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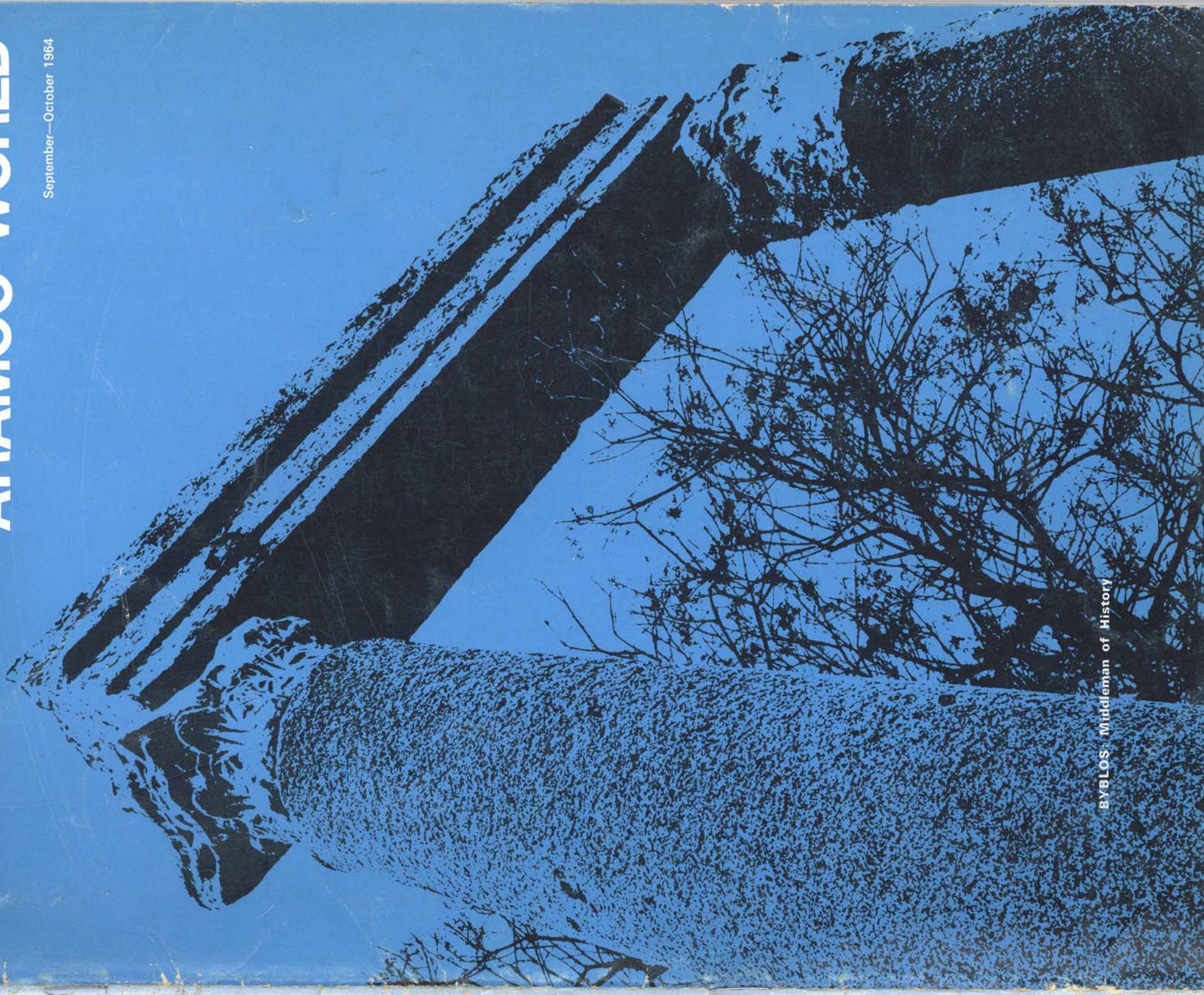

BYBLOS: Middleman of History

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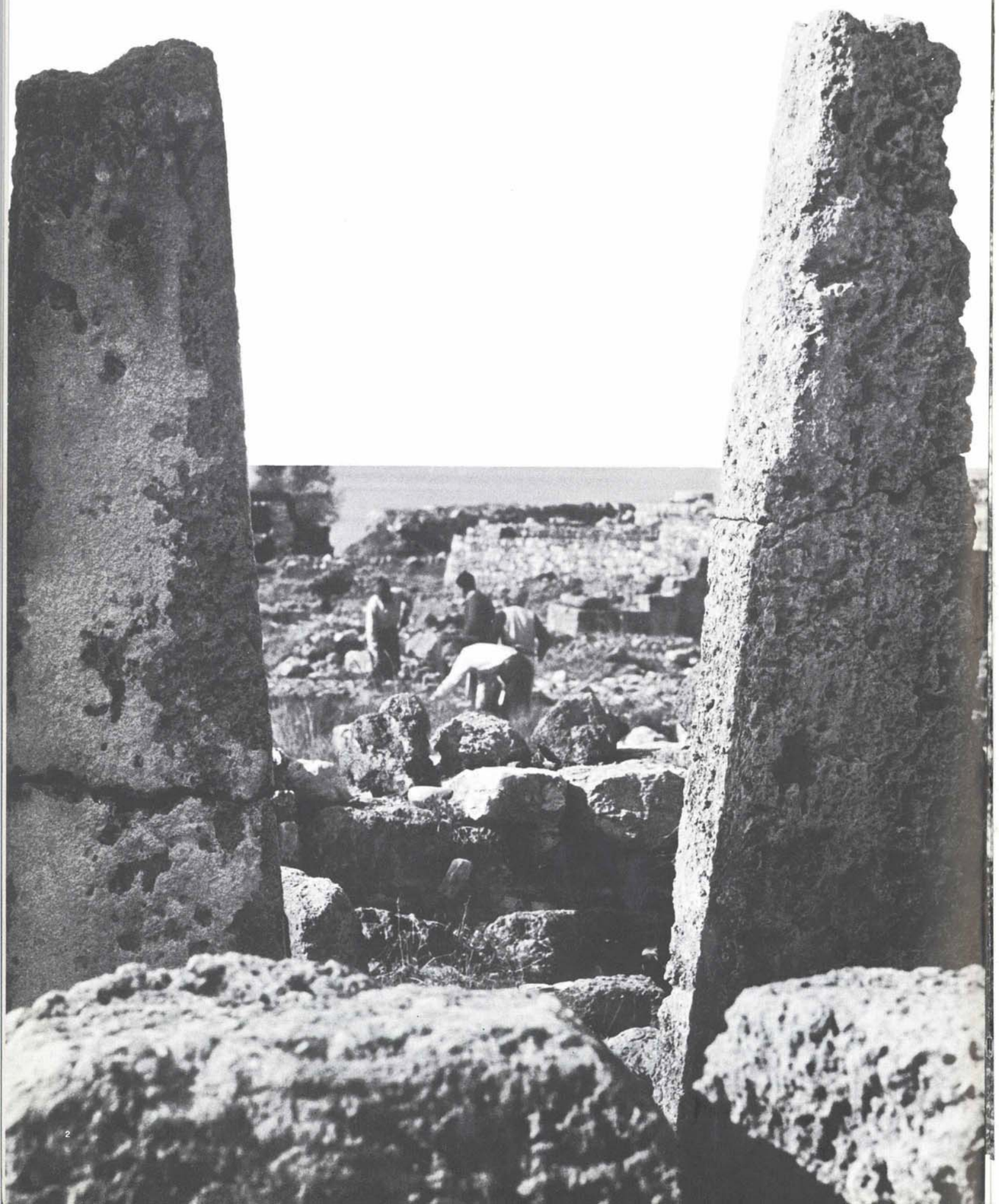
Cover: Wherever the Romans went, they left their imprint. Cities and temples sprang up, frequently upon a coast or a hill, with their great stone columns reaching toward the sky. So in Byblos, to which so many invaders came through the centuries, it is not surprising to find remnants of Rome's passage in the Mediterranean: granite columns and a fragment of entablature, thought to be sections of a temple built about 300 A.D.

Wave after wave, the invaders came, but Byblos rose each time more prosperous than ever...

View of two obelisks, at the Temple of Risaef.



BYBLOS MIDDLEMAN OF HISTORY

BY JOHN BALLANTINE

Ur of the Chaldees was more civilized, Mesopotamian Babylon more populous, Cretan Knossus mightier, and the dynastic Egyptian capital of Thebes incomparably more majestic, but the record for antiquity and tenacious longevity probably goes to what is today the small, little known Lebanese town of Byblos.

Slumbering peacefully in the warm sun of the eastern shore of the Mediterranean, Byblos can remember when those great cities of the past blazed forth to dominate, each in its turn, the fortunes of the ancient world, only to decline and be forgotten except as vague names and dates to generations of squirming schoolboys.

Yet all the while Byblos, which contests the claims of Jericho, Erbil and Damascus to be the world's oldest continuously inhabited city, went quietly about its business of serving as middleman in the vast Mediterranean trade. So adroitly did it retain the good will, or at least the neutrality, of the powers of the moment in a warring world that it not only survived repeated invasion and destruction but rose each time more prosperous.

In its ultimate impact on world history, too, Byblos outshone its more celebrated contemporaries, for besides valuable timber, wheat, oil, wine and glass transported by their pine ships, the Phoenician merchant-captains of Byblos carried the length and breadth of the Mediterranean Sea an infinitely more precious cargo — the alphabet. Their customers eagerly adopted the invention and molded it according to their needs and tastes into the many alphabets we know today—the Greek, Latin, Arabic, and Sanskrit, to name a few—and thus made possible the easy accumulation and transmission of ideas and information upon which all civilizations are built.

The Greeks, who purchased Egyptian papyrus from Byblos, immortalized the city's name by giving the diminutive *biblion* to the paper-like product imported from it. In time the term was applied to any book written on papyrus, and early in the Christian era came to be reserved for the Christians' most important book—the Bible.

With an abundance of papyrus available, the business-minded Phoenicians used it for their bills of sale, contracts, deeds, prospectuses and ledger accounts, writing swiftly with an alphabet of 22 letters while less advanced nations still used the cumbersome syllabic script either written on papyrus or chiseled out of solid rock, or incised complicated wedge-marks — cuneiform — in soft clay. Ironically, many of the stone and clay inscriptions, though eroded by intervening centuries, are legible today, while the papyrus was destroyed by fire or decayed with age. Thus, the nation most responsible for the spread of the ancient world's twin blessings of papyrus and alphabetic writing is itself but meagerly represented by historical records. It remains to this day a land with a largely unfathomed past.

The little evidence that survives at Byblos in the form of funerary inscriptions, tombs and temples, pot sherds and fragments of buildings, indicates that while the city was constantly changing its profile and masters, it maintained throughout its long history the essential character of a trading center. This role stemmed directly from its geographical situation. Crowded onto a thin stretch of coastline, cut off from the deserts of Syria to the east by the looming Lebanon and Anti-Lebanon mountain ranges paralleling the coast, Byblos was at once partially protected from the power struggles of the interior and forced to look to the sea for its living.

The first known dwellers of Byblos were Neolithic men of some 8,000 years ago, whose villages, covering more than eight acres, boasted such refinements as houses with beaten-earth walls and burnished clay floors. Physically, they were remarkably like present-day inhabitants—long-headed and with delicate features, but a good deal shorter, averaging only five feet in height. This race of men ruled the eastern Mediterranean seaboard from about 6000 to 4000 B.C., until a new civilization appeared.

Early Bronze Age man, with tools of metal that could cut down men as well as grain, submerged New Stone Age man with his primitive flint axes and sickles. He also knew how to fashion pointed-bottomed amphorae, jars kept upright by being imbedded in sand or earth, to store wine and olive oil.

It was in this period, before 3000 B.C., that Byblos established its first sea-borne trade with Egypt, which was to become in turn its best source of raw materials, its principal market, its colonizer and overlord, and finally its weak and despised enemy when the power of the pharaohs had withered.

The economies of Egypt and Phoenicia (or Canaan, as it was then called), were in many ways complementary. Egypt lacked wood for ships and roofing, grapes for wine,

olive oil, and resins for mummification, all of which Canaan had in abundance. In return, Byblos and the other three Canaanite city-states of Sidon, Tyre and Aradus, which came into prominence in this epoch, received papyrus, grain and gold.

The Book of Ezekiel lists, as items of Canaan's burgeoning trade, slaves and brass vessels from Ionia, silver, tin, iron and lead from Spain, linen from Egypt, and lambs and goats from the Arabian Peninsula. Byblos and its sister city-states, in fact, performed the same function that England would discharge centuries later: it capitalized on its mastery of the seas to control trade and eliminate competition for its manufactured products—possibly history's first instance of mercantilism at work.

The people of Byblos in time became as mixed as its trade. As its prosperity increased, the city and its fertile coastal plain attracted Semites from Arabia, Amorites, Hittites, Hurrians, Mitannians, Hyksos (misnamed the Shepherd Kings), Egyptians, Aramaeans, Assyrians, Persians and, in still later ages, Greeks under Alexander, Romans under the Caesars, Muslim Arabs, European Crusaders, even the Free French under General Charles de Gaulle.

Some came as peaceful traders, others as arrogant conquerors, still others as refugees from political persecution in their own lands. Byblos opened its gates to those who came in peace, conciliated those who bore the blood-stained sword, and made such an art of patience and diplomacy that the city outlasted them all, friend and foe alike. Meanwhile, its canny citizens neglected no means of buying cheap and selling dear—and the enemy was often the best customer.

The Byblos of today is an enormous wedding cake, layer upon layer of anthropological and historical riches from which archeologists have nibbled only bits of the icing. A shaft sunk vertically through the center of the ruins would reveal the vestiges of the successive masters of Byblos, who sought to blot out the memory of former rulers simply by building a new city on the remains of the old. Excavations at Byblos by the French archeologist Maurice Dunand have peeled back strips of the past—at one place to the days of the Crusaders, at another to the time of King Ahiram, at yet another to the period of Egyptian domination of 2000 B.C.

The digging has raised far more questions than it has answered, for to lay bare a complete stratum at, say, the level of 1000 B.C. would necessitate the destruction of all traces of civilizations of more recent times. The archeologist has thus been forced to string together such provocative bits of information as could be unearthed piecemeal on a thread of speculation and hypothesis, sometimes with gaps of centuries between solid facts. What has emerged clearly, however, is the remarkable story of the Phoenicians from the time they seized their independence from Egypt in 1200 B.C. at the zenith of their power and launched what was one of the most aggressive campaigns of trading and colonization in ancient history.

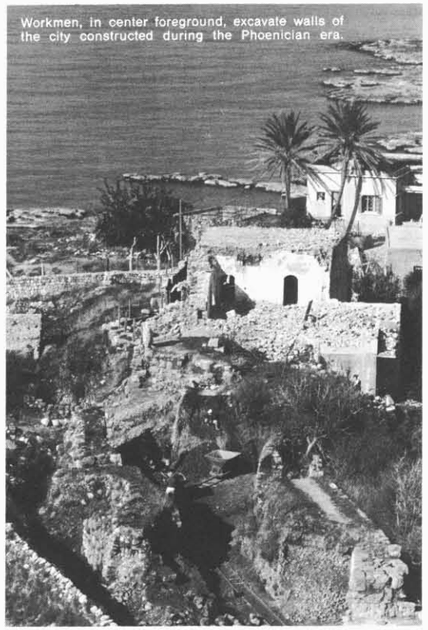
Expert seamen and navigators, the Phoenicians were soon reported by the Greek historian Herodotus—and modern research seems to bear him out—to have circumnavigated the continent of Africa, some 2,000 years before the Portuguese. Certainly the Phoenicians made the Mediterranean their private lake. In their square-rigged ships with two banks of oars they cruised incredible distances, beyond the Pillars of Hercules to the Scilly Isles off Britain, and probably even to the Azores in the mid-Atlantic, in a never-ending search for new goods to trade and new customers to buy them.

From the British Isles the Phoenicians obtained lead and tin, bartering pottery and salt with the Cornish miners in return. The tin was then used in Phoenician factories for making weapons, which they traded to Egypt and the tribes of Asia for still other commodities. The most precious local product the Phoenicians had to offer was the purple dye they obtained by a tedious boiling and processing of the tiny shellfish *Murex Trunculus*, a dye so rare that to be "born to the purple" was synonymous with royal rank. Indicative of the industry's importance to the economy is the fact that *Phoenicia* is derived from the Greek word for the color of the dye—*phoinix*.

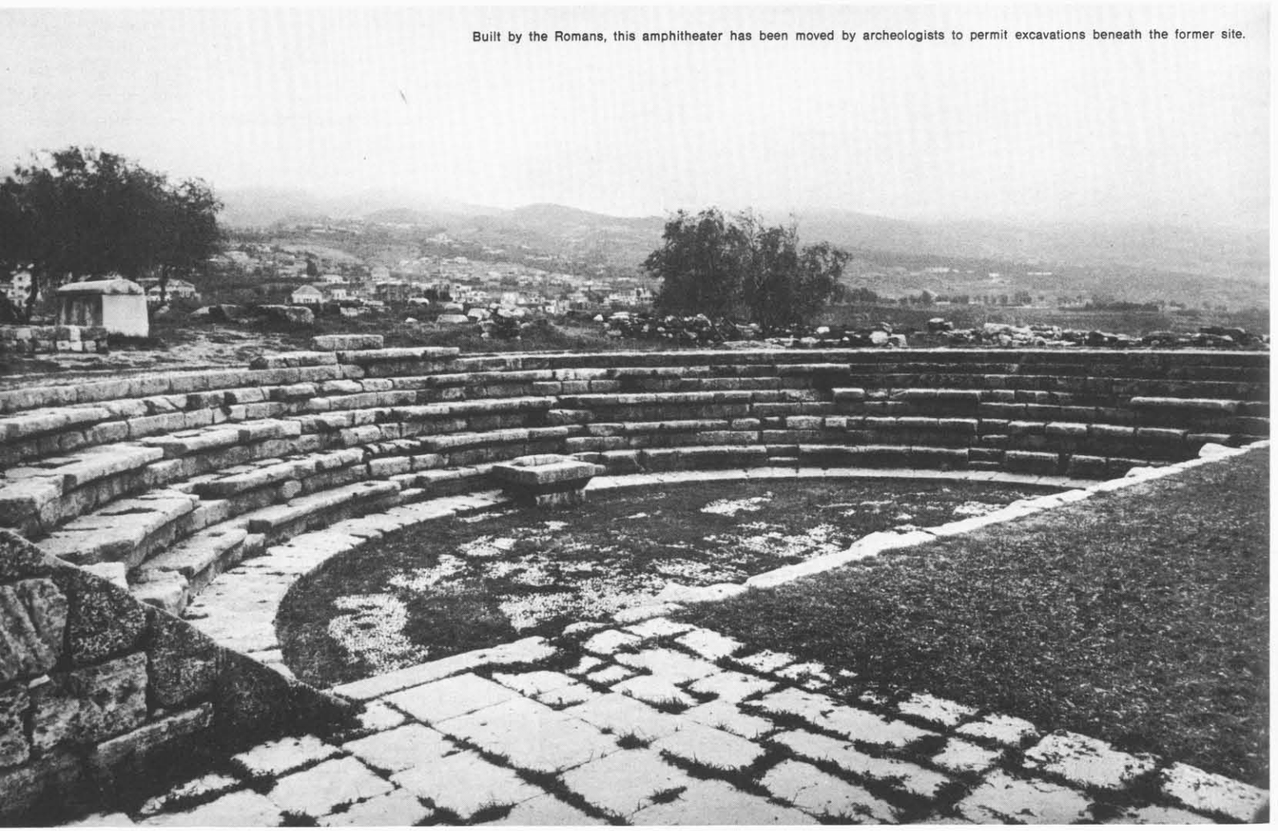
Because they were master ship builders as well as sailors, the Phoenicians were commissioned by King Solomon to build the first fleet from his area in history. Pine logs were floated from Mt. Hermon down the Leontes River to the sea, and shaped into men-of-war at Sidon and Tyre. The mountains behind Byblos also provided Solomon with materials for his temple. As reported in *I Kings*, Solomon sent 30,000 men to his friend King Hiram of Tyre, under whose protection were collected in one month the "cedars of Lebanon," wood of the fir tree, and building stone used to construct Solomon's temple in Jerusalem.

Panoramic view of the site of ancient Byblos. At top right is an early Bronze Age reservoir, at left the 3,700-year-old Temple of Rissef.

Entrance to the ancient city of Byblos was this gateway, nearly 4,700 years old.



Workmen, in center foreground, excavate walls of the city constructed during the Phoenician era.



Built by the Romans, this amphitheater has been moved by archeologists to permit excavations beneath the former site.

The sarcophagus of Ipshemuabi, King of Byblos about 1900 B. C.

So vital were the sea trade routes to the survival of Byblos that every effort was made to conceal them from such business rivals as the Johnny-come-lately Greeks and Romans. Phoenician sea captains had standing orders to elude any ship that followed them, whatever the cost. Sometimes the cost was high. If he couldn't shake his shadow, the Phoenician captain ran his vessel onto a reef, destroying his own command as well as that of the close-following pursuer. He was secure in the knowledge that the state would pay for his ship as well as its cargo, for after all, wasn't the ruling council of elders composed exclusively of sea captains?

When even the most heroic efforts failed to maintain the Phoenician monopoly over Mediterranean trade, the Phoenicians took the logical step of guaranteeing both ends of their trade routes by establishing trading stations abroad. As citizens of a small, unmilitary nation, intent on trade rather than conquest, the Phoenicians were welcomed as immigrants almost everywhere. When a promising area was unpopulated or underdeveloped, they established full-scale colonies, built their trading posts, and opened their doors for business.

Starting close to home, the Phoenicians founded cities on the island of Cyprus, only 90 miles away, then pushed on in widening circles to establish bases in Rhodes, Crete, Malta, Sardinia, Sicily, and finally on the mainland of North Africa and Spain. Gades (Cadiz) in Spain and Utica in present-day Tunisia, both founded about 800 B.C., became mighty entrepôts and anchors of the Phoenician empire.

The Phoenician colony of Carthage, in North Africa, which soon overshadowed its mother country and aroused the hatred of Rome by its commercial prowess, was founded, according to tradition, in the year 814 B.C.; it was destroyed utterly after the Carthaginian leader Hannibal had almost succeeded in conquering Rome. The great cities of Palermo in Sicily and Cordoba in Spain were both sites of powerful and prosperous Phoenician settlements. As one historian put it, "The Phoenicians were, relative to their age, the greatest traders and mariners of all time."

This ascendancy was all the more remarkable when it is remembered that Byblos itself fell time and time again to such invaders as the Persians, slogging up the coast to pillage Greece, or those heading south toward Asia for the same purpose, such as Alexander the Great and his Macedonians.

Not that Byblos didn't try to keep the invading hordes at arm's length: they added to the city's walls seven times, until at last they were 130 feet thick in places, apparently forgetting that the customary mode of entry was over, rather than through, a city's walls. Nevertheless, Byblos managed to survive each incursion with its commercial institutions intact. The probability is that Byblos was worth more alive than dead, providing an outlet for the plunder of its temporary master so long as it preserved —as it invariably did—a careful political neutrality. It was thus to the ancient world what Hong Kong, delicately poised between East and West, is today.

Though the people of Byblos probably never suspected it, not even their priceless Tyrian purple approached, in its value to future ages, their utility of the writing system

with which they listed their inventories, solicited orders and settled accounts. Until the Phoenicians adopted the basic idea from Egypt, the most sophisticated writing system was a shorthand version, called "hieratic," of the laborious picture-writing used by Egypt's priestly class. Even hieratic was too cumbersome and too slow for the Phoenicians, whose nimble wits and acquisitive instincts demanded a rapid and efficient system to record their ceaseless transactions.

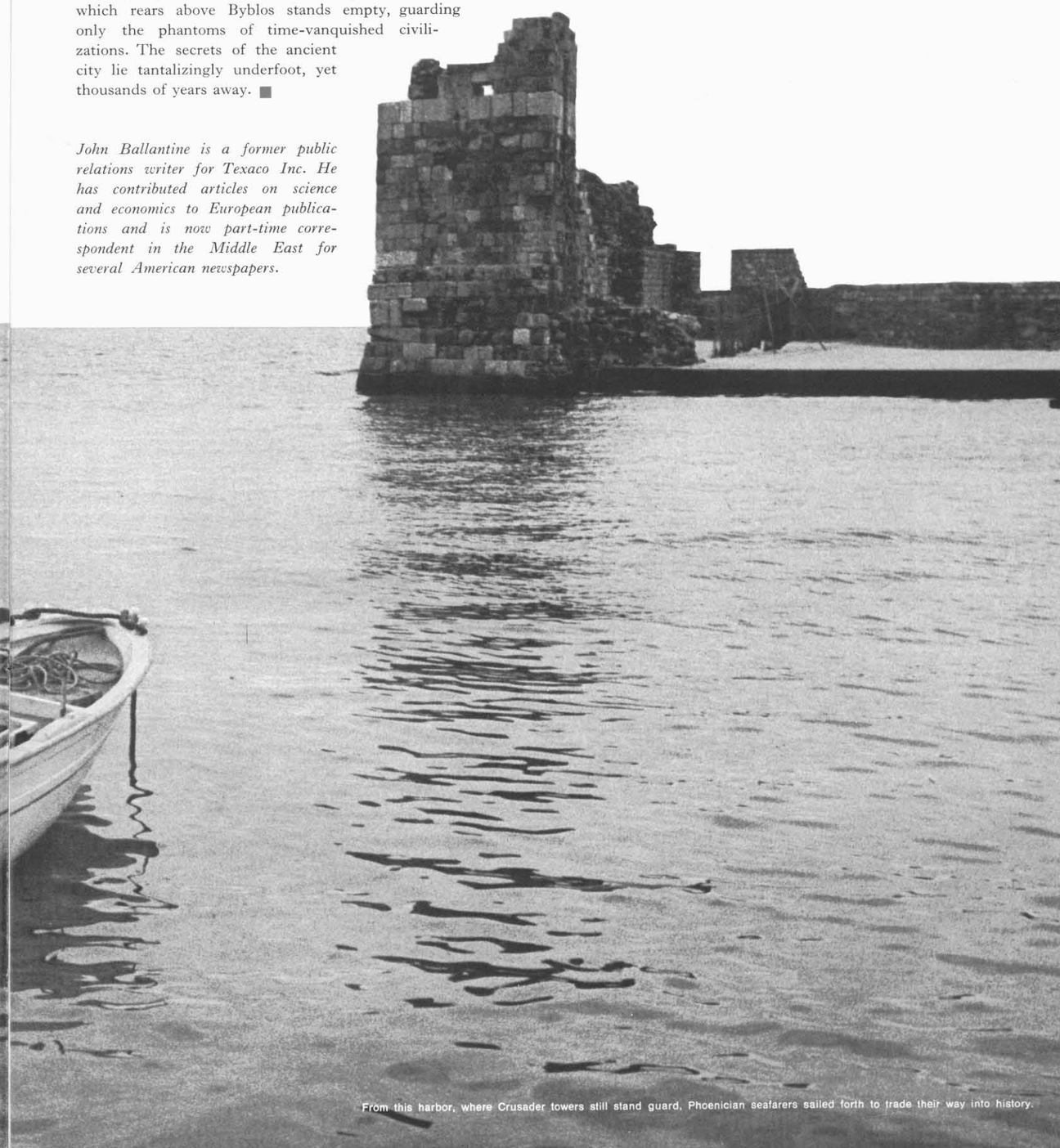
In short order the Phoenicians adapted it to their own requirements by reducing hieratic's 40-odd characters to the 22 consonantal sound pattern of the language spoken in Phoenicia. The Greeks, ever ready to borrow a good thing, picked up the system from Phoenician traders, and called it by the Greek version of the first two letters—alpha-beta. They introduced their own complexities by not only writing from right to left, as the Phoenicians did, but also from left to right in alternate lines. Despite the clumsiness of the system, it was the vehicle by which the Greeks recorded their masterpieces of science and literature, and opened the window to man's understanding of himself.

By the sixth century B.C. Phoenician power had begun to wane. In 586 B.C. King Nebuchadnezzar of Babylon seized Palestine and broke the back of Phoenician power along the Lebanese coast. Sidon had already been leveled by the Assyrian Sennacherib in 675, and Tyre in 322 was razed by Alexander the Great, whom it had the colossal bad judgment to defy, with the result that 8,000 Tyrians were slain, 2,000 crucified, and the remaining 30,000 sold into slavery. Carthage, the jewel of Phoenicia, was obliterated by the Romans in 146 B.C., and the city's site plowed and sown with salt so that no living thing would grow there again.

But Byblos itself endured. Successive conquerors seized the city and used it as a provincial headquarters, before slipping reluctantly under the waves of history. The city's highly-developed talent for survival, accommodation and compromise, honed to a razor-keen edge by millennia of living side-by-side with powerful enemies, brought it bobbing to the surface like a cork every time. It survived every change, including that of the city's name from Gebal to Egyptian *Gubla*, to Greek *Byblos* to its modern name *Jbail*.

The power and the splendor of Byblos is gone, but not the mystery. The massive but lonely Crusader castle which rears above Byblos stands empty, guarding only the phantoms of time-vanquished civilizations. The secrets of the ancient city lie tantalizingly underfoot, yet thousands of years away. ■

John Ballantine is a former public relations writer for Texaco Inc. He has contributed articles on science and economics to European publications and is now part-time correspondent in the Middle East for several American newspapers.



From this harbor, where Crusader towers still stand guard, Phoenician seafarers sailed forth to trade their way into history.

Wanderers, warriors, and trackers, they are "Al Murrah," the ...

PEOPLE OF THE CAMEL

BY ROBERT L. HEADLEY

There's a saying in Saudi Arabia, *Fi al Sama barqiyah, Fi al ard Marriyah*, which means, "In the sky the telegraph; on the ground Al Murrah." The saying, in couplet form, pays a subtle tribute to the tribe of nomads which more than any other has given birth—and considerable substance—to the colorful image of the desert Bedouins: Al Murrah, one of the largest and most important tribes of the country.

Behind the tribute lies an admiration verging on awe. For the tribesmen and kinsmen of Al Murrah are trackers of such repute that their feats would be scarcely credible if not based on incontrovertible fact. Their ability to follow trails over miles of difficult terrain and through milling crowds, or to pick out unerringly a single track of man or beast from among hundreds is not only famous, but is accepted by Saudi Arabian courts without question. As courts in most parts of the world accept fingerprints, so courts in Saudi Arabia accept Al Murrah.

Yet, remarkable as it may be, the tracking skill of Al Murrah is but one thread in the tapestry of fact and fiction that has been woven into extravagant legend for many years and extended to all those tribes of nomads called generally, and often inaccurately, "Bedouins." The term "Bedouins," an English word going back to *Badiyah*, Arabic for the arid regions where nomads live, springs directly from *Badawi*—or *Badu* in the plural—and is used to distinguish the nomadic Arab from his sedentary countrymen in the villages and oases. It is significant, however, that the Bedouin often rejects this term when speaking of himself and says simply, "Arab." It is significant because in using "Arab," the Bedouin excludes all Arabs but nomads and infuses the word with more than a hint of arrogance which suggests the pride and independence that has helped him survive and even prosper in the midst of that great wasteland in the southern half of Saudi Arabia, the Rub' al-Khali, or, as it is more commonly known, The Empty Quarter.

The Rub' al-Khali is an enormous expanse of sand covering some 250,000 square miles of the Arabian Peninsula. Forbidding, barren, remote, it was for many years one of the largest unexplored regions of the world and consequently subject to the misconceptions, rumors and exaggerations from which legends are born. The very name "Empty Quarter" with its implications of mystery came to suggest a region somehow ominous and dangerous when in fact the name does not mean an area destitute of life, but is actually a *direction*—southeast of the settled points of central and eastern Arabia. It was cartographers who applied the term "Empty Quarter" to the area, not the *Badu* who call it *al-Rimal*, "The Sands." If less mysterious than legend would have it, however, the Empty Quarter is nonetheless a harsh land demanding of its inhabitants knowledge, fortitude and courage. And it is here, anywhere from Najran near the border of Yemen to the foothills of Jabal al-Akhdar, the mysterious Green Mountain of Oman, that Al Murrah make their home.

Like the deserts in which they lived and found refuge from whatever threatened them, Al Murrah were for years the subject of conjecture and legend, partially because of a decided lack of information but also because the tribesmen themselves, with admirable cunning, spread grossly exaggerated tales of their exploits and of the rigors of their habitation, thus perpetuating and adding to the legends and, behind this screen of myth, carefully guarding their secrets. Contributing to the legend too were British intelligence reports which were written prior to and during World War I, but which were, nevertheless, the most authoritative sources of information about both the tribe and its place of habitation for many years. One such report, for example, stated flatly that Al Murrah tribesmen, although brave, were "ill provided with any domestic apparatus or clothing in advance of the Stone Age." The same report even speculated that these particular desert tribesmen might be some sort of freakish survivors of a pre-Arab civilization.

In the 1930's, with the explorations of Bertram Thomas and H. St. John Philby and the subsequent publication of their documented findings, and with the initial explorations by the company that was to become the Arabian American Oil Company (Aramco), the distorted picture of Al Murrah began to come into focus. Then, with the intensive exploration of the Empty Quarter after World War II, the last traces of mystery were dispelled forever. During the initial explorations oil men not only gathered comprehensive information about the topography and geology of the desert, but learned a great deal about its inhabitants. As the explorations went on, the Arabic-speaking research men of Aramco began to delve into the background and history of Al Murrah, and the full story of the sturdy, independent nomads slowly emerged.

The tribe of Al Murrah traces its origins back to Qahtan, the progenitor of a group of Arabs known as the South Arab. From Qahtan a lengthy genealogy ascribes the noble bloodlines of the tribe through Yam and Jusham to Murrah and his two sons, 'Ali and Shabib, who lived in the far southwestern corner of Saudi Arabia near the ancient town of Najran. Once, long ago, the seat of a Christian bishopric, Najran more recently has been in the news in reports about the Yemen conflict.

The tribe of Al Murrah still maintains blood ties with kindred groups among both nomadic and settled Arabs in the Najran area—chief of whom are Al Hindi, Al Dimnam and Al Hutailah. The Arabic word *Al* which precedes these three names as well as that of the tribe itself means simply "the family of," just as *ibn* means "the son of." The naming system of the tribes is very similar to that employed in Scandinavia where, until quite recently, a boy named Gunnar, the son of Nils, the grandson of Harald, would become Gunnar Nilson, the son of Nils Haraldson. The system was important to historians who could trace by such means the ancestries of societies whose bloodlines are considered important;

and the recent change that has begun among some Arabs of standardizing their names has been a blow to such research.

Research has traced the tribe of Al Murrah back to two main branches, the descendants of 'Ali ibn Murrah and those of his brother Shabib. Those branches in turn are divided into sub-groups which, to historians accustomed to ancestry patterns in neat pyramidal shapes, grow increasingly confusing because intermarriage among branches of the tribe goes on continually.

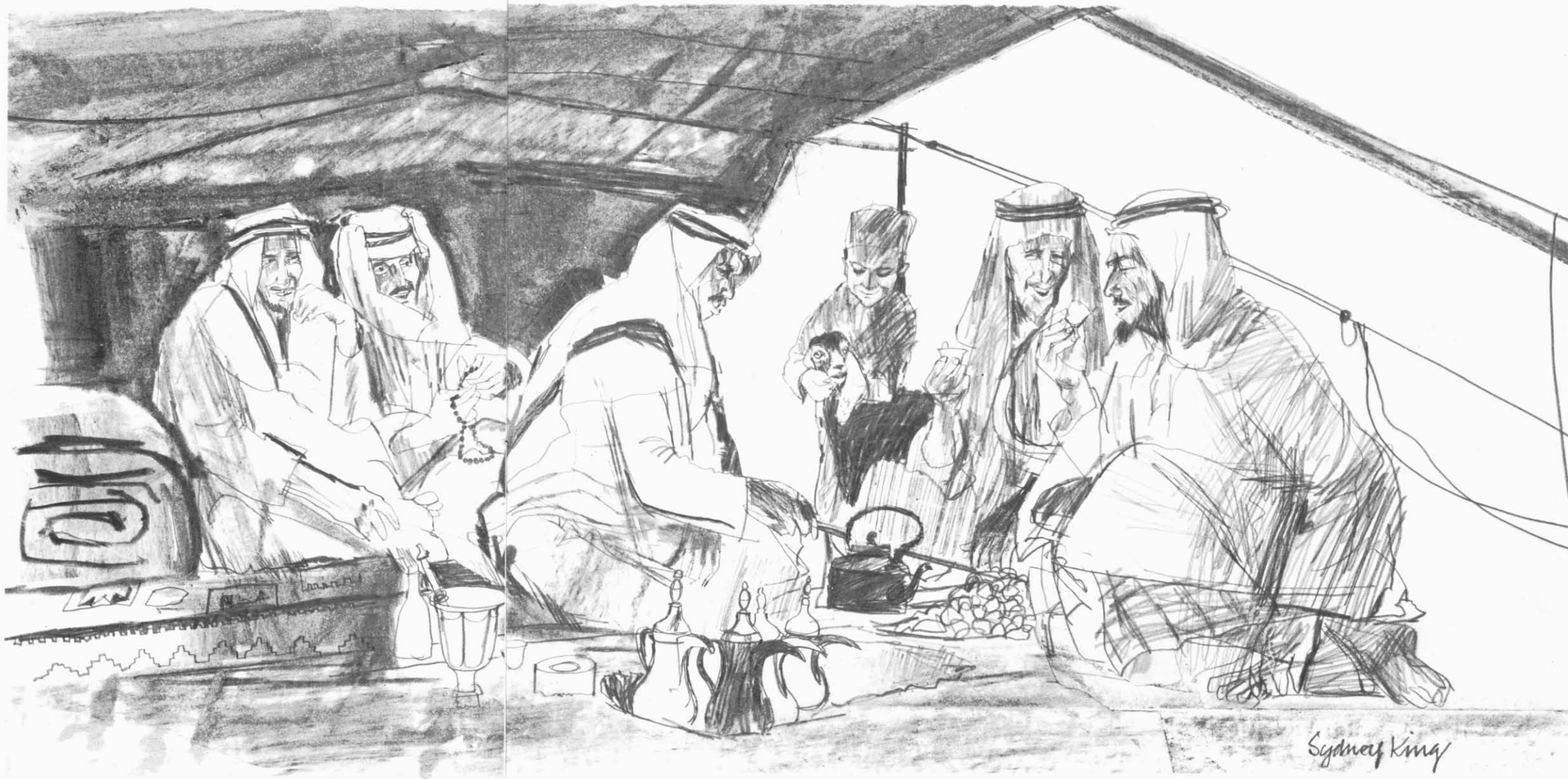
The Shaikh of Al Murrah, or Amir as he is commonly called, is Amir Talib ibn Muhammad ibn Shuraim from the family of Al Shafi' of the sub-tribe of Al Fuhaidah. Al Shuraim is the traditional ruling family of the tribe and has provided its Amirs for many generations. The rule of primogeniture, however, does not hold in the desert where every man must prove his mettle. The most worthy man, as decided by the councils of the heads of families, is chosen as Amir. While Al Shuraim is so large that a worthy chieftain can always be supplied from among its members, no bearer of the family name has positive assurance that he will succeed to the leadership of Al Murrah.

Precisely why the tribe migrated from its place of origin is unknown, but it was probably because of some disaster, the nature of which is now lost in history. The *direction* of the shift from the southwest to the northeastern parts of Arabia fits into the pattern of movements of other tribes at about the same time, suggesting some kind of upheaval so enormous as to alter the environment of many thousands of people and make emigration mandatory. In any event, Al Murrah moved—so far that they can be found today ranging from Najran in the south to Kuwait in the north and the Oman mountains in the east.

In the years that followed, Al Murrah slowly accumulated the lore essential to survival in their hostile environment, such as the location of the grazing lands for the beasts that have permitted them, more than any other tribe, to penetrate regions where other Bedouins fear to go, and there survive and flourish. Those beasts are, of course, camels, and because of their dependence on and close association with these animals, Al Murrah are sometimes given the name *ahl al-ba'ir*, the "people of the camel."

Unlike the Bedouins of the north who travel frequently in hordes—as depicted in motion pictures—Al Murrah today travel in small groups, usually carrying no more than three or four of the small black tents which are the mark of the Arabian nomads. The size of the groups is determined by the amount of grazing area available for their camels and water is generally no problem, for if there is any at all there is enough for the usual numbers of tribesmen moving as a unit.

To those who know it well the trackless sands of the Rub' al-Khali can provide an ample living. When grazing has died out on the plains to the north and wells are running low, Al Murrah may be found in the midst of



their reputedly barren lands tending well-fed herds and living comparatively well. During certain periods of the year the pastures of the Rub' al-Khali, provided one knows where to find them, are greener than elsewhere. In the summer months when the other tribes are constantly on the move to the north seeking grazing areas and water, Al Murrah camp by briny water holes in the deep sands. Although this water is too salty for human consumption, camels can and do live on it for long periods of time, and in addition provide the milk on which the tribesmen largely survive. To this they add rice and dried dates and occasionally desert game, and on special occasions, such as the advent of an honored guest, a sheep.

The fame of Al Murrah is based upon other foundations too. Throughout a great part of their history, Al Murrah were also noted as breeders of fine horses, a reputation reflected in an old saying of the desert which compares the Al Murrah tribe to the 'Awazim, a tribe that maintained large flocks of sheep as a source of mutton: "The horses of Al Murrah were as numerous as the sheep of 'Awazim." The fame of the Arabian steed, of course, has since spread throughout the world and many a rider is justly proud of a mount whose bloodlines go back to the desert of Al Murrah.

Breeding and raising horses in such a land as theirs, however, was a luxury that few tribesmen could indulge in on any scale without the ancient and honorable custom of raiding. After that was outlawed Al Murrah reluctantly turned away from their fine horses to concentrate instead on fast greyhound-like saluki dogs.

Prior to the decree of the late King 'Abd al-'Aziz ibn Sa'ud outlawing raiding, Al Murrah had carved another niche in desert history with daring exploits that added to their reputation for courage. Internecine raiding was then common, not only because of the practical need to accumulate wealth and livestock but also to sustain personal reputations for bravery. Forays were especially common during the summer when heat and drought drew animals and herdsmen to scarce water wells. Al Murrah tribesmen enjoyed unusual protection afforded them by the wilderness in which they lived and at the same time could launch swift raids into the border lands. When no isolated targets could be found, Al Murrah were known to attack even the walled towns of eastern Arabia, inspiring fear and adding substance to the legends that surrounded them.

Today the life of Al Murrah has changed as the modern age that has come to Saudi Arabia has steadily crept out into the desert. Their once impenetrable homeland has been explored and charted. Their tracking skills are gradually being replaced in the Department of Public Security by modern police methods. Their horse breeding has become too difficult and their personal courage has lost its outlet as the fierce tribal warfare has come to an end. Al Murrah, it would seem, are about to lose their identity.

Yet today a now familiar sight, on both the asphalt highways of Saudi Arabia and in the desert, is that of slight, powerfully built men at the wheels of huge-tired diesel trucks hauling tremendous loads between points of commerce to the remote oil exploration camps of Aramco. Their thick braids of hair tucked up under their headcloths, they swing agilely into the high cabs and with puffs of diesel smoke roar off into the desert, often guiding their 25-ton loads through the once unknown lands where enemy raiders feared to go, often pulling up by an unknown water hole to greet families and friends and distribute gifts, before rolling off again across the towering dunes. Al Murrah tribesmen have not fled the coming of the modern age but with the adaptability that enabled them through the centuries to survive in the Rub' al-Khali have begun to adjust to the demands of another life. It is not easy, of course, but it never has been; and it is unlikely that the challenges of the future will be able to defeat Al Murrah any more than the challenges of life in "The Sands" could defeat them during centuries past.

Robert L. Headley, who studied in the U.S.A., England and the U.A.R. and spent ten years with Aramco's Local Government Relations Department in Dhahran, is the co-author of several books on the Arabian Peninsula and the oil industry and a contributor to the second edition of the Encyclopaedia of Islam.

THE LONG STEEL SHORTCUT

Fourteen years and more than a billion and a half barrels of oil ago, they began to build "Tapline" ... BY DANIEL DA CRUZ

Against the blue sky, the long, low shape of the tanker was sharp and clear as it eased toward one of four berths a mile offshore from the oil terminal outside Sidon, on the coast of Lebanon. Guided by the precise instructions of a mooring master, his eyes sighted like a marksman's on a huge, painted target on shore, the ship nosed into position, dropped its anchors and began to swing clockwise into its berth. Mooring launches moved in to fasten the lines and on deck, alert crewmen quickly connected the ship's manifold valve to the 16-inch flexible marine hose that curved upward from the bottom of the harbor. As the connections clicked into place, the mooring master sent a final signal ashore. Within minutes, oil from the fields of Saudi Arabia began to pour into the cavernous belly of the great vessel.

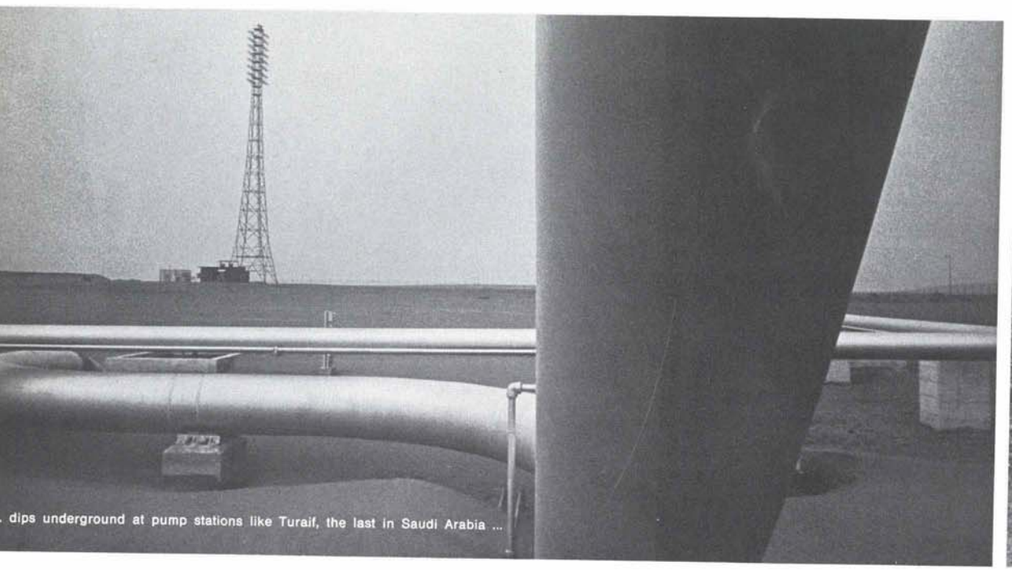
The ship was the *Esso Trinidad*, a 50,000 deadweight-ton tanker flying the quartered, rectangular flag of Panama. The time was 3:43 p.m. The date was February 7, 1964, and when the operating day had ended the Sidon terminal of the Trans-Arabian Pipe Line Company had loaded aboard the *Esso Trinidad*, and six other tankers that had preceded it into the loading area, 1,881,263 barrels of crude oil, an all-time high in the 14 years of the company's operation. It was a date that was to go into the record books as a highlight, to join the long list of other highlights that have been compiled since the day in the early 1940's when the companies which own the Arabian American Oil Company (Aramco) looked across the desert toward Europe and decided that the time was at hand to build an overland pipeline to the Mediterranean—a long steel shortcut to waiting western oil markets.

In those days, the early days for Aramco, oil from new wells in Saudi Arabia was emerging at what, compared to today's production, was a mere trickle—less than 20,000 barrels a day. But the proved reserves were tremendous and as the war drew to a close and the exhausted nations of Europe prepared for the great tasks of reconstruction, it was obvious that vast supplies of oil would be needed. At that time, however, to move Saudi Arabian oil to Europe required a nine-day, 3,600-mile voyage by ship from the Arabian Gulf, through the Strait of Hormuz, the Gulf of Oman, the Arabian Sea and the Gulf of Aden, up the Red Sea, through the Suez Canal to the Mediterranean. It was long and costly—involving $40,000 in Suez Canal tolls alone. Accordingly, in July, 1945, Aramco's original parent companies, Standard Oil Company of California and The Texas Company (now Texaco Inc.) obtained a Delaware charter for the Trans-Arabian Pipe Line Company—a name shortened almost immediately to "Tapline"—and prepared to construct a pipeline.

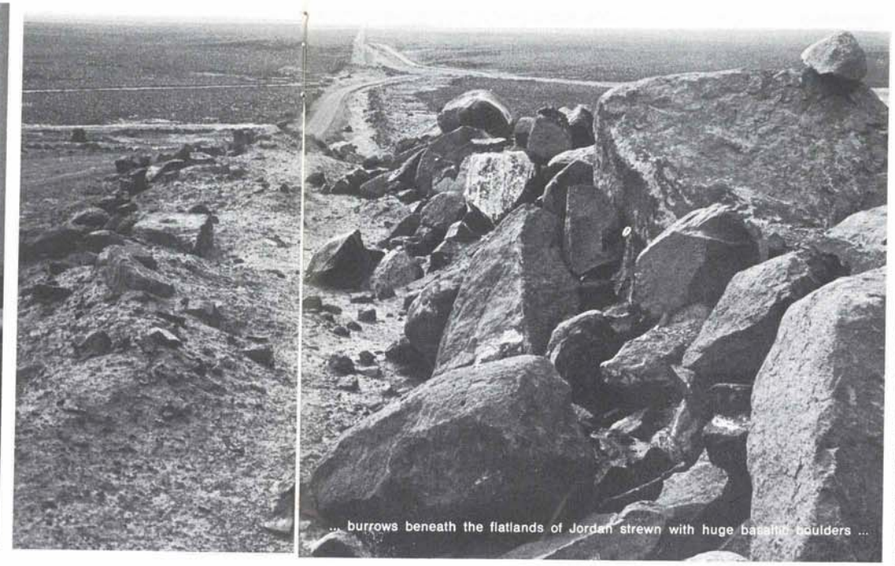
An area more hostile to man and his works than the region in which Tapline was to operate is hard to conceive. In some areas along the right-of-way there was not a single water well, or road of any description, or permanent habitation. At places whole years may pass without a drop of rain. Temperatures recorded along the route range from a freezing 10° F to a high of 121° F "in the shade"—an amusing irony where neither branch nor leaf exists to shelter man against the desert sun.

The course which the pipeline would follow from Saudi Arabia to Lebanon passes across four distinct types of terrain, only a short stretch of which, near the Arabian Gulf, corresponds to the layman's idea of what a desert

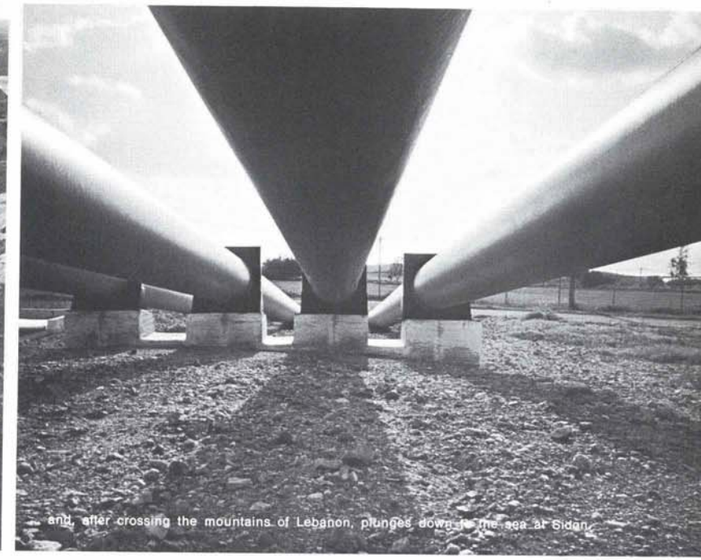
En route to the Mediterranean, Tapline crosses desert sands and plains ...



... dips underground at pump stations like Turaif, the last in Saudi Arabia ...



... burrows beneath the flatlands of Jordan strewn with huge basaltic boulders ...



... and, after crossing the mountains of Lebanon, plunges down to the sea at Sidon.

should look like. That is the dune country, where shifting pinkish-brown sand mountains creep sluggishly across the landscape. Toward the northwest, parallel to the southern edge of Iraq, the dunes quickly give way to pebbled, rolling plains and fractured-limestone flats, with a paper-thin covering of topsoil and fine sand. At the Jordanian border the character of the land changes again. Black boulders of basalt, many man-size, carpet a jagged lava plain, rendering it completely impassable to wheeled vehicles. Near the Syrian border the basaltic plains give way to fertile wheat lands alternating with stony reaches of bare limestone. And on the threshold of Lebanon, the pipeline right-of-way careens up the Anti-Lebanon mountains, plunges down its terraced sides, then up and over the Lebanon mountains to the sea at Sidon. The terrain, in short, was, for engineers, a Herculean challenge, and halfway around the world, at the San Francisco offices of Tapline, the general plan for the pipeline that was to traverse it began to take shape, with the first, crucial decision. This was the deceptively simple matter of the optimum pipe diameter.

"Deceptively simple," explained an engineer veteran of Tapline's first tentative steps into the desert, "but actually the hinge on which the entire future of Tapline would turn. Flow requirements, pumping station equipment, labor costs, initial capitalization, and every other factor in our planning was largely conditioned by the size and specifications of the pipe itself. Once that pivotal decision was made, we would have to live with its economic consequences from then on.

"Say that Aramco had predicted a daily throughput of 300,000 barrels—Tapline's original rated capacity, as it turned out. There would be but two basic variables we could juggle to achieve that flow: pipe diameter and pressure. Since pressure in this case can be roughly equated with the number of pumping stations, we figured that a pipe about 30 inches in diameter and six evenly-spaced pumping stations on the 1,000-mile line would accommodate a 300,000 barrel-per-day throughput efficiently and economically. We could have decreased the diameter of the pipe while increasing the number of pump stations, or vice versa. That is, you could use pipe the size of a soda straw hooked up to the power plant of the Grand Coulee Dam, or you could use pipe the diameter of the Mississippi River and a bicycle pump—at least in theory," he added with a grin.

"The point is, the decision was essentially an economic rather than a technical one. The price of steel fabrication, of labor, of ocean freight, of pumps, of personnel, of a thousand goods and services, had to be balanced so that the pipeline not only would handle the anticipated flow on a rising world market, but do so at a cost low enough to compete with tankers. One bad guess at this stage would have cost us a whole day's throughput—of red ink."

Once it was agreed that about 30 inches was the optimum diameter, decisions and ideas came swiftly after. One suggestion, a brilliant stroke that halved shipping costs and delivery time, led to a modification in the standard practice of using pipe of constant diameter. By using *two* diameters—30 inch and 31 inch—the pipe could be shipped from the United States together, the smaller pipe nested within the other, at great savings of time, space, and, therefore, money. Having departed from one tradition, engineers went on to depart from another. Since oil pressure within a pipe decreases in direct proportion to its distance from the pump, engineers reasoned, why not profit from it by decreasing the thickness of the pipe wall correspondingly, and lay them in descending order between pump stations? That was done, again with substantial economies in steel.

So, for nearly a year and a half, went the planning, until, at last, the lengths of pipe were nested, one within the other, and, with other supplies crammed inside them, hoisted aboard ships and sent to the Arabian Gulf. There, barred by shallow waters from a close approach to shore, the ships tied up at a great "island" of steel pilings three miles off the coast while the "skyhook," a huge aerial tramway, whisked the pipe ashore to be de-nested, welded into longer lengths and sent thundering into the desert on massive tractor trailers.

There are, basically, only two ways to construct a pipeline—above the ground or beneath it—and each method has its drawbacks. Buried pipeline is more common but requires ditching (54″ deep in the case of Tapline) which may mean expensive blasting if the subsurface is solid rock, as is often the case in Saudi Arabia. It requires, besides, a meticulous multi-layered coating of inert materials to protect the pipe from rust and corrosion. The alternative—above-ground construction—dispenses entirely with ditching, is not subject to corrosion and is easily repaired in the event of a leak, but creates a barrier of such proportions that it is not feasible except in the most isolated areas. Tapline engineers decided to use both methods, depending on the terrain, but above-ground construction whenever economic, and so settled down to devise a means of eliminating another standard practice—construction in a lazy zigzag which allows for contraction and expansion.

What they came up with was described by a mechanical engineer—with an eye for analogy—this way: "It's like putting a hungry python in a steel strait jacket. But for its own good of course." In more formal terms, it was a straight-line design with the pipe to be restrained in ring-girders—collars of steel—at 66-foot intervals to prevent all lateral or vertical movement. The pipe would also be anchored in massive piers of concrete and steel, at angle points where the pipe changed direction or climbed a hill. At certain critical locations—gate valves or places where the wall thickness changed—anchors were to be built which could withstand the tremendous longitudinal force—up to 600,000 pounds—which could be exerted by the pipe when its temperature changed substantially.

With the pipe locked into place in this manner, its effort to expand or contract when temperatures changed would be borne by internal stress in the pipe. In order to limit the amount of this stress, it was necessary to control carefully the temperature at which the pipe was "tied-in," or restrained, as it was being constructed. The "tie-in" temperatures were specified for each area based upon the expected operating temperature range.

The problems confronting the men who built the pipeline were not all of a technical nature. Frequently they faced situations that were probably unique. One, recalled today with fond humor, involved the engineers and workmen who were stunned one day when a tribe of Bedouins approached and politely asked to water its camels at a recently-drilled well.

"How many camels do you have?"

The spokesman for the Bedouins waved a hand behind him and there, stretching in a line almost a mile long, were some 3,500 camels. The engineers knew that

From the Sidon shore, underwater extension lines carry oil out to berthed tankers.

their supply of water was not enough to water the herd and keep the job going too, but they knew also that their agreement required that water be made available to any person or animal needing it. They closed down the job and patiently waited until each thirsty camel had drunk its fill.

Because of the magnitude of the pipeline project, Tapline had hired three major construction firms to build the line and its auxiliary facilities, one to work from Sidon, the other to work from Saudi Arabia, and the third to build auxiliary facilities. Between January 16, 1948, when the first main line weld was made, and September 25, 1950, when the last weld joined the two sections of the 1,068-mile line together—near the border of Jordan and Saudi Arabia—an army of 1,550 Americans and 14,560 men of other nationalities, most of them Arabs, labored 210,000 man-months to transform blueprints into a functioning reality. Along the way, aside from the pipeline and the pumping facilities which are the backbone of the enterprise, a host of subsidiary structures including five complete cities in microcosm had to be built. All the pipeline lacked was crude oil, the production of which at Aramco fields had by then, true to predictions, shot up from the pre-1944 figure of 20,000 barrels per day to 600,000. On November 10, 1950, the first oil from Tapline began to fill the storage tanks at the Sidon terminal.

Today, more than a billion and a half barrels of oil later, the essentials of the Tapline operation are very much as they were then. Improvements—substantial improvements—have been made, but the operation basically remains the same. And that begins when Saudi Arabian crude oil, roused from its slumber of uncounted millions of years, rises to the surface and moves on to Tapline's easternmost pump station at Qaisumah, Saudi Arabia, where a battery of six 1,700-horsepower pumping units adds to the incoming oil a forward thrust of up to 1,040 pounds per square inch and sends it on its way.

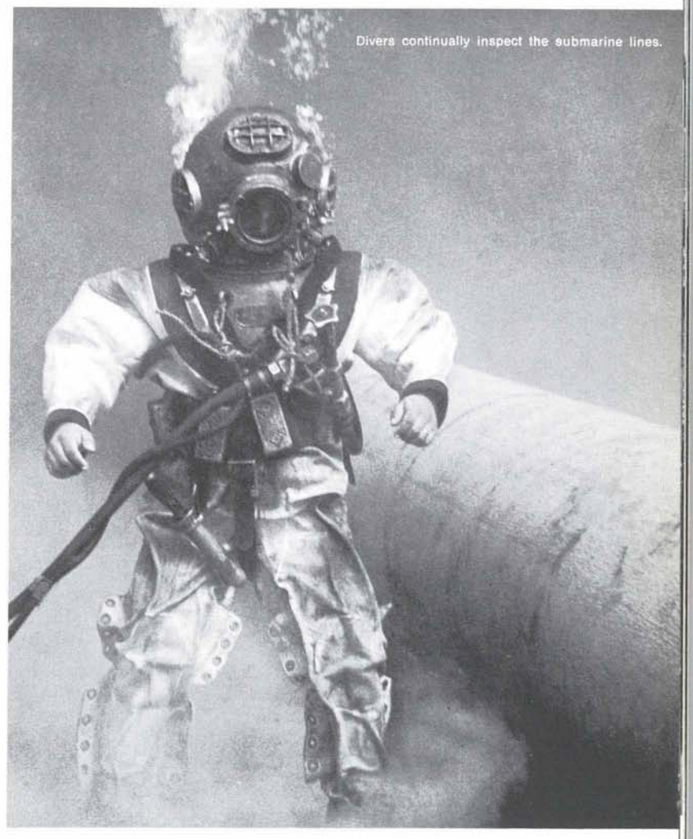
The crude oil thus set in motion will proceed with but few pauses until it reaches refineries in up to 16 countries throughout the world. The speed at which it passes through the pipeline, depending on flow requirements, ranges from about $3\frac{1}{3}$ miles per hour—the pace of a man on his way to the dentist—to $4\frac{1}{3}$ mph—his speed on the way back. Were it not for the one factor which limits the efficiency of all machines, the oil would flow on and on forever upon a single application of pressure. The inhibiting factor is, of course, friction, which, by the time the crude reaches the next station, reduces pressure to near its original level, which is precisely the reason the next station is located where it is. Once again the pressure is boosted to above 1,000 pounds per square inch, and again the pressure gradient falls steadily until the next pump station is reached 170-odd miles downstream, and so by successive impulses does the crude oil move toward its land terminal in Sidon.

The pressure, temperature and flow inter-relationships are so crucial to economical operation that many Tapline engineers spend their working days thinking of little else. Heat, for example, building up inside the pipeline—to a temperature considerably higher than the temperature outside—can reduce the flow by as much as 12,000 barrels a day. Stresses caused by cold—such as the fluke cold of last January—can tax the stress limits of the pipe so much that pressures, and, consequently, flow must be sharply reduced. Some of these problems cannot be solved. Others, through imagination and ingenuity, can, and in perfecting a method to grapple with sudden pumping station stoppages, for example, engineers demonstrated how.

"Analogies can be misleading," warned our analogizing mechanical engineer, "but providing you don't stretch them too far, you can see what happens when a pumping station suddenly shuts down, by visualizing a line of people hurriedly churning through a turnstile at a major football game, ten seconds after kickoff. Then the turnstile jams. For a moment the line of people continues to press forward and then, compressed to its limits, all at once surges back. In a pipeline, this surge wave, running counter to the direction of flow, is produced when a pump station stops functioning without warning. The high-pressure surge wave ripples back upstream at the rate of one kilometer per second. So if you remember that the nearer the upstream pump the higher the pressures within the pipe, it's easy to see that at some critical point the oil pressure plus the surge wave may combine to rupture the pipe and inundate the desert for a country mile in all directions.

"The best way to handle a high-pressure wave is to intercept it with a low-pressure wave, and this is precisely what Tapline engineers have done. When an emergency shuts down a pump station, its Very High Frequency radio automatically sends a signal to the next station upstream ordering an immediate drop in pressure there. This produces a low-pressure wave which travels downstream, also at a kilometer a second. When the two waves meet about midway between the two stations, they cancel each other out, smooth as silk." This original concept enabled Tapline to increase its throughput by more than 10 per cent.

If the pump station is the beating heart of Tapline, then the dispatcher's office in downtown Beirut is its brain. By VHF radio it is in instantaneous communication with every pump station and with the terminal—and through the terminal with approaching ships—and compiles detailed information on crude oil requirements. From the sum of such radio exchanges the dispatcher calculates daily the flow through the pipeline necessary to meet anticipated needs, and sends a cable to Aramco offices at Dhahran and Abqaiq in Saudi Arabia ordering an amount of crude oil to achieve that flow. Pressures in the pipeline and shutdowns for maintenance are likewise coordinated by the dispatcher, who has final responsibility for all the oil in the line from the moment it is gauged at Qaisumah until it flows into the tanker's hold without his ever setting eyes on a single drop of it.



Divers continually inspect the submarine lines.

The process of accommodating a tanker captain's signal to "Fill 'er up!" differs from that of the Sunday driver mainly in degree. Yet the amounts of combustible crude to be transferred are so great—the average tanker of today carries up to 27,000,000 gallons—that extraordinary attention to detail must be observed for the safety of the ship and the terminal itself. The tanker is still several miles at sea, and already in touch with Sidon and Beirut by radio telephone, when a Tapline mooring master, himself a veteran tanker skipper as well as an expert on local waters, boards the ship to pilot it to loading berths where, within minutes of mooring, oil begins to pour into the hold of the ship. Flowing downward by gravity from Tapline's 3,600,000-barrel tank farm, which serves as the reservoir for the pipeline's unceasing throughput, the crude oil passes through a maze of control valves into submarine pipes. Extending more than one mile from the shoreline, the four parallel sections of submerged steel pipe terminate just below the respective ship berths in some 80 feet of water. Connected to their terminals are flexible heavy-duty rubber hoses, whose other ends are lifted from the sea bed to be connected to the ship. To these are attached additional lengths of hose which reach to the ship's manifold. Once the connection is made the mooring master signals shore control to open the main valve and begin loading.

Although the Sidon terminal sprawls along a wide stretch of coastline from the tank farm, 350 feet above sea level, to the Mediterranean, its 35 miles of pipe and 20 huge tanks are controlled by a shift of only six men. Automation, intensive training and rotation of jobs which permits great work-force flexibility during emergencies, and instant communication by radio between Sidon and the other nerve centers of Tapline, have combined to make the Sidon terminal operation a model of efficiency.

Huge hoses link underwater lines to tankers.

Tapline is perhaps most easily distinguished from other pipeline operations by its involvement in matters having no direct connection with the oil transportation business at all. It built and maintains one of the major roads in Saudi Arabia, over which passes a large percentage of that nation's surface trade with Lebanon, Syria and Jordan. It assists municipal development of the towns of the northern frontiers of Saudi Arabia, providing planning and expert counseling in the organization of such locally-unfamiliar services as a city-wide electric supply system financed by public subscription. It has drilled water wells which provide uncounted thousands of nomadic Arabs with an assured supply of water for their flocks. Most noteworthy of all is the Tapline medical service, which, next to the actual transportation of crude oil, involves more company personnel and expenditure than any other phase of Tapline operations.

This service, based on an agreement between Tapline and Saudi Arabia, provides for emergency care of travelers, plus considerable medical help to those in the immediate vicinity of pumping stations. A modest service at the beginning, it has, today, grown to proportions far in excess of original plans. "At first," the Arab medical director of one of Tapline's hospitals explained, "the burden was negligible primarily because of a reluctance to try our brand of medicine. That this has changed can be seen in figures for 1963: at the four Tapline hospitals—at Turaif, Badanah, Rafha and Qaisumah—there was a total of 15 doctors, 48 nurses and 68 beds. During those 12 months there were 300,940 clinic calls, of which 249,445 were *non*-company, and 10,946 hospital days."

Like the hospitals, the road along the pipeline was built in response to contractual obligations to the Saudi Arabian Government, but also because of engineering requirements. Getting men and materials to the construction site made an all-weather road imperative from the beginning and, from the standpoint of the type of traffic it bore, it was certainly unique. In addition to bulldozers, cranes, earth-movers and a host of other equipment, the road was constantly churned to dust by 150, 50-ton trucks hauling pipe, 120, 10-ton trucks, 500 trailers, 80 refrigerator trucks for fresh food, 12 lunch-serving trailers, and 40, 60-passenger buses, plus a handful of automobiles. The unpaved road surface was no trouble to the huge machines, but their tires were constantly being punctured by the welding-rod ends which littered the pipeline right-of-way until electro-magnets were installed on trucks which patrol the road.

Tapline currently spends more than $500,000 a year to maintain the road which, besides company vehicles, now carries a veritable caravan of commercial traffic. Turaif, which did not even exist in 1945, is now the third largest port of entry in Saudi Arabia. Until recently, the marl-surfaced road was periodically reconditioned by scraping, spraying with water, and rolling, the resulting surface baking under the hot sun almost to brick hardness. A more permanent road, conforming to U.S. two-lane specifications, was begun in 1963 using the old road as a base. Starting at Qaisumah, the asphalted road is now proceeding westward at the rate of one kilometer a day, and is expected to reach Turaif in late 1967.

Nothing—not even the vital road link with the Mediterranean—has so transformed life in the northern provinces of Saudi Arabia as the water wells drilled by Tapline. Until the pipeline came, the area for more than 200 miles on either side of the present right-of-way was one broad belt of barren desert, with spots of green at great intervals to which hurried the tribesmen on their annual north-south migrations in search of pastures for their camel herds. A total of 43 water wells were drilled, 24 in close proximity to the projected pump stations, the others in more remote areas. Collectively, these wells produce more than 1,000,000,000 gallons of water each year for the pump stations and towns along the line and for an unknown number of travelers, nomads, and herds.

The easy availability of water and the presence of jobs with Tapline has led to a social revolution in northern Saudi Arabia. In less than a generation Saudi Arabs, whose ancestors for thousands of years were nomads, have settled more or less permanently in the vicinity of Tapline pump stations, to the extent that towns of more than 5,000 inhabitants, with schools, mosques, shops and government services, have been established. Depending about equally on Tapline, commerce generated by the road, the semi-floating pastoral population, and government patronage, these towns are here to stay, and proud of a rampant westernization tempered by a concern to preserve traditional values. Tapline has encouraged local enterprise by purchasing from independent merchants whenever possible and by sponsoring the construction of modern housing by its local employes under the company's Saudi Home Ownership Plan. Through the aid of the plan, 31 employe houses were built in 1963 and the total now is more than 140.

In turn, Tapline's impact has been reciprocated with interest by those employes who have seized opportunities for advancement to positions of responsibility. Hamoud Nazzal, a personable Saudi in his early thirties, dressed in starched khakis, takes pleasure in showing visitors around the immaculate turbine plant in Turaif, of which he is senior shift foreman. Speaking at first in technical language, he easily switches to fluent colloquial English when he sees he is not getting his message across:

"That roar you hear is practically identical to the noise of a commercial jet," Hamoud matter-of-factly explains in the relative quiet of the control room, "and up close you must wear a set of these foam rubber and plastic 'Mickey Mouse' headsets if you don't want to go deaf. Only

Despite the most modern equipment the last lengths of hose must be muscled into place.

Hoses are tied into ship's manifolds.

Turaif has turbines, by the way; the other stations of Badanah, Rafha and Qaisumah work on diesel power. The models you see through the glass supply 5,000 horsepower. Inside temperatures reach 900°F, the turbines turn at 6,000 revolutions per minute, and the air compressors hit 7,000 rpm. When they become encrusted with carbon scale we clean them by throwing quantities of plain uncooked rice into the air intake. Officially, the turbine is called a 'General Electric Simple-Cycle Two-Shaft Gas Turbine,' the 'simple-cycle' referring to..."

Listening to him speak, one gains the impression that he has had a technical education and tinkered with engines all his life. In fact, as a Lebanese engineer observed, "Hamoud Nazzal and the rest of the 75 per cent of Tapline employes who are Saudi Arabs were, almost without exception, nomads less than 20 years ago. Their contact with the world outside was zero, and their prospects for a different kind of life very faint indeed. But once they joined Tapline, they proved extremely quick to learn and receptive to new ideas. Today, two of the three shifts at all our pump stations are manned exclusively by Arabs, and many of Tapline's most demanding jobs are filled by Arabs. At Sidon for example, 'Abdallah Assaly, Najib Wehbeh, Fouad Hneineh and Mahmoud Salman comprise the vital crew of divers charged with maintaining the submarine lines. In Beirut the six-man dispatcher's staff, headed by Emile Ayash, is all Arab."

The American and other foreign employes, like the Saudis, have had to adapt to new conditions. They live in small, self-contained communities at each station. Amusements are of the home-grown variety, including golf courses consisting mainly of continuous sand traps; even the "greens" are made of rolled sand, held in place by generous applications of discarded lubricating oil, while the balls are often painted red for better visibility.

Even with a private airline—two DC-3's— to facilitate supply, keeping Tapline going from day to day is a tremendous exercise in logistics. The 1,070 employes of the pipeline company perform 410 different jobs, and each of them requires a host of tools and equipment. In 1963 Tapline purchased exactly 27,397 different items, and the total of items kept in stock runs to nearly 40,000. Purchases range from toothpicks to microwave transmitter towers. Tires for Tapline vehicles in Saudi Arabia alone cost some $93,000 a year. The flexible high-pressure hoses, of which there are 27 lengths each 25 feet long in each of Sidon's four loading berths, cost from $2,000 to $4,000 each, and must for safety's sake be discarded at the first sign of ruptured reinforcing wires or even slight scratches in the outer rubber carcass. Huge inventories (currently amounting to about $4,000,000) of seldom-used equipment must be maintained because sometimes up to 12 months may elapse before orders can be filled.

The best planning in the world cannot forecast the occasional mishaps that sting the company's troubleshooters into action like the bite of a sand fly. Foremost among these during the early days, when the pipeline was a novelty, was the rifle bullet fired at the above-ground pipe, either out of exuberance, the hope that the pipe contained water, or a detached curiosity to discover how far the oil would spurt into the desert. The answer was, pretty far, and a repair crew would be off to the scene on the double. Leaks however rarely reach major proportions, but if they do, pressure on that section of the line can be dropped to zero, and valves on each side of the break can be closed to prevent further loss by gravity-drain of crude through the rupture. Only one such major break has occurred in Tapline's history, a 14,000-barrel spill at kilometer 390 in February,1957. The traffic on the road, moreover, has increased to such a degree that no leaks can go undetected for more than a few hours. In recent years, leaks have overwhelmingly been in the corrosion-pinhole category.

In the years that have been passed since the completion of Tapline, the role of Tapline in the world economic picture has steadily increased in importance. The United States is criss-crossed with an evergrowing network of lines carrying crude oil and its products, natural gas and coal. In North Africa, where major oil discoveries have been made recently, pipelines are carrying large quantities of crude from the desert producing fields to Mediterranean terminals. In Europe pipelines now carry oil from coastal refineries into the interior—such as the line from the French Mediterranean coast to Strasbourg, France, and Karlsruhe, West Germany. Yet there is, between pipelines and tankers, whose size, economy and efficiency have grown considerably each year, a constant struggle. To keep pace, pipelines must operate at maximum capacity. And Tapline has kept pace, moving, each year, a little closer to the maximum.

Some of the additional capacity has resulted from a continuing research program which has raised permissible pipe pressures, while maintaining a constant safety factor. One important step, for example, was the addition of four giant Auxiliary Pumping Units—huge, remote-controlled units, sandwiched midway between the original pump stations in Saudi Arabia—which have doubled the hydraulic pressure and boosted potential capacity from 360,000 barrels per day to nearly 480,000. Another was the improvement of loading methods at the terminal so that tankers can take their oil aboard and leave in record time.

It is only by such imaginative solutions and by operating efficiency that Tapline can continue to compete with automated supertankers, carrying ever-larger cargoes with ever-smaller crews, for the other basic factor in the equation—the diameter of the pipeline—is immutable. Yet, whatever its short-range prospects, Tapline's long-term outlook couldn't be better. The direct correlation between commercial energy consumption and national prosperity has not gone undetected by the underdeveloped countries of the world: the United States, for example, consumes three times as much energy per capita as Europe, 20 times as much as Asia, 26 times as much as Africa, and the emerging nations are hurrying to redress the balance. So rapidly is the use of fossil fuels expanding that, according to sober estimate, between now and the end of this century the world will consume three times as much energy as has been consumed in all previous history. And Tapline, which in its brief 14 years of operations has already loaded 10,160 tankers with 1,550,000,000 barrels of crude oil, seems destined to do it all over again—many times. ■

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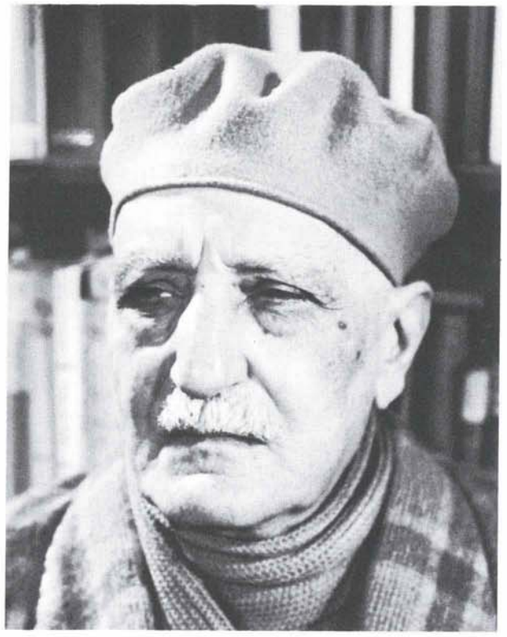
With all connections tightened and pressure gauges attached, the oil begins to flow.

CURRENTS IN THE RIVER

BY 'ABBAS MAHMOUD AL-'AKKAD

Slowly, clearly, the accepted patterns of Arabic literature are giving way to new trends ...



'Abbas Mahmoud al-'Akkad, eminent Egyptian man of letters, died in Cairo, March 12, 1964, at the age of 75, and is mourned throughout the Arab literary world. Nicknamed "The Giant," he was the author of more than 70 books on poetry, philosophy, religion and literary criticism. He was also a contributor to newspapers and magazines, a member of the Arab Language Academy and a man whose life was dedicated to literature and education. This article, written expressly for Aramco World and completed a few weeks before his death, is at once a summation of the changes in Arabic literature and a fine illustration of the rich metaphorical approach of the literature to which he contributed so much. — ED.

Like a great river flowing between its banks, Arabic literature, like all literature, has been subject to concurrent, yet sometimes conflicting, movements. One has been the evolution of form and content, a progressive development and improvement—like the current in a river, flowing quietly but steadily toward the sea. The other movement has been the temporary fashion or fad, not always in harmony with the first, like waves rippling across the surface, sometimes surging wildly, but usually breaking on the far shore without changing the course of the river or deepening its channel.

Most of such fads or fashions, which are frequently but erroneously called "schools" or "doctrines," arose from a misunderstanding of modern scientific and social doctrines or out of a misapplication of their findings. The most striking example of that today is found in the misunderstandings or exaggerations of the theories of Freud and his fellow pioneers regarding psychoanalysis, particularly those theories concerning the subconscious mind.

With the general acceptance by society of those theories, there developed the belief that the senses of sight, sound and touch were henceforth to be disregarded as valid criteria for artistic selection. According to this argument, only the subconscious imaginings and reactions of the artist were to be considered.

In presenting this argument, those who adopted it seem to have forgotten or brushed aside the fact that the subconscious always has played an important role in the artistic vision, whether the artists openly recognized it or not, being in fact the very intuitive quality that guided them toward the truth of feeling, likeness and color. They seem to have forgotten too that even if the subconscious is a valid criterion for artistic judgment, its presentation must, nonetheless, hold to recognizable standards of quality and execution and that distinctions must still be drawn between care and negligence in execution. It is not strange, therefore, that all efforts guided by such an approach have resulted in confusion and will end in defeat.

Similarly, the currents of literature have been affected by the misunderstanding of social doctrines no less than the misunderstanding of psychological studies. Socialism, for example, aimed at the outset to eliminate unfair ownership of misappropriated wealth, monopoly and exploitation, but mass understanding of those aims became something else again. To the ordinary mind it came to mean the suppression, not only of social privileges, but also of even those natural endowments of intelligence, talent and judgment. In this distorted view no talent ought to have exceeded the levels of the ordinary individual, a view that eventually must come to mean that there is no need for the rules of drawing and coloring in painting, no need for grammar in languages and no need for rhythms in poetry. The misunderstandings of the original preachings of such doctrine led to another effect too, the conviction that literature which dealt with any theme but that of wages, costs of living and consumption, or which tended toward subjects above the understanding of the ordinary individual, regardless of the level of his intelligence or the degree of his literacy, was a departure from the principles of the creed and was contrary to the interests of the people.

Despite the influence of such fashions, however, they have not, like the waves on the surface of the river, affected the progressive course of Arab literature, nor can they be termed more than a casual interruption in what, for 70 years, has been uninterrupted evolution and development.

Where, then, is that river flowing? What are the developments in Arabic literature in the past seven decades?

To put it briefly, the course of Arabic literature is toward independence; independence from tradition and from imitation. One indication is that original composition is on the increase, exceeding translations in all fields but science and certain cultural subjects. It is particularly noticeable in poetry, where the deeply-felt, very personal approach of an individual is at last squirming out of the strait jacket of expression to which, for so long, the poet had, understandably, submitted.

The general pattern that obtained for so long was poetry that spoke in accepted and rigidly prescribed phrasing—"the poetry of samples"—that poured into one central mold the varied thoughts and responses of the individuals. Thus, if a hundred poets sang the praises of their beloved, each girl and woman would emerge alike, identical in every aspect—eye, nose, mouth, and waist; each would possess in equal measure the virtues and faults of coquetry and pride; each would suffer at separation, sigh at reconciliation. Should a poem on the achievements of a great leader be written, that leader would emerge not as a particular person with individual characteristics and identifiable qualities, but as a composite of other great leaders, as a replica of other men.

Through the years this has slowly, almost undetectibly, changed; some 70 years ago a new age dawned, the age of the "person," during which the poet and his subject emerged in fresh terms and new colors. The beloved became real, shaped not by convention but by her own gifts of beauty, voice, stride and those small yet distinctive mannerisms and habits that set her apart from another. And thus the poet emerged too, responding as an individual in an individual way to the stimuli of sight and sound and sense, and particularly to social change.

Last fall in Alexandria there was held a poetry festival at which this movement toward independence could be seen beneath the subject matter chosen by the poets as the material for their works. More than 10 poems were presented, each by poets already famous. Seven of the poems clearly took cognizance of the social and psychological needs of the people and therein mingled incident and relationship, social trends and psychology and added moreover another dimension, that of the individual response to incidents and relationship. There was, in those poems, a tone of personal search for meaning echoing beneath the description and emotion of the surface narrative.

This shift from the general patterns of the past to the individual expression of the later decades emerges in other ways too. Change is occurring in that most traditional region of classical, or literary, poetry with its patterns of repetition in word and rhythm. In song, both popular and traditional, and in poetry composed in the colloquial tongue and idiom, there is change in content, a move toward the specific, be it an incident or relationship. In the theater, dramas restore life and personality to the stereotypes of history.

In prose, the trend is the same, but social awareness is even more strongly reflected. At the festival it appeared that the fiction of today—which in output now overshadows all other forms of writing—has indeed turned away from the patterns of the past toward the "objective" story, the story that has as its primary point national, social and moral goals. From the romantic and historical themes of the past, prose today turns for its content to life in the streets of the city and town and village. It is rare to find today books devoted to emotional pleasures, or works requiring the luxury of leisurely contemplation.

There are, certainly, writers who still delve deeply into the human personality, who penetrate the surface and produce, in consequence, symbolism and even mysticism. And there are others, notably playwrights, who adopt the conventions of leisure literature, but even here the social and intellectual goal is discernible. The theater, in fact, has widely adopted the "objective" approach and has turned to producing plays in the colloquial idiom.

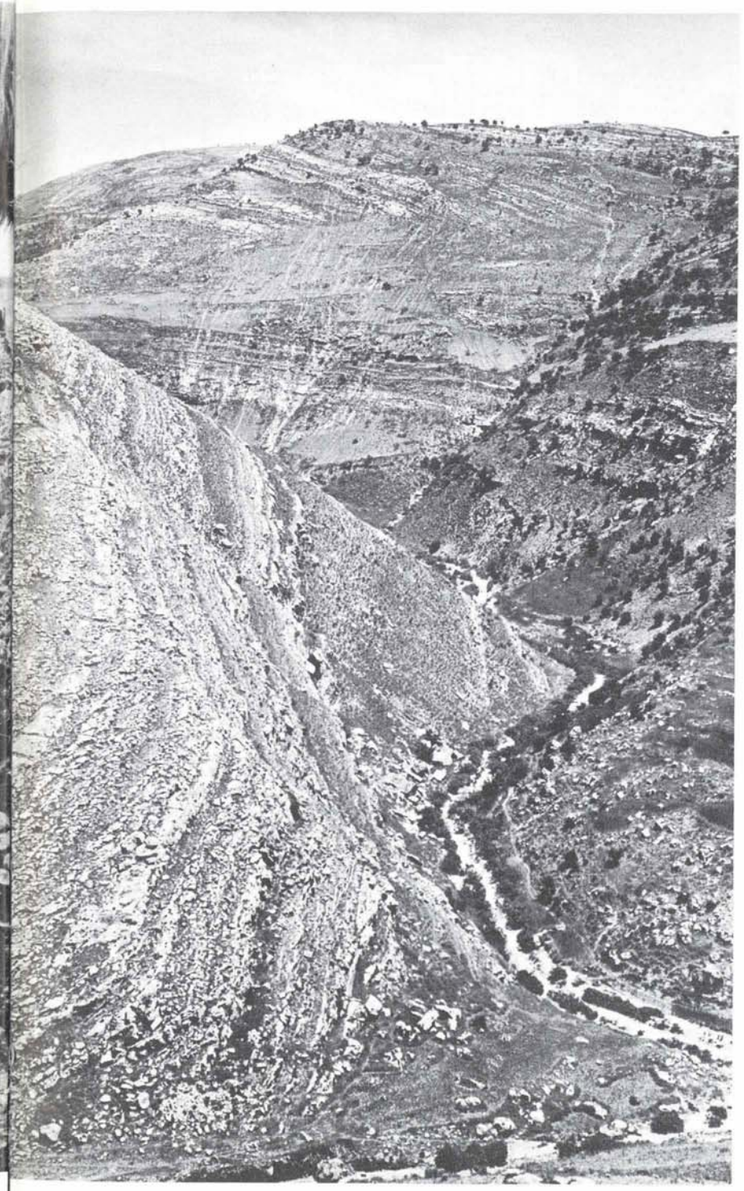
The movement of our current can be seen too in essays, in literary criticism and in literary history, all of which are developing in importance and volume by comparison with similar offerings of 15 years ago. Such writing demonstrates the current most clearly; it is an effort to blend the trends of Occident and Orient, to adopt newer principles to older forms, yet reserving the right to differ and to preserve those elements of Arabic composition which rest on a meter fixed by the rules of derivation. Translation of foreign works is freer and broader in an attempt to achieve this synthesis.

The trends in modern literature also include the contributions of women as well as men, although no distinction can really be made in literature on the basis of sex; valid judgments on literature can only be applied according to standards of achievement irrespective of sex, age or temperament. Some 10 women participated at the poetry festival and if their offerings, some in poetry, some in criticism, differed in any way it was in their tendency to abide more closely by older standards with regard to rhyme and meter. Yet even here, in the very participation of women in the festival, there is a mark of independence, a clear indication of a trend which, like our river, gains strength with each passing day. ■

THE HORNED DILEMMA

In the foothills of the Middle East the conflict has begun — between the goat and the tree ... BY WILLIAM TRACY

Goats are unquestionably valuable to the economic structure of the Middle East, but in foraging they wrench vegetation from the ground, roots and all, leaving the soil exposed.



Jordan's hills show contrast between erosion on bare slopes and on those protected by even a few trees.

In the distance, across the green valley, the goats moved erratically but swiftly across brown, nearly barren hills. Like a column of black warrior ants they nibbled their way upward and along the line of sheer bare cliffs, nimbly leaping from rock to rock, pausing sporadically to wrench a clump of grass from the ground, rearing up occasionally to strip a tempting leaf from a high bush or a slender tree. Behind them plodded the herdsmen, a bearded elder leaning on a staff and a boy aimlessly lobbing pebbles into the air.

Such a scene, pleasant, pastoral, at moments idyllic, is common in the Middle East. It is a tableau certain to engage the eager eye of the tourist in quest of the "picturesque." Yet it was just a scene that a United Nations representative was describing in an address at Duke University several years ago when she said: "Every time I saw a flock of black goats scrambling over those barren hills, I shuddered."

The U.N. representative bore no particular grudge toward goats; she was merely expressing her anguished reaction to what, in most of those lands which edge the eastern Mediterranean, is a serious problem: the impact of the goat on the efforts of man to halt the steady erosion of precious, life-giving soil.

Driving in the Lebanese mountains after a winter cloudburst, one can look down on the coast and see a graphic example of the effects of erosion—a straight brown front of rain water pushing into the blue sea. The water is brown because it carries with it great quantities of soil torn away by torrents that churn down the slopes in swift streams and rivulets. In the mountains themselves there is on every hand equally clear evidence of the effects of erosion—gullies and valleys gouged into the soft limestone cliffs where wind and rain have already worn away the thin but vital cover of vegetation.

The Lebanese mountains were not always this vulnerable. In ancient days, Lebanese cedars, those sturdy monarchs among trees, spread their graceful horizontal caps across the slopes in great forests that covered more than 650,000 acres, according to Herodotus. Joining their deep strong roots to the web of smaller roots and root hairs extending from the myriad grasses and shrubs below, the great trees kept a tight, protective hold upon the soil. Through the centuries, however, the great trees fell victim to the need and greed of Egyptian pharaohs, Levantine kings, Roman emperors and Turkish sultans, until, in the 19th century, Queen Victoria of England dispatched funds to build a wall around the pitiful remnants—a small grove of some 400 trees—and preserve them from extinction. As the trees vanished, the grasses and shrubs, deprived of their protection, gave way too, and soil followed, as it always does when nature's delicate ecological structure is thrown out of balance.

Over the years, of course, other men have tried to restore that balance. Lebanese farmers have hewn terraces into the mountain side to create steps and narrow ledges which check the destructive downward flow and funnel it toward thirsty crops. In modern times private electric companies have built dams and reservoirs such as those on the Bared, Adonis and 'Asi rivers. Today a small corps of planners, university professors and government experts is helping too. It has become clear, however, that to repair the ravages of many centuries of exploitation, and to restore the slopes to even a semblance of their once verdant and valuable condition, will require substantial reforestation. It has become equally clear that refor-

estation will have little chance of success until something has been done about that mortal enemy of the tree, the voracious, hollow-horned, sure-footed goat.

As in other parts of the world, goats in the Middle East are valuable elements in the economic structure. Hardy, ubiquitous, able to live off weeds, shrubs, and grass—in short, off vegetation—the goat, like its cousin the sheep, is an important source of several economically valuable products. Its hide produces soft leather. Its long, coarse hair is woven into tough, durable rugs. Its flesh provides a meat so tender that it is a staple of the area, delicious when carved from vertical spits and served with mint as *chawarma* or skewered with tomatoes and onions and served as *shish kebab*. And in many Middle East suburbs it is a common sight to see herds of nannies clicking stiff-legged through the streets, delivering, right into the jugs and pans of housewives, a daily ration of fresh milk which is not only free from any taint of tuberculosis, but is also richer in proteins and fats than cows' milk and, furthermore, is particularly suitable for the manufacture of a salty white cheese. Goats have, from the standpoint of the small farmer, an added advantage: they are inexpensive to get and keep.

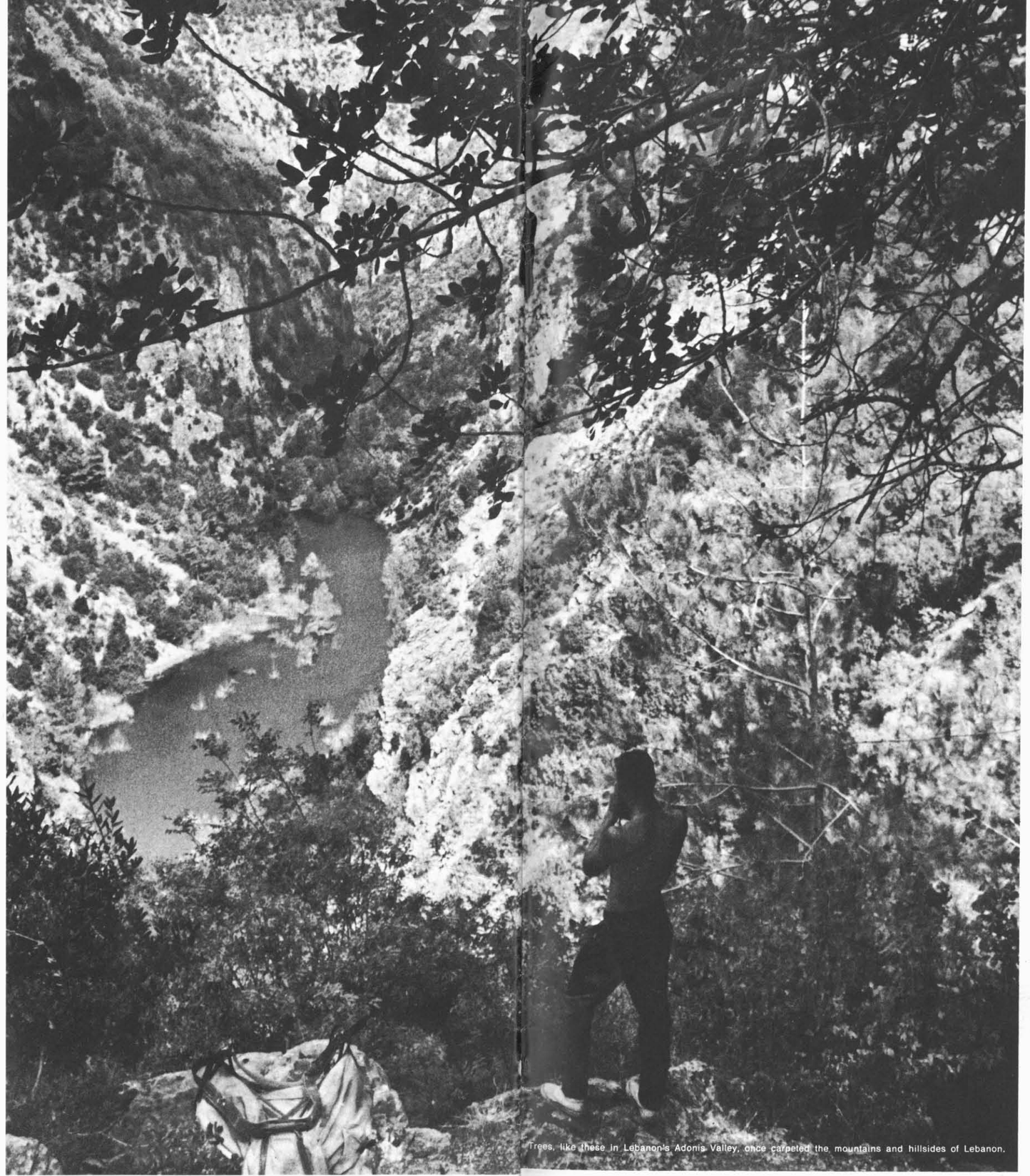
Goats, however, have other characteristics too. In foraging for food they not only snap up every trace of vegetation they come across in their wanderings, but do so in such a fashion that the vegetation cannot easily replenish itself. This characteristic, shared in part with sheep, was what roused the wrath of cattlemen on the western grasslands of the United States years ago and sparked the sometimes deadly conflicts between cattle ranchers and sheepmen over grazing rights. Sheep, unlike cattle, do not nibble the tips of grass, but crop it right down to the ground, leaving little or nothing for other grazing animals. And goats go sheep one better; they wrench the grass right out of the ground in clumps, roots and all. More importantly, with regard to reforestation, goats thrive on young trees; what damage results from this habit was described recently by a bitter farmer. Four years before, the farmer related, he planted thousands of trees on his farm in the mountain pass along the Beirut-Damascus highway. One night, while a careless watchman slept, a herd of goats wandered onto the land. By morning four years of painstaking efforts had disappeared into the stomachs of the goats.

Near Antioch in Turkey, there is a striking example of what this characteristic means to reforestation. Along the Syrian road leading to Antioch are rich green forests and lush meadowlands where cows graze peacefully. But over the border the forests suddenly, dramatically, thin out and give way to harsh, empty terrain. And there, above the deep gullies, silhouetted against the hillside, are herds of long-haired black goats. The lesson is plain.

Thus for the economists, naturalists and planners who are convinced that reforestation is a key factor in the struggle against erosion, the outlines of the conflict are clear. Goats are valuable, even essential, to large segments of the economy in the Middle East where the smaller farmers simply cannot afford cattle. They are, moreover, woven into the fabric of life in villages and rural areas. But they are at the same time a definite threat to reforestation. Which, then, are more important, goats or trees?

In maintaining the balance of nature, trees have a vital role to play. With their wide underground network of roots, they draw huge quantities of water from the earth or help channel it into porous strata far beneath the surface through which it can slowly seep into springs for controlled use in time of drought. On the Mediterranean coasts of Syria and Lebanon, for example, the rainfall is sufficient to support extensive agriculture, but much of it comes during the winter months when ground cover is slight and so pours uselessly into the sea. Forests would catch and hold that water and direct it into the ground where it could seep into caves like Jeita, Afqa and Kadisha which honeycomb Lebanon, or into potholes —deep natural pits—as at Laklouk, through which underground rivers flow, to emerge in the hot rainless summer as springs and wells. And there would be an important defensive value too; forests would check the torrents of mud and water which in the past few years have regularly ravaged the low-lying river quarters of Tripoli, Beirut and Sidon, destroying valuable bridges, gardens and houses, and even taking lives.

Forests make many contributions. Their roots, forcing their way inexorably into formations of rock, break it down into soil. Their leaves, falling to the ground and decomposing, enrich the soil with precious chemicals. In swampy areas the network of roots reaches into the excess water and drains it off, assisting the reclamation of land and the elimination of malarial breeding grounds. In summer, forests cool the air above them as much as 5° F. In winter they slow the melting of snow. They reduce the force of winds, encourage the formation of dew, protect farms from frost and hail and even increase the frequency and amount of local precipitation. Forests, moreover, filter impurities from the air; scientists estimate that there are up to 28 times fewer bacteria in forest air than in urban areas and point to India where great cholera epidemics of the past rarely touched forested areas.



Trees, like these in Lebanon's Adonis Valley, once carpeted the mountains and hillsides of Lebanon.

In Lebanon, sources of water such as Afqa's underground river are ample, but much is wasted because of the lack of vegetation to hold it.

And to all those benefits are added the more tangible gifts of fuel and timber. Properly harvested, rather than exploited, trees could, in the Middle East, provide sorely needed fuel for such small enterprises as the smelting of copper in Jordan and iron in Lebanon, and provide more timber for packing crates in which to ship Lebanon's huge output of fruit. As a building material, timber is also needed, as proven by the famous "beehive" houses of Syria, ingenious domed houses of mud brick, made necessary by the lack of timber for roof beams.

Last, there is beauty—the shaded peace of a forest in which man can withdraw from the hectic pace of urban demands as he does in the villages of Aley, Broummana, Dhour Choueir, Ehden in Lebanon and Slenfih and Kassab in Syria.

Such riches, compared to other areas of the world, are sparse in the Middle East. The Arabian Peninsula, for example, is estimated to have 1,150,000 acres of woodland, mostly in the west, which is only 1.5 per cent of the total land area. In Palestine, Syria and Jordan there are an estimated 770,000 acres of forests, only 1.7 per cent of the total area. Such percentages contrast sharply with Europe, where forests cover 31 per cent of the land, North and Central America, 26 per cent, and Africa, 10 per cent.

For all those reasons, forestry and other agricultural experts, in recent years, have been pushing forward with ambitious reforestation projects, such as Lebanon's "Green Plan" to recapture large areas of desolate mountains with fruit trees and covering forests. A United Nations Special Fund Ground Water project is also underway, in collaboration with the Ministry of Public Works, to tap underground water sources. Bulldozers are lent out at low cost and seedlings are distributed. This year 50,000 young cedars are being planted in addition to 1,000,000 olive and apple trees and vines, which were sold recently to farmers at token prices. Over 5,000,000 ornamental trees from government nurseries like that at Choueifat were sold to home owners or planted along highways. Private enterprise has joined in by planting 40,000 pines and hardwoods at the summer and winter resort of Laklouk. In Barouk, under a U.N. forestry project, bulldozers have opened forestry roads and plowed a series of deep horizontal ditches along the slopes to break rock slides, loosen the earth and catch rain water. In these narrow, temporary "terraces," rows of delicate, slow-growing cedar shoots have been planted and half covered with barricades of rocks. Alternating with the cedars are plastic-wrapped shoots of hardier, faster-growing locust and pine which will soon offer shelter to the cedars. The huge mountain-amphitheater or "bowl" at the Cedars ski resort has been similarly planted.

Elsewhere in the Middle East other projects are under way. In Kuwait, broad green belts of trees have been planted and are being irrigated with distilled sea water. In the south of Jordan are fenced trial plots on opposite sides of the main road for miles, each plot containing six experimental varieties of trees. The government there has also replanted the sacred Mount of Olives and has begun forestation on rugged hills along the Jerusalem-Amman road. In Syria, on the Homs-Aleppo route, large fenced tracts of pine have been planted as roadside parks outside hot, dusty villages. North of Latakia on the Syrian coast there is a surprise for the tourist. "Welcome to the Forests. Be Careful With Fire," reads a large billboard stuck into a naked chalk-white hillside and soon, as the road winds into the mountains, a few young trees appear and the tourist finds himself in the midst of misty green hills reminiscent of North Carolina's Smoky Mountains.

By such projects the experts hope to reverse the destructive cycle of drought and flood, recarpet the land with vegetation, turn back the desert, and — since trees can thrive where other vegetation cannot, even without irrigation—introduce trees into lands where they have never occurred naturally. Naturalists even hope that trees will extend the moderate climate of the Mediterranean basin into the arid, barren areas beyond.

In the face of these projected accomplishments the goat's value fades into relative insignificance. Yet the fact remains that the goats are present in large numbers—there are some 500,000 in Lebanon alone—and are a constant threat. For even if the present plantings can be safely guided to maturity the grown trees will only be safe for their lifetime; they will not be able to reproduce themselves and spread as long as the goats roam freely about, hungrily devouring seedlings. Furthermore, cedars, although they last hundreds of years once they are established, require a full decade to grow their first few feet, and during that time are vulnerable to the voracious appetite of goats.

A start, however, has been made. Following the example of Italy, Cyprus and Tunisia, where governments clamped strict controls upon the large herds that roamed the countryside, Middle East authorities have begun to cope with the problem. The approach adopted has been to substitute cattle and sheep for goats. In Lebanon, authorities have begun the substitution program with 50,000 cattle, enough to reach about a fourth of the rural population. Substitutions will be made village by village over a five-year period in all four provinces. It is a slow process, but one, experts believe, that can avoid the sudden economic upsets to farmers, deprived of livestock, and consumers, deprived of meat, that would be bound to occur if goats were simply banned outright. Moreover, the goats that are retained will be restricted in their formerly wide wanderings and live more on fodder than forage. Authorities have begun to attack the problem from an educational standpoint too; each summer, volunteers from nearly 100 secondary schools swarm into the hills to help plant and tend seedlings.

Even with this approach, of course, patient education of herdsmen and villagers will be necessary. Last summer, driving over the crest of the 8,000-foot pass from the Cedars into the broad Beka' Valley in Lebanon, a writer was struck by the stark contrast of the slopes to the seaward—gouged perhaps, but generally green—with the rocky aridity of the eastern slope. He stopped to talk to a young herdsman about the government's efforts to replace goats with sheep. "We don't like the government to interfere up here," the herdsman said immediately.

Discussing it further, he acknowledged that goats did destroy trees, but added, "That's why we chase them out of the apple trees in the village and send them up there." He pointed upward to the boulder-strewn gorge where herds were busily stripping the slope of every surviving twig and blade of grass. "All I could do," the writer said, "was shudder." ■

William Tracy, a teacher, free lance writer and photographer, has lived in the Middle East on and off for 14 years, and is now working toward an advanced degree in political science at the American University of Beirut. His photo book, A Photographer on the Phoenician Coast, *was published this year.*

At Laklouk in Lebanon a worker plants apple trees to help in the struggle against erosion and to improve the agriculture of the country.