the dangers of the sea for easier jobs in the small factories now sprouting on the outskirts of Hatyai and Yala. Families may decide that watching the new television set carries more immediate interest than teaching a dove to sing.

But one thing seems certain to survive, and even grow: the interest in Islam. At the central mosque in Pattani businessman Abdullah Abdulwahab says, "Islam is getting stronger. Every mosque has a place to teach Islamic studies, and 40 percent of the people send their children to these schools. Each year, 1,000 people from the Pattani area do the Hajj. I did it three years ago, and I think I'll do it again." His confidence is surely right. Pattani, like the rest of southern Thailand, is leaving the era of the moped. Taking part in the noon prayer when we visited Pattani was a man with lettering on the back of his overalls. It said, "Chief Mechanic, Toyota, Pattani."

John Andrews is The Economist*'s Hong Kong bureau chief and has reported extensively on Southeast Asia. He graduated in Arabic from Cambridge University and taught at the University of Libya and the American University of Beruit before becoming a journalist.*



IN SEARCH OF BEDOUIN WEAVERS

WRITTEN AND PHOTOGRAPHED BY JOY MAY HILDEN

After three and a half years in Saudi Arabia, I was finally on my way to visit a Bedouin weaver. I had been admiring, buying, looking at, studying and imitating Bedouin weaving, with its wonderful variety, color and hardiness, and trying to find a woman to teach me to weave the Bedouin way. The break came through some television work I was doing: We were to make a short documentary on local weaving, spinning and dyeing.

We drove up the coast of the Arabian Gulf to 'Anak, a village near the ancient seaside town of Qatif. There were no house numbers, but we had spoken with the weaver in the Qatif market and she had given us a description of the place.

A small boy with big brown eyes opened the gate and invited us into the sitting room, its floor covered with carpets and lined with cushions. Our hostess entered, wearing the customary *'abaya* cloak and the *burqu* or half-veil. She greeted us warmly and served juice and tea, then got down to the business of the day. For later filming, she showed us how spinning is done on a hand spindle, or *mighzal*, the fleece held in the left hand and the spindle rotated swiftly in the right, whorl uppermost and shaft at an angle. She showed us how she plies the yarn – twists two strands into one stronger one – on the same spindle, and laughed at my efforts to imitate her. I asked about the processes of weaving and the Arabic words for various tools and techniques. Her fleece comes from the *suq*, she said, and she washes it in Tide.

Normally, Bedouins weave on ground looms made of two sturdy lengths of wood staked into the ground. The long warp threads are stretched back and forth between them and the weaver sits at one beam inserting the wefts, or crosswise yarns. But our hostess, Latifa, came from a Bani Khalid tribe that has been settled for over 25 years; she had adapted her loom to her concrete house. One beam, a heavy dowel, spanned an open doorway; the other was held by the stair-footing at one end and by a concrete block at the other. Latifa adjusted the tension in the warp with a sword beater, a heavy, flat stick pointed at both ends, 75 centimeters (30 inches) long by 75 millimeters (3 inches) wide. She slid the stick under the warps and then tightened them by turning the flat side vertical.

An acrylic-yarn pile rug in progress at al-Jawf, above. Below, a loom established on an 'Anak roof top. Opposite, a two-piece weft-twined rug probably woven in the 1950's.

The weaving in process was a narrow five-centimeter (two-inch) band, a decorative strip that would hang from a saddlebag. These bands are called *hatwa* and the technique used is weft twining: The weft, usually hidden in the weave by the closely-spaced warps, is here used on the surface in a bright, jewel-like tapestry pattern. Eagerly I watched Latifa work – so fast! – and then accepted her offer to try my hand at it, too.

Later we went upstairs to the walled roof, where Latifa and her sister had their spacious, sunny, perfectly equipped workshop. A beautiful long weaving, about 60 centimeters by 4.5 meters (two feet by 15 feet), was stretched between groups of reinforcing rods that protruded from the roof floor. Bright nylon ropes acted as tensioners between the rebar and the warp beams. Latifa stretched a loom remnant for us to practice weaving on, just as she would for a child learning the skill. The two sisters demonstrated spinning and plying, this time using a distaff, called a *ghazallah*, that they had made from a split palm branch.

The dyeing came next. Pots of dye were already cooking on propane burners. Iridescent crystals of maroon dye went into one pot; though the dye was synthetic, Latifa called the color *qirmiz* – in English, kermes – the name of a parasitic scale insect whose females have been used since ancient times to create a deep red dye. When the crystals dissolved, she started throwing into the 30-centimeter (12-inch) pot one skein after another of heavy, plied wool yarn. I couldn't believe how much yarn was crammed into that pot – something a Western dyer would be warned against. I asked Latifa whether she knew of a way to fix dyes to prevent bleeding when wet. The colors never fade and are very bright, she said, but "if anyone tells you they can fix the dyes, they're lying!"

Dyes are exported to Saudi Arabia from India, Kuwait, and other Arab countries; Latifa buys hers in the local *suq*. I asked about natural dyes, but the sisters didn't know of any. Indeed, in all my inquiries so far, I haven't found any women who still use them. Formerly the leaves, roots, stalks and petals of indigenous plants were used in Arabia to make dyes, and other natural dye materials – kermes, indigo, madder and cochineal – were imported. One can still find such things as dried pomegranate skins, lichens, and henna in the markets, but they are all used for other purposes than wool dyeing today.

Before we left, I begged Latifa to show me how she makes her heddles, a technique that had mystified me for years. Heddles are loops of string that are wound around a wooden rod across the warp; each loop hangs down to hold alternate warp threads fast. The weaver pushes the free set of warps down past the heddles, or pulls them up, creating the opening or shed into which the weft yarns are pushed with a stick shuttle. Latifa demonstrated the looping-in of an extra horizontal yarn to hold the loops firm along the heddle rod – a process I needed to learn. I also discovered, to my delight, a warping pattern I hadn't noticed before, for a design created by a pickup technique.

Pickup techniques make it possible to create more intricate patterns than the usual vertical or horizontal stripes. The horizontal stripes can be made to create checks or *numayla*, which means "little ants"; a pattern called *sinun*, or "teeth" can be created the same way. But Latifa's weaving had a small strip of a pickup weave called *drusa*, or "molars," and a strip of a pebbly pickup pattern called *al-wayrjan*, usually done in three colors and quite common in Bedouin weaving. Pickup weaves take a lot more work and time than stripes, and hence aren't as common. The sections of pickup weave are warped with a dark and a light yarn together in each heddle, acting as one. In the weaving, only one of them is chosen to create the desired pattern, the rejected one left to "float" at the back of the cloth.

On another trip, we found weavers at work in Ragayga, on the outskirts of the oasis city of Hofuf. Two women worked interchangeably on a *hijab* or tent ceiling, a long, narrow, brown sheep's wool piece about nine meters (30 feet) long and 75 centimeters (30 inches) wide. The weaving was staked into the sand with metal rods in a large empty space between buildings; the weaver sat on the finished weaving, the warp stretching out far in front of her in the sand. The fabric was fairly loose and felt elastic as I bounced my hand on its surface, but the warps, as always in this type of weaving, were made of tightly-plied yarn, strong enough to withstand the punishment of the weaving process as well as wear and tear on the finished product.

The weaver let me weave one pass of weft, but when I attempted to change the shed, she became impatient. Changing sheds is the most difficult part of the weaving, and takes skill and muscle. A new opening must be made after each pass by forcing the free set of warps up above the fixed or heddled warps, punching and pulling apart the resistant, sticky yarns.

A weaver selects her colors in a section of pickup weave, above. Opposite, a storage bag woven in a region that includes Saudi Arabia's northern Najd and parts of Syria and Jordan.

After the opening is made, the sword beater is placed into it vertically to widen it; the upper warps are then twanged upward with a hook beater to open them further. The weft is passed through and the sword beater is turned horizontally and beaten hard against the new weft yarn to secure it. The next shed is created by pushing the loose warps down past the heddled ones. This weaver used a hook beater she called a *qarin*, or horn, because gazelle horns were used for this purpose in the past. Hers was made from an eight- or 10-centimeter-long (3- to 4-inch) piece of heavy wire, hooked at one end and pushed into a wooden handle at the other.

Later that year, I convinced my husband to use his two-week semester break to continue our search for Bedouin weavers on the other side of the Arabian Peninsula. We decided to camp our way to the region of al-Jawf, in the north of the country near the Jordanian border. I had heard that there was a new museum there, and an amir interested in preserving the area's crafts. In his book *Traditional Crafts of Saudi Arabia* (See *Aramco World*, September-October 1987), John Topham mentions the pile weaving distinctive to al-Jawf and the weaving contest sponsored by the amir. I was eager to see for myself.

The road to al-Jawf turned southwest off the Tapline road, and immediately the countryside changed from drab to dramatic. Violet-gray peaks and rolling hills appeared as we dipped into a lovely valley, with roadside villages and some agriculture. The air was crisp and clear.

Our host in the town took us to Dar al-Jawf lil 'Ulum, the al-Jawf Sciences Center, newly built by the Abdul Rahman al-Sudairy Foundation. Over coffee and tea, the director explained the foundation's goals and projects to us, and confirmed that the amir sponsors a craft competition; some of the winning entries are placed in the local libraries and museum. He also informed us that the foundation plans to open a spinning and dyeing industry using local fleece. As we toured the elegant men's and women's libraries and the ethnographic museum, I asked if the local weavers used natural dyes; our guide enthusiastically described a springtime desert toadstool called *burnooq* which was used as a mordant and a dye, producing a variety of colors. He offered to take us to visit a woman who could answer all my questions about weaving.

Muneera is the matriarch of a large clan of settled Bedouins who live in a compound of large houses. After we drank tea flavored with thyme in the *majlis*, or living room, she brought me a weaving in progress, which she unrolled and explained. Its warp beams and heddle bar were still attached, as well as another transverse stick behind the heddle bar which keeps the warps in order. Then we were led through a shadowy courtyard and into an area between the buildings, where a group of tents loomed. Lanterns cast a soft yellow light on bright cushions and rugs, and on the hand-printed patterns on the lining of the canvas tent. Women lounged, spun or worked over small fires. Children played and an old man and woman sat nearby. Muneera's sister, Sabha, was knotting a pile rug with acrylic yarn on a ground loom. She proudly showed me how she did it and answered my questions, and other women showed us how they plied acrylic yarn on hand spindles to make it strong enough to be woven on such a loom, Bedouin-style. Plying is a constant activity among the women and girls in the compound.

The following day, I arranged another visit and was taken from house to house, tent to tent, happily consuming as much information as my hostesses could provide. I was impressed by the skill of the weavers and by the beauty of their work – including the acrylic pieces I'd seen sewn into cushions, a practical modern adaptation of Bedouin weaving. Though acrylic yarns are not hand-spun – only hand-plied – they can be washed, which contemporary locally-dyed wool can't. In the old days, there was so little water available to the Bedouin that washability of their weavings wasn't a concern; for settled groups today, however, there's plenty of water, and acrylic has an advantage.

As we watched that last day, Tarfa, Muneera's daughter, worked on a long runner on a ground loom in a gravel-covered yard. The warps were tied in bunches to keep them in order, and Tarfa worked some pickup designs as she went along. Instead of a gazelle horn, she used a metal hook for a beater that she called a *shisa*, and she showed me how to make one from a 15-centimeter (six-inch) iron tent pin. The sharp end of the pin is heated over the coals of a fire and bent, and the other end, looped into an eye, is padded with rags and yarn to make a handle.

She also showed me a beautiful fragment of weaving, this one too with its heddles and heddle rod still in place. The bright acrylic yarns contrasted beautifully with the black background, and when I asked if I could buy it, she gave it to me. Bedouin generosity is never-ending – and it continued throughout our stay in al-Jawf. From a modern villa some of whose residents had been educated in the United States, we were taken to visit a *bayt al-sha'ar* – a "house of hair," as the black Bedouin tents are known – whose owners were making the change from a nomadic to a settled life. We bought from them some beautifully woven camel trappings whose worn metal fittings spoke of real use, possibly by the groaning and snorting animals we could hear in the dark outside.

We left al-Jawf exhilarated by the hospitality there, by the antiquities and other sights we had seen, and by the gifts and purchases of Bedouin weavings. We are determined to return some day, for we've learned enough about Bedouin weaving in Saudi Arabia to know that there is much more to learn, and many more weavers to search for.

Joy May Hilden is an artist and teacher from California who has been weaving for the past 13 years. She now lives in Saudi Arabia and researches Bedouin weaving methods.