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CYRENAICA.

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I. THE PROBLEM OF CYRENAICA.

BETWEEN the lowlands of Egypt and of western Tripoli Africa projects northward as the high plateau of Cyrenaica which enjoys a bracing climate, a rich easily-tilled soil, and the finest mountain scenery on the northern coast of Africa. It stands moreover beside the northern end of the caravan road across the Sahara, which brought to the Mediterranean the tropical products of the Sudan. No wonder this favoured land, being the nearest part of Africa to Greece, was early colonized by Greeks; and about 623 B.C. a party of emigrants under Battus established the famous city of Cyrene beside the fountain of Apollo, one of the chief springs on the northern front of the Cyrenaican plateau. The country proved a very useful supplement to Greece. It had no permanent rivers and its water-supply was scanty; but the Greeks were accustomed to similar conditions during the summer in their own land. The plateau however, after wet winters, produced abundant crops of corn; its coastal plains grew rice and dates; the flowers of its limestone moors yielded honey which rivalled that of Hymettus; and from its herbs were extracted condiments and drugs that were highly prized by epicures and apothecaries who could not draw on the spice islands of the East. So the Greek colony flourished; it was known from its five cities as the Pentapolis; and its citizens proved famous for intellectual power and physical prowess. There the philosophers of the Cyrenaic school partially anticipated Hume; thence came many of the

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victors in the Olympic games ; and it has special claims to the respect of geographers as the home of Eratosthenes and the site of localities so famous in classical folklore as the River Lethe and the Gardens of the Hesperides.

With the rise of the Roman Empire in Africa Cyrenaica became still more important. Wide desert wastes lay in front of it to east, south, and west ; and this relatively fertile plateau was indispensable to the overland route from Egypt to Carthage. The country is littered with evidence of the Roman occupation. The roads from the ports to the cities on the plateau are still marked by the ruts worn by heavy traffic. Innumerable remains of terraced cultivation, many irrigation channels, wells, and aqueducts show that the Romans used to the utmost every available supply of water. Thanks to their skill and care Cyrenaica then attained the zenith of its prosperity ; it was inhabited by a quarter or perhaps half a million of inhabitants, among whom was its most world-famous citizen, Simon of Cyrene. With the fall of Rome and the conquest of North Africa by the Arabs, Cyrenaica was devastated, its water-supply works fell into ruins, and it lost its value as a commercial station with the close of the regular traffic between Egypt and Algeria. The traditions of the ancient prosperity of the country are still recounted, and are confirmed by ample existing evidence. For the ruins of the cities are still uncovered ; the broken piers of Marsa Susa help Greek smugglers to land arms for the Senusi, where the Romans shipped their cargoes of grain ; and the decorated Greek tombs of Cyrene serve as goat pens to Arab settlers at the Fountain of Apollo. Yet in spite of its classic interest Cyrenaica is now the least known and most idle land on the shores of the Mediterranean.

After a long period of independence under the Barbary pirates, Turkey reannexed all Tripoli in 1835 ; its development however was beyond the Turk. Traveller after traveller in Cyrenaica has vividly contrasted its modern desolation with its classical prosperity, and poured forth rhapsodies over its beauty and fertility. It is true that Leo the Moor in 1600 described the country as "a rough and unpleasant place, being almost utterly devoid of water and corne" (Leo, 1600, pp. 266, 25) ; and its Arab inhabitants as a "verie rude, forlorne, beggerly, leane, and hunger-starved people, having God (no doubt) alwaies displeased against them." The more pleasing modern accounts of the country begin with the reports of Della Cella, who in 1817 visited it as medical officer attached to a military expedition from Tripoli. "The olive and the trees mentioned by Theophrastus, as of extraordinary beauty in Cyrenaica, still flourish there," he said, "with such vigour and luxuriance as I never saw anywhere surpassed." And "struck as I frequently was with this extraordinary degree of fruitfulness and with the pure and temperate quality of the air," he repeatedly referred to its many advantages for colonization ('Della Cella,' 1822, p. 118). Sir F. W. and H. W. Beechey, who surveyed the classical antiquities of

Cyrene in 1821 and 1822, repeatedly describe the fertility of the land; they were often troubled by the rankness of the vegetation and were enthusiastic over its continuous succession of beauties. They compared its valleys to those of Switzerland and Savoy; they declared that they could scarcely recollect anywhere more pleasing scenes, and of a ravine near Ptolemeta that they could never forget "this enchanting retreat" (Beechey, 1828, pp. 358, 478).

Sir R. Murdoch Smith and E. A. Porcher, who brought from Cyrene the statues now in the British Museum, declared (1864, p. 2) the locality "scarcely inferior for beauty and fertility to any on the surface of the globe;" yet they represent the population of Cyrenaica as insignificant.

Playfair in Murray's 'Handbook to the Mediterranean' (1881, p. 41) describes the country as "a succession of wooded hills and smiling prairies, well watered by rain and perennial springs; the climate is healthy and cool. . . ."

According to F. B. Goddard (1884, p. 33), "It is probable that of all the countries bordering the Mediterranean none has a more luxuriant vegetation." (See also G. Dennis, "On Recent Excavations in the Greek Cemeteries of the Cyrenaica," *Trans. R. Soc., Lit. Ser.* 2, vol. 9, 1870, p. 142.)

Dr. G. Hildebrand (1904) summarizes the opinions of travellers in Cyrenaica as "overwhelmingly enthusiastic" and "unanimous in the opinion that here lies a region brilliantly endowed by Nature" and capable of providing a home for millions of Europeans.

Mr. Weld Blundell, writing from Cyrene in 1894 to the *Geographical Journal* (vol. 5, p. 168), declares that "the rhapsodies of former travellers scarcely do justice to it. It is like a ten days' ride through the Malvern Hills and Shropshire, if you could imagine all the evidence of human beings in the way of buildings, etc., removed, and arbutus, laurestinus, and juniper, etc., instead of oaks and elms. Stretches of beautifully fertile plains, with rich red soil covered with flowers and shrubs, and well-sheltered valleys and glades of fine short grass, not like the ordinary coarse growth of the tropics, but like an old pasture and even a lawn-tennis ground! There are whole square miles like an English park, and one almost expects to see a head gardener appear to warn you off the grass. In spite of this I do not think that, with the exception of a little village called Merj (ancient Barka) and this place, I have seen fifty inhabitants in the whole journey from Benghazi."

Mr. Israel Zangwill ('Introduction to Report of the Ito Expedition,' p. vii.) after quoting many opinions on the country concludes "from the earliest records up to the very year of the Ito expedition, there is a positive chorus of unanimity. Cyrenaica was of yore an earthly Paradise."

The attractiveness of the scenery, the richness of the soil, and the glamour of its ancient glory have led to repeated schemes for the colonization and development of Cyrenaica. The Turks settled there some

thousands of Mohammedans who fled from Crete when that island was transferred to Greece; and Hildebrand (1904, pp. 69-76) enumerates eleven schemes, Russian, Turkish, British, American, French and Italian, during the past century and a half for the resettlement of this promising but apparently derelict land. After the Berlin Treaty Italy turned her attention to Tripoli and endeavoured to gain a foothold by a policy of commercial penetration. Missions, schools, agencies and banks were established; and numerous Italian explorers, Mamoli, Giuseppe Hamann, Bottiglia, and Camperio, visited the country. Rizzetto discussed its commercial value. But the results were disappointing. The commercial agencies proved financial failures. The explorers represented Cyrenaica as having so much barren land and so little water that in 1896 the Italian efforts were suspended and Cyrenaica was left again to the Arab and the Turk.

II. THE ITO EXPEDITION OF 1908.

About ten years later Cyrenaica attracted attention as a suitable home for the oppressed Jews of eastern Europe. The immediate acquisition of Palestine by the Jews was clearly impossible, but Cyrenaica might serve as a temporary land of refuge; and a successful Jewish settlement there might lead, if political changes should weaken the Turkish hold on Palestine, to a refulfilment of the prophecy of Obadiah that Jewish exiles from Sepharad (Cyrenaica) should reoccupy the cities of southern Palestine.

The Turkish administration in Tripoli was prepared to welcome a Jewish colony; so I was asked by the Council of the Jewish Territorial Organization to organize an expedition to Cyrenaica to investigate the suitability of the country for an extensive Jewish settlement. Our party consisted of Mr. M. B. Duff, of the firm of Messrs. Middleton, Hunter & Duff, as expert on water-supply and engineering; Dr. Trotter as expert on north African agriculture; Dr. Eder as doctor and to report on the healthiness of the country; and we were accompanied by Professor Nahum Slousch of the Sorbonne, who is intimately acquainted with the long history of the Jewish connection with Cyrenaica.

We first visited Tripoli to meet Redjeb Pasha, Governor-General and Commander-in-Chief of Turkish Africa. The letters of that enlightened and high-minded official enabled us to visit the country under much freer conditions than were usually permitted; for he was anxious to advance the development of his province, and it was hoped that a Jewish settlement would prove an extra obstacle to the dreaded Italian seizure of the country.

From Tripoli we crossed the Great Syrtis, and near Tocra had our first near view of the Cyrenaican plateau, and of the hanging valleys which notch its edge. We landed at Derna, the chief town between Benghazi and Egypt. The importance of Derna is due to the permanent stream which flows from two springs in the Wadi, and is used to irrigate the

DERNA FROM THE WEST.

THE NORTH-EASTERN NECROPOLIS OF CYRENE.

WADI DIMI-ELL WEST OF MARSA-SUSA.

RUINS OF ROMAN QUAYS AT APOLLONIA.

delta. We engaged a house on the bank of the river, hired camels and drivers, and were allotted an escort from the Turkish garrison. While organizing our caravan we made excursions through the irrigated gardens on the delta, to the water-mill built during the American occupation of the town in 1805, to the ruined Roman aqueduct; we also visited the deep Wadi Derna to inspect the rocks exposed in its cliffs and the springs at Seghia and Bonmansur which maintain the permanent flow of the stream; and we crossed the hills to the east to observe the nature of the land on that side of Derna, and determine the relations of the plateau to the coastal plain at its foot.

During these excursions we found the site of a palæolithic camp on the floor of the Wadi Derna, and examined the Gasr el Harib, a megalithic ruin on the plateau. Mr. Duff measured the discharge from the two springs in the Wadi and found they were then yielding six million gallons a day. (Photographs of the adjacent waterfall show that the flow over it is sometimes much greater than it was then.) The springs rise near a step across the valley which has been formed by a bank of calcareous tufa, and the upper stream falls over its corniced terraced front. Thanks to these springs the town of Derna is a garden city, but from the edge of the irrigated ground it is only one step into the desert.

I was anxious to go eastward in order to see the nature of the country between Derna and Egypt; but that district was closed to Europeans as the Sultan feared that any accident to a traveller amongst its turbulent Arabs would be used as the excuse for the annexation of the country to Egypt. I had pledged my word to Redjeb Pasha that we would not go further east than we could manage in a single day's excursion from Derna. So when our caravan was ready we turned westward to march overland to the port of Benghazi, the ancient Berenice, the chief town of western Cyrenaica. Our visit was in summer, at the end of an unusually dry season; so water was scarce and we had to trust to camel transport. This season of the year was the most suitable for our purpose, as it would have been impossible during the rains to have estimated the permanent water-supply of the country.

Leaving the gardens of Derna we marched westward along the coastal plain between the plateau and the sea over dunes of calcareous sand and low hills of limestone. Our first camp was beside a dry wadi and a deep well which had been sunk almost to sea-level. To our surprise and disappointment the well was absolutely dry, showing that the rocks are sometimes completely drained to sea-level, and that wells sunk below it would probably soon become brackish by sucking in water from the sea. Next day we climbed by a steep track on to the plateau; the rocks near the foot of the cliffs included a soft white limestone, whose resemblance to chalk is increased by nodules and layers of flint. This bed was covered by varied limestones, but I searched in vain for any beds of clay which would uphold water and thus provide useful wells. The surface of the plateau is

a gently undulating moorland, with some thin woodland and evergreen scrub; there are extensive areas of bare limestone; and the best land consists of sheets of limestone waste in the hollows. We followed generally the line of the old Roman road to Cyrene and frequently saw well-preserved wheel-ruts made by the ancient traffic; and as they have doubtless been exposed since Roman times they indicate that the climate has never since their formation been wetter than it is at present; for if these ruts had been often occupied by runnels of water they would long ago have been washed away.

In the first part of the journey over the plateau wells were fairly frequent, and we passed near some considerable settlements around the monasteries of that strict religious order, the Senusi, which has already exercised great influence throughout Mohammedan Africa.

Journeying westward the plateau rose gradually from the level of 1100 to 1800 feet; its undulations became gentler and the vegetation scarcer; near Cyrene we followed the ruined aqueduct which carried water to the city from some Roman reservoirs which had been excavated in a limestone hill at Safsaf. We turned aside to visit them and found them quite dry. Dr. Trotter's measurements show that they had a capacity of one and a half million gallons; and as the Romans thought this small quantity worthy of a $7\frac{1}{2}$ -mile aqueduct water must have been a precious commodity.

Our next camp was beside the famous Fountain of Apollo at the site of the ancient city of Cyrene. This was the most attractive locality we saw in Cyrenaica. The Fountain of Apollo discharges through a cave on the upper face of the plateau, beside some large olive trees; and the stream rushes in a foaming brook down the cliff on to a terrace where its water is used in cultivation. From the edge of this terrace a lower cliff falls abruptly to the shore. The ancient port of Cyrene was 12 miles distant, at Apollonia or Marsa Susa. Mr. Duff and I devoted two days to an excursion there, to observe the general nature of the route and estimate the cost of reopening the port and connecting it with Cyrene by a light railway.

The descent to Marsa Susa is of great beauty. The road winds down over successive limestone terraces, passes through some thin forest, and commands one magnificent view down the canyon of Wadi Dimi-ell. It then descends steeply to a narrow plain between the dissected front of the plateau and the sea. The old piers at Marsa Susa indicate that the land stands at almost, if not quite the same level as in Roman times, though the harbour has been altered by silting. The only fresh water at the time of our visit was a spring, an hour and a half's distance up the wadi; and the commandant told me that there was then not a single resident along the coast route between Marsa Susa and Derna. Marsa Susa was occupied by fifty-five families, mainly Cretan refugees, who raise crops of cotton, onions, barley, wheat, maize and beans.

We were charmed with the beauty of Cyrene and deeply interested in its classical remains, including the ruins of the scattered limestone villas which have been described as marble palaces, the city walls, the amphitheatre, and the Necropolis in which the tombs have been quarried out of a soft Nummulitic limestone on the upper face of the plateau. We would gladly have remained longer; but we made only a brief stay, for we were disappointed with the economic possibilities of the locality. Mr. Duff's measurement of the Fountain of Apollo showed that its discharge was a paltry eighty-four thousand gallons a day. The Arabs said, no doubt correctly, that its flow was fairly uniform throughout the year and that it had been steadily failing since Europeans had visited the country. The decline was probably due to the succession of dry seasons from 1896 to 1908.

No doubt more use could be made of the water if the night and winter flows were stored; but the total volume from all the springs in this locality would not serve for any extensive irrigation, and the area irrigated in Roman times was apparently small.

The total water-supply of Cyrene at the time of our visit would have given about ten gallons per head per day for 18,000 people, not allowing any for irrigation or domestic animals. The Romans supplemented this supply from the reservoirs at Safsaf, which would have given a gallon a day for three months to 15,000 people; and the fact that the Romans went so far for so small a supply indicates that the springs at Cyrene were probably not more prolific in Roman times than they are at present.* As Cyrene offered no opening for any considerable agricultural population, and the limestones were too porous for large storage reservoirs, we thought it best to hurry on in the hope of finding more suitable localities.

We had so far marched along the northern edge of the plateau where the rainfall is heaviest, the land most fertile, and the trees and vegetation most abundant; and probably most of the inhabitants were then collected in that belt owing to the scarcity of water elsewhere. It seemed advisable to examine the conditions further back from the coast. Our escort objected to this project, owing to danger from the Arabs and the lack of water. So we agreed that the main caravan should continue along the northern road, while Dr. Eder, Mr. Duff, and myself, with a couple of

* The population of Roman Cyrene has been estimated as high as 100,000. This amount seems to me excessive in consideration of the available water-supply. The amphitheatres, of which there are three, possibly belonging to different dates, are each, according to the plans of the Beecheys and Smith and Porcher, about 200 feet across. The large temple near the Stadium, according to Smith and Porcher's measurements, has an internal measurement of 100 feet by 50 feet. The size of these structures suggests that the city of Cyrene at its best had a comparatively small population. The area within the city walls is about one and a quarter million square yards. At 50 square yards per inhabitant, a rate which has been often adopted for Eastern cities but would probably be too low for Cyrene, the population would be about 25,000. The various methods by which I estimated the ancient population gave results varying from 15,000 to 25,000.

Turks, made a rapid excursion south and rejoined the others at the wells of Messa.

To lessen the anxiety of our nervous escort we discarded our pith helmets and used the red fez, so that they could pass us off as Turkish officials. I heard afterwards that I had been represented to the Arabs as a Kurdish cavalry pasha as my ignorance of Arabic was thus explained. As we rode southward the level gradually rose; we left behind the trees and green gardens of Cyrene, and crossed brown rolling downs which were littered with stones and outcrops of brown-stained limestone. For hours the most conspicuous feature in the landscape was the rounded cupola of the shrine of some holy hermit, and we felt that we had passed from classical Cyrenaica to the home of the Bedouin. Some figures and the head of Jupiter Ammon carved on the limestone beside the well at Slonta showed that the Romans had a station here, for it was on the southern road through Cyrenaica. From the hillside above the wells we looked southward over vast treeless rolling plains, which so far as we could learn from the Arabs, descend gradually southward, though the maps represent the plateau as bounded on the south by a steep descent to the plains from Siwah to Aujila (see Sketch-map, Fig. 1).

The Slonta wells contained little water; we had heard that many Arabs were assembled around the wells, but we saw only two or three who were living in tombs excavated in the hillside and were tending some flocks of sheep. The Arabs told us that most of the people had withdrawn with their cattle to the better-watered region in the north.

At Slonta we turned north-westward and passed one of the best-preserved Roman castles near the head of the Wadi Khumas. We descended that valley, which deepened to a picturesque wooded canyon, and found on its floor evidence that it has been occupied by a stream several feet deep; but that there had been no flow down the wadi in recent years was shown by some banks of loose debris which had collected across the stream-bed. Climbing again on to the plateau we rejoined the northern road by the wells at Messa, which now, as in classical times, is one of the most important centres in the country. The wells are prolific, and a Turkish detachment and a considerable assemblage of Arabs were camped beside them. We were at once given permission to take as much water as we required.

While at Messa I searched for a reported "Stonehenge," which proved to be a part of a Roman aqueduct. The country contains many large standing stones and trilithons, which have been accepted by Barth and later authorities as megalithic; but most of those I saw had been worked by metal tools and probably date from Roman times. The stone circles of the Gasr-el-Harib to the east of Derna appear however to be pre-historic and megalithic.

From Messa, after loading our camels with as much water as we could carry, we continued westward along the main road to Benghazi. We soon

CARVED FIGURES ON ROCK FACE AT SLONTA.

FOUNTAIN OF APOLLO AT SHIAHAG.

GARDENS OF THE HESPERIDES.

GREAT RESERVOIR AT SAFSAF.

had to descend into the valley of the Wadi Jeraib, about 600 feet deep (this ravine appears to be the outlet from the Wadi Jeraib, which is usually represented as a basin without an outlet); growing on its floor are the finest trees we saw in Cyrenaica, some groves of tall cypresses. We climbed again on to the plateau by a track once guarded by a ruined castle, the Gasr el Migden, the most conspicuous Roman building in the country. Thence our way continued over limestone moorlands, sometimes covered with scrub, and in places, as at the Wadi Argub, hollowed

FIG. 1.

into flat-floored basins, the soil of which, if adequately watered, would doubtless prove of great fertility. The wells, reservoirs, and watercourses that we passed were all dry; but most of the cultivable land showed traces of cultivation; some patches of soil, only a few yards in area, lying in hollows in the limestone are tilled by the thrifty Arabs.

We traversed one belt of low forest and that evening reached a well in the Wadi Gharib where, after some trouble, we were allowed to replenish our water-bags. The night was noisy owing to the quarrel between the natives camped at the well and some strangers who had driven their cattle there for water, which for a while was angrily refused.

Next day we reached the Turkish fort at Merj, the ancient Barca. Its garrison controls the plains of Merj, which, with their continuation westward along the route to Benghazi, form the best considerable tract of cultivable land that we saw. These plains, 160 square miles in area, occupy a series of basins at the foot of a long fault scarp. They are probably all tilled by the Arabs in suitable seasons and with the intervals necessary in their primitive system of agriculture.

From Merj we made a branch excursion to the sea at Ptolemeta, descending from the plateau to the shore down a very steep, picturesque gorge. The ruins of the ancient city are now occupied by a Senusi settlement. After our return to Merj we continued along the alluvial plains to the west. Three days later we ended our traverse of Cyrenaica by descending to the coast plains and passing the River Lethe and the Garden of the Hesperides to Benghazi.

There we found that during our journey the Turkish revolution had deposed the Sultan Abdul Hamid, that our friend Redjeb Pasha had been recalled to Constantinople as Turkish Minister of War, and next day we heard of the irreparable tragedy of his death.

III. THE ECONOMIC GEOGRAPHY OF CYRENAICA.

(a) *Its Geographical Relations and Structure.*—Our special study in Cyrenaica was concerned with its economic geography, which involved preliminary consideration of its geology and physiography, of which singularly little was known. Della Cella had collected at Cyrene fossils which he described as having "the characters of ammonites" (this record is doubtless based on the large nummulites); and as they are common fossils in Algeria and Tunis they supported the view that the core of Cyrenaica consisted of Mesozoic rocks and is a continuation of the Atlas. This conclusion has been supported by Sir R. L. Playfair and it appeared the more probable since the crystalline marble of the statuary at Cyrene has been represented (Camperio, 'Esplor,' 6, 1882, p. 16) as a local rock. We found however no trace of ammonites or of rocks likely to contain them, or any ancient marbles. The country along our route consisted entirely of Kainozoic limestones, similar to those found in Egypt and Malta; and from their general horizontal position the same rocks probably constitute the whole of the Cyrenaican plateau. The country in fact appears to consist of one block of limestones which, though occasionally tilted, are usually nearly level. The limestone plateau is bounded to the north and west, and probably also to east, by great faults, by which its former continuation has foundered beneath the Mediterranean. The nature of the descent eastward to Egypt is still uncertain; but the Jebel Akbar, the "Abrupt Hills" to the east of Derna, and the adjacent coast are traversed by many conspicuous north and south lines which indicate that the main features in the topography of these hills are due to fractures. Clear evidence of great

faulting is also afforded by Crete, across the deep trough to the north of Cyrenaica (see Fig. 2). The faults no doubt belong to the same series as those which in recent geological times (upper Miocene to Pleistocene) broke up the land which extended from Cyrenaica to the Balkans, formed the *Ægean* Sea and its archipelago, and fractured Greece (see Sketch-map, Fig. 3). The southern margin of Cyrenaica is the Siwah-Aujila valley, which in places descends below sea-level; according to most maps the plateau ends abruptly against this valley.

Cyrenaica is therefore a great horst. It is also a karst-land, that is a highland composed of limestone. Its water-supply is also deplorably

SECTION FROM THE PLATEAU S. OF CYRENE TO CRETE

FIG. 2.

limited. So Cyrenaica may be briefly described as an arid, karst-land horst.

(b) *Water-supply.*—That Cyrenaica consisted largely of limestone we fully expected; but we had hoped to find interbedded with the limestones layers of clay, which by holding up the water would maintain abundant wells, and also be useful for the construction of water-collecting surfaces and reservoirs. The amount of impermeable rock in the country is however very small. The limestones are several thousand feet in thickness, and among them are some beds of clayey limestone which act as relatively impermeable layers and form the springs at Cyrene. The country as a whole is, however, so porous that most of the rain soon sinks below the surface and escapes to the sea and to the low-lying southern oases through

behind Ptolemeta and Marsa Susa the hills rise to the height of 2000 feet. Tripoli is built upon a series of silts and sands which absorb the water that pours into the oâsis after rain; and these beds have no free drainage, for the adjacent sea shelves gradually northward so that the depth is only 100 fathoms at 120 miles from the shore (see Fig. 4). The impermeable sea

FIG. 4.

floor holds the water back, and nearly all that reaches the sands can be obtained from the numerous prolific wells. On the Cyrenaican coast on the other hand the sea floor sinks rapidly and sometimes (Fig. 5) to the

FIG. 5.

depth of 1800 fathoms only 60 miles from the shore. On so steep a slope the floor deposits are probably thin, and as the lower water may be under the pressure of a column 1000 feet high, it is doubtless forced into the sea, and in dry seasons lies in the rocks at depths inaccessible by ordinary wells.

The amount of the water which can be obtained in Cyrenaica depends directly upon the rainfall, which has been often regarded as over 20 inches a year. This estimate appears unduly optimistic. Knox in his 'Climate of Africa' reports the rainfall of Tripoli as 18.58 inches for the years 1892-95; and he quotes from Supan the average of 13.64 inches for the period of 1879 to 1892. According to Knox the average for Benghazi from 1891-99 was only 11.94 inches. Records at Benghazi from 1891 to 1904, for which I was indebted to Dr. Shaw, give the rainfall as an average of the thirteen years as 10.56 inches. They have been reprinted by Mr. Duff ('Ito Report,' p. 46). Eredia, 1912, p. 63, quotes 282.1 mm. (11.1 inches) as the mean from 1891 to 1905. The Benghazi records relate to a period during which the rainfall was probably somewhat below the average.

A heavier rainfall has been claimed from Cyrenaica on the ground that there is so great a discharge of fresh water to the sea that the water along the Cyrenaican coast is abnormally fresh. This claim, if substantiated, would certainly encourage the hope that the rainfall is much heavier than is shown by the available rainfall records; but it is not supported by the report of Luksch and Wolf (1892, pls. xxi.-xxiv.) on the observations made during the Pola Expedition in 1890 and 1891. Their maps of the eastern Mediterranean show that the water on the Cyrenaican coast is above the average in saltiness. Their conclusions are represented in the Sketch-map, Fig. 6, which shows the distribution of salinity on the surface, at the depth of 100 metres, and on the sea floor.

The Cyrenaican rainfall occurs mainly in the winter, and much of it falls in torrential storms; and this distribution is the most favourable for the collection of water in reservoirs, the method which we assumed would be necessary for the agricultural development of the country. For ordinary agriculture, however, the same amount of water would be more useful if it fell in gentler and longer spring rains.

(c) *The Soils*.—That the Arabs are able to produce much corn under the adverse local conditions is due to their skill in dry farming. This method is sometimes referred to as if it meant farming without water; but even in Australia, where the conditions are unusually favourable, an annual rainfall is required of not less than 14 inches, though ultimately it may be commercially practicable where the rainfall is as low as 10 inches. But in Cyrenaica the conditions of the soil are in many places unfavourable to this system of agriculture. The soils are scanty in consequence of the exceptional purity of the Cyrenaican limestones. As these rocks weather, most of their material is dissolved and very little debris is left behind. Accordingly the weathering of the rocks produces comparatively little soil, and the particles are light and fine grained, and they are easily removed by the wind. Hence the country includes an unusually high proportion of bare rock and its soils are thin and scanty. The soils themselves are no doubt of excellent quality. As Dr. Trotter remarked in the 'Ito Report,' they belong to the class of soils the most prized by

FIG. 6.

agriculturists. They are light, easily worked, calcareous soils. They are rich in the mineral plant foods; for example the average of phosphoric acid in thirteen analyses by Dr. Trotter is 1.5 per cent. Owing to the hot dry summer they are naturally poor in nitrogen. Their chief defect however is in quantity. They are usually thin and often lie in small patches surrounded by exposures of hard bare limestone.

(d) *Conditions of Deposition of the Cyrenaican Limestones.*—The lack of coarse-grained sediments in the Cyrenaican limestones is surprising, since the collection of deep-sea deposits by the *Pola* shows that even in the deepest parts of the Levant and eastern Mediterranean the sea floor is strewn with abundant grains of quartz, felspar, hornblende, zircon, and other minerals. As Windt and Berwerth have remarked (1904, p. 294) much of the material must have come from old rocks. Sir John Murray's report on the "Deep Sea Deposits" of the *Challenger* (1891, Chart I.) represents the whole of the Mediterranean as floored with terrigenous deposits or sediments derived from the lands. During the formation of these Cyrenaican limestones the continental rocks of northern Africa were probably exposed on land less than 200 miles south of Cyrene. I therefore expected a larger quantity of mechanically formed sediment in the rocks than we found. In one or two layers we saw quartz pebbles; but as a rule the rocks are remarkably free from terrigenous material—a fact confirmed by a microscopic study of these limestones kindly made by Mr. D. P. McDonald.

The explanation of the unusual poverty of these limestones in mechanical sediment is that though they were deposited near land no great rivers then discharged into the sea along this coast, so that the sea floor was covered mainly by materials of organic origin. The contrast with the abundant terrigenous fragments on the bed of the adjacent sea shows how recently the floor of the eastern Mediterranean has sunk to its present depth.

(e) *The Rainfall in Classical Times.*—The present disappointingly low rainfall of Cyrenaica suggests that it must have been heavier in classical times, and that conclusion has been advocated by many authorities, such as Fischer and Elsworth Huntington. During the Glacial period of Europe northern Africa no doubt had a better rainfall than at the present time, for the European cyclone track lay further to the south, and the north African coastlands must have received more abundant rain. During this period the Dead Sea was covered by a fresh-water sea, and powerful perennial rivers in Cyrenaica excavated its deep wadis, which had attained their present depth before the advent of Palæolithic man. Although the assumption of a greater rainfall in classical times would afford a simple explanation of the then flourishing condition of the country, the evidence is overwhelming that the "pluvial period" ended long before historic times, and that the Greek colony of the seventh century B.C. found Cyrenaica with a climate essentially the same as prevails to-day. The classical

records show that the country produced the same crops as it does now; it was mainly famous for its cereals, and its most valuable present export is the dry hard barley which is sent to Scotland for the manufacture of whisky. The other chief products were wool, oil, and an extract from the much-debated herb, the silphion, which is generally thought to have been deliberately exterminated in ancient times. The country was liable then as now to long periods of drought, which caused terrible famines. The arid climate of the country to the south is indicated by the abundance of locusts, from which the country was usually saved by laws enforcing the systematic destruction of the eggs and young; sometimes these regulations proved ineffective and the country was devastated by plagues of locusts, which led to famines and pestilence.

The general geographical similarity of the classical and present conditions is shown by the descriptions of Strabo. According to his account the tree belt was 100 stadia or a little over 11 miles wide, and it was succeeded to the south by another 100 stadia where the land was sown but from excessive heat did not grow rice; further south the country was very sterile and dry, and Aujila was even then an oasis in the desert. Strabo reported that when Marcus Cato marched from Benghazi (Berenice) round the Syrtis, his army "of more than 10,000 men separated into divisions on account of the watering-places; his course lay through deep sand under burning heat." Strabo's account of the zones of vegetation in Cyrenaica and of the condition of the country to the south would apply well at the present time; so that any serious change in the climate since his day is improbable.

Direct geographical evidence confirms the historic records. In Roman times the chief settlements were all around the existing wells, which were then as all-important politically as they are to-day. The port of Ptolemeta had no well and was dependent on an aqueduct. The soil over the Roman ruins is a light loam which was doubtless deposited under similar conditions of moisture to those that prevail at the present time. The abundance of the Roman waterworks show the intensity of the struggle with drought, and that the water-supply was the limiting factor in the progress of the country.

(f) *Cause of the Contrast between Classical and Modern Conditions.*—If then the climate of Cyrenaica has not changed, what is the explanation of the contrast between its past and present conditions? Many travellers, recollecting its classical importance and charmed by the beauty of its scenery and the verdure on its limestone hills after rain, have been led to exaggerate its fertility and blame the Turks for the modern state of the country. But the Turks have only held it for seventy years, and since 1835 they have done far more to improve it than has been generally recognized. They have improved the roads, introduced the telegraph, and established garrisons which have kept peace between the turbulent Arab tribes. The Turkish administration and the influence of the Senusi have led the

Arabs to adopt a more settled life, to the extension of the growth and export of corn, and to a great increase in the size and prosperity of the ports. The treelessness of the country, despite a well-known saying, is not the fault of the Turks, for most of Cyrenaica was treeless in the time of Strabo.

The fact that the country is now of secondary commercial importance is due to changes over which the Turks had no control. Its chief products corn and wool have become less profitable owing to the competition of the extra-European countries, and its honey has been superseded by the sugar-cane and beet-root. In recent years the Trans-Saharan trade, which had an annual value of between two and three million pounds in the middle of last century, had declined to less than half a million by the end of the century owing to the diversion of the Sudan trade by railways to the Niger and Nile. Further the development of steam navigation has deprived Cyrenaica of its strategic importance on the great north African land route.

The conclusion that Cyrenaica has no connection with the Atlas Mountains but is a western outlier of Egypt undermines the hopes based on the frequent comparison of Cyrenaica with Morocco, Algeria, and Tunisia. Those countries are traversed by the Atlas Mountains which rise to 14,750 feet in height; they have a rainfall varying from 20 to 40 inches, and in many respects they are European rather than African. Thus biologically they are united with Europe and placed on a distinct zoological region from the rest of Africa. Tripoli and Cyrenaica on the other hand are typically African. The position of the city of Tripoli corresponds not with Algiers but with Biskra, for they are both oases on the edge of the Sahara. Cyrenaica has no folded mountain range and has not the varied rocks and valuable minerals of the Atlas. As regards mineral wealth it must be compared with Egypt, for it is really part of its up-lifted western margin. And Cyrenaica is an Egypt without the Nile.

(g) *The Future of Cyrenaica*.—The decline of Cyrenaica may be explained by the land having lost its former strategic and commercial importance owing to changes in the main trade routes and to its products having been superseded by the opening of the prolific trans-oceanic lands. The improvement of the country is therefore a more hopeful task than if it had been ruined by an irremediable climatic change. The expectation of Senator de Martino (1908, p. 65) that Italy will find Cyrenaica "an inexhaustible fountain of richness" appears too sanguine, though the view that the country is all a useless desert is equally extreme. My report of 1908 may easily be regarded as more unfavourable than was intended. The country seemed to me unsuitable for a refugee colony since, instead of being practically unoccupied, it has a considerable population of turbulent Arabs; and they would fiercely resist the appropriation of their best land and the control of the coast through which pass the arms and ammunition for the Senusi and their allies in the Sahara and the Soudan.

It does not follow that because the country proved ill fitted for a Jewish settlement it is an undesirable possession for Italy, which being willing to spend £100,000,000 on its conquest, should not grudge a few millions for the necessary water-supply works, roads, railways, harbours, and afforestation.

The development of the country will be a most instructive experiment, which Italy can undertake with the best prospects of success; for she is near at hand, has a deep sentimental interest in this old Roman province, and an overflowing population of peasants who are skilled in cultivation of the olive, which is probably the most profitable product Cyrenaica can grow at present.

The difficulties in the way are that Cyrenaica is a high limestone plateau, which has low winter rains and no summer rain. And the possibilities of such country may be appreciated by comparison with other Karst-lands around the Mediterranean. The Karst-lands had many attractions in mediæval times; for they were healthy, productive, and easily defended. Under modern conditions they have declined in value and importance. The Adriatic Karst-lands have many advantages over Cyrenaica; for they have a heavier rainfall, a cooler climate, and a magnificent position between a rich populous hinterland and an important coast which is provided with numerous excellent harbours. Nevertheless Montenegro is poor and sparsely peopled, while Dalmatia and Herzegovina have not repaid the money and care Austria has devoted to their development.

It is still too soon to judge Italian progress; but since the conquest of Tripoli Italian literature and maps (for example, 'Map Nuove Province Italiane. Tripolitania e Cirenaica.' Published by Istituta Geografico de Agostini. Novara, 1912) of the country show that it is now generally recognized that Cyrenaica is not a colonial paradise, and that expenditure upon it may give a better political than commercial return. We have no reason to regret that Italy has undertaken this task. It was one of her first long steps toward withdrawal from the Triple Alliance, and the establishment of this colony between the French possessions and Egypt must tend to link Italy with France and Britain. Progress in Cyrenaica will probably be slower than in Algeria, and in Egypt; but we can watch it with sympathetic interest, and feel grateful to any Power that will help in the pacification and development of the long derelict lands of northern Africa.

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The PRESIDENT: Prof. Gregory is very well known to us all. We know him as a traveller who has often come before us to give us the results of his journeys. He has wandered in many parts of the globe, from Spitsbergen to the centre of Australia. He has visited the Rift Valley of Africa, and from wherever he has been he has brought back valuable results, geographical as well as geological. To-night he is going to talk to us about a country which has a special interest at this moment—Cyrenaica, the eastern wing of Tripoli, which the Italians conquered four years ago, and which is now, unfortunately, one of the many seats of war on the face of the globe.

(Prof. Gregory then read the paper printed above and a discussion followed.)

Mr. HOGARTH: I have listened to Prof. Gregory to-night with the same admiration for his clearness of statement and sureness of touch as I felt four or five years ago when reading the report which he presented to the Jewish Territorial Organization after his return from Cyrenaica. To-night, as then, I have agreed entirely with his conclusion, though not with all the reasons with which he supported that conclusion. The country is manifestly not fitted for settlement by the kind of colony which the Jewish Territorial Organization wished to place there, and for which it wishes to find some room or other in the world. I thought then, however, and on hearing him again to-night I felt, perhaps not quite so strongly, that Prof. Gregory had taken a rather excessively bad view of the aridity of Cyrenaica when he was there. He passed through the country in August, the hottest and worst month, and I fancy that, though the Turks—represented then by Ragheb Pasha, who was afterwards killed—were very anxious that Jews should settle there, the local Arabs, who are a singularly truculent lot well armed and not fond of strangers, were by no means so anxious that he should see the best of Cyrenaica. I have not seen much of the country myself, but I have seen more water, at any rate at an earlier season of the year, than will justify Prof. Gregory's low estimate of the supply of the country; and a great many photographs taken by the American expedition, which was there a year or two later, show a fertility on the limestone plateau very different from those which he has shown on the screen.

There was one class of argument used by Prof. Gregory which I may be allowed to mention, since it occurs in the paper as it will appear in the *Journal*, and that is the argument from (or rather against) antiquity. It is stated on what is singularly good authority that the city of Cyrene had a population