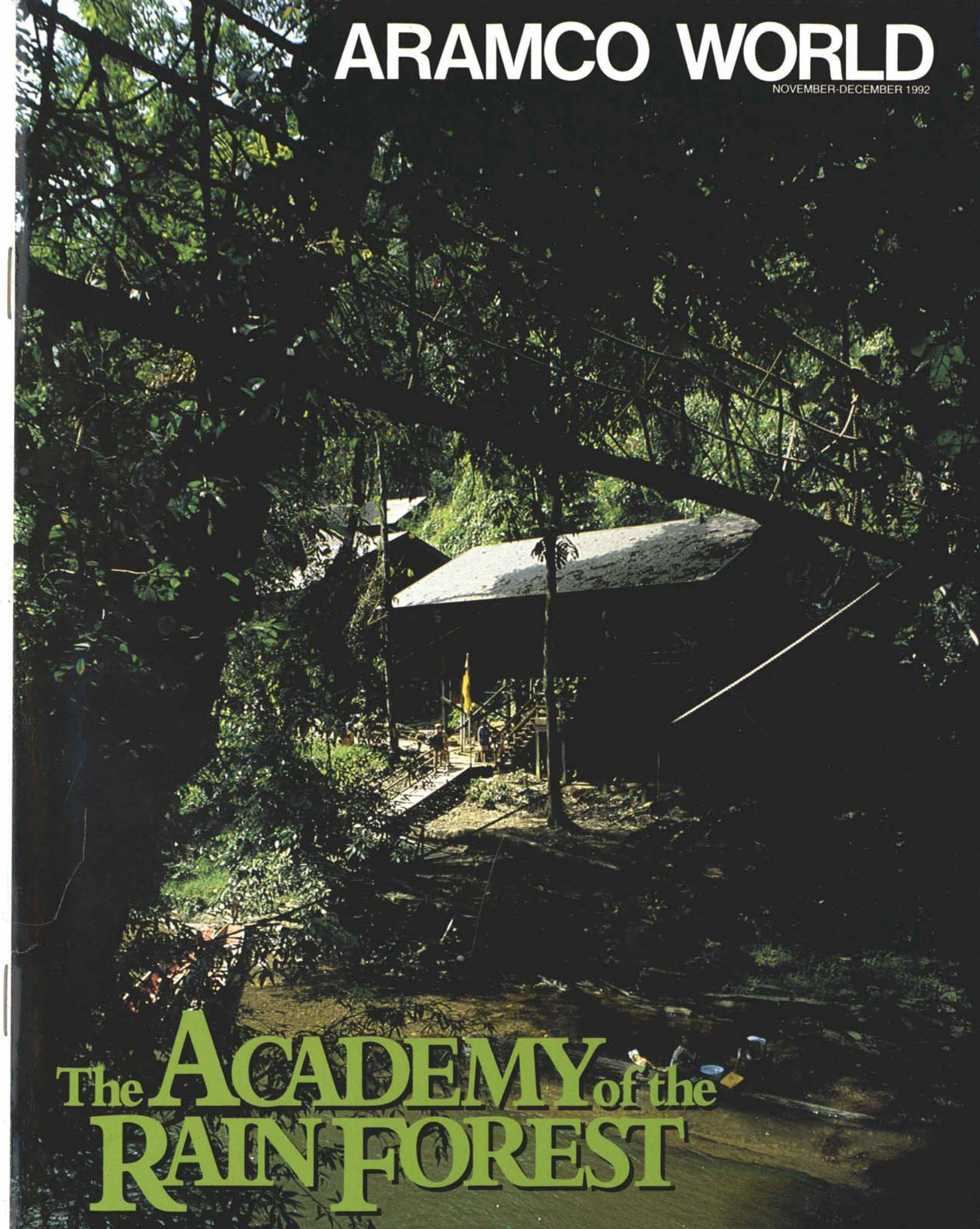
ARAMCO WORLD



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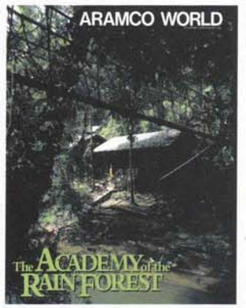

Cover: The rain forest and the river – one almost as wet as the other – surround the buildings of the Kuala Belalong Field Studies Center in Brunei, where an international scientific team works to study, understand and ultimately preserve a piece of the tropical rain forest. Photo: Tor Eigeland. Back cover: Striking mineral specimens and a pylon with a bilingual text introduce the science of geology and its early Arab and Muslim practitioners to Aramco Exhibit visitors. Photo: S. M. Amin.

◀ A weather station atop Bukit Belalong records the downpours.

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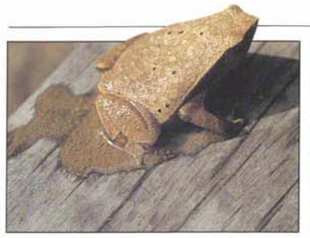

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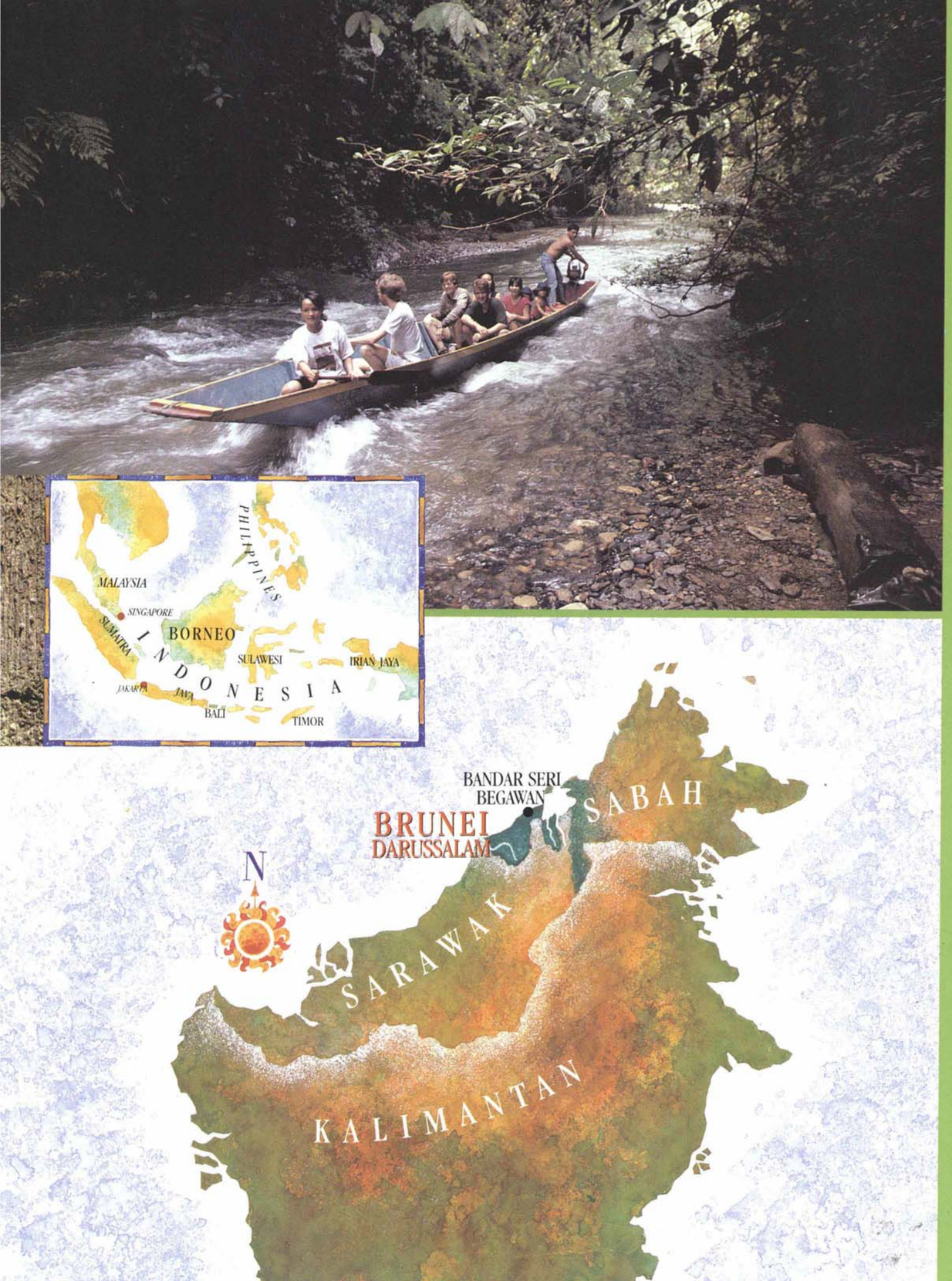
The world is green and beautiful and God has appointed you as His stewards over it. He sees how you acquit yourselves.
—*The Prophet Muhammad*

WRITTEN AND PHOTOGRAPHED BY TOR EIGELAND

The ACADEMY of the RAIN FOREST



During the autumn of 1991, a vast cloud of smoke hung over much of Sumatra, Malaysia, Singapore and Borneo. In parts of Indonesia, the sun was invisible. In Singapore, for months, people had trouble breathing when the wind blew the wrong way.

Destructive logging operations that dried out the land, and fires sometimes set as part of those operations, coupled with a four-month drought to produce blazing infernos, reaching 500 to 600 degrees Celsius (900 to 1100°F), in the forests of the Indonesian islands of Sumatra, Sulawesi and Kalimantan – the Indonesian part of Borneo.

Yet not far away, to the accompaniment of a symphony of unfamiliar wilderness sounds, I observed a large butterfly of exquisite beauty soar and glide in an unspoiled rain forest. Riding the air currents, only occasionally moving its transparent, black-dotted wings, this elegant, lovely creature seemed as unreal as its lush, otherworldly surroundings.

The setting was the Batu Apoi Forest Reserve in the Temburong district of the Muslim sultanate of Brunei, also on the island of Borneo. The State of Brunei Darussalam, as it's formally known – the name means Brunei, Abode of Peace – is a small country made up of two coast-and-jungle enclaves measuring 5765 square kilometers (2226 square miles) altogether, with a population a little over a quarter of a million. Although a regional power centuries ago, when it ruled all of Borneo and much of the Philippines, Brunei today is a tiny newcomer among nation-states, achieving its independence from almost 100 years as a British protectorate only in 1984. Best known for its oil wealth, the sultanate is also building a reputation as a protector of its natural resources.

Very few people, except for indigenous Iban hunters and, recently, a few respectful scientists, have ever set foot in this rain forest. Man has not yet managed to spoil the environment here, thanks to the conservation policies of the Brunei government. And because of westerly winds, this area was also largely spared the suffocating layer of smoke that last year engulfed much of Borneo and the neighboring islands.

Batu Apoi is a remarkable place. "Here," says Dr. David Edwards, a biologist from the University of Brunei Darussalam (UBD), "in an area 100 meters long by 100 meters wide [2½ acres], there are more than 550 trees with a trunk diameter of 10 centimeters [4 inches] and over, representing more than 120 different species."

Nigel Stork of London's Natural History Museum discovered 400 beetle species living in just *one* tree in Batu Apoi. Indeed, a single acre (4000 square meters) of tropical rain forest like this one can be home to about 20,000 different kinds of insects and 100 varieties of plants; a typical 1000-hectare area (2560 acres) may house 1500 species of flowering plants, 750 kinds of trees, 400 bird species and 150 varieties of butterflies.

In the middle of this virtually inaccessible reserve, UBD and Britain's Royal Geographical Society (RGS) have established what could be called an "academy of the rain forest." Its real name is The Kuala Belalong Field Studies Center and its initial phase – a partnership between UBD and RGS, under the patronage of the Prince of Wales – is called the Brunei Rain Forest Project.

"We're here to provide a scientific database that will allow UBD to manage the Center as its own preserve," said the Earl of Cranbrook, leader of the project, a biologist and an expert on Southeast Asian forests. "So we're coming to grips with certain basic elements of the biology and physical geography of the area, as well as putting in weather stations, rain-gauging – all sorts of things they're likely to need for future research."

Spaced along the Belalong River, with steep, forest-covered slopes rising on both sides, are six wooden chalet-style houses on stilts. From the air, their roofs are barely visible through the tree canopy; on the ground, they are joined by wooden walkways that prevent the vegetation from being trampled. The Center also includes a large laboratory, a computer room and a dining room where two cheerful Indonesian cooks, Yulis and Martinah, serve a variety of regional dishes.

The Center can be reached only by outboard-powered longboats expertly handled by Iban tribesmen. The boat trip involves maneuvering through 25 stretches of rapids, and can take anywhere from a dry half-hour, when the river is low and the skies are clear, to a very wet two and a half hours, amid roaring white water and a drenching downpour.

Above the river banks, trees more than 60 meters (200 feet) tall cling to topsoil that is mere centimeters deep. The river affords one of the few opportunities to view the giant trees from top to bottom since, once inside the rain forest's dense greenery, you can rarely see the treetops, and still less the sky.

The boat trip also offers a rare opportunity to feel the warmth of the tropical sun on your skin. Most of the scientists and students at the Center become fit as Gurkhas because of the physical demands of their work – but they remain paler than mid-winter Londoners in the gloom of the rain forest.

Here, struggling in the wet in a remote corner of a Southeast Asian island, it would be easy to lose track of the ultimate aims of this innovative, cross-disciplinary effort in the jungle: to educate the world about the value of the tropical rain forests, to study and to preserve them.

"The world's tropical rain forests represent one of the most fragile, most diverse, and least understood of all natural ecosystems," Britain's Prince Charles, patron of the project, pointed out at its inauguration. "They are also currently perhaps the most threatened."

And British Secretary of State for the Environment Chris Patten, now governor of Hong Kong, offered some good reasons why such biological diversity should be

Previous spread: Danish botanist Carlo Hansen, exploring the Batu Apoi Forest Reserve, inspects the enormous buttress roots of a rain-forest evergreen. Such roots stabilize the tall trees in shallow topsoil. Facing page: Skimming Kuala Belalong's shallow water, scientists in an Iban longboat set out for their study sites. Above: New growth soon springs from the rotting wood of a fallen tree.

protected: "Species of plants and animals are disappearing fast, some of them before we have even registered their existence. As natural products have been a major source of medicines and pharmaceuticals, we should be investigating the other shelves in the larder, rather than sweeping things off them."

In fact, about one-quarter of the prescription medicines on the market today are derived from plants, but less than one percent of tropical rain forest species have been examined for possible medicinal value. Seventy percent of plants identified as useful in the treatment of cancer are found only in rain forests – which are being destroyed worldwide at a rate of 32 hectares (80 acres) every minute.

The floor of the Batu Apoi rain forest is crawling with life: leeches, millipedes, centipedes, scorpions, ants great and small, yellow-throated king cobras and pit vipers – as well as the sodden Ph.D. students and full-fledged scientists who bravely attempt to conserve them.

Snakes, though very abundant – and welcome as a good indicator of undisturbed rain forest – mostly keep out of sight. The leeches, the wetness, and the steepness of the terrain are the scientists' biggest problems.

Straight-and-level walking is impossible here; there is hardly a straight or level stretch anywhere within the 50 square kilometers (20 square miles) of the reserve. You climb, slip and skid along the forest slopes in a strange twilight broken only by rare shafts of sunlight where a giant tree has crashed to the ground and left a temporary hole in the forest canopy.

Although the Equator passes across the island of Borneo just four degrees south of Brunei Darussalam, there is no intense heat in Batu Apoi: Temperatures hover in the 30's Celsius (around 80°F). But there is 100 percent humidity, and any physical effort is enough to make the sweat glands pump furiously. Even without rain, one is constantly dripping wet – hair, glasses, instruments, cameras are all wet. Clothes never seem to dry out.

Perhaps the wettest of all the scientists is Alan Dykes, a tall, lanky Ph.D. candidate and physical geographer from the University of Bristol in England. On the go day and night, Dykes's task is nothing less than finding out what rain does to the rain forest – specifically, what it does to the topography and drainage patterns of the area.

One of his studies is a perfect hands-on lesson in what happens to rain-forest soil when it is disturbed. On a slope, Dykes fenced in with solid timber three plots of jungle, each 2½ meters by five meters (eight by 16 feet), in order to create controlled areas.

In the first plot, he cleared out all the living and dead plant matter on and in the soil, leaving just bare earth. In the second, all the loose leaves and branches were taken out, leaving behind just roots and soil. In the third, he left the ordinary forest floor undisturbed – rotting leaves, roots, everything.

After a heavy rain, we went to observe the results. From the first cleared plot, a large bagful of sediment, so heavy we could hardly lift it, had washed out into a measuring device. From the second area, not nearly as much topsoil had been lost. From the third, only a large fistful of soil had been washed off, demonstrating that leaves and roots are perfect protection for the scarce few centimeters of topsoil that are both characteristic and essential in a rain forest.

After those precious five to 10 centimeters (two to four inches) of topsoil are gone, absolutely nothing grows in the underlying clay or on the rock below. Dykes's experiment makes it clear that logging, unless carefully controlled, would eventually make a desert out of such an area. An estimated one billion people around the world are now suffering the effects of this kind of exploitation in terms of lost water resources, homes, food, fuel and other raw materials.

Dr. Joe Charles of the Department of Biology of UBD, assisted by Samhan bin Nyawa, warden of the Field Studies Center and expert woodsman, studies the distribution and abundance of mammals and birds in the forests at Belalong.

"We cover the whole range of animals," said Charles. "Mouse deer, Bornean gibbons, langurs, civets, sun bears, barking deer, hornbills, giant squirrels, pheasants, pigtailed macaques – whatever large animal happens to come our way."

I told him I didn't see any animals in the forest – I just heard things. "You have to be there at first light," said Charles. "Sometimes you just need to sit still at some vantage point. Yesterday I saw a barking deer just 10 meters [30 feet] away from me. It came right up, not knowing I was there. It was a beautiful male, lovely horns. Suddenly it stopped in its tracks. It began to clack its teeth – an alarm call. Abruptly, it bounded away, barking. Then it stopped and roared, and shot off."

Another striking animal here is the giant squirrel, about one meter (three feet) long from nose to tail-tip. Flying lizards are also common. Said Charles: "The lizards are very cryptic – the same color as the bark of a tree. You'll never see one unless it moves. It has two sheets of skin between the forelegs and hind legs which it uses to maneuver in the air when it launches itself from a high place to lower ground."

From the cat family, there are the marten, the Malay weasel and the clouded leopard, which is on the endangered species list. And there are monkeys – invisible in the canopy but very audible.

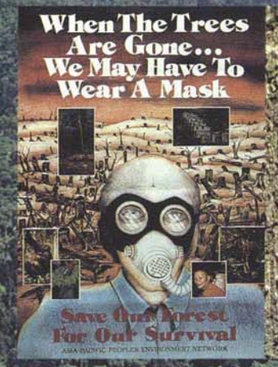
Carlo Hansen, intrepid curator and researcher from the Botanical Museum of the University of Copenhagen, is there to study the taxonomy of Melastomataceae, a plant family better known as the Singapore rhododendrons. Wearing shorts and a beat-up pair of old sneakers without socks, clinging to roots, trees and lianas, Hansen climbs straight up and down the slipperiest of slopes searching for plants. While his colleagues

Above: The red-sided sticky frog's glue-like skin secretions may dismay predators who sniff or touch it before they pounce. Facing page: Myrmecologist Ruth Levy of Oxford University crosses the Gurkha-built "Burma Bridge" as she returns from her ant studies in the field. Next page: Heavy overnight rains swell a tributary of the Belalong.

TREES and ISLAM

Trees cover a third of our earth. They regulate climate, protect water supplies, nurture millions of species of animals. They soak up carbon dioxide and other gases and, therefore, maintain a natural balance in the world's temperature and climate.

Today, tropical forests in many regions are being cut for timber or to provide extra land for cultivation. Large areas are being cleared to be turned into pastures for cattle in order to export their meat to meet the demand of other countries. The situation has become so desperate that the United Nations Environmental Program, working closely with other United Nations agencies and international environmental organizations, called for eight billion dollars to be spent on its Tropical Forestry Plan, which works to reconcile economic needs with conservation.



Islamic legislation on the preservation of trees and plants was laid down some 14 centuries ago, and covers not only forests but also wildlife. According to these laws, certain areas, called *haram* or *hima*, are set aside and protected. This code of ecological conservation has its origins in the life and sayings of the Prophet Muhammad. One of the latter, reported by Bukhari and Muslim, the most reliable compilers, states that "Whoever plants a tree and looks after it with care, until it matures and becomes productive, will be rewarded in the Hereafter."

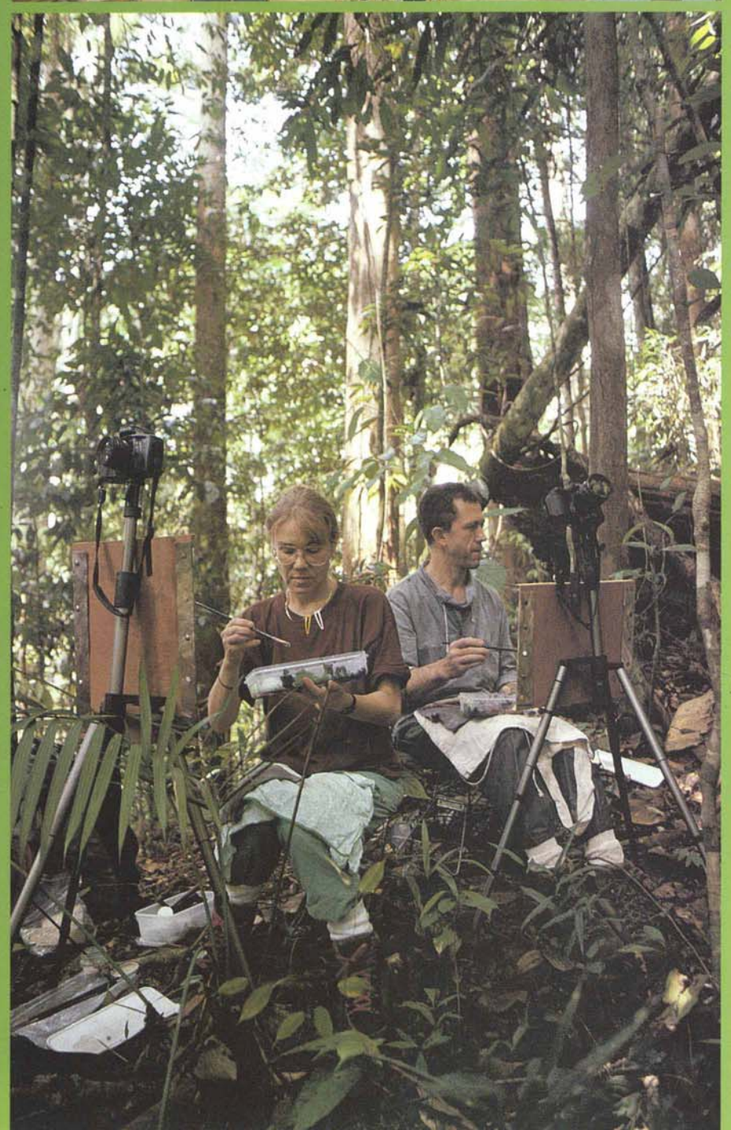
The Prophet also declared the uncultivated trees in and around the holy cities of Makkah and Madinah to be protected.

Early Muslims understood and respected such legislation. Tabari tells us that Abu Bakr, the first Caliph after the death of the Prophet, instructed troops he was sending into battle, "Do not cut down trees, and do not kill animals except for food" in enemy territory.

In later years, Muslim lawmakers based the Islamic legal system on such decrees, and formulated similar laws covering, among other things, the conservation of forests, prevention of over-grazing, and the protection of water resources and animal rights.

Adapted by permission of Sterling Publishing Company, Inc. (387 Park Avenue South, New York, NY 10016) from an essay by Al-Hafiz B.A. Masri in Islam and Ecology, *edited by Fazlun Khalid with Joanne O'Brien. (London, Cassell, 1992, ISBN 0-304-32377-2).* © *1992 by World Wide Fund for Nature. Masri is the founder of the Muslim Association for Animals and Nature.*

Above, a poster from the Asian-Pacific People's Environment Network underlines one reason to treasure trees. At left, top to bottom, a caterpillar, a gleaming leaf of the philodendron family, an orchid and an unidentified rain-forest flower.



wear boots and long trousers tucked into socks for protection against leeches, Hansen prefers just to pull the leeches off.

"There are," said Hansen, "perhaps 50 species of Singapore rhododendron in the area. It never ceases to amaze me when I return to the jungle how few flowers one actually sees. You know the place is teeming with life, but 99 percent of it you cannot see. Most of it, of course, happens up in the canopy. That's another world."

Another scientist, Dr. Kamariah Abu Salim of UBD, is working with tribal medicine men to extract and record some of their wisdom before it is lost. "The Malay people still use traditional medicine," she says, "but the Iban, the people of the rain forest, now just go to the hospital, since it is effective and free. One has to be very careful in such situations or irreplaceable information gets lost."

So far Abu Salim and her informants have identified 162 plants with nutritional or medicinal uses. "I've brought with me medicine men from three different tribes," she said. "They just walk through the forest and say, 'Oh, this is the plant we use for so-and-so.' And we collect it. Then they give me the local name. So far I've collected more than a hundred species of plants that haven't yet been classified scientifically on a species level, but only identified on that indigenous level."

Dr. David Edwards of UBD, deputy director of the Brunei Rain Forest Project, is doing a survey of ferns in the Belalong area: "We have something like 400 different ferns in Brunei and about 250 in Belalong. So far there are about four species I cannot identify, so there's a good chance those are new."

Edwards's fascination with ferns is easy to understand. "They're an ancient group, about 350 million years old. They have outlasted just about everything. They were there before the great cycad forests of the dinosaur era, which gave way to the flowering plant forests we have in the tropics now. The ferns successfully lingered on in dark and damp areas – the latter restriction because ferns need free water for their sperm to swim through."

As the scientists worked, two artists were recording remarkably life-like images of the rain forest. But the one thing their paintings could not capture was the amazing sounds of the forest.

At dawn every morning, amid myriad sounds from near and far, the voice of one lonely bird caught our attention, as it attempted a simple melody that it never seemed to complete. Trumpet-like blasts from a type of cicada began soon afterward, while others whined like high-speed chain saws. Other insects just whirred on anonymously. Throughout the morning, unseen gibbons whooped and screeched from the treetops, while punctually every evening, the "Six O'Clock Cicada" let its presence be known – just before the hour.

What are the Center's findings at this stage? "Most of our findings so far are fairly superficial," said David Edwards. "They're limited to things like unusual plants and animals. The more scientific findings will come from the longer-term studies: Things like Colin Pendry's study of nutrient cycling and Alan Dykes's study of water run-off and hydrology. That's going to be more important in the longer term, and that's the sort of work we want to encourage in the future – rather than pure survey work. These people will remain associated with our university after the short-term study is over."

Another highly sophisticated new tool will ease the task of future visiting scientists: John Wills and Kam Tin Seong have set up a computer-based Geographical Information System – a way of putting all the accumulated information onto one map.

"First we enter all the topographical data," Wills says. "Then, overlaid, come all the other facts from the scientists about soil, vegetation, climate, animal life and so on. This means that the next line of scientists will be presented with all the groundwork – and their own work will be added in turn."

The University of Brunei Darussalam is now developing its own research plan for the next 10 years, involving scholars from all over the world.

"What we want to do is to create a major international center of excellence for rain forest research and education," said Professor Sharom Ahmat of UBD. "The Sultanate of Brunei will ensure that there is no human encroachment in the area, and [the Field Studies Center] is going to be adjacent to the national park that will now be created here."

Another task is to win the support of Bruneians themselves, who generally have little interest in their forest. Already, though, groups of about 14 Bruneian schoolchildren at a time make their way to the Center four days a week, accompanied by teachers. They are taken on trails through the forest where the wonders of nature are pointed out and explained to them. At stops along the way, they make drawings and do other projects.

Outfitted with life jackets, the children are also taken upriver in longboats. "From the reports we have been getting back," says Catriona Prebble, Brunei project officer of the RGS, "it seems to be extremely popular, and the camp is booked up for ages! The children seem to be enjoying themselves thoroughly, as well as learning, which is very encouraging."

In light of the unrestrained destruction of rain forests in many countries around the world, I asked Lord Cranbrook whether he saw any impending threat to the Brunei rain forest around us.

Said he: "Quite the reverse. The Sultan's government has declared its firm intention to dedicate the whole of this Upper Timburong Valley, including the Belalong Valley, as a national park. This means an area of over 50,000 hectares [almost 124,000 acres]."

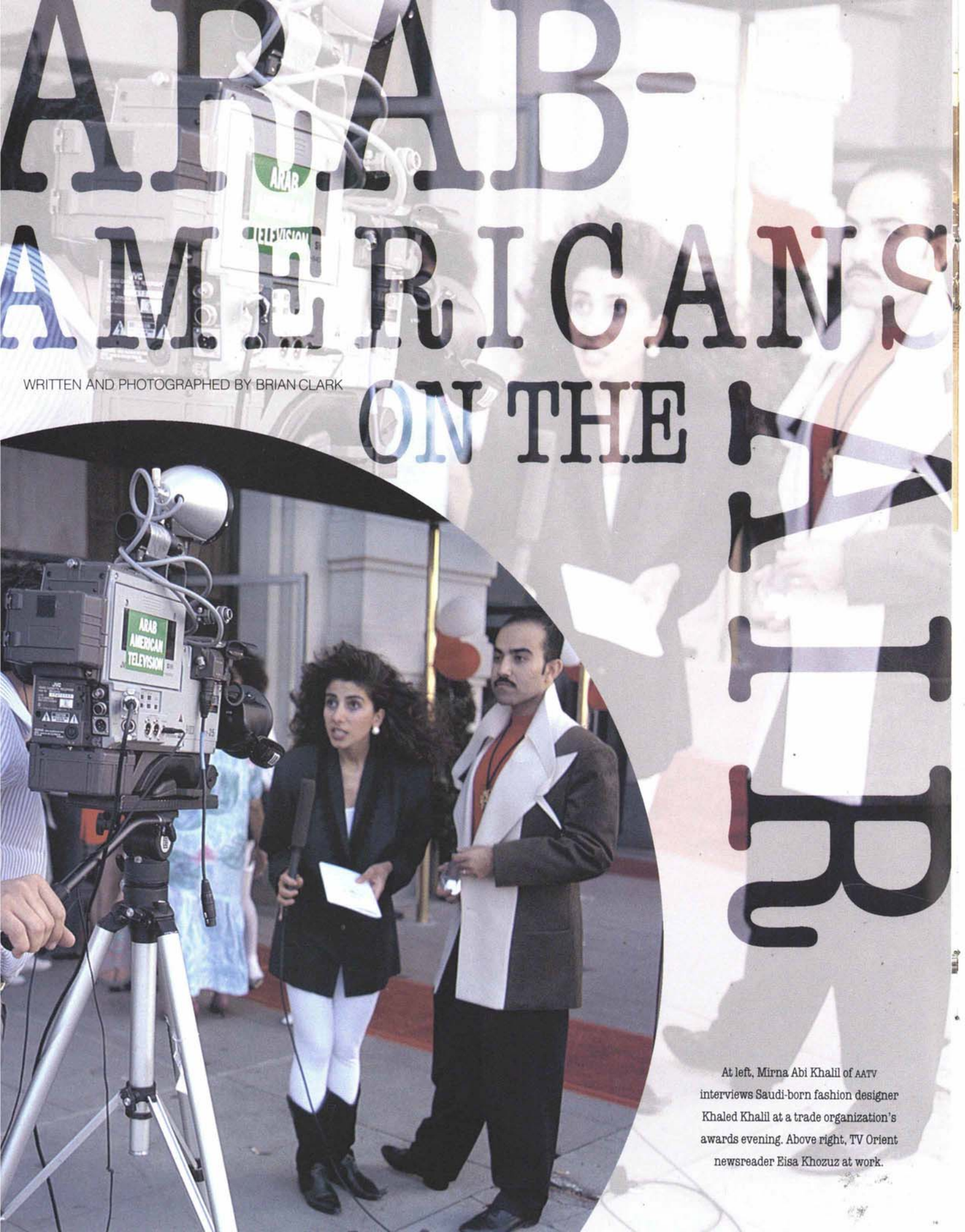
But the protection of the rain forest is necessarily a long-term project. Perhaps, among the schoolchildren now visiting the "academy of the rain forest," there are future leaders of Brunei who will carry on in the same vein. Clearly, the more they – and we – learn now about the rain forest and its ecological role, the better the chances that future generations will be able to assure its long-time survival.

Photojournalist Tor Eigeland, a long-time contributor to Aramco World *and now soon to be a father, is based in London.*

Facing page, left: Alan Dykes installs an instrument to measure automatically the height of the Belalong's waters. Facing page, top: Ethnobotanists Kamariah Abu Salim (left) and Junaidah Abu Bakar work in a UBD laboratory with extracts prepared from plants identified by tribal medicine men. Facing page, right: Artists Leslie and Fionnuala Boyd paint the scenery of the rain forest.

ARAB-AMERICANS ON THE AIR

WRITTEN AND PHOTOGRAPHED BY BRIAN CLARK



At left, Mirna Abi Khalil of AATV interviews Saudi-born fashion designer Khaled Khalil at a trade organization's awards evening. Above right, TV Orient newsreader Eisa Khozuz at work.

At four in the afternoon, every Saturday, at the Said Al-Asha home in suburban Los Angeles, everything stops. That's when the Arab-American Television program airs on Channel 18.

Family members cluster around the set and soak up local and international news, a feature on an Algerian musician and a short segment on a Saudi-born student who has won a prestigious Southern California design honor.

"My family waits for it," says Al-Asha, a Lebanese businessman who has lived in Los Angeles for 21 years. "We plan our lives around it. I would go so far as to say that we would be lost without this program. It really is super."

The Al-Asha family isn't alone in its attraction to what is known locally as AATV. The program started 10 years ago, the brainchild of Wahid Boctor, a former Egyptian architecture student and documentary-film maker; today, in addition to the Saturday show, Boctor also produces a daily cable program that airs in more than 300 localities around the United States on the International Channel.

Around the country, many other Arabic-language and Arab-American radio and television programs are equally popular – especially with more recent immigrants, says Faris Bouhafa, public affairs director of the Arab-American Institute in Washington, D.C. In Detroit, promoters say "TV Orient" is watched by tens of thousands of Arab-Americans. Though different programs entirely, Chicago and Boston both have shows called "T.V. Arabic Hour." And – in what is probably the most extensive Arabic-language programming in the United States – the Time-Warner Cable Network in the New York boroughs of Queens and Brooklyn broadcasts Arabic-language news, features and soap operas at least 10 hours a day on Channel 62. A number of smaller American cities with Arab-American populations also have their own local cable programming.

Bouhafa calls these programs "an important link for many people to their former homelands. Format and quality vary," he says, "but these shows satisfy an urgent need. The Arabic radio station here in Washington carries the BBC's Arabic-language news broadcasts, very extensive and in-depth. For immigrants here who are interested in politics, it is a must."

Norman Kiminaia, who founded Detroit's "TV Orient" five years ago, says he started the program "in response to a desperate need. We did a survey that showed that the Arab community needed a program that would cover everyone."

TV ORIENT

Kiminaia, who likes to interview local politicians, has a programming mix of news, features, educational offerings – and even some Egyptian soap operas – in a format that is 60 percent in Arabic and 40 percent in English, and that reaches out to a Detroit-area Arab-American population that he estimates at more than 250,000.

"Our philosophy is simple: We want to have good ethnic programming and keep our community informed. We have ties with some 20 Arab-American groups, from the Lebanese to the Yemenis to the Iraqi Chaldeans," explains Kiminaia, whose program is supported by memberships and advertising.

"We have viewers who are recent immigrants and people whose families have been in the US for generations. We appeal to all, and I think a majority of the Arab-American households in the Detroit area watch us," he says.

Though Kiminaia says "TV Orient" has the most air time in greater Detroit, that region, with its large Arab-American population, also has several other Arab-American television programs.

In Chicago, the program for Americans of Arab descent is the "T.V. Arabic Hour" on UHF Channel 13. According to Mufid Halawa, the program's Palestinian-born executive producer, the current program was started about six years ago after a previous effort failed.

"I was president of the Council of Arab Americans of Chicago at the time and we felt the loss," he says. "It seemed all the other ethnic groups had their programs, but we didn't."

Backed by advertising and shares sold to members of the local Arab community, the program was launched using a broad format of cultural, social, and political and entertainment news – and with an all-volunteer staff, says Palestinian-born Halawa, who earns his living as an importer.

Today, the program airs from 3:30 to 4:00 p.m. on Saturdays in Chicago, but it is also broadcast in the same time slot by Channel 69 in South Bend, Indiana, Milwaukee's Channel 65, and Channel 33 in Rockford, Illinois. The cities form a triangle more than 200 kilometers (125 miles) on a side.

"In our four-state area, we figure there are 200,000 Arab-Americans, with some 120,000 of them in Chicago," Halawa says. "So our news focus is regional. We also want to appeal to the whole family, so we have 30 percent of the program in English, for the younger people who might not speak Arabic.

"We are proud of our program. We have segments from lawyers and doctors from our community who give their time. We try to make it as interesting and useful as we can for our people," Halawa says.

In the Boston area, people with an interest in the Arab world tune in to Channel 27 on Sundays from 9:30 to 10:00 a.m. to watch "T.V. Arabic Hour." It is run almost entirely by volunteers and has been on the air for more than a decade.

Rather than being directed exclusively at Boston's Arab-American community, this program is aimed at the general public too, says Evelyn Menconi, who does educational and cultural interviews.

"We have news from the Middle East, the Arab-American communities in our region and things that might affect people's lives – like immigration controversies. We try to give a balanced and fair picture. But we also have fun, and we entertain, with celebrity interviews, for example, and segments on Arab cooking," says Menconi, a Lebanese-American.

"Our show is almost entirely in English, since we think most Arab immigrants do speak English well enough to understand. And they love it, especially the music. But we want the broader public to be able to watch and learn from this program, too," she says.

John Zogby, president of a New York research group and an expert on Arab-American demographics, says Arab-American television programs "are most often an effort by members of the immigrant group to stay in contact with their original culture."

Zogby, who helped AATV's Boctor syndicate his program on cable television on the east coast, says most of the programming has a similar format of news, entertainment, and interviews with Arab figures of interest in the United States.

"The programming tends to be pan-Arab in its outlook. One day there could be an interview with a Maronite Christian leader from Lebanon, the next day with a director of the Palestine Liberation Organization," he says.

"These programs are a living link with Arab culture. And the most successful ones are those that are pan-Arab," he says. "I've found that even recent immigrants are willing to listen to most sides of an issue. And programs that represent the whole Arab community do the best business-wise, too," he says.

Zogby finds the pan-Arab approach encouraging. "Because the programs tend to open their doors to everyone, it makes it possible for diverse sides to be heard. So, besides being an excellent bridge for people in a new land, this acceptance of different ideas could give a little hope for Arab unity," he says.

Though there are many small newspapers around the country that are aimed at Arab-Americans, Zogby says that television is often the most direct connection to immigrants.

"This is partly because television is quite developed in the Arab world, and they are familiar with it. Also, you tend to find that the people running these programs in the US are often from those Arab countries where television is most developed. The video techniques and the production values are quite sophisticated. It can be impressive," he says.

For Al-Asha in Los Angeles, it is the news that he waits for. "I like to know what is going on in Southern California and the Arab world. This station gives me news that I want and that I don't think I could get anywhere else," he says.

"For my mom and my sisters, I think it is the music and the entertainers they like the best. I like the interviews with Arab officials, but the program has different things that appeal to all of us. For my mother, who doesn't speak English too well, AATV is her life-line to the outside world," says Al-Asha.

Though Al-Asha generally gives AATV high marks – especially for its coverage during the Gulf War – and calls its programming fair and impartial, he says that he sometimes thinks it is "too fair."

"During the war in Kuwait, AATV got news directly from Arab nations that wasn't broadcast anywhere else in the US. That coverage was fantastic and I think it earned the program a lot of respect. But sometimes I don't agree with the people on the programs."

For AATV founder Boctor, stirring up a little controversy now and then is part of his duty as a television producer and journalist. "I am independent and obliged to no one but the people who watch my program. I don't do propaganda. I want to give them news and features and advertising they can't get anywhere else," he says.

"Some people, especially the newer immigrants, are surprised that we can be so open and cover both sides of an issue. Sometimes they are shocked by the questions we ask. But that's okay," he says.

On a typical program, Boctor might have interviews with Saudi government officials visiting California, a film clip of Egyptian President Hosni Mubarak addressing his country's People's Assembly, or news about a famous Lebanese singer who is to perform soon in Los Angeles. Many of the segments are filmed on location in that city or at the station's modest five-room studio in Hollywood.

When Boctor arrived in Los Angeles 15 years ago, he had no television plans. Rather, he was headed for the University of Southern California to get a doctorate in architecture. Soon, however, he grew bored and switched to Loyola Marymount University, where he eventually earned his master's degree in film and television.

"Don't you agree that film and television are more exciting than architecture? You can do so much more, no?" asks Boctor with a twinkle in his eye.

After receiving his degree, Boctor worked on the highly acclaimed film *Being There*, starring Peter Sellers. He also made several documentaries, including one on the Southern California way of life called *California Dreamin'*.

Around 1980, he got the bug to produce his own television program aimed at Arab-Americans, of whom he estimates there are more than 300,000 in Southern California alone. Nationally, according to the Arab American Institute, there are between 2.5 million and 3 million citizens who consider themselves to be Arab-Americans (See *Aramco World*, September-October 1986) – a figure that includes both the most recent immigrants and those whose families have been in the United States for generations.

"I wasn't always happy with what I saw on domestic television. In fact, I was frequently disappointed with the portrayal of Arabs," says Boctor. "Unfortunately, the American media still tend to stereotype Arabs as either rich shaykhs or terrorists. As an Egyptian, I knew that it wasn't true. I also saw that there were so many Arabs here in Southern California who were my potential market.

"I thought to myself, 'I can make a program for these people and represent them as they are – proud to be Algerian, Saudi, Lebanese or whatever.' I figured that if I could represent all these different communities fairly, it would work," he says. "And I still have that same philosophy. If my program helps people to be proud of being Arab-Americans and proud of their heritage, than I am happy. I don't emphasize Palestinian or Jordanian or Moroccan. Though it is sometimes splintered by nationalities and religions, we are part of one large community." Boctor estimates that he reaches at least 200,000 of the Arab-Americans dispersed throughout Southern California.

"Through AATV, we bring Arab-Americans together. We don't try to change people – that would be expecting too much. But we can help newcomers adapt to what seems to many to be a strange land."

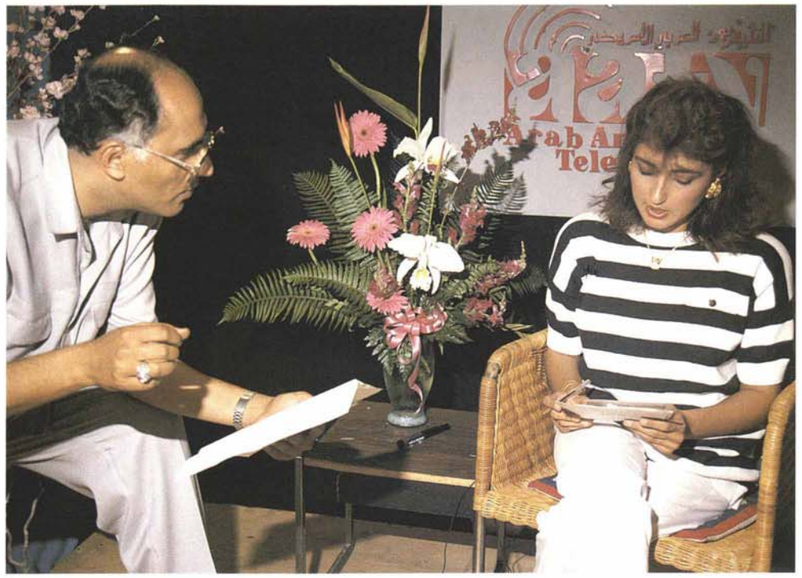
Boctor started his efforts in his own apartment with the help of a few volunteers. He had almost no overhead.

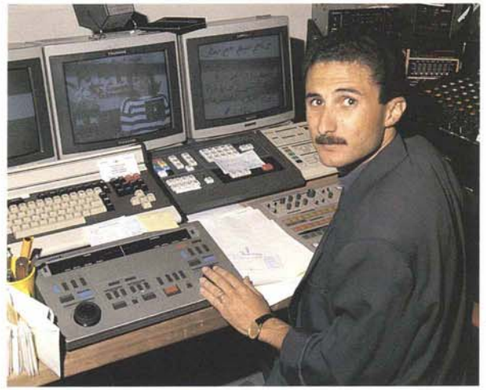
"We had to prove ourselves. We had to earn the respect of the community. We nearly closed down three or four times, for financial reasons, but we earned that all-important respect. Because of that, things have clicked," he says.

Eight years ago, a key donation helped keep the program afloat and made an expansion to a one-hour format possible. "For that help we are still extremely grateful," Boctor says.

One of the early AATV volunteers was Mona Ibrahim, another Egyptian emigré who saw one of the first programs when she was channel-cruising around the television dial.

"I heard Arabic and saw that this was a local program," says Ibrahim. "I called the station and told them I would do anything to help. I sold ads. At times, it was just stubbornness that kept us going."





At AATV's studio in Hollywood, program coordinator Mustafa El Deeb goes over a script with newsreader Maram Fakhouri (above) while producer Hadi Khalil (right) waits at the control panel. On facing page, the program's founder, Wahid Boctor, discusses plans with associate producer Mona Ibrahim.

Ibrahim, who is now an associate producer and program host, is one of a staff of 15, nearly half of whom are volunteers. All are Arab-Americans, and their homelands cover most of the map of the Arab world.

"Gaining the trust of the community took four years. People also came to see that the program increased business activity," says Ibrahim, who handles the station's finances. "The advertising gained credibility because it worked."

Support for community concerns was also important in establishing AATV's credibility, and it continues. Last month, for example, the program ran a four-hour telethon to raise funds for victims of Egypt's October earthquake. Film and television stars from Egypt took part, as did the country's Los Angeles consul-general.

Roughly 80 percent of AATV's program is produced in Arabic, with the remaining 20 percent in English. That language split causes some problems between the generations of Arab-Americans, Boctor says. "Those who have been here for several generations, and can't speak Arabic well, wish we had more English. And those who are new immigrants, well, they wish it were all in Arabic."

The program tried subtitles for the programming, but found they were too expensive, Boctor explains. Much of the advertising, especially commercials for restaurants and doctors, is in English.

Boctor, who says his job description is "making sure things get done right," also hosts political interviews on the program, usually with Arab diplomats and officials who come through the region. Some of them seek out the station beforehand, because they value the access it gives them to the Arab-American community.

The Gulf War was a particular test for AATV. Boctor worked hard to maintain the program's impartiality – harder, he feels, than mainstream television. "I think much of the US media's coverage was superficial and even inhumane toward Arabs. We were one of the few programs that gave Iraqi casualty figures, and showed the carnage of the war," he says.

"For our coverage, we interviewed the Kuwaiti ambassador and the Consul-General of Saudi Arabia. But we also talked to the Iraqi ambassador, and we interviewed people on the street about their feelings."

Says Ibrahim, "We go into the community to talk to people about their conflicts and problems. We sponsored conferences during the war about people's concerns, and we were one of the first stations to report harassment of Arab-Americans by the FBI, something which was later denounced by President Bush."

Certainly not all of the programming is hard news, however. The station also brings in entertainers from the Middle East for performances; the national days of 22 Arab lands are celebrated on the program; and during Ramadan, special music is played.

"Once a woman called me up and cried over the phone," says Boctor. "She said, 'You make me feel like I am back in the country of my birth – and I miss it so.'"

Amer Assoum, a Los Angeles waiter and business-administration student born in Lebanon, doesn't get emotional when he tells why he likes AATV.

"I just enjoy being able to watch an Arabic channel. I couldn't get this kind of information anywhere else. Not the news, not the ads and not the entertainment," says Assoum.

For Dikran Khanjian, a Los Angeles jeweler who was born in Syria and lived in Kuwait and Saudi Arabia before coming to the United States, one of the best things about AATV is "that it doesn't take sides.

"That neutrality is important. The program covers many aspects of life from the arts to politics to news from the Arab world. It is a tough job for [Boctor] and his crew, but I think what they produce is encouraging," says Khanjian.

Maha Akeel, a Saudi Arabian, says she enjoys the music and community services as much as the news. Her praise could apply in equal measure to Arab-American programming all over the United States.

"Not only does it keep us in touch with what is happening in the Arab world," she says, "but it also lets us know what is going on in our own community. That's quite an accomplishment."

Brian Clark, a frequent contributor to Aramco World, *free-lances from his base in Washington state.*

"touch, think and explore..."

The Discovery Principle

WRITTEN BY ARTHUR CLARK
PHOTOGRAPHED BY S. M. AMIN

ABDULAZIZ ABDUL LATIF

"This museum's cool. It has ***action***."

Zi-Zi Udezue, fourth grade

GEOFF GRAHAM

Former British prime minister Margaret Thatcher was among the Aramco Exhibit's high-ranking visitors. The museum's principles were outlined for her by Ismail Nawwab of Saudi Aramco Public Affairs.

Business is booming at the Aramco Exhibit, a unique, high-tech museum near Saudi Aramco's Dhahran headquarters that dramatically tells the story of the petroleum industry in Saudi Arabia and spotlights, as well, some of the Muslim world's technological heritage. Five years old in October, the Exhibit receives tens of thousands of visitors a year – especially school children and families, the latter particularly during the Muslim holidays of 'Id al-Fitr and 'Id al-Adha.

But museum guests also include a fair number of VIP's, for the Exhibit is often on the itinerary of international visitors. Margaret Thatcher, former British prime minister, and Daniel Yergin, author of *The Prize*, the Pulitzer Prize-winning history of the oil industry, are among recent explorers at the Exhibit – and like the families, many of them want to come back again too. Wrote Thatcher in the museum guest book, "A truly wonderful exhibition. I hope to return to view it more fully...."

Just what's the Exhibit's pulling power?

For one thing, it uses state-of-the-art technology to intrigue, involve and educate visitors. Its repertoire includes interactive computer games and a variety of ingenious hands-on displays.

For another, the Exhibit holds unique material, including rare film footage of historical events. Its location, in one of the world's most important centers of oil production, is also first-rate, with Saudi Arabia's 1938 discovery well just a kilometer (1100 yards) away and Saudi Aramco's cutting-edge Exploration and Petroleum Engineering Center another kilometer beyond that (See *Aramco World*, May-June 1988).

Most important, however, the Exhibit boasts at its center an eye-opening series of displays that its founders say make-up the world's finest museum presentation of the contributions of medieval Muslim scientists to humanity.

Colorful museum catalogs, available at the entry, go straight to the point of the Exhibit: It is meant to be "a place for joyful learning, ... a caravansary for the curious," revealing secrets about the past, the present and the juxtaposition of the two.

That theme is reinforced at the museum's orientation display. Press a button, and a voice invites you – in Arabic or English – to "touch, think and explore," and then gives a sample of what lies ahead: "Turn a wheel to open a pipe valve, or operate a drill bit. Watch a video program about photosynthesis, or take a computer quiz on how objects float. Pump water in the fashion of 13th-century inventors, investigate ship shapes and create a sound wave," says the narrator. "You'll be surprised by your discoveries."

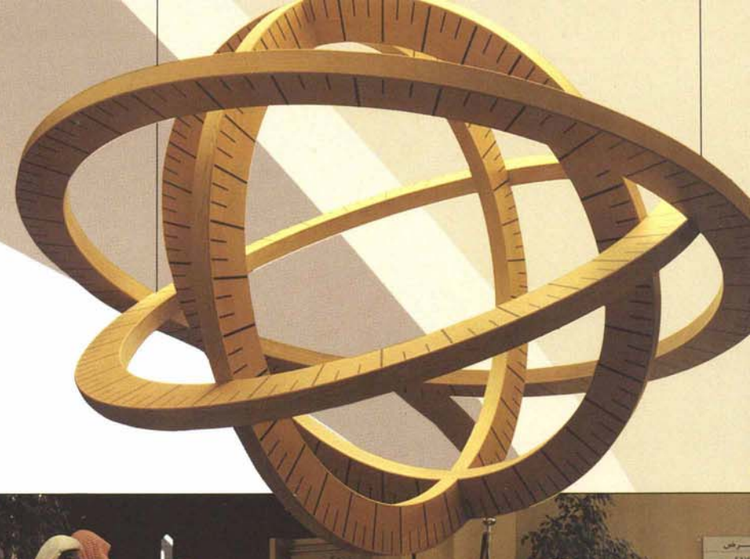
The museum operates on the principle of discovery common to facilities around the world that share its teaching mission. The Smithsonian Institution in Washington, the Lawrence Hall of Science at the University of California at Berkeley, the Exploratorium in San Francisco, the Museum of Science and Industry in Chicago, the Deutsche Museum in Munich and the British Science Center in London all opened their doors to help Aramco Exhibit personnel gain operations ideas.

But what distinguishes the Exhibit among all those institutions is its prototype Arabic-Islamic Technical Heritage section, and the ultramodern way it tells the tale of the petroleum industry in Saudi Arabia. What's more, everything – from portions of important medieval Islamic manuscripts to videos and computer games – is presented in both Arabic and English.

"There is no oil and gas museum like it in the world in terms of scale or sophistication," says Ismail I. Nawwab, general manager of Saudi Aramco Public Affairs, whose Exhibit Division runs the facility. "But it is the Arabic-Islamic Technical Heritage section that makes it unique."

Saudi Arabia, of course, is the heartland of Islam, where the Prophet Muhammad received his calling and where the Qur'an was revealed to him (See *Aramco World*, November-December 1991) – thus the special place in the museum for Muslim scientists and their gifts to humanity.

"We wanted to link the Exhibit with our culture, not just with the oil and gas industry," explains Nawwab. "We wanted it to reflect Saudi Arabia's position in Islam *and* some of the seminal technical contributions of Islam to world civilization."



A time line covering the major political and scientific developments in each of the first 10 centuries of Islam – the seventh through 16th centuries by Western reckoning – puts the Islamic scientific contributions at the museum's heart into historical perspective (See *Aramco World*, May-June 1982). The displays themselves touch on on geology, geography, navigation, mathematics, astronomy, timekeeping, optics, mechanics, hydraulics and alchemy, the forerunner of modern chemistry.

While the section's scope is vast, it's studded with carefully selected information and items to focus the mind and the eye: quotations and pictures from medieval Muslim manuscripts, working models, sparkling rock crystals and even a huge armillary sphere, one of the most accurate of the astronomical measuring and teaching devices of medieval Muslim experimental scientists.

Among the scholars noted here are Jabir ibn Hayyan, the father of Arab alchemy; Muhammad al-Khwarizmi, who wrote the first treatise on algebra; Hunayn ibn Ishaq, a noted physician and translator who wrote one of the first treatises on the eye; Abu al-Rayhan al-Biruni, who contributed to scholarship in many fields, including geography, astronomy, matheatics and comparative religion; and al-Hasan ibn al-Haytham, a physicist who laid the foundations of modern optical science.

Striking examples of these scientists' work are only steps away.

Take al-Biruni, for example. Visitors playing the touch-screen computer game "Measuring with Triangles" can learn some of the principles of trigonometry, a subject elaborated by the 11th-century scholar. Or they can learn how he surmised that "the desert of Arabia was at one time a sea," a hypothesis confirmed in the museum's Origins of Petroleum section, where visitors can see firsthand how that prehistoric ocean laid the base for Saudi Arabia's oil fortunes.

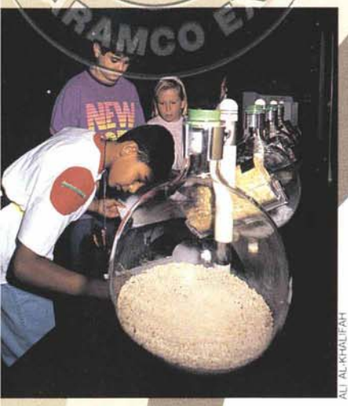
"Drawing upon the scientific traditions of the ancient world, Muslim thinkers enriched the stream of knowledge with their original contributions and then passed it on to future generations," sums up the museum catalog. "Within 300 years of the birth of Islam [that is, by the mid-ninth century], Arabic had become the international language of scientific thought. As Europe emerged from the Dark Ages, the works of these scholars, as well as their translations of classical texts and original learning, were absorbed by the West, providing a foundation for the Renaissance."

The debt that modern-day technology, science and mathematics owe to Muslim scholars becomes clear on a stroll through the museum. In a sense, repayment of that debt began just 60 years ago, when the western technological revolution came to Saudi Arabia, spearheaded by the US petroleum industry.

To help prepare the Arabic-Islamic Technical Heritage section of the Exhibit, Saudi Aramco consulted Islamic scholars of international renown. They included Abdul Hamid Sabra, Harvard University professor of the history of science, who helped lead a team of experts in different areas of medieval Islamic science. A number of the exhibits in this section and elsewhere display photographs of the original scientific manuscripts and their hand-drawn illustrations, giving the museum a vibrant and realistic air of discovery in process.

Arrayed counterclockwise around the Technical Heritage exhibits are seven sections of the museum

In the museum's foyer, a group of Saudi students (above) gathers around a wellhead from Dammam No. 7, Aramco's 1938 discovery well. At top, the armillary sphere.



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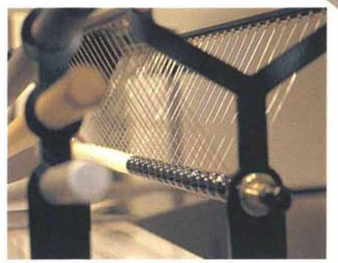


GEOFF GRAHAM

Beginning in the Aramco Exhibit's light-filled lobby (center, top), visitors can explore the museum's various sections. Fourth-graders from Saudi Aramco's Abqaiq School (above) study the sediments that form rocks of differing porosity in the Exhibit's Origins of Petroleum section. In the Arabic-Islamic Technical Heritage section, a partly transparent model of a geared astrolabe (above right) stands before a graphic panel that explains its functions. Laboratory flasks (center, below) in the Oil Refining and Gas Fractionation section display catalysts used in those processes.

devoted entirely to petroleum – often in novel, eye-catching ways. At The Aramco Story on a recent afternoon, a group of school children watched a film showing a smiling King 'Abd al-'Aziz Al Sa'ud, the founder of Saudi Arabia, arriving in Ras Tanura in May of 1939 to dispatch the first tanker-load of Saudi Arabian crude oil. Across the way in the Origins of Petroleum section, youngsters were examining fossil seashells up to half a billion years old, and trying to outscore each other in a computer game about the chemistry of oil. In Searching for Petroleum, they met some of the first oil prospectors in the kingdom and inspected their gear, or vigorously hammered a rock to create simulated seismic shockwaves. Many exhibits refer back to the scientific principles introduced in the Technical Heritage section.

Everywhere are levers to pull, buttons to push, and things that flow out or flare up or fall down. In the Drilling, Producing and Reservoir Management section, kids view a film about sinking a well and turn a crank to rotate a three-cone drilling bit. They perform tests to measure the relative mechanical advantage provided by the inclined plane, wheel and axle, pulley, lever, and gears. In Oil Refining and Gas Fractionation, they listen as the complex work of distilling hydrocarbons is expressed in simple terms, and poke each other in amazement when they see displays of the products made from petroleum – ranging from hairbrushes to aspirin tablets, and from rayon fabrics to many of the parts of a gleaming red motorcycle.

Says 11-year-old Andy Greenleaf of nearby Abqaiq, whose father is in the oil business, "You think that petroleum is only used to start engines. I didn't think it could *make* things – even clothes. Petroleum's in everything, just about."

To advise on the museum sections about the petroleum industry, Saudi Aramco relied on its own in-house experts, employees knowledgeable in various facets of oil operations. They included specialists in exploration, drilling, producing, refining and transportation, as well as project engineers, photographers and media specialists.

Staff translators and writers were also intimately involved in the project. Translating technical terms from English to Arabic, for the museum's hundreds of labels, display panels and explanatory signs, proved particularly challenging. "This was the first time some of these terms had been translated for the layman," explains Nawwab, who headed the effort. "To make the technical terms intelligible to the public we actually coined phrases."

The museum, he says, is the fruit of "a huge collaborative effort involving people with many specialties from across the company and across the world." The objective from the outset was to make "an original and professional contribution, intelligible to visitors of all ages.

"Besides its content, we wanted all the related aspects of creating a museum to be considered and given their due importance: modern Muslim architecture, construction methods, use of space, traffic planning, lighting and acoustics, all types of audio-visual presentations, computer technology and, not least important, interactive displays that could survive whatever treatment might be meted out to them by thousands upon thousands of visitors – all this was undertaken with the single objective of erecting an institution which would be visually and pedagogically dramatic."

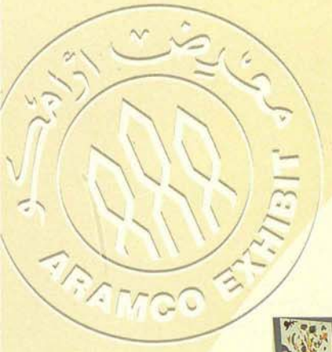
A leading San Francisco exhibit-design group, working from ideas vetted and approved in Dhahran, carried out the conceptual development of the project. Two US exhibit fabricators had the main responsibility for realizing the designers' ideas. A top Saudi architect won the competition among six Saudi firms to design the building, a 6660-square-meter (72,000-square-foot) structure whose displays cover 2340 square meters (25,000 square feet).

Standing in rocky terrain, the Aramco Exhibit building reflects traditional Islamic architecture in modern terms. It is faced with marble and features white precast concrete arches. Light streams in through a two-story glass wall and glints from stainless steel screens and railings; a bubbling, basement-level fountain provides a never-ending song. A *musalla*, or prayer room, is nearby. The hallways in the ground-floor administrative area are arcades resonant of mosque architecture, while the arches of the Arabic-Islamic Technical Heritage section convey the library-like ambiance of a *madrasah*, or school, of classical Islamic times.

The building holds a 300-seat auditorium for multimedia showings and a mini-theater for short presentations to small groups. It also has a small library, a general science laboratory, a computer classroom and a large space for temporary exhibits.

The seed that grew into the Aramco Exhibit was planted back in 1976, when Nawwab and his family visited the Lawrence Hall of Science at Berkeley, one of the centers of the then-novel interactive museum technology. His son, Muhammad, six years old, began playing with an interactive display and "wouldn't quit," Nawwab recounts. "He didn't want to leave. I thought that was fantastic. His interest made me wish we could do something like that in Saudi Arabia someday."

Young Saudi visitors examine a globe dotted with symbols indicating regional oil reserves (above, top), one of the features of the Exhibit's section on Aramco itself. A sliding microscope allows a Bahraini student (above) to compare the structure of different types of rock in the museum section called Searching for Petroleum; nearby, a series of suspended metal spheres (above left) can be used to demonstrate the principle of transfer of energy.



A.Y. DOBAIS

In a classroom at the Exhibit (right), younger children draw pictures of some of the things they've seen during their visit. The crayons they use (above) are among the everyday objects made from petroleum. A pattern of repeating arches (top right) sets apart the Exhibit's core section on the contributions of Arab and Muslim scholars to today's science and technology.

Opportunity knocked several years later when Saudi Aramco decided to update its antiquated Oil Exhibit Center. Planning for the new museum began in 1980, ground was broken in 1984 and it opened in October of 1987.

Besides being a house of discovery, the museum in Dhahran is meant to serve as a prototype for other facilities of its kind elsewhere in the world. "We are the trail blazers. What we hope is that the Exhibit will encourage others to do similar museums, that it will serve as a stepping-stone for others in the areas of petroleum and Islamic heritage," says Nawwab.

"Today's museums address a visually and intellectually sophisticated public – a critical public," he continues. "Museums have become a integral part of contemporary society, a focal point where people and ideas mix. They are an embodiment of that wonderful quality, 'solidarity of specification,' which the writer Henry James ascribed to successful fiction – and which applies equally to facts and reality."

The wish to make the museum a beacon may be coming true already. Malaysian Prime Minister Mahathir Mohammad, who visited the Aramco Exhibit in 1989, subsequently sent a delegation back to Dhahran to meet with Saudi Aramco representatives with a view to establishing a similar museum in his own country.

Visitors to the museum can take pot luck and sample exhibits at random, but it's probably best to plot a course and stick with it. In light of the wealth of material at hand, teachers often arm their students with worksheets and pencils to help focus learning. But strait-laced, formal "educating" is not what is expected, or even hoped for.

"When the first class of school children came, they all lined up and didn't touch anything," says museum director Farooq al-Janahi. "But we are changing that whole philosophy. We want children to have the freedom to play, to explore, to touch, to examine. We want them to have the freedom to think, to play a game for half an hour if they wish. The first thing we tell teachers is to let the children explore on their own."

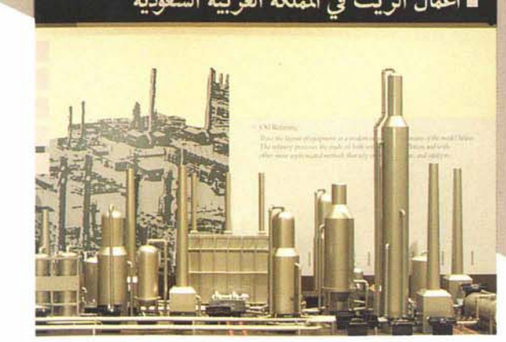
The museum is "for everybody," says al-Janahi, whose staff numbers 32, including 18 bilingual guides. "Everybody" ranges from kindergartners, who see a film, take a guided tour of specific exhibits and then receive Exhibit coloring books and crayons, to adult family members brought by students who have visited before. "The kids know how to read and write, but maybe their mother or father doesn't," says al-Janahi. "Here, they too can look, listen and learn."

While the philosophy of allowing children free rein may disturb adults schooled in quieter, less frenetic environments, it obviously inspires the youngsters, who dart from display to display with the speed – and the twittering – of swallows. The idea has also won many converts among educators.

Dr. Sa'id A. Abu 'Ali, director general of education in Saudi Arabia's Eastern Province, where Dhahran is located, is one fan. He puts the museum high on the list of field-trip sites he recommends for the 125,000 students under his wing in grades one through 12. Visits to the museum are part of the syllabus in social sciences and applied sciences, and particularly in courses on the history of the Eastern Province and the petroleum industry.

"The Exhibit helps to crystallize many different points," he says. "The majority of students feels that what they've heard there about history, industry and science has accelerated their learning."

The museum highlights Saudi Arabia's "will to introduce oil and the will to use it to modernize, which is in itself an educational value from which we can benefit," Abu 'Ali says. The huge transfer of technology to the kingdom since the discovery of oil in 1938 has meant that "many foreigners have



come to our country. We have been able to accept them, and at the same time we have been able to build a bridge of understanding between the newcomers and our society."

The museum itself shows the extent to which technology transfer has given way, over the years, to technological innovation within Saudi Arabia. The museum's Aramco Story displays, for instance, highlight the company's huge training program, and visitors get video introductions to some of today's Saudi professionals. These employees, among them a petroleum engineer, a physician, an airplane pilot, an accountant and a paleontologist, explain – in two languages – what they do at work.

The museum's realistic presentations of what are often dry "schoolbook" facts may fire the imaginations of future professionals, too. The Aramco Exhibit fleshes out what students learn in the classroom, says Atiyyah al-Ghamidi, principal of Ibn Battutah School in Qatif, a town 30 kilometers (19 miles) up the coast from Dhahran. "Refining is explained in a very vivid way, and because of the vivid examples of refinery products like tar and gas that the student has in front of him, he will never forget," al-Ghamidi says.

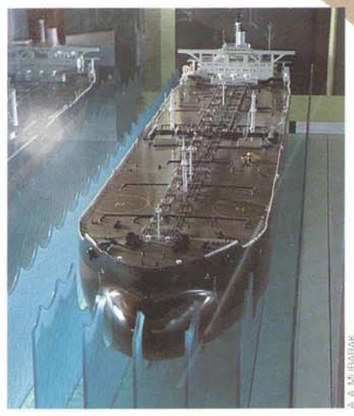
Teachers like the museum, too. "It's wonderful; it's overwhelming," notes Trulee Reed, a fourth-grade teacher at Saudi Aramco's Abqaiq School. "The kids really enjoy it. They love the hands-on and the video exhibits where they can interact – and they're amazed that Dhahran used to be just a few little tents out in the middle of nowhere."

What's in the future for the Aramco Exhibit? Plenty, say its operators.

It's targeted to become a place where volunteers from many walks of life can invest time to further education on many levels, in line with the Islamic tenet of service to the community. "In Islam, you worship God by devotional prayer and also by serving society," says Nawwab. "That's a tradition we would like to keep and enhance here."

Projects in the planning stages include starting a computer club, with Arabic programs for children and computer courses for Saudi Aramco retirees. Another idea: using the museum as a venue where company employees and retirees can teach English and mathematics to Saudi schoolchildren during vacations and on weekends.

Volunteers from the local community, assisted by museum guides, have already shown what can be accomplished. During 'Id al-Adha in June, they



A. A. M. IBARAK

Scale models of a bulb-bowed supertanker (left) and of sections of an oil refinery (top left) are features of the Transportation and the Oil Refining sections of the Exhibit. An illustration of astronomers at work, from a 16th-century manuscript in the Istanbul University Library, is reproduced at the center of the astronomy exhibit (above) in the Arabic-Islamic Technical Heritage section.

helped children mount a rousing cultural program, focusing on nine countries around the world, which was performed in front of friends and families in the museum auditorium. Twenty-three youngsters participated – and more want to be involved next year.

Finally, museum executives say they're working on a plan to establish an open-air exhibit area. Here, equipment such as a full-size drilling rig or a pipeline pump the size of a jumbo-jet engine could be displayed, providing a whole new arena for hands-on adventure.

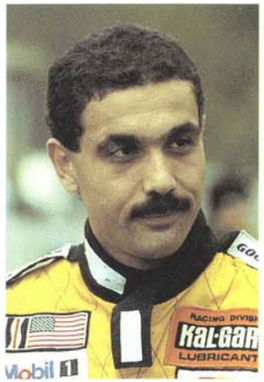
The museum aims to keep pace with the times and remain "perennially interesting," says Nawwab, with updated displays and a variety of temporary exhibits – like the exhibition of historic industry photographs dating back to the 1930's that was mounted in September. Traveling exhibits are planned as well: The first one is slated to go from Dhahran to the Houston Children's Museum.

But the best news for the museum comes from its most precious audience, the youngsters who've stopped at the Saudi Aramco caravansary and found it to be both challenging and fun. As a beaming Ismail Ibrahim, 14, of Riyadh, put it, "I like this place because it asks so many questions and gives so many answers. Can I come back?"

Arthur Clark, a staff writer for Saudi Aramco, visits the Aramco Exhibit with his daughter Caitlin.

TAKING THE FLAG

WRITTEN BY PINEY KESTING
PHOTOGRAPHED BY KEVIN HANDLY



"You don't race for money or fame," Saeed Gazzar explains as he steps into his single-seat race car. "You do it because you love it." Slipping into the narrow seat, Gazzar snugs on a yellow-and-black helmet, waits for his mechanic to buckle him in tight, and then, engine brumbling, rolls slowly out of paddock 13 to the pit lane at Lime Rock Park, Connecticut.

The first Saudi Arabian to race professionally in the United States waits tensely for the signal. With a flash of the flag, the race begins. Engines roar and tires screech as 24 sleek Indy-style cars pull onto the track, passing and dodging one another as each driver vies for the lead in the 30-minute nonstop sprint.

Lime Rock Park is the fourth of 12 races for Gazzar, who is competing in the 1992 Zerex Saab Pro Series championship, sponsored by SABIC Marketing America, a subsidiary of Saudi Basic Industries Corporation. Previous test races in England, Germany and Belgium during the last five years prepared him for his first professional races in the United States.

A native of Riyadh, 32-year-old Gazzar has loved racing ever since he first sat behind the wheel of a car. Already driving at age eleven, he began racing stock cars in Beirut when he was 16. Gradually he advanced to single-seaters.

Eager to sharpen his skills and qualify for the professional racing circuit, Gazzar attended the Jim Russell racing course in England in the winter of 1988. During one of the rigorous practice sessions, his car lost its front right wheel, and Gazzar was seriously injured. He reluctantly decided to put his racing career aside, and returned home to his computer business in Riyadh.

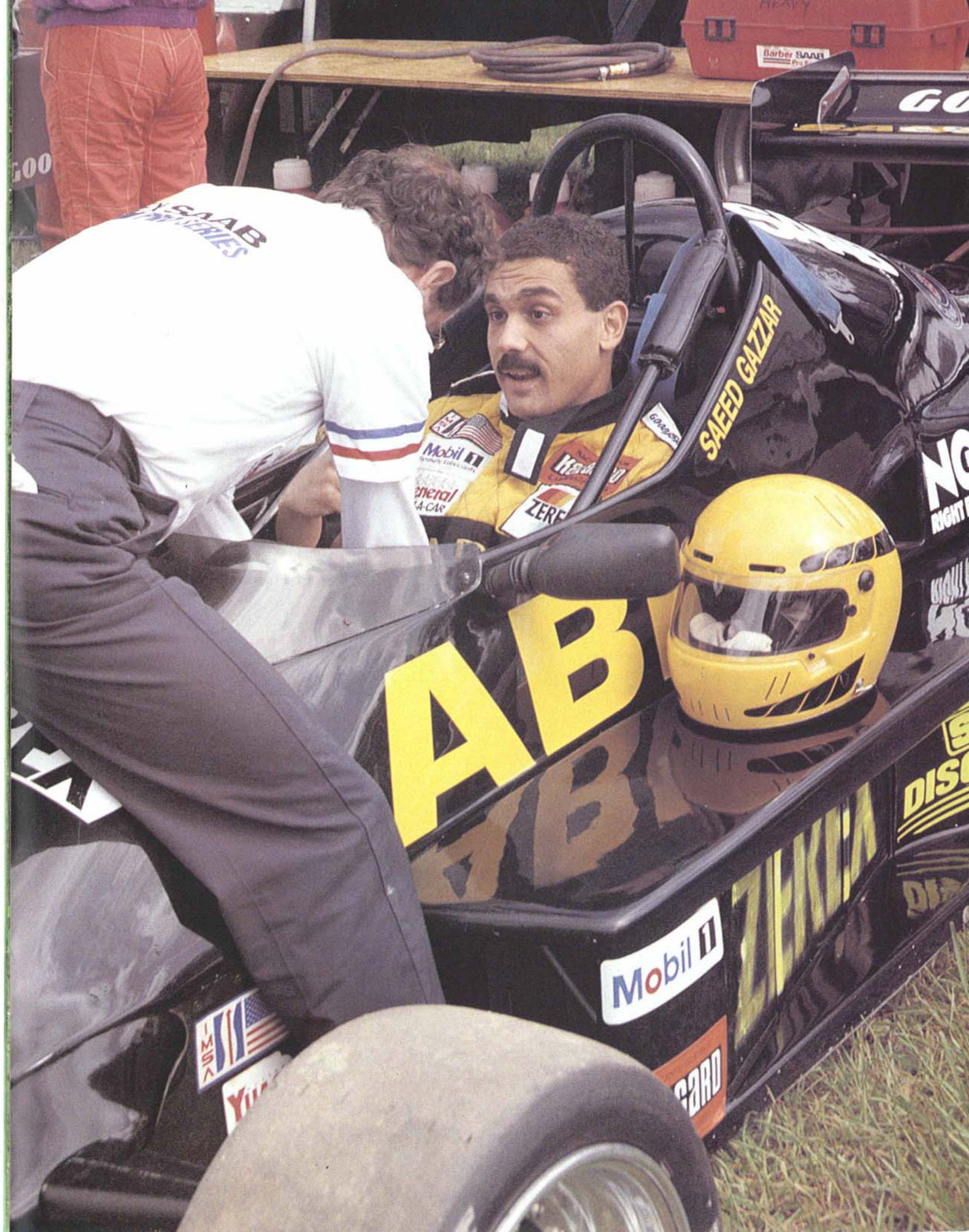
"I discovered, however, that I couldn't stay away from racing," recalls Gazzar. Determined to reenter the sport, he began a long search for a Saudi sponsor. Less than two weeks before the Miami Grand Prix in February, 1992, SABIC agreed to sponsor him in the Zerex Series. He packed his bags – and his videotapes of every Formula One race dating back to 1971 – flew to Florida and began to train all over again.

Recognized as a leading entry-level professional single-seater championship, the Zerex Series is a challenge for Gazzar, who acknowledges he "has a lot of catching up to do with other [more experienced] drivers." Rick Rosso, media relations director for the Zerex Series, comments that Gazzar "needs work, but he has all the basics down. He's a very smart, very safe driver. Furthermore, he's great for the series. He gets a lot of attention."

A quiet person, who loves racing because it is a "one-man sport," Gazzar is surprised by all the attention. "As soon as I get out of the car, I have kids lined up wanting to take photos of me," he says. And when they discover he served in the Saudi army during the Gulf War, "they want to know all the details."

Gazzar hopes that his entry into professional racing will open the door for other talented young Saudi racers – and he includes them in his own future plans: He would like to start a racing school of his own in Saudi Arabia. But, for the time being, Gazzar is just looking forward to slipping behind the wheel of his racer – and heading for the next finish line.

Piney Kesting is a frequent contributor to Aramco World *from her base in Boston.*

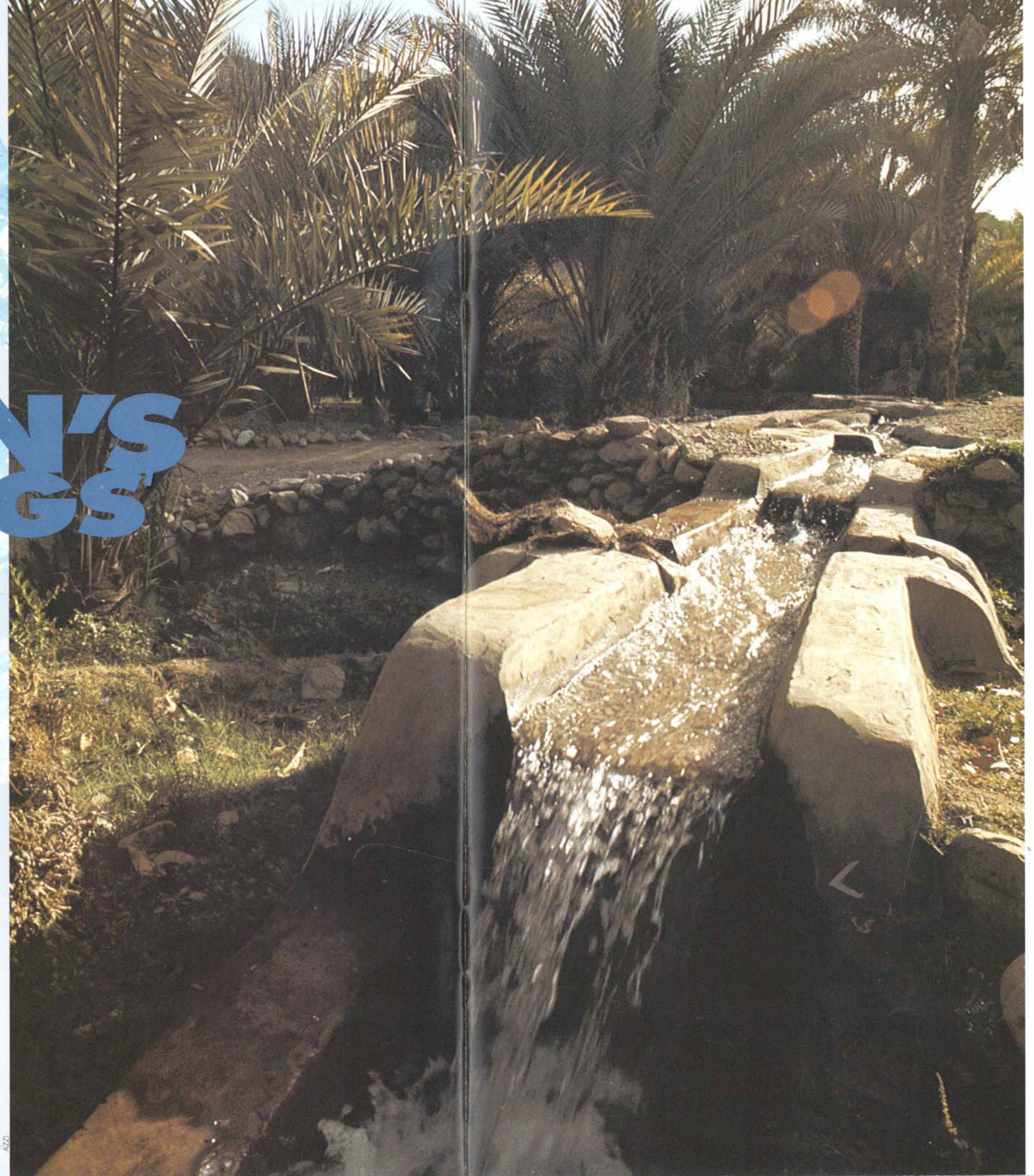


OMAN'S 'UNFAILING SPRINGS'

A pre-Islamic poet sang long ago of verdant Oman as "a goodly land, a land abounding in fields and groves, with pastures and unfailing springs." But in the region at the desert's margin, where no natural rivers flow and where farming is impossible without irrigation, it is the splendidly-engineered *aflaj*, the system of underground and surface canals, that have watered the country's agriculture for millennia.

WRITTEN BY LYNN TEO SIMARSKI
PHOTOGRAPHED BY LYNN TEO SIMARSKI AND ROBERT AZZI

Water rushes down a falaj channel in a date grove; one of two side outlets, leading down to ground level, is plugged with palm fiber as part of the distribution pattern.



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Ancient aflaj (singular: *falaj*) still course like arteries beneath the hills and plains of Oman, twisting along precipitous cliffs and threading villages and date-palm groves, bringing to the parched land water and coolness and life itself. Today, the aflaj of Oman deliver a total of 900,000,000 cubic meters of water per year – 730,000 acre-feet or 238 billion US gallons – which is more than 70 percent of the country's total water use. Water from aflaj irrigates about 55 percent of Oman's farmed land.

Debate continues to swirl over the origin of this irrigation system, which is at least 2700 years old: Sargon II of Assyria recorded the destruction of the aflaj of the Urartian city of Ulhu in 714 BC.

The word *aflaj* itself denotes not only the water canals but also the irrigation network that relies on them and the social system that apportions water to the owners of water-shares. The aflaj have helped to shape the history and settlement patterns of Oman, and they continue even now to tie together each community that draws upon the falaj's flow. As part of traditional greetings, an Omani will invariably ask about the condition of the aflaj, which evokes the reply, "*Insha' allah*, they are full." As concern expands over the best use of Oman's precious water resources, the state of the aflaj will undoubtedly continue to affect Omani life in the oil age and beyond.

The aflaj constitute an elegant and relatively efficient system for tapping underground water in the wetter mountain areas and delivering it to flatter areas where agriculture is possible. Since water flows in the canals by gravity, no outside energy is needed for transport. Beyond the initial investments of capital and effort to build the network, the aflaj require comparatively little labor to maintain. A further advantage – though a two-edged one – is that, unlike wells, the self-regulating aflaj system does not exhaust the aquifer, or underground water-bearing layers, that it taps: In times of drought, for example, all farmers receive proportionately less water.

"We have no rivers and our underground reservoirs are very limited," points out Kamal Abdurredha Sultan, a prominent Omani businessman and farm-owner concerned about the future of agriculture in Oman. "The rainfall on the whole, throughout the country, is unreliable. The past generations, perhaps realizing the circumstances, used the available water resources as efficiently as possible....

The wonderful and intricate falaj system was in complete harmony with the water circumstances, and responded well to the wet and dry periods, each lasting several years, that were a feature of Oman's climate – and still are."

Different types of aflaj were built to suit the water sources available. Some 90 percent of precipitation falling on Jabal Akhdar, northern Oman's mountainous core, percolates down to the underground water table. Those canals, known as *qanat aflaj*, collect water in the rock, sand, and gravel aquifers skirting the mountains' edge, and run beneath the land surface for kilometers to emerge at an oasis. The supposed length of aflaj is, in fact, grist for fables: A camel stick, dropped by the Caliph of Baghdad into the Euphrates, is said to have surfaced in an Omani well called Ain Sariq.

Other aflaj exploit shallow or surface waters. Most mountain wadis, or valleys, are lined with gravel and silt, which overlie consolidated rock in the valley floor. Water flows perennially through the surface layers of the wadi deposits, and this may be tapped by a *ghayl falaj*, which collects and conveys the water in an open channel to an oasis. Still other aflaj simply conduct water above-ground from a spring, such as those channeling the hot springs welling up from diaphanous, calcite-encrusted pools near the towns of Nakhle and Rustaq.

The skills of falaj construction and repair are preserved today in Oman by the Awamir, a partly settled, partly nomadic tribe based near Izki, whose falaj specialists still travel throughout Oman, carrying out their trade. They have a respected reputation for water divining.

To begin a new qanat falaj, a diviner generally scrutinizes the topography, soils, and vegetation at a promising site for a mother well, or *umm al-falaj*, the vertical shaft down to the aquifer. Some Omani diviners are said to use less orthodox methods: A hydraulic engineer recently observed one enter a prolonged trance, during which he called upon Sulayman ibn Da'ud – Solomon, the son of David – and summoned a jinn from Africa to assist his search.

The shaft of a mother well averages 20 meters (66 feet) deep, but some mother wells descend as much as 60 meters (200 feet). At the bottom, the horizontal channel or gallery that is excavated downslope from the well is left unlined, so that the water can seep into it from surrounding porous layers.

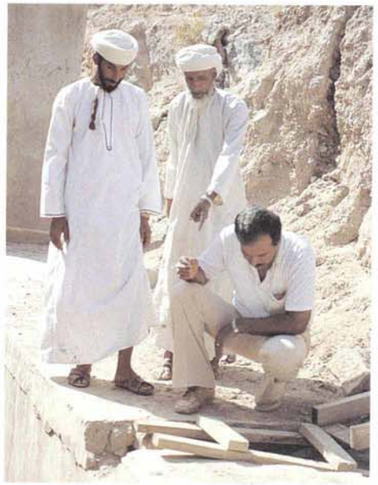
After the collection gallery for the mother well is dug, the builders move downslope. Here they dig another vertical shaft and begin burrowing back almost horizontally toward the mother well. Crouching in the tunnel, they excavate with hammer and chisel. Successive vertical shafts extend the underground tunnel toward the point at which it surfaces kilometers away. The Awamir are particularly accomplished at excavating aflaj through hard rock – a daunting task, for a tunnel one kilometer (1100 yards) long and one-half meter (20 inches) in diameter requires removing between 3000 and 4000 tons of rock.

From the air, Oman's landscape, particularly the mountainous heartland, is dotted with holes that look like chains of bomb craters. These holes mark the successive vertical shafts sunk to excavate the horizontal tunnel of a falaj, and they indicate its course from source to the oasis. The original builders left the holes open after the underground canal was completed, so that their access shafts could be used for subsequent inspection and repair.

The hazards of falaj work are legion. In Iran, excavators baldly call the qanat falaj "the murderer" in Persian. An Oman Ministry of Agriculture engineer marvels at the skills of the original builders, who worked without air pumps or safety equipment. In an access shaft, a worker may be struck by falling stones, while tunnels pose the danger of collapse. Added to this, the stifling heat and poor air circulation within a falaj may allow work for only 20 minutes at a time. The worker faces particular danger when, tunneling uphill, he nears the mother-well gallery where water has collected. Many have drowned in the onrush of water as the final rock gives way between the tunnel and the gallery.

Oman's rugged topography tested the ingenuity of ancient planners, who produced engineering solutions that are part of Oman's architectural heritage. Some aflaj run along the contour lines, tracing the curves of wadis or valleys, like the falaj near Tanouf in the Jabal Akhdar that hugs the cliff wall high above the wadi floor. Parallel abandoned channels, cut into the wadi wall some distance above the flowing falaj, probably testify to past changes in water level or flow.

Where a falaj crossed wadis, such as near Rustaq and Nakhle on the Jabal's coastward slopes, architects bridged the valleys with arched aqueducts often more graceful than the sturdy poured-concrete ones built today. Wherever the torrential flood of a wadi was strong enough to wash away an aqueduct, engineers built inverted siphons – closed U-shaped tunnels. In these, the horizontal falaj flow disappears down a vertical shaft on one side of the wadi, tunnels straight across beneath the wadi floor, and reemerges up a second vertical shaft on the other side. Because the lip of the second shaft is slightly lower than the siphon entrance, the head of water forces the flow through the structure.



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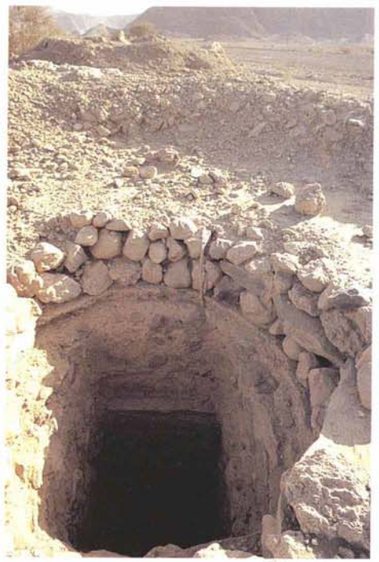

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Above, a falaj running along the contour of the land feeds the town and the date grove of Birkat al-Moy. In harsher terrain, at top, a narrow ribbon of water snakes along the skirt of a mountain outcrop. Opposite, at top, local and national water officials consult on needed repairs to a poured-concrete section of Falaj al-Salil. Opposite, centre, rows of "craters," formed by the rubble excavated from the vertical shafts of a now-abandoned falaj, mark its path across the plain. The vertical shafts of some aflaj, left, are dug as deep as 60 meters into the desert floor.

Oman's numerous aflaj are the best-known of those in Arabia, but similar underground channels can be found under various local names from China to the western Sahara – in Afghanistan, Pakistan, Iraq, Iran, the Levant, Cyprus and northwest Africa – as well as in Sicily, Spain, South America and even Korea and Japan.

Such a widespread distribution complicates the question of who invented the falaj. The word itself is quite ancient, stemming from a Semitic root (*plg*) that denotes division. The related Arabic three-consonant root *flj* signifies the division of property, suggesting the falaj's purpose as a system for dividing or distributing water.

Many investigators cite ancient Persia as the home of the aflaj, which are called *kariz* in Persian. As geographer Paul Ward English writes, "The core area of *qanats* [aflaj] ... lies in the realm of the Persians, whose language is rich in words relating to *qanat* technology and where *qanats* are very old, very numerous, and construction techniques are fully developed."

This theory postulates that the Persians carried qanat technology with them to the lands they colonized in Achaemenid times during the sixth century BC; indeed, one measure of a Persian leader at the time was the number of qanats he had built in the lands he ruled. Commercial incentives were used – the builder of a qanat was granted the profit from it for five generations, like a patent – and they were apparently successful: Iran is still home to perhaps 40,000 qanats stretching some 161,000 kilometers (about 100,000 miles) altogether; they still supply many cities, including Tabriz, Tehran and Yazd.

Recent archeological investigations, however, may suggest an indigenous origin for the aflaj of Oman. The country's oldest aflaj are said to be those of the al-Jauf region near Nizwa, in the interior. Tradition identifies the most ancient as Falaj al-Malaki, which still supplies the town of Izki in the region (See *Aramco World*, January-February 1989). Mining and hydraulic techniques were developed in the Arabian Peninsula by 1000 BC, and sophisticated mining techniques – related to those of falaj builders – were employed in Oman even in the third millennium BC.

"The problem of the origin of the falaj, therefore, remains open to further speculation," believes archeologist Paolo Costa. "This must take into consideration the technical skill in water management and mining known to have been acquired by the ancient Arab populations long before [the Persian] Cyrus the Great's conquests."

An Omani falaj of especially elegant construction, Falaj al-Kamel near Rustaq, dates from Ya'ariba Imamate rule of Oman during the 17th and 18th centuries, an era that also bequeathed a number of the country's most spectacular forts (See *Aramco World*, January-February 1991). Visitors must descend a flight of stone steps into the falaj and wade through the tepid, flowing water to appreciate the artistry of this underground monument, which is said to have extended 32 kilometers (20 miles) in the past. Tiny fish nibble at waders' bare toes, while the sultry gloom is pierced only by light from access shafts, themselves the lairs of snakes and bats. The falaj was not merely tunneled through rock, but is distinctive for the segment lined with an arched vault of local Omani cement.

Nearby, a falaj leading to al-Hazm fort, another notable Ya'ariba monument, demonstrates the role aflaj played in Oman's turbulent history. Enemies might try to cut a falaj to deprive the community and fort of their water supply, but a line of dummy shafts parallels the al-Hazm falaj, illustrating the imam's craftiness in protecting his domain. The phony falaj could be blocked while, unknown to the attackers, the real canal would continue to serve the besieged fort.

In modern Ruwi in the capital area, the historic falaj in the museum-fort of Bayt al-Falaj has been put to new use watering

graceful gardens in the fort's precincts. But to best see aflaj in their traditional setting, one must travel inland to Oman's heartland, which is far less touched by modern development. Here, distant smudges of green against the feet of the mountains resolve upon approach into date-palm groves and villages. Mounds of earth typically surround the oases, left after excavating garden basins to the proper level to receive the falaj's gravity-propelled flow.

A typical qanat falaj surfaces at the head of an oasis, where a time-hallowed hierarchy governs the use of its flow. At the top of the village is a special place for drawing drinking water, which is free to all. Downstream lie the men's bathing facilities, open-roofed bathhouses with private cubicles, and next, the women's; below these is the place for washing the dead. A mosque or an important fort, such as al-Hazm, may have direct access to the falaj, although most private houses do not; however, a house's proximity to the point at which the canal enters the village can indicate its family's prominence. Farther downstream, past sites for washing clothing, dishes, and cooking utensils, the falaj flows on to irrigate the gardens.

Palm trees, goes a traditional saying, "like their heads in fire [sunlight] and their feet in water," making them well-adapted to cultivation on the desert's edge. Date palms constitute three-quarters of Oman's tree crops, a proportion reaching seven-eighths in the country's interior. Other tree crops include citrus, banana and mango. Fodder crops, notably alfalfa, are planted along with vegetables and other crops further down the falaj network. Such placement capitalizes upon times of good flow to grow a variety of crops, which can be sacrificed during drought in favor of the more valuable palms.

Falaj water is apportioned to villagers based upon an age-old system, and religious authorities arbitrate disputes over water rights. Gardens are irrigated for a certain time period, called an *athar* and commonly half an hour long. Successive plots are irrigated in sequence in the course of a cycle that may last six to eight days before the first plot is watered again. At the designated time, the farmer – or a water-watchman called *haris al-bidar* – diverts the falaj flow into the designated plot with a simple dam, usually a flat stone or section of palm trunk wedged into the channel with scraps of fabric.

Some villagers may own rights to a certain number of athar of water in perpetuity. Others lease their athar at half-yearly auctions. In a village with a complex system of water shares, such as Izki, a falaj book records the owners of water rights, who may number more than 200.

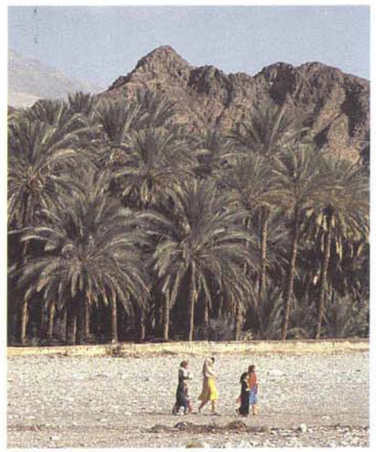
In central Oman, money for maintaining a large falaj usually comes from these auctions of shares of falaj water. During an auction in Izki, for instance, bidders ring the auctioneer, touching him with their camel sticks to indicate a bid, and dropping out from the contest by lifting their sticks until only one bidder remains.

Many villages have a sun clock to measure time periods of irrigation. A smaller village may have a simple clock, a mere patch of flat ground in an area open to the sun, with a wooden or metal post at its center. On either side of the post, a row of parallel lines is scratched into the earth. As the sun passes overhead, the shadow of the stick strikes successive lines at 30-minute intervals. Different plots are designated by small stones embedded at or between the lines; when the shadow falls upon a stone, it is time to water the plot it represents.

In a large and complex oasis watered by several aflaj, such as Rustaq, the sun clock is an expansive rectangular platform set with many large stones of different colors. The smaller sun clock in the town of

Pomegranates, above, are among the tree crops that rely on falaj water, but all the produce for sale at Nizwa market, below, was also grown with water from Oman's unfailing falaj.

Bottom, a woman fills her plastic jerry can with water clean enough for drinking and cooking by tapping the falaj at the upper edge of town.



At top, boys swim in a warm spring near Rustaq. Above, the straight line of the falaj and the water it carries are all that separate the dry gravel of the river bed from the fruitful green of the date grove. Inside back cover: Where a falaj channel divides, one arm of the Y is dammed to send the flow to another section of the grove.

Adam, with lines carved into a fallen tree trunk, is also still used, although a local farmer admits to consulting his watch on cloudy days. But the falaj flows day and night, so a timing method is needed for nighttime use as well.

Nighttime irrigation in Oman was formerly timed by the movement of designated stars. In Mudayrib, a village north of the Wahiba Sands (See *Aramco World*, January-February 1988), watchers traditionally observed the night sky from the Reckoning Mosque (Masjid Al-Hisab).

In Iran, instead of a sun clock, a water clock is used that consists of a brass bowl with a small hole in its bottom, set in a larger container of water. The irrigation time unit is the length of time it takes for the brass bowl to fill and sink – a period that is the same for a given bowl, day or night.

As John C. Wilkinson demonstrates in his landmark study of the aflaj of Oman, the geographic distribution of water resources and aflaj help explain the pattern of scattered small habitations in the country's heartland. A falaj can support only a limited number of people, and even the largest towns supplied by several aflaj, such as Rustaq and Nizwa, have fewer than 10,000 inhabitants. Since the falaj system demands cooperation for its maintenance and operation, it has helped to organize life in the isolated, tightly-knit communities of Oman's interior.

Aflaj also play a role in local legend. One spring-fed falaj called Ma'awil, near Ibri in the interior, is wreathed in myth because of its intermittent flow. Local belief holds that long ago, a girl of the Maqrashi tribe descended to the falaj to collect water, and disappeared. Legend maintains that she was taken by the head of the jinn, who to this day releases water only when her tribesmen visit the falaj, to compensate them for the kidnaping of one of their daughters. Hydrogeologists, more prosaically, attribute the spring's stops and starts to a natural siphon effect, which allows the spring to fill only under certain conditions.

The aflaj that animate legend and life in the villages of Oman suffered various mishaps throughout history. Evidence of abandoned aflaj indicates that Oman's agriculture was considerably more extensive in former times; indeed, Wilkinson believes that the cultivated area of the country may be only half as large today as it was at the end of the sixth century. Floods swept away many aflaj, while others were destroyed during civil wars – a calamity that provides the dramatic backdrop for Hammond Innes' 1960 novel *The Doomed Oasis*. In the oil era, the migration of populations and modern development, including the introduction of new agricultural techniques such as mechanical pumping, have all contributed to the decline of the aflaj. It is a sign of change that the Awamir falaj experts are called upon increasingly to excavate mechanical wells as well as aflaj.

As part of its demonstrated and increasing concern for the viability of the country's agriculture and water resources, the Omani government launched an effort in recent years to document all the country's aflaj, and has spent millions of riyals on repairing the systems. Ministry of Agriculture staff estimate that they renovate sections of approximately 150 aflaj every year, building new concrete channels to numerous ancient villages, and constructing such works as the concrete inverted siphon to carry a falaj beneath a new road near Rustaq.

As agriculture has been modernized, some observers believe that mechanical pumping in the new wells poses a particular threat to the falaj system, through lowering the water table in some areas. The government prohibits new wells within 3.5 kilometers (two miles) of a falaj's mother well – at least in those cases where its location has not been lost to history.

A longer-term consideration is identified by a Ministry of Water Resources scientist who has assessed Muscat's rainfall pattern over the past century. The area has enjoyed higher than average precipitation during the past three decades or so, he notes; if pumping is now depleting the aquifer during a time of favorable rainfall, the aflaj may suffer if rainfall again decreases below the norm.

"Some of the aflaj have been permanently destroyed, others have stopped flowing," observes Kamal Sultan. "Among them are the famous falaj of Jabrin, and those in Wadi Naam, Ibra, and so on. The level of most of them is gradually falling.... When they are restored, it will be wonderful to see people back in the dead villages that were perhaps deserted when their aflaj fell into disuse or couldn't be repaired."

During what is clearly a time of reckoning for the remaining aflaj of Oman, experts and officials are now engaged in a broad effort to preserve this venerable institution, along with the way of life it has so long made possible.

Washington-based free-lance writer and photographer Lynn Teo Simarski specializes in Middle Eastern topics. She wrote on Oman's forts in an earlier issue of Aramco World.

Islamic Art and Patronage: *Selections From Kuwait.* More than 100 Islamic masterworks – ceramics, glass, metalwork, stonework, illuminated manuscripts, textiles, and rugs – from the Al Sabah Collection. **New Orleans** Museum of Art, November 15, 1992, through January 10, 1993.

The Munayyer Collection of antique Palestinian and Syrian costumes is touring public libraries in New Jersey. Remaining schedule: **Clark**, November 1992; **Scotch Plains**, January and February 1993; and **Bridgewater**, June 1993.

Current Archeology of the Ancient World. A series of talks on current research and discoveries. Among Middle Eastern or Islamic topics: The Vault in Pharaonic Architecture (November 20); Between Sea and Desert: Ed Dur, A Coastal Site in Oman (November 27); Three Coptic Mummies from the Musée des Beaux-Arts in Lille (December 11). Musée du Louvre, **Paris.**

Pakistan: *From Out of the Shadows.* London free-lance photographer Jonathan Eeles traveled throughout Pakistan in 1989, capturing scenes, objects and people in remote mountain villages and sprawling metropolises. His photographs are displayed at the Commonwealth Institute, **London,** through November 22, 1992.

Making Your Mark: *7000 Years of Seals.* Once described as "devices to make honesty unnecessary," seals have been used since at least 5000 BC. A selection from the museum's holdings, including many from the Middle East. British Museum, **London,** through November 29, 1992.

Nusantara: *Lands and Peoples of Indonesia.* This exhibit surveys the varied cultural heritage of the world's most populous Muslim country. National Museum of American History, **Washington, D.C.,** through November 29, 1992.

The Afghan Folio. Luke Powell's celebrated photographs of Afghanistan displayed as dye-transfer prints. Bicentennial Gallery, Purdue University Calumet, **Hammond, Indiana,** through December 3, 1992; **Bismarck [South Dakota]** State College, March 12 through April 16, 1993.

19th-Century Topographical Photographs. This exhibit features works by six photographers who documented the Middle East and other locales between the 1860's and 1880's. **Minneapolis** Institute of Arts, December 5, 1992, through February 21, 1993.

Arts of Moghul India. Paintings and other artworks from the late 16th to the 18th centuries, including portraits of emperors and courtiers provide a good introduction to the Moghul Empire. Smithsonian's Arthur M. Sackler Gallery, **Washington, D.C.,** through December 6, 1992.

The Westward Migration of Chinese Blue and White. Some 50 pieces of ceramic ware from China, Iran, Vietnam, Turkey, Europe and America illustrate the global spread of underglaze blue and white porcelain from its birth in China in about AD 1250. **Minneapolis** Institute of Arts, December 12, 1992, through June 6, 1993.

Arts of Empire: *Moghul Indian Painting, 16th-17th Centuries* features imperial artwork from the museum's own and other collections. Harvard University's Arthur M. Sackler Museum, **Cambridge, Massachusetts,** through December 13, 1992.

Islam and China. Drawing on Harvard University's rich collections, this exhibition compares and contrasts Islamic approaches to artistic design with those of China. Arthur M. Sackler Museum, **Cambridge, Massachusetts,** December 19, 1992, through February 14, 1993.

Sifting the Sands of Time: *The Oriental Institute and the Ancient Near East.* This exhibition traces the history of the University of Chicago's Oriental Institute in ancient Near Eastern research and scholarship. Oriental Institute Museum, **Chicago**, through December 31, 1992.

Vanished Kingdoms of the Nile: *The Rediscovery of Ancient Nubia.* This special exhibit offers an overview of the flourishing culture of the Nubians in Sudan and southern Egypt. Oriental Institute Museum, **Chicago**, through December 31, 1992.

Yemen: *A Culture of Builders.* A photographic exhibition takes an artistic look at Yemeni architecture. Andrews University, **Berrien Springs, Michigan,** January 4 through February 5, 1993.

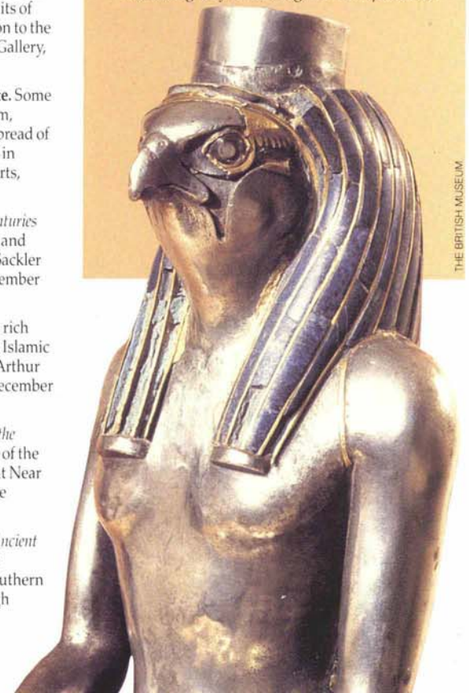
Cultures at Crossroads: *Southeast Asian Selections From the Australian National Gallery.* The exhibition examines the impact of India, China and Islamic cultures on the textiles of Southeast Asia. Asia Society, **New York,** through January 17, 1993.

Art of the Persian Courts: *Selections From the Art and History Trust.* This survey focuses on the arts of the book, and features about 125 manuscripts, paintings, drawings, calligraphies and other objects from a collection in Liechtenstein. **Los Angeles** County Museum of Art, through January 24, 1993.

EVENTS & EXHIBITIONS

Howard Carter: *Before Tutankhamun.* A long-awaited exhibition marking the 70th anniversary of the discovery of the tomb of Tutankhamun. The focus is not on Carter's most celebrated find, but on the 30 years of archeology in Egypt that led up to the discovery. Carter's colorful life is traced from relatively humble beginnings, through his activities in Egypt as assistant to archeology legend Flinders Petrie and his tenure as inspector general of antiquities for Upper Egypt, to his fateful meeting with the Fifth Earl of Carnarvon. Their partnership led to the discovery of Tutankhamun's burial chamber and the unmatched treasures within. The exhibition features Egyptian antiquities from top collections, including New York's Metropolitan Museum of Art, Boston's Museum of Fine Arts, the Brooklyn Museum, the Louvre and others. Also exhibited will be pieces lent by the present Earl of Carnarvon and paintings, documents and artifacts from other private collectors, many of which have never been publicly exhibited. British Museum, ***London***, November 19, 1992, through May 31, 1993.

Solid silver statue of Horus, about 1070-664BC. Carter was among the first to recognize its importance.



THE BRITISH MUSEUM

Egypt's Dazzling Sun: *Amenhotep III and His World.* The golden age of Egyptian art is recalled in this exhibition of nearly 150 works from major collections. Kimbell Art Museum, **Fort Worth, Texas**, through January 31, 1993; Grand Palais, **Paris,** March 2 through May 31, 1993.

Byzantium: *Art From the National Collections.* Byzantine art treasures – marbles, silks, manuscripts, ivories, icons, goldwork – from throughout France were brought together for the first time for this exhibit. Musée du Louvre, **Paris,** through February 1, 1993.

Painting With Light: *The Photographic Aspect in the Work of E.M. Lilien.* He was famous at the turn of the century for his *Jugendstil* illustrations. The exhibit features his photos and drawings of Ottoman Palestine. **Minneapolis** Institute of Arts, February 6 through April 4, 1993.

Bukhara: *Traditional Weavings From Pre-Soviet Central Asia.* Boldly patterned turn-of-the-century hangings, garments and carpets crafted in and around the Silk-Roads city of Bukhara. Textile Museum, **Washington, D.C.,** through February 15, 1993.

A Kurdish Reed Screen. The textile arts and culture of the Kurds are explored in this exhibit, built around a monumental dwelling partition woven by Kurdish pastoralists. Textile Museum, **Washington, D.C.,** through February 15, 1993.

The Aramco Exhibit. Centered on the Arab-Islamic technical heritage, this permanent interactive, "learn-by-doing" scientific exhibit relates the historical background to today's petroleum exploration, production and transportation (See article in this issue). **Dhahran, Saudi Arabia.**

Information is correct at press time, but please reconfirm dates and times before traveling. Readers are welcome to submit information for possible inclusion in this listing.

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