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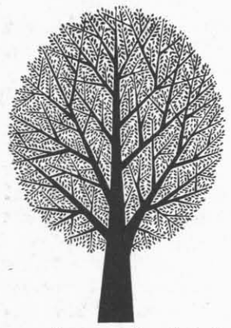
OIL THAT GROWS ON TREES



CENTURIES AGO Arabs discovered that the nuts growing on a certain palm tree yielded an oil that could be used in making soap, candles and greases; the ancient Egyptians used oil from the beans of the carob tree as an adhesive in the wrapping of mummies. Taking oil from trees is an idea as old as history, but today it is done by modern methods for modern purposes. Tree oils now are utilized in the manufacture of paint, food, drugs, textiles and many specialized products that people use nearly every day.

The oil palm, whose nuts were harvested by Arabs long ago, continues to be an important source of tree oil in many parts of the Middle East and even in South America. It is also an important source of income. The trees begin bearing nuts when they are about five years old and may go on producing an annual crop of about 2,000 nuts each for as long as fifty or sixty years. Similarly the carob tree, from which the Egyptians obtained their adhesive, is still valued for its oil. Today it is grown commercially, and its oil used in the manufacture of paper, textiles and certain food products that require a "binding agent" to make them hold together.

Another ancient oil-producing tree, but one that has been grown commercially only since the 1930's, is the tung. The word comes from the Chinese for "heart-shaped," which describes its interesting leaves. Marco Polo noted the tung in the course of his thirteenth-century travels, but it was not until Americans imported it to the United States from China some 30 years ago that its oil was farmed on a large scale and used in paint, printing ink, brake lining and pressed board manufacture.

The tung is not only one of the most valuable oil trees, but also one of the most difficult to grow. A delicate tree somewhat resembling the common crab apple, it must be planted and cultivated with great care and will grow only in certain areas along the Gulf Coast. The trees require a short, cold winter, an early spring, then steadily warm summers with plenty of rain. They also require a well-drained soil, which means they must be planted on the sides and tops of hills—which are not too plentiful in the areas where the climate and soil are suitable. Once the nuts have ripened and dropped to the ground, farmers have to put them in miniature burlap bags and tie them *back* onto the tree for drying and aging. Only then can the nuts be finally harvested and their oil extracted. Despite the problems of growing the tung, the 200,000 acres of trees annually produce around 20,000 tons of oil. More than half of this comes from one small area in the southwest corner of Mississippi.

Two trees that produce oils with pharmaceutical qualities are the South American copiaba tree and the California sugar pine. The leaves of the copiaba yield an oil useful in treating certain kidney ailments, and the oil of the sugar pine is presently being studied as a possible rich source of vitamin B.

Common olive oil, widely used in cooking today, was known at least as far back as ancient Greece where it was an exotic luxury item used by the wealthy classes as a beauty aid.

A tree oil that is familiar to everyone but seldom thought of as an oil is turpentine, a useful solvent and ingredient in paint. The thin, highly volatile fluid is distilled from the resin of certain pine trees, and resembles white gasoline more than it does other tree oils.

Tree oil production is small compared to the 1.2 billion tons of crude petroleum pumped from the world's oil wells last year, but the oil that comes from farmers instead of drillers has numerous special uses and continues to be an important product, even as it was many centuries ago. ■

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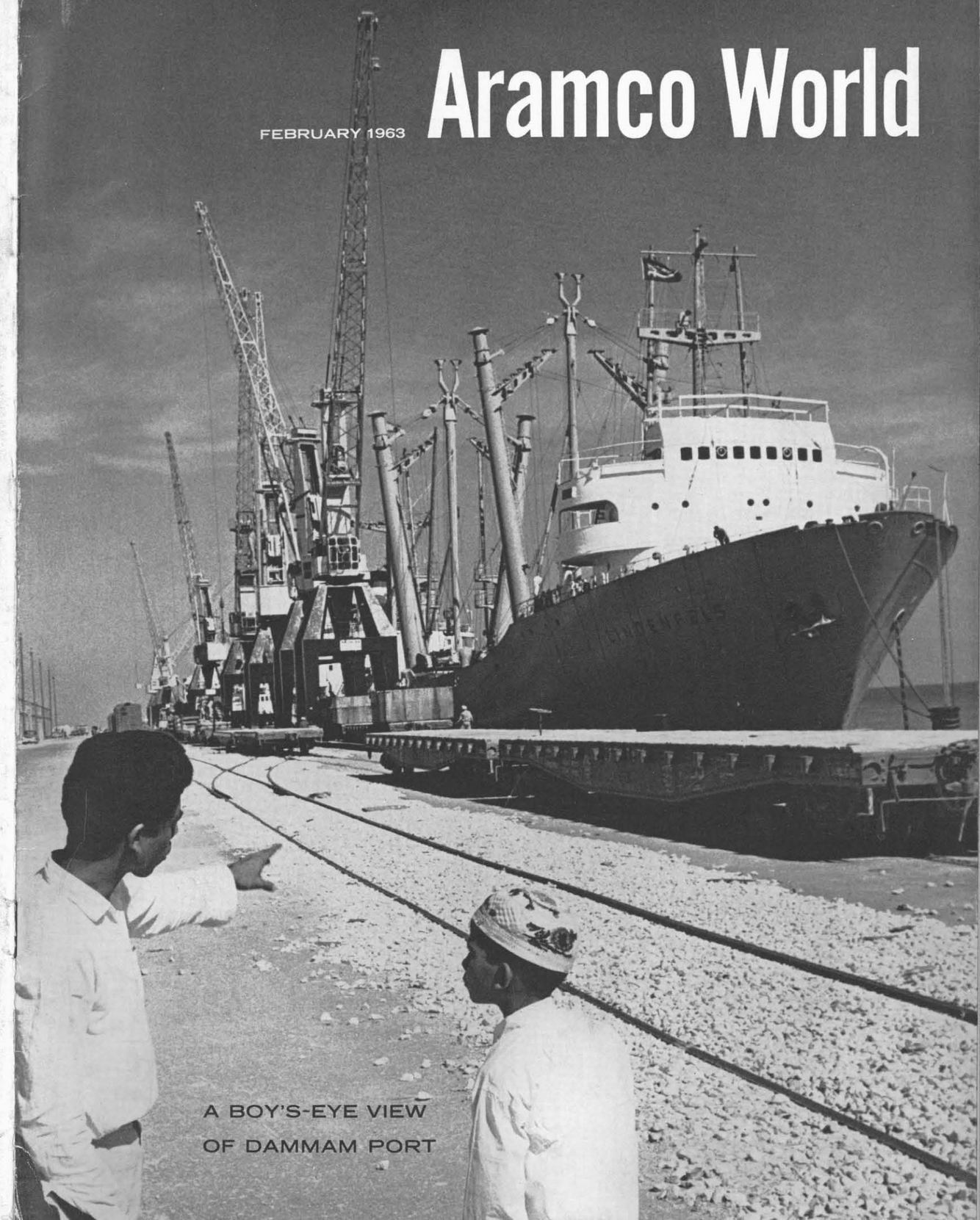

A BOY'S-EYE VIEW
OF DAMMAM PORT

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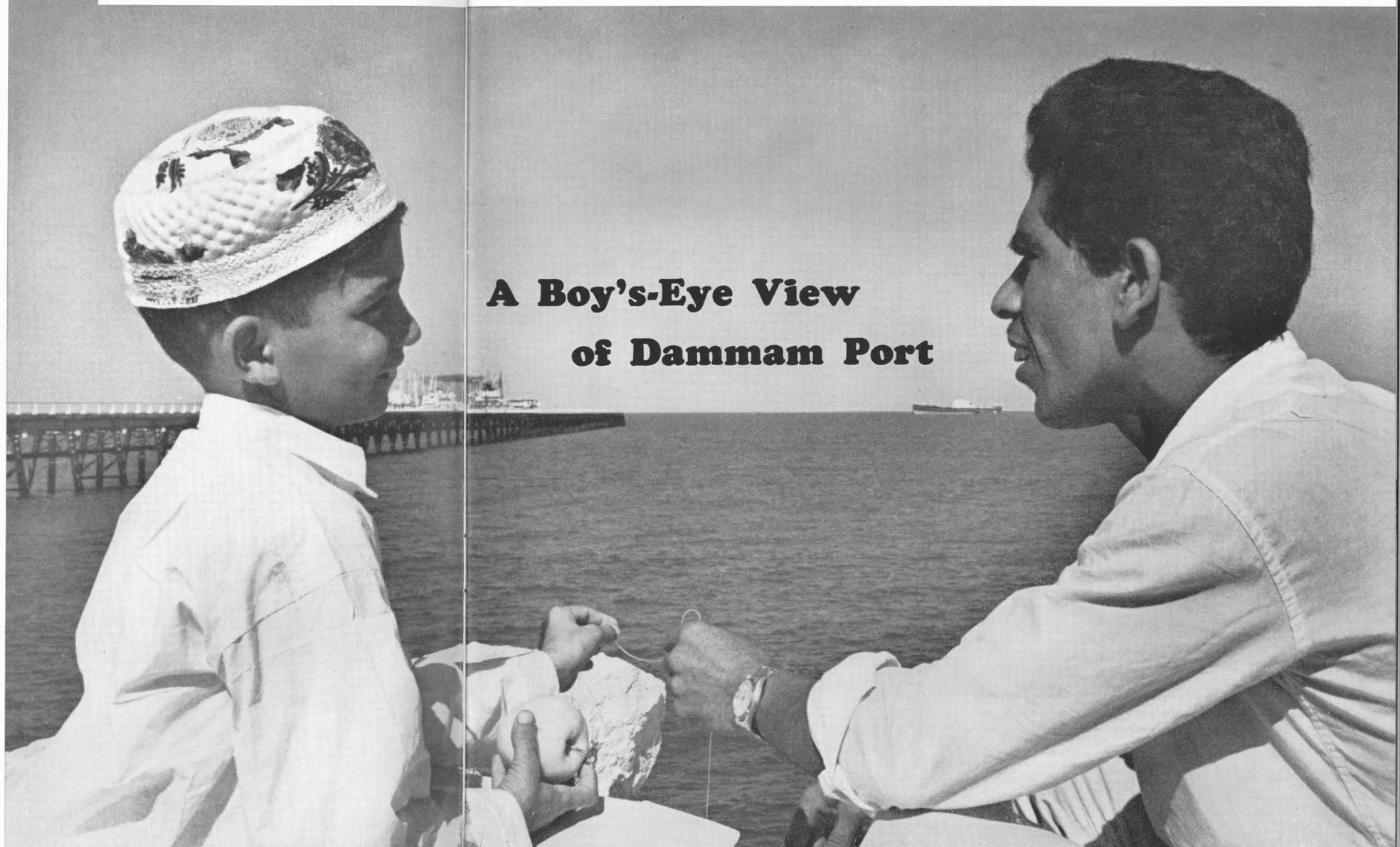
Older folks may point to this Saudi Arabian port's economic significance, but to a ten-year-old boy it's ships and cranes that count

A Boy's-Eye View of Dammam Port

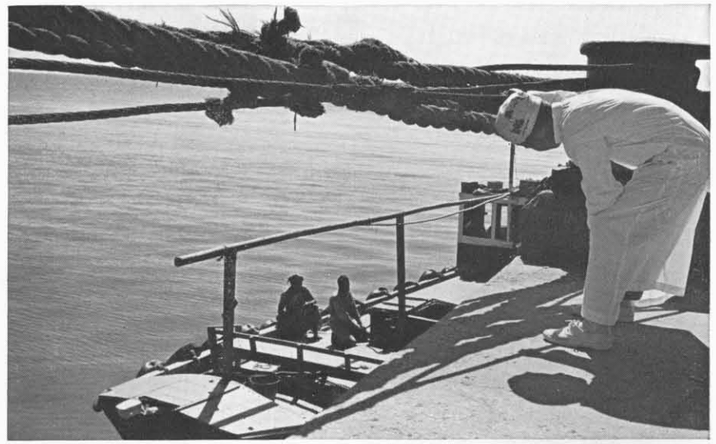
HASSAN ALI SAYAR works in Dammam for the Saudi Arab shipping firm of Yousif ibn Ahmed Kanoo. He has an intimate knowledge of Dammam Port, principal east coast point of entry for imports into Saudi Arabia. At home Hassan frequently tells his son, Faisal Hassan, about all the activity going on around the piers there. One recent Friday, which is the Muslim Sabbath, Hassan took the boy on a tour of the Persian Gulf pier facilities. Faisal was not quite old enough to appreciate the economic importance of the growing port that serves the entire eastern half of his country. For a ten-year-old, it was enough to marvel at diesel switch engines, giant cranes, railroad cars, busy tugboats, and ships bringing in goods from all over the world.

Visiting Dammam Port, Faisal Hassan Sayar (left) and his father pause for lunch and fishing near the port's seven-mile railroad trestle.



A BOY'S-EYE VIEW OF DAMMAM PORT

On his first visit to busy Dammam Port, young Faisal Hassan Sayar stops to inspect the huge hawsers that secure a ship to a pier for unloading.



Faisal pauses at the top of a gangway leading to the quarter-deck of a freighter while his father, Hassan Ali Sayar, explains how large cranes are used to unload the ships and transfer their cargoes to railroad cars parked on sidings.

Above, the captain of the Dutch freighter *Heemskerk* demonstrates how he controls the speed and direction of his ship's engines by means of the engine-room telegraph. At left, Faisal enjoys the breath-taking view from inside the operator's cab of a towering crane.

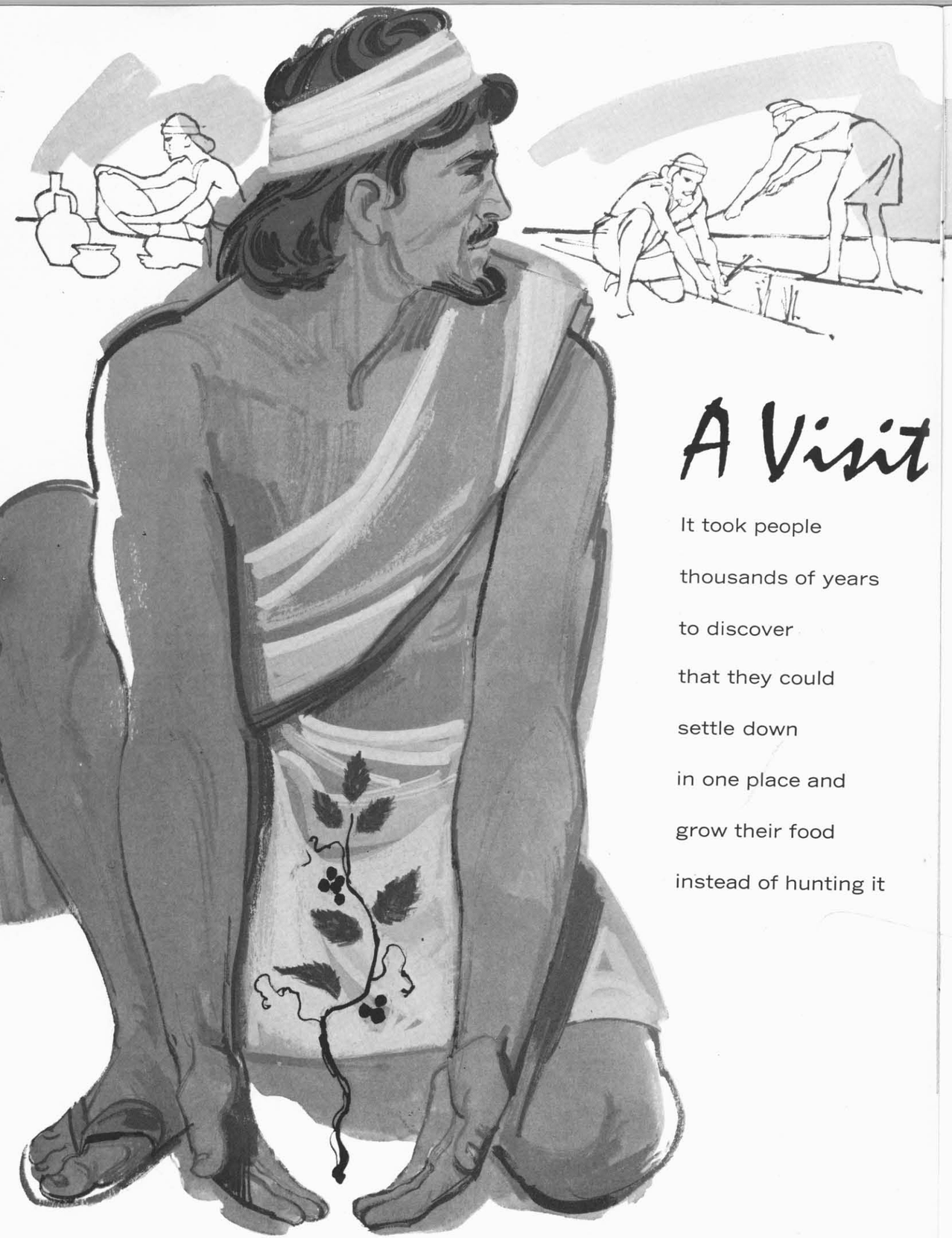
A BOY'S-EYE VIEW OF DAMMAM PORT

Inspecting trucks on a flatcar, Faisal learns from his father that Dammam Port is the eastern terminus of the railroad that runs 367 miles inland to Riyadh, Saudi Arabia's capital city.

Faisal watches with interest as workmen unload a cargo of sacked goods from the freighter *Heemskerk* onto flatcars for shipment to Riyadh.

At left, a crewman on the *Lindenfels* presents a curious sight as he climbs down a rope hand-over-hand from deck to maintenance scaffold. The conventional route is the ladder which hangs from the ship's rail.

PHOTOGRAPHS BY B. H. MOODY



A Visit To Some Early Cities

It took people

thousands of years

to discover

that they could

settle down

in one place and

grow their food

instead of hunting it

IMAGINE A FOOT-WEARY traveler in ancient Cilicia, the region near the border of Turkey and Syria, walking down a dusty path 6,000 years ago. He is short and stocky, a bearded man wearing a skirt-like wool garment, cap and sandals. From time to time he pauses to rest, seating himself on the bank of the swiftly flowing Tigris River. He is on his way to Uqair, the first city to arise in this rich Mesopotamian delta, and possibly in the entire world.

Were it 1963, he would be following a road in Iraq, perhaps heading toward Baghdad or Basra. But it is 4,000 B.C. and he knows only that he is going to a place unlike any he has ever been – a place where people live together as a group, in sturdy, permanent buildings intended to outlive the men who built them. He himself has seen only the crude straw shacks and rough-hewn cave dwellings scattered across the countryside, and he is filled with both wonder and trepidation.

Entering Uqair, our voyager gazes wide-eyed along a street lined with strange houses. The walls are low and made of mud-daubed reeds or baked mud bricks, topped with flat roofs. Doors are made of reeds or wood and pivot on hollow stones. Walking over to an open door, he peers inside to find five or six individual rooms. He has seen nothing like this before and hardly knows what to make of it.

Had he made this same trip 5,000 years earlier, he would have found a boundless wilderness – no fields of waving wheat, no herds of sheep and cattle, no houses or other signs of human hands at work. On his visit to Uqair, he undoubtedly failed to realize that this amazing city and the productive land around it were closely related.

The relation is a simple but important one: farming. Until primitive man learned to farm, he spent every day from dawn to dusk trying to find enough food to keep himself and his family alive. He had no time for any other interests. For thousands of years man roamed, picking berries, netting fish and killing game – following food instead of raising it.

Gradually his hunting methods improved. He learned to hunt systematically and in groups, instead of scavenging for himself, and by combining his own knowledge with the knowledge of others he began to learn the secrets of the land. His tools and methods became more specialized and refined, and finally, some 10,000 years ago, he learned that he could make his berries grow where he wanted them by planting seeds, and that if he captured animals and kept them, they would bear young animals, providing him with still more food that was as handy as his own back yard.

This discovery of farming and raising animals took place on the grassy uplands of the Fertile Crescent, where many of man's beginnings were made. There the soil was rich and the rainfall generous. Wheat, barley and other grains flourished. Goats, sheep, wild dogs, pigs, cattle and horses abounded. With his food supply at hand he no longer had to wander, and he settled down in small communities to supply his needs and improve his home, tools and comforts, and out of it all to come up with a system of interdependence which today is given the weighty name of "civilization."

Archaeologists recently excavated two of these early farming villages on the slopes of the Zagros mountain range, both dating back to between 7,000 and 6,500 B.C. Jarmo, a permanent, year-round settlement with about two dozen mud-walled houses, is in northern Iraq; Tepe Sarab, in Iran, was occupied only during certain seasons.

Jarmo was a little over three acres in size and had about 150 people. No doubt the citizens of Jarmo hunted and gathered food as did their forefathers, but they had other interests as well. Pottery, woven baskets and rugs, and clay figurines of fertility goddesses found at the site indicate they had religion and crafts, and had learned to share ideas.

As these early people learned more about farming, they

began looking for level ground where water was more plentiful, and about 5,000 B.C. they discovered the rich land between the Tigris and Euphrates Rivers. Thus Mesopotamia, "the land between the rivers," was born.

During the next thousand years another development took place. The excellent climate, rich soil and better farming methods made food so plentiful that not everyone had to be a farmer in order to eat. Some began to make things that other people needed, in exchange for food. From this simple farming community came the city as we think of it today – a place where men work at trades, producing what others need in return for what they themselves need.

So it was that man progressed from a wandering hunter, to farmer, to city dweller. The first step was the longest and most difficult, taking more than 250,000 years. But once man learned to raise his own food, it was only a relatively short 1,000 years before he was beginning to build cities.

Early Mesopotamian cities were much different from the tiny upland farming villages where community living first began. Wheat and barley remained important food, but the date palm, the "tree of life," became valued as both food and building material. Livestock became the responsibility of the officials in the cities' temples, making these men important supervisors of the local economy. Men further learned to cooperate and work together in building canals to irrigate farm land, and thereby reduce their dependence on rainfall.

Our traveler to Uqair marveled at a city he did not understand. He wandered through its streets aware that it was something very new and different, but he – and probably the people who lived there – could not fully grasp the reasons for its being and the functions it performed. Those born and raised there knew they could not do without it, but they were already accustomed to city life and might have found it difficult to explain it to an astonished visitor. Had he questioned some wise old man, though, he might have learned that four things made the city possible and necessary. One was the surplus of food supplied by farmers outside the city's gates. Another was the need to organize, build and control the elaborate irrigation system which made the surplus of food possible. A third was the need to band together for protection against warring neighbors who envied their wealth. Finally, the city was a logical and necessary place for the storage and exchange of goods.

Archaeologists have divided the rise of the Mesopotamian city-state into four periods. The first is called the Ubaid, which began around 4,000 B.C. During this time the village of Uqair was built by people from the Iranian highlands who lived a simple life of farming, boat building and fishing. The Ubaid period lasted for about two centuries and gave way to the relatively brief but important Warka period.

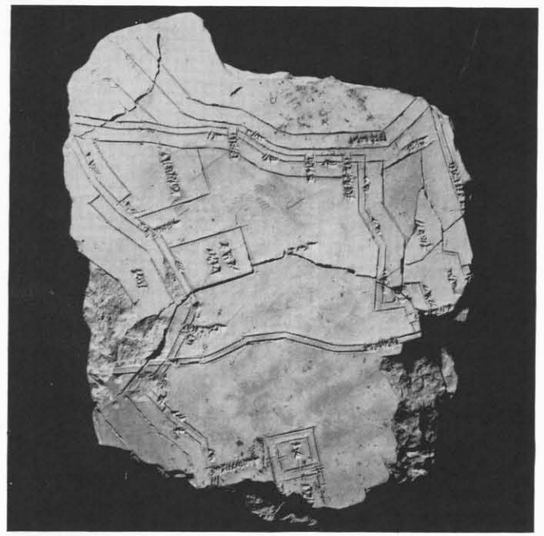
The people of the Warka period came from Central Anatolia in Turkey and progressed far beyond the simple Ubaid marsh dwellers. During this time architecture developed rapidly, and the simple temples and shrines became large, elaborate buildings of worship. Then the first written records appeared, introducing the Protoliterate period which lasted until about 3,000 B.C.

Finally the Early Dynastic period, beween 3,000 and 2,500 B.C., saw the development of the Sumerian city-state with its millions of inhabitants, elaborate religious, political and military orders, and more advanced forms of technology and commerce.

Our Cilician voyager found Uqair an amazing city in 4,000 B.C. Had he made his visit a thousand years later he would have been even more astonished at what he saw and at the way people lived. Most were still farming their own land, but these plots were all outside the huge stone walls that protected each city in this Early Dynastic period. In the center of the city were massive public buildings – temples, palaces and administrative halls. Leading away from the center were the streets where the city's wealthier citizens and officials lived. Unlike the houses of the city's poor, which were on alleys between or behind the larger buildings, the homes of the wealthy were built around spacious courtyards.

Merchants sold their wares from booths and small shops near the city gates, for market places and bazaars had not yet appeared. More and more craftsmen were specializing in luxury items for the wealthy and in equipment for the military. Cloth manufacturing also increased since textiles could be exchanged for the raw materials needed for making weapons and other goods.

Our visitor to Uqair saw none of this. But even in its early, simple form the city was impressive to a man who had known nothing more permanent than a burial cave. He could not foresee that over the centuries cities would become centers of commerce, culture, government and learning, and play perhaps the leading role in the rise and spread of world civilization. ■



The physical layout of an early community is depicted in this map of Nippur, a religious and scientific center in ancient Babylonia.

FANCY'S FAVORITE PLANET

"Is there life on Mars—or isn't there?"
The day is growing close when the old
controversy over our neighborly
red orb will be settled once and for all

EXCITEMENT RAN HIGH in the world's observatories in 1877. That year, the mysterious red planet Mars came unusually near the earth, permitting astronomers to view it at close range and make two important discoveries. The first discovery—that the planet had two tiny moons—stirred intense interest among scientists, but the second captured the imagination of people

According to Roman mythology, Mars was the god of war and the protector of Rome.

FANCY'S FAVORITE PLANET

everywhere and provoked controversy and speculation that still go on today. From Milan, Italy, Giovanni Schiaparelli announced to the world that through his powerful telescope he could see peculiar dark lines crossing the surface of the planet in all directions, and *to him they looked like canals.*

Astronomers had been studying Mars through telescopes since the days of Galileo, in the seventeenth century, but none had been able to observe "canals" that might imply the existence of life on the planet. Schiaparelli himself was very cautious not to draw any firm conclusions, but one noted scientist of his day wrote with conviction: "It is no longer permissible to doubt that the planet Mars is inhabited by a race of intelligent beings... that these beings execute works; that they possess, in consequence, industrial means; that they know science, the arts, and also astronomy."

The discovery of the mysterious lines on Mars sparked new interest in the planet and the building of new and improved observatories. In Flagstaff, Arizona the renowned astronomer Percival Lowell set up the now famous Lowell Observatory. The location was chosen for its unusually clear sky, and today the observatory is one of the best equipped in the world. In 1894, when Mars again orbited closer to the earth than its usual distance, Lowell made an intensive study of the planet and was able to sketch more than four hundred different canals. As far as he was concerned, they were irrigation canals, built by Martian inhabitants to carry water from the melting polar snowcaps to the desert regions near the equator.

The famous French astronomer Camille Flammarion had another idea. He maintained the lines showed cultivation along the banks, not the canals themselves, but this also argued for the existence of life on Mars.

Still, there were many astronomers who dismissed such ideas. Some said the lines were not lines at all, but stretches of land irregularities blending together. Others, while agreeing that the lines were solid, did not feel they necessarily meant the presence of intelligent life. Father Moreux, director of the Observatory of Bourges in France, declared: "Nature offers examples of nearly perfect geometric forms ... the study of crystals, cells and tissues will enlighten you on that point."

The mathematician Alan Webb argued otherwise. To distinguish between a network traced at random, as in a cracked vase, and one deliberately laid out, Webb devised a mathematical criterion, and according to it the Martian canals appeared to be intentionally designed.

Science fiction writers had a field day with the stimulating idea that life might exist on Mars, and for a while books and magazines by the hundreds speculated on the nature of the planet's inhabitants and the possibility of their invading the earth with strange ships and weapons. Probably the most famous such story was *The War of the Worlds,* written by H. G. Wells in 1898, in which Martians landed in space ships and began to conquer the world with huge robots. Mankind was saved only because the invaders proved susceptible to the world's lowest form of life – the common germ. In 1939 the story was made into a realistic radio program, causing panic among many listeners who became convinced they were hearing the sensational news of an actual Martian invasion. Although the program was clearly identified as a fictional radio play when it began, people who tuned in late heard only the voice of a terror-stricken newscaster giving an eyewitness account of Martian monsters destroying everything in their path as they advanced on New York City.

Mars has been an object of fascination ever since man first studied the heavens. The ancient Greeks wondered much about the stars and planets and believed they revolved around the earth. This interest in the planets led to astrology, still practiced by those who believe the planets have personalities and control man's destiny.

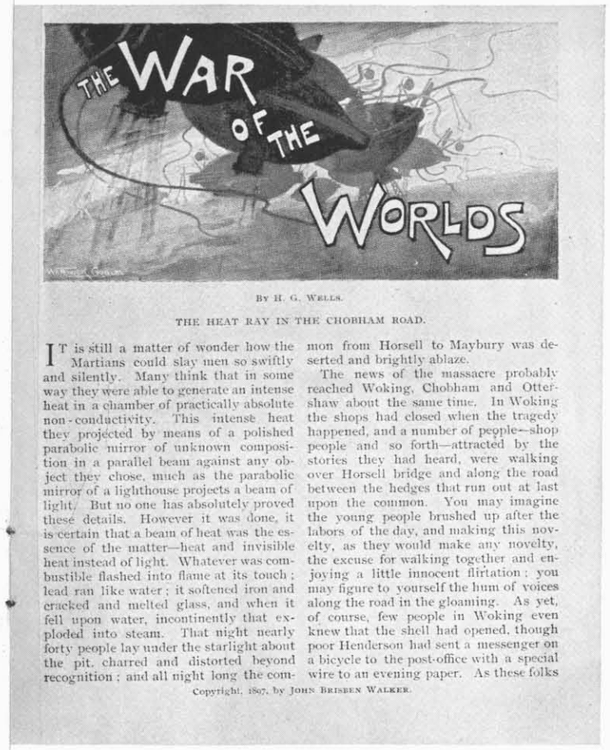
Mars, for instance, was the Roman god of war, which would seem appropriate in view of what astronomers have discovered about the planet. It is reddish – the color associated with blood and energy – and its surface appears to be a wasteland swept by icy winds and clouds of dust.

In Roman mythology, Mars was the father of Romulus and Remus, the legendary twins who were raised by a she-wolf. Romulus was considered the founder of Rome and Mars its protector. The two horses which pulled Mars' chariot were Deimos and Phobos (Dread and Fear), and these names were given to the planet's two moons after they were discovered by Asaph Hall at the Naval Observatory in Washington in 1877.

Although the planet Mars has been an object of interest since ancient times, its size, appearance, and distance from the earth were not known until the telescope was invented. To the telescope has since been added the spectroscope, a device that separates a ray of light into its different colors for study of the light source. To these two instruments astronomers owe most of the knowledge they have of Mars.

Mars is about 4,200 miles in diameter, inclined on its axis, and its period of rotation is about 25 hours. In these respects it is not too different from the earth. The Martian year is 687 days, about twice the earth's, and since the planet is around 140 million miles from the sun it is much cooler than the earth, which is around 93 million miles. Its two moons are very small, only about ten miles in diameter.

It is known that Mars has an atmosphere because clouds can be seen, but its air is very thin and mostly carbon dioxide. Without oxygen, animal life as we know it cannot exist. Plant life, on the other hand, needs carbon dioxide. Mars has white polar caps, which are thought to be snow since they expand during the planet's cold season and shrink during the warmer periods.


THE WAR OF THE WORLDS

By H. G. Wells.

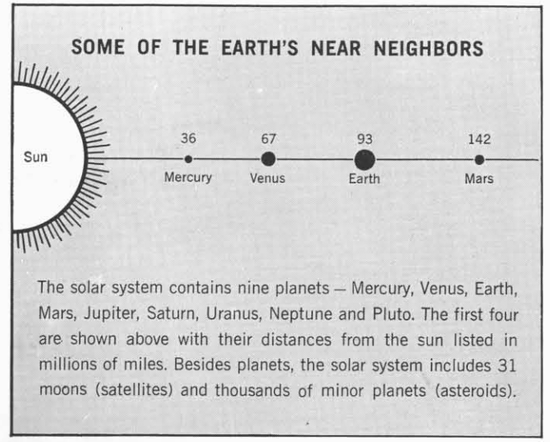
THE HEAT RAY IN THE CHOBHAM ROAD.

IT is still a matter of wonder how the Martians could slay men so swiftly and silently. Many think that in some way they were able to generate an intense heat in a chamber of practically absolute non-conductivity. This intense heat they projected by means of a polished parabolic mirror of unknown composition in a parallel beam against any object they chose, much as the parabolic mirror of a lighthouse projects a beam of light. But no one has absolutely proved these details. However it was done, it is certain that a beam of heat was the essence of the matter—heat and invisible heat instead of light. Whatever was combustible flashed into flame at its touch; lead ran like water; it softened iron and cracked and melted glass, and when it fell upon water, incontinently that exploded into steam. That night nearly forty people lay under the starlight about the pit, charred and distorted beyond recognition; and all night long the common from Horsell to Maybury was deserted and brightly ablaze.

The news of the massacre probably reached Woking, Chobham and Ottershaw about the same time. In Woking the shops had closed when the tragedy happened, and a number of people—shop people and so forth—attracted by the stories they had heard, were walking over Horsell bridge and along the road between the hedges that run out at last upon the common. You may imagine the young people brushed up after the labors of the day, and making this novelty, as they would make any novelty, the excuse for walking together and enjoying a little innocent flirtation; you may figure to yourself the hum of voices along the road in the gloaming. As yet, of course, few people in Woking even knew that the shell had opened, though poor Henderson had sent a messenger on a bicycle to the post-office with a special wire to an evening paper. As these folks

Copyright, 1897, by JOHN BRISBEN WALKER.

Speculation about the "canals" seen on Mars inspired H. G. Wells to write his famous early science-fiction story, *The War of the Worlds.*



The solar system contains nine planets – Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto. The first four are shown above with their distances from the sun listed in millions of miles. Besides planets, the solar system includes 31 moons (satellites) and thousands of minor planets (asteroids).

Temperatures on Mars range from a low of about minus 70 degrees F. at the poles to nearly 50 degrees at the equator, which is chilly by earth standards but adequate to support some forms of plant life even in the colder regions. On earth, moss and lichens are found even on the icy peaks of our highest mountains. Recently some scientists collected moss and lichens from Mount McKinley, the Painted Desert and the Grand Canyon. They put the plants in glass jars and replaced the air with low-pressure "Martian air," then heated and cooled the containers to approximate conditions on Mars. The plants continued to thrive.

It is fairly certain that plants can live on Mars, and since plants produce oxygen it is possible there may also be some forms of simple animal life. Some scientists believe that Mars once was able to support even human life. The reddish color of the planet is thought to be iron oxide—rust—which could have been produced in some remote past when oxygen and water were plentiful. And this possibility leads to the interesting speculation that Mars once may have had inhabitants who perished when the planet's supply of water and oxygen was exhausted. Some writers have even suggested that the Martians foresaw this, and built subterranean cities engineered for comfortable atmosphere, humidity and temperature, where they live to this day manufacturing their air from the oxygen-rich soil. A Russian astrophysicist, Chklowski, maintains that the planet's moons are actually artificial satellites launched long ago by highly intelligent beings.

Man may not have to wait much longer to learn the answers to many of the red planet's mysteries. Space probes launched from earth will soon be radioing back data, perhaps even pictures, that may tell us about the strange markings called canals. From what we know of the planet now it seems too much to hope that any inhabitants will be found. But as Schiaparelli said when the same thing was suggested in 1877, "I am very careful not to combat this supposition, which includes nothing impossible...." ■

GEOGRAPHER STRABO, FIRST CENTURY B.C.

. . . the Middle East in 25 B.C.,

ACCORDING TO STRABO

A ROMAN FLOTILLA converged on the island of Elephantine in the spring of the year 25 B.C. The rowers pulled in their oars as the prows of their galleys nosed up onto the beach. A landing party of legionaries swarmed over the side with drawn swords, waded ashore and secured a beachhead. When the rest of the legion landed, a fortified camp was quickly set up facing Syene (modern Aswan) on the east bank of the Nile.

The Prefect of the Egyptian Province of the Roman Empire stepped gingerly along an improvised gangplank held in place by two files of his sailors. He was Aelius Gallus, a rising figure of the Imperial administration, and he had come by water all the way from Lower Egypt. His purpose, by order of the Emperor Augustus, was to locate the site of a permanent legionary encampment that would block the path of invading armies from the upper reaches of the Nile.

Since he intended to push on into lands unfamiliar to the Romans, the Prefect had brought with him a professional geographer to map the topography of the border area – the illustrious Strabo, Greek scientist and author of one of the world's great books. Even today, Strabo's *Geography* remains an important source of information about the Middle East of his time.

Strabo proved his value to Aelius Gallus almost immediately. One feature of Elephantine was a deep well with mysterious, graduated markings up and down its interior. Later a group of Roman commanders escorted the Prefect to the well, which he examined silently for a few minutes. Then, obviously puzzled, he turned to his Greek friend and asked what it could mean.

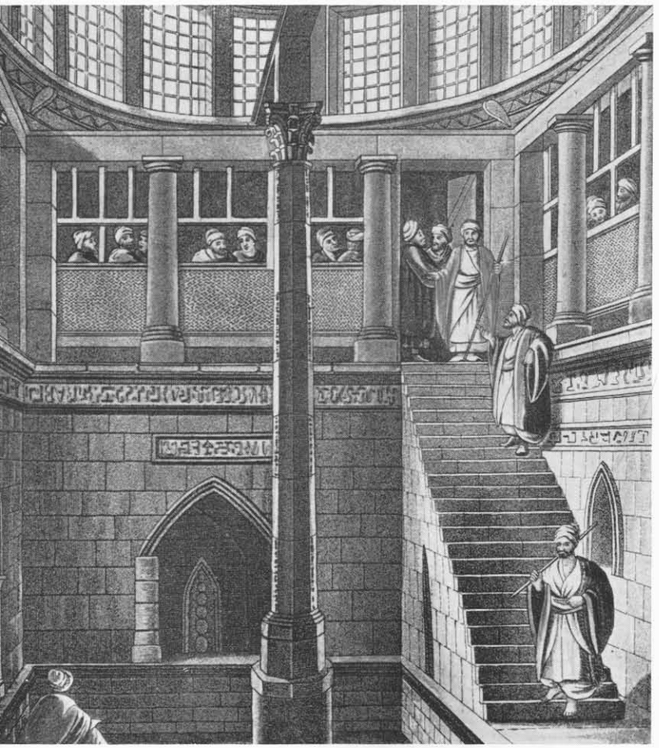
"Aelius Gallus," replied Strabo, "this is a device to indicate the highest, lowest and mean levels of the Nile. The river and the well communicate underground; hence they rise and fall together. By consulting this Nilometer, the people around Elephantine know when to irrigate and when to plant."

Such specialized knowledge was common to Strabo. Born in Pontus (modern Turkey), educated in the Greek and Roman schools, he inherited enough wealth to permit him to indulge his consuming pastime, hobby and vocation – travel. His connections helped. He knew influential politicians and administrators like Aelius Gallus, whom he calls "my friend and companion." He may have been introduced to the Emperor Augustus. Some scholars believe that he wrote his *Geography* for Queen Pythodoris of Pontus.

Strabo's audience explains his marked difference from Herodotus, the famous Greek historian of the fifth century B.C. Where Herodotus writes for himself primarily, and looks for the anecdotal material that interests him, Strabo invariably has the viewpoint of his aristocratic readers in mind. His work has been interpreted as a handbook for rulers and diplomats, a manual from which they might learn about people and places elsewhere in the known world.

There are many dramatic highspots in the 17 volumes of the *Geography*. One is Strabo's description of Elephantine, Syene and the upper Nile. Even better is his account of what happened to Aelius Gallus after the Prefect was suddenly recalled to Alexandria and given the task of conquering Arabia Felix. Strabo wrote classical pages about the disastrous march of the Romans southward across Arabia.

His most arresting sentence touches the motives that enticed the Romans across the Red Sea to their doom. Aelius Gallus was, by order of the Emperor Augustus, in quest of the wealth of Arabia Felix – the spices and gems and pre-



The Nilometer on the island of Elephantine was described by Strabo on his visit to the Nile in 25 B.C. Markings in the well measured the level of the Nile and indicated best times for planting crops and irrigating.

ACCORDING TO STRABO

cious metals of the lush kingdom at the southern end of the Arabian Peninsula. What kind of reception he would receive, the Prefect did not know when he set out, so he came prepared for anything. "He intended," says Strabo, "to make opulent friends, or to conquer opulent enemies."

Aelius Gallus did neither. His Greek friend, anxious to absolve him of the blame, attributes the fiasco to the treachery of a guide, "who exposed the Romans to danger by leading them where there was no road, or where the road was impracticable for an army, or where they were compelled to make long detours over terrain destitute of food or water."

That, according to Strabo, was how the desert defeated Aelius Gallus. That was why he eventually returned to Egypt bedraggled and empty-handed. Strabo, incidentally, makes it perfectly clear that the famous Roman Prefect retreated, not from Marib, the capital city and site of the legendary dam, but from a lesser place named Marsiaba.

Added to the story of the military failure is a description of Arabia Felix that shows its fame to have been no myth. The land abounds in "cassia, cinnamon and nard." The houses are "sumptuous and of stone." The people usually take their meals in groups "entertained by musicians." The rulers are "servants of the people who are required to render frequent reports on their administration."

Strabo is obviously regretful not only that his Roman friend failed so catastrophically, but also that so splendid a province was not added to the Roman Empire.

When Aelius Gallus left Egypt for Rome, Strabo left for Syria. He traveled as far as the Cilician Mountains in the north, observing lands and cities, peoples and customs, and then to Tyre. There his interest was stirred at the spectacle of an island "joined to the continent by a mound of earth that Alexander raised when he was besieging the city." To the ancients, Tyre meant "Tyrian purple." Strabo paused to examine "the shellfish from which the dye is procured," and the factories that turned out "the fabrics that we all know with their brilliant purple hue."

No ancient traveler, if he could avoid it, would leave the Middle East without a tour of the Land of the Two Rivers. Strabo took passage on a coach headed east toward the river Euphrates.

He rode past the leveled site of Nineveh without being able to place it any more exactly than somewhere in Assyria. Nineveh would remain "lost" for another 1,900 years. Strabo explored Gaugamela, the scene of Alexander's crushing victory over Darius. He stopped for a longer look at Babylon, where "the roadway upon the walls will allow chariots with four horses to pass each other with ease."

Strabo has a passage about one of the Seven Wonders of the World that he found in this fabled city:

"In the Hanging Gardens of Babylon, trees grow on terraces. Stairs give access to the highest story, and there are water engines by means of which skilled engineers raise water from the Euphrates to the gardens. They can do this because the Euphrates flows through the city, and the Hanging Gardens are on one bank."

Strabo remarks on the Chaldean stargazers who combined astronomy and astrology. He portrays water traffic on the Tigris and Euphrates. He explains how the soft earth of the terrain compelled a corps of workmen to stay on the job cleaning the irrigation canals of Mesopotamia.

One product of the Middle East, naphtha, beguiled Strabo a great deal. "When naphtha is brought near a fire, the fire catches hold of it; and if an object smeared with naphtha is brought near a fire, that object burns with a fierce flame that cannot be extinguished except with a vast quantity of water." Strabo could not guess the future importance of naphtha as fuel and solvent.

The credit often given Strabo is that he covered so much ground. If he is not deep, he is broad. If he is sometimes less than exciting, he is always factual. Following him step-by-step, one can see clearly what the Middle East was like when it was beginning to feel the power of the upstart in the West, the Roman Empire. ■

Thirty years ago the rugged Arabian desert was a place of hardship and adventure for pioneering American oilmen

THE SEARCH BEGAN IN 1933

A SMALL MONOPLANE flying thousands of feet above the sand *massifs* of the eastern Rub' al-Khali is witness to a dramatic instance of man's ability to package his environment and take it along. Far below the plane on a sun-baked flat, where survival can be a marginal proposition, a group of white cubes glisten in the fierce light.

Down in the midst of this remote desert bivouac a generator hums. It pumps electrical life into the mobile camp and powers its electronic voice. There trained men work efficiently in air-conditioned comfort carrying on the costly search for oil.

However, even before the exploration field parties of the Arabian American Oil Company had large office, laboratory, dining hall and dormitory trailers to support them, the deserts of Saudi Arabia were being forced to yield their geologic secrets.

Let's go back 30 years and follow two bearded geologists in Bedouin dress into the desert in December 1933. They head across the sandy steppes in a Ford touring car, knowing that at any moment the washboard terrain may break a spring. They are accompanied by a pickup truck, but that is the limit of their automotive equipment.

The field party with the two geologists includes an interpreter, a cook, a cook's helper, a houseboy, a mechanic, a mechanic's helper, a driver, 30 escorts (a warrant of the King's good will) and four camel drivers.

The transport includes 25 riding camels and a dozen baggage camels each capable of hauling about 400 pounds. The camels carry three large goat hair tents and a silk tent, grass floor matting, collapsible tables, chairs, cots, food, cooking utensils, gasoline stoves and lamps, and gasoline in five-gallon tins.

In the small mountain of baggage are a chronometer, a surveyor's transit, a sketchboard, three Brunton compasses, drafting equipment, some one-gallon water cans, half a dozen large waterskins, tools, spare motor parts, spare tires and extra front springs.

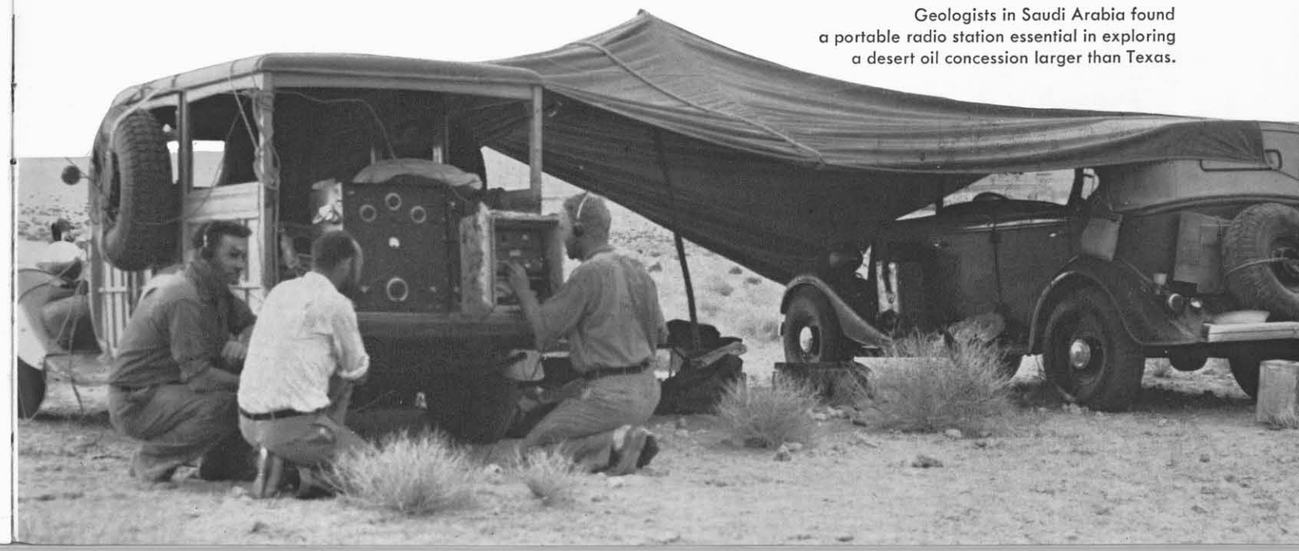
The geologists carry no radio. Once over the horizon they will be out of contact with headquarters until they return.

Such was the equipment and mode of travel of an overburdened geological field party in the eastern Saudi Arabian desert late in 1933. It was Aramco's first field season in the unmapped (or *mis*-mapped) reaches of its newly acquired 300,000-square-mile oil concession.

The first field season started almost the instant the first two American geologists came ashore at Jubail, Saudi Arabia on September 23, 1933. It ended June 7, 1934 when the summer heat made further field work impractical.

That pioneer season in the desert required an unusual group of men. Their responsibility was great, for their company was investing large sums of money against heavy odds. They had to work fast in an unknown terrain; the depression had crippled the major world economies and the United States had gone off the gold standard. Furthermore, they were halfway around the world from home base.

And yet, despite tough obstacles, the doughty exploration team that started with two men and grew to ten did a remark-



Geologists in Saudi Arabia found a portable radio station essential in exploring a desert oil concession larger than Texas.

THE SEARCH BEGAN IN 1933

able job. Guided by Bedouin trackers well-schooled in the desert traverses, the seven geologists on the team charted dunes, *jebels* (hills) and sand marches, and by the end of the pioneer season had determined, and marked for drilling, an area where in less than four years the discovery of oil in commercial quantities would confirm their judgment.

Who were these men? And what led them to the shores of the Persian Gulf to search for oil? All but three of the pioneers were petroleum geologists, and they went to the Middle East because a geologist goes wherever the search for oil may take him. Another was an engineer who had already surveyed one nearby Persian Gulf oil field. One was a mechanic and one was a co-pilot-mechanic, both wanting to try what sounded like an interesting venture.

The roster for the first field season began with geologists Robert P. (Bert) Miller and Schuyler B. (Krug) Henry, who had both searched for oil in the jungles of Venezuela. Miller had arrived in the Middle East in April 1932. He had been sent by the Standard Oil Company of California (Socal) to observe the drilling of the company's first well on Bahrain Island in the Persian Gulf just off the coast of Saudi Arabia. He was also assigned to determine the best site for the second well.

The Bahrain Petroleum Company, a Socal subsidiary, discovered oil on Bahrain in June 1932. Socal then extended its oil exploration in the Persian Gulf area. In May 1933, the company obtained a concession to search for oil, and develop production, in Saudi Arabia. In order to carry this work forward efficiently, Socal assigned the concession to a new subsidiary, the California Arabian Standard Oil Company, which in January 1944 was re-named the Arabian American Oil Company (Aramco).

Miller had been working in Bahrain for about a year and a half when he drew the assignment to start the geological work on the new Saudi Arabian concession. He knew Arabic and had become skilled in the technical and diplomatic problems of geological exploration in foreign lands.

His partner on the new project, Henry, had been in Bahrain for about a year. Henry, like Miller, had picked up everyday Arabic. Both of them had grown beards and had decided to set foot on the Arabian mainland in desert dress: long shirt, lightweight robe and cloth headdress. The clothing was both functional and politic.

Oil explorers Tom Koch (left) and Hugh Burchfiel, with Saudi Arab guide, used a car with over-sized tires for driving in sand.

Geologist Tom Koch takes time out from his work in the desert to relax for some coffee and conversation with a Saudi Arab guide.

The day they landed, Miller and Henry went to work. Thus, the first field season opened without ceremony.

Four weeks later, J. W. Hoover, another Socal geologist, became the third member of the pioneer party. He came over from Bahrain and landed at al-'Uqair about 100 miles down the coast from Jubail where Miller and Henry had landed. Al-'Uqair was the port for the al-Hasa oasis and had a customs house. At that time about ten people lived there, but in 1922 al-'Uqair had been the scene of a historic meeting at which Great Britain recognized the right of King 'Abd al-'Aziz to rule the eastern section of Saudi Arabia, an area he had already ruled efficiently for ten years.

Almost as soon as "Soak" Hoover stepped ashore at the customs house Miller took him to a group of limestone hills that Miller and Henry had named the Dammam Dome.

Less than three weeks later the fourth and fifth geologists —Art Brown and Tom Koch—landed at al-'Uqair. Thus, the pioneer group had grown to half its ultimate size by November 10th. In another 11 days Hugh Burchfiel arrived to round out the geological team for 1933.

The seventh man ashore was an engineer, Allen White, another Socal foreign veteran. He too had worked in Venezuela and had surveyed the entire Bahrain concession for Socal. White arrived early in December and took charge of the branch office that Miller had set up in Hofuf, the principal village of the al-Hasa oasis. During the early days of oil exploration, White was the Arabic scholar among the Americans. Before he had been on the scene many weeks the roster of pioneers went up to eight: Felix Dreyfus, a mechanic, came over from Bahrain where he had been nursing a burned hand after arriving from the States with Burchfiel.

The handful of geologists bumping around on hardpan, skirting dunes and digging out of the sand had learned one thing by the year's end: they couldn't possibly investigate much of the concession, which covered an area larger than the entire state of Texas, without the help of an airplane.

Early in March 1934, the plane arrived. Aboard were geologist-pilot-aerial photographer Richard Kerr and co-pilot-mechanic Charley Rocheville. The ten-man team was finally complete with less than three months left to go in the first field season. The plane would soon speed up the desert exploration considerably, but some impressive work had already been done.

During their months of service in Bahrain, Miller and Henry had often seen a group of limestone hills across the water on the Arabian mainland. They were anxious to get a close-up look at them. Within a week of their landing in Saudi Arabia, they had already worked their way inland to al-Hinnah and returned to their temporary headquarters at Jubail. They then reconnoitered about 120 miles of coastal desert southward past Tarut Island and the Qatif oasis and on into the tantalizing limestone outcroppings. On September 28th, five days after landing, they were chipping samples from Jebel Dhahran, the most prominent of the hills they had seen from Bahrain.

Two days later Miller and Henry were in Hofuf examining a house that the Gosabis, the merchant family who acted as agents for the oil company, had suggested be used for exploration headquarters. Miller decided to maintain headquarters at Jubail and use the house in Hofuf as a branch office. The geologists moved on quickly and a few days later were back once again at al-Hinnah. They thus closed their first set of traverses.

When "Soak" Hoover arrived at al-'Uqair on October 22nd, he was accompanied by three Ford touring cars. Miller met him and took him immediately to a new camp at Dammam Dome. There Hoover and Henry set to work detailing this important structure. Miller left them two of the Fords.

The automotive inventory grew a week later when Art Brown and Tom Koch arrived at al-'Uqair. Two three-quarter-ton trucks came with them, but they soon proved impractical in the desert.

When Burchfiel came ashore on November 22nd, his first assignment was north of Jubail. He set to work to map the country west of the American headquarters. Before the month was out he was joined by Henry and Hoover, who stopped their detail work down at the Dammam Dome and left their survey stakes in place.

By the end of January 1934, they had mapped as far west as al-Lihaba. Work proceeded simultaneously to the south where Koch and Brown were mapping the desert west and north of Hofuf. White had arrived early in December to take charge at Hofuf, and he was busy transferring data from the field parties to the base maps of the reconnaissance.

After Christmas the services of a good mechanic were available with the arrival of Dreyfus. During January and February the field parties made long desert traverses. They suffered their difficulties with few complaints, but they knew for all their effort they were making little headway in their tremendous task. Brown and Koch had set up a camp northwest of Hofuf at 'Uray'irah, and to the north Henry, Hoover and Burchfiel continued to move west from Jubail deeper into the desert.

When Kerr and Rocheville arrived with the plane in early March, several weeks passed before the Saudi Arab government permitted them to use it for aerial reconnaissance. On March 30th they made their first aerial traverse. Throughout April and May they were able to get in three or four good flying days a week with two geologists aboard to observe and sketch terrain features. In late April they were permitted to start flights into the interior and to use their radio.

At the end of April the plane set Henry and Hoover down in a new base camp 150 miles west of Jubail, the deepest ground penetration yet into the desert. But early in May, Henry and Hoover were called in from the desert and sent back down to the Dammam Dome to finish their detail work. On returning to their old camp they found that the survey stakes had been destroyed, probably by passing Bedouin.

By the end of May it was getting hotter by the day, and the time had come to pull in all the geologists from the desert camps. Time was needed to study results and replenish the pioneer team, some of whom were ill. Charley Rocheville needed hospital care—he was the first "casualty" among the explorer vanguard.

On June 6th Dick Kerr came down from Jubail to the camp at the Dammam Dome to take pictures. The same day, Henry and Hoover completed their detail work on the structure. The next day the branch office at Hofuf closed, and Allen White went up to Jubail. The wings of the plane were folded back, and it was wheeled away for the summer.

When "Krug" Henry and "Soak" Hoover finished their last day's work at the Dammam Dome, they built a cairn of rocks where they thought it would be best to drill the first oil well in Saudi Arabia.

The visitor who today flies over the air-conditioned trailers of an Aramco field party might well be amazed if he were swept back in time and saw the black tents and touring cars and the tired, bearded men in desert dress who raised the historic rock cairn among the limestone outcroppings.

Ten men had changed the map of Saudi Arabia during the first field season in the desert. None of them could know how great the changes really were. ■

Cars, trucks and buses have long since replaced camels that were common in Saudi Arabia when J. W. Hoover (left) and Bill Lenahan arrived in 1933.