ARAMCO WORLD
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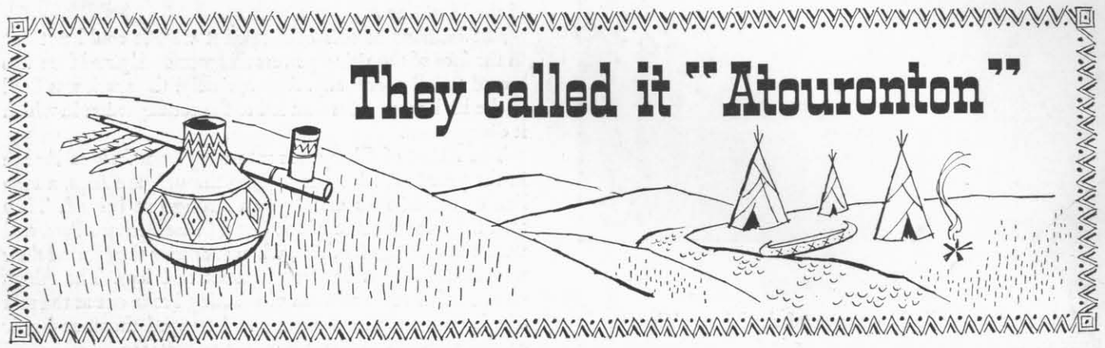


THE THICK MATERIAL was like tar or molasses, but the American Indians had learned to thin and purify it by heating and straining. Its principal use was as a medicine for sprains and rheumatism. The Iroquois, however, used it as a balm for troublesome sores on horses, and Chippewa braves would rub it on their bodies and claim that it made them active and quick. It had different names in different parts of North America, but at least five tribes — the Sioux, Miami, Seneca, Ottawa and Iroquois — referred to it as *atouronton*. Today this substance is known as petroleum.

Contemporary archaeologists are constantly unearthing remains of ancient American cultures which indicate that petroleum was in use thousands of years before the first colonials arrived. No written proof of this has yet been found, but the signs, coming in from Canadian and Mexican as well as numerous sites in the United States, are difficult to dispute.

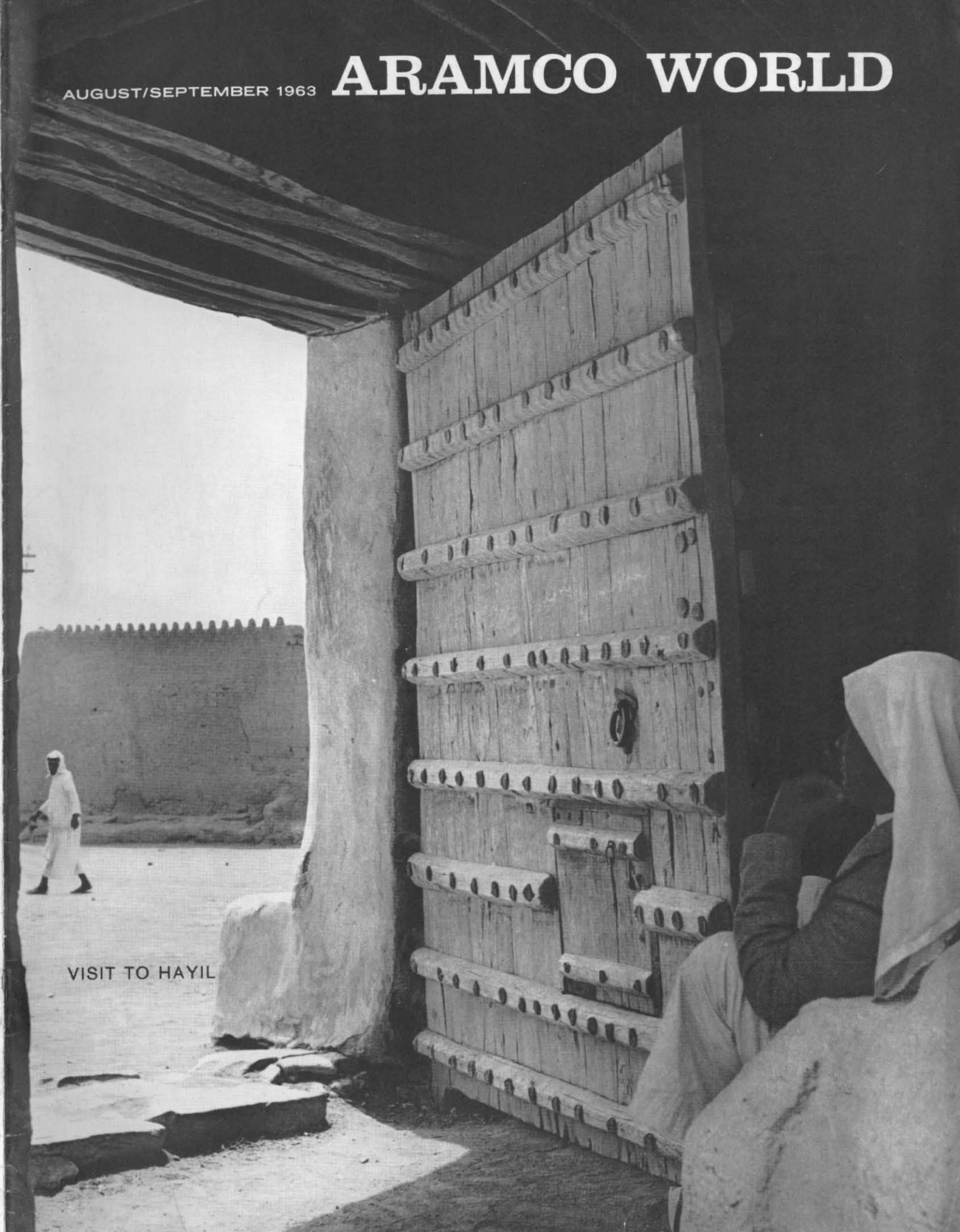
When the first colonials came to America, they found that the Indians regularly gathered surface oil. The substance built up as a thick layer over oil springs and pools formed by surface seepages. Skimming was the normal method of collection, and a broad, knife-edge board was used. "Directly after the harvest," a Pennsylvania historian reported in 1724, "the Indians will put their prize in wooden casings. When it has been heated and fetched to a liquid state, it is stored in stone or clay vessels."

Almost every tribe observed the custom of "peace trails" and "war trails." Along the peace trails were common necessities, such as salt deposits, oil springs and game. A party of Indians using the peace trail could traverse hostile territory to obtain supplies without fear of attack. Early explorers learned of this convention and thereafter stuck to the peace trails whenever possible. In this way, they soon discovered oil and its common uses, such as medicine for themselves and their animals, and they, of course, treasured it as a lubricant for the axles of wagons and carriages.

When the land became more settled, the pioneers developed the custom of laying blankets on the ground wherever petroleum appeared and then wringing it out of the cloth. The quantity gained was small, and peddlers were able to hawk it at a high price, calling it "Seneca Oil" or "Indian Oil." Settlers, like their Indian neighbors, applied oil to the body as a cure for rheumatism, but a handful of strong-stomached trappers went a step further and took it internally. In the latter seventeenth century, each pioneer used about a pint of oil a year, Indians much more.

The first truly American word for oil, *atouronton*, meant "free in giving," or "abundant." Now, centuries later, the term retains a surprising currency. Its meaning aptly describes petroleum's abundant applications. ■

AUGUST/SEPTEMBER 1963 **ARAMCO WORLD**



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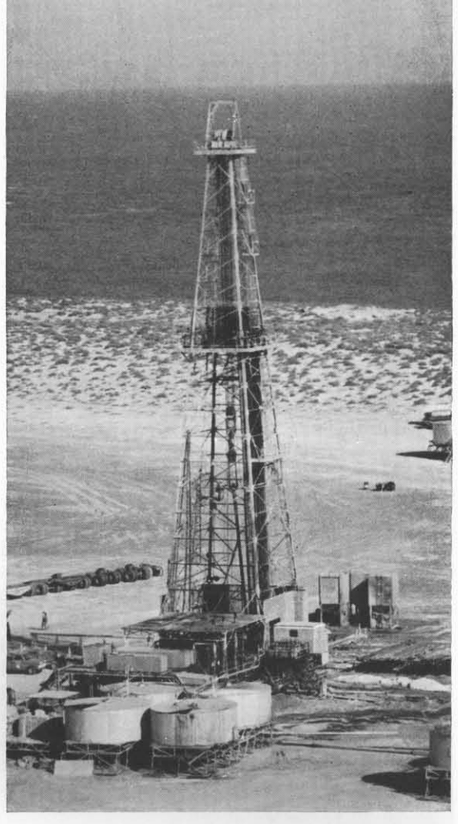
HOW TO BRING IN AN OIL FIELD

Aramco's decision to produce Manifa was the first link in a chain of events that will call upon the design, engineering and fabrication skills of many people in many countries



Aramco drilling rig at Manifa field. Most Manifa wells are offshore in the Persian Gulf.

LAST SUMMER the management of the Arabian American Oil Company decided to bring the offshore Manifa oil field in Saudi Arabia into production. This is how Aramco went about the job, a large-scale engineering and construction project that will not be completed until early 1964.

Many skills were needed. Aramco engineers were assigned to the project, and technical specialists in a number of countries were assembled into a temporary project team. By Christmas they will have broken ranks, as it were, and gone on to other ventures; Manifa will be ready to go on stream. Probably the most pertinent thing to be said about how to bring in an oil field is that it isn't easy — you can only succeed by trying.

Aramco had already had considerable experience in putting oil fields into production, both onshore and offshore, when it tackled Manifa, which lies adjacent to the eastern shore of Saudi Arabia. Ghawar, Aramco's most famous field, has remaining proved reserves of about 27 billion barrels of crude oil and thus stands in the front rank of the world's great oil discoveries. Another Aramco field, Safaniya, is the world's largest offshore reservoir. So, whatever problems lay ahead at Manifa, Aramco had undoubtedly tackled them in one form or another.

The decision of the Aramco management to place Manifa in production was announced in July 1962. (A look behind the scenes into the many factors that Aramco had to weigh

HOW TO BRING IN AN OIL FIELD

in developing Manifa was given in "Manifa: Profile of A Decision," *Aramco World,* June/July 1963.) The field's wildcat well—Manifa No. 1—had discovered oil four years earlier, in 1958. Six more wells had then been drilled to delineate the area and depth of the field. In 1960, the first phase of the delineation was completed.

An oil field in Saudi Arabia goes into production with a pre-determined number of wells. The initial production at Manifa will flow from eight wells. Of the seven wells drilled at Manifa during wildcatting delineation, five were suited to Aramco's production plans; two were not. An additional three wells needed to put the field in production will be drilled in late 1963.

The new wells were part of the extensive inventory of requirements for Manifa at the time the company decided to produce the field. There is need of an impressive array of facilities to carry Manifa's crude from the field to Aramco's marine terminal and to process the crude for handling and tanker shipment.

The *offshore* requirements include three production tie-in platforms standing in the waters of the Persian Gulf. These platforms will gather crude flow from individual wells before the oil enters an underwater trunkline leading to the shore. An underwater pipeline system consisting of a main trunkline and smaller-diameter lines to the individual wells will also be required. A variety of work boats will be needed to service the wells. The "existing fleet" assigned to the Safaniya field further north in the Gulf was considered sufficient to serve Manifa also.

The *onshore* requirements include a gas-oil separator plant; a pumping station to move the "separated" crude through a tie-in to an already-existing major pipeline system; electrification from Ras Tanura to Khursaniyah; and new, 3,000-horsepower pipeline booster pumps, which will be the largest electric motor-driven pumps ever installed in Saudi Arabia.

Manifa crude is sour; that is, it contains hydrogen sulfide, a poisonous and highly corrosive gas which must be removed in a stabilizer before it can be shipped in a tanker. Therefore, additional stabilization capacity will have to be constructed at Ras Tanura to handle the new production for export. Also, two 280,000-barrel storage tanks will be added at the marine terminal.

Such was the inventory of progress, and the inventory of requirements, at the time Aramco announced it would place Manifa in production. A tremendous job lay ahead. The decision to produce Manifa was the first step in a chain of events that would call upon the design, engineering and fabrication skills of many people in many countries. In the past Aramco's oil handling facilities have included components manufactured in Australia, Germany, Belgium, the United States, Switzerland, France, Japan, England, Holland and Italy.

The second step was to calculate the cost of the project and submit the proposed expenditures for the necessary approvals. At the same time, design and engineering groups proceeded with preliminary surveys for roads and pipelines.

Saudi Arab contractor's workmen apply coating of cement to pipe that will form gathering system when Manifa offshore field goes on stream.

They also undertook wave studies in the Gulf off Manifa Bay and made bore tests for construction foundations at various sites.

Next, some preliminary design work on the facilities was done. The actual engineering drawings were prepared by contractors under the supervision of the Aramco Overseas Company in The Hague, Holland. During this preliminary work a project manager was assigned by Aramco to coordinate all aspects of the vast Manifa undertaking.

After management approval was given to place Manifa in production, *critical path schedules* for the project were completed on July 10, 1962.

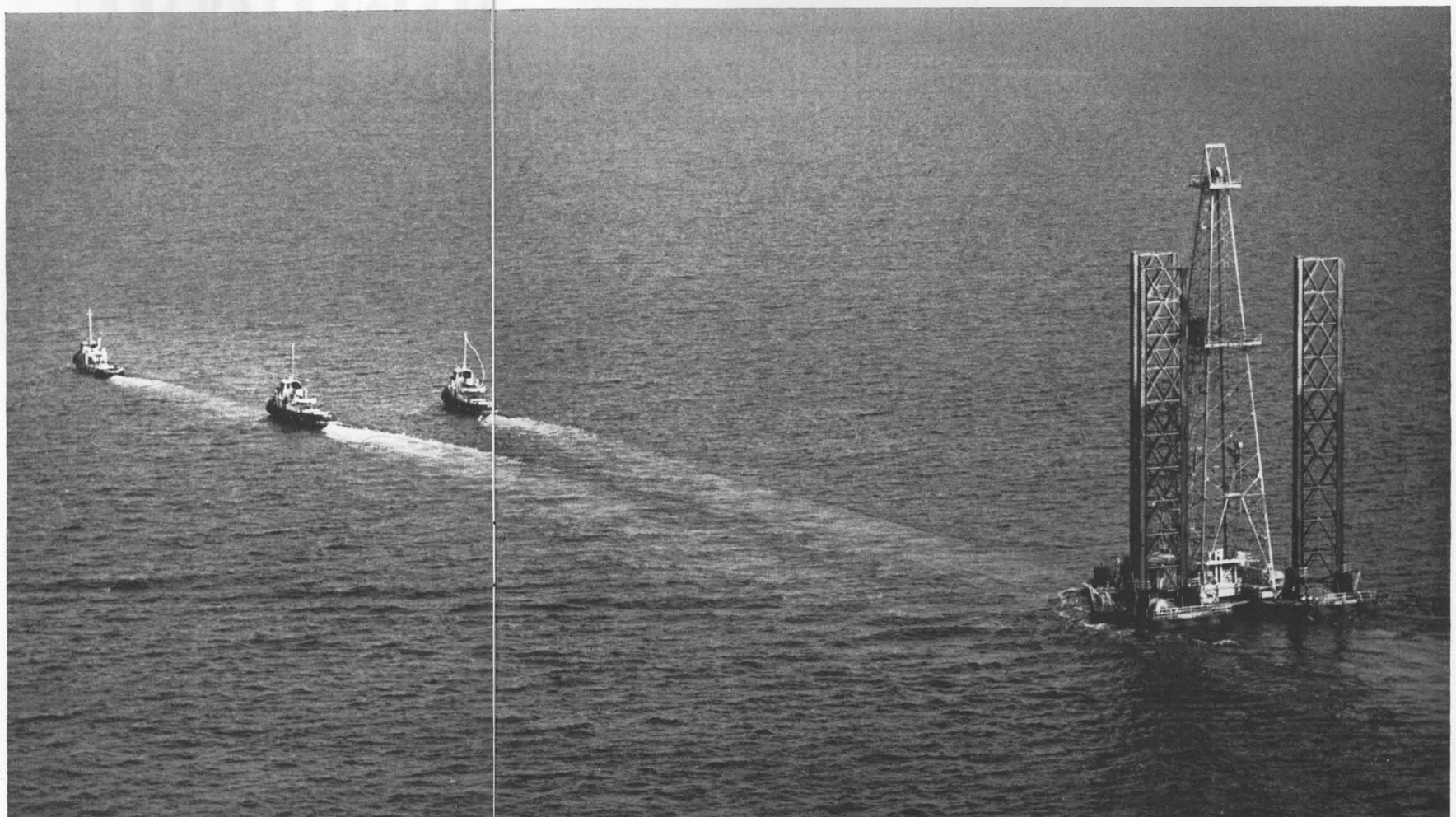
These schedules are logistical master plans much like the famous "D-minus" plans used in military operations. D-days are assigned for the completion of each component, such as a pumping station, the gas-oil separator plant and the submarine pipeline system, of the project. Incremental deadlines are then set by subtracting a determined number of days from the D-day of each component. For example, it takes a certain number of days to ship pipeline pipe from a given port. The pipe must be at the port by D-day (its date of arrival in Saudi Arabia, say) minus the number of days it will be at sea.

During the time the critical path schedules were nearing completion, the preliminary designs for Manifa's facilities were being reviewed by Aramco experts. A *project proposal meeting* was then called to determine the exact location, as well as the capacity and other specifications, for each facility.

The project manager then solicited final design bids through the Aramco Overseas Company in The Hague. The design was completed in stages so that the fabrication of components could get under way as soon as possible. All final design was reviewed by specialist groups (instrumentation, processing, electrical) within Aramco, and inspection requirements were established. As each design stage was completed, purchase orders were placed with the successful bidders among the manufacturers. The design work took about nine months to complete.

During manufacturing the company carefully inspected every component. Some of the inspecting was done by

Aramco tugs tow drilling rig to Manifa in Persian Gulf. When rig is at well site, three legs, raised here, will be lowered to Gulf's floor.



HOW TO BRING IN AN OIL FIELD

Aramco personnel, and some was carried out for the company by specialist organizations under contract.

Slowly, a strange miscellany moved toward ports around the world. Special instruments, pipe, huge pumps, and the vessels and other components of processing units began to make their various ways to Saudi Arabia.

As has already been noted, Aramco purchases its supplies in many countries. In the past it maintained one of the world's most extensive purchasing networks. Today, Aramco buys one-third of all its supplies through Saudi Arab merchants who now import a wide range of consumer goods and industrial material.

About 50 per cent of all materials and supplies for the Manifa project is being obtained from local Saudi Arab sources. For example, the purchase from abroad of the pipe for the field's underwater gathering system was handled by local merchants in the cities of Dammam and al-Khobar. An independent Saudi Arab contractor established a new plant in the Dammam area designed to apply wrapping and special cement coating to the pipe in order to give it vital protection against corrosion and the necessary weight to anchor it.

When the first components for Manifa were being fabricated earlier this year in distant factories, Aramco began to gear up in Saudi Arabia for a big construction program. Manpower estimates were prepared, and the company opened negotiations with Saudi Arab contractors.

Several contracts were made also with world-wide service organizations skilled in oil industry construction, and a contract was made with one construction company to provide experts to supervise construction work for Aramco. The submarine work at Manifa was contracted to a firm that specializes in underwater construction and installation.

At the beginning of March of this year work was moving forward on schedule in all sectors of the project. The "critical path schedules" at that time showed:

Engineering Design: Completed, except for some of the detail drawings.

Purchasing: Completed.

Fabrication: Work progressing on processing vessels, electric motors, pumps, and so on.

Shipping: Some pipe, vessels and other materials had arrived in Saudi Arabia; more on the way.

Construction: Tie-in pipeline started, site for gas-oil separator plant graded, spheroid being erected at plantsite, foundations for the terminal tanks being built.

Field Testing: Not started.

Field testing will be the last step in the series of critical evaluations that started with the early design reviews within Aramco. Some of the field inspection will be carried out by Aramco experts, and some of the testing will be done by contract specialists, who will use their own equipment.

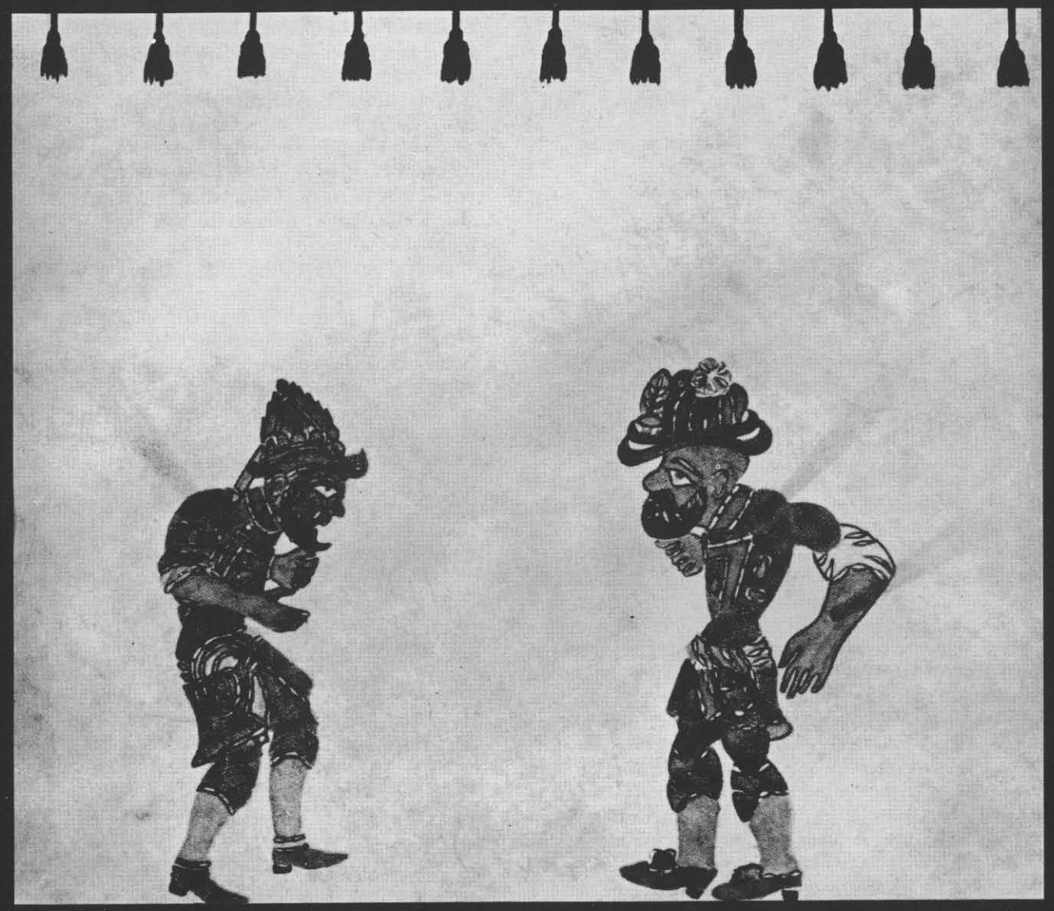
When the field tests of all facilities from the gathering lines at Manifa to the storage tanks at Ras Tanura are completed, the company will accept them as installed and ready to operate.

The final step in bringing in Manifa will be the "plant start-up," as it is called. Aramco operations, engineering, processing, mechanical and instrumentation personnel will all be present to observe the preliminary production of the field through its new complex of facilities. In the cases of some highly specialized components, the design firm and the manufacturer will also have representatives present to assist in the start-up.

And that, in brief, is an explanation of how to place a new oil field in production.

On January 1, 1964, the Manifa project manager will turn over the facilities to the operating crews and production will be ready to begin from another Saudi Arab oil field. By that time some Aramco project manager will have yet another oncoming oil field somewhere along its "critical path schedule." ■

This completed offshore well with its Christmas tree platform is at Safaniya field but is similar to platforms that will be used at Manifa.



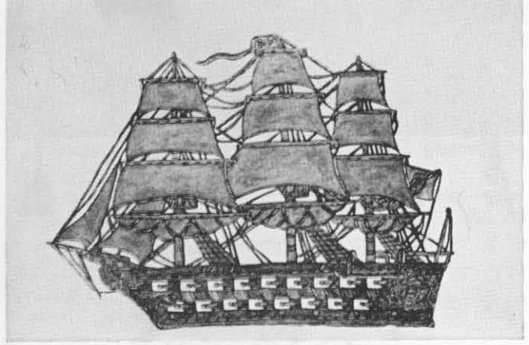
Hacivad (left) depicts the pompous, self-important man; his foil, Karagoz (right), characterizes an adventurous, witty rascal.

The Performance of Shadows

In many lands of the Middle East the Karagoz puppet theater was an eagerly awaited event each year

INSIDE THE COFFEE HOUSE, it was almost pitch-black. The Tunisian night air is quiet, expectant. Patrons who would ordinarily be laughing and chatting over a cup of thick, dark coffee sit silently on wooden benches and chairs ranged around the room.

Suddenly a small screen at one end of the room is brightly lighted. There are shouts of delight, followed by the strains of a sentimental song. The youngsters in the first few rows of benches sit up, their eyes wide and excited. The theater is



A three-deck man-of-war.

The Performance of Shadows

about to begin! Everyone concentrates on the white screen.

They have been waiting a whole year, for this is no everyday spectacle. This is *Karagoz,* the famous shadow puppet theater of the Middle East and one of the oldest folk traditions of the Muslim world. It is Ramadan, and for 28 nights they will see a different play each evening.

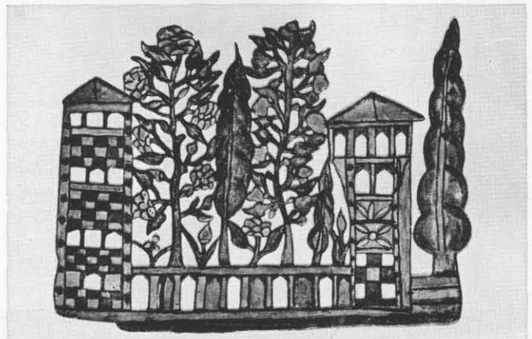
As the plaintive melody ends, Hacivad makes his appearance – Hacivad, the pseudo-intellectual man-of-the-world who introduces the play and acts as foil for the boisterous, comic Karagoz, a witty rascal who falls into wild adventures. Some even consider Karagoz a gypsy because in Turkish his name means "black eye."

"This is the performance of shadows," Hacivad begins, and the audience settles down to an evening of hilarity at the expense of the foolish, the pompous and the pretentious.

Shadow puppets are found all over the world. Karagoz, the roguish hero of the East, is the brother of England's Punch, France's Guignol, Germany's Kasperl, America's Lafleur, Italy's Pulcinella and Russia's Petrushka. He bears the same relationship to the heroes of the shadow drama of India, China, Siam, Japan, Indo-China and the Dutch East Indies. Yet Karagoz is older than any of these forms, with the exception of India, where the shadow-theater tradition is recorded as far back as twenty centuries ago.

Karagoz was invented somewhere in Asia, and early allusions to it are found in Arabic writings of the eleventh century. Its spread probably followed the route of Turkish expansion in the Orient, Middle East and North Africa, for initial mentions of it coincide with the era of Turkish influence in the Muslim world. This does not mean that Karagoz is necessarily a Turkish invention, but the Turks, originally from Central Asia, were intimately acquainted with the shadow puppet theater and probably spread it through their nomadic wanderings. Initially it was a form of entertainment enjoyed by the masses, for to them it represented life as they observed it. Later, Karagoz became popular in court and aristocratic circles.

Legend has it that although the shadow-theater form came into being earlier, the two protagonists – Karagoz and Hacivad – date to the fourteenth-century reign of Sultan Orhan. A mason and a blacksmith by those names were supposed to have lived at that time. Commissioned to work on a mosque being constructed by order of the Sultan, the two wisecracking cronies kept their colleagues in constant laughter. The Sultan, wondering why the construction proceeded at a snail's pace, had them done away with when he learned of their distracting antics. A man named Seyh Kusteri, wishing to console the Sultan when he was overcome with remorse for his impulsive harshness, erected a screen in a corner of the palace and showed silhouettes of Hacivad and Karagoz up to their most amusing tricks.



A kiosk and garden.

At this time, the plays were primarily humorous. Slapstick was the core of action. Whenever Karagoz wearied of Hacivad's tedious recitations of poetry and philosophy, a few well-aimed blows served to terminate them. Through the centuries, Hacivad has always represented the pretentious man of "culture," who injects learned words into his own language to demonstrate a false elegance, much as some twentieth-century counterparts pepper their conversations with foreign phrases. Karagoz, on the other hand, has always been portrayed as the down-to-earth, common-sense embodiment of the people.

As the plays became rowdier, religious and secular leaders acted to discourage their performance. In 1451, Sultan Jakmak of Egypt forbade Karagoz and ordered that all sets and props be burned. In the sixteenth century, however, Karagoz had a revival and became established as a respectable form of theater. It was then that it developed some of its satirical overtones.

This was an era when the people had fewer outlets for grievances. Since they could not express their dissatisfaction openly, the puppets did it for them. After all, puppets could not be held responsible for their words or deeds! Historical events paved the way for satire of this type and, since officials could not be overtly depicted, the puppet characters became stereotypes and the plays a triumph of good over evil.

Karagoz puppets are brightly colored, two-dimensional figures made of thin camel skin. Their limbs are hinged so that they can perform amazing feats of derring-do, leap out of windows, fight and dance with utter realism. Somewhere in their mid-section is a small hole into which a long thin rod is inserted. The puppets are then pressed tightly against the linen or greased-paper screen and are moved by means of this rod, which is held at an angle so that the audience cannot see it.

Most of the plays are presented by one man, who must simultaneously speak all the roles in varying voices, provide his own sound effects, sing, recite and manipulate all the puppets. The most difficult task he faces, however, is pleasing an audience that usually knows the plays as well as the puppeteer, for the framework of each play has been handed down from generation to generation.

A sherbet vendor's shop.

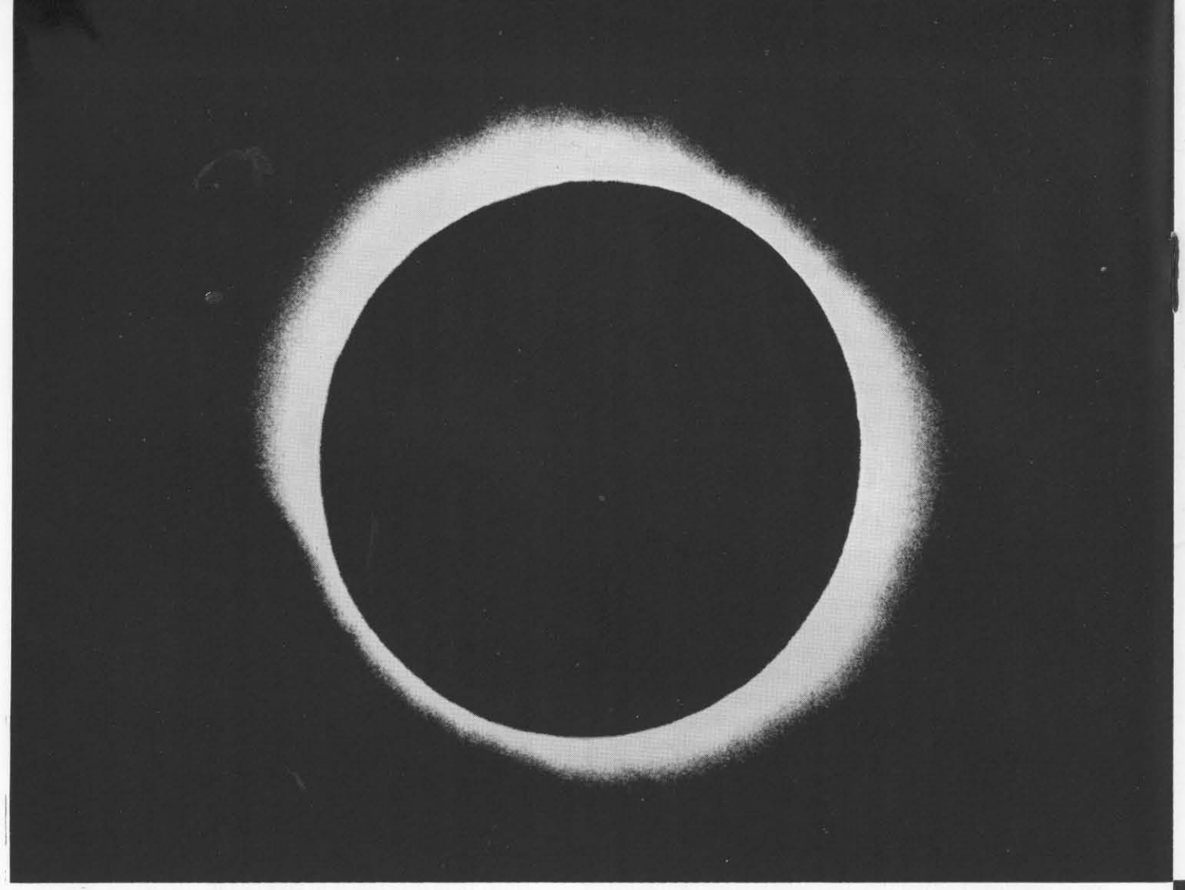
He must satisfy the children with Hacivad's eloquent flights of rhetoric, interrupted by Karagoz' fisticuffs, and he must amuse the adults by cleverly inserting topical references to neighborhood doings. All this he must do while remaining strictly within the established structure of the play. At least 28 different plays must be in each puppeteer's repertoire.

The plays that comprise the Karagoz repertoire often seem to the Westerner, unfamiliar with the tradition, to be a series of disconnected episodes. Actually, the plays are separate and distinct pictures of such topics as family life, marriage, and the coffee house. Each is a commentary on a facet of daily life in the Middle East.

Like the Punch and Judy puppet shows, Karagoz is far more than merely a form of juvenile entertainment. It is broad social comedy, meant to bring laughter to the average man and provide him with a few minutes' relief from his workaday problems.

Today, performances of the shadow puppets are not nearly as common as they once were. In most Middle East countries they have all but disappeared, and when they are seen, they are likely to be part of a special revival of an old folk art. But on the rare occasions when Hacivad and Karagoz come to life on the linen screen, that screen once again becomes a mirror of society which reflects what the people think of themselves, their world and their time. ■

Karagoz theater has great variety of standard figures. Puppets are made of thin camel skin and are held by a rod against linen or greased-paper screen.



Every star in the universe whirls through a celestial cycle of birth, development, and decline

BIOGRAPHY OF A STAR

When English poet Alfred, Lord Tennyson wanted to describe the bright stars of the Pleiades against their misty background, he called them "a swarm of fireflies tangled in a silver braid." His poetic vision, expressed in simple yet beautiful metaphor, was an entirely effective means to give his readers insight into a subject that is so far away, so immense that it almost defies comprehension.

As long as man has lived on earth, he has watched the skies, utterly fascinated, perhaps overwhelmed by the magnificence of the display. The study of the heavens may well be man's oldest science – proof of his relentless quest to understand more and more about the structure of the universe. But he has had to wait for the growth of science and coming of sophisticated tools to win most of the knowledge he now possesses. His understanding of the nature of the universe has been gained largely through the study of stars – their birth, development and eventual death.

Much indeed has been discovered about the life of stars within the past decade, but where and how a star's story begins are still matters of educated speculation. One theory contends that there was originally *one* primeval atom. Perhaps ten billion years ago that single atom burst, and from the radioactive explosion of the proton-electron-neutron-meson materials came every other star, planet and galaxy in the universe. A more common theory holds that there was no beginning point. The billions of stars in the galaxies were always there, forming and re-forming themselves out of what Tennyson called "silver braid."

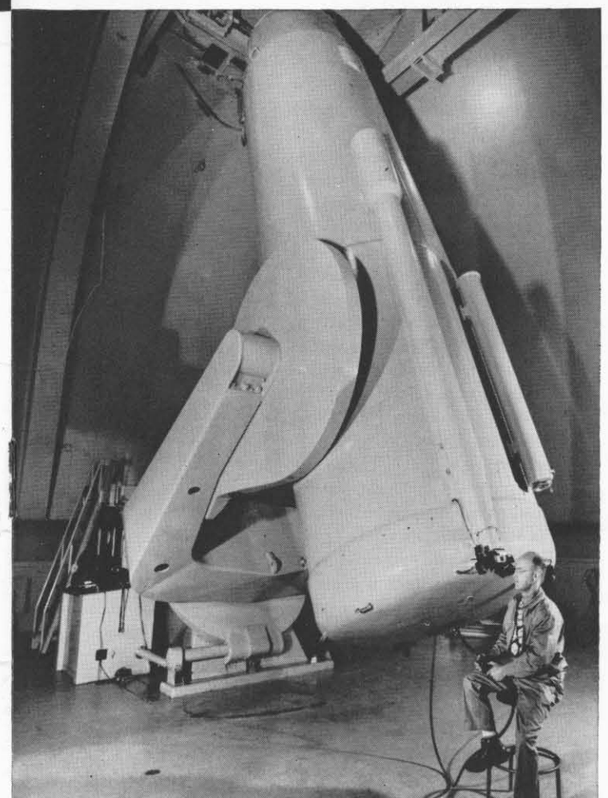
Scientists call this substance by the less romantic name of "the field of nebulosity" – interstellar gases floating everywhere in space in cloudlike formations. There appears to be a continual flow of movement in space, and sooner or later some of these gas clouds come together, contract, and become dense enough to form a new star. Newton's Law of Gravitation holds that a massive body will tend to collapse under its own gravitational attraction. Yet the stars, most of them far bigger than the sun (which is more than 300,000 times as massive as the earth) keep their balance.

The secret is in their substance. The gases forming a star are so hot and dense that they exert a counter-pressure to the outside pressure. The sun, for example, is estimated to have a central pressure more than a billion times the air pressure at the surface of the earth. And the sun is but a relatively small star that appears big only because it is, by astronomical standards, so near – just 93,000,000 miles mean distance from earth. The sun's light reaches earth in a little over eight minutes, with light traveling at 186,000 miles a second. The next nearest star after the sun, Proxima Centauri, needs four and one-half years for its light to reach us.

Because of its nearness, the sun is a comparatively easy-to-study and spectacular example of how a star lives. Basically, the sun is a sphere of hot gas a little less than one million miles in diameter, with about three hundred thousand times as much mass (weight) as the earth has. The surface temperature is about 10,000 degrees F., rising steeply in the interior to a peak at the center which is believed to reach millions of degrees.

In the sun, as in other stars, is a thermonuclear crucible which is constantly synthesizing the lighter atoms of the gases into heavier atoms. For example, the sun burns 564 million tons of hydrogen into helium each second, liberating as much energy as the explosion of several billion H-bombs.

A series of calculations have been carried out by nuclear physicists for stars more massive than the sun. They show that as the helium content is built up in the star, the central areas shrink, releasing gravitational energy, while the outer areas expand. The star must make a drastic reorganization to the sudden new production of energy in its interior. Nuclear



The only star that can be studied at close quarters is the sun (upper left), shown here with its blazing corona during a total eclipse, July 1963. Sun is thought to be a star "in the prime of life." Star studies are made with instruments such as this Schmidt telescope at the Mount Palomar Observatory, California. With a mirror at bottom of tube and glass correcting plate at top, this type of telescope is useful in photographing large areas of the sky.

Galaxy known as Ursa Major is made up of billions of individual stars but is so far away from earth that it appears as giant swirl of light.

BIOGRAPHY OF A STAR

physicists believe that not only helium is formed in the interior of stars, but all other elements as well.

It takes a temperature of one or two hundred million degrees to transform helium into the main isotopes of carbon, oxygen and neon. And it takes temperatures of from two to five billion degrees to make the nuclei of atoms like iron and nickel. The common carbon atom is twelve times heavier than the hydrogen atom; iron is 56 times heavier; uranium is 238 times.

Whatever the atom activity in the center of the star, eventually the energy will move outward to the surface and be radiated into space. This heat radiation is what is seen as the star's twinkle.

Estimates of the age of stars range from ten to twenty million years for youngsters and from ten to twenty billion years for celestial senior citizens. As they pass "middle age," something may go wrong with the inner thermostatic controls, and the star can no longer shine on steadily and uneventfully, quietly manufacturing heavier and heavier atoms. Aging stars appear to become what astronomers call blue giants, then red giants, and eventually white dwarfs.

The aging sequence begins when a star's hydrogen supply runs low. As the star approaches extinction, its old age shows up on the telescope in changes in color and brightness, and it may appear to pulsate.

A white dwarf is a "dead" star, that is, a star that no longer shines because its nuclear fires have died down and it has cooled off. One authority has called the white dwarf "the burned out skeleton of a star," destined to float anonymously through space for eternity. Thus, the last stages of a star's story are spent as a white dwarf.

It is thought that the death of a star comes from violent explosion, whether from unstable internal conditions or from collision with another star. Time after time the skies have yielded what appears to be a brilliant, new star – a nova. It is not really a new star, but for a short time it looks like something new in the sky as the explosion, with its flare-up of light-producing energy, fills the space around with its dying radiance. What appears to be a new star is more likely an old star blowing its mass back into space in the form of interstellar gas and leaving behind its skeleton – a white dwarf.

A truly spectacular phenomenon is the blow-up of a supernova, an explosion so brilliant that some have appeared to be fifty million times more luminous than the sun.

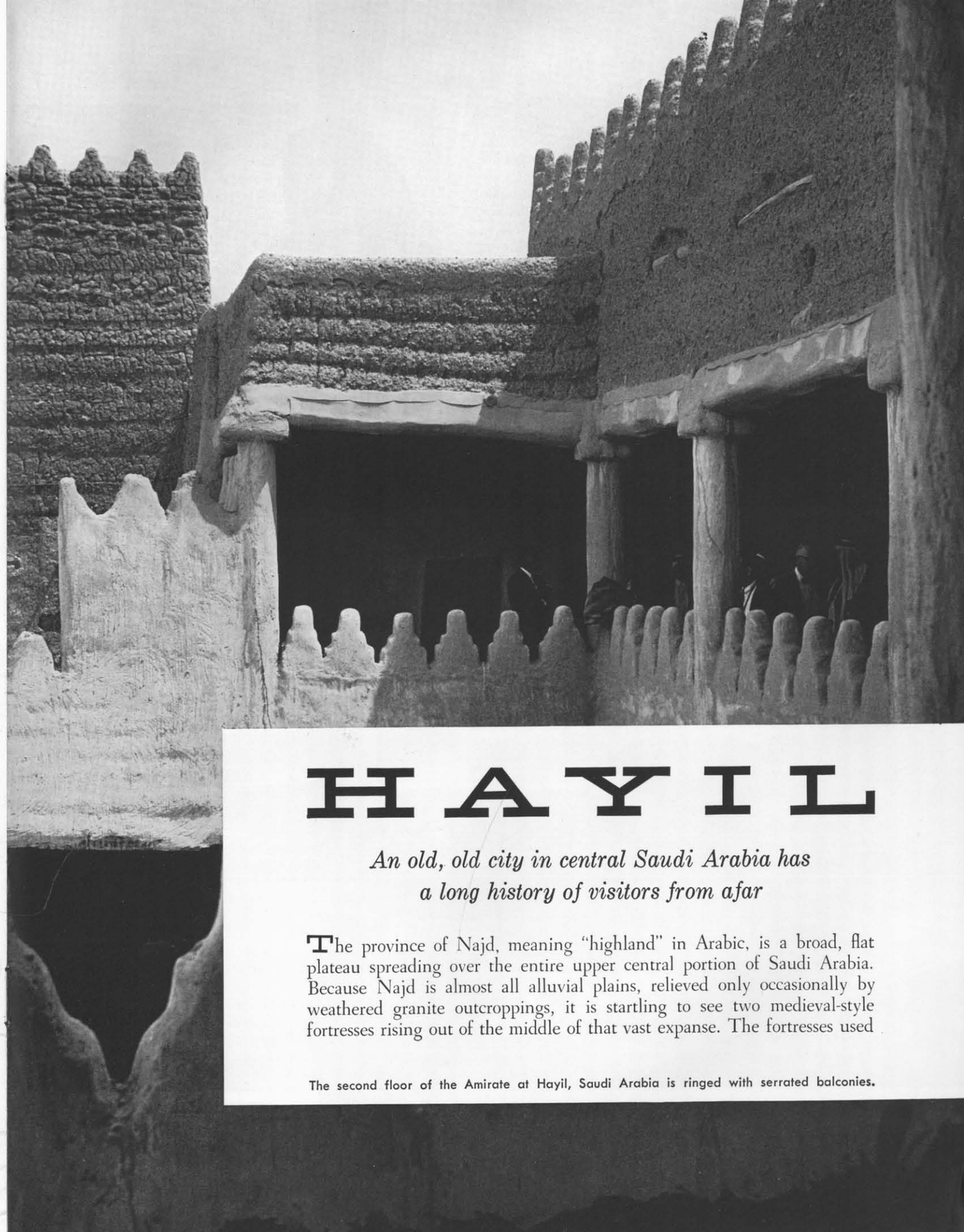
On July 4, 1054, Chinese and Japanese astronomers studied a dazzling new light in the sky, a light that outshone all others. It was so bright that for a week it could even be seen in the daytime, and its visibility at night lasted until April 17, 1056. Then the "star" faded from the sky, and no more was known of it.

Centuries later astronomers noted a small, faint nebulosity, or gas cloud, in the constellation Taurus, the same position the star had occupied. Because of its shape, it was named the Crab Nebula, and it is visible today. At the center are two small stars, probably white dwarfs. Studies through the spectrograph show the nebula expanding at the rate of about 700 miles a second, with its filaments reaching out into space for billions of miles. Calculating back from its steady rate of expansion, astronomers have been able to establish its date of origin. The nebula was indeed the star which had lighted the Oriental skies in 1054. The explosion which caused the light had actually occurred some 4,000 years before the supernova had first been seen.

Since what is now seen happened forty centuries ago, scientists aren't sure what has happened to the supernova of the Crab Nebula. The materials may have been dispersed through space, and parts already gathered elsewhere to make a new star.

Astronomers have made spectroscopic observations indicating that very young stars are richer in metals than the older stars. "Second generation" stars may have formed from the material of the old, exploded stars. There is speculation that the sun may be a third generation star, as it contains all kinds of heavy atoms.

The stars in earth's galaxy number about 100 billion, spread out in a space so great that light takes a hundred thousand years to travel from one side to the other. There are other galaxies, beyond counting, many millions of light-years distant from earth. Like earth's galaxy, they are composed of stars, with interstellar gases. As earth's galaxy is continually moving and evolving, so, scientists speculate, are the other galaxies. But since it is all a matter of deduction from what scientists know today, it may be that a discovery in the next month will give an entirely new perspective. ■



HAYIL

An old, old city in central Saudi Arabia has a long history of visitors from afar

The province of Najd, meaning "highland" in Arabic, is a broad, flat plateau spreading over the entire upper central portion of Saudi Arabia. Because Najd is almost all alluvial plains, relieved only occasionally by weathered granite outcroppings, it is startling to see two medieval-style fortresses rising out of the middle of that vast expanse. The fortresses used

The second floor of the Amirate at Hayil, Saudi Arabia is ringed with serrated balconies.

HAYIL

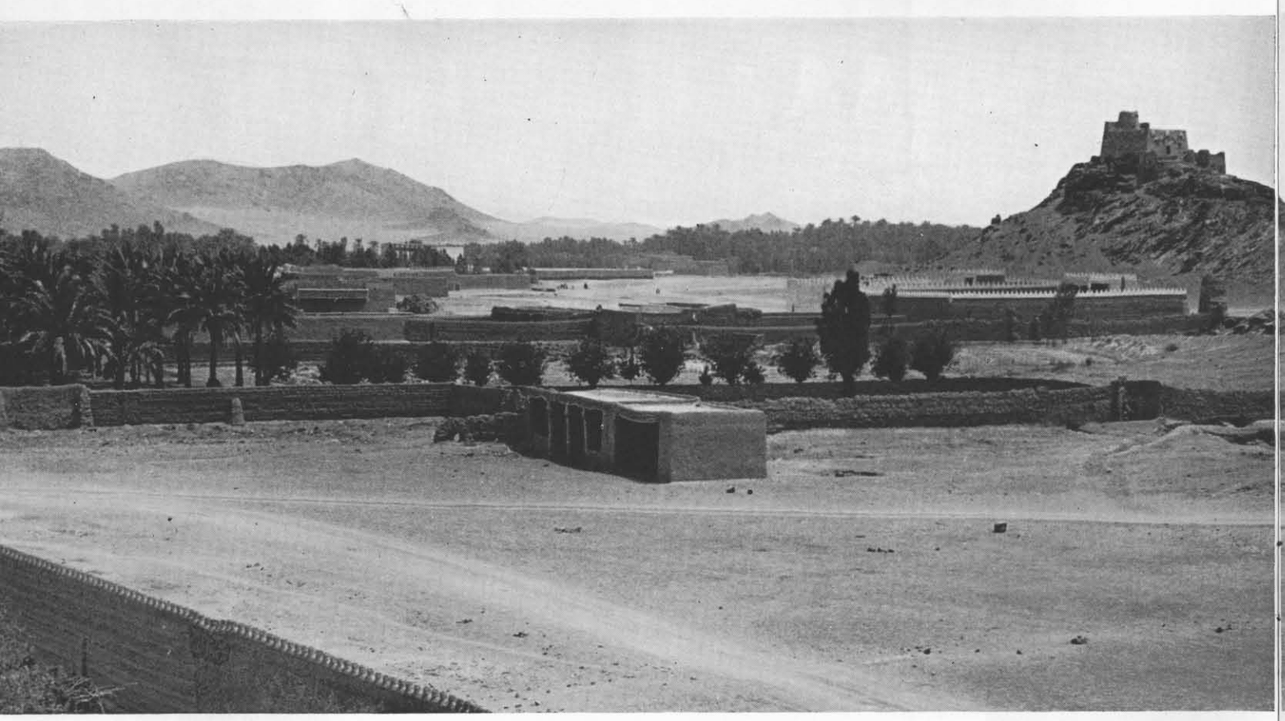
to guard the southern flanks of Hayil, largest and most important community in north central Najd.

Hayil is significant in the history of Arabia as the home of the House of Rashid, for generations the rivals of the Sa'ud family, which has provided the modern nation's rulers. The Rashid forces were overthrown at Hayil in 1921 by the late King 'Abd al-'Aziz Al Sa'ud. That event was a vital factor in the unification of the country under one crown.

The extreme geographical isolation of Hayil has never prevented travelers with an adventurous spirit from going there, nor the people of the old city from receiving them well. Some of the most vivid first-hand impressions of urban Arabian life as lived in the highland city are contained in the journals of Doughty, Palgrave, Guarmani and Lady Anne Blunt, who all made stops in Hayil during the latter half of the nineteenth century.

Remoteness from waterways, good roads or any of the other normal avenues of trade has not been a handicap to commercial enterprise in Hayil, either. The city is on one of the main routes traditionally taken by pilgrims from the north to the Holy Cities of Mecca and Medina in the

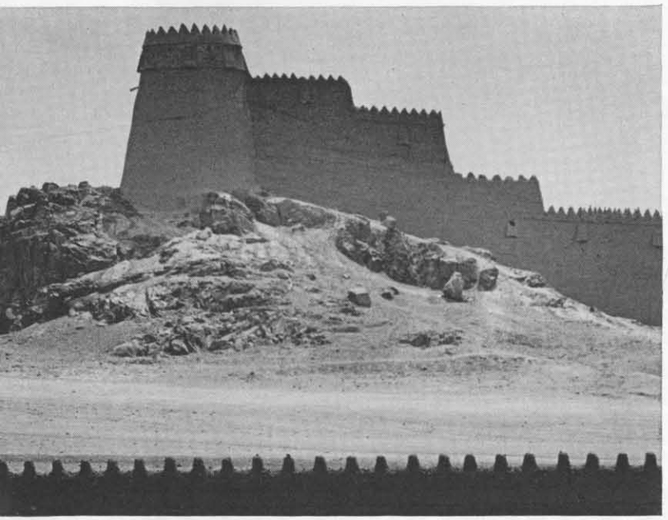
These Bedouin of Najd Province are part of the Amirate guard at Hayil.



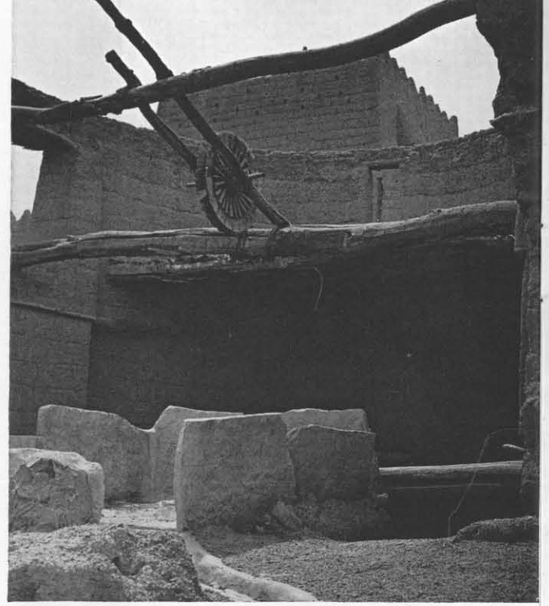
Hayil, largest city in north central Najd, is on route often taken by pilgrims from the north to Holy Cities of Mecca and Medina.

High walls surrounding blocks of houses accent the geometric design of central Hayil. The city has a flatness characteristic of Najd Province as a whole.

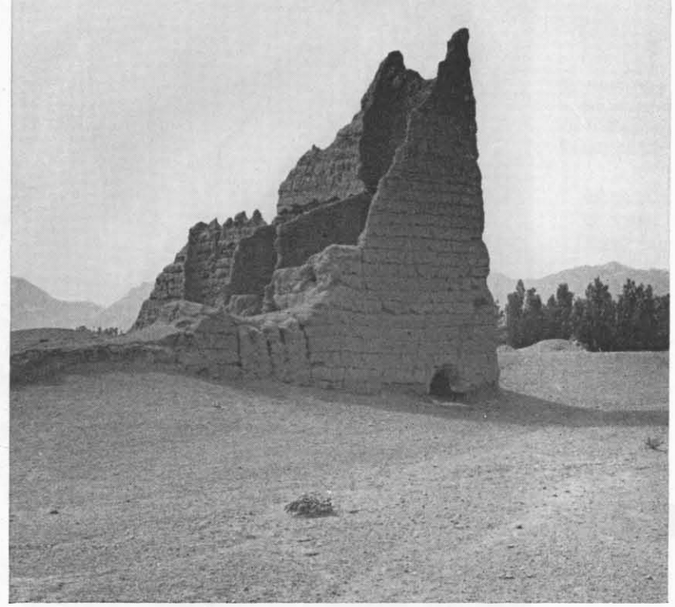
HAYIL



The first landmark seen by travelers as they approach Hayil over the Najd plains from south is this imposing fortress left over from an earlier age.



Government building section on edge of Hayil includes palace



Old water wheel (center left) at Hayil was built of clay brick. It has a large wooden wheel to help draw up water from great depths, as the water table in this part of Saudi Arabia is very low. Samuel Zwemer, writing about the city over 60 years ago, said, "Hayil lies in the midst of a barren land and is an oasis not by nature but by the pluck and perseverance of its founders." At left, crumbling remains of a home remind visitors that two centuries ago Hayil was nearly depopulated by a great plague.

of H. H. Amir 'Abd al-'Aziz ibn Musa'ad ibn Jiluwi in right background, police headquarters on left, and water well under white structure at right.

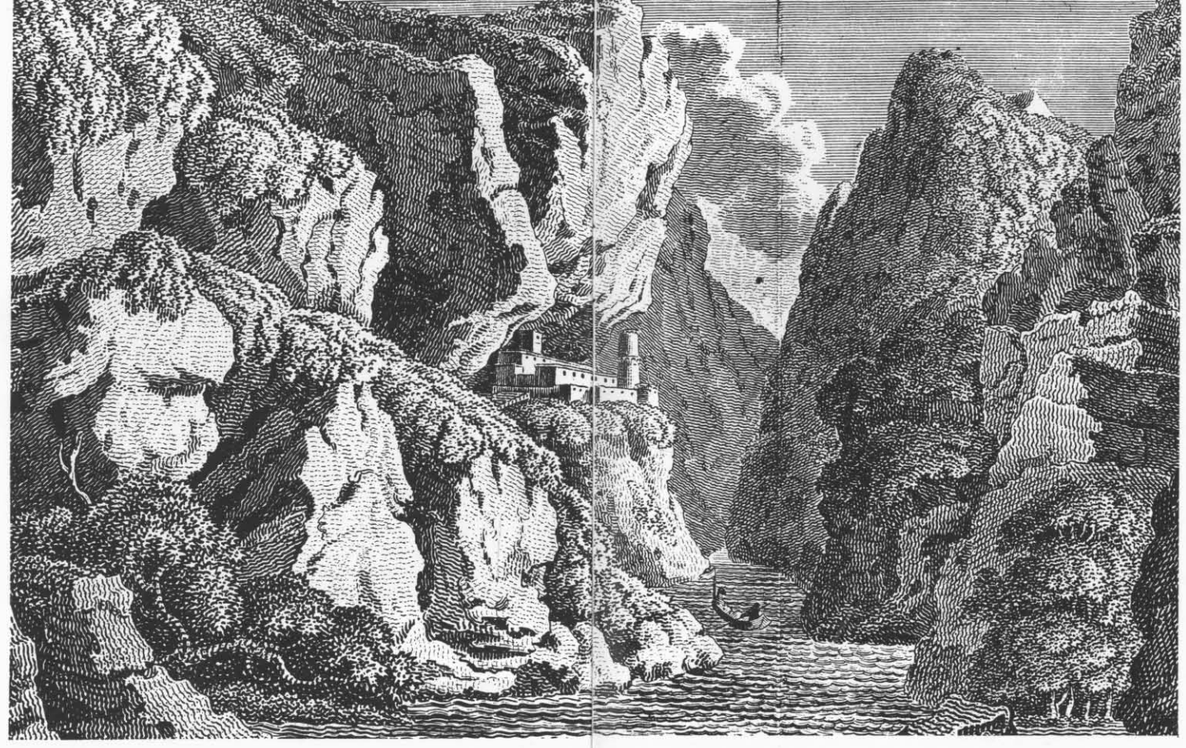
Hijaz. Many a traveler on a camel caravan has crossed through Hayil on long journeys between the East and the Mediterranean.

Ninety years ago Charles Doughty observed the people of Hayil wearing calico from Manchester and Bombay, working with European-made spades and crowbars, using chests from China for storage, and trading in Spanish reals, Turkish crowns, English sovereigns and Maria Theresa dollars. Karl Twitchell reported in the 1940's that the main market street had a "surprisingly large" variety of commodities, consisting of both local and imported products. Today several enterprising merchants from Jiddah operate branch stores in Hayil.

Last spring a planeload of passengers from Aramco made the 525-mile trip from Dhahran to Hayil to participate in the opening of the company's Mobile Exhibit being held in the city. The same features which have been impressing visitors for the last hundred years struck members of the Aramco party. They noted the neat, rectangular blocks of houses, separated by unusually large streets. They admired the general cleanliness of the city. With water resources as deep as 75 feet under the ground, the people of Hayil have managed against all odds to maintain a high standard of agriculture. For ages guests in the area have enjoyed the fruits of their labors. ■

An unusual sidelight on Europe's past tells of a craggy realm known as

Alpine Islam



By manning strategic passes in the Maritime Alps, Saracen forces controlled the French province known as the Mountains of the Moors.

THE QUIET OF THE NIGHT was broken only by the soft splash of oars beating rhythmically into the quiet waters of the Mediterranean off the French coast. The blackness of the night lay around the galley like a shroud until the lookout spotted a light on shore.

"Sir Captain," he whispered in the accents native to Islamic Spain, "I think we have arrived. Look, up there in the hills!"

Captain Ahmad Tariq turned to where the lookout was pointing. A light, indeed – but was it the signal they were waiting for? Six times the beam blinked on and off, a pattern repeated after an interval, then repeated again.

"Yes, we are here," replied the captain to his lookout. Then, to his boatswain: "The next headland is the one we desire. Bear to the left when we reach it and pull ashore." With a hand lantern he returned the signal.

The galley rounded the peninsula that is today known as the Moulins de Paillas, swung gracefully past the spot where the city of St. Tropez would one day stand, and edged up to dry land. A band of men materialized out of the darkness to meet them. The crew and passengers stepped out of the vessel for a long stretch and a few minutes of fraternizing, but there was little time for pleasantries. The galley had come laden to the gunwales with food, arms, tools and the odds-and-ends that soldiers needed to survive against powerful enemies. Several bales contained such items as Spanish lace, embroidered slippers, and gold ornaments – obviously intended for the ladies. This cargo had to be unloaded and moved inland before daybreak.

Busily they set about it. Those who had been waiting for the galley moved out in a long file with their burdens on their shoulders, followed by the passengers who had made the voyage, twenty soldiers and three civilian officials. As they disappeared, the rowers returned to their oars, pulled out into deep water, and pointed their ship's prow west toward Spain.

Who were these men of Islam? What were they doing on the Riviera? The answers to these questions involve one of the forgotten pages of European history. Yet it is a page without which some of Europe's present-day geography is unintelligible.

Consider the following place-names on the map. In the south of France, between Hyères to the west and Frejus to the east, there is a whole province called the Mountains of the Moors. Nice has its Saracen Quarter, La Garde Freinet its Saracen Chateau. An Alpine peak between France and Italy is known as Monte Moro. The Swiss topographical designations Almagell and Allalinhorn are thought by some philologists to be of Arabic origin.

In other words, the Arabs were there, and they left an indelible imprint on the geography and the speech of modern Europeans.

They got there from Spain in the eighth century, when Moorish armies marched across France to the Alps. The Frankish counterattack under Charlemagne and his successors cut them off by reaching the Mediterranean between the Pyrenees and Hyères. But roving bands of Saracens held out east of Hyères in the mountain fortress that came to be called after them the Mountains of the Moors. They made their survival known to the caliphs in Cordova, and as time passed they received reinforcements by the maritime route from Barcelona. Men and women came. A new state grew up amid the European duchies and counties along the coast and inland to the north. The Moors extended their power through the Alpine passes from France to Italy, and they ascended the Rhone to Switzerland.

This was Alpine Islam.

Its great age came in the first half of the tenth century. No unified power could be thrown against the invaders since Europe, following the collapse of the Carolingian Empire, disintegrated into a chaos of petty provincial lordships. The King of France held no power on the Riviera, which belonged to the Count of Provence, while the sub-Alpine territories of Italy belonged to the Count of Turin.

The genius of Alpine Islam was Mohammed Al-Qasam, who saw that he and his followers, once entrenched in the Mountains of the Moors, with access to the sea and the maritime route to Spain, could maintain themselves indefinitely. He chose the spot to build Great Fraxinet, his central stronghold, part of the original walls of which can still be seen in the French town of La Garde Freinet. Around Great Fraxinet, on the summits of the billowing crystalline rocks, he established sentry posts which could flash word in a few minutes on sighting an approaching enemy whether by land or by sea. Big armies could be stopped by relatively few men stationed at the throats of the mountain passes.

Virtually an armed camp in a hostile country, Alpine Islam could not adopt a settled existence based on farming or trade. As the name implies, it derived much of its livelihood from operations in the Alps. Occupying the main passes of the Western Alps – Mont Cenis, Mont Genevre, Great Saint Bernard – the Saracens levied tolls on travelers, of whom there were many, for the tenth century was a classical period for the pilgrimage to Rome.

When the Alpine tolls were not enough, Mohammed Al-Qasam sent expeditions into Italy, Switzerland and France to bring back what was needed at Great Fraxinet. And the Spanish base of supplies remained open, at least by night when Islamic galleys could slip past the shore patrols of the local dukes and counts. Thus did the Moors remain masters of the Maritime Alps for a century.

But brilliant as this achievement was, it could not last in the face of the rising powers all around. Alpine Islam was bound to fall eventually. Appropriately, the spark was fired in the high mountains that led to the conflagration in which it disappeared.

The Abbot of Cluny was returning from Italy to France in the year 972, his mule jogging through the Alps, a long line of ecclesiastics and laymen strung out behind. They took the famous route of the Great Saint Bernard Pass, and were entering the foothills, when suddenly they found their way blocked by a barrier of stones and logs. The Abbot reined in his mule as a din of shouting broke out at the rear of the caravan. The Saracens had trapped them, and now carried them off to Great Fraxinet as hostages.

Although they were freed unharmed after being ransomed, the incident involving the Abbot of Cluny proved to be more than the local lords were willing to endure. They had been harassed for too long, their political and military strength had been growing, and they felt that now was the time to do something about the warriors from Spain.

The Count of Provence and the Count of Turin joined forces. They entered the Mountains of the Moors with the mightiest army that Provence had seen since Carolingian times. Scattering the Saracen outposts, capturing the hilltop forts, fighting doggedly through the passes, they pressed on toward Great Fraxinet.

A medieval chronicler suggests that the stronghold was betrayed from within by a defender whose lady love had been stolen by his commander. Whether this tale was true or not, the Europeans stormed into Great Fraxinet and destroyed it.

As with the Roman Empire, the puzzling thing is not why Alpine Islam fell, but how it managed to remain standing for so long. The geographical setting, the international conditions, the fortitude of a few men and women (Great Fraxinet held about one thousand people during its heyday), these are the basic facts.

Alpine Islam did not decisively alter the course of history, but it wrote a fascinating chapter in the annals of the Alps, and it remains an eloquent witness to the remarkable vitality of the Saracens in the Middle Ages. ■