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Yemen (Aden)

July 1973

NATIONAL INTELLIGENCE SURVEY

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Military Geography

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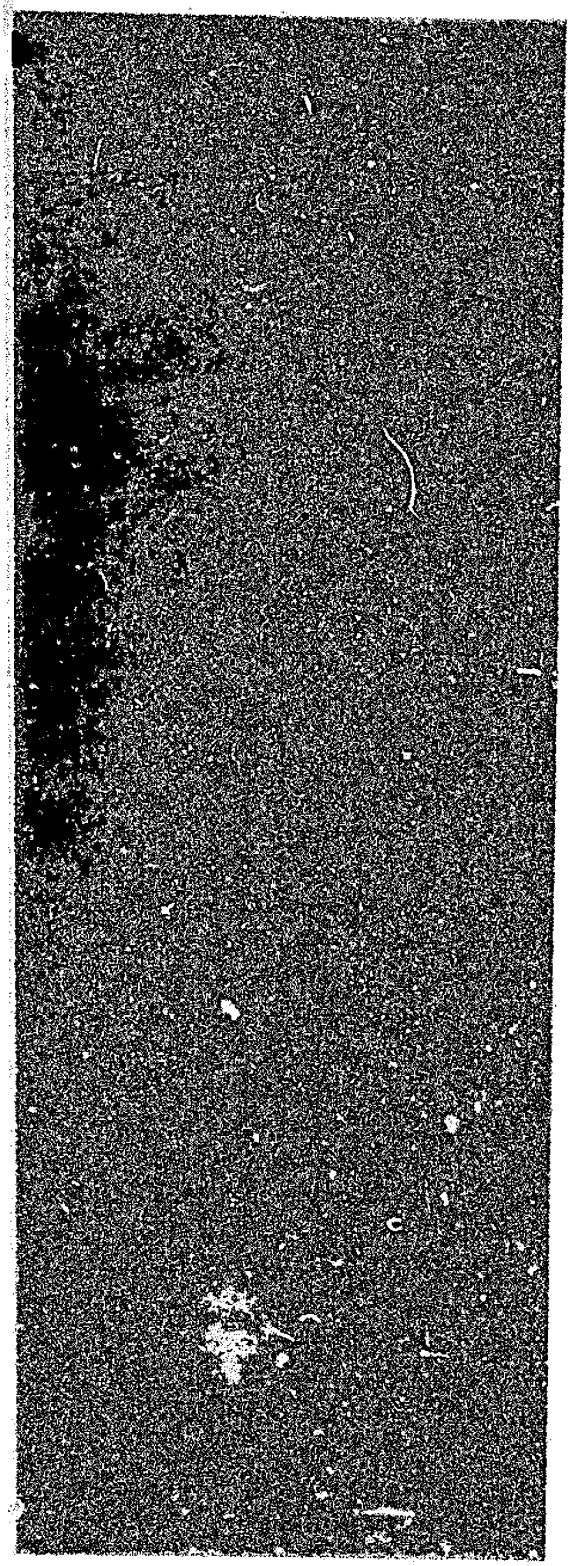


YEMEN (ADEN)

CONTENTS

This chapter supersedes the geography coverage in the Southern Yemen portion of the General Survey on Southern Yemen/Muscat and Oman dated September 1969 which should be destroyed.

FIGURES

Military Geography

A. Location and description (U/OU)

The People's Democratic Republic of Yemen, referred to as Yemen (Aden) in this chapter, extends along the southeastern coast of the Arabian Peninsula in a position to command the narrow straits leading to the Red Sea and the Persian Gulf. Yemen (Aden) includes the strategically located islands of Perim, which lies in the strait of Bab el Mandeb; Kamaran, which is in the southeastern part of the Red Sea; Socotra, which lies close to the Horn of Africa; and other small island groups (see the Military Geographic Factors Map at the end of the chapter). The country is about 650 miles[1] long, ranges in width from 25 to 230 miles, and has an area of approximately 111,000 square miles. It is about the size of the state of Arizona and is only sparsely inhabited, with a population of about 1,355,000.

1. Topography

The terrain consists of a wide band of flat-topped hills and rugged mountains flanked by narrow coastal plains in the southwest and extensive desert plains in the central and interior sections

[1]Distances are in statute miles unless nautical miles are specifically stated

FIGURE 1. A large part of the rugged highlands consists of flat-topped uplands deeply dissected by numerous winding flat-bottomed wadies. The upper valley walls are nearly vertical and most of the lower walls have slopes greater than 45%, contrasting markedly with the nearly level, almost featureless upland surfaces, where slopes are less than 10%. The wadi shown here is incised 900 feet below the upland surfaces. (C)

The hills and mountains generally are 2,000 to 5,000 feet in elevation and cover an area about 650 miles long and 50 to 150 miles wide. Much of this area is the Hadhramaut (Figure 1), a maze of flat-topped hills and sinuous ridges dissected by an intricate network of winding flat-bottomed valleys, gullies, and deep canyons. Slopes are generally less than 10% along valley bottoms and on the flat hill and ridge tops, but are commonly greater than 45% along most valley sides; many canyons and gullies have nearly perpendicular walls. Hills and ridge tops are generally 500 to 1,000 feet above adjacent valley bottoms except along the northern edge of the Hadhramaut, where the dissection is less severe. Rugged, rocky mountains (Figure 2) in discontinuous ranges border most of the southern and western Hadhramaut. Elevations generally range from 3,000 to 8,000 feet, and the summits are generally between 2,000 and 3,000 feet above adjacent valleys and coastal lowlands. Small areas of coastal plains, from 5 to about 30 miles wide, border the mountains. These plains are flat to moderately dissected; in places, they are interrupted by sand dunes, boulder fields, low hillocks, and scattered areas of rough lava and low volcanic cones and are cut by wadies that have banks as high as 50 feet. Kamaran and Perim Islands primarily are flat to gently rolling plains. Socotra and adjacent island groups are characterized by rugged hills and mountains and narrow, discontinuous coastal plains. The hills and mountains are drained by wadies that have developed intricate dendritic patterns (Figure 3). Most wadies trend toward the sea, although a few empty into flat basins in the interior desert plains. Generally dry, the wadies carry water only after heavy rains, when they may be torrents. Wadi Hajr[2] is the only perennial stream in the country. Wadi Hadramawt, over 200 miles long and with more than 1,000 miles of tributary valleys, is the largest drainage system in Yemen (Aden). In its middle course, Wadi Hadramawt is about 4 miles wide and has scattered areas of cultivated vegetation and many villages bordering the sides of the wadi floor. Cultivated crops, date palms (Figure 4), scrub, and grasses line many valleys in the southwestern hills and mountains.

[2]For diacritics on place names see the list of names on the apron of the Military Geographic Factors Map and the map itself.

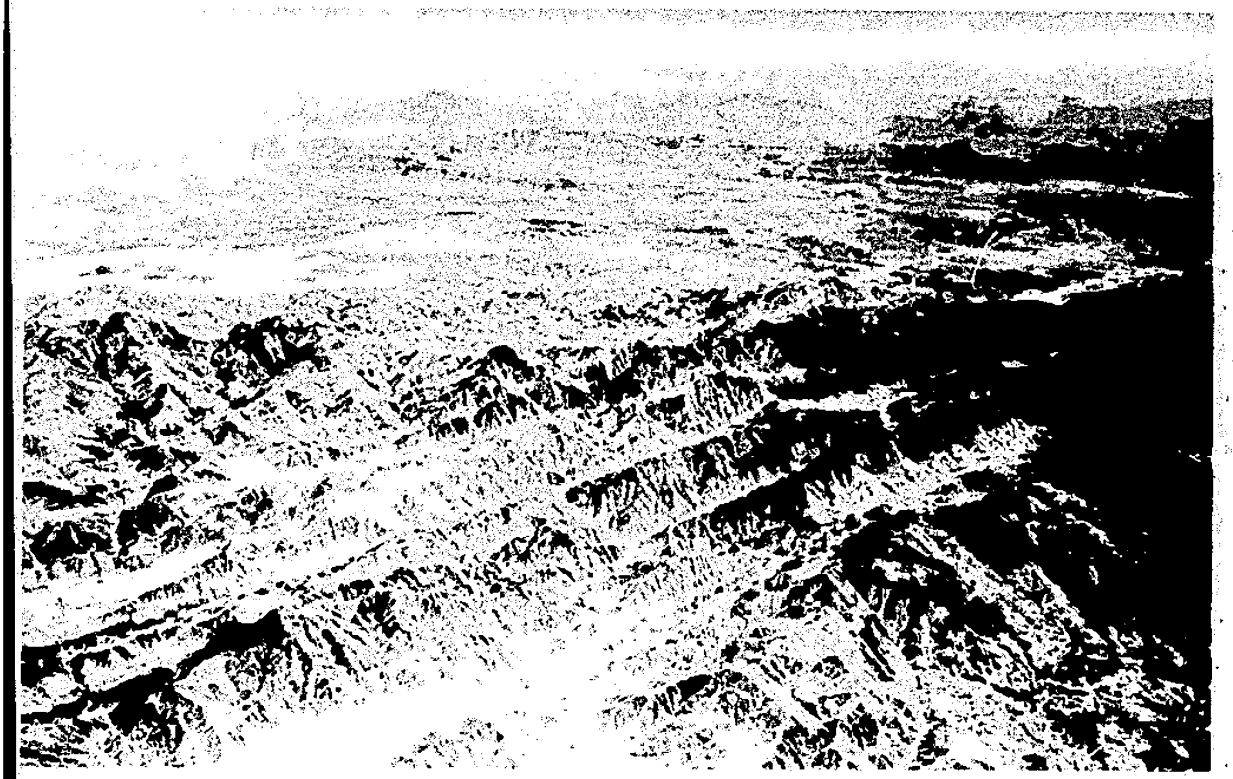
Extensive terraced areas (Figure 5) on hillsides and lower mountain slopes contain small gardens. Terraces are mainly in the better watered highlands north of Aden and along the western part of the border with Yemen (San'a'). Palm trees grow in small oases on the coastal plains. Elsewhere in the hills and mountains, vegetation is generally limited to scattered small trees, bushes, and desert grasses; many areas are barren.

Broad desert plains occupy much of the interior of Yemen (Aden), are flat to moderately dissected, and have sand and gravel surfaces. In places adjacent to highlands, the plains are deeply dissected by steep-banked wadies, which flow toward the Rub 'al Khali, a desert known as "the empty quarter," in Saudi Arabia. Areas of sand dunes (Figure 6), part of the extensive Rub 'al Khali dunes, border parts of the interior plains. Elevations in the plains increase gradually from about 200 to 500 feet near the coast to about 3,000 feet near the hills and mountains in the southwest. Slopes are less than 5% except in sand dunes, dissected areas, and near the highlands, where slopes may be as much as 15%. Local relief is generally less than 100 feet, although a few dunes are more than 200 feet above the surface of the plains. Vegetation on the desert plains is mainly limited to widely scattered small bushes and grasses. A few areas of cultivated vegetation and small oases with palm trees occur near the northeastern highlands, in some wadies, and along the coast.

Water supplies are scarce or lacking in most of the country. Small quantities of often brackish ground water may be obtained from a few widely spaced wells in wadi bottoms. Generally fresh supplies of ground water are available from wells in some mountain valleys along the border with Yemen (San'a'), although access to the sites may be severely hindered by steep slopes and rugged terrain. Surface water supplies are extremely limited and generally only seasonally available.

Most of the people live in the Aden area or in small widely separated towns and villages in the better watered southwestern hills and mountains, at sources

FIGURE 2. Sharp-crested ranges are separated by a multitude of sinuous steep-sided valleys and a few falt-bottomed valleys (foreground) and intermontane basins (left background). Mountain slopes are deeply dissected and are commonly 45% or more. (C)



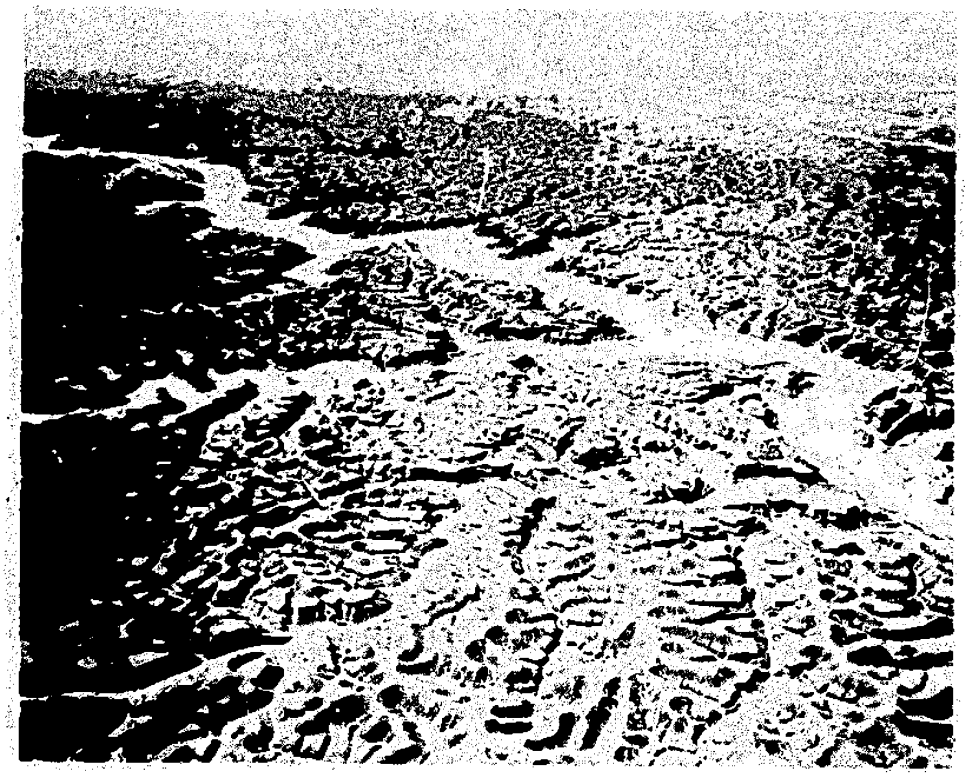


FIGURE 3. The intricate network of deeply dissected wadies snakes through the hills and mountains. Most of the wadies have V-shaped valleys, but a few have broad flat-bottomed valleys, such as the Wadi Hadramawt, shown here. (C)

of water along old caravan routes, and along the coasts. These population centers are connected by a sparse network of surfaced and unsurfaced roads (Figure 7), trails, and tracks. Most settlements are old, compact, and surrounded by clay walls. Buildings are flat-roofed structures (Figure 8) from one to as many as seven stories high and are constructed of sun-dried mud-brick or stone; many have enclosed courtyards. Streets are predominantly narrow, winding, and unpaved. Aden, the only large seaport and a principal market center, has numerous modern buildings up to seven stories high, constructed of reinforced concrete or stone and broad, paved streets forming grid patterns.

2. Climate

The climate is hot and extremely arid everywhere except above about 5,000 feet in the mountainous regions, where temperatures are moderated and annual rainfall is greater but still meager (Figure 9). The latitude, the rugged mountains within and adjacent to the area, the proximity of large bodies of water, and the monsoonal airflows determine the climate. Two primary seasons are delineated: the northeast monsoon (November through March) and the southwest monsoon (June through September). April-May and October are transitional periods between the monsoons.

The northeast monsoon is the coolest season. Mean daily maximum temperatures are in the low or middle 80's (°F.), and mean daily minimums vary from 65°F. to 75°F. on the coast to between 45°F. and 60°F. in the interior deserts. The mean daily temperature range at elevations above 5,000 feet is from the upper 60's to the low 40's. Relative humidity is persistently high on the coast, is somewhat lower in the mountains, and is lowest in the interior deserts where afternoon values often drop below 40%. Precipitation is extremely sparse almost everywhere during this season. The infrequent and irregular rain usually occurs as brief local showers which sometimes become heavy

FIGURE 4. Cultivated vegetation occupies small areas of oases, which are located chiefly in valley bottoms. Here, in a wadi in the Hadhramaut, date palms predominate; they are 10 to 30 feet high and have trunks 1 to 2 feet in diameter. Other cultivated vegetation consists of grains. These deep, winding canyons and their tributaries permit habitation in the Hadhramaut. (C)

downpours. The showers accumulate average amounts of less than 1 inch per month, and prolonged droughts are commonplace. Thunderstorms are rare. Clear to partly cloudy skies prevail during this season and early morning tends to be the cloudiest time of the day. Visibility conditions are normally very good throughout this season. Light to moderate northerly winds are prominent in the interior deserts, but the monsoonal winds are quite modified in the mountains by the terrain and on the coasts by pronounced land and sea breezes.

The southwest monsoon is the hottest season. Mean daily maximum temperatures are in the 90's (°F.) and low 100's; some afternoon temperatures in the interior deserts approach 120°F. Mean daily minimums are in the 60's in the desert but are comparatively high on the coast, in the upper 70's and low 80's. The oppressive heat, coupled with rather high humidities, creates sultry conditions that are extremely debilitating to humans; this is especially true in the coastal sections. Precautions should be taken against

FIGURE 5. The better watered seaward slopes of the hills and mountains in western Yemen are extensively terraced and intensively cultivated. Grains, including sorghum, wheat, and barley, are the main crops. The terraces are supported by stone walls commonly 6 to 120 feet high. (U/OU)

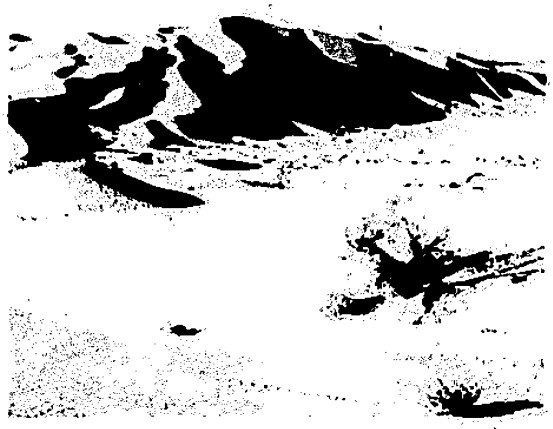


FIGURE 6. Crescent-shaped sand dunes are characteristic of much of the northern part of the broad interior desert plains, which are extensions of Rub' al Khali, the great sand desert of Saudi Arabia. The dunes have steep, unstable surfaces, which rise as much as 700 feet above the barren surfaces of the plains. (C)

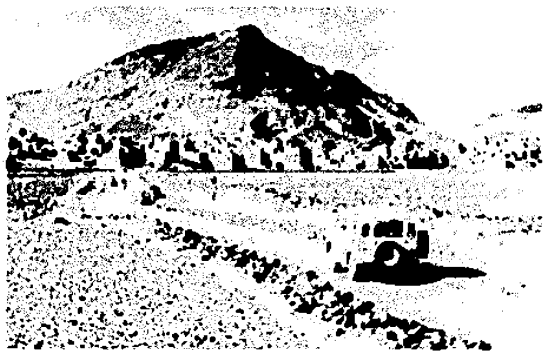


FIGURE 7. Most of the roads are narrow and unsurfaced. This one leading to a village nestled at the base of the highlands near the border with Yemen (San'a') is marked by rocks removed from the right-of-way across the bouldery desert plain. (U/OU)

overexertion. The only relief is in the mountains above 5,000 feet; here, mean daily maximum and minimum temperatures are 20 to 30 Fahrenheit degrees cooler and relative humidity is within comfortable limits. Shower activity on the coast and in the interior deserts continues its infrequent and irregular pattern throughout this season, and average monthly rainfall remains small. In the mountains near Yemen (San'a'), however, heavy orographic showers occur on a fairly regular basis in July through September, when 2 to 3 inches per month are normal. Some of the downpours are torrential, occurring in the two to four or more thunderstorms per month. Clear to partly cloudy skies

FIGURE 8. Most highland towns are congested. They consist of closely spaced multistory buildings of sun-dried clay and mud or stone. Roofs are flat and surmounted by parapets, and streets are narrow and unsurfaced. This is Tarim, which lies in Wadi Hadramawt. (U/OU)

are still prevalent everywhere. The cloudiest periods are produced by morning stratus on the coast and by afternoon cumulus in the mountains. The parched soils during this hot season allow fine sand and dust particles to be raised by winds to great heights. As a consequence, a haze layer hangs suspended throughout much of this period and often reduces visibility below 6 miles. Winds are light at night and in the morning, but afternoon sea breezes are moderate to strong. Occasionally the sea breeze reinforces the southwest monsoonal winds to gale speeds (27 knots).

B. Military geographic regions (C)

Differences in terrain are the basis for dividing Yemen into two military geographic regions—Southwestern Highlands and Desert Plains (Figure 15). The combination of environmental conditions within each region would have a relatively uniform effect on military operations, but there would be marked differences between the regions.

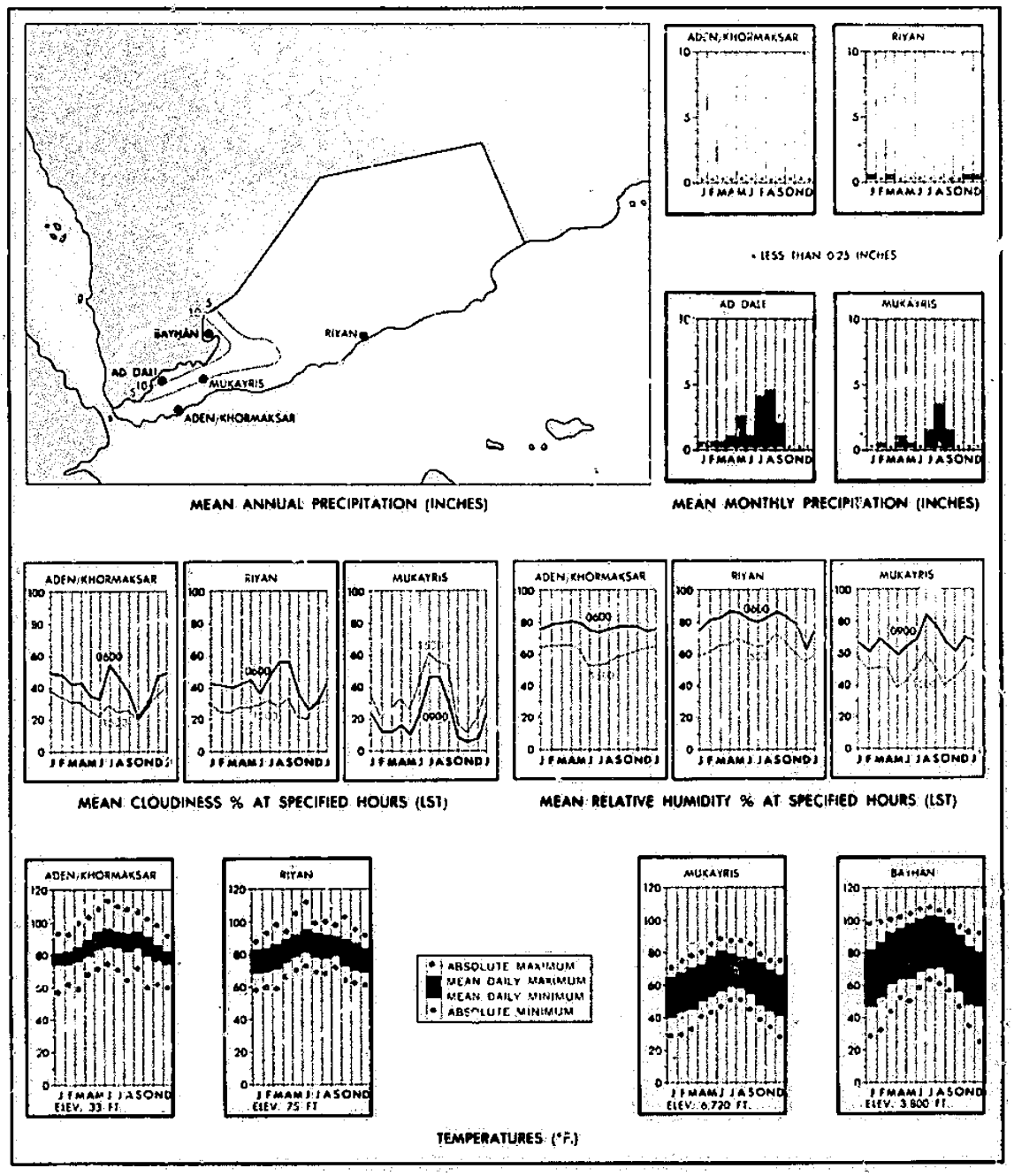


FIGURE 9. Precipitation, cloudiness, relative humidity, and temperatures. (U/OU)

1. Southwestern Highlands

This region is predominantly hills and mountains that have rugged surfaces, a sparse vegetation cover, and few roads. The city of Aden and several large towns are within the region.

Most of the region is poorly suited for large-scale conventional ground operations. Cross-country movement would be severely restricted by rocky slopes in the mountains, steep-sided valley sides in the Hadhramaut, and by dunes, boulders, and areas of rough lava on parts of the discontinuous coastal plains. Vehicular cross-country movement would be limited to small, flat areas in the coastal plains and, except after heavy rains, narrow, winding wadi bottoms in the Hadhramaut. Ouroad movement would be limited to the few roads, which primarily are in the southwestern half of the region. Although the principal roads are two lanes wide and have bituminous or gravel surfaces, movement would be slowed in many places by sharp curves and steep grades. Unsurfaced roads and tracks generally are in poor condition and would deteriorate rapidly when subjected to heavy military traffic. After heavy rains, road surfaces become slippery or miry, washouts are numerous, and landslides are common in many areas. On many roads and tracks, wadi crossings are bottlenecks during flash floods, when streams are too swift to ford. In most places offroad dispersal would be precluded by steep slopes. The construction of additional roads would be difficult; alignments would be severely restricted, and steep grades, switchbacks, and considerable blasting would be required. Roads could be aligned along wadi bottoms; however, they would be subject to severe damage from flash floods. Construction materials generally are available, but there are only limited quantities of water, and the desert climate would make construction difficult. Concealment from air observation would be limited to trees in a few valleys and to buildings in towns and villages. Concealment from ground observation and cover from flat-trajectory fire, however, would be afforded in most of the hills and mountains by steep slopes and surface irregularities and in the coastal plains by steep wadi banks. Numerous tunnel-type installations having short adits and thick, stable roof cover could be constructed in the rugged hills and mountains; rocks are hard, and much blasting would be required. Conditions are favorable for the construction of bunkers in the deep, fine-grained soils in the coastal plains; poor drainage, however, would be a problem in places during July and August.

The region is largely unsuited for airmobile and airborne operations because of steep slopes and rugged terrain. Scattered sites suitable for parachute drops and helicopter landings are available in the narrow coastal plains and in some of the broader wadies in the highlands, but approaches generally would be restricted. Sites suitable for landing assault-type aircraft are limited to the few existing airfields, which are concentrated in the western part of the region. At times, visibility would be restricted by a haze resulting from duststorms in the interior. Airfield construction would be confined almost entirely to the narrow coastal plains and a few broad valleys in the highlands, but even in these areas, orientation of runways and poor foundations are major problems.

The region is poorly suited for irregular force operations. In most of the region there is no concealment from air observation and little potable water. Food and shelter materials generally are lacking except at widely separated villages, mostly located in the southwestern half of the region. Supplies could be airdropped, but recovery would be difficult in the rugged highlands. Supply by sea is limited by flat nearshore gradients and nearshore obstructions. Hills and mountains of bordering Yemen (San'a') afford concealment from ground observation of irregular forces crossing the border and could provide sanctuaries for forces operating in the region.

The coast of the Southwestern Highlands, including the offshore islands, is mostly unfavorable for large-scale amphibious operations because of flat nearshore gradients, poor exits, and restricted visibility caused by duststorms during early June through September. The offshore approaches are mostly clear except for several banks and islands; nearshore approaches are partly obstructed by rocks, shoals, islets, and wrecks. A few widely spaced groups of sandy beaches are along the mainland coast and range up to 50½ miles in length but most are less than 3 miles long. Except for some bituminous-surfaced roads in the vicinity of Aden, exits from the beaches are generally by desert tracks and trails connecting a few coastal villages. Three sandy beaches line the northern and western coasts of Socotra; exits are mostly by tracks.

2. Desert Plains

The region is characterized by broad, flat to dissected desert plains, a lack of developed transportation facilities, extremely limited water supplies, and sparse vegetation. The region is backed by the Rub' al Khali of Saudi Arabia.

Most of the region is poorly suited for ground operations of large-scale conventional forces. Cross-country movement generally would be easy for long distances across nearly flat rocky and gravelly surfaces but would be difficult in the severely dissected areas adjacent to the highlands and in dune areas along the

border with Saudi Arabia. Existing routes across the region are limited to a few tracks and trails. Duststorms and clouds of dust raised by moving vehicles would limit visibility. In most areas of flat plains, roads could be constructed with fairly good foundations, mostly unrestricted alignments, slight grades, and gentle curves. Elsewhere, construction would be severely restricted by sand dunes and dissected areas. Construction materials generally are available, but a lack of water in most places and extremely high temperatures are major construction problems. Possibilities for concealment from air and ground observation are extremely limited. Some concealment from ground observation and cover from flat-trajectory fire would be available locally from sand dunes and steep-sided wadies. Cover and concealment generally would be nonexistent in the extensive gravel-covered plains. The region is mostly unsuited for the construction of underground installations. Construction of tunnel-type installations would be restricted by inadequate overhead cover in most of the region and by unstable rock in areas adjacent to the highlands. Bunker construction would be limited by shallow or unstable soils and by sand dunes. Bunkers could be constructed in part of the region, mostly in the north, where soils are stable and drainage is good.

Conditions are unfavorable for airmobile and airborne operations in deeply dissected areas adjacent to the highlands and in sand dunes along part of the interior border of the plains. Many sites suitable for parachute drops and landings of helicopters are available in scattered areas in the north, but a lack of water, poor cover and concealment, high summer temperatures, and periods of restricted visibility would make operations difficult. The few widely separated airfields in the region constitute additional sites and could accommodate assault-type aircraft. Large airfields could be built in parts of the northern section of the region, where foundations are firm, little grading would be required, approaches generally would be unrestricted, and construction materials, except for water, generally are available.

The region is unsuited for irregular force operations because of poor concealment and an almost complete lack of water, food, and shelter materials. Although irregular forces could move on foot easily in most of the region, concealment from air observation would be lacking, and concealment from ground observation and cover from flat-trajectory fire would be available only in the dissected areas adjacent to the highlands and in sand dunes along parts of the border with Saudi Arabia. Sustenance is generally unavailable, and most of the region is uninhabited. Supplies could be obtained via airdrops almost everywhere.

C. Strategic area (C)

The strategic area (Figure 10), encompassing the city of Aden (Figure 11) and the town of Little Aden

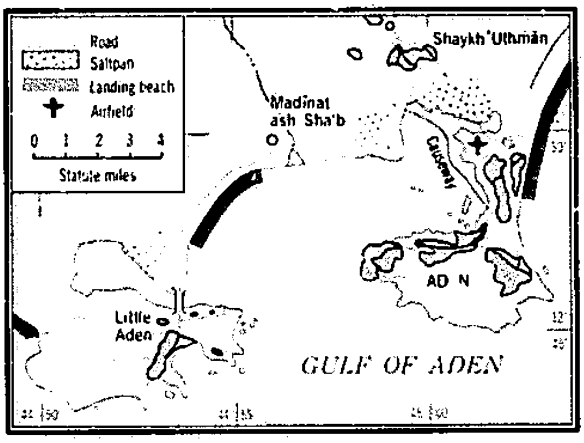


FIGURE 10. Aden strategic area (C)

FIGURE 11. Aden occupies the nearly level surfaces between dissected ridges forming a narrow promontory jutting from the southern coast. Aden is the chief port for the country as well as for the entire southern coast of the Arabian peninsula. (C)

and their environs, is on the southwestern coast, near the narrow straits leading to the Red Sea. Aden (1973 estimated population 150,000) is the capital, a bunkering port, a chief transshipment and distribution center for the southern Arabian Peninsula and northeastern Africa, and the site of several military installations. Its bunkering role and entrepot trade have diminished considerably since 1967, when the city was dealt a double blow with the closing of the Suez Canal in June and the withdrawal of the British from Aden in December. A large international airfield is located immediately north of the main built-up area. Little Aden (1965 estimated population 15,000) has a petroleum port, several storage areas for crude oil and refined petroleum products that have a combined capacity of over 7 million barrels, and a refinery. The refinery, which is one of the major installations of the strategic area, has a throughput capacity of 140,000 barrels of crude oil per day; at present, it is operating below capacity.

D. Internal routes (C)

The internal routes (see the map at the end of the chapter) provide the easiest avenues of movement between the land approaches from Yemen (San'a') and the strategic area. The amphibious landing area provides direct access to the strategic area.

The route connecting the approach from Ta'izz, Yemen (San'a'), to Aden crosses rugged hills and mountains and dissected coastal plains. The route contains a two-lane, partly gravel and partly bituminous-surfaced road in good condition; there are numerous sharp curves. Movement would be slowed after heavy rains by slippery surfaces and washouts, and traffic would be stopped at times by water in some wadies. Narrow, winding streets through scattered settlements are potential bottlenecks. Conditions for offroad dispersal and cross-country movement are generally poor to unsuited because of steep slopes and rocky surfaces.

The route connecting the approach from Harib, Yemen (San'a'), to Aden is across flat desert plains, rugged hills and mountains, and sandy coastal plains. The route contains a one- to two-lane road that is mostly unsurfaced and in good to poor condition. Offroad dispersal and cross-country movement generally would be easy in the plains but would be difficult in the hills and mountains because of steep slopes.

E. Approaches

The perimeter of Yemen consists of about 1,020 miles of land boundaries and 860 miles of coastline. Yemen claims territorial jurisdiction for 12 nautical miles off shore. Specific data on land boundaries are contained in Figure 12. (U OU)

1. Land (C)

Conditions for cross-country movement in the border areas generally are unfavorable for conventional forces because of rugged terrain and extensive sand dunes. Rugged hills and mountains (Figure 13) preclude movement along parts of the boundary in the southwest and southeast, and dissected plains and sand dunes restrict cross-country movement along most of the remaining border area. Only a few roads and tracks cross the borders.

The approach from Ta'izz, Yemen (San'a'), is across rugged mountains that are covered by brush, scattered trees, and cultivated vegetation in the valleys and along the lower slopes. The approach contains a winding, two-lane, bituminous-surfaced road in good condition. Cross-country movement and offroad dispersal generally would be precluded by steep, rocky slopes.

FIGURE 12. Boundaries (U/OU)

BOUNDARY	APPROXIMATE LENGTH	STATUS	TERRAIN
	Miles		
Yemen (San'a').....	500	Southwestern one-third defined and demarcated; remainder undefined. Unfortified except for ruins of a few ancient mud-walled forts.	Narrow, barren coastal plain; rugged hills and mountains with scattered small trees and bushes, and flat, interior desert plains dissected by widely separated wadies.
Saudi Arabia.....	440	Undefined and unfortified.....	Desert plains, partly covered by sand dunes; generally barren.
Oman.....	180	Between coast and Habarut defined and demarcated; remainder undefined. Unfortified.	Between coast and Habarut, narrow coastal plains and dissected hills and mountains; remainder, barren desert plains covered by sand dunes in the north.

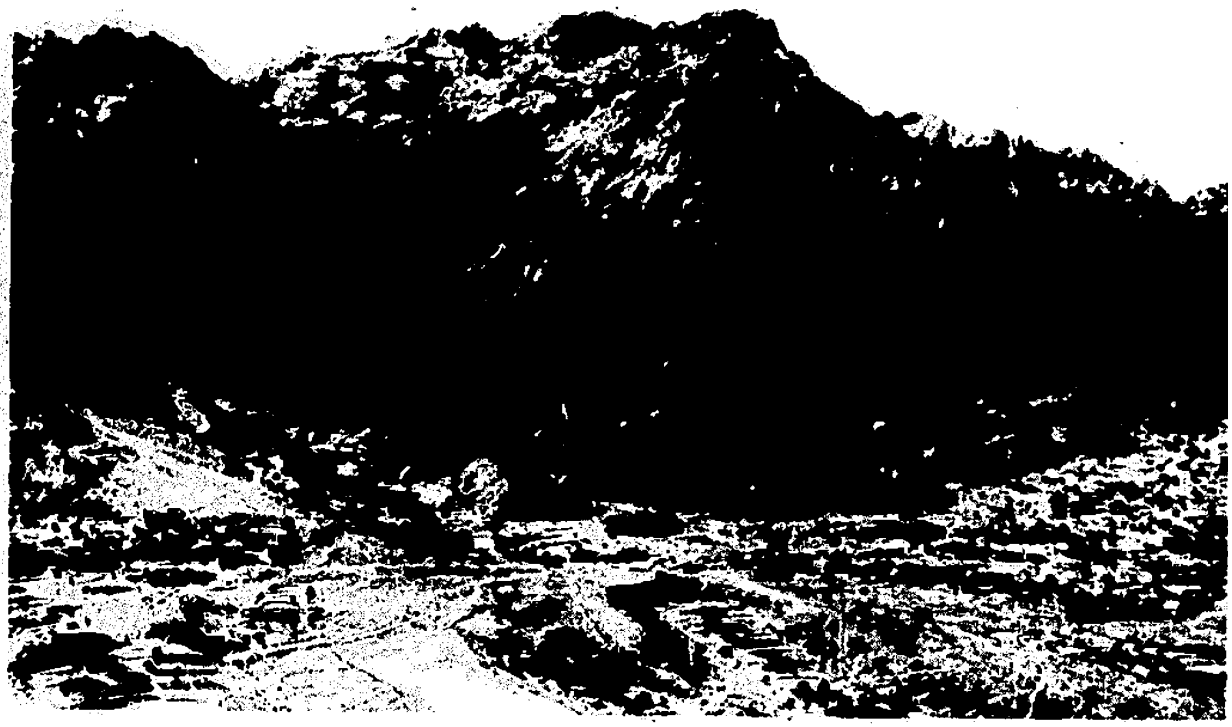


FIGURE 13. Rugged, rocky mountains lie along part of the western border with Yemen (San'a'), precluding all but local movement of wheeled and tracked vehicles. These angular, rough-surfaced mountains could readily provide sanctuaries for irregular forces crossing the border. (C)

The approach from Harib, Yemen (San'a'), is across a flat, sandy plain dissected by a few widely separated wadies. The plain is generally barren except for areas of date palms and cultivated cropland along some wadi bottoms. The approach contains a one-lane, gravel-surfaced road in fair condition. Offroad dispersal and cross-country movement would be easy but would be restricted locally by areas of soft sand and by steep-sided wadies.

2. Sea (C)

Sea approaches are through the Gulf of Aden and Arabian Sea. Conditions are generally unfavorable for large-scale amphibious operations because of partly obstructed approaches and predominantly flat nearshore gradients. Except for several islands, the offshore approaches are generally clear; nearshore approaches are partly obstructed by rocks, shoals, reefs, wrecks, and islands. Nearshore bottom slopes are mostly flat. Nearshore bottom material is mostly sand, gravel, and rock. Surf 4 feet or higher can be expected to occur infrequently except during July through September and November through March when surf greater than 4 feet occurs over 20% of the time along the coast between Ra's Fartak and the border with Oman. Tides range from 4 to 5 feet. Only a few widely spaced groups of beaches border the coast. Most of the beaches are less than 5 miles in length and most have a moderate to steep gradient. Exits are mostly by tracks or by cross-country movement. The amphibious landing area shown on the Military Geographic Factors Map provides access to the strategic area. The landing area is described in Figure 14.

3. Air (U/OU)

Air approaches[1] to Yemen (Aden) from the northwest and north are over Yemen (San'a') and southern Saudi Arabia; approaches from the east and southeast are over western Oman and the Arabian Sea; approaches from the south and west are over the Gulf of Aden, northern Somali Republic, French Territory

[1] The discussion zone for air approaches extends approximately 200 nautical miles beyond the borders of Yemen (Aden).

FIGURE 14. Amphibious landing area (C)

LOCATION	APPROACH	BEACH	TERRAIN BEHIND BEACH AND EXIT
Centered at Aden. . . .	Seaward of 6-fathom curve, clear except for shoal off northeast part; shoreward, partly obstructed by reefs, wrecks, and shoals. Nearshore bottom sand and mud; gradients 1 on 100 to 1 on 665; mostly unsuitable for dry-ramp LST landings. Surf 4 ft. or higher infrequent in all months. Diurnal tidal range 5 ft.	Contains 4 main beaches. Beach west of Ra's Imran (Military Geographic Factors Map) 23 mi. long; all usable. 75 yd. wide at L.W. and 30 to 35 yd. at H.W. Gradients 1 on 30, L.W. to H.W., and 1 on 15 in H.W. zone; material sand. Beach east of Ra's 'Imran 3½ mi. long; all usable. About 135 yd. wide at L.W. and 65 yd. at H.W. Gradients 1 on 50, L.W. to H.W., and 1 on 20 in H.W. zone; material sand. Beach northwest of Aden (Figure 10) 3 mi. long; interrupted near northeast end by wadi; nearly all usable. About 335 yd. wide at L.W. and 65 yd. at H.W. Gradients 1 on 200, L.W. to H.W., and 1 on 40 in H.W. zone; material sand. Beach northeast of Aden 30½ mi. long; all usable. 165 yd. wide at L.W. and 65 yd. at H.W. Gradients 1 on 50 to 1 on 100, L.W. to H.W., and 1 on 20 in H.W. zone; material sand.	Beaches backed mainly by low sand dunes partly covered by desert brush or low trees. Dunes backed by a narrow coastal plain extending inland to rugged hills and mountains; wadies flow into marshy area behind northeastern beach; small villages are behind some beaches; city and port of Aden flank south end of northeastern beach. Exits generally by cross-country movement to desert track or to bituminous-surfaced roads closely paralleling beaches west and northeast of Aden.

of the Afars and Issas, and eastern Ethiopia. The weather in most approaches is generally good all year but is best during the northeast monsoon. The most hazardous weather occurs during the rare occasions when tropical cyclones affect the Arabian Sea approach sector. The average occurrence of these severe storms is once in 3 years, most likely in May, October, or November. They are accompanied by strong gales or hurricane-force winds, severe turbulence, extensive multilayered cloudiness, and torrential rains.

Throughout the northeast monsoon, cloudiness is generally less than 40% in most approaches and thunderstorms are infrequent everywhere. Visibility is usually very good except over the desert regions during an occasional duststorm or sandstorm. Turbulence is light to moderate at low levels over mountainous areas and heated land surfaces but occasionally may become severe in the high-level westerly jet stream. The upper westerlies prevail in all approaches at this time of year above about 20,000 feet and extend to at least 55,000 feet. Mean speeds reach a maximum of 75 knots near 40,000 feet in the northern sectors. The average height of the freezing level is near 15,000 feet in most approaches; however, there is little risk of aircraft icing because of infrequent occurrence of clouds above the freezing level.

During the southwest monsoon cloud amounts remain small in the approaches over the deserts but increase in amount over much of the remaining sectors. Maximum cloudiness occurs in the approach zone over the Arabian Sea along the Oman coast. Here, extensive low stratus cloudiness, up to 90% in July and August, persists throughout much of the day; this is usually accompanied by greatly reduced visibilities for long periods. Cumulonimbus clouds are prominent in the approaches over the mountains in Yemen (San'a') and in Africa and result in as many as 10 thunderstorms per month in some months during May through September. Severe aircraft icing above 17,000 feet and severe turbulence are most likely in the thunderstorms. Hazardous icing also occurs in towering cumulus above the 17,000-foot freezing level. Moderate turbulence, duststorms, and sandstorms may be expected over the deserts at low levels. Turbulence is also present over the mountains at low levels and in the easterly jet at high levels. The upper easterlies prevail throughout this season in all approaches; mean speeds in the easterlies are strongest, 55 to 65 knots, near 55,000 feet in the southern approaches.

(1)

Places and features referred to in this General Survey (u/ou)

	COORDINATES	
	° 'N.	° 'E.
Abū 'Ubaydah (*military camp*)	12 49	45 02
Abyan	13 05	45 20
Aḍ Ḍāli'	13 42	44 43
Aden	12 46	45 01
Aden, Gulf of (*gulf*)	12 00	48 00
Aden Peninsula (*peninsula*)	12 45	45 01
'Alawi (*semidependent sheikhdom*)	13 28	44 45
Al 'Abr	16 05	47 22
Al 'Anad	13 13	44 47
Al Burayqah	12 44	44 53
Al Ḥawṭah	13 28	44 57
Al Ḥiḍn	13 17	45 17
Al Ḥiswah	12 50	44 57
Al Huraydah	15 34	48 13
Al Ittiḥād	12 50	44 56
Al Mahrah	17 50	54 30
Al Mukallā	14 32	49 08
Al Wahidi (*tribal area*)	14 20	47 50
Ansāb	14 31	46 30
Arabian Sea (*sea*)	18 00	71 00
Ash Shiḥr	14 44	49 35
As Sa'id	14 20	46 52
'Ataq	14 33	46 48
Ath Thumayr	13 31	44 52
At Tawāhi	12 47	44 59
At Turbah	12 40	43 30
'Audhali Sultanate (*semidependent sultanate*)	14 20	46 52
Az Zanjabār	13 07	45 23
Bab el Mandeb (*strait*)	12 30	43 20
Baḥaq	15 19	45 23
Bandar at Tawāhi (*bay*)	12 48	44 57
Bayḥān al Qiṣāb	14 48	45 44
Crater	12 46	45 02
Dathina, State of (*semidependent state*)	13 50	46 00
Dhofar, Oman (*region*)	17 00	54 10
Fadhli Sultanate (*semidependent sultanate*)	13 25	45 40
Ḥabarūt	17 20	52 40
Ḥabbān	14 21	47 05
Hadhramaut (*region*)	15 00	50 00
Ḥaḍramawt, Wādi (*wādi*)	15 55	50 00
Ḥajr, Wādi (*wādi*)	14 04	48 40
Halimayn	13 40	44 55
Ḥarib, Yemen (San'ā')	14 56	45 30
Haushabi (*semidependent sultanate*)	13 20	44 50
Ḥawf	16 37	53 01
Hūd, Qabr (*tomb*)	16 05	49 27
Jabal Ḥadid (*hill*)	12 48	45 01
Ji'ār	13 13	45 18
Kamaran Island (*island*)	15 21	42 34
Kathiri (*semidependent sultanate*)	16 00	48 50
Khanfar	13 13	45 18
Khormaksar	12 49	45 02

	COORDINATES	
	° 'N.	° 'E.
Kirsh	13 25	44 32
Khūryān Mūryān (*islands*)	17 30	56 00
Lahij	13 04	44 53
Lawdar	13 53	45 52
Little Aden (*township*)	21 45	44 52
Lower 'Aulaqi (*semidependent sultanate*)	13 45	46 45
Lower Yafa'i Sultanate (*semidependent sultanate*)	13 40	45 25
Ma'alah	21 47	45 01
Maflahi Shiekhdom (*semidependent sheikhdom*)	13 45	45 08
Mayfa'ah	14 20	46 00
Mukalla Bay (*bay*)	14 30	49 06
Mukayris	13 56	45 40
Muṣayṭi'ah	15 01	50 38
Nūbat Dikaim	13 17	44 45
Oman, Gulf of (*gulf*)	25 00	58 00
Perim (*island*)	12 39	43 25
Persian Gulf (*gulf*)	27 00	51 00
Qa'ṭabah	13 51	44 42
Radfān	13 30	44 55
Ra's al Jarib	12 48	45 01
Ra's Baradli (*point*)	12 36	44 59
Ra's Fartak (*point*)	15 38	52 15
Ra's Hedjuff (*point*)	12 47	45 00
Ra's 'Imrān (*headland*)	12 41	44 43
Red Sea (*sea*)	25 00	35 00
Rub' al Khali, Saudi Arabia (*desert*)	20 00	51 00
Ṣalalah, Oman	17 00	54 06
Ṣan'ā', Y.A.R.	15 23	44 12
Say'ūn	15 50	48 47
Shaykh 'Uthmān	12 52	44 59
Shibām	15 56	48 38
Shu'ayb	24 53	54 57
Socotra (*island*)	12 30	54 00
Ṣubayḥi	12 45	43 42
Tarim	16 03	48 59
Ta'izz, Y.A.R.	14 47	44 02
Upper 'Aulaqi (*semidependent sheikhdom*)	14 20	46 52
Upper Yafa'i Sultanate (*semidependent sultanate*)	13 50	45 20
Wuday'ah, Saudi Arabia	17 00	47 10

Selected airfields

Al Ghaydah	16 10	52 15
Khormaksar	12 50	45 02
Ataq	14 33	46 50
Beihan	14 47	45 43
Mukayris	13 56	43 39
Riyan	14 39	49 19

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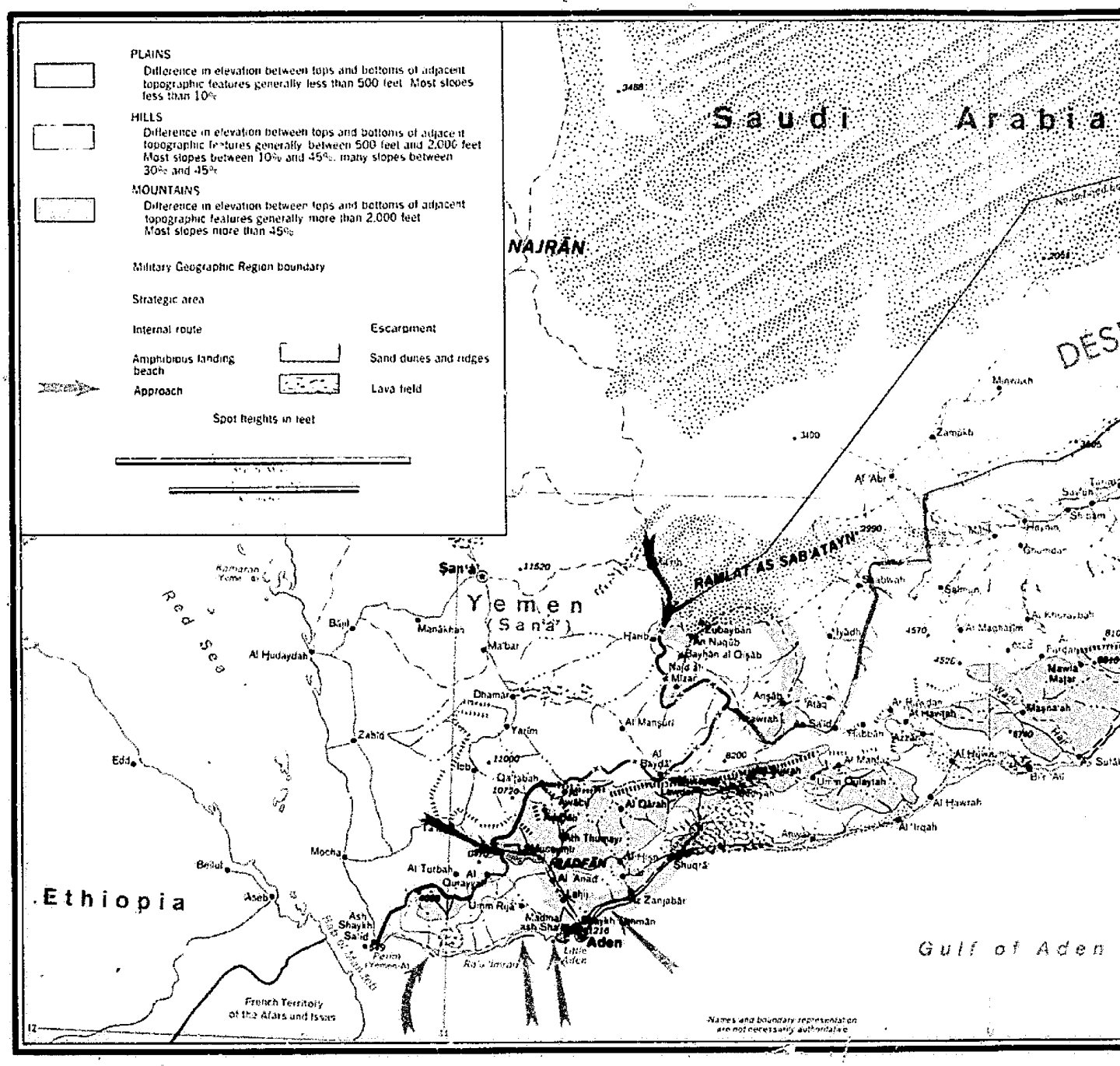

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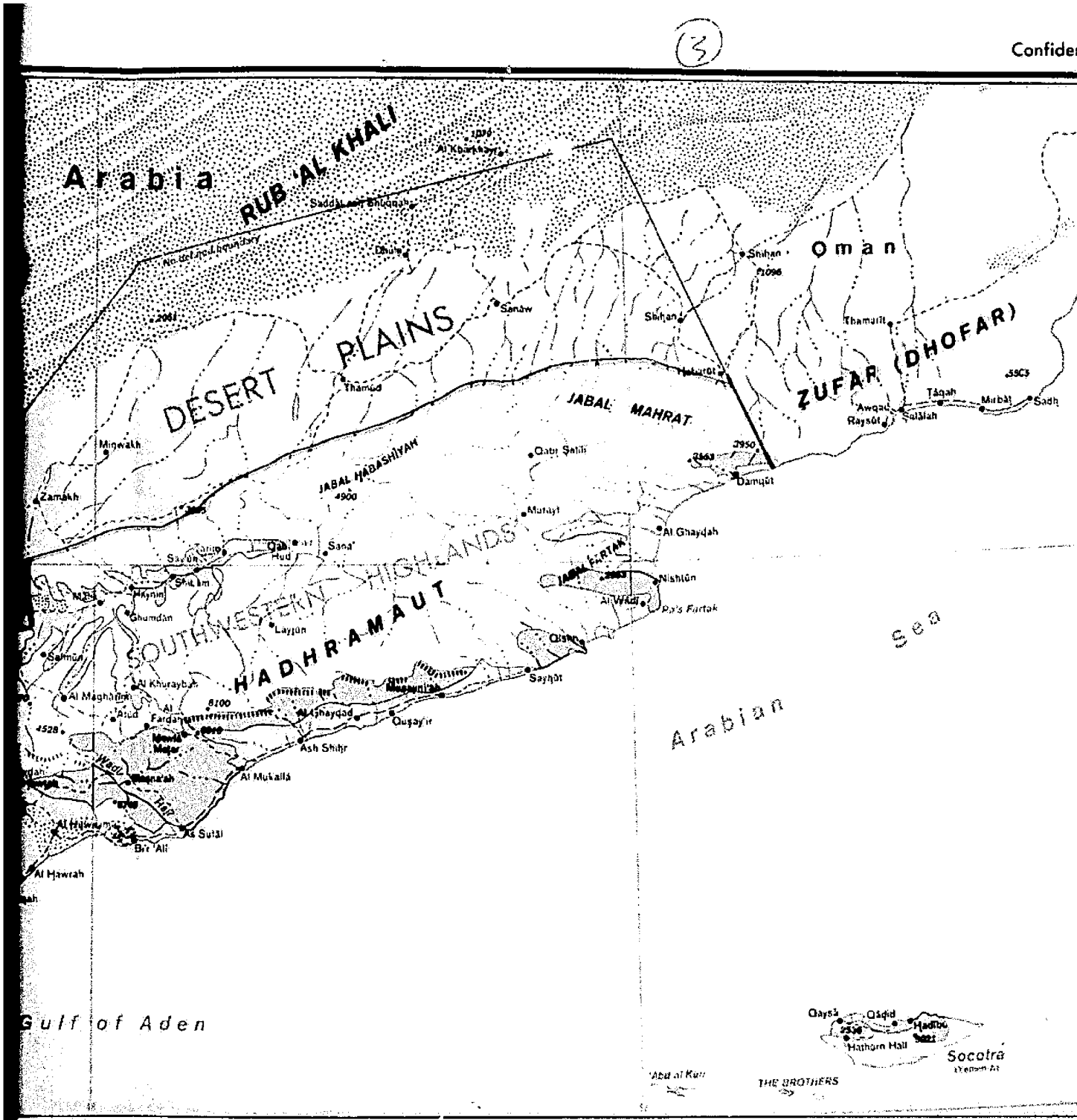

Military Geographic Factors Figure