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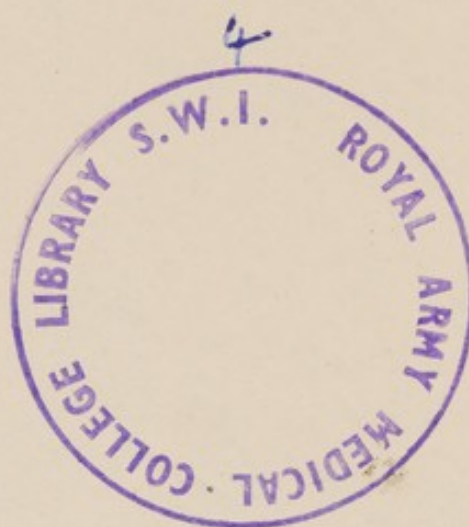
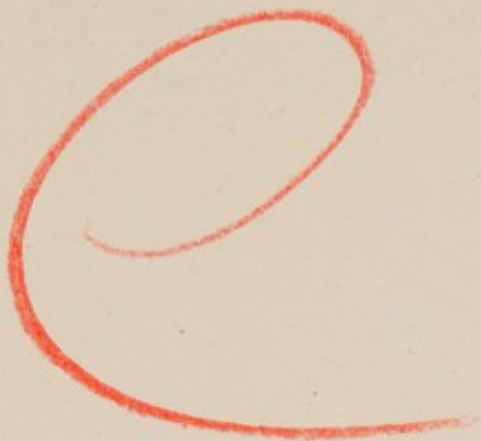
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GEOGRAPHICAL
HANDBOOK
SERIES

ALGERIA

VOLUME I

NAVAL INTELLIGENCE DIVISION



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1. Grande Kabylie from the south

B.R. 505

GEOGRAPHICAL HANDBOOK SERIES

ALGERIA

VOLUME I

FEBRUARY 1943

NAVAL INTELLIGENCE DIVISION

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member of the public.*

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This volume was in the press in November
1942 and contains little information of later
date.

PREFACE

IN 1915 a Geographical Section was formed in the Naval Intelligence Division of the Admiralty to write Geographical Handbooks on various parts of the world. The purpose of these handbooks was to supply, by scientific research and skilled arrangement, material for the discussion of naval, military, and political problems, as distinct from the examination of the problems themselves. Many distinguished collaborators assisted in their production, and by the end of 1918 upwards of fifty volumes had been produced in Handbook and Manual form, as well as numerous short-term geographical reports. The demand for these books increased rapidly with each new issue, and they acquired a high reputation for accuracy and impartiality. They are now to be found in Service Establishments and Embassies throughout the world, and in the early years after the last war were much used by the League of Nations.

The old Handbooks have been extensively used in the present war, and experience has disclosed both their value and their limitations. On the one hand they have proved, beyond all question, how greatly the work of the fighting services and of Government Departments is facilitated if countries of strategic or political importance are covered by handbooks which deal, in a convenient and easily digested form, with their geography, ethnology, administration, and resources. On the other hand it has become apparent that something more is required to meet present-day requirements. The old series does not cover many of the countries closely affected by the present war (e.g. Germany, France, Poland, Spain, Portugal, to name only a few); its books are somewhat uneven in quality, and they are inadequately equipped with maps, diagrams, and photographic illustrations.

The present series of Handbooks, while owing its inspiration largely to the former series, is in no sense an attempt to revise or re-edit that series. It is an entirely new set of books, produced in the Naval Intelligence Division by trained geographers drawn largely from the Universities, and working at sub-centres established at Oxford and Cambridge, and is printed by the Oxford and Cambridge University Presses. The books follow, in general, a uniform scheme, though minor modifications will be found in particular cases; and they are illustrated by numerous maps and photographs.

The purpose of the books is primarily naval. They are designed

first to provide, for the use of Commanding Officers, information in a comprehensive and convenient form about countries which they may be called upon to visit, not only in war but in peace-time; secondly, to maintain the high standard of education in the Navy and, by supplying officers with material for lectures to naval personnel ashore and afloat, to ensure for all ranks that visits to a new country shall be both interesting and profitable.

Their contents are, however, by no means confined to matters of purely naval interest. For many purposes (e.g. history, administration, resources, communications, &c.) countries must necessarily be treated as a whole, and no attempt is made to limit their treatment exclusively to coastal zones. It is hoped therefore that the Army, the Royal Air Force, and other Government Departments (many of whom have given great assistance in the production of the series) will find these handbooks even more valuable than their predecessors proved to be both during and after the last war.

J. H. GODFREY
Director of Naval Intelligence

1942

The foregoing preface has appeared from the beginning of this series of Geographical Handbooks. It describes so effectively their origin and purpose that I have decided to retain it in its original form.

This volume has been prepared by the Oxford sub-centre of the Naval Intelligence Division under the direction of Lieut.-Colonel K. Mason, M.C., M.A., R.E., Professor of Geography in the University of Oxford, and is the work of a number of contributors, whose names are given on page 274.

E. G. N. RUSHBROOKE
Director of Naval Intelligence

FEBRUARY 1943

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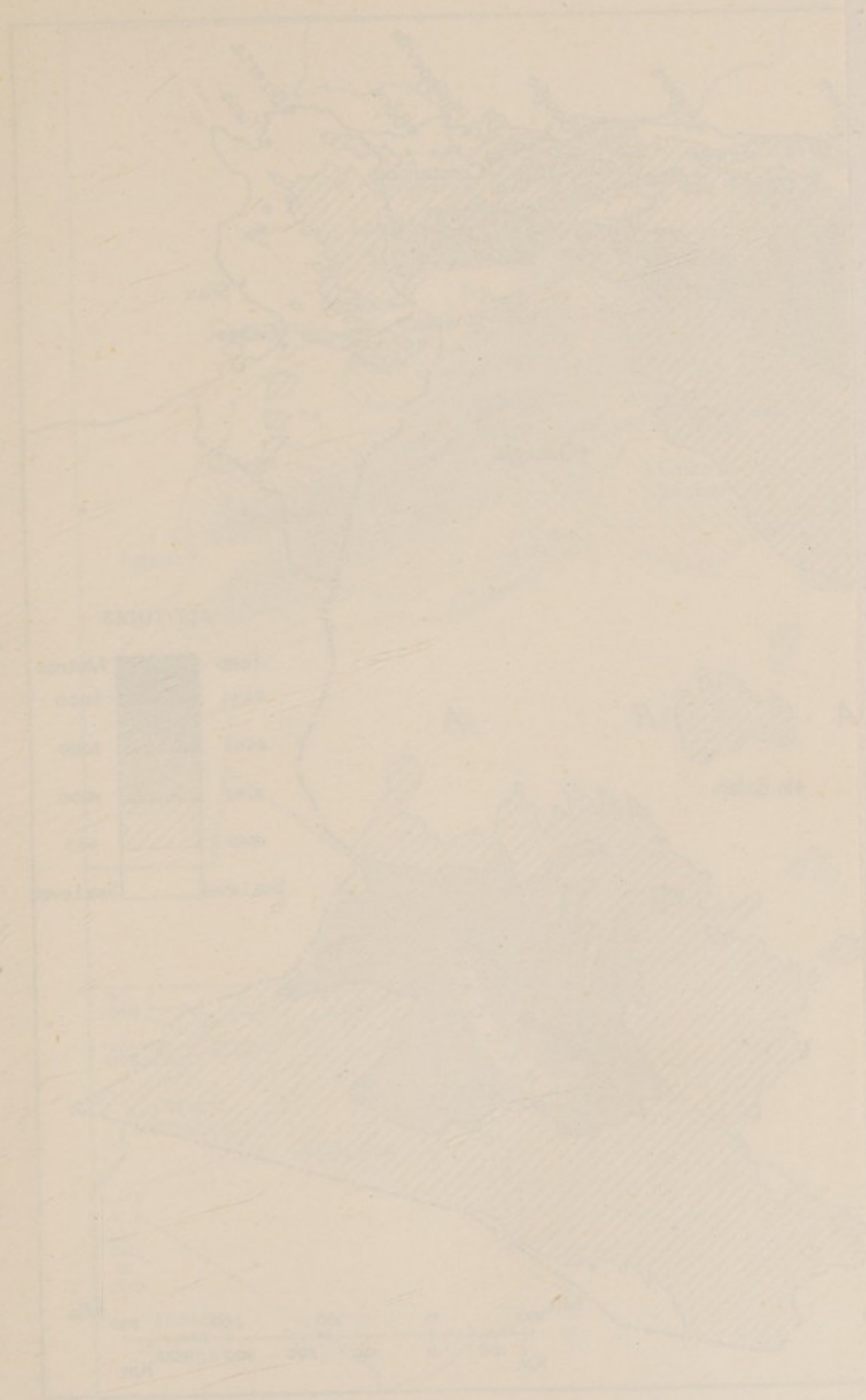
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Map of the Gulf of Mexico and Caribbean Sea

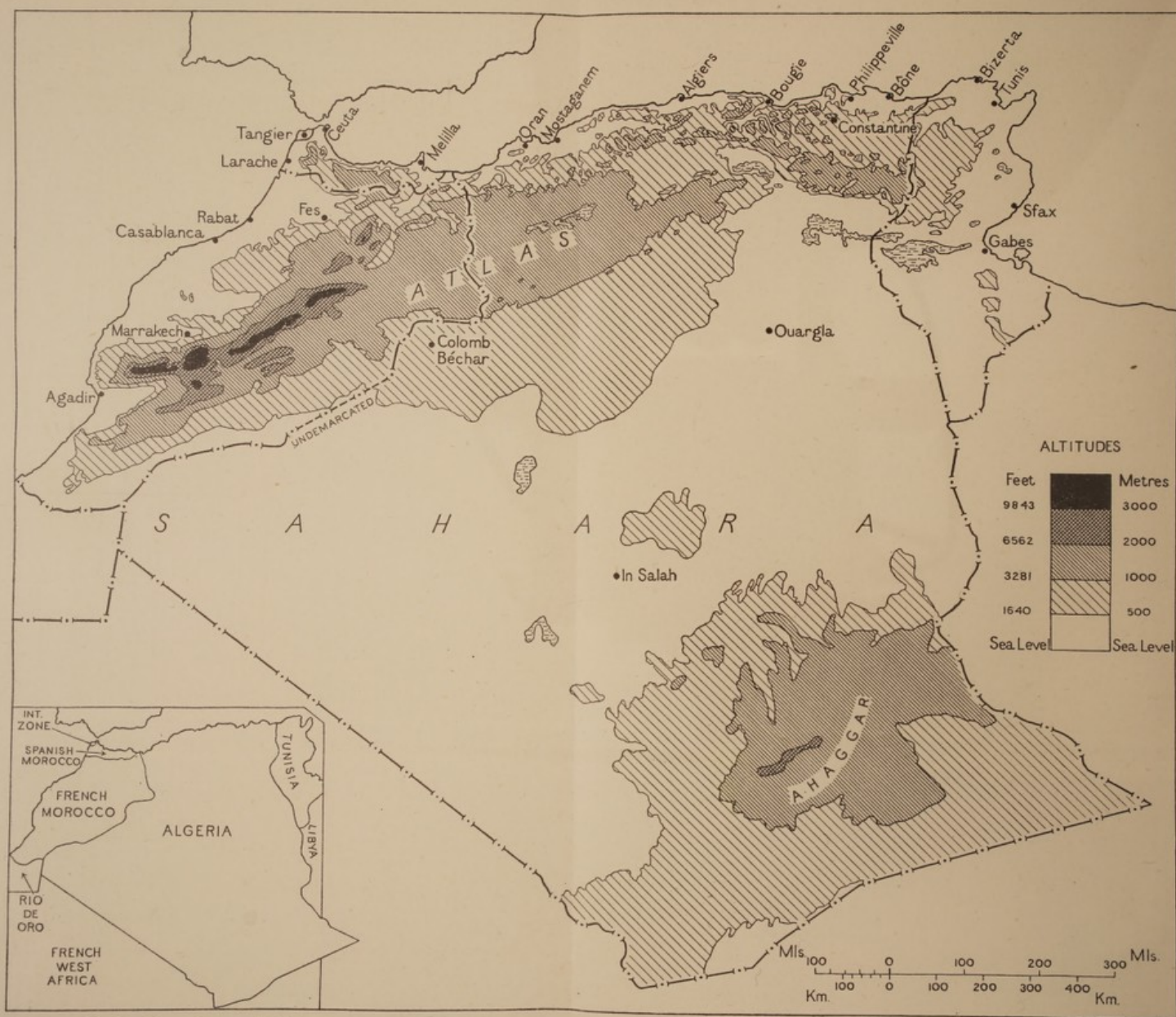


FIG. 1. The Barbary States with the Territoires du Sud

CHAPTER I

INTRODUCTION

Area and Population

ALGERIA is a part of Metropolitan France between the two French protectorates of Morocco and Tunisia. Other adjacent territories are the Spanish colony of Rio de Oro on the west, French West Africa on the south, and Italian Libya on the east (Fig. 1). The country covers a total area of 847,500 square miles, of which 80,117 square miles lie in northern Algeria, the best watered and most densely populated part, and 767,435 square miles in southern Algeria, or the Algerian Sahara. The total population at the census of 1936 was 7,234,684, including 6,247,432 natives and 987,252 Europeans (853,209 French). All but 642,651 of the total live in the three northern departments of Algiers, Oran, and Constantine, which, constituting the most important part of the country, are described in detail in this handbook. Thus Algeria has an area ten times the size of England, Scotland, and Wales combined, but only one-sixth of the population; the three northern departments with 91 per cent. of the people are approximately equal in size to England and Scotland (without Wales). Some indication of the size of the whole country is given in Fig. 2.

Boundaries (Fig. 1)

The boundaries of Algeria are, for the most part, artificial. On the west the Oued Moulouya forms the natural dividing line between the French zone of Morocco and Algeria, but the accidents of political history have made the districts of Oudjda, Taourirt, and Berguent parts of eastern Morocco. The boundary follows the line of the Oued Kiss from its estuary at Port Say and passes between Marnia and Oudjda to the ridge of Ras Asfour. From here it extends in a southerly direction as far as Figuig, which lies on the Moroccan side of the frontier. It then trends in a south-westerly direction to the upper course of the Oued Draa, which it follows to the junction with the north-eastern corner of Rio de Oro and southern Morocco, though some sections of this boundary have never been delimited. For 80 miles the boundaries of Algeria and Rio de Oro coincide. That of Algeria then extends for nearly 1,000 miles south-eastward as far as latitude 19° N., thus placing parts of the Tanezrouft and nearly all of the Adrar des Iforas in French West Africa. The boundary then



FIG. 2. *The size and administrative divisions of Algeria. The British Isles are shown on the same scale. The divisions are given their French names. Oran, Algiers (Alger), and Constantine are departments of France, but the Territoires du Sud are under semi-military administration*

runs east-north-eastward for about 170 miles and then north-eastward as far as the western boundary of Libya, which it meets almost on the Tropic of Cancer. From here the boundary of Algeria with Libya continues in a generally north-south direction to a point a short distance northward of Ghadames. This general direction is also followed by the boundary with Tunisia which passes between the Chott Melghir and the Chott Djerid and crosses the mountainous district of the Algerian-Tunisian chains to reach the coast about 2 miles eastward of Cap Roux, between la Calle and Tabarka.

Relief and Climate

Algeria is dominated by its geological constitution. Mountains have been thrown up, separated by trough-like valleys and gashed by profound gorges. In the western half of the country the coast is parallel with the prominent mountains and uplands of the Tell Atlas, but in the eastern part plains, plateaux, and mountains merge one into the other. In the interior the Tell Atlas gives place southward to the arid and desolate High Plateaux of eastern Morocco and western Algeria in which are the salt lakes and marshes of the chotts: in the east the coastal mountains and massifs are bordered by high plains stretching into Tunisia. Mountains, widely separated and isolated one from another, traverse the high plains and plateaux, and may be traced southward into the successive chains of the Saharan Atlas.

South of the Saharan Atlas lies the Sahara, mounting imperceptibly southward and culminating in the great mountain massif of the Ahaggar. River valleys, now dry except in their headwaters, extend far into the Sahara from the Ahaggar and from the southern flanks of the Saharan Atlas and the mountains of southern Morocco. In the recent geological past water flowed along the now disappearing water-courses of the desert, carrying with it vast quantities of sand and mud. Although much of the material has been swept by wind into lowland basins, which accordingly are burdened by sand-dunes, by far the greater part of the desert surface consists of bare rock, loose debris, and pebbles. The popular conception of ubiquitous sand-dunes in the Sahara is a myth.

The climate deteriorates from the Mediterranean to the Sahara, as do vegetation and crops. The rainfall diminishes from north to south, from the high northern mountains of the Tell, through the steppes of the inland High Plateaux, to the Saharan Atlas and the Sahara itself, which is virtually rainless. The mountains of the interior receive more rain than the desolate country around them,

and within these fastnesses the people have maintained themselves. The Saharan Atlas excludes Saharan influences from the Tell, as the Tell excludes Mediterranean influences from the High Plateaux. The summer is generally hot throughout the country; the winter is mild in the lowlands near the sea, but cold on the mountains (where passes are blocked with snow) and in the Sahara.

The People, their History, and the French Penetration

The history of Algeria has consisted largely of the struggles of the indigenous population against the attempts of innumerable foreign invaders—Phoenicians, Romans, Vandals, Arabs, Byzantines, Turks, and French—to organize and exploit the land. The non-European population consists mainly of Berbers, more or less affected by Arab influences: the number of pure Arabs in the country is very small. The Berber-speaking peoples, however, are now found only in restricted areas and places of refuge, such as the higher mountains and the oases in the desert—a contrast to Morocco, where they are still the dominant stock over most of the interior.

Most of the Europeans are French, though there are important Spanish and Italian minorities. Since geology and relief combine to divide the country into three distinctive belts parallel to the coast, the French have had to overcome a succession of mountain barriers and gorges as they penetrated inland. Nevertheless the grain of Algerian relief, parallel to the coast, has enabled them to spread into Morocco and Tunisia. The French have also penetrated into the Sahara, an area distinct in almost every respect from northern Algeria. In the past the great desert was a reservoir of fierce Berber tribes who from time to time, under capable leaders, swept into the maritime Barbary States. It has been an ocean of rock and sand, with the oases as its islands, traversed by struggling convoys bringing the precious cargoes of the Sudan, the Niger, and Equatorial Africa—slaves, spices, precious metals, ostrich feathers—much of which was destined for European markets. The whole of this vast area has been annexed to Algeria as the 'Territoires du Sud'.

French Achievements in Algeria

The French have been in Algeria for a hundred years. In that time generations of Frenchmen have grown up who regard Algeria, not merely as the country of their birth and as their heritage, but as an integral part of France. They are no longer colonists but Algerian-French, although among them are communities, for the most part

farmers, who are colonizing and developing new lands. Many of the natives are highly civilized and educated, but French liberalism must perforce recognize less evolved communities, like those of the Sahara, the mountain strongholds, and parts of eastern Algeria in particular, which know only a local and tribal patriotism. With the spread of European development and colonization, these people have come to occupy an inferior position, but in some degree the majority share the prosperity that France has undoubtedly brought to their shores. The administration must be credited with success in many spheres, not least in that of public health. Fever and the usual African ills remain in unhealthy lowlands and in the Sahara, but in the country as a whole, though they are present, they are under control. Native mortality does not seem to be excessive: Europeans thrive and raise healthy families.

Administration

Physical features divide Algeria into two main parts—western and eastern. The west is primarily the country of the Tell Atlas; the east consists principally of coastal massifs and broad plateaux, interrupted by deep gorges and lowlands, isolated hills, ridges, and hollows. The administrative division into the three departments of Oran, Algiers, and Constantine bears no relation to these features. Each department is regarded as a part of France and organized as closely as possible, though not exactly, on the model of the departments of France itself. Certain services for non-Moslems, such as justice, education, and religion, come directly under the appropriate ministries in Paris. Algeria is not, therefore, a 'colonial' territory of France. It is represented in Parliament in Paris by three senators (one for each department) and ten deputies (three each for Oran and Constantine, and four for Algiers). The rest of the country, comprising the sparsely peopled and largely waterless Territoires du Sud, is under semi-military administration. The French Parliament legislates for Algeria, and other matters are regulated by decree of the President of the Republic issued through the Governor-General. The latter is advised by a Superior Council of elected members and high officials. Algeria has its own budget and enjoys partial financial autonomy. The political vote is exercised by all French citizens—that is, by persons born in France and their descendants, and by natives who have acquired full citizenship—and since 1919 the municipal vote has been open to French subjects who are not citizens. The number of natives who have become citizens is relatively small (less than 3,000), since in

order to gain this status a Moslem has to abandon his submission to Moslem law and become subject to the French civil code. Many Moslems wish to exercise the full rights of French citizenship without abandoning Moslem law, but the citizens of French birth fear that they would be heavily outnumbered by Moslem voters. The administrative organization of the country is shown in summary form in Fig. 3. It will be described in detail in the second volume of this handbook.

Resources and Communications

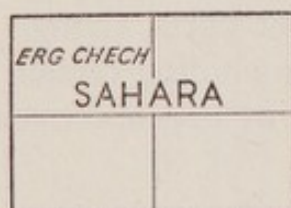
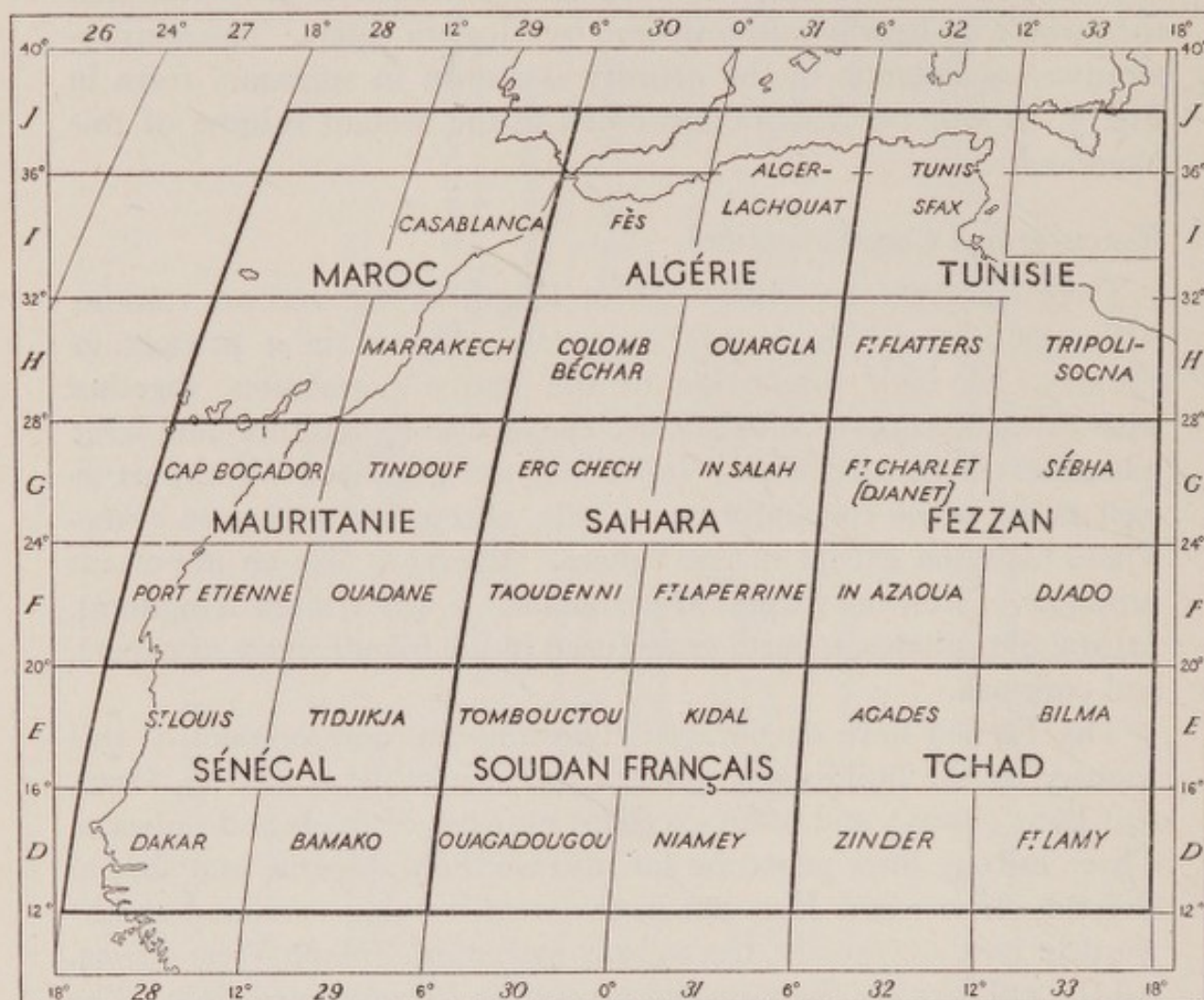
These subjects are dealt with at length in the second volume. Although not rich in natural resources, Algeria is a prosperous country. A high proportion of the native population, together with many European colonists, are engaged in agriculture, and large quantities of cereals, fruits, and wines are produced for export as well as for home consumption. Cattle, sheep, and goats are everywhere common except in the Sahara. Algeria is also an important producer of iron-ore (exported particularly to the United Kingdom), natural phosphates, esparto grass (used in the manufacture of paper), and cork oak.

The French have encouraged the economic development of this country by the building of modern ports, notably at Algiers, Oran, and Bône (Bona), and of an excellent network of roads and railways. Three railway lines penetrate far into southern Algeria, and that to Colomb Béchar and Kenadza in the west is being extended southward to join, eventually, the railway system of French West Africa. All the railways are State-owned except for a few mineral lines. The road network is most complete in the three northern departments, especially near the coast and around the larger ports, though there are also important roads leading southward, including certain well-defined trans-Saharan routes which can be followed by motor vehicles.

Maps

French surveyors have done excellent work in Algeria, and nearly all the maps available are of French origin. These are illustrated in Fig. 4, and are briefly described in Appendix H. Most generally useful are the maps on the scales of 1/2,000,000, 1/1,000,000, and 1/500,000, but for finer detail reference may be made to the 1/200,000 and 1/50,000 maps. In this handbook the location of places mentioned is indicated on maps in the text, wherever possible, or on the 1/2,000,000 map of northern Algeria included in the pocket at the

end of the book. This pocket also contains a relief map of north-west Africa on the scale of 1/4,000,000 and a geological map of the Barbary States with the Territoires du Sud.



G.S.G.S. 2465 1:1,000,000 NG30 ERG CHECH

G.S.G.S. 2871 1:2,000,000 N. $\frac{G30.31}{F30.31}$ SAHARA

The letter N, written before the sheet number indicates that the sheet is north of the Equator

FIG. 4. Index to the International 1/1,000,000 and 1/2,000,000 series

Spelling of Place-names

To avoid confusion and inconsistency place-names in the text are normally given in their French form, except where well-known English forms exist (e.g. Algiers, not Alger). There is, however, little uniformity in the maps published: *gh*-, *rh*-, and *r*-, for example,

are all renderings of the same Arabic letter, and spellings of the same name may, therefore, vary. In this particular case the spelling *gh-* has normally been followed to keep in line with the spellings adopted in the companion volume on Morocco, though *rh-* would appear to conform with modern usage. Place-names beginning with the words *el* or *la* have in most cases been printed thus, and not as *El* or *La*. Generally French names have been adopted for mountains (Djebel, not Jebel), rivers (Oued, not Wadi or Wad), and other features. The use of alternative names is confined to Chapter III, the special principles of which are described therein. A short glossary of Arabic, Berber, French, and other words is given in Appendix G.

British measures have been used in this volume, but as conversions will sometimes be necessary tables are provided in Appendix I.

CHAPTER II

RELIEF, DRAINAGE, AND GEOLOGY OF ALGERIA

I. INTRODUCTION

ALGERIA, with the Territoires du Sud, may be defined by physical features (Fig. 1) as:

- (1) The Atlas, folded chains of Tertiary age, with ancient resistant massifs, plateaux, plains, and lowlands.
- (2) The Sahara, an ancient stable platform, locally fractured, elevated or depressed, against which the Atlas were forced.

Of the three physical divisions into which the Atlas of western Algeria falls (Fig. 5), the Tell Atlas comprises complex ranges, plateaux, and massifs with a 'grain' parallel to the coast, often separated one from another by valleys parallel to that 'grain' and pierced by gorges at right angles to it. The resulting network forms the pattern of the country and divides it into areas each with its own topography and economy. Generally well watered, with a Mediterranean type of climate, the Tell Atlas supports considerable forests and valuable agricultural lands.

The High Plateaux, on the other hand, are arid steppes, providing grazing for sheep, and alfa grass, which is exported for paper making. During rainy periods water collects in large, shallow, undrained basins or *chotts*: later this water is absorbed or evaporated and the *chotts* decrease or disappear, leaving unstable or dry mud-flats, swamp, and salt marsh.

The Saharan Atlas flanks the Sahara from Morocco to Tunisia: a number of chains rise along this front, but each breaks down into discontinuous ridges. The mountains, therefore, present no serious obstacle to communications with the Sahara. Rocky bastions stand out on the mountain wall, and the highest of them, such as the Monts des Ksour in the west and the Aurès mountains in the east, remained impenetrable strongholds until the last stages of French occupation. Few of the mountains of the Atlas in Algeria exceed 6,500 feet above sea-level (Aurès 7,638 ft., Djurdjura 7,572 ft.): much of the country is over 3,000 feet, and plains below 600 feet are few in number and near the coast.

This threefold division into Tell Atlas, High Plateaux, and Saharan Atlas is not clearly marked in eastern Algeria.

The Sahara consists of vast plains and plateaux (Fig. 19). The chotts of the Tunisian frontier are below sea-level, and Ilamane (9,550 ft.) and Tahat (9,850 ft.) in the Ahaggar are the highest peaks in the whole region. There are enormous basins and areas of sand-dunes, pebble and rock desert, broken here and there by oases.

The same rocks are flat in the Sahara and folded in the Atlas, where the ancient floor on which they lie is revealed in the upheaved masses in eastern Algeria, trenched by deep gorges. In western Algeria the rocks of the ancient platform are little exposed but underlie the broad elevated tracts of the High Plateaux.

II. GEOLOGY AND RELIEF

(See geological map in pocket and Appendix A)

1. Geological History

The region occupied by the Atlas, in the broad sense, is long and fairly narrow, and alined east-west (Figs. 1, 5). On the south lies the Saharan or African continental platform, and on the north the Mediterranean is the site of another (Tyrrhenian) land-mass, of which only fragments remain (the Kabylie in Algeria, Calabria in Italy, Corsica, Sardinia, and the Maures and Esterel in Provence): the rest has sunk down in geologically recent times (late Tertiary).

The Atlas occupy the place of a long-sustained depression or geosyncline, and the mountains were produced by pressure between the two masses, movement and consequent folding being mainly towards the Sahara. The movements were not completed in a single phase, but were accomplished mostly in two stages of Tertiary development, Pyrenean (Cretaceous-Eocene) and Alpine (chiefly Miocene).

The Saharan platform, and outlying parts of it within the general province of the Atlas, were not only affected in some degree by mountain-building processes within the geosyncline, but modified those processes. The ancient and resistant platform in its broader parts had a history of its own throughout its geological evolution. The platform itself consists of very ancient rocks (Archaean, Pre-Cambrian), highly folded and usually much metamorphosed, worn down to an even, or fairly even, surface. The folds run generally north-south, that is, at right angles to the Atlas geosyncline. This fact has an important bearing on the disposition of the rocks throughout the region of the Atlas. Upon the platform Palaeozoic sediments were laid down: Cambrian in the west, Ordovician to Carboniferous

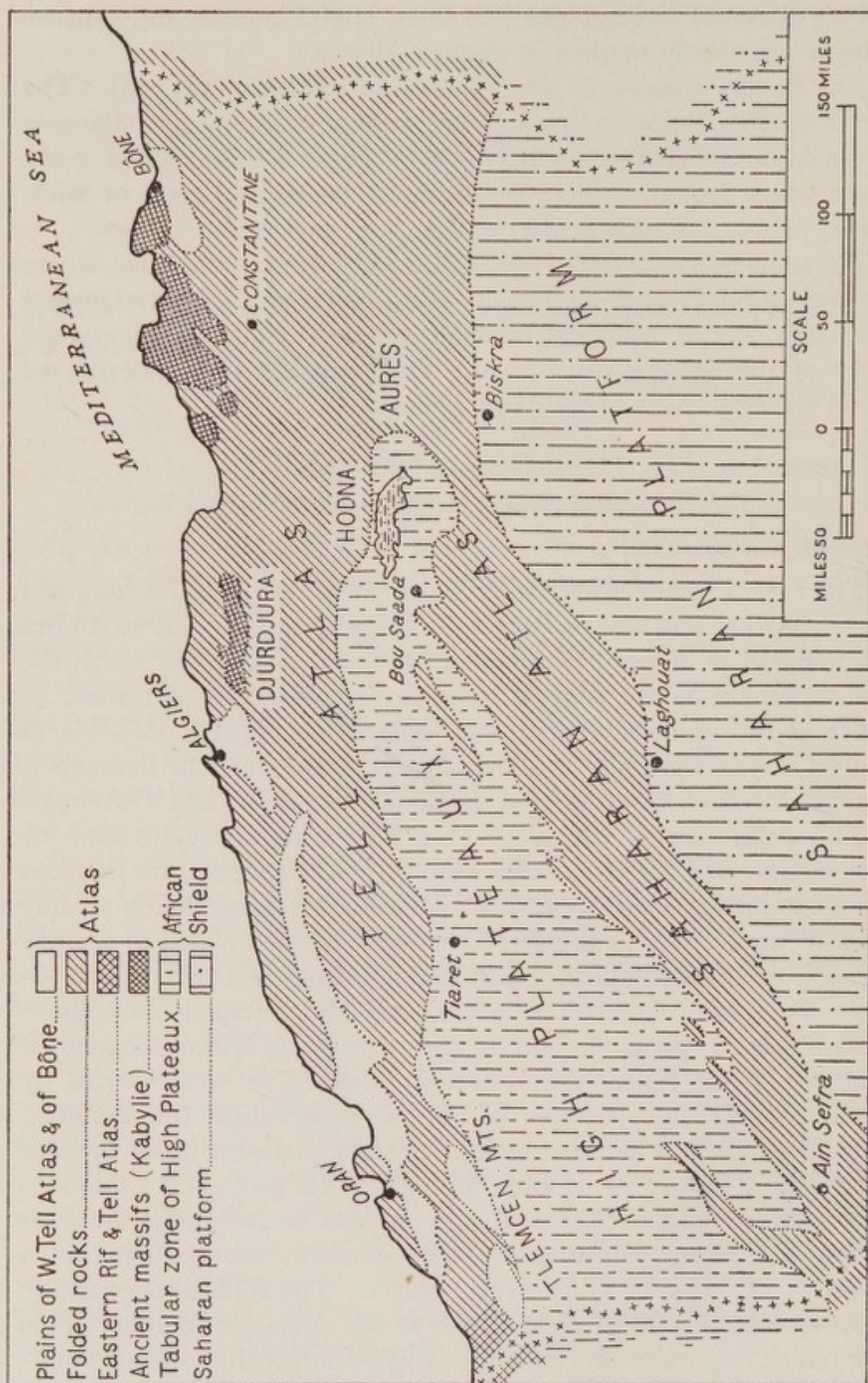


FIG 5. The structure of northern Algeria

over wide areas of the Sahara. They are now locally worn away or covered by younger beds, but in some places (for example around the Ahaggar) are exposed on a grand scale. Within the great thicknesses of deposits marine beds with fossils are widespread, marking the spread of a fairly shallow sea far and wide over the platform, but interbedded with them are Silurian shales with graptolites (suggesting a wider, or deeper, sea) and bright-coloured sandstones of continental origin, that is, sand-dunes and the like consolidated to form massive beds. Over most of the interior these still lie more or less horizontally, or are gently tilted into anticlines and synclines, domes and basins, of great size.

In Morocco and south-western Algeria late Palaeozoic (Hercynian) folding was more marked and more severe, aligned north-south. In Algeria Palaeozoic beds are little exposed, and in Tunisia neither they nor the Archaean rocks reach the surface. Within the Atlas, in fact, older rocks are exposed progressively from east to west, and the altitudes attained by the mountains increase also in the same direction.

The general elevation, with local folding, which thus marked the later stages of the Palaeozoic, converted the Sahara, and in fact most of north Africa, into a land surface. Much of it was exposed to weathering and erosion, the products of which were laid down in broad lowlands. The climate may have been very similar to that of the present day. In the Sahara, therefore, subsequent geological history is marked either by denudation or by sandstones and other beds of which the age is difficult to determine. In the region of the Atlas rapid denudation provided conglomerates and pebble beds (especially in Morocco), followed by Triassic rocks of peculiar type—red and variegated clays rich in rock-salt and gypsum. These are of continental origin (i.e. laid down on land-surfaces), produced probably in shallow basins under hot and arid climatic conditions. They have had a remarkable effect on the subsequent tectonic development of the country. Buried under younger sediments, which have received a copious rainfall, the clays, salt, and gypsum have played the part of lubricants. During the Tertiary folding periods they fulfilled this role, and both then and later were forced upward through the overlying rocks so that to-day they form mountains of salt. Throughout the Atlas they are rarely seen in their correct stratigraphical position; they have flowed and migrated and now appear among other beds, frequently in vertical 'intrusions' in the most capricious manner. They simulate the behaviour of molten rocks rising from below through the overlying beds. Only in the eastern part of Algeria and

Tunisia are they seen in their correct stratigraphical position, and in these districts also they have shifted in some localities, folding and throwing into disorder the beds that lie upon them.

A new marine invasion of the land began in the succeeding Jurassic period (Liassic and Jurassic), and in the region of the Atlas massive marine limestones mark this movement of the sea. The rocks now form bold mountainous topography, as in the Tlemcen district and in the Djurdjura. The Jurassic sea does not seem to have spread south of the northern margin of the Sahara. In the following Cretaceous period, on the other hand, wide areas of the Sahara were submerged under a shallow sea, in which limestones were deposited. On the north, where the Tell Atlas now stand, lay deep water in which clays were formed. In the High Plateaux and Saharan Atlas the limestones are accompanied by Cretaceous beds of continental origin—hard red sandstones, often with fossil wood and tree-trunks. In the Sahara similar sandstones are widespread, and, like those of the Palaeozoic, represent sand-dune accumulations: it is often impossible to distinguish Palaeozoic from Cretaceous rocks. These sandstones play a vital part in the circulation of underground water, and oases such as Touat and Tidikelt obtain their water from them.

During the Tertiary period the sea withdrew finally from the Sahara, and continental deposits have been formed there down to the present time, for the most part of desert origin, varied by river- and lake-accumulations, especially during the Quaternary episodes (the 'Ice Age' of higher latitudes). Final adjustments of level by elevation and depression have taken place, accompanied by faulting and volcanic activity.

In the region of the Atlas depression, on the other hand, Tertiary marine sediments are widespread. Of these perhaps the most noteworthy are the Lower Eocene limestones, the famous phosphate-limestones, of Tunisia, eastern Algeria, and Morocco. These were the products of a fairly shallow sea, but from the east coast of northern Tunisia westward into Morocco lay deeper water. In the Kabylie region, at a little later date (Middle and Upper Eocene), marine sandstones were formed which now support some of the best forests of Barbary.

The succeeding Tertiary periods (Oligocene, Miocene, Pliocene) were marked by marine oscillations, transgressions and regressions, and final withdrawal. During this long space of time the Atlas themselves were being upheaved and folded, the depressions between the mountain masses being the last places occupied by the sea. The

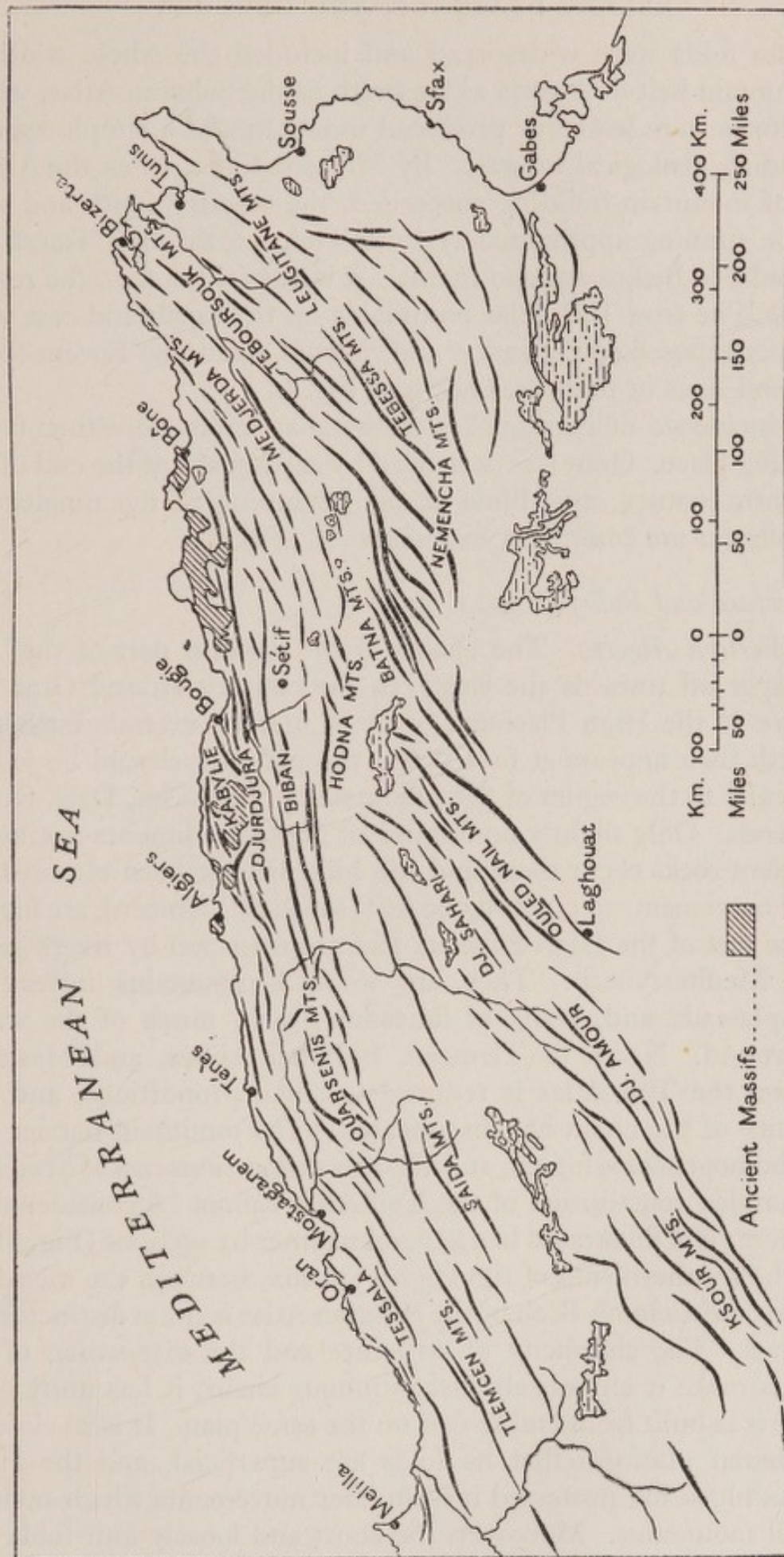


FIG. 6. The trend lines of folds in Algeria and Tunisia

Pyrenean folds were widespread and included the whole width of the mountain belt of Algeria as far south as the Saharan Atlas, where their effects were least but produced mountains of a simple type of outstanding geological interest. By Miocene times, when the Alpine phase of mountain building succeeded, the country south and west of a line running approximately from Tlemcen through Tiaret and Bou Saada, to Biskra was continental: it is less folded than the rest of Algeria. The true Tell Atlas mountains on the north and east were now superimposed on the earlier and violent Cretaceous-Eocene folds. The trend lines of folds are shown in Fig. 6.

The incidence of earthquakes shows that minor adjustments are still taking place. Oran was destroyed by earthquake at the end of the eighteenth century, and Blida at the beginning of the nineteenth. Minor shocks are commonly experienced. (Fig. 7).

2. *Structure and Relief* (Figs. 1, 5, 8)

(a) *Western Algeria.* The chains of the western part of the Tell Atlas taper off towards the west. In the country around Oran the structure of the High Plateaux, or Oran meseta, extends farther to the north than appears at first sight; the plateaux should be joined structurally to the region of the mountains of Tlemcen, Daia, Saida, and Frenda. Only slightly undulating or faulted sediments resting on the ancient rocks occur there and the hills, having been elevated by vertical movements to 5,500–6,000 feet (south of Tlemcen), are higher than the rest of the High Plateaux and are dissected by rivers going to the Mediterranean. They are wooded mountains instead of steppe-plateaux and, being of limestone, carry much of the water underground. North of Tlemcen, Sidi bel Abbès, and Mascara, therefore, the Tell Atlas is reduced to small proportions, and the continuity of the chain has disappeared. The mountain barrier becomes homogeneous, higher, and of larger proportions east of Mascara. The complex constitution of the Tell Atlas cannot be considered in detail here: it is illustrated in a general manner by sections (Fig. 8).

On the southern side of the High Plateaux, between the meridian of Biskra and Colomb Béchar, the Saharan Atlas is quite distinct from the above. The simplicity of structure and the disposition of its elements make it an entirely discontinuous chain: it has unity only because it is built from end to end on the same plan. It is so close to the Saharan platform that its folds are superficial, and the High Plateaux block has protected it from later movements which revived the Tell mountains. Moreover, the short and loosely knit folds are

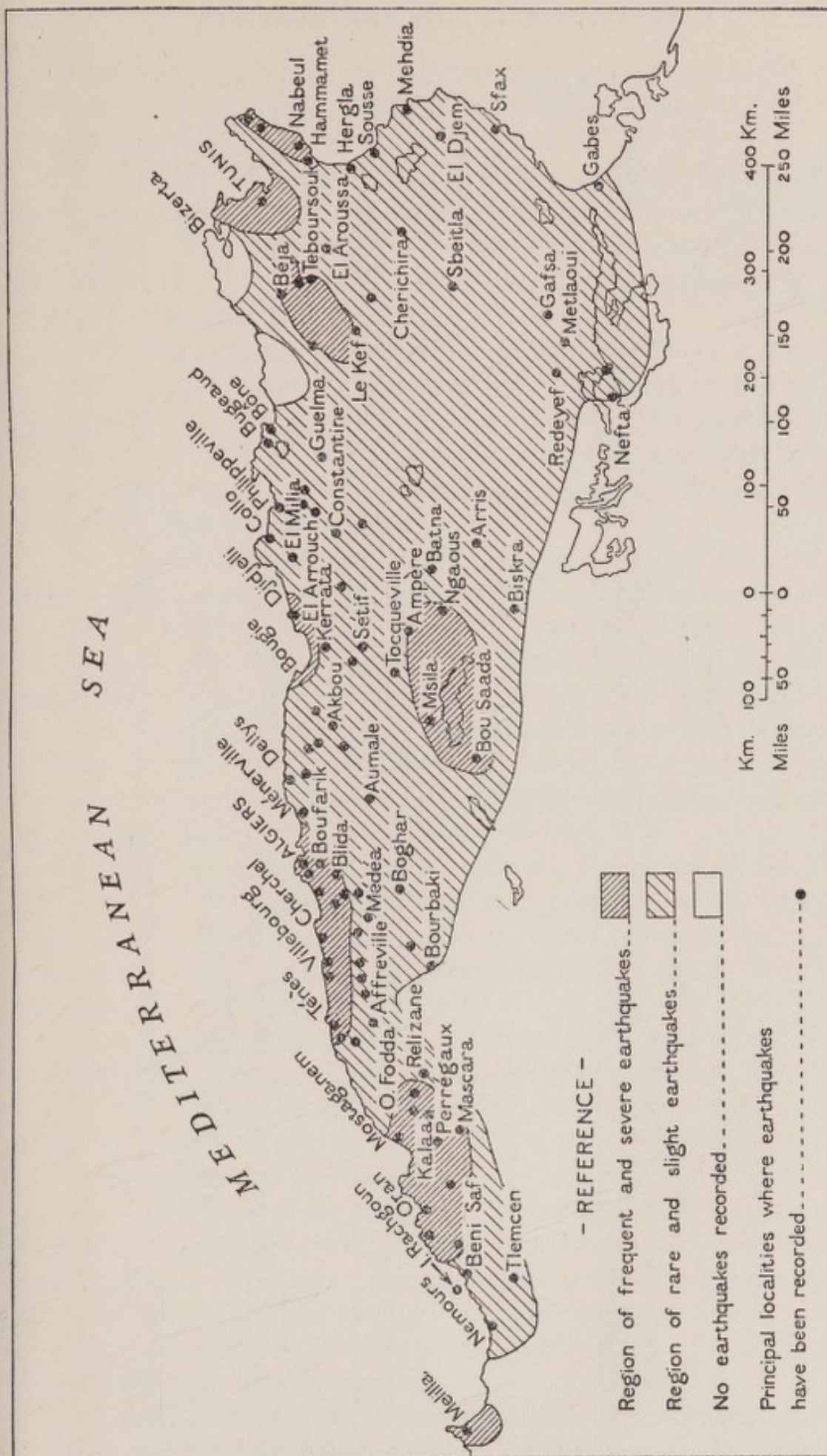


FIG. 7. The distribution of earthquakes in Algeria and Tunisia

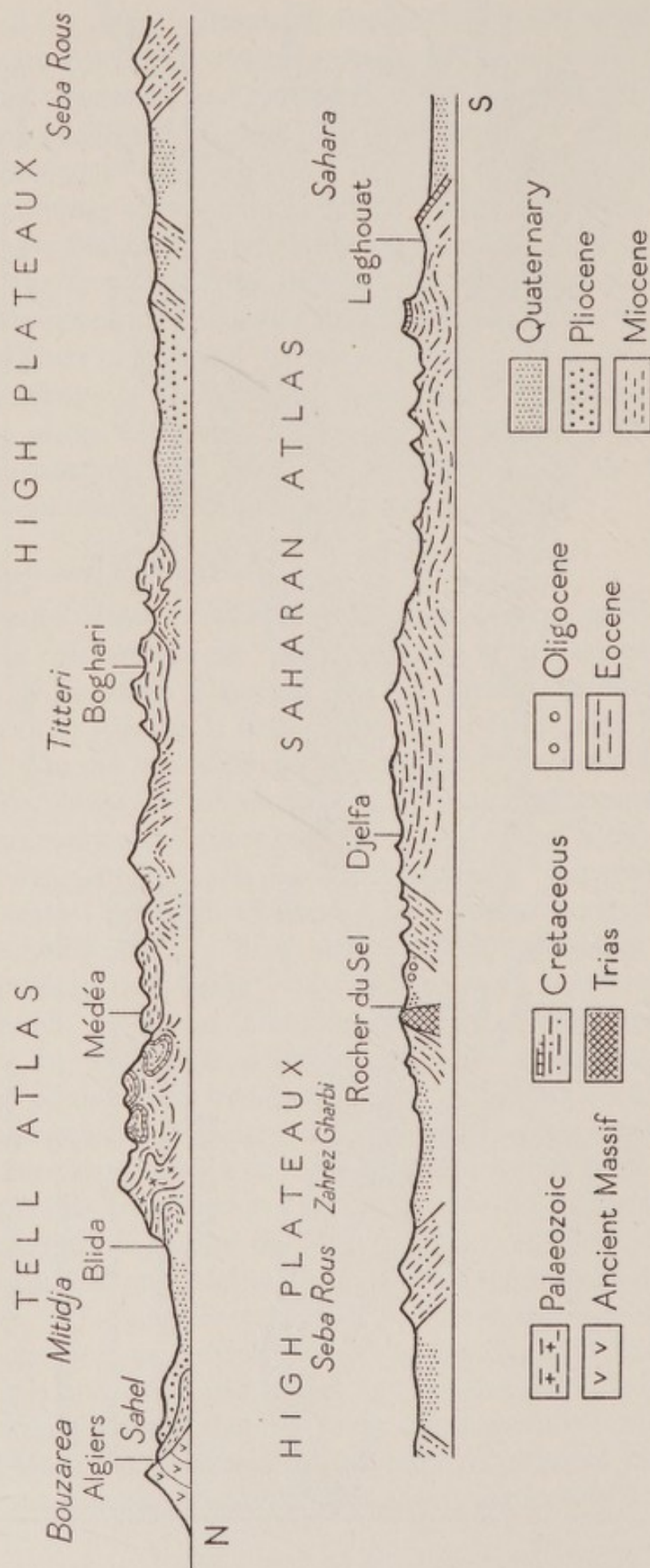


FIG. 8. Diagrammatic geological section from Algiers to Laghouat

less oblique to the meridians than the chain as a whole, and they die out one after another, i.e. *Monts des Ksour*, *Djebel Amour*, and *Monts des Ouled Nail*.

The western folds are the most striking. They include all the summits over 6,500 feet and their peaks exceed those of the coastal mountains. The folds rarely produce continuous barriers, such as the wall of the Grouz in Morocco which in that direction is the most westerly chain of the Saharan Atlas.

In the whole chain the dominant heights are short and narrow massifs, well described as 'scattered like caterpillars on the march'. Between them are large trenches, where the plains are surrounded by the sharp profile of the summits. Thus the plain runs into the heart of the chain, and often occupies a more important place in the relief as a whole than do the mountains.

The High Plateaux, which the Tell Atlas and Saharan Atlas contain between them, contrast with them by reason of the almost complete absence of relief. The rigid basement has stopped the propagation of the folds, although the superficial beds have suffered by reaction and recoil. Gentle undulations and fractures result like those on the northern margin of the tabular zone, but for the most part beds so affected are hidden under a mantle of debris: the undulation must, therefore, be very pronounced to project through this mantle and to form ridges amid the huge basins of the chotts.

The only ridges which really break the monotony of the High Plateaux are the ripples that here and there branch off from the Saharan Atlas towards the north: one of them advances far into the steppes and ends in the marked crest of *Djebel Antar*: elsewhere the slopes cannot be detected.

To the west the High Plateaux are prolonged into Morocco, where they attain their greatest breadth and altitude, more than 4,000 feet. To the east they end in the Hodna basin, the bottom of which is only about 1,375 feet above sea-level: this is the most depressed and the narrowest part of the tabular zone.

Between the two border chains which converge on one another the High Plateaux plunge eastward, like an enormous wedge or fault block, and disappear. Thus the continuity of the zones of relief parallel to the coast is broken at the Hodna basin, but reappears to some extent in eastern Algeria, where a new arrangement of the Atlas chain profoundly modifies their character.

(b) *Eastern Algeria*. East of the line Algiers-Biskra, the attitude of the Tell and Saharan Atlas changes. To the west, in spite of their

gradual approach, the two folded zones remain largely independent, but eastward of the Hodna basin branches issue from the two chains and join them together.

The Hodna depression is dominated on the north by a line of heights which mark a mountain arc, one of the most clear-cut and best traced in the whole of Algeria, called the Hodna chain. It separates two different regions, the High Plateaux and the high plains of Constantine. Some of these heights bear witness to two types of folding, which in the west characterize the Tell and Saharan chains. The Hodna chain may be considered as a virgation or arc of the Tell Atlas, breaking away in a south-east direction and bending near Batna towards the Aurès massif, which is undoubtedly associated with the Saharan Atlas.

The folds of the Saharan Atlas have an extension towards the north. It is not a strongly marked branch; multiple, spaced out, and discontinuous short chains, often simple domes, seem to emanate from the Aurès or from the last massifs of the Hodna chain and to run north-eastward to meet the coastal mountains. These lines are drawn together in true chains only in north-eastern Algeria and the adjacent parts of Tunisia. The folds are locked together at the very narrow ends of the Tell Atlas, of which the final heights must be sought beyond the frontier on the Tunisian littoral.

Between the Hodna chain and Tunisia, therefore, the two Atlas systems cease to be clearly separated. If the resistant block of the High Plateaux, broken towards the Hodna, is prolonged as far as this it is deeply buried and its cover of sediments has been more strongly rippled. Reference is often made to the High Plateaux of Constantine, in which horizontal lines have a place that they never have in the Tell mountains. These plateaux are not, however, analogous to those in the west. They are comparable with them in altitude, but do not display a limitless horizon; the view is always interrupted at some distance by abrupt slopes, isolated peaks, or stumps of chains. These rise up here and there in the plains and divide them into basins studded with salt sheets, which are of insignificant size when compared with the enormous chotts of the west. The country would be better called the high plains, or plateaux of the chotts, of Constantine.

The two Atlas systems also change their character in this intermediate region. The Tell Atlas is now a compact bundle of mountains. The variety of rocks leads to dissimilarity of relief; there are blocks of ancient rocks, jagged limestone barriers and ridges, high sandstone brows with blankets of scree, and clay slopes washed out by torrents.



2. *The Rummel gorge near Constantine*



3. *Gravel desert (reg) near Ouargla*



4. *Sand-dunes adjoining the oasis of Ouargla (in background)*

From Algiers to Bône the mountains dominate the coast and no wide plain occurs between them, such as is found in western Algeria. The geological evolution has not been the same. In general the eastern Tell Atlas is old, dominated by Pyrenean folds, and has been elevated to form land since Oligocene times, the Neogene sea penetrating only in a few small gulfs. Orogenic movements have not created here the great plains which are intermingled with the mountains of the western Tell. The principal role of the movements seems to have been to uplift massifs already worn down by erosion and so to rejuvenate the rivers. Also, although few summits exceed 6,500 feet, the general altitude is higher than in the western Tell Atlas. Only the walls of the Djurdjura and some other limestone peaks recall the general appearance of high mountains. The eastern Tell is a country of deep gorges, such as the gorges of the Rummel, on the side of which Constantine is perched. (Photos. 2, 14).

At the other (eastern) end of the high plains the Aurès massif is the most impressive in Algeria, not only because it includes the highest mountain, Djebel Chelia, 7,638 feet, but because it comprises a number of heights, and its relief is very bold. High parallel ridges, running from south-west to north-east, are cut in a sheaf of sharp and closely packed folds. Deep, enclosed valleys which join narrow gorges are cut between lines of cliffs and rough slopes of bare rock.

The Aurès is a part of the Saharan Atlas of which the relief is not generally so bold. The two phases of folding which have affected the Tell Atlas are superimposed in the Aurès. It is separated from the rest of the chain by the Hodna gap, where the High Plateaux disappear and the Saharan Atlas also fade away. By this break, which the Aurès dominates, there is a relatively level passage from the Sahara to the Hodna basin. On the south the country falls away steeply: towards the Saharan lowlands, where in some places the surface of the ground is several feet below sea-level, the fracture of the side of the Aurès is continued in depth; a great tectonic fosse runs at the foot of the mountains, and the Upper Tertiary continental sediments may be 6,500 feet thick. The contact of the Atlas and the Saharan platform helps to produce this feature, and the striking relief of the Aurès is associated with it and with the plunging of the High Plateaux under the Hodna.

Eastern Algeria is a compact block, a great bastion limited on the south by the Hodna and Aurès mountains, and on the north by the bold coast, dominated to the east by the steep slopes and chains of Tunisia. In the interior the lines of parallel relief die out. The

prevailing features are the distinct compartments and individual massifs.

(c) *The Sahara* (Fig. 19). The relief of the Sahara may be broadly defined. The highlands are in the south-east, 600 miles from the Atlas. Only the Ahaggar region much exceeds 3,000 feet. The Koudia du Hoggar or Atakor, rising to 9,850 feet in the peak of Tahat, is the centre of a great massif, on the north side of which are high plateaux, the Tassili des Ajjer, Mouydir, and Ahenet (Photos. 24, 25). On the south and west there are enormous depressed basins towards which go the great valleys, now dry, from the Ahaggar. A single valley reaches the Niger, and trace is soon lost of the great Oueds Tamanrasset and Tafasaset where the slopes become gentle. On the north the pattern is more involved because the Ahaggar massif is bordered throughout its length by a depression—the Tidikelt and Djoua—dominated on the northern side by the cliffs of the Tademait and Tinghert plateaux (Photo. 22). But north of this trench the contours curve round again, and there are side by side the sand-encumbered basins of the western Erg and the Igharghar or eastern Erg, separated by the Tademait-el Gantra-Chebka du Mزاب. The western basin, shut in on the west by the mountains of the right bank of the Oued Saoura, communicates by Touat and the Erg Chech with the great depression of the western Sahara and the gigantic Taoudenni basin. In the western Sahara the broad elevation of the Eglab plays a role, on a smaller scale, analogous to that of the Ahaggar, and north of it lie the Iguidi dunes. The eastern basin, which extends into Tunisia and Libya, is shut in by the Dahar and Hammada el Homra, and on the south by the Tinghert Hammada. Thus the desert surface shows a juxtaposition of more or less regularly rounded basins, which are hollowed out round culminating massifs, but it must be remembered that they are closed basins, of which all the slopes are towards the interior and not to the sea. On all the borders of the Sahara the ground rises, more rapidly on the north towards the barrier of the Atlas, more gently to the south and west towards the southern plateaux and the highlands of the Atlantic coast. The persistence of the closed basins perpetuates the desert. In humid climates rivers re-establish the general slope towards the sea and the whole topography is modified; in deserts the basins remain.

The structure of the Sahara is simple. The most ancient rocks (Archaean, Pre-Cambrian) were for the most part intensely folded long before Palaeozoic times and worn down by denudation to form a peneplain—the Saharan platform. Palaeozoic marine movements and prolonged continental phases provided a blanket of deposits upon

the platform. Renewed earth movements at the end of Palaeozoic times (Hercynian mountain-building) led to considerable folding along the northern fringe of the platform and in detached areas of the general region occupied by the Moroccan and Algerian Atlas. The trends of the folds are generally north-south, as may be well seen in the districts of Figuig and Colomb Béchar, and along the Saoura.

In the interior of the Saharan platform the resistance of the ancient folded rocks protected the sediments that lay upon it from folding. Broad undulations resulted which have been perpetuated and possibly accentuated by later movements, as for example the elevated area, known to natives as el Gantra ('the bridge'), from the Ahaggar to Laghouat between the western and eastern basins. It is maintained, especially by French geologists, that the north-south undulations profoundly affected the disposition of the Atlas mountains themselves, especially in the region of Médéa, which is regarded as the northern end of the north-south el Gantra ridge. Similarly the occurrence of the greatest elevation and the oldest rocks in the western sector of the Atlas and of the least altitude and the youngest rocks in the east, and the step-like arrangements from west to east, are considered to be governed by the presence of such undulations.

It is claimed, further, that the Tertiary foldings of the Atlas, though almost exclusively limited to the northern area between the Tyrrhenian land mass and the Saharan platform, imposed east-west undulations upon that platform. Thus the depression from the Tidikelt to the Djoua, between the Ahaggar and the Tademait plateau, has been attributed to Tertiary movements though the association may be fortuitous, since considerable movements of the Saharan platform took place in Tertiary and later times, giving rise to, or reviving, features like the gigantic dome of the Ahaggar.

The more marked of the dislocations have been accompanied by volcanic activity, and the most imposing heights of the desert are the remains of extinct volcanoes. The Koudia du Hoggar is a vast dome of the ancient platform, elevated more than 6,500 feet, surmounted by gigantic volcanic peaks, huge craters, and flows. Other flows fill valleys and some are quite fresh, rough, and difficult to cross.

The last effect of vertical movement has been to revive erosion. Across the plateaux, known as *hammada* or *tassili*, valleys and gorges have been cut which are impressive in the Mouydir and the Tassili des Ajjer: the margins of the plateaux are cliffs. The ancient planed-off rocks have locally attained a new relief: in the parallel bands which

mark out on the surface the trace of folded and worn-off beds, the softer rocks have been worn down and the harder stand out; such are the ridges which run along the right bank of the Saoura, and in the western part of the Ahaggar.

3. *Running Water*

The decrease of rainfall from the coast inland affects not only the behaviour of the rivers but the physical features, which only in a small part of Algeria are of the type found in Europe: in the rest there is interior drainage (that is, the rivers do not reach the sea), and in the Algerian Sahara the headwaters of a few *oueds* (*wadis*) flow only in winter, for example, the Saoura and the valleys of the Ahaggar. There is also run-off from the Moroccan Atlas.

(a) *Mediterranean Oueds*. Even the oueds that flow to the Mediterranean are full only in time of flood: the largest—the Tafna, Sig and Habra, Chélif, Rummel, Seybouse—in the height of summer have pools of various sizes in the deeper parts of their beds, joined by feeble trickles which wander among sandbanks. Steep river-banks indicate the severity of the winter floods.

Discontinuity of surface run-off is characteristic of all oueds, big and small. For long stretches water disappears; it flows underground and frequently springs re-supply the dry oueds. Impoverished by evaporation, and absorbed by the alluvial deposits, which are increasingly abundant downstream, rivers lose their character and the natives give different names to each stretch. All but a few of the oueds are short and have limited basins; evaporation reduces run-off and supply is not sustained in spring by reserves of snow. Except for special cases—such as the powerful springs coming from the limestones of the Djurdjura—the watercourses cannot supply much power, though some of them are sufficient to turn small native mills. It is possible to use them for irrigation, but schemes which tap directly the least impoverished oueds fail at the moment when irrigation is most needed. Water must therefore be stored behind barrages, where it can accumulate during the rainy season, or from year to year. These are costly, and subject to breakage and silting up. Some have supplemented the irrigation of wide areas in the dry plains of the department of Oran and in the Mitidja since the end of the nineteenth century. Large reservoirs have been built since the last war (*see* Vol. II, Chap. XII).

Besides some watercourses in Oran which dissect the margin of the tabular zone, only four of the oueds of the Mediterranean slopes

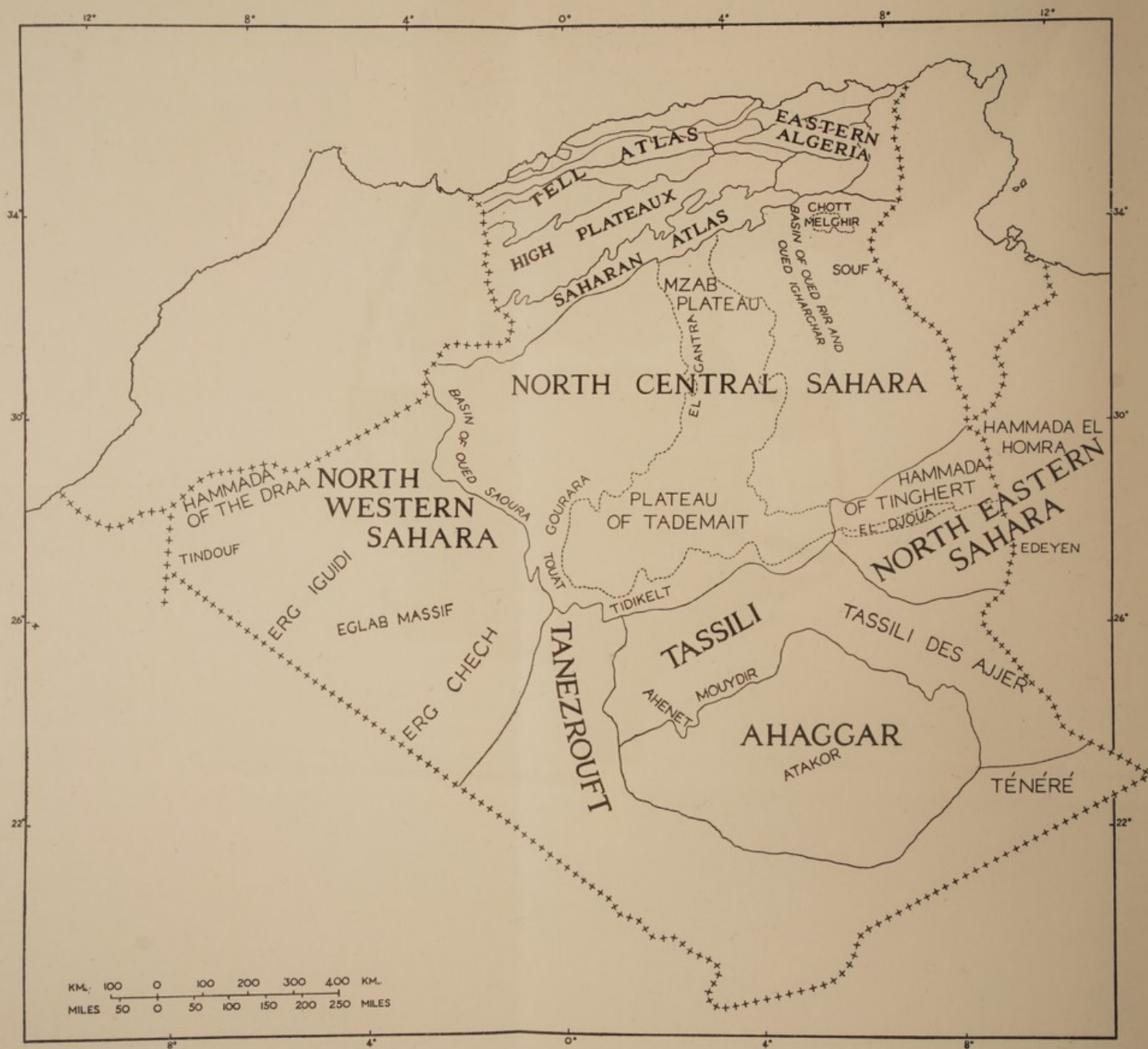


FIG. 9. The major physical regions of Algeria

succeed in breaking through the whole width of the Tell Atlas and in pushing their headwaters beyond. The Seybouse, the Rummel, and the Bou Sellam drain parts of the northern high plains of Constantine. The Chélif rises in the High Plateaux and the Touil, one of its branches, traverses their whole width, but is only a chain of marshes, independent of the Chélif, for most of the year. Otherwise, once the Tell is left behind, the zone of interior drainage is encountered. The precarious supply of the Mediterranean oueds makes them powerless to cut farther southward into the country of closed basins.

(b) *Closed Basins of the Atlas.* Under the most favourable circumstances the valleys carry water towards basins of variable size, from which it does not escape but forms sheets of water of insignificant depth and ephemeral on account of absorption and evaporation. Normally the bottom of the chott is laid bare, a sheet of mud, reddish or whitened by salt efflorescence, a huge area of unstable ground, crossed by certain known tracks. In the majority of cases, however, the incoming water is lost before reaching the chott, in the huge plains and slopes of debris which flank the mountains.

The drainage system collects not only the rainfall but moves the debris torn away by erosion. The Mediterranean oueds, whatever their failings, scour their valleys and carry alluvial material to the sea, only a little remaining in the valleys. In the interior the whole of the debris remains, raising the level of the basins, and then, as the slopes become more gentle through the process, watercourses become choked. Deposits of silt creep nearer the margins of the basin, floods go shorter distances and in due course barely leave the mountains. The whole of the High Plateaux is variably covered with debris spread out in this way.

(c) *Wind and Water in the Sahara* (cf. p. 80). The plains of the Sahara have much the same origin as that described above, but under present climatic conditions there are no streams capable of filling the enormous basins. The remains of the old drainage system are plainly visible. From the heights of the Atlas, from the Tademait, or the Ahaggar, the valleys of the Igharghar, Tafasaset, Mya, and Saoura can be traced for hundreds of miles: all these save the last are dead. Their beds provide pasturage on account of subterranean moisture, but they function as rivers only after rare storms, which continue to erode the upper valleys.

Wind has transported and piled up the finer material from all the surfaces of debris, though its erosive effect in the high parts is clearly

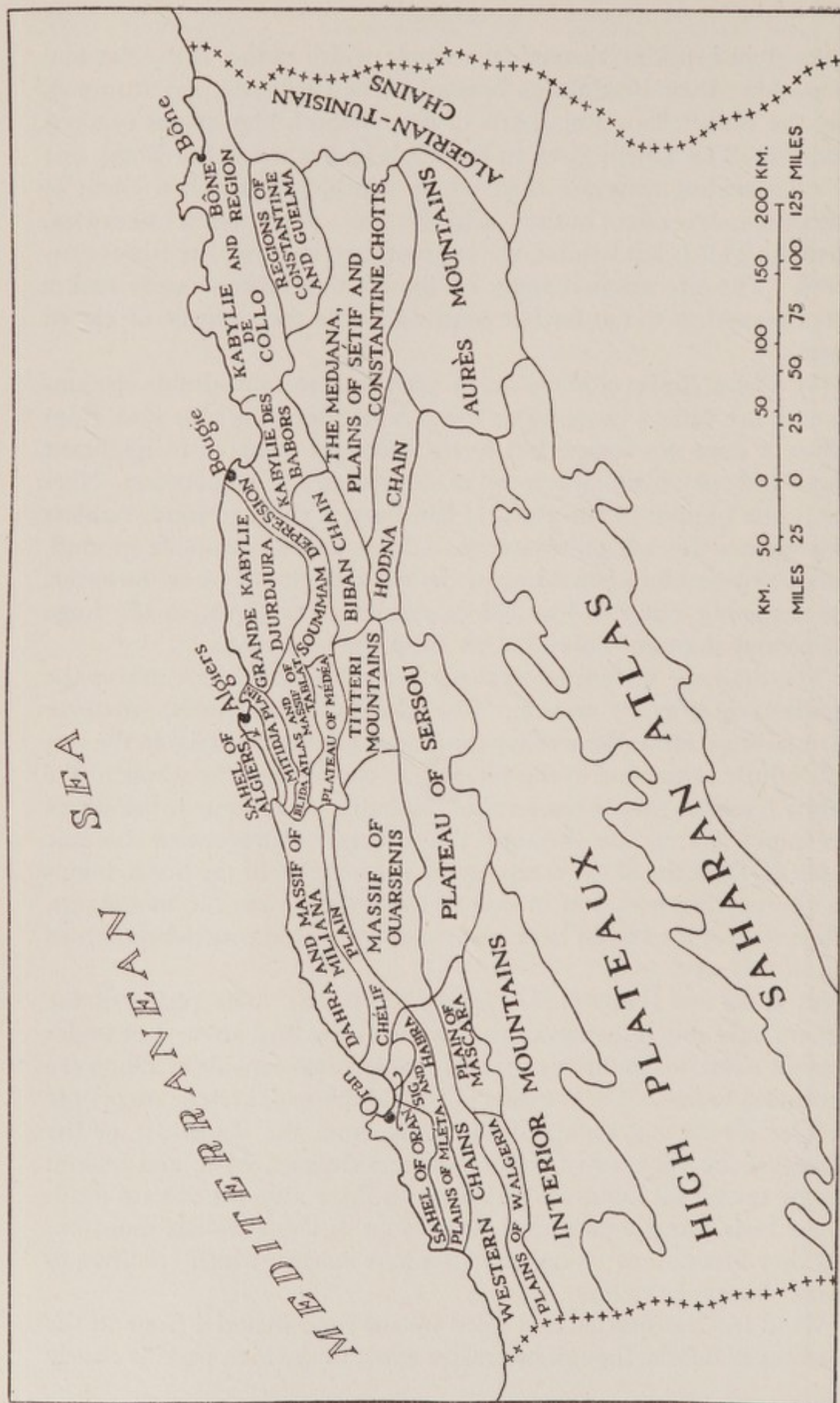


FIG. 10. The physical regions of northern Algeria

subordinate to that of running water. The wind-scoured surfaces have a concentration of pebbles and gravels, and the resulting plains are called *regs* (Photo. 3). The sand-dune areas are called *ergs* (Photo. 4), the major dune systems being located in the bottom of the great basins, where the ancient rivers piled up most alluvium and *seif* (*sif*) dunes, long parallel ridges of sand occur, marked at intervals by pyramid sand peaks (*oghourd*) rising 600 to 1,000 feet above the general surface. Between the dune lines are sand-free corridors (*fedj*, *feidj*, or *gassi*). The whole system is marked by a parallel arrangement corresponding with the dominant wind, in eastern or western Erg or Iguidi alike. The old drainage system disappears under the ergs.

III. CHARACTER OF THE COUNTRY

IN the following description of the country distinctive regions are considered in order, as far as possible from the coast inland and from west to east. This plan imposes an arrangement which will be found to differ from that adopted in scientific text-books, particularly those of French origin, and the separation of western from eastern Algeria diverges in some respects from that to be found in such books. Notably the Grande Kabylie (Djurdjura) is here included with the Tell Atlas of western Algeria, rather than with eastern Algeria, because the plan to be followed in this handbook must be in harmony with that of other official sources of information in conjunction with which it may be used.

The geology of the topographical divisions of the country (except the Sahara) is so diverse that it cannot usefully be given in general terms region by region. Such geological information as is desirable is, therefore, included in the description of subdivisions. It is intended for the information of readers needing technical knowledge and it may be ignored by those requiring only a general description of the country (*see also* geological map in pocket and Appendix A).

The following are the regions to be described (Figs. 9, 10):

I. THE TELL ATLAS

1. *The Coastal Mountains*

- (a) The Sahel of Oran and the Coastal Plain
- (b) The Dahra and the Massif of Miliana
- (c) The Sahel of Algiers
- (d) The Plain of the Mitidja
- (e) The Blida Atlas and the Massif of Tablat
- (f) The Grande Kabylie (Djurdjura)

2. *The Oran-Bougie Depression*
 - (a) The Plains of the Mléta, Sig, and Habra
 - (b) The Plain of the Chélif
 - (c) The Plateau of Médéa
 - (d) The Soummam Depression and the Plain of Bougie
3. *The Middle Mountains*
 - (a) The Western Chains
 - (b) The Massif of Ouarsenis
 - (c) The Titteri and Ouennourha Mountains
4. *The Southern Plains*
 - (a) The Plains of Western Algeria
 - (b) The Plain of Mascara
 - (c) The Plateau of Sersou
5. *The Interior Mountains*

II. THE HIGH PLATEAUX

III. THE SAHARAN ATLAS

IV. EASTERN ALGERIA

1. *The Coastal Mountains*
 - (a) The Kabylie des Babors
 - (b) The Kabylie de Collo and the Bône Region
2. *The Biban Chain*
3. *The Hodna Chain*
4. *The Medjana, the Plains of Sétif, and the Constantine Chotts*
5. *The Regions of Constantine and Guelma*
6. *The Aurès Mountains*
7. *The Algerian-Tunisian Chains*

V. THE SAHARA

1. *The Northern Sahara*
 - (a) The North-western Sahara
 - (b) The North-central Sahara
 - (c) The North-eastern Sahara
2. *The Central Sahara*
 - (a) The Ahaggar
 - (b) The Tassili: the Ahenet, Mouydir, and Tassili des Ajjer
 - (c) The Tanezrouft

I. THE TELL ATLAS

The Tell Atlas consists of a series of mountain masses separated by plains or by river valleys, and forming distinct belts which cross the country from west to east as follows:

1. *The Coastal Mountains*, bordering most of the coast, from the Sahel of Oran eastward to outstanding mountains like the Grande Kabylie (Djurdjura).
2. *The Oran-Bougie Depression*, an almost continuous depression, giving to the country and to its principal communications the distinctive west-east grain, and providing valuable agricultural land.
3. *The Middle Mountains*, beginning in eastern Morocco (Beni Snassene), dominating the coast behind Nemours, and running inland towards Sidi bel Abbès and Mascara (the western chains): they are continued farther east in the extensive massif of Ouarsenis and the Titteri mountains.
4. *The Southern Plains* run eastward from Morocco in the vicinity of Oudjda as a corridor from Tlemcen to Sétif, broken here and there by higher ground, between the Middle Mountains and the northern mountainous flanks of the High Plateaux.
5. *The Interior Mountains* are a series of mountains, mostly of limestone, which flank the northern side of the High Plateaux.

1. *The Coastal Mountains*

These and the plains that are associated with them fall into six groups which will be described briefly from west to east.

(a) *The Sahel of Oran and the Coastal Plain.* The Sahel, or coastal belt, of Oran extends from the mouth of the Rio Salado and Cap Figalo eastward to the gulf of Arzeu and consists for the most part of small hills and plateaux, remnants of a broken and denuded coastal range (of Mesozoic limestones and later Tertiary rocks). West of the Rio Salado to Nemours and the Moroccan border the coast is dominated by the broken and desolate uplands of the Massif des Traras, trenched by deep ravines (p. 43). Recent volcanic rocks form steep and high cliffs in the Habibas islands, and along the coast opposite them: otherwise the topography is fairly uniform.

An outstanding feature of the bay of Oran is Djebel Murdjadjo, a ridge of steeply tilted slates and quartzites capped by Miocene limestones which form a plateau. On its northern flank the Murdjadjo slopes steeply to the bay of Mers el Kebir (Photo. 34), and to the Plaine

des Andalouses, the soils of which reach as far as the steep rocks of Cap Falcon. The sandy soils are cultivated for early spring crops.

East of Oran there is a Pliocene sandstone plateau which forms cliffs along the coast and reaches inland towards St. Louis and to the northern slopes of Djebel Kahar and Djebel Orousse, which are about 2,000 feet above sea-level: in places the soft denuded sandstone becomes a confused mass of sand-dunes. The plateau is cut off from that of Mostaganem by the bay of Arzeu and the marshes of the Macta. North of the valley of the Chélif the plateau reappears. Folds have buckled the region between the coast and the Chélif valley (the Dahra) into south-west to north-east ridges.

The coastal plains begin at the mouth of the Rio Salado south of Cap Figalo, on both sides of which sand-dunes run inland. The plains have been raised above the sea in geologically recent times, the later Pliocene deposits having been tilted almost vertically.

The bay of Oran describes an arc of a circle open to the north, flanked on the west by Djebel Murdjadjo and on the east by a sandstone plateau, which rises from the sea by tawny cliffs about 600 feet high (Photo. 35). The country around Oran is some of the most prosperous in Algeria and is thickly colonized by Europeans, many of them Spanish. Unfortunately the soils are often saline or alkaline, thus limiting the types of crops that can be grown, and the lower reaches of the Sig and Habra are unduly marshy for successful farming.

Oran itself is an exceedingly prosperous and progressive modern town and port, and in 1936 it contained a higher percentage of Europeans than any other of the larger towns of French North Africa (about 153,000 out of nearly 201,000 inhabitants). High ground south-west of the town limits its growth, and it has spread especially to the east and south. The port has modern equipment, but is separated from the town and the railway stations by a steep cliff, communications thus being impaired. The port handles almost the entire export and import trade of western Algeria; it is joined by the main railway line to Algiers on the east and Casablanca on the west, and is, in effect, the rail head of Fes and much of Morocco, and of the Colomb Béchar-Kenadza line.

(b) *The Dahra and the Massif of Miliana.* The Dahra is the region between the coastal plain and the Chélif valley eastward to the Oued Damous, east of which lies the massif of Miliana. The coast is very wild, with steep, rocky cliffs, providing little shelter, and the ports, such as Ténès, are small (Photo. 38).



5. *Algiers from the west*



6. *Boufarik: plantations of orange-trees*



7. *Blida and the Oued el Kebir*



8. *Michelet and the Djurdjura*

The Dahra consists of two parts: plateaux usually less than 1,600 feet above sea-level, generally level, little broken by erosion, bare or with scanty vegetation; and a mountainous tract lying between 2,500 feet and 3,300 feet which is partially covered by forests of evergreen oak and Aleppo pine. The plateaux are limited on the south by a continuous ridge running west-east. Seen from the valley of the Chélif the Dahra appears uniform and featureless, but from the north deeply cut narrow valleys and breaches in the plateau are visible. Springs are numerous, but are usually not very productive. The district is poorly served by roads, and there are few European settlers. The native population is poor and scattered in small groups living on the valley-sides: they cultivate figs, olives, and fruit-trees.

East of the Oued Damous lie the Cretaceous limestone mountains of Zaccar, around Miliana, and, near the coast, Djebel Chenoua (Liassic limestone on Palaeozoic rocks). They dominate a region which is largely forested. The culminating points of the Miliana massif are the Zaccar Gharbi (or Zaccar de Miliana, 5,180 ft.), with steep rocky slopes, and the more broken Zaccar Chergui (or Zaccar de Margueritte, 5,025 ft.). Between them lies the Col des Rirhas, which is followed by the Miliana-Cherchel road. Abundant springs rise in the massif.

Considerable numbers of Europeans have settled in the Miliana region, especially on the coastal terrace on which Cherchel and Gouraya are situated, and in the wide level alluvial valleys of the Oued Damous and Oued el Hachem. The incidence of abundant rains and good soil has led to prosperous farming. Miliana, situated at the junction of fissured limestones and impermeable clays, owes its importance to its excellent springs which follow a long fault-line.

(c) *The Sahel of Algiers.* The Sahel of Algiers consists of a plateau cut up by valleys, generally less than 650 feet above sea-level and never exceeding 1,000 feet, lying between the sea and the Mitidja plain. The slopes are gentle. Soft Pliocene limestones, locally capped by red sand and lying on marly clays, give rise to an attractive countryside which is notably green. The clays provide an important water-table beneath the limestone, but where laid bare are denuded into monotonous and barren hills. On the north the plateau ends sharply and at its foot are more or less consolidated sand-dunes.

During late geological times the sea retreated from the land, leaving behind a step-like succession of terraces: each step was accompanied by the formation of sand-dunes which have survived along much of the coast of the Sahel.

The foot of the hills of the Sahel is given over to market gardening; rows of hurdles protect the early spring crops. At about Staouéli vineyards take the place of market gardens. In all, the pleasant and, on the whole, prosperous Sahel, dotted with villas and gardens among the crops, forms an attractive country suburb to the city of Algiers. Ruins such as those of Tipaza indicate the prosperity in Roman times.

Algiers is situated in the western part of the semicircular bay which extends from the promontory of the Bouzarea massif in the west to Cap Matifou in the east. The lowland coastal strip is narrow, the shore consisting of hard ancient rocks, a narrow band of alluvium, and more or less consolidated dunes: behind, the hills of the Sahel rise sharply. The original town is situated on an area of rock (gneiss) which is separated from the Bouzarea by the deep valley of the Bab el Oued. The site, being easy to defend and constituting with some small islands a natural harbour against the westerly winds, served the Barbary corsairs for three centuries. The native town was confined to a small promontory until the French occupation in 1830. To-day the built-up area stretches, almost without interruption, for more than 10 miles from Pointe Pescade (north-west of St. Eugène) to Maison Carrée. The population (including suburbs) is now about 344,000, including 226,000 Europeans. It is a great modern port, still expanding, and is rivalled in Algeria only by Oran (Photos. 5, 40).

(d) *The Plain of the Mitidja.* Behind the Sahel of Algiers is the Mitidja, a plain about 60 miles long from west to east and 10 miles wide, sloping very gently to the sea and to the Sahel. Its southern margin rests against the Blida Atlas and the massif of Tablat. The geological movements which gave the Mitidja synclinal basin its present form lasted from the Neogene into the Quaternary: at the end of the Pliocene the torrents from the Atlas carried their load of pebbles as far as the Sahel, and the Mitidja did not then exist.

Most of the drainage is north-east to the Mazafran, which is formed by the union of the Oueds Chiffa and Djer at the southern margin of the Sahel. The lower course of the Mazafran is deeply incised, the gorges near Koléa being some 600 feet deep. In the east the plain is drained by the Oued Harrach, which reaches the sea to the east of Algiers.

The plain presents an apparently level and uniform surface (Fig. 11), though in reality it consists of a number of alluvial cones or fans resting against the slopes of the Atlas, thick undulating masses of debris which have been deposited by swiftly flowing rivers. Water which sinks into these fans, among the beds of clay and gravel,

supplies the springs and wells of the plain, some of which are artesian. The northern and eastern sections of the plain, which were formerly marshy, have been extensively drained. Lake Halloula and the marshes of Oued Smar remain obstacles to communications, as also are the large drainage ditches (often lined by trees) in the reclaimed areas.

The Mitidja is regarded as a show-piece of French colonization in north Africa: it is well adapted to cultivation, including magnificent vineyards, fruit-trees, tobacco, and flowers for scent-making. Early



FIG. 11. *The plain of the Mitidja (foreground)*

colonists concentrated in villages for mutual protection, but to-day great estates are widespread. Boufarik, once a malarial swamp where colonists died almost as quickly as they arrived, is the centre of this district (Photo. 6).

Blida (Photo. 7), in the extreme south of the plain on a great alluvial fan of the Oued el Kebir at the foot of the Atlas, is the centre of another intensively cultivated area. The European and commercial town lies within the protecting wall; a native town and widely scattered houses in gardens are outside the fortifications. Abundant supplies of water are obtained from the Oued el Kebir (Fig. 12) for the whole of the Blida district: oranges, citrus, and almonds thrive, and on native property cereal crops and vegetables grow beneath the trees and between the irrigation ditches. Blida was destroyed by an earthquake in 1825, was rebuilt, and was again severely damaged in 1867.

(e) *The Blida Atlas and the Massif of Tablat.* This mountainous district, sometimes known as the Mitidjian Atlas, is linked to the massif of Miliana by the Soumata massif, which is a wooded area, with a fairly smooth surface except where it is cut by the deep and narrow ravines of the Oueds Djer and Bou Roumi. It thus serves with the massif of Miliana and the western extension of the Djurdjura to hem in the Mitidja plain. The Blida Atlas includes the chain of Beni

Salah and the mountains of Beni Messaoud and Beni Miscera, wild country south of Blida, broken up by deep gorges, with inaccessible slopes cut in Cretaceous marls or shales crowned by ridges and outliers of limestone. A considerable area of the mountains immediately



FIG. 12. *The valley of the Oued el Kebir, near Blida*

south of Blida consists of older rocks: the spectacular gorge of the Oued Chiffa reveals slates (probably Palaeozoic) (Fig. 13). The massif of Tablat, which lies on the east side of these mountains, is a monotonous mountain mass, with bare and rounded summits.

The Blida and Tablat mountains are a serious barrier to communications southward from the Mitidja, and their relief renders them unsuitable for European colonization. The natives live in hamlets built on patches of flat or sloping ground on the valley sides, well above the oueds. The annual snowfall and extensive forests of the Blida Atlas provide valuable water resources, but almost complete deforestation between 1,800 feet and 3,000 feet has led to severe erosion of soil and rock, and to the cutting of deep valleys. Woods of oak, pine, and cedar need to be rigorously preserved from destruction by the natives, who tend to clear them higher and higher up the mountain and valley

sides. If measures are not enforced irreparable damage will result, not only within the mountains but in the Mitidja plain, where disastrous floods may occur, the run-off being suddenly checked there after its turbulent course on the mountains.

(f) *The Grande Kabylie (Djurdjura)*. This great mountain massif should, from the point of view of its geology and inhabitants, be



FIG. 13. *The gorge of the Oued Chiffa*

regarded as a part of eastern Algeria. For general purposes, however, it will be included here with the coastal Atlas of western Algeria. It is in many respects the most striking region in the whole of Algeria. It is bounded by the sea and by the line of depressions which are occupied on the south-west by the Oued Isser and its tributary the Oued Djemaa, and on the south-east by the Oueds Sahel and Soummam. On the west it is joined to the Blida Atlas (massif of Tablat) by Djebel bou Zegza.

The massif of Archaean and Pre-Cambrian rocks, which form the nucleus of the Djurdjura, is separated from the sea by a coastal range

and by the depression in which the Oued Sebaou flows. The coastal range, of Cretaceous and older Tertiary clays and sandstones, extends inland to form the triangle of mountains forested with various types of oak (including cork oak) between Port Gueydon (Azeffoun), Akbou, and Bougie. The Oued Sebaou depression lies between the central massif and the coastal range, and the rivers of the southern massifs drain into it. The Sebaou traverses Djebel Aissa Mimoun, an isolated outcrop of the ancient rocks, by a deep gorge cut into the hard rocks (schists and gneisses): otherwise the valley of this river is fairly wide



FIG. 14. *The village of Ait Mimoun, near Fort National, Grande Kabylie*

and its alluvial deposits are cultivated. The agricultural colonies of Camp du Maréchal and Mirabeau lie in these lowlands, in spite of the risk of fever. Communications make use of the Sebaou valley; road and railway from the coast at Dellys use the lower valley, the road following the upper valley before climbing to the plateau on which Fort National stands.

South of the Sebaou is the main massif. Its height increases from 2,000 feet in the west to 4,000 feet in the east. There has been heavy denudation owing to its elevation, the amount of snowfall, and the rapidity of the run-off to the Sebaou lowlands. The valleys are so deep and numerous that they break up the whole area into a succession of narrow ridges. Roads and tracks, therefore, avoid the valleys and keep as far as possible to the high ground in order to negotiate the heads of the ravines. Thus the Dellys-Tizi Ouzou-Fort National-Col de Tirourda route follows the axis of the main chain of Ait Iraten,

and reaches 3,196 feet at Fort National, 3,494 feet at Icheridene, and 4,092 feet above Michelet (Photo. 8). This route was made in three weeks by French troops during the Kabylie expedition of 1857. Fort National (then Fort Napoléon) was built at the same time to ensure the submission of the region. The massif of ancient rock with its vegetation contrasts violently with the bare slopes of the Sebaou depression. The sweet-acorn oak and ash (the branches of which are stripped in summer as fodder) are almost all that is left of the natural vegetation; the rest has been despoiled. Figs and olives grow on the



FIG. 15. *A series of villages on the hill-tops in Central Kabylie, with the Djurdjura in the background*

steepest slopes, olives up to about 2,600 feet, and figs even on the highest ground. Beneath the trees the ground is turned over with mattocks or worked by primitive ploughs drawn by oxen or donkeys. Nevertheless, the amount of cultivable ground is insufficient to feed the population, the region being the most densely peopled area in Algeria. Much of it carries 580 inhabitants to the square mile; if the whole of Algeria were so populated there would be 100 million people instead of $7\frac{1}{4}$ millions. The numerous villages are sometimes on the slopes of the hills, but usually on ridges between 1,800 and 4,000 feet above sea-level: along some ridges, dwellings are almost continuous (Figs. 14, 15; Photos. 62, 64). The valley floors are deserted. The surplus population used to travel about Algeria as agricultural workers or pedlars, but after the War of 1914-18 they went to France in

great numbers, especially to Paris, to provide cheap unskilled labour (p. 226). Unemployment before the present war checked, but did not stop, this exodus from the country.

To the south of the outcrops of ancient rocks mentioned above, the great chain of Djebel Djurdjura itself rises steeply from the clay lowland of Dra el Mizane, which is only about 1,200 feet above sea-level. The limestone barrier extends for nearly 40 miles from west to east (Figs. 15, 16; Photos. 1, 8). The chain consists of two lines of crests, composed of acutely folded Permo-Triassic sandstones, Liassic limestones, and Eocene clays, sandstones, and limestones, for the most part more than 6,000 feet above sea-level. The main peaks are Haizeur (6,998 ft.) and Akouker (7,563 ft.) in the north, and Lalla Kredidja (7,573 ft.) in the south. The ridges are bare, scored with scarps and scree, slashed by deep gorges, eroded by swiftly flowing rivers. The high parts and grass slopes are used for pasture called *agounis*; flocks work steadily up them as the summer advances. In some places dry stone wall enclosures serve as sheep-folds, as in European highlands. On patches of sandstones cedars grow, replacing oaks and junipers above about 4,250 feet.

Snow lies all the winter; normally the Col de Tirourda route can be used only from mid-April to mid-November. The southern slope of the Djurdjura, which leads down to the valley of the Oued Sahel, is thinly covered with evergreen oaks. At the bottom of the lower slopes is an extensive platform of coarse pebble beds, much cut up by streams. The eastern slopes of the Djurdjura and the Soummam valley are, like the Fort National region, mainly devoted to the native cultivation of fig and olive.

2. *The Oran-Bougie Depression*

The west-east corridor, which runs almost unbroken from the coast at the mouth of the Rio Salado (about midway between Nemours and Oran) back to the Mediterranean at the mouth of the Soummam (Bougie), marks, for the most part, the flood plains of the main rivers flowing from the mountainous interior.

(a) *The Plains of the Mléta, Sig, and Habra.* South of the Sahel of Oran is the lowland of the Sebkha of Oran, the plain of the Mléta, continued in the plain of the Tlélat, and, farther east, of the Sig and Habra. Alluvial plains occupy the sites of former salt marshes, or surround enclosed basins (*sebkhas*) cut off from drainage to the sea. These sebkhas, in which water accumulates in winter and usually disappears in summer, owe their origin to low rainfall, to underlying



FIG. 16. *The Djurdjura, Grande Kabylie*

Triassic rocks which allow subterranean drainage, and to the fact that, from a geological point of view, the relief is so new that the rivers have not had time to establish their valleys. Only two rivers of any size debouch on to the coastal plain, the Oued Mékerra-Sig and the Oued el Hammam-Habra, which unite to form the Macta. The barrage of Cheurfas on the Sig irrigates a large area around St. Denis du Sig, and the barrage of the Oued Fergoug on the Habra controls the irrigation of agricultural land around Perrégaux (Vol. II, Chap. XII). Downstream of les Trembles the Mékerra leaves its old bed (through Oued Imbert and St. Lucien), which is followed by the railway between Tlélat and Sidi bel Abbès, and flows north-eastward, as the Oued Mebtoub, to the lowlands at St. Denis du Sig. Near the sea neither the Sig nor the Habra has a defined bed: both lose themselves by spreading out in a delta-like zone. The plain of the Habra is the reclaimed part of the depression; the marshes of the Macta are in process of filling up.

(b) *The Plain of the Chélif.* The longest tributary of the Chélif is the Oued Sebgag or Touil, rising in the Saharan Atlas. But the Oued Touil loses water as it passes across the steppes of the High Plateaux and is almost entirely dry when it is joined by the Nahr Ouassel, the actual headwaters of the Chélif, which come from Tiaret along the southern side of the Ouarsenis massif. The Chélif spreads out in marshes in the neighbourhood of Bou Guezoul, and then suddenly, at Boghari, enters the Tell mountains, which it crosses by a meandering course entrenched in the rocks, its bed being steeply inclined (Photo. 9).

The river then describes a curve and flows from east to west, running parallel to the coast in a depression, formerly a gulf of the sea, which it has filled with alluvial deposits. The valley is constricted at two points, and has, therefore, three divisions, the plains of Affreville, les Attafs, and Orléansville; at the western end of the last the river is joined by the Oued Mina, which drains a wide area of the interior mountains. Finally, the Chélif valley narrows to pass through the Dahra, and thence to the sea. Although it receives tributaries from the Dahra on the north and the Ouarsenis on the south, it remains a river of no great size, and its flow is very irregular. It floods between November and March, especially in December and January, and is reduced in late summer to muddy lakes and pools joined one to another by feeble trickles of dirty water.

The coastal mountains shelter the Chélif valley from the rain-bearing winds, and rainfall is therefore irregular (at Orléansville

22 in. in 1917, 10 in. in 1920). Evaporation is intense, and in summer the valley is like a furnace. The natives, living in *gourbis* or huts surrounded by juniper hedges, or in tents, are poor and eke out an existence with their flocks and by growing cereals, of which the yield is uncertain. Europeans get good results when the rains are good. In all, the Chélif valley is a blot on the landscape between the good farming land of the Oran district and of the Mitidja.

Irrigation is the only hope of salvation, and some progress has been made. There are important water supplies only 18 or 20 feet beneath the surface at a number of points, in particular in the plain of Inker-mann. A few pumping stations have been established to take water directly from the Chélif, overflow dams have been built at Carnot, Pontéba (upstream of Orléansville), Malakoff, and Charon, along the river, and reservoirs on the tributaries where they leave the mountains. The best tributaries are those from the Ouarsenis, though the flow even of these is very variable. The discharge of the Oued Fodda, for example, was 34 million cubic yards in 1926 and 324 million cubic yards in 1928. During floods the Algerian rivers are heavily charged with alluvium and thus the construction of big barrage-reservoirs involves not only high costs but risks of breaking and of silting-up (Vol. II, Chap. XII).

The various works have been built with a view to the production of cotton, a crop abandoned in the years before the present war, but now likely to be revived. The extension of irrigation also improves the production of existing crops, notably cereals and fodder (and thereby stock-raising), and, above all, will allow the substitution of fruit-trees, such as olives, almonds, and apricots, for annual crops which have a poor resistance to the extreme dryness. It is obvious that in a region of this type misuse of irrigation would lead to salt-enrichment and ruin the soil.

(c) *The Plateau of Médéa*. The plateau of Médéa interrupts the Oran-Bougie depression and, geologically, is a transverse undulation in which Tertiary beds have been elevated to about 4,000 feet (p. 23). The plateau lies on the south side of the Blida Atlas and is the boundary between the coastal Tell and the Kabylie mountains.

A spur unites the Médéa plateau to the Zaccar, making a partition between the lowland plains of the Chélif and Mitidja. The clays and marls widely exposed in this district are deeply eroded. They stretch as far as Bou Medfa and Hammam Rirha, where an important fracture throws out thermal springs, around which travertine (calcium carbonate) has accumulated. The clay slopes are capped by sandstones

which give rise to the monotonous ridge of Djebel Gontas (2,858 ft.). South of the ridge the Miocene basin is crossed by the Chélif. In the middle of the Miocene lands the Cretaceous rocks crop out, usually covered with woodland.

The Médéa plateau is an important watershed, streams flowing westward to the Chélif, northward to the Chiffa valley, and eastward to the Isser. The higher hills of shale and clay are wooded; the sandstone platforms give rise to abundant springs, which account for the wealth of the district. The clays are given over to cereals, but their denuded slopes, which slip and slide, are a serious hindrance to all public works. Vines and fruit-trees flourish, and make much of the area a veritable orchard.

(d) *The Soummam Depression and the Plain of Bougie.* East of the plateau of Médéa lie the plains of Beni Slimane, Arib, and Hamza, about 2,000 feet above sea-level, and drained either to the Oued Isser or to the Oued Sahel. They correspond to the depression between the massif of Tablat (eastern prolongation of the Blida Atlas) and the Aumale chain (western end of the Biban chain). The hills are covered with scrub and bush (*maquis*) and have been cleared for cultivation by native farmers despite the stony nature of the ground. The Beni Slimane plain is little suited to colonization, the Arib plain is fertile, and the regions of Ain Bessem and Bouira (Hamza plain) are prosperous.

The plains are continued in the valley of the Oued Sahel, known as the Soummam in its lower course, which reaches the sea in the gulf of Bougie. This valley forms a great depression between the Djurdjura and the Biban, in which continental deposits—conglomerates, sandstones, and red clays—have accumulated. The abundance of volcanic rocks south of Bougie marks the presence of a fracture between the Grande Kabylie (Djurdjura) and the Kabylie des Babors.

The upper part of the Oued Sahel is robbed of rain by the Djurdjura, but the lower valley is covered with olive plantations, especially around Maillot, Tazmalt, and Akbou.

The plain of Bougie is wide and fully exposed to the rain-bearing winds and is one of the main centres of European population in Algeria. The gulf of Bougie, sheltered by the rocks of Cap Carbon, is one of the largest and most marked indentations of the Algerian coast (Photos. 10, 43).

Although elsewhere between the Mitidja and the plain of Bône the Kabylie massifs prevent access from the sea to the High Plateaux and high plains of the interior of Algeria, here the valley of the Soummam



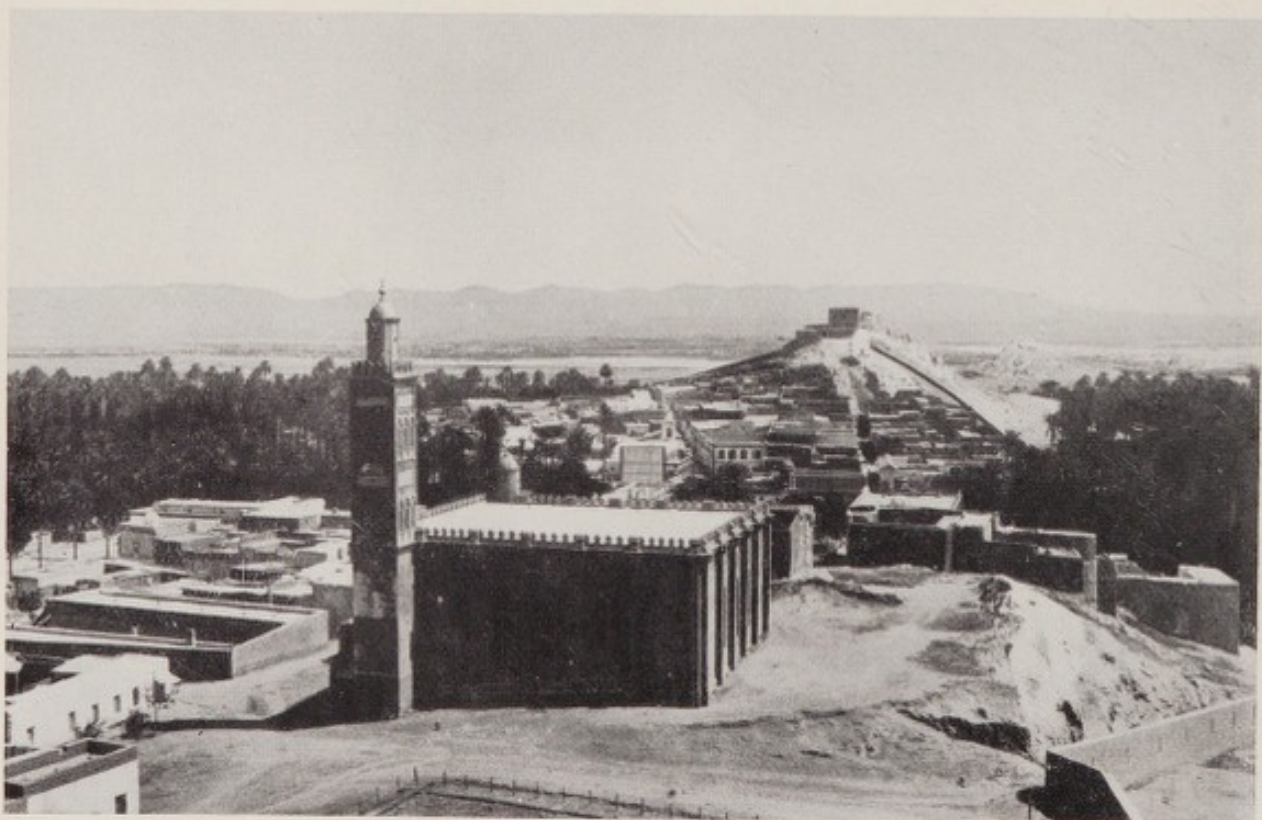
9. *The Oued Chélif near Boghari*



10. *Cap Carbon near Bougie*



11. *The gorge of el Ourit near Tlemcen*



12. *Laghouat*

opens an easy way inland. Bougie is well situated and should become the outlet for the mineral wealth of the Kabylie des Babors.

3. *The Middle Mountains*

These disconnected mountains maintain the west-east alinement already observed in the Coastal Mountains and the Oran-Bougie depression.

(a) *The Western Chains.* The mountains begin in eastern Morocco and run eastward between two depressions: on the north that of Oran, and on the south the long strip of lowland which flanks the plateau of the Inner Mountains (Jurassic limestones).

The Massif des Traras, on the Moroccan frontier, may be regarded as a prolongation of the Beni Snassene uplands, between the lower Moulouya and the Oudjda-el Aioun-Taourirt plateau in eastern Morocco. Relief is rugged, with deep ravines, vegetation is poor and woodland scanty.

Eastward the mountains change their character towards the lower hills of Ain Témouchent into the Tessala mountains and the mountains of Beni Chougran (3,058 ft.), which lie on the east side of the valley of the Mékerra-Sig. In the region of Ain Témouchent there are extensive areas of volcanic rocks. Lava flows, scoriae, and tuffs have weathered to produce a black, light soil, rich in alkali, of outstanding merit. Vines and many other crops are grown with great success. In addition iron ore is mined in the district behind Beni Saf. The rest of the Tessala mountains is ridge-and-plateau country of Cretaceous and older Tertiary sediments.

The mountains of Beni Chougran are difficult of access and cut by deep gorges of the rivers Mékerra-Sig and Habra. Monotonous clay marls are widespread, but the relief is very broken and the geological structure is complex. In these hills is the small petroleum area of Tliouanet, the only field, except for that of Ain Zeft in the Dahra, exploited in Algeria (up to 1937): since 1914 it has produced 12,000 metric tons.

The breaches in the western mountains made by the rivers provide corridors for roads and railways to pass southward. Thus the main railway from Oran to Morocco passes round the north-eastern end of the Tessala mountains by the Mékerra-Sig valley to Sidi bel Abbès, and thence westward to Tlemcen, where it is joined by the narrow-gauge line which follows the Oued Tafna from Beni Saf for nearly 20 miles.

(b) *The Massif of Ouarsenis.* The massif of Ouarsenis is bounded

on the north by the Chélif, on the west by the Oued Mina, and on the south by the plateaux of the Tiaret country. Eastward, between Teniet el Had and Boghar, it is continued in the massif of Matmata.

The culminating point of the massif is a great limestone peak, the Kef Sidi Amar (6,538 ft.), the upper parts of which are bare and steep, while the lower are surrounded by evergreen oaks and cedars. In contrast to this impressive central pyramid the rest of the massif is monotonous, consisting of Cretaceous marls and clays covered with brushwood and pine forests often ravaged by fire. On the sandstones near Teniet el Had there is a cedar forest (Photo. 46). Nearly all the rivers draining the massif follow a south-south-east to north-north-west direction to join the Chélif, which also flows in the same direction between Boghari and Dollfusville across the eastern part of the massif of Matmata. The natives, who are locally fairly numerous, live in forest clearings, more or less hidden and remote from the communications of the country.

So far there has been little colonization, although cultivation is possible on the southern slopes of the Ouarsenis, in the valley of the Nahr Ouassel. These areas receive enough rain, are open to the humid winds following the Mina valley, and have abundant springs. The local conditions seem to be intermediate between the Tell and the steppe, and are suitable for cereal crops and sheep raising.

Confusion has often arisen between the valley of the Nahr Ouassel, which is sufficiently watered, and the Sersou proper. Djebel Nador, a Jurassic limestone mountain, which is short of water, rises in the middle of the latter. Colonization has been attempted here, in a region which is in reality a steppe.

The Mina, flowing to the west of the Ouarsenis, is well supplied by perennial springs in the neighbourhood of Mechra Sfa (on the south bank of the river opposite Prévost-Paradol), near which the Barrage de Bakhadda has been built: there is plenty of water, even in summer. Downstream there are no more springs, and, on account of the intense evaporation, the river is almost dry by the time it reaches Relizane. The barrage serves to improve this state of affairs.

The valley of the Mina divides the mountains in two dissimilar parts. On the west bank the Jurassic limestone mountains flanking the High Plateaux, which have run without interruption from the Moulouya, come to an end in the mountains of Frenda. On the east bank the folds of the Tell Atlas proper make their appearance.

Tiaret, on the flank of a sandstone plateau, is the centre of communication of the region—westward by way of the Mina valley to

the plains and the coast, eastward by the Nahr Ouassel to the upper Chélif, northward across the Ouarsenis massif by the Oued Riou to Inkermann: the first two are easy, the last follows a deep torrent-course, and a better route lies along the Nahr Ouassel to the vicinity of Vialar, and thence northward across the massif to the Chélif valley at Orléansville. Tiaret in effect lies at the junction of the Tell Atlas and the High Plateaux, and can communicate easily both with the coast and the south.

Farther east the district of Boghar, on the southern flank of the massif of Matmata, a few miles west of the Chélif, also marks the limit of the Tell, which is here much cut up. To the south of Boghar the relatively undisturbed High Plateaux follow sharply on the broken and folded country of the Tell, and the change in vegetation is no less marked, a land of trees and crops giving place to the steppe and alfa grass of the High Plateaux over which nomads range with their flocks.

(c) *The Titteri and Ouennourha Mountains.* The Titteri mountains, rising on the east side of the Chélif near Boghari, are much cut up by a number of ravines, occupied by rivers which flow either westward to the Chélif or eastward to the Hodna. The ridges consist of Eocene sandstones, the eroded slopes of marly clays. The highlands are continued eastward in the mountains of Ouennourha, and in this direction they overlap the arbitrary line here made between western and eastern Algeria, since they lie between the chains of the Biban on the north and the Hodna on the south: from a geological point of view they would be better included in eastern Algeria. In this eastern sector the highlands rival in height the Biban mountains, and consist of rounded and usually bare summits, formed of sandstones lying nearly horizontally and about 2,000 feet thick. There are abundant springs at their base, where, locally, patches of marl provide good agricultural land. A depression cut out of the marly Miocene beds broadens in the Medjana or Bordj bou Arréridj plain, which has increased in value with colonization. Although the plain lies some 3,000 feet above sea-level, it is hemmed in by mountains which rise steeply from it. It is separated only by low hills from the basin of the Bou Sellam and the plain of Sétif.

4. *The Southern Plains*

These fall into two groups: those of the west, continued westward into Morocco and eastward through the plain of Bel Abbès to the plain of Mascara, and the eastern plains which lie between the massif

of Ouarsenis and the High Plateaux. The first group is vital to the west-east communications of the country and to the routes leading into Morocco.

(a) *Plains of Western Algeria.* South of the Traras massif is the plain of Marnia, a continuation of the plain of Angad in Morocco. It thus forms a part in the long corridor which leads from Algiers and Oran through the gap of Taza (between the Rif mountains and Middle Atlas of Morocco) to the towns and ports of the Atlantic coast. Marnia is an important route centre. Eastward the plain of Marnia is continued by rich agricultural plains which lie at the foot of the plateau of Tlemcen, from which they obtain ample supplies of water. On the Tafna, which traverses the plains from south to north, the barrage of Beni Bahdel has been recently finished, and will store nearly 44 million cubic yards of water to irrigate more than 30,000 acres in the plain of Marnia (Vol. II, Chap. XII).

Still farther east the plains are continued by the plain of Bel Abbès, a gently undulating region drained by the Mékerra. The river is extensively used for irrigation, its water being taken off by canals, so that its volume at Sidi bel Abbès is usually small, but it receives here a number of springs issuing from sandstones and conglomerates along a line of cliff. Over the plain as a whole rain is readily absorbed by the permeable soils.

The plain of Bel Abbès is a flourishing centre of European colonization: it is well situated and healthy, and has ample and varied resources. It is now one of the great cereal-producing areas of Algeria, instead of a region of brushwood, dwarf palm, and bare ground. The soils are of good quality and are stated to contain natural phosphate of lime. The parts of the Mékerra valley that can be irrigated are utilized for market gardening and orchards. Vine and olive are established on sandstone outcrops and on sandy or pebbly alluvium. The native has no place in this vast scheme, which owes much of its success to the industry of the original Spanish colonists, who are very numerous in this part of Algeria.

(b) *The Plain of Mascara.* This plain, known also as the plain of Eghris, lies at the foot of the Beni Chougran, but is more stony and less fertile than the Bel Abbès plain. The vegetation is everywhere poor except around the afforested slopes of the lake artificially created to supply the barrage of the Habra. Nevertheless, Europeans have settled both here and in the valley of the Mina, between Relizane and Tiaret.

(c) *The Plateau of Sersou.* This is an area across which the Nahr

Ouassel flows gently eastward from its source in the region of Tiaret to join the Chélif. To the north the plateau extends into the Ouarsenis massif in a series of clay basins; to the south it passes by a series of hills into the High Plateaux. The northern parts are well watered by springs, by the rivers which come down from the Ouarsenis, and by rain-bearing winds which reach them through the gap of the Oued Mina.

5. *The Interior Mountains*

The Tlemcen-Magenta-Saida-Frenda country on the south side of the southern plains of western Algeria forms part of the tabular zone of the High Plateaux, and is, from a geological point of view, part of the Oran meseta. The Jurassic dolomitic limestone, of which it is largely composed, recalls that of the Middle Atlas of Morocco, and its disposition contrasts with the broken country of the mountains nearer the Mediterranean. Rain is fairly abundant, and sufficient to enable forests to maintain themselves and to allow cultivation; there is considerable denudation. In the steppes immediately to the south these conditions are absent. Although the plateau and its northern scarp are geologically part of the High Plateaux, so far as climate and conditions of life are concerned they belong to the Tell.

The plateau stretches for about 200 miles from west to east, and throughout this length presents a great scarp to the north, overlooking the depression which lies on the south of the folded Tell. There are flowing streams and waterfalls, and water circulates underground within the jointed limestone. As the thick limestones overlie sandstone and clays at the base of the scarps, the underground water issues in abundant and perennial springs. Areas of cultivation and population, called *dir*, cluster round these sources.

The limestones are as much as 1,200 feet thick, and there are the usual characteristics of such rocks—caves, sink-holes, disappearing and reappearing streams, underground rivers. Such country in Europe is known as *causse*, and accordingly the region is frequently called the Oran *causses*.

As at Debdou and in the Beni bou Zeggou in Morocco, here and there the folded Palaeozoic rocks are exposed in a framework of limestone where denudation has cut deep and the rocks are elevated, as for example in Ras Asfour (5,100 ft.), a great ridge which dominates the Oudjda plain, and near the Oued Tifrit, north-east of Saida.

The region consists of a series of steps, the highest on the south, on the border of the High Plateaux with the steep side of each generally

towards the north, rising from 3,275 to 5,900 feet. The country also rises to the south-west, dominating the Tafna valley and its tributaries by a succession of escarpments called the Twelve Apostles. The so-called Lamoricière route, from Sebdou in the west via Daia (Bossuet), Saida, Tagremaret, and Frenda to Tiaret, follows a depression between two limestone escarpments.

The plateau is cut up by the tributaries of the Isser and the Tafna, which flow in steep-sided narrow valleys, with numerous falls and rapids, gorges and steep-sided valley-heads, especially in the north. The source of the Tafna, in a cave near Sebdou, gives a mean of 176 gallons per second of remarkably good and clear water. It flows to the plain of Sebdou in a series of waterfalls and sinks rapidly into the valley of Tafessera. Its large tributary valleys similarly start with slight slopes, then narrow and pass into gorges when they enter the Jurassic limestones.

The limestones are more or less bare, but the sandstones on the northern flanks are well forested with evergreen oak, juniper, thuya, and Aleppo pine. The rivers of the Tell draw on the water resources of this forested region and transfer their supply to the northern zones, which would otherwise be waterless in summer.

The natives usually live in tents or in villages, close to springs, or else on small, steep-sided, and almost inaccessible plateaux known as *gadas* (as in some parts of Morocco); some of them can be reached only by stairways. Europeans are gradually settling on the best lands, especially where marls outcrop, and there are large and prosperous farms around Ain el Hadjar (5 miles south of Saida), Magenta (in the upper Mékerra valley), and Télagh. The northern front of the mountains is marked out by the towns of Tlemcen, Lamoricière, Chanzy, and Prévost-Paradol. Of these, Tlemcen (2,800 ft.) stands at the edge of the plateau above the huge basin crossed by the Tafna and its tributaries. Protected from the south winds and exposed to winds from the Mediterranean, it receives abundant supplies of excellent water from the gorge of el Ourit (Photo. 11), and has magnificent orchards.

II. THE HIGH PLATEAUX

The vast region between the Tell Atlas and the Saharan Atlas, between the plains of the Moulouya river on the west and the Chott el Hodna in the east, is conveniently known as the High Plateaux, of which the general altitude is 3,300 to 4,000 feet (Fig. 17).

The region is an undulating steppe-land with ridges, escarpments, and rocky eminences sharpening the relief: extensive flats are provided by the chotts. The Chott Gharbi is the most westerly: it is limited by cliffs on all sides and filled with deposits in its central part, with muddy salt-basins in the western and eastern ends.

The great depression of the Chott Chergui is about 100 miles in length from west to east, but, unlike the Chott Gharbi, has flat, low margins: the central part is likewise silted up, there being a sill at



FIG. 17. *Alfa (halfa) steppe in the High Plateaux*

Kreider between the western and eastern basins. Beyond the eastern end of the Chott Chergui the country is drained to some extent by the upper reaches of the Oued Touil, which flows into the Chélif, but its course is dry in summer and marked only by springs and shallow wells.

The next two chotts towards the east are the Zahrez Gharbi (west) (2,713 ft.) and Zahrez Chergui (east) (2,477 ft.), salt lakes almost dry in summer, separated by rather higher ground, used by the Algiers-Djelfa railway and the motor road from the coast, via Djelfa and Laghouat, to Ghardaia. The chotts lie in a depression between two uplands of about the same altitude—the Seba Rous (3,609 ft.) on the north-west and Djebel Sahari on the south-east—the latter appearing as an outpost of the Monts des Ouled Nail (a part of the Saharan Atlas): on these highlands north and south of the Zahrez, woods of juniper, thuya, and Aleppo pine have survived.

Farther east is the Chott el Hodna, at an altitude of only 1,312 feet, in the extensive plain of that name; it is a salt marsh with indistinct banks and is often dry. This region seems to have been fairly prosperous until the Middle Ages: ruins of agricultural and irrigation works and buildings remain. An artesian water-supply has now been found and a scheme for irrigation has been planned.

Sheep range over the whole area of the High Plateaux. Alfa grass

(Photo. 50) is grown extensively, and salt is produced by primitive methods from the saline lakes and streams. Rock-salt is also quarried, notably at Rocher du Sel (Djebel Sahari) (cf. Fig. 8).

III. THE SAHARAN ATLAS

The Saharan Atlas continues the mountain barrier of the High Atlas from eastern Morocco to Tunisia. The altitude is less than that of the High Atlas, and the mountains project like islands from an accumulation of debris. The ranges merge northward into the High Plateaux and along their length fall into certain groups: these are (from west to east) the Monts des Ksour, Djebel Amour, and the Monts des Ouled Nail. Some parts of the ranges stand out boldly. Thus the south-western end of the Monts des Ksour constitute, in the Figuig massif (about 6,560 ft.), great bastions with vertical walls and plateaux partially forested. Near Ain Sefra, where a narrow valley followed by the Oran-Colomb Béchar railway breaks through the mountains at about 3,500 feet, bastions rise to 6,628 feet in Djebel Mekter on the south side of the railway and to 7,336 feet in Djebel Aissa on the north. Towards the east-north-east the mountains lose altitude, denudation is intense, and the plains become larger. Water and grazing land are good and abundant, especially in spring, and underground sources of water are available.

The mountain front rises again in the Djebel Amour range (4,600–5,600 ft.): the eastern part is characteristically a region of sandstone table-mountains, or gadas, cut off one from another by vertical cliffs, which make natural fortresses. This formidable region possesses pasturage and some forests or thickets of thuya and evergreen oak: its climate is temperate, in contrast to the severe climate of the steppes to the north. The streams on the north go to the Oued Touil, and thence to the Chélif and the Mediterranean; those on the south go by a number of watercourses to the low country which runs along the Saharan front of the mountains, some of them disappearing under the sand-dunes.

To the east are the Monts des Ouled Nail, a series of uplands separated by wide plains. The mountains merge into the High Plateaux in a region of broken plateaux and ridges: denudation in this district has produced some unusual results. A sharp limestone ridge, the Kef Guebli, trenched by straight gorges (*kheneg*), is the southern limit of the mountain system (Fig. 18).

The important oasis of Laghouat is situated on the southern edge

of the Monts des Ouled Nail; it possesses an abundant water-supply and contains about 30,000 palms. It lies on the Algiers-Djelfa-Ghardaia road and is the only outstanding oasis on the flank of the Sahara between Figuig and the Ziban-Biskra district (Photo. 12).

The Monts du Zab constitute an important lowering of the mountain wall between the Ouled Nail and Aurès mountains, south of the Hodna plain between Bou Saada and Biskra. Into this gap the Sahara



FIG. 18. *A valley in the Monts des Ouled Nail*

desert has advanced as far as Bou Saada: the gap was a route for the Arab invasion, and to-day the nomads of the Biskra region use it to reach the Algerian Tell. First-class roads from the Tell run to Bou Saada, and from Sétif and the east to Biskra. The gap itself is criss-crossed with routes which radiate from Ouled Djellal. To the south lies the fertile Zab (plur. Ziban) palm district.

The Ziban group of oases marks the terminal deltas of the Oued Djedi and the Oued Biskra. Part of the water supply is superficial, but this is of minor importance: the greater part is obtained from abundant artesian supplies held in Cretaceous and Eocene limestones which mark the foot of the Saharan Atlas. The water essential to the Ziban oases therefore comes from the north and from the Saharan Atlas, not from the south. The oases of Zab Chergui and Zab Dahraoui belong to two dissimilar hydrographic zones. The former (except for Chetma) depends on superficial supplies from alluvial

deposits washed from the Aurès region; these deposits are, for the most part, impermeable clays and marls. Zab Dahraoui, on the other hand, flourishes on the wells which tap the artesian water of the limestone.

The region as a whole comprises 59 oases, strung out over 30 miles west of Biskra and 60 miles east of it. There are reported to be more than a million palm-trees and more than half a million other fruit-trees.

The country immediately to the south of the Saharan Atlas is described on p. 63.

IV. EASTERN ALGERIA

Eastern Algeria differs considerably from the western part of the country, where alternate mountain barriers and plains and plateaux provide a strongly marked west-east grain. Near the coast, from Algiers to Philippeville, this plan is still evident, but from Philippeville to the Tunisian frontier plateaux and plains supervene. The coastal massifs are higher than those of the west, so that snow falls more heavily and lies longer, but generally speaking the transition from Tell to plateaux is more gradual than it is in the west. Communications with Tunisia are not confined to valleys between mountain ridges, as are those with Morocco.

In the west the Tell Atlas and the Saharan Atlas are distinct and separated by the High Plateaux; in the east the distinction is lost, and the high plains of Constantine are divided into a number of small basins.

Again, the High Plateaux of the west are monotonous steppes, while the valleys to the north of them are fertile and support a large European population: in eastern Algeria there is a larger native population. In contrast to the bleak uplands of some parts of the Tunisian frontier region, the Aurès mountains, standing high above the Saharan plains, enable the vegetation of the Tell to extend as far south as Biskra.

The country falls into the following divisions (Fig. 10):

1. *The Coastal Mountains*, a continuation of the Grande Kabylie, which is usually included in eastern Algeria, but here, for special reasons, already described as a part of western Algeria (p. 26).
2. *The Biban Chain*, lying between the Grande Kabylie and the eastern end of the interior mountains of western Algeria, con-

- tinuing eastward and to some extent occupying the position of the middle mountains of the west.
3. *The Hodna Chain*, forming the eastern mountain barrier of the High Plateaux, curving south-eastward from the eastern end of the interior mountains towards the Aurès mountains.
 4. *The Medjana and the Plains of Sétif*, interior lowlands and plains between the Biban chain and the Hodna chain running eastward to the high plains and river valleys south and west of Constantine.
 5. *The Regions of Constantine and Guelma*, mainly plateau country cut by valleys.
 6. *The Aurès Mountains*, an eastern bastion of the Saharan Atlas, dominating the Sahara to the south and communications from the desert through Biskra to the Mediterranean.
 7. *The Algerian-Tunisian Chains*, to the east of the Aurès, forming plains and undulating hilly country between the Aurès mountains, the Constantine-Guelma region, and the Tunisian frontier: they contain rich deposits of phosphates.

1. *The Coastal Mountains*

These fall into two groups, the western or Kabylie des Babors, and the eastern or Kabylie de Collo with the Bône Region.

(a) *The Kabylie des Babors, or Petite Kabylie*. These mountains lie very close to the sea all round the gulf of Bougie from Cap Carbon in the west to Cap Cavallo in the east and form very steep cliffs, a 'corniche' coast of striking proportions resembling the coastal scenery of southern France between Nice and Mentone. As in the Djurdjura, the highest peaks are of Jurassic (Liassic) limestone such as the Grand Babor (6,575 ft.) and the Tababor (6,447 ft.). The region as a whole consists essentially of folded Jurassic and Cretaceous sediments. Erosion is severe, and the streams flow swiftly in deep valleys. The most important river is the Oued Agrioun which cuts through the main limestone chains by precipitous-sided defiles, of which the most striking is the Chabet el Akra ('the gorge of death'), about $4\frac{1}{2}$ miles long (Photo. 13). This area is one of the best watered parts of Algeria, with an annual rainfall of 40 inches or more, but as yet there has been practically no European colonization. The native population is small and scattered, and communications are rudimentary. The vegetation includes excellent cedar forests near the coast, abundant cork oak at all heights up to about 4,000 feet,

with Portuguese oak at lower altitudes. On Babor and Tababor Numidian fir and a species of poplar make their only appearance in north Africa. Fruit-trees and orange plantations grow in the valleys. Iron, zinc, lead, calamine, and copper ores occur, and there are mineral springs.

(b) *The Kabylie de Collo and the Bône Region.* The Kabylie de Collo, stretching from Djidjelli to Bône, is divided into two parts by depressions and plains: (1) the Kabylie de Collo in a restricted sense (3,880 ft. at Djebel el Goufi), running from Djidjelli eastward to the vicinity of Philippeville; (2) the massif of Edough (3,306 ft.), between Cap de Fer and Bône. The Numidian chain forms the southern limit of the region.

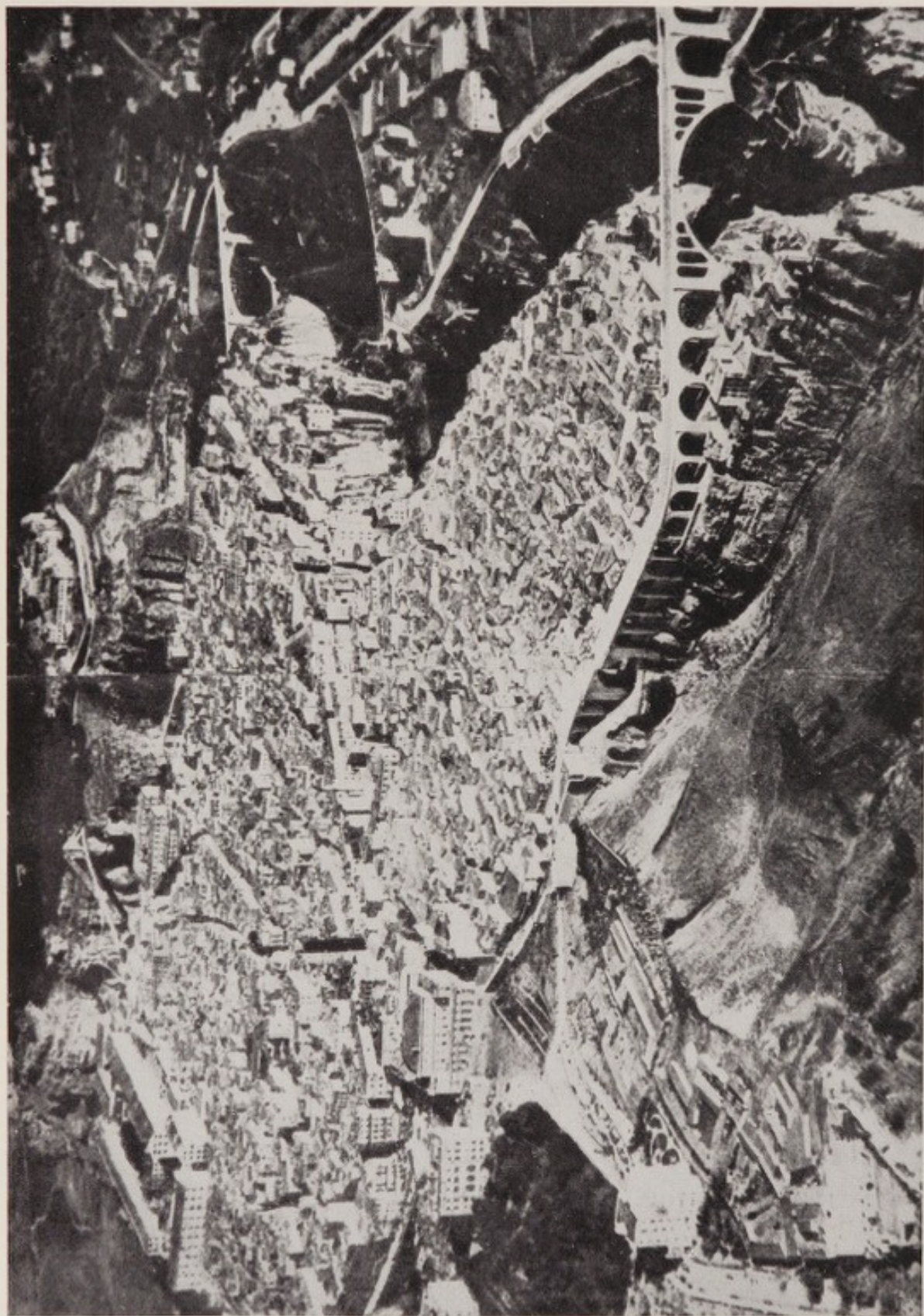
The mountains of Kabylie disappear east of Bône and their place is taken by the extensive coastal plain of Bône, which is backed by sandstone hills. The geology of the Kabylie de Collo and massif of Edough is of interest on account of the extensive exposure of the ancient crystalline rocks (gneisses and schists) and Palaeozoic slates. They are also exposed in the coastal region of the west in the Djurdjura, in the Massif des Traras (on the Moroccan frontier), and in the Rif (Spanish Morocco). The shales and slates are impermeable and the country is much cut up by steep-sided valleys. Over wide areas older Tertiary sandstones, and, locally, Jurassic and Cretaceous rocks are seen upon the older rocks. The prominent headlands of Cap Bougaroun and Cap de Fer consist of large areas of eruptive rocks, which also are prominent in the central part of the Kabylie de Collo. The Oued Rummel, coming from Constantine, breaks through the Kabylie de Collo to reach the sea: it is known as the Oued el Kebir in its lower reaches.

Three-fifths of the region between Djidjelli and Collo are forested, about two-thirds of the forested area consisting of cork oak, the remaining third of Portuguese oak. The undergrowth is tangled and often impenetrable: settlement in the district and the growth of large villages have thus been hindered and the people live in *gourbis* (temporary dwellings, p. 220) scattered over the hill-sides. Agriculture in the forested areas is limited to small clearings.

The Collo and Edough massifs are separated from one another by the gulf of Stora, continued to the south by the depression of St. Charles, in which flows the Oued Safsaf. East of St. Charles is another basin, that of Jemmapes. In both basins, and in the lowlands around Philippeville, cereals, vegetables, vines, and olives are grown.



13. *Chabet el Akra, Oued Agrioun*



14. Constantinople from the south

The Numidian chain (3,800 to 5,000 feet) is composed of limestones, cut by deep gorges, including that of the Oued el Kebir (Rummel): the summits are of sandstone: severe folding involves Permian, Mesozoic, and Older Tertiary beds, and there are extensive Miocene outcrops on the southern side in the Smendou depression. The mountains separate the St. Charles basin on the north from the Smendou depression on the south.

On the landward side the massif of Edough is surrounded by lowlands, on the south by the depression in which lies Lake Fetzara, and on the south-east by the alluvial plain of Bône, across which meander the Seybouse river and its tributaries, lined with trees. Lake Fetzara is an extensive marsh nearly 10 miles from west to east and between 5 and 6 miles from north to south. It dries up in summer and the muddy bottom cracks (hence its name Ouerra Fetzara, 'lake of cracks'). Rushes grow round the edge. The lake is separated by dunes about 20 feet high from the lowlands around Bône and is becoming increasingly brackish: attempts to drain it have so far been on too small a scale to succeed.

The plain of Bône, between the Edough massif and the eastern end of the Numidian chain, stretches for 60 miles from west to east and about 30 from north to south. As it is almost entirely level, there are unhealthy marshes and lakes. St. Augustine died of malaria here. It is crossed by the Seybouse, which has for long tended to shift its course towards the west. The present course lies about 4 miles west of the old channel, still plainly visible, from which it diverges at the village of Randon.

Few parts of Algeria are more thoroughly colonized than this plain, in spite of its unhealthy environment. It is open to the sea, and possesses a first-class soil. Farms and major agricultural schemes, vineyards, and tobacco plantations are numerous and prosperous.

East of Bône the Kabylie mountains disappear. The coast is no longer a steep wall rising out of deep water; a wide continental shelf takes its place. On both sides of la Calle there are lakes which were created when the sea invaded the older river valleys. Some of these are salt, such as Lake Melah, others are freshwater, such as Lake Tonga and Lake Oubeira. Cork oak grows on the Eocene sandstone areas around la Calle and continues eastward into the Kroumirie district of Tunisia. Bône is geographically in a similar position to Oran and Algiers, with 86,000 inhabitants (including 46,000 Europeans). It is the main port of the phosphate mines and shares

the trade of eastern Algeria with Philippeville and Bougie (Photo. 45).

2. *The Biban Chain*

So far as relief is concerned, the middle mountains of the Tell Atlas divide at the western boundary of the province of Constantine, the northern branch forming the Biban chain and the southern the Hodna chain. The Biban chain is practically joined to the Kabylie des Babors in the north-east and extends as far as Djebel Megriss (5,699 ft.), which lies north of Sétif. Geologically, however, the Biban chain should be regarded as a separate unit, since the folding is of early Tertiary age, while the Hodna chain is mainly of Alpine age (i.e. later Tertiary). The folding of the former may be regarded as completed before that of the latter was accomplished.

The tilted Cretaceous limestones form sharp, knife-edged ridges through which the rivers have cut deep gorges, such as those of Aumale, the Portes de Fer (Iron Gates), and Guergour. The Iron Gates, through which the railway from Algiers to Constantine passes, are cut in limestones which have been tilted almost vertically, forming walls separated by ravines cut in marly beds. The gorges cut through the chain form gateways (Arabic *biban* (sing. *bab*), door or mouth) in the mountains to which they have given their name.

The soil is everywhere thin and covered with brushwood, with a few oaks on the shales, and Aleppo pines on the limestones. East of the Iron Gates the Kabylie tribes, especially the Guergour people, are crowded on the northern flanks of the mountains, whereas the southern slopes are thinly peopled.

3. *The Hodna Chain*

The Hodna mountains are roughly parallel to the Biban chain, but diverge to the south-east, where their continuation in the Bellezma massif (north-west of Batna) is hardly separated from the Aurès mountains. They therefore form the northern flank of the eastern end of the High Plateaux and the southern margin of the Tell. Their geological constitution is substantially that of the Biban—Jurassic and Cretaceous rocks—but their structure is complicated by folding of more than one period.

The chain is divided into three sections by the Oued Ksob and the Oued Soubella: Djebel Djedoug (4,075 ft.), Djebel Maadid (6,063 ft.), and Djebel bou Thaleb (6,339 ft.). The region does not seem to have been traversed by the main routes used by the pastoral

peoples of the high plains, who have deforested only the lower slopes, leaving on the upper parts pine, oak, and remarkable remnants of the ancient cedar forests.

East of Bou Thaleb the Hodna chain is continued in the Bellezma massif, and the Touggour-Chellala chain (6,869 ft.) flanks the eastern end of the Hodna basin on the north. The uplands as a whole are well forested with cedar; oak and juniper also cover very large areas.

In the surrounding plains of Zana, Seriana (Pasteur), and Bellezma there is good agricultural and pastoral land: olives, vines, and cereals are grown.

4. *The Medjana and the Plains of Sétif*

The bare high plains of the Sétif region extend to the plains of Medjana on the west, the Hodna chain with Djebel bou Thaleb on the south-west and south, and the Guergour mountains on the north: the mountains descend to the plain in a series of steps. On the east there is no clearly defined limit; the undulating plains of Sétif are followed by those of St. Arnaud, and the landscape does not really change until Ain Mlila is reached. The plains are for the most part between 2,500 and 3,300 feet above sea-level, and from their general surface rise isolated stumps of mountain chains of various sizes and shapes, standing usually about 1,000 feet above the plains, running west-east. In former times the Sétif plains were an enclosed basin occupied by a large lake extending from about Ain Tagrout, 16 miles west of Sétif, to Ain Beida and even to la Meskiana, midway between Ain Beida and Tébessa. The surface of the plain is formed of the lake deposits, pebble beds, coarse sandstones, clays, and red loams round the margin, and fresh-water limestones in the centre.

The northern part of the plains drains to the sea by the Bou Sellam and the Oued el Kebir, both of which, aided by abundant rainfall, have cut back across the Babors and Biban chains, until their headwaters have invaded the plains. In the Sétif region the flow is from north to south, because the surface-water drained originally southward into the chotts and marshes south and south-west of Sétif. Thus the Bou Sellam, after running from north-east to south-west from its source on the south side of the Tell Atlas at Megriss, turns sharply north-west, and passes through the deep gorges of Djebel Guergour to join the Oued Sahel, which, as the Oued Soummam, enters the sea near Bougie. In its upper course

its slope is very gentle, in the gorges very steep. The same feature is seen in all four rivers that drain the southern Algerian plateaux—the Chélif, Bou Sellam, Rummel, and Seybouse.

Farther south some of the former sebkhas now drain towards the Mediterranean. The ground is so level that streams often disappear after flowing short distances. Still farther south there is no drainage to the sea and small chotts appear.

The soils of the plains of Sétif are generally fertile, though some of them are stony. The loams frequently contain at slight depths a limy crust or 'pan', which is characteristic of all such soils in a dry climate. The climate is, on the whole, dry and at times very cold. Rain is not very abundant (only 19 in. at Sétif) and highly irregular. The temperature variation is enormous. Cold and drought lead to steppe vegetation. Nevertheless there are considerable areas under cereal crops, mostly native grown: there is also some successful European farming of cereals and cattle.

The Constantine chotts lie to the east of the plains of Sétif and extend as far as Ain Beida; the one passes into the other almost imperceptibly, the region of *bled es sraouat* (region of small crests) giving place to the *bled es sbakh* (enclosed basins), dotted with small isolated hills such as the dome-shaped Djebel Sidi Rgheiss (5,341 ft.), about 15 miles north-west of Ain Beida.

Discontinuous lines of hills running south-west to north-east stand above the plains of the chotts; in Djebel Nifenser, Djebel Guerioun, and Djebel Hanout (about 20 miles south of Ain Mlila) folds of the Saharan Atlas are superimposed on those of the southern Tell Atlas. Gypsum and salt-bearing beds, which are abundantly exposed in this region, give rise to low hills. Among the hills lie plains of loam and other lake deposits, usually between 2,500 and 3,000 feet above sea-level, which are so flat that it is often difficult to recognize the direction of slope. Streams often disappear or split up to form marshes.

Small basins are the relics of the great lake which once stretched over the whole region: their waters are saline, but salinity varies from lake to lake. In times of flood the Chott Tinecilt and the Sebkhah ez Zemoul spill over into the Rummel. The Tarf, some 11 miles long and 9 miles wide, is the largest of the many basins.

The alluvial soils, often containing phosphate of lime, produce good wheat, but the salt lands are desolate and lifeless. The salt marsh around the chotts, however, gives good grazing, and in general terms the region of the Constantine chotts may be regarded as good

rough pasturage. The Chaouia people range over this country and a few European colonists cluster in villages as far south as the foot of the Saharan Atlas (Photo. 65).

5. *The Regions of Constantine and Guelma*

Between Sétif and Constantine are the Ferdjioua mountains (south-west of the Numidian chain), which consist of clays and marls beneath limestones. They form a number of small chains, following no well-marked direction, which reach 4,882 feet above Djemila. Tributaries of the Oued Rummel have dissected the northern slopes, and the main river flows eastward in a deep trench along the south side of the Numidian chain until it turns sharply northward to cross the chain by means of a series of deep gorges.

The St. Arnaud district is the watershed between rivers flowing to the Mediterranean and those passing into the interior. The upper branches of the Rummel and its tributary the Oued Seguin have scarcely cut into the plain; their drainage gives rise to small valleys green with vegetation. South of St. Arnaud all the streams flow to the Sebkhah el Bazer, the most northerly of the inland lakes of the Sétif region. Drainage towards the Mediterranean has gained steadily on the high plains, so that a change of slopes often marks the northern limit of the basins which were once without drainage. Thus the Bou Merzoug, which joins the Rummel above Constantine, has pushed its headwaters as far as Ain Mlila, and so drains a large area of the high steppes of Constantine: ultimately it will drain the Chott Saboun.

North-west of Constantine is the site of an old lake basin 10 to 12 miles wide and 50 to 55 miles from west to east, 1,000 to 2,000 feet above sea-level, and filled with gypseous clays, pebble beds, lignite-bearing clays, and fresh-water limestones. Most of these beds are soft, the clays forming low, monotonous hills and the pebble beds hillocks which are often bright red. The general surface is undulating, but locally it is deeply dissected.

The basin is dominated on the south by the faulted and eroded mountains of Constantine, running in general from south-west to north-east. The ridges are flanked on the south-west by the plains of St. Donat and Châteaudun du Rummel, and run thence through the chains of the Oued Seguin. They are cut transversely by deep river gorges of which the best known is the cañon of Constantine (Photo. 2).

The town of Constantine is an ideal route-centre and market, although the Rummel gorge makes it difficult of access, since it

commands numerous valleys through the mountains. Roads converge on it from the ports of Philippeville and Bône, and from Sétif, Batna, and Souk Ahras. The population is about 114,000, including 54,000 Europeans (Photo. 14).

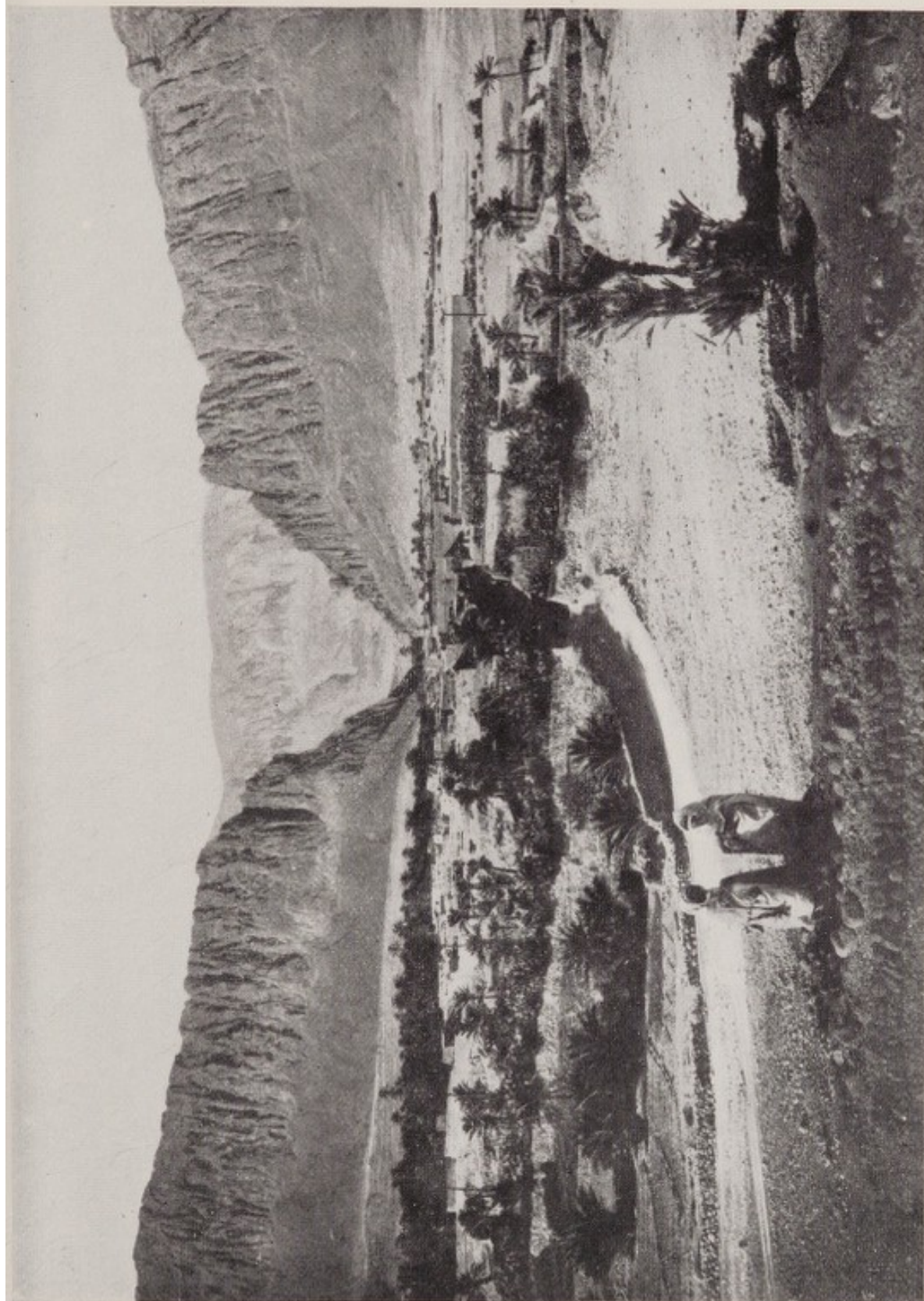
The cañon of Constantine is not the only gorge of the Rummel: wherever the river cuts across the mountains deep gorges occur, such as the Cluse du Grouz above Constantine, the Cluse du Kreneg below the town, and the Cluse des Beni Haroun where the river crosses the Numidian chain. The slope of the river-bed is very irregular. The Constantine region is rather gloomy country, cold, treeless, and not very fertile: cereals and vines are grown in the lower parts, though olives seem to have grown on the mountains in ancient times. Irrigation is used only in the Hamma area, at the foot of the Rocher de Constantine, but more use could be made of it for stock-raising.

The Guelma basin lies north-east of the Constantine region. It consists of a series of depressions along the course of the Seybouse between Oued Zenati and Duvivier, dominated on the north by Djebel Taya and Djebel Debar, off-shoots of the Numidian chain. Marls, clays, and pebble-beds outcrop in the depressions, which are much denuded. Around Hammam Meskoutine, about 12 miles farther up the Seybouse than Guelma, the same beds occur, broken by faults up which abundant hot springs reach the surface; the medicinal hot-springs are surrounded by extensive beds of travertine (calcium carbonate). The mountains, consisting for the most part of sandstones, are wooded in the higher parts and around Djebel Taya, but towards the plains have been much deforested. The Guelma basin is well covered with vegetation, contrasting with the Constantine basin, and colonization has been considerable. Fruit-trees and olives have been extensively planted, vegetables are grown, and Guelma cattle are the best known in Algeria.

The Seybouse rises near Ain Beida in the plateaux of the Constantine chotts, where it is called the Oued Cherf. The Seybouse itself is a river of the Tell, and rapids occur where the two sections unite. The river escapes from the Guelma basin by way of a deep and narrow gorge through Djebel Nador to reach the plain of Bône and the sea.

6. *The Aurès Mountains*

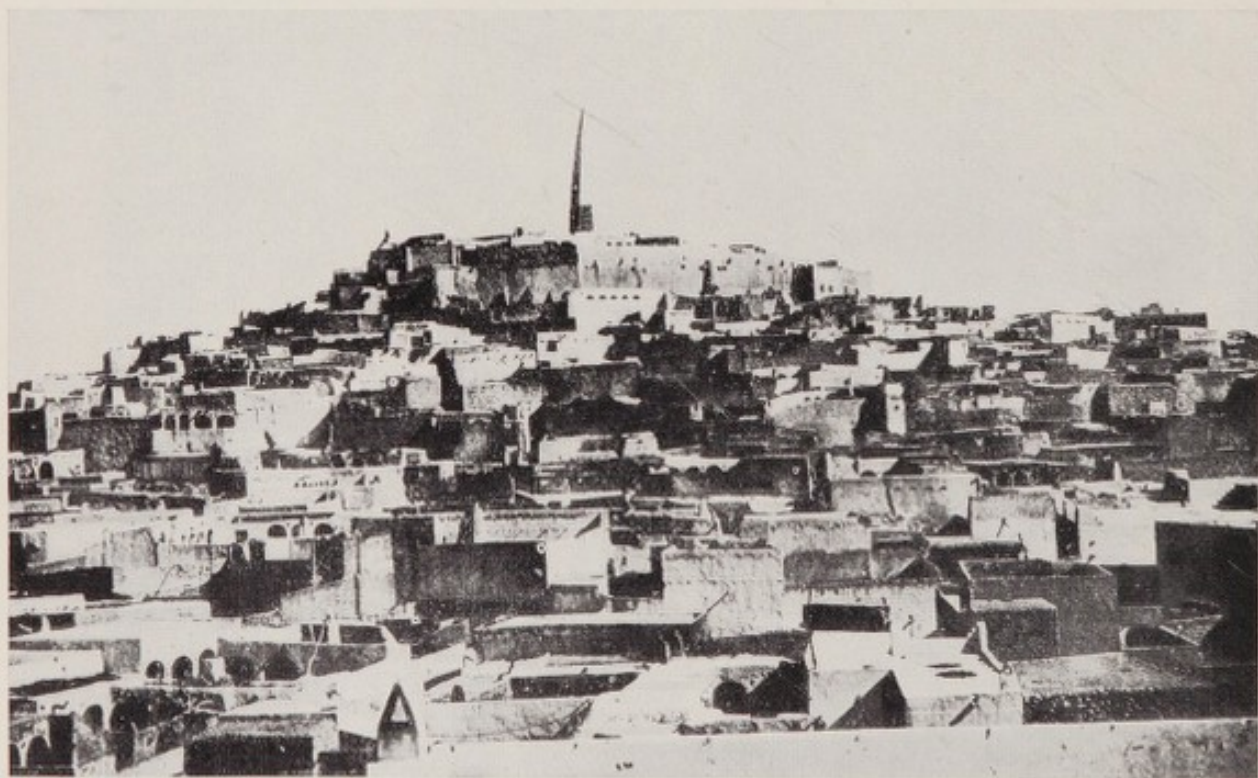
These mountains, of folded Jurassic to Lower Tertiary sediments, are some of the most striking in Algeria, and include the highest



15. *El Kantara*



16. *Beni Abbès with the dunes of the western (Saoura) Erg (in background)*



17. *Ghardaia*

peak in the country, Djebel Chelia, 7,638 feet, together with others of almost equal magnitude, such as Djebel Mahmel (7,615 ft.), Djebel Amamra (7,044 ft.), and Ahmar Khaddou (6,310 ft.). In the west the mountains run south-west to north-east and then turn eastward: they are weathered into peaks and needles arranged in long, straight ridges. They dominate the huge plains of the Tarf and Khenchela (about 3,300 to 3,600 ft.) to the north, and the eastern Zab and the Saharan plateau on the south.

This formidable region has been a refuge, virtually impregnable, throughout the history of Barbary. Some of the villages are perched on escarpments and can be reached only by steps and ropes, or are placed in easily defended positions (Photo. 63). The houses are built in terraces one above another, dominated by a *guelaa* or *thaguelat*, a building that serves as both granary and fort.

Woods of Aleppo pine, oak, and cedar survive on the northern part of the mountains (Photo. 48). In the deep valleys fruit-trees, vines, and water-melons are cultivated, and honey is gathered: a little barley and wheat are grown in the plains that occur within the mountains (e.g. Arris, Medina). The people, however, range with their flocks of sheep over the Biskra country to the south, and their villages are more or less deserted during these migrations. Their provisions are stored in the granaries, and in some degree the villages are as much warehouses as living places. The ruins of Roman towns round the northern margin of the Aurès, including the famous site of Timgad, indicate former prosperity (Photos. 54-6).

In the south-east Djebel Chechar (6,113 ft.) is an outlier of the Aurès and is succeeded to the east by the Nemencha country which stretches to the Tunisian frontier, a country of plains and plateaux given over to alfa grass.

Valleys debouch from the mountains into the plains to the north and south, that in which el Kantara is situated being an exceptionally important route for communications between the Sahara and eastern Algeria: it is followed by both road and rail (Photo. 15). In this valley also, at el Outaya, is Djebel Melah (Malah), a mass of rock-salt about 1,000 feet high, 3 miles long, and 2 miles wide.

7. *The Algerian-Tunisian Chains*

In the region between the Aurès mountains and Souk Ahras, east of the Constantine chotts, there are mountains of simple structure, domes being frequent, orientated in various directions: between them and limited by them are isolated plains, like a chess-board.

Geologically this region is part of the Saharan Atlas, but its climate and agriculture are those of the Tell, though the ground is denuded, bare, and marked by patches of salt. Chief interest centres around the mineral wealth. Important haematite iron ores are worked at Djebels Ouenza and Bou Kadra, served by the Souk Ahras-Tébessa railway, near the Tunisian frontier. Phosphates occur in Djebel Onk, Djebel ed Dir, and Djebel Kouif (Tébessa), but only at the last are they exploited.

The highlands around Souk Ahras are much the same as those described above, the topography being very confused. Remains of Roman occupation are numerous and their location is reputed to be related to the distribution of marls with phosphates. Souk Ahras is the southern limit of European colonization in this part of Algeria. North of Souk Ahras the Monts de la Medjerda, a westward continuation of the northern Tell of Tunisia, dominate the country.

V. THE SAHARA

That part of the Sahara which falls within the confines of the Territoires du Sud may be conveniently divided into two sections, the Northern and the Central (Figs. 9, 19). The former may be regarded as the deserts stretching southward from the foot of the Saharan Atlas, from the Atlantic to the gulf of Sirte; the latter has as its central highland the Ahaggar massif.

1. *The Northern Sahara*

The northern deserts fall into three parts, which may be defined as follows:

(a) The *north-western Sahara* is bounded on the west by the Spanish Sahara or colony of Rio de Oro, on the north by the Oued Draa and the Atlas of southern Morocco, and on the east by the Oued Saoura. On the south the deserts continue into Mauritania and the French Sudan, and across them runs a purely artificial administrative boundary, from the frontier of Rio de Oro south-west of Tindouf to the massif of Adrar des Iforas, separating French West Africa from the Algerian Sahara.

(b) The *north-central Sahara* may be taken to include the region of Colomb Béchar, with the great north-south Oued Saoura as its western limit, and the Saharan Atlas as its northern boundary, extending eastward to comprise the Touat, the Mzab, the Igharghar, and the Oued Rir, and passing into Tunisia.

(c) *The north-eastern Sahara* includes the deserts south-east of the Igharghar and north of the Ahaggar, that is the Hammada of Tinghert: the region extends across the whole of the Italian desert territories of Libya to the Libyan desert of Egypt.

(a) *The North-western Sahara*

The region effects a junction between territories which are described in other handbooks—Morocco on the north, French West Africa on the south, and Rio de Oro on the west. The following description will therefore include references to sufficient of these adjoining territories to ensure a proper overlap between the handbooks.

Geology. The denuded platform of the ancient rocks (Archaean) is widely exposed from the west, that is from Mauritania and Rio de Oro, north-eastward to the massif of the Eglab, a region of gneiss, granites, and metamorphosed sediments (with Palaeozoic rocks), attaining an altitude of about 1,300 feet. On the north and south of the broad anticlinal ridge so constituted, from the Atlantic coast to the Eglab, lie enormous synclinal basins of Palaeozoic sediments, for the most part of marine origin. On the north is the syncline of Tindouf, the northern margins of which have been laid bare in the basin of the Oued Draa and in the anticlines of Djebel Bani, the Anti-Atlas, and southern High Atlas of Morocco (where the Archaean rocks are again exposed). The trough of the syncline is occupied by continental deposits. The southern syncline, that of Araouane, is substantially of the same constitution: it is traversed by the Niger between Ségou and Gao and lies almost entirely in French West Africa. The axes of the anticlinal ridge and the synclines run approximately from south-west to north-east, and are, therefore, parallel to the trends of the Saharan and High Atlas.

Across the eastern ends of anticline and syncline alike lie vast areas of continental sandstones, of various geological ages but in the main probably Cretaceous. At the eastern end of the syncline of Tindouf the Palaeozoic sandstones are also widely exposed in folds running north-west to south-east between the Oueds Daoura and Saoura, both of which originate in the southern Moroccan Atlas.

Relief and Water. The region consists essentially of plateaux, broken by scarps, lying between 600 and 1,600 feet above sea-level. The highest ground occurs in the north-west, in the southern slopes of the Anti-Atlas, and in the flat, rocky plateaux or Hammada of the Draa and the Guir. The only other highlands are the Eglab and the

ridges between the Daoura and Saoura. The Eglab is flanked by successive gentle slopes and saw-toothed ridges; the scarps face the massif. They may be followed south-west through the region of el Hank for nearly 400 miles, for the greater part in French West Africa. There are also interior lowlands between the Eglab and Taoudenni, and in the north-eastern deserts of Mauritania. Extensive sand-dune areas occur: thus the Erg Iguidi lies between the Eglab and the Draa Hammada, and the Erg Chech, flanking the south-east side of the Eglab, continues northward round the massif to join the north-eastern part of the Iguidi dune area. From the Erg Chech the dunes may be traced south-westward, in isolated chains, to the southern part of Rio de Oro and into Mauritania, where they are very extensive.

The proximity of the Atlantic ensures to the north-western Sahara sufficient rain to maintain drainage channels; there are traces of erosion by rivers which are not to be found in the rest of the Sahara (except on the highest ground). Nevertheless only the valleys of the Draa and the Seguiet el Hamra, traversing Rio de Oro, reach the sea. The Draa is joined by numerous tributary valleys from the Anti-Atlas and High Atlas. The Seguiet el Hamra has its origins south-west of Tindouf: it contains numerous wells and fortified villages (*ksour*), and bushy vegetation grows on the terminal delta. Farther east the drainage channels of the southern flanks of the High Atlas unite in the Oued Ziz, which passes southward across the desert as the Oued Daoura; the lower valley is not well known but is believed to be continued by the Oued Ethel, thus explaining the abundance of water on the border of the Iguidi dune area. The Daoura, and all similar oueds, end in interior drainage basins.

Much of the north-western Sahara provides extensive patches of camel-pasture, especially in the sand-dune areas near the coast.

(b) *The North-central Sahara*

It would be a mistake to regard the territories lying between the Saharan Atlas and the Ahaggar as useless or uninhabited desert: on the contrary they contain numerous well-watered, moderately prosperous, and populous palm-groves and oases. Depressions which traverse the limestone plateaux reveal water-bearing beds which support palm-groves: vast areas of drifting sand surround oases with good water and pasturage.

Geology. The structure of the region is simple. On the west, along the line of the Saoura, Palaeozoic strata (mostly sandstones) are

widely exposed: they also form the southern margin, a region of plateaux which form the northern flanks of the Ahaggar. The Palaeozoic rocks are slightly tilted, contrasting therefore with the folded beds of the west. On the north lie the folded zones of the Algerian Atlas, with the Saharan Atlas at their ultimate southern margin.

Within the framework so formed are vast areas of continental deposits, pebble beds, sandstones, and sands of widely different ages but similar composition. Over most of these the Cretaceous sea, encroaching from the north, laid down thick limestones which now form two extensive plateaux: the western stretches from the region of Ghardaia to the Tademait (i.e. el Gantra), and the eastern runs from the Mediterranean coast near Gabes southward to Ghadames, and thence westward (as the Hammada of Tinghert) towards the Tademait. Two enormous sand-dune areas occur, the western (Saoura) Erg between the Saoura and the western limestone plateaux, and the eastern (Igharghar) Erg, flanking the eastern plateaux (Hammada el Homra and Hammada of Tinghert).

Relief and Water. The north-central Sahara may be subdivided into three regions. From west to east they are: (i) the basin of the Oued Saoura and district of the Touat, (ii) the limestone hammadas and the Mزاب, and (iii) the basin of the Oued Igharghar and the Oued Rir.

(i) *The Basin of the Oued Saoura and District of the Touat.* The Saoura, with the drainage basin of the Zousfana, the headwaters of which are in the Saharan Atlas, is the principal flow of water in the Sahara between the Atlantic and the Nile. During the Ice Age, when the Sahara had a greater rainfall than at the present day, the Saoura also received the surface run-off from the Eglab and flowed as far south as the Ahaggar: the Ziz, rising in the High Atlas and now ending in the Sebkha ed Daoura, may have continued as far as the Erg er Raoui, in the hills west of the Saoura. Under present climatic conditions only the Guir succeeds in joining the Saoura at Igli. The oueds of the High Plateaux of Algeria and the Saharan Atlas—the Namous, Gharbi, Seggueur, and Zergoun—which were once tributaries of the Saoura, are now lost in the sand-dunes east of the Saoura, although the rainfall in the Saharan Atlas is sufficient to flood their valleys in some years, but not annually. The floods are of such force that the cliffs flanking the valleys fall and the river-banks are changed, and the resulting swirling body of water, rock, sand, and mud sweeps southward. The erg of the Saoura begins where the waters

of the floods spread out, and no flood is able to break through the sand-barrier (Photo. 16). As the oueds pass southward their channels become shallower, their banks lower, and the water loses force, volume, and velocity until it ceases to flow.

South of the erg, which runs for nearly 400 miles from west to east and 60 miles from north to south, the former courses of the oueds may be identified in the Sebkha du Gourara, where salt patches increase in size when storms and floods cause subterranean water to flow out on the surface. Thus the water, which has been transmitted under the dunes, finally reaches the Sebkha.

Only the Zousfana-Saoura has succeeded in the struggle against the invading and overwhelming dunes. On its west side it lies against rocky hills, limestones upstream of Igli and sandstones downstream. The watercourse marks the boundary between hard Palaeozoic rocks on the west and softer Mesozoic and later beds on the east, and it is, therefore, threatened by sand-dunes only on the east. It has thus been able to maintain a deep bed as far as Foug el Kheneg, where the flood waters flow within boundary walls which keep them from spreading out and dissipating themselves. Thanks to this channel, the snow and rain of the Atlas bring prosperity to the heart of the desert, a distance of nearly 400 miles. The Saoura is an unrivalled route of migration, trans-Saharan communications, and trade. It is a green line of palms running from Figuig, at the foot of the Saharan Atlas, to the northern foothills of the Ahaggar, and to it Figuig owes its highly important geographical situation.

South of Foug el Kheneg, the Saoura, here called the Oued Messaoued, traverses the Touat. In this region it spreads out and fails, floods lose their speed and volume, and from year to year the bed changes position. A sand bar is sufficient to turn its course. In former times floods reached the Touat, but now they rarely do so: sand bars their way to the south, and over a distance of some 100 miles the Saoura fades out.

About 100 miles east of the Oued Messaoued the desert surface rises to the Tademaït plateau, the south-western prolongation of the Cretaceous limestone hammada of el Gantra which stretches southward from the district of Ghardaïa. As the limestones of the Tademaït rest on pebble beds and sandstones of continental origin, the potential water resources of the surrounding plains are good. Thus three great regions of oases surround the Tademaït—the Gourara, Touat, and Tidikelt. The Gourara, lying at the lowest point between the Atlas and the Tademaït, is an elongated basin, open to the west, towards

which oueds converge from the Atlas and the Tademait. A line of sebkhas, of which the principal is Timimoun, marks the junction of Cretaceous and older beds, where the subterranean water is thrown out in springs and determines the situations of oases. The Gourara is better supplied with water than the Touat or Tidikelt: its population is about 21,000, with 800,000 palm-trees. The people are almost exclusively Berbers, Arabs being restricted to a few fortified villages (ksour). The Zenata of the Gourara have kept their language, although it has almost disappeared from the Touat region as a whole, as a result of Mohammedan reaction in the fifteenth century, with its massacres and forcible conversion of the Jews.

In the Touat the 'route des palmiers' (date road) from Figuig along the Saoura is straight for a distance of 120 miles between Bouda (near Adrar) and Taourirt. The row of sebkhas, often bordered by cliffs, suggests that the oases mark the former bed of a oued, probably the Saoura, but the Oued Messaoued passes to the west of the oases. The water comes from the Tademait and supports a population of 17,000 and 450,000 palm-trees.

The Tidikelt district marks the southern border of the Tademait. Its structure differs from that of the Gourara and Touat because the strata are folded to some extent, and all the palm-groves lie along north-south lines in basins. Thus the palm-districts of In Salah, In Rhar, and Aoulef are parallel to one another, each with its own characteristics and its own source of water. In the Gourara and Touat the oases are alined end to end. Some of the water also seems to come from outside the region, in fact from the Mouydir (a district on the northern flanks of the Ahaggar).

The population is about 12,000, with about 400,000 palms. Political predominance is in the hands of the Arabs, but the Touareg were suzerains before the French occupation. The Tidikelt is thus at the frontier of two civilizations and two languages, and the proximity of the Touareg stronghold of the southern Saharan massifs is manifest. The same character is revealed by the fact that a considerable fraction of the population remains nomadic, whereas the people of the Gourara and Touat are sedentary.

(ii) *The Limestone Hammadas and the Mzab.* A vast area of plateaux, arranged in horse-shoe fashion, surrounds the Igharghar basin and Chott Melghir, separating them from the Saoura (Photos. 18, 19). The great amphitheatre includes the Mzab in the north, the Tademait in the south-west, the Tinghert in the south-east, and the Hammada el Homra (chiefly in Italian territory) in the east. The plateaux are



18. *The Hammada of the Tademait*



19. *The Chott Melghir*



20. *The gara Krima near Ouargla*



21. *Berriane in the chebka of the Mزاب*

limestone hammadas, rocky, desolate, and without soil. The fundamental division is between the *bled el ateuch*, 'the land of thirst' (the hammadas), and the *bled el biar*, 'the land of wells and oases'.

Although the plateaux seem to be horizontal, in fact they slope eastward and end on the west in an escarpment. They are cut up by valleys, which are often wide and deep. Where the valleys cross one another are regions of *chebka* (streams and criss-crossed ravines). In the middle of the valleys isolated rock-masses remain, called *mehasser*, and on the plateaux are higher parts, left by denudation, known as *gour* (sing. *gara*) (Photo. 20). The margins of the plateaux are outstanding lines of cliffs, crowned by steep rock outcrops, called *kef*, or, if of considerable size, *djebel*. Southward from the Saharan Atlas and the district of Laghouat lies a region of shallow enclosed basins (*daya*), where storm-water accumulates until it sinks into the ground. Many of the hollows owe their occurrence to solution of the limestones.

The plateau which lies south of the *dayas* forms the *chebka* of the Mزاب (Photo. 21); it maintains a uniform altitude of 2,000–2,300 feet and ends on the west in the great cliff of el Loua, which extends for some 50 miles. The valleys crossing the hammada slope from west to east, and the Mزاب oases lie in them. There are five oases in the Oued Mزاب: Ghardaia (Photo. 17), Melika, Beni Isguen, Bou Noura, and el Ateuf. Berriane (Photo. 21), Guerrara (Fig. 20), and Metlili are in other depressions.

These oases of the Cretaceous plateaux are in an anomalous position, explicable only by their history. Some reserves of water are held at depth at the contact of the limestones with underlying marls, but the water-bearing beds are poor. Wells must be 175 feet or more deep to reach them. Barrages are used to collect water which occasionally flows in the Oued Mزاب, but years pass without a drop of rain, and, on an average, flooding of the valley may be expected in one year out of thirteen. Attempts in recent years to reach artesian water succeeded only in 1937, when a bore struck the water-bearing bed below the whole of the Cretaceous rocks at a depth of 1,417 feet.

The explanation of the presence of the Mزاب oases lies in the fortunes and industry of the Mozabites, a puritanical sect who were driven out of Tiaret by orthodox Mohammedans (p. 231). Their gardens are better kept and richer than any others: they have become a legend and are, in fact, gardens of great luxury. The only considerable palm-groves owned by the Mozabites are in Ouargla (Photo. 4). The seven towns of the Mزاب have a total population



FIG. 20. Guerrara, one of the cities of the Msab

of 30,000, with 260,000 palm-trees: the Metlili group comprises in addition about 2,000 people and 4,000 palms. The Mozabites are clever builders, using a high-grade mortar of limestone and gypsum called *timchent*. Ghardaia, on a rock standing above an open valley, is a striking example of their architecture (Photo. 17).

The Mزاب plateau is continued southward in the el Gantra, or el Goléa, plateau, which ends on the west in a continuous cliff, like that of el Loua. The oasis of el Goléa is situated at the foot of the cliff, at the margin of the dunes of the western Erg (Photo. 28). The oasis has been enlarged and has taken on a new lease of life as a result of the successful sinking of a dozen artesian wells. Above it, a *kasba* (fort) is perched on a steep-sided rock. The plateau itself is bare and arid. Eastward the hammada of the white limestones grades into the reddish hammada of pebbles and sandstones. The great Oued Mya, coming from the Tademait, passes through both types of hammada and continues towards Ouargla as a valley about 20 miles wide.

The Tademait itself, lying south of the el Goléa plateau, is absolutely barren, and the hard rocks are denuded to form sharp and rugged topography. The northern slopes are long and gentle with some vegetation and gum-trees in the long oueds; the southern flanks are abrupt. On all sides the plateau ends in steep cliffs called *baten*. At the foot of the cliff in the north lies the Meguidène plain, a pebble-desert (reg) without definite slope: the cliff rises about 400 feet above the plain. On the south-west the vertical cliffs of the Tademait, cut by steep-sided niches and slopes, stand above the Touat and Tidikelt (Photos. 22, 23).

(iii) *The Basin of the Oued Igharghar and the Oued Rir*. The Oued Igharghar, on the east of the Mزاب-Tademait plateaux, matches the Oued Saoura on the west side, but it slopes from south to north. It is occupied by ancient alluvial deposits and by the dunes of the eastern Erg, corresponding with the western Erg on the other side of the el Goléa plateau.

The Erg of the Igharghar extends to the south as far as el Biodh and north-east to Ghadames, ending sharply against the limestone plateaux of the Hammada of Tinghert and the Hammada el Homra. On the west it breaks up into isolated dunes, distributed over sandy plains. On the north the dunes lose height and merge into the plains, cut up by enclosed basins, which reach the margin of the Chott Djerid. Sand-free corridors, some of them 20 miles wide, traverse the sand area. The great sand area as a whole, therefore, differs

considerably from place to place; so also does its value as an obstacle.

During the Ice Age the Oued Igharghar crossed the Sahara from the region of the Ahaggar to the foot of the Saharan Atlas. Its torrents profoundly denuded the Tassili escarpments of the Ahaggar and cut a great trench, of which the steep banks and cliffs remain across the Tingher plateau. The oued disappears beneath the dunes, and the Gassi Touil marks its former course from el Biodh to Ouargla, near which the Oued Mya joins the Igharghar. The Kantra region corresponds with an old delta, over which are scattered gour, or hillocks standing isolated one from another, bearing witness to the force of the streams that swept away all else (Photo. 20).

The oasis of Ouargla lies in an enclosed basin bordered by a belt of sebkhas and invaded by sand at many points. An artesian water-table at a depth of about 100 feet supplies flowing wells. There are about a million palm-trees in the area (Photo. 4).

The eroded channel by which the Igharghar spread out towards the great Tunisian chotts is known as the Oued Rir, the valley of which is some 12 miles wide and slopes gently from 260 feet above sea-level to 43 feet below it at the margin of the Chott Melghir. It is clearly defined, in some parts by two lines of cliffs, and even the old meanders may be identified. Nevertheless it has been thrown into disorder by later changes, by the spreading out of alluvium, and by desiccation; water no longer flows on the surface.

In this low-lying region, which is as richly endowed with artesian water as any in the world, lie numerous important oases. The palm-groves begin at Blidet Amor, 13 miles south-west of Touggourt, and continue for 75 miles to the Chott Merouane. All the conditions needed for the formation of subterranean water resources are fulfilled. There are natural artesian springs called *chriats*, reaching the surface at the tops of small hills, perforated by craters from which the water gushes, like an eruption, owing to the high pressure. The natives have long understood how to dig artesian wells by primitive methods, but when the French occupied the Oued Rir in 1854 most of the oases were reported to be dying out. The French have transformed the country since that time and, with justification, are proud of their work. It is claimed that the yield of the wells has increased sixfold, to 66,000 gallons a minute, while date palms have increased fourfold, to 1,700,000, of which 80,000 are owned by Europeans. The population has increased from 25,000 to 61,000, and Touggourt is now linked to northern Algeria by the railway from Biskra.

The artesian water has been proved in recent years to come from the Sahara, not from the Atlas. The water-bearing beds slope down generally from south to north: the highest is only 40 feet below the ground-level, the deepest 525 feet at Touggourt and 620 feet at Mraier. Yields are variable; the biggest recorded are Ain Steeg (Mraier), 9,240 gallons per minute (1924), and Ourir, 14,300 gallons (1928).

The artesian resources are not inexhaustible and the maximum production seems now to have been reached. It appears unlikely that the flow can much exceed about 70,000 gallons per minute, whatever number of bores are utilized. To attain greater quantities bores would have to be made through the superficial deposits (which provide existing supplies) and the Cretaceous limestones to the sandstones on which they rest. The depth involved would certainly be very great, but no estimates are available.

The original flows of wells are not maintained and fall off with the passage of time, though at various rates. Wells upstream in the Oued Rir are dried up by wells downstream, and the failure of old palm-groves is the price of excessive development of young plantations. The 220 wells of the centre and north (Djamaa-Mraier) provide among themselves more than 44,000 gallons per minute, twice as much as the 914 wells of the southern oases (Megarine-Touggourt-Témachine). The multiplication of wells leads to loss of pressure, and recourse is made to pumping: each new bore henceforth borrows its water from pre-existing bores. Steps have, therefore, been taken by the French authorities to restrict the liberty of boring and to regulate the exploitation of subterranean water.

Irrigation necessitates drainage, and a drainage canal, or *khandek*, 23 feet wide and 5 feet deep, has been dug from Touggourt to the Chott Melghir to carry off used water, to aid its flow, and to drain marshes which make the oases unhealthy. Other works are planned, including the concrete lining of canals to reduce loss of water.

Sixty miles east of Touggourt on the Djerid route lie the oases of Souf, surrounded on all sides by sand. There are neither wells nor springs here; instead the water absorbed by the sand is stored in the underlying alluvial deposits, and the roots of the palms gain their moisture therefrom. When a new plantation is started a hollow is first dug in which the young trees are planted: rubbish is piled up to form a projecting mass like a funnel of sand, from which the green palm-leaves emerge. High winds cause the sand to invade the plantations, and it is then carried out again in baskets and emptied on to the other side of the dunes. The natives carry out this task of Sisyphus without

ceasing. The Souf oases comprise 39,000 people, excluding nomads, and there are 100,000 palms. The nomads own plantations in el Oued and flocks, which they pasture in the erg. In addition many of the Souafa (people of Souf) emigrate into the Tell Atlas, like the Mozabites, Biskris, and many other Saharan peoples. The houses of the Souf are unusual in that they are cubes made of a gypseous clay-stone, which serves both as stone and as mortar. The cubes are crowned by domes.

To the north the Oued Rir is bounded by a cliff—the Kef ed Dohr—which stands 260 feet above the northern margin of the Chott Merouane: the run-off from the cliff is eastward towards the Chott Melghir. The prosperous oases of the Ziban and Djerid receive their water from the north, and not from the south as does the Oued Rir (p. 51). The palms of the Ziban, Djerid, Oued Rir, Ouargla, and Souf together amount to more than 4 million.

(c) *The North-eastern Sahara*

Geology and Relief. The zone of Cretaceous limestone plateaux which extends south of the Atlas from Laghouat to the Tademaït describes an arc towards the east, enclosing the Igharghar basin and ending at the gulf of Sirte.

The limestone plateaux are narrowest in the Hammada of Tinghert, which is, in fact, a ridge between two great sand-dune areas, the Edeyen on the south and the Igharghar on the north. On the south the plateaux are followed by a depression, the Djoua, and form rocky country dotted with small limestone hills and cut by ravines. The Igharghar, coming from the south, breaks through by a gap and then dies out in the sands of the Erg. Near the frontier between the Algerian Sahara and Italian Libya the hammada swings northward and broadens into the vast Hammada el Homra, which lies in Libya, and is perhaps the largest, most lifeless, barren, unbroken, and monotonous of the limestone plateaux of north Africa. Its western escarpment, scarred by oueds, forms the eastern limit of the eastern Erg, especially in the frontier zone between Libya and Tunisia. Desert routes cross the frontiers at a number of points, converging on Ghadames, Brach, and Ghat, all in Libya. In the Algerian Sahara these routes, and others running from north to south, are controlled by administrative posts or forts established by the French. In this region, therefore, contact is made with territories to be described in other handbooks (those of Tunisia and Libya), and the north-eastern Sahara lies essentially within their boundaries.



22. *The southern slopes of the Tademait*



23. *The northern slopes of the Tademait*



24. *Tahat in the Ahaggar: view towards the south-west*



25. *Tazerouft, Adrar des Ajjjer*

2. *The Central Sahara*

In the centre of the Sahara lie mountainous massifs, owing their origin to broad elevations of the ancient rocks: along their borders lie huge plains. The altitude of the massifs lessens in some degree the rigours of the Saharan climate, and rainfall is sometimes considerable, resulting in the flooding of the oueds. Water is carried out along the drainage channels to the plains, but it soon sinks into the parched ground; by doing so it augments the potential subterranean water resources of the plains at great distances from the highlands.

The country may be divided as follows:

(a) The largest of the massifs is the Ahaggar.

(b) Surrounding the Ahaggar are elevated and tilted sandstone plateaux, known as *tassili*, which fall into districts termed the Ahenet, Mouydir, and Tassili des Ajjer.

(c) On the west of the region formed by the Ahaggar and the Tassili lie the great plains of the Tanezrouft.

(d) South-west of the Ahaggar lies another, smaller, massif of analogous constitution: this is the Adrar des Iforas. Only the north-east corner of it lies within the Algerian Sahara, the remainder being in French West Africa: it will not be described in this handbook.

(a) *The Ahaggar* (Photo. 24)

The Ahaggar is a desolate, rugged, and mountainous highland trenched by deep valleys which support variable amounts of vegetation, and here and there are sufficiently well watered for gardens to be maintained. The Touareg are the famed inhabitants of the massif (p. 229), living where they may in the valleys and in secluded spots, raising vegetables and other products in their gardens, and pasturing their much valued camels in the broader oueds, where thorn and desert plants are to be found.

Geology. In broad terms the geology of the Ahaggar is simple. The Archaean-Pre-Cambrian rocks, metamorphosed in varying degree and folded on north-south lines, have been elevated in a broad dome. Their worn surface, already peneplaned before the Palaeozoic, has been deeply denuded, and the Palaeozoic sediments which covered it have been stripped off. The massif is crowned by volcanic craters, necks, and flows, which now form fantastic and wild scenery. The Atakor or Koudia du Hoggar is the highest part of the plateau, a great dome capped by volcanic necks and flows. It was peneplaned, then elevated *en bloc*, the fractures providing passage for eruptive rocks,

first phonolites, then andesites and trachytes, and lastly basalts. The phonolite necks, the cores of former volcanoes, stand up 1,200 to 1,700 feet above the general level. The period of volcanic activity lay between late Tertiary and Recent times.

Relief and Water. The Ahaggar is a vast plateau, an assemblage of level tracts separated by steep steps. The flat expanses are usually formed of schists, penetrated by volcanic rocks. The Atakor, which dominates the region, is a shapeless massif, without harmony or clear-cut lines, an emaciated skeleton, but its colours transform it into weird and fairy-like scenery. Black basaltic plateaux rise out of a rose-coloured plinth of granites, and the volcanic needle-like necks turn lilac when the sun is setting, a wilderness of rock which appears unreal. The highest point of the Atakor is Tahat, recorded as 9,850 feet, but commonly regarded as about 10,000 feet: the volcanic peak of Ilamane is sharper and more characteristic. There are numerous peaks exceeding 6,500 feet. Towards the north an important mass, the Tefedest, reaches 7,645 feet; it is an imposing buttress of granite which was regarded as inaccessible and, in native legends, is the home of spirits. The upper valley of the Igharghar separates the Atakor from the Éguéré, which is another plateau capped by volcanic rocks. Eastward the Atakor is prolonged in another plateau, the Anahef, of much the same structure. In the middle of the mountain mass is the plain of Amadrar, a pebbly desert (reg), 75 miles long and 35 miles wide. The Atakor is lowered by about 3,300 feet in a single drop on the north and west.

The plateau has been cut up by running water in recent times and by the old rivers which run north towards the Igharghar and west to the Tanezrouft. Their relative activity has been governed by variations of climate and by movements of the massif itself. There is evidence that the climate was more humid in relatively recent times.

The Oued Tamanrasset and other watercourses, now flowing only from time to time, spread over the plain which stretches west and south of the Ahaggar (Fig. 19). Rain is not rare on the Atakor highlands, and the rivers which flow from them allow water to remain for long periods in certain valleys. Sometimes the water reappears, thanks to the presence of an undulation in the crystalline rocks below the surface, and small lakes result, called *aguelmans*. Shallow wells called *abankor* draw on sub-surface water in the oueds, a fact of great importance to the Touareg. In the higher ground there are permanent or semi-permanent streams. The main centres of population, such as Tamanrasset, Tazerouk, Idelès, and In Amjel, are in the low

levels of the Ahaggar, at about 4,900 feet. In spite of their poverty these centres or *arremes* prove that sedentary life is possible in the region (Photo. 26). The Touareg are, above all, pastoral people, and when rains are bad and pasturage poor they are forced to wander far afield with their camels. These people are few, and the total population of the Ahaggar as a whole does not exceed 5,000 in a region a quarter the size of France. Tamanrasset (Fort Laperrine), the administrative centre of the district, lies on the south side of the Atakor, between two granite masses separated by a hollow filled with sandy alluvium.

(b) *The Tassili: the Ahenet, Mouydir, and Tassili des Ajjer*

The Ahaggar is surrounded by a belt of Palaeozoic sandstone plateaux called tassili, barren uplands trenched by valleys in which live the scattered families of the Touareg.

Geology. An important series of 'Cambro-Silurian' sandstones, unconformable on the Archaean platform, with Silurian graptolitic shales, pass upward into Devonian to Carboniferous sandstones which are partly marine, partly continental, and finally continental only. It is thus seen that the sea transgressed over the platform of the Sahara, reaching the region of the Ahaggar in the Ordovician. Subsequent elevation and regression of the sea led to a spreading of continental deposition, the sea being entirely excluded probably before the end of the Carboniferous. Hercynian folding, which was severe in the north-western Sahara, did not seriously affect the central Sahara. There are north-south undulations in the Ahaggar-Tassili massif: elevation, associated with them, was followed by denudation and by the deposition of continental pebble beds and sandstones. Denudation and deposition have continued to the present day, though prolonged marine transgressions, both Cretaceous and Eocene, provided the materials of much of the surrounding plains and plateaux. The Ahaggar-Tassili dome was probably formed in later Tertiary times.

Relief and Water. The geological succession dominates relief. The older sandstones form the plateaux of the Internal Tassili, the shales are marked by lowlands, and the younger sandstones constitute the External Tassili plateaux. The lower sandstone group ends in cliffs broken by striking gorges like those of Arak (Photo. 27). The valley between the Internal and External Tassili, to some extent filled with sandy alluvium, is continuous from the Asedjrad to the Ajjer. The External Tassili end in a cliff above a gloomy flat plain, where the rocks appear here and there from beneath expanses of sand. The

plain, from north-west to north-east, separates the sandstone Tassili from the limestone plateaux of the Algerian Sahara: it is extremely arid between the Ahenet and Tidikelt, a little less desolate towards the east between the Tassili des Ajjer and the Hammada of Tinghert.

The belt of the Tassili is of very variable width. Often, as in the Ajjer country, it is wide, elsewhere it is locally much reduced by out-lying exposures of the Archaean rocks: nevertheless the two series of plateaux are always separated by a chain of depressions.

The Tassili plateaux spread over more than 10° of longitude and play an important role in the Sahara by reason of their relative wealth in water and pasture. They are absolutely desolate, but the sandstones are permeable and also fulfil conditions which encourage the creation of water-bearing beds, both superficial and subterranean. The floors of the oueds and the basins form a network of moist ground and vegetation.

The vast belt of the Tassili falls into well-marked divisions in terms of latitude, but is difficult to differentiate by reference to longitude. The most westerly part, the Ahenet, is a mountainous massif of which the base is about 1,650 feet above sea-level and the summits about 1,000 feet higher. The massif, being of no great height and bordering the arid Tanezrouft plains, is without running water except for floods in the oueds after rains. The floods are discharged north-westward and are lost in the Sebkha Azzel Matti. There are some wells, springs, and aguelmans (temporary lakes), but no arremes (centres of population) comparable with those of the Ahaggar. The Ahenet is a country of nomads, and nearly all its former inhabitants have abandoned it and gone to the Ahaggar and Adrar des Iforas.

The Mouydir (more correctly, Immidir) precisely resembles the Ahenet; the only difference is that of altitude, the Mouydir being higher, reaching 5,500 feet. Water is more abundant and pasture more widespread, and there is poor cultivation. Politically and ethnically the Mouydir is an appendage of the Ahaggar.

The Tassili des Ajjer lies between Amguid, where the Igharghar leaves the mountains, and Ghat (in Italian Libya). It rises in steps and includes difficult mountainous country, ending in steep cliffs and trenched by deep gorges. The main peaks, those of the Adrar des Ajjer, exceed 6,500 feet (Azéo Settefen, 7,743 ft.; Tazerouft, 6,726 ft.) (Photo. 25). Lava flows have come down from them and filled the plain of Dider, thus recalling the basalts of the Ahaggar. Water filters into the basalts and flows out in the sandstone areas. The Oued Iherir, a tributary of the Imhirou, trenched in sandstones, flows



26. *The Touareg settlement (arrem) at In Amjel, Ahaggar*



27. *The Arak gorge in the Mouydir*



28. *El Goléa: view from the ksar*



29. *Fort Charlet and the oasis of Djanet*

continuously from October to April, but it is unique: its deep gorge is adjacent to a high massif of permeable rocks (basalt). Beside the river, negroes live in dry-stone huts or *noualas*: they are not *haratin* (p. 231) and presumably are a very ancient stock. There are numerous indications that the Sahara was long habitable in the vicinity of the Ajjer, where the last remaining cypress and crocodiles have been reported. Elephants and hippopotami are portrayed in rock drawings here, as they are in most, if not all, of the Saharan and Libyan massifs, in which the present degree of aridity is possibly only a few thousand years old, perhaps considerably less.

The Admer plain is a part of the great marginal depression which surrounds the central massif from Amguid to Djanet (Fort Charlet), broken up by fairly recent earth-movements and by lava flows. Djanet lies at the bottom of a notch which breaks the line of the escarpment: it supports 1,500 people and 30,000 palms, and is a halting-place on the Air-Fezzan caravan route. Houses and mosques here resemble those of the Fezzan (Photo. 29).

The nobles of the Ajjer people traverse the Tassili valleys, where their serfs live, and drift towards Djanet, Ghat, and Mourzouk.

(c) *The Tanezrouft*

Apart from the highlands, the central Sahara is exceedingly arid, and falls into the category of *tanezrouft*, a word which is reserved for the most sterile parts—deserts in the most rigorous sense of the word. They are still imperfectly known.

Geology. The Tanezrouft lies between the northern flank of the Araouane syncline, composed of Palaeozoic sediments, and the western flanks of the Ahenet, Ahaggar, and Adrar des Iforas. The central part consists of pebbly continental deposits of no great age, lying on others which are, at least in part, Cretaceous, but between it and the Adrar des Iforas is a broad expanse of marine Cretaceous beds. In the north it encroaches on the Tidikelt-Touat country and on the north-west passes into the great sand-dune area at the eastern end of the Eglab. Here it consists of expanses of the Archaean platform with ridges of Palaeozoic rocks. Perhaps the most striking geological facts are the evidence of long-continued continental phases, and the proof of the magnitude of the Upper Cretaceous transgression into the heart of the Sahara.

Relief and Water. Between the Ahenet and the Adrar des Iforas the Tanezrouft has a width of 300 miles from north-east to south-west, and it is still wider farther west. For the most part it is excessively

flat, more or less free of sand, and its surface is pebbly. Water is, on the whole, very scarce and the region formidable to camel caravans: nevertheless, it has never been an absolute barrier provided the available water-points were known and duly reached. The surface presents little difficulty to modern motor transport, the effective use of which is a matter of organization.

The word *tanezrouft*, though applied geographically to the region outlined above, is descriptive of a condition rather than a place, and a zone of this nature exists round the south-west, south, and south-east flanks of the central massif of the Ahaggar, on the eastern side of which the word *ténéré* indicates similar conditions of surface and climate. No detailed description is needed here of these expanses, which pass into French West Africa, French Equatorial Africa, and finally into the south-west corner of Italian Libya.

NOTE ON MEANS OF SECURING WATER IN THE SAHARA (Fig. 21)

The following notes are intended to indicate the methods usually employed for raising or conveying water: they do not deal with sources of water, which are described in the appropriate sections of the text.

Only a few palm-growing districts are crossed by running water from which supplies can be taken throughout the year. They are to be found, above all, on the north-western fringe of the Sahara, where the mountains are high and snow abundant. In the river-oases a permanent centre is given up to palm-growing, and an outer circle devoted to cereals; the size varies with the magnitude of the seasonal flooding.

Few of the Saharan peoples ever see a river flow, and they must, therefore, exercise their ingenuity to obtain water from sub-surface sources.

For shallow wells the *shaduf* (French *chadouf*), used throughout Egypt, is by far the most widespread method in the Algerian Sahara and southern Tunisia (Photo. 30). It consists of a beam, pivoted between uprights, bearing at one end a balance-weight (frequently a mass of stone or of dried mud) and at the other a bucket. The bucket is attached to the beam by a long pole, which replaces the use of rope. The device is worked by hand, the bucket being thrust down into the water by manipulating the pole, and raised by hand, aided by the counterpoise. For irrigation the bucket is usually emptied into a narrow channel either made of hollowed palm-trees or lined with mud or stone. Otherwise the water is tipped into some form of tank.

Where the water is too deep to be raised by this ancient, primitive, but effective machine, rope and pulley are used, the water being drawn by a man or animal walking away from the well-head with the rope. This is known as a *bir*. In some places a ramp is built downward from the well-

head to facilitate drawing (Photo. 31). It follows that the depth of the well is indicated by the length of the beaten track or ramp trodden by the drawer of water: such ramps may be seen in the Mزاب, and in Italian territory in the Fezzan, and at Ghadames and Tripoli.

The mechanism known as *noria* consists of a horizontal (usually toothed) wheel meshing with a vertical wheel above the well, from which an endless rope with buckets passes down into the water. This is the *saqia* of Egypt, but it seems to be known only in a few places in the Algerian Sahara and the Fezzan.

Where the normal wells yield insufficient water for the available cultivation, subterranean channels are driven through the rock to tap additional supplies. These systems are called *foggaras* (Fig. 22). Where a water-bearing bed is found at some distance from the ground required to be



FIG. 22. *The tapping of underground water by foggaras*

irrigated, and at a higher level, shafts are sunk at intervals of about 30 feet and joined by vaulted underground passages. The floors of the passages are made horizontal or are slightly inclined, and the water flows along them, sometimes for many hundreds of yards, without loss by evaporation. These systems are widespread in the Algerian Sahara and the adjacent northern territories; they reach their highest development in the oases of the Gourara, Touat, and Tidikelt. In the vicinity of each oasis parallel lines of shafts, each with its mound of rock-debris, stretch to the horizon, forming a country of geometrically arranged mole-hills (Photo. 33). The whole of this astounding amount of work has been laboriously executed with no better implements than pick and basket. With the passage of time the excavations have had to be carried deeper and farther afield, bearing witness thereby to a possibly increasing desiccation of the country.

Oases endowed with flowing springs demand the least effort to secure irrigation, since the arrangement of the strata causes the water to flow out on the surface unaided: it then requires only *seguias*, or distributing canals (Photo. 32). Cultivators in such places have the supreme advantage of a constant volume of water, in contrast to the capricious flow of water in the streams and rivers of the desert margins.

In the course of centuries the Saharan peoples have learned to tap artesian sources, and the digging of artesian wells was the monopoly of a guild or corporation of *rhetessa*. With the means at their disposal the work was



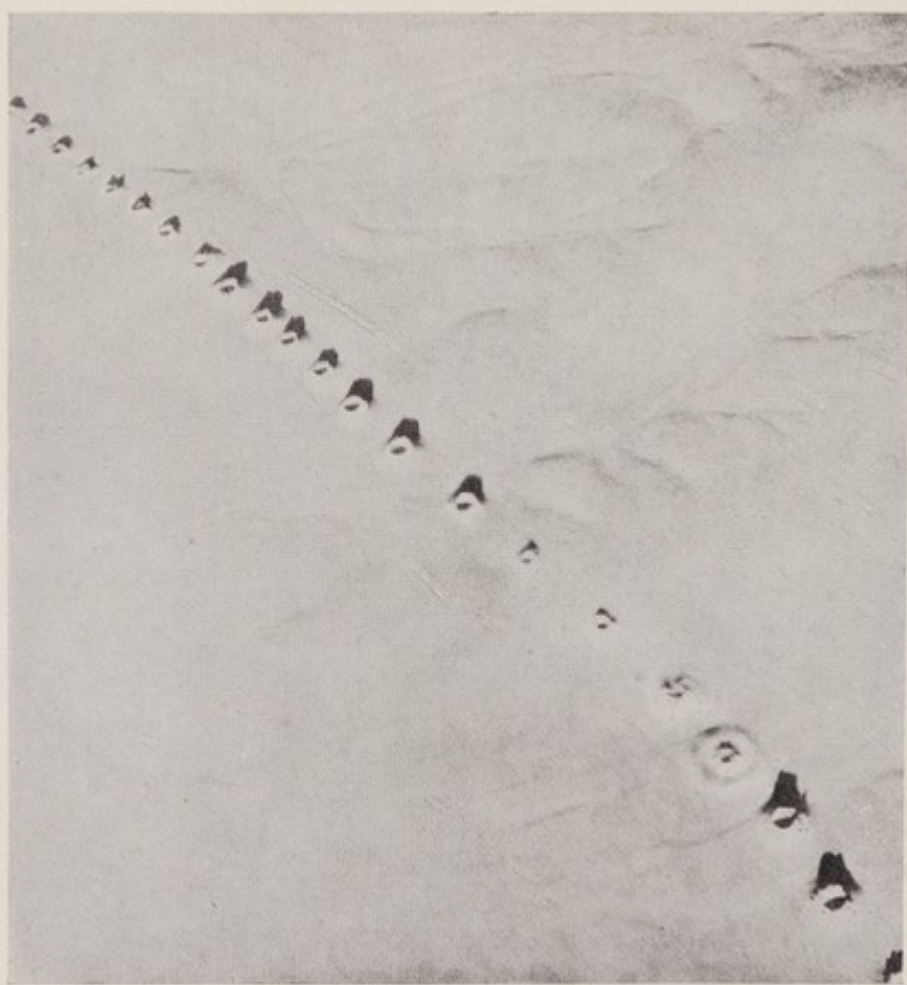
30. *Shaduf (chadouf)*



31. *Mozabite wells at Ghardaia*



32. *Seguias (distributing canals), Timimoun*



33. *Foggaras*

difficult and dangerous, and their efforts have in later years been partially supplanted by European methods of exploitation introduced by the French.

Ouargla and the Oued Rir are the main centres of artesian wells, while the Touat district is noted for its foggaras. The distinction has an obvious geological explanation, since the limestone hammada of the Tademaït lies between the two districts. Ouargla is situated at the bottom of a basin on the east of the plateau; the Touat district is on the margin of a dome and depends on springs near the surface.

To the above normal water-supplies some exceptional types may be added: for example, the Souf palm-groves (p. 73) and the Mzab (p. 69).

Water rather than land is held in ownership in the Sahara, and meticulous local laws and customs govern its use and division. For example, in Figuig the period of time during which the cultivator has the use of irrigation water is measured by the time a copper vessel with a hole in it takes to fill, that is to say, a water-clock or *karrouba*. In the Touat the usual water-gauge is called a *chekfa*. This is a copper plate with holes each of a known diameter; one of these is the unit of measure (*habba*), the remainder are fractions or multiples of that unit. With this instrument the water is divided among those with a right to it.

Each oasis or small group of water-supplies has its own guardian of supplies, the *amin el ma* or *kiel el ma*, who is also judge or arbitrator of disputes about irrigation. There has been prolonged strife not only for the possession of oases, but among their inhabitants for the possession of water.

It should be borne in mind that the date-palm, which needs artificial pollination every year, is not only the basis of all human existence in the Sahara, demanding sub-surface water, dry air, and great heat, but the umbrella under which all other crops may grow. Thus, in the oases, other fruit-trees—apricots, peaches, almonds, pomegranates, figs, vines—can be maintained beneath its shade, and beneath this double canopy grow wheat, barley, onions, beans, water-melons, henna, and tobacco.

The needs of defence have led the native population of the oases to gather in villages, either on the margin of the cultivated land, near the water-source, or on high ground capable of defence. The villages are called *ksour* (sing. *ksar*); most of them are surrounded by a wall, with a fort or citadel (*kasba*). Often isolated castles and watch towers are sited on the edges of the palm-groves. The architecture varies from place to place, according to available materials, local skill, and long tradition. Within the walled villages the narrow alleys are covered over and dark, the whole being reminiscent of an ant's nest. The *kasbas* and *ksour* are perhaps most typically developed in southern Morocco, but they are also to be found in the Mzab, Djerid, Souf, Ouargla, and elsewhere. They are not found in the highlands of the central Sahara, where date-palms do not flourish: small open villages or enclosures called *arremes* take their place at points where water is sufficient to raise crops and to support a few fruit-trees, but even these settlements seem to be a recent innovation (Photo. 26).

CHAPTER III

THE COAST OF ALGERIA

IN the following account, emphasis has been laid upon those parts of the Algerian coast where landing can be effected and upon the communications available at these points. Details of the sections of coast where landing is impossible, here dealt with briefly, can be obtained in *The Mediterranean Pilot*, volume i. Further information for the ports is given in volume ii of the handbook (Chap. XI). The names given are those commonly found on French maps of Algeria (especially those of the scale 1:200,000), except where well-known conventional English names exist, e.g. Algiers, not Alger. Alternative names, taken from other French and English maps and charts, and from the text of *The Mediterranean Pilot*, volume i, are normally given only twice in this chapter: at the first, and at the main, reference to the particular name. They are also given, wherever possible, on the maps illustrating the text. To avoid unnecessary repetition, the following abbreviations have been used:

- C. for *cap* and cape.
- Dj. for *djebel*, jebel, mountain, &c.
- O. for *oued*, wad, wady, river, &c.
- Pte. for *pointe* and point.
- St. for *saint*.
- Ste. for *sainte*.

Thus, O. Seybouse (Seibus) = Oued Seybouse, or Wad (or Wady) Seibus. The term 'main railway line' is used in the text for convenient reference to the railway line from Morocco in the west to Tunisia in the east, passing through the following Algerian towns: Tlemcen, Orléansville, Algiers (Alger), Sétif, and Guelma.

The distances given at the head of the following sections are approximate and refer to straight line distances, not those measured along the coastline.

The symbols used on the maps are explained in Fig. 23 only.

I. GENERAL SUMMARY

The coast of Algeria extends eastward from the mouth of the O. Kiss (Skiss) for about 615 miles to C. Roux, and is for the most part bold and rocky. Off it are a few small islands, but none at a

greater distance than 6 miles off shore; it has not been considered necessary to describe landing facilities on these islands in the following account. The land behind the coast is usually high, and often mountainous, especially in eastern Algeria, where the mountains of Kabylie rise over 7,500 feet. There are several deep bays, affording good anchorages, but no natural harbours, and a considerable number of artificial harbours have been constructed, the most important being (from west to east) Oran, Algiers, Bougie, Philippeville, and Bône. The coast is generally sparsely populated, except in the neighbourhood of the towns and where the plains of the Tell, the most fertile and highly cultivated part of Algeria, reach the sea. Further information as to the geographical characteristics of the coastal zone is given in the preceding chapter.

II. DETAILED DESCRIPTION

(1) *Moroccan Frontier-Oran* (98 miles) (Figs. 23, 26)

The western boundary of Algeria is the O. Kiss (Skiss), a small stream in summer, but much swollen in winter. Half a mile eastward of its mouth is Port Say (Adjeroud), built in 1906, but now silted up. There is no coast road, but an excellent road leads inland to Oudjda (Morocco), with branches to Nemours and Tlemcen. The O. Kiss can be crossed 1 mile inland at Saidia, which is linked by road with the Moroccan towns of Berkane, Melilla, and Oudjda.

From Port Say to Nemours the coast consists of a succession of bays, beaches, and rocky points for about 16 miles. None of the beaches is suitable for landing owing to the lack of good exits and the height of the land, which reaches 2,047 feet at Sidi bou Krirat, 8 miles south-south-eastward of Port Say. Port Kelah, which has a transporter for loading ore and lies on the eastern side of Pte. bou Madane (Ras bu Madane), 2 miles eastward of C. Milonia, is served only by poor tracks, as are the various small bays, such as Anse de Lemnis (Lemmis cove) and Mersa Oben Aid, where small ships load esparto grass during the summer.

The Baie de Nemours is an open bay with a clear sandy beach, the small artificial harbour of Nemours, protected by two jetties, lying in the eastern part. Near the western entrance-point of the bay is a harbour for fishing-vessels. The town (7,000 inhabitants) is on the southern side of the harbour at the foot of a plateau about 400 feet high, behind which rise the Traras mountains (Fig. 24). Good roads connect it with Port Say, Oudjda, and Oran (via Tlemcen and Ain

Témouchent). The only coast road goes eastward in the direction of Beni Saf, but beyond Ziatine becomes a mere track. Nemours is also connected with the main railway line by a normal-gauge line to Oudjda and serves as a commercial outlet for eastern Morocco as well as the westernmost districts of Algeria.

Between Nemours and Beni Saf (about 30 miles) the coast is generally irregular, high, and rocky, with cliffs often more than



FIG. 24. *The town of Nemours*

300 feet high. Landing can be effected on several beaches but, because of the height of the land near the coast, access to the interior is difficult. There is a small bay with a sandy beach on the eastern side of Pte. Lella Selti (Rastrella Selti), a point $1\frac{1}{4}$ miles south-eastward of the north-eastern extremity of C. Tarsa (Tarça), but the only exit is a steep track to the road leading eastward from Nemours. In Mersa Honain (Bay of Honain), on the eastern side of C. Noé, there is a sandy beach, with several piers for loading ore on the north-eastern side of the bay, but communications are poor and unconnected with the road system of western Algeria. The cove at Bordj Ouled Amar, south-eastward of el Mokreun, in which landing is possible, has land rising steeply to about 1,000 feet immediately behind it. At the peninsula of Lubar Damah, about $2\frac{3}{4}$ miles north-eastward of el Mokreun, there are also no exits from the

coves lying on either side; the western cove is available for small craft and the eastern has a shingle beach. The only beach with a suitable outlet is that of Mersa Tremezen (Tafna bay), where landing can best be effected some distance eastward of the mouth of the O. Tafna, which enters the sea in the middle of the bay. A good road leads eastward to Beni Saf and southward, along the Tafna valley, to Tlemcen, and also gives access at various points to the Beni Saf-Tlemcen railway.

Beni Saf, near the centre of the 7-mile stretch of high coast between C. d'Acra and C. Oulassa (Ussa, Gros) has an artificial harbour, formed by two jetties, and maintained for the export of the iron ore mined in the district (Fig. 25). The town (13,000 inhabitants) lies south-eastward of the harbour and is connected with the main railway



FIG. 25. *The artificial harbour of the iron-ore port of Beni Saf*

line by a narrow-gauge line to Tlemcen, and by first-class roads to Tlemcen and Oran via Ain Témouchent. There are also roads to the various mines near the town and, along the coast, westward to the mouth of the O. Tafna and eastward to C. Oulassa.

From Beni Saf to C. Lindles (Lindless), a distance of 37 miles, the coast consists mainly of steep cliffs, about 300 feet high, with occasional bays and beaches. There is no access from the shore to the Beni Saf-C. Oulassa road, and the first conspicuous break in the cliffs is Plage de Rio Salado, a beach $7\frac{1}{2}$ miles north-north-eastward of C. Oulassa, where the O. Melah (Mela, Rio Salado) reaches the sea. This beach is linked to the Ain Témouchent-Oran road and railway only by a narrow track about 9 miles long, and by a track leading south-eastward to the secondary road which passes through Turgot (Targa) to join the Oran road in the village of Rio Salado. Close eastward of C. Figalo (Fégalo) is a bay, Mersat bou Zedjar (Mersa bu Kejar), on the eastern side of which is a small sheltered creek, forming the mouth of the O. el Karvel (Kubi, el Farsh). A good road leads from this bay at Moul el Bahar to the Oran road and

railway at Lourmel, 8 miles inland. As far as C. Lindles the coast forms inaccessible cliffs backed by mountains rising steeply to 1,000–1,300 feet. There are coves on either side of the headland, Dj. Lalla Kadra (Allai Kadra): Mersat Ali bou Nouar (Mersa Ali ben Nuar) is on the south-western side and Mersat Madakh (Mersa Madagre) on the north-eastern side, but landing cannot be effected and only tracks lead inland. Landing is possible in some small creeks, about $2\frac{1}{2}$ miles north-north-eastward of Dj. Lalla Kadra; these creeks are

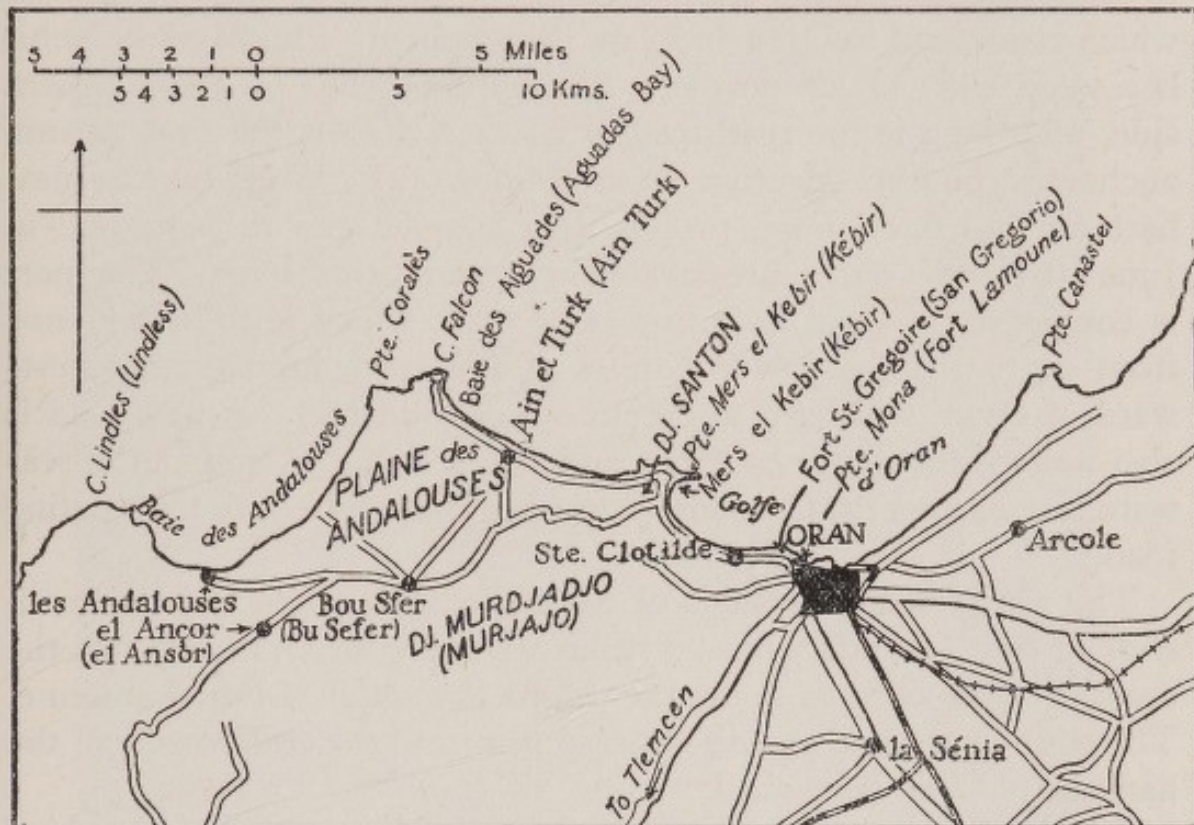


FIG. 26. *The coast: Oran district*

abreast and close southward of a steep-to islet, 112 feet high and lying close inshore, but there is no exit to the interior.

The Baie des Andalouses, extending for 17 miles from C. Lindles to Pte. Coralès, is backed by an elevated plain, Plaine des Andalouses, behind which Dj. Murdjadjo (Murjajo) rises steeply to 1,585 feet. Along the southern edge of the plain are the villages of el Ançor (el Ansor) and Bou Sfer (Bu Sefer), both of which are linked by a good road to Oran, as is the village of les Andalouses, on the bay itself: landing is best effected on the beach in the neighbourhood of the latter village.

C. Falcon is the rocky north-eastern end of the broad promontory of which Pte. Coralès is the north-western extremity, and is the

westernmost point of the Golfe d'Oran which extends for 16 miles north-eastward to C. de l'Aiguille (Abuja point). On the south-eastern side of C. Falcon is the small Baie des Aiguades (Aguadas bay), where landing can be effected on the beach near a path leading to the lighthouse; from here there is a good road to Oran, with a branch to Ain Témouchent. Between C. Falcon and Pte. (Ras) Mers el Kebir (Kébir), the easterly projection of Dj. Santon, the coast is formed by a clean sandy beach and backed by a well-cultivated plain, in the centre of which is the village of Ain et Turk (Ain Turk), from which roads lead to Oran and Ain Témouchent. Pte. Mers el Kebir has steep cliffs on its northern side with beaches on the southern side, off which is the roadstead of Mers el Kebir, the best natural anchorage on the Algerian coast (Photo. 34). Work on the new harbour and naval base, proposed in 1935, began in 1937, and in June 1939 the outer breakwater was 200 yards long. The port is connected to Oran by a first-class road, which is to be widened from 33 to 131 feet: over 3 miles of this road, immediately westward of Oran, will have to be cut out of solid rock. A new road is also being built between Oran and Mers el Kebir, round the seaward face of Fort St. Gregoire (San Gregorio) and above the existing road.

The sandy beach of Mers el Kebir, behind which lies the road, ends at Ste. Clotilde, about 3 miles westward of Oran, whence the coast becomes cliffy as far as Pte. Mona, on which is Fort Lamoune. The cliffs then cease and do not reappear until the eastern side of the harbour of Oran is reached.

Oran, the chief port of western Algeria, also deals with much of the trade of eastern Morocco. It is surrounded by hills and cliffs and so can be more easily defended than most north African ports. The artificial harbour consists of six basins, protected on the northern side by a breakwater extending eastward for about $1\frac{1}{2}$ miles from Pte. Mona. The town lies on high ground, sloping down to westward and dropping abruptly on the northern side to the harbour (Photo. 35). The population is 200,671 (including 152,603 Europeans, half of whom are Spanish with a mixture of Portuguese) together with the adjoining towns of Mers el Kebir, la Sénia (Senia), and Arcole. Oran is an important centre of roads, including those to Tlemcen (via Ain Témouchent), Sidi bel Abbès, Algiers (via St. Denis du Sig or via Arzeu (Arzew)), and the local coast roads westward to Mers el Kebir and beyond, and eastward to within 1 mile of Pte. Canastel. There are normal-gauge railways to Ain Témouchent and Ste. Barbe



34. *The bay and naval base of Mers el Kebir, near Oran, from the north-east*



35. The port of Oran from the west (sandstone plateau in background)

du Tlélat, where the main line branches, eastward to Algiers, and westward to Sidi bel Abbès, Oudjda (Morocco), and Casablanca (Morocco). From this western line there is a branch at Tabia to Ras el Ma (Crampel). A narrow-gauge line connects Oran with Arzeu and Mostaganem (Mostaghanem). Railways serve two of the quays in the harbour.

(2) *Oran-Algiers (Alger)* (218 miles) (Figs. 26, 27, 28, 30, 31)

From Oran to Algiers a first-class road generally lies within a short distance of the coast, passing through Arzeu, Mostaganem, Ténès (Tenez), and Cherchel (Cherchell, Port Shershel), but the coast is mainly cliffy with very few beaches suitable for landing. Between Oran and Arzeu, Djs. Krichtel (Kristel), Bonrousse, Orousse, and Sidi Moussa form a great hilly promontory rising to 2,076 feet in Dj. Orousse, $3\frac{1}{2}$ miles south-eastward of C. de l'Aiguille (Abuja point), and falling to the sea in cliffs. The only communications are mineral railways and inferior tracks which seldom reach the coast. The Oran-Arzeu road and railway both follow the lower-lying land southward of the promontory.

The Golfe d'Arzeu, extending from C. Carbon for about 30 miles east-north-eastward to C. Ivi, has Arzeu on its western side, Port aux Poules at its head, and Mostaganem on its eastern side. Its shores are mostly low, being backed by the plains of the O. Sig and the O. Habra. Arzeu (Arzew) is a small port with a few quays sheltered by a jetty extending east-south-eastward from Fort de la Pointe (Fort Point) (Photo. 36). The town (8,805 inhabitants) lies westward of the quays and is linked by road with Oran, Algiers (along the coast), and Sidi bel Abbès (via Ste. Barbe du Tlélat and via St. Denis du Sig). There are narrow-gauge railway lines to Oran, Mostaganem, les Salines (a local mineral line), and the main line at Perrégaux, from which a narrow-gauge line continues southward to Colomb Béchar and Kenadza.

Southward of Arzeu the shore is sandy, and backed by low cliffs, for 8 miles to Port aux Poules, where the O. Macta, the combined estuary of the O. Sig and the O. Habra, enters the sea. The port affords no shelter, being merely a slight indentation in the coast, and is visited by only a few coasting vessels. Eastward from Port aux Poules the sandy shore continues for about 3 miles to C. Rouge, forming Macta beach. Here landing is easy and there are good exits, by railway to Oran, Mostaganem, and the main line at Perrégaux, and by road to Oran and Mostaganem. Cliffs, 60 to 130 feet high,

trend north-eastward from C. Rouge almost continuously for 11 miles to Pte. de la Salamandre (Mazagran point), but they are broken by two beaches, la Stidia Plage, fronting the village of la Stidia, about 5 miles north-eastward of C. Rouge, and a beach about $2\frac{1}{2}$ miles south-westward of Pte. de la Salamandre, opposite the Mazagran signal station. Both beaches lie close to the Arzeu-Mostaganem road.

Mostaganem (Mostaghanem) harbour, on the eastern side of the Golfe d'Arzeu, 1 mile north-eastward of Pte. de la Salamandre, is formed by two moles; the entrance between their heads faces south-westward (Photo. 37). Dredging operations have been carried out in recent years and extensive works were in progress in 1939. The town (38,555 inhabitants, including 18,150 Europeans) stands on a tableland, nearly 1 mile eastward of the port. Its chief road connexions are along the coast to Oran and Algiers and inland to Perrégaux and Relizane. There is a narrow-gauge line to the main line at Relizane, from whence it continues to Tiaret and Burdeau. Another narrow-gauge railway links Mostaganem with Oran (via Arzeu), from which a line branches off near the mouth of the O. Macta to the main railway at Perrégaux, and, beyond Perrégaux, to Colomb Béchar and Kenadza.

At Pte. Karouba (Karuba, Ras Mostaghanem), 2 miles north-north-eastward of Mostaganem, cliffs reappear for 3 miles until the low ground near the mouth of the O. Chélif (Chéliff, Shelif) begins. This river, the largest in Algeria, has very little water over the bar, especially in summer, and its entrance is obstructed by a considerable sandbank. The beach, which extends 1 mile northward of the mouth, is difficult and dangerous to approach, as are the small beaches farther northward to C. Ivi. The coast road, after crossing the O. Chélif by an iron bridge half a mile inland, lies within half a mile of these beaches, but beyond C. Ivi, where the coast becomes rocky, the road lies farther inland, although the land slopes more gradually to the sea. From this road a main road follows the Chélif valley to join the Oran-Algiers road between Relizane and Orléansville, and branches reach the coast at Port de Bosquet (Bosquet Plage) and Petit Port (Porticioli). Port de Bosquet, about $4\frac{1}{2}$ miles north-eastward of C. Ivi, has a small masonry jetty, but is available only to small craft. Petit Port, a small village with a pier, is 6 miles farther north-eastward on the eastern side of Pte. d'el Aoua (el Aua), a bare rocky point $2\frac{3}{4}$ miles east-north-eastward of Kef el Asfer (Assfer). Near C. Kramis (Khamis), 20 miles north-eastward of Port de Bosquet, the road again

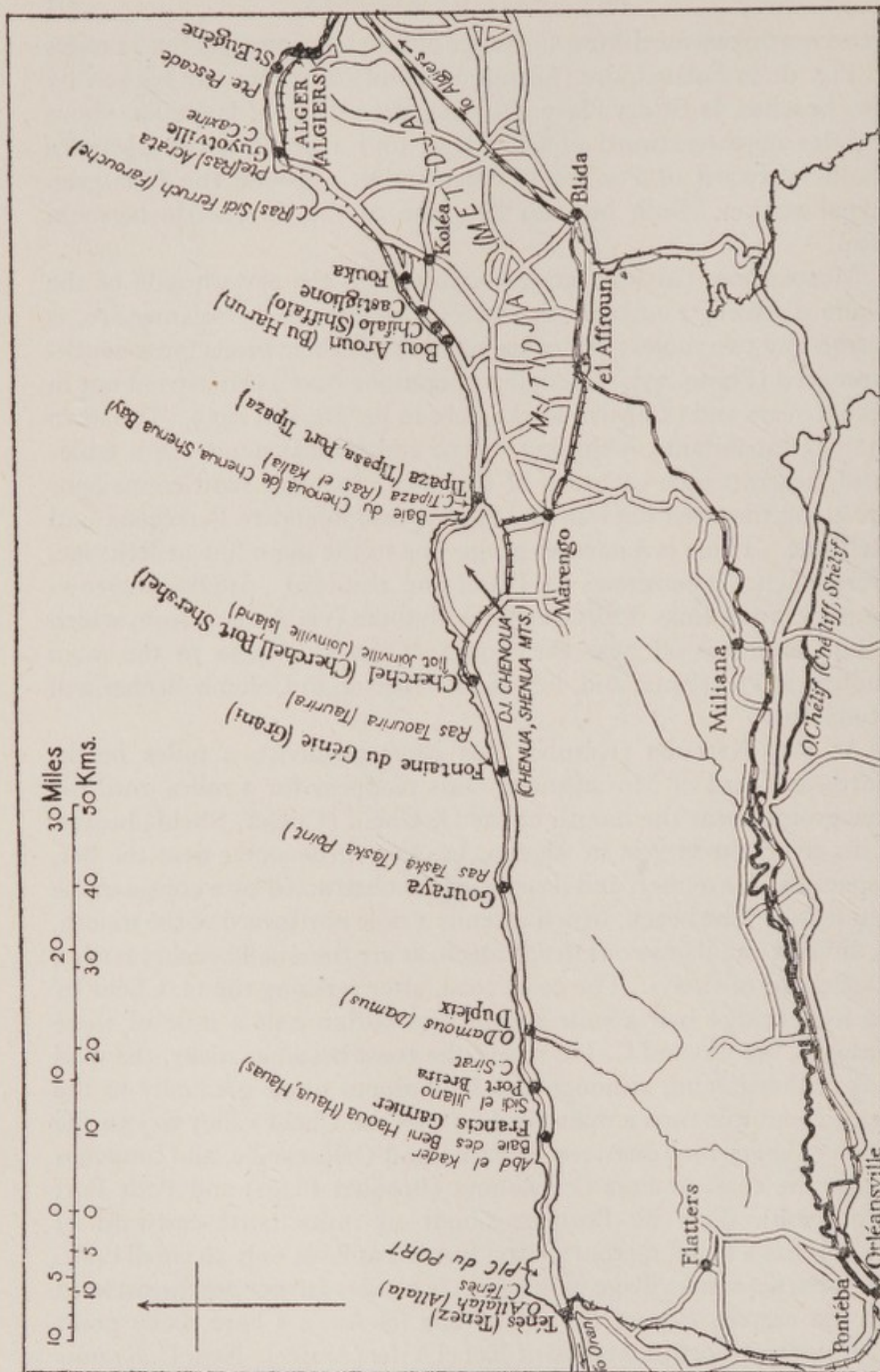


FIG. 28. The coast: Ténès to Algiers

approaches the coast and as far as Ténès is never more than half a mile inland. From C. Kramis past C. Magroua (Magrowa) to Pte. de Colombi the coast consists of a sandy beach backed by downs, but landing cannot be effected. Beyond Pte. de Colombi the coast is high and rocky for about 22 miles to Ténès, landing being possible only in a cove between Pte. Rouge and the bay, el Mersa; the cove is exposed to northerly winds, but has easy access to the coast road. El Mersa and Mainis bay, 2 miles eastward of C. Kalah, have anchorages but no landing-beaches.

The port of Ténès (Tenez) is about $1\frac{3}{4}$ miles south-westward of the western extremity of C. Ténès, the cliffs of which are nearly vertical and from 600 to 1,000 feet high, and backed by a ridge reaching 1,148 feet in Pic du Port. Ténès harbour is formed by a north-eastern and a south-western jetty, and its entrance, facing north-north-westward, is protected by a detached breakwater (Photo. 38). The town (5,200 inhabitants) is 1 mile south-westward of the harbour, on the western side (left bank) of the O. Allalah (Allala). The south-western quay is connected with the narrow-gauge railway joining Ténès to the main line at Orléansville. The roads include the coastal roads to Oran and Algiers, and those to Orléansville, Pontéba (via Flatters), and Fromentin.

Between C. Ténès and Cherchel there is a succession of bays, backed by cliffs and separated by headlands, but landing can be effected at only a few points, and access is generally difficult to the coast road, even though it usually lies within a short distance of the sea. There is a clean sandy beach in the Baie des Beni Haoua (Haua, Hauas), between Pte. Abd el Kader and Sidi el Jilano, an islet joined to the mainland by a foot-bridge. The village of Francis Garnier lies at the head of the bay with Port Breira in the lee of Sidi el Jilano, where there is an electric transporter by means of which small coasting vessels can load ore, though the port is now disused. About a mile eastward of C. Sirat is another beach, through which the O. Damous (Damus) enters the sea, about half a mile westward of the village of Dupleix. From Dupleix a road goes southward from the coast road for about 5 miles along the gap in the mountains formed by the O. Damous. At Gouraya (Guraya), half a mile south-westward of Ras Taska (Taska point), there is a jetty, alongside which small vessels can secure. Landing is also possible at various points along the shingle beach extending for 7 miles eastward of Ras Taska to Ras Taourira (Taurira), and westward of Ras Taourira, near the village of Fontaine du Génie (Grani).

Cherchel (Cherchell, Port Shershel) a small artificial basin constructed between Îlot Joinville (Joinville island) and the coast southward of it, gives excellent shelter in all weathers to small vessels drawing 9 to 12 feet (Fig. 29). The town (12,225 inhabitants) lies immediately southward of the harbour, and is backed by hills. A narrow-gauge railway links it with the main line at el Affroun, and there are road connexions with Algiers (via the coast, and via Marengo, el Affroun, and Blida), Miliana and Orléansville (via Marengo), and Ténès and Oran (via the coast road).

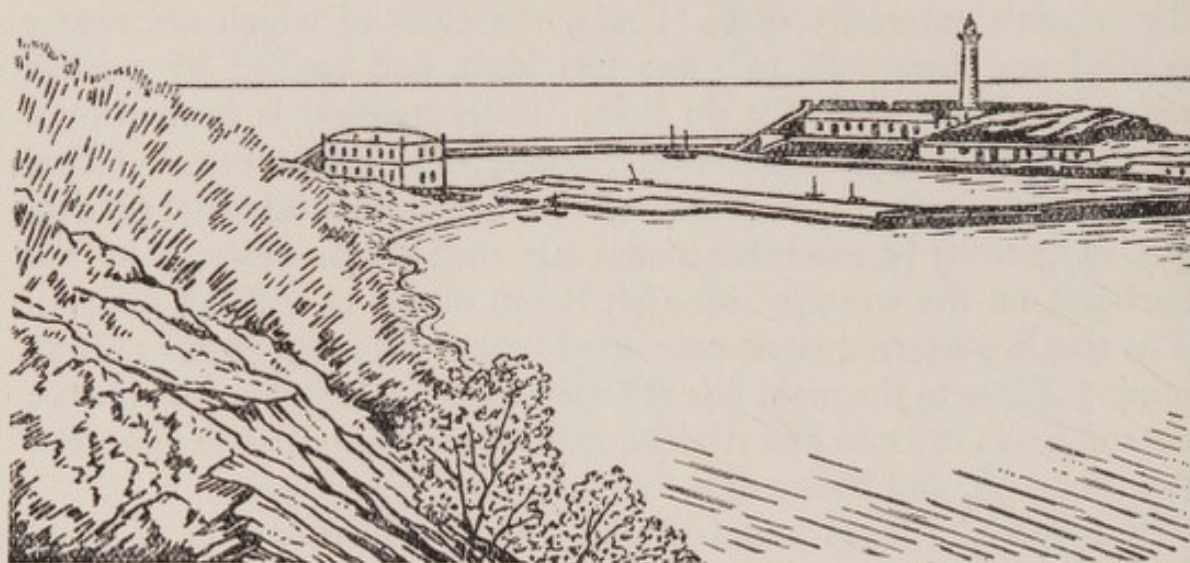


FIG. 29. *The port of Cherchel*

Between Cherchel and Tipaza (Tipasa, Port Tipaza) is a rounded promontory dominated by Dj. Chenoua (Chenua, Shenua mountains), reaching 2,969 feet; for considerable distances it is bounded by cliffs. There are several bays with sandy beaches, notably that of the Baie du Chenoua (Baie de Chenua, Shenua bay), into which the O. Nador flows, but communications inland are difficult, the main road here having left the coast to pass southward of the mountains. Landing is possible only at Tipaza, a small haven (4,230 inhabitants) near an open roadstead, on the Baie de Tipaza, which lies eastward of the Baie de Chenoua and extends from C. Tipaza (Ras el Kalia) to Jezirat Sidi Said (Photo. 39). The shelter afforded is poor and landing on the mole extending northward from the shore is difficult, and sometimes impossible, in summer, even with light onshore breezes. Close westward of the town, which lies on the southern side of the haven, is a good sandy beach. There are main roads to Cherchel and Algiers, and, via Marengo, to Miliana and el Affroun, and also a road to



36. *The port of Arzeu from the north*



37. *The port of Mostaganem*



38. *The port of Ténès from the south*



39. *Tipaza from the west*

Cherchel along the coast of the Chenoua promontory. The nearest point of the Cherchel-el Affroun railway line is about 4 miles distant.

Beyond Tipaza the coast trends east-north-eastward for $21\frac{1}{2}$ miles to C. (Ras) Sidi Ferruch (Farouche) and is fronted by lines of cliffs alternating with sandy beaches, some of which are extensive. The main road is generally within a short distance of the coast, which

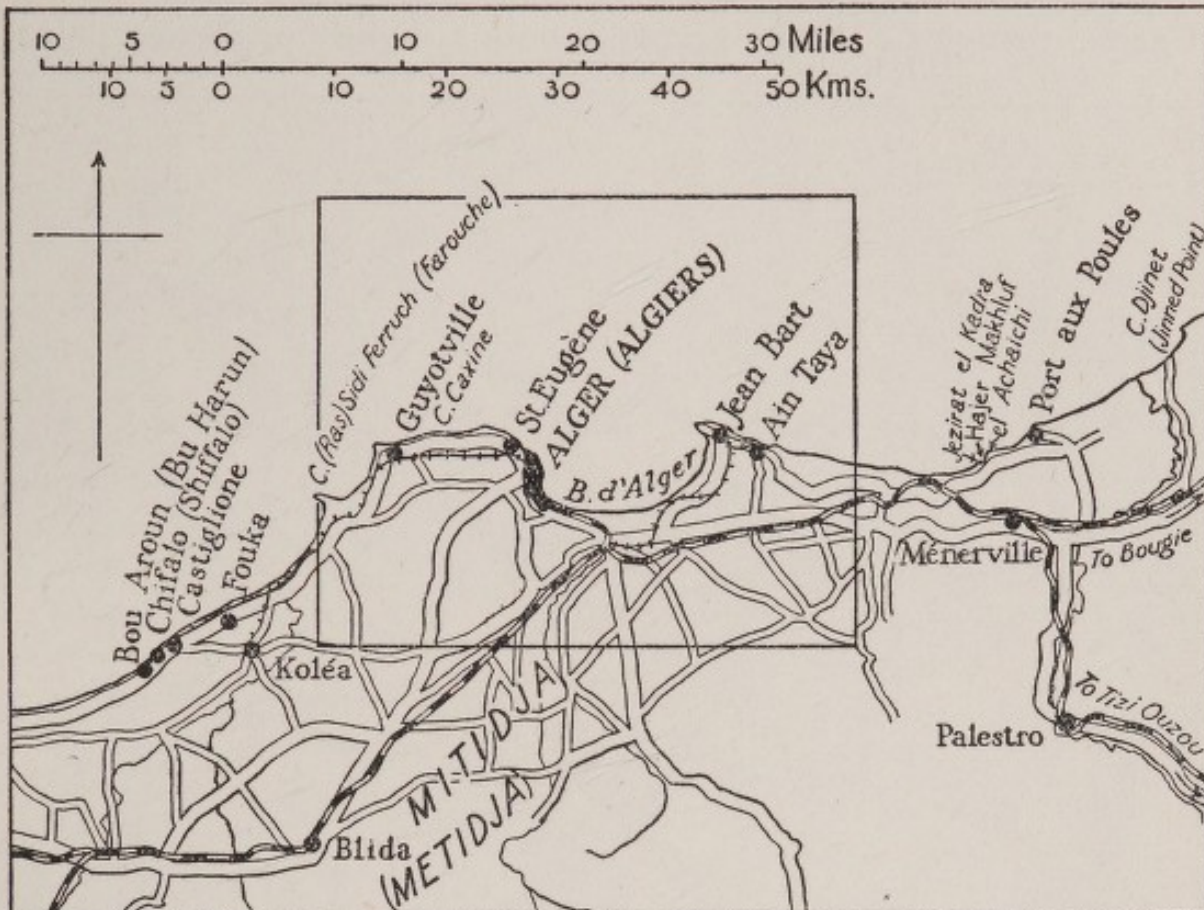


FIG. 30. *The coast: Bou Aroun to Port aux Poules and Cap Djinet. The area near Algiers included in the rectangle is shown in greater detail in FIG. 31*

is backed by a ridge of hills, 650 to 920 feet high. Small harbours for fishing-boats have been constructed at Bou Aroun (Bu Harun) and Chifalo (Shiffalo), respectively 2 miles and 1 mile south-westward of Castiglione, a village 12 miles eastward of Tipaza and linked to Algiers by the coast road and a narrow-gauge railway. About $2\frac{1}{2}$ miles east-north-eastward of Castiglione there is a beach, fouled by rocks at its north-eastern end, below the village of Fouka (Fuka). There are also extensive beaches on either side of C. (Ras) Sidi Ferruch (Farouche), the end of a small T-shaped promontory, 10 miles westward of Algiers. That to south-westward, the scene of the main French landing in 1830, is very suitable for landing, being

sandy and fairly steep-to, with a clear approach from the sea and with many exits through cultivated ground. There is easy access to the good roads linking Cherchel and Algiers either along the coast or across the promontory between Sidi Ferruch and Algiers, and to the narrow-gauge coast railway eastward to Algiers and westward to Castiglione and Koléa.

The promontory westward of Algiers is generally known as C. Caxine, though C. Caxine proper is only a slightly projecting point

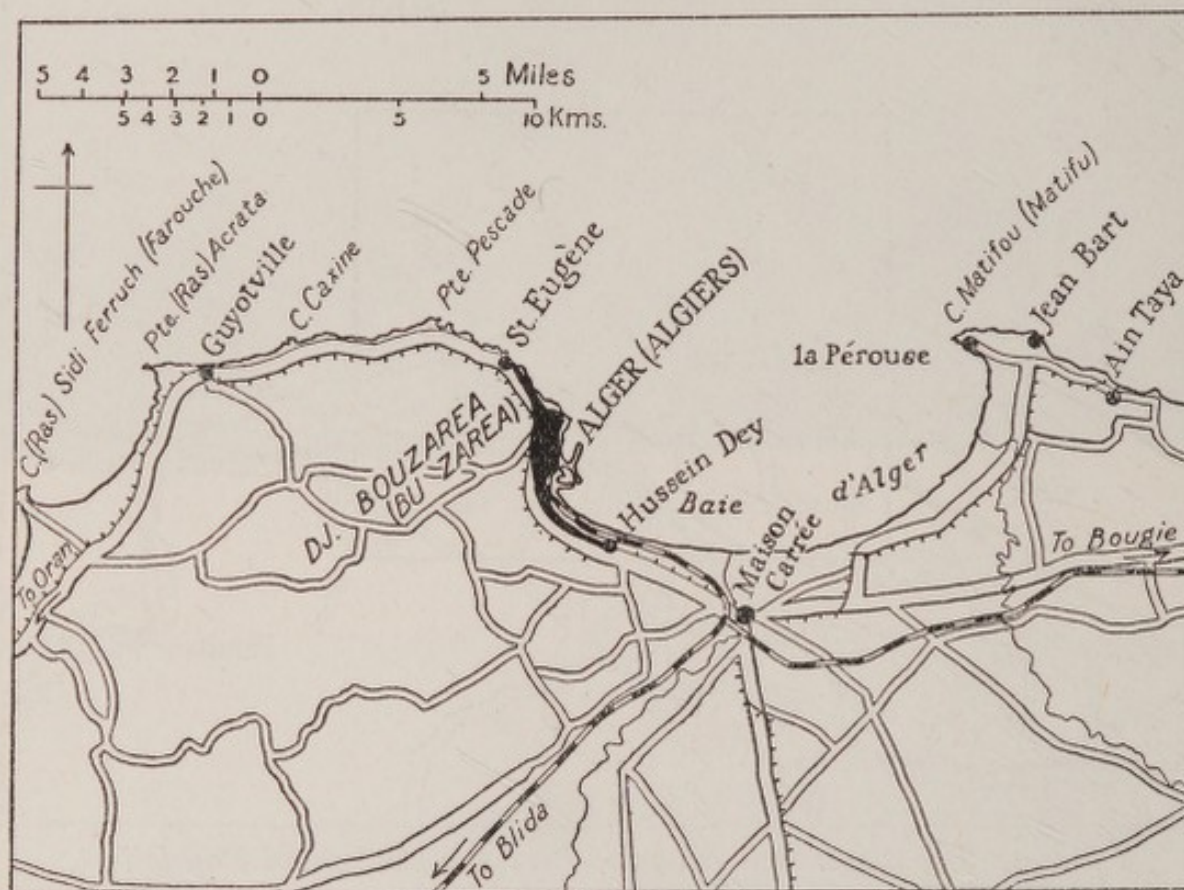
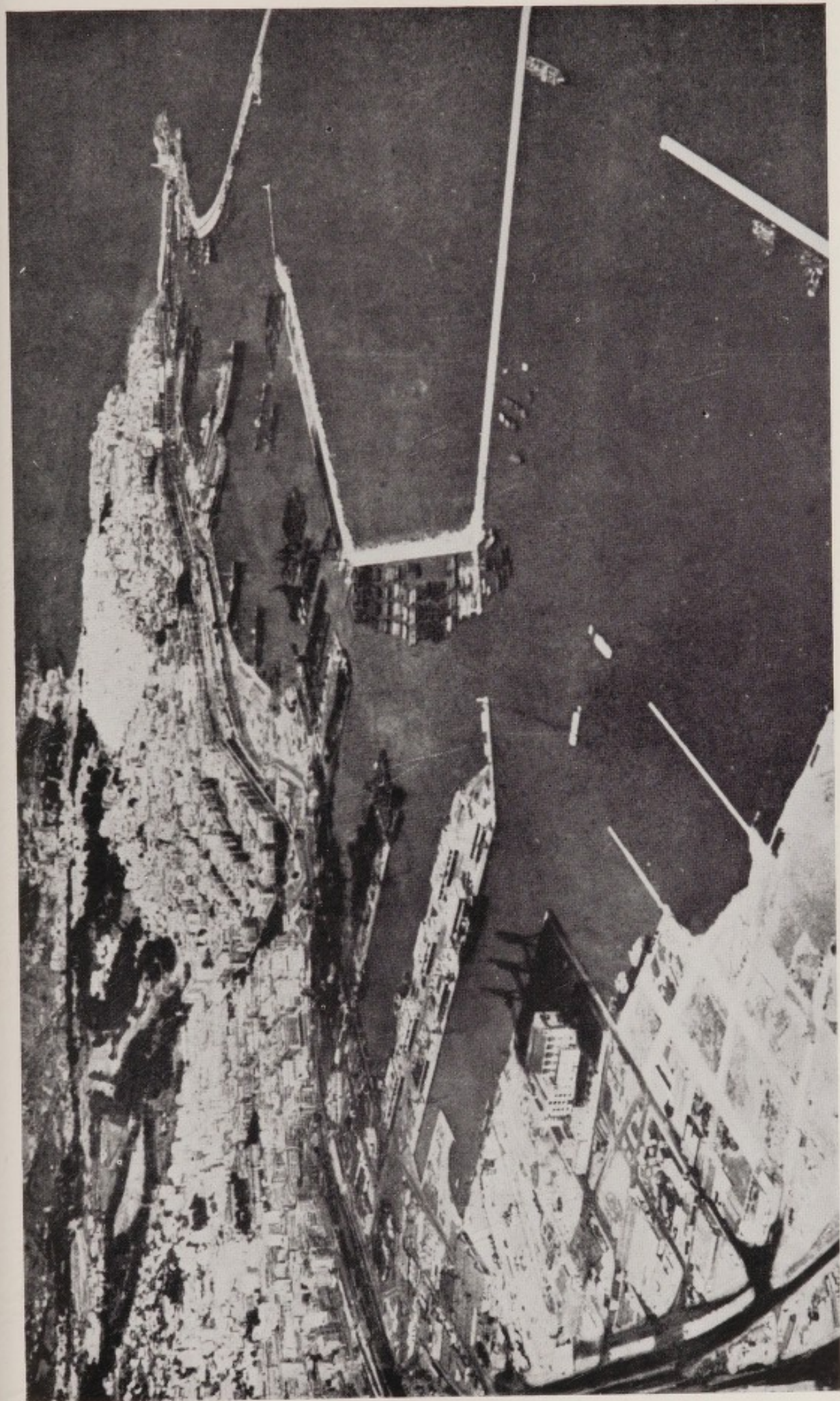


FIG. 31. *The coast: Algiers district*

about 6 miles north-eastward of Sidi Ferruch. Sandy beaches extend for about $3\frac{1}{2}$ miles from Sidi Ferruch to Pte. (Ras) Acrata, but the coast as a whole to Algiers is cliffy, rock-bound, and useless for landing. There is a small mole at Guyotville, 1 mile eastward of Pte. Acrata, and a landing-jetty westward of the eastern part of the double point, Pte. Pescade, about 3 miles eastward of C. Caxine lighthouse. From both landing-places an excellent road leads to Algiers through its suburb of St. Eugène.

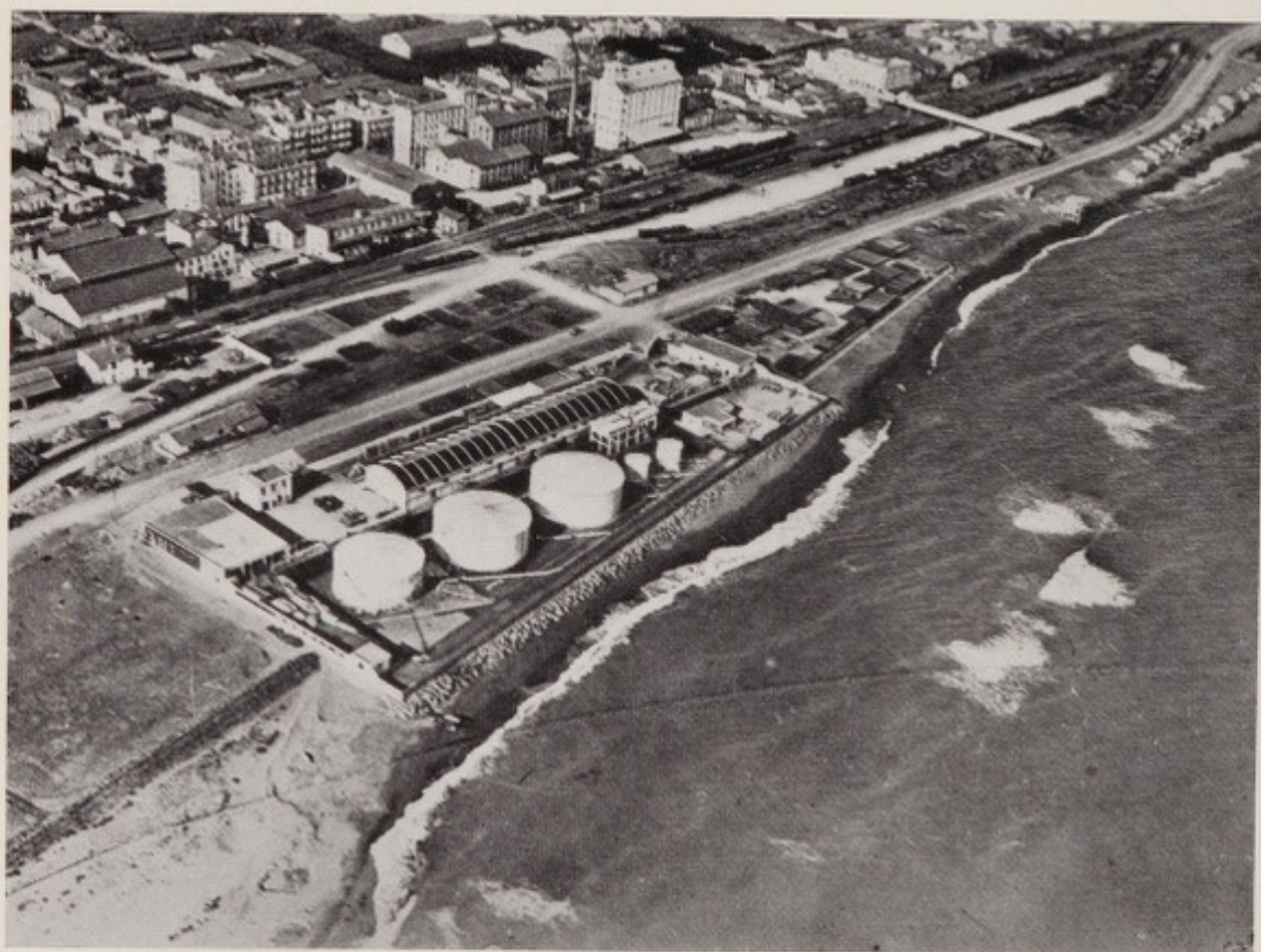
The Baie d'Alger (Algiers bay), extending for about 20 miles from Pte. Pescade to C. Matifou (Matifu), is open to northward. Its shore consists mainly of a sandy beach, but on the western side there are



40. *The port of Algiers from the south*



41. *The port of Collo from the south-west*



42. *Hussein Dey, east of Algiers (the refinery and tanks have been enlarged since the photograph was taken)*

cliffs between Pte. des Consuls and Pte. des Anglais. These are succeeded by the shallow, sandy Baie de Saltpetre, which extends to Pte. el Ketani (Kettani), beyond which lies the port of Algiers.

The port of Algiers (French, Alger) consists of three basins: the Bassin du Vieux Port, the northernmost and oldest, the Arrière Port, southward of the Vieux Port, and the Bassin de Mustapha, the southernmost basin, still under construction (Photos. 5, 40). A wide road and a railway serve all the docks, with branches of the railway to every quay. Algiers (264,232 inhabitants, including 182,503 Europeans) is the capital and chief port of Algeria and the residence of the Governor-General. The town is hemmed in between the sea and the hills of Dj. Bouzarea (Bu Zarea), which reach 1,200 feet, and the built-up area extends for over 10 miles, from Pte. Pescade in the north to Hussein Dey and Maison Carrée in the south. Most of the buildings are on the fairly steep southern slope of Dj. Bouzarea and are dominated by the Kasba, or citadel, and a number of forts. The best roads from the town are those along the coast in both directions and those inland to Blida and Médéa, Aumale, Sétif and Constantine (via Bouira), and Bougie (via Tizi Ouzou). There are railways westward to Oran and Morocco and eastward to Tunisia, with branch lines at Ménerville for Tizi Ouzou and at Beni Manşour (Mançour) for Bougie (both normal gauge); there are also narrow-gauge branches at Blida for Djelfa and at el Affroun for Cherchel.

(3) *Algiers-Bougie* (109 miles) (Figs. 30, 31, 32)

Eastward of the port of Algiers, the Baie d'Alger continues for about 14 miles to C. Matifou and is surrounded by sandy beaches, behind which is the low-lying, level plain of the Mitidja (Metidja). Conditions for landing are probably best at the beach stretching for about 2 miles eastward of Hussein Dey station (Photo. 42), but the whole coast has easy access to the Algiers-Tizi Ouzou-Bougie and Algiers-C. Matifou roads, and to the railways which lead eastward to Constantine and Tunisia and westward to Oran and Morocco. There is also a narrow-gauge line from Maison Carrée to Ain Taya, which is connected by a good road to the landing-jetty at la Pérouse, near C. Matifou.

From the village of Jean Bart, near the eastern extremity of C. Matifou, the coast trends in a general east-north-easterly direction for about 31 miles to C. Benngut (Bengut), and consists mainly of a sandy beach, backed by sandhills and occasionally broken by steep headlands. Landing can be effected at several places between Ain

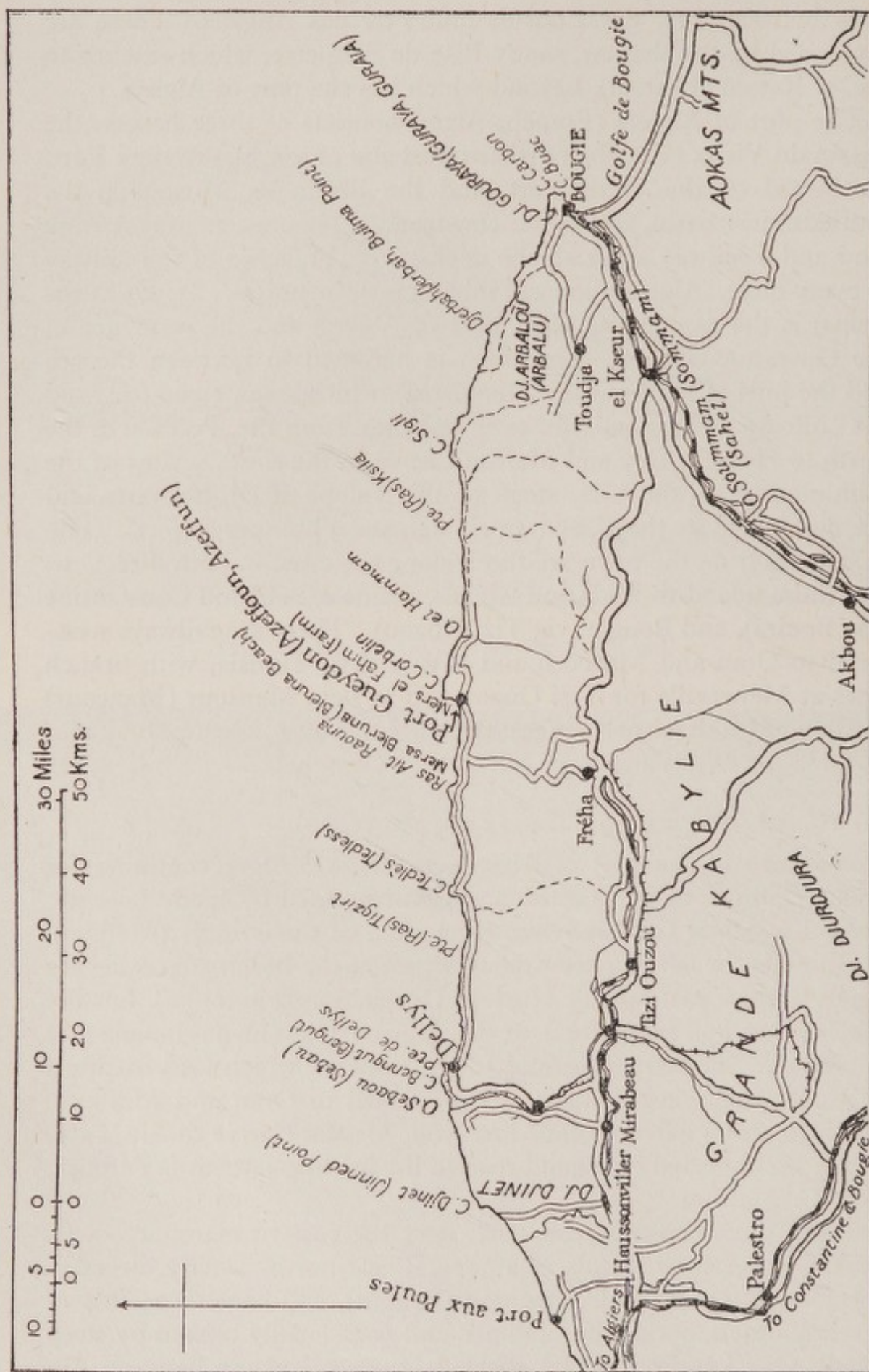


FIG. 32. The coast: Port aux Poules to Bougie

Taya and C. Djinet (Jinned point), the best beach probably being that in the small bay of Hajer Makhluf. This lies between Jezirat el Kadra and el Achaichi and has easy access to a coast road connected with the Algiers-Tizi Ouzou road. This latter road is also linked to the sea at Port aux Poules by a secondary road. Beyond C. Djinet, the termination of Dj. Djinet (Jinned), which is 1,447 feet high $1\frac{1}{2}$ miles south-eastward of the cape, the Kabylie mountains lie close to the coast and

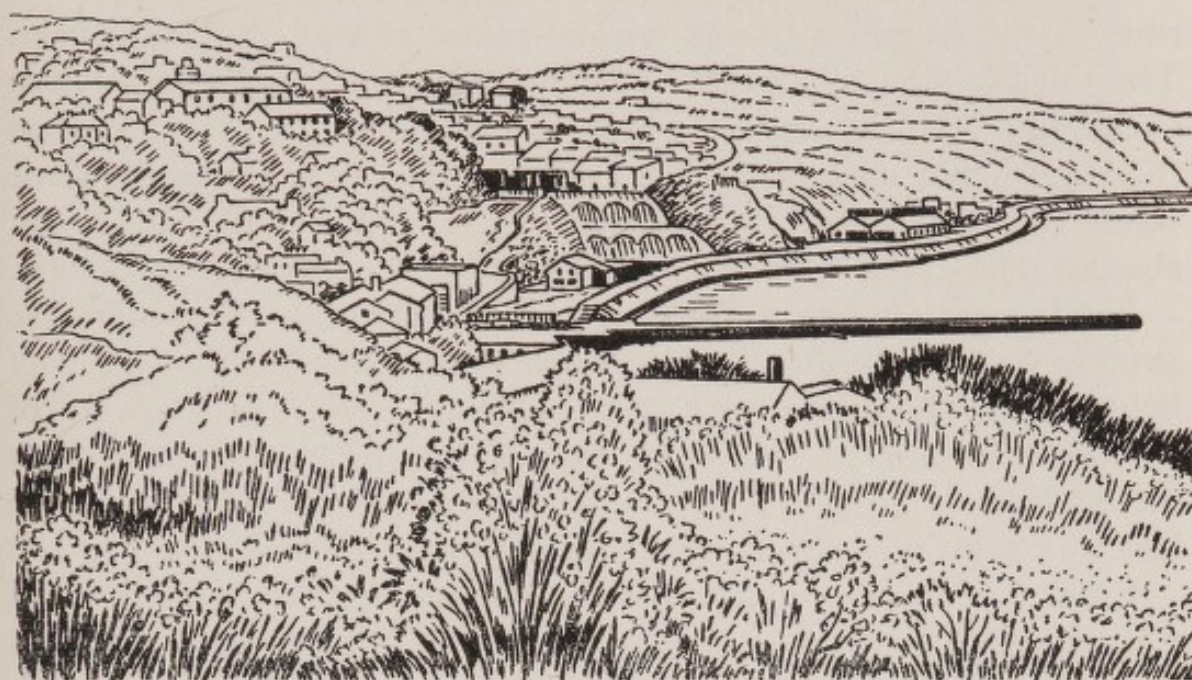


FIG. 33. *The town and port of Dellys*

there are no coast roads as far as the valley of the O. Sebaou (Sebau), but beyond the river a road and a railway are within a short distance of the sea for about 4 miles past C. Benngut to Dellys. Pte. de Dellys has a short jetty, at which landing is possible in all weathers, on its south-eastern side, with the small port of Dellys farther southward. The harbour is sheltered by a breakwater extending in a south-south-easterly direction and the town (3,000 inhabitants) is on its western side (Fig. 33). A narrow-gauge railway follows the valley of the O. Sebaou to join the Algiers-Tizi Ouzou railway at Mirabeau, and there are road connexions with the Algiers-Tizi Ouzou road at Mirabeau and Haussonviller. There is also a coastal road eastward of Dellys to Port Gueydon (Azeffoun, Azeffun) and beyond, but through communication with Bougie is impossible.

Eastward from Dellys the mountains are nearer the sea than between Algiers and Dellys, but a main road closely follows the coast to C. Corbelin (24 miles), and for about 8 miles beyond. Sandy

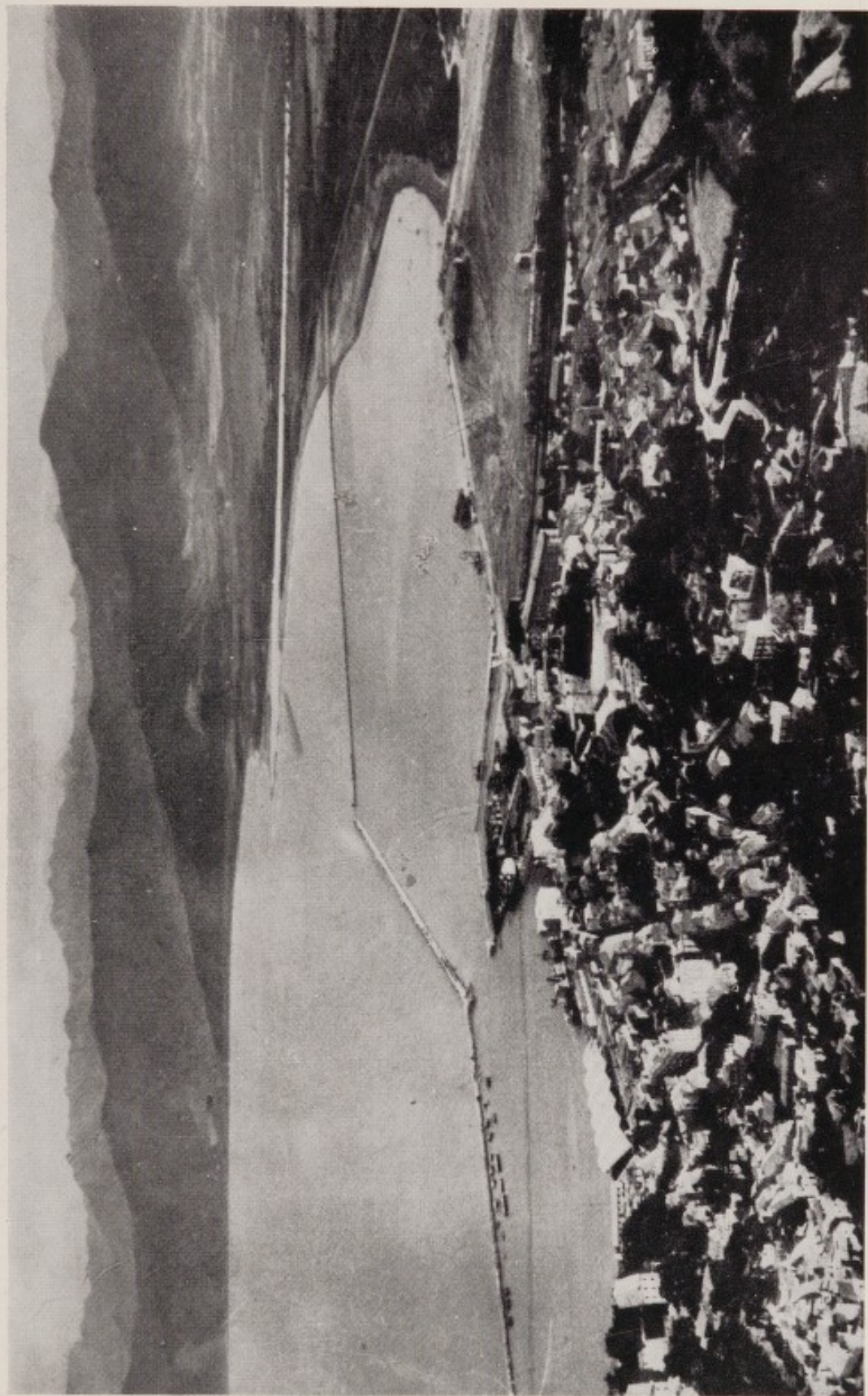
beaches alternate with rocky points, but access to the coast road is generally difficult and landing is possible at only three points. Pte. (Ras) Tigzirt, about 4 miles westward of C. Tedlès (Tedless), has a small masonry jetty near to the coast road, with a difficult southward connexion to the Algiers-Tizi Ouzou road and railway. Bleruna beach, in Mersa Bleruna, eastward of Ras Ait Raouna, is also linked to the coast road, and to the roads of the interior by means of a road to Fréha, a town from which a narrow-gauge line (of limited capacity) runs to the terminus of the normal-gauge railway at Tizi Ouzou. The third landing-place, with a boat slip and jetty, is Port Gueydon (Azeffoun, Azeffun), in the south-eastern corner of Mers el Fahm (Farm), the bay westward of C. Corbelin. It has access to the same roads as Bleruna beach; eastward the corniche road extends for about 8 miles, after which it deteriorates into a mere track to Bougie.

Between C. Corbelin and C. Sigli, 16 miles eastward, there are stretches of sandy beach, interrupted by rocky cliffs, especially between the O. el Hammam and Pte. (Ras) Ksila, but eastward of Pte. Ksila the cliffs are almost continuous. The beaches are unsuitable for landing owing to the steepness of the coastal mountains and the lack of a main road throughout this section of coast.

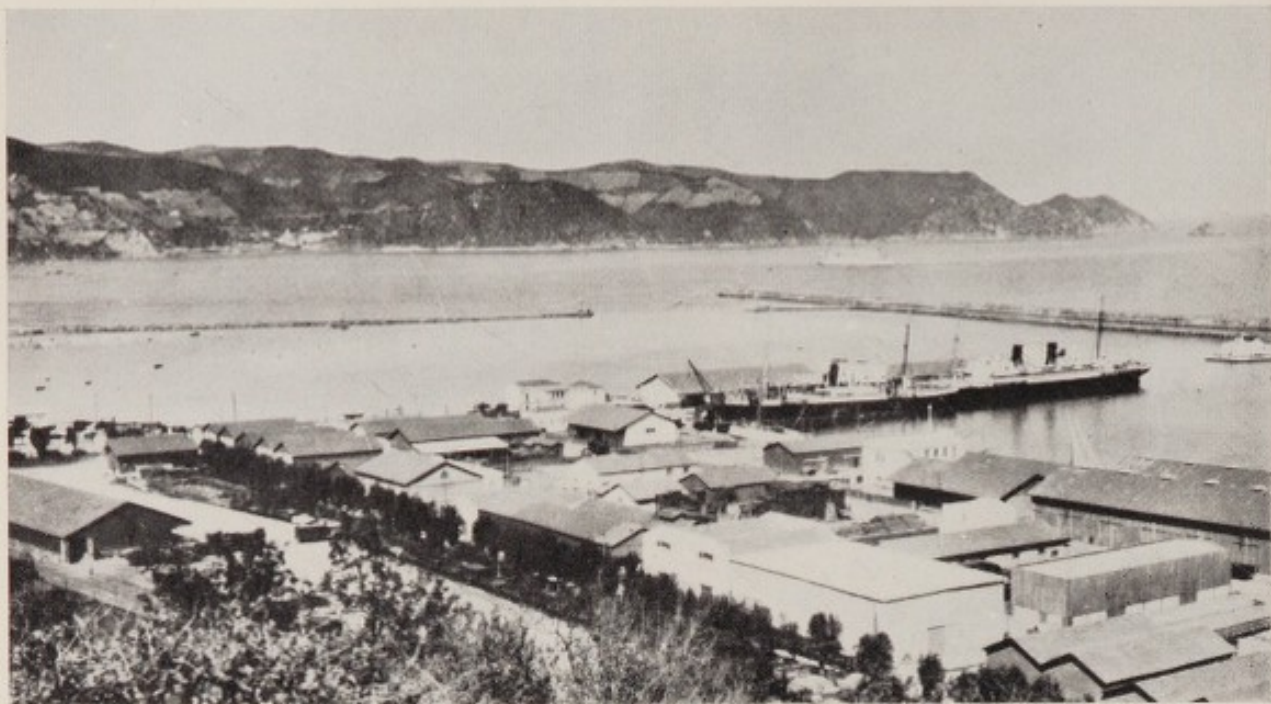
From C. Sigli the coast trends east-south-eastward for about 18 miles to C. Carbon and consists mainly of cliffs, usually between 330 and 650 feet high. It is dominated by mountains which reach 4,321 feet in Dj. Arbalou (Arbalu), 10 miles south-south-eastward of C. Sigli, and communications are poor. Landing can be effected in a small natural harbour with a narrow entrance on the western side of Djerbah (Jerbah, Bulima point), about 12 miles east-south-eastward of C. Sigli, at the eastern end of a sandy beach from which a track leads to the secondary road from Toudja to Bougie.

The Golfe de Bougie extends from C. Carbon to C. Cavallo, 24 miles eastward. In the west there are extensive sandy beaches, with small rocky points, though high, steep cliffs occur between C. Carbon and the port of Bougie: in the east there are cliffs with small beaches. The land near the sea is generally low, but is backed by steep, arid mountains which in places exceed 6,000 feet (Photo. 10).

The port of Bougie, on the western side of the Golfe de Bougie and about 1 mile southward of C. Carbon, consists of three connected basins: the Avant Port, south-westward of C. Buac; the Middle Basin, south-westward of the Avant Port; and the Arrière Port, south-westward of the Middle Basin (Photo. 43). Reconstruction work carried out in recent years has made Bougie one of the best



43. *The port of Bougie from the north*



44. *The port of Philippeville from the south-east with the Golfe de Stora
(in background)*



45. *The port of Bône from the north-west*

ports in north Africa. The town (31,619 inhabitants, including 6,109 Europeans) lies on the south-eastern slopes of the mountainous massif of Dj. Gouraya (Guraya, Guraia) and has two good roads to Algiers, branching at el Kseur, the northern route passing through Tizi Ouzou and the southern through Akbou, Bouira, and Palestro. There are also main roads to Djidjelli (Jijelli) and Bône along the coast, and to Sétif, Constantine, and Biskra. A normal-gauge railway connects the town and the Middle Basin of the port with the main line at Beni Mansour (Mançour).

(4) *Bougie-Philippeville* (99 miles) (Fig. 34)

The coast eastward of Bougie is dominated by the chain of the Petite Kabylie, reaching 6,575 feet in Dj. Babor (Grand Babor). Landing is possible, though not easy, at a number of points between the O. Soummam (Sommam, Sahel) and C. (Ras) Aokas, respectively 3 and 8 miles eastward of Bougie, on gradually shelving sandy beaches. These beaches merge into ground only slightly higher for about 100-300 yards inland to the Bougie-Djidjelli coast road. This road is level, with a first-class surface, and is suitable for all traffic. Within 100 yards of its southern side an escarpment rises sharply at first and then falls back into scrub-faced bluffs. The only other road goes 5 miles into the Aokas mountains, southward from C. Aokas. Between this cape and the O. Agrioun (Agriun) conditions are very similar except that the level ground behind the foreshore gradually widens to more than 1 mile at the mouth of the river, and is well covered with scattered trees. The ground rises gently to the bluffs, at the foot of which the road runs, with a branch southward along the valley of the O. Agrioun to Kerrata and Sétif. A mineral railway line also follows this valley for about 6 miles. The river, which is almost dry in October, has a bed between 200 and 300 yards wide, and is crossed by a steel-girder bridge (single track), about 70 yards long. Eastward of the river low cliffs rise sheer from the sea, carrying the road on their face, and continue to Djidjelli, though interrupted in places by small rocky bays with sandy beaches on some of which landing can be effected in fine weather. Anse des Falaises has a transporter for loading zinc ore, brought by the railway from the O. Agrioun. Landing is possible in the bays on either side of Pte. Ziama, in the small bay on the eastern side of Pte. Mansouria (Mansuria), and in the bay at the mouth of the O. Guehl (Guelil), a small stream with good water even in the dry season, about $2\frac{1}{2}$ miles eastward of Île Mansouria (Mansuria island). There are exits to the

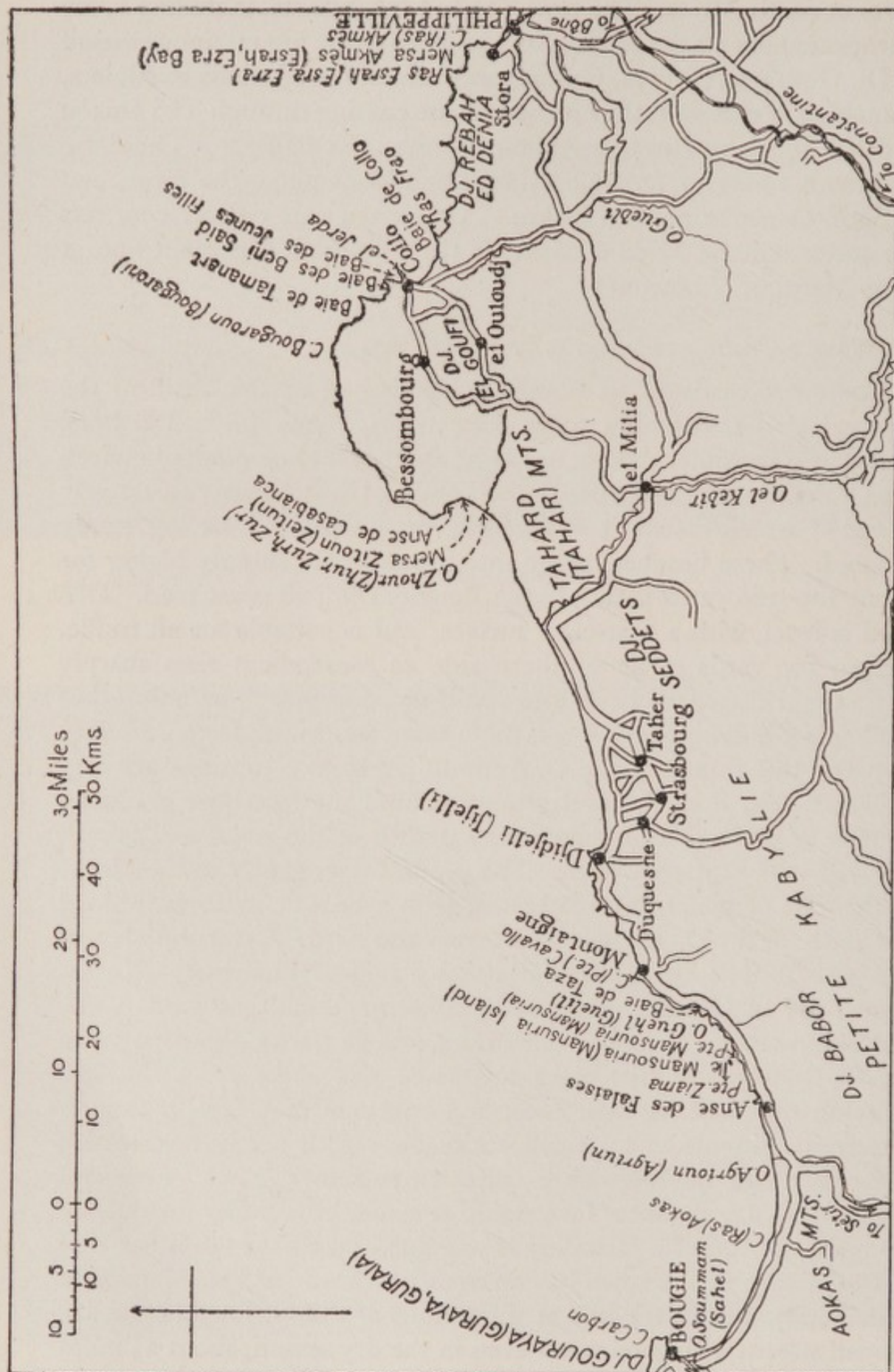


FIG. 34. The coast: Bougie to Philippeville

coast road from all these bays and from the small jetty at Montaigne, on the eastern side of C. (Pte.) Cavallo. Other bays, such as the Baie de Taza and those between C. Cavallo and Djidjelli, afford rather poor shelter and access to the interior, and landing is impossible.

The harbour of Djidjelli (Jijelli), on the eastern side of a peninsula, is protected by breakwaters on its northern and south-eastern sides and has two quays in its southern corner (Fig. 35). There are no railway lines, but good roads connect the town (12,846 inhabitants,



FIG. 35. *The port of Djidjelli (Jijelli)*

including 1,992 Europeans) along the coast with Bougie and Philippeville, and inland with Constantine, with a branch to Sétif.

From Djidjelli a sandy beach extends for about $14\frac{1}{2}$ miles east-north-eastward with low-lying land inshore, rising gradually to mountains, 3,137 feet high in Dj. Seddets. The Djidjelli-Philippeville main road, which at first lies 3 or 4 miles inland, is connected to a local coast road by a number of secondary roads from Duquesne, Strasbourg, and Taher. About 11 miles eastward of Djidjelli the main road again approaches the coast as far as the mouth of the O. el Kebir, before following this valley upstream to el Milia and cutting across the base of the huge C. Bougaroun (Bougaroni) promontory to reach Philippeville along the valley of the O. Amida. About $1\frac{1}{2}$ miles north-eastward of the mouth of the O. el Kebir the Tahard (Tahar) mountains reach the coast in a small peninsula, on the western side of which is a creek in which landing may be effected, and from which access is possible, by means of a narrow track, to the Djidjelli road near the mouth of the O. el Kebir. From the O. Zhour (Zhur, Zurh, Zur), about 10 miles east-north-eastward of the O. el Kebir, the coast is high and steep, with rocky cliffs, which are almost continuous to

C. Bougaroun and beyond to Collo, and are backed by mountains rising sharply to 3,891 feet at Dj. el Goufi (Gufi), 7 miles inland. There are no roads near the coast, and exit is impossible from any of the bays affording anchorage, such as Mersa Zitoun (Zeitun), the Anse de Casabianca, and the bay sheltered by C. Bougaroun itself, where a landing-place exists among the rocks on the eastern side of the cape. The Baies de Tamanart, des Beni Said, and des Jeunes Filles, between the cape and Collo, are also useless.

The Baie de Collo, extending from the el Jerda peninsula (Jerda point) to Ras Frao, is one of the best open anchorages in Algeria, and is well sheltered from westerly and northerly winds. Landing can be effected in almost any weather near Collo (3,012 inhabitants), which lies at the landward end of the el Jerda peninsula, with a jetty extending southward on the eastern side of the town (Photo. 41). There are main roads to Philippeville, Constantine, and Djidjelli, with two secondary roads to Djidjelli (via Bessombourg and via el Ouloudj), but no railways nor coast roads.

From Collo to Ras Frao there is a 3-mile stretch of sandy beach crossed by the O. Guebli and with a good exit to the Collo road. Beyond Ras Frao the coast is rocky, with steep cliffs, and landing is impossible. There is good shelter and a clean, sandy beach in Mersa Akmès (Esrah, Ezra bay), between Ras Esrah (Esra) and C. (Ras) Akmès, but the only exit from the beach is by way of a very steep and winding road across Dj. Rebah ed Denia to Stora. The Golfe de Stora affords better anchorage and has on its northern side a small jetty, but this appears to be useless now owing to silting alongside it. Landing is possible on the sand and shingle beach opposite the village of Stora, behind which are rocky cliffs, 60 feet high. There are two roads to Philippeville, one along the sea-front and the other, which passes through a tunnel half-way to Philippeville, along the edge of the high ground 100 yards behind.

The artificial harbour of Philippeville, 3 miles south-south-eastward of C. Akmès, and 2 miles south-eastward of Stora, has a jetty, the *Jetée du Château Vert*, on the western side and a long breakwater extending westward from Ras Skikda (C. Skikdah). The town (with suburbs, 66,112 inhabitants, including 33,836 Europeans) lies on the sides of a hill southward of the port (Photo. 44). Philippeville is the port of Constantine, to which it is linked by rail and road: there are also roads to Collo and Bône and, along the coast, westward to Stora and eastward to St. Louis, and a narrow-gauge railway to Bône.

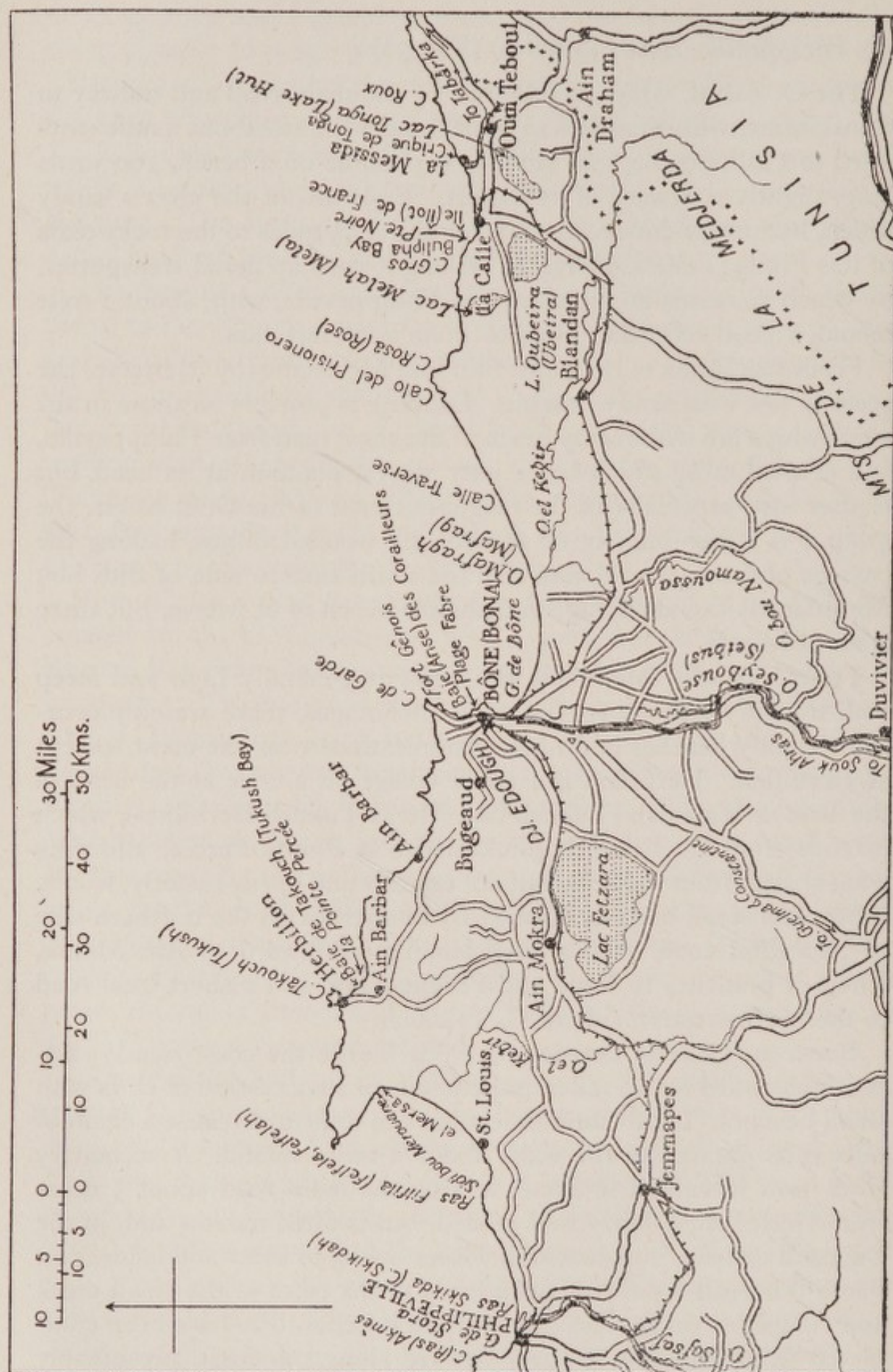
(5) *Philippeville-Bône* (46 miles) (Fig. 36)

The O. Safsaf, which is followed by the main road and railway to Constantine, with branches to Bône, enters the sea about a mile eastward of Philippeville, and landing is possible on a beach, 100 yards long, slightly westward of its mouth. Eastward of the river a sandy beach, backed by downs, extends for about $5\frac{1}{2}$ miles to the rocky cliffs of Ras Filfila (Felfela, Felfelah). Along it runs an aerial transporter, by which minerals are conveyed to Philippeville, with, about 1 mile inland, a good secondary road to Bône and Herbillon.

From Ras Filfila to the point Sidi bou Merouane (bu Meruane) the coast is low with sandy beaches. Landing is possible on those in the west, which are within easy reach of the coast road from Philippeville, and at St. Louis, which has a jetty with a pontoon at its head, but farther east, especially in the neighbourhood of the O. el Kebir, the ground is either marshy or covered by wooded dunes, making the passage of transport difficult. On the south-eastern side of Sidi bou Merouane is the anchorage and shingle beach of el Mersa, but there is no good exit.

From Sidi bou Merouane the coast is generally high and steep and, though there are several good anchorages, there are only occasional sandy beaches and no communications near the coast, except at Herbillon. Herbillon is a small village on a cove at the head of the Baie de Takouch (Tukush bay, Mersa Tukush Herbillon), which extends from C. Takouch (Tukush) to la Pointe Percée, affording good shelter from westerly, but not easterly and north-easterly, winds. There is a small harbour formed by two jetties on the northern side of Herbillon cove, with a road leading southward to Ain Mokra, where it branches to Bône and Philippeville, and a short local road to the north-western side of C. Takouch.

Between la Pointe Percée and C. de Garde the coast trends east-south-eastward for 19 miles and consists of a succession of cliffs with small beaches. Land communications are difficult because a chain of hills runs parallel to the coast about 2 miles inland. A secondary road from Herbillon to Bône, leaving the main road about 5 miles from Herbillon, is fairly well graded, but is often narrow and, in the Bugeaud district, impassable in winter owing to snow and landslides. From this road a difficult track leads to the coast at the small creek and village of Ain Barbar. A new road is believed to have been completed from Bugeaud to the westward along the coast, presumably for military purposes, as the district is almost uninhabited.



The Golfe de Bône, extending from C. de Garde to C. Rosa (Rose), 21 miles eastward, has generally low coasts with sandy beaches backed by extensive plains and downs, but low cliffs, becoming gradually higher, appear towards the extremities. Between C. de Garde and Bône the mountains, which are 3,200 feet high 8 miles inland in the Edough (Edugh) massif, leave the coast and there are a number of beaches and a good coastal road, 16 feet wide, joining the cape and Fort Gênois to Bône. Owing to the rough and steep slope between the beaches and the road, landing can be effected only in the Baie (Anse) des Corailleurs, where the Plage Fabre, a beach about 100 yards long, in the south-western corner and 2 miles north-westward of the outer port of Bône, is the most suitable. A lane in good condition and with an easy gradient leads from the beach to the main road and should be capable of carrying heavy traffic.

Bône (Bona) is on the western shore of the Golfe de Bône, about 4 miles southward of C. de Garde. Its harbour is protected by jetties and divided into three basins, the outer harbour (Avant Port), the large basin (Grande Darse), and the small basin (Petite Darse). The town (86,232 inhabitants, including 46,082 Europeans, of whom about 8,000 are Italians) lies westward of the port, with the residential districts to northward and the industrial areas to southward (Photo. 45). A normal-gauge electrified line, leading southward, joins the main Algiers-Tunis line at Duvivier, and there are narrow-gauge lines to Philippeville, through Ain Mokra, and eastward to the coast at la Calle. Roads lead to Herbillon (via Bugeaud), Philippeville (via Ain Mokra and Jemmapes), with a branch to Herbillon at Ain Mokra, Constantine (via Guelma), Tébessa (via Duvivier and Souk Ahras), and la Calle (via Blandan). There is also a secondary road to la Calle, between the main road and the coast.

(6) *Bône-Tunisian Frontier* (47 miles) (Fig. 36)

The O. Seybouse (Seibus), which enters the sea half a mile southward of Bône harbour, is the most regular river of Algeria and retains its water during the summer. Its estuary can generally be used by small boats despite the presence of shoals. Eastward of this river there is a 9-mile stretch of sandy beach, backed by low wooded dunes, with many small streams and lagoons, behind which are extensive plains. The beach is unsuitable for landing owing to surf, and access is difficult across marshy country either to the secondary Bône-la Calle road or to the narrow-gauge railway and main road which skirt the mountains on the landward side of the coastal plain. About

3 miles eastward of the O. Mafragh (Mafrag), the combined estuary of the O. bou Namoussa (bu Namussa) and the O. el Kebir, the beach ends and the land rises gradually to C. Rosa (Rose), the cliffs of which are 160 to 300 feet high. Landing is possible in Calle Traverse, a small cove much obstructed by rocks, about $6\frac{1}{2}$ miles east-north-eastward of the O. Mafragh, and in two coves used by fishing-vessels nearer to C. Rosa, the larger and more western of



FIG. 37. *The town and port of la Calle*

which, Calo del Prisionero, has a shingle beach at its head. All these coves are bounded by rocky cliffs, however, and have no exits to the interior.

Between C. Rosa and C. Gros, 8 miles eastward, a number of bays provide shelter from westerly, but not north-easterly, winds, and are backed by sandy beaches and low cliffs, but landing is possible only in Lac Melah (Mela, Bheira Guera el Melah), which small craft can enter. From the lake there are tracks eastward to la Calle, and southward to the road to la Calle which passes between lakes Melah and Oubeira (Ubeira). Between C. Gros and Pte. Noire, $1\frac{3}{4}$ miles south-eastward, is Bulipha bay, which has a sandy beach with the foundations of a jetty about 1 mile south-eastward of the cape. Landing is possible, though difficult, and there is access to a road leading to la Calle.

La Calle (Port de la Calle) is a minor port affording little shelter and used solely by small vessels, which can enter only in fine weather.

The harbour lies open to north-westward between the mainland and the Île (Îlot) de France, a rocky peninsula on the southern side of which are the quays, and is almost impossible to enter when fresh north-west winds are blowing. The town (5,000 inhabitants) is mostly built on the southern side of the harbour, though partly on the Île de France (Fig. 37). Bône is linked to la Calle by a narrow-gauge railway, a main road, and a secondary road passing between lakes Oubeira and Melah. There is also a road eastward to Oum Teboul (Kef Um Tebul), where it forks, the north-eastern branch going along the coast to Tabarka and the south-eastern inland to Ain Draham, both towns of western Tunisia.

From la Calle to the Tunisian frontier the coast trends east-north-eastward and is rocky, though broken by several small creeks. It is backed by brushwood-covered dunes, between 300 and 500 feet high, behind which is the la Calle-Oum Teboul road, which skirts the northern shore of Lac Tonga (Lake Hut, Garaet Mta el Hout). This lake has an outlet to the sea along the O. Messida, which breaches the coast at the small sandy Crique de Tonga, near which, at la Messida, is the terminus of a narrow-gauge tramway to Oum Teboul. From the creek to C. Roux the coast is bordered by small cliffs, between which are sand-hills. There is a small bay on the eastern side of the cape, but access to the Oum Teboul-Tabarka road is difficult. The boundary between Algeria and Tunisia lies about 2 miles eastward of C. Roux.

CHAPTER IV

THE CLIMATE OF ALGERIA

ALGERIA falls conveniently into two major divisions—the three northern departments of Oran, Algiers, and Constantine, or Algeria proper, and the Algerian Sahara, known as the Territoires du Sud, lying south of the Saharan Atlas. In the section devoted to Algeria proper there are references to climatic conditions in the Sahara, the main description of which will be found in the special section (p. 131). Rainfall figures are given in inches and temperatures in degrees Fahrenheit. The tables to which reference is made are in Appendix B.

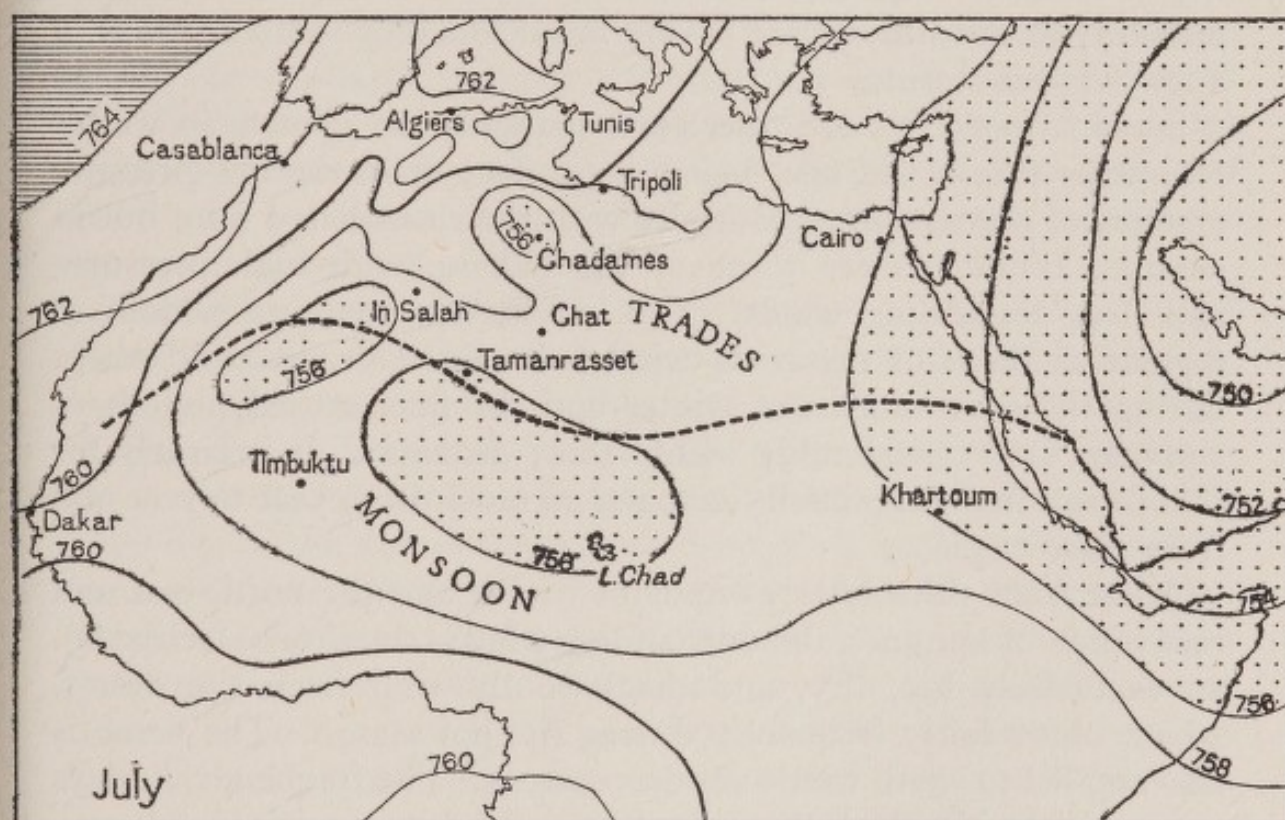
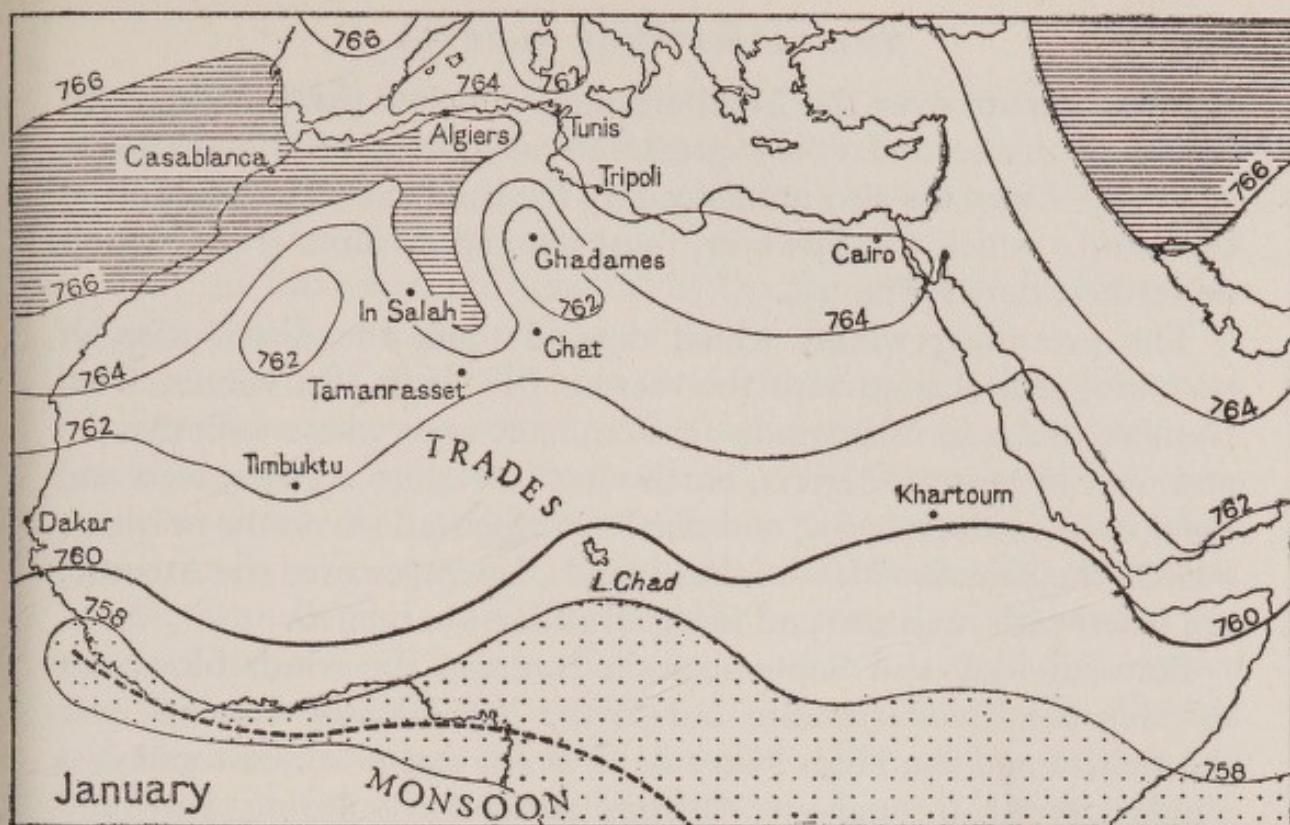
ALGERIA

1. *Introduction*

The outstanding feature of the climate of Algeria is the contrast between the seasons and results from the country's position between the Mediterranean and the Sahara. In winter it experiences the depressions of temperate latitudes and so receives considerable rainfall. In summer it is under the influence of the dry winds of the sub-tropical belt of high pressures and is, therefore, almost rainless. The winter is cool or cold and wet, the summer is hot and dry, and there is usually abundant sunshine in all months of the year. The essence of the seasonal contrast lies in the amount of the rainfall which, though it varies considerably from place to place, is everywhere the most potent factor influencing the various types of economy and the distribution of population. The alternation of good and bad years and of excellent crops and serious famines is also more dependent upon the rainfall than upon any other factor, and it is significant that terms such as Tell, Steppe, or Sahara all refer, basically, to climatic facts, particularly those of rainfall.

2. *Pressure and Winds* (Fig. 38, Table I)

Different pressure systems affect Algeria at different times of the year and so give the country its seasonal variations. In winter the Sahara is colder than the Mediterranean and forms a region of high pressure, whilst a secondary high pressure forms over the High Plateaux of Oran, which are cold because of their height. Meanwhile, over the Mediterranean is a low-pressure system which frequently changes its position, form, and intensity. In summer the position is reversed, the desert now being warmer than the sea, so that high



Miles 500 250 0 500 1000 1500 2000 2500 Miles

Highest pressure Limit of the trade winds
 Lowest pressure and the monsoon

FIG. 38. Pressure distribution over northern Africa in January and July
 A 1928

pressure occurs over the Mediterranean and low pressure over the Sahara, with a secondary low-pressure system over the High Plateaux of Oran. Algeria is also influenced by the constant high pressures of the Azores which are, however, most marked in summer when they lie farthest north (Fig. 38).

The prevailing winds, which depend upon the distribution of pressure, also change with the seasons (Table I). In winter, from October to April, west winds are dominant everywhere—south-west and west in western Algeria, north-west in eastern Algeria, west and north-west in the interior, and north at some stations on the northern edge of the Sahara. Most of these winds, having crossed the Atlantic, are laden with moisture and bring considerable rainfall.

Between May and September, in contrast, the winds blow, not towards the Mediterranean, but to the low-pressure systems over the Sahara and the High Plateaux of Oran, and north-east and east winds prevail throughout Algeria, particularly during July and August. Since these winds are already dry and become increasingly dry towards the equator, rain and cloud are rare, and the relative humidity of the atmosphere is very low. The only rainfall comes in a few, violent storms.

Seasonal contrasts are, therefore, marked; the climate in winter resembles that of Europe, being dependent upon the low-pressure systems of the temperate latitudes with their associated rain, but in summer conditions are those of the Sahara, with high pressures and dry, descending winds. The winds, however, are seldom as regular as those of the trade wind belt of the desert and, except during the great storms of winter and the fine, settled periods of summer, vary considerably within short distances. It is largely for this reason that the rainfall fluctuates so much from year to year and from place to place.

Apart from the westerly winds of winter and the north-east and east winds of summer, the outstanding wind is the sirocco (scirocco), an excessively hot, dry, and dusty south wind from the desert, which blows fairly frequently during the hot season. The name is also applied to south winds at other seasons. The frequency, in days per month, with which they may be expected is:

<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>April</i>	<i>May</i>	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>	<i>Year</i>
3	2	4	4	6	5	5	5	5	5	3	4	51

Sometimes they are only light or moderate, at other times they blow with gale force. Their maximum speed is generally in the afternoon.

The sirocco is generally more common in Tunisia than in Algeria,

in both of which countries it is known sometimes as the *guebli*, or south wind (cf. the *chergui*, or east wind, of Morocco). In Algeria it is most common in the High Plateaux between the Moroccan border and Constantine, where it blows on 30 to 40 or more days a year; on the coast, particularly in the departments of Oran and Algiers, it seldom blows on more than 20 days a year.

The abnormal heat, dryness, and dustiness of the sirocco in summer have a very enervating effect upon the body, since temperatures often rise rapidly to above 100° F. while the relative humidity may fall to less than 20 per cent. Not only do men and beasts find the intensity of evaporation very hard to withstand, but vegetation readily withers and turns black, and harvests are sometimes destroyed within a few hours. A leaden-hued veil frequently obscures the sun, and dense clouds reduce visibility to a few yards. During light siroccos, mirages are also observed. The winter sirocco is a pleasantly warm wind which is very dry. When blowing strongly it often carries much dust, but without forming the dense black clouds of the summer sirocco.

The extent and duration of siroccos vary considerably. Some of the hot winds of summer are extremely local, but the dust of widespread siroccos has occasionally been carried from Africa as far north as Denmark. Sometimes they blow for less than an hour, and sometimes for several days. The most persistent are usually the light southerly winds of autumn.

The exact pressure distribution giving rise to the sirocco varies with the season, but the wind is always a depression wind. In early spring the depressions responsible have usually entered the southern Mediterranean from the Atlantic, and are moving eastward along the north African coast. In late spring and summer the wind is often due to the depressions which have developed over the western Sahara, or to very shallow local depressions, not visible on the ordinary charts. In autumn it is due to widespread low pressure with weak gradients over the western Mediterranean. The far-reaching strong sirocco, which occasionally penetrates northward across western Europe, is chiefly a feature of spring, associated with deep depressions over the north-western Mediterranean or western Europe.

The proximity of the Sahara is not the only cause of the Algerian sirocco: indeed that of the coast often has its origin in the uplands of the country, across which the wind blows, becoming warmer as it descends to the coast. It resembles, in certain respects, the warming *föhn* winds of Switzerland.

Local Winds. The sirocco is too distinctive to be classed amongst the local winds, the chief of which are land and sea breezes. Of these, the sea breeze is, generally speaking, more prominent than the land breeze, particularly on open coasts. Sea breezes are well developed during the hot season from April to October in the bays and gulfs of north Africa; they also occur during fine weather in winter, but are then much weaker and less regular. At many places on the coast sea breezes constitute the prevailing winds of the summer, and greatly temper the heat of the day. In summer they begin at about 0900 hours, in spring and autumn at about 1000 hours, and in winter at about noon. They reach their maximum between noon and 1400 hours, when they blow gustily. Towards evening the winds veer, often blowing parallel to the coast before they disappear at nightfall. The breezes are often fresh, particularly in exposed positions, and locally they may reach gale force for short periods, as at Ténès (Tenez) and Bône, where trees are sometimes uprooted and considerable damage caused. The inland range of the sea breezes is greatest in the afternoon but seldom exceeds 20 miles from the coast even where the relief is favourable, and in sheltered valleys such as the Chélif their cooling effects are entirely lost.

The land breeze is usually little marked and occurs only in bays and gulfs. Normally it blows from three hours after sunset to one hour after sunrise, setting in at about 2000 hours, after the evening calm, and disappearing by about 0800 hours. It is usually strongest in the early morning.

Gales (Table II). Off the coast, as far east as Algiers, gales are few, being almost unknown in summer, and about equally frequent in autumn, winter, and spring. They are mainly between west and north. Strong winds of forces 6-7 are also generally most common in winter and spring, when they blow particularly between south-west and north-west, though in winter strong winds from the east are also fairly frequent. In summer and autumn they are chiefly from between north and south-east and from south-west.

East of Algiers gales are much more numerous, particularly in winter and spring, and, to a less extent, in autumn; there are none in summer. They come mainly from west and north-west, though occasional gales come in winter from north, north-east, and south; in spring from south-east and south; and in autumn from north-east and south-east. Winds of forces 6-7 are also most frequent in winter and spring, when they are chiefly west and north-west. In summer

north-west and north winds are most common, and in autumn west, north-west, and south-east. Strong east winds are the least frequent.

3. *Temperature* (Figs. 39 and 40; Table III)

Owing to the proximity of the sea and the Sahara, and the effects of altitude and exposure, temperatures often vary greatly within short distances. The sea has a much greater influence on temperatures than latitude and warms the coastal belt in winter and cools it in summer. Algeria has nothing comparable, however, to the cooling influence of the Canaries current on the Atlantic coast of Morocco.

In the coastal belt the effect of the Mediterranean is greatest in the winter, mean temperatures for January (usually the coldest month) being from 50° to 54° , with average maximum temperatures of 59° , and minima of from 43° to 46° (Fig. 39; Table III). The warmest areas then are the prominent capes, Cap Falcon (54°), for example, being warmer than Oran (52.5°) and Cap Caxine (54°) than Algiers (53°). Algiers is, however, warmer than either Oran in the west or Philippeville (51°) in the east, and its average minimum for January (49°) is unusually high. Frost is rare, and most of the sheltered valleys are suited to orange and olive growing, but away from the sea, even in the plain, temperatures are much lower, e.g. Rouiba 39.5° , Boufarik 40° .

Mean summer temperatures on the coast average 75° to 79° , with maxima of 85° and minima of 68° , and from July to October there is almost uninterrupted hot weather (Fig. 40; Table III). Near the sea August is nearly always the hottest month, and at Algiers September is warmer than June. In general the maxima increase from west to east. Day temperatures of over 100° are not uncommon, the highest recorded at Algiers being 112° . North-east winds often blow during the hottest hours of the day and to some extent moderate the heat, but they are generally very moist, and so make the atmosphere of the coastal districts like that of a Turkish bath.

Spring is generally considerably cooler than autumn on the coast, April and May often being quite cold, and really hot weather is seldom experienced before the beginning of July. At the changes of the seasons, strong south-east winds and blasts of the hot, dusty sirocco (p. 114) are frequent.

The effect of the sea is not felt far inland, and even low-lying valleys, which are sheltered from the sea by uplands, such as the Chélif, have continental conditions. The coastal belt occupies only a small part

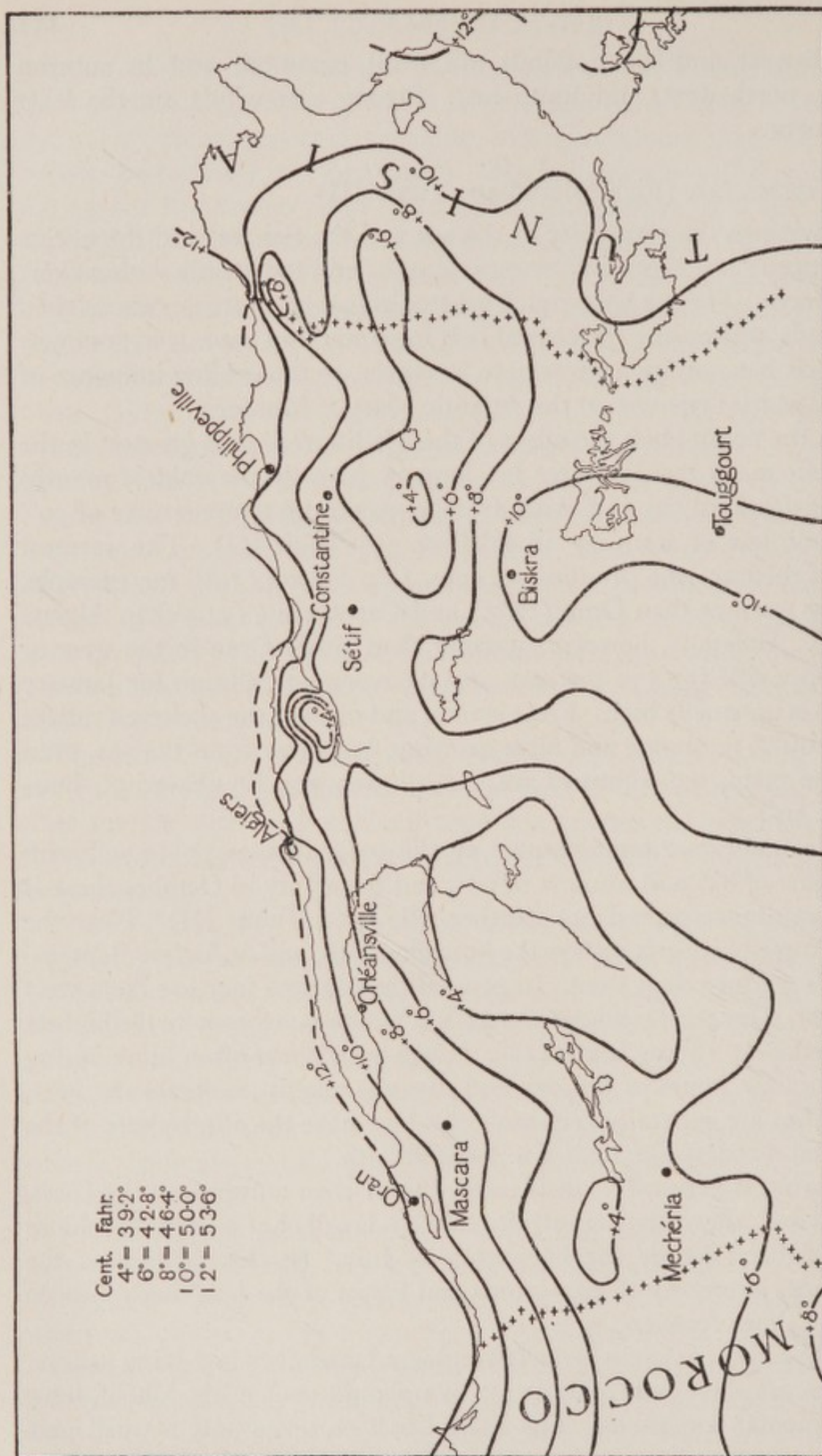


FIG. 39. Mean temperatures (degrees Centigrade) in January. Fahrenheit equivalents are given in the top left-hand corner

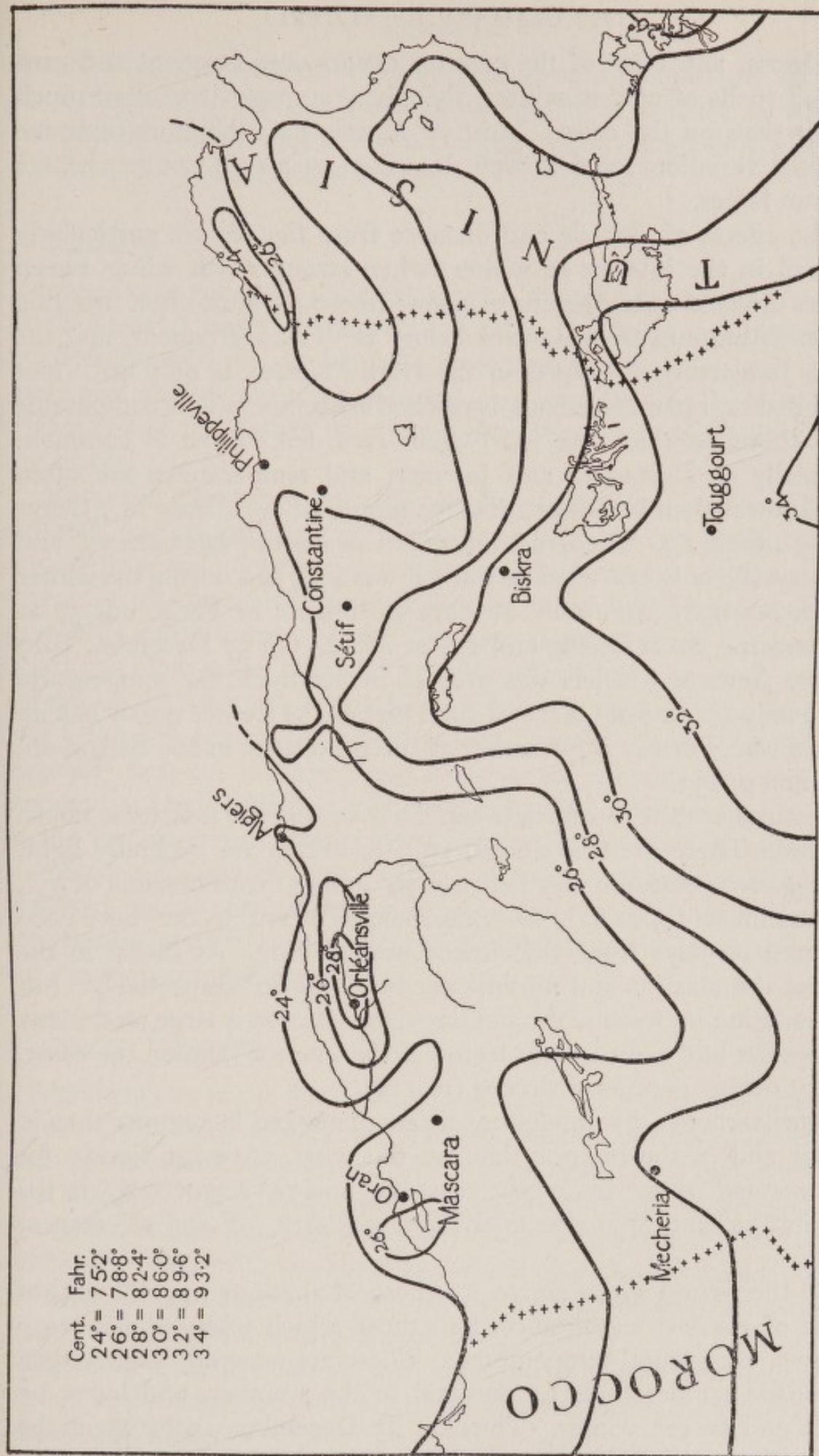


FIG. 40. Mean temperatures (degrees Centigrade) in July. Fahrenheit equivalents are given in the top left-hand corner

of Algeria, and most of the country experiences frequent and prolonged spells of cold in winter, though in summer it is often much hotter than on the coast. Most of Algeria has, therefore, extreme seasonal variations, and is well described as a cold country where the sun is hot.

The effects of altitude and distance from the sea are particularly marked in the interior in winter, when strong north winds sweep across the land at temperatures below freezing-point, often bringing snow. Minimum temperatures below 32° F. are frequent, and the mean January temperature on the High Plateaux is only 40° . Not until Biskra, 150 miles inland, is reached are temperatures comparable with those on the coast (50°) again recorded. Frost is common, especially in December and January, and temperatures are often much lower than in western Europe (e.g. Sidi bel Abbès 14° , Géryville 9° , Sétif 2°). The temperature at Constantine has been 27° and at Géryville only 16° when in Paris it was 41° ; and during the winter of 1900-1 there were only 48 days with frost in Paris, but 57 at Constantine, 82 at Djelfa, and 139 at Aflou. On 30 December 1917 the ice-cover at Chellala was over $4\frac{1}{2}$ inches thick, the temperature being only 19° , and at Ghardaia and Ouargla the ice was nearly half an inch thick. Further information of the conditions in the Sahara are given on p. 133.

In summer the contrast between the coast and the interior is not so marked. There are few clouds, and the winds are generally light. Average temperatures vary between 79° and 83° with maxima of 95° , and minima of 61° to 63° . Absolute maxima of 118° to 122° have been reported on days when the sirocco was blowing. At Biskra in the Sahara the maxima and minima are 104° and 80° respectively. But the variation between night and day temperatures is large, and many Europeans find summer less trying in the interior than on the coast, except during periods of sirocco (p. 115).

Diurnal ranges of temperature are more marked in summer than in winter and in the interior than on the coast. Average figures for summer and winter are, on the coast, 16° and 14° respectively, in the interior, 36° and 21° respectively, and at Biskra, 19° and 18° respectively.

All the figures given above are those of shade temperatures, but those of greatest significance, and those which often explain crop failures, are ground temperatures. These are generally higher than the shade temperatures by day and in the summer, and lower by night and in the winter. Thus on 25 December 1908, when the

standard thermometer recorded 45° , the ground temperature showed 7° of frost, whilst the mean figures for Algiers in January 1920 were 49° (shade) and 42° (3.93 inches (10 cm.) from the ground) and for Chellala, 36° and 32° respectively.

4. *Visibility*

Visibility is generally good in Algeria, though fog and mist sometimes occur at night in marshy and other low-lying areas, such as the Mitidja, and the dust-storms, which are fairly common in summer, give rise to haze. Conditions are generally best in the High Plateaux and the Sahara where radiation at night is rapid and dews are heavy.

Along the coasts and over the sea, fog is common, particularly in summer, but as the fog usually occurs in local patches navigation is seldom impeded. Off the coast at Algiers, fogs occur on 13 or 14 days a year, of which about half are in summer and most of the remainder in spring and autumn. These fogs are usually caused by marked cooling at night when the wind is feeble. Visibility is normally good, exceeding 10 sea miles on more than half the days in every month and being less than 2 sea miles on very few days in the year. It is generally best in the spring and worst in the winter. Fog is more frequent at Oran, which is particularly liable to radiation fogs, owing to the low minimum temperatures commonly recorded at night. It is frequent in winter and rare in summer. General visibility is, however, best in autumn and worst in summer, though, as at Algiers, the seasonal contrasts are small, and visibility ranges of over 10 miles are common throughout the year.

5. *Clouds* (Table IV)

Algeria is one of the least cloudy regions in the world. During the summer, especially in July and August, little of the sky is covered, even on the coast, where there are seldom more than two overcast days a month; inland, still clearer conditions prevail. The degree of cloudiness is also small in the winter (the rainy season), and, even during the weeks with the heaviest rainfall, clear days and long hours of sunshine are common. The average number of overcast days a month in winter and spring is generally five.

Detailed statistics, which are available for only two stations, Algiers and Oran, show that Algiers is considerably more cloudy than Oran (Table IV).

6. *Precipitation* (Figs. 41 and 42; Tables V and VI)

Precipitation consists partly of snow, important in some of the interior districts, but chiefly of rain, the amount of which distinguishes the seasons much more than the temperature. In general the rain decreases steadily towards the interior, though the rainfall tends to increase where the land is higher, and lower-lying areas, sheltered from maritime influences, are usually exceptionally dry (Fig. 41). There is usually a sharp contrast between the exposed wet north and west slopes of mountains and hills and the sheltered and much drier south and east slopes.

Along the coast the total rainfall increases regularly from Oran (14.8 in.) to Bougie (40.8 in.), from which it decreases gradually towards the Tunisian frontier. In western Algeria the rainfall is small because the coastal mountains are low and the region lies in the shadow of the mountains of Spain and Spanish Morocco, on which the west and north-west winds deposit the bulk of their moisture. Eastern Algeria includes, in contrast, some very well-watered areas, with more than 60 inches in places. This is mainly due to the presence of high mountains near the coast in the area where the westerly winds have crossed the Mediterranean at its widest. In western Algeria the rainfall is heavier on some of the higher areas inland, such as the massifs of Tlemcen and Ouarsenis, than on the coast, but in the east the interior plateaux of Sétif and Constantine are sheltered by the high Kabylie mountains and so are rather drier than the coastal highlands. Thus the depth of the well-watered belt of country is usually smallest, as in eastern Algeria, when the amount of rain falling in the vicinity of the sea is greatest.

There is a steady diminution of rainfall towards the south. The Saharan Atlas, despite its height, receives only 14 inches, and the Aurès only 16 inches, though this is sufficient to maintain forests. South of the Saharan Atlas the rainfall never exceeds 8 inches and is usually less than 4 inches; indeed no rain may fall for several years in succession (p. 135).

The seasonal distribution of the rainfall is as important as its total amount (Table V). In most districts the bulk falls in the autumn, winter, and spring. Algiers, for example, has 80 per cent. of its total in the winter half of the year, and almost 50 per cent. (14.7 in. out of 29.8 in.) in November, December, and January. June to September, in contrast, is almost rainless. In the Tell there is normally a single maximum, in December

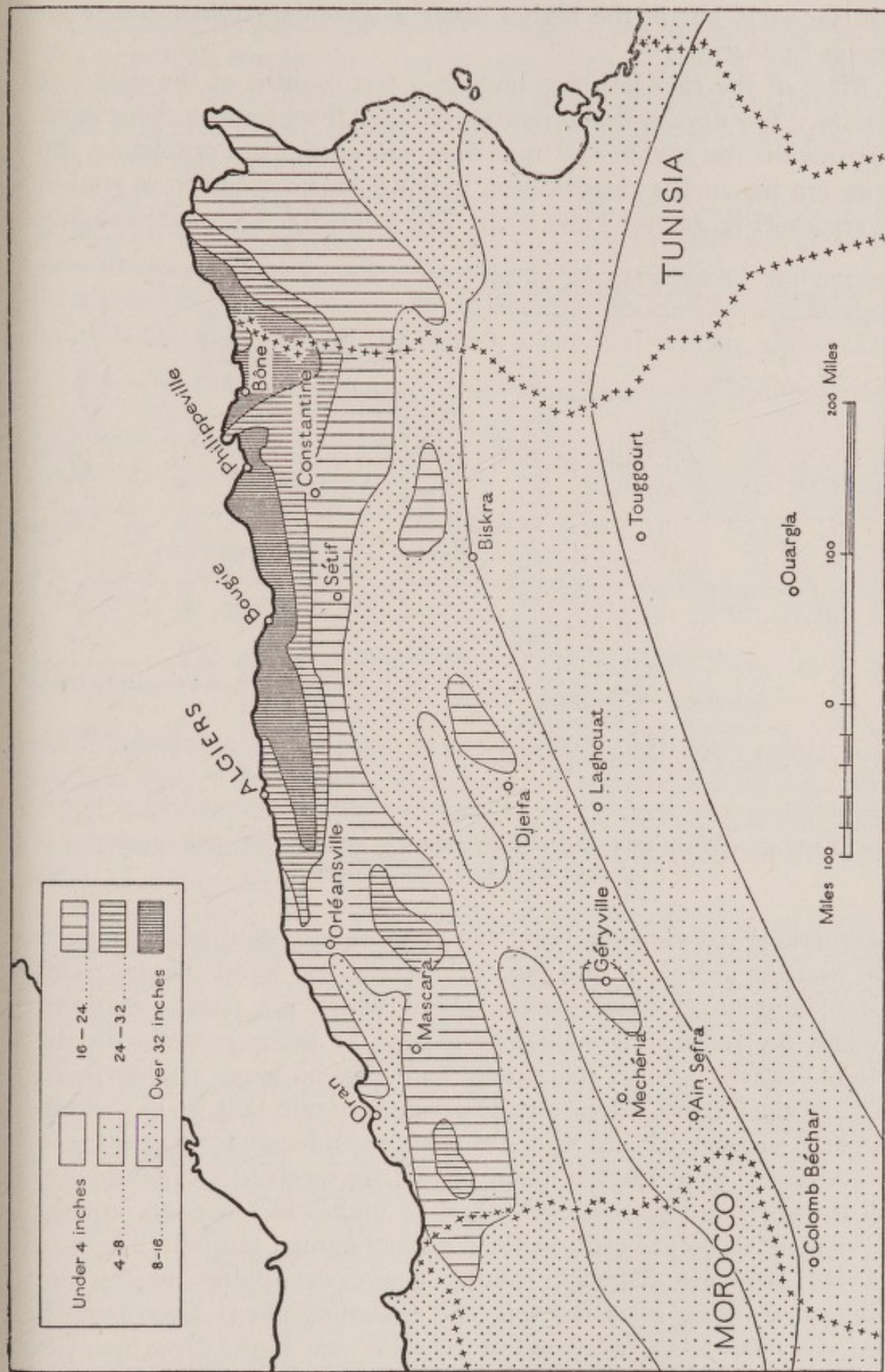


FIG. 41. Mean annual rainfall

and January, but in the higher areas a secondary maximum often occurs in March.

Most of the rain falls not only in a few months of the year but also on a few days in those months, and in a few hours on those days. Figures for the number of 'rain days' per annum are unreliable, the criterion for such a classification varying considerably from station to station (Fig. 42 and Table VI). The following figures are roughly

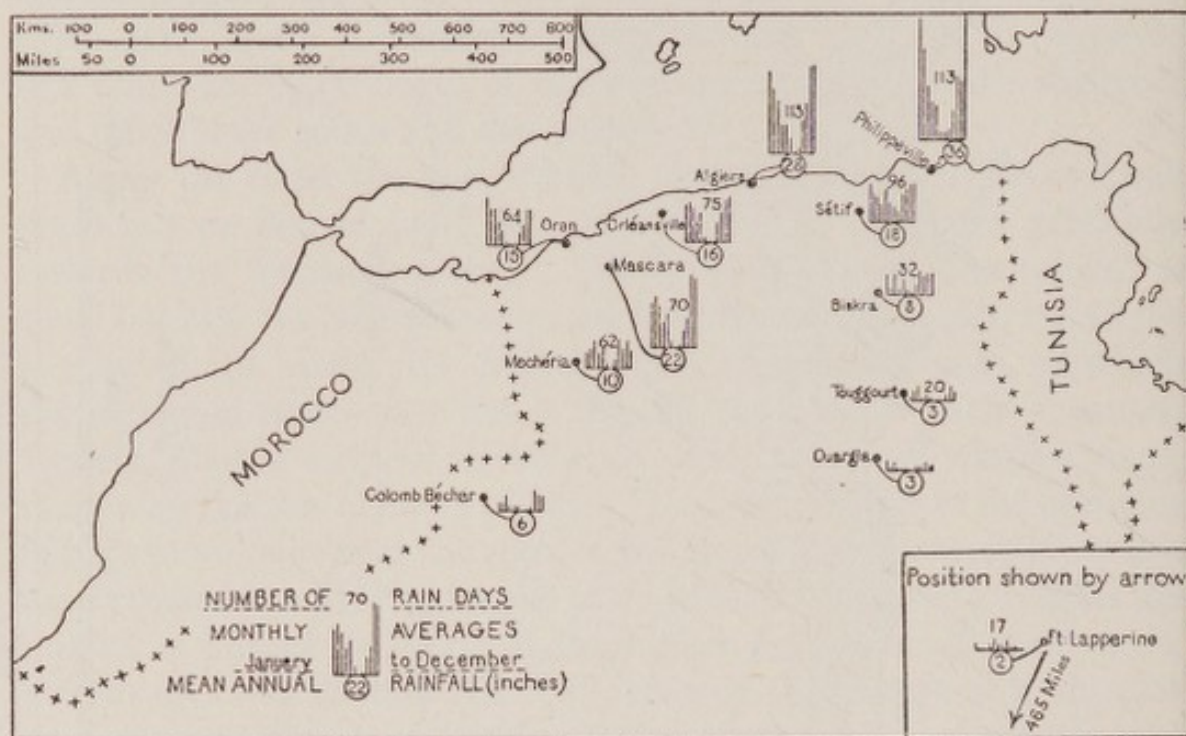


FIG. 42. *Mean annual rainfall, monthly distribution, and number of rain days at selected stations*

comparable with one another: 120 or more rain days per annum in the wettest area (e.g. Bougie), 113 at Algiers, 80 at Ténès, 64 at Oran, and 60 at Mostaganem, all of which are coastal stations. Inland the number is considerably less, 40 being common in the High Plateaux and in the Aurès, and only 20 along the northern edge of the Sahara. Occasionally very heavy rain falls, as in western Algeria, in 1927, when it rained almost continuously for 6 days (24–9 November); even the low plain of the Sig received 14 inches, and all the surrounding mountains had 17 inches or more, an amount equivalent to 80 per cent. of their normal annual rainfall. The rain caused extensive damage, ruining crops, destroying houses and villages, washing away the soil, and drowning about 2,500 people. Extensive floods also occurred in the same year in the department of Oran when on the night of 25–6 December 1927 over 5½ inches were

recorded at the dam on the Oued Fergoug. Even the short and sharp, but torrential, storms, so common over much of Algeria, are capable of causing considerable soil-erosion; furthermore such rain is of very little agricultural use, and soon evaporates, owing to its exposure to wind and sun.

Mean rainfall figures are valueless in most parts of Algeria, particularly in the steppe and desert regions, and the seasonal amounts also fluctuate considerably. Algiers has had as much as 51 inches in a year (1847) and as little as 15.7 inches (1913), and the January rainfall has ranged from 9.4 inches to 0.2 inches (Fig. 43). The

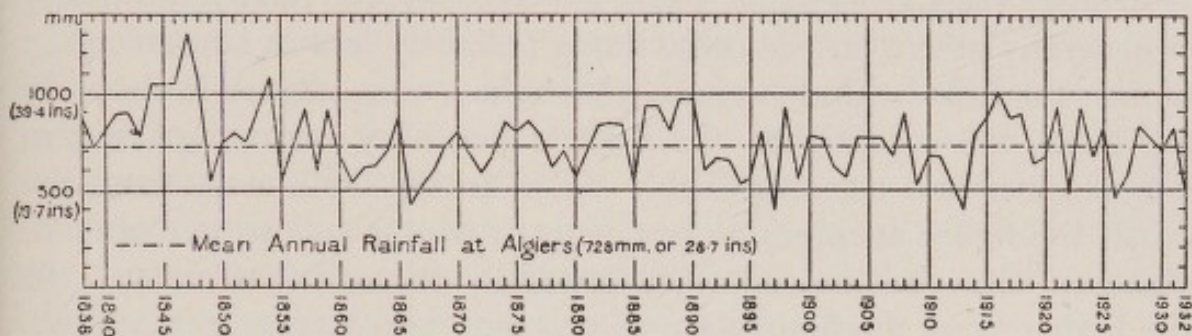


FIG. 43. *Variations in the rainfall at Algiers from 1838 to 1932 (after L. Petitjean)*

maximum rainfall may come in any month between November and March, and, in the interior, even later. These fluctuations naturally affect water-supply, natural vegetation, cultivated crops, and livestock, and artificial storage of water is essential in most districts. (Vol. II, Chap. XII.)

Snow. Snow is infrequent on the coast, falling on 1 or 2 days a year at many places at sea-level, usually after a series of north winds has led to intense cooling. Inland it is much more common, falling almost every year, normally on about 5 days a year above 2,000 feet, about 15 days above 4,000 feet, and on 20 or more days in the Saharan Atlas (as at Aflou) and in the Djurdjura. Snow also falls from time to time at Figuig, Laghouat, and even Ghardaia. The heaviest snows are at altitudes of about 8,000 feet, and fall between November and April (sometimes May), though chiefly from January to March. In the Djurdjura it lies from November till the end of May, and even the end of June, after which it remains only in isolated sheltered patches; but for most of the country little information is available. Though the total snow-fall in Algeria is small compared with that of the mountains of Morocco, its effects are very important. Melting snow provides water for the irrigation

of crops along the mountain borders, and unusually early snow sometimes kills large numbers of sheep. Transport is seriously hindered by snow on a number of roads (Vol. II, Chap. XV), and in the past snow has interfered with military expeditions in the country. It is, in fact, generally recognized that, although Algeria is warm in summer, summer rather than winter is the season best suited to military operations in the interior.

Dew. There is less dew in Algeria than elsewhere in north Africa, though it is of some significance in the High Plateaux and in the Saharan Atlas, where there is rapid radiation at night.

Relative Humidity (Table VII). On the coast the relative humidity is generally above 70 per cent. though slightly less in summer (e.g. Oran); the hills behind Algiers, where the average figure is about 67 per cent., are exceptional, the highest humidity occurring there in late summer and autumn (Table VII). In the Tell, away from the coast, the figure averages 70 per cent. in winter and 50 per cent. in summer, the seasonal contrast generally increasing eastward; in the higher areas the figures are 70 per cent. and 40 per cent. respectively. On the High Plateaux the relative humidity is 60 per cent. in winter, and, in the departments of Algiers and Oran, 30 per cent. in summer, and, in the department of Constantine, about 40 per cent. In the Sahara the figure throughout the year is about 30 per cent. or less.

Evaporation. The few statistics of evaporation are confusing, but the general facts are clear; in winter evaporation is greater on the coast than on the cold High Plateaux, and in summer there is a steady increase southward. Evaporation is always more marked than in temperate latitudes, owing to the generally clear sky, and is particularly rapid during the sirocco.

Rainfall Zones. As rainfall plays a dominant part in the determination of the seasons and in the life of the whole of Algeria, the four main rainfall zones are described in some detail (Fig. 41). The first zone, with 24 inches or more of rain per annum, includes the whole of the coastal regions between Cherchel and the Tunisian frontier, stretching as far as Miliana, Médéa, Bouira, Constantine, and Souk Ahras. Farther south there are outlying areas with the same rainfall in the massif of Tlemcen and in the Ouarsenis. A large part of this belt receives more than 32 inches of rain per annum, notably the chief mountains of the Tell of eastern Algeria. Bessombourg, near Collo, with 70.8 inches has the heaviest rainfall recorded in north Africa.

The second zone, with from 16 to 24 inches, includes the coast of the department of Oran, west of Ténès, a large part of the Ouarsenis, the plains of the Beni Slimane and the Arib, and the northern part of the High Plateaux of Constantine. Its southern boundary passes through Marnia, Sebdou, Boghar, Bordj bou Arréridj, and Can-robert. There are also small areas in the Hodna mountains, Djebel Amour, and the Djelfa and Aurès mountains. The 16-inch isohyet roughly marks the limits of the Tell and the steppes.

The third zone (8 to 16 in.), lying immediately south of the second zone, includes almost the whole of the High Plateaux and the Saharan Atlas, except for a few small mountain districts which are better watered, and certain lowland areas where the rainfall is even less. The lower Chélif valley, the Sig plain, and the Sebkha of Oran receive rather less than 16 inches. Areas with more than 12 inches are intermediate between the Tell and the steppes, but those with less than 12 inches are steppe. The 8-inch isohyet, which follows the foot of the Atlas, marks the truly Saharan districts where cultivation is impossible without the aid of irrigation.

The fourth zone (less than 8 in.) covers the whole region between the southern limit of the Atlas and the southern frontier of Algeria. The rainfall is everywhere negligible, or occurs at most irregular intervals. It also includes some of the interior, dry basins of the High Plateaux, such as the chotts of the department of Oran, the Zahrez, and the Hodna. The average rainfall at Laghouat is 6.9 inches, at Ghardaia 3.7 inches, at Touggourt 2.8 inches, and at el Oued 3.2 inches, but these average figures are of little significance, since often several years pass without as much as a single storm (cf. p. 135).

7. *Storms* (Table VIII)

Thunder is rare in the Oran Tell and in the Chélif valley, but is fairly common in the coastal districts of eastern Algeria, particularly around Algiers and farther east in the Kabylie and the coastal mountains of the department of Constantine. Thunder also occurs quite often in the upper valley of the Tafna and in Djebel Amour and the Aurès. At most places the maximum number of storms is in autumn and, to a less extent, in spring, with the minimum in winter, but at Cap Carbon and Cap de Garde the maximum is in late winter and early spring (Table VIII).

Hail-storms are rare, but generally occur in the same areas as thunderstorms, with which they are often associated, particularly in spring or early summer. The storms, which usually accompany

the passage of a cold front, generally move from west to east. March is the month of greatest frequency in most districts.

Dust-storms are fairly frequent on the coast during the hot season, occurring between hot and dusty south-east-south-west winds and the succeeding cooler winds from west or north-west. Dust and sand are sometimes carried considerable distances over the sea and give bad visibility. Similar, though much less frequent, storms, with strong winds, also occur at times during the winter.

Information relating to gales is given on p. 116.

8. *Miscellaneous*

Swell (Table IX). Along the coast of north Africa the west or north-west winds prevailing between October and April are often fresh and gusty and raise a heavy sea. The winds are especially strong and the weather very boisterous during December, particularly when the wind draws round to north-west or north-north-west. Gales from north-north-west are often preceded by a heavy northerly swell.

Data are available only for Djebel Krichtel (Kristel, Krichel) near Oran, and Cap de Garde (Table IX). Rough seas in western Algeria are usually limited to winds from between west and north inclusive. Other information shows, however, that north-east and east gales are not infrequent in places, and these gales are also at times preceded by swell. Certain localities are especially liable to rough sea, notably the roadstead of Ténès, on account of sudden storms from the north.

Mirage. Mirage is of fairly frequent occurrence. 'Inferior' mirage, similar to the summer mirage of desert areas, occurs in summer when the surface air, especially in shoals or shallow coast waters, is at a higher temperature than that of the air immediately above it. The horizon is depressed, distant low-lying objects are not seen at all, and objects which are seen appear to be nearer, clearer, and at a higher altitude than usual. This mirage is chiefly associated with the morning, when surface temperatures are rising rapidly, but before large-scale convection has begun. These mirages are apt to be confusing, especially at dawn, when it is very difficult to estimate ranges, and the appearance of objects is deceptive.

'Superior' mirage, in which objects appear raised above their usual positions and may be seen even when their distance exceeds the distance of the normal horizon, is relatively uncommon. It occurs

most frequently on calm evenings in coastal waters at the time when the surface temperature is falling rapidly.

Mirages are common throughout the High Plateaux and the desert areas of southern Algeria, particularly during the summer months.

Squalls. Along the Algerian coast there are occasionally isolated squalls from a westerly direction during spells of calm or light easterly winds. There are not yet sufficient observations to explain their origin.

Waterspouts. These occur from time to time, more particularly off the coast of western Algeria, usually during thundery weather, or in the vicinity of actual thunderstorms. Occasionally they cause considerable local damage.

9. *Climatic Regions*

Algeria is usually divided into four climatic regions—the coastal zone, the inner Tell, the steppes with the Saharan Atlas, and the Sahara itself. These regions are briefly described below.

The coastal region has a maritime Mediterranean climate. The winter is cool but mild and rainy, resembling an English autumn without its dampness. The summer is hot, though the temperatures are moderated by the breezes, and rainless, but the humidity of the air is great and conditions are generally oppressive. The diurnal range of temperature is small. Tropical clothing is commonly worn in Algiers between July and September. The conditions described are most noticeable in the area extending farthest into the sea and with the most marked relief, that is between Algiers and la Calle. Conditions month by month at Algiers are described below (p. 130). In the department of Oran continental influences make themselves felt, to some extent, right to the coast, but conditions in Oran itself are similar to those at Algiers, except that the air is far less humid.

The second region, that of the inner Tell, has cold winters, often with considerable snowfall: the summers are agreeable, with cool nights, though the heat may be excessive about midday during July and August. In western Algeria the mountains of Tessala, Tlemcen, and Ouarsenis are well watered, particularly where they are exposed to winds from the sea. The high plains of the interior, as around Sidi bel Abbès, are dry, hot, and fairly continental with a considerable range of temperature. The lower plain of the Chélif, surrounded on all sides by mountains, is even drier and hotter. In

eastern Algeria there is heavy rain and snow in the Djurdjura, the Kabylie des Babors, the Kabylie de Collo, and the Edough mountains. The chains lying behind, such as those of Berrouaghia, Aumale, Biban, and Constantine, have a more or less maritime climate, owing to their greater height and exposure. The high plains of the department of Constantine (as around Sétif) are cultivated in the north, but merge gradually into steppe towards the south.

The third region, the steppes and the Saharan Atlas, is excluded from Mediterranean influences and has a continental climate. The High Plateaux of the departments of Oran and Algiers, though between 2,500 and 3,000 feet in height, are low in comparison with the mountains surrounding them, and the seasonal contrasts are very marked. The winters are very cold, strong northerly winds often bringing heavy snow: the summers, in contrast, are hot, with clear, dry air, unclouded skies, and great diurnal variations of temperature, the range sometimes exceeding 35° . The rain falls mainly in the spring, though thunderstorms may occur in summer. The temporary lakes, or chotts, formed in spring, dry up in the summer, though marshy tracts may remain. In the higher land surrounding the High Plateaux, notably in Djebel Amour and the Aurès mountains, the rainfall is rather greater, and the summer temperature somewhat lower. In the low-lying Hodna region the temperature is not as low in winter and rather higher in summer.

The fourth climatic region, that of the Sahara proper, is characterized less by the height than by the great range of its temperatures, the very dry nature of the atmosphere, and the almost complete absence of rain. It is discussed in some detail on pp. 131-8.

Algiers (for climatic figures, see Appendix B). The wet season is from October to March inclusive. April and May have little rain, and the remaining months are almost rainless. The heaviest rains are those coming after the long drought of summer, but the highest monthly totals are in November and December. Rain falls on between 110 and 120 days in the year, usually coming with cold north-east winds. Temperatures are moderate in winter, when the sirocco is merely a pleasantly warm, dry breeze. When the sirocco blows during the summer, shade temperatures reach 100° even near the sea, and conditions are excessively hot and difficult. The sky is dimmed and the air is charged with fine sand. Except during the sirocco the nights are usually cool, even in July and August, and the dew is copious.

Weather conditions during each month at Algiers are described by a resident of fifteen years' standing as follows:

<i>January, February</i>	Heavy rain, and sometimes snow.
<i>March</i>	Fairly good weather with intermittent rainstorms.
<i>April, May, June</i>	Excellent weather.
<i>July</i>	Hot. Sirocco winds.
<i>August</i>	Excessively hot. Sirocco winds.
<i>September</i>	Usually good weather, but hot at times.
<i>October</i>	Either very hot or rainy.
<i>November, December</i>	Fair weather, with intermittent rain; can be very cold late in December.

THE SAHARA

1. *Introduction*

THE climatic conditions of the Sahara are so different from those of the three northern departments of Algeria that they are described in a separate section, though reference has been made in the previous pages to many of the places on the edge of the desert, such as Biskra. The general climatic features of the Sahara—the Arabic word, *Sahra*, means wilderness—have been recognized, but definite information has been confined to the occasional observations of travellers. Of late years, however, meteorological stations have been set up on the edge of the Sahara, and since February 1932 regular observations have been taken at the Jules Carde observatory at Tamanrasset (Fort Laperrine), in the Ahaggar mountains, 4,429 feet above sea-level. Some of these figures are given in the climatic tables in Appendix B.

2. *Pressure and Winds* (Fig. 38)

The pressure distribution and winds of the Sahara have already been described (p. 112). In the winter the Mediterranean is warmer than northern Algeria, which, in its turn, is warmer than the northern parts of the desert. The highest pressures are in the north of the continent, especially in the Moroccan Atlas and the High Plateaux of Algeria (Fig. 38). In the Sahara the pressure falls towards the gulf of Guinea.

The high-pressure system of the northern Sahara is more or less constant throughout the winter, and north and north-west winds

prevail at Biskra, Ouargla, and In Salah. Only very rarely do low-pressure systems, bringing rain or, occasionally, snow, penetrate the deserts. In the southern Algerian Sahara, north-east trade winds, sometimes called the winter monsoon, prevail, though they never blow as constantly as they do over the ocean.

In the summer conditions are completely reversed (Fig. 38). The continent is now warmer than the surrounding oceans, and the centre of the desert warmer than the peripheral regions. There is a steady diminution of pressure southward from the Mediterranean and the equatorial low-pressure systems invade the southern Sahara. Winds, therefore, blow inward to the central Sahara from all directions. In the north, between the Atlas and the Ahaggar, the north-east trade winds blow strongly, almost every day at Timimoun and In Salah, and on five or six days out of every ten at Touggourt and el Goléa respectively. The other important winds are the north and north-west. In the southern Sahara south-west and south-east winds are common and compete with the north-east wind known as the 'harmattan', which is one of the major causes of aridity in the desert during the summer. The south-west wind, in contrast, brings rain from the gulf of Guinea and is, in reality, the monsoon wind of the summer. It advances farther and farther north as the season advances, and regularly affects the Adrar des Iforas and, in some years, even the Ahaggar. In autumn it gradually weakens and gives place to the trade wind which, according to observations at Tamanrasset, blows throughout the year at heights of 3,500 feet and upward.

The most common and serious disturbances of the atmosphere in the Sahara are caused by sand-storms, accompanied by strong winds, of which there are several, though not always easily distinguishable, types. The sirocco (scirocco), of the northern departments, known by the Arabs as the *guebli*, has been described on p. 114, but there is also a desert sirocco, known as the *chihili* (*chili*), resembling the *khamzin* and *simoon* of other parts of the Sahara, and affecting a far greater area than the *guebli*. The *chihili* is a south-west wind which blows during temporary disappearances of the north-east trade wind, and is the forerunner of a depression moving from west to east. It usually starts with amazing suddenness, blue sky and intensely still air sometimes being replaced within ten minutes by a violent gale. Not only is the sun usually obscured, but the immediate surroundings may be completely blotted out by a yellowish-grey pall. There is no escape from the sand which penetrates houses through

closed doors and shutters. Being hot and dry, these winds occasionally cause fatal cases of heat-stroke. They affect the morale of Europeans stationed in the desert, for the nervous strain of the days of howling gale, with its irritating and choking dust, brings on attacks of *cafard*, or temporary madness.

Small swirls or whirlwinds ('dust devils'), often of considerable violence, are common in the desert.

3. *Temperature* (Table X)

The Sahara is one of the hottest, if not the hottest, regions of the world. Mean annual temperatures exceeding 86° occur over much of the central area and nearly all the Algerian Sahara is included within the 79° isotherm. But these mean figures give a very inadequate picture of the true conditions, as they bear little or no relationship to the life of plants, animals, or men, and completely obscure the importance of the huge diurnal variation of temperature. At midday the desert is a veritable furnace, but immediately after sunset there is a rapid loss of heat from the bare ground, as the air is clean and dry, and the nights are nearly always cool and refreshing. Saharan travellers have recorded diurnal ranges exceeding 54° , and the average figures for Ouargla are 23° in winter and 36° in summer, and for In Salah 29° in winter and 34° in summer (over 50° on some days in August). The corresponding figures for Algiers throughout the year are between 14° and 16° . There are even greater differences—of 85° or more—between the minimum temperatures recorded at night and the highest sun temperatures. In contrast to these great diurnal ranges the annual range of temperature is not great and seldom exceeds 25° . In view of the significance of the extreme figures, absolute maximum and minimum temperatures for four Saharan stations are given in Table X of Appendix B.

In the northern Sahara there is a single hot season, the highest figures usually being recorded in July. In the remote south there are two hot periods, the first in May and June, before the arrival of the monsoon, the occasional clouds and rain of which have a certain cooling effect; the second, in September, after the monsoon's retreat. The highest temperature ever recorded under standard conditions was that of 136° at Azizia in Tripolitania on 13 September 1922, but Algeria also had some high figures— 118° at Biskra, 129° at Touggourt, and 132° at Timimoun, with an unofficial recording of 133° at In Salah in August 1914. Temperatures of this height appear, in fact, to be quite common, since there is not a great difference between

the absolute and average maxima of the warmest months. In 1913, for example, In Salah recorded maxima of 118° throughout a period of forty-five days, during which the highest temperature exceeded 127° and there were no observations below 70° . Under such conditions the surface of the ground scorches any part of the body that comes in contact with it, and burns the soles of shoes. At the battle of Metarfa, fought in summer in the sand-dunes, native troops are said to have stood up under fire in preference to submitting to the agony of lying down and taking cover in the blistering sand.

In most parts of the Sahara there is, however, one season which, though it lasts only a few weeks, is cooler than the rest of the year. In Salah, for example, despite its low latitude (27.6°) and comparatively low elevation (below 1,000 ft.) is only slightly warmer in January than Algiers. Minimum shade temperatures below freezing-point are, indeed, by no means rare and frost occurs regularly each year in many of the oases. Touggourt, Ouargla, and Biskra have more days with frost than Algiers and other Mediterranean stations, and the irrigation canals in these oases are often covered by sheets of ice for some time after sunrise. Adrar, though only 4° north of the Tropic of Cancer, and at an altitude of less than 1,000 feet, has an average of 17 days with frost each year; In Salah has 9 days, and Tidikelt 5. The low temperature records include 23° at Ouargla, 25° at In Salah, and 28° at Biskra; 14° was observed on one occasion by the Foureau-Lamy mission which reported frost on 25 days in December 1898 and January 1899. The most severe conditions are experienced in the Ahaggar where, at Tamanrasset (4,429 ft.), there were 14 days with frost during 1910 with a minimum temperature below 19° .

The diurnal variations of temperature are more marked if ground, instead of air, temperatures are considered. The former are usually much lower at night and higher during the day than the latter, especially where the surface consists of sand-dunes. In the Erg er Raoui, for example, water has been frozen with an air temperature of 50° . Rocky surfaces are generally less heated than sand by day and retain more of their warmth at night.

4. *Visibility*

Visibility is generally good, though it may be poor, if there is mirage (p. 128) or during the occasional dust palls of the southern Sahara where, especially during the monsoon season of summer, a

grey, yellow, or black pall sometimes veils the sky and a thick, but perfectly dry, haze may cause very poor visibility. Fine particles of dust suspended in the air seem to be the cause of these mists which may last for several hours, or even days.

5. *Clouds*

The Sahara is even less cloudy than the three northern departments, only two-tenths of the sky usually being cloud-covered, as compared with four-tenths at Algiers. The sky is often completely cloudless, especially at night. A few clouds may appear during the day, and trails of rain may be seen descending from them, but before the rain can reach the ground it has usually been evaporated by the thirsty desert air; and all clouds disappear quickly after sunset, giving clear nights during which radiation of heat from the surface continues without interruption.

6. *Precipitation*

In the Sahara, as in northern Algeria, precipitation consists mainly of rain, though snow is not unknown; but even rain is infrequent, especially in those districts separated from the sea by upland areas, where it is a rare and most irregular phenomenon. Aridity is accentuated by the Atlas mountains though these are not the primary cause of it. The rain that does fall usually comes in heavy storms, which seldom last for long and affect only localized districts. Fig. 41 shows that the 8-inch isohyet passes near Colomb Béchar and Laghouat, and through Biskra, and the 4-inch isohyet near Beni Abbès and Touggourt. These lines represent, however, average conditions which are of little meaning in such an arid region and can be most misleading. The outstanding feature of the Sahara is that there is no *regular* rainfall and the amounts received from year to year are highly variable. In the northern Sahara rain comes only when low-pressure systems from the Mediterranean cross the desert, usually between October and April. Most of it comes at the transition seasons: in spring, when the pressure may suddenly be lowered as a result of the rapid heating-up of the desert, and in autumn, when the conditions are reversed. In winter rain seldom falls, this being the season when the high-pressure system of the northern Sahara is best established. There are, however, a great many exceptions to these general rules, extreme irregularity being everywhere the keynote. Colomb Béchar, for example, has had an annual fall of 5.6

inches, 1.5 inches of which have fallen in October, and Laghouat 6.9 inches, with 2.0 inches falling between September and November. In contrast the maximum figure for Ouargla, 200 miles south-east of Laghouat, is only 2.6 inches, and for Beni Abbès 3.0 inches.

Farther south there is seldom more than one real fall of rain in a year and usually none. El Goléa, for example, has had only one fall in 7 years, and Tidikelt and the Touat only one in 10 years. The total rainfall recorded in 3 years at Timimoun amounted to 1.4 inches and in 4 years at In Salah to 0.4 inches. Still more arid conditions occur farther to the south, in the flat areas of absolute desert around the Ahaggar (the *tanezrouft*) which are unaffected by either Mediterranean or Sudanese conditions.

Though the relative humidity is low (p. 137), the absolute humidity—the total amount of moisture contained in the air—is considerable. The mountain regions of the desert, therefore, receive more rain than the surrounding lowlands, and the Air, the Adrar des Iforas, and the Ahaggar are all affected by tornadoes and other storms on a few occasions in the year. Information about the rainfall régime of the Ahaggar is gradually being accumulated at the Tamanrasset observatory. The region appears to be on the limit of both summer and winter rainfall. In 1933, for example, out of a total fall of 6.3 inches, 2.0 inches came in January and 3.5 inches in May. The winter rainfall was caused by the west-east passage of a depression from the Atlantic to the Tassili des Ajjer; that of May came in a series of storms associated with depressions passing from the Sudan and the Adrar des Iforas north-eastward to the Tassili des Ajjer. In both seasons the area receiving rain extended to Djanet and Fort Polignac. In some years, therefore, rain falls in both winter and summer (as in 1933); in other years, in only one season; and, in bad years, in neither (as in 1910). Thus aridity and irregularity are as important features of the highest parts of the Sahara as of the rest of the desert, though sufficient rain usually falls in the Ahaggar to maintain running streams in some of its valleys (p. 76).

Such rain as falls in the Sahara usually comes in violent storms, sometimes accompanied by hail. Adrar has had 3.7 inches in a few hours and Timimoun 1.8 inches in the course of an afternoon: 3.0 inches once fell in Ain Sefra in 2 days. These storms are least common in the summer, but the month when they are most probable varies considerably—December at el Goléa, February at Ghadames, in Tripolitania, near the Algerian frontier, and March at Ouargla. Owing to the lack of vegetation cover the rain quickly finds its way

into the oueds, causing sudden, though short-lived, floods which may do much damage. A flood of this type destroyed part of the town of Ain Sefra and drowned a number of people, and in the Touat storms are always regarded as harmful rather than beneficial, since they bring salt up to the surface and destroy the foundations of buildings. It is, however, mainly by these storms that the underground water-supplies, on which all life in the desert depends, are replenished: the rainfall of slight showers is useless as it evaporates immediately.

Snow. Snow has been recorded on several occasions at Laghouat and Ghardaia. It has also appeared above 8,000 feet in the Ahaggar but never lies for more than twenty-four hours. Reports that some of the highest peaks are snow-capped for considerable periods appear to be incorrect.

Dew. At night there is rapid radiation of the air which often cools below the dew-point in many parts of the Sahara. Copious dew may be deposited, but this is quickly re-evaporated in the morning sun.

Relative Humidity. Though there is often abundant moisture in the air, the relative humidity is low and the air is so dry 'physiologically' that few plants can grow. The relative humidity is sometimes less than 10 per cent. and even in the most favoured areas the average is below 50 per cent. At Laghouat, Biskra, and Tougourt the figure ranges from 60 per cent. in January to 30 per cent. in July, and at In Salah from 49 per cent. to 24 per cent. At Tamanrasset, the relative humidity averages 31 per cent. in January and 21 per cent. in June, but in dry years these figures may fall to 21 and 4 per cent. respectively. (Table VII.)

Evaporation. Though no statistics are available, evaporation is known to be severe in all parts of the Sahara, owing to the cloudless skies and the great heat of the sun, particularly during the chehili.

7. Storms.

See p. 136.

8. Miscellaneous

Mirage. See p. 128.

Sand-storms. See p. 132.

Climatic Changes. This is a controversial subject beyond the scope or purpose of this book. Reference should be made to the literature mentioned in Appendix H.

9. *Climatic Regions*

The Sahara, as a whole, has already been distinguished as one of the four major climatic regions of Algeria (p. 130), with the following characteristics: great aridity, great variation of temperature, and an exceptionally dry atmosphere. These features appear in almost all parts of the desert, and our information about the climate of the Algerian Sahara is not yet sufficient to make possible any detailed subdivision. Three areas with somewhat different characteristics are, however, recognizable—the area immediately south of the Atlas, the Ahaggar, and the area lying in between them.

The northern part of the Sahara receives rather more rainfall than is general over the desert proper as a result of the occasional passage across the region of depressions from the Atlantic and Mediterranean. The amount of rainfall rapidly diminishes southward, however, and is insufficient to maintain a permanent flow in the streams. All the torrents of the southern slopes of the Ksour, Djebel Amour, and Aurès mountains soon disappear into the sand, where they provide important reserves of artesian water.

The Ahaggar, a mountain region in a desert, experiences a modified form of desert climate. The air is usually very dry, but rain may fall at any season above 8,000 feet and snow occasionally appears on some of the higher peaks in the winter. The amount of the rainfall fluctuates considerably (p. 136). There is a large diurnal range of temperature throughout the year, greater in winter than in summer in years when the south-west monsoon extends farthest, but greater in summer than in winter when the monsoon fails to reach the region. Maximum temperatures at Tamanrasset are often high, though they are usually about 10° lower than those of the Tidikelt and Touat. Statistical information for Tamanrasset is included in several of the tables of Appendix B.

Between the Atlas and the Ahaggar, and especially in the tanezrouft, or extreme parts of the desert, there is almost continuous fine weather. The north-east trade wind is the dominant wind, though the dust-laden chehili also blows frequently. Above the trade wind a counter wind blows throughout the year and from time to time it reaches the surface and blows in place of the trade, but it has an equally dry and parching effect. The diurnal range of temperature is everywhere great, but particularly in the areas covered by sand-dunes.

CHAPTER V

THE VEGETATION AND FAUNA OF ALGERIA

VEGETATION

FROM the point of view of its plant life Algeria is best divided into four parts—the coastal belt with the Tell Atlas, the High Plateaux, the Saharan Atlas, and the Sahara (Fig. 44). The first three are essentially Mediterranean in the broad botanical sense: the last belongs to the great Saharo-Sindian desert region and is described in a special section below (p. 151). The division between the Medi-

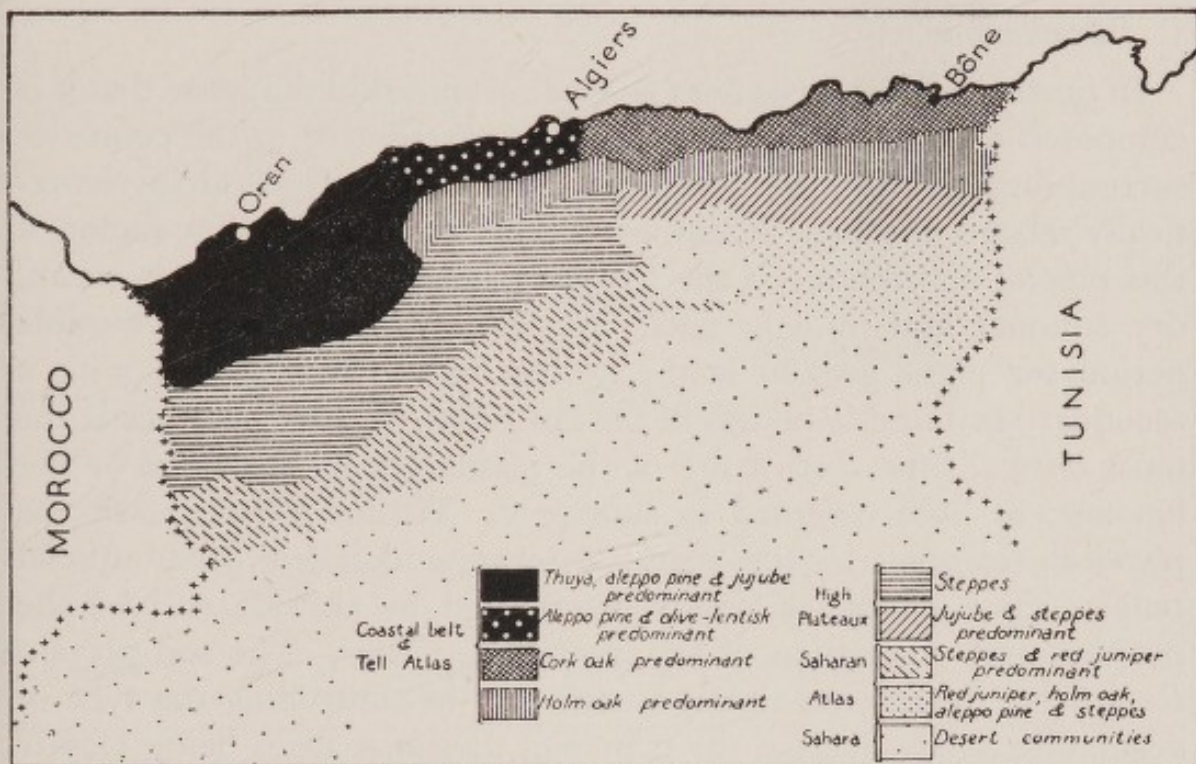


FIG. 44. *The distribution of types of vegetation*

terranean and Saharo-Sindian regions is sharp and, for Algeria, is best drawn immediately south of the Saharan Atlas. The total flora of Algeria consists of over 3,000 species of vascular plants. In general, the vegetation becomes progressively poorer from north to south as the rainfall diminishes and the flora becomes less Mediterranean and more African in character. There are local exceptions to this generalization, the eastern and western parts of the country, in particular, showing important differences, but none of these differences is as great as are those between the two major botanical regions—the Mediterranean and the Saharo-Sindian—whether the natural

plant life or the cultivated crops and general economic botany be considered. A somewhat isolated treatment of the Algerian Sahara (roughly the Territoires du Sud) is, therefore, necessary. In this chapter technical botanical names of plants have been omitted except where there are several varieties, and where, for the sake of clarity, the botanical name is essential. An index to botanical names of the plants mentioned in the chapter is in Appendix C; the main details of the more important plant communities of Algeria and an index of Arabic and Berber names will also be found in this appendix.

ALGERIA

1. *Introduction*

In northern Algeria the flora is Mediterranean in the sense that it is composed of plants more or less widely distributed in the countries surrounding the Mediterranean Sea, or of plants which are systematically related to others in this area. The major controlling factor of this type of distribution is the Mediterranean climate with its warm, dry summer and mild or cool, wet winter. The most favourable period for plant growth is the spring and early summer, with a secondary favourable period in the autumn. The dry summer is the most critical time, and many of the plants are by structure or behaviour, or both, adapted to survive it. Within Algeria itself the physical features, in the main, determine detailed distributional ranges, since climate is largely determined by altitude and by the position and orientation of the mountain masses. The soil plays a secondary, though not unimportant, part in controlling the type of vegetation in any district, the main soil divisions again being closely correlated with the climatic divisions.

2. *The Coastal Belt with the Tell Atlas*

This area includes all the coastal districts of Algeria and the Algerian Tell, and also extends eastward into northern Tunisia and westward into Morocco. It has a relatively short, dry, and warm period (4 to 5 months) and a humid, but not very cold, period, with an annual rainfall varying from 16 to 60 inches. The vegetation, where unaffected by man, is mainly high forest. This area can be subdivided into: the Oran, the Algiers, the Numidian, and southern Tell sectors (Fig. 45).

The Oran Sector. This sector stretches from the Moroccan frontier

to Cap Ténès along the coast and southward to the High Plateaux. It has the driest climate of the four sectors. The dwarf palm is abundant, but there is little cork oak. In the southern part, in the mountains of Tlemcen and the plateau south of Sidi bel Abbès, the holm oak and Aleppo pine are respectively very abundant. The holm oak (Photo. 47) usually occurs in the form of a rather low, dense forest with a thick canopy which opens up when the substratum includes much clay or rock: but its range and vigour are mainly depen-

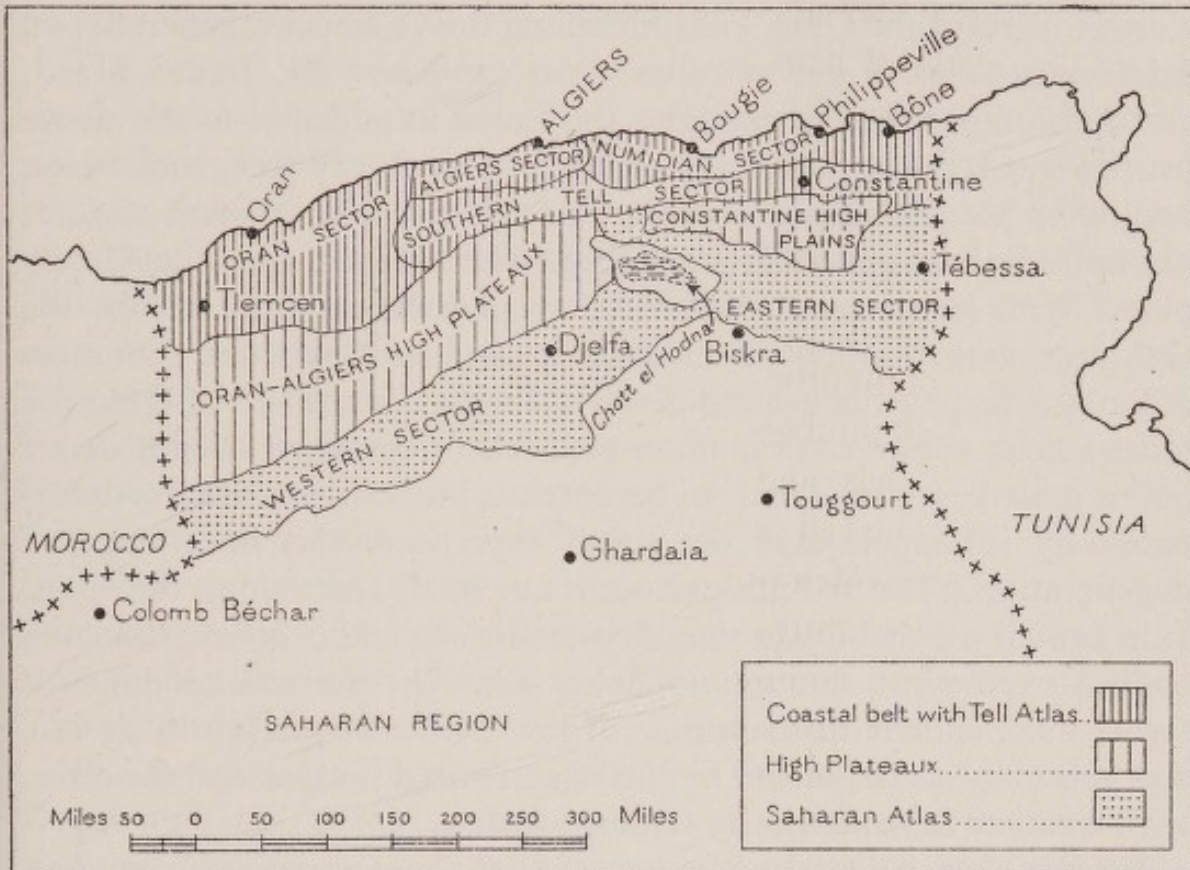


FIG. 45. *The vegetation regions and sectors of northern Algeria*

dent on climatic conditions, the species being nearly indifferent to the nature of the soil. The variety occurring in Algeria (var. *ballota*) has edible acorns which are used as food by the inhabitants. It attains its maximum development in the colder mountains, which have fairly abundant rainfall but rather low humidity, such as the mountains of Tlemcen. It can develop from sea-level (except when in competition with species better suited to warmer conditions) up to about 6,300 feet. In the mountains of southern Oran holm-oak woods are composed of low trees, rarely with a continuous canopy, mixed with ash (*Fraxinus xanthoxyloides*), red and Mediterranean junipers, and turpentine trees. The woody undergrowth is rather poor, but the field

layer of herbs is well developed. The Aleppo pine frequently competes with the holm oak in the higher and colder parts of the mountains. In western Algeria the Aleppo pine is rare in, and even absent from, areas which would appear to be suitable for it. Fires have restricted the tree but they cannot completely destroy it since it quickly rejuvenates from seed, unless there is a number of successive fires. Resistance to pasturage is much less. Rosemary and a low shrubby plant known as *Globularia alypum* are constant associates of the Aleppo pine. The Barbary thuya is especially well developed in the western parts of the Oran Tell, and along the Oran coast generally, on calcareous soils. Trees of olive (*Olea europaea*), St. John's bread, and red juniper may accompany the thuya in addition to the dense brushwood layer of lentisk, buckthorns, strawberry tree, rock-roses, and other Mediterranean plants. The thuya is less resistant to cold, but more resistant to complete deforestation by man, than the Aleppo pine. With its power of throwing up new shoots from stools, the thuya recovers eventually from both fire and cutting better than most other conifers, but its growth is slow. In the department of Oran the olive-lentisk community is often reduced to brushwood with dwarf palms mixed with jujubes. An herbaceous bulbous community dominated by asphodels and sea squill represents the final stage of degeneration. The red juniper occurs in small areas along the coast. It is a small tree, which prefers dry conditions and is often associated with Aleppo pine, thuya, and holm oak. On the coastal dunes it forms independent communities of low dense woods (16 to 23 ft.), and is usually accompanied by the large-fruited juniper and the olive, with a rather dense shrubby undergrowth.

On the clay plains the highest type of plant community is often brushwood of jujube or lotus and betoum or Atlantic turpentine tree. The jujube grows extensively in the alluvial plains or foothills which have low rainfall (12 to 16 in. a year) and deep soils, even if the latter are slightly saline. It replaces Mediterranean hard-leaved communities where drought and cold are unfavourable to the latter, and consists of high bushes, fairly close together, interspersed with small trees never more than 20 feet high. The jujube is dominant but is sometimes mixed with a shrubby member of the potato family (*Withania frutescens*), cottager's tea shrubs, and sumachs. The herbaceous layer is largely formed of grasses. The jujube is bare of leaves in winter, when it has a characteristic grey appearance, but is bright green in early summer.

Many Spanish and Moroccan plants and much of the steppe flora

extend into this region; halfa (*Stipa tenacissima*),¹ for example, is found nearly everywhere in the coastal zone, and white wormwood is common.

The Algiers Sector. This sector extends from Cap Ténès to the mouth of the Oued Isser, east of Algiers. The rainfall here is more abundant (24 to 36 in.). In the western part of the region Aleppo pine (Photo. 48) and holm oak are common, while in the part east of Algiers the olive-lentisk community is dominant with some cork oak. The cork oak plays a secondary role in the flora which is characterized by certain herbaceous plants. The dwarf palm is abundant and the sandarach or arar tree common.

The littoral type of Aleppo pine community is characteristic of fixed coastal dunes, as at Zéralda. Near the sea the pines are dwarfed, gnarled, and rather widely spaced, and are associated with red juniper, lentisk, and kermes oak. Inland the trees are taller and closer together, forming a pure tree layer with reduced undergrowth. When the forest is exploited the shrubby and herbaceous layers increase in importance. Sub-littoral communities occur on low hills (750 to 1,000 ft.), as in the forest of Tala ou Malou, north of Mouzaiaville. Here the tree forms an open forest with more or less flexuose trunks and a very abundant mixed shrubby undergrowth. The herbaceous layer consists largely of great tufts of the diss grass (*Ampelodesma mauritanica*). In the coastal zone the Aleppo pine is abundant in the west, but in the east occurs only in scattered localities, and is not found east of Dellys. The main area of holm oak is the Zaccar, north of Miliana.

The cork oak (p. 144) occurs mainly in the eastern part in the Bou Zegza highland, south of Fondouk, on non-calcareous soils. It is associated with the olive-lentisk community which is found extensively over the eastern part of this region south of the Mitidja and in the coastal regions from Algiers to the Oued Isser.

The marram grass or *oyat*, though classified with steppe vegetation, is, in Algeria, limited to a narrow strip on the seaward side of the coastal dunes. The Mediterranean marram grass, like the common marram of more northern coasts, of which it is sometimes considered to be only a variety, is admirably adapted to life on mobile sands because of its deep root system, its power of growing through blown sand, and its resistant leaves. On the dunes another grass (*Sporobolus pungens*) assists the marram in fixing the sand, and various

¹ In this account the name halfa or alfa (Arabic) is retained for *Stipa tenacissima*, and the French *sparte* is used for *Lygeum spartum*. Both these grasses are used and exported as 'esparto grass' (p. 148).

bulbous and rhizomatous perennial herbs and a number of annuals also occur. Immediately behind the marram dunes are the fixed dunes which are occupied by forest communities.

The Numidian Sector. This sector stretches from the Oued Isser to the Tunisian frontier (and beyond) along the coast and lies north of the southern Tell region. It has the heaviest rainfall of any part of Algeria (28 to 60 in.). The dominant soils are siliceous, and are often deep and fertile. There are extensive forests of cork oak (Photo. 49), and also a large number of plants not found elsewhere in Algeria. The holm oak occurs extensively over the western parts of this sector, especially in the Djurdjura. The Aleppo pine is limited to the driest areas, such as the limestones of the Gouraya de Bougie and the stabilized sand-dunes. In the west the cork oak is mixed with olive, lentisk, and holm oak, but from Bougie to the eastern frontier it is dominant with patches of deciduous trees such as Portuguese and Afarès oak, elm, and ash, and in a few coastal districts is replaced by the maritime pine. These trees are generally localized in the coastal areas on siliceous soils, and form rather dense forests of somewhat twisted trees, up to 30 or, rarely, 50 feet in height and accompanied usually by a well-developed undergrowth. In Algeria the maritime pine does not grow above about 2,400 feet. The shrubby undergrowth, which makes an impenetrable thicket, is mainly composed of Mediterranean maquis species, such as strawberry tree, heaths, lentisk, myrtle, and woody climbers such as smilax, clematis, and *Aristolochia altissima*.

The cork-oak forest is only developed in regions with relatively high rainfall (more than 24 in. a year), and is luxuriant when conditions are wet and fairly warm with high humidity, and when soils are deep and non-calcareous. The tree is deep rooted and does not flourish on compact clays or soils with a calcareous substratum near the surface. It does well on loose soils resulting from the disintegration of mica-schists, gneisses, granites, sandstones, and certain volcanic rocks. It grows from sea-level to heights of about 3,300 feet, and, under very favourable circumstances, to 5,300 feet. Some of the cork-oak forests have been excessively exploited, even to the limit of complete deforestation. The pasturing of animals prevents the natural rejuvenation or regeneration of the cork oak. Stages of degeneration are represented by high macchia, low rock-rose communities, and finally stretches of bracken or asphodel communities. In the shrub layer of the cork-oak forest Mediterranean plants dominate, including tree heath, strawberry tree, lauristinus, myrtle, buck-



46. *Cedars in the forest of Teniet el Had*



47. *Holm oaks on Djebel Takintoucht,
Kabylie des Babors*



48. *Aleppo pines in the Aurès*



49. *Cork oaks after the removal of the bark, near Philippeville*

thorn, a privet-like plant (*Phillyrea media*), rock-roses, dwarf palm, and lavender (*Lavandula stoechas*). Numerous woody climbing and clambering plants, such as smilax, ivy, species of clematis and honeysuckle, roses, and brambles, tend to bind together the shrubs. The field layer of herbs is poorly developed except in clearings.

The Portuguese oak and Afarès oak are both found in numerous districts in the eastern part of this sector, and also occur in isolated areas in the cork-oak region. The Portuguese oak community develops on a wide variety of soils, its range being determined chiefly by its need for water. It grows only in areas with heavy rainfall (at least 32 in. a year) and high humidity, and flourishes best between 3,300 and 5,300 feet. There are several varieties of Portuguese oak. It is known as *zan*, *zéén*, or *zen*, and to natives as *techt* or *tachta*. The leaves are rather late in falling (January) and are sometimes almost evergreen. The typical community is a dense high forest with a continuous canopy casting a deep shade. The tree layer is either pure Portuguese oak or is mixed with Afarès oak, service trees, maples (*Acer obtusatum* and *A. campestre*), and, more rarely, holm oak or cork oak. Excessive exploitation, fire, and pasturage lead to degeneration, through the stages of impoverished forest, and brushwood, to stretches of bracken, asphodels, or poor diss grassland.

The Afarès oak usually forms a high forest with a continuous canopy, which is somewhat lighter than that of the Portuguese oak because the branches spread less and the leaves are narrower. The shrub layer is not very dense and includes tree heath, brooms, butcher's broom, and bramble. The field layer of herbs is well developed. The community develops on non-calcareous soils where the rainfall exceeds 32 inches a year, and usually between 2,000 and 5,000 feet (though locally it may be present at lower altitudes, as for example at 500 feet near el Milia). Degradation stages are oak brushwood, grassland of diss or dyss, and bracken communities.

Mixed cedar forests are developed on the deeper soils and better watered localities of the calcareous marls of the eastern Djurdjura. Mixed with the cedar are Portuguese oak, service tree, white beam, maples (*Acer obtusatum*, *A. opulifolium*), gean, yew, and holly. Where the shade is not too dense the shrub layer is well developed and includes such plants as spurge laurel, honeysuckle, hawthorn (*Crataegus laciniata*), the common juniper, and butcher's broom. The field layer of herbs may be well formed and contains many interesting and rare plants. In the Kabylie des Babors and the Tababor mixed cedar forests are accompanied in the tree layer by a

rare fir (*Abies numidica*) and the aspen. On the highest summits of the Djurdjura there is a natural brushwood of dwarf cedars, between which is a low scrub of broom (*Cytisus balansae*) and another legume (*Erinacea anthyllis*).

The Southern Tell Sector. This sector stretches from the Oran sector south of the Algiers and Numidian sectors and north of the High Plateaux, as far east as the Tunisian frontier and beyond it into Tunisia. It includes part of the Tell Atlas as well as portions of the plains and valleys which occur between the ranges of the Tell Atlas and the coastal ranges. It is relatively badly watered, and has a continental climate with a prolonged dry season. The Aleppo pine, the holm oak, and the sandarach or arar tree are common. The Aleppo pine has a wide range and its communities differ considerably. It usually forms open forest with the trees averaging 26 feet in height. Usually there is dense undergrowth forming shrubby, herbaceous, and even moss, layers. The tree is adapted for growth under warm and dry conditions. It frequently competes with the cork oak on non-calcareous soils, and with the olive-lentisk community on impermeable soils. It forms an important and almost continuous zone in the Ouarsenis, the eastern part of the Blida Atlas, and the Biban massif. On the seaward chains of the Tell Atlas the Aleppo pine occurs up to about 4,500 feet.

In the Tell Atlas the holm oak (Photo. 47) is generally conspicuous from 1,300 feet. Spoliation leads usually to increasingly open brushwood. A number of communities are recognizable, of which two may be briefly described. In the lower levels of the Tell Atlas the holm oak is usually mixed with olive, ash (*Fraxinus oxyphylla*), or Aleppo pine. It forms a low brushwood, rather than forest, with numerous shrubs and woody climbers and a fair development of field and moss layers. In the upper level of the Tell Atlas a higher forest occurs with holm oak dominant, generally mixed with Portuguese oak, maples, gean, and Mediterranean juniper. Neither the shrub layer nor the field layer is very dense. Holm-oak forest occurs widely over the whole of this sector. Portuguese and Afarès oaks are also found in the Tell Atlas, the former up to 6,000 feet and the latter between 2,000 feet and 5,000 feet, but they need a good rainfall and are not found nearly so extensively as in the Numidian sector.

The olive-lentisk community is very common in the Tell from sea-level up to 3,300 feet, but has been much modified by man. On calcareous soils it is associated with Aleppo pine, thuya, and holm

oak. When unspoilt, the olive-lentisk community occurs as low forest or high brushwood. It is dense and even impenetrable on loose soils, but fairly open on heavy clay soils. Brushwood of lotus and Atlantic turpentine tree occurs on the clay plains, and the steppe flora penetrates into the region at certain points.

The high mountains, especially in the east of the Tell Atlas and in the Ouarsenis, have islands of cedar communities. In these districts the winter is rigorous and there are long periods during which snow remains unmelted. The summers are relatively warm with fairly high humidity and a dry period of only three months. The best known cedar forest in Algeria is that of Teniet el Had in the Ouarsenis (Photo. 46). It covers the slopes of Djebel el Meddad (5,897 ft.) to the west of Teniet. On the lower slopes it is mixed with holm oak, Portuguese oak, and cork oak, but in the higher parts the cedar is dominant, and some of the trees are very old and large.

The Atlas cedar under favourable conditions is 150 feet tall with a circumference at 5 feet of 10 feet or more. It has at first a pyramidal form which later becomes tabular. It grows best in areas which are dry in summer and cold in winter; its flexible branches allow snow accumulating on them to slide to the ground. Only on very dry mountain slopes does it give way to *thurifer*. On the northern slopes of the Tell Atlas the cedar first appears at about 4,300 feet, or in ravines at about 3,300 feet, and occurs up to 7,300 feet. On the southern slopes and in the Aurès it extends to rather higher altitudes. Cedar forests are of two types, pure and mixed. The pure, intact cedar forest is dense and forms an abundant black humus; often there is no shrub layer except in clearings. The mixed field layer consists of plants able to withstand shade. Pure cedar woods grow mainly on shallow soils; where the trees are widely spaced and in damp ravines there are usually bushes of holly, yew, and holm oak. Excessive exploitation of pure cedar woods quickly leads to the development of stony pastures, which are composed of hardy grasses and other herbs. The *thurifer* may accompany or replace the cedar. Above the high forest 'sub-alpine' brushwoods may be developed, but the mountains are nowhere high enough for the latitude to permit the development of a true alpine vegetation.

3. *The High Plateaux*

The High Plateaux have a continental climate, with a long, dry season of 6 or 7 months, and an irregular rainy season with an annual rainfall of between 12 and 20 inches. The summer temperatures are

high and the winters rather cold. These conditions are unfavourable to the development of high forest, and steppe is the principal type of vegetation. Two main sectors are recognized—the western, that of the High Plateaux of Oran and Algiers, and the eastern, that of the High Plains of Constantine, separated by the basin of the Chott el Hodna, an outlier of Saharan vegetation (Fig. 45).

The High Plateaux of Oran and Algiers. These are poorly watered (rainfall 12 to 16 in.) and have immense steppes covered with halfa, sparte, and white wormwood, with brushwoods of lotus and Atlantic turpentine trees in the muddy depressions (*dayas*), which are only full immediately after rain. The forest vegetation is limited to occasional open groups of red juniper and holm oak, with Aleppo pine and a very few arar trees where there are hills.

Steppe communities are abundant in all poorly watered areas. Where rain is very rare the steppe passes into desert; where it is more abundant there is, under natural conditions, a gradual transition to forest. The steppe is characterized by the absence of trees and shrubs, the single-layered vegetation being formed exclusively of herbs and dwarf plants growing in tufts separated by bare soil (Fig. 17). The halfa (alfa) is a perennial grass which is extremely resistant to drought and only grows naturally where the yearly rainfall does not exceed 20 inches. It cannot withstand the least stagnation of water at its roots and is excluded completely by high concentrations of mineral salts in the soil. It generally grows in the form of large tufts which may attain a height of 3 feet and are sufficiently close together to appear from a distance as a continuous turf (Photo. 50). Very few other plants accompany the halfa, except those which develop in the spring in the shade of the halfa and quickly flower, set seed, and die. Halfa is exploited for its leaves, the most important of the species being exported as 'esparto grass'. It is grazed by camels, but not by sheep. Some of the halfa areas in Algeria represent the final stages of degradation of red juniper or Aleppo pine forests, but others are true climatic communities. The chih or white wormwood replaces halfa in muddy alluvial and clay plains and depressions, and in valley bottoms which are not saline. Sparte steppe is dominant on clay or saline soils and provides only poor pasturage for sheep, goats, and camels.

The sandy soils of the High Plateaux and of parts of the northern Sahara are occupied by a grass known in all the drier parts as drinn. In common with other grasses especially suited to growing on mobile sand, the drinn can withstand both the piling up of sand and prolonged wilting. Its extremely long and well-developed root system helps to

fix the sand, and the abundant production of root-hairs, protected by a sheath of mucilage, enables the plant to extract the maximum possible amount of water from the permeable substratum. The leaves are hard and roll up in a dry atmosphere. The tufts of drinn are lower than those of halfa and sparte. The community gives excellent pasture for camels, and the natives collect and eat the drinn grains, which they call *loul*.

Salt-steppe plants occupy the clay basins rich in mineral salts, and occur both near the coast and in the interior, being particularly extensive around the chotts. Locally, numerous plants able to withstand high salinity (known technically as *halophytes*) are dominant, including rice-grass, sea rushes, sea lavenders, and many members of the chenopod family. The salt steppes form excellent pasturage, being permanently green, and during the dry season ensure food for the herds of the High Plateaux when the other steppes offer very meagre nourishment.

The Atlantic turpentine tree grows in the *dayas* of the High Plateaux. It is a Saharan community which only extends into northern Algeria under semi-desert conditions; by excessive grazing it usually appears associated with jujube brushwoods.

On the dry mountains of the High Plateaux the red juniper forms independent communities of low woods (16 to 23 ft. high) which have the composition of forest-steppe. It is more resistant to cold than the Aleppo pine and reaches altitudes of 7,500 feet. The shrub layer, consisting of rosemary and a few other species, is usually open. In the more open parts there are numerous tufts of halfa and sparte.

The High Plains of Constantine. These are somewhat wetter with a rainfall of 16 to 24 inches, and are largely under cultivation. The dominant plant community of the sector is jujube. On the marginal mountains there are meagre forests of holm oak. Halfa steppes are rare, but where they do occur the vegetation is like that of the High Plateaux of Oran and Algiers, and around the chotts there are salt-steppe plant communities.

4. *The Saharan Atlas*

The western part of this area is a continuation of the eastern Moroccan High Atlas and can be conveniently divided into two sectors, the western and the eastern, separated by the Hodna depression (Fig. 45). The annual rainfall varies between 14 and 22 inches. Steppe communities are dominant on the lower hill-slopes and plateau areas, but the mountains carry a good deal of forest.

The western sector (the Saharan Atlas proper) has forests of Aleppo pine and holm oak on the summits, with red juniper forming open woody communities, interpenetrated by steppe flora, in many parts. The Aleppo pine forests are exceptionally fine, and vary from dense to open, the former nearly excluding undergrowth. Pines with straight trunks form a rather open forest, sometimes accompanied by holm oak, and are associated with a fairly mixed undergrowth of juniper, turpentine tree, lentisk, yellow jasmine, hawthorn (*Crataegus monogyna*), and other shrubs. In clearings halfa grass forms the field layer. In very favourable localities the lentisk, strawberry tree, maple (*Acer monspessulanum*), and smilax are relicts or outposts of Mediterranean maquis. The Aleppo pine forests are particularly well developed in the Monts des Ouled Nail at about 5,000 feet.

Military Significance of Vegetation

	PASSABILITY				COVER FROM VIEW
	1. Density	2. Height	3. Diameter of trunks	4. Under-growth	5. Ceiling (Canopy)
Aleppo pine	Usually open	Average 26 ft. (up to 60 ft.)	1½-4 ft.	Dense	Fairly continuous
Maritime pine	Often close	30 to 120 ft.	Up to 4 ft. or more	Dense	Often continuous
Barbary thuya	Usually open	Up to 30-40 ft.	1-1½ ft.	Dense	Usually much broken
Red juniper	Open	16 to 23 ft.	Up to 2 ft.	Sparse and low	Broken
Thurifer	Open to close	Usually less than 30 ft.	2 ft. at most	Sparse	Fairly continuous
Cedar	Close	Up to 150 ft.	Up to 5-6 ft. and more	Sparse	Continuous
Cork oak	Open	15-40 ft.	1-4 ft.	Dense	Broken
Holm oak	Close	10-50 ft.	Up to 2 ft.	Sparse	Fairly continuous
Olive and lentisk	Close	10-20 ft.	1 ft. and less	Dense	Continuous
Portuguese (zen) oak	Close	Up to 120 ft.	Up to 5 ft.	Sparse	Continuous
Afarès oak	Close	Up to 100 ft.	Up to 3 ft.	Rather sparse	Continuous
Elm and ash	Close	30-50 ft.	1-2 ft.	Dense	Continuous
River-banks	Close	20-50 ft.	1-2 ft.	Dense	More or less continuous
Betoum	Open	10-20 ft.	½-1 ft.	Sparse	Broken
High mountain brushwood	Close to open	A few ft.	..	..	..
Jujube brushwood	Dense	Up to 15-20 ft.	..	..	..

The eastern sector (southern Constantine) is well forested in all its mountain parts. The higher mountains have fine forests of cedar and thurifer: the latter is restricted as a separate community to a part of the Aurès mountains and to some of the slopes of Djebel Mahmel. The lower mountains have woods of holm oak, Aleppo pine, and red juniper. There are extensive forests of Aleppo pine

and holm oak in the Aurès mountains, and in the higher parts of the Aurès and the Batna highland cedar is dominant: in the Aurès it extends above 7,000 feet.

Steppes of halfa and white wormwood dominate on the plateaux, but the former probably represent the ultimate stages of forest degradation in most parts. The diss grass is also fairly abundant on the mountain slopes.

The military significance of vegetation is shown in the table on p. 150. The data are generalized, and measurements are for mature (i.e. fruiting) trees or shrubs, undamaged, or not unduly damaged, by human agencies. Degradation stages are exceedingly common, and the above particulars may not then apply.

THE SAHARA

1. *Introduction*

The whole of Algeria south of the Saharan Atlas is desert in the sense that rainfall is very low and irregular, and plant and animal life is, therefore, sparse and, in a variety of ways, adapted to extremely arid conditions. This huge area is, however, by no means deprived of all vegetation, nor are conditions everywhere uniform. Variations in the physical characters of the subsoil, in the depth of the water-table, and in altitude, combined with latitudinal position, give a much greater range of flora and vegetation than is generally realized. The northern boundary of the Sahara is not sharply differentiated botanically, but is here taken as the southern foot of the Saharan Atlas (Fig. 44). Further field research may enable a more definite boundary to be established, possibly somewhat farther north. Within the Sahara there are three rather vaguely defined sub-regions: the northern Sahara, including, as an outlier, the area around the Hodna depression, with Mediterranean (or derived Mediterranean) types dominant: the central Sahara, with a mixture of Mediterranean and tropical African types: and the southern Sahara which, except in the mountainous areas, consists almost exclusively of tropical types. On the whole the parallel of 28° N. can be taken as a convenient line of division between predominantly Mediterranean and predominantly tropical vegetation, again excepting the mountain massifs, particularly the Ahaggar. The northern area receives fairly regular rainfall, though it is small in amount and limited in season, and has vegetation on practically all types of soils. The central and southern regions, in contrast, have rainfall at very irregular intervals, and vegetation

is confined to those areas where water accumulates during the rains and is conserved for a period in the soil.

Two very distinct types of flora and vegetation occur in the desert: the permanent and the ephemeral. The permanent consists of perennials—a few trees (betoum, acacias, &c.), shrubs (jube, tamarisks, &c.), and a relatively large number of sub-shrubs and perennial herbs. These perennial plants show peculiarities of structure and behaviour adapting them to the conditions in which they live. Water is the limiting factor to the luxuriant development of plant life. Only those plants which can live and reproduce with a low and irregular water supply can form the desert vegetation. Any plant will die unless it can maintain its internal water supply by keeping a balance between water taken in by the roots and water given out in transpiration. Internal factors, not yet completely understood, such as the power of withstanding long periods of wilting, are of considerable importance, especially in such tree plants as the betoum or Atlantic turpentine tree with their large leaf-surfaces. Typical desert plants, on the other hand, show marked structural characters such as dwarf and often compact form, small leaves, hard foliage, development of hairs or other superficial covering, production of ethereal oils, and strong development of spines. All of these in varying degrees retard loss of water, while the intake of water is increased by vertically and horizontally extensive root systems with strong development of root-hairs. In the Sahara the succulent habit is not important, unlike the deserts and semi-deserts of South Africa and America.

The second type of vegetation, the ephemeral, consists of delicate herbs whose seeds germinate immediately after rain, grow rapidly, flower for a very short period, set fruits and seeds at once, and then die. The dried leaves and stems are quickly reduced to powder by the desert winds and nothing remains except the seeds, which are scattered through the desert to await, in a dormant condition, the next rain. This ephemeral vegetation is known to the inhabitants of the desert as *acheb*. The plants have no structural peculiarities to adapt them to desert conditions: they survive drought by avoiding it.

As shown below, the term 'desert' is relative. Areas from which all plant life is absent form only a very small part of the Sahara. They include the Tanezrouft to the west of the Ahaggar, and the Hammada of Tinghert, which borders the eastern Erg to the south of Ghadames. Sand deserts are by no means the most barren parts of the desert. High mobile dunes can carry little or no plant life, but many sandy stretches are well suited to the growth of vegetation, since

they occupy the terminal basins of the great oueds of Quaternary times and cover the most important underground water reserves of the Sahara.

The influence of man on Saharan vegetation has been twofold: the cultivation of oases, including the introduction and spread of the date palm, and the grazing of domesticated animals. The date palm is of major economic importance in the desert, its fruits providing food for the inhabitants and for trade, and the crushed seeds food for camels. Grazing has greatly affected the vegetation and has often caused the survival of 'useless' plants, and the reduction of those specially palatable. The oleander is poisonous to camels, and the retam broom (with purple and white flowers) is also carefully avoided by animals. Wild herbivorous animals are no longer numerous, though the gazelle still has some influence on the vegetation. Camels, goats, and sheep graze in large numbers in the neighbourhood of settled oases, especially in the northern Sahara. Most of the flocks wander far, returning to an oasis to water once every two or three days. They thus influence vegetation over a radius of 12 to 24 or more miles into the desert. Camels wander much farther, and along the caravan routes all vegetation fit for fuel or forage has generally been utilized.

Within the Sahara a considerable number of major plant communities can be recognized. While these are all desertic in character and the vegetation is sparse and very open, recent studies emphasize their scientific interest and economic importance, actual and potential. They may be considered under the following headings: oases, dayas (depressions), oueds or wadis (valleys), sand deserts (erg), gravel deserts (règ), stone and rock deserts (hammada), saline areas, and mountains.

2. *Oases*

Oases occur where permanent water reaches the surface or where the water-table is so near to the surface that a perennial supply can be easily obtained. They vary in size but are nearly always under cultivation. The transition to desert at their edges is frequently abrupt. The cultivation of date palms is the most characteristic feature of the Saharan oases (Photos. 52, 53). The original source of the date palm is unknown, but it is known to have been in cultivation for at least 5,000 years. In the Sahara the palm, whether cultivated or spontaneous, now forms forest galleries along all the permanent or sub-permanent watercourses. The plantations sometimes, as at Ghardaia, have a thick canopy of grape vines which reach from

palm to palm. In the oases of the northern Sahara gardens are common, with vegetables, trees (such as the common cypress), flowers, and fruit-trees of many kinds. The following description applies to most of the permanently occupied oases. Small rectangular plots of ground, about 9 feet long, are bounded by low earth ramparts. They are irrigated by flooding every few days, the water being directed into each plot in turn by opening or damming the channel of the open conduit. The chief crop is barley, the foliage of which is kept to within a few inches of the ground, until the flowering stem appears, in order to provide fresh fodder for the animals. Two crops can be grown in a season. Wheat and millets are also grown and other and more incidental crops include onions, tomatoes, gourds, mint, fennel, and other household vegetables and herbs. Fig-trees occur in the larger oases. In the oases of the central and southern Sahara there are few introduced weeds. The natural vegetation of the oases is difficult to determine, but the oleander is probably the most important species, sometimes accompanied by tamarisks, chaste tree, and Euphrates poplar. Between and beneath these taller plants cosmopolitan marsh plants make a second layer and include reed grass, reed mace, rushes, club rush, and sea sow-thistle.

3. *Dayas*

Dayas are depressions or basins separated from one another by low ridges or stretches of plain and receiving the drainage of limited areas. They approximate to oases with an uncertain water supply, but their soils are often fertile and of fine texture, so that as rain falls on them, or reaches them from higher ground, it sinks deeply, is conserved, and may later be utilized by plants. While these *dayas* have no visible drainage outwards there is no excessive accumulation of salts, as in the *chotts*, and subterranean drainage probably occurs. The characteristic plant community, especially in the *dayas* of the northern Sahara, is that of the *betoum* or Atlantic turpentine tree and the *jujube* or *lotus*, sometimes accompanied by the olive. The community is often heavily grazed and much degraded. The *jujube* is a strong, spiny, spreading shrub avoided by herbivores and growing to a height of 9 to 14 feet. The *betoum*, on the other hand, is unarmed and its leaves and shoots are extremely palatable. Heavy grazing has undoubtedly reduced its numbers very considerably, and young plants only occur where they can grow up through a *jujube* bush under the protection of its armature. The *betoum* grows to a height of up to 50 feet and has a circumference



50. *Halfa (alfa) steppe in southern Oran*



51. *The daya of Tilrempt*



52. *Date-palms at Zolfana near Ghardaia*



53. *The oasis of Taghit, Oued Zousfana*

of up to 14 feet at 3 feet above the ground. It grows in a compact form and casts a dense shade, an unusual feature in a desert tree. The lowest branches of a mature tree mark the height to which browsing camels can reach (Photo. 51). The leaves are compound and formed of seven to nine large leaflets. Herbaceous plants commonly found in dayas include the turkey-red plant, a crucifer (*Zilla macroptera*), some chenopods (*Haloxylon articulatum*, *Anabasis articulata*), and desert grasses.

4. *Oueds (wadis)*

Oueds or wadis are generally dry, at least during most years, but have subterranean watercourses with the water-table often not far below the surface. The oued beds are frequently sandy, but the sand layer sometimes overlies clay or other deposits which influence the supply of water and hence the vegetation. In the northern Sahara the typical woody community is that of tamarisk (*Tamarix articulata*) which forms a rather tall tree, and is sometimes accompanied by other species of tamarisk (*T. bounopaea*, *T. balansae*) and by a species of broom (*Retam raetam*). In the oueds of the central and southern Sahara, the vegetation, when fully developed, is dominated by two small trees, *Acacia seyal* and *A. raddiana*, a large tufted grass, *Panicum turgidum*, an interesting tree known as *teborak* which has spiny branches and edible fruits, and bushes of *irak*.

5. *Sand Deserts (erg)*

In the Sahara these occupy a smaller area than is generally supposed. Two fairly distinct types can be distinguished: the *nebkas* or small areas of sand, generally on a clay subsoil, and the erg (pl. areg) or large dune system. The nebkas show all transitions in vegetation from open steppe to that of saline ground. The erg consists of drinn steppe with a drought-resisting grass as the dominant species. Bushes of the retam broom and of a switch plant (*Ephedra alata* ssp. *alenda*) are also common. There is considerable development of ephemeral plant life, or *acheb*, after rainy periods. On the mobile dunes little or no permanent vegetation except some drinn can occur and even the ephemerals are scattered or absent (Photo. 4).

6. *Gravel Deserts (reg)*

Large areas, sometimes representing flood plains of former ages, have a gravelly covering often underlain by clay (Photo. 3). The vegetation of these is sparse and is formed mainly of dwarf perennials

especially adapted to withstand drought (*xerophytes*) together with ephemerals for a short period after rain. In the northern Sahara many species occur including a number of chenopods, crucifers, rock-roses (*Helianthemum*), and grasses. In the central and southern parts of the desert, as in the Tanezrouft, the regs are often absolute desert without water and pasture, although the least depression, in which water can accumulate after rain, allows the production of temporary acheb.

7. *Stone and Rock Deserts (hammada)*

The extensive stone and rock deserts, or hammadas, include the most barren parts of the desert (Photo. 18). Vegetation is open and sometimes exceedingly sparse. Most of the perennial plants are dwarf and sub-shrubby, bulbous and rhizomatous plants are practically absent, and ephemerals are limited to earth-filled and shady fissures. In some hammada areas 'hardpan', at some distance below the surface of the ground, probably accentuates the unfavourable conditions. Fertility is greatly increased when sand drifts over from neighbouring dunes, for even if the layer of sand be very thin it acts as a mulch.

8. *Saline Areas*

Apart from the large chotts in the north-east of the Algerian Sahara, chotts are less frequent than in the High Plateaux, but saline areas of varying size are frequent, especially in the north. The vegetation of saline areas in the Sahara resembles that of similar areas in the High Plateaux (p. 149), except that the number of species represented is generally smaller. Chenopods are most important, and tamarisks also occur. Such vegetation, even in the Sahara, often provides valuable grazing.

9. *Mountains*

The highest mountains of the Algerian Sahara, which are in the centre and south, show considerable varieties of climate and vegetation: the lower slopes have an essentially tropical plant life. The tropical zone of the Tefedest massif is well developed with a vegetation analogous to that of the Ahaggar, but even its granitic crest (exceeding 7,500 feet) has no Mediterranean vegetation. The Tassili des Ajjer, a sandstone plateau, is mostly bare apart from the gorges, except for the ephemerals and the relicts of a cypress forest of an indigenous or endemic species (*Cupressus dupreziana*)

recently discovered and known to the inhabitants as *tarout*. The stony gorges of the Tassili are occupied by desert savanna dominated by acacias and panicum grass. Where there is any permanent water, oleander and tall reed grasses (*Phragmites*, *Erianthus*) border the pools. Fig also occurs locally in the ravines, and on damp slopes of loose rock, myrtle, reed mace, and grasses (*Erianthus*, *Imperata*, *Eragrostis*) grow abundantly.

The Ahaggar with its formidable mountains reaching nearly 10,000 feet, its deep valleys, and its relatively great water-supply, is of particular botanical interest. There are three vegetational zones: the tropical zone from the base up to about 6,000 or 6,300 feet; a lower Mediterranean zone from 6,000 or 6,300 feet to 7,700 feet or 8,000 feet; and an upper Mediterranean zone from 8,000 feet to the highest summits.

The tropical zone is very similar to that of the southern Sahara generally. Acacias and panicum grass are often dominant in an open savanna or desert type of community, and acheb springs up after rain or flooding. A crucifer (*Morettia canescens*) is common among the ephemeral plants. In the lower Mediterranean zone a permanent vegetation covers the stony slopes of the mountains and parts of the plateaux; it includes a grass (*Aristida obtusa*), a rock-rose (*Helianthemum lippii*), and a chenopod (*Anabasis articulata*). The ephemeral flora changes its character and another crucifer (*Moricandia arvensis*) covers the blackish and greyish-yellow rocks with a temporary veil of pale lilac after rain. In the valleys and gorges the vegetation may be dense. In the sandy or sandy-clay areas wormwood, orach, and an umbellifer (*Pituranthos scoparius*) form most of the vegetation. In the rocky areas two small trees, the olive and the sumach, find sufficient water in deep fissures and are associated with numerous shrubs, sub-shrubs, and herbs, such as labiates and lavender, composites (*Phagnalon purpurascens*, *Centaurea foucauldiana*), pinks, grasses (*Pennisetum*, *Andropogon*), and even ferns. The vegetation of the upper Mediterranean zone includes white wormwood or chih, a composite (*Pentzia monodiana*), and numerous other Mediterranean elements. The rocks carry olives, knapweed, and 'jointed firs' (*Ephedra altissima* and *E. major* var. *villarsii*), the latter going up to the limit of higher vegetation, and, in places, are covered with several species of lichen. In some of the gorges and ravines the vegetation is even luxuriant. Locally the Spanish black horehound forms an almost pure shrubby community. A Mediterranean clematis (*Clematis flammula*) is a rather remarkable relict.

FAUNA

THE fauna of Algeria resembles that of other Mediterranean countries except that many animals once common to southern Europe and north Africa, such as the leopard, hyena, and jackal, are now extinct in Europe. The fauna has been considerably modified within historic times, less by the introduction of new varieties than through the disappearance of old forms. Thus the elephant and the bear have both disappeared, the lion has recently become extinct, only a single species of monkey survives, and hyenas and leopards are now comparatively rare. Many wild animals have disappeared, or become rare, as a result of widespread killing during the last forty or fifty years. To-day the greatest variety of animals is to be found in the forest-clad mountains of eastern Algeria, especially in Kabylie. Other districts where the fauna is abundant are indicated below (p. 162).

Towards the south the relationship of the fauna with that of southern Europe gradually diminishes, first for mammals, and then for birds, and the resemblance to the fauna of the Sudan is increasingly apparent. The fauna of the desert, like its vegetation, is highly specialized. On the northern and southern edges gazelles and wild goats are often found; bustards are common on the southern side of the Saharan Atlas; and snakes and scorpions are numerous.

Mammals

Lions (Arabic *seba*) were formerly numerous, especially in the highlands, but have fairly recently become extinct.

The leopard or panther (Arabic *nemer*), also common in the past, is now rare. It is still encountered occasionally in certain isolated districts, notably in the Kabylie mountains between Azazga and Taourirt Ighil. It sometimes does much damage to the natives' flocks and is much feared by the people. The north African leopard is closely allied to the common variety found in India.

The hyena (Arabic *deba*) is nearly extinct, as a result of the large number killed during the last half-century.

The wild boar (Arabic *halluf*) is common wherever there is sufficient cover, especially in the forests and those areas covered by brush or maquis. It sometimes does considerable damage to crops and is willingly hunted by the Arabs who, unlike many Mohammedans, do not seem to have any feelings of repugnance towards it.

Jackals (Arabic *dib*) are still fairly common, especially in the forests around Hammam Rirha.

Lynx (Arabic *ghenza*), tiger-cat, Barbary wild-cat, and other carnivores are sometimes seen in the mountainous parts of eastern Algeria.

The Barbary ape (*Pithecus* or *Macacus inuus*, Arabic *chadi* or *kird*), the only type of monkey existing in north Africa, is still found in some of the upland areas. The same species occurs on the Rock of Gibraltar.

The Barbary or red deer (*Cervus elaphus barbarus*, Arabic *farthass*) is still found in the forest of Beni Salah in the department of Constantine, but is being exterminated by forest fires and poaching. It differs from the typical European species only in the fact that the second tine is absent from its antlers, a peculiarity which it shares with the red deer of Spain and Corsica.

Barbary sheep or moufflon (*Ovis lervia*, Arabic *aroui* or *oudad*) live in the Aurès mountains. They prefer rocky and precipitous ground and are remarkably sure and swift of foot. They are, therefore, almost impossible to hunt, though in the past the natives have organized large drives to kill them, as a result of which their numbers have been greatly reduced. Hunting is now forbidden.

There are three types of gazelle in Algeria. The Dorcas gazelle (*Gazella dorcas*, Arabic *ghezal*) is common in the steppes. The mountain gazelle (*Gazella cuvieri*, Arabic *edem*) is a large animal and sheep-like in build; it is not common, occurring only at heights of between 6,000 and 7,000 feet, usually where there is juniper forest. The desert gazelle (*Gazella dama mohr*, Arabic *rim*), the swiftest type, lives on the northern and southern edges of the Sahara, where it constitutes an occasional source of food. The Arabs hunt them on horses, riding them down until they are exhausted, and then shooting them at close range. The skin of the desert gazelle is much prized by the natives on account of its beauty.

Oryx and addax, two species of desert antelope, range over the southern parts of the desert, and were formerly more widely distributed.

Hare (Arabic *arneb*), rabbit (Arabic *gonia*), fox (Arabic *taleb*), porcupine, hedgehog, rat, and mouse are all widely distributed.

Domestic Animals. Most domestic animals occur in the country. Their economic significance is discussed in detail in Vol. II, Chap. XII. The cows are generally small and give little milk. Algeria, with Morocco, was the country of origin of the merino sheep, and the large flocks bred on the High Plateaux are an important source of wealth. Goats are numerous and their milk is widely used. There

are some excellent horses in the country, though the pure-bred original Arab stock is rare outside the military studs, such as that at Blida. Asses are common, but are not of such a fine species as formerly. The camel is of vital importance in the desert and is considered superior to the Asiatic species. Its milk is made into good cheese. Old camels are fattened for killing, the flesh being wholesome.

Birds

The following birds are common: Barbary red-legged partridge, woodcock, quail, bustard, owl, thrush, snipe, wild duck, curlew, and plover.

The wading birds include heron, pelican, and stork. Storks, which arrive in mid-January and leave at the beginning of August, often build their nests on the tops of native houses. The natives do not interfere with them, regarding them as bringers of good fortune, possibly because they keep down the numbers of locusts.

The birds of prey include several varieties of eagles, vultures, and hawks. Falcons are generally found in the Djebel Amour district and are tamed by the Arabs. Well-trained falcons are used for hunting partridges, large birds such as bustards, and hares.

Ostriches have become scarce in recent years, and are now only found on the borders of the Sahara. They are difficult to catch as they outstrip the fastest horse. Ostrich eggs are sold at from six to twelve shillings each. There is a small establishment for breeding and domesticating ostriches in the Jardin d'Essai in Algiers.

The comparative rarity of grubs and butterflies may, it has been suggested, be due in part to the large number of insectivorous birds.

Reptiles and Insects

Compared with other parts of Africa, north Africa has few reptiles and insects. Snakes, tortoises, turtles, chameleons, and lizards occur. In the Algerian Sahara scorpions, horned vipers, and lizards are fairly common. The doss, a kind of lizard found in oases, is eaten by the natives and its skin is used for making pouches. The large waran, or Egyptian monitor, sometimes exceeding 3 feet in length, looks like a small crocodile. It is reputed to be the deadly enemy of the horned viper and is much feared by the natives on account of the magical powers attributed to it. The crocodile still survives in some areas, as in the upper tributaries of the Igharghar.

Locusts are common and in some years do great damage. Mosquitoes and other insects which adversely affect health are discussed in Chap. VI.

Fish

The marine life of the Algerian coast is normally related to that of the other shores of the Mediterranean and is rich in a variety of species. The most common fish include sardine, anchovy, tunny, mackerel, sea-bream, shad, grey and red mullet, dory, and sole. The chief crustaceans are lobsters, prawns, shrimps, and crayfish. Sea-fishing is very little developed for a country with a coastline more than 600 miles long. The fishing and fish-canning industries are described in detail in Vol. II, Chap. XIII. The chief sardine fisheries and canneries are in the districts of Philippeville, Collo, and la Calle. Algerian prawns are noted for their size and taste, especially those caught near Bône. Fishing for the red or precious coral (*Corallium rubrum*) of the Mediterranean used to be important between Bône and la Calle, but ceased almost entirely some years ago since it was no longer sufficiently remunerative; latterly, however, the industry has revived to a small extent.

As regards freshwater fish, there are 31 species, 5 of which are peculiar to the country. None is of economic value except the barbel and eel, which are fairly common. There are at least 17 varieties of barbel in north Africa, including 2 in the desert, the Biskra barbel (*Barbus biscarensis*) and the desert barbel (*Barbus deserti*). Trout are rare and probably occur only in the Oued Zhour to the west of Collo; fry have been successfully introduced into the mountain streams of the Ouarsenis and Kabylie. Pike and perch are unknown. There are several species of fish in the waters of the various hot springs in the country. The species *Tellia* and *Cyprinodon*, for example, occur in the very saline water of the Oued Melah where it leaves the hot springs of Hammam Salahine, near Biskra. Another peculiar species, the *Harmout lazera*, a large type of cat-fish, found in the neighbourhood of Tolga (35 miles south-west of Biskra), has not been recorded elsewhere so far north of the equator.

Sport

The shooting season lasts from August to February and for migratory birds from 15 March to 15 April. The hunting of the Barbary deer, the Barbary sheep or moufflon, and the large antelope addax

is always forbidden. Dangerous animals may be shot throughout the year.

The shooting in all the more accessible areas is poor. The best districts are:

- (a) Azazga-Taourirt Ighil district in the Grande Kabylie, between Tizi Ouzou and el Kseur. Small and large game abound in the forests, including hyena, leopard, wild boar, hare, and partridge.
- (b) Cherchel district. Hare, partridge, and woodcock abound and, between mid-March and mid-April, many migratory birds.
- (c) Hammam Rirha (34 miles inland from Cherchel via Marengo) in the pine forest of Chaiba (1,800 acres). Hares, rabbits, wild boar, red partridge, and quail offer good sport when in season, with the help of Arab beaters. Birds are plentiful in March and April. Jackals are common, and hyenas and leopards are occasionally seen.
- (d) The marshes of la Macta on the Oued Macta near Arzeu. There is a fair amount of game including wild duck, partridge, and bustard.
- (e) Lake Fetzara, a swampy lake covering nearly 35,000 acres, about 14 miles west of Bône. Wild fowl are common during the winter.
- (f) The Aurès mountains. Wild life of all kinds is plentiful, especially around el Kantara.

CHAPTER VI

DISEASES, PESTS, AND HYGIENE OF ALGERIA

General

IN considering the medical and hygienic conditions of the Barbary States, it must be remembered that they have for centuries been isolated from other regions. Corsairs and pirates controlled the coast until the beginning of the nineteenth century, and the sultans and beys permitted no contact with Christians or Europeans, whilst to the south there has always been the great natural barrier of the Sahara. Barbary did not share, therefore, in the trade of West Africa or the West Indies, from which certain diseases and pests might have been derived, and although much caravan traffic crossed the desert, there were no routes by which sick men, pests, or parasites were likely to pass from south to north of the Sahara. For these reasons the French territories in north Africa are distinctly Mediterranean in their prevalent diseases, as in their climate and natural flora and fauna. There is, however, a danger that in these days of rapid communications there may be an extension into these countries of infections from which they have hitherto been free.

The great Mohammedan pilgrimages to Mecca and Medina, where so many peoples and infections mingle promiscuously, have not greatly disturbed the isolation of the Barbary States, because the distances from Arabia are so great and the numbers of pilgrims are only small. Algeria, for example, has sent only from 600 to 1,600 pilgrims per annum in recent years. Of greater significance are the local pilgrimages to the *zaouias* or shrines in all parts of the country, for these cause great concentrations of people who often remain crowded under the most insanitary conditions for considerable periods. The control of diseases is also made difficult by the movements of nomadic peoples, particularly in the desert and in the High Plateaux around Batna and Khenchela, and by the seasonal migrations of agricultural and other labourers, especially in years of drought when people crowd into the towns seeking food and employment. Hygienic conditions in some of the ports, where very mixed populations crowd into small areas, also leave much to be desired.

The climate, the details of which are given in Chap. IV, varies greatly in different parts of the country, owing to differences of exposure and of distance from the sea. The extreme irregularity of the

total annual rainfall is of great medical importance, for, if much below the average, famine may result and encourage outbreaks of typhus fever and other epidemics. If more than the usual amount falls, particularly in the spring, the breeding of *Anopheles* mosquitoes is favoured, and malaria may become epidemic.

Owing to the long period of French rule and colonization, and particularly to the foundation of the Pasteur Institute at Algiers in 1910, the knowledge of the diseases of the country is in a fairly advanced state. The policy of this Institute has been to maintain small laboratories in many parts of the country and to send out expeditions even to remote districts.

The Sahara presents few hygienic problems, but particular attention should be given to the oases where people live crowded together and the water is fouled with excrement. Malaria is generally rife and there is much danger of infection from various parasitic worms. A short section on hints on travelling in the desert is given on p. 180.

Vital Statistics and Prevalent Diseases

Outside the large towns there is little systematic recording of births and deaths. Returns are made of cases of infectious disease but, except in the event of large-scale epidemics, most of these notifications come from the towns. Cases of infectious disease notified in the three years 1936-8 include:

	1936	1937	1938
Plague	5	1	0
Small-pox	101	15	13
Typhus fever	1,168	3,299	1,564
Typhoid and paratyphoid fever	792	1,502	1,066
Relapsing fever	2	1	0
Dysentery	5	19	19
Erysipelas	76	78	39
Acute poliomyelitis	7	6	5
Encephalitis lethargica	4	2	2
Cerebrospinal meningitis	38	43	51
Leprosy	2	2	5
Mumps	745	1,631	863
Chicken-pox	116	223	89
Measles	527	635	890
Scarlet fever	230	289	215
Diphtheria	349	394	363

This table doubtless gives an inadequate idea of the prevalence of most of the diseases listed; it shows, however, that most of the common infectious diseases of temperate Europe occur in Algeria.

The table below gives the infant mortality rate of the town of Algiers for 1936, 1937, and 1938 together with the death-rates per 100,000 attributed to certain specified causes. Corresponding figures for Casablanca, Tunis, and Marseilles are included for purposes of comparison.

	Municipal population	Deaths of infants under one year per 1,000 live births			Typhus fever. Deaths per 100,000			Scarlet fever. Deaths per 100,000		
		1936	1937	1938	1936	1937	1938	1936	1937	1938
Algiers .	252,000	132	139	151	0.8	1.6	0.8	2.4	1.2	0.4
Casablanca .	258,000	..	..	..	0.0	38.1	20.6	..	..	..
Tunis .	220,000	149	159	149	3.2	5.5	17.8	1.4	0.0	0.0
Marseilles	914,000	..	..	..	..	..	..	0.1	0.4	0.9

	Municipal population	Measles. Deaths per 100,000			Typhoid and paratyphoid. Deaths per 100,000			Diphtheria. Deaths per 100,000		
		1936	1937	1938	1936	1937	1938	1936	1937	1938
Algiers .	252,000	39.2	10.3	29.3	12.7	48.7	17.8	4.0	5.2	3.6
Casablanca .	258,000	0.4	0.8	1.6	6.6	24.9	105.7	2.3	1.6	1.6
Tunis .	220,000	99.4	71.1	5.9	16.4	31.0	33.3	15.0	9.6	2.7
Marseilles	914,000	0.4	2.3	6.8	15.1	11.9	11.9	4.2	4.7	4.7

	Municipal population	Whooping cough. Deaths per 100,000			Pneumonia and broncho-pneumonia. Deaths per 100,000			Pulmonary tuberculosis. Deaths per 100,000		
		1936	1937	1938	1935-1936	1936-1937	1937-1938	1936	1937	1938
Algiers .	252,000	8.7	12.7	3.6	121.3	90.8	113.3	122.9	147.8	168.4
Casablanca .	258,000	0.4	0.0	0.0	213.5	217.9	432.4	96.7	116.9	100.2
Tunis .	220,000	11.4	20.5	16.0	248.1	191.5	225.3	139.5	194.7	203.9
Marseilles	914,000	0.8	1.5	3.0	58.4	31.0	..	80.4	92.5	119.8

	Municipal population	Influenza. Deaths per 100,000			Diarrhoea and enteritis. Total deaths under 2 years of age			Malaria. Deaths per 100,000		
		1935-1936	1936-1937	1937-1938	1936	1937	1938	1936	1937	1938
Algiers .	252,000	1.2	6.3	1.2	498	699	822	4.4	7.9	2.4
Casa-blanca .	258,000	..	..	..	573	593	486	4.7	6.2	11.3
Tunis .	220,000	31.5	30.6	27.4	577	803	697	10.5	10.9	6.8
Marseilles	914,000	7.9	4.9	15.4	100	166	..	0.2	0.4	0.5

The infant mortality rates, varying between 130 and 150 per thousand live births, are more than double those of most western European cities, but are normally considerably lower than those of Tunis. Pulmonary tuberculosis is an important cause of mortality and appears to be very much more prevalent in Algiers than in other north African towns, with the exception of Tunis. Pneumonia and broncho-pneumonia cause fewer deaths, though they contribute appreciably to the death roll, notably that of infants. The deaths of infants attributed to diarrhoea and enteritis are indicative of low hygiene standards. The prevalence of typhoid fever varies much from year to year; considerable epidemics may occur. Typhoid fever is somewhat more prevalent in the second half of the year. Each year some deaths are attributed to typhus fever. This important epidemic disease is discussed on pp. 171-3. Malaria, though making but a small direct contribution to the death-rate of the town of Algiers, is a serious cause of sickness in Algeria as a whole, and is, therefore, described at some length.

DISEASES AND PESTS

MALARIA

The malaria parasite is always transmitted from man to man by the bite of the *Anopheles* mosquito; an adequate survey of Anophelines is, therefore, an essential preliminary to the study of malaria. Different species have very different habits, and the malaria of the northern part of Algeria together with the Saharan Atlas is quite distinct from that of the Sahara itself. The problem is best understood if the two areas are considered separately.

Northern Algeria

(a) *Anopheles Mosquitoes*. Throughout the whole of this region the dominant species is *Anopheles maculipennis*. Only one race of this insect, *labranchiae*, appears to be present, though it must be admitted that surveys of eggs, on which alone the races can be determined, have been reported only from the Tell near Algiers. From general considerations and analogy with other countries this species of mosquito is certainly the main, and perhaps the only, transmitter of malaria in Algeria.

This mosquito breeds in a variety of waters, but especially in stagnant swamps and slowly moving weedy rivers, and in gardens where there are wide shallow wells and water that has accumulated owing to excessive irrigation. It cannot successfully colonize water that is in rapid movement, nor does it breed in large sheets of open water where there is wave action; some of the larger chotts are not, therefore, infested. Algeria also avoids the problem of rice mosquitoes as rice is little grown. The mosquito larvae are commonly found in very fresh water; also, as they have a considerable tolerance for salt, they can live where the salinity is as high as 1 per cent., that is, about one-third that of sea-water.

In the winter months the females hibernate in houses, stables, caves, and other similar places, and there are no larvae or other stages in the waters: the hibernating females are not, however, completely inactive but continue to bite man during the winter, so that there is probably some transmission of malaria in houses. Larvae begin to appear in the spring in mid-April at sea-level near Algiers, and at a somewhat later date inland and at greater heights. After that several generations are reared and larvae are continuously present until the end of November. In carrying out measures of control it must be remembered that the adults are capable of flying a long way, sometimes as much as 4 miles.

Of the other species of *Anopheles* in northern Algeria, *A. hispaniola*, which breeds in streams and torrents, is the most common. Adults are known to enter houses and this species may be, to some extent, a transmitter of malaria in north Africa, though this possibility has never been investigated. Other species occurring include *Anopheles marteri*, which like *A. hispaniola* breeds in streams and torrents, and *A. algeriensis* and *A. bifurcatus*, both of which breed in swamps and are most common in winter.

(b) *Incidence of Malaria*. The incidence of malaria varies con-

siderably from year to year, depending largely on the amount and the precise season of the rainfall. If the winter rain is above the average, and particularly if there are large falls in the spring, the streams and marshes are unusually full and may remain so throughout the summer. These conditions give rise to epidemic malaria. Malaria is relatively scarce, in contrast, if the rainfall is so deficient that the marshes dry up before the summer, that is, before *Anopheles maculipennis* comes out of hibernation and begins to multiply. The position is also affected by the migrations of people within the country, such as the regular movement of thousands of nomads each spring from the northern edge of the Sahara to the High Plateaux region. To what height indigenous malaria extends is unknown, but as the disease is endemic in the High Atlas of Morocco at 6,000 feet it seems probable that it could occur in every inhabited part of Algeria.

The local prevalence of malaria is best measured by studying children, because they have not yet acquired immunity, and the best measure of chronic malaria is the spleen rate, i.e. the percentage of children showing an enlargement of the spleen. A map published in 1928 by the Pasteur Institute of Algiers gives the spleen rates at the time for some 200 places, mainly, though not exclusively, on the coast and in the Tell. It shows that malaria is very widely distributed but that its incidence varies greatly from place to place, dependent probably on the distance of each settlement from the nearest stream or swamp. In the ports the following spleen rates were recorded:

Algiers (town)	.	.	.	.	nil.
„ (suburbs)	.	.	.	.	10-100 per cent.
Arzeu (Ste Léonie)	.	.	.	.	40 per cent.
Bône	.	.	.	.	no figure available.
Bougie	.	.	.	.	no figure available.
La Calle (eastern side)	.	.	.	.	40 per cent.
Oran (les Andalouses)	.	.	.	.	25 per cent.
Philippeville	.	.	.	.	60 per cent.

In the Tell spleen rates generally ranged between 30 and 50 per cent., indicating a very high incidence of the disease, and similar figures were recorded in many places in the foothills and hills. Spleen rates of nil were discovered in only five of the places examined, at Djelfa and at four villages in the open plateau of the chotts. Along the Tunisian frontier from la Calle through Souk Ahras to Tébessa the figures were always high, from 20 per cent. to 100 per cent. in Tébessa itself. The Moroccan frontier was less fully studied. In

the Tafna valley, from Marnia to the confluence of the Tafna and the Oued Isser, spleen rates of 50-70 per cent. were recorded. The rate at Figuig was 40 per cent. It must, however, be understood that these figures are now somewhat out of date, drainage and land reclamation having substantially reduced malaria in a number of places.

The incidence of malaria is always very localized, and it is, therefore, difficult to give a general indication of its intensity. It is probably true to say that malaria in Algeria is about as grave as it is in Greece or Albania and more grave than in Spain or Bulgaria.

(c) *Control of Malaria.* Judged by the considerable incidence of malaria in the suburbs of Algiers (100 per cent. at Maison Carrée) and by the reports of foreign delegates who attended the anti-malaria congress at Algiers in 1930 and toured much of the country, the control of malaria does not appear to be very effective. Troops in Algeria would, therefore, almost certainly be able to adopt a large number of obvious and easy methods of control which should achieve a considerable reduction in the disease with little trouble.

The drainage and reclamation of swamp land, usually for agricultural purposes, has had a considerable influence in many districts, notably in the Tell. The most important works of this nature are those in the plain of the Mitidja behind Algiers, and in the marshes near Oran, Bône, and la Calle.

Much use has also been made of the small mosquito-destroying fish, *gambusia*, which multiplies rapidly and will achieve effective control in large swamps and marshes, at least during the hot weather. In autumn and spring the fish tend to move into the deeper waters of the marsh and a considerable amount of mosquito breeding may then take place along the shallows. These fish are of little value in some of the large swamps which are not quite permanent and dry up in years of low rainfall. In large streams the fish have to be reintroduced after each winter because floods wash them away.

As the marshes are full of reeds and other vegetation it is probable that anti-larval oil would not be effective, and that better results might be obtained by the use of Paris Green. In some of the larger breeding-places it might be necessary to distribute it by boat or even by aeroplane, as has been done in the Gharb of Morocco. Another economical way of dealing with the marshes might be by the use of windmills, as has been done successfully in several Mediterranean countries. The objection is sometimes made that windmills are ineffective and slow, but this point is hardly valid, as to check malaria it

is only necessary to ensure that the marshes are dry by mid-April when mosquito breeding starts: they need not be kept drained throughout the winter.

The destruction of adult mosquitoes in houses, by hand-sprayers of liquids which resemble Flit, is a useful method of malaria control. It is particularly suitable on active service, when troops may have to move into areas in which adequate control of mosquito breeding is not practicable.

As stated above, it is not yet known whether *Anopheles hispaniola* is a carrier of malaria or not, but if it is, special methods will have to be adopted in hill streams, especially towards the end of the summer. There is evidence from the Algiers district that, though the larvae of *A. maculipennis* may be found from the middle of April, those of *A. hispaniola* do not appear until the middle of June.

The Sahara

(a) *Anopheles Mosquitoes.* Most of the oases in the Sahara are infested by *Anopheles* mosquitoes. In some oases the water comes from a spring and is spread by irrigation, becoming increasingly saline owing to evaporation, and finally forming a salt swamp. In other oases the water comes from wells, in which breeding of mosquitoes will not occur owing to frequent agitation. Disused wells, however, become dangerous breeding-places, as do the swamps resulting from excessive irrigation. Occasional heavy storms may leave flood water in the beds of streams and lead to outbreaks of malaria, as at Djanet in 1928. At el Oued, Mechéria, Ghardaia, and Laghouat there is no surface water and, therefore, no *Anopheles*. All other oases, however, are malarial.

There are two important carriers of malaria which are widely distributed, even at Djanet and in the Ahaggar: *Anopheles sergenti* which breeds in fresh water, and *A. multicolor* which breeds in brackish or salt water. Other species are *A. hispaniola*, widely scattered but of doubtful importance, *A. d'thali* and *A. broussesi*; but the typical species of tropical Africa, *A. gambiae* (*costalis*), has not been found.

(b) *Incidence of Malaria.* In contrast to the northern areas where the incidence of malaria varies considerably according to the rainfall of any particular year, conditions in the oases are relatively constant. Little is known, however, of the incidence of the disease except that malaria is very common in the Ziban, and comparatively infrequent at In Salah where the spleen rate is only 3·1 per cent. Malignant tertian or subtertian malaria (due to *Plasmodium falciparum*) appears

to be more common than benign tertian (due to *P. vivax*), and quartan malaria exists in several places.

In view of the very localized nature of the problem in the oases, many of which cover only a few square miles, it is somewhat surprising that malaria has not been abolished from them. The problem is easier to deal with in that it is, to some extent, man-made, and a few months of intensive work along familiar lines should succeed in the complete extermination of the *Anopheles*.

TYPHUS

In the Mediterranean area two diseases, epidemic (exanthematic) typhus and murine typhus, occur; they are fundamentally different, though they have been frequently confused. Murine typhus is an infection of rats which is transmitted by fleas (generally *Xenopsylla cheopis*), either from rat to rat, or occasionally from rat to man. Human cases are, therefore, sporadic, and most frequent among those whose occupation brings them into contact with rats and their fleas.

In epidemic typhus no rodent or other animal is involved, the micro-organism, *Rickettsia prowazeki*, being transmitted by lice directly from man to man. The disease tends, therefore, to occur, often as a great epidemic, among those who are infested with lice, particularly body lice; it especially attacks such people as prisoners, soldiers, refugees, and the victims of famine or earthquake, living crowded together in insanitary conditions where facilities for personal cleanliness are non-existent. The louse does not transmit the infection by its bite. The infectious material is the dried excrement of an infected louse, which enters the human body through scratches and cuts (and perhaps through the surface of the eye). The excrement, which remains infectious for many weeks, blows about, so that those who have not actually been bitten by a louse may contract the disease. Typhus is particularly frequent among medical staff and those dealing with the clothes or bedding of the sick.

Whereas murine typhus has no military significance (though a few cases might occur in a force) epidemic typhus might be a major factor in a campaign. Large outbreaks might occur in locally recruited labour, unless active preventive measures were taken.

(a) Epidemic Typhus

Epidemic typhus is a large and serious problem and of greater importance in Algeria than in most Mediterranean countries. Large or small outbreaks occur every year, and all parts of the country and

all sections of the community are affected, though Europeans and the native Jews tend to escape the disease as they are more particular about washing and changing clothes. The typhus seasons are generally winter and spring, since the increase of body lice is most favoured at these times, when people crowd together and wear most clothes. Epidemics have been observed, however, during the hot months (June to September), even in the Algerian Sahara.

The larger outbreaks are, to some extent, associated with privation and so usually occur in years of drought when the crops fail, or after hard winters which kill the sheep in the hills, or when locusts have been abundant. There are also some permanent centres of the disease, coinciding with those regions which are agriculturally unproductive: these include Ammi Moussa and Télagh in the department of Oran; parts of the Chélif valley and Beni Hindel in the department of Algiers; the southern and south-eastern parts of the department of Constantine, especially the Aurès mountains; and Laghouat, the Ziban, and the Chellala region in the Territoires du Sud. Typhus also occurs where many pilgrims assemble and live a crowded, insanitary life at the *zaouias* or shrines, or when nomads carry the disease about, as happened in the Khenchela district in 1932.

In north Africa there is a tendency, as yet unexplained, for typhus to increase at long intervals. Between 1919 and 1923 there were large epidemics in Algeria, with between 1,000 and 7,000 cases each year. In 1928 there were 4,760 notified cases in Morocco, Algeria, and Tunisia together, followed in 1929 by a decrease to 448. There was then a gradual increase to 2,169 in 1936, 8,925 in 1937 (Algeria, 3,299; Tunisia, 3,804; Morocco, 1,822), and 11,377 in 1938 (Algeria, 1,564; Tunisia, 2,376; Morocco, 7,437).

Since September 1939 information is scanty, but there appears to have been a severe epidemic of typhus in the early months of 1942. This outbreak would seem to be much more widespread than any of its predecessors, no part of the country being spared. In the seven months between 1 October 1941 and 30 April 1942 more than 26,300 cases of typhus fever were reported, the monthly total increasing from 335 in October to 2,067 in December and 7,133 in March. There was a slight fall in April to 6,970. Of the total, 8,632 were in the department of Algiers, 7,347 in Constantine, 6,953 in Oran, and 3,436 in the Territoires du Sud.¹

¹ Figures from the *Weekly Epidemiological Records* issued by the Health Section of the League of Nations. Figures for more recent months show a further decline: May 1942, 5,975; June, 4,729; and July, 1,742.

Two principal methods have been adopted by the French to control typhus—mobile disinfecting units which fumigate clothing with hydrogen cyanide, and large vaccination campaigns accompanied by publicity. The French are convinced that vaccination can effectively check an epidemic, though a British authority visiting Algeria early in 1940 was sceptical of the value of this method.

(b) *Murine Typhus*

In Algeria, as in the surrounding countries, cases of murine typhus in man have been detected, but though the disease is perhaps widely spread, it is not common.

(c) *Exanthematic Fever*

Exanthematic Mediterranean fever, or *fièvre boutonneuse*, is a third member of the typhus group of diseases. This is an infection of dogs and is transmitted from dog to dog by the tick *Rhipicephalus sanguineus*. As this tick occasionally bites man, some cases in man may occur.

RELAPSING FEVER

As in other parts of the Mediterranean area, two distinct types of relapsing fever occur, the epidemic louse-carried disease and the sporadic tick-carried disease.

The louse-carried type of relapsing fever, which occurs only in human beings, is apparently very rare in Algeria, a surprising fact in view of the abundance of louse-carried epidemic typhus. Several epidemics were studied about thirty years ago in the Algerian Sahara at Beni Ounif, Figuig, and Beni Abbès, but since then the disease has been almost unknown, though this may be because it is easily missed, often passing as 'fever'. The tick-carried type, due to *Spirochaeta hispanica*, is an infection of rats and wild rodents, but occasionally an infected tick bites a man, especially one whose work brings him in close contact with rats. Cases have occurred, for example, in workers in the grain trade and in piggeries, and in men who work or live in caves (as in Palestine during the War of 1914-18). In Algeria cases in man have been detected in the Tell, the region of the chotts, and in the northern Sahara. The tick generally concerned, as in Morocco, Tunisia, and Spain, is *Ornithodoros erraticus*, but the common dog-tick, *Rhipicephalus sanguineus*, which is very abundant and in close association with human beings, may also

transmit the infection to man. *Ornithodoros savignyi*, which may be another carrier of relapsing fever, occurs in very arid areas, as around Ouargla.

LEISHMANIASIS

There are two types of leishmaniasis in Algeria, visceral and dermal. These are very dissimilar diseases, though the parasites are similar and both are almost certainly transmitted by sand-flies (*Phlebotomus*).

Visceral leishmaniasis, or kala azar, appears to be rare in Algeria, but its distribution is not accurately known. The Mediterranean form of the disease is largely confined to children, and the condition is therefore of no military significance.

Dermal leishmaniasis, or oriental sore, is widely distributed and locally common. A few cases have been seen in the coastal region, as at Bône and Algiers, but the disease is probably more common in the region of the chotts, the Aurès mountains, and the Saharan Atlas (el Kantara, Biskra, Batna, MacMahon). In the Sahara it is frequent in localized spots along the northern fringe of the desert, from Figuig through Laghouat to el Oued, and as far south as Ghardaia and Ouargla: it seems to be absent from the region farther south. The disease might have some slight military importance in the areas in which it occurs, since it may produce some disturbance of health as well as a chronic ulcer.

It is not known which species of sand-fly transmits either kala azar or oriental sore in Algeria. The three species which are most probably concerned are *Phlebotomus papatasi*, *sergenti*, and *pernicius*, all of which are widely distributed throughout the country.

PLAGUE AND TULARAEMIA

Plague was epidemic on the coast of Barbary until about 1820, when it disappeared and was not again observed in Algeria until 1899. Since then plague cases have been of frequent occurrence. Between 1928 and 1934 their numbers varied between nil and 88 per annum.

Plague has occurred in all the important ports and is most frequent in the coastal zone, where it doubtless exists among domestic rats. Rat plague has been detected in the uplands, as at le Hamma near Constantine, as well as in the Tell. Rural plague appears to be unusual. Little is known of the plague fleas of Algeria, but the

principal plague flea of hot countries, *Xenopsylla cheopis*, has been found on rats in Algiers and at Biskra.

Tularaemia, which resembles plague in its clinical aspects, has been detected in Tunisia and may well be present in Algeria.

YELLOW FEVER

Yellow fever has occurred in Mediterranean countries in the past, though no cases have been recorded for a very long time and the small number of 'protection tests' carried out in north-west Africa seem to show that the infection is not present. There is some risk, however, that air traffic might be the means of introducing infection from west to north Africa, particularly in war-time, when the customary quarantine and other sanitary conventions of peace-time are somewhat relaxed.

The mosquito which transmits yellow fever, *Aedes aegypti*, is common in Algeria only in the summer and in the ports, though it has been recorded at several places in the High Plateaux, and at Ghardaia in the Sahara. Any epidemic would, therefore, be limited in both season and area, though as yellow fever has so long been absent, the population is probably highly susceptible.

SAND-FLY FEVER AND DENGUE FEVER

Epidemics of sand-fly fever would almost certainly affect troops recently sent from cold countries and spending their first summer in the Mediterranean, and whole units might be incapacitated for several weeks. The chief species of sand-flies, *Phlebotomus papatasi*, *sergenti*, and *perniciosus*, are found throughout Algeria.

Dengue might also occur, but only in summer and in the coastal zone to which the appropriate mosquito, *Aedes aegypti*, is confined. An epidemic of dengue would probably be of considerable military importance as it might incapacitate a large proportion of civilians as well as of troops, with serious consequences in any port or on a railway line.

SCHISTOSOMIASIS

Urinary schistosomiasis, or Bilharzia disease, occurs only in places where a particular water snail (*Bullinus*) is found. The worm (*Schistosoma haematobium*) causing the disease goes through part of its early development in this snail which lives in slowly moving water,

especially where it is deep. After leaving the snail the worm enters the human body by piercing the skin of those coming into contact with infested water. So far cases have been detected at only two places, but the snail, *Bullinus*, is known to be present in a number of places along the coast from Mostaganem in the west to Bône and la Calle in the east.

Infection with this disease might cause a considerable number of admissions to hospital. Precautionary measures should include the surveying of the areas close to the camps and hospitals, the examination of the urines of small children, and the searching of natural waters for the snail. Infected or dangerous waters should be put out of bounds. Water containing the infective stage of the worm becomes safe, and fit for washing purposes, if army cresol is added (1 in 10,000). Water also becomes safe if stored for forty-eight hours.

OTHER HELMINTHIC DISEASES

(a) *Tape-worm*

There are two tape-worms which may be acquired from food, *Taenia saginata* from beef and *Taenia solium* from pork. The beef tape-worm is common in man in many parts of Algeria, and the pork tape-worm probably infects many of the European farmers who keep pigs. Mohammedans do not keep pigs or eat pork, and do not, therefore, suffer from the latter worm. Men become infected with these two tape-worms by eating imperfectly cooked beef or pork, derived from infected animals, which would be rejected by a competent meat inspection. Prevention is attained by the thorough cooking of meat, and by not eating such things as sausages and smoked meat. The tape-worms themselves are no more than unpleasant parasites, the real danger to the infected man being that detached segments of the worm may migrate over the buttocks depositing eggs, which may then be transferred by finger to mouth. He may then develop the larval stage (*cysticercus*), which may cause permanent damage in the brain and other organs.

(b) *Hydatid Disease*

Hydatid disease is due to infection with the larval, cystic stage of a tape-worm, *Taenia echinoccus*, which inhabits the intestine of the dog, and so occurs amongst those closely associated with dogs. It is fairly common in many parts of Algeria, but is unlikely to be of any military importance.

(c) *Other Worms*

The hook-worm (*Ankylostoma duodenale*) is widely distributed in the moist and irrigated areas of northern Algeria and there is a focus in the Hodna, but there is no record to show that the infestation is heavy or clinically serious. The round-worm (*Ascaris lumbricoides*) is doubtless common but apparently of no serious importance.

VENEREAL DISEASES

Syphilis and gonorrhoea, which are nearly world-wide, are believed to be very prevalent in Algeria, especially the former. As facilities for the active treatment of syphilis are not widely available, its more horrible manifestations, now rarely seen in Europe, are still not uncommon.

OTHER DISEASES

Outbreaks of *enteritis*, *diarrhoea*, and perhaps *dysentery* would very probably occur, and might hamper military efficiency in any part of Algeria throughout the warmer months. The incidence of these diseases is almost certainly higher than notified cases suggest (cf. tables on pp. 164-6). Danger of infection can be greatly reduced by the chlorination or boiling of water, cleanliness in the preparation of food, the control of house-flies, and thorough discipline in all these matters. *Enteric fevers* (*typhoid* and *paratyphoid*) can also be avoided by these measures and by inoculation. In the past *small-pox* was almost universal, but it is now effectively controlled by vaccination, which, as in many other Mohammedan countries, is generally popular. *Acute conjunctivitis* is common and is particularly trying in a sunny and dusty climate. *Trachoma* is extremely prevalent among the natives, infection rates of about 70 per cent. being reported in villages in the High Plateaux and Saharan Atlas. *Tuberculosis* is serious in northern Algeria, but becomes less common towards the south. Cases of *undulant fever* (*Malta fever*) are uncommon, but not unknown.

PESTS AND VENOMOUS ANIMALS

MOST of the insects of medical interest have already been described in connexion with the diseases which they transmit, and reference should be made to the appropriate sections above.

Lice

Body lice are extremely prevalent, especially among the Arabs and Berbers, who wear many garments and wash and change them seldom. The native Jews are much cleaner in this respect. Head lice and pubic lice are said to be rare, because of the custom of shaving these parts of the body.

Myiasis

There is a large grey fly, *Wohlfahrtia magnifica*, which puts its maggots in wounds and cuts on men or animals. The maggots destroy the tissues with great rapidity and spread sepsis. This insect may cause serious and rapidly increasing injury. The larvae may readily be destroyed, in the tissues, by free irrigation with chloroform water, or by instilling chloroform dissolved in liquid paraffin. This is far more efficacious than swabbing with alcohol or iodine.

Mites

The itch mite (*Sarcoptes*), the cause of scabies, is doubtless very common, and a related species, a small mite, *Pediculoides*, occurs in barley and straw. It attacks the human skin and causes serious eruptions in people handling such materials. It is common in many sub-tropical lands, and appears to be particularly troublesome in Algeria.

Scorpions

Deaths from the sting of scorpions occur every year, usually among children and especially in the Saharan Atlas and along the northern edge of the Sahara, in the Mزاب country and at Touggourt, Ouargla, and Biskra. Human beings are generally stung when lying on the floor indoors, in the hot season. An anti-serum has been produced by the Pasteur Institute of Algiers and seems to be effective provided it is injected very soon after the patient is stung.

The black spider, *Latrodectus*, almost certainly occurs in Algeria. Its bite may cause intense pain and loss of consciousness. The rigid board-like abdomen has sometimes been mistaken for that due to peritonitis.

Snakes

Venomous snakes occur throughout Algeria, and precautions should be taken to avoid them in warm weather: they are unlikely to be met during the winter months, unless disturbed by digging or

the clearing out of old houses, ruins, water-holes, or vegetation. In warm weather, when they are active, they may be found in the surroundings indicated, but vipers are also likely to lie on bare rock or in sand. Owing to the colouring of the upper parts of the body they are usually extremely difficult to see, since they may lie motionless for many hours. In soft sand their tracks are obvious, either as continuous shallow trails or as a series of parallel lines in echelon. Where the trail ends the snake may be found either coiled on a rock, usually out of the wind, or concealed in the sand. In chilly weather, especially at night, snakes may enter tents, and bedding or other material on the ground, to find warmth.

It is unwise to go barefoot when snakes are likely to be encountered, or to pry into vegetation, rubble, &c., with bare hands and arms. Ankle boots, anklets, or field boots are a reasonable protection against attack.

There is an element of chance in meeting snakes, even where they are known to be common: none may be seen for many weeks or several in a day. Reasonable precaution should become instinctive. It is unusual for snakes to attack unless provoked or frightened. They cannot be relied upon to hiss before they strike, as is commonly supposed.

The puff adder (*Bitis arietans*) occurs throughout Algeria. The back is dirty yellow or orange in colour, with large black chevron bands, and an oblique band behind the eyes. The belly is yellow and either uniform in colour or speckled with black.

The horned viper (*Cerastes cornutus*), which is common in the Egyptian and Libyan deserts, may be confused with *Cerastes vipera*, which appears to be common in Algeria. In *Cerastes cornutus* the head, which is distinct from the neck, has a short and very broad snout. The body is cylindrical, and the tail rather short. The back is yellowish-brown or grey in colour, sometimes with brown spots forming four to six regular series. Of these the central ones represent cross-bars. There is also an oblique line behind the eyes. The belly is white.

Cerastes vipera, similar in general appearance to the horned viper, is of a dull yellow, pale brown, or reddish colour, with or without black spots. The belly is white, and the tail usually black.

These three snakes are small, 2 or 2½ feet being the average length, though the puff adder is sometimes 4 or 5 feet long; their bite is dangerous and often deadly.

The treatment for snake-bite is as follows:

1. A tourniquet, preferably of rubber, should be *immediately* applied as tightly as possible above the fang puncture to delay absorption of the venom.
2. A deep incision should be made into the fang punctures, and bleeding encouraged by suction in an endeavour to wash out the venom.
3. The patient must be kept at rest, as exercise may lead to exhaustion.
4. If anti-venom is available, it should be injected in the region of the fang punctures, and also intravenously, within a few minutes of the patient being bitten, as otherwise it is useless.
5. The application of potassium permanganate crystals or solution is *not* advised nowadays.

HINTS ON TRAVELLING IN THE SAHARA

TRAVEL in northern Algeria does not differ appreciably from travel in the countries of southern Europe, and does not, therefore, demand special consideration. Conditions in the Algerian Sahara are, however, exceptional, and particular care must be taken to ensure that adequate supplies of food and water are available. The peculiar conditions of the desert for motor transport are discussed in Vol. II, Chap. XV; here the emphasis is on the maintenance of health. Reference should also be made to the preceding section on the diseases and pests of the Sahara.

In general, the best months for travel in the desert are in the cool season, between October and April, and especially December, January, and February. The climatic conditions of these months are described on pp. 131-8. Though the days are hot, the nights may be bitterly cold. Travel at night should be avoided if possible; on little known tracks it should not be attempted even with a guide.

Food

All requirements of food must be carried. There are local supplies only in the oases, where they may be scarce, but some of the less desolate regions have game, mostly gazelle (p. 159).

Diet should be as well balanced as possible, and in hot weather, at any rate, the main meal should be eaten in the evening. The

mainstays of European diet are tea or coffee, bread (or flour equivalent, including biscuit), preserved fruits or jam, sugar, fresh vegetables when available (or tinned equivalent), bully beef (or other tinned meat), fresh meat from native sources or game when available, tinned milk (fresh goat, camel, or other milk should be boiled), chocolate (in winter). Oranges and dates can be had in many oases, where eggs and other fresh supplies can be bought in small quantities. Europeans can and should do without many of the foods that they regard as essential at home: even an austere diet should be balanced. Few Europeans can accommodate themselves to the meagre native diet and retain health and maximum efficiency. Native food usually consists chiefly of dates, flour, lentils or beans, and milk (in certain circumstances); other foods (including meat on special occasions) are regarded as luxuries. Many European tinned foods are treated with suspicion or disliked by natives: they may become an acquired taste, especially among the well-to-do in settled communities.

About 2 cwt. of food or other stores can be carried by one camel if correctly loaded. Camels thrive by browsing on thorn bushes and by grazing on numerous desert plants, but animals taken from soft pasture must accommodate themselves to harsher foods. Camels fed on dry fodder carried for them on the march need more water than those living by browsing or grazing.

Water

A large force must carry its water, although at certain points it could be replenished by camel-transport. Distances between water-points in the desert are often great, and many of the wells can supply water only for a limited number of men. The various methods of obtaining water in the Sahara are outlined on pp. 80-3. Some wells are deep, often exceeding 150 feet. Some means of raising water should be carried. In the north the water is sometimes brackish, and, in the south, magnesian: anti-magnesium mixture should, therefore, be carried. Water from all sources frequented by man or beast is usually contaminated.

Water is usually carried in metal containers. One camel can carry two metal containers each holding 9 gallons (40 litres), or four casks each holding $3\frac{1}{4}$ to $4\frac{1}{2}$ gallons (15 to 20 litres), or 22 gallons (100 litres) of water in goatskins. If goatskins are used the above quantities should be increased by at least a quarter, owing to unavoidable losses and leakage. Camels demand considerable supplies of water. They should be watered as often as possible, and at least every five to

eight days. Each animal will drink 10 or more gallons of water. When thirsty, camels may take an initial drink and then stop: this does not mean that they have had all they need. They should be allowed, whenever possible, to make up their reserves of water at leisure. Camels, and natives, can drink water which a European finds unpalatable or worse, but this does not mean that they can drink any water.

Clothing

In view of the considerable ranges of temperature (sometimes from over 100° F. in the day to about 40° F. at night), protection from cold is as important as protection from the sun, and woollen clothes are essential for the night, though light clothing is suitable during the day. The changes of temperature are often sudden, and underclothing should, therefore, be chosen to protect against chill. During the day, according to the season of the year, aertex or flannel khaki shirts are best, with shorts or trousers, and sandals, boots, or shoes. Socks or stockings should be worn with any form of boot. In thorn and harsh grass country protection of the body, especially the legs, is necessary: strong ankle boots and puttees or knee-length boots may be essential, though fatiguing. Boots give a sense of security against snakes and scorpions. For chilly evenings, cold weather, and cold winds, stockings, trousers, pullovers, Balaclava helmets, great-coats, and scarves are useful, and gloves are often needed for driving in the early morning. In intense hot sunshine a loose thick jacket often gives more comfort, by keeping off the sun's rays, than light clothing or nudity.

Pith helmets or broad-brimmed double terai felt hats should be worn for travelling or working in the sun, though turbans are sometimes better since they protect from cold as well as from heat. During sand-storms, a *cheich* (fine muslin wound round the turban) helps to protect the head. Dark glasses relieve the glare of the sun, Crookes' lenses being excellent. Goggles are essential when driving vehicles. Plenty of warm bedding should be available.

Accommodation

The larger centres in the desert have small hotels (*see* Vol. II, Chap. X), but indoor accommodation is not essential. Large forts, such as In Salah, can house up to 500 men, but the ordinary military post, such as In Guezzam, can only accommodate some 40 or 50 men in the cells around the courtyard.

Tents are generally unnecessary unless a long stay is made in one place, and shelter from wind and sun during the day is essential; they should have a separate fly-sheet. At night they are of little advantage. For a camp of several days, or as shelter from a shower of rain, a light sheet of canvas stretched between two cars is an efficient substitute.

At night, protection may be wanted against dew, creeping insects, and mosquitoes. In the interior of the deserts, stones constitute a problem of hard lying which can be avoided by choosing a camp site with sufficient sand-drift sleeping accommodation, or by making a hollow among the stones to fit the hips. Dew can be kept out by a light canvas valise of the Wolseley pattern, but the canvas cover must extend high enough to be pulled over head and pillow if necessary. Creeping insects may be avoided by the use of camp beds, though these are awkward and heavy, and more draughty than a well-chosen sand-drift. With a camp bed a kapok or similar light mattress is almost essential to conserve the warmth of the body on winter nights. Very comfortable beds can be made readily from palm-leaf ribs or from timber (acacia, &c.), with a rope mattress. Additional protection against creeping insects may be obtained by standing the legs of the bed in tins, either empty or filled with water or other liquid. Mosquitoes can be kept off the person by the use of a mosquito-net.

Other Hints

In addition to the above hints, the following notes may be useful for those travelling in the Sahara away from medical advice:

1. Disease is likely to be picked up from the natives of the country, and Europeans should, therefore, always live as far as possible from native villages. Camps should preferably be placed up-wind and, if near running water, upstream of them.

2. Drinking during the heat of the day should be kept to a minimum, and all water, however clean it may look, should be chlorinated or boiled before it is drunk or used for cleaning the teeth. Fresh milk or locally prepared mineral waters should not be drunk, and all food should be carefully inspected before being eaten. Native cooks should be made to keep themselves and their cookhouses clean. If there is any likelihood of Bilharzia disease (urinary schistosomiasis), no water should be allowed to come in contact with the skin in any way until it has been boiled or treated with army cresol, or stored for forty-eight hours (cf. p. 176).

3. Gastric troubles, which are very common in Europeans in warm climates, are due to germs which may be swallowed in water, milk, or uncooked food, such as raw fruit or salads. The best treatment is rest (taking small quantities of clean boiled water only for a day or two), warmth, and a dose of castor-oil.

4. Celluloid eye screens or goggles should be used if the weather is windy and dusty or when travelling in a convoy in a cloud of dust. If the eye is inflamed it should be washed in clean drinking water which has been previously boiled, and to which salt (one teaspoonful to a pint of water) has been added. A corner of a clean handkerchief or the smooth point of a pencil will remove a piece of grit on the eyeball or inside the lid. A drop of castor-oil will often soothe an eye inflamed by dust.

5. Every precaution should be taken to keep bedding dry and to avoid wearing damp clothes any longer than can be helped.

6. Snakes, scorpions, poisonous spiders, and centipedes take refuge in clothing, boots, and bedding, especially at night. Mattresses and other things on the ground must be lifted every morning and evening to see that no insects have crawled underneath. Before clothes and boots are worn, or towels and sponges used, they should be thoroughly shaken. Generally snakes and scorpions are to be expected in the vicinity of water and around oases, and are less frequent in entirely arid districts, but snakes sometimes maintain themselves in the most unlikely places (pp. 178-80).

7. Malaria has been described in some detail above (p. 166). To avoid the bite of the *Anopheles* mosquito, camps should be placed as far as possible from swamps, rivers, and irrigated lands, and from native villages. In malarial areas, such as most of the oases of the Sahara (p. 170), 5 grains of quinine may be taken daily as a preventative. Mosquito-nets should be used and tucked in carefully. Legs and arms must be protected as much as possible during the hours of darkness. If no doctor is available a malarial case is best treated by making the patient lie down and take 10 grains of quinine and a dose of salts. He should be kept in bed until his temperature is again normal. If the fever continues the patient should be seen by a doctor as soon as possible.

8. All Europeans should be vaccinated against small-pox and inoculated against typhoid, paratyphoid, and tetanus.

9. If possible, the following medical supplies should be taken: aspirin, bismuth, boric acid, calomel, carbolic ointment, cascara

sagrada, castor-oil, chlorodyne, cold cream, corrosive sublimate, Dover's powder, iodine, lanoline, lysol, oil of cloves, paregoric mixture (or better, pills of extract of opium), phenacetin, potassium permanganate, quinine, sodium sulphate, yellow ointment (Ung. Hyd. Ox. Flav.), zinc ointment, zinc sulphate, eye lotions or materials for making them, with eye-bath, anti-scorpion serum, and anti-venom serum. The sera should be fresh. They are reputed to be useless unless injected immediately after the sting or bite has been inflicted.

CHAPTER VII

THE HISTORY OF ALGERIA

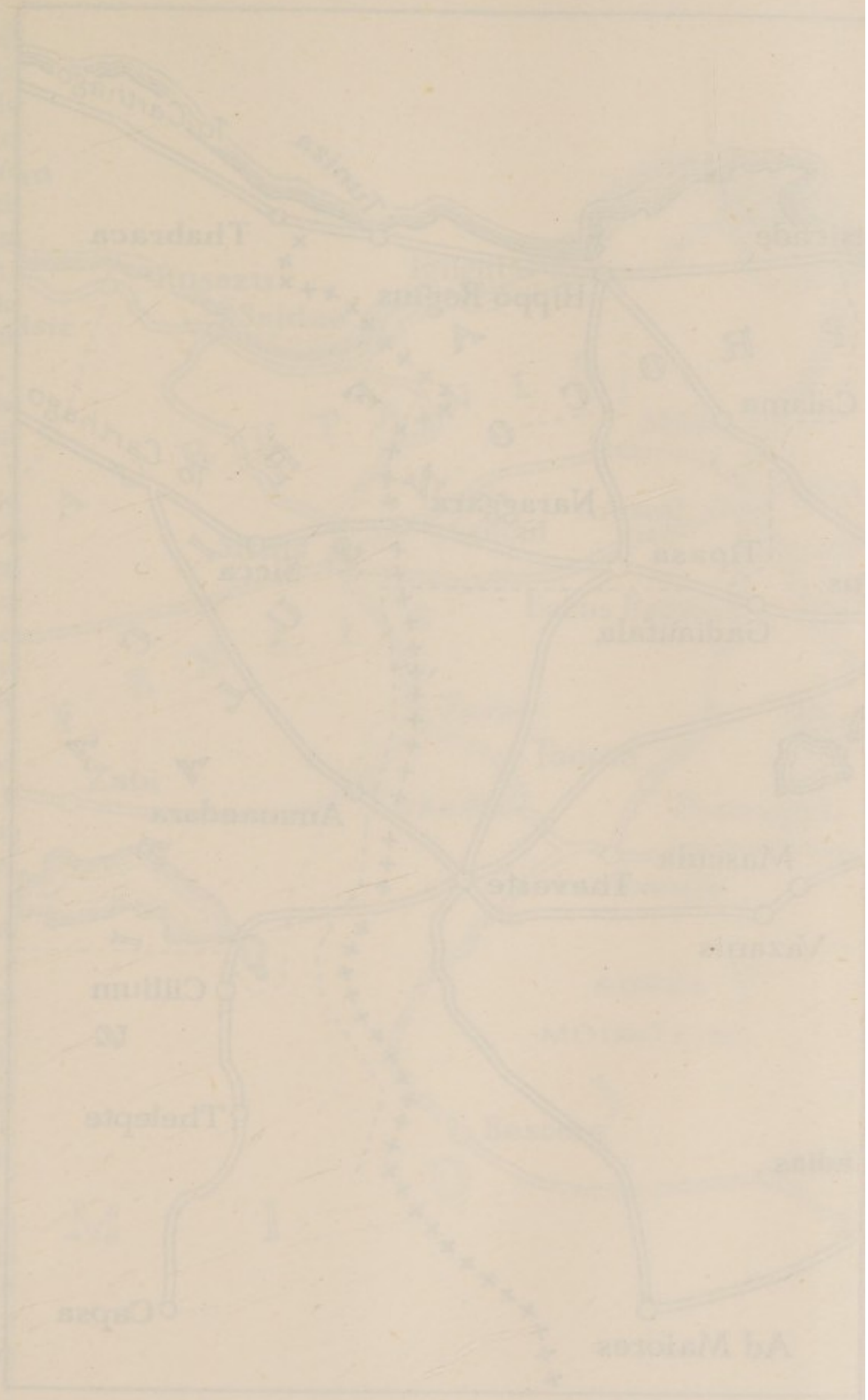
THE history of Algeria is the history of domination by Phoenicians, Carthaginians, Romans, Arabs, Turks, and finally French, against a background of tribal conflict. The native Berber tribes, handicapped by the geographical disunity of their country, have never succeeded in presenting a united front for any length of time, so that bitter resistance has always been followed by piecemeal reduction. In spite of this, the Berber race has maintained itself, and to-day the native population is 30 per cent. pure Berber both in race and civilization, the rest being largely composed of Berbers showing different degrees of Arab influence.

The Phoenicians and Carthaginians

In the classical period it is difficult to separate the history of Algeria from that of the whole of north Africa. The Phoenicians colonized the coast from the twelfth century B.C. until their control of the Mediterranean was broken by the Greeks. Then Carthage superseded Phoenicia in the western basin of the sea, and from being merely a maritime power with all the country outside her walls belonging to the natives, she expanded inland until her direct power covered northern Tunisia and a part of the province of Constantine. The Carthaginians were the first to introduce agriculture to Algeria. In the Punic wars Rome and Carthage struggled for supremacy, the native princes of Algeria allying with either side in turn. In the Second Punic War (218 B.C. to 202 B.C.), however, Massinissa, king of the Massyles tribes of eastern Algeria, as a reward for his alliance with Rome, was assisted in extending his sway over the kingdom of Syphax, who ruled in western Algeria. Henceforward he and his son became the principal agents of Roman policy in Africa, and their kingdom of Numidia, with its capital at Cirta (Constantine), grew extremely prosperous. Like the Carthaginians, they encouraged the pastoral nomads to settle on the land and till the soil. A few towns were developed by Roman merchants.

The Romans

After the destruction of Carthage in 146 B.C. a small part of its territory in Tunisia became the Roman province of 'Africa', but the greater part was added to the kingdom of Numidia. This remained



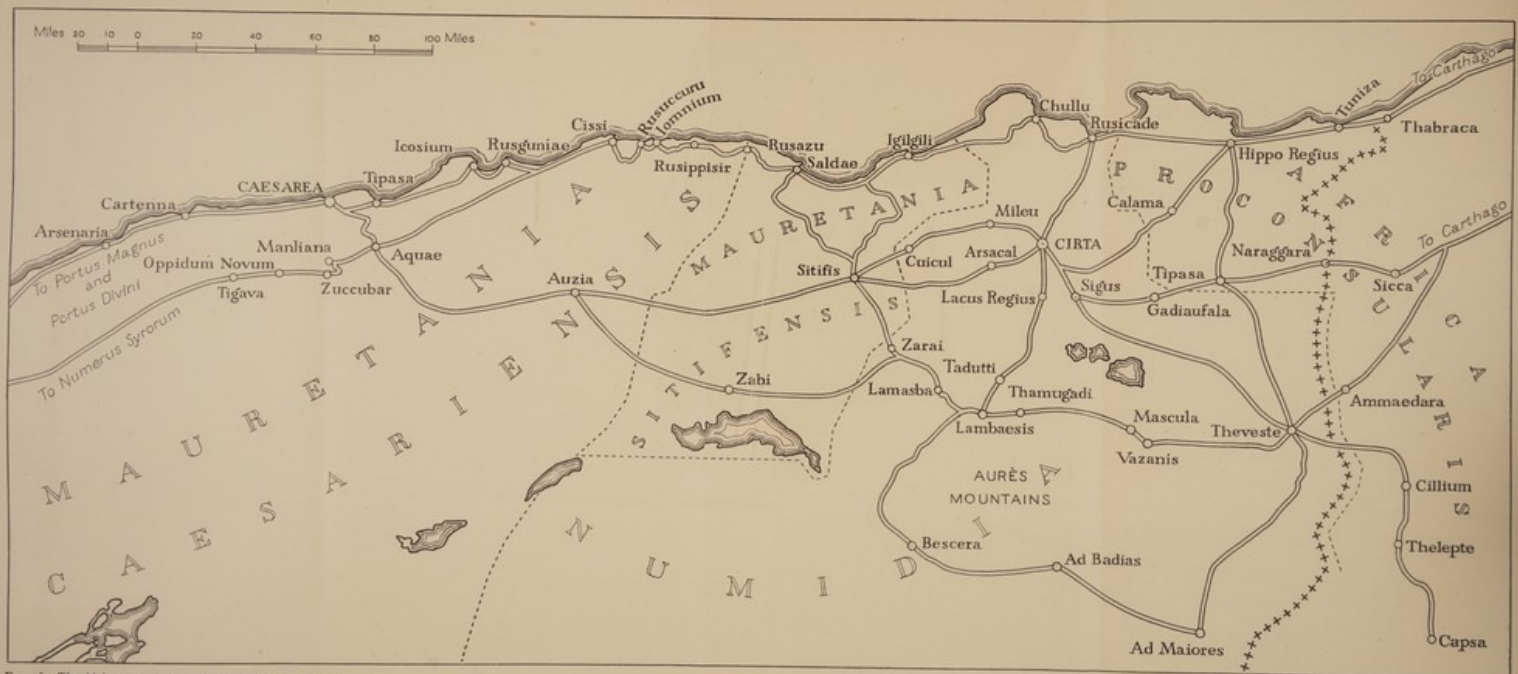


FIG. 46. The chief towns and the road system of Roman Algeria

an allied state under Roman suzerainty, despite the eight years' revolt of its ruler Jugurtha (112 B.C. to 104 B.C.) until it was finally annexed by Julius Caesar in 46 B.C. and was added to the old province of Africa, the whole being eventually known as Africa Proconsularis.

West of the Ampsaga river (el Kebir) the kingdom of Mauretania continued to exist till A.D. 42, when it was annexed as Mauretania Caesariensis. Roman Algeria was not a unity but had three independent administrations: a procurator ruled Mauretania at Iol (Cherchel), while the eastern districts were divided between the proconsul at Carthage and the 'legate' in command of the army based on Tébessa and, later, Lambaesis. For the first two centuries A.D. pacification and settlement spread steadily southwards, in the east as far as the Aurès, which were encircled by military posts, but in Mauretania the limit was very much farther north and the Kabylie massif was not effectively occupied. Roman control was considerably simplified by the fact that the camel had not yet been introduced to Barbary, so that desert nomads from the south did not trouble the peaceful areas of the north.

Roman colonization of north Africa was considerable, and the native population was rapidly, if superficially, romanized. The modern department of Constantine, and the coast as far as Cherchel and Ténès, became a land of towns and cities in the Italian style, of which many remains still exist (Fig. 46, Photos. 54-6, Appendix D). By A.D. 150 the Roman army in Africa was being recruited locally, and Latin-speaking Africans were taking part in the general life and administration of the whole empire. The contribution of Africa to Latin literature was remarkable. Algeria produced Apuleius, author of *The Golden Ass*, from Madauros (Mdaurouch), and later the Christian apologist St. Augustine, a native of Hippo (Bône). Latin was generally the language of the towns and the army, but the rural population spoke Punic—the language of Carthage—in the east and Berber dialects in the west and south. Economic prosperity was based on agriculture, which gained ascendancy over stock raising. The export of oil from the ubiquitous olive was the main product, but corn, wine, and skins were also important (Photo. 58). There was also a luxury trade in wild animals, including elephants and lions—now extinct—from the thinly populated regions of the south and west.

After the death of the Emperor Severus, himself a native of Africa, in A.D. 212, troubles began, and by A.D. 238 the long era of unbroken prosperity was ending. There were four Berber revolts between

A.D. 238 and 297, and the general insecurity of north Africa led to the gradual decay of town and country life and to the dominance of military force over the civil power. The power of the independent Berbers was greatly increased by the substitution of the camel for the horse as the nomad mount. The military decadence of Roman power in Africa also resulted from the rapid growth of Christianity. Civil strife between pagans and Christians was succeeded by the bitter rivalry of Catholics and Donatists. The latter, a sect of African puritans, were strong in the rural population, whereas the Catholics were the leaders of the urban *bourgeoisie*.

The Vandals and Byzantines

The Roman domination was brought to an end by a Vandal chief, Genseric, who, invading from Spain between A.D. 427 and 430, conquered north Africa from Gibraltar to Bône, and established a powerful, if short-lived, empire. After his death in A.D. 477 the influence of the Vandals was effective only over a limited area, and in A.D. 533 it was overthrown entirely by the Byzantines.

Belisarius, a famous general, was sent west to north Africa by Justinian, Emperor of Constantinople, to establish there the authority of the Byzantine Empire and the Orthodox Church. He rapidly occupied Carthage, Iol-Caesarea, and Cirta, and set up a government in the country. The Roman towns of the east recovered some prosperity and many were fortified, such as Tébessa, the Byzantine walls of which were so strong that they were later used by French engineers (Photo 57). Byzantine rule added two centuries to the life of Latin civilization in Africa, although it never extended over the whole of Roman Algeria, and heavy taxation and religious rivalry of Catholic and Orthodox always weakened the influence of the Byzantines. In the seventh century they went down before the Arab assault: the long struggle between east and west for Africa ended in the triumph of the east. For centuries Mediterranean unity was shattered.

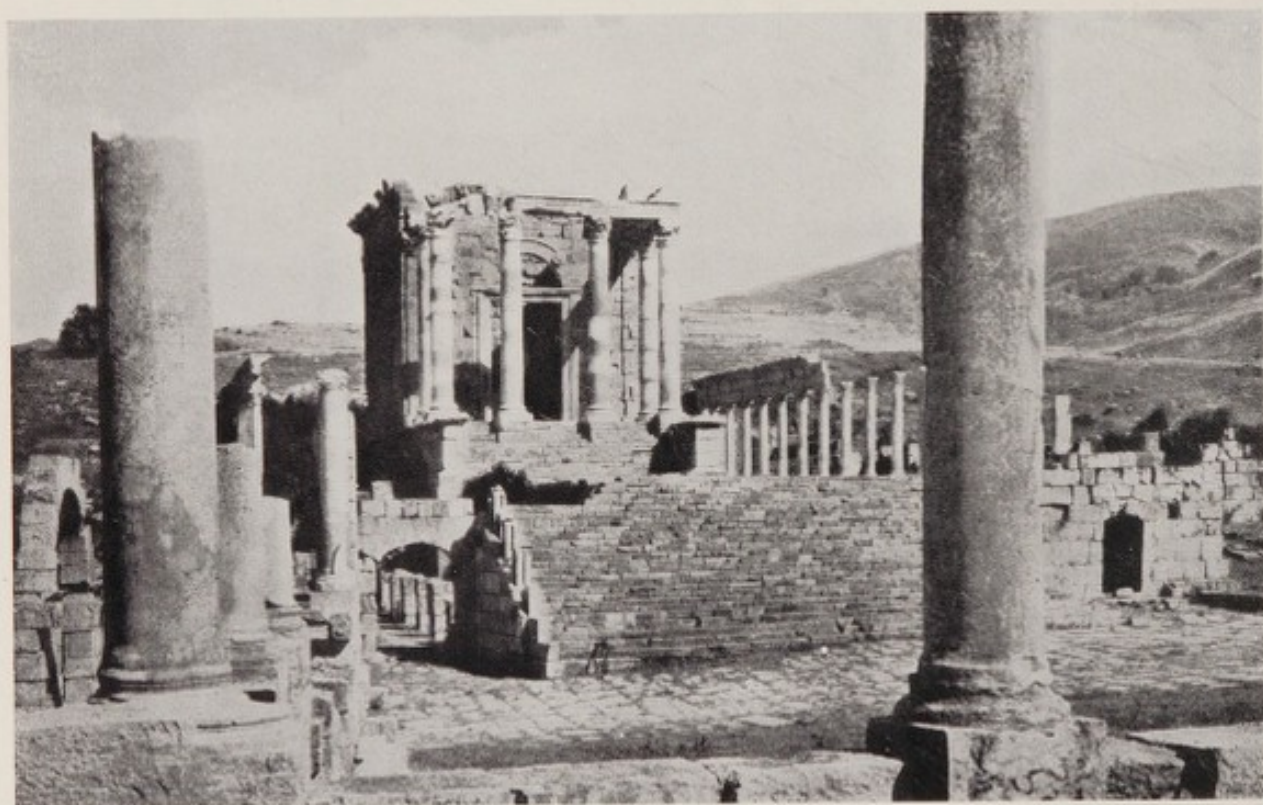
The total disappearance of Roman moral civilization is remarkable: language and institutions left no trace behind them. This must be attributed in part to the comparatively limited amount of immigration and to the vitality of Berber life, which permitted only superficial assimilation, and to the insufficient conquest of the Kabylie territory where many Berber tribes maintained their independence. But the Berber tribes only became a serious menace with the introduction in the third century of the camel in large numbers for military



54. *Tingad (Roman Thamugadi)*



55. *The colonnade and stalls of the Roman market at Djemila (Roman Cuicul)*



56. *Roman temple at Djemila*

purposes. The Roman way of life was destroyed by the uncompromising Hilalian invasion in the eleventh century (p. 190); the earlier dynasties, as in Egypt, were less destructive.

The Arabs

In the year 640 the Arabs crossed the isthmus of Suez and established themselves in Egypt and Cyrenaica. Their first raid into Barbary was in 647, and various other expeditions were made, but it was not until Okba ben Nafi with his Syrian army founded a base at Kairouan (Kairawan) that there was any serious attempt at permanent occupation. In 681 he raided Barbary, known to Arab geographers as el Maghreb ('the West'), pushing as far west as Tangier, but was killed in 683 by Berber and Byzantine forces.

A second Arab assault in 697 met with stubborn resistance organized by the queen of the tribes of the Aurès mountains, who at first was successful, though native disunity led to her defeat five years later. With her death an internal conflict succeeded between the agriculturists, represented by the sedentary tribes and Greek farmers, and the stock-raising nomadic tribes, who formed the chief opposition to the Arabs. By the beginning of the eighth century the Byzantine coast towns and the whole central Maghreb recognized Arab supremacy. As they were conquered, the Berbers became Moslems, receiving the new faith with as much ardour as their forefathers had accepted Christianity. The Arabs used this religious zeal and the warlike qualities of their new subjects in the conquest of Spain, and large numbers of Berbers fought for them in Spain, and, in 732, as far north as Poitiers.

The Religious Struggles

The history of Algeria till the arrival of the Turks largely consists of struggles between various Berber elements supporting different religious sects, all of them opposed to Moslem orthodoxy as represented by the Sunnites (Malekites) (cf. p. 222), but all mutually antagonistic.¹ The first sect to make itself felt was the Kharijite, whose followers were morally austere and politically democratic and, in the name of a religious ideal, found expression for their hatred of the foreigner and of despotic authority. Throughout the eighth, ninth, and tenth centuries they played an important part in Algerian life, and their successors are still found to-day

¹ An account of the rise and development of Islam is given in the Geographical Handbook of Syria (B.R. 513).

amongst the Mozabites (p. 231). In 740 they organized a rising which lasted through the century, as the Arabs were too occupied by revolts in the east to assert their authority in the centre and west. Consequently two Berber kingdoms, with their headquarters at Tiaret and at Sidjilmassa in Tafilalt, were able to maintain their independence until the coming of the Fatimites.

At the end of the ninth century the Fatimite, Obeid Allah, fleeing from persecution, came to the Maghreb. Some Berbers, particularly the tribes of the Petite Kabylie, were attracted by the mystical tendencies of Shiism, the sect which supported the Fatimite claim to the succession of the Caliphate through Fatima, the daughter of the Prophet. They were ready to support the opponents of orthodoxy, and, owing to lack of cohesion between the different Berber groups, helped the Fatimites to overthrow the kingdoms of Tiaret and Tafilalt, depose the rival dynasties in Morocco and Tunisia, and establish a kingdom with its centre at Mahdia in Tunisia. The Caliphs of Cordova, however, who belonged to the Ommayyad dynasty, were not prepared to see their rivals established in the Maghreb without a struggle, and encouraged the powerful nomads of the south-west to resist the Fatimites. During the tenth century, therefore, the old quarrel between the nomads and the sedentary agriculturists was merged into the greater contest between the Caliphs of Cordova and Cairo, and was much embittered by foreign gold and greed.

The Fatimites, not content with their new territories, moved east to conquer Egypt, helped by the tribes of the Kabylie, particularly the Ketama, and by the Sanhadja, a tribe from the desert in the south. The capital was moved to Cairo, and as a reward for their help Barbary was left under the Zirid chiefs of the Sanhadja tribe who were nominally the Caliph's viceroys. In actual fact, they gradually built up a powerful state, the weakness of which lay in its size. Between 995 and 1016 it split into eastern and western kingdoms, the western, in particular, becoming of considerable commercial importance. These two kingdoms, comprising the Tell of the modern departments of Algiers and Constantine, owed nominal allegiance to the Caliphate of Cairo, but the nomads of the south and south-west remained loyal to the Caliphate of Cordova.

The Hilalian, Almoravid, and Almohad Invasions

Towards the end of the tenth century the Fatimites moved the turbulent Arab tribes of Hilal and Soleim from Upper Egypt, where they had been causing trouble, to the country on the left bank of the

Nile. Arab historians say that in 1049 when el Moezz ibn Badis, the Emir of the eastern kingdom, rejected Shiism and allegiance to the Fatimites for the orthodox Sunnite faith, the Caliph at Cairo in revenge encouraged these warlike tribes to move west to Barbary. As a result a mass invasion of the Hilal and Soleim tribes, with other nomads, took place, commerce and industry disappeared, and east and central Barbary was reduced to anarchy. Many Berbers took refuge in the mountains, and their descendants are found to-day in the villages of the Aurès and Kabylie, hardly touched by Arab blood, but in the plains Berber and Arab mingled together for the first time and formed new tribes.

The confusion in the central Maghreb opened the way for the expansion of the powerful Berber Empire which had arisen in the west. In the eleventh century tribes of the southern desert had banded themselves together for a Holy War. Under the name of Almoravids they asserted their authority over their neighbours, and between 1064 and 1069 moved west under the leadership of Youssef ben Tachfin, a soldier and holy man, and conquered Morocco; from there they gained control over Algeria as well, as far east as Algiers. They would in all probability have also subjugated the country farther east had not Youssef responded to an appeal for help from the Spanish Moors. When he died in 1106 or 1107, his empire stretched from the Ebro in Spain to Senegal, and from the Atlantic to Algiers. The incorporation of Spanish territory, and Youssef's respect for Andalusian culture, led to the spread of Spanish civilization in north Africa, but the Almoravid Empire was unable to maintain its power, and had collapsed within half a century.

Under Abd el Moumen a new military and religious sect known as the Almohads usurped the authority of the Almoravids, and by 1158 had in their control a large area of the Maghreb stretching from Tangier to Tripoli. Abd el Moumen defeated the Almoravid Sultan, destroying his kingdom, conquered the Hilalian tribes, drove the remnants of the Byzantines out of the ports, set up a prosperous kingdom, and established trade with the ports of the northern Mediterranean. His successors had continuous trouble with warlike Arab tribes, and towards the end of the twelfth century the new empire disappeared.

The Period of Anarchy (c. 1200-1518)

On its ruins there arose three kingdoms, corresponding roughly to modern Morocco, Algeria, and Tunisia, which were constantly

struggling with one another during the thirteenth and fourteenth centuries. Tlemcen, the capital of the 'Algerian' kingdom, endured an eight-year siege beginning in 1299, and was occupied by the Merinid dynasty of Morocco from 1337 to 1359. From 1389 Algeria was a vassal state of either 'Tunisia' or 'Morocco', and was also being constantly ravaged by the Hilalian tribes living within its borders.

By the beginning of the sixteenth century anarchy was at its height, and foreign intervention was inevitable. When the Spanish had recovered their possessions in Spain, they turned their attention to north Africa, and believing the conquest of Algeria to be necessary for their expansion, sent an expedition in 1505 against Mers el Kebir. By 1510 the whole of Algeria was virtually a subject state of Spain, but Spanish energies were fully absorbed by European and American commitments, so that men and munitions could not be spared to deal with various native risings.

Turkish Supremacy under the Beylerbeys (1518-87)

The rebellious natives soon found a valuable ally in the Turks, one of whom, Aroudj, a pirate, had established a base on the island of Djerba, off the coast of Tunisia, in 1512. There the Kabylies of Bougie sought his help against the Spanish, and Aroudj, recognizing the principle, which the Spanish and, at first, the French ignored, that the country could be mastered only by the occupation of the interior as well as of the coastal zone, speedily conquered most of the ports together with areas such as the Mitidja, the Chélif valley, the Titteri, the Dahra, the Ouarsenis, and the Tlemcen district.

Aroudj was succeeded by his brother, Barbarossa (Khair ed Din), who greatly improved his power and position by offering homage to the Sultan of Constantinople. By this astute move he abandoned the role of pirate chief for the office of *Pasha* and *Beylerbey* ('Bey of Beys'), and obtained the moral and material support of the Turkish Empire for the preservation of his inheritance.

With Turkish soldiers and artillery he defeated the Spanish before Algiers, and occupied most of the towns of the coast and in the Tell. His lieutenant, Hassan Aga, the Governor of Algiers, repulsed a heavy attack by Charles V in 1541, with such losses that Algiers was thought to be invincible, and the European Powers hesitated to make any further attempts to break the Turkish rule.

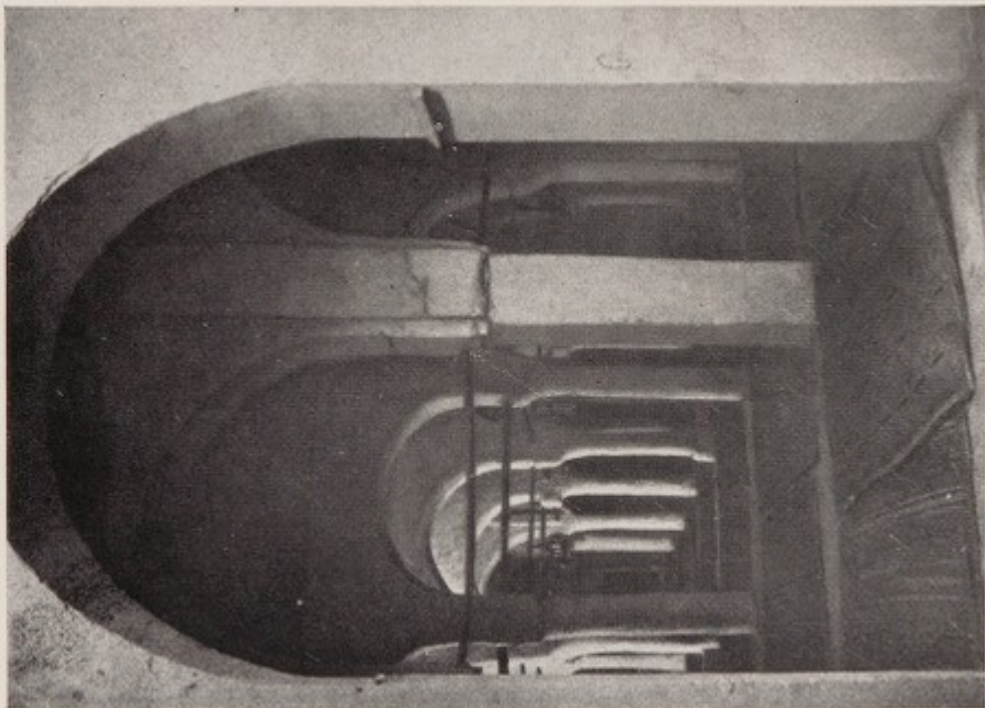
His son and the succeeding Beylerbeys continued to defeat the Spanish, whose land forces and fleet were destroyed in 1560, though Oran remained in Spanish hands until 1792. The most remarkable



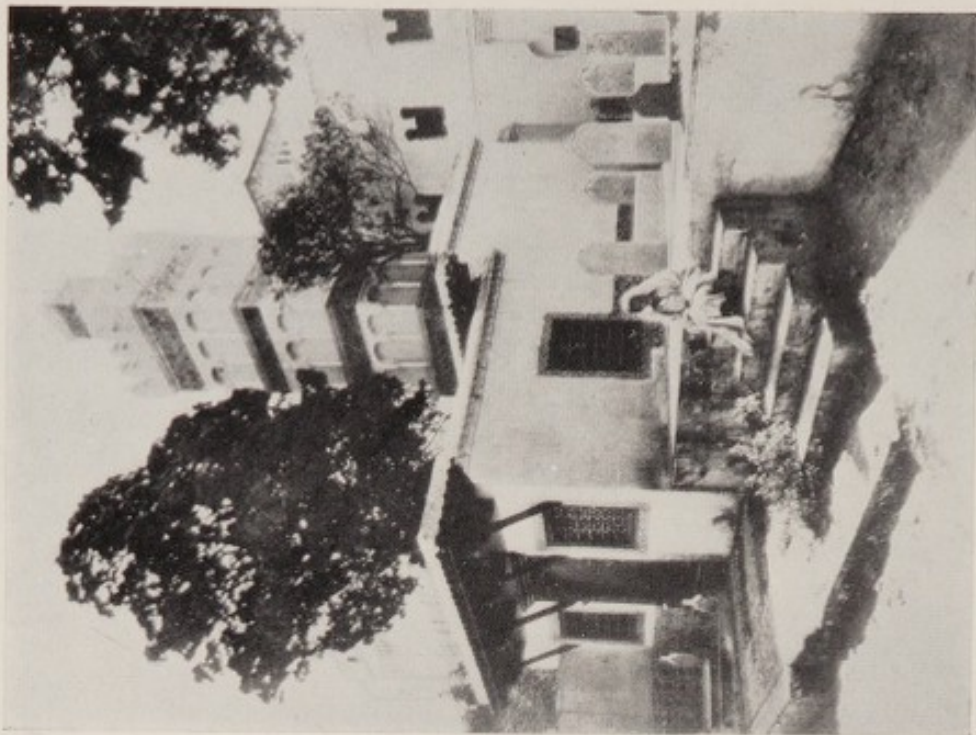
57. *Byzantine gateway and wall of Tébessa*



58. *Oil-press and tanks at Madauros (Mdaurouch)*



59. *The interior of the mosque at Sidi Okba
near Biskra*



60. *The mosque of Sidi Abd er Rahman bou
Kobrin at Hamma, near Algiers*

of the Beylerbeys was Euldj Ali (1568-87), who increased the Algerian navy and formed the Corsair fleets which harassed the Christian world for half a century. He, more than any other, helped to establish Turkish power in the western Mediterranean, and during his lifetime the Regency of Algiers reached the limits it maintained until 1830.

Turkish Supremacy under Pashas, Aghas, and Deys (1587-1830)

The Sultan in Constantinople, alarmed by the growing power and ambition of the Beylerbeys of Algeria, decided to supersede them by *pashas* appointed for only three years, and ruling in direct subordination to Turkey. As their term of office was so short the pashas concentrated on filling their own pockets, and the real rulers of the country were the pirate chiefs, or *raïs*, and the Turkish soldiers whom the Beylerbeys had tried to suppress. For a short time in the middle of the seventeenth century the *aghas*, or chiefs of the militia, seized power and reduced the pashas to impotence, but there was perpetual conflict, and in 1671 the *raïs* gained control, and elected one of their captains to the office of *dey*, or protector. The pasha became a mere figurehead, with no effective power, and in 1710 the offices of pasha and dey were united. As the Ottoman control of north Africa decreased the deys became independent, and the people grew rebellious.

During the seventeenth century the Corsairs played an important part in the life of the country, turning piracy into a lucrative trade, and living like merchant princes in magnificent palaces in Algiers. Their galleys and smaller craft dominated the Mediterranean and made it unsafe for Christian traffic. They plundered merchant ships and took slaves with such success that their prizes often exceeded two or three million *livres* in a year. The citizens, growing wealthy on the proceeds of the expeditions, looked on the Corsairs as their benefactors, and the governors, whose revenue came from the same source, had to endure their growing power.

Many attempts were made to rid the Mediterranean of the Corsairs. The English under Blake and the Dutch under de Ruyter led expeditions against Algiers; the French bombarded the port in 1661 and 1668, and the Spanish attempted a landing under O'Reilly in 1775. Little success attended these early efforts, but by the end of the eighteenth century the growth of stronger national navies in western Europe was having an effect, and the power of the Corsairs declined, leaving the Regency in a deplorable condition.

The French Occupation (1830)

The French occupation of Algiers was the culmination of the series of assaults on the pirate stronghold, and was not intended to be a permanent extension of French territory overseas. It was undertaken by Charles X to allay the suspicion with which the people regarded his ineffective government by appealing to their love of glory, and turning their attention away from domestic affairs. He also wanted to protect French commerce in the western Mediterranean, which had been considered as a French sphere of interest since the fifteenth century. In Algeria itself there had been a financial conflict between the dey and the Paris government, and an excuse for final armed intervention was provided by an insult to the French consul, whose face was hit by the dey's fly-flap.

After a three years' blockade of Algiers, which dislocated Mediterranean commerce but had no perceptible effect on the dey, the French revived a plan of Napoleon's for an attack on the town from the landward side. The army under Bourmont landed at Sidi Ferruch (Farouche), about 15 miles west of Algiers, unexpectedly won the battle of Staouéli, and marched on Algiers, which surrendered on 5 July 1830. The victory, which has been described as greater than Fontenoy, Marengo, or Austerlitz because of its consequences, was received with complete indifference by the French, who were far more interested at the time in constitutional and religious controversies than in empire building. Less than a month after the occupation, Charles X was driven from his throne, and the government of Louis Philippe, his successor, looked on Algeria as an embarrassing legacy.

The French in Algeria (1830-71)

Three alternative policies faced the French in Algeria in 1830. They could evacuate the country, or conquer it from the Turks, or compromise by occupying merely the coastal towns and the surrounding districts. The official Commission recommended the latter policy, and in 1834 Drouet d'Erlon was appointed the first Governor-General of the limited French possessions in north Africa. From 1834 until 1871 chaos reigned in the country, accompanied by frequent, and sometimes serious, revolts. While the French occupied only the coastal districts, they had no control over the warlike tribes of the interior, who took advantage of the constant changes of governors and policies, and the insecurity of the internal government of France. Fig. 47 shows the progress of the French occupation of the country from 1830 to the present century.

In eastern Algeria several attempts were made to capture the great stronghold of Constantine (Photo. 14), but they failed owing to the difficulties of the country, until in 1837 a force of 10,000 men under General Damrémont captured the town in a very costly attack. The main opposition to the French until 1847, however, was directed by the Emir Abd el Kader, an energetic leader and skilful soldier and politician. Many attempts were made to break his power, but until 1840 they met with little success, owing to the lack of foresight shown by the governors. Thus in 1834, in a desire to use the native chiefs as French agents, he was recognized as ruler of a large part of the interior, whilst the Treaty of Tafna in 1837 repeated the mistake of giving the emir too much power for one chief. In contrast, in eastern Algeria, this mistake was avoided by dividing the government between five different chiefs.

After 1840 the French Government, alarmed at the state of the country, abandoned the policy of limited occupation for one of total conquest and colonization. Bugeaud was sent to Algeria and reorganized the army for African warfare. Realizing that it was useless to hold a line of towns in the Tell without controlling the area to the south as well, he placed garrisons in the interior at Boghar, Teniet el Had, and Tiaret. Meanwhile Abd el Kader had gained the assistance of the Sultan of Morocco, but their combined forces were defeated in 1844 at the battle of Isly, near Oudjda, and an attempt was made to delimit the boundary between Algeria and Morocco. Abd el Kader was finally defeated in 1847. All Turkish Algeria now recognized the authority of France, and the power of the Kabylie tribes was much reduced: the heroic period of the French conquest was complete.

Resistance, however, had not ended. The fall of Louis Philippe in France in 1848 involved the retirement of the Duc d'Aumale, who had been a successful governor, and during the next four years there were no fewer than seven governors. Consequently control in Algeria was weak, and there were continual risings, particularly in the Kabylie. The most serious revolt came about twenty years later, in 1871, when the Kabylie fought fiercely for their independence and for their lands, which had largely been confiscated for the settlement of colonists. After ten months they were defeated, and lost their autonomy and more of their land.

The French in Algeria (1871-1914)

This was the last serious trouble to occupy the military authorities and there were no further revolts except for sundry disturbances in

the south and on the Moroccan frontier and, during the War of 1914-18, when native conscription was introduced. Towards the end of the nineteenth century the army was chiefly concerned with projects for the conquest of the Sahara, which are described in greater detail on pp. 203-5. El Goléa was occupied in 1891, In Salah in 1900, and a hard campaign was fought for the mastery of Tidikelt, Igli, and Gourara (Fig. 47). Various schemes for railway construction were considered, including one from Algiers to Timbuktu.

In May 1903 Colonel Lyautey was put in command of an independent territory round about Ain Sefra and charged with solving the problems of the southern part of Oran. For three years he worked ceaselessly for the extension of French influence and authority, putting down tribal revolts, extending the railway, and covering the desert with a network of military posts which might serve as bases for mobile forces. His tactics immediately popularized the system of 'peaceful penetration', and prepared the way for the conquest of Morocco.

The French in Algeria (1914-39)

Some of the first shots of the War of 1914-18 were fired off the Algerian coast, when Philippeville and Bône were bombarded by two German ships on 4 August 1914. The Germans hoped to create rebellions throughout Algeria, particularly in Kabylie, but despite intensive propaganda the country remained peaceful apart from the general spread of banditry and minor disturbances amongst the Beni Chougran between Perrégaux and Mascara (5 Oct. 1914), and in the Bellezma (11 Nov. 1915). The most serious effect of the war lay in the economic consequences arising from the difficulties of communication between France and Algeria, as a result of the submarine warfare in the Mediterranean. In man-power Algeria provided 173,000 men for the services, 25,000 of whom were killed or missing, and about 120,000 workers, mainly from Kabylie, in armament and other factories in France.

From 1918 to 1926 Algeria was little affected by the efforts of the Tunisian natives to obtain constitutional government or with the military resistance in Morocco. There was a minimum of co-ordination between the three territories, in spite of various conferences between the Governor-General of Algeria and the Residents-General of Tunisia and Morocco. Unrest, however, gradually increased from 1926, stimulated by the Arab nationalist movement in Syria and elsewhere, and by the growth of Communism in France. It took

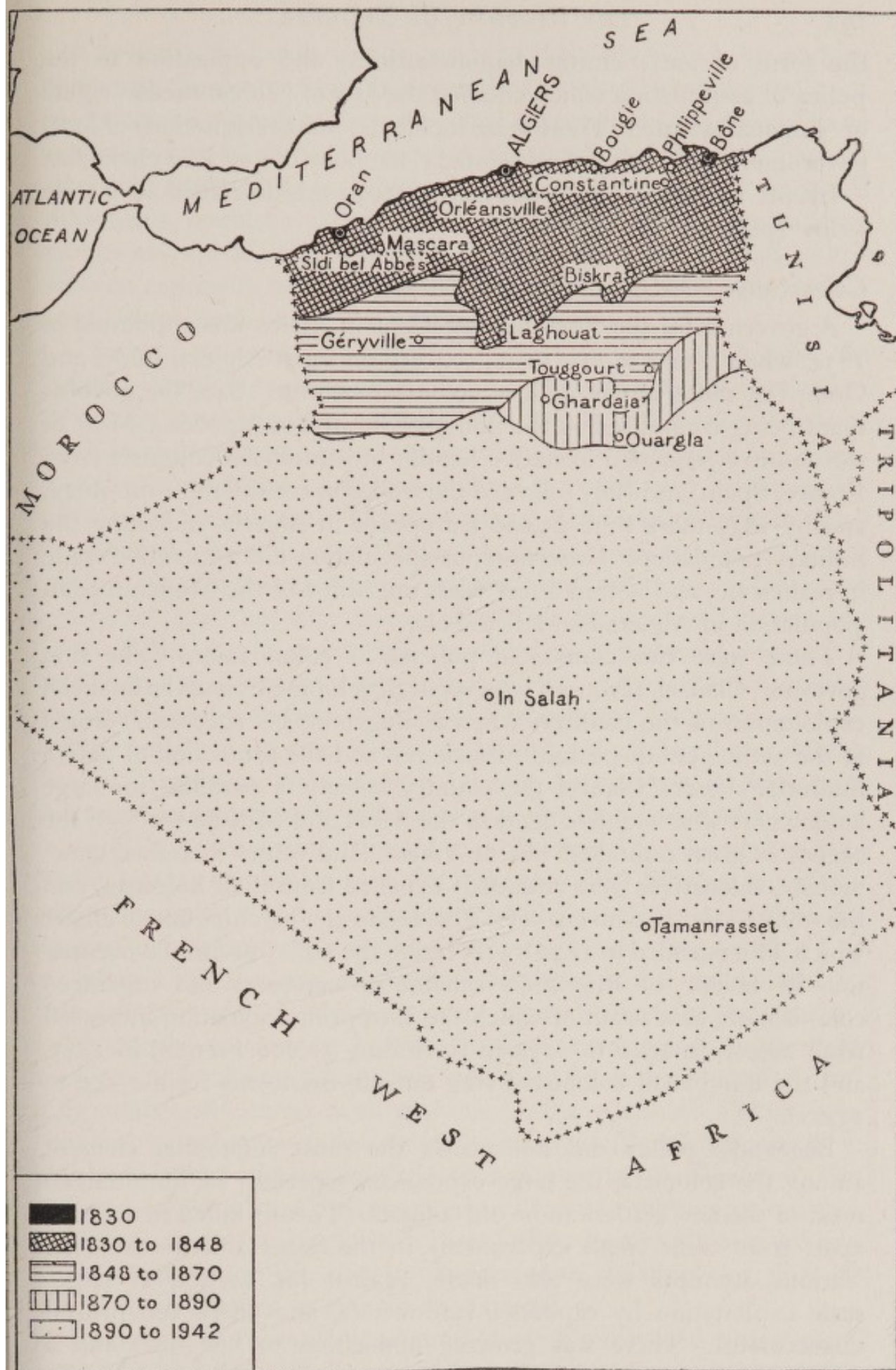


FIG. 47. *The territorial growth of Algeria since 1830*

the form of anti-Semitic demonstrations, and opposition to the policy of assimilation which entailed the loss of Mohammedan rights or 'personal statute'. There were incidents, mass resignations of local government officials, and occasional riots, none of a serious character.

Events in Algeria since September 1939 are described in a note below (p. 205).

Colonization since the French Occupation

A governor for the French possessions in Africa was appointed in 1834, when courts of first instance were set up at Algiers, Bône, and Oran, but there was no official colonization until 1840, the government being committed to the policy of limited occupation. Most of the country remained in native hands; but unofficial colonists from France, Spain, and Italy followed the troops in considerable numbers, and by 1839 there were 25,000 Europeans in Algeria, including the military population. Unscrupulous speculators did a lucrative trade in real estate, and within a few years one-third of the Mohammedan population of Algiers had left the city.

There were two contrasted policies of colonization. The first governor, Clauzel, favoured large-scale developments and the financial exploitation of the country, whereas Bugeaud, his successor, aimed at the settlement of peasant proprietors and the protection of native interests. Under Clauzel the country became a paradise for large landowners who acquired land in the Sahel and Mitidja through the agency of great capitalists like de Vialar: land values increased enormously, the natives were ruthlessly expelled from their holdings, and the small settler had no chance. This led to an anarchic state of affairs which Thiers ended in 1840 by reversing the policy of limited occupation in favour of Bugeaud's scheme of conquest and organized colonization, as a result of which the European population increased from 28,000 in 1840 to 107,000 (including 52,000 French) in 1847, and the number of colonists living outside the towns from 1,500 to 15,000.

Bugeaud's policy did not please the most influential element among the colonists, the large capitalists, especially as he intended most of the new settlers to be old soldiers. This he failed to achieve, apart from some small experiments in the Sahel and the Mitidja. Various attempts were also made, against his wishes, at large-scale exploitation by capitalist landowners, and these too proved unsuccessful. There was growing opposition to his ideas and a widening rift between the army and the colonists. It was also diffi-

cult to settle the conflicting interests of the natives and the settlers, and resist the demands of the latter for the adoption of the policy of *cantonnement* whereby the natives were dispossessed and the colonists acquired their land. Ordinances of 1844 and 1846 decreed that any land not cultivated, or for which the tribe could not produce adequate title-deeds, could be expropriated. Land was also confiscated after revolts and in this way much of the best land was occupied by the settlers, especially near Algiers, Bougie, and Oran, whilst the natives were driven back to the less fertile areas inland.

The economic crisis accompanying the revolution of 1848 led the Second Republic to make a further attempt at state-aided colonization by voting 50 million *livres* to settle Paris strikers and other revolutionaries in the country. Forty-two settlements were founded in Oran, but the venture was mismanaged from the start, and Napoleon III abandoned the project in favour of the capitalist exploitation initiated by Clauzel. By a decree of 1860 the sale of land was again allowed and in 1864 all grants to small settlers were forbidden, as Napoleon was convinced that Algeria was unsuitable for the small settler, but when Pélissier, the governor, attempted to legalize the practice of *cantonnement* there was opposition on all sides. Public opinion favoured the protection of native interests and the Emperor, whose policy had changed after a visit to the country, declared that Algeria was an Arab state rather than a colony. Accordingly an attempt to protect native ownership was made in the *Sénatus-consulte* of 1863, though in practice this inflicted great hardship on the natives, and extended the public lands at the expense of the tribal areas; it was also instrumental in disintegrating the tribal units, led to endless disputes, and completely stopped colonization from 1864 to 1870.

After 1870 the loss of Alsace-Lorraine revived enthusiasm for official colonization, and plans were made to transfer thousands of dispossessed peasants to Algeria. New areas were made available for settlement by the confiscation of land after the Kabylie revolt (1871). Simultaneously many vine-growers in the south of France were anxious to emigrate to the coastal districts of Algeria because of an outbreak of phylloxera in their own vineyards. A decree of 1878 offered grants to small settlers on condition that they improved their holdings, and stayed for at least three years. As a result rural population increased greatly, and, for the first time, the number of French-born citizens began to gain on the foreign.

Increased European colonization inevitably involved native expropriation, and French relations with the natives deteriorated. A new

law of 1873, which attacked communal landownership, the basis of Arab society, and substituted the French system of individual ownership, caused further hardship and created many of the problems of modern Algeria. In practice, it failed to give the natives the benefit of private property, and instead involved them in ruinous legal proceedings which often resulted in the expropriation of their land by speculators. It is estimated that between 1883 and 1889 the natives lost 40 per cent. of their lands, mainly by forced judicial sales. In 1897 natives were allowed to own their land privately, but the rights of the tribe were protected; this was a partial remedy but could not undo the evils of the past. Between 1900 and 1937, 1,976,300 acres passed from native to European hands, and to-day Europeans own 5,931,000 acres. In contrast 22,734,000 acres are held individually by the natives, and 17,300,000 acres collectively.

Administration since the French Occupation

For many years after 1830 there was bitter conflict between the civil and military elements. Owing to the unrest and revolts which continued till about 1871, the civil population was dependent upon the military authorities, but at the same time it resented their power in directing the affairs of the country.

Until 1840 there had been no settled form of government, though various experiments were made. Bugeaud reintroduced one of these attempts, establishing a Direction des Affaires arabes in 1841. The new territories he conquered were organized on a Turkish model, being governed by *khalifas* who had authority over *aghas*, *caïds*, and *cheikhs*, and were responsible for the collection of taxes. In 1844 he set up *bureaux arabes* composed of Arab-speaking officials, to investigate and settle native difficulties. These soon obtained immense authority over the tribes and, because of their knowledge of tribal affairs, had an important influence in military councils. Usually they took the natives' part against the colonists, a fact which explains the natives' undoubted preference for military instead of civil government, and the colonists' intense dislike of military rule.

Bugeaud's relations with the Europeans steadily deteriorated, and his autocratic temper, impatience of argument or of any external control, and his general scorn for the civilian, made him detested. To pacify the colonists, and avoid a military dictatorship, each province was divided by an ordinance of 1845 into three zones, civil, mixed, and military, but this proved too complicated an organization for a new country.

The proclamation of the Second Republic was, therefore, the signal for violent demonstrations among the colonists against military control. The generals managed to maintain their position, although some modifications in administration were made. The civil territories were formed into three departments with prefects and general councils, whilst the governor kept complete control of the military territories of the south. Justice and other departments were detached from the Ministry of War, and connected with the corresponding ministries in Paris. Universal suffrage was granted to the European population with power to elect four representatives to the Constituent, and three to the Legislative, Assembly of France. Despite this, the governor soon acquired almost complete ascendancy over the prefects, and in 1852 the military regime was restored, and Algerian representation in the Legislative Assembly was suppressed.

Between 1852 and 1858 opposition to military rule increased, the bureaux arabes in particular being attacked, and when the Kabylie tribes submitted to French rule in 1857, the last justification for military government disappeared. The governor was replaced in 1858 by a *commandant supérieur* for military affairs, while a Ministry of Algeria and of the Colonies was established in Paris for civil government. Prince Jerome, the first minister, instituted a campaign against the power of the generals, but other difficulties arose. He found that centralization had completely disorganized all the services and that discontent was growing, and soon resigned.

Napoleon III was convinced after visiting Algeria that the policy of assimilation to France meant anarchy, and reintroduced military rule. He appointed Marshal Pélissier, who was given greater power than any previous governor, having ministerial powers as well as military authority. He was succeeded by General Martimprey and then by Marshal MacMahon, who was unpopular with the colonists. Napoleon's second visit to the country did little to allay their grievances, his main interests being in the army and the natives. His schemes for public works did, however, benefit the colonists indirectly; roads, dams, railways, and harbours were built, and mining and the production of cotton, tobacco, flax, and silk encouraged. The serious famine of 1868 brought matters to a head. Lavigerie, the Bishop of Algiers, supported the opposition to military rule, a commission of inquiry was set up and advised a considerable extension of the civil territory, the appointment of an independent governor with ministerial rank to live at Algiers, and the introduction of other reforms demanded by the colonists.

The war of 1870 and the fall of the Empire intensified this anti-militarist agitation. An insurrectionary commune was set up at Algiers, and similar movements occurred at Oran, Constantine, and Philippeville. A constitution was drawn up for Algeria, its aim being to destroy the military regime and assimilate the country completely with France. To this end a decree of 1870 established a civil governor for the three departments, and a consultative committee and three prefects with authority over the generals; and at the same time the power of the bureaux arabes was lessened by putting them under the control of the Ministry of the Interior. Unrest in the country continued, however, until the arrival in 1871 of the new governor, Admiral de Gueydon, who, though regarded as another representative of the military regime, administered on non-military lines and managed to conciliate the colonists.

From 1873 to 1881 reaction against the military regime led to continual increases in the civil territories. Thus, in 1873, the general councils were given power analogous to the departmental assemblies of France, and mixed communes were instituted for districts where there was a large preponderance of natives. Later the civil territory was further extended and the decree *de rattachement* of 1881 completed the work of assimilation. In 1889 an attempt was made to deal with the preponderance of foreign European settlers over French colonists by the introduction of automatic naturalization.

Since 1889 public opinion in Algeria has tended to support decentralization, since assimilation has not proved the cure for every evil. The reports of Burdeau (1892) and Jonnart (1893) emphasized the dangers of excessive centralization, and that of Jules Ferry argued strongly against *rattachement*. Measures of decentralization followed: a decree of 1896 abolished the connexion between Algerian services and the Paris ministries, and gave the governor power to centralize under his authority the higher administration.

Other changes between 1896 and 1902 resulted in the institution of an Algerian finance committee, the Délégations financières, and of the Conseil supérieur, which received power to vote the budget, thus giving the colonists financial autonomy, although this was gained at the expense of the French taxpayer. Until 1921 the budget was balanced only because the French Government bore many of the charges, and in 1921 the post-war economic crisis and the effect of four years' drought in Algeria made necessary a loan of 1,600 million francs, to make up the deficit. The Délégations financières, which were originally purely consultative, soon acquired self-confidence,

and by 1927 their influence on legislation and policy was an accepted fact.

Before the collapse of France in 1940 Algeria was represented in the French Parliament by three deputies for the department of Oran, three for Constantine, and four for Algiers, and by three senators, one for each department. The French Parliament legislated for the country, and other matters were regulated by decree of the President of the Republic. Certain services for non-Moslems in Algeria, notably justice, education, religion, and treasury matters, were directly under the appropriate ministries in Paris (Fig. 3). Details of the administration are given in Vol. II, Chap. IX; the various nationalist and other political parties in Algeria are discussed in Chap. VIII, p. 224.

Since 1930 there has been considerable unrest in Algeria, as throughout French North Africa, and various attempts have been made to co-ordinate administration in the three territories of Algeria, Tunisia, and Morocco. Reference to the appointment and subsequent recall of General Weygand as Delegate-General in French North Africa and the establishment of a permanent General Secretariat for French Africa under Vice-Admiral Fenard is made on pp. 206-8.

The French Penetration of the Sahara (Fig. 47)

Until the beginning of the nineteenth century little was known about the Sahara, save for the inaccurate accounts given by ancient and Arab historians. But when the French, after the occupation of Algiers, began to dream of a vast north African empire, the idea germinated that the Sahara, though a formidable enemy, was not invincible, and various expeditions were made into the interior. In 1825 Major Gordon Laing crossed the desert from Tripoli to Timbuktu, and in 1826 René Caillié, disguised as an Arab, reached Timbuktu, and, after exploring the middle reaches of the Niger, returned via Morocco to northern Algeria. The first scientific expedition to contribute valuable information on the nature and possibilities of the Sahara was that of Barth, who made extensive journeys between 1850 and 1855. Meanwhile French military authority was extending southwards; in 1852 Laghouat and the Mzab (Ghardaia) were occupied, and in 1854 Touggourt and Ouargla, so that the French had control of the line of northern oases.

Further advance was difficult owing to the endless stretches of hammada, erg, and tanezrouft to the south of the oases, but more particularly owing to the hostility of the Touareg tribes who threatened any possible lines of communication. The subsequent history of the

Sahara has been one of struggle against the tribesmen and, during the War of 1914-18, against the Turks and their agents. At first, misled by a report of the explorer, Henri Duveyrier, the French believed that the Touareg could be trusted, and made an agreement with them, by which safe conduct was granted to caravans. The futility of this treaty was tragically proved in 1879 when Colonel Flatters was sent out to survey a possible trans-Saharan railway, and was killed with most of his force by the Touareg of the Ahaggar. The French Government then abandoned the idea of further expansion, and refrained from punishing and subduing the tribes, who consequently became more hostile. Not until 1898 did a new expedition under Foureau and Lamy set out to cross the Sahara and unite with other forces marching northward from the Congo and the Niger. In spite of difficulties the three columns met near Lake Chad, and defeated the black Sultan Rabah in the battle of Koussir, at the same time proving that it was possible for armed forces to cross the desert.

From 1900 the French, under their great leader Laperrine, spent their energies in making the routes safe from Touareg raids and ensuring southward expansion. In 1900 Laperrine was given command of the northern oases, and, in spite of restrictions from Paris, in the battle of Tit in 1902 defeated a large force of Ahaggar Touareg. He followed up his military victory by conciliation, and by 1905 the Ahaggar tribes were subdued. In the same year the boundary between southern Algeria and French West Africa was delimited.

Between 1905 and 1914 Laperrine turned his attention to the east, and was occupied with the Touareg of the Tassili des Ajjer district, and with disputes over the ill-defined frontier between Algeria and Tripolitania. The Touareg of these areas were aided in their resistance by the Senoussi from Tripolitania, who in their turn were encouraged by the Turks. The Turks occupied the oases of Ghat, while Laperrine built a new armed outpost, Fort Polignac; between the two a no-man's-land was instituted, but the Turks constantly violated its neutrality. The French Government, anxious not to provoke the Turks, refused to let Laperrine deal with the situation, in spite of many incidents and continual skirmishes for the possession of Djanet. In June 1910 he was recalled to France, and the result might have been disastrous had not another brilliant soldier, Captain Charlet, decided that it was useless to treat with the Touareg. In 1911 Charlet took Djanet and Tarat and in April 1913, at the village of Esseyen, a small detachment of his forces defeated the Ahaggar Touareg, after which most of the chiefs made their submission.

The War of 1914-18 prevented the peaceful development which seemed possible in 1913; large numbers of troops had to be withdrawn from Algeria, and the Senoussi took advantage of this to undermine the still precarious loyalty of the Touareg, encouraging them to revolt. In 1916 Djanet was lost and the French were pushed west as far as Fort Flatters. At the same time there were general revolts, Tibesti had to be evacuated, and the monk, de Foucauld, who had always been the friend of the Touareg, was assassinated. The Government, realizing the gravity of the situation, sent General Laperrine back to north Africa as Commander-in-Chief of the Saharan territories. In 1918 Djanet was reoccupied by the French, and by October 1919 peace had been established.

Since 1919 there has been peaceful penetration and the extension of French control. Laperrine lost his life in 1920 on a flight to survey the possibilities of an air service between Algiers and the Niger, but his work continued and regular air services have now been established along the lines of the chief oases. In 1926 the desert was first crossed by unarmed commercial vehicles, and a well-organized trans-Saharan bus service was later instituted. In the oases, water-supply, public health, the conditions of the people, and of their livestock and crops have been improved, and no longer is there any danger to trade from hostile tribesmen. From 1907 to 1934 the French, under General Lyautey, were occupied in the pacification of Morocco, but by the latter year peace had been firmly established on the western frontier of Algeria, as in the south. The eastern frontier with Italian Libya became the focus of danger in the years preceding the outbreak of war.

NOTE ON EVENTS IN ALGERIA, SEPTEMBER 1939-NOVEMBER 1942

All parties, including the Moslem dignitaries and the Algerian Communist party, supported France loyally and enthusiastically when war broke out in 1939. More men were called to the colours than the entire number recruited between 1914 and 1918, and volunteers were numerous. North African troops distinguished themselves in the battle of France.

The fall of France and the armistice in June 1940 was not readily accepted in North Africa and for a short time it seemed likely that resistance would be continued or the armistice terms rejected. By the end of the month, however, a declaration of loyalty to the Pétain Government had been issued, though a period of 'hesitation' lasted until September, accompanied by riots in Oran and the arrest of supporters of General de Gaulle. General Noguès, Commander-in-Chief in French North Africa, was replaced by General Gouraud, though he remained Resident

in Morocco, and M. Le Beau, Governor of Algeria, was replaced by Admiral Abrial. To what extent resistance was possible is uncertain, because it seems likely that North Africa had been denuded of troops: reports put the garrison at two divisions.

By September, hope of resistance had been undermined by pro-Axis and anti-British partisans, and by the recognition of the *fait accompli*. In October General Weygand arrived as Delegate-General and Commander-in-Chief. A new spirit arose in the form of a patriotic movement binding North Africa more closely than ever to France, and refusing even a 'non-belligerency' favourable to Britain. British service personnel, Allied shipping, and crews were held in internment.

The armistice terms accepted by France were binding on North Africa and were administered by the Central Armistice Commission: in Algeria they involved the demilitarization of Oran and of the frontier with Libya, whence French troops were withdrawn from zones of from 30 to 125 miles. The strength of French troops in North Africa was later fixed at 120,000, but it is doubtful if this figure was ever reached.

To supervise the provisions of the armistice, Armistice Commissions were sent to French North Africa: they were to be composed of Italians, but Germans accompanied them in increasing numbers, attached unofficially or otherwise. The replacement of the Italian Commission in Morocco by a German Commission, which increased to 200 early in 1941, took General Weygand to Vichy in protest and led to a Cabinet declaration on 9 March that North Africa would be defended against any aggressor by French forces alone.

The Armistice Commissions assumed control not only of shipping, as was allowed by the terms of the Armistice, but also of civil aviation: stocks of petrol were requisitioned as 'war material', agents spread anti-French propaganda among the natives, and their headquarters became the rendezvous of all German 'tourists'. Weygand was well aware of these activities. Soon after his arrival he was at variance with Laval, whose dismissal in December 1940 probably strengthened Weygand's hand and enabled him to persuade the Cabinet to resist German demands on North Africa, including the use of Algerian ports, in opposition to Admiral Darlan, who was prepared to acquiesce. In July 1941 Weygand took over the post of Governor of Algeria from Admiral Abrial and appointed M. Châtel, former Resident in Tonkin and his collaborator since October 1940, as assistant Governor.

The external affairs of Algeria and of French North Africa included trade and communications with France and America and relations with Great Britain. Considerable bitterness resulted from the shelling of units of the French navy at Mers el Kebir, near Oran, by ships of the Royal Navy on 3 July 1940, and from the application of the British blockade to French Africa. The action at Mers el Kebir resulted in the battle-cruiser *Dunkerque* being damaged, the battleship *Bretagne* being sunk, and the battle-

ship *Provence* heavily damaged. Two destroyers were sunk or set on fire. The seaplane carrier *Commandant Teste* was also set on fire, but escaped from the harbour, as did the battle-cruiser *Strasbourg*, which was subsequently damaged. The blockade did not seriously hinder trade between North Africa and France: sea communications between Marseilles and Algeria were resumed in the middle of July 1940 and gradually returned to normal. But the whole of French Africa was cut off from the rest of the world and North Africa could trade only with an impoverished France. As early as August 1940 the State arranged to buy colonial produce and to guarantee bank advances on stocks in ports of the French Empire, but these measures of relief did not provide the goods that North Africa usually received from countries other than France, such as coal, machinery, and textiles.

Great efforts were made throughout French North Africa to increase the production of foodstuffs for export to France, in spite of difficulties arising from the lack of petrol and oil for agricultural machines, and the absence of the prisoners of war. The irrigated areas of Morocco, Algeria, and Tunisia have been extended, crops such as cotton and oil-seeds have been much increased, and exports to France of most products were larger than before the war. The loss to France and Germany brought about by the Allied occupation is, therefore, the greater.

Industrial development since the fall of France has been remarkable. Innumerable French firms set up branches in the hope of escaping German domination, and a sweeping flight of capital funds from France took place, with an influx of refugees estimated at nearly 700,000. There have sprung up everywhere factories for canning, drying, and freezing foodstuffs; sugar, textile, match, and hardware factories; works for producing agricultural machinery and chemical fertilizers, and even blast-furnaces. Exports of phosphates and iron ore have increased and large shipments have been made to Germany and Italy.

These developments could not make North Africa self-sufficient, and certain foodstuffs fell into seriously short supply. Sugar, tea, oil, and soap were rationed, but the natives received double supplies of sugar, tea, and oil (Europeans had the same amount as they would in France). Sales of meat and wine were restricted but the most serious shortage was that of textiles, and collections of clothing were organized in France for the benefit of the North African natives. Piece-goods usually imported from overseas could not be supplied by the French textile industry, which depended on German supplies of raw materials.

At the end of June 1941 it was announced that trade between French North Africa and the United States was to be resumed, four French ships being allowed to ply between New York and Casablanca with British navicerts, to carry food, clothing, oil, and other necessities to North Africa and to take in return cork, olive-oil, gum arabic, and similar products. Supplies were sent to North Africa under strict guarantee that they would not be used for military purposes or re-exported to metropolitan

France. An American central commission was responsible for the distribution of supplies and carried on counter-propaganda against the German Armistice Commissions. Mr. Robert Murphy, Counsellor of the American Embassy in Vichy, and later Consul-General in North Africa, was responsible for most of the negotiations. It was understood, moreover, that the French army under Weygand's command would not become involved in major military action against British forces, and that French North Africa would not be put at the disposal of the Axis. The British Government also agreed to release a French oil tanker which had been seized on its way to Casablanca.

The conclusion of these arrangements added to Weygand's prestige and improved morale in North Africa, so that in October 1941 the German authorities began to demand his dismissal. On 20 November he 'retired', and his post of Delegate-General was abolished and replaced by a permanent General Secretariat for French Africa under Vice-Admiral Fenard and directly responsible to Admiral Darlan. General Juin, a released prisoner of war, became Commander-in-Chief in North Africa, and M. Châtel the Governor of Algeria. The trading arrangements with the United States ceased for a time on Weygand's dismissal and again when it was found that food and vehicles were being sent to the German army in Libya via French North Africa. An agreement to resume them was made only a few weeks before Laval's return to power in April 1942, when a further suspension ensued until August.

With Darlan in control of French North Africa, Axis penetration and demands seemed likely to increase, and it is significant that General Odic, Commander of the North African Air Force, who was in America at the time, resigned. Darlan made few significant changes of policy, but events tended towards a tightening of the German-Italian grip. Darlan allowed certain supplies to be sent to Libya through French territory, and, when the United States protested, Pucheu, the Minister of the Interior, was sent to investigate the state of opinion in North Africa (March 1942). He reported that the North African army opposed collaboration with Germany and the transit of supplies to Libya: shortly afterwards he was dismissed. General Jacquet, head of the Army commissariat in Tunisia, had already resigned (December 1941) as a protest against the export of Tunisian foodstuffs to Libya under orders from the Armistice Commission.

In February 1942 German Consulates were set up in Algiers and Casablanca, and the activities of the Armistice Commissions increased. There were reports that Germans had taken over the coastal batteries on the Atlantic coast of Morocco, that the battleship *Jean Bart* had been completed with German aid, and that Germans had been planted in the Foreign Legion as agents. By August 1942 relations between French officials and the German Armistice Commission in Morocco were tense; and the French officials seem to have done little to prevent the frequent attacks on and attempted assassinations of the Germans.

Measures taken by the Vichy Government for the administration of Unoccupied France were gradually applied, with certain modifications, to Algeria, and to a less extent to the Protectorates of Tunis and Morocco. In Algeria Weygand strove against corruption in the administration, and accelerated administrative procedure by increasing the powers of the prefects and by creating economic services in each department. In 1941 a Privy Council and a Legislative Committee were set up to assist the Governor, but the *Délégations Financières* and the *Conseil Supérieur*, which were representative institutions, were replaced by a *Commission Financière* composed of Europeans and others nominated by the Minister of the Interior. The Jewish laws were applied in modified form owing to the numerical importance of Jews in Algeria, but Jews suffered particularly by the abrogation, in October 1940, of the *Loi Crémieux* (p. 216), by which they were granted French citizenship. Vichy industrial and labour legislation was very largely applied in Algeria, and various movements sponsored by Vichy, such as the ex-servicemen's *Légion Française*, flourished. The *Légion's* *Service d'Ordre Légionnaire* was also organized in North Africa, as were the *Chantiers de la Jeunesse*. The *Action Française* had long been well established, and various Fascist leaders, notably Doriot, played on the anti-Jewish feeling in North Africa to strengthen their position.

The native population has shown considerable loyalty to the French regime and has been little affected by German anti-French propaganda. Four Moslems were appointed to the Vichy *Conseil National*. In August 1942 an assembly of 20,000 Moslems in Algeria sent a message of loyalty to Pétain. German propaganda has played on native discontent over the shortage of foodstuffs, blaming French shipments of North African food to France, but omitting to mention German requisitions of these same shipments at Marseilles. The propaganda was well directed because native farmers resented French requisitions of meat and wool, particularly when they could find nothing to buy with the cash payments which they received. Nevertheless, even by September 1942, this propaganda had failed to win the better class Moslems, who remained loyal to France and considered Nazism and Islam as irreconcilable, and were angered by the German discrimination against French North African troops who were taken prisoner. The lower classes of the urban population were affected to some extent, and a mutiny of Arab garrison troops near Algiers in the autumn of 1941 may have had its origin in German propaganda.

Resistance to German influence, both direct and indirect, was maintained by many sections of the community, and in the autumn of 1941 a drive against Fighting French sympathizers was started. Many members of the Army and Air Force were sent to prison for trying to join General de Gaulle, and many of those who did get away were sentenced to death in absence. The police were said to be lenient towards such people, and towards those who had escaped from concentration camps; these included thousands of foreigners. The Communists, who have a

considerable following in Algeria, also took an active part in resistance. A Communist cell was discovered at Bône in the autumn of 1940 and ninety Communists were arrested in Oran in August 1941.

The vast majority of the population, both European and native, seems to have remained until the autumn of 1942 anti-German, non-collaborationist, and loyal to France and to the person of Pétain, and a growing body of responsible men was prepared to regard an Allied occupation as in the interests of France and as a necessary step in the fight against Axis domination. Many of them were ready to take up arms once more.

Forces of the United Nations landed at a number of points on the coast of French North Africa on 8 November 1942. Hostilities ceased in Morocco and Algeria on 11 November.

CHAPTER VIII

THE PEOPLE OF ALGERIA

ELEMENTS OF THE POPULATION AND LANGUAGE

WHEN the French conquered Algeria, the people whom they met near the coast spoke Arabic and were Moslem, and, until they were more closely studied, were described as Arabic. There are, however, few, if any, pure Arabs in the country, most of the population being Berber, affected, in varying degrees, by Arab influences. The name Berber is a corruption of the Greek *Barbaroi*, 'those who speak a strange tongue', but the people call themselves *Imaziren*, and the ancients knew them as Libyans or Numidians. They have maintained their national temperament with great persistence, and show few traces of alien stock despite the introduction into Algeria of Phoenician, Roman, Vandal, Arab, Turkish, Jewish, and negro blood. Particularly striking is the way in which Berbers and Arabs have refused to amalgamate, even though they have lived in the closest proximity for over a thousand years. During this time the Arab has imposed his religion, language, dress, and many of his customs on a large part of the Berber community, but the Berbers have preserved their distinct racial type. The Arab remains essentially a herdsman, living in tents, with a tribal organization, and is always fanatical and deeply superstitious. The Berber, in contrast, is a highlander, a cultivator, and a dweller in towns and villages; he is by nature democratic and, although occasionally liable to fanaticism, is rarely moved by religious enthusiasms.

Though all the Berbers belong to the Hamitic race, there are many different types, as a result of their mixing with other peoples. Three main physical types, described in more detail below, are usually recognized: those akin to 'Mediterranean' man, particularly found in the department of Constantine, and around Algiers, and in the far south, where they tend to exhibit certain negroid characteristics; those more like 'Alpine' than 'Mediterranean' man, as in the Kabylie and, in the south, in the Mزاب; and those not unlike the 'Nordic' races, such as the Chaouia (Shawia) of the Aurès mountains and the tribes of other mountainous and remote districts.

The dolichocephalic (long-headed) 'Mediterranean' type has an

average height of 5 ft. 5 in. and a cephalic index of 72-3.¹ The back of the head generally projects, often forming a distinct bulge, so that, seen from above, the head appears distinctly pentagonal. The face in most cases is short and broad, and the cheek-bones are generally well developed; the nose is fairly broad, the chin is prominent and often well bearded, and the lips are full. The long bones are heavily built, with the insertions of the chief muscles especially well marked. The skin is swarthy and the eyes dark. These short, dark, long-heads are almost certainly the north African representatives of the proto-Egyptian stock of the Nile valley, and show close affinity to the early neolithic inhabitants of France and to the present-day southern Europeans, particularly the Sardinians.

The brachycephalic (round-headed) 'Alpine' type of people is usually less than 5 ft. 5 in. in height, with broad and short faces, broad foreheads, and short and rather broad noses, with an index of 70-2. These people may be descendants of the short round-heads of southern Arabia, though others think they are more closely related to the 'Alpine' race in France. The coastal round-heads may owe their existence to the 'Barbary Corsairs' who were largely of Levantine origin, and had a great influence in north Africa from the end of the fifteenth century onward. The round-heads of the interior, it has been suggested, are the remains of a wave similar to that which carried the 'Celtic' peoples, who were round-headed 'Alpines', into Greece about 1,000 B.C.

The dolichocephalic (long-headed) 'Nordic' type has a height of about 5 ft. 7 in. and an average cephalic index of 74 or 75. The outline of the skull, seen from above, is generally oval, and the supra-orbital ridges are strongly marked. The face is long, tending to oval, the nose long and narrow, and the chin square with rather scant beard. In the Aurès mountains the high stature of this type is maintained, but there is a tendency to brachycephaly, generally attributed to an admixture with the round-head stock. These measurements show unmistakably either that these people are derived from the 'Nordic' of northern Europe, or that they share a common origin. Their light-coloured skin—a characteristic of most Berber tribes, even when sunburnt—is especially marked amongst the Chaouia of the Aurès mountains, most of whom are remarkably European in

¹ The cephalic index shows the proportion of the breadth to the length of the head as a percentage: two units are added for the difference between observations on the skeleton and on the living. Indices below 75 represent a long narrow head, termed dolichocephalic: those above 80 indicate a round head, or brachycephalic: those between 75 and 80, which are most common, are usually called mesocephalic.

appearance. The boys of about fifteen years of age in particular, if similarly clothed, would be almost indistinguishable from English boys of the same age, except that dark hair would predominate more than in most parts of England.

The Arab tongue and religion have generally been adopted in the plains and towns where French, rather than a Berber dialect, is usually spoken as a second language, but the old dialects and customs survive in the less accessible regions of the mountains and deserts. Berber dialects vary, people from different parts of the country usually finding it difficult to understand one another. The most common group is the *Zenatia* to which belong the dialects spoken by the natives of the Dahra, Aurès, Cherchel, Mascara, Mzab, Ouargla, Touat, and other regions. The only other important dialect is that used by the tribes of the Kabylie.

The Berber-speaking areas form a series of islands throughout the country, corresponding to the mountainous districts in the north and the oases in the south (Fig. 48). The most important are the Kabylie du Djurdjura and the Kabylie des Babors, the home of 800,000 natives, many of whom know no Arabic. Another important Berber stronghold is the Aurès mountains, which cover a wider but less densely peopled area than Kabylie. There are other groups in the Blida Atlas, the Ouarsenis, the district south of Tlemcen, and elsewhere, and in the Sahara near Figuig and among the Mozabites and the Touareg (Tuareg). Excepting the Touareg, the political and social organization of most of these peoples varies little. The Kabylie usually build houses with tiled roofs and place their villages on hill-tops for security (Photos. 62, 64). The men are mainly farmers and fruit-growers and the women, who are unveiled, are skilled in the making of pottery which is the same to-day as it was 3,000 years ago. The fair-haired, light-skinned Chaouia tribes of the Aurès live in flat-roofed stone houses built in terraces, the roof of one house being level with the floor of the one above (Photo. 63). Because of the isolation of these tribes much of their old life has been preserved.

In some parts of northern Algeria the Spanish and Turkish invasions of the past have had an important influence on the people. In Tlemcen and Algiers, for example, the influence of Moslems from Spain is particularly noticeable, and the Koulougdis, a mixture of Turk and native, still form a compact group in Tlemcen. There are also some in towns such as Mascara, Médéa, Algiers, and Mostaganem, which formerly had Turkish garrisons. To-day, however, the Jews

form the most distinct 'foreign' element in the native population

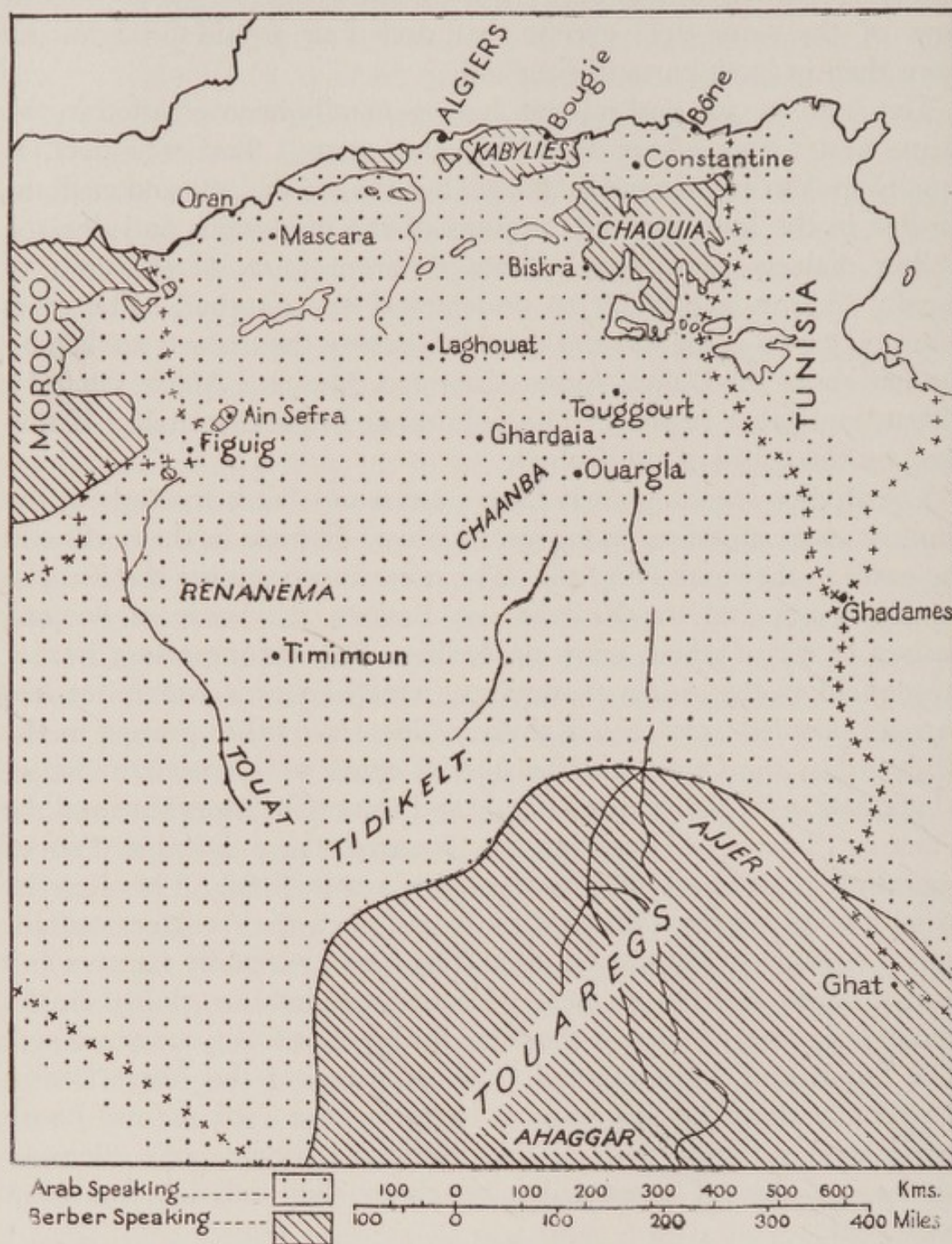


FIG. 48. *The distribution of Arab-speaking and Berber-speaking peoples*

apart from those groups in the Sahara such as the Mozabites, described on pp. 229-31.

Jews have lived in Algeria from the beginning of historic times. To-day they probably number about 90,000, though since 1921 they

have not been registered separately from French-born citizens. They vary in origin, large numbers in the north being Spanish Jews, but Eastern Jews and even Berbers converted to Judaism are found. Most of them live in the towns, usually in special areas; thus there are separate Jewish quarters in Oran (where Jews form one-seventh of the population), Algiers, Tlemcen, Mascara, Blida, Constantine, Bou Saada (where they are mainly goldsmiths), and the oases of the Mزاب, particularly Ghardaia. They occupy a position between the Berbers and the European colonists. Large numbers are employed in industry, and in Oran there are many Jewish doctors and lawyers. Not all are rich, some living in extreme poverty, but even the poorest usually retain their individuality, and resist French influences.

Europeans settled first on or near the coast at Algiers, Bône, Oran, Philippeville, Constantine, and other towns, and have spread farther inland where cultivation is possible, and where the native population is least dense. They are, therefore, more numerous in the department of Oran than in Constantine. Altogether there are (1936) 987,252, including 853,209 French citizens (Department of Algiers 365,504, Department of Oran, 399,674, Department of Constantine 213,119, Territoires du Sud 8,955). About 60 per cent. of them live in the towns, especially in the larger cities, 25 per cent. being in Algiers alone. There are many different types of Europeans. Most people of French stock have been in Algeria for several generations, since comparatively few Frenchmen now come from France. The Spanish, numbering 91,942, are the most numerous and compact of the foreign groups, being found all over the country, but particularly in the department of Oran, where they are merchants, farmers, and tobacco planters, or, in many cases, artisans. They usually live simply and are loyal and well assimilated. People from the Balearic Isles are mainly employed as market gardeners round Algiers and other large towns. The Italians, of whom there are about 21,000, live mainly in the east, where they work in the mines and phosphate quarries, and form the bulk of the fishermen and sailors. Owing to pressure from Italy they have been less easy to assimilate than the Spaniards. The Maltese, who have been readily assimilated, are mainly petty traders and number nearly 3,000. There are also some Germans, Swiss, Belgians, Poles, and Greeks.

The naturalization policy of the French lessened the differences between the various Europeans represented in the country. In 1889 foreigners were automatically naturalized, and since that date, with the additional help of many mixed marriages, a Franco-Algerian

people has been created with a strong local patriotism, with French ideals and institutions, and using the French language. All Jews were given French citizenship by the Loi Crémieux in 1870. Since 1865 Moslems have been permitted to acquire French citizenship if they are willing to abandon their 'personal statute', that is, their Islamic laws and customs, but until 1938 only between two and three thousand had applied for citizenship.

HABITS AND CUSTOMS

Social Organization

Before the French occupation Algeria was not a state in the European sense of the word, but was divided into many small autonomous groups called *kbila*, based on a patriarchal system. One of the main effects of the French conquest has been to weaken the powers of these native authorities. The true unit is the family, in which the father demands absolute obedience. Groups of related families make up the clan, which is ruled by the senior man; he supervises every aspect of the life of his group, and controls its relations with other clans. Several clans sometimes live together in a cluster of tents or huts known by the nomads as a *douar*, and by the Kabylie as a *thaddert*. This settlement is ruled by a *djemaa*, a council made up of the chief men, who elect one of their number to be *cheikh* (sometimes *amrar*, *kebir*, or *amin*) for a year. The *djemaa* in theory controls finance, justice, the upkeep of mosques and cemeteries, land tenure, and water-supply, but in fact it is usually too weak to impose its will, especially as most villages are divided into two *sofs* or groups, which are antagonistic to one another. The origin of the *sof* is unknown: it is not a political party in the English sense, since its members belong to it by birth.

The family, clan, and village are still strong, but the tribe, made up of a collection of clans and villages, is losing a great deal of its power. Its function in the past was to preserve its own honour or *horma*, to control the tribal lands, and to regulate relations with other tribes; all these duties have declined in importance with the pacification of the country and the decrease in the area held communally.

Methods of Life (Fig. 49)

The obvious division into nomadic and sedentary peoples is not an adequate description of the Algerian population, since many nomads are nomadic for only part of the year. There are two distinct types of

true nomads; some travel many miles from the south to the north of the country, whilst others move only short distances, as, for example, from the south of the Aurès mountains to the higher pastures of the north. The sedentary people also fall into two groups, those cultivating fruit-trees and those growing cereals.

The growers of fruit-trees are closely tied to the soil because the trees demand constant care and are a perennial source of wealth. Their homes are permanent, and large numbers can support them-

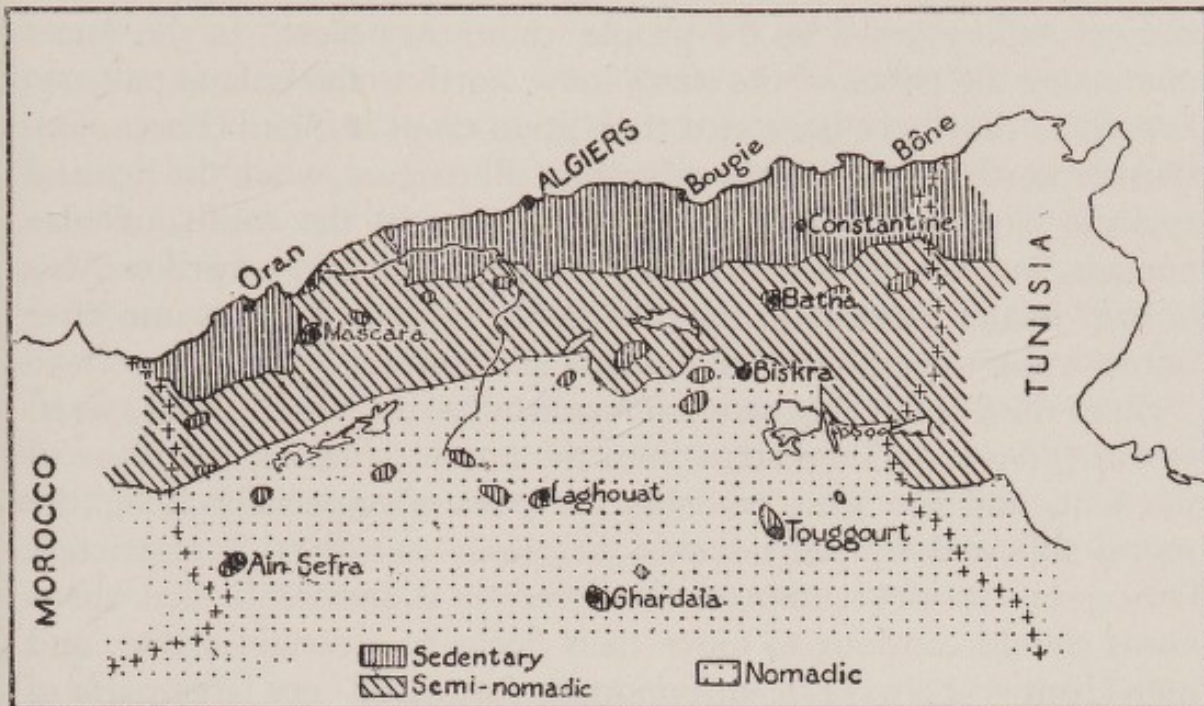


FIG. 49. *The distribution of nomadic and sedentary peoples*

selves on comparatively small areas. They live particularly in districts that are hilly and well watered, such as the Kabylie du Djurdjura, and around towns such as Tlemcen, Nedroma, Mazouna, Algiers, Blida, Koléa, and Constantine.

The cereal farmer, in contrast, has no need to build a permanent farm, for, since native methods are so simple and primitive, he usually visits his fields only to sow the seed and harvest the crop. Whilst doing this he lives in a temporary hut, and stores his grain in a silo in the field. For the rest of the year he follows his flocks or herds and is, therefore, semi-nomadic rather than sedentary.

The herdsman dominates the life of most of Algeria, particularly in the south. He is a nomad and tent dweller, and in the past was feared by the sedentary people whose lands he crossed in his travels. In the Tell are found the *beggara* or cattle farmers, and in the Sahara

the *djemala* or camel owners, while the nomadic shepherds drive their flocks widely over the country in search of pasture. Sometimes they own small fields of wheat or barley which they work themselves, but more usually they have them cultivated by sedentary farmers whose flocks they tend in return.

The extent of the migration of the nomads varies in different parts of the country. The Saharan tribes go the longest distances and have their own routes and wells; sometimes they combine commerce with herding, carrying dates and salt from the oases to exchange for fruit and vegetables grown by the people whom they meet. In the Aurès mountains the tribes of the south move north to the upland pastures as soon as they have harvested their grain crops in April (Photo. 65). Farther north they delay the migration till August, when the figs and apricots have been gathered. Many Arabs in the south are also nomads, but not herdsmen. They leave the Sahara in April or May to help in the harvests in the Tell, and return in late autumn after transporting the grain to the markets and towns.

Since the French occupation nomadism has decreased. The *gourbi*, or hut (Photo. 61), and sometimes the house, is taking the place of the tent, and the land available for pasture, especially along the routes followed by the nomads, has been considerably restricted. Owing to the dry summers, however, it is inevitable that shepherds should continue to move their flocks to a certain extent, and nomadism will always be an important feature of very large parts of Algeria.

The *hadar*, or town-dwellers, are very different from the peasants. They are made up of a mixture of Arab and Berber peoples together with Moslems from Spain, Turks and Koulougdis, Jews and Mozabites. Every year, too, an increasing number of peasants, especially from the Kabylie, leave their villages to work in the towns. The native town is usually distinct from the quarter where the Europeans live. Its streets are narrow, and its houses are shut away from the road; in a good many cases the Jews still retain their own quarter, the *mellah*. There is usually a covered market, or *souk*, each trade occupying a special part of it. Most of the people are artisans or small tradesmen.

Arts, Crafts, and Education

The chief heritage of Algeria from the centuries before the French occupation is to be found in its buildings. Dolmens and rock drawings belonging to prehistoric times have been found in some parts,

but Roman and Arabic remains are more common. Many of these, after being neglected for centuries, have been repaired and restored by the French. In the north there are Roman baths, houses, arches, forums, and camps, and throughout the country there are Arab-built mosques, fortresses, tombs, monasteries, and palaces. (Photos. 54-60, cf. Appendix D.)

Native art flourishes to-day mainly in the villages where the methods of the Middle Ages have been handed down from generation to generation. Pottery is made by the Kabylie women in their own homes and, on a larger scale, by artisans in Algiers. Hand-made carpets are produced all over the country, and special schools exist to teach the art. Mats of esparto grass, or of grass mixed with wool, are made near Tlemcen and in Bou Thaleb, and most women are skilled in making cloth and lace. In the towns the Jews manufacture jewellery and small ornaments.

Music and dancing are almost the only recreations of the people. Bands of musicians go round the towns playing in cafés and for family festivals and occasionally musicians and actors penetrate to the country districts. The melodies they play have a pronounced rhythm and are usually variations on very simple themes. As the women work they often sing, and in Tlemcen many old chants derived from Grenada may still be heard; the dances are also rhythmic.

Literature and science in Algeria show little originality, being closely bound up with Islam. The Koran is almost the only book studied by the scholars in the Koranic schools, which are held in the mosques, and knowledge of literature is confined to the religious and legal sayings of the Prophet. The French, however, have established schools which teach the French language and practical subjects such as agriculture, and the University of Algiers is open to students of all races. Algeria has already produced two young painters, M. Mohammed Racim and M. Mammeri, and it seems that as education increases and knowledge spreads there should be some cultural advance in the country in place of the present state of stagnation.

Dwellings

Dwellings in Algeria can be divided roughly into movable and immovable types, but as a sharp distinction between nomadic and sedentary peoples cannot be drawn, no exact classification is possible. The type of dwelling does, however, usually bear a close relation to the occupation of the inhabitant, and to the nature of the district.

Tents (Photo. 61). Tents, which occur over a greater area than any other form of dwelling, are usually found in scantily peopled districts since they are mainly used by pastoral nomads who graze their flocks over extensive areas. Everywhere the tent is made of *flidj*, or strips of material 30 to 40 inches wide, woven from wool, goat-hair, the fibre of the dwarf palm ('vegetable fibre'), or alfa (esparto grass). The strips are stretched over a framework of poles. A woollen cloth divides the tent into two parts, one for the men and the other for the women and children; the furniture is simple, consisting mainly of carpets and mats, because it must be easily moved. In the past the tents were grouped in large circles or douars for protection, but now the douars are smaller. The tent is used mainly in the Sahara and the steppes of the south, as far north as the southern limit of the Tell Atlas, though where there are no mountain barriers in the way of the nomads, as in the department of Oran, tents are found even on the coast.

Gourbis (Photo. 61). In the Tell the gourbi, or hut, is the most common type of dwelling. Its occupant is usually semi-nomadic, owning fields as well as herds, so that he needs a temporary habitation intermediate between a permanent house and a tent. The gourbi, which often stands by itself, is built near the fields and is used whilst the farmer is sowing and reaping his crops. It is then abandoned for a tent in which the native lives as he follows his livestock. Gourbis vary in appearance according to the type of building material available. Some are made of stone with roofs of branches, others of *toub*, a mixture of clay and chopped straw, whilst in the forests of Collo they are made entirely of wood.

Flat-roofed Houses (Photo. 63). The only important differences between gourbis and the poorer types of houses are that the latter are intended to be permanent dwellings, and are usually found in groups, whereas gourbis are isolated. *Toub* is the chief material used, and the houses are built in good defensive sites on the slopes or crests of hills, often in terraces, one above the other. They occur in the south and in the mountainous districts of the north, such as the south of the Kabylie du Djurdjura, the Blida Atlas, the Dahra between Ténès and Cherchel, the Tlemcen and the Traras uplands, and the Aurès. Their occupants are generally cultivators of fruit-trees and need to live permanently near their orchards.

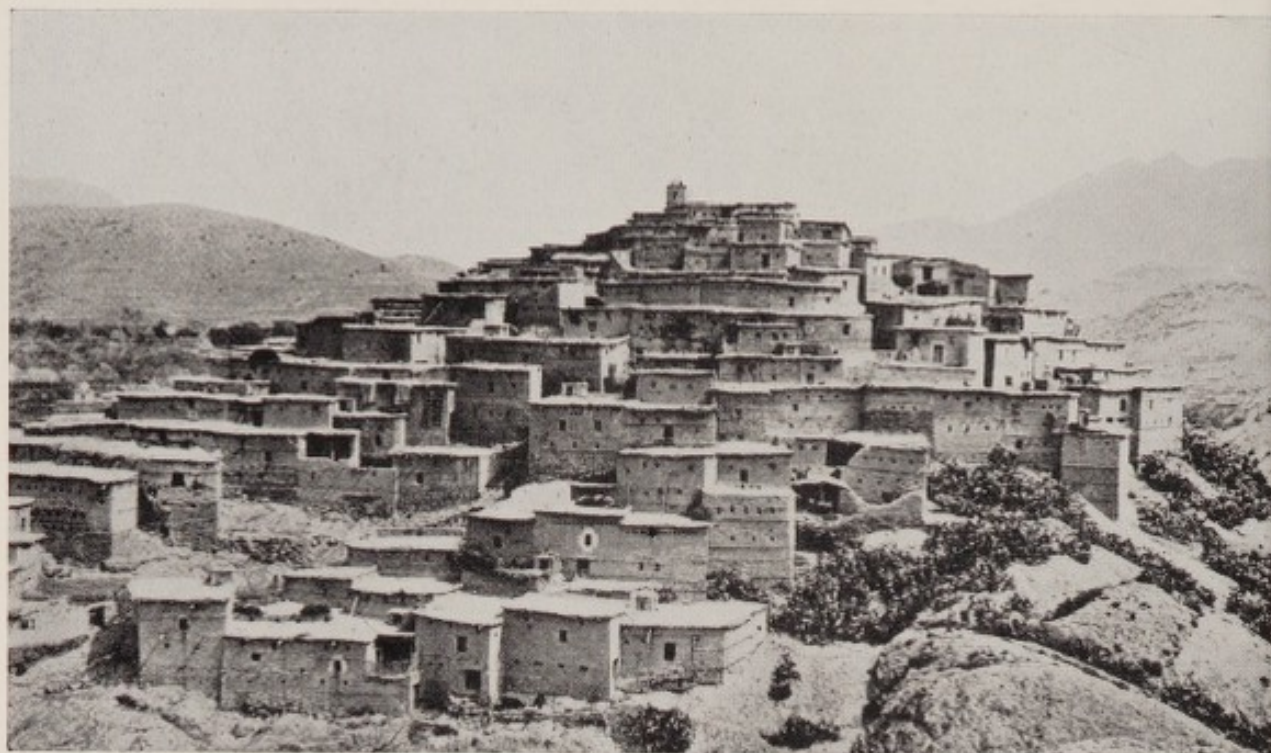
Tiled Houses (Photo. 62). Tiled houses, very like the dwellings of the French peasant except that they have no chimneys, are found in parts of the Kabylie du Djurdjura and the Kabylie des Babors.



61. *Tents and gourbi (on right)*



62. *Tiled houses in the village of Taourirt Amokran, near Fort National, Grande Kabylie*



63. *The village of Menaa in the Aurès*



64. *The village of Ait el Arbaa, near Fort National, Grande Kabylie*

European Houses. As nomadism has been restricted and the native cultivators have adopted European methods of farming, the number of houses of European style has increased throughout the country, and would be still larger but for the relatively high cost of building materials and construction. At present such houses are found chiefly in the large towns such as Oran, Algiers, Bône, Mostaganem, Sidi bel Abbès, and Mascara, and in other districts where there has been considerable European colonization.

Dress

The dress of rich and poor in Algeria is very similar, varying only in quality. The men usually wear a cotton shirt next the skin, over which is a second shirt-like dress, reaching to the knees. The normal outer garment is a white woollen cloak, or *gandoura*, which leaves the legs bare, and is draped, when walking, so that the left arm rests as if in a sling, while the right arm remains free below the elbow. Over all these garments, a *burnous*, or loose cape with a cowl, is sometimes worn. The burnous may be made of camel cloth, wool, or fine linen, and may be either plain or very beautifully embroidered with silk, according to the wealth of the wearer. More than one is often worn in cold weather. On the head a man usually wears a red fez, round which a piece of cloth is wound as a turban. The dress of the Kabylie differs slightly from the above; it consists of a piece of white muslin material draped from a large, round, white felt cap and in addition a gown, or *gandoura*, of carpet-like material.

The women also have two shirt-like garments, over which they wear, when out-of-doors, a long strip of white woollen material, known as a *haik*, which shrouds them from head to foot. The haik has no real hood or cowl, but a fold is thrown over the head and drawn down over the forehead, to shade the eyes. This can be pulled farther down if required to meet the veil, though most Berber women are unveiled. The haik is sometimes worn by men, but it is more commonly a woman's garment. The women also wear baggy trousers which are drawn tightly around the ankles. They decorate themselves with ear-rings, bracelets, and anklets, which are sometimes made of silver (Photo. 66). Indoors, wide trousers of silk or crêpe de Chine, known as *serroual* (*sarwal*), and reaching only half down the leg, are generally worn, with a jacket or *ghlila* of brocaded silk, held round the waist by a *fouta* or silk sash.

The people in the towns wear a modified form of the native dress, with the addition of certain Turkish and Jewish characteristics.

Voluminous coloured trousers, caught in at the knee, are worn by both men and women. Vests and coats are also brightly coloured, and are often well cut and embroidered with gold or silk. In the larger cities many of the men have adopted European clothing of a cheap and shoddy type.

The Jews are also increasingly wearing European dress, though some of them are still easily recognizable by their dark blue turbans, blue stockings, and black hair. Their women often have very beautiful and expensive dresses made of velvet, silk, or stiff brocade, and decorated with heavy gold embroidery.

RELIGION

Islam, the sole link in Algeria between the different tribes and clans, regulates and controls every aspect of the native's life. In the country as a whole it is a narrow and intolerant faith, a form of civilization rather than a religion. The strictest school of Sunni orthodoxy, that of the *imam* Malek, is that followed by the people, and Arab lawyers and magistrates regard the *Commentaire de droit malékite de Sidi Khelil* as a sacred text in which the solution of all their difficulties can be found.

There is no clergy, in the European sense, amongst Algerian Moslems. The highest office is that of the *mufti*, who can decide religious controversies, but is often a civil official as well. The mosque is controlled by various men, none of whom has much influence with the people. The *mouderris* teaches beliefs, the *khatib* gives the sermon on Fridays, the *imam* directs prayers, the *mouekkit* decides the hours of worship, the *muezzine* calls the people to prayer, and the *hezzab* recites the Koran.

The *marabouts* (*mrabitin*) or holy men have a far greater influence than either the *mufti* or the *imams*. The marabouts, and often their descendants, are venerated as saints, and are considered to be invested with *baraka* or divine blessing. Pilgrimages are made to their tombs, where offerings are given and petitions said; the sanctuaries at their tombs range from humble *koubbas* and country mosques to large and elaborate buildings in the towns (Photos. 59, 60.)

As in other parts of the Moslem world there are brotherhoods founded in the past by holy men who are worshipped as marabouts. By their ritual prayers, pious formulae, and the observance of the rules set by the founder, these brotherhoods endeavour to raise the soul of man from earthly imperfection to the perfection of God. Altogether there are twenty brotherhoods, with more than 300,000

adherents. They vary in character, some being mainly political, others purely religious, and others ascetic. In the past they have provided many of the *mahdis* (messiahs) who have led rebellions, but to-day, owing to lack of discipline within the brotherhoods, they are, for the most part, powerless.

The following are the chief religious orders. Some are peculiar to Algeria, others are found throughout the Moslem world.

1. The Kadriya take their name from Sidi Abd el Kader el Djilani, a well-known saint of the eleventh century, to whom many koubbas on the hill-tops are dedicated.
2. The Aïssaoua are followers of the sixteenth-century saint, Sidi Mohammed ben Aïssa, whose tomb is at Meknès. The members, who swallow glass, swords, and other objects, usually belong to the lower classes of society.
3. The Ammariya are jugglers, mainly found in the department of Constantine.
4. The Rahmaniya, the most important order in eastern Algeria, have more than 200,000 adherents and 150 *zaouias* (monasteries), the chief of which are at Châteaudun du Rummel, Akbou, Tolga, el Hamel (Bou Saada), Constantine, and Khanga Sidi Nadji in the Aurès. The two tombs of the founder, Sidi Abd er Rahman bou Kobrin, are in Kabylie and at Hamma near Algiers (Photo. 60). The members of this brotherhood have been active in insurrections against the French.
5. The Tidjaniya have always been loyal to the French administration; their centre is at Ain Mahdi, and they have many adherents in the Sahara and Sudan.
6. The Chadeliya are little organized and unimportant.
7. The Youssefiya are numerous round Miliana and Tiout.
8. The Cheikhiya are centred round Ouled Sidi Cheikh.
9. The Taïbiya, disciples of the *cherifs* (*churfa*) of Ouezzane, are numerous in northern Algeria, and in the Touat in the south.
10. The Derkaoua are mainly beggars who have struggled against French influence in western Algeria and Morocco.
11. The Senoussiya, founded by Sidi Mohammed es Senouiss, have never had the political influence in Algeria that they possessed in Libya and Chad, although during the War of 1914-18 they undermined the loyalty of the Touareg, and encouraged them to revolt against the French.

Other unimportant brotherhoods are the Naceriya, who are not very numerous, and the Kerzaziya, who are found only near Kenadza and Kerzaz in the south of the department of Oran.

The extent to which the people are Islamized varies from district to district. The Mozabites, as a result of their unorthodox beliefs, set up communities for themselves in the Sahara where their *azzaben*, or clerks, direct chants and dances quite alien to Islam. Elsewhere, particularly in the Berber-speaking parts of the mountains, worship consists largely of superstition and fetichism; springs, streams, trees, stones, and sometimes animals are venerated. Many of the natives in the Aurès mountains carry charms, such as white skulls on silver hands with extended fingers, to ward off the evil eye.

The Jews for the most part still practise their own religion. Amongst the Europeans there are both Catholics and Protestants, with their own churches and cathedrals. Some attempt has been made to convert the natives to Christianity but has met with little success.

ARAB MOVEMENTS AND PARTIES

In Algeria there was no unified system of native administration prior to the organization of the country as an integral part of France by the French Ministry of the Interior; but in recent years a nationalist movement towards self-government has been created. The leadership and inspiration of this and, indeed, of all movements are Arab, even though Berbers participate in them.

Prior to the War of 1914-18 the marabouts and religious brotherhoods formed the centres of resistance to French influence, but the efforts of the administration to neutralize their power lowered their prestige amongst the Moslems, and led to a split in the orders. Some sided with religious reforms aimed at decreasing the power of the marabouts, some even joined secular political movements, whilst others favoured closer co-operation with the French.

Various currents of thought have inspired the nationalist movement in Algeria. With the great improvement in communications and the increase in education and national self-consciousness, the spirit of the Islamic renaissance in the East began to permeate the educated classes, and to exert a powerful influence upon their political ideas. The pan-Arab movement in the Near East further stimulated the Algerian Moslems, who, at a congress in 1935, demanded the recognition of Arabic as the official language of Algeria, and the establishment of a unified syllabus of instruction in Arabic and north



65. *Chaouia family on the road*



66. *Chaouia dancing girls*



67. *Touareg nobleman and woman: the man is wearing a litham or veil*



68. *Touareg women: the woman on the right is playing an amzad, a one-stringed mandoline*

African history throughout Barbary. Many new social doctrines and political tendencies were also entering the country from France, including communist propaganda, which found a ready hearing among the large colonies of Algerian workmen both in Paris and in the cities of Algeria itself. The nationalist and communist groups, despite their differences, united because they felt that their fundamental objectives were similar. This union aroused the suspicion of the administration and alienated large sections of the Moslems, so that the government was able to take effective measures of repression in 1937 and 1938. Since June 1940 little information is available, but prior to that date there were four main parties, two right wing and two left.

The right wing parties were La Société des Oulémas Algériens and La Réforme Musulmane. La Société des Oulémas Algériens was founded to promote Moslem religious reform in north Africa, its efforts being directed particularly against the marabouts and brotherhoods. Through its opposition to the policy of assimilation it has gradually begun to assume the character of a nationalist movement with a religious basis. Its pan-Arab propaganda was intensified during 1937 and caused a rift which led the more moderate section to break away and found a new society under the name of La Réforme Musulmane. The present leader and the condition of La Société des Oulémas are not known. La Réforme Musulmane pursues a policy of religious, social, and political reform, seeking to reduce the conflict with the marabouts and to co-operate in the political sphere with the French administration.

The two left wing groups were La Fédération des Élus Musulmans Algériens and L'Étoile Nord Africaine. The former consists of the Moslem members of elected public bodies, such as municipal councils, who have not accepted French naturalization. They constitute the leaders of the group called *évolués* whose objectives are generally secularist and westernizing; they have always shown a desire to co-operate with France as far as possible. The federation has pressed continuously for equality of treatment between French citizens and Algerian Moslems, for whom it claims full civil rights. L'Étoile Nord Africaine, the most revolutionary of the Arab parties, was founded by Algerian workmen in Paris in 1924, and because of its communist sympathies has been several times suppressed, only to be re-formed. In January 1937 it was finally dissolved by presidential decree, but its place was immediately taken by the Parti du Peuple Algérien, which in July 1937 demanded an Algerian Parliament, the freedom of

the mosques from all Government restrictions, and the recognition of Arabic as the country's official language. In consequence the leader, Misali al Hajj, was imprisoned and the organization broken up, though it survived in France till November 1939, when it too was dissolved by presidential decree.

DISTRIBUTION AND DENSITY OF POPULATION

The distribution of the population of Algeria is discussed at length in Vol. II, Chap. X, and only the more general features are described here. The total population at the census of 8 March 1936 was 7,234,684, including 6,247,432 natives and 987,252 Europeans, and was estimated to have increased by 1939 to 7,490,000. The bulk of the people live in the three northern departments—2,240,911 in Algiers, 1,623,356 in Oran, and 2,727,766 in Constantine—and only 642,651 persons in the Territoires du Sud.

Since 1856 the population has increased by 190 per cent. and is still increasing—the Europeans steadily and the natives rapidly (Fig. 50). The growth has been due to the immigration of Europeans, especially from southern Europe, the excess of births over deaths, the improvement of social conditions, the introduction of health services, and, above all, the fecundity of the native population. The density of population decreases from north to south, the most thickly peopled area being a belt along the coast corresponding to the zone of heaviest rainfall (Fig. 51; cf. Fig. 41). The width of this belt varies, but is greatest in eastern Algeria where the Tell extends farther inland and the rainfall is heavier than in the west.

Three-quarters of the natives live in the Tell, and many of the mountain areas, such as the Aurès and Traras mountains, are densely settled. The density falls on the High Plateaux and is very slight in the Sahara except in oases, such as Ghardaia and Touggourt. In recent years the increase in the number of natives in the towns has resulted in many difficult social problems. There has also been considerable emigration, though measures have been taken in order to conserve a supply of labour within the country. The emigrants, mainly from the Kabylie, have gone especially to the northern cities of France as factory hands and labourers and in 1931 numbered 44,000, of whom 14,000 were in the Paris district.

Europeans at first lived almost exclusively in the large towns near the coast, such as Algiers and Oran, and although groups are now found in all parts of the country, most of them are still in the Tell, especially in areas such as the Mitidja. The European population is

generally greatest where there is a comparatively small native population. Thus in the department of Oran the ratio of natives to Europeans is three to one (1,224,000 to 400,000) and the density of the European population is thirteen to the square mile: in Algiers

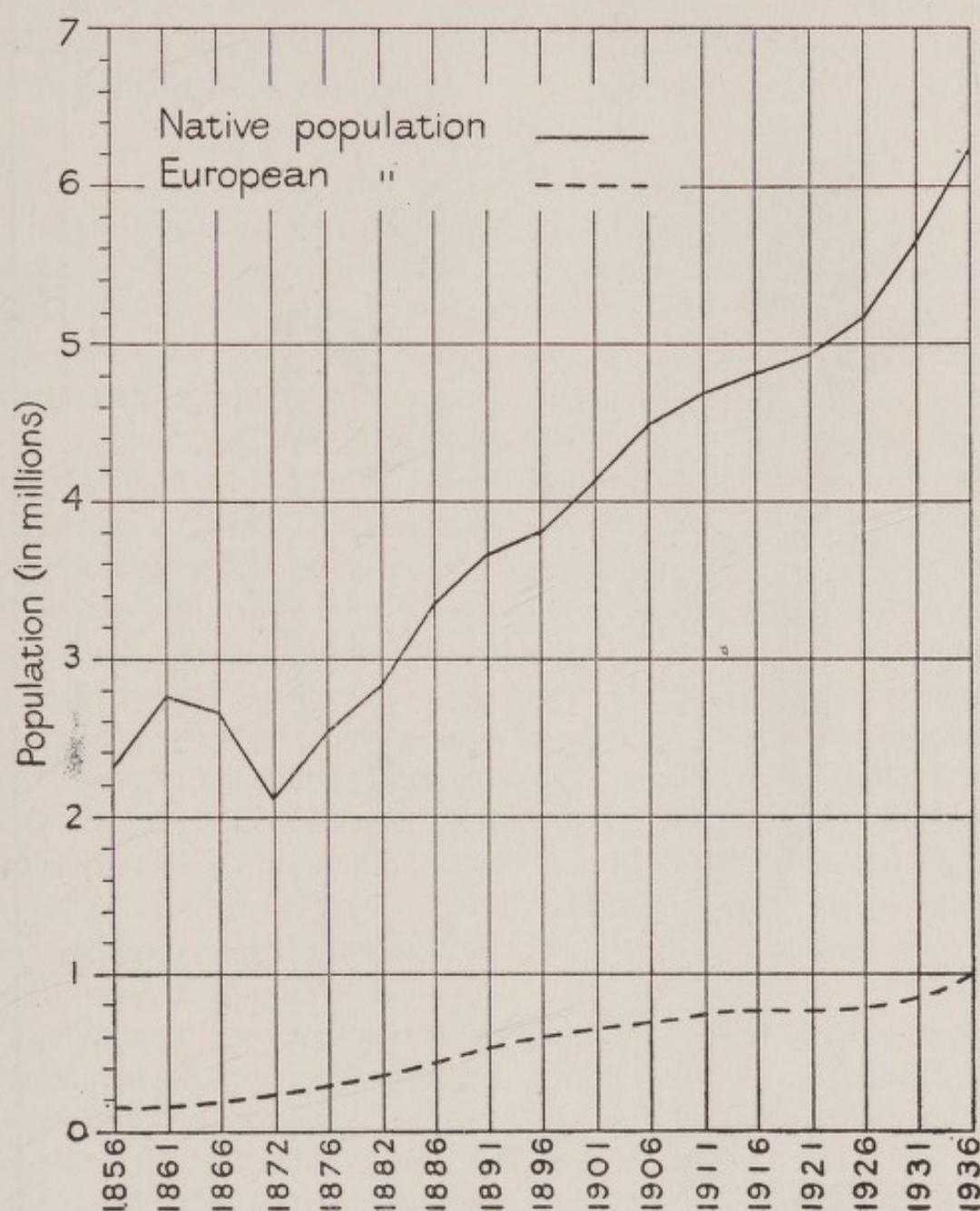


FIG. 50. *Increase of native and European population, 1856-1936*

the ratio is five to one (1,875,000 to 366,000) and the density thirteen: and in Constantine twelve to one (2,515,000 to 213,000) and the density five to the square mile. The proportion of Europeans living in the towns is higher than that of the natives, and one-quarter of all the Europeans in Algeria live in the neighbourhood of Algiers.

The number of town-dwellers, both European and native, has

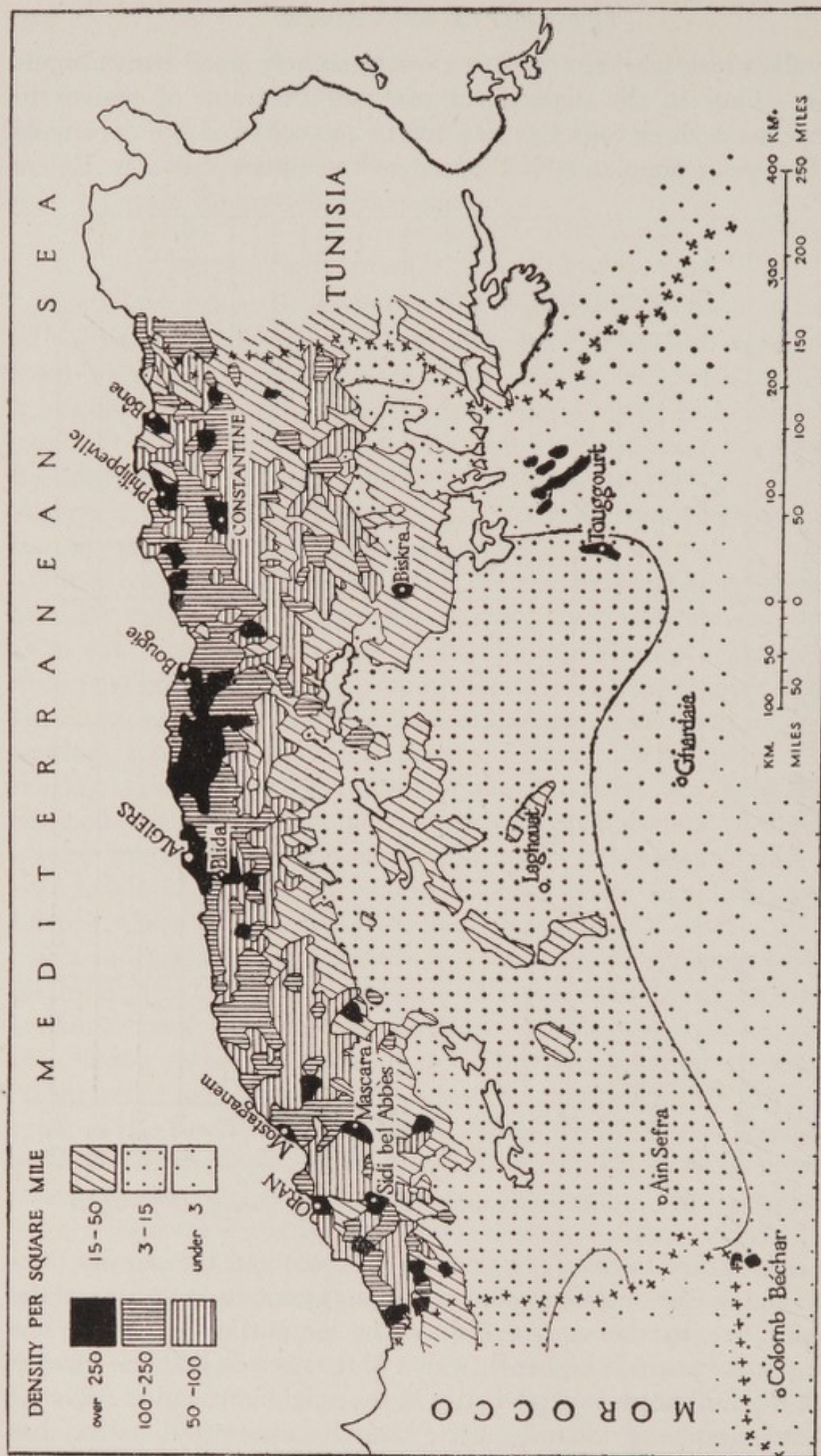


FIG. 51. The density of population, 1936

doubled since 1911, and the larger towns in particular are constantly growing. Algiers had in 1936 a population¹ of 252,321 (76,627 natives and 175,694 Europeans), Oran 194,746 (46,177 natives and 148,569 Europeans), Constantine 106,830 (56,363 natives and 50,467 Europeans), and Bône 83,275 (38,227 natives and 45,048 Europeans). These centres are described in detail with the other towns of Algeria in Vol. II, Chaps. X and XI.

PEOPLE OF THE SAHARA

The population of the desert is made up of three large ethnic groups, the Touareg of the central Sahara, the 'Moors' of the western Sahara, and the Toubou (Tibu) of the eastern Sahara; the last are not represented in Algeria. In addition there are a number of smaller groups such as the Mozabites of the Mزاب (Fig. 48).

The Touareg (Tuareg) are camel nomads and live in the desert, particularly in the Ahaggar. They are often called the People of the Veil, since all male Touareg wear a *litham*, or veil, which they lift only in order to eat, when they hold the hand over the mouth. The veil consists of a long strip of cloth wound round the head to form a hood and covering the mouth and nose, with a slit of about an inch wide in front of the eyes (Photo. 67). The rest of their clothing is less striking; they wear a full, sleeveless shirt made of indigo cotton, often richly embroidered, and gathered in at the waist with a belt; under this are wide trousers and another shirt, and on their feet leather sandals. The women are unveiled, and wear a strip of blue cotton, gathered in at the waist; the richer also wear a blouse. Silver rings are often caught in their hair at the level of their ears, and many wear silver bracelets (Photo. 68).

The women enjoy a degree of liberty unknown elsewhere amongst Moslem peoples. The Touareg are essentially monogamous, and women play an important part in every aspect of life. They are not compelled to do hard work, and can often read and write. The basis of the family is matriarchal, and the child is noble or slave according to the state of his mother and not of his father. The tribes are divided into two distinct classes, the 'nobles' (*imajeghan*) and the 'servants' (*imrad*), but the physical variation is usually slight, except that the *imrad* sometimes show traces of an admixture of negro blood. Most Touareg are tall and handsome with long black hair, straight narrow

¹ These figures refer to the *municipal* population and are rather smaller than the figures of *total* population (including army and naval personnel, &c.) given elsewhere in the handbook.

nose, and prominent but not high cheek-bones; they are more dolichocephalic than any other group in north Africa.

The nobles, numbering only a few hundred, are the political and military chiefs, despising all manual work, and spending their time policing the territories and taking command in war. The imrad occupy a position midway between slaves and vassals; they pay tribute to the nobles, but fight at their side. There are also slaves procured from the Sudan, who are usually well treated. When on the march the Touareg content themselves with a few branches for shelter, but in their encampments the nobles live in skin tents and the imrad in gourbis. The existence of a noble, or warrior class, is a necessity in the poor lands of the desert where a tribe is made up of only ten to fifteen families who cannot defend themselves, but must depend on the protection of the nobles. The tribes are grouped into confederations, but the links between them are very weak, and when the French asserted their authority the Touareg were living in a state of anarchy.

The Touareg live in the heart of the desert in the central massif and surrounding plateaux, both within and outside Algeria (Fig. 48). In the north there are two confederations; in the east the Ajjer in the Tassili, from where they spread as far as Ghadames and the Fezzan, and in the west the Hoggar (Ahaggar) in the Atakor. The southern Touareg include, in Algeria, the Iforas of the Adrar, and, in other parts of the French Sahara, the Ioulemmeden of the Timbuktu and Niger regions and the Kel Oui and Kel Gress of the Air. The Iforas of the Adrar consider themselves a holy or marabout tribe, and although they live in the south pay tribute to the Hoggar tribesmen.

The 'Moors' of Algeria live in the western parts of the Territoires du Sud, and are known by the natives as *Beidan*, or whites, as compared with the black people of the Sudan. They represent a mixture of Berber and Arab, in which the Berber element is predominant, and are for the most part nomadic. They have been completely islamized unlike the Touareg, from whom they differ in language, culture, customs, and dress. By comparison with other Moslems in the deserts, they are a very cultured people. Most of them are nomadic and live in tents, though there are a few sedentary groups. The men usually wear blue cloaks known as *draa* and the women blue tunics or *malhafa*.

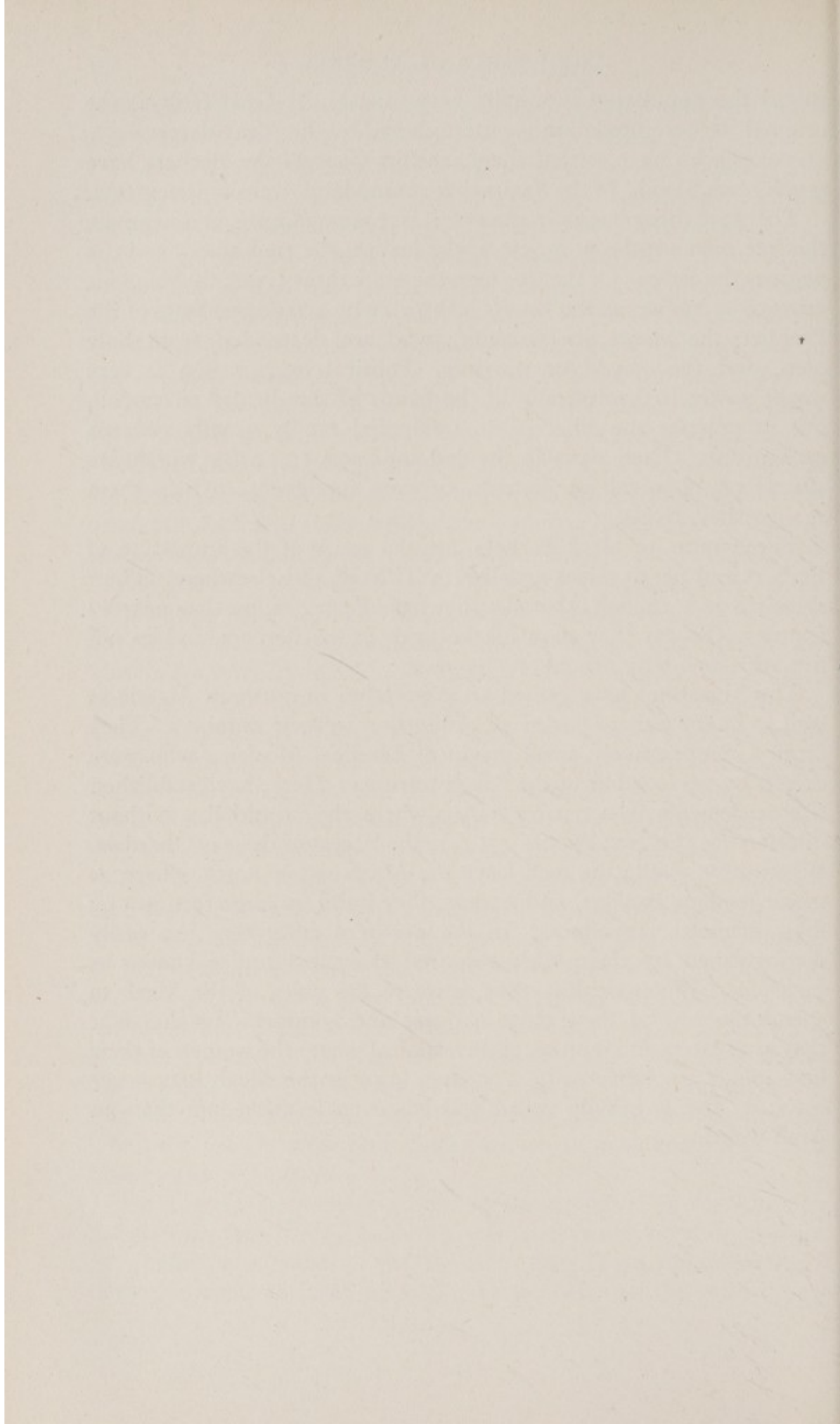
There are other smaller groups of people found in the Algerian Sahara (Fig. 48). The Chaanba are Arab-speaking nomads who are the traditional enemies of the Touareg; throughout the desert their name has come to mean 'nomad'. In the oases on the great desert

routes the population is usually very mixed. At Ghat (Libya) the original Berber population is outnumbered by the many descendants of slaves who have settled there, and in Ouargla the Berbers have much black blood. In the Saoura live some Maqil Arabs or Renanema.

There are three classes in the oases, free men, *haratin*, and negroes; the free men are the proprietors, the *haratin* the tradesmen, and the negroes the slaves. Of the free men there are three types, the religious aristocracy known as the *cherifs* (*churfa*), who are descendants of the Prophet, the *marabouts* (*mrabitin*), who are descended from holy men, and the *djouad* or warriors. Political organization is very weak; power is theoretically in the hands of the *djemaa* or council, but in practice the chief of an influential family usually governs each group. Each oasis is divided into *sofs* (p. 216), which are always ready to call in nomads, or even foreigners, to help them against their rivals.

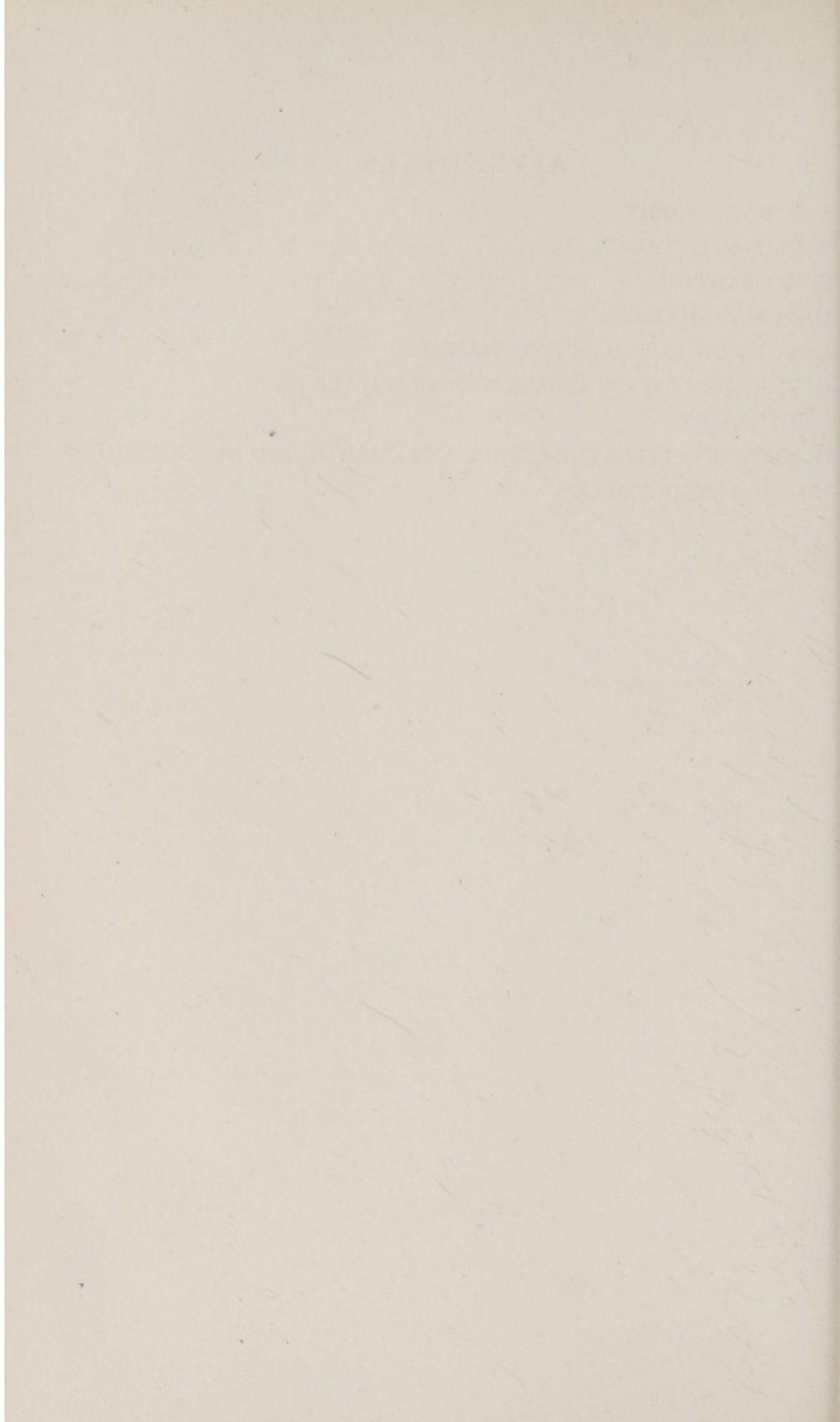
The *haratin*, or black Berbers, are the result of the admixture of Berbers and negro slaves and live in Tidikelt and elsewhere. Their skins are dark, though otherwise they have Berber rather than negroid features. To-day they show all the pride of the Berbers, and do not live with or intermarry among negroes.

The Mozabites have gained an importance in northern Algeria as well as in the Sahara out of all proportion to their numbers. They form a comparatively small group of heretical Moslems who were driven by persecution to the Mزاب territory. Here they established five settlements in a narrow valley where they could live without interference (Fig. 20; Photos. 17, 21); the largest of these is Ghardaia. When quite young the men leave the Mزاب and go north, where, as moneylenders, bankers, and traders, they build up large fortunes by their financial shrewdness. In the northern cities they are easily distinguished by their multi-coloured sleeveless tunics known as *cachabias*. When wealthy they retire to the cities of the Mزاب to spend the rest of their days in peace and comfort. In character they are austere and morose, and tyrannical where the women of their households are concerned. A woman born in the Mزاب may never leave it; she is heavily veiled and has even less freedom than an Arab woman.



APPENDIXES

- A. STRATIGRAPHY
- B. CLIMATIC TABLES
- C. VEGETATION
- D. ROMAN ALGERIA
- E. NOTE ON CUSTOMS AND MANNERS
- F. THE MOSLEM CALENDAR AND FESTIVALS
- G. GLOSSARY
- H. NOTE ON LITERATURE, MAPS AND CHARTS, AND AUTHORSHIP
- I. CONVERSION TABLES



APPENDIX A

STRATIGRAPHY

THE following summary refers essentially to northern Algeria: notes on the Algerian Sahara are included. Thicknesses are given as known in northern Algeria; it must be remembered, however, that many of the beds not only vary widely in thickness and lithological character, but are also folded or displaced: correct estimates of thickness are, therefore, difficult to assess.

Detailed stratigraphical subdivision of fossiliferous beds is excluded from this Appendix, which is primarily intended to supplement the geological map (in the pocket at the end of the book).

SEDIMENTARY ROCKS

QUATERNARY

Superficial sands, gravels, and alluvium with intercalations of clay and gypsum; detrital deposits of the chotts; usually with calcareous and siliceous cement near the surface. Also raised beach deposits. Sahara: sand-dunes and old alluvial deposits.

PLIOCENE

Near the coast thick blue-grey marine marls beneath loose sands and sandstone. Uppermost deposits are locally freshwater clays and sandstones: local conglomerates. Inland, continental beds filling basins and hollows. The beds are reputed to attain thicknesses exceeding 4,000 feet.

MIOCENE

Upper (*Sahelian*): near the coast; marine at base, bluish shale and marl, local limestone; gypsum and marl at top. Inland; Middle and Upper Miocene continental beds.

Middle (*Vindobonian*): limited to the Tell and the district of Tiaret: sandstones with marl and some limestone in the lower beds, clay covered by sandstones or pebble beds in the upper part.

Lower (*Cartennian*): littoral and subaerial. Below, purplish conglomerate, sandstone, and shale: middle, mudstones and foraminiferal marls, 3,300 feet thick: upper, sandstones and conglomerates. Transgression to Biskra district. Total thickness of Miocene reputed to exceed 10,000 feet.

OLIGOCENE

Coarse, red, basal conglomerate (130-720 ft.) with large sub-angular boulders passing up into red and variegated banded sandstone or shale, with gypsum along bedding plains and joints. Partly littoral, partly marine, in the northern Tell. Some beds are inseparable from Miocene continental deposits. Total thickness, 330-1,850 feet.

Neither Oligocene nor Miocene beds are identified in the Sahara: they may be incorporated in accumulations of later Tertiary age.

EOCENE

Upper In the Tell: mainly marine, thin-bedded shale, calcareous beds, and siliceous sandstone. Local carbonaceous layers and clay-ironstone common. Eastern Algeria, Numidian sandstone. Thickness, 1,300 feet.

Middle Variable calcareous and sandy shale and sandy limestone, with irregular beds of sandstone and dense, blue nummulitic limestone. Locally the beds contain gypsum, glauconite, flint, and concretions. Thickness, 1,300-1,600 feet.

Lower (*Suessonian*): In the Tell: white calcareous shale and shaly limestone with interbedded mudstone, sandstone, and pebble beds. Flint layers and nodules occur. In eastern and south-eastern Algeria lie the valuable phosphatic limestones. Thickness, 330-650 feet.

Transgressive marine Eocene beds occur in the northern Sahara in the district of the Ziban oases.

CRETACEOUS

Upper In the Tell, alternating mudstones, marl, calcareous shale, sand, and limestone (the last more than 1,600 ft. thick). In the Saharan Atlas sand and sandstones predominate. In the Sahara transgressive, shallow-water limestones, dolomitic in part, clays and marls, often with gypsum, thickening from south to north: the beds may be about 1,500 feet thick.

Lower Sandstones in the Saharan Atlas and southern High Plateaux (Neocomian-Albian). In the Tell, variable sandstones, limestones, marls, and clays.

Total thickness of the Cretaceous in northern Algeria, 6,600-9,800 feet.

Purely continental beds represent the Saharan deposits below so-called Albian lagoonal and estuarine beds that preceded the Upper Cretaceous transgression: they are, in part, Cretaceous, and it is possible that they include Jurassic deposits. They form a part of the *continental intercalaire* which, in the aggregate,

may be taken to represent the late- and post-Carboniferous to Cretaceous continental phase. No estimate of thickness can usefully be given.

JURASSIC

Upper and Middle Dense limestones (in places dolomitic), marl, shale, and sandstone.

Lower (*Lias*): Massive limestones, sometimes thin-bedded or passing to calcareous shale in the upper part. The massive lower limestone contains haematite.

Estimated total thickness of Lias and Jurassic, 1,640–3,300 feet.

Marine Jurassic beds are absent from the Sahara.

TRIASSIC

Bright, variegated shale and marl with beds of salt and gypsum: these beds are rarely in place in any part of the Atlas mountains. There are also some sandstones and tuff. Beds are cut by basic dykes ('ophites'). Contemporary marine limestones are recorded in the Algerian-Tunisian border region. There is some doubt as to the relationship of Triassic to Permian beds. Thickness: owing to the disturbed state of the beds estimates of thickness are unreliable.

No Triassic beds of the above type are exposed in the Sahara.

PALAEOZOIC

In northern Algeria metamorphosed sediments, phyllite, schist, quartzite, and marble, are exposed in a few places (considered to be Silurian and Carboniferous). There is also a Permian conglomerate, 980–1,300 feet thick. From the southern margin of the Saharan Atlas unaltered Palaeozoic marine sediments, and continental beds associated with them, are widely exposed in the Sahara. They include 'Cambro-Ordovician' dolomitic beds and sandstones, Gothlandian (i.e. Silurian in the restricted sense, excluding the Ordovician) shales, Devonian limestones and shales, and Carboniferous limestones and sandstones (with coal at Kenadza). No estimate of aggregate thickness of the beds given above is considered satisfactory for incorporation here.

ARCHAEOAN—PRE-CAMBRIAN

The complex of crystalline rocks, gneiss, and schist is exposed especially in north-eastern Algeria, and in a few outcrops in northern and western Algeria. The complex is exposed on the widest scale in the Ahaggar and other massifs, and on the Mauritanian borders of the Territoires du Sud.

IGNEOUS ROCKS

Prominent groups of igneous rocks are:

Volcanic rocks, mainly post-Cretaceous (Tertiary and Quaternary rhyolite, andesite, basalt, &c., also granites).

Intrusive rocks, mainly Pre-Cambrian and Palaeozoic granite, porphyries, syenite, gabbro, &c.

MOUNTAIN-BUILDING MOVEMENTS

The following are observed in northern Algeria:

Alpine (Miocene and Pliocene), especially in the Tell Atlas (roughly parallel to the coast): in the Sahara no Tertiary mountain-building: undulations, faults.

Pyrenean (Cretaceous-Eocene), whole Atlas system, generally parallel to present coast: for Sahara, see above.

Hercynian (end of Palaeozoic) (north-south): in the Sahara generally only simple folds and undulations, faults.

Archaean-Pre-Cambrian complex (north-south): also forms the Saharan platform.

APPENDIX B

CLIMATIC TABLES

(Mainly supplied by the Meteorological Office, Air Ministry)

Table	I. Wind Direction.
„	II. Number of Days with Gales.
„	III. Mean Temperatures, Mean Daily Maximum Temperatures, and Mean Daily Minimum Temperatures.
„	IV. Average Amount of Cloud.
„	V. Mean Rainfall.
„	VI. Mean Number of Rain Days.
„	VII. Relative Humidity.
„	VIII. Mean Number of Thunderstorms.
„	IX. Number of Days per year of Rough Sea, &c., in relation to wind direction.
„	X. Absolute Temperatures, Maximum and Minimum. Saharan stations.

Note. In these tables the figures for the Saharan stations are based on observations for the following periods: Biskra, 1928-37; Mechéria, 1928-37, Tamanrasset, 1924-35, and Touggourt, 1928-37.

TABLE I. *Wind Direction (percentage of observations)*

(Times of observation, 0700, 1300, 1900 hours G.M.T.)

		J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year (mean)
<i>Algiers</i>														
Mean Force 0-9		3.3	3.4	3.4	3.4	3.2	3.1	2.9	2.9	3.0	3.1	3.2	3.2	3.2
Percentage of observations from	N.	13	16	16	16	22	22	26	25	23	18	13	12	19
	NE.	7	10	12	11	14	20	23	22	18	13	8	7	14
	E.	11	12	13	20	21	20	23	27	23	18	14	9	18
	SE.	6	5	6	6	5	5	5	5	6	5	5	5	5
	S.	8	5	4	3	3	2	2	2	3	5	7	7	4
	SW.	14	12	10	8	5	4	3	2	3	8	12	13	8
	W.	27	26	25	23	19	16	7	8	12	20	29	33	20
	NW.	13	13	13	12	10	10	10	8	10	10	10	12	11
Calm		1	1	1	1	1	1	1	1	2	3	2	2	1
<i>Oran</i>														
Mean Force 0-9		1.6	1.6	1.8	1.8	1.5	1.5	1.6	1.6	1.6	1.7	1.8	1.8	1.7
Percentage of observations from	N.	25	26	29	31	32	32	37	41	37	29	26	21	31
	NE.	2	2	2	2	2	1	1	2	2	2	2	2	2
	E.	1	2	2	1	1	1	1	1	0	1	1	1	1
	SE.	7	6	6	5	4	4	4	4	4	5	5	8	5
	S.	32	30	25	25	19	20	16	16	18	27	31	37	25
	S.W.	10	12	11	10	9	7	5	4	7	8	11	12	9
	W.	6	7	8	6	9	10	9	7	9	6	7	6	7
	NW.	12	12	14	16	16	19	21	20	19	19	14	10	16
Calm		5	3	3	4	8	6	6	5	4	3	3	3	4

TABLE II. *Number of Days with Gales*

Station	Height above sea-level (ft.)	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year (total)
Algiers	1,128	3	4	3	4	2	2	1	1	1	2	2	3	28
Oran	171	1.5	2	2	1	0.3	0.5	0.2	0	0.2	0.3	0.8	1	10

TABLE III. *Mean Temperatures, Mean Daily Maximum Temperatures, and Mean Daily Minimum Temperatures (° F.)*

(A = mean temperature, B = mean daily maximum temperature, C = mean daily minimum temperature)

Station	Height above sea-level (ft.)	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year (mean)
Algiers (University)	194	A 53	54	57	60	65	71	75	77	74	68	60	55	64
		B 59	60	64	68	73	78	83	85	81	74	66	60	71
		C 49	49	51	55	60	65	70	71	69	63	56	51	59
Algiers	1,128	A 49	50	53	56	61	68	73	75	70	64	57	52	61
		B 59	60	63	66	71	76	81	82	79	73	66	61	70
		C 47	48	50	53	58	63	67	69	66	59	55	50	57
Biskra	410	A 51	55	60	67	75	84	89	88	82	70	59	52	71
		B 61	64	71	80	87	98	104	103	95	83	70	62	81
		C 43	45	52	58	65	75	80	79	74	63	53	45	61
Mascara	295	A 48	50	54	60	64	73	80	82	75	65	55	49	63
		B 55	58	63	70	75	85	92	94	86	75	62	56	73
		C 40	42	45	49	53	61	67	69	63	55	47	42	53
Mechéria	3,829	A 44	46	51	58	63	75	82	82	72	61	51	46	61
		B 52	55	61	69	74	87	95	94	84	71	60	54	71
		C 35	37	41	47	52	62	68	69	60	51	42	37	50
Oran	171	A 53	55	56	59	65	70	73	75	72	66	60	55	63
		B 61	63	66	69	73	79	83	84	80	74	69	63	72
		C 45	46	49	53	58	63	68	69	66	59	53	47	57
Orléansville	367	A 50	52	57	62	68	79	85	85	78	67	57	52	66
		B 57	60	66	74	80	92	99	99	90	77	65	59	77
		C 42	43	47	50	56	65	70	70	66	57	49	44	55
Philippeville	233	A 51	52	55	60	64	71	75	77	74	67	60	54	63
		B 57	58	62	67	72	78	83	84	81	74	66	59	70
		C 45	45	48	52	56	63	67	69	67	60	53	48	56
Sétif	3,540	A 41	42	48	54	60	71	77	75	69	59	49	43	57
		B 49	51	57	65	71	83	90	88	80	68	57	51	67
		C 33	33	38	43	48	58	63	62	58	49	41	35	47
Tamanrasset (Fort Laperrière)	4,429	A 54	58	64	72	78	83	84	83	79	74	65	58	71
		B 67	72	79	86	92	95	96	95	91	86	79	71	84
		C 40	43	49	58	64	70	72	71	67	60	51	44	57
Touggourt	226	A 51	50	61	70	77	87	92	90	84	72	61	53	71
		B 62	67	73	83	90	100	106	104	97	84	72	64	83
		C 39	42	49	56	63	73	77	76	71	60	49	41	58

TABLE IV. *Average Amount of Cloud (Scale 0-10)*

(Monthly averages in tenths of the sky covered)

Station	Height above sea-level (ft.)	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year (mean)
Algiers	1,128	5.1	4.8	4.8	4.7	4.3	3.3	2.9	2.8	4.0	4.6	5.2	5.1	4.3
Oran	171	2.9	3.3	3.2	3.2	2.5	2.3	2.2	2.3	2.6	3.1	3.2	3.2	2.8

TABLE V. *Mean Rainfall (inches)*

Station	Height above sea-level (ft.)	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year (total)
Algiers (University)	194	4.6	3.6	2.9	1.6	1.6	0.6	0.1	0.2	1.7	2.8	5.0	5.1	29.8
Algiers	1,128	3.9	2.4	3.2	2.1	1.8	0.7	0.2	0.2	1.1	3.0	3.4	3.7	25.7
Biskra	410	0.9	0.4	1.0	0.3	0.7	0.2	0.1	0.4	1.2	0.9	1.0	1.0	8.1
Mascara	295	2.6	2.9	2.3	1.4	1.0	0.3	0.0	0.1	0.8	1.7	4.1	3.9	22.1
Mechéria	3,829	0.7	1.0	1.4	0.6	0.9	0.2	0.1	0.3	1.6	1.0	1.5	1.0	10.3
Oran	171	2.8	1.9	2.0	1.2	0.8	0.2	0.0	0.1	0.5	1.3	2.1	2.0	14.8
Orléansville	367	2.1	2.2	1.8	1.0	1.6	0.2	0.0	0.9	1.7	2.3	2.5	2.5	16.3
Philippeville	233	6.8	5.0	3.0	2.2	1.9	0.3	0.3	0.5	1.7	3.6	3.4	6.9	35.6
Sétif	3,540	2.2	1.7	1.6	1.0	1.9	0.9	0.6	0.4	1.6	1.9	2.0	2.1	17.9
Tamanrasset	4,429	0.3	0.0	0.0	0.2	0.5	0.2	0.1	0.4	0.1	0.1	0.0	0.0	1.9
Touggourt	226	0.2	0.4	0.6	0.1	0.2	0.1	0.0	0.0	0.0	0.2	0.6	0.4	2.8

TABLE VI. *Mean Number of Rain Days*

Station	Height above sea-level (ft.)	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year (total)
Algiers (University)	194	15	13	13	10	8	5	1	2	7	10	14	15	113
Algiers ¹	1,128	15	13	13	11	9	5	2	2	7	10	13	15	117
Biskra	410	3	3	5	1	3	1	0.9	0.7	3	3	4	4	32
Mascara	295	9	9	10	5	5	2	0.1	0.3	3	7	10	10	70
Mechéria	3,829	5	7	7	4	5	4	2	3	7	5	8	5	62
Oran ¹	171	9	7	7	7	5	3	1	1	4	6	8	8	64
Orléansville	367	10	10	11	6	5	2	0.3	0.5	4	6	10	10	75
Philippeville	233	17	14	12	10	7	3	2	2	7	11	11	17	113
Sétif	3,540	12	10	9	8	8	5	2	3	7	9	11	12	96
Tamanrasset	4,429	1	0.4	0.4	0.7	2	3	2	3	3	0.5	0.6	0.5	17
Touggourt	226	2	2	3	0.7	2	0.8	0.3	0.3	1	2	3	3	20

¹ Rain day = 0.1 mm. or more of rainfall. Amount for other stations unspecified, but probably 0.1 mm.

TABLE VII. *Relative Humidity (percentages)*

Station	Height above sea-level (ft.)	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
Algiers (University)	194	74	72	70	68	71	73	72	72	72	70	72	72	71
Algiers	1,128	65	65	65	65	65	65	68	70	69	67	67	68	67
Biskra	410	59	53	47	38	35	31	28	31	43	48	54	60	44
Mascara	295	78	74	72	64	63	56	50	51	59	67	72	77	65
Mechéria	3,829	60	54	46	40	43	37	32	33	44	52	56	62	47
Oran	171	77	76	75	74	73	72	74	75	77	77	77	77	75
Orléansville	367	83	77	70	61	59	50	48	51	59	70	77	83	66
Philippeville	233	77	74	72	68	71	75	69	73	74	76	76	77	73
Sétif	3,540	77	69	61	54	53	45	41	45	53	62	73	74	59
Tamanrasset	4,429	31	25	23	20	24	21	23	25	24	26	28	31	25
Touggourt	226	60	56	51	46	44	37	35	38	42	54	61	65	49

TABLE VIII. *Mean Number of Thunderstorms*

Station	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year (total)
Oran ¹	0.2	0.5	0.5	0.7	0.2	0.6	0.2	0.4	0.9	0.8	0.2	0.1	5
Dj. Krichtel (Kristel)	0.6	0.8	1.2	1.3	1.0	1.6	1.7	1.2	3.1	2.0	1.1	0.8	16
Dj. Bouzarea (Bu Zarea)	0.8	2.1	1.4	2.1	2.3	1.9	2.0	2.2	5.1	4.7	2.8	1.7	29
C. Carbon	3.2	2.6	2.7	2.6	2.9	3.9	3.1	1.9	7.1	4.6	2.4	3.1	40
C. de Garde	2.3	1.0	1.6	1.9	2.7	3.4	3.0	2.0	6.9	5.5	2.5	1.9	35

¹ The figures for Oran are of days with thunder heard, over a ten-year period; for other stations the figures refer to the ten-year period, 1899-1908.

TABLE IX. *Number of Days per year of Rough Sea, &c., in relation to wind direction*

	N.				NE.				E.				SE.			
	S.	HS.	R.	VR.	S.	HS.	R.	VR.	S.	HS.	R.	VR.	S.	HS.	R.	VR.
Dj. Krichtel (Kristel)	8	3	1	1	5	2	..	..	2	1	..	..	1	1	..	..
C. de Garde	6	1	..	1	3	3	..	..	1	..	1	..	2	..	..	..
	S.				SW.				W.				NW.			
	S.	HS.	R.	VR.	S.	HS.	R.	VR.	S.	HS.	R.	VR.	S.	HS.	R.	VR.
Dj. Krichtel (Kristel)	2	..	..	..	1	1	..	..	22	10	3	1	6	5	1	..
C. de Garde	3	1	..	..	4	1	..	1	9	4	4	1	20	9	10	5

S. = Swell. HS. = Heavy Swell. R. = Rough Sea. VR. = Very Rough.

TABLE X. *Absolute Temperatures, Maximum and Minimum (° F.).
Saharan stations*

Station	Height above sea-level (ft.)	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
Biskra	410													
Max.		74	79	88	98	104	115	117	121	110	101	85	80	121
Min.		30	32	34	46	53	61	70	67	59	47	43	30	30
Mechéria	3,829													
Max.		68	76	80	88	92	100	105	104	99	88	78	69	105
Min.		23	15	23	30	35	45	54	53	47	35	29	21	15
Tamanrasset	4,429													
Max.		79	82	90	96	98	101	99	100	97	91	86	81	101
Min.		20	25	32	42	45	59	62	62	56	47	36	27	20
Touggourt	226													
Max.		77	91	100	104	109	117	121	122	112	106	92	81	122
Min.		27	30	33	42	52	61	68	66	53	41	30	27	27

APPENDIX C

VEGETATION

- I. Index to Latin Names of Plants.
- II. Summary of Important Plant Communities.
- III. Arabic and Berber Names of Important Plants.

I. Index to Latin Names of Plants

- | | |
|--|---|
| Acacia (Gum), <i>Acacia seyal</i> , <i>A. raddiana</i> . | Crucifers, <i>Zilla macroptera</i> , <i>Morettia canescens</i> , <i>Moricandia arvensis</i> , <i>Farsesia</i> , <i>Savignya</i> , &c. |
| Afarès oak, <i>Quercus afares</i> . | Cypress, <i>Cupressus dupreziana</i> . |
| Aleppo pine, <i>Pinus halepensis</i> . | Diss grass, <i>Ampelodesma mauritanica</i> . |
| Alfa (Halfa), <i>Stipa tenacissima</i> . | Drinn, <i>Aristida pungens</i> . |
| Arar (or Sandarach), <i>Callitris articulata</i> . | Dwarf palm, <i>Chamaerops humilis</i> . |
| Ash, <i>Fraxinus xanthoxyloides</i> , <i>F. oxyphylla</i> . | Elm, <i>Ulmus campestris</i> . |
| Asparagus, <i>Asparagus acutifolius</i> . | Euphrates poplar, <i>Populus euphratica</i> . |
| Aspen, <i>Populus tremula</i> . | Fern, <i>Cheilanthes pteridioides</i> . |
| Atlantic turpentine tree (or Betoum), <i>Pistacia atlantica</i> . | Fig, <i>Ficus telouakat</i> . |
| Barbary thuya, <i>Callitris articulata</i> . | Fir, <i>Abies numidica</i> . |
| Betoum (or Atlantic turpentine tree), <i>Pistacia atlantica</i> . | Gean, <i>Prunus avium</i> . |
| Black horehound, <i>Ballota hispanica</i> . | Gum tree (Acacia), <i>Acacia seyal</i> , <i>A. raddiana</i> . |
| Black poplar, <i>Populus nigra</i> . | Halfa (Alfa), <i>Stipa tenacissima</i> . |
| Bramble, <i>Rubus numidicus</i> . | Hawthorns, <i>Crataegus monogyna</i> , <i>C. laciniata</i> . |
| Brooms, <i>Cytisus triflorus</i> , <i>C. balansae</i> , <i>Genista tricuspidata</i> , <i>Retam raetam</i> . | Heaths, <i>Erica scoparia</i> , <i>E. arborea</i> . |
| Buckthorns, <i>Rhamnus oleoides</i> , <i>R. alaternus</i> . | Holly, <i>Ilex aquifolium</i> . |
| Butcher's broom, <i>Ruscus aculeatus</i> . | Holm oak, <i>Quercus ilex</i> (var. <i>ballota</i>). |
| Cedar, <i>Cedrus atlantica</i> . | Honeysuckle, <i>Lonicera kabylica</i> . |
| Chaste tree, <i>Vitex agnus-castus</i> . | Horehound (black), <i>Ballota hispanica</i> . |
| Chenopods, <i>Haloxylon articulatum</i> , <i>Anabasis articulata</i> , <i>Noaea</i> , <i>Salsola</i> , <i>Halocnemum</i> , &c. | Irak, <i>Salvadora persica</i> . |
| Chih (or white wormwood), <i>Artemisia herba-alba</i> . | Jasmine (yellow), <i>Jasminum fruticans</i> . |
| Clematis, <i>Clematis cirrhosa</i> , <i>C. flammula</i> . | Jujube (or Lotus), <i>Zizyphus lotus</i> . |
| Club rush, <i>Scirpus holoschoenus</i> . | Juniper (common), <i>Juniperus communis</i> . |
| Cluster (or maritime) pine, <i>Pinus pinaster</i> . | Juniper (large-fruited), <i>Juniperus macrocarpa</i> . |
| Cork oak, <i>Quercus suber</i> . | Juniper (red), <i>Juniperus phoenicea</i> . |
| Cottager's tea shrubs, <i>Lycium intricatum</i> , <i>L. arabicum</i> . | Kermes oak, <i>Quercus coccifera</i> . |
| | Knapweed, <i>Centaurea</i> . |

- Laurel, *Laurus nobilis*.
 Lauristinus, *Viburnum tinus*.
 Lavender, *Lavandula stoechas*.
 Lentisk, *Pistacia lentiscus*.
 Lotus (or Jujube), *Zizyphus lotus*.

 Maples, *Acer obtusatum*, *A. campestre*,
 A. monspessulanum, *A. opulifolium*.
 Maritime (or cluster) pine, *Pinus*
 pinaster.
 Marram grass (or Oyat), *Ammophila*
 australis.
 Myrtle, *Myrtus nivellei*.

 Oleander, *Nerium oleander*.
 Olives, *Olea europaea*, *O. laperrinei*.
 Orach, *Atriplex halimus*.
 Oyat (or Marram grass), *Ammophila*
 australis.

 Pine (Aleppo), *Pinus halepensis*.
 Pine (cluster or maritime), *Pinus*
 pinaster.
 Pink, *Dianthus fimbriatus*.
 Poplar (black), *Populus nigra*.
 Poplar (Euphrates), *Populus euphratica*.
 Poplar (white), *Populus alba*.
 Portuguese (or Zen) oak, *Quercus*
 lusitanica.

 Red juniper, *Juniperus phoenicea*.
 Reed grass, *Phragmites communis*.
 Reed mace, *Typha australis*.
 Rice grass, *Spartina stricta*.
 Rock-roses, *Cistus*, *Helianthemum lippii*.
 Rosemary, *Rosmarinus*.
 Rushes, *Juncus acutus*, *J. maritimus*.

 St. John's bread, *Ceratonia siliqua*.
 Sandarach (or Arar), *Callitris articulata*.
 Sea-lavender, *Limonium*.
 Sea-rush, *Juncus maritimus*.
 Sea sow-thistle, *Sonchus maritimus*.
 Sea squill, *Urginea maritima*.
 Service tree, *Sorbus torminalis*.
 Smilax, *Smilax aspera*.
 Sparte, *Lygeum spartum*.
 Spurge laurel, *Daphne laureola*.
 Strawberry tree, *Arbutus unedo*.
 Sumach, *Rhus pentaphylla*, *R. oxy-*
 acantha.
 Switch plant, *Ephedra alata*.

 Tamarisks, *Tamarix articulata*, *T.*
 balansae, *T. bounopaea*, *T. gallica*.
 Teborak, *Balanites aegyptiaca*.
 Thurifer, *Juniperus thurifera*.
 Thuya (Barbary), *Callitris articulata*.
 Turkey-red plant, *Peganum harmala*.
 Turpentine tree (Atlantic), *Pistacia*
 atlantica.

 Umbellifer, *Pituranthos scoparius*.

 White beam, *Sorbus aria*.
 White poplar, *Populus alba*.
 White willow, *Salix alba*.
 White wormwood (or Chih), *Artemisia*
 herba-alba.
 Wormwood, *Artemisia campestris*.

 Yellow jasmine, *Jasminum fruticans*.
 Yew, *Taxus baccata*.

 Zen (or Portuguese) oak, *Quercus*
 lusitanica.

II. Summary of Important

(A) CONIFEROUS FOREST

	Density and height	Undergrowth
1. Aleppo pine (<i>Pinus halepensis</i>)	Usually open forest. Height of trees: 26 ft., but vary from 13-16 ft. on littoral dunes to 30-50 ft. in High Plateaux.	Dense, forming shrub, herbaceous, and even moss layers.
2. Maritime or cluster pine (<i>Pinus pinaster</i>)	Rather dense forests of somewhat twisted trees in coastal areas. Height: up to 30 ft. and, very rarely, up to 50 ft.	Well developed, shrubby undergrowth makes an impenetrable thicket of Mediterranean maquis species, such as strawberry tree, heaths, lentisk, myrtle, and woody climbers.
3. Barbary thuya (<i>Callitris articulata</i>)	Open woods of tall brushwood or very open forest with numerous clearings. Height: 30-40 ft. and 3-5 ft. in circumference.	Dense brushwood layer of lentisk, buckthorns, strawberry tree, rock-roses, and other Mediterranean plants.
4. Red juniper (<i>Juniperus phoenicea</i>)	Low woods, rather dense on coastal dunes. Inland it forms forest steppe. Small tree, 16-23 ft.	Dense, shrubby undergrowth. In more open parts there are numerous tufts of halfa and sparte.
5. Thurifer (<i>Juniperus thurifera</i>)	Usually less than 30 ft.	..
6. Cedar (<i>Cedrus atlantica</i>)	(a) Pure, intact cedar forest is dense. (b) Mixed cedar forest more open. Height: about 150 ft. Circumference at 5 ft. is 10 ft. or more.	(a) No shrub layer except in clearings. Mixed field layer consists of plants able to withstand shade. (b) Where shade permits, shrub layer is well developed and includes spurge laurel, honeysuckle, hawthorn, the common juniper, and butcher's broom. Field layer of herbs.

Plant Communities

<i>Climatic conditions</i>	<i>Soils</i>	<i>Other notes</i>
Warm and dry.	Grows on limestones, non - calcareous soils, impermeable soils, and sand-dunes. Near coast limited to limestones and stabilized sand-dunes.	Upper limits: 4,300-4,700 ft. in Tell Atlas; about 5,300 ft. in north Aurès; 7,000-7,300 ft. in Saharan Atlas. Associated with rosemary and a low shrubby plant (<i>Globularia alypum</i>).
..	Siliceous soils.	Upper limit 2,400 ft. Associated with cork oak.
Less resistant to cold than Aleppo pine.	Calcareous soils.	Grows in coastal regions and Oran Tell. Associated with olive, St. John's bread, and red juniper trees.
Prefers dry conditions.	..	Reaches altitudes of 7,500 ft. Grows in coastal areas, High Plateaux, and Saharan Atlas. On dunes accompanied by the large-fruited juniper and olives.
..	..	Grows on Aurès mountains and slopes of Djebel Mahmel. Associated with cedars.
Prefers dry summer and cold winter.	(a) Forms an abundant humus and grows mainly on shallow soils. (b) Mixed cedar forests develop on deeper soils in better watered localities, e.g. calcareous marls of the eastern Djurdjura.	On northern slopes of Tell Atlas cedar first appears about 4,300 ft. and occurs up to 7,300 ft. On southern slopes and in the Aurès it extends to rather higher altitudes. (a) Where trees are more widely spaced and in damper ravines there are bushes of holly, yew, and holm oak. (b) Mixed with cedar are Portuguese oak, service tree, white beam, maple, gean, yew, and holly.

(B) EVERGREEN BROAD-LEAVED FOREST

	Density and height	Undergrowth
7. Cork oak (<i>Quercus suber</i>)	Low, open wood. Tree layer rarely forms a continuous canopy, the trees usually being well spaced, and over-topping a shrub layer. Height: 20-40 ft. (occasionally up to 65 ft.).	Shrub layer, 6-12 ft. high, which is made impenetrable by a considerable development of woody climbers. Field layer of herbs is poorly developed except in clearings.
8. Holm oak (<i>Quercus ilex</i> var. <i>ballota</i>)	Low, dense forest with a thick canopy. Height: 10-50 ft. (a) In lower Tell Atlas forms low brushwood rather than forest. (b) Higher forest in upper Tell Atlas. (c) In mountains of south Oran woods composed of low trees rarely with continuous canopy.	Sparse. Neither shrub layer nor field layer is very dense. In lower Tell Atlas numerous shrubs and woody climbers with fair development of field and moss layers. In south Oran woody undergrowth poor, but field layer of herbs well developed.
9. Olive and lentisk (<i>Olea europaea</i> and <i>Pistacia lentiscus</i>)	Low forest or high brushwood, with continuous canopy. Dense and even impenetrable on loose soils, but open on heavy clay soils. Height: 10-20 ft.	Dense. In Oran region it is often degraded to brushwood with dwarf palms and jujubes.

(C) DECIDUOUS BROAD-LEAVED FOREST

10. Portuguese or zen oak (<i>Quercus lusitanica</i>)	Dense, high forest with continuous canopy casting a deep shade.	Poorly developed.
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<i>Climatic conditions</i>	<i>Soils</i>	<i>Other notes</i>
Relatively high rainfall (more than 24 in. a year). More luxuriant when conditions are wet and fairly warm with high humidity.	Deep and non - calcareous. Does not flourish on compact clays or soils with a calcareous substratum near the surface.	Sea-level to about 3,300 ft. and in very favourable circumstances to 5,300 ft. Shrub layer includes tree heath, strawberry tree, lauristinus, myrtle, buckthorn, a privet-like plant (<i>Phillyrea media</i>), rock-roses, dwarf palm, and lavender. Numerous woody climbing plants, such as smilax, ivy, species of clematis, honeysuckle, roses and brambles, tend to bind together the shrubs.
Maximum development in colder mountains with fairly abundant rainfall, but rather low humidity.	Almost indifferent to nature of soil. Forest opens up when substratum includes much clay or rock.	Grows from sea-level up to about 6,300 ft. In Tell Atlas it is usually conspicuous from 1,300 ft. (a) In lower Tell Atlas is mixed with olive, ash, or Aleppo pine. (b) In upper Tell Atlas is mixed with Portuguese oak, maple, gean, and Mediterranean juniper. (c) In mountains of south Oran is mixed with ash, red and Mediterranean junipers, and turpentine tree.
Develops best under relatively wet Mediterranean climatic conditions.	Grows on calcareous and non-calcareous soils.	Very common in the Tell from sea-level up to 3,300 ft. Associated with cork oak on non-calcareous soils, and with Aleppo pine, thuya, and holm oak on calcareous soils.
Heavy rainfall (at least 32 in. a year): high humidity.	Grows on wide variety of soils. Range determined by need for water.	Can appear at sea-level, but grows best from 3,300 to 5,300 ft. On Tell Atlas it reaches 6,000 ft. Tree layer is Portuguese oak by itself, or mixed with Afarès oak, service tree, maple, and, more rarely, holm or cork oak.

	<i>Density and height</i>	<i>Undergrowth</i>
11. Afarès oak (<i>Quercus afares</i>)	High forest with continuous canopy—lighter than Portuguese oak.	Shrub layer not very dense and includes tree heath, brooms, butcher's broom, and bramble. Field layer of herbs well developed.
12. Elm and ash (<i>Ulmus campestris</i> and <i>Fraxinus oxyphylla</i>)	High forest with continuous and thick canopy.	Abundant undergrowth composed of mixture of shrubs with deciduous leaves such as hawthorn and sloe, and others with persistent leaves, including myrtle and lentisk. Woody climbers and clambering plants very common.
13. River-bank woods and brushwoods	Usually narrow, but sometimes dense, belt.	Dense shrub layer composed of oleander, tamarisk, willow, or chaste tree. Woody climbers often abundant. Herbaceous layer formed of plants characteristic of damp soils.
14. Atlantic turpentine tree or betoum (<i>Pistacia atlantica</i>)	..	..

(D) BRUSHWOOD

15. High mountain brushwood	..	..
16. Jujube or lotus (<i>Zizyphus lotus</i>)	Consists of high bushes fairly close together, interspersed with small trees never more than 20 ft. high.	Herbaceous layer largely formed of grasses.

<i>Climatic conditions</i>	<i>Soils</i>	<i>Other notes</i>
Rainfall exceeding 32 in. a year.	Grows on non-calcareous soils.	Usually between 2,000 and 5,000 ft., though sometimes lower (e.g. 500 ft. in the Kabylie de Collo, near el Milia). Tree layer usually Afarès oak alone, but sometimes mixed with Portuguese oak. Degradation stages are oak brushwood, diss grassland, and bracken communities.
In areas with relatively high rainfall, unless soil water-table is high.	Especially developed on loose or mobile soils and clays.	Maquis, grassland, and bracken are successive stages of degradation.
..	Dependent on abundant water.	Commonest tree is white poplar, frequently mixed with black poplar and alder.
Very dry.	Muddy, waterlogged in rainy periods.	Developed in the dayas of High Plateaux. Saharan community only extending into northern Algeria under semi-desert conditions. Sometimes trees are well-spaced and associated with jujube brushwoods.
Cold and severe with short growing season.	Mostly stony and rocky.	Even highest summits of Djurdjura and Aurès (between 7,300 and 7,600 ft.) have natural brushwood.
Low rainfall, 12 to 16 in a year.	Deep soils, sometimes saline.	In alluvial plains or on low hills. Jujube is dominant but sometimes mixed with shrubby member of potato family, cottager's tea shrubs, and sumachs.

(E) STEPPE

	<i>Density and height</i>	<i>Undergrowth</i>
17. Halfa (alfa) (<i>Stipa tenacissima</i>)	Large tufts may attain 3 ft. and are sufficiently close together to appear from a distance as a continuous turf. The tufts die at the centre, and break up into a number of separate tufts.	..
18. Chih or white worm-wood (<i>Artemisia herba-alba</i>)	Grows in spaced tufts.	..
19. Sparte (<i>Lygeum spartum</i>)	..	..
20. Drinn (<i>Aristida pungens</i>)	Tufts are lower than those of halfa and sparte.	..
21. Marram or oyat (<i>Amphila australis</i>)	Up to 4 or 5 ft.	..
22. Salt steppes	Usually less than 1 ft.	..

<i>Climatic conditions</i>	<i>Soils</i>	<i>Other notes</i>
Only grows naturally where yearly rainfall does not exceed 20 in. Extremely resistant to drought.	Cannot withstand stagnant water at its roots or high concentrations of mineral salts in the soil.	Very few other plants accompany the halfa, except ephemerals.
Abundant in insufficiently watered areas.	Muddy alluvial and clay plains, depressions, and valley bottoms which are not saline.	Passes gradually, according to varying soil conditions, into sparte or drinn communities. Accompanied by another wormwood, a chenopod, some sparte grass, and, in the spring, numerous annuals.
Abundant in insufficiently watered areas.	Dominant on clay or saline soils.	Often mixed with wormwoods and, between the tufts, a number of other perennial herbs and rare annuals.
Arid to desert conditions.	Sandy soils.	Can withstand both the piling up of sand and prolonged wilting. The leaves are hard and roll up in a dry atmosphere.
Mediterranean coastal climate.	Mobile sands.	Limited to a narrow strip on the seaward side of mobile coastal dunes. Another grass (<i>Sporobolus pungens</i>) occurs with it; bulbous and rhizomatous perennial herbs and a number of annuals also occur.
Arid to desert conditions.	These occupy the clay basins rich in mineral salts, e.g. sodium and magnesium chlorides, magnesium and sodium sulphates, and calcium carbonate.	Occur both near the coast and in the interior, and are particularly extensive around the chotts.

III. Arabic and Berber Names of Important Plants

	<i>Arabic</i>	<i>Berber</i>
Acacia (gum)	thala or talha	azouka
Aleppo pine	snouber	taida
Alfa	halfa	ari
Atlas cedar	arez, meddad	inguel, begnoan
Atlantic turpentine tree	betoum	igg
Barbary thuya	arar	amelzi, azouka
Cork oak	fernana	tafrent, izgui
Diss	diss	atles
Dwarf palm	doum	tizzemt
Gum (acacia)	thala or talha	azouka
Halfa	halfa	ari
Holm oak	guerrouch	asaf
Irak	irak	..
Jointed tamarisk	tlaia (plur. ethel) or tarfa	takaout
Jujube	sedra	azeggar
Lentisk	derou	fadis
Lotus	sedra	azeggar
Mastic	derou	fadis
Oleander	defla	..
Olive	zebbouj or zeitoun	azemmour
Orach	guettaf	..
Portuguese oak	zan, zen	techt, tacht
Red juniper	tagga	ahifs
Sparte	sennar	..
White wormwood	chih	izri
Zen oak	zan, zen	techt, tacht

APPENDIX D

ROMAN ALGERIA

(Fig. 46, Photos. 54-6)

THE ruins of Roman civilization in Algeria are so remarkable and so extensive that the following technical explanation may be of interest. It deals mainly with the period before the decline of the Roman Empire and the change of system made by Diocletian (A.D. 284-302).

Roman Algeria was eventually divided between three provinces. *Mauretania Caesariensis* lay west of the Ampsaga river (Oued el Kebir); its eastern portion, the region of Sétif (Sitifis) between the Oued el Kebir and the Oued Sahel, formed a sub-province called *Mauretania Sitifensis*. *Numidia* was the area between the Ampsaga and the frontier of modern Tunisia except for the north-eastern corner including Bône, Guelma, and Souk Ahras. This latter district belonged to the province of *Africa Proconsularis* which otherwise nearly coincides with Tunisia. The most heavily populated parts in antiquity were:

- (a) The coastal plains and the more open of the river valleys.
- (b) The central plains and the mountains bordering them, extending from *Mauretania Sitifensis* through *Numidia* to the broken mountain country of the Tunisian border, and as far south as the foothills of the Aurès.

In *Numidia* and *Mauretania Sitifensis* Roman influence seems to have spread outwards from the central plains, where the main communications lay. The mountains immediately north of the line Sétif-Constantine-Guelma-Souk Ahras had many ancient settlements, which became rarer and rarer farther north towards the coast. In the south there was a similar thinning out around the chotts. The Roman penetration of the Aurès, though far from complete, was very remarkable. The massif was encircled and a line of romanized settlements held the valleys of the el Abiod, Abdi, and Nerdi. In the northern Sahara not only Biskra but the Oued Djedi was held as far as Mlili and Ouled Djellal.

Mauretania Caesariensis west of the Oued Sahel remained a somewhat empty country. The native Berber communities were thinly scattered, and romanized settlements were rare except in particular coastal regions and valleys, such as the Sahel of Algiers and the Sebaou from Dellys inland to Tizi Ouzou. There were many wild animals, such as elephants and lions, which have long since disappeared with the extension of human settlement. The hold of Roman power and Roman civilization was slight and superficial outside the regions named above. Few Roman or romanized settlements

have been found in the Kabylie country south of the Sebaou valley. A thin line of military posts controlled a military road which ran through the plain south of the Kabylie, along the Chélif valley and westwards along the plateaux to the frontier of Morocco (Mauretania Tingitana).

Towns

The Romans made the town the unit of civilization. Before the conquest there were very few towns in Algeria except the fortress-capitals of the kings, such as Cirta, and a few Phoenician trading stations along the coast. Under Roman influence the native population tended to group itself in towns instead of in villages. These towns, often of considerable size, were built on the same pattern as those of Italy, and became centres for the dissemination of Roman civilization and the Latin language. They were doubtless intended to impress the simple Berber with the wealth and power of the Roman Empire.

The towns were not industrial centres; their wealth was based on agriculture. Their population included the wealthy landowners and small farmers and tenants whose lands were within reach of the town. But all the inhabitants of the city territory (*territorium*), whether they lived inside or outside the towns, were fellow citizens (*municipes, cives*) of the community, voted for the local magistrates (*duoviri, aediles, quaestores*—judges, executive officials, and treasurers) or councillors (*decuriones*) at yearly elections, and enjoyed the various festivals, public games, and theatrical shows which took place in the town. The whole unit was called either a *civitas*, a *municipium*, or a *colonia*. These terms were simply grades of civic dignity and meant 'borough'; the town itself (*oppidum*) was the administrative and economic centre of the self-governing borough in the midst of which it lay. Strictly speaking a *colonia* was a settlement of colonists from Italy or of Roman legionary soldiers, who were sometimes settled on the land when their military service was finished; but during the second century A.D. it became an honorary title.

The Roman towns of Algeria were all very much alike, both in layout and individual buildings. They were usually entered by a triumphal arch, which marked the power of the Roman Empire. The centre of municipal life was the *forum* or town square, where town meetings were held. This was surrounded by public buildings: the *curia* or town hall where the town council (*ordo*) met, the *basilica* or court of justice where the chief magistrates (*duoviri*) held their court, and usually a temple (*aedes*) representing the official cult of the Roman State, dedicated either to the old Roman triad of Jupiter, Juno, Minerva, or to the worship of the Emperors, who were regarded as semi-divine beings. Elsewhere in the town would be numerous other temples. Another group of buildings, often on the outskirts of the town, provided for amusements: a theatre (open to the sky), sometimes an amphitheatre or 'circus', a library, and public baths: these latter (*thermae*) were huge vaulted buildings with an elaborate arrangement of

saloons. The necessities of life were provided by markets (with separate shops or stalls), public fountains, paved streets with side-walks and sewers beneath the pavements, and public latrines. The main street was often colonnaded against the sun. The private houses of the wealthy were built around small colonnaded courts (*atrium*); the poorer classes lived in tenement-like blocks. Water-supply was carefully maintained either by bringing water through an aqueduct from a spring sometimes many miles away, or by storing it in huge underground cisterns. This water was a luxury for personal use and not for agricultural irrigation.

Fortifications

These were not required in the peaceful parts of the Roman Empire during its heyday; hence the cities of which there are substantial remains are unwallled. After the Vandal invasion and the Byzantine reconquest conditions became much more insecure, and walls and fortresses were built. But Byzantine control did not reach beyond eastern Algeria (Numidia), and the small square fortresses resembling medieval castles, still common in Tunisia, are less so in Algeria (Photo. 57).

Churches

After the recognition of Christianity as the official religion by Constantine in A.D. 326 there was a great period of church building in north Africa. Often the material, particularly the pillars, was taken from pagan temples. Many sites are dominated by the ruins of large churches of the basilica type—a long pillared hall with an apse at the east end—dating from the fourth and fifth centuries. Characteristic features are the martyr's tomb, usually in an antechapel at the west end, and the elaborately mosaicked baptisteries.

These features are to be found in ruined cities all over north Africa; the most remarkable sites in Algeria are:

Thamugadi (modern Timgad), lying in rolling steppes north of the Aurès (Photo. 54). This place is notable because the oldest part of the town was built to order by Trajan in A.D. 100. Trajan's town is square, but the place soon spread far beyond and covered a huge area.

Cuicul (modern Djemila), in hilly country north of Sétif. This is a small compact town of irregular shape (dictated by its site), which contrasts with Thamugadi in size, but not in the extravagance of its buildings; it was built a few years earlier (Photos. 55, 56).

Lambaesis, west of Timgad, the Aldershot of Roman Algeria. This for three centuries was the permanent camp of the Roman legion *Tertia Augusta* which formed the core of the Roman army in north Africa. The camp buildings are very well preserved, and adjoining is the town where officers and men lived and kept their families.

Thibilis (modern Announa), just off the main road from Constantine to

Bône and in a rich side valley of the upper Seybouse. This is quite small and very largely in ruins, but has most of the usual features.

Tipasa (Tipaza), on the coast between Algiers and Cherchel. This is the most interesting early Christian site in Algeria, with two great churches, one of which was a shrine to the martyr St. Salsa; around the walls of this church the tombs of the faithful crowd impressively. Tipasa was also a small port dating back to Phoenician times (cf. p. 96 and Photo. 39; and Vol. II, Chap. X).

Theveste (Tébessa), in the steppes east of Timgad. This is not a ruined city, but is noted for the preservation of its Byzantine city wall, complete with triumphal arch, for the only unruined Roman temple in Algeria, and for a ruined but remarkable monastery and church outside the city wall (cf. Photo. 57; and Vol. II, Chap. X).

Defence

Numidia was policed by a force of about 12,000 men consisting of the third Augustan legion—*legio tertia Augusta*—and smaller units called *auxilia*. Mauretania had a garrison only of *auxilia*, totalling some 8,000 men. The legion, 6,000 strong and divided into ten battalions (*cohortes*), was stationed first at Ammaedara (modern Haidra) in Tunisia, about 22 miles north-east of Theveste. With the extension of the settled area in the first century A.D. it was moved west first to Theveste and then to Lambaesis, where it remained till the collapse of Roman power in Africa. Here the legion controlled the main passage south through the Aurès by el Kantara—the Heel of Hercules—and could strike north by an excellent road system to control the semi-nomadic tribes of central and western Algeria. In central Algeria (Numidia) the Romans, during the second century A.D., successfully cantonized such tribes as were unwilling to adopt agriculture and the municipal form of life, and the legion had few military functions to perform until the fourth century. Its main job was not warfare, but engineering and architecture. The legionary soldier was a technician or 'tradesman', both sapper and pioneer. He built roads, bridges, aqueducts, and even whole cities, such as Thamugadi. The legionaries were both the technical corps and the heavy infantry of the army. Light infantry and cavalry were provided by the *auxilia*; they were organized as independent battalions (*cohortes*) of infantry, or mounted infantry (*cohortes equitatae*), either 500 or 1,000 strong, and squadrons (*alae*) of cavalry, 500 strong. These units were recruited from the provincial population and were called after their country of origin, e.g. *cohors Britan-norum*, *ala Syrorum*. After the first century these troops were not normally used in their native country.

Legionary detachments (*vexillationes*) and auxiliary units were used to garrison detached posts, called *stationes*. In Mauretania there was a string of posts along the highway which followed the Chélif valley and struck westwards to the Moroccan frontier. The Aurès massif was controlled by

a string of posts through the el Kantara gap and along its southern edge. There was at least one *statio* in the interior of the massif at Menaa, in the valley of the Oued Abdi.

The most remarkable fact about the standing Roman army in north Africa was its small size compared with the vast area which it had to control. In special crises reinforcements were sent from overseas, but normally the legion and the auxiliary forces were responsible for the maintenance of law and order in Mauretania, Numidia, and also Africa Proconsularis, where no troops were stationed except a single cohort at Carthage. The French required about 60,000 men—before the age of motor transport—to do the work done by the Romans with perhaps a maximum of 20,000. This economy of man-power was only made possible by the excellence of the road system, which gave the military forces great mobility, and by the fact that a rather high percentage of the auxiliary troops were mounted units.

Roads

Roman roads were built by two authorities. The Emperor, that is to say the State, built the grand trunk roads which passed from one end of the province to the other, and the municipalities built their own roads to open up their territory and to link it to the neighbouring municipality. Since the territory of the municipalities was often very extensive these roads were 'county' rather than local roads, and sometimes covered great distances. Some roads that would appear to be national trunk routes were in fact built by the successive efforts of the municipalities which lay along them. The roads were paved and marked by milestones, some of which still remain in position.

The road system consisted of east-west highways which were linked together by groups of roads which radiated from four focal points—Theveste (Tébessa) and Lambaesis south of the central plains, Cirta (Constantine) and Sitifis (Sétif) north of them.

The Grand Trunk Routes. (1) The southern military highway ran from Carthage near Tunis, in Africa Proconsularis, south-west to Theveste, and thence west along the Aurès foothills to Thamugadi and Lambaesis. (2) The northern military highway, branching off from this road in western Tunisia, crossed the modern frontier at Naraggara (east of Souk Ahras), whence it ran through hilly country to the valley of the Oued bou Merzoug at Sigus, which it followed to Cirta. It then continued west to Sitifis by two routes, either south of the mountains through the upper valley of the Rummel, or north of the massif by Cuicul (Djemila). From Sitifis a single route continued westward by Auzia (Aumale) across the plateau, passing 25 to 40 miles to the south of the Djurdjura to the Chélif valley, and thence through Relizane by a direct route to Tlemcen and Mascara. (3) A coast road of little military importance linked the various ports west from Tunisia to Portus Divini (Oran), making

considerable detours inland to avoid mountain blocks such as the Edough massif.

The main transverse roads, centred on the four nodal points of eastern Algeria, were as follows:

From Theveste on the southern trunk route roads ran north-west to Cirta on the northern trunk road; north, crossing the same road, to the coast road at Bône (Hippo Regius); south-east into southern Tunisia; and south to the military stations beyond the Aurès.

Lambaesis, at the end of the southern trunk road, was linked north-east to Cirta by more than one route, north-west to Sitifis, west through the Hodna basin to Auzia (Aumale) on the northern trunk road, and south through el Kantara to Biskra and the military stations beyond the Aurès (also reached from Theveste).

From Cirta, on the northern grand trunk route, there was a direct cross-country route north to the port of Rusicade (Philippeville). East and north-east a road ran through Calama (Guelma) to the port of Hippo Regius; this used river valleys but did not follow the main stream of the Oued Seybouse. Roads already described led south-east to Theveste and south-west to Lambaesis.

Sitifis on the northern trunk route was linked north-west to the coast by a devious route which led to the Oued Sahel and down the valley to Saldae (Bougie). North-east to the coast at Igilgili (Djidjelli) went a winding route through the Petite Kabylie, partly by river valleys and partly over mountain ridges. South-east was the road to Lambaesis.

The only complex road system in the west was in the region of Icosium (Algiers). The coast route ran through the Sahel, joining Cissi (Dellys) through Icosium to Tipasa and Caesarea (Cherchel), the capital of the province of Mauretania. This road was linked to the grand trunk artery of the province by a short road which ran from between Caesarea and Tipasa south to the upper Chélif valley at Aquae. From Aquae a transverse road ran north-east directly across the Mitidja to the coast route east of Cap Matifou.

APPENDIX E

NOTE ON CUSTOMS AND MANNERS

THE following notes on conditions of life, as they affect the non-Moslem foreigner, may be useful: they apply especially to the country and the oases, where tradition is strong and the foreigner may be treated with reserve.

The flat roofs of native houses are reserved primarily for women of the household: the master of the house may go there if he desires, but visitors will not be taken there unless the women have first been removed. Intrusion, whether it be through ignorance or military circumstances, will certainly lead to trouble. The necessity for observance of the rule is perhaps more urgent during hot weather when the native family sleeps on the roof.

A Moslem's house is his castle: strangers will be received in a certain quarter of it, but they will get no farther: if they are escorted to an inner court the women will first be well concealed: they are likely to watch proceedings through lattices and screens, and may be heard to discuss the visitor. A well-meaning visitor will cause umbrage to his host if he takes notice of the presence of the women: it is not politic to do so, nor to inquire after their health. These rules apply equally to the tents of nomads. No stranger will enter the women's quarters under any circumstances. It is a good rule never to speak to a native woman anywhere. Women visitors may be invited to enter the female quarters of a house, and should accept the hospitality.

Moslem girls and women are voluminously dressed and take great care to keep themselves covered. Searching them, should it be necessary, presents great difficulties. Women, preferably Moslem women, must be employed, and even so consternation and lasting hatred will be engendered. It is absolutely essential that searching be avoided if possible. In spite of the extreme views on the seclusion and protection of women held by Moslems, it must not be assumed that women are necessarily held in high regard or affection. Polygamy is much less common than it was, but divorce is simple and not unusual. Unmarried adult daughters are a stigma; marriageable daughters are a financial asset.

European women who go about scantily clad, apeing men in shirts and shorts, and so on, earn the contempt and disgust of Moslem manhood. Moslems do not, in fact, appreciate the wearing of shorts by men, but accept it as a European or military custom. Natives will often finger European clothing out of sheer interest in its quality.

It is not the custom to call on a native of good family and position without due warning. A messenger, servant, or letter should be sent as

long as convenient before the time chosen for the visit, and a reply, usually by a member of the household or a trusted servant, may be expected: this messenger may act as guide at the appointed time. In country districts and in the oases it is likely that a party may ride out to meet a visitor to whom high honour is considered to be due.

Meetings and leave-takings are accompanied by dignified ceremonial to which strict attention must be paid: grave insult may be given by Europeans who fail to observe the custom. A courtesy visit must in no circumstances be hurried: the native is not in a hurry.

It is well to find out—with due discretion—on what scale the native of distinction expects to receive or intends to show hospitality: customs are well known among the people. If time is no object and the native hospitable, he will give, and expect, a formidable meal, chickens, sheep, and the like being slaughtered for the purpose. Celebration of this sort, in which considerable numbers may take part, may assume astonishing proportions. The native can eat enormous quantities of food on such occasions, and he regards as impolite or second-rate the European who does not do likewise.

As an alternative to this feast a European may be invited to lunch in a native house: his host may withdraw during the meal, the European's servant then waiting upon his master, not infrequently taking his own cutlery, plates, &c., for the purpose.

Alternatively tea or coffee may be taken in company with considerable ceremony. It is frequently sufficient for the European, especially if he is on a journey, to invite his host or visitor to take tea or coffee with him in his camp: a gift—sugar, tea, or some personal possession according to the status of the parties concerned—will usually be acceptable: it should be presented with due dignity.

Old men are much respected by the young and have much influence: Europeans should show them marked courtesy.

Most of the above notes refer also to dealings with Berbers (including the Touareg) and Jews, but among these peoples women do not occupy a secluded position and are not veiled (p. 229).

It should be remembered that nomads and most rural people in north Africa, even if half starved and dressed in rags, are proud, independent, and virile, and resent bullying or undignified treatment: if these virtues are appreciated and respected by Europeans, relations should be harmonious and advantageous. There are, nevertheless, groups which, through long misfortune, poverty, disaster, or natural inclination, are outcasts, thieves, or dissidents: they are well known in their own districts and due precaution must be taken in dealing with them.

Holy places of all types are to be found throughout Algeria: some are Moslem, others are of far more ancient origin. They may be marked by trees, rings of stones, flags, or rags tied to sticks or trees: they may be unmarked, but will be well known to local guides. These places are best

avoided: many of them are associated with saints and spirits, and meddling with them may cause grave disquiet, which is likely to be associated with the evil eye or ill-fortune in one of many forms.

Native cemeteries, mosques, and places of worship should be avoided by all Europeans and foreigners associated with them, especially during feasts, fasts, and gatherings, when religious and racial feelings may run high.

Photography of any of the above, and frequently of men, women, and children, should only be allowed after consulting local opinion: it also is associated with the evil eye. The use of optical instruments, including surveying equipment, may also give rise to native suspicion. In the towns, and in districts where there has been long association with Europeans, most of the rules suggested above may be relaxed in some degree.

Throughout Africa the native attitude to animals differs greatly in certain respects from that which is the code of most Anglo-Saxons. Native owners take a pride in well-bred or pedigree stock, whether horses, camels, cattle, or sheep: they value them as possessions, as visible wealth, and therefore take considerable trouble to maintain their condition and to dress wounds, though the treatment may be painful and seem cruel. The native rarely considers the question of inflicting or relieving pain, and will cause pain as a means to an end: he will prick on or flog an animal until it dies, but he is totally unconscious of any wrong-doing. Left to himself he treats his own kind in the same way: to him human life has little value unless a blood feud is involved. Indignant Europeans, unused to cruelty to animals, may try to intervene and be mixed up in brawls, the results of which may be serious: direct action of this sort does little good and sometimes much harm, and, in any case, is not understood by the natives. The only effective prevention of the ill-treatment of animals is the long-term policy of teaching natives that kindness reaps its own reward, a policy which, though it often seems doomed to failure, has met with surprising success in some parts of Africa. It must be remembered that African standards are not those of the Anglo-Saxon of the twentieth century: the assortment of blind, diseased, and verminous children and beggars outside any mosque illustrates an attitude of mind rather than a social ill.

To the Moslem the pig is unclean, and so he does not rear it or keep it in his house or tent as he keeps his savage, half-wild dogs or his pure-bred hounds: but to call him a dog, or the son of a dog, is an insult that may easily end in trouble. Such apparent inconsistencies are firmly established in most creeds and races. Finally it should be remembered that to the less sophisticated of the peoples of Algeria many European practices are as inexplicable or as distasteful as some of their own may be to Europeans.

APPENDIX F

THE MOSLEM CALENDAR AND FESTIVALS

Calendar

THE Hegira, or flight of Mohammed from Mecca to Medina, is reckoned to have taken place on the night of 20 June A.D. 622. The Mohammedan era, instituted seventeen years later by the Caliph Omar, dates from the first day of the first lunar month, Moharram (Thursday, 15 July A.D. 622). The years are lunar and consist of twelve lunar months, each beginning with the approximate new moon, without any intercalation to keep them in step with the solar months, so that they retrograde through all the seasons in about $32\frac{1}{2}$ years. They are partitioned also into cycles of 30 years, 19 of which are common years of 354 days each, and the other 11 intercalary years, having an additional day added to the last month.

Lunar Months (Shuhur Kamariyeh)

Moharram	.	.	.	.	.	30 days
Safar	.	.	.	.	.	29 „
Rabi el Awal	.	.	.	.	.	30 „
Rabi et Thani	.	.	.	.	.	29 „
Jumada el Oula	.	.	.	.	.	30 „
Jumada et Thaniya	.	.	.	.	.	29 „
Rajab	.	.	.	.	.	30 „
Shaban	.	.	.	.	.	29 „
Ramadan	.	.	.	.	.	30 „
Shawal	.	.	.	.	.	29 „
Zul Kadeh	.	.	.	.	.	30 „
Zul Hija	.	.	.	.	.	29 days (or, intercalary years, 30)

The beginning of the civil month may differ from that of the religious month by one or two days; the latter begins at sunset of the day when the new moon is first seen after sunset, or at latest on the third evening after astronomical new moon. To avoid confusion official documents are dated by the day of the week as well as the day of the month.

The Moslem day begins at sunset, not midnight. Hence the night of the sixth in European style is the night of the seventh in Moslem style.

Festivals

The principal Moslem festivals are:

<i>Festival</i>	<i>Date</i>
New Year	1 Moharram
Yom Ashura (date of Noah leaving the Ark, and of the death of Husein at Kerbela)	10 Moharram

<i>Festival</i>	<i>Date</i>
Muled el Nebi (Mohammed's birthday)	12 Rabi el Awal
Muled el Husein	6-29 Rabi et Thani
Lailat el Raghaib (night of Mohammed's conception)	Eve of first Friday in Rajab.
Muled el Sayida Zenab (festival of this granddaughter of Mohammed)	15 Rajab
Lailat el Meraj (night of Mohammed's ascension)	27 Rajab
Lailat al Baraat (Night of Decrees, when the guardian angels receive from the Almighty tablets recording the fate of their charges in the coming year)	15 Shaban
Ramadan	1-30 Ramadan
Lailat el Kadr (Night of Power, on which the requests of all worshippers are believed to be granted)	27 Ramadan
Id el Fetr (Sheker Bairam—3 days)	1-3 Shawal
Arafeh (the eve of En Nahar)	9 Zul Hija
Id el Adha or En Nahar (Kurban Bairam—3 days; sacrifice of a sheep to commemorate Abraham's willingness to slay his son)	10-12 Zul Hija

APPENDIX G

GLOSSARY

MOST of the words in this glossary are Arabic or Berber; some European forms are also included. Wherever possible, page references are given to those terms which are explained in the text. Arabic and Berber names of common plants are given in Appendix C and are not repeated here, nor are the Arabic names of animals (*see* pp. 158-9).

French transliteration is used in conformity with policy, but it should be clearly understood that *ch* is pronounced *sh*, and that *ou*, when followed by a vowel, is pronounced *aw* with consonantal *w*: thus *Chaouia* is pronounced *Shawia*, and *asouak*, *aswak*. The French also omit vowels which are usually included in English renderings: thus *Tnine* is pronounced *Tenine* (the *i* being long). The rendering of vowels in French and English varies: thus *beggara* (French) and *baggara* (English), *cheich* (French) and *shash* (English).

The following abbreviations are used: *abbr.* (abbreviation), *adj.* (adjective), *dimin.* (diminutive), *Eng.* (English), *Fr.* (French), *Ital.* (Italian), *n.* (noun), *p.* (page), *pl.* (plural), *sing.* (singular), *Sp.* (Spanish).

Abankor, shallow well (in Sahara) (p. 76).

Abou, bou, father of, owner of.

Acheb, type of desert vegetation (p. 152).

Adrar (pl. *idraren*), mountain.

Agadir (pl. *igoudar*), escarpment, fortress.

Aghbalou (pl. *ighboula*), spring.

Agouni, plateau (p. 38).

Aguelman, aguelmam, lake.

Ain (pl. *aioun*), spring, well.

Aioun (sing. *ain*), springs, wells.

Ait (sing. *ou*), children of.

Ali, high.

Amin, amim, amrar, chief of a village (p. 216).

Ank, pass, defile.

Anse (Fr.), bay, creek.

Arba, four, Wednesday.

Areg (sing. *erg*), sand-dunes (p. 27, Photo. 4).

Arrem, small open village or enclosure (p. 77, Photo. 26).

Asif (pl. *isaffen*), stream.

Azrou, rock.

Azzaben, Mozabite clerk (p. 224).

Bab (pl. *biban*), entrance, door, gate (p. 56).

Baraka, divine blessing.

Baten, steep cliffs (p. 71).

Beggara, baggara, cattle farmers (p. 217).

Bel (abbr. of *ben el*), son of.

Ben (pl. *bemi*), son of.

Biban (sing. *bab*), entrances, doors, gates (p. 56).

Bir (pl. *biar*), well (p. 80, Photo. 31).

Blad, small town.

Bled, countryside, region, territory of.

Blida (pl. *bouldane*), town.

Bordj (pl. *boroudj*), bastion, tower, rest-house.

Bou, abou, father of, owner of.

Burnous, loose cape with cowl (p. 221).

Cachabia, sleeveless Mozabite tunic (p. 231).

Cadi, kadi (pl. *coudat*), Moslem judge.

Caïd, kaïd (pl. *kiad*), tribal chief.

Calle, cala, kalaa, creek, cove.

Chaba, chabet (pl. *chaab*), gorge, defile.

Chadouf (Eng. *shaduf*), method of irrigation (p. 80, Photo. 30).

- Chebka*, streams and criss-crossed valleys, chaotic area (p. 69, Photo. 21).
Chechia, turban.
Chehili, *chili*, desert sirocco (p. 132).
Cheich, piece of white cloth wound round the turban (p. 182).
Cheikh (pl. *chioukh*), old man, chief (p. 216).
Cherg, east.
Chergui (pl. *cheraga*), oriental, from the east, east wind (p. 115).
Cherif (pl. *churfa*), holy man (p. 223).
Chili, *chehili*, desert sirocco (p. 132).
Chott (Eng. *shott*), salt marsh or lake (p. 25, Photo. 19).
Chriat, natural artesian spring (p. 72).
Churfa (sing. *cherif*), holy men (p. 223).
- Dahra*, north.
Daia, *daya*, low wet ground, marshy depression (pp. 69, 154).
Dar, house, habitation of.
Daya, *daia*, low wet ground, marshy depression (pp. 69, 154).
Dir, cultivated area (p. 47).
Djama (pl. *djouama*), mosque.
Djebel (pl. *djebal*), (Eng. *jebel*), mountain.
Djebila (pl. *djebilat*), small mountain.
Djemaa (pl. *djemoua*), type of council (p. 216), Friday.
Djemala, camel owners (p. 218).
Djerid, country of palms, tribal assembly.
Djezira (pl. *djezirat*), island.
Djorf, escarpment, steep bank.
Djouad, horse, race-horse, desert warrior (p. 231).
Djouf, north.
Douar, group of tents, huts, or families (pp. 216, 220).
Draa, blue cloak (p. 230).
- El*, *ech*, *es*, *et*, &c., the.
Enfida, ravine.
Erg (pl. *areg*), sand-dune, country or group of sand-dunes (p. 27, Photo. 4).
- Fedj*, *feidj*, *gassi*, defile, sand-free corridor (in Sahara) (p. 27).
Fidjij, *figuig*, small defile.
Flidj, strip of material (p. 220).
Foggara (pl. *fegaguir*), method of obtaining water by an underground channel (p. 82, Photo. 33).
- Fondouk*, *fondak*, covered market, inn.
Fouk, above, top.
Foum, mouth, opening (in Sahara).
Fouta, waist cloth (p. 221).
- Gada*, plateau with vertical cliffs (p. 48).
Gandoura, white woollen cloak, gown (p. 221).
Gara, *garet* (pl. *gour*), isolated, flat-topped hill (p. 69, Photo. 20).
Gassi, *fedj*, *feidj*, defile, sand-free corridor (in Sahara) (p. 27).
Gharb, west.
Gharbi, western, west wind.
Ghlila, jacket made of silk (p. 221).
Ghorfa, grotto, creek, bay.
Gour (sing. *gara*, *garet*), isolated, flat-topped hills (p. 69, Photo. 20).
Gourbi, hut, temporary dwelling (p. 220, Photo. 61).
Guebli, southern, south wind (p. 115).
Guelaa, *kalaa*, *kelaa*, fortress, often used as a granary (p. 61).
Guelta (pl. *ogla*, *oglat*), pool, well.
Guerra, *guera*, marsh, rain.
Guettar, place where water falls drop by drop.
- Had*, one, Sunday.
Hadar, town-dwellers (p. 218).
Hadjeb (pl. *houadjeb*), side of mountain.
Haik (pl. *hiyyak*), long white robe (p. 221).
Hamma, warm spring.
Hammada, *hamada*, rocky plateau (pp. 23, 68; Photo. 18).
Hammam, bath.
Hank, tributary.
Haratin, Berber-negro half-castes (p. 231).
Hassi (pl. *houasi*, *hasian*), well, water-point.
Hezzab, official of a mosque (p. 222).
Hodna, plain surrounded by mountains.
Horma, honour (of a tribe) (p. 216).
- Ida*, sons of.
Ighzer (pl. *ighzran*), ravine, stream.
Imam, leader of prayers in a mosque (p. 222).
Imi (pl. *imiouen*), door, mouth, opening.
Imin, defile.
- Ƶ. See under *Dj*.

- Kadi, cadi* (pl. *coudat*), Moslem judge.
Kaïd, caïd (pl. *kiad*), tribal chief.
Kalaa, cala, cove.
Kalaa, kela, guelaa, fortress, often used as a granary.
Kantara, kantra, kantret, kentra (pl. *knater*), arch, bridge.
Kasba, kasbah, kasbet (pl. *ksabi*), citadel, stronghold (p. 71).
Kbila (pl. *kbayil*), small autonomous group of people (p. 216).
Kebir, great, chief of a village (p. 216).
Kef (pl. *kifan*), rock, cliff, hill (p. 69).
Kelaa, kalaa, guelaa, fortress, often used as a granary (p. 61).
Kentra, kantra, kantara, arch, bridge.
Khamsa, five.
Khandek, drainage canal (p. 73).
Khanga (pl. *kheneg, kheng*), defile, gorge.
Khatib, official of a mosque (p. 222).
Khemis, Thursday.
Kheneg, kheng (sing. *khanga*), defiles, straight gorges (p. 50).
Kifan (sing. *kef*), rocks, cliffs, hills (p. 69).
Knitra (dimin. of *kantra*), small bridge.
Koubba (pl. *kebeb*), sanctuary, room, dome, tomb of Moslem saint (p. 222).
Ksar (pl. *ksour*), fortified town, walled village (pp. 65, 83).
Ksabi (sing. *kasba*), citadels, strongholds (p. 71).
Ksour (sing. *ksar*), fortified towns, walled villages (pp. 65, 83).
- Lalla*, Lady (title of female saint).
Litham, veil worn by Touareg men (p. 229, Photo. 67).
Loul, grains of drinn (p. 149).
- Ma*, water.
Macchia (Ital.), *maquis* (Fr.), thicket.
Maden, madene, mineral, mine.
Maghreb, west, sunset.
Mahdi, messiah (p. 223).
Malhafa, blue tunic (p. 230).
Maquis (Fr.), *macchia* (Ital.), thicket.
Marabout, mrabit (pl. *mrabitin*), Moslem priest or saint, holy man (p. 222).
Mascara, camp.
Marsa, mers, mersa, mersat (pl. *mrasi*), port, anchorage.
Mechra, ford.
- Medina, medinet* (pl. *medoun*), Arab town.
Mehasser, isolated mass of rock in valleys (in Sahara) (p. 69).
Medjez, meguez, ford.
Mela, melah (adj.), *melh* (noun), salt.
Mellah, Jewish quarter (p. 218).
Merdja, merja (pl. *mroudj*), marsh.
Mers, mersa, mersat, marsa (pl. *mrasi*), port, anchorage.
Mouderris, official of a mosque (p. 222).
Mouekkit, official of a mosque (p. 222).
Mrabit, marabout (pl. *mrabitin*), Moslem priest or saint, holy man (p. 222).
Muezzine, official of a mosque (p. 222).
Mufti, interpreter of Moslem law (p. 222).
- Nador*, watch-tower, semaphore.
Nahr, river.
Nebka, small dune (p. 155).
Noria, waterwheel (p. 82).
Nouala (pl. *nounail*), hut (p. 79).
- Oghourd*, pyramid sand peaks (in Sahara) (p. 27).
Ogla, oglat (sing. *guelta*), group of wells.
Ou (pl. *ait*), son of.
Oued (pl. *ouidan*) (Eng. *wadi, wad*), river, stream, dry watercourse.
Ouled, sons of.
Oum, mother of, head of a valley.
Outa, plain.
- Ras* (pl. *rous*), cape, headland, summit.
Reg, stony plain (p. 27, Photo. 3).
Rh, see under *Gh*.
Rio (Sp.), river.
Rmel, sand, sandy earth.
- Sahel*, coast, shore.
Sahra, sahara, wilderness, desert (p. 131).
Scirocco, sirocco, dry south wind (p. 114).
Sebaa, seven.
Sebkha (Fr. *sebkra, sebkret*), salt lake, often dry; enclosed basin (p. 38).
Sebt, Saturday.
Seguia (pl. *souagui*), irrigation channel, distributing canal (p. 82, Photo. 32).
Seif, sif, dune (p. 27).
Serroual, sarwal, wide trousers worn by women (p. 221).
Sh. See under *Ch*.

- Si*, Sir, Mr. (used before name of educated person).
Sidi, Master (used before name of noble or saint).
Sif, *seif*, dune (p. 27).
Sirocco, *scirocco*, dry south wind (p. 114).
Smala, small fort occupied by Spahis (native cavalry in French service).
Sof, group of blood-relations (p. 216).
Souk (pl. *asouak*), market, market-place (p. 218), often followed by the day of the market: e.g. *Souk el Had*, Sunday market.
Soumaa, *soummam* (pl. *souama*), minaret.
- Taddert*, *thaddert*, group of tents, huts, or families (in Kabylie) (p. 216).
Taksebt, citadel.
Tala, *talaint*, spring.
Tamgout, summit, peak.
Tanezrouft, absolute desert (p. 79).
Taourirt, small peak.
Tarf, cape.
Tassili, barren plateaux (pp. 23, 75).
- Tell*, inhabited and partly cultivated high ground.
Ténéré, absolute desert (p. 80).
Tenia, *teniet*, pass.
Thaddert, *taddert*, group of tents, huts, or families (in Kabylie) (p. 216).
Thaguelat, *guelaa*, fortress, often used as a granary (p. 61).
Timchent, type of mortar of limestone and gypsum (p. 71).
Tit (pl. *titaouine*, *tetaouene*), spring, source, eye.
Tizi, pass, col.
Tleta, three, Tuesday.
Tnine, two, Monday.
Toub, mixture of clay and chopped straw, for building purposes (p. 220).
- Wad*, *wadi* (Fr. *oued*), river, stream, dry watercourse.
- Zab* (pl. *ziban*), oasis (p. 51).
Zaouia, shrine, monastery (p. 223).

APPENDIX H

LITERATURE, MAPS AND CHARTS, AND AUTHORSHIP

LITERATURE

No geographical handbook of Algeria was published by the Admiralty during the War of 1914-18, and the geographical literature is mainly in French. Relatively little is available in English apart from a number of books of varying quality written by travellers. The following list includes some of the books and articles that have been found useful in the preparation of this volume, but it is not to be regarded as a complete guide to the geographical literature. Bibliographies will, however, be found in many of the publications included below.

GENERAL

- BERNARD, A. *L'Algérie* (7th edition) (Paris, 1929).
— *Afrique septentrionale et occidentale* (Géographie Universelle, edited by P. Vidal de la Blache and L. Gallois). Tome xi (i), 'Généralités—Afrique du Nord' (Paris, 1937). Tome xi (ii), 'Sahara—Afrique occidentale' (Paris, 1939).
— and LARNAUDE, M. *Algérie, Sahara algérien* (Livret-guide de l'Excursion B4: Congrès international de Géographie, Paris, 1931) (Paris, 1931).
— and ROQUEVAIRE, R. de Flotte de. *Atlas d'Algérie et de Tunisie* (fascicules i-xv) (Algiers and Paris, 1923-35).
GAUTIER, E. F. *L'Afrique blanche* (Paris, 1939).
— *Le Sahara* (Paris, 1928).
— SAVORNIN, J., and others. *Les Territoires du Sud de l'Algérie* (4 vols.) (Algiers, 1930).
TURNBULL, P. *Sahara Unveiled: a Great Story of French Colonial Conquest* (London, 1940).
Mélanges de Géographie et d'Orientalisme offerts à E. F. Gautier (Tours, 1937).

ATLASES AND MAPS

- Algérie: Atlas historique, géographique, et économique* (Paris, 1934) (text with various maps).
Atlas des colonies françaises, protectorats, et territoires sous mandat de la France (Paris, 1932) (text and maps).
Carte géologique internationale de l'Afrique (1/5,000,000) (Paris, 1936).
Service de la Carte Géologique (maps, 1/50,000, and memoirs).
The various topographical maps published by the Service Géographique de l'Armée are described below (pp. 273-4).

RELIEF, DRAINAGE, AND GEOLOGY

- BOURCART, J. 'Sahara algérien' in *La Géologie et les mines de la France et d'Outre-Mer* (Paris, 1932).
- DALLONI, M. *Géologie appliquée de l'Algérie* (Coll. Cent. Algérie) (Algiers, 1939).
- GLANGEAUD, L. *Géologie de la province d'Alger* (Bordeaux, 1932).
- KRENKEL, E. *Geologie Afrikas*, vol. iii (Berlin, 1938).
- PERRET, R. 'Le Relief du Sahara', *Rev. géogr. phy.* viii (1938), p. 211.
- SANDFORD, K. S. 'Observations on the Geology of Northern Central Africa', *Quart. Journ. Geol. Soc., London*, xciii (1937), p. 534.
- SAVORNIN, J. *La Géologie algérienne et nord-africaine depuis 1830*. (Coll. Cent. Algérie) (Algiers, 1931).

COAST

- LESPÈS, R. *Alger, étude de géographie et d'histoire urbaines* (Paris, 1930).
- *Oran, étude de géographie et d'histoire urbaines* (Paris, 1938).
- Mediterranean Pilot*, vol. i (7th edition) (Hydrographic Department, Admiralty, London, 1937).

CLIMATE

- BROOKS, C. E. P. 'Le Climat du Sahara et de l'Arabie', in *Le Sahara*, vol. i (i), edited by M. Hachisuka (Paris, 1932).
- CAPOT-REY, R. 'Une Carte des pluies et des crues au Sahara', *Annales de Géographie*, xlix (1940), p. 223.
- KNOX, A. *The Climates of the Continent of Africa* (Cambridge, 1911).
- PERRET, R. 'Le Climat du Sahara', *Annales de Géographie*, xlv (1935), p. 162.
- ROUCH, J. *Notice météorologique sur les côtes de France et d'Algérie* (Paris, 1929).
- Weather in the Mediterranean*. Vol. i, General information (Meteorological Office, London, 1937). Vol. ii, Local information (Meteorological Office (Naval Division), London, 1936).

The following refer to the problem of possible climatic changes within historic times in northern Africa, including the Sahara.

- BOVILL, E. W. 'The Sahara', *Antiquity*, (iii) (1929), p. 414.
- JONES, B. 'Desiccation and the West African Colonies', *Geogr. Journ.* xci (1938), p. 401.
- STEBBING, E. P. 'The Threat of the Sahara', *Journ. Roy. Afr. Soc.* xxxvi (1937) (supplement).

Note. A recent publication (J. GOTTMAN, 'New Facts and some Reflections on the Sahara', *Geogr. Rev.*, xxxii (1942), p. 659) reviews the modern work by R. Capot-Rey and others on Saharan climate, and develops the theory that 'hydrogenesis' (substantially the natural condensation of the moisture in air spaces in rock or soil) provides a proportion of the water-supply of foggaras (cf. p. 82).

VEGETATION

- BATTANDIER, J. A., and TRABUT, L. *Flore analytique et synoptique de l'Algérie et de la Tunisie* (Algiers, 1904).
- CANNON, W. A. *Botanical Features of the Algerian Sahara* (Washington, 1913).
- CHIPP, T. F. 'The Vegetation of the Central Sahara', *Geogr. Journ.* xxvi (1930), p. 126.
- MAIRE, R. *Carte phytogéographique de l'Algérie et de la Tunisie* (Algiers, 1926).
- RIKLI, M., SCHRÖTER, C., and TANSLEY, A. G. 'Vom Mittelmeer zum Sahara-Atlas', *Karsten v. Schenck, Vegetationsbilder*, x (1913).
- SUMMERS, T. W. 'Some Impressions of Algerian Forestry', *Empire Forestry Journal*, xviii (1939), p. 235.

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- BUCHANAN, A. *Sahara* (London, 1926).
- BUXTON, P. A. 'Les Conditions de la vie animale dans les déserts', in *Le Sahara*, vol. i (i), edited by M. Hachisuka (Paris, 1932).
- JOLEAUD, L. 'Les Régions zoogéographiques de l'Afrique du Nord', *Revue de Géographie Marocaine*, vi (1928), p. 17.

DISEASES, PESTS, AND HYGIENE

- FOLEY. 'Aperçu de la pathologie indigène dans les Territoires du Sud algérien', *Arch. Inst. Pasteur, Alger*, xvii (1939), p. 1.
- MEUNIER, R. 'Quelques données numériques concernant le typhus exanthématique en Afrique du Nord, et particulièrement en Algérie', *Bull. off. internat. hyg. publ.* xxx (1938), p. 2767.
- PARROT, L. 'Notes sur les phlébotomes: xiii, Stations africaines nouvelles de *Phlebotomus sergenti* Parr., ses rapports avec les leishmanioses', *Arch. Inst. Pasteur, Alger*, xiii (1935), p. 246.
- SENEVET, G. '*Aedes aegypti* en Algérie', *Arch. Inst. Pasteur, Alger*, xvii (1939), p. 598.
- SERGEANT, E., PARROT, L., DONATIEN, E., and LESTOQUARD, F. 'La Prophylaxie de la leishmaniose générale méditerranéenne', *Arch. Inst. Pasteur, Alger*, xvii (1939), p. 221.

HISTORY

- BOVILL, E. W. *Caravans of the Old Sahara* (London, 1933).
- GAUTIER, E. F. *L'Islamisation de l'Afrique du Nord. Les Siècles obscurs du Maghreb* (Paris, 1927). Second (extensively revised) edition, *Le Passé de l'Afrique du Nord. Les Siècles obscurs* (Paris, 1937).
- GSELL, S. *Histoire ancienne de l'Afrique du Nord* (8 vols.) (Paris, 1913-28).
- JULIEN, C. A. *Histoire de l'Afrique du Nord* (Paris, 1931).

PEOPLE

- BERNARD, A. *Enquête sur l'habitat rural des indigènes de l'Algérie* (Algiers, 1921).
- BERTHOLON, L., and CHANTRE, E. *Recherches anthropologiques sur la Berbérie orientale* (2 vols.) (Lyons, 1913).
- HILTON-SIMPSON, M. W. *Among the Hill-folk of Algeria* (London, 1926).
- KIMBLE, G. H. T. 'The Berbers of Eastern Algeria', *Geogr. Journ.* xcvi (1941), p. 337.
- RODD, F. R. *The People of the Veil* (London, 1926).
- SELIGMAN, C. G. *The Races of Africa* (London, 1930).
- WILKIN, A. *Among the Berbers of Algeria* (London, 1900).

GUIDE BOOKS

- ALLEN, E. F. *North Africa* (Morocco, Algeria, Tunisia, and Libya) (Cook's Traveller's Handbook, London, 1933).
- Algeria and Tunisia* (Cook's Traveller's Handbook, London, 1926).
- Algérie et Tunisie* (Les Guides Bleus) (Paris, 1938).

MAPS AND CHARTS

Maps. Algerian mapping is a model of progress, and its coastal areas are better surveyed than the greater part of Metropolitan France. It was in Algeria that the French learned to abandon the traverses necessary in the poor visibility of Europe and took to the plane-table, and also where the French topographers really surveyed instead of relying upon the hand-made reductions of Napoleon's cadastral and communal plans. Surveyors accompanied the army during the conquest and occupation of the country just as Napoleon's armies were accompanied by *officiers topographes*. Little consistent mapping was done, however, before 1840. From that date triangulation began, surveys were 'placed' in their proper positions, and a *Bureau topographique* instituted orderly progress. In 1886 a trigonometrical connexion was made between Algeria and the Spanish coast in much the same way as the Ordnance Survey had connected the triangulations of England and Ireland. Since then topographical surveying has been pushed vigorously and most of the country has been covered. South of about latitude 26° N. the Sahara has not been surveyed in any detail, though there is a good sketch on the scale of 1/1,000,000.

Because it had been decided that the largest scale at which France could afford to map itself was that of 1/80,000, this scale, together with the 1/400,000 and the 1/1,600,000, was at first adopted in Algeria. The maps on these scales have now been discarded, and the maps listed below are those most generally useful to-day. They have all been published by the Service Géographique de l'Armée, but many of them have also been reproduced by the Geographical Section, General Staff, and the G.S., G.S. numbers are appended where appropriate.

1/50,000, covering the whole of the coastal strip to a depth of between 60 and 100 miles (G.S., G.S. No. 4232).

1/200,000, covering the whole country as far south as latitude 26° N. (G.S., G.S. No. 4180).

1/500,000, covering the same area as the 1/200,000 (G.S., G.S. No. 4175).

1/1,000,000. The sheets of the International map covering Algeria are shown in Fig. 3 (G.S., G.S. No. 2465).

1/2,000,000. This map of Africa is the result of French, Belgian, and British co-operation. The sheets covering Algeria are shown in Fig. 3 (G.S., G.S. No. 2871).

1/5,000,000. The 'Afrique Nord-Ouest' sheet of this map (Feuille No. 1) includes the whole of Algeria.

Many town-plans have also been produced recently by G.S., G.S. (No. 4275).

Charts. The following are the numbers of the Admiralty charts and plans of Algeria: 160, 165, 178, 252, 449, 812, 1567, 1710, 1766, 1909, 1910, 2158A, 2437, 2555, 2717, 3301. There is an index to these charts facing p. 1 of the *Mediterranean Pilot*, vol. i (1937). Fuller information is given in the *Catalogue of Admiralty charts and other hydrographic publications*.

AUTHORSHIP

This volume has been written mainly by K. S. Sandford, of the Department of Geology, University of Oxford, and R. W. Steel, of the School of Geography, University of Oxford, with contributions by Winifred M. Meara, Eileen M. Steel, and A. N. Sherwin-White (Fellow of St. John's College, Oxford).

Technical information has been provided by Professor P. A. Buxton (London School of Hygiene and Tropical Medicine), Dr. W. B. Turrill (Royal Botanic Gardens, Kew), Dr. Norman White, Brigadier H. S. L. Winterbotham, Service departments, the Meteorological Office, the Royal Institute of International Affairs, and the Royal Geographical Society.

The text-figures and maps have been prepared by the drawing staff of the Oxford sub-centre under the direction of K. W. Hartland.

APPENDIX

CONVERSION TABLES

METRIC AND BRITISH UNITS

All metallic standards are subject to molecular change. Tables differ according to the date of the comparison on which they rest. These are based on the 1896 comparison between Yard and Metre, which gives:

$$1 \text{ metre} = 39.370113 \text{ inches.}$$

Tables 1 to 6 give the ratios between units of the same sort.

Space, and printing, deny the use of many decimal figures. Therefore such a figure as 0.00000032 is given as 3.2×10^{-7} (which means that the first significant figure is the seventh after the decimal point: 0.0001925 becomes 1.925×10^{-4} , and 0.0000734 is 7.34×10^{-5}).

Tables 7 to 20 give ratios *in extenso* between single units.

These deal with conversions from metric into the equivalent British units.

Figures referring to metric units are given in italics; metric units (1 to 9) are given at the top of each table, reading horizontally from left to right; metric tens read vertically from top to bottom on extreme right and left of the table.

Thus in Table 8, if 87 centimetres are to be converted to inches, the 8 is read on the left edge, and following the horizontal line until it comes in the 7 unit column the answer 34.252 is read.

LIST OF TABLES

1. Units of Length
2. Units of Area
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11. Hectares to Acres
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18. Numbers per Square Kilometre to Numbers per Square Mile
19. Degrees Centigrade to Degrees Fahrenheit
20. Millibars, Millimetres of Mercury, and Inches of Mercury

TABLE 1. UNITS OF LENGTH

Nautical mile	Statute mile	Kilometre	Metre	Yard	Foot	Inch	Centimetre
1	1.152	1.853	1853	2027	6080	72,960	185,300
8.684×10^{-1}	1	1.60934	1609.34	1760	5280	63,360	160,934
5.396×10^{-1}	6.21372×10^{-1}	1	1000	1093.61	3280.84	$39,370.1$	100,000
5.396×10^{-4}	6.21372×10^{-4}	1.0×10^{-3}	1	1.09361	3.28084	39.3701	100
4.934×10^{-4}	5.68182×10^{-4}	9.14399×10^{-4}	9.14399×10^{-1}	1	3	36	91.4399
1.645×10^{-4}	1.89394×10^{-4}	3.048×10^{-4}	3.048×10^{-1}	3.33333×10^{-1}	1	12	$30.48(00)$
1.371×10^{-5}	1.57828×10^{-5}	2.54×10^{-5}	2.54×10^{-2}	2.77778×10^{-2}	8.33333×10^{-2}	1	$2.54(000)$
5.396×10^{-6}	6.21372×10^{-6}	1.0×10^{-5}	1.0×10^{-2}	1.09361×10^{-2}	3.28084×10^{-2}	3.93701×10^{-1}	1

† This is the customary British practice, and not the international nautical mile, of 1852 metres, which Great Britain has not adopted.

Rough rules: 1 millimetre = 0.04 inch.
 1 metre = $\frac{10}{3}$ feet.
 1 kilometre = $\frac{5}{8}$ of a mile.

TABLE 2. UNITS OF AREA

Square mile	Square kilometre	Hectare	Acre	Square metre	Square yard	Square foot
1	2.58998	258.998	640	$258,998 \times 10$	$30,976 \times 10^2$	$278,784 \times 10^2$
3.86103×10^{-1}	1	100	247.106	1,000,000	$119,599 \times 10$	$107,639 \times 10^2$
3.86103×10^{-3}	1.0×10^{-2}	1	2.47106	10,000	11,959.9	107,639
1.5625×10^{-3}	4.04685×10^{-3}	4.04685×10^{-1}	1	4046.85	4840	43,560
3.86103×10^{-7}	1.0×10^{-6}	1.0×10^{-4}	2.47106×10^{-4}	1	1.19599	10.7639
3.22831×10^{-7}	8.36126×10^{-7}	8.36126×10^{-5}	2.06612×10^{-4}	8.36126×10^{-1}	1	9
3.58701×10^{-8}	9.29029×10^{-8}	9.29029×10^{-6}	2.29568×10^{-5}	9.29029×10^{-2}	1.11111×10^{-1}	1

Rough rules: 1 square kilometre = $\frac{3}{8}$ square mile.
 1 hectare = $2\frac{1}{2}$ acres.

TABLE 3. UNITS OF VOLUME

Kilolitre	Cubic metre	Cubic yard	Bushel	Cubic feet	Imp. gall.	Litre	Pint
1	1.000027	1.30799	27.4969	35.3157	219.976	1000	1759.80
9.99973×10^{-1}	1	1.30795	27.4962	35.3148	219.970	999.973	1759.75
7.64532×10^{-1}	7.64553×10^{-1}	1	21.0223	27	168.178	764.532	1345.43
3.63677×10^{-2}	3.63687×10^{-2}	4.75685×10^{-2}	1	1.28435	8	36.3677	64
2.83160×10^{-2}	2.83167×10^{-2}	3.70370×10^{-2}	7.78602×10^{-1}	1	6.22882	28.3160	49.8306
4.54596×10^{-3}	4.54608×10^{-3}	5.94607×10^{-3}	1.25×10^{-1}	1.60544×10^{-1}	1	4.54596	8
1.0×10^{-3}	1.000027×10^{-3}	1.30799×10^{-3}	2.74969×10^{-2}	3.53157×10^{-2}	2.19976×10^{-1}	1	1.75980
5.68245×10^{-4}	5.68260×10^{-4}	7.43258×10^{-4}	1.5625×10^{-2}	2.00680×10^{-2}	1.25×10^{-1}	5.68245×10^{-1}	1

TABLE 4. UNITS OF WEIGHT

Ton	Millier or metric ton	Quintal	Kilogram	lb.
1	1.01605	10.1605	1016.05	2240
9.84207×10^{-1}	1	10	1000	2204.62
9.84207×10^{-2}	1.0×10^{-1}	1	100	220.462
9.84207×10^{-4}	1.0×10^{-3}	1.0×10^{-2}	1	2.20462
4.46429×10^{-4}	4.53592×10^{-4}	4.53592×10^{-3}	4.53592×10^{-1}	1

Rough rule: To turn metric into British tons deduct $1\frac{1}{2}$ per cent.

TABLE 5. UNITS OF PRESSURE

<i>Atmosphere normal</i> 760 mm. Hg at 0° C. ($g = 980.665$ cm. per sec. per sec.)	<i>Bar</i> ($= 10^6$ dynes per sq. cm.)	<i>lb. per sq. inch</i> ($g = 980.665$ cm. per sec. per sec.)	<i>Inches of mercury at 32° F.</i> ($g = 980.665$ cm. per sec. per sec.)	<i>Millibars (1,000 dynes per sq. cm.)</i>
1	1.01325	14.6959	29.9213	1013.25
9.86923×10^{-1}	1	14.5037	29.5300	1000
6.80461×10^{-2}	6.89477×10^{-2}	1	2.03603	68.9477
3.34210×10^{-2}	3.38639×10^{-2}	4.91153×10^{-1}	1	33.8639
9.86923×10^{-4}	1.0×10^{-3}	1.45037×10^{-2}	2.95300×10^{-2}	1

TABLE 6. YIELD PER AREA

<i>Ton per acre</i>	<i>Metric ton per hectare</i>	<i>Quintal per hectare</i>
1	2.51071	25.1071
3.98294×10^{-1}	1	10
3.98294×10^{-2}	1.0×10^{-1}	1

TABLE 7. METRES TO FEET. 1 metre = 3.28084 feet

	0	1	2	3	4	5	6	7	8	9	
1	..	3.3	6.6	9.8	13.1	16.4	19.7	23.0	26.3	29.5	1
2	32.8	36.1	39.4	42.7	45.9	49.2	52.5	55.8	59.1	62.3	2
3	65.6	68.9	72.2	75.5	78.7	82.0	85.3	88.6	91.9	95.1	3
4	98.4	101.7	105.0	108.3	111.6	114.8	118.1	121.4	124.7	128.0	4
5	131.2	134.5	137.8	141.1	144.4	147.6	150.9	154.2	157.5	160.8	5
6	164.0	167.3	170.6	173.9	177.2	180.5	183.7	187.0	190.3	193.6	6
7	196.9	200.1	203.4	206.7	210.0	213.3	216.5	219.8	223.1	226.4	7
8	229.7	232.9	236.2	239.5	242.8	246.1	249.3	252.6	255.9	259.2	8
9	262.5	265.8	269.0	272.3	275.6	278.9	282.2	285.4	288.7	292.0	9
10	295.3	298.6	301.8	305.1	308.4	311.7	315.0	318.2	321.5	324.8	10
11	328.1	331.4	334.6	337.9	341.2	344.5	347.8	351.0	354.3	357.6	11
12	360.9	364.2	367.5	370.7	374.0	377.3	380.6	383.9	387.1	390.4	12
13	393.7	397.0	400.3	403.5	406.8	410.1	413.4	416.7	419.9	423.2	13
14	426.5	429.8	433.1	436.4	439.6	442.9	446.2	449.5	452.8	456.0	14
15	459.3	462.6	465.9	469.2	472.4	475.7	479.0	482.3	485.6	488.8	15
16	492.1	495.4	498.7	502.0	505.2	508.5	511.8	515.1	518.4	521.7	16
17	524.9	528.2	531.5	534.8	538.1	541.3	544.6	547.9	551.2	554.5	17
18	557.7	561.0	564.3	567.6	570.9	574.1	577.4	580.7	584.0	587.3	18
19	590.6	593.8	597.1	600.4	603.7	607.0	610.2	613.5	616.8	620.1	19
20	623.4	626.6	629.9	633.2	636.5	639.8	643.0	646.3	649.6	652.9	20
21	656.2	659.4	662.7	666.0	669.3	672.6	675.9	679.1	682.4	685.7	21
22	689.0	692.3	695.5	698.8	702.1	705.4	708.7	711.9	715.2	718.5	22
23	721.8	725.1	728.3	731.6	734.9	738.2	741.5	744.8	748.0	751.3	23
24	754.6	757.9	761.2	764.4	767.7	771.0	774.3	777.6	780.8	784.1	24
25	787.4	790.7	794.0	797.2	800.5	803.8	807.1	810.4	813.7	816.9	25
26	820.2	823.5	826.8	830.1	833.3	836.6	839.9	843.2	846.5	849.7	26
27	853.0	856.3	859.6	862.9	866.1	869.4	872.7	876.0	879.3	882.5	27
28	885.8	889.1	892.4	895.7	899.0	902.2	905.5	908.8	912.1	915.4	28
29	918.6	921.9	925.2	928.5	931.8	935.0	938.3	941.6	944.9	948.2	29
30	951.4	954.7	958.0	961.3	964.6	967.8	971.1	974.4	977.7	981.0	30
31	984.3	987.5	990.8	994.1	997.4	1000.7	1003.9	1007.2	1010.5	1013.8	31
32	1017.1	1020.3	1023.6	1026.9	1030.2	1033.5	1036.7	1040.0	1043.3	1046.6	32
	1049.9	1053.1	1056.4	1059.7	1063.0	1066.3	1069.6	1072.8	1076.1	1079.4	

	0	1	2	3	4	5	6	7	8	9	
33	1082.7	1086.0	1089.2	1092.5	1095.8	1099.1	1102.4	1105.6	1108.9	1112.2	33
34	1115.5	1118.8	1122.0	1125.3	1128.6	1131.9	1135.2	1138.5	1141.7	1145.0	34
35	1148.3	1151.6	1154.9	1158.1	1161.4	1164.7	1168.0	1171.3	1174.5	1177.8	35
36	1181.1	1184.4	1187.7	1190.9	1194.2	1197.5	1200.8	1204.1	1207.3	1210.6	36
37	1213.9	1217.2	1220.5	1223.8	1227.0	1230.3	1233.6	1236.9	1240.2	1243.4	37
38	1246.7	1250.0	1253.3	1256.6	1259.8	1263.1	1266.4	1269.7	1273.0	1276.2	38
39	1279.5	1282.8	1286.1	1289.4	1292.7	1295.9	1299.2	1302.5	1305.8	1309.1	39
40	1312.3	1315.6	1318.9	1322.2	1325.5	1328.7	1332.0	1335.3	1338.6	1341.9	40
41	1345.1	1348.4	1351.7	1355.0	1358.3	1361.5	1364.8	1368.1	1371.4	1374.7	41
42	1378.0	1381.2	1384.5	1387.8	1391.1	1394.4	1397.6	1400.9	1404.2	1407.5	42
43	1410.8	1414.0	1417.3	1420.6	1423.9	1427.2	1430.4	1433.7	1437.0	1440.3	43
44	1443.6	1446.9	1450.1	1453.4	1456.7	1460.0	1463.3	1466.5	1469.8	1473.1	44
45	1476.4	1479.7	1482.9	1486.2	1489.5	1492.8	1496.1	1499.3	1502.6	1505.9	45
46	1509.2	1512.5	1515.7	1519.0	1522.3	1525.6	1528.9	1532.2	1535.4	1538.7	46
47	1542.0	1545.3	1548.6	1551.8	1555.1	1558.4	1561.7	1565.0	1568.2	1571.5	47
48	1574.8	1578.1	1581.4	1584.6	1587.9	1591.2	1594.5	1597.8	1601.0	1604.3	48
49	1607.6	1610.9	1614.2	1617.5	1620.7	1624.0	1627.3	1630.6	1633.9	1637.1	49
50	1640.4	1643.7	1647.0	1650.3	1653.6	1656.8	1660.1	1663.4	1666.7	1669.9	50
51	1673.2	1676.5	1679.8	1683.1	1686.4	1689.6	1692.9	1696.2	1699.5	1702.8	51
52	1706.0	1709.3	1712.6	1715.9	1719.2	1722.4	1725.7	1729.0	1732.3	1735.6	52
53	1738.8	1742.1	1745.4	1748.7	1752.0	1755.2	1758.5	1761.8	1765.1	1768.4	53
54	1771.7	1774.9	1778.2	1781.5	1784.8	1788.1	1791.3	1794.6	1797.9	1801.2	54
55	1804.5	1807.8	1811.0	1814.3	1817.6	1820.9	1824.1	1827.4	1830.7	1834.0	55
56	1837.3	1840.6	1843.8	1847.1	1850.4	1853.7	1857.0	1860.2	1863.5	1866.8	56
57	1870.1	1873.4	1876.6	1879.9	1883.2	1886.5	1889.8	1893.0	1896.3	1899.6	57
58	1902.9	1906.2	1909.4	1912.7	1916.0	1919.3	1922.6	1925.9	1929.1	1932.4	58
59	1935.7	1939.0	1942.3	1945.5	1948.8	1952.1	1955.4	1958.7	1961.9	1965.2	59
60	1968.5	1971.8	1975.1	1978.3	1981.6	1984.9	1988.2	1991.5	1994.8	1998.0	60
61	2001.3	2004.6	2007.9	2011.1	2014.4	2017.7	2021.0	2024.3	2027.6	2030.8	61
62	2034.1	2037.4	2040.7	2044.0	2047.2	2050.5	2053.8	2057.1	2060.4	2063.6	62
63	2066.9	2070.2	2073.5	2076.8	2080.1	2083.3	2086.6	2089.9	2093.2	2096.5	63
64	2099.7	2103.0	2106.3	2109.6	2112.9	2116.1	2119.4	2122.7	2126.0	2129.3	64
65	2132.5	2135.8	2139.1	2142.4	2145.7	2149.0	2152.3	2155.5	2158.8	2162.1	65
66	2165.4	2168.6	2171.9	2175.2	2178.5	2181.8	2185.1	2188.3	2191.6	2194.9	66

	0	1	2	3	4	5	6	7	8	9
67	2198.2	2201.5	2204.7	2208.0	2211.3	2214.6	2217.9	2221.1	2224.4	2227.7
68	2231.0	2234.3	2237.5	2240.8	2244.1	2247.4	2250.7	2253.9	2257.2	2260.5
69	2263.8	2267.1	2270.4	2273.6	2276.9	2280.2	2283.5	2286.8	2290.0	2293.3
70	2296.6	2299.9	2303.2	2306.4	2309.7	2313.0	2316.3	2319.6	2322.8	2326.1
71	2329.4	2332.7	2336.0	2339.2	2342.5	2345.8	2349.1	2352.4	2355.6	2358.9
72	2362.2	2365.5	2368.8	2372.0	2375.3	2378.6	2381.9	2385.2	2388.5	2391.7
73	2395.0	2398.3	2401.6	2404.9	2408.1	2411.4	2414.7	2418.0	2421.3	2424.5
74	2427.8	2431.1	2434.4	2437.7	2440.9	2444.2	2447.5	2450.8	2454.1	2457.3
75	2460.6	2463.9	2467.2	2470.5	2473.8	2477.0	2480.3	2483.6	2486.9	2490.2
76	2493.4	2496.7	2500.0	2503.3	2506.6	2509.8	2513.1	2516.4	2519.7	2523.0
77	2526.2	2529.5	2532.8	2536.1	2539.4	2542.7	2545.9	2549.2	2552.5	2555.8
78	2559.1	2562.3	2565.6	2568.9	2572.2	2575.5	2578.7	2582.0	2585.3	2588.6
79	2591.9	2595.1	2598.4	2601.7	2605.0	2608.3	2611.5	2614.8	2618.1	2621.4
80	2624.7	2628.0	2631.2	2634.5	2637.8	2641.1	2644.4	2647.6	2650.9	2654.2
81	2657.5	2660.8	2664.0	2667.3	2670.6	2673.9	2677.2	2680.4	2683.7	2687.0
82	2690.3	2693.6	2696.9	2700.1	2703.4	2706.7	2710.0	2713.3	2716.5	2719.8
83	2723.1	2726.4	2729.7	2732.9	2736.2	2739.5	2742.8	2746.1	2749.3	2752.6
84	2755.9	2759.2	2762.5	2765.7	2769.0	2772.3	2775.6	2778.9	2782.2	2785.4
85	2788.7	2792.0	2795.3	2798.6	2801.8	2805.1	2808.4	2811.7	2815.0	2818.2
86	2821.5	2824.8	2828.1	2831.4	2834.6	2837.9	2841.2	2844.5	2847.8	2851.0
87	2854.3	2857.6	2860.9	2864.2	2867.5	2870.7	2874.0	2877.3	2880.6	2883.9
88	2887.1	2890.4	2893.7	2897.0	2900.3	2903.5	2906.8	2910.1	2913.4	2916.7
89	2919.9	2923.2	2926.5	2929.8	2933.1	2936.4	2939.6	2942.9	2946.2	2949.5
90	2952.8	2956.0	2959.3	2962.6	2965.9	2969.2	2972.4	2975.7	2979.0	2982.3
91	2985.6	2988.8	2992.1	2995.4	2998.7	3002.0	3005.2	3008.5	3011.8	3015.1
92	3018.4	3021.7	3024.9	3028.2	3031.5	3034.8	3038.1	3041.3	3044.6	3047.9
93	3051.2	3054.5	3057.7	3061.0	3064.3	3067.6	3070.9	3074.1	3077.4	3080.7
94	3084.0	3087.3	3090.6	3093.8	3097.1	3100.4	3103.7	3107.0	3110.2	3113.5
95	3116.8	3120.1	3123.4	3126.6	3129.9	3133.2	3136.5	3139.8	3143.0	3146.3
96	3149.6	3152.9	3156.2	3159.4	3162.7	3166.0	3169.3	3172.6	3175.9	3179.1
97	3182.4	3185.7	3189.0	3192.3	3195.5	3198.8	3202.1	3205.4	3208.7	3211.9
98	3215.2	3218.5	3221.8	3225.1	3228.3	3231.6	3234.9	3238.2	3241.5	3244.8
99	3248.0	3251.3	3254.6	3257.9	3261.2	3264.4	3267.7	3271.0	3274.3	3277.6
100	3280.8									

TABLE 12. SQUARE KILOMETRES TO SQUARE MILES

1 square kilometre = 0.386103 square miles

[illegible]

TABLE 13. CUBIC METRES TO CUBIC FEET

1 cubic metre = 35.3148 cubic feet

[illegible]

TABLE 14. KILOGRAMMES TO POUNDS

1 kilogramme = 2.20462 pounds

[illegible]

TABLE 15. LITRES TO GALLONS

1 litre = 0.219976 gallons

[illegible]

TABLE 16. METRIC TONS TO TONS

1 metric ton = 0.984207 ton

	0	1	2	3	4	5	6	7	8	9	
..	..	0.984	1.968	2.953	3.937	4.921	5.905	6.889	7.874	8.858	..
1	9.842	10.826	11.810	12.795	13.779	14.763	15.747	16.732	17.716	18.700	1
2	19.684	20.668	21.653	22.637	23.621	24.605	25.589	26.574	27.558	28.542	2
3	29.526	30.510	31.495	32.479	33.463	34.447	35.431	36.416	37.400	38.384	3
4	39.368	40.352	41.337	42.321	43.305	44.289	45.274	46.258	47.242	48.226	4
5	49.210	50.195	51.179	52.163	53.147	54.131	55.116	56.100	57.084	58.068	5
6	59.052	60.037	61.021	62.005	62.989	63.973	64.958	65.942	66.926	67.910	6
7	68.894	69.879	70.863	71.847	72.831	73.816	74.800	75.784	76.768	77.752	7
8	78.737	79.721	80.705	81.689	82.673	83.658	84.642	85.626	86.610	87.594	8
9	88.579	89.563	90.547	91.531	92.515	93.500	94.484	95.468	96.452	97.436	9
10	98.421										10

TABLE 17. QUINTALS PER HECTARE TO TONS PER ACRE

1 quintal per hectare = 0.0398294 ton per acre

	0	1	2	3	4	5	6	7	8	9	
..	..	0.03983	0.07966	0.11949	0.15932	0.19915	0.23898	0.27881	0.31864	0.35846	..
1	0.39829	0.43812	0.47795	0.51778	0.55761	0.59744	0.63727	0.67710	0.71693	0.75676	1
2	0.79659	0.83642	0.87625	0.91608	0.95591	0.99574	1.03556	1.07539	1.11522	1.15505	2
3	1.19488	1.23471	1.27454	1.31437	1.35420	1.39401	1.43386	1.47369	1.51352	1.55335	3
4	1.59318	1.63305	1.67283	1.71266	1.75249	1.79232	1.83215	1.87198	1.91181	1.95164	4
5	1.99147	2.03130	2.07113	2.11096	2.15079	2.19062	2.23045	2.27028	2.31011	2.34993	5
6	2.38976	2.42959	2.46942	2.50925	2.54908	2.58891	2.62874	2.66857	2.70840	2.74823	6
7	2.78806	2.82789	2.86772	2.90755	2.94738	2.98721	3.02703	3.06686	3.10669	3.14652	7
8	3.18635	3.22618	3.26601	3.30584	3.34567	3.38550	3.42533	3.46516	3.50499	3.54482	8
9	3.58465	3.62448	3.66430	3.70413	3.74396	3.78379	3.82362	3.86345	3.90328	3.94311	9

TABLE 19. DEGREES CENTIGRADE TO DEGREES FAHRENHEIT

	<i>Centigrade minus</i>										
	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9	
-2	-4.0	-5.8	-7.6	-9.4	-11.2	-13.0	-14.8	-16.6	-18.4	-20.2	-2
-1	14.0	12.2	10.4	8.6	6.8	5.0	3.2	1.4	-0.4	-2.2	-1
..	32.0	30.2	28.4	26.6	24.8	23.0	21.2	19.4	17.6	15.8	..
..	32.0	33.8	35.6	37.4	39.2	41.0	42.8	44.6	46.4	48.2	..
+1	50.0	51.8	53.6	55.4	57.2	59.0	60.8	62.6	64.4	66.2	+1
+2	68.0	69.8	71.6	73.4	75.2	77.0	78.8	80.6	82.4	84.2	+2
+3	86.0	87.8	89.6	91.4	93.2	95.0	96.8	98.6	100.4	102.2	+3
+4	104.0	105.8	107.6	109.4	111.2	113.0	114.8	116.6	118.4	120.2	+4
+5	122.0	123.8	125.6	127.4	129.2	131.0	132.8	134.6	136.4	138.2	+5
+6	140.0	141.8	143.6	145.4	147.2	149.0	150.8	152.6	154.4	156.2	+6
+7	158.0	159.8	161.6	163.4	165.2	167.0	168.8	170.6	172.4	174.2	+7
+8	176.0	177.8	179.6	181.4	183.2	185.0	186.8	188.6	190.4	192.2	+8
+9	194.0	195.8	197.6	199.4	201.2	203.0	204.8	206.6	208.4	210.2	+9
+10	212.0										+10
	<i>Centigrade plus</i>										
	0	1	2	3	4	5	6	7	8	9	

TABLE 20. PRESSURE: EQUIVALENTS OF MILLIBARS, MILLIMETRES OF MERCURY, AND INCHES OF MERCURY AT 32° F. IN LATITUDE 45°

Mercury in.	Milli- bars	Mercury mm.	Mercury in.	Milli- bars	Mercury mm.	Mercury in.	Milli- bars	Mercury mm.	Mercury in.	Milli- bars	Mercury mm.	Mercury in.	Milli- bars	Mercury mm.
27.02	915	686.3	27.82	942	706.6	28.62	969	726.8	*29.41	996	747.1	30.21	1,023	767.3
27.05	916	687.1	27.85	943	707.3	28.65	970	727.6	29.44	997	747.8	30.24	1,024	768.1
27.08	917	687.8	27.88	944	708.1	28.67	971	728.3	29.47	998	748.6	30.27	1,025	768.8
27.11	918	688.6	27.91	945	708.8	28.70	972	729.1	29.50	999	749.3	30.30	1,026	769.6
27.14	919	689.3	27.94	946	709.6	28.73	973	729.8	29.53	1,000	750.1	30.33	1,027	770.3
27.17	920	690.1	27.97	947	710.3	28.76	974	730.6	29.56	1,001	750.8	30.36	1,028	771.1
27.20	921	690.8	28.00	948	711.1	28.79	975	731.3	29.59	1,002	751.6	30.39	1,029	771.8
27.23	922	691.6	28.03	949	711.8	28.82	976	732.1	29.62	1,003	752.3	30.42	1,030	772.6
27.26	923	692.3	28.05	950	712.6	28.85	977	732.8	29.65	1,004	753.1	30.45	1,031	773.3
27.29	924	693.1	28.08	951	713.3	28.88	978	733.6	29.68	1,005	753.8	30.48	1,032	774.1
27.32	925	693.8	28.11	952	714.1	28.91	979	734.3	29.71	1,006	754.6	30.51	1,033	774.8
27.35	926	694.6	28.14	953	714.8	28.94	980	735.1	29.74	1,007	755.3	30.53	1,034	775.6
27.38	927	695.3	28.17	954	715.6	28.97	981	735.8	29.77	1,008	756.1	30.56	1,035	776.3
27.41	928	696.1	28.20	955	716.3	29.00	982	736.6	29.80	1,009	756.8	30.59	1,036	777.1
27.44	929	696.8	28.23	956	717.1	29.03	983	737.3	29.83	1,010	757.6	30.62	1,037	777.8
27.46	930	697.6	28.26	957	717.8	29.06	984	738.1	29.86	1,011	758.3	30.65	1,038	778.6
27.49	931	698.3	28.29	958	718.6	29.09	985	738.8	29.89	1,012	759.1	30.68	1,039	779.3
27.52	932	699.1	28.32	959	719.3	29.12	986	739.6	29.92	1,013	759.8	30.71	1,040	780.1
27.55	933	699.8	28.35	960	720.1	29.15	987	740.3	29.94	1,014	760.6	30.74	1,041	780.8
27.58	934	700.6	28.38	961	720.8	29.18	988	741.1	29.97	1,015	761.3	30.77	1,042	781.6
27.61	935	701.3	28.41	962	721.6	29.21	989	741.8	30.00	1,016	762.1	30.80	1,043	782.3
27.64	936	702.1	28.44	963	722.3	29.24	990	742.6	30.03	1,017	762.8	30.83	1,044	783.1
27.67	937	702.8	28.47	964	723.1	29.26	991	743.3	30.06	1,018	763.6	30.86	1,045	783.8
27.70	938	703.6	28.50	965	723.8	29.29	992	744.1	30.09	1,019	764.3	30.89	1,046	784.6
27.73	939	704.3	28.53	966	724.6	29.32	993	744.8	30.12	1,020	765.1	30.92	1,047	785.3
27.76	940	705.1	28.56	967	725.3	29.35	994	745.6	30.15	1,021	765.8	30.95	1,048	786.1
27.79	941	705.8	28.59	968	726.1	29.38	995	746.3	30.18	1,022	766.6	30.98	1,049	786.8

INDEX

B. = Baie, bay; C. = Cap, cape; Dj. = Djebel (mountain); G. = Golfe, gulf; L. = Lac, lake; Mts. = Monts; mts. = mountains; O. = Oued (river); Pte. = Pointe; R. = River; St. = Saint; Ste. = Sainte.

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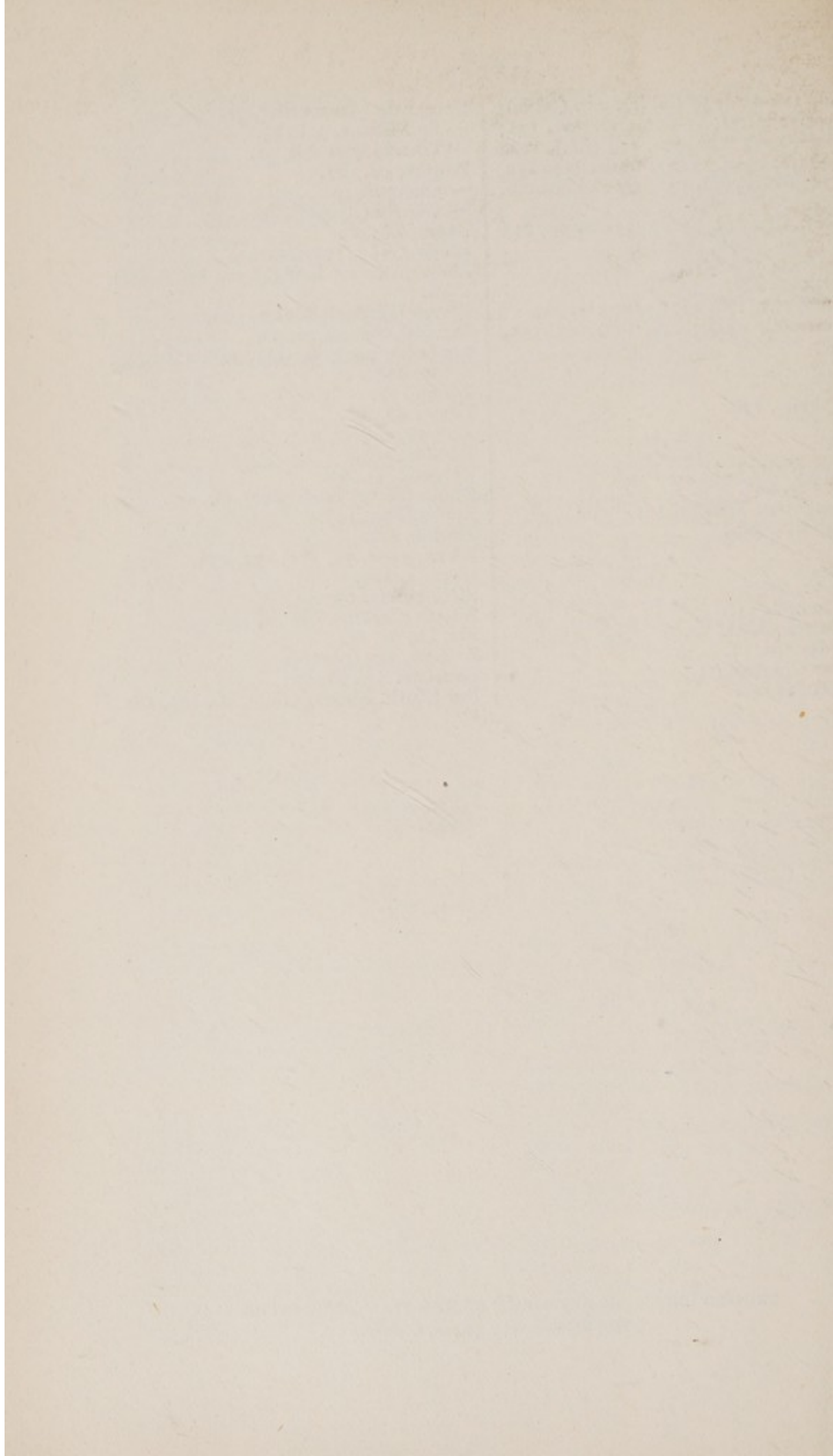
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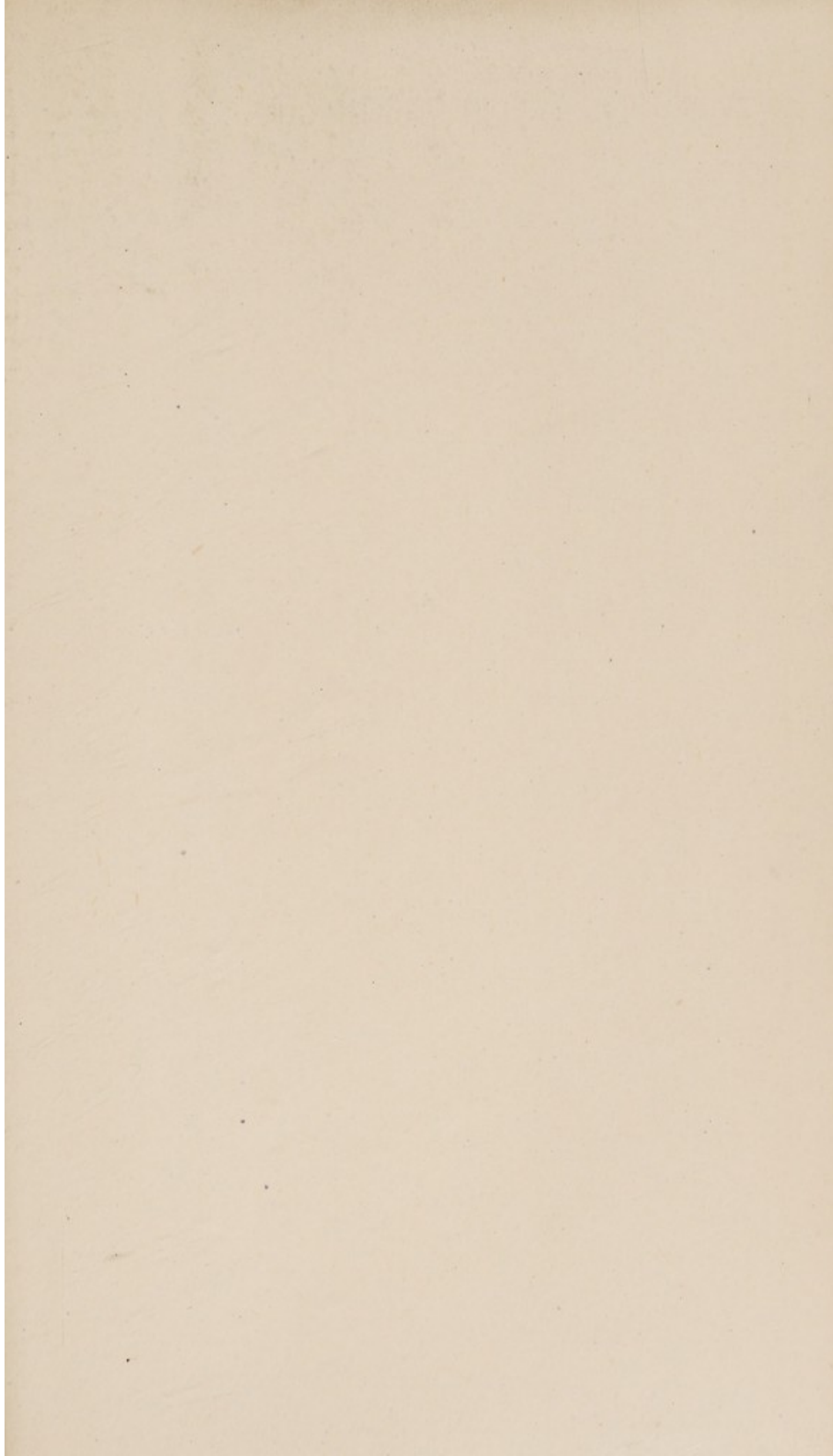
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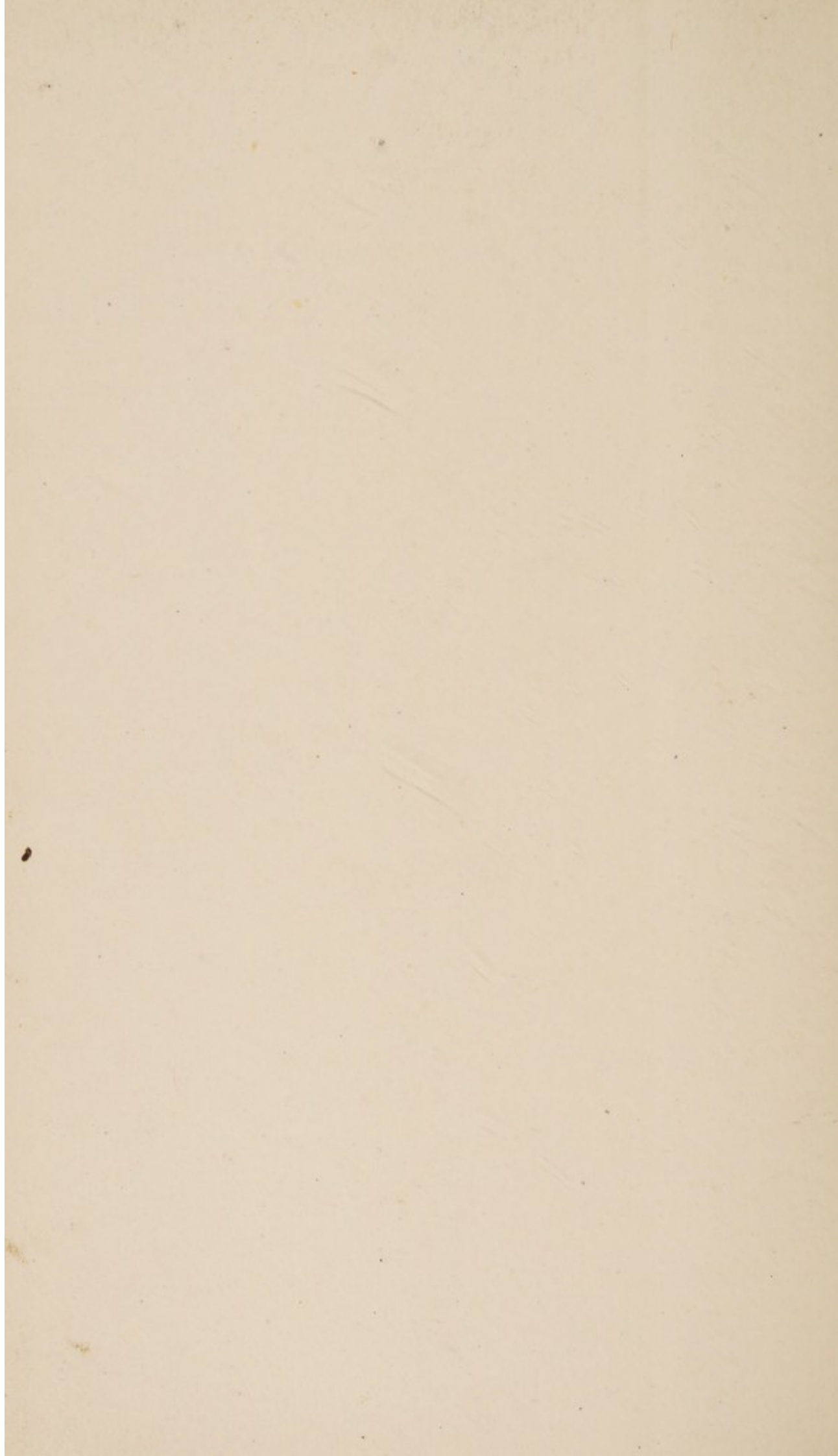
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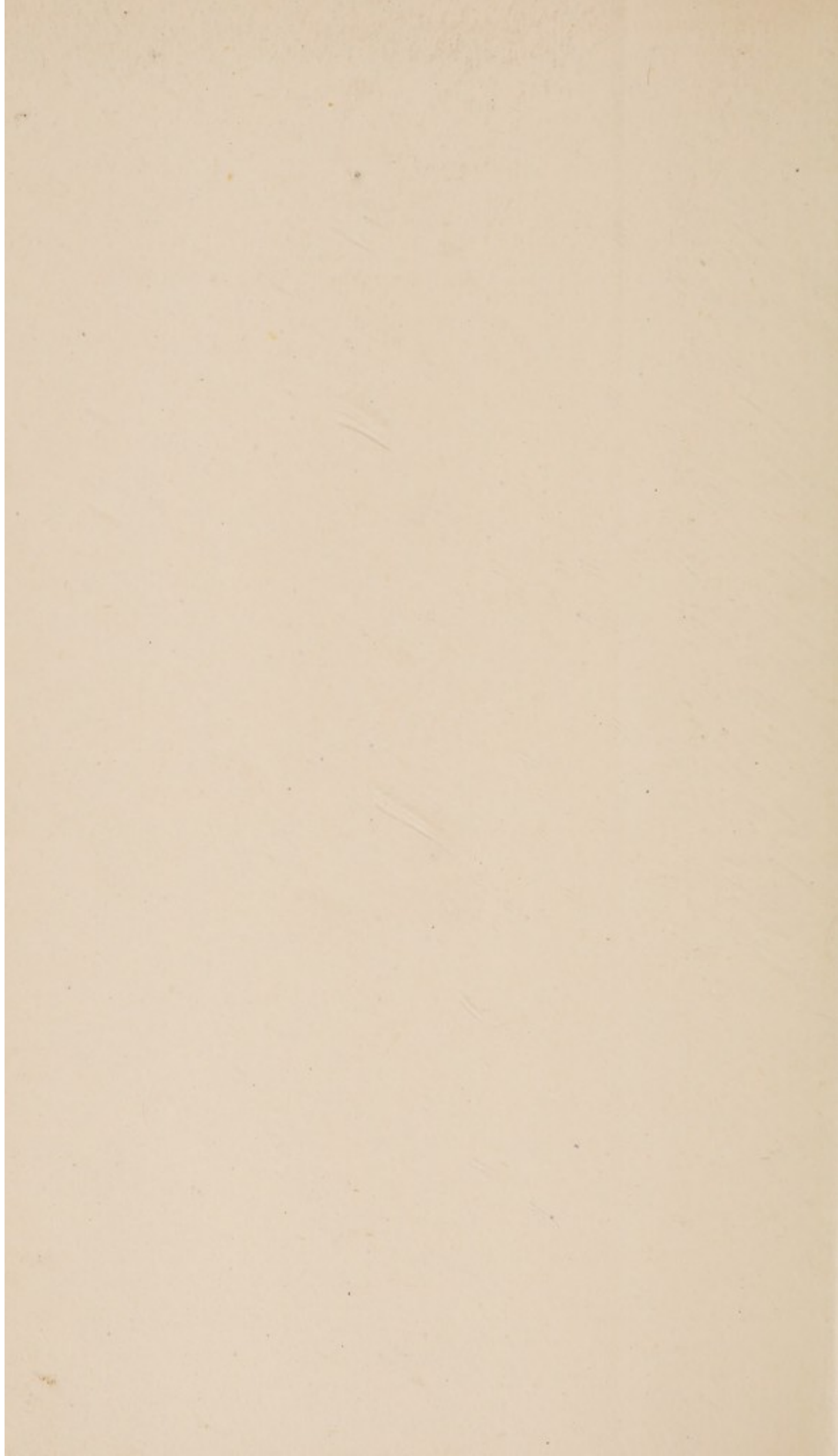




BARBARY WITH THE TERRITOIRES DU SUD



This map is compiled mainly from the *Atlas des colonies françaises, protectorats, et territoires sous mandat de la France* (Paris, 1932) and the *Carte géologique internationale de l'Afrique*, feuille no. 1 (1:5,000,000) (Paris, 1936), but recent work and unpublished information have also been taken into consideration. In some instances symbols do not fully represent local geology; they are intended to give an interpretation of the region as a whole.

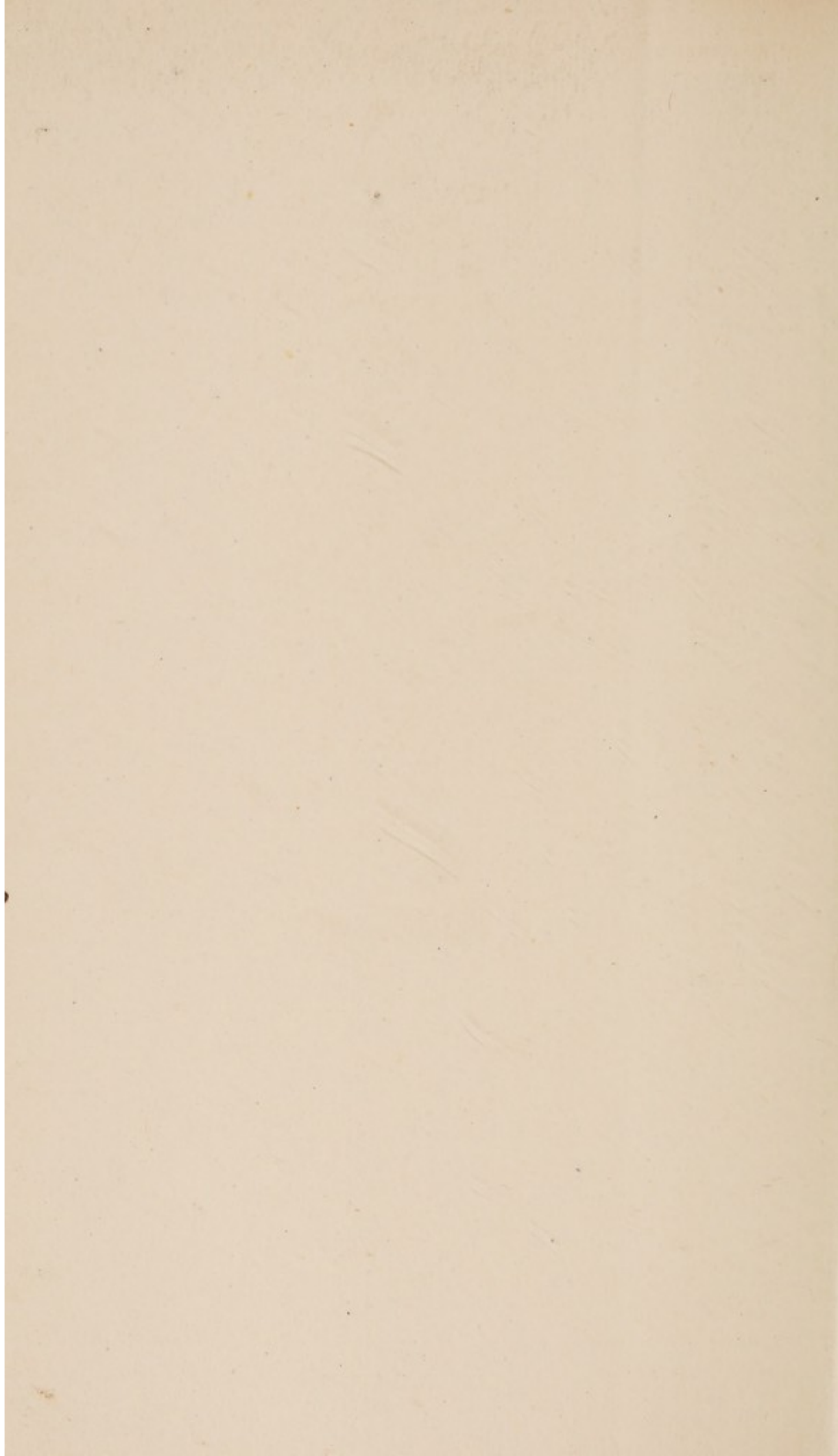


ALGERIA

Scale 1:2,000,000 — 1 inch to 31.56 Miles

Miles 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Kilometres 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150





NORTH-WEST AFRICA

