Chapter 18 The Hot Desert and Mid-Latitude Desert Climates

Distribution

Deserts are regions of scanty rainfall which may be hot like the hot deserts of the Saharan type; or temperate as are the mid-latitude deserts like the Gobi. The aridity of the hot deserts is mainly due to the effects of off-shore Trade Winds, hence they are also called *Trade Wind Deserts*. The temperate deserts are rainless because of their interior location in the temperate latitudes, well away from the rain-bearing winds.

The major hot deserts of the world are located on the western coasts of continents between latitudes 15° and 30°N. and S. as shown in Fig. 131. They include the Sahara Desert, the largest single stretch of desert, which is 3,200 miles from east to west and at least 1,000 miles wide. Its total area of 3.5 million square miles is larger than all the 50 states of U.S.A. put together. The next biggest desert is the Great Australian Desert which covers almost half of the continent. The other hot deserts are the Arabian Desert, Iranian Desert, Thar Desert, Kalahari and Namib Deserts. In North America, the desert extends from Mexico into U.S.A. and is called by different names at different places, e.g. the Mohave, Sonoran, Californian and Mexican Deserts. In South America, the Atacama or Peruvian Desert is the driest of all deserts with less than 0.5 inches of rainfall annually.

Amongst the mid-latitude deserts, many are found on plateaux and are at a considerable distance from the sea. These are the Gobi, Turkestan and Patagonian Deserts. The Patagonian Desert is more due to its rain-shadow position on the leeward side of the lofty Andes than to continentality.

Climate

Rainfall. Few deserts whether hot or mid-latitude have an annual precipitation of more than 10 inches. For example William Creek in Australia has 5.4 inches, Kotah in India has 4 inches. Yuma, Arizona, U.S.A. has 3.3 inches. In Salah in the mid-Sahara and Arica in the mid-Atacama have practically no rain at all. In the latter, less than 0.02 inches fell within a period of 17 years in three light showers! In another station less than 150 miles away at Iquique, not a single drop of rain was recorded for four years and then a torrential down-

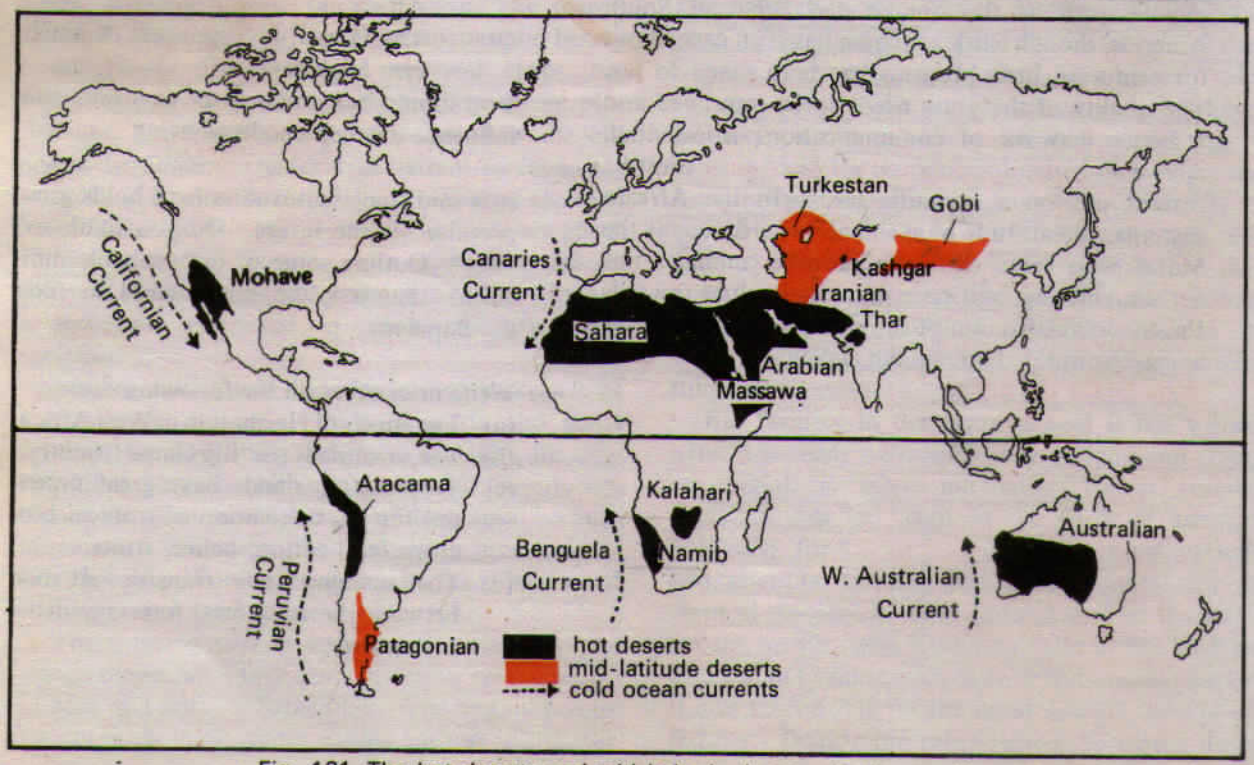


Fig. 131 The hot deserts and mid-latitude deserts of the world

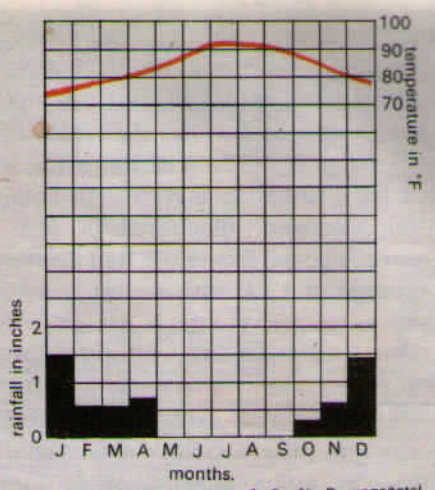
pour suddenly came one afternoon in which 2.5 inches of rain fell! The aridity of deserts is the most outstanding feature of the desert climate. We shall examine more closely why they are so dry.

The hot deserts lie astride the Horse Latitudes or the Sub-Tropical High Pressure Belts where the air is descending, a condition least favourable for precipitation of any kind to take place. The rain-bearing Trade Winds blow off-shore and the Westerlies that are on-shore blow outside the desert limits. Whatever winds reach the deserts blow from cooler to warmer regions, and their relative humidity is lowered, making condensation almost impossible. There is scarcely any cloud in the continuous blue sky. The relative humidity is extremely low, decreasing from 60 per cent in coastal districts to less than 30 per cent in the desert interiors. Under such conditions, every bit of moisture is evaporated and the deserts are thus regions of permanent drought.

Precipitation is both scarce and most unreliable Coastal stations like Massawa on the Red Sea, as illustrated in Fig. 132(a) receive light scattered showers from the on-shore winds, amounting to 5.9 inches for the year. On the western coasts, the presence of cold currents (indicated by arrows in Fig. 131) gives rise to mists and fogs by chilling the on-coming air. This air is later warmed by contact with the hot land, and little rain falls. The dessicating effect of the cold Peruvian Current along the Chilean coast is so pronounced that the mean annual rainfall for the Atacama Desert is not more than half an inch! Rain normally occurs as violent thunderstorms of the convectional type. It 'bursts' suddenly and pours continuously for a few hours over small areas. An inch or more may be recorded in one single shower! The thunderstorm is so violent, and comes so suddenly that it has disastrous consequences on desert landforms.

Temperature. The deserts are some of the hottest spots on earth and have high temperatures throughout the year. There is no cold season in the hot deserts and the average summer temperature is around 86°F. The highest shade temperature recorded is 136°F. on the 13 September 1922 at Al Azizia, 25 miles south of Tripoli, Libya, in the Sahara. Days are unbearably hot, and in the open barren sands, 170°F. is often recorded. The reasons for the high temperatures are obvious—a clear, cloudless sky, intense insolation, dry air and a rapid rate of evaporation.

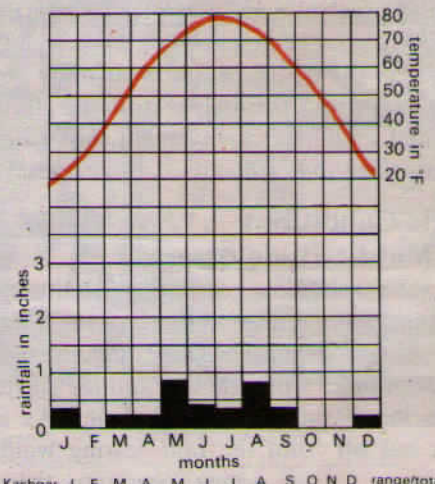
Coastal deserts by virtue of their maritime influence and the cooling effect of the cold currents



Massawa	J	F	M	A	M	J	J	A	S	O	N	D	range/total
Temp.	78	79	81	84	88	92	95	94	92	89	86	81	17°F
Precip.	1.5	0.6	0.6	0.8	0	0	0	0	0	0.3	0.7	1.4	5.9"

Place: Massawa, Ethiopia (16°N., 39°E.).
Altitude: 64 feet
Annual precipitation: 5.9 inches
Annual temperature range: 17°F. (95°–78°F.)

Fig. 132 (a) The Hot Desert Climate



Kashgar	J	F	M	A	M	J	J	A	S	O	N	D	range/total
Temp.	22	34	47	61	70	77	80	76	69	56	40	26	58°F
Precip.	0.3	0	0.2	0.2	0.8	0.4	0.3	0.7	0.3	0	0	0.2	3.5"

Place: Kashgar, China (39°N. 76°E.)
Altitude: 4,255 feet
Annual precipitation: 3.5 inches
Annual temperature range: 58°F. (80°–22°F.)

Fig. 132 (b) The Mid-Latitude Desert Climate

have much lower temperatures, e.g. Arica has a mean annual temperature of 66°F., Iquique 65°F., Walvis Bay, South-West Africa, only 63°F. The hottest months seldom rise beyond 70°F. and the annual temperature range is equally small, e.g. 9°F. in Arica, 10°F. in Iquique and 10°F. in Walvis Bay.

The desert interiors, however, experience much

higher summer temperatures and the winter months are rather cold. For example In Salah, in the Sahara, has a temperature of 99°F. in the hottest month but only 55°F. in the coldest month. The annual range is 44°F. The range for Yuma is 36°F. and for Jacobabad is 41°F. In comparison, the station Massawa, illustrated in Fig. 132(a), located near the coast, facing the Red Sea has only a moderate range of 17°F. Its hottest month is July (95°F.) and its coldest month is January (78°F.).

The diurnal range of temperature in the deserts is very great. Intense insolation by day in a region of dry air and no clouds causes the temperature to rise with the sun. The barren ground is so intensely heated that, by noon, particularly in summer, a reading of 120°F. is common. But as soon as the sun sets, the land loses heat very quickly by radiation, and the mercury column in the thermometer drops to well below the mean temperature. A daily temperature range of 30° to 40°F. is common, though in the Death Valley of California, an exceptionally great diurnal range of 74°F. has been recorded. Frosts may occur at night in winter. These extremes of temperature make desert living most trying. This explains why the desert people wear thick gowns all day long, to protect themselves from the glaring heat by day and chilling frost by night, not to mention the sand grains that are carried by the wind.

Climatic Conditions in the Mid-Latitude deserts

The climatic conditions of the mid-latitude deserts are in many ways similar to those of the hot deserts. Aridity is the keynote. These inland basins lie hundreds of miles from the sea, and are sheltered by the high mountains all around them. As a result they are cut off from the rain-bearing winds. Occasionally depressions may penetrate the Asiatic continental mass and bring light rainfall in winter, or unexpected convectional storms may bless the parched lands with brief showers in summer. For example Kashgar in western China in the Gobi Desert, as illustrated in Fig. 132(b), has most of its 3.5 inches of annual precipitation in the summer. Due to their coldness and elevation, snow falls in winter.

From Fig. 132(b), it is clear that summers are very hot (80°F. in July at Kashgar) and winters are extremely cold with two months below freezing point. The annual range of temperature is 58°F., much greater than that of the hot deserts. Continentality accounts for these extremes in temperature. Winters are often severe, freezing lakes and rivers, and strong cold winds blow all the time. When the ice thaws in early summer, floods occur in many places. The greatest inhibiting factors to settlement are the winter cold and the permanent aridity, besides remoteness from the sea.

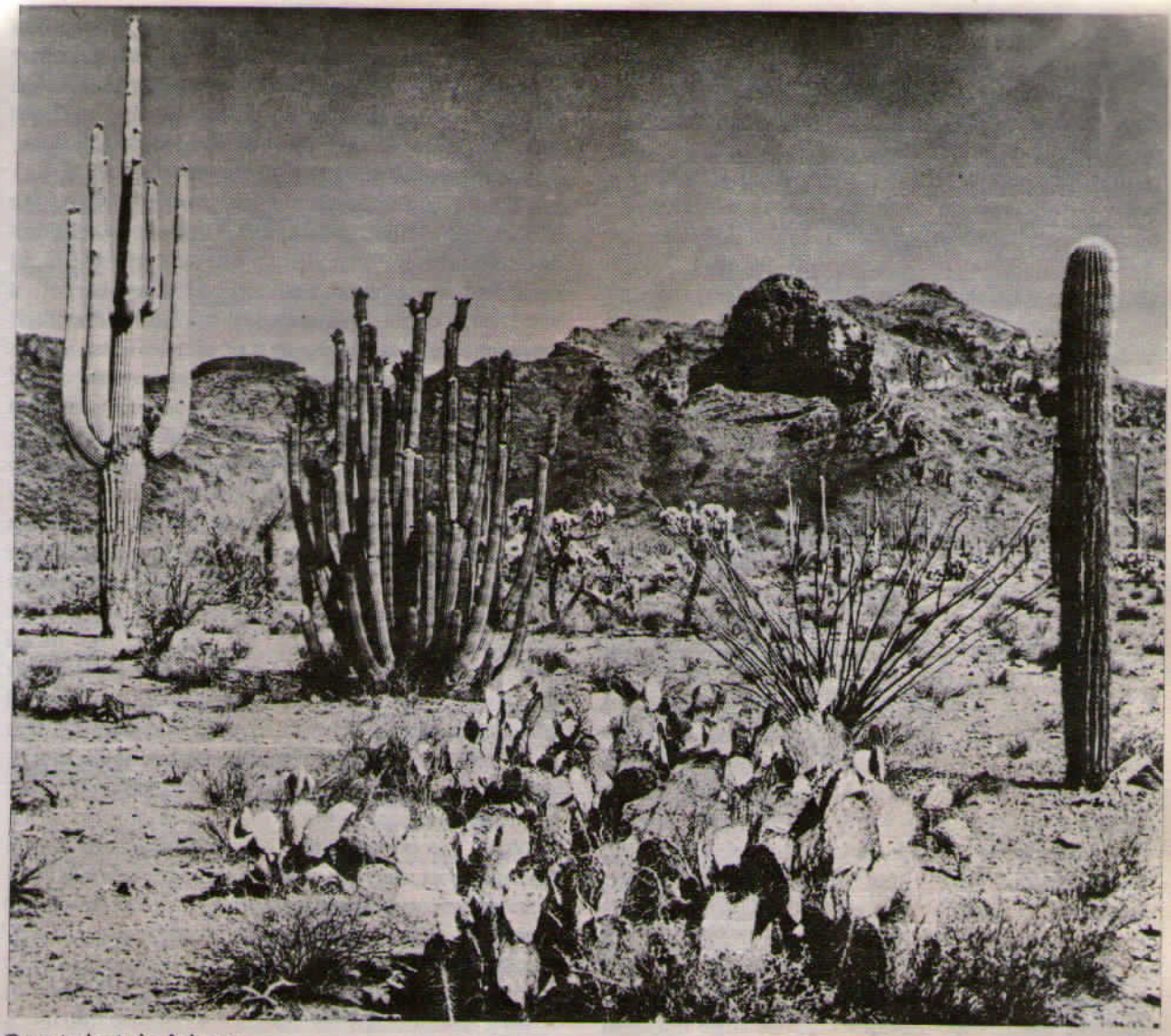
Desert Vegetation

All deserts have some form of vegetation such as grass, scrub, herbs, weeds, roots or bulbs. Though they may not appear green and fresh all the time, they lie dormant in the soil awaiting rain which comes at irregular intervals or once in many years. The environment, so lacking in moisture and so excessive in heat, is most unfavourable for plant growth and a significant vegetation cannot be expected. But *very rarely* are there deserts where *nothing grows.*

The predominant vegetation of both hot and mid-latitude deserts is xerophytic or drought-resistant scrub. This includes the bulbous cacti, thorny bushes, long-rooted wiry grasses and scattered dwarf acacias. Trees are rare except where there is abundant ground water to support clusters of date palms. Along the western coastal deserts washed by cold currents as in the Atacama Desert, the mists and fogs, formed by the chilling of warm air over cold currents, roll inland and nourish a thin cover of vegetation.

Plants that exist in deserts have highly specialized means of adapting themselves to the arid environment. Intense evaporation increases the salinity of the soil so that the dissolved salts tend to accumulate on the surface forming hard pans. Absence of moisture retards the rate of decomposition and desert soils are very deficient in humus. Plants, whether annuals or perennials must struggle for survival against both aridity and poor soil.

Most desert shrubs have long roots and are well spaced out to gather moisture, and search for ground water. Plants have few or no leaves and the foliage is either waxy, leathery, hairy or needle-shaped to reduce the loss of water through transpiration. Some of them are entirely leafless, with pricks or thorns. Others like the cacti have thick succulent stems to store up water for long droughts. There are still others that shed their leaves during droughts. The seeds of many species of grasses and herbs have thick, tough skins to protect them while they lie dormant. They germinate at once when their seeds are moistened by the next rain. In short, all plants must adapt themselves to survive in such an inhospitable region as the desert.



Desert plants in Arizona

Life in the Deserts

Despite its inhospitality, the desert has always been peopled by different groups of inhabitants. They struggle against an environment deficient in water, food and other means of livelihood. Some, like the Egyptians have attained a high level of civilization, others like the Bedouin Arabs have fared quite well with their flocks of sheep, goats, camels and horses. The Bushmen of the Kalahari and the Bindibu of Australia remain so primitive in their mode of living that they barely survive. They are, in fact, a relic of the Old Stone Age in the modern world. The desert inhabitants may be grouped under the following categories.

1. **The primitive hunters and collectors.** Of the primitive tribes, the Bushmen and the Bindibu are the best known. Both the tribes are *nomadic hunters and food gatherers*, growing no crops and domesticating no animals. The Bushmen roam the Kalahari Desert with their bows and poisoned arrows, spears, traps and snares. They are not only skilful and strong but have great endurance. In order to capture their prey, they have to be very patient and if necessary run many miles to track down the wounded animals. In this way, they hunt antelope, and other smaller animals. The women and children collect insects, rodents and lizards, and gather honey, roots, grass and grubs. Great skill is required in obtaining water in the desert. Dew is carefully gathered from leaves early in the morning and stored

in ostrich shells. Very often, it is necessary to dig a hole in damp sand and suck the water up from the ground through a hollow reed. This is often a very slow process. Bushmen either wear a loin cloth or go virtually naked. They travel in small family groups, and live together in open *sherms*. This is a hollow dug beneath a thorn tree, surrounded by bushes. At night a fire is lit to keep the family warm.

The Bindibu or Aborigines of Australia live in very much the same way as the Bushmen. They are lean and dark but healthy. They are skilled trackers and some of them use wooden throwing sticks or *boomerangs* and spears. They also domesticate the *dingo*, a wild dog that assists them in tracking down kangaroos, rabbits and birds. The women gather grass, roots, seeds, berries, moles and insects, to supplement their diet. Like the wandering Bushmen, the Bindibu move in family groups in search of fresh hunting grounds. But one distinct difference is that they always stay close to a water supply as they still have not devised a means of tapping and storing water. They live in *wurlies*, simple shelters made of branches and tufts and grass.

2. The nomadic herdsmen. These people represent a more advanced group of desert dwellers who pursue a livestock economy. They ride on animals instead of walking and are heavily clad against the blazing sun, the stormy winds and the chilly nights. The Bedouin of Arabia ride on horses and live in tents; the Tuaregs of the Sahara are camel riders and dwell in grass *zeriba*, while the Gobi Mongols ride on horses to herd their yaks and live in portable *yurts* (a kind of tent). The Bedouin are the best examples of a desert group who have fared well as nomadic herdsmen. Besides keeping large flocks of animals, they are also engaged in trade with the caravan merchants and the oases people. All round the year, the Bedouin wander with their herds in search of water and green pastures. Their wealth is their animals: sheep, goats, camels and perhaps a few horses. The animals provide them with all that they require, daily milk and cheese and on occasions meat as well. Their skin is used for hides or leather, for making tents, clothing, belts, footwear and water bags. From the hair and wool, the Bedouin make clothes, mats, ropes, rugs and carpets. These can also be exchanged at trading stations or oases for other necessities of life which the desert herdsmen cannot produce like dates, grain, beverages, medicines, firearms and other manufactured articles.

The Bedouin move in groups of about a hundred. They follow a regular pattern of routes, along which are scanty patches of pastures, wells or springs. In this manner, one group rarely clashes with the other in their search for new grounds to pitch their tents. Since they move so often, they always travel light and only the essentials are carried along.

3. The caravan traders. These were the travelling merchants of the desert. Their journeys across the wastes of the Sahara or Russian Turkestan sometimes lasted months or even years. They travelled at night as a team and were well armed. They carried a wide range of goods into remote interiors where their merchandise was highly sought after. These goods were sold or exchanged for hides, rugs, carpets and other valuable products of the deserts. Though profits were high, the risks were equally great.

The pack-animal used by the caravans to carry their goods across the deserts was the camel, aptly described as the *'ship of the desert'*. Unlike horses which have sharp hooves that sink readily in the sandy desert, the camel has broad padded feet that will not slip in the sand. A pack-camel, adequately fed, can carry a load of 350 pounds and travel 50 miles a day. And a racing camel can do twice the distance when ridden! The camel has several other advantages, it provides milk and hair. It can store up water in its stomach, and fat in its hump, so that it can go for long periods without either food or water.

With the introduction of modern air, road and rail transport, the role of the caravan traders is greatly reduced. Goods can be conveyed much more cheaply and with greater security by desert jeeps, vans or trucks. But between the interior oases and scattered out-posts beyond the reach of roads, the caravan routes remain the only form of available transport.

4. The settled cultivators. For crops to be cultivated in the desert, irrigation is indispensable. This is obtained either from oases, rivers or dams, through a network of canals. In Egypt, the Nile supports a population of 25 million, mainly concentrated in the Nile valley and delta. The life-giving waters of the Nile made it possible for the Egyptians to raise many crops as early as 5,000 years ago. When the Nile flooded in summer, the overflowed water was caught in basins with raised banks and led into the fields to irrigate the crops. This was basin irrigation, which was widely practised by the ancient Egyptian farmers and is still employed by the Egyptians today. Rice and cotton are cultivated in summer, followed by wheat, barley, beans and other minor crops in winter. Modern concrete dams constructed across the Nile e.g. Aswan and Sennar Dams are even more

effective for extensive irrigation works. The flood-water can be held back and controlled and then released at any part of the year to feed the fields that yield two, three or even more crops a year. In the same way, desert cultivators rely on the Indus in Pakistan, the Tigris-Euphrates in Iraq, and the Colorado in the Imperial Valley of California, and are able to irrigate millions of acres of arid land for crop production.

In the deserts, wherever there are oases, some form of settled life is bound to follow. These are depressions of varying sizes, where underground water reaches the surface. Some of them are abnormally large like the Tafilalet Oasis in Morocco which measures 5,000 square miles, supporting many settlements, including large towns. Others may be so small that they are no bigger than the mining pools that we are so familiar with, e.g. the Ghadames Oasis of Libya is only one square mile in size. Life in an oasis is secure and well organised. A wall is usually constructed around the oasis to keep out the violent dust storms called simooms. The oasis people live in mud-brick houses with flat roofs, closely packed together. The streets are narrow and winding, and the heart of the settlement is dominated by the suq (central market place), the mosque, school and shopping blocks. *Suqs* may also be set up miles from anywhere and people come from a number of surrounding settlements on special days to trade.

Around the settlement are the agricultural lands. Water is led to the fields by irrigation channels or drawn up from wells by camels or mules. The most important tree is the date palm which is grown in dug-out hollows so that its roots can penetrate deep into the ground in search of water. The fruit is consumed locally and also exported. Other crops cultivated include maize, barley, wheat, cotton, cane sugar, fruits and vegetables. With the development of motor routes across the deserts, many sophisticated foreign goods can now reach the oases.

5. The mining settlers. The lure of mineral wealth has attracted many immigrants into the desert. Mining camps and isolated settlements have sprung up following the discovery of certain mineral deposits. It was gold that brought immigrants scrambling into the Great Australian Desert. Water and food supplies have to be brought 300 miles from Perth to keep the mines going. Some of them like Kalgoorlie and Coolgardie have become towns of considerable size. In the Kalahari Desert, the discovery of diamonds and copper has brought many white men to the 'thirstland' as it is called. Even in the most

The oasis of El Golea. The dunes are gradually encroaching on the date palms *Camera Press*

arid Atacama, in northern Chile, large mining camps have been established for the mining of caliche (cemented gravels) from which *sodium nitrate*, a valuable fertilizer, is extracted and exported to all parts of the world. The mines are worked by local Indian labourers and supervised by foreign technicians. Besides nitrates, copper is also mined. These two products have directly or indirectly contributed to the growing size of the Chilean towns of Arica, Iquique, Antofagasta and Chuquicamata. The last named is the world's largest copper town. Similarly in the deserts of North America, *silver* is mined in Mexico, *uranium* in Utah and *copper* in Nevada. A host of other minerals and their by-products have, in fact, greatly altered the landscape and the economy of such arid regions.

In recent years, the discovery of oil in many parts of the Saharan and Arabian Deserts has transformed this forgotten part of the globe. In Algeria, oil wells have been sunk two miles deep to tap oil. In the Middle East, pipelines over 1,000 miles long have been laid to bring oil from the shores of the Persian Gulf across Saudi Arabia to Saida (Lebanon) and Banias (Syria) on the Mediterranean coast. With still half of the world's reserves of oil untapped in this region, the deserts here will virtually be paved with gold! In Iraq, Kuwait, and Saudi Arabia the desert landscape is fast changing. New roads, huge palaces, ultra-modern hospitals, air-conditioned apartments and swimming pools, are examples of a thriving new era created entirely by oil–*'liquid gold'*.

QUESTIONS AND EXERCISES

1. Explain how the aridity of the desert is related to
   (a) off-shore Trade Winds
   (b) the Sub-Tropical High Pressure Belts (the Horse Latitudes)
   (c) cold ocean currents

2. Bring out any distinct differences between the hot deserts and mid-latitude deserts in
   (a) climate
   (b) vegetation
   (c) way of life

3. With reference to actual examples, describe the activities and modes of living of the different groups of people that inhabit the deserts. Attempt to account for their differences.

4. Explain any *three* of the following.
   (a) The hot deserts of the world are located on the western coasts of continents.
   (b) Patagonia is a desert in the rain shadow of the Andes.
   (c) The annual range of temperature is much greater at Kashgar (Gobi) than at Iquique (Atacama).
   (d) Desert plants must adapt themselves to survive.
   (e) Camels are the 'ships of the desert'.

5. Write brief notes on any *three* of these topics.
   (a) The Bindibu of the Great Australian Desert.
   (b) Date palm cultivation in an oasis.
   (c) The role of oil in the development of desert economy.
   (d) The Bedouin—the wandering herdsmen.
   (e) Agricultural development of any selected desert region.