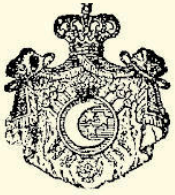
MINISTRY OF FINANCE.

SURVEY DEPARTMENT, EGYPT.

THE GEOGRAPHY AND GEOLOGY OF SOUTH-EASTERN EGYPT.



BY

JOHN BALL

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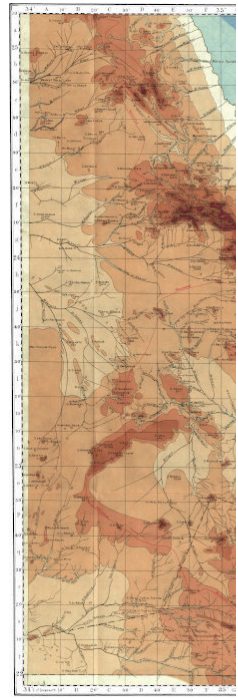
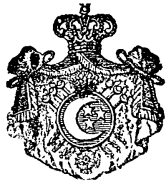


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

(*Largest-*



Price 40 p.t.

This book is an attempt to give a systematic account of t
the four years 1905-1908, and has been written in the interv

In the first or introductory chapter, I have given a sum
languages, and is not always easy of access.

The second chapter is a concise systematic account of t
knowledge is too scanty, to be treated of specially in the suc

The third chapter is an account of the surveying method
necessary for the assessment of the value of any contributio
type of country. The principal geographical results are give
further surveys.

In the fourth to sixth chapters the drainage lines and hill

In the seventh chapter the important question of water su

The eighth to tenth chapters deal with the various rock
considerable masses, detailed studies of Egyptian petrology h

The eleventh chapter summarises the general geological s

In the twelfth chapter I have set down the information I v

The thirteenth and concluding chapter of the book consis

In regard to the cartographic material, most of which is
draughtsmen, it is almost impossible that mistakes have bee
preference to the map, as mistakes in the text are usually m
only on the large scale maps, which are given for the most i
survey exists than is shown on the maps in this book.

The plates illustrating the scenic types are from my own
plates of rocks are mainly designed to enable prospectors to
part of the world, which are not frequently met with in the g
chloride; they will appear slightly diagrammatic in places, o

Much detailed surveying of this mountainous and arid re
beginning has been made towards this end, and that future v

CHAPTER I. — Introduction
„ II. — General Description of South-Eastern Egypt
„ III. — Surveying Methods and Principal Geographical
„ IV. — The Wadis draining Westwards to the Nile
„ V. — The Wadis draining Eastwards to the Sea
„ VI. — The Mountains and Hills
„ VII. — Water Supplies
„ VIII. — Geology.—Sedimentary Rocks
„ IX. — Igneous Rocks
„ X. — Metamorphic Rocks
„ XI. — Tectonics and General Geology
„ XII. — Tribal Boundaries
„ XIII. — Notes on the Road from Halaib to Port Sudan
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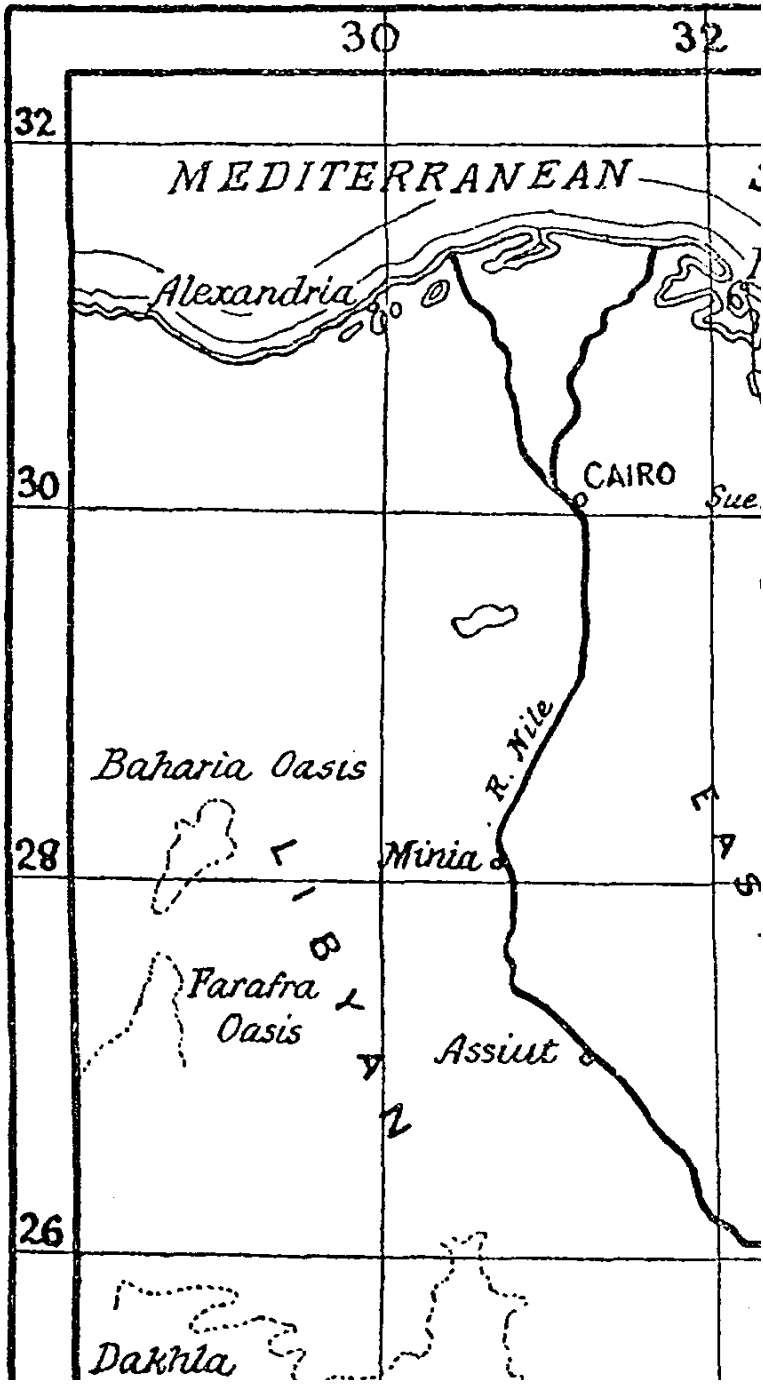
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FIG.

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5. Red pegmatitic granite of Wadi Gemal
6. Biotite-granite of Gebel Abu Hegilig
7. Hornblende-granite of Gebel Elba
8. Hornblende-granite of Gebel Hamata
9. Granite-porphyry of Kreishim Hill
10. Quartz-felsite of the Wadi Huluz
11. Quartz-felsite from a dyke at Gebel Kolaiqo
12. Altered quartz-felsite of Gebel Igli el Iswid
13. Microperthitic structure in felspar of quartz-felsite of Gebel H
14. Fractured felspar crystals in crushed quartz-felsite of Wadi Hu
15. Syenite of Gebel Zergat Naam
16. Syenite-porphyry of Gebel Zergat Naam
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18. Diorite of Gebel Allawi

19. Diorite of Wadi Baaneit
20. Augite-diorite of Wadi Um Hargal
21. Augite-diorite of Gebel el Anbat
22. Mica-diorite from a dyke at Gebel Abu Hegilig
23. Diorite-porphyrite of Gebel Abu Hodeid
24. Augite-porphyrite of Wadi Muelih
25. Kersantite of Gebel Fereyid
26. View near the top of Gebel Sufra
27. Andesite of Gebel Sufra
28. Gabbro of Gebel Dahanib
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30. Hypersthene-gabbro of Hadal Aweib Meisah
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45. Serpentine (probably from a mica-peridotite), east of Erf el Fa

46. Serpentine (from lherzolite), hills near Wadi Um Khariga
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48. Serpentine (from dunite), low hills near Bir Abraq
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51. Serpentine (from harzburgite,), Gebel Korabkansi
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59. Tourmaline in talc-schist, Sikait
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61. Junction of sandstone and granite, west of Gebel Um Reit
62. Faulting near Wadi Saalek


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32
32
MEDITERRANEAN
Alexandria
CAIRO
Suez
30
Baharia Oasis
R. Nile
28
Minia
Farafra Oasis
Assiut
26
Dakhla

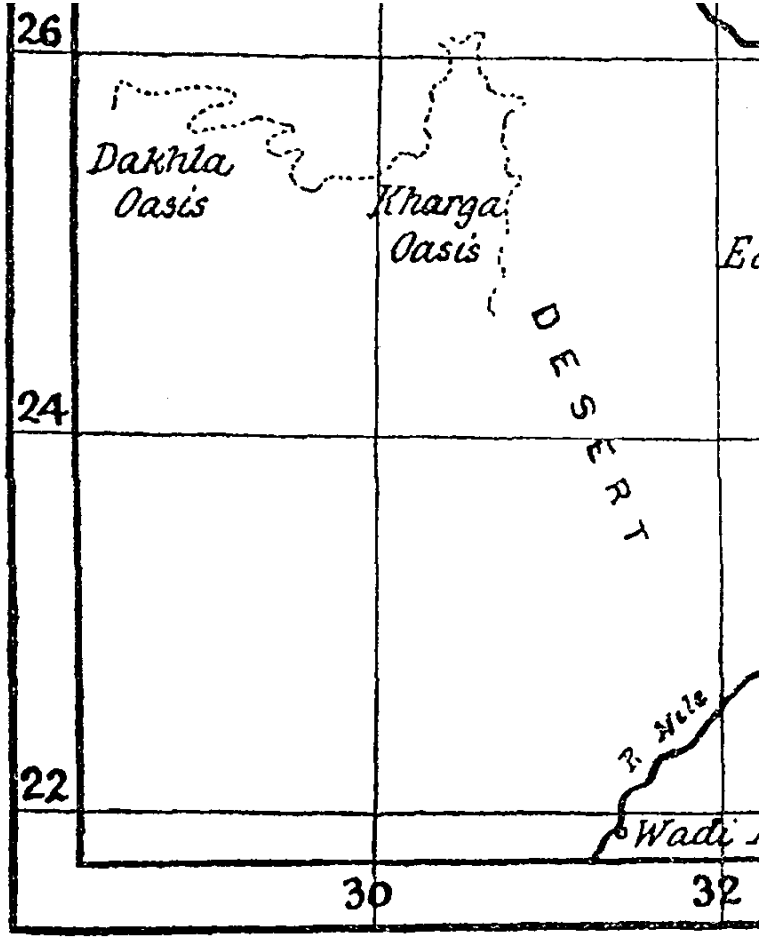


Fig. 1.–
The shaded area show

The district treated of in this volume constitutes the ext
56,000 square kilometres, and includes some of the most mo

The district has been comparatively little visited by trav
the road for transporting goods from the Red Sea to the Nile

References to this part of Egypt occur in the writings of
shadow at the summer solstice from which they inferred t
difference being caused by the secular change in the obliqui

in latitude 25°, which is about 15′ higher than the true posi
Berenice is mentioned, with lists of stations and water reser
closely in estimating the total distance at about 258 Roman
peridot, is probably the *Topazos Insula* of Diodorus, and the
too low. Ptolemy states that the coast was inhabited by the *I*

The books of the Arab geographers, EDRISI and ABU EL F

D'ANVILLE, in his *Mémoires sur l'Egypte*, Paris, 1766, pp.
enable any approach to be made to an accurate map.

It has been thought that BRUCE discovered the island of
and its distance from the coast as three miles,[2] whereas Ze
than a day (in fact he states that they were only three miles
made a large error in his observation for latitude, for the sul

It is to the French traveller CAILLIAUD[3] that we owe th
search for mines in the Eastern Desert. On his first expedit
emerald mines of Zabara and the sulphur mines of El Ranga
emeralds (beryls) for presentation to the Pasha. On this sec
and elegance.

JOMARD, in notes prefaced to Cailliaud's account of his t

In 1818, BELZONI,[4] fired by Cailliaud's discoveries, se
station) and Wadi Ghuel to the Zabara mines, where he foun
Gemal to the sea. Proceeding then southward along the coas
of "Cape Galahen" (Ras Benas). The ruins were so inconspic
space near the temple 1,600 feet broad and 2,000 feet long.
spring of Um Sueh. After copying some Greek inscriptions at

Belzoni's map[5] of his routes is of course very crude and
are fairly accurate, that of the rock temple of Sikait being a

The extreme south-east corner of Egypt was first explore
arose is very curious. He had read the accounts of Diodorus
Alaqi into the Nile by a storm torrent, he at once inferred
discovery to Mohammad Ali Pasha, that prince commissione
the more extensive workings at various places round the he
Meisah (*Kr*), east of which he discovered the old mines of R
the Arabs, and he only ascended a minor peak before comm

the springs of Abu Saafa (*Em*) in the course of his march.

Linant thus performed for the south portion of the distr interesting than his descriptions of the ruins and mines whi also compiled a small Bisharin-French vocabulary as an app errors; Gebel Is (*Jt*), for example, is placed more than sixty remained the only source for cartographers for a large portic instance, contains much of Linant's material, though a comp

WILKINSON[7] gives very brief notes on Berenice and the Berenice road, besides another smaller one not mentioned in and Belzoni regarding this part of Egypt.

In 1836, WELLSTED,[8] a lieutenant in the Indian Navy, temple, which he partially cleared, and in which he found fr

Between 1830 and 1840 important contributions were directions formed the foundation of the "Red Sea and Gul information about the coast. The principal errors are that al details of the inland relief as are given on the charts are not "Southern peak" of the chart, in latitude 23° 18′, is Gebel Asotriba, the highest mountain of the Elba group.

In 1846, BARTH made a journey from Aswân to Bereni Khashab, past the tomb of Sheikh Shadli (*Df*) and the gran Kalalat) south-west of Berenice, on his way to the temple, o Shenshef (*Jj*), where there are well preserved remains of sul south of the Abu Hamamid-Hamata mountains. Crossing th proceeded by winding tracks past Bir Ghadir (*Ec*) and on to

The next traveller to visit the district, VON HEUGLIN, ex Tundeba. Further south, he enumerates the various openings Rounding Ras Benas, he passed the coral island of Mukawar Roman coins, a quartz sistrum and pieces of beryl, besides anchorage called Gota, near Ras Fatma. He mentions Kwol which he notes to the south of Halaib, is doubtless Mersa Qa

It is to the veteran African traveller SCHWEINFURTH tha country from the coast, making excursions inland. Starting flora of the country, but his accounts[18] contain much geog

of the Elba district he found to be sharply marked off from
have lately found to form the great mountain masses of Abu
which we should now call by other names. The sulphur mir
existing, though it contains many inaccuracies, particularly
notice that Qash Amir (*Os*), (the "Scragged Hill" of the Adm
Elba Island of the charts) is called Geziret Abu Fendira by S
mountain of the group, lying just within the Sudan; the nar
character, though he gives high recognition to their beauty

In 1873, Colonels PURDY and COLSTON, two American
Colston[20] travelled overland from Qena *via* Qoseir to Beren
pas de grandes difficultés," the reconnaissance appears to
hypsometer. The compass must often have been unreliable o
in the concluding paragraph of his paper: "Je me permets d
pas assez pour la pression atmosphérique, et sa marche est
only are many of the place-names given by Purdy erroneou
while it is stated that no water exists between Gebel Dif (*Fm*
route from Qena to Berenice there was no published cartogr
this cannot be very correct, for it is evident on comparison w

In January 1889, GOLÉNISCHEff made an expedition fron
of his journey is also of geographical interest. Starting from
(*Cc*), he found another small station on the way to Abu Had
Khashir (in which another ancient station was discovered),
Wadis Khashab, Kharit (*Ag*), and Abu Modellim, to the Nile.
of the old roads by classical writers and by Colston. He co
considers to be the station *Cabalsi* of the Antonine Itinerary,

In 1891, FLOYER, at the head of a scientific exploring ex
the expedition were embodied in an English paper read at t
scale of 1:760,320, reduced from one prepared by the Intel
previously appeared, and it formed the principal source of g

The geological observations made by Floyer during his e
into which Floyer's limited acquaintance with geology cause
of Zabara as "blue clay,"[28] and to the dark schists and dio
Gemal, and typical gneisses and granites in the Nugrus and
activity reported by him (*Geog. Journal*, 1893, p. 430) been

An account of a short visit to the Elba district was publis
Feda and Edrisi, and that it is a place of purely Arab origin
looked upon as a more ancient form of sepulture. His "Geb
considerably in error; thus Gebel Shendib is really 6,273 fee
only some 300 fighting men in the entire district from Asot
Bent's paper is only to a very small scale, and formed practic

MACALISTER[30] has given a detailed and interesting acc
from the valley is not very correct, but the detail maps of
metamorphic areas of the entire Eastern Desert. Macalister
only too well merited by a large section of the tribe, it is pr
great expenditure of time and care, even by those who have

The brilliant series of investigations carried out by the of
of interest connected with the land.[31] The positions detern
method used was the transport of chronometers, and this m
the officers of the "Pola" on the compass-variation at Beren
the rate of secular change of this magnetic element in the di
observations which show a decided increase in the force of g

Turning now to the work of the GEOLOGICAL SURVEY in
survey was commenced primarily with the view of enabling
had defined the administrative frontier between Egypt and t
positions even of these important features were uncertain to

The main interest in the field methods used, which will l
the case. The costly nature of camel-transport, and the rela
detailed topographical mapping, and geological surveying, a
with the Nile Valley, a network of large triangles was thrown
in some cases over a hundred triangulation points were sig
trigonometrical survey of the Sudan, thus linking up a conti
1,200 minor points were fixed by subsidiary triangulation fr

Levels were taken trigonometrically for all points fixed
adjusted to the initial and terminal points of the day's march

For the control of the maps, latitudes and azimuths were

The topographical sketching, carried out on plane-tables
possible. When marching, plane-table stations were fixed b

readings from the stations, using specially devised long dista
an extensive use of vertical angles, were employed. On an
necessary to remain for at least a week to get sufficiently cle
triangulation stations that little or no detail was visible. Th
west limit of the map have been added from reconnaissance
this tract recently made by Mr. J. MORROW CAMPBELL, B.Sc
this region, and thus enabled Mr. Campbell's map to be acc
almost blank in this particular area. Mr. Campbell's map doe
account the depth of shading of the different hill masses and

The sea coast north of latitude 24° 10′ was adapted from
triangulation. The local circumstances, in the existence of hi
the Admiralty Charts. It was frequently possible to check th
coast-line shown is the high water-line. The tidal change of l

Very special care was taken with place-names, which are
g is almost always soft, like an English *j*, and the *q* is always
the orthography is correct in almost all cases.

The geology was examined along every line of march, an
the plane-table sheets in the field, and the remainder have l
difficult, owing to insensible gradations, to decide exactly w
on the small scale used, even if the exact limits were traced l

Throughout the three seasons' work I was accompanied l
useful help. The Egyptian unskilled staff employed consisted
Arab sheikh.

The total cost of the field-work was approximately L.E
representing the expenditure on salaries and allowances of tl

---

[1] The references in parentheses aft

[2] *Bruce's Travels to discover the Sou*

[3] CAILLIAUD, *Travels in the Oasis of*
Eastern Desert is unfortunately wanting

[4] BELZONI, *Narrative of the Operatic*

[5] *Plates illustrative of the Researches*

[6]LINANT DE BELLEFONDS, *L'Etbaye*

[7]WILKINSON, *Topography of Thebes*

[8]WELLSTED, *Notice of the Ruins of*

[9]*Red Sea and Gulf of Aden Pilot.* 5t

[10]At Halaib Fort the difference is

[11]This should not be confounded

[12]Qash Amir is quite a separate m

[13]BARTH, *Reise von Assuan über Be* names being given in the journal.)

[14]V. HEUGLIN, *Reise in Nordost A* Khedivial Library).

[15]This I think is an error. A small

[16]There was no "Geziret Elba" kn

[17]Though the Bisharin are now ve

[18]SCHWEINFURTH, *Reise an der Ku* another paper, *Das Land am Elba- und S*

[19]I found many of the natives cou very different from the local name.

[20]COLSTON, *Journal d'un voyage d*

[21]PURDY, *Reconnaissance entre Bér*

[22]CORA, *La route de Kéneh à Bérén*

[23]GOLÉNISCHEFF, *Une Excursion à*

[24]Golénischeff names this place *A*

[25]FLOYER, *Etude sur le Nord Etbai.*

[26]*Further Routes in the Eastern Dese*

[27]*Notes on the Geology of the North*

[28]Professor HULL, in the discussi suggestion.

[29]BENT, *A visit to the Northern Sud*

[30]MACALISTER, *The Emerald Mines*

[31] *Berichte der Commission für Ocea*

[32] *See* p. 65.

In this chapter will be given a brief general account of th

1. Extent.
2. Relief.
3. Hydrography.
4. Coast-line.
5. Climate.
6. Scenery.
7. Animal and Plant Life.
8. Water Supplies.
9. Geology.
10. Mineral Products.
11. Antiquities.
12. Inhabitants.
13. Languages.
14. Industries.
15. Communications.
16. Government.

The subjects of topography, water supplies, and geology,

As already mentioned in the introduction, the district tr
kilometres (22,000 square miles).

The higher mountains of the Eastern Desert generally fo
west.

Commencing from the north (*see* the orographical map, F

(i) The Migif — Hafafit — Nugrus — Hangalia — Zabara

(ii) The Abu Hamamid — Hamata — Abu Gurdi group (1

(iii) The Um Gunud — Dahanib — Batoga group (1,270 r

(iv) The Abu Dahr — Orga — Um Tenedba group (1,131

(v) The Faraid group, the *Mons Pentadactylus* of Ptolemy,

(vi) The Awamtib — Abraq — Dif — Aqab el Negum — N

(vii) The Gerf — Abu Hodeid group, a mighty mass rising

(viii) The Meisah — Adar Qaqa — Is group, between the

(ix) The Elba — Shendib group (1,912 metres[35]), a grea

Besides these main groups, there are numerous more or l
1,078 metres) are examples.

Some of the mountains, especially the granite “bodkin”
account of its steepness, and Gebel Abu Dahr (*Gk*) by reaso
north.

The course of the main watershed which parts the Red S
Wogud, in the north, it passes east of Gebel Atut, thence thr
Gebel Nukheira, it takes an eastward bend, passing along th
Abu Gurdi, thence dropping to the south on the plain near th
crosses the low tract at the head of Wadi el Arned to the sa

detail, but from guides' statements and the indications of the curve south-eastwards to Gebel Soaorib, at the head of Wadi

The watershed is for a great part of its course quite impa Lahami, Wadi el Fil, Wadi Arned, and Wadi Um Reit, passes though in some of them, as, for instance, at the head of Wad

The principal drainage-basins are shown on the small sc while Alaqi debouches near Dakka. The eastward drainage i independently to the sea.[37]

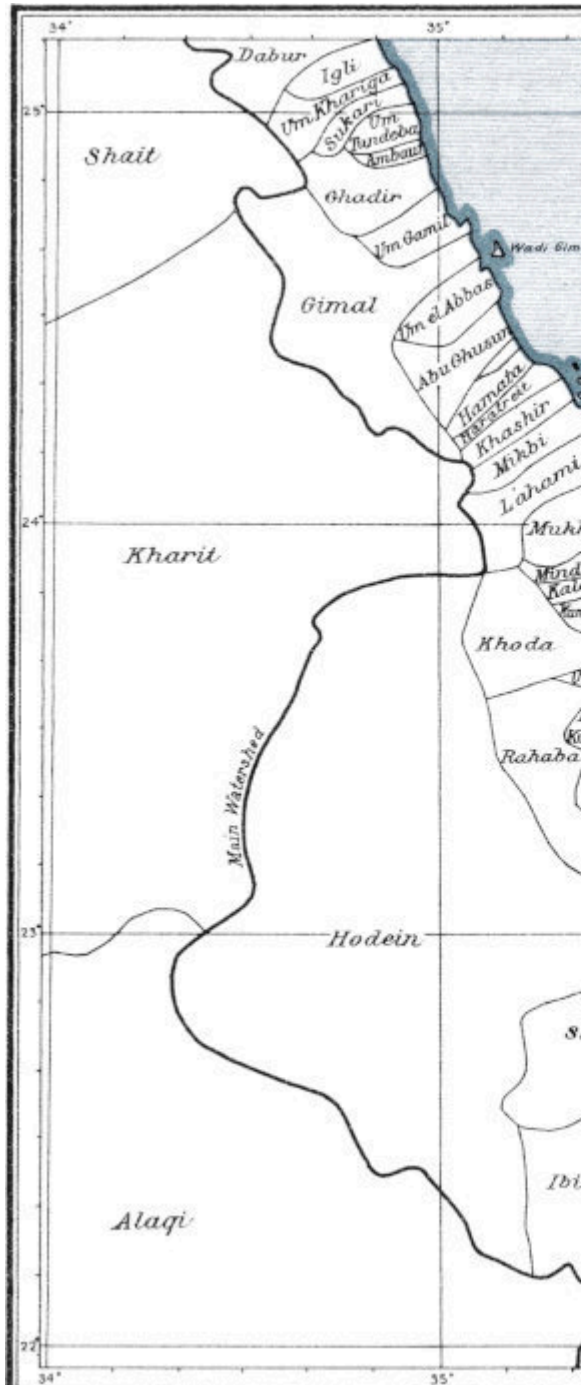
Nearly all the wadis contain vegetation in the form of tr however, exceptionally barren. Forming, as they do, the only of no interest to the Arabs, except when they contain water- thus have two names when situated between two wadis, the

The coast-line of this part of Egypt is somewhat irregular of existing maps), is very marked, extending nearly to 37° Between the feet of the mountains and the sea there extend the vegetation which occurs along them. A rather surprising it, and several times more steep than the beds of the wadis w

The climate of the district is predominantly hot and dry t watershed, and the transition from piercing cold to great he Cool north-west winds prevail in the north part of the area swathed in clouds for weeks together, especially from Janua and the air is thick with sand and dust. Rain falls in most downrushes in the wadis, filling them for short periods with receives far more rain than any other portion of the area, for

SKETCH-MAP OF
Showing

Ball. Geography & Geology of South-Eastern Egypt.


34°
35°
25°
24°
23°
22°
Dabur
Igli
Um Kharga
Sukari
Um Tundeba
Ambaut
Shait
Ghadir
Um Gamil
Wadi Gim
Gimal
Um el Abbas
Abu Ghusun
Hamata
Hafafrat
Khashir
Mikbi
Lahami
Kharit
Khoda
Rahaba
Main Watershed
Hodein
Alaqi

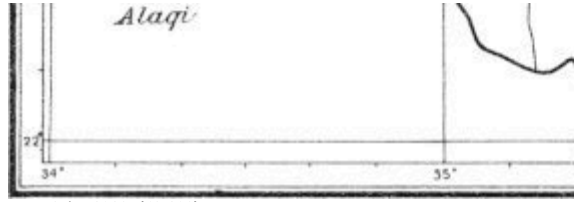


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

Scale

The predominant types of scenery are extensive sandy p
struggle for existence is often evidenced by miles of withered
flowering plants thrive high up the mountain-side along all t
(*Dc*), Selaia (*Fh*), and Um Rasein (*Jr*), jagged and spiky gran
(*Ef*), Hamata (*Gf*), and Gerf (*Hp*). Perhaps the most remarka
while one specially sharp peak is styled very appropriately
together. The views from the mountain-tops are extensive a
which only the higher peaks project like islands from a gre
made out; the cone of Zeberged Island was, however, often s

Both animal and plant life is mainly confined to the drai
occasionally be obtained round Abu Saafa, while doves are
inhabit the rocks near Bir Abraq and Bir Madi. The wild as
recent times. Vultures, kites, and ravens are everywhere in
seldom met with. Of butterflies and moths, especially the la
trees used as shade by travelling Arabs. Earwigs are in some
all sorts of gasteropod dwellings.

Of plant life the district contains a great variety. The nor
flowering plants not found further north are met with, whil
kilometres from the summit owing to the closeness of the tr
sweet-smelling flowers and some fruit-bearing trees unfamil
300 species of plants collected in the Elba district, the vast
fifteen species were of those found wild in Europe.[43]

The sources of water comprise *galts* (rock basins forming springs and wells, the latter usually rude excavations in the a

The small scale map on Plate III, which shows all sources a radius of about sixty kilometres of itself, but *galts* and well the Sudan Administration is far richer in water that the Egyp

Water can usually be obtained at intervals of about two especially after a long interval without rain. That of others, a

The rocks composing this part of Egypt are principally i country, and huge masses of serpentines form the mountains same rock also occurs along the sea coast in the north part o neighbourhood of Halaib.

Shov

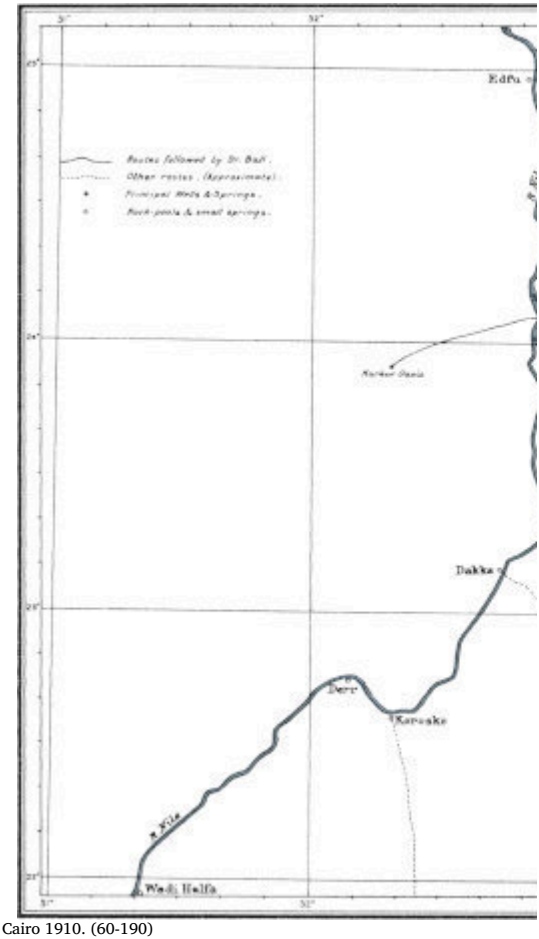


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

Crushing of the older rocks is almost everywhere strongl
tangential earth movements, so rare in this part of the world

The mineral resources of this part of Egypt are not of ver
bear iron ores, gypsum, sulphur, steatite, asbestos, and magn

The presence of ruins and excavations at places like Har
mills where gold was the thing sought for, confirm the state

In recent years much prospecting has been done to test w
are believed to be those referred to with a map in the Turin
being carried out, and in three localities the results have bee

The following tables, compiled from information supplie

Licence No.	Date of Licence.	Principal Mineral sought.	Hol
49	Nov. 1 1909	Gold.	
50	„ 1 1909	„	
75	May 14 1911	„	
59	Feb. 17 1910	Sulphur.	M
60	„ 17 1910	„	
61	March 19 1910	„	

Lease No.	Date of Lease.	Period for which granted.	Mineral e
13	Dec. 1, 1910	30 years.	Gol
15	Jan. 1, 1912	30 years.	Gol
55	June 1, 1906	30 years.	Perio

Of the above three mining leases, the last mentioned (the
mines. The two gold mining undertakings have been comme

The archæological remains of pre-Arab times in this par
sundry markings on rocks near the roads.

The **Temple of Berenice** is a low inconspicuous structur

Benas) of which it is built, it is in a very dilapidated conditic
sun at the summer solstice. Of the village (one can hardly ca

There are three **temples in Wadi Sikait**; they are small r

Many attempts have been made to trace the **ancient mi**
absence of any reliable map of the main features of the cou
ones, so that it cannot be hoped that all the ruined stations,
easier for future travellers to locate precisely any ruins they

Of the road leading from *Contra-Apollinopolis* (Edfu) to th
Edfu, past Bir Abad, the ruins of a large station and rock tem
Department. About forty-five kilometres further on is the sta
rubble ruin. As all the stations just mentioned lie outside the

Edfu
Kanais
Gariat Abu Medrik
Samut

The next station after Samut appears to have been the ru
Gemal, where there are two more cisterns, this time in a tria

A third ancient road is believed to have led northward
Company's mine of Um Gariart.

The **ancient emerald mines of Zabara and Sikait** con
Romit, and the Darahib district, are on a considerable scale,
is given on Plate IV. The ancient quartz-grinding mills, mos
nature of penal settlements (Prof. Mahaffy[52] has aptly term







Besides those at the mining camps and stations, there are built houses, furnished with doors and windows, formed of situation of the place, suggest that it may have been a slave the slaves, and sentinels at the watch towers prevented any springs has been thought by Purdy[54] to have been a huntin

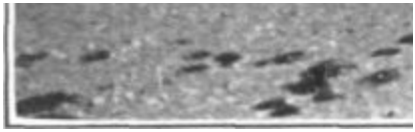
In many places there are **marks and drawings on the** branches of Wadi Garara, the drawings are accompanied by

Another class of remains are found scattered over the are

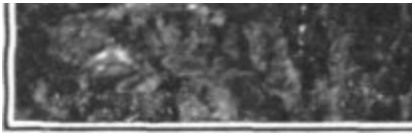
Of **Arab tombs** in the area, the most considerable is that to this place by the Ababda Arabs, who hold the memory of devotions, and smaller tombs of the same type, built of drift-

The South-Eastern Desert of Egypt is inhabited by noma Koatil, and Balgab) inhabit the country to the south.[56] On would lead one to think that it was inhabited to an even less knows how to handle them. They share, however, in the un own independent roaming life, and it is impossible to retain nomads; they do not know the country, but fear the desert skeleton on which they arrange their knowledge is always th very vague ideas of proportion, and can only read a map wh Bisharin of the Elba district is that they are superior, in indu great mass of the Bisharin understand only their own langua boys. All the Arabs are of course Moslems, but they are not a









The manner of life of the Arabs is very simple. Most of
diameter, but the men commonly sleep in the open, shelteri
having heavy “mops” of curled black hair plentifully supplie
of gruel of flour and water, and of dates, which are importe
Arabs. For arms, they carry swords and knives, seldom fire-
amusements.

Slavery appears to be non-existent at present, for in the c

My own study of the Ababda and Bishari tongues has bee
their tongue is a fondness for diminutives. Thus we have *Se*
change in the placing of the stress. The commonest special
mountain; *galt*, a rock basin containing rain water; and *mega*

As soon as one passes into Bisharin country the change
geographical terms are: *kwan*, a wadi; *da-aiyob*, a depressior
(applied to wells). Hence we get such combinations as: *Had*
deep well in Wadi Seyet, and so on. A mountain called *adar*

The principal industries carried on by the desert Arabs
Administration. Their camels are very superior animals, and
rates there prevailing. It is common to find a flock of hundre

Charcoal burning has been practised, especially in the A
camels in years of drought.

In recent years some employment has been found for the

For the information of future travellers, it may be worth
fodder for camels, their own provision of water and food for

Responsible sheikhs in charge of all Arabs
Skilled guides (also employed as beacon builders)
Postmen journeying regularly to and from the Nile Valley
Baggage camels, each to carry 300 pounds' load, with one driver t
Riding camels
Porters

A small amount of agriculture is practised in the Wadi Di

A little fishing is carried on near Berenice and at Mersa S and Halaib, I noticed that but few of my Bisharin cared to pa

Halaib is the only permanent village, and even it is mere local Arabs.

There are numerous camel-roads connecting the various Berber. The roads lie mostly along wadis, and are far from b by luggage camels, and the roads are fairly good; water is le any particular traveller is naturally that which his guides ha is only a track by which camels have passed at some time c opening up of Port Sudan, the Elba district is most easily re about two days' intervals.[60] To reach Elba from the valley, and irregularly by coasting boats and Coast Guard steamers.

The geographical frontier between Egypt and the Sudan that of Egypt. The administrative frontier therefore runs bet the coast.[61] A territory of some 16,000 square kilometres maintained in the fort of Halaib. The remainder of the area tribe in return for police protection and other advantages; th of Anglo-Egyptian officials in settling their disputes. One of whom a number of Bisharin Arabs engaged in disputes state

towards the government, and prefer to settle their difference
acquainted with Bedouin ideas and customs, while the Arab
which is done for the Arabs of the Sudan, for their country i
so that many are lost, and the only way a tax could be raise
thorny acacia trees being the principal reserve camel food
consequent on the prosecution of the charcoal industry in th

[33]The mountains and hills will be

[34]The altitudes refer to the highes

[35]This is the altitude of Shendib, t

[36]In the map on Plate I, I have sh
Morrow Campbell's map (referred to or
more closely than I did, the watershed l
extension of the heads of Wadi Soaorib

[37]The wadis will be found describ

[38]See the *Red Sea and Gulf of Aden*

[39]See my short paper on the mete

[40]I have given short accounts of s

[41]D'ANVILLE, *Mémoires sur l'Egypt*

[42]*See* BARRON and HUME, *Topogr*

[43]SCHWEINFURTH, in *Petermann's*

[44]For a fuller description of the w

[45]For a fuller account of the geolc

[46]SUESS, *The Face of the Earth*. Mis

[47]Lib. III, 12-14.

[48]*See* DUNN, *Notes on the Mineral*

[49]For a plan of the temple and no

[50]MACALISTER, *Geog. Journal*. Vol

[51]*Op. cit.* Golénischeff gives sketcl

[52]*The Empire of the Ptolemies*. Lonc

[53]DIODORUS (I. 49) probably gre
account, mainly derived from Diodorus,

[54]*Bulletin Soc. Khéd. de Géogr*. 188

[55]According to Mr. Bramly (The A

[56]Regarding the geographical bou

[57]Schweinfurth did not have the

improved.

[58]On the Bishari language, *see* ALI

[59]The millieme is practically equi

[60]For a detailed description of thi

[61]Arrêté of the Ministry of Interio

Base-Lines—The triangulation was commenced by meas
such a position as to afford easy connection with points alre
The inequalities of the ground between the pegs were leve
measuring, the tape was laid on the ground, stretched to a
Temperatures were taken in several places along the tape b
levels of the pegs were found by spirit levelling. After corre
different tensions, to be 2,482·280 metres. The azimuth of t
Nile Valley by Mr. Villiers Stuart to be latitude 24° 53′ 36″·7

A second connexion to a base-line was made near Gebel
to the actual base-line, but to another main line tied directly

Latitude N.
Longitude E.
Length of line to Dagalai beacon

Reconnaissance for triangulation points was carried c
from short bases, and such selection made as seemed most
peaks and other features were fixed by intersection from tw

figures being generally measured. The average length of side

Beacons.—Main stations were marked by wrought-iron l top of the tube were affixed four sheet iron wings, bolted on across the base of the cairn, and about a metre wide across t

Intersected points were sometimes marked with a beacon

Measurement of Horizontal Angles.—Angles were mea to eliminate circle errors. Intersected points were observed o

Field Computation and Plotting of Triangulated Poin were only taken to five places. The length of the sides havin taken out to the nearest 10″. The abbreviated form of compu

l = 20042 m.

Z = 64° 29′ 20″

Log l = 4·30194

Log cos Z = 1·63416

B 2·51194

2·44804

$d\varphi$, 1st term =

2nd term =

$d\varphi$ =

=

φ =

φ' =

Whence

260 $\left\{\begin{array}{ll} \varphi' & = \\ \lambda' & = \end{array}\right.$

In the above, it will be noticed that the azimuth is alwa contains the word south,—if it is from the north, while th subtraction is made. It was found in the field that this metho

The geographical coordinates thus found were plotted di
then into kilometres by multiplying by the factors appropria
drawing the graticule, and in general the points had to be pl

Astronomical Observations.—Astronomical checks on t

The method used for **latitude** was that of observing th
altitudes, in that the observations are more easily made, an
The theodolite used was the same as was employed in trian
by the observation. The first star taken was usually *Polaris*,
was found better, than taking bubble readings and correctin

The method which I found best in the field for reducing
formula

$$\sin h = \sin \varphi \sin \varepsilon + \cos \varphi \cos \delta \cos t$$

If the assumed latitude and watch error were correct, all

$$h + \cos A \, d\varphi + \cos \varphi \sin A \, dT - h_0 = 0$$

where A is the star's azimuth, $d\varphi$ the required correction to
from the ordinary formula

$$\sin A =$$

---

by four-place logarithms (using the approximate values for φ
correction to the assumed latitude was at once obtained.

As the method is one not usually treated of in books on p

Station on Gebel Um Heshenib. January 30, 1906.

Approximate $\varphi = 24^\circ\ 20'\ 50''$ N.
„ $\lambda = 34^\circ\ 51'\ \ 0''$ E.

Sidereal watch U. and C. 30811, approximately $2^m\ 22^s$ fast on I

Observed times of equal altitudes by watch:—

Polaris	$3^h\ 33^m\ 54^s{\cdot}2$
α *Columbæ*	3 42 40 ·8
ε *Canis majoris*	4 24 35 ·8

Watch time		$3^h\ 33^m\ 54^s{\cdot}2$
Watch fast		
L.S.T.		3 31 32 ·2
Star's R.A.		1 25 9 ·1
	t	2 6 23 ·1

$\varphi = 24^\circ\ 20'\ 50''$

$\delta = 88^\circ\ 48'\ 33''{\cdot}1$

$\varphi = 24^\circ\ 20'\ 50''$

$\delta = 88^\circ\ 48'\ 33''{\cdot}1$

$t = 31^\circ\ 35'\ 46''{\cdot}5$

Whence the equation for *Polaris* is

$35{\cdot}8 + 1{\cdot}000\ d\varphi - 0{\cdot}011\ dT - h_0 = 0$ (1)

Watch time	$3^h\ 42^m\ 40^s{\cdot}8$

Watch fast		
L.S.T.		3 40 18·8
Star's R.A.		5 36 15·6
	t	1 55 56·8

$\varphi = 24^\circ\ 20'\ 50''$

$\delta = 34^\circ\ 7'\ 45''{\cdot}7$

$\varphi = 24^\circ\ 20'\ 50''$

$\delta = 34^\circ\ 7'\ 45''{\cdot}7$

$t = 28^\circ\ 59'\ 12''{\cdot}0$

Whence the equation for α *Columbæ* is

$51{\cdot}1 - 0{\cdot}896\ d\varphi + 0{\cdot}404\ dT - h_0 = 0$ (2)

Watch time		$4^h\ 24^m\ 35^s{\cdot}8$
Watch fast		
		4 22 13·8
Star's R.A.		6 54 57·1
	t	2 32 43·3

$\varphi = 24^\circ\ 20'\ 50''$

$\delta = 28^\circ\ 50'\ 52''{\cdot}7$

$\varphi = 24^\circ\ 20'\ 50''$

$\delta = 28^\circ\ 50'\ 52''{\cdot}7$

$t = 38^\circ\ 10'\ 49''{\cdot}5$

Whence the equation for ε *Canis majoris* is

$51{\cdot}5 - 0{\cdot}801\ d\varphi + 0{\cdot}546\ dT - h_0 = 0$ (3)

Collecting the equations of the three stars, we have

$35{\cdot}8 + 1{\cdot}000\ d\varphi - 0{\cdot}011\ dT - h_0 = 0$ (1)
$51{\cdot}1 - 0{\cdot}896\ d\varphi + 0{\cdot}404\ dT - h_0 = 0$ (2)
$51{\cdot}5 - 0{\cdot}801\ d\varphi + 0{\cdot}546\ dT - h_0 = 0$ (3)

By solving these equations for $d\varphi$, we find

$d\varphi = + 6''{\cdot}5$

whence the latitude is found to be

$24^\circ\ 20'\ 56''{\cdot}5$

It may be remarked that the above process was considera error was found at once from the difference between the st nautical almanac star could be found culminating at an altitu altitudes. The best results are obtainable when the interval b good latitude; for, as Gauss[67] pointed out, "the essential c that place."

The following table shows the latitudes found by observ possibly more than double that amount due to plumb-line d of the figure of the earth, for which latter purpose more elab

West Peg, Muelih Base
Beacon on Gebel Um Heshenib
„ „ Hill near Gebel Selaia
„ „ Berenice Temple
„ „ Gimeida Hill

Azimuths were determined in the usual manner[69] by e
globe, placed at a distance of one to two kilometres, with its

Station of Observation.
Peg at West end of Muelih Base
Beacon on Gebel Um Heshenib
„ „ Hill near Gebel Selaia
„ „ Berenice Temple
„ „ Gimeida Hill
Centre of Halaib Fort

The observed azimuths, unlike the observed latitudes, w
continuing a chain of azimuths with the unadjusted values
results of the observation, and continued to the next station
computed positions of points for plotting on the maps.

Connexion with the Sudan Surveys.—At the south en
observed latitude and a telegraphically determined longitud
Sudan points connected, and amounted to 3″·5 in latitude a
Sudan positions now that a complete chain of triangulation

Levels of Triangulation Points.—The altitudes above s
awash in the sea among the triangulated points. To secure
refraction and curvature were eliminated by reciprocal obse

d^2 was used, the value of d tan θ being first found by five-fig

d^2 by means of the very convenient “Universal” slide rule of
and this value for the coefficient was employed throughout t

d^2 by the slide rule, a mark R was scratched at 1210[73] on t
the mark vertically under that logarithm on the log scale of
a single point were obtained from a corresponding number c

The constant combination of vertical angular measureme
could not be identified among a number of similar peaks vis
on working out the triangles to the nearest minute of the ob
worked out, assuming the distances correct; in only one ca
accuracy in a very few minutes by means of the slide rule, a

Checks on absolute level were frequently obtained by ob
that very small variations in refraction cause rather large err

The following tables give the geographical positions and
with the Sudan Surveys. Stations occupied are indicated by
a single mountain mass possesses several peaks or summits,

Field Number of Point.	
21	G. Hamrat Wogud
29	G. Iteima
* 204	G. Igli
* 26a	G. Atut
* 203	Erf el Fahid
14	G. Hagar Dungash
* 218	G. Sukari
216	G. Um Tundeba

*	202	Muelih base
	219	Isolated hill near sea
*	201	Muelih base
	19	G. Muelih
*	225	Kurdeman mines
	71	Marwot Rod el Ligah
	206	G. Mudergeg
	205	G. Hangalia
*	215	G. Ghadir
*	32a	G. Nugrus
*	25	G. Migif
*	214	G. Allawi
	211	G. Zabara
	224	G. Lewewi
	212	Ridge near G. Zabara
	221	Hill near sea
	208	G. Hamrat Selma
	210	Peak in G. Hafafit
	240	Wadi Gemal island
*	223	G. Sikait
	213	G. Um Moghar
	24a	G. Abu Khrug
	20	G. Sufra
	241	Wadi Gemal island
	207	G. Nahud
*	209	Peak in G. Hafafit
*	222	Madaret Um Gamil
	226	G. Abu Had
	242	Low spur of coast
	235	G. Um Regeba
	233	G. Nahud
	239	Low spur of coast
	247	G. Um Suerab
	231	G. Um Sueh
	236	G. el Abiad
*	227	G. Abu Hegilig
	237	G. Um el Abbas
	232	G. Nukheira
	73	G. Um Goraf
	252	G. Durunkat
	274	S. end of low sandy island
	255	G. Um Sedri
	234	G. el Heda

	248	G. Sarobi (S. peak)
*	228	G. Um Heshenib
	243	G. Hefeiri
	246	G. Khulla
	253	G. Tarfawi
	251	G. Marasan
	249	G. Abu Ghusun
	245	G. Metawit
*	230	G. Abu Hamamid
	250	G. Um Usher
	259	G. Um Hasidok
*	229	G. Hamata
	258	G. Abarun
	257	G. Abu Argub
	75	G. Hamrat Mukbud
	254	G. Ras el Kharit
	261	G. Khashir
	262	G. Ras el Kharit
*	256	G. Kahfa
*	399	Hill near Bir Qoleib
	400	Bir Qoleib
	287	G. el Anbat
	263	G. Mikbi
	276	G. Um Huk
	279	G. Um Sellim
	320	Peak N. of Berenice
	264	G. Egat
	273	G. Egat
	280	G. Abu Ghalqa
*	260	G. Abu Gurdi
	288	G. Derhib
*	315	Hill near Berenice
	268	G. el Homur
	289	G. Um Gunud
*	339	Limestone hill on Ras Benas
	271	G. Selaia
*	317	Hill on Ras Benas
*	316	Limestone peak, Ras Benas
*	338	Hill on Ras Benas
	291	G. Aidab
	270	Hill near G. Selaia
*	275	Low hill near G. Selaia
	278	G. Geneina

	336	G. Um Maiat
*	313	Berenice Temple
	290	Marwot Elemikan
	319	Peak N. of G. Kalalat
	334	Hill near Wadi Mindeit
	340	Sheikh's tomb at Ras Benas
	341	Tip of Ras Benas
	266	G. Abu Derega
	335	G. Um Maiat
	333	High range N. of G. Kalalat
	77	G. el Nekeiba
	330	Hill near Wadi Kalalat
	318	G. Um Maiat
	332	High range N. of G. Kalalat
	331	G. Kalalat
	294	N. end of Mukawar Island
	293	G. Batoga
	329	G. Kalalat
	294a	S. end of Mukawar Island
	314	G. Batoga (S. peak)
*	282	G. Kalalat
	328	G. Batoga
	353	Minor peak of G. Kalalat
	355	G. Um Hegilig
	327	G. Dibag
	308	G. Dibag
*	265	G. Dahanib
*	269	G. Um Bisella
*	277	G. Zergat Naam
	345	G. Reyan
	346	G. Reyan
*	343	Hill near Shenshef ruins
	292	Erf el Gemal
	272	G. Hagar el Fil
	281	G. Shut
	398	Bir Abu Hashim
*	397	Hill near Bir Abu Hashim
	348	Hill near W. Salib Abiad
	325	G. Um Etli
	384	G. Abu Husenat
	326	G. Um Etli
	324	G. Um Etli
	295	G. Hendusi

	344	G. Um Akra
*	385	Ruins of Um Eleiga
	302	Peak near G. Abu Dahr
*	79	Um Harba
	356	G. Um Akra
	347	G. Hindia
	337	Zeberged Island
*	267a	G. Abu Dahr
	305	G. Abu Sieiyil
	321	G. Faraid
	323	G. Faraid
	361	Hill S. of G. Abu Dahr
	322	G. Faraid
	342	G. Faraid
	360	Hill S. of G. Abu Dahr
	362	Hill S. of G. Abu Dahr
	359	Hill S. of G. Abu Dahr
*	285	G. Faraid
*	85	G. Um Khafur
	357	G. Faraid
	286	G. Faraid
	350	G. Faraid
	351	G. Faraid
	352	Granite peak near Wadi Rahaba
	349	G. Faraid
	297	G. Orga
	363	Hill near Wadi Rahaba
*	296	G. Abraq
	365	Hill near Wadi Rahaba
	389	G. Faraid
	358	G. Faraid
	395a	G. Abraq
	395	G. Abraq
*	87	G. Awamtib
*	299	G. Um Tenedba
	368	Hill near G. Um Tenedba
*	390	Plateau near Abu Saafa
	307	G. Saalek
*	354a	G. Fereyid
	394	G. Hodein
	380	G. Hodein
	304	Peak W. of G. Um Reit
	306	Peak W. of G. Um Reit

	366	Hill near Wadi Rahaba
*	300	G. Um Reit
*	298a	G. Harhagit
	393	G. Tibatib
	387	Hill near Wadi Hodein
	396	Granite peak near Wadi Rahaba
	392	Rock in sea
	310	Isolated hill west of G. Etresia
	388	Hill near Wadi Hodein
	423	G. Kala
	503	G. Etresia
	303	Hill E. of G. Etresia
*	375a	G. Anfeib
	364	Hill NE. of G. el Anbat
*	386	Close to Bir Shalatein
	502	G. Etresia
	407	G. Kala
	311	Isolated hill north of G. Shigigat
	425	G. Kala
	424	G. Kala
	501	G. Etus
*	367a	G. el Anbat
	312	G. Shigigat
	406	G. Kala
	500	G. Aqab el Negum
	496	G. Natetiai
	499	Peak near Aqab el Negum
	498	Peak near Aqab el Negum
	497	Peak near Aqab el Negum
	495	G. Natetiai
	373	G. Niqrub el Tahtani
	373a	G. Niqrub el Tahtani
*	369a	G. Beida
	494	G. Natetiai
	508	Peak in S. part of G. Feg
	391	G. Humariai
	382	Hill S. of Wadi Beida
	507	Peak in S. part of G. Feg
	381a	Hill S. of Wadi Beida
	379	G. Mismih
	381	Hill S. of Wadi Beida
	510	Conical hill
*	401	G. Kolaiqo

*	374	G. Niqrub el Foqani
	509	G. Waqif
	466	Tree at Mersa Shab
	419	G. Um el Kalala
	506	G. Sheyenit
	505	G. Sheyenit
	415	G. Um el Kalala
	418	Hill close to Bir Madi
*	408	G. Meneiga
*	402	G. Meneiga
	430	Hill near Wadi Tikosha
*	410	Gemeida hill
	437	Hill SSE. of Bir Meneiga
	434	Peak near Wadi Ti Ilak
	376	G. Shabih
	527	G. Mishbih
	378	G. Mishbih
	440	Ridge near head of W. Shellal el Gharbi
	447	Qrein Salama
	435	Peak near Wadi Ti Ilak
	431	Hill N. of Wadi Muqur
	414	G. el Naga
	91	G. Seiga
	377	G. Mishbih
	526	G. Mishbih
	413	G. el Naga
	445	G. Tueiwi
*	403	G. Gerf
	427	G. Gerf
*	370	G. Gerf
	412	G. el Naga
	436	Peak near Wadi Muqur
	493	G. Mishbih
	432	Peak near Wadi Muqur
	383	G. Muqur
	433	Hill near Bir Sararat Seyet
	426	Peak near Wadi Diqdib
	438	Peak near Wadi Qadiloi
	429	Peak near Wadi Eirahimib
	371	G. Shweib
	428	Peak near Wadi Eirahimib
	531	Mt. near Bir Baaneit
	404	G. Gerf

	405	G. Korabkansi
	446	G. Korabkansi
	614	G. Hamra Dom
	439	Peak near Wadi Diqdib
*	372	G. Korabkansi
	420	Peak near Wadi Difoteb
*	417	G. Hamra Dom
	450	Tibansi Tikam Ankwei
	475	Peak near Wadi Sherefa
	411	G. Hamra Dom
	473	Hill near Wadi Um Saha
	532	Hill near Wadi Um Saha
	444	G. Dreb
	615	G. Hamra Dom
	443	G. Dreb
	442	G. Dreb
	476	G. Dreb
	478	G. Dreb
	477	G. Dreb
	504	G. Kulyeit
	441a	G. Dreb
	533	Kilia Arib
	441	G. Dreb
	535	G. Dreb
	534	Tibashoi Tomakolat
*	449a	Kolmanab hill
	566	Hill near Wadi Ibib
	619	Point near Kolmanab
	612	G. Medarai
	520	G. Medarai
	610	G. Medarai
	485	G. Anweiyib
*	567a	G. Eqrun (W. summit)
	567	G. Eqrun
	665	Adar Aweib Um Bishtit
	577	Granite hill
	522	G. Medarai
	528	G. Anweiyib
	587	G. Um Rasein
*	416	G. Um Rasein
*	575	Einiwai hill
	521	G. Abu Hireiq
	609	Hill near Wadi Merdiyeb

	613	Tahaqayet
	596	Hill near Wadi Odruk
	595	Hill near Wadi Odruk
	582	Granite hill
	592	Near Wadi Odruk
	523	G. Abu Hireiq
	581	Osnei hill
	455	Hill near Bir Um Bishtit
	472	Mt. near Wadi Abu Hireiq
	611	G. Adatalob Hadal
	451	Titailibab
	459	G. Orgem
	576	G. Orgem
	488	G. Anweiyib
	471	Mt. near Wadi Abu Hireiq
	486	G. Anweiyib
	664	Hill S. of Titailibab
	422	G. Abu Hodeid
	572	G. Adatalob Adara
	603	Near Wadi Tikraneib
	454	G. Meis-heit-ar
	470	Mt. near Bir Abu Hodeid
	479	G. Mansur Diab
	469	Mt. near Bir Abu Hodeid
	457	Hill near head of Wadi Qidmib
	583	G. Tishushi Tiboki
	647	Abu Hodeid Oqla
	492	G. Um el Tiur el Tahtani
	666	G. Meis-heit-ar
	580	G. Tishushi Tiboki
*	569a	Ti Keferiai
	598	G. Hamra Tit
	461	G. Qidmib
*	456	O Shakafa
	597	G. Geror
	462	G. Qidmib
	464	G. Qidmib
	463	G. Qidmib
	616	G. Geror
	584	G. Qidmib
	453	Adar Aqdeib
	490	G. Um el Tiur el Foqani
	602	G. Geror

	649	G. el Sela
	487	G. Hadal Derqa
*	460	Hadal Aweib Meisah
	650	G. el Sela
	491	G. el Adraq
	421	Qara Saba
	601	G. Um Seleim
	480	G. Hadal Derqa
	585	Hadal Aweib Meisah
	604	G. Leqaq
	512	G. Heianai
	668	G. Hamida
	620	Qash Amir
	651	G. Sul Hamid
	568	G. Balatitda
	513	G. Hilwit Hasium
	468	G. Adar Qaqa
	482	G. Heianai
	618	G. Hamida
	608	G. Adar Qaqa
	448	G. Hamida
*	458	Halaib Fort
	556	G. Elba
	652	Hill E. of G. Balatitda
	555	Karam Elba
	525	G. Shanaiyet
	653	Hill near Wadi Warabeit
	676	G. Elba
	662	G. Balatitda
	489	G. el Hateib
	674	Hill near Wadi Siamtit
	516	G. Hilwit Hasium
	669	Mt. south of Hadal Aweib Meisah
	481	G. el Arib
	579a	G. Um Ein
	667	Hill near head of Wadi Warabeit
	467	G. Soaorib
*	536	G. Elba
	621	G. Elba
	675	G. Elba
	483	G. Heleikonti
	573	G. Warabeit
	518	G. Soaorib

*	571	Adar Aweib
	538	G. Elba
	606	G. Soaorib
	98	G. Muqsim
	589	Mt. near Wadi Baueiwai
	537	G. Elba
	617	G. Mashushenai
	605	G. Soaorib
	678	G. O Sir Eirab
	677	Hill near W. O Sir Hadal
	519	Peak near Wadi Kirir
	465	G. Soaorib
	590	Mt. N. of Wadi Adar Ameit el Sharqi
	670	Hill near Wadi Aqwem
	578	Hill near Da-aiyob Wushaq
	681	G. Hanquf
	591	Mt. N. of Wadi Adar Ameit el Sharqi
	682	G. Hanquf
	524	G. Um Reddam
	657	G. Miatit
	511	Mt. near G. Egat
	484	G. Egat
	586	G. Miatit
	659	Mt. near Wadi Adar Ameit el Gharbi
	540	G. Hanquf
	452	Hill near W. Di-ib
	655	G. Suruk
	588	G. Suruk
	673	Hill near G. Suruk
	656	G. Shendib
	515	Mt. near G. Himeitra
	685	G. Shendib
	539	G. Shendodai
	672	Hill near G. Suruk
	661	G. Shiab
*	607	G. Hadarba
	654	G. Shiab
	517	G. Himeitra
	474	G. Is
	599	G. Is
	627	G. Shendodai
	684	Hill near G. Shendib
	600	G. Is

671	Hill near G. Suruk
593	Mt. east of G. Is
570	G. Hanquf
640	G. Shendib
641	G. Shendib
594	Mt. east of G. Is
642	G. Shendib
543	G. Shendib
546	G. Shendib
544	G. Shendib
687	Hill near G. Shellal
557	G. Shellal
529	G. Shellal
574	G. Shellal
545	G. Shendib
547	G. Shendib
550	G. Shendib
645	G. Shendib
549	G. Shendib
644	G. Shendib
646	G. Shendib
660	Low hill near W. Shendib
541	G. Qeda
542	G. Qeda
514	Hadal Aweib
628	G. Asotriba
551	Eir Aweit
552	Eir Aweit
564	G. Obkeik
548	G. Asotriba
565	G. Obkeik
553	Eir Aweit
554	Eir Aweit
658	Adar It
409	
558	Arit
559	Arit
663	Karai Awa
562	Arit
560	Arit
563	Arit
561	Arit

It is interesting to compare the positions found for certa
defined points of comparison are Berenice temple, the cent
triangulation points, but the published charts enable one to
56′ 16″, is 1′ 26″ north of the temple, so that the equivalent
the temple as 23° 54′ 40″. My triangulation gives the latitud

At St. John's Island, owing to the smallness of the scale
the Admiralty latitude for the peak is 23° 36′ 40″, while the
27″. I found the latitude of the peak to be 23° 36′ 16″, thus a

At Halaib Fort, the Admiralty latitude is 22° 14′ 10″, wh
seems to prove the Admiralty latitude of this point to be som

Summarizing the latitudes of the three points for compar

Admiralty Chart	
"Pola" Expedition	
Ball (Triangulation)	

If we make corresponding comparisons of the longitudes
determinations were made by transport of chronometers fro

For Berenice Temple the Admiralty longitude (obtained b
to a longitude of 33° 30′ 20″ for his observation point, whicl
by exactly 1′ from the value found by Lieut. Koss.

For St. John's Peak, the longitude scaled from the Admir
the peak is 36° 13′ 13″. My triangulation gives 36° 11′ 42″, b

For Halaib Fort, the Admiralty longitude is 36° 37′ 3″, wh

Summarizing the longitudes obtained for the three points

Admiralty Chart	

“Pola” Expedition Ball (Triangulation)	

There can, of course, be no doubt of the immensely great carried nor what care is taken in the work. The above differ its return to the same port on January 27, 1896. If we exam Halaib, a six days’ voyage, we have:—

Halaib Fort Berenice Temple	

showing an error of only 42″, or about three seconds of time

The triangulation-positions:—

Berenice Temple St. John’s Peak Halaib Fort	

may therefore be taken as practically correct, and the three p

All detail visible along lines of march from camp to cam longitude, and all the triangulation points previously fixed commanding hills being selected, and the positions of these to the true orientation of the table. The plane-table station h along the directions given by the alidade.

In the telemetric measurements a 5-inch tacheometer w maximum distance of 800 metres directly readable by the fo following process. Bringing the centre wire to the base of t difference giving the angle subtended by the four-metre staff

In the case of very long sights, even this method failed, b
brought to the base of the staff as before, and a first readinę
tangent screw, and so on, three or four times, and then a
intercepts in this way, a very much more accurate value of t
any number of minutes of difference of reading after a four-
as, moreover, errors were not cumulative, owing to the inc
tacheometry, finely graduated staves were of no use; the for

An average of about six or eight conspicuous points havi
stations. At the stations the pencil sketching of relief was by

Occasionally, when a high hill-station was employed ove
observing the depression-angles to these points. The slope o
Thus, suppose the near point was close under the station, w
rule or three-figure logarithms, the near point was found to
that if the observed depression-angle to it was, say, 4° 40′, it

---

, or 1·8 kilometres. Any possible error of preliminary estimat

The process of traversing between stations was seldom
tortuous cañon-like wadis, where great and time-consuming

Levels along the line of march were measured trigonom
corrected for refraction, were found by the slide rule in the
them and points of precisely determined altitude.

Names of places were written down by the guides in Aral
the guides to give them from several different stations.

It was generally necessary to remain for at least a weel
Occasionally the entire landscape was blotted out for ten or
use of to map all visible detail within a moderate range (say

In this work the first stage was to find a small base, one
the base. The six-inch theodolite being at the main station, t
The length of the base was found by including one or two

alidade and the calculated distances. The base being short, levels of these minor points were determined by vertical ang the difference of height between any other parts of the wadi map below the station, a hundred or more points along th reducing the vertical triangle by means of the slide rule on t alidade on the plane-table sheet it was not difficult to sketcl were necessary. In other cases more than one small base was

By the combined use of minor triangulation for peaks, ar same time by tacheometric work on the lower ground, and t

In the earlier portion of the work, *i.e.*, north of latitude 2 while others were determined by observing the depression a

$$d = 35{\cdot}497\,(\theta - \sqrt{\theta^2 - 11621\,h}\,)$$

where d = distance in metres, θ = depression angle in se observations at the same station. Prominent points having be

It was sometimes a little difficult, however, to identify th question by the great expenditure of time and money whicl speed and accuracy. The directions of a series of points suffi the points, they were plotted by a special scale graduated di rate of four or five points a minute, and it was frequently po further here, but would refer those interested to the publicat

With the aid of the new method the entire coast-line fron of the delineation of the coast, both by mapping the same st on or near the coast; and in all cases I found the accuracy to sea-level were practically negligible during the operations. I much more correct than that shown on any previous charts. the outlying dangerous reefs, mapped by the Admiralty surv

By an Arrêté of the Ministry of Interior issued in 1902 it

Commencing at Bir Shalatein on the coast of the Red Sea, the li

This frontier was defined after a commission had sat, at
Ababda tribes (with one exception) under the Government o

Part of my work comprised the precise fixation of the p
certain difficulties arose in the location. In the first place, th
was unspecified; I assumed the highest peak to be the point
Arrêté. I assumed the text of the order to be determinative,
approximately fixed; it is said by guides to be a narrow road

The following table gives the positions found for the vari
the two sets of positions will show how much the survey has

Bir Shalatein
Bir Meneiga
Gebel Niqrub (El Foqani)
Gebel Um el Tiur (El Foqani)
Deiga (approx.)

Careful observations were made of the variation of the c
be free from local magnetic disturbance. Berenice is on the
coast about 220 kilometres south-east of Abu Saafa.

The instrument used was a five-inch theodolite fitted wit
with an independent setting of the needle, were made, and t

Place.
Berenice Temple
Abu Saafa Springs
Near Halaib Fort

In order to find to what degree of accuracy the results of observations for the declination at Helwân gave the westerly

	2° 41′·2
	2° 58′·8
	2° 55′·0
Mean	2° 55′·0

while the true declination as given by the Kew magnetomete

It is rather curious to note that the declination observe however, possibly owing to errors of observation of the mag which rest presumably on eruptive and metamorphic rocks.

It is interesting to compare the observations of declinatio

	Ber
Rossler, Nov. 27, 1895	
Ball, Jan. 6, 1907	

We thus arrive at a yearly secular diminution of declin concluded that the rate of 3′ per annum given in the “Admir

Travellers in the Eastern Desert should exercise care in t abound, disturbances are likely to occur. Local deviations o fragment of the rock no larger than a nut, so rich are some o presented to it.

[62]This measurement was made in

[63]The logarithms A′, B, and C are

[64]CHAUVENET (*Spherical and Prac* latitude is required the stars are best sel latitude would be precisely determined

[65]I am indebted to Mr. B. H. Wad

[66]The signs of the coefficients foll
the star is east or west of the meridian.

[67]CHAUVENET, *Astronomy*, Vol. I,

[68]In this connexion it is interestin
attraction, thus explaining why the obs
latitude agrees closely with the calculat

[69]The method of observation and
work.

[70]The Sudan Survey's positions ar

[71]For calculations of this type an
the *Cairo Scientific Journal*, "On the Use

[72]A careful discussion which I ha
pass over land or sea. I hope later to pu
0·1503 + 0·0000164 (h − 830), where
resulting altitudes of intersected points
0·13 will only change the altitude by tw

[73]This number 1210 represents th

, 6·84 metres being the correction given

---

d^2 for a distance of ten kilometres.

[74]*Berichte der Commission für Ocea*

[75]In particular, the adoption of th
of some 650 miles; but by regarding Ha
discussion is certainly worth undertakin

[76]The disturbance of the needle w
serpentine deposits of Sikait, as much a

[77]I have given a somewhat fuller

[78]JORDAN, *Handbuch der Vermessu*

[79]*A New Method of Coast Surveying*

[80]The observations at Halaib were

[81] *Berichte der Commission für Ocea*

[82] *Magnetic Observations in Egypt*, 1

[83] *Red Sea and Gulf of Aden Pilot*. 5

It has been already mentioned (p. 21) that all the draina
those parts of these wadis and their tributaries which are kn
—

WADI SHAIT

WADI KHARIT

Wadi Alaqi

Most of the drainage-lines mentioned in the description v

Wadi Shait, an important main trunk wadi draining wes
nearly 200 kilometres, and an average fall of three metres pe
340 metres, or an average gradient of six metres per kilomet

The head of Wadi Shait is formed by the union of a num
divides. Passing in a south-westerly direction to the west of
open country, and then narrows among hills north-west of tl
name of the well indicates) is very bitter, and is generally
kilometres below Bir Murra. Bir Um Gubur is a shaft about
Gubur, **Wadi Hamish** joins Wadi Shait from the north-east.
tributary wadis are Muelih, Beza, and Midrik, all of which jo

The upper portions of Wadi Shait contain a fair abundanc

Wadi Muelih originates in the mountain called Gebel Ite
kilometres long rising among crushed diorites and schists to
more enclosed by low hills. The first hills passed on the righ
schists on the left. At ten kilometres below Erf el Fahid, or

kilometres further on, a band of diorite gneiss cuts across t
higher as one descends, and near the meridian of 34° the w
passing Gebel Muelih the wadi, which has here a width of c
water drinkable only by camels. North-east of the well a tra
and then takes a more southerly course draining into Wadi S

The wadi floor falls from a level of 484 metres near Erf
the actual gradient varies from about two metres per kilome

The upper parts of Wadi Muelih are barren and sandy, b
Samut, entering on the right in long. 33° 54′, and Wadi Sibri

Wadi Gerf is the collective name given to a number of
commences at about an altitude of 811 metres due east of th
Wadi Hangalia are some old ruins of a mining camp, and a
Nugrus, at an altitude of 691 metres. These two main heads
called **Rod el Atut**, takes the drainage from all sides of the
mines, chiefly in talc schists. The drainages from these vario
Abu Seyal and **Wadi Um Seyal**, south-east of Gebel Atut, **R**

The principal hills of the plain over which Wadi Gerf and
Sagur; these two last rise to 514 and 523 metres above sea-le

Wadi Gerf possesses a fair amount of vegetation, except w

Wadi Sibrit is a long narrow wadi following a course s
excavation in the wadi floor, in longitude 33° 58′; it is said t

Wadi Kharit, one of the greatest trunk wadis of Egypt, h
collecting the drainage from numerous great wadis on its wa
and of its tributaries probably more than twenty times as gre

The principal tributaries of Wadi Kharit, which will be s
the course of the main wadi in some detail, leaving its greate

The main head of Wadi Kharit is on the Nile-Red Sea divi
sandy plain with hills of bouldery granite, and curves round

Wadi Hilgit originates on the main watershed in longitu
wadis are called Wadi Hilgit lil Kharit and Wadi Hilgit lil H
mountains of the same names.

Wadi Egat drains part of the west slopes of Gebel Abu Gı

After passing Gebel el Anbat, Wadi Kharit continues its c limit the plain to the north. The principal of these feeders a mass of low dark hills called Gebel Geneina, and here it rece the **Rod el Geneina**, draining from the hills of Geneina. A li

The next feeder is the **Wadi Helie**, which drains the wes same character as Bir Abu Hamamid; it was yielding plenty c

About ten kilometres below the point of influx of Wadi I opposite side conveying the drainage from the north-west fla

In the remaining portion of its course to the Nile, Wadi K

On the whole, Wadi Kharit is poor in vegetation; trees a usual for caravans to journey along the wadi from its mouth **Qoleib**. Bir Qoleib is a good well in a small tributary of W Qoleib to the well of Abu Hashim, south-east (on the road to

Wadi Elemikan is the name given to an ill-defined syste which descends to the sea. At this point, which is 590 met through which narrow wadis descend rapidly towards the s dazzling whiteness to a height of sixty-eight metres above th Wadi Abu Gurdi, which divides into two channels on emerg Wadi Kharit north of Gebel Geneina in longitude 34° 36′. It granite boss of Gebel Selaia. I obtained a small supply of ver

Wadi Abu Hamamid, an important tributary of Wadi Kh west to longitude 34° 41′, then turns south-west and enters t Hamra, to Bir Abu Hamamid, and then turning south-west b

Bir Abu Hamamid is an important well; it is a rude irreg any of the other wells in the neighbourhood; the water was r

From near Bir Abu Hamamid, a track leads north-westwa the plain.

A small tributary which joins Wadi Abu Hamamid from t pass is 685 metres above sea; it is quite practicable for bagga

Wadi el Sheikh, the only great tributary of Wadi Abu Ha mainly a direction a little west of south, fed by numerous la

Hargal. Near the point where Wadi Um Deheisi joins it, the
tomb, from which the wadi derives its name, is a white don
close to the tomb, is a shallow excavation in the stony allu
being maintained almost level with the ground by undergro
the quality simultaneously falls off and the water acquires a

After passing Bir Shadli and entering on the plain, Wadi
Hargal, draining from the north flanks of Gebel Kahfa. Uniti

Bir Shadli is one of the best-known centres of the Ababd
Many roads converge here. To the west, a track leads to Bir
the south-east there are several alternative routes by which
Hargal, and by an easy pass into Wadi Helie, a small tributa

Wadi Khashab commences its course near Gebel el Hed
Homr Akarim and entering Wadi Kharit from the north in a
numerous as to give a very pleasing contrast to the dreary w

The principal feeders of Wadi Khashab are Wadi Metaw
Metawit, excavated about eight metres deep in the centre
large acacia trees, was yielding a plentiful supply of excellen

Wadi Antar originates near the hills of Nukheira and El
the left a little further on; it turns again westward and then

Wadi el Garara, the great southern tributary of Wadi K
north of Gebel Um Harba, and turns somewhat more to the
Gebel Um Harba as a great valley nearly full of blown sand
latter tributary is very barren, but is of some importance as
pass, a well known water-hole called **Galt el Aguz**. This gal
it becomes dry in a few months of drought; rude Greek ins
tributary first mentioned takes that from the sandstone hills

A little lower down, Wadi Garara receives feeders from t

Wadi Timsah heads among high granite hills a little nort
feeders from the eastern hills are richer in vegetation, and
Wadis Um el Rid, **Awamtib** (with Wadi **Um Marakh**), **Sha**
Rid, there is a very easy pass over the main watershed into W

Of the **Wadi Ghadrib**, which heads near the hills of Geb

character is sandy and arid.

The small tributary called **Wadi Abu Hashim**, which en wadi floor, and furnish good water at a depth of about eigh metres above sea and sixty-six metres above the wells. The p and to Abu Saafa Springs (a journey of about one hundred k

Wadi Natash commences among the low hills forming t conspicuous cones called El Nahud (the breasts), and afterw enters on the great plain called Atmur Nugra, where it joins

There is, I believe, no water source in Wadi Natash itself which good water can generally be found at a depth of abou same year.

Wadi Alaqi, the greatest of all the Egyptian wadis drain general westerly course, winding at first, past the old minin Um Gariart, and enters the Nile Valley opposite the large v 44,000 square kilometres. Its heads and upper tributaries lie wadi into a temporary stream for a part or all of its length. torrent from the Wadi Alaqi into the Nile was so great as to 1902 as a consequence of heavy rains in the mountainous c that great waters were coming down the wadi. Except for a kilometres of the mine, and when the alarm was given, at 6. o'clock there was a mighty stream, over 300 metres wide an did not reach the Nile; after flowing for some seventy kilon informs me that the water did not penetrate the sandy and g absorb enough water to yield any supply to wells sunk in it.

The part of the basin of Wadi Alaqi falling within the lin Alaqi, all entering the main wadi from its north side. The fol

Wadi Himeitra is a small wadi draining the south face c kilometres in a south-westerly direction, joining the Wadi Al

The **Miti Kwan**, the next tributary of Alaqi, has its head Adar Qaqa range. About fourteen kilometres further down winding course among the hills for some eleven kilometres, receiving Wadi Miaus, the Miti Kwan continues a winding c

the Abu Hodeid and Meisah wells, leads up the Miti Kwan fc

Wadi Dageina is a small many-branched tributary of Ala

Wadi Alfawi, which enters Wadi Alaqi a little lower dow

Wadi Egat, the next important tributary of Alaqi, drains kilometres up from its junction with Alaqi, and there are ex and after receiving various feeders, the principal of which is

Wadi Hateib,[88] which enters Wadi Alaqi about twenty receives small feeders on the west from Gebels Adraq and Gu

Wadi Guqub, a very small wadi which enters Alaqi six quantity. A road leads from Wadi Alaqi up the Wadi Guqub

Wadi Um Teneideb drains the western faces of Gebels e point of junction with Wadi Alaqi. The old mines of Betam a

Wadi Defeit, which is probably the most important Egyp chord east and west; the total length of its main channel, fr times as great. The principal head of Wadi Defeit is called **W** Gebel Heleikontî. Passing between the high ranges of Heiana mountain to the south; continuing westwards, it cuts throug Heianai range and the more northerly mountain of Anweyib feeders, **Wadi Meladoyeb**, **Rod Hauanin**, and **Wadi Bagha**

Wadi Seiga, the next great northern tributary of Wadi A side of the mass of Gebel Seiga; and about thirty kilometres from the west, called **Wadi Deheis**, heads in Gebel Deheis a eastern tributary, called **Wadi Um Derera**, drains the south limits of the maps in this volume.

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[84]Dry in 1906.

[85]To be distinguished from anothe

[86]To be distinguished from the be

[87]"L'Etbaye." p. 1.

[88]Mr. Campbell's map names this names the mountain Gebel Suhin; it pr

hill-mass into Wadi Egat.

The eastward drainage differs strikingly from the westwa basins, there are on the seaward side no less than forty-seve the remainder being relatively small.

The following list gives the names in order, from north t parentheses. It may be remarked that the minor feeders and

WADI DABUR.

WADI IGLI.

WADI UM KHARIGA.

WADI SUKARI.

WADI UM TUNDEBA.

WADI AMBA-UT.

WADI GHADIR

WADI UM GAMIL.

Wadi Gemal

Wadi Um el Abbas

Wadi Abu Ghusun

Wadi el Ranga.

Wadi Hamata.

Wadi Haratreit.

Wadi Khashir.

Wadi Mikbi.

Wadi Lahami

Wadi Mukhit

Wadi Abu Dibban.

Wadi Mindeit

Wadi Kalalat

Wadi Um Goran.

Wadi Kunserob

Wadi Abu Beriga.

Wadi Khoda

WADI UM ETLI.

WADI SORUBIAB

WADI RAHABA

WADI HODEIN

Wadi Kolaiqo.

Wadi Shab

Wadi Ibib (Hasium)

Wadi Meisah

Wadi Kiraf (Di-ib)

Wadi Di-it.

Wadi Eikwan.

Wadi Yoider

Wadi Aideib

Wadi Todhi.

Wadi Delowa.

Wadi Serimtai

Wadi Shellal.

Wadi Aqilhoq.

Wadi Aqwei.

Wadi Kreit-reit-or.

Wadi Qabatit.

Wadi Dabur falls only partly within the district to be de limits shown on the map.

Wadi Igli is a short wadi draining from Gebel Igli and co

Wadi Um Khariga has its principal head in a *cul-de-sac* v communication with Hangalia mine; the highest point of th north-east, receiving just below the bend a large tributary w Further on in its course towards the sea, Wadi Um Khariga hills and enters the sea in about latitude 25° 5′. The total len

Wadi Sukari, the next wadi to the south, heads at a pass the sea a little south of Wadi Um Khariga. Near the south en

Wadi Um Tundeba heads near the mountain of the sam **Galt Um Tundeba**. This is a rock basin situated about one permanent water source.

Wadi Amba-ut is a small wadi originating near the grani

Wadi Ghadir, which drains by numerous tributaries the channel, not counting its feeders, of about forty-five kilomet

The principal head of Wadi Ghadir is at an easy pass betv of Gebel Ghuel; the principal of these feeders, **Wadi Ghuel**, are some old gold mines, and then receives as tributaries **Wa** draining the craggy felsite hill of the same name; there are s

The **Wadi Zabara**, an important tributary draining the n by the separate names of **Wadi Atabi**, **Wadi Um Abid**, and ancient emerald mines, as well as a series of rock basins whi

After receiving the Wadi Zabara, Wadi Ghadir continues into which the wadi splits as it passes round a low island-li digging it out until the rock basins were empty; it is an impo

About six kilometres below the well, Wadi Ghadir passes
enters Ghadir a little to the east of Gebel Allawi; both Allawi

Wadi Um Gamil, the next wadi entering the sea to the so

Wadi Gemal is the terminal portion, about sixty kilome
kilometres in length, the Wadi Gemal drains the Hafafit an
proper, leaving the great wadis which join to form it, and its

The name Wadi Gemal is first given to the drainage at th
granite hills, some of which have remarkable shapes, with a
easterly direction, receiving the Wadi Um Suerab lil Gemal a

About six kilometres below the point of influx of Wadi
whence a track leads south-east past the ruins and across the

Passing a remarkable bell-shaped hill (Gebel Um Regeba,
and then the important tributary called Wadi Hafafit enters f

Below the point of influx of Hafafit, the Wadi Gemal bec
tributaries of Wadi Gemal, enters from the north-west at a r
Abiad, which next joins Wadi Gemal from the south, is an in
Sellimi, in which there are water pools after rain. The wadi
north-westerly direction, passing close south of the hill sumr
has not been surveyed beyond four kilometres east of Madar

The fall of the Wadi Gemal averages about six metres p
interesting to note that the observations of level indicate a lo
Wadi Hafafit.

Wadi Huluz is a long winding wadi, mostly shut in by
turning sharply eastward, it enters more open country and t
slope is much flatter, being twenty metres per kilometre. Fr
the Wadi Gemal, it is only six and a half metres per kilometr

The principal heads of Wadi Huluz are close to the south
unite to form the main channel, which due south of Hamata
it passes west of the great mass of Hamata, receiving the dra
which drains the north face of Hamata and the south flanks

The next feeder of Wadi Huluz, called **Wadi Mahali**, ent
Tarfawi, draining the mountain of the same name from the

tributaries enter Huluz near together from the south. The u
Gebel Abu Hamamid. Nearly opposite the mouth of Wadi U
Arabs preferred to reach Gebel Um Heshenib by a small wa
obstructions in it.

About eight kilometres further on, on the north-east sid
receives two tributaries together; one, from the south-east, i
east and south to the well and tomb of Sheikh Shadli.

Two sheikhs' tombs and some smaller graves exist at a l
from the south. The wadi now becomes very tortuous. Near
basins fed by rain water draining down steep gorges from th
four kilometres lower down, the **Wadi Um Iteili** enters from
Wadi Gaetri leads by an important pass into the more open c

At the open space above-mentioned, Wadi Huluz turns no

Wadi Durunkat, a tributary of Wadi Gemal, forms an im
very easy pass in longitude 34° 46′, thus cutting off the long

Wadi Hafafit, another tributary of Wadi Gemal, has its h
nearly forty kilometres south-east, with the remarkable rang
accumulations of blown sand. **Wadi Abu Had**, a small weste
Gemal, is called by the diminutive name of **Wadi Hefeifit**.

Wadi el Abiad, likewise a tributary of Wadi Gemal, de
northerly slopes of Gebel Um Heshenib. There is a very stee
hills on each side. It narrows further down, at a point oppo
receiving the **Wadis Um Seyal el Foqani** and **el Tahtani** fr
Seyal el Foqani there is a pass leading by the Wadai el Anz i

Wadi Nugrus, an important tributary of Wadi Gemal, co
line for nearly forty kilometres to join the Wadi Gemal in lat
the wadi is rocky and steep; the slope for the first few kilom

The approach to the head of Wadi Nugrus from the nort
nature of the track and the rapid fall. The wadi here is in fa
in a narrow gorge, is the spring called **Megal el Harami**, sit
the wadi broadens out considerably, with a sandy floor in th
south-east flanks of Gebel Nugrus and the west flanks of Ge
Gebel Nugrus. The pass is, however, impracticable for bagga

Beyond the junction of Wadai el Nom, the Wadi Nugrus
the **Wadi Abu Rusheid** from the north, and a little further
basins yielding water after rain, but these were dry in 1905.

Wadi Sikait, a tributary of Wadi Nugrus, heads in some l
yield excellent water. These two heads join at a well recentl
sunk well, which has only yielded water of inferior quality.
tower, ascending gradually to a pass into one of the heads
track leaves on the east for **Wadi Um Heran**, in which I an
where it enters Wadi Nugrus, or an average slope of twenty

Wadi Um el Abbas originates by the union of several he
Abu Hegilig. Another, close east of Gebel Abu Hegilig, leads
Abiad. The course of the Wadi Um el Abbas has only been su

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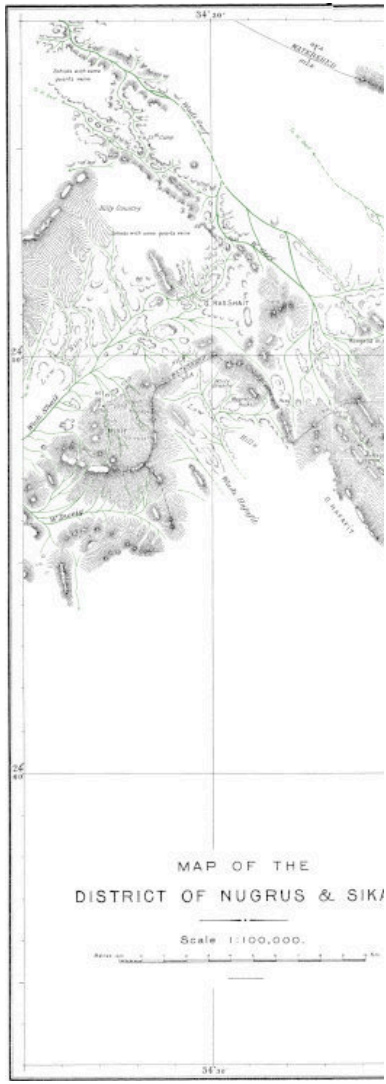


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

Wadi Abu Ghusun commences its course among the hig
more to the east, receiving Wadi Romit as an important tribu

Wadi Romit, a tributary of Abu Ghusun, originates in th
Abu Ghusun. It receives several important tributaries. The c
drains the south part of Gebel Um el Abbas, while a third is
rather rapid fall.

Wadi Hamata drains the eastern flanks of the high hills
reaches the sea in about latitude 24° 24′.

Of the three wadis draining seawards south of Hamata, c
drained by them have, however, been mapped, and their cou
the upper parts of these wadis must have an extremely rapid

Wadi Lahami, which enters the sea north of the penins
kilometres north-east of the white quartz cone called Marwo
general north-easterly direction. About six kilometres below
in a rough steep pass over the hills into the Wadi Abu Daba
forming reservoirs of rain water; these contained good suppl
north of it, by a series of feeders, the principal of which are
channel for a road. Just receiving Wadi Sefent, Wadi Laham
these feeders are said to contain natural reservoirs full of w
traced in detail. It passes north-west of the well marked gra
below the pass at its head, and turns off south-east up the tri

Wadi Lahami is well supplied with trees; it presented a
approximately fifty kilometres, its average slope twelve metr

The drainage from the low hills on the **Peninsula of Ras**
the peninsula than to the north, the wadis draining southwa
from south to north is only possible to camels at a few pla
peninsula, the nearest reliable source of supply being a galt
coast. It is chiefly built of wreckage cast up on the beach. Fr
venerated by sailors, and several of my camel men made pilg

The **Island of Mukawar**, about six kilometres south of tl
thirty-four metres above the sea-level.

Wadi Abu Daba drains the eastern flanks of Gebel Eidat
is **Wadi Murra** which enters it from the south-west a few k

debouches on to the coast plain is marked by a group of low

Wadi Abu Dibban is a short wadi draining eastwards f landmark five kilometres north-west of Berenice.

Wadi Mindeit drains the hills between Gebel Um Maiat fresh water source to Berenice; it leads to a rock basin or gal

Wadi Naait[92] is a narrow tortuous gorge, with a sandy forms the usual road from Wadi Lahami to Berenice. Its act enter it from the north-west, and **Wadi Abu Ghalqa**, enteri lower part of the wadi is free from lateral branches. The fall Port Berenice, some fifteen kilometres further east. The nan Benas. Some three kilometres north-east of the mouth of Wa and the crossing of it in a high wind is very trying by reason

Wadi Kalalat heads in the north-west portion of Gebel rather rapidly. At its head a rough steep pass is said to exis former draining the north-east face of Gebel Kalalat and the the hills on the coast-plain. About two kilometres above the of access in a few minutes from the main wadi. About one a of Wadi Kalalat from here to the sea, about eleven kilometre

Wadi Um Goran is a small wadi draining by many heads

Wadi Kunserob, draining the south parts of Gebels Kal through the hills and across six kilometres of sandy coast-pla

Wadi Abu Berigâ is a short drainage line from among th

Wadi Khoda is an important main drainage channel so kilometres being across the sandy coast-plain. With a basin a the sea; it thus receives a fair amount of water in rainy years

The head of Wadi Khoda is formed by the union of three Betan and the old mines of Um Eleiga. The one to the north face of Gebel Abu Dahr and the high hills east of it; the feed with Khoda a track leads up a gully south-westward over an to the prevailing white and dark colours of the sand in the re

A little below the union of the three arms above-menti Dahanib, is mostly shut in by high hills, and is relatively we

its head.

About eight kilometres below the point of entry of Wadi sandy rapidly-falling wadi draining Gebel Hindia.

Some five kilometres further down, **Wadi Um Akra**, drai head of Wadi Shut is on the west side of Gebel Kalalat, wh twenty-three kilometres to its junction with Wadi Khoda. W course is **Wadi Um Tawil lil Shut**, which drains the south water source, the exact locality of which has not, however, b

Just below the place where Wadi Shut joins it, Wadi Kho from the south, and five kilometres further the **Wadi Um Se**

The **Wadi Gumudlum**, the next great feeder of Khoda, Kalalat. A little below wadi Gumudlum, near a boss of whit called Gebel Um Etli.

The last feeder of Wadi Khoda, the **Wadi Shenshef**, ent among high hills. If it be followed up for about ten kilometr **Shenshef**, which attest the former existence of a town or la the hills. As there are apparently no mines in the hills her stronghold.

For some eighteen kilometres south of the Wadi Khoda, guides' statements, the **Wadi Um Etli**, coursing eastward an the north part of Gebel Faraid. The sandy coast-plain in this

The **Wadi el Sorubiab**, draining from the north part of wadi, for which I could not obtain any name from my guides

Wadi Rahaba, with a basin of about 900 square kilomet Azrak, a tributary of Wadi Khoda. About three kilometres be At this point there is an important well, **Bir Rahaba**, sunk i tributary called **Wadi Abu Reye** enters Wadi Rahaba from t a little further on, and then the wadi, which has thus far tak

This **Wadi el Abiad** drains the western side of the northe a sandy plain at the foot of the highest peak of Faraid, and b

About three kilometres lower down than the point of in kilometres up from its opening into Wadi Rahaba. Some six

is broken by small hills, and is limited east and west by othe
receives several tributaries, the principal being **Wadi Hutit**
hills two or three kilometres east of the main Wadi, joining t

Wadi Rahaba curves round to the south of Gebel Fereyid

The upper parts of Wadi Rahaba, where it is shut in by
vegetation and the openness of the plain. The total length is
only five metres per kilometre in the broad and sandy course

Wadi Hodein, one of the largest and most important of
of the Wadis Arned, el Sania, Um Sumur, Saalek, Um Reit, a
three metres per kilometre. For the first fifteen kilometres
through lower metamorphic hill country; and in the last tw
pleasantly wooded, and contains the perennial springs of Al
and form important lines of communication by leading to e
course of the main wadi in detail to the sea, noting the influ

The most important of the wadis which join to form the
mention.

Wadi el Arned originates on the main watershed about f
divide actually is; the wadi in fact heads in a sandy plain al
south by its most important feeder, the **Wadi Muegil**. This
flows in a northerly direction, entirely among sandstone hil
kilometres, one can reach a rather steep and sandy eastward
isolated hill on the east side of the Wadi Arned, there appea
Lower down its course, Wadi Arned is at first very sandy ar
Wadi Hodein it contains abundant vegetation. The Wadi Arn

Wadi Saalek is a short wadi with many feeders, drainin
Gebel Um Reit to Wadi and Bir Um Reit.

Wadi Um Reit heads in the granite mountain called Geb
Reit leads to a pass north-west of the mountain into Wadi Sa
of Wadi Timsah. The well called **Bir Um Reit** is a deep exc
kilometres by road from Bir Abu Hashim, the nearest well t
supply at Abu Saafa can always be relied on for quantity and
almost entirely in sandstone hills; it has not been mapped in

We turn now to the main channel of Wadi Hodein, which

feeders, **Talet Um Danaqa** and **Talet Kurit** on the south, ar
the **Wadi el Gihab**. The main Wadi Gihab has not been follc
to a very steep and difficult pass into Wadi Dif; this pass is p

The **Springs of Abu Saafa** are situated in the Wadi Ho
sandstone scarps. There are four springs, all issuing from th
westerly of the four springs is a mere trickle; the next yields
and has yellow incrustations near it. The rate of flow, even f
the sand of the wadi floor; but the pools are large enough fc
six small date palms, and the wadi hereabouts has many otl
that an impetuous stream about half a metre deep had flow
high sandstone plateaux, contains water holes about three ki

Wadi Hodein now opens out, the high sandstone scarps
kilometres below the opening of scarps, Wadi Hodein receiv
Hodein from the south-west about six kilometres further on;
el Atshani joins Wadi Hodein from the north-west; the Wad
Both the Wadis Orga are said to originate near Gebel Orga, s
its junction with Hodein. On the opposite (south) side, Wadi
either side of a small group of isolated hills; and nearly opp
its course from Wadi Hodein. Several feeders come in from t
On the other (south) side is the mouth of Wadi Khashab, dr
spur running north-west from Gebel el Anbat nearly cuts acr
chief bears the name of **Wadi Um Seleim**. Near Gebel el Anl
a little north of east, merges into the coast-plain, over whi
mountain of the same name and containing two wells; and a
on the ground, being almost lost in the general sandy plain.

Bir Shalatein, a very salt well in the Wadi Hodein, abou
of government. It is merely a few shallow pits sunk in the
inconspicuous, to be easily found.

Wadi Naam, a great tributary of Wadi Hodein coming fr
about forty-nine kilometres to its junction with Wadi Hodei
course is very ill-marked. Its slope decreases from five metre
large tributaries, of which the chief are the Wadis Silsila and

The **Wadi el Fil**, which may be regarded as the main hea
which yield water for a short time after rain.

Wadi Abu Seyal drains the south part of the same range;

Wadi Um Bisilla drains Gebel Um Bisilla, which it half e
west of the mountain, Wadi Um Bisilla receives, from the no
Khiua have not been surveyed in detail; their courses as sho

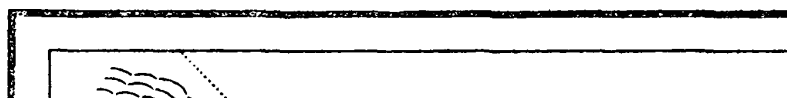
Wadi Erf Um Araka heads as a series of small wadis am
south, to join Wadi Naam about five kilometres lower down
Araka, and on into the heads of Wadi Um Bisilla.

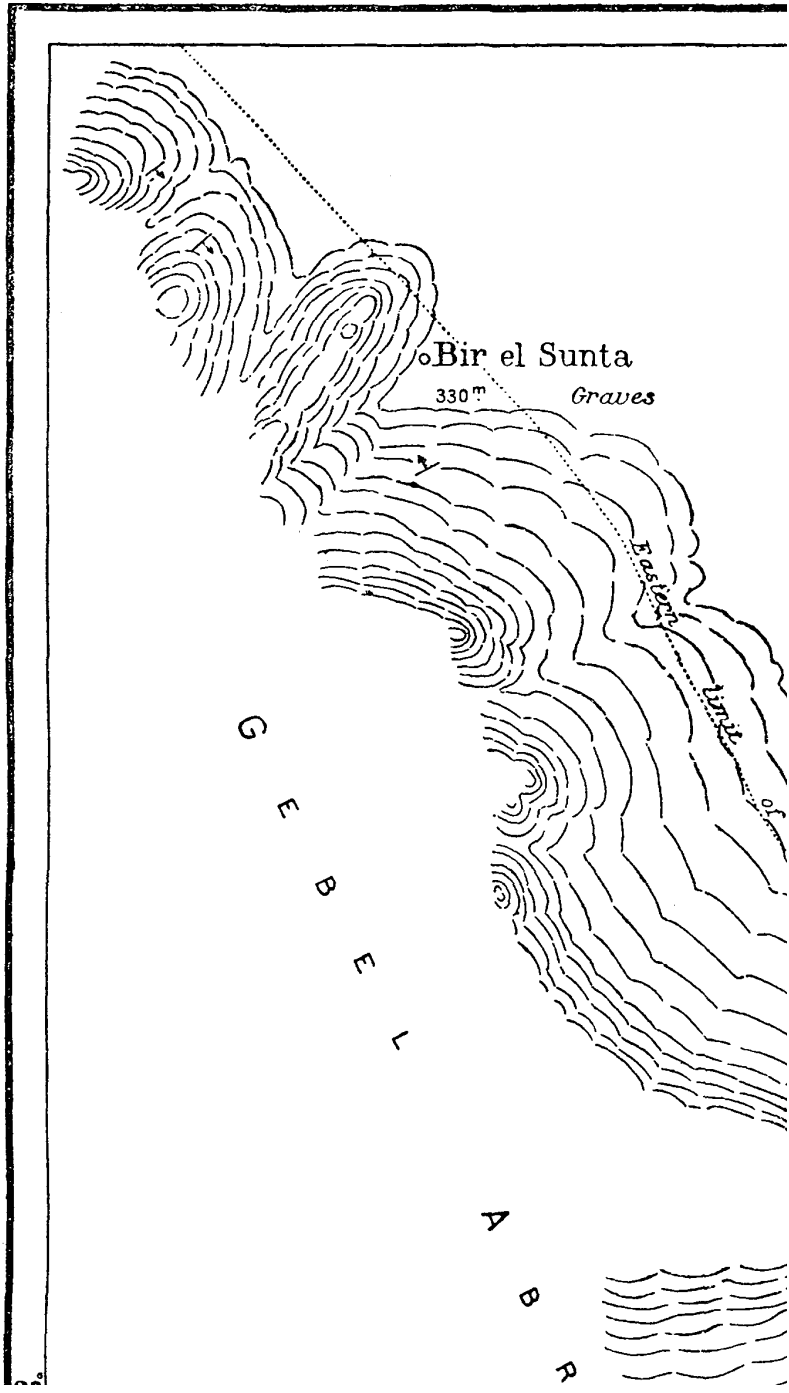
Wadi Arais originates by the union of many small feede
Wadi Um Guruf, draining the hills round the conspicuous g
draining the east face of the long gneiss range called Erf Um
called Gebel Arais to join Wadi Naam. Its junction with Wa
metres above sea at the pass into Wadi Erf Um Araka, to 345

Wadi Silsila[97] heads in high sandstone hills on the me
great deal of blown sand. Feeders enter it from the sandston
Naam, Wadi Silsila cuts through the range of low sandston
reaching this range, entering the drainage of Wadi Abraq ov

Wadi Abraq is a rather ill-defined drainage line which c
Naam, about nine kilometres above its junction with Hodeir
Abraq Springs. There are no less than five springs within a

The first spring from the north, called **Bir el Sunta**, is a
rapidly as it is emptied. The second and third springs, calle
Abraq, is situated a short distance up a stony gully which e
three kilometres further south-east, and, like the others, at t




Bir el Sunta
330m
Graves
Eastern limit of
G E B E L
A B R

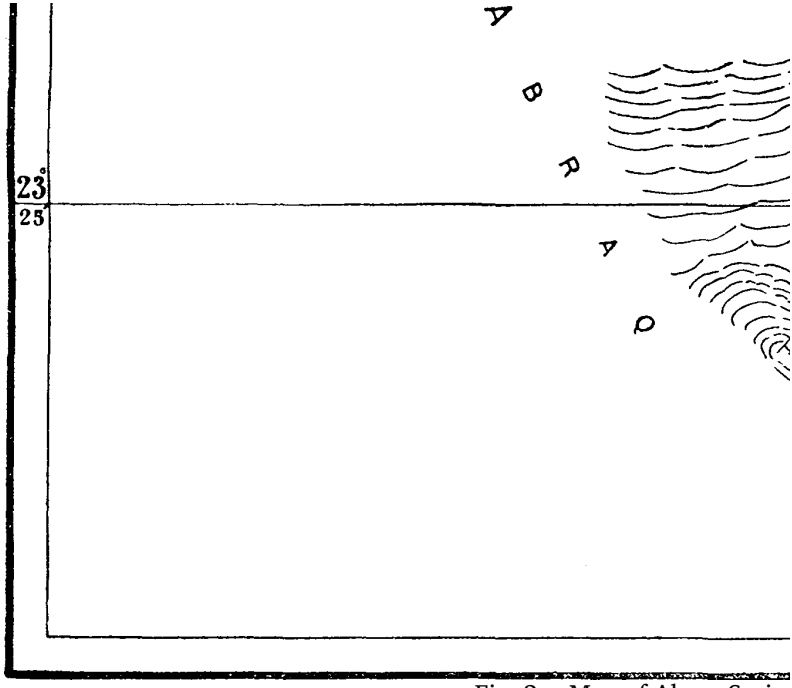


Fig. 2.—Map of Abraq Sprin

The water at all the Abraq Springs is of excellent quality but Bir el Sunta is rather easier of access for camels. The spr trees in the vicinity; consequently, the Arabs of the neighbo low hill east of Bir Abraq, and some Arab graves a little furtl

Wadi Betan originates on the north side of Gebel Abu D Naam a few kilometres only above its junction with Wadi H important part, as containing water sources and old mine wo

About five kilometres below its head, Wadi Betan contai further up Wadi Betan, close to a small tree. Both these wel Arabs to open them, as a galt at the head of the wadi, just so

Just above the wells, Betan receives from the south the f extensive ruins and old workings about two kilometres up fr is to be seen near the ruins.

The **Wadi Abu Debebi lil Betan**, which joins Betan on t Bir Betan. **Wadi Abu Sieiyil** is a small feeder entering Betar Debebi pass, and turning south near Gebel Hendusi, receive

which in turn flows into Wadi Betan. A well, **Bir Abu Beid**, **Wadi Egat**, nothing has been seen; it is, however, stated by

Wadi Dif originates in the sandstone hills round Bir Dif, part of its length of twenty-nine kilometres it is very narro through the low hills which separate the Wadi Hodein from few insignificant feeders. Of these, **Talet Um Karaba** and **W** flanking the plateau, joins Wadi Dif just above its junction w

Bir Dif is situated in a small gully forming the head of tributary coming in from the west; but the Arabs restrict the up the gully, at the junction of sandstone and schists. The ap

Wadi Feqoh, a tributary of Wadi Dif, is many times long times that length. Though only portions of Wadi Feqoh have out. It is for the most part a very barren wadi, forming an i Soaorib, only some twenty kilometres north of the 22nd par Hadal Derqa. Curving slightly to the north, it crosses the gre close west of the low range called Gebel Um el Kalala, and seventy-two kilometres, is from 470 metres to 280 metres ab

Wadi Feqoh has many tributaries. Those near its head, a which are probably the most important, have been mapped kilometres before its junction with Wadi Dif. The tributaries Bir Sararat Seyet.

The most southern tributaries of Wadi Feqoh which hav each coursing for about sixteen kilometres across a sandy pla

The main head of Wadi Gimal is called **Wadi Seyet**. It o from the south-west is **Wadi Wadhait**, collecting the south and the south-west parts of Gebel Gerf. These both join Wa wadi only down to where it passes through a narrow gap b presented an almost park-like appearance at the end of 190 1907. It is said to be twenty metres deep and to yield plent digging out the well when further supplies were necessary.[Gemal lower down its course.

The country between Gebel Korabkansi and Gebel Niqru channel runs fairly straight in a north-westerly direction, re

channel again by the **Wadi Haletiai**, which also collects the feeders from the west and north of Gebel Niqrub Foqani, of the dark cone called Gebel Mismih. From Bir Sararat Seyet t about four and a half metres per kilometre; its slope is thus r Wadi Gemal and its tributaries contain as a rule a fair abund

Wadi Abu Hashim, which joins Wadi Feqoh about three tributary of Wadi Madi. Wadi Abu Hashim follows a north-w has a length of seventeen kilometres, and an average slope o

Wadi Anfeib, which enters Wadi Hodein from the south respectively the northern, central, and southern parts of the Wadi Anfeib has a course of only about seven kilometres to r

Wadi Madi, the next great tributary of Wadi Hodein from in longitude 35° 7′, five kilometres lower down Wadi Hodein Wadi Gemal, which enters Wadi Hodein by way of Wadis Fe the rest going into Wadi Sherefa el Gharbi. A similar fate is s wadi courses in a direction a little south of west, falling very The next head of Wadi Madi to the north is formed by **Wad** commences to be applied to the drainage is uncertain, as Ar Difoteb, divides into two parts, the lesser going down Wadi 22° 46′. There are numerous feeders from the low hill count 47′, where it turns sharply, almost at a right angle, to the no its mouth lined with stone slabs; in December 1907, when I level. A beacon on the granite hill overlooking the well has little north of latitude 22° 50′, where it gets into more open from the west and east respectively, Wadi Madi becomes na the Wadis Shellal el Gharbi, Tugudbaia, Sinatib, Atluk and I where it is wide and sandy, are more barren. Its principal h fifty-four kilometres of its course from Bir Madi to Wadi Hod

Wadi Shellal el Gharbi, a tributary of Wadi Madi, orig Radad. Flowing at first nearly due west, Wadi Shellal el Gha Wadi Shellal el Sharqi, and one westward into the head of W It has a rather rapid fall, and contains a fair quantity of trees

Wadi Sinatib, which enters Wadi Madi about six kilomet

Wadi Tugudbaia conveys to Wadi Madi the drainage fro

Wadi Berendiyeb, which joins Wadi Madi from the we almost a sandy plain to join Wadi Madi. Its length along its special names, being broad and sandy and without much veg

Wadi Atluk, which flows into Wadi Madi from the soutl Wadi Kreiga, while the other part retains its northerly direct

Rod Mukrayib is a many-branched wadi which drains tl the north face of Gebel Niqrub el Tahtani; while a third drai of its channel is fifteen kilometres, with a fall of from 405 r narrow in, about nineteen kilometres above its junction with

Wadi Kolaiqo, which joins Madi almost opposite Rod M rather high hills, coursing west-north-west with a length of r

Wadi Edunqul, a small tributary entering Wadi Madi, kilometres.

Wadi Khashab, a tributary of Wadi Hodein, drains by m reaching the pass, there is a large quartz vein with some rui parallel to Wadi Hodein its length is about twenty-six kilon feeders course in trenches across the stony slopes at the feet

Wadi Beida originates at a pass 395 metres above sea-le the high hills on either side. It then turns abruptly at an acu turning south for one and a half kilometres to a point marke round into a north-easterly direction, as a narrow gorge thr The upper well is at the opening of a defile leading south-e down the wadi, at a sharp bend in its course; it is an excav years without rainfall, but the water only infiltrates slowly, s

About four kilometres below the well, Wadi Beida emerg divides, still preserving its general north-easterly direction, i

From Bir Beida the nearest wells are Bir Meneiga and E mentioned south-east of the upper (dry) well, thence into W distant, one descends Wadi Beida into Wadi Hodein and foll

Wadi Kreiga, the last great tributary of Wadi Hodein, Meneiga.

Wadi Korbiai and **Wadi Meneiga** have their heads only

of “navigability” of the wadi is formed practically by these s

Bir Korbiai consists of two wells, both situated at the fo stone is placed to prevent infilling by downwash. In Decemb yield good supplies for three or four years after rain has falle

Below the wells, Wadi Korbiai sweeps round in a semici Small feeders enter from both sides. The bed of the wadi is northerly course into the Wadi Atluk, a tributary of Wadi Ma

Bir Meneiga is important, not only as giving a perennial northern spring is taken as marking the frontier; its position Each of the springs consists of a tiny pool among the rocks There are numerous ruins at Bir Meneiga; they consist of ruc

Above the springs, Wadi Meneiga soon becomes impassa Kreiga. The fall in this seven kilometres is 200 metres, so t lateral feeders, including one from the east, three kilometres

From the mouth of Wadi Meneiga, Wadi Kreiga courses north-west, six kilometres below the mouth of Wadi Menei opposite sides: that from the north is called **Wadi Eberer**, w this point the country opens out considerably, and the wac receives a tributary from the north-west just before it passes into Kreiga from either side, and the wadi emerges on to a s mouth of Wadi Meneiga to Wadi Hodein is about fourty-on where the wadi bed is stony, is of course somewhat greater,

Wadi Kolaiqo is a very ill-defined drainage line headir absolutely barren except for a little scrub in its upper parts.

Wadi Shab, with a basin of about 1,250 square kilometr It has a great number of heads, most of which bear special n great trunk channel. From the circumstance that its heads ar Shab and its feeders are well stocked with trees. Only in th barren. Its principal heads and feeders are Wadi Radad (fed Sherefa el Sharqi, and Kwat Hewah. At least three of these c described in detail below, commencing from the northernmc

Wadi Radad may be more properly described as a tribu courses eastward for about thirty-six kilometres, joining Wa

course was mapped from the triangulation station of Gebel C

Wadi Shellal el Sharqi, a large feeder of Wadi Radad, o tributary of Wadi Madi; while another, a little further south Wadi Radad about eighteen kilometres below the head of th

Wadi Muqur heads in the eastern mountains of the Gerf which camels can go up the gorge is marked by a well calle rock basins at slightly lower levels. The flow was at the rat water ceases to flow as a spring they dig out the debris and mountains to the west, it turns sharply eastward and emerge low hills west of Qrein Salama, and its bed divides and anas Shab, Wadi Muqur has a length along its main channel of ab

A few kilometres before reaching Wadi Shab, Wadi Muqu

The **Wadis Qadiloi** and **Baaneit** drain from the east face which flows into Wadi Qadiloi; south of this extension there Baaneit, near its head; it is said to yield water always, but re plain, south of the main channel, are the two ruins called **I** dome; there are about twenty Arab graves near the ruins.

South of Wadi Baaneit the plain is crossed by many drain four kilometres south Bir Baaneit, is called **Wadi Kilanai**.

A little south of Wadi Kilanai the plain cuts far back to t hills break the monotony of the plain and cause much bran right in the heart of the mountain mass. In one of the head because of its situation in a closed-in wadi and thus not bein leaving the mountains it splits up, part of its drainage going

The **Wadi Um Saha** drains the hills south-west of Bir Baa

Wadi Sherefa el Sharqi, which drains the south portion Gebel Um Rasein to Bir Sararat Seyet by way of Wadi Sher kilometres of its course. A feeder which enters Wadi Sherefa Feqoh. For the first seven kilometres of its east-south-easter Arib, part of its drainage going southward to join Kwat Hew Wadi Shab.

Kwat Hewah drains the eastern flanks of Gebel Dreb an

mentioned above. As it passes Eir Arib, Kwat Hewah divides Medarai. From the head of Kwat Hewah there is said to be a

Wadi Ibib, which drains the eastern slopes of Gebels Me and the smaller hills south of it, is formed by the union of which is simply the upper portion of Ibib, its total length alo

Wadi Hasium, which forms the upper portion of Wadi I Wadi Alaqi. Near its head, Wadi Hasium contains a small **Hasium**, draining the mountain of the same name and conta open to the north, bounded on the west by the mountains o broken by low hills, the principal of which, Gebel Hamra Ti east across it, receiving the Wadi Medarai and becoming mountains to the south and from the hills on the plain. Thes

Wadi Shinai, draining the hills south of Gebel Abu Hode be about seven kilometres from its junction with Hasium.

Wadi Delawet, another small feeder which likewise dra access to **Bir Odis Maaleq**, I have not visited this water sou to be a spring fed by the rainfall on the surrounding high m the Wadi Odis directly, is that the latter route is very difficu distance of Bir Odis Maaleq from the mouth of Wadi Delaw kilometres, some of which is climbing. My native assistant, metres higher than Bir Abu Hodeid.

Wadi Abu Hodeid, which drains the mountain mass of t and a very rapid fall. Its principal feeder is the short Wadi C important spring of good water in the wadi, called **Bir Abu** the guides. My native assistant, who passed the spring on hi midst of high mountains, Wadi Abu Hodeid must at times of camels, and there is no road through its head, but guides st remarkable rounded peak of Abu Hodeid Oqla to join Wadi

The **Rod Anut Berer**, which joins Wadi Hasium about th

Wadi Tikraneib, a small wadi full of trees, drains a jagg

Wadi Abu Hireiq, draining the mountains of the same Hireiq. This latter wadi passes between the main mountains neighbourhood, caused by the feeders from the hills and by

Wadi Abu Hireiq is applied to all of them collectively.

Wadi Odruk is a small wadi draining between two group

Wadi Nilateib, another small wadi further north, drains
Um Rasein to join Wadi Hasium by two channels. There is a
Wadi Hasium is approached they become more sandy and ba

The drainage from the east face of Gebel Um Rasein joins

Wadi Medarai, which forms the Wadi Ibib by its junctio
tributaries, many of which contain abundance of trees and s
to a rather difficult pass, south of Gebel Medarai, into the **W**
to, and changes its direction to a little south of east, passing
Wadi Merdiyeb, which originates ten kilometres south-wes
thirteen kilometres, joining Wadi Medarai close north of Ge
foot-hills of Gebel Um Rasein.

Vegetation ceases to be abundant both in Wadi Medarai a
some fifty-seven kilometres to Mersa Shab. In this fifty-seve
this, while that of Wadi Medarai is about twice as great.

But though Wadi Ibib itself is barren, it has some great t
with their feeders drain the mountains of Soaorib, Qidmib, C

Wadi Soaorib originates in the midst of high mountain
westward into the head of Miti Kwan, a tributary of Alaqi.
which the principal is the **Wadi Haiyo**, draining the eastern
into the more open country which forms the south end of th
drains the western flanks of Hadal Aweib Meisah and enters
Gebel Um Seleim. From this point onwards, Wadi Soaorib c
called Baqari Daba. In this part of its course, Wadi Soaorib
receives more important tributaries from the mountains to th
mountain. Wadi Qidmib has two main heads; the western o
Wadi Soaorib, Wadi Qidmib is joined by other feeders draini

From its head at the pass into Miti Kwan to its junction w
metres in a length of about forty-one kilometres, giving an a
becomes more and more barren. The place where it enters o
are Kurbeilab territory.

Wadi Um Bishtit, which joins Wadi Ibib some five kilom into the head of Wadi Habliai, another tributary of Wadi Ibi lower down is another small tributary from a rocky gorge ar sharp bend, about a kilometre up from the main wadi. Acco can be got, as it fills slowly; at the time of my visit there wa sea-level.

The total length of Wadi Um Bishtit is about fourteen kil the south, and turns northward in opening country to join W

Wadi Orgem, which joins Wadi Um Bishtit about four k Meisah. From the pass, the Wadi Orgem runs between the hi

Wadi Habliai, which heads in an easy pass about three much lower than those on the west, and their feet are swath

The last feeders of Wadi Ibib are those draining from the Ibib, while others from the east side course east and north- grazing for great flocks of sheep. The most northerly draina place where the wells are is called **Ti Dabei Hamra Dom**. O numbers of Arabs were encamped there with their flocks an from the holes to fill their skins preparatory to forsaking the

Wadi Meisah, which drains the north and east slopes of channel (including Wadi Awitla, the central one of its three

Wadi Meisah has three main heads, called by separate n head, **Wadi Awitla**, drains the north slopes of Hadal Aweib easily into the heads of Wadi Baueiwai, while one of the gul supplies of water in April 1908.

These three heads, each of which has numerous feeders, drainage channel is called Wadi Meisah. The little plain wh Shakafa, Wadi Meisah receives from the south the **Sarob K** there is a track from the east side of the wadi over a very ea it in March 1908, it was filled with downwash, and as there good as that obtainable from the galts, so that they only op short distance up from their mouths; these were both yieldi three heads. The northern one, **Akla Da-Aiyob**, is a very sa called the **Wadi Eqaiyib**, is only separated from Meisah at i

another easy pass at its head into Wadi Um Bishtit; the total

In its lower stages Wadi Meisah traverses broad open san direction across the sandy coast-plain to the sea. In the last lower portions are not always entirely barren, for after rec kilometre; lower down, the gradient gradually lessens, and i

Wadi Kiraf, the next wadi to enter the sea south of Meis for a distance of some thirty-one kilometres up from its mo terminal portion of its length which lies in Egypt, that is, n wadi must drain an enormous basin, for the average slope i "Sudan Handbook," it rises far to the south, probably near th alluvial mud, on which crops of *durra* are grown; my came tributaries which lie north of the 22nd parallel, describing fi

Wadi Di-ib enters Egypt a little west of the 36th meridia Shendib,[100] draining the western flanks of the high mounta of Gebel Hanquf, probably enters Di-ib a little north of it. Fo then receives an important tributary from the west, called W country, being shut in for some fifteen kilometres by Adar Meheriqa are of interest. That from the east is really a drai depression called O Harbub, about four kilometres above it Wadi Di-ib about one and a half kilometres below Bir Meh difficulty when unmounted, and it is quite impracticable fo above sea-level.

Bir Meheriqa is a spring situated in the mouth of a smal access. The floor of the gully is covered with conglomerate c but is drinkable. The portion of Wadi Di-ib which lies among

About six kilometres below Bir Meheriqa, Wadi Di-ib is j the route to Bir Meisah from Bir Meheriqa *via* the well know

Soon after receiving Wadi Warabeit, Wadi Di-ib gets into group of low hills of Tishushi it is joined by the Wad el Qirei

From its junction with Wad el Qireira to the sea, Wadi D sea, with only one insignificant feeder, **Halal Hendiyeb**, jo absorbing most of the drainage. But to the west of the mout visit it, but the Arabs say there is no wadi there, and it is po

the same locality.

Of the **Wadi Shendib**, only a few of the heads are situat lower hills flanking the main mass, to form the main channe is shown on the map from the statements of guides combine (the highest peak of Shendib, marked by an iron beacon, is 1 at certain seasons.

Wadi Hareitra, which lies just within Egypt, has likewi longitude 36° 20′, between Gebels Shendib and Hanquf. Fro the plain westward, turning south-west among low dark hills

The unnamed drainage channel which is blocked by sanc of Elba itself, which goes northward by other more import principal interest of this drainage line lies in its forming a cc road, one leaves the drainage line to the south on the plain, kilometres south of Qash Amir, and follows an easy pass intc

Wadi el Qurat, which joins Wadi Di-ib from the west in junction with Di-ib, and the first part of its course is through rather complex, owing to numerous anastomosings and cross in **Wadi Mashushenai**, part of the drainage of which it ca mentioned, while the rest continues as Wadi Mashushenai, fl

Wadi Hashimaiyib heads between Gebel Warabeit and (kilometres. Besides the Wadi Mashushenai above-mentione channel of ten kilometres. There is an easy road up this wa going north by Wadi Wieqwer, and the other south by Wadi

Wadi Warabeit has its most important head at the easy a Hamida and those forming the south prolongation of Gebel (Gebels Hamida and Warabeit, and turns rather sharply to draining northwards from the hills west of Adar Aweib. It th Di-ib is nineteen kilometres, and in this length it falls from while coarse grasses abound in places. Wadi Warabeit forms

Wad el Qireira, which joins Wadi Di-ib from the south-v Keferiai. It is a broad shallow drainage line across the sandy some time after rain. To the south are the low hills of Tishus

Wadi Didaut, a feeder of the Wad el Qireira, commence

Adar Aqdeib, called **Megwel Didaut**, while a small feeder a
wadi. After passing Adar Aqdeib, Wadi Didaut curves round
then between the red granite hills of Adatalob Adara and the
possess abundance of vegetation, the beautiful flowering bu
between the high hills called Qara Saba and Gebel Um Ein, t

Wadi Baueiwai heads in the mountains south of Hadal A
in by mountains and high hills, with an outlet south-west o
round the foot of Gebel Um Ein, Wadi Baueiwai turns north-
easy pass by the east side of Hadal Aweib Meisah into the h
the west side of Qara Saba forms an easy route to Wadi Dic
north-east along the west side of Gebel Nubitra, and reachin
Gebel Miatit. Lower down its course Wadi Aqwem is fed by t
kilometres up the Wadi Nubitra, among high hills. One of th

The **Wadi Hamida** heads in the mountain of the same n
above referred to, it receives a small gully from the east; by
trickle, very salt; a galt a little further up the gorge was dry
one can either go south-east for two kilometres to the easy p
and joins Wadi Baueiwai south-east of the hill of Ti-Keferiai.

Wadi Di-it drains the north parts of the hill mass of Sul I
upper parts among the hills. Of its total course of about thirt

Wadi Eikwan is a broad shallow and sandy channel drai
at first a northerly direction past the west side of Qash Ami
slope is about nine metres per kilometre.

Wadi Yoider, the next wadi to the east, is of considerab
(Bir Akwamtra). The main head of Wadi Yoider may be con
easy pass close to the well of **Bir Salalat O Sir**, about 450 n
below its head. It then emerges from the mountains and tu
downwards to the north, receiving the small and narrow **Wa**
well called **Bir Nabit**, situated in Wadi Yoider, a few hundre
west of it, as well as the important **Wadi Akwamtra** from t
among the lower flanking hills, and dividing into two chan
Wadi Akwamtra, about three kilometres up above the place
diameter in a wide open hollow which filled as fast as it co
was dry, and only the principal well was being used. The flo

visited the place there were numerous Bisharin Arabs at the
principally acacias, so close together that laden camels can
mud; they are said to have been erected by Dervishes in 188

As the densely wooded and stony character of Wadi Akw
Akwamtra for about a kilometre and to cross the Asut Duk p
north of the pass. The head of Wadi Yahameib is also full of

Wadi Aideib, with its principal tributary the Wadi Yaha
of almost all the wells close to the coast, its water is probabl
one and a half kilometres wide between the mountain spurs
the sloping plain, receiving the Wadi Yahameib from the we

Wadi Yahameib originates on the north-west flanks of
head, but just before it enters the plain there is a small feed
Kansisrob and Akwamtra, but is too steep for animals loade
Gebel Elba. Wadi Akau contains a small spring, called **Meg**
Kansisrob is second only to Bir Akwamtra in importance, an
the foot of Elba up the head of Wadi Yahameib with baggage
Egypt where vegetable growth is so abundant as seriously to
ground is common enough; but for the arrest to be due to t
yellow. When we could get no further with our camping equ
place was a jungle.

Wadi Todhi drains the high hills about Karam Elba. In t
tract, called **Karam Hindi**, covered with trees, whence part

Suakin el Qadim, is a collection of mounds close to the
deep into the ground, may be looked upon as a more ancient

Wadi Delowa is a small wadi entering the sea about six
Onqwab on the north and the granite hills of Kreishim and T

Wadi Serimtai is an important drainage line, the main
Shendodai, from which last-named mountain it receives a f
numerous feeders from Gebel Hanquf. It then turns north-ea
from its mouth, Wadi Serimtai contains a well called **Bir Sa**
then turning sharply eastward. At the turn is a well in the w
Egypt to its mouth, Wadi Serimtai has a length of forty-five l

Mera Kwan is a wadi draining north-eastward from Geb

its upper parts. The lower half of its course is rather sandy, p

Halaib, the only permanent village on the Red Sea coas established European spelling as given on the charts, none block-house; there are a few rude wooden shanties, mostly the command of a moawen, the men being lodged in the fo eight metres above the sea and there are low banks west of i two flagstaffs, from which the British and Egyptian flags ar access to the roof, which is carried on iron rails and plaste reduced to centre. The block-house is a smaller rectangular alongside.

There are five wells at Halaib, all within a few hundred garden near the fort contains a few small date palms, but th can be purchased from the Arabs, who possess a few fowls, a can be got from the hills at a day's notice, a good fat one co same time. The people are very friendly, but only a few spea

There are two islands a little north of Halaib, both low channel in low states of the sea. On it is the grave, marked b nearly circular shape.

Halaib possesses an excellent harbour, though it is some enquiry of the local sailors, I found most of the names given Dara was called by the natives Shekra el Delam, while Elba locate them exactly on the maps, as the sailors could not rea southward, Mersa Abu el Qâsim is near the mouth of Wadi e at the mouth of Wadi Yoider, where there is a well called Kwolala, and then to Mersa Halaib itself. South of Halaib th be called indifferently Mersa Hadarba (from the hills near it)

Wadi Shellal heads between the high mountain masses coast-plain, it is a broad shallow drainage channel full of scr

Wadi Aqilhoq, which drains the eastern parts of Gebel S hills called Gebel Balatitda. This well yields a constant sup approximate, but its direction having been pointed out with

Wadi Aqwei drains east of north from among the foot-h dividing round a low but conspicuous gravel bank before rea

Kreit-reit-or is a similar wadi to that last mentioned, co
three and a half kilometres from the coast, and thirty metre
plain. The wells are lined with slabs of selenite. The water
neighbouring valleys.

From the group of conspicuous though not very high hill
lines form the north side of the hills reach the sea east of Ti
the actual cape, rocks are visible at the coast, and the quic
swallowed up; the colour of its surface is distinctly darker th

On either side of the 22nd parallel, near the sea are low
wadis, called **Wadi Qabatit**, enters the sea at a well defined
mersa and 3·85 kilometres south of the 22nd parallel. The g
the Arabs say it does not purge them.

[89]Floyer's map (*Geog. Journal*, 189

[90]This road is said to lead *via* Ghu

[91]For a brief mention of the ruins

[92]Each of the three vowels in Naa

[93]*Allawi* = crooked.

[94]I did not hear anything of this i
know the place well and who all agreed

[95]The authors of "The Anglo-Egyp
boundary between Egypt and the Sudan

[96]This and the other main feeders

[97]The final syllable in *Silsila* is har

[98]To be distinguished from the W

[99]Bir Madi, 12¼ kilometres north

[100]This and the other main Egypt

[101]*Geographical Journal*, 1896.

[102]Qoseir is in latitude 26° 6′ nort

[103]The position given is that of th

[104]*Kwolala* is the Bishari word for

[105]*Red Sea Pilot.* 1900. p. 130.

It has been already mentioned (p. 19) that the principal r

i. The Migif — Hafafit — Nugrus — Hangalia — Zabara g

ii. The Abu Hamamid — Hamata — Abu Gurdi group;
iii. The Um Gunud — Dahanib — Batoga group;
iv. The Abu Dahr — Orga — Um Tenebda group;
v. The Faraid group;
vi. The Awamtib — Abraq — Dif — Aqab el Negum — Mis
vii. The Gerf — Korabkansi — Abu Hodeid group;
viii. The Meisah — Adar Qaqa — Is group;
ix. The mountains of the Alaqi basin west of Gebel Adar Q
x. The Elba — Shendib group;

while there are numerous more or less isolated mountains a
principal outlying hill-masses being considered along with th

The highest mountains of the group (*see* the detailed ma
north and west. A striking feature of the central cluster is the

Gebel Nugrus, the central and highest mountain of this
close in on it from either side, there are passes both east and
west and south-east. Gebel Nugrus is on the main watershed
the Wadi Gemal and thence to the sea. The ascent of the m
altitude of 691 metres above sea-level, so that the ascent fr
hours. When ascended from this side, there appear to be two
steep. Though tiring, the climb is not very difficult. The top
latitude 24° 48′ 34″, longitude 34° 35′ 47″, is on a rounded
found by a subtense method, as the roughness of the mounta
the north-east is the black cone of Atut; northward, seen ove

The sea is visible to the north-east and east, but the sea l
horizontal. They caused a peculiar phenomenon at sunrise, p
horizon, which was only thus discovered, the sun being seen
over the top of the cloud, so that parts of two sun disks were

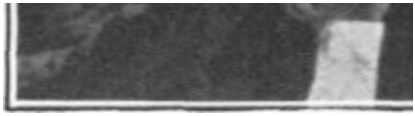
Before descending from the mountain, I went along the r
the way would be easier by keeping on the east side of the r

with the rock. The descent from the north-west end of the r
side to where I started; that pass is 120 metres higher than t

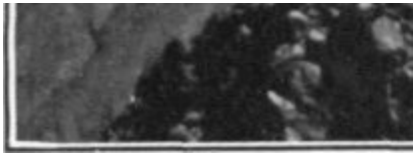
Gebel Hafafit is a very long range, chiefly of gneiss, runı
decrease gradually further south. Half way down the range
metres. This last-named point is marked by a beacon, in la
Gemal; the west faces are drained by Wadi Hafafit, and the e

East of the south part of Gebel Hafafit are some remarka
Gemal, is shaped like a bell with a handle on the top; this hi









Gebel Migif is a very spiky gneiss mass situated about th
in latitude 24° 47′ 23″, longitude 34° 27′ 30″, 1,199 metres
mountain, I pitched my camp 2·7 kilometres north of the b
metres, took two hours steady climbing, and was not difficu
view from Gebel Migif is shut in to the east by the high ma
more open country in which the two remarkable cones of El
Hamata and Abu Hamamid, eighty kilometres to the south-s
behind the Hafafit range; in the lower, the masses close in a
side of Gebel Migif is evident in both views.

The north and west sides of Gebel Migif are drained by t
Hafafit.

Gebel Dweig is a small group of high hills close to the so
south side of the narrow opening by which Wadi Dweig le
semicircle.

Gebel Hamrat Selma is a high ridge rising from the plai

El Nahud (the breasts) is the name given to two very re
being south-east of the other. The north-eastern cone is the s

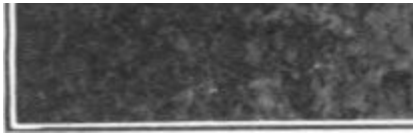
Gebel Abu Khrug is a granite hill-mass with a remarkab
has an altitude of 870 metres above sea-level. Abu Khrug, fr
ascent was very difficult.

Gebel Sufra is a mass of rather flat-topped high hills, pa
13″, at a height of 690 metres above sea-level, and 340 metr

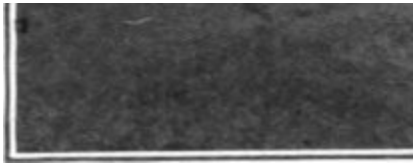
Gebels Nazla and **Um Serg** are moderately high hills lyi

Gorf el Natash is a syenite hill on the south side of Wadi









Gebel Ras Shait is a group of high rugged-looking reddi
eastern and northern slopes drain into Wadi Gerf, which joi
composed of dark schists with white granite at its western fo

Gebel Mudergeg is a high range of reddish hills, which v
black aspect, which have not been approached closely.

Gebel Hangalia is a great mountain ridge running soutl
partly to the Nile by the Wadi Hangalia (a tributary of Wadi

Gebel Zabara, a mountain mass rising to 1,361 metres a
east sides by feeders of the Wadi Ghadir, while its western
mountain, about two and a half kilometres from its summi
consisted of splintery schists, and though the climbing is st
metres above sea-level; the climb from them to the summit
hills flanking Gebel Zabara to the south, which have not bee

Gebel Ghuel, which forms a northward extension of Geb
Fegas, both tributaries of Wadi Ghadir, while its western fla
Ghuel contains important water holes.

Gebel Um Khariga is the name given to several high h
Hangalia; the western range can be crossed at a gap by an e
of its northward course, beyond which the country become
northward for about ten kilometres from Gebel Ghuel, from
ridge is flanked by high hills, especially on the east side. O
there are two other passes, one round its north end into Wa
consist of highly magnetic schists, and compass readings in t





Descendi

Gebel Igli el Iswid is a rather rugged mountain mass ri above sea-level. The mountain forms a tripartite watershed wadis courses separately to the sea. In occupying the triang The climb of 370 metres to the top from this camp was no devitrified felsites (*see* p. 281). There are galts in some of th the mass; but the rock basins in the gully which I ascended v

Gebel Igli el Ahmar, sometimes called *El Atshani*, is a lo

Gebel Atut is a high black conical hill thirty kilometres r
recognition. Its summit, marked by a beacon, in latitude 25°
cone, and the ascent is easily made in about an hour. The rc
up. The blocks have rusty-looking surfaces, but are perfectly
The view from Gebel Atut is a very extensive one. To the w
Migif and Nugrus, while eastward one looks over a great exp

The hills of **Um el Huetat**, the highest of which rise over
in talc schist. They are drained by the Rod el Farag, a tributa

On the other side of the Rod el Farag, *i.e.*, further west
coarse gabbro and numerous quartz veins.

Still further west is the remarkable ridge called **Erf el Fa**
marks the triangulation station, its position being latitude 25
Wadi Muelih is a curious horse-shoe-shaped hill of aplite, ca

Gebel Muelih is a great boss of white granite situated cl
wadi which courses round its south flank, and from which it

Gebel Hagar Dungash is a great mass of high hills situ
numerous sharp peaks, one of the most conspicuous of whic
Haggar Dungash are chiefly dark schists.

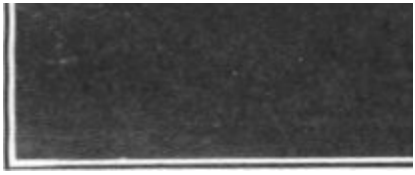




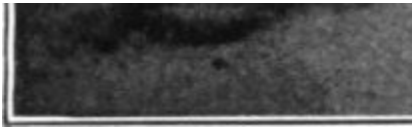












Gebel Iteima is a group of high granite hills rising from

Gebel Hamrat Wogud, which is likewise of granite, is a southwards by the Rod Um el Farag, a tributary of Wadi Ger

Between Gebels Muelih and Mudergeg is a sandy plain v very remarkable black hills eleven kilometres due south of E

Gebel Sukari is a very craggy high ridge of granitic rock ridge further south, in latitude 24° 56′ 50″, longitude 34° 42

Kurdeman is the name of a low hilly district on the east on a hill just above the workings, in latitude 24° 52′ 35″, lon

Gebel Sabahia is a craggy felsite hill five kilometres sou Sabahia, north-east of the hill, are some old gold mines.

Gebel Um Tundeba is a high granite hill near the head c the summit of the hill.

Gebel Amba-ut, seven kilometres south of the foregoing,

Gebel Ghadir, the summit of which, in latitude 24° 50′ 9 sea-level in one of the gullies draining westward to Wadi Gh

Gebel Allawi, situated on the south side of the Wadi All and 160 metres below it. There are some interesting old gol 24° 46′ 42″, longitude 34° 49′ 39″.

Gebel Lewewi is a dark craggy hill range eight kilometr the lower hills two and half kilometres south-east of Gebel L

Gebel Sikait is a rugged ridge of schists and serpentine and 771 metres above sea-level, and 330 metres above the rocks. It is the Sicily of the Eastern Desert. Beryl, tourmalin compass was found to be disturbed by no less than 40° near the Wadi Sikait, and the ascent, not a difficult one, is render

Gebel Ras Um Gamil and **Gebel Um Gamil** are two higl

Madaret Um Gamil is a conspicuous double-topped hil
metres above sea. It is best ascended by a very winding tril
Gamil are mostly schists, but the top of the hill is a hard ga
hills between it and the coast.

This group of mountains is remarkable both for its exter
earth's surface between latitudes 24° 0′ and 24° 30′, in whic
(1,562 metres) forms the great terminal peak of a south-east

Gebel Abu Hamamid is a great ridge of hard greenish sc
a sugar loaf form; the beacon is on the most northerly and h
face. By ascending this wadi till camels could go no higher c
882 metres to be made on foot. The ascent, which occupie
represents pretty nearly the limit of possibility in getting in
peaks among the thousands visible, seemed an ample recom
where one can spread one's blankets for the night with ev
observations, belong to the least pleasant of my experiences
north wind blew with great violence; a rude rubble shelter v
a small level platform where we were sheltered from the bit
days to look over the surface of the clouds, as over a bound
clouds began to disappear, and on the first clear day a very
on the Nile — Red Sea watershed, its eastern parts draining





Typical V

Gebel Um Semiuki is a sharp cone rising to 1,283 metre
and grey hornfels of which it is composed. It is drained by th

Gebel Abu Argub is a very conspicuous mountain, almos

Selaia. Its peak, 1,690 metres above sea-level, is a good land

Gebel Kahfa is a many-peaked mountain of granite risin mass, being separated from it by the heads of Wadi Um Re approached it from Bir Shadli by a well-marked track which crossed the pass at its head into the head of Wadi Um Retba to the top occupied three hours. There is good bivouacking interest; one can reach many points overlooking tremendou elsewhere one is surrounded by low hills. The principal drai

Gebel Medsus is a small group of high hills rising among

Gebel Metawit is a high granite hill rising conspicuousl Gebel Metawit is a good landmark for Bir Metawit, which is

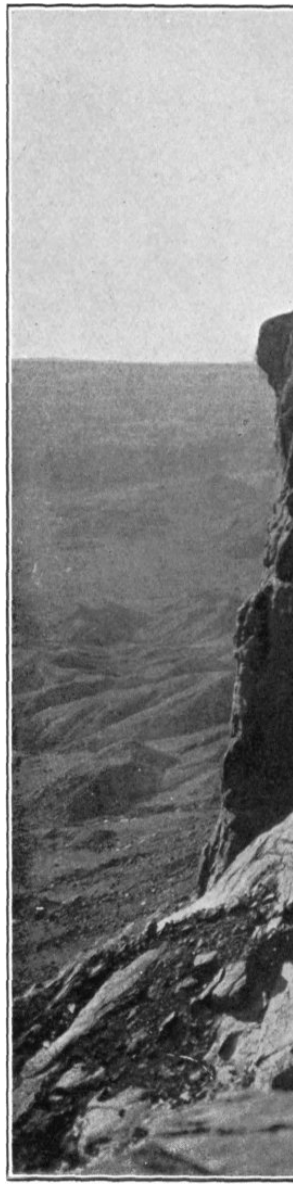
Gebel Hamrat Mukbud is a great red granite mass risi country) render Hamrat Mukbud one of the finest and best owing to its great steepness.

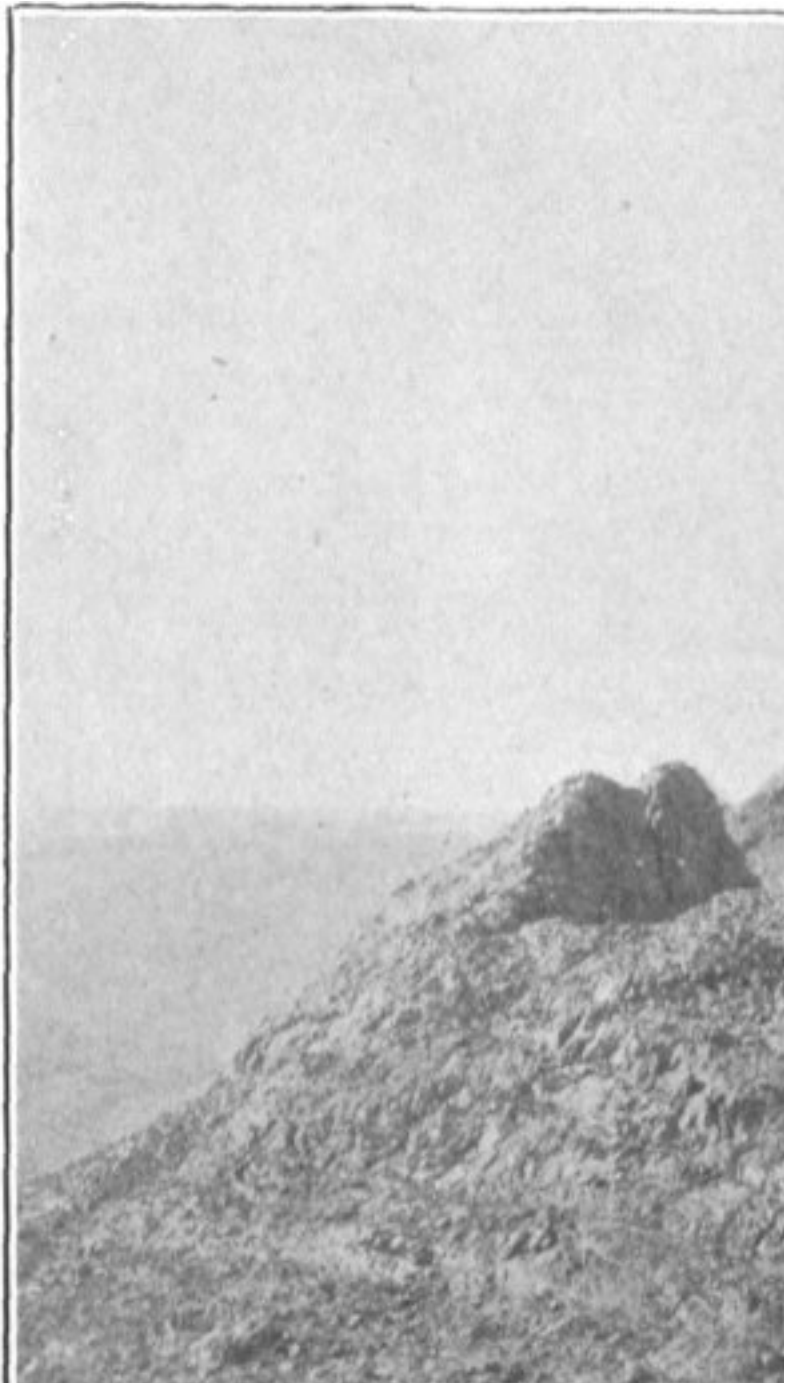
El Hamra is another red granite mass, much smaller than

Gebel Homr Akarim is a hill about thirty-three kilometr

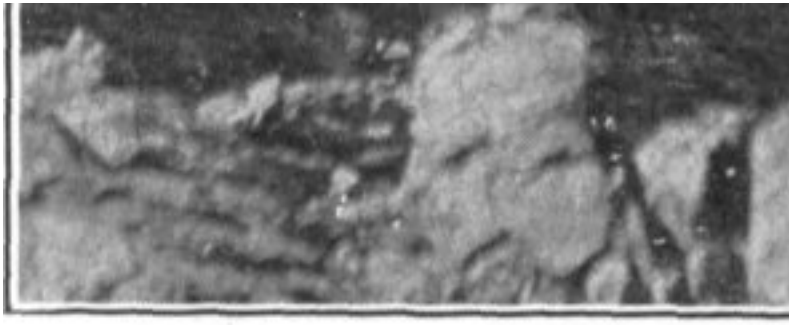
Gebel Marasan is a range of mountains north-west of Al Marasan and Marasani, which drain north-east and south-w commonly given only to the peaks north of the pass, as they

PLATE XIII.









Two Views on Gebel Kahfa. (Granite).

Gebel Khulla is a range lying a few kilometres west of G

Gebel Um Sedri is a remarkable pair of twin peaks on o about 460 metres above the floor of Wadi Huluz, are very c from the hills round Gebel Um Sedri which feeds the water h

Gebel el Heda is a conspicuous hill situated ten kilometr

Gebel Nukheira is a group of high hills on or near the m

Gebel Ras Abu Etl is a lower hill seven kilometres north Etl, which joins Wadi Huluz to form the Wadi Gemal.

Gebel Um Suerab is a great high ridge of dark looking Hamamid. The top of its ridge, which appears to be nearly l northward to join Wadi Gemal, while the other, called Wadi

Gebel Durunkat is another apparently flat-topped hill e sea-level.

Gebel Abarun is a mountain range situated a short dist Abarun, is 1,602 metres above sea, and overlooks the great p

Gebel Um el Tiur is a range extending south-east from G west by the Wadis el Shel and el Anbat (tributaries of Wadi h

Gebel el Anbat is a group of lower dark coloured hills fo metres above the plain at its base. These hills are drained by

Gebel Um Usher and **Um Hasidok** are conspicuous pea They are drained to the south by the Wadi Hilgit lil Kharit, a

Gebel el Mahali is a rather high peak of grey porphyry v

Gebel Hamata, with one exception[106] the highest mou point of the Nile, and rises to an altitude of 1,978 metres ab watershed, which curiously enough is not always formed by Hamata and Abu Ghusun, and thus only takes a small porti distances. Looked at from the north or south, it is like a grea In proceeding up the Wadi el Abiad from Wadi Huluz, one is suddenly into full view. My camels were coaxed on with the

1,025 metres above the sea. The ascent of the remaining 95
which rings under the hammer and weathers into rusty brov
fine one in clear weather, including as it does an extensive
perpetually over the coastal regions in the neighbourhood
clouds filled all the wadis and covered the lower country, w
remained a continuous haze, especially over the coast and o
this north wind is dry and persistent, the air is clear; but sho
the sun's rays during the day, only to precipitate itself aga
improvise a rude tent from a blanket and a few sticks over o

Gebel Abu Ghusun is a mountain range north of Hamat
west of Gebel Hamata, is 1,389 metres above sea-level. It is
separately.

Gebel Um Laham is a mass of lower hills a little west of

Gebel Tarfawi is a complex mountain range fourteen k
tributary of Wadi Huluz, and to the north by feeders of Wad

Gebel Um Heshenib is a great ridge situated twenty-two
granite, but the upper third is of dark schists, while the actu
Wadi Huluz. I ascended it on two occasions from opposite si
stony pass and along narrow stony wadis. But the climb is lo
of the mountain lies at an average level of 250 metres highe
used as a latitude station (*see* p. 47) There is a very difficult
the statement true, as although I did not consent my men we

Gebel el Abiad is the name given to two distinct ranges
kilometres from Gebel Tarfawi to near the place where Wa
Heshenib, and rises to 957 metres above sea. This eastern ra
peaks, eleven kilometres north-north-east of Um Heshenib, i
which curves round the south end of the range, thus separa
Durunkat. It is the coarse white granitic sand resulting from
however, blackened by hornblendic downwash from the schi

Gebel Shoab is a very high white granite hill close to the

Gebel Hefeiri is a very sharp granite peak a little west of
landmark. There is a smaller very sharp peak two and a half

Gebel Um Sueh is a conspicuous granite hill six and a ha

Wadi Um el Abbas.

Gebel Um el Abbas is a very remarkable granite hill bet
It is drained by the Wadi Um el Abbas, which goes independ

Gebel Abu Hegilig is another high granite hill, three anc
26′ 16″, longitude 34° 58′ 32″. The hill is drained by feeder
metres was not difficult, and only occupied a little over an h
to centre.

Gebel Sarobi is a small hill-range twenty-two kilometres
seen, but it must be very conspicuous to any one travelling i

Gebel Ras el Kharit is a mountain range forming part o
south-south-east of Hamata. Of the many other peaks of the
drained by the heads of the Wadi Huluz, while the southern

Gebel Khashir, which forms an eastward extension of G
Khashir, the heads of which end in the precipitous eastern fa

Gebel Mikbi is a long high ridge on the main watershed
ridge running north-west and forming the continuation of th
camels owing to the great steepness of the eastern side.

Gebel Zatit is another high ridge about five kilometres e

Gebel Egat is a high mountain close to the south-west o
while the north-east one is 1,277 metres above the sea. The

Gebels Um Sellim and **Gumudlum** are high hill ranges
620 metres above the floor of Wadi Lahami. These ranges a
rock basins or galts which retain large supplies of water for s

Gebel Abu Gurdi is a great mountain in latitude 24° 0′,
ridge, Abu Gurdi from most points of view looks like a rathe
at the head of Wadi Lahami. The south-west parts of Abu Gu
the Wadis Um Karaba, Um Rishan, Um Homar, and Sefent. C
as far as the point of influx of Wadi Um Karaba and then as
foot from the camp occupied two and a quarter hours of fair
top of Abu Gurdi on a clear day must be extremely fine, but
to the south-south-east, formed the most striking feature in t

Gebel Derhib, 1,160 metres above the sea, is a mountair

Gebel Um Goradi is likewise in reality part of the Abu G
Um Gunud.

Gebel Selaia[107] (the bald head) is a very remarkable r
metres above sea-level and about 260 metres above the plai
it appears much steeper.

South-east of Gebel Selaia stretches a line of four smalle
further on, is larger, while the third is larger still, rising to
latitude 23° 55′ 30″, longitude 34° 54′ 37″.

Gebel el Homur is an isolated mass of granite hills on t
which passes north of the mass on its way across the plain to

Gebel Abu Derega is an isolated mass of higher granite
watershed, which crosses the plain from east to west in this
feeders of the Wadi el Khiua, a tributary of Wadi Um Bisilla,

Besides the hills above described, there are many smaller
situated twelve kilometres east of Abu Derega. These hills, t
one, with a triangulation beacon on its summit, rises to 648
mid-way between them.

The mountains of this group, occupying the country east
north portion of the group is formed by the line of mountain

Gebel Um Gunud is the northernmost mountain of the r
from the west by the Wadi Um Gunud, a feeder of Wadi Lah
has fallen, and which are fairly easy of access from Wadi Lah

Gebel Eidab, the next member of the range to the south,
steep pass is said to exist from east to west between the head

Gebel Um Maiat, a long high ridge stretching south-east
respectively. Another broken ridge, of similar height, for wh
from north to south, to 875, 821, and 627 metres respectivel
it going Nilewards; part of the drainage is probably taken by

To the east and north-east of the Um Gunud — Eidab —

this lower hill country are Gebels Um Huk, Abu Ghalqa, and

Gebel Um Huk is a sharp granite peak, surmounted by a

Gebel Abu Ghalqa is another high granite hill, also marl

Gebel Um Hegilig in a small rather spiky range of red gr

To the north-west of Berenice are several low hills on the the plain, thirteen and a half kilometres north-west of Bere kilometres north-west, is a low granite hill, isolated on the p

The **Hills on the Peninsula of Ras Benas** are sharply m long axis of the peninsula. The highest points of these whit weathered into knife-like projections which cut one's hand exploiting that mineral. But the quantity appears far too sma

The other hills on the peninsula are darker in colour, bei highest point of the first-named group is 276 metres, while courses south-eastwards to the sea.

Gebel Batoga, a granite mountain fifteen kilometres sou (central) peak rises to 802 metres above sea-level; the south Kalalat, and from the south by the Wadi Kunserob. There is Wadi Kalalat, the floor of which is here about 160 metres ab

Gebel Kalalat, situated about six kilometres west of Geb while another conspicuous peak one and a half kilometres occupy the triangulation station, I followed up the Wadi Ka kilometres north-east of the beacon and 300 metres above se a line of galts (rock basins) containing rain water, but they very good view of the surrounding mountains is obtained fr Wadi Kalalat, and from the south by the Wadis Gumudlum a north-west face of the mountain. A rough steep pass, impract

Gebel Dibag is a high dark ridge five kilometres south flanks, while the Wadi Dibag lil Kunserob drains its eastern f

Gebel Shenshef is a mass of high dark hills between the so high as others further west, a beacon has been erected ov foot.

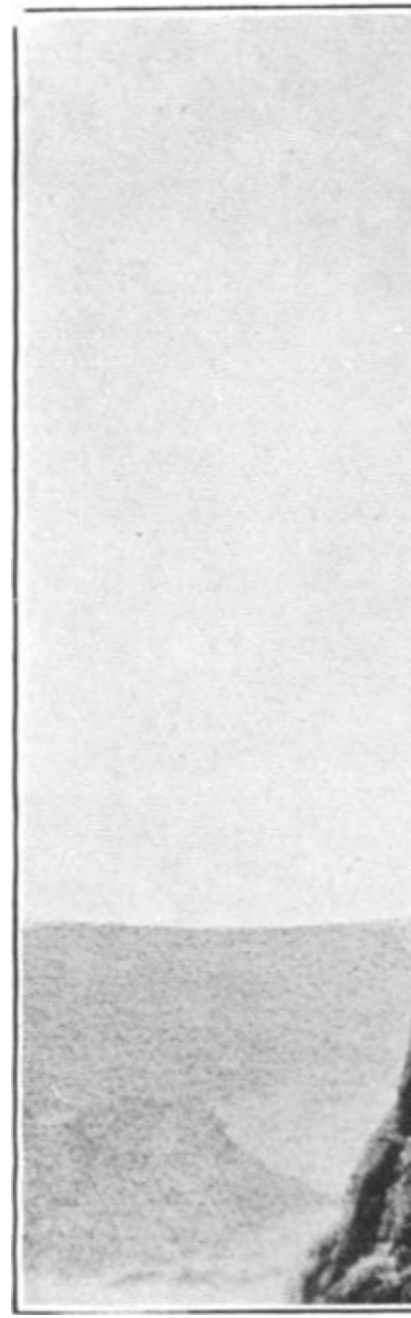
Gebel Dahanib is a mountain of dark coloured rocks (di

latitude 23° 45′ 44″, longitude 35″ 11′ 10″, and 1,270 metre
Wadi Kalalat, along the coast-plain and up the Wadis Khod
Wadi Allawi until camels could get no further, I was able to
dangers, and occupied two and a half hours. A galt, contain
winter months Dahanib, like all the mountains near the coa
were free from fog or haze. It was on Gebel Dahanib that I fi
from the eye-piece of my theodolite striking me over the ey
hissed loudly. In this and all other cases of a like kind, I judg

Gebel Dahanib is drained by the Wadis Allawi, Um Tawil









Gebels Um Hegilig, Reyan, and Shut, are high hills situa
Dahanib and Kalalat. **Gebel Reyan**, a little further south-eas
five kilometres north of the Wadi Khoda. A very large galt is

Gebel Um Bisilla is a dark mountain of gabbro rising c
above sea-level. Gebel Um Bisilla is drained by Wadi Um Bi
kilometres west of the mountain. There is an easy passage f
camp in one of the gullies draining from it to Wadi Um Bisil
an hour and a half.

Erf el Gimal is a high dark ridge surrounded by lower hi
hill called **Gebel Abu Shigelat**.

Gebel Zergat Naam, sometimes called **Hagar el Fil**, is a
drained partly by the Wadi Abu Had, a feeder of the Rod el
but the northern peaks are more conspicuous from some po
was in one of the heads of Wadi el Fil, 527 metres above t
northern summits are formed by east and west bands of a v
south of one is the enclosed sloping plain across which run t
sudden drop into the head of Wadi Abu Seyal. The Arabs sta
recent rains had filled other smaller rock basins in the gulli
lower hills to the south and west; these are of sandstones wi

On the great sandy plain to the north and north-east of Z
Geneina Gharbi; it is a mass of hills composed chiefly of di
Gebel Geneina Sharqi, is smaller and situated fifteen kilon
above the sea, or about eighty to one hundred metres above

In the low country to the west of Zergat Naam, between
triangulation cairn, 570 metres above sea-level and thirty-fo
Nikeiba; **Erf Abu Homur**, a ridge at the head of Wadi Abu
west of the last-named hill; and **Gebel el Ghar**, a hill on the

The mountains of this group occupy the tract between th

Gebel Abu Dahr, the highest mountain of the group, is
46″, is 1,131 metres above sea-level. Its western face is drai
west, where there is low hilly country containing the wells
Wadi Salib el Azrak (a tributary of Wadi Khoda) and its feed
and Wadi Um Karaba. A short distance to the south-west o
triangulation station, I fixed my camp in a small stony wad
ascent, which occupied three hours, was rather difficult an
summit, the striking peaks of Faraid being a marked feature
west. The rock of Gebel Abu Dahr is highly magnetic, and se

Gebel Abu Dahr and the high hills round it, especially to
a radius of about fifteen kilometres of the summit of the m
forty kilometres from the coast, and its considerable height,
serpentine rocks are not only of an impermeable nature, but
exists in the case of most other localities in the Eastern Dese
wells; while in the case of the mountains of Faraid, which a
known to exist in their neighbourhood.

Between Gebel Abu Dahr and Gebel Um Bisilla there are
conspicuous sharp granite peak rising to 678 metres above t

Gebel Abu Sieiyil is a many-peaked hill range running
visited. Its central peak, fixed by triangulation, is 833 metres

Gebel Arais is a considerable range of gneiss peaks situ
above the sea. The range is cut through from east to west b
directly.

Gebel Belamhandeit or **Erf Um Araka** is a long range
the Wadi Erf Um Araka, a tributary of Wadi Naam, and on t

To the east of Gebel Belamhandeit are several granite bos

Gebel Orga, eighteen kilometres south by east from Geb
latitude 23° 26′ 21″, longitude 35° 8′ 17″, is 682 metres abov

Gebel Um Tenedba is a mass of dark hills of crushed bas
23° 19′ 48″, longitude 35° 10′ 40″, and 654 metres above se
Tenedba, about 1,200 metres south-east of the beacon and 3

Gebel Harhagit is an isolated granite boss rising among
at an altitude of 542 metres above sea-level, or 326 metres a

Gebel el Anbat is conveniently considered here, though
on its summit. The position of the beacon is latitude 23° 6′ 5
calcareous schists. Gebel el Anbat is practically in the Wadi
metres south of the beacon and about 255 metres below it; t

Eastward of Gebel Abu Dahr there extends for some thir
and Gebel Um Etli. These mountains have only been seen fr
of Abu Dahr, rises to 873 metres above sea-level, and is dra
1,050 metres above the sea, while a ridge a little further sou
plain, has three main summits, reaching respectively to 844,
Etli, which reaches the sea independently.

The mountains of this group cover a tract about forty ki
twelve kilometres from the coast. They consist entirely of gr
the three northern ones are called collectively Faraid, while

The most northern mass of **Gebel Faraid** is the highest, i
its western peak seeming to overhang slightly like a thumb,
northern mass, and not to the Faraid group as a whole.

The second mass presents from most aspects the form of
main triangulation point; it is too sharp to support an instr
station I approached it from the west by the Wadi el Abiad a
metres was steep, but not dangerous, and occupied about thr

The third mass of Faraid is a great expanse of peaks exte
28′ 58″, longitude 35° 20′ 35″, and rises to 1,232 metres abo
in nearly all directions, and a very conspicuous landmark. S
compact mass across which there appears to be no passage f

Gebel Fereyid, the fourth and most southerly of the mas
the north-western one is slightly the higher and is surmount
nameless wadi draining past the north face of the mountain
difficult and rather dangerous, and there is very little room

The drainage from the western faces of the entire Faraid
southern parts are drained by various other tributaries of W
main peaks on the west. Of the eastern drainage, less has be
30′. The head of the Wadi Bint el Kurdum is between “The
Wadi Abu Ribian; but I did not have an opportunity of testi
about twelve kilometres near Gebel Fereyid. Notwithstandin
probably to be sought in the fact that the weathering of the

The mountains of this large and irregular group occupy t
northern mountains of the group are high broken sandstone
district (*see* the large scale map on Plate XV) one of great im

Gebel Awamtib is the highest peak of a great mass of
highest peaks of the mass are mostly well to the west of the
mass, and is itself situated about six kilometres west of the v
so easily distinguished from the east. It may, however, be p
Wadi Awamtib (a tributary of Wadi Timsah), the heads of
above sea-level. The climb from this place was easy enough,
could have been placed much closer and the ascent would r
extremely steep and probably unscalable. The top of the mo
Shebakhit, only two kilometres distant; but the peaks of Ge
Shigigat, Aqab el Negum, Etresia, Um Reit and Saalek. The r

Gebel Shebakhit is a group of high sandstone hills a few

Gebel Dagalai, the next member of the sandstone hill-r
obtained.

DISTRICT OF


34°40'
34°50'
Low Hills
Low sandstone hills
Sandy
with low
G. ABRAS
Very high sandstone hills
Low hills
ABRAS

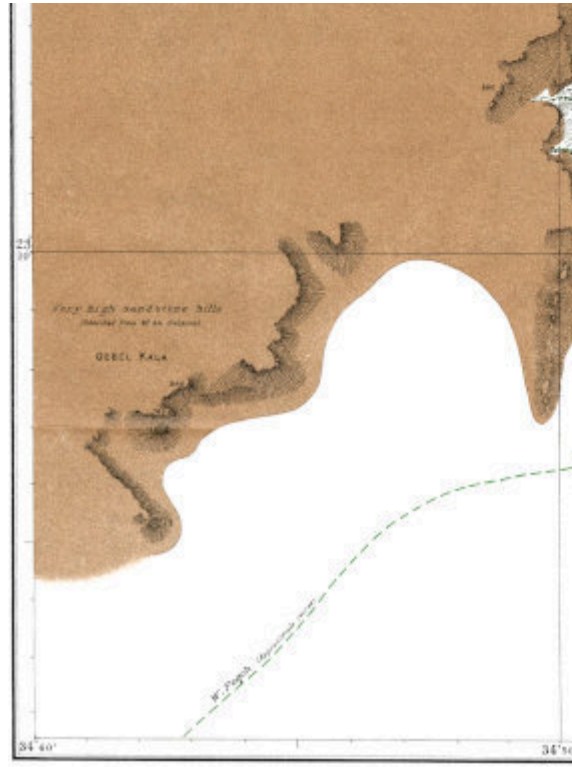


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

Gebel Um Khafur is a group of high sandstone ridges o longitude 34° 29′ 19″. A remarkable feature of Gebel Um Kh to these features there are developed a series of long ridges, from these channels, the chief of which is called the Wadi Ur

Gebel Um Harba is a conspicuous sandstone peak marke north-north-west and south-south-east from the Wadi el Gar Gebel Um Harba northwards to Garara. A marked feature of steep basset edges to the west. Gebel Um Harba overlooks mentioned, and fixed the camp at 487 metres above sea-leve near the top of the hill, but presents no great difficulty. For a kilometres south-south-east of Gebel Um Harba, in a gully c reason.

Gebel Um Sididad is a mass of high sandstone hills on t was 623 metres above sea-level and nearly 300 metres above

Gebel Abraq is a great high sandstone plateau cut up b
probably two peaks close together on its east side, midway l
springs of Abraq and Abu Saafa, which occur along its easte
and to the passing travellers. There are two beacons on Geb
longitude 34° 46′ 48″; while the latter is on the eastern edge
many points, and are the home of many conies and rock pa
difficulty.

Gebel Hodein is a high sandstone plateau forming the s
point of the plateau in latitude 23° 16′ 20″, longitude 34° 53
Wadi Gihab into Wadi Dif, and forming a short cut from Abu

Gebel Dif and **Gebel Anfeib** together form a still further
east, and the highest points are near the west edge of the m
the south end of the high plateau of Gebel Anfeib; it is 705
occupying the point as a station, I approached it from Bir Di
camp in one of the heads of Wadi Edunqul, at 315 metres ab
metres, is steep, but not difficult, and occupies less than two

Gebel Tibatib is a conspicuous dark conical peak among

Gebel Butitelib is a steep-sided little hill mass of grey fe
metres above the sandy pass.

Gebel Lilowit, the south end of the schist range which fl

Gebel Niqrub el Tahtani is a conspicuous isolated jagge
level and about 500 metres above the Rod Mukrayib. A cons

Gebel Niqrub el Foqani is a mountain of granite and fe
render it a conspicuous object in the landscape from great d
west side, where a camp can be got 1,500 metres due east o
two hours, and was not very difficult; but an attempt from
broken that it is an hour's hard work to get along its 700 r
enclosing a small sandy plain south-west of the summit. This
from the panorama drawn to scale from theodolite measurer
complete my observations, most of the time being spent in
between Egypt and the Sudan, the limit proceeding east-sout

The low hill country between Gebel Niqrub and Wadi M
the well called Bir Madi; the beacon is 556 metres above sea

To the south-west of Gebel Hodein the sandstone runs of
been closely approached, but its principal peaks have been
sandstone ceases just beyond Gebel Kala, and its place is tak

Ball. Geography & Geology of South-Eastern Egypt.

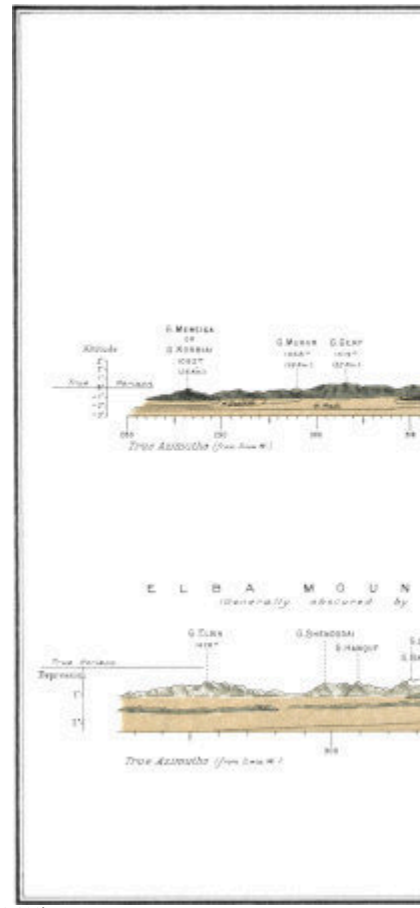


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

Gebel Um Reit is a conspicuous granite mountain rising
Wadi Timsah and crossing the watershed (which is here flat

the west side of the mass. By following this up, a camp can
beacon (latitude 23° 15′ 4″, longitude 34° 34′ 17″), a good
sandstone plateaux.

Extending south-west from Um Reit is a complex of gra
given in Chapter III. The chief peaks are **Gebels Etresia** (1,(
the watershed at Aqab el Negum, though quite practicable f
isolated hills rise to heights of 901 and 703 metres respectiv

Further south along the watershed, in latitude 22° 50′, ar
887 metres above sea-level, while the northern one attains 8

Gebel Mishbih is a huge bristling mass of granite peak
remarkable feature for long distances. Though it has not bee
many peaks, near the south-west end of the mass, reaches 1
drained by feeders of the Wadi Feqoh.

Gebel Shweib is a smaller hill-mass a little to the south-

Gebel Shabih is a very remarkable granite mountain risi
passes it going south it is seen to be slightly elongated meri
probably be a matter of some difficulty. The Wadi Feqoh pas

Gebel Um el Kalala is a small range of granite peaks cl
hilly country further north there are three conspicuous little
Kalala, and about six kilometres east of Wadi Feqoh. **Gebel**
the west side of Wadi Feqoh, and attains only 504 metres.

To the west of the Um Harba and Awamtib ranges there
intervals by extensive masses of moderately high sandstone
and a little east of the Wadi Timsah; it forms a detached n
sandstone hills separating the Wadis Timsah and Ghadrib. T
386 metres above sea, and sixty-six metres above the wadi fl

Gebel Mowisat, seventeen kilometres south of Gebel Zir
this hill.

Round the heads of the Wadi Ghadrib, about the paralle
Rewat, **Um Ghalqa**, and **Um Gotto**, while between these a
igneous and metamorphic rocks which build up the main ma
flanks drain into the Wadi Um Ghalqa, a feeder of Wadi Seig

To the west of Gebel Mishbih there is hilly country, in
twenty-two kilometres west of Gebel Mishbih, with several
the Wadi Seiga; **Gebel Nesheb Hasan** and **Gebel Abgeya**, t
(810 metres), to the west of Wadi Um Ghalqa; and **Gebel K**
granite.

The central mountains of the Gerf — Korabkansi — Abu
an extremely rugged mountain tract some twenty kilometres
metres; while the detached mass of Korabkansi on the west
north, and the Hamra Dom range to the east. The main char
wells and springs in the wadis draining from this group of m

Gebel Gerf (*see* map on Plate XVII) is a mass of rugged
marked by a beacon 1,419 metres above sea-level, is somew
of the mass are entirely impassable for camels. There is no
northern part of the mass, which is semi-detached by the pa
it; and the north-eastern peaks are sometimes called **Gebel**
entire group of mountains, with scores of separate peaks, ex
to me by the guides was quite comprehensible; they stated t
it. They can get all round it only by a rough journey of sev
satisfactory notion. The immense interest which the guides t
of the principal summits.

MAP O

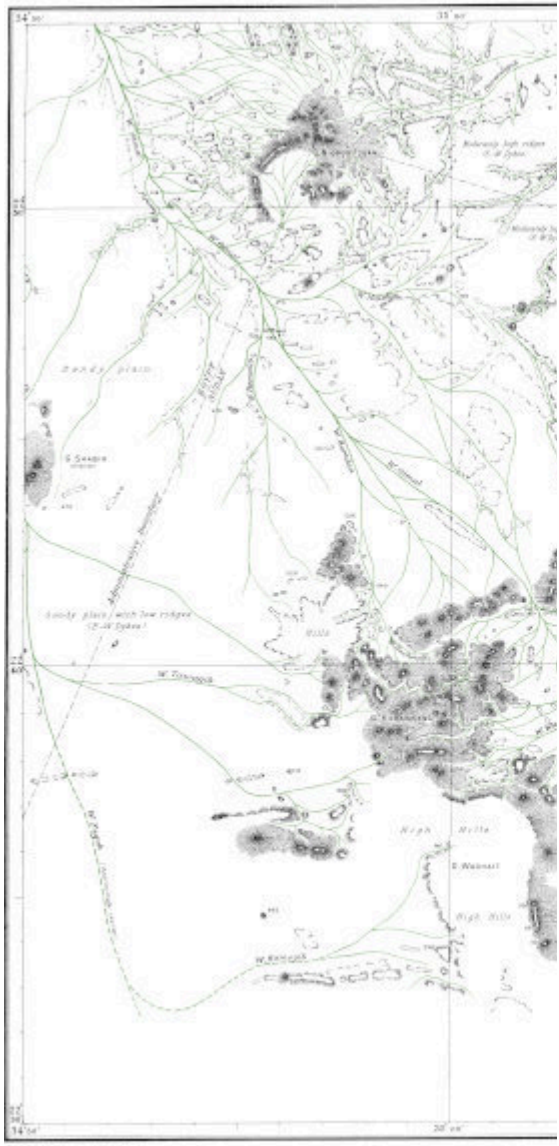


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

The highest point of Gebel Gerf had been singled out a approach being made by ascending the Wadi Eirahimib, and high up the wadi as possible, lay about 1,500 metres west o tiresome traversing of connecting ridges. The summit of Gel and nights in January 1907, in order to obtain the observa room for an instrument, but about 100 metres southward al

On a clear day, the view from the summit of Gerf is a n distant mountains. In the north, the most striking features a coast-plain, with the granite peaks of Gebel Hamra Dom br else is clear. To the south, one looks out, over the gneiss bo granite mass of Gebel Obkeik in the Sudan, more than 100 lower figure on Plate XVI (p. 206). To the south-west, one c

The north portion of the Gerf mass, sometimes called G perennial springs of good water, easily accessible to camels. Diqdib, and Wadi Sherefa el Sharqi. The Wadis Muqur, Baa Gerf mass are drained by the feeders of Wadis Feqoh and M forms a direct road from Bir Sararat Seyet to the well of Um

Gebel Dreb is a many-peaked mass of mountains coveri other peaks of but little inferior altitude. Its south-western p the head of Wadi Kreim, a tributary of Wadi Feqoh. Another

Gebel Medarai, the next mountain mass to the south-ea heads of Wadi Medarai westwards into the Wadi Kirwau, a t faces of the mass are drained by Kwat Hewah, a tributary of

Gebel Abu Hireiq, the mountain-mass next south of Me Hireiq is 1,319 metres above sea. Its eastern flanks are drain

Gebel Abu Hodeid, which forms a higher southward ex 18″, longitude 35° 14′ 9″, being 1,482 metres above sea. Th **Abu Hodeid Ogla**, which forms a good landmark for trave feeders of Wadi Hasium, and all leading to important water broad opening where Wadi Hasium passes to the south of th

Gebel Mansur Diab, a dark mountain, 1,091 metres hi approaching from the west.

To the south of Gebel Mansur Diab, between the heads o

These are **Gebel Hadal Derqa** (1,108 metres), which as see
peaks some three and a half kilometres apart, the higher or r

Gebel Korabkansi is a rugged mass of dark serpentine p
longitude 34° 59′ 55″, and rises to 1,230 metres above sea. T
the Wadi Gemal. The upper portion of Wadi Gemal is called
hill range. For the ascent of the mountain, it is best to turn
level, and the ascent of 465 metres to the summit, from whi
summit to camp was 29¼°) and the rottenness of the rock, v
feet firmly in the mass and slide down with it for a hundre
about the mountain. The mass of high hills which forms the
Wadi Seyet, and on the west by the Wadi Kamoyib, a tributa

Gebel Um Rasein is a triple-headed gneiss boss rising u
important landmark for the well, Bir Um Rasein, which exi
ascending the mountain, it is best to follow up the Wadi M
climb of 523 metres to the beacon is steep in places, but can
region, and there is a good view from it. The beacon is on a
sleep in.

Kilia Arib, another isolated granite mass about six kilom

To the east and south of Kilia Arib are some smaller gra
southern ones are called respectively **Tibashoi Dumat**, **Tiba**

Qrein Salama is a little group of diorite hills rising from

Berget Abu Sarib is a tract of low dark hills, with much

Gimeida, a small but conspicuous black conical hill, ris
summit, the position of which is latitude 22° 46′ 29″, longitu

Gebel Hamra Dom is a range of remarkable red granite
near the centre of the range. A beacon on this highest peak
the beacon is on the southernmost one of the three peaks
occasionally favoured with some rainfall. In January 1907 th
up when I arrived there in February. At times of rainfall the
almost entirely by feeders of Wadi Ibib.

There are numerous smaller hills to the west of Gebel Ha
the beacon on Gebel Hamra Dom.

Gebel Khashab and **Gebel Beidâ** together form a compl
average breadth of about eight kilometres. The highest poin
by the heads of Wadi Khashab, a tributary of Wadi Hodein.
Kreiga, itself a tributary of Wadi Hodein. So far as I know,
metres above sea, stony but not steep) which separates the h

Gebel Humariai is an isolated hill, 563 metres above sea

Gebel Kolaiqo is a small hill-mass lying off the south-ea
35° 24′ 34″, at an altitude of 320 metres above sea-level. Th
sandy coast-plain. To the north of Gebel Kolaiqo there are tv

Ti Qireira is the name given to two low hills rising from
they are conspicuous landmarks, and hence bear a name.

The Meisah — Adar Qaqa — Is group of mountains exten
it from the mountains of the Elba group; while to the west i
Hadal Aweib Meisah (1,224 metres) forms the highest poin
detached mountain and hill-masses, of which the principal a

Hadal Aweib Meisah is a conspicuous double-topped m
plan it is almost circular, three-fourths of the circumference
Gebel Qidmib. The ascent of the mountain was made from a
but a camp can be placed a little way further down the gull
gabbroid rock, the summit being composed of great blocks,

MAP OF THI

Ball. Geography & Geology of South-Eastern Egypt.

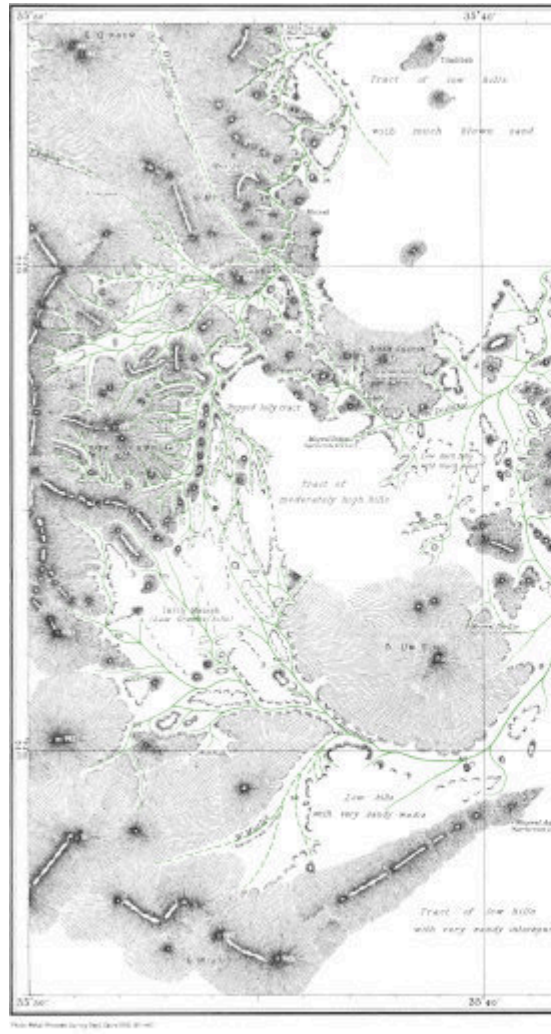


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

Iarih Meisah is the name given to a tract of low granite

About three kilometres west of Hadal Aweib Meisah, a h
northwards to Wadi Ibib, has its head between the two bran

O Shakafa is a very remarkable hill seven kilometres no
crest, formed by a ridge of hard jaspery quartzite, rises prec
42″, and 751 metres above sea-level. There is barely standin
north-east of the summit; and for the easy pass of Sarob Kwa

To the north of O Shakafa there extends a great tract of l
to 779 and 775 metres above the sea, while its northern end
is rather more complex, and is cut into two parts by the Wad

Gebel Adar Qaqa is a very conspicuous granite mountai
level. Adar Qaqa is drained principally by the Wadi Hasium,

Gebel Soaorib is a rather long mountain range which ad
Wadi Mantil Hasium, which forms one of the heads of Wadi
of Wadi Alaqi.

Gebel Leqaq (1,192 metres) and **Gebel Um Seleim** (1,0
Wadis Hasium and Soaorib, the principal being the Rod Anu
to join Wadi Soaorib.

To the north of Gebels Leqaq and Um Seleim there stret
Hamra Tit, a double-peaked granite hill, rising to 642 metr
Hamra Tit.

Gebel Is, the next great mountain to the south, forms the
seen from the north, Gebel Is is a somewhat flat-topped m
westward, and a high ridge, more or less detached, rises to
drained by various heads of Wadi Is.

Between Hadal Aweib Meisah and Gebel Is there stretch
region. The first, called **Adar Ameit**, is a high pass practicab
of the watershed. The second pass, said to be a difficult one,

Gebel Miatit (1,257 metres) and **Gebel Suruk** (1,377 m
of which there is said to be a water source called Megwel Aq

Gebel Shiab is a collection of peaks rising from a rugge
important feeder of Wadi Di-ib.

Eqrun (the horns) is a conspicuous group of schist hills
and is 473 metres above sea-level; the other is about 400 m
little inferior height.

The country south of Eqrun forms an extensive tract of lo

Kolmanab and **Einiwai** are two small but very conspicu latitude 22° 32′ 26″, longitude 35° 53′ 36″, 137 metres abov between Kolmanab and Einiwai is an isolated low hill called

Osnei is a small but conspicuous red granite hill, rising t

Ti Keferiai is a conspicuous little isolated group of dark east flanks of the mass. The triangulation beacon on the sur some lower hills five kilometres south-west of the beacon. ancient grinding mills of diorite lie scattered about the place

Four kilometres north of Ti Keferiai, on the opposite side but of black aspect, called **Adatalob Hadal**. West of Ti Kef called **Kikeiyet Sharqi** and **Kikeiyet Gharbi**.

East of Ti Keferiai is a great sandy tract stretching to the

Qara Saba is a high and steep hill mass of dark aspect, r a waste of blown sand through which low hills protrude in p

Adar Aqdeib, a granite hill 736 metres high on the nor Aqdeib, is on the east side of the hill, in a little tributary of Sarob Kwan, half of which courses south-east to Wadi Didau

Gebel Um Ein is a huge hill-mass of dark rocks, rising to drained by the Wadi Baueiwai, which curves round the soutl

A great tract of high hills lies between the Wadis Baueiw flanked by huge accumulations of blown sand, while its sou separate names. **Gebel Hamida**, which with **Gebel Nubitra** reached by following up the Wadi Hamida till one comes d wearisome climb. To the north-east of Gebel Hamida is the p which forms the head of the Wadi Warabeit, lies south-east metres) lies a little to the east of Gebel Warabeit; its north p ultimately reaches Wadi Di-ib by way of Wadi el Qurat. **Ada** triangulation beacon in latitude 22° 10′ 50″, longitude 35° 5 the eastern foot of the mountain. The camp was placed abou gathered in the lower part of the ascent; the upper portion v led down to Bir Meheriqa, in the Wadi Di-ib; but the camels

To the south of the group of hills just described, there is
Wadi Di-ib pursues its northward course, becoming closed in

The mountains of this group, which are scattered over a
principal peaks have been fixed by triangulation from consid

The positions determined for the principal peaks will be
reference only to the principal mountains is possible here.

Gebel Anweiyib (921 metres) and **Eir Arib** (1,112 metre

Gebels Duag (1,328 metres) and **Himeitra** (1,231 metre
mountain, and also for the ruins of Darahib, which lie in the

Gebel Heianai (1,256 metres) is a long range of mountai

Gebel Heleikonti (1,151 metres) appeared from the nort

Gebel Egat, one of the best known and most remarkable
Bir Egat, which lies about five kilometres to the east, and for

Gebel Shanaiyet (907 metres) and **Gebel Hamida** lie so

Gebel Hateib or **Suhin** (854 metres) forms the main coll

Gebel Um el Tiur el Foqani is a group of very high stee
the administrative boundary between Egypt and the Sudan.

Gebel Um el Tiur el Tahtani, situated some twelve kilo

Gebel el Adraq (770 metres) and **Gebel Guqub** are two
the collecting ground, the drainage of which supplies the im

Gebel Muqsim is a conspicuous mountain on the south s
Muqsim forms a point on the administrative boundary betwe

This group of granite mountains is situated near the sea
2,216 metres) is in the Sudan, and we shall here consider on

(1,529 metres), and Shellal (1,409 metres). Besides these, v
belonging to the group. The principal of these outlying hills
the main masses. The general relations of the Elba district w

Towering to great heights from the coast-plain, the mou
invisible even when one is fairly near to them. These very n
wadis, but along all clefts right up to the tops of the mounta
to approach the mountains very closely with loaded camels,
centre of desert population, and there are considerable settle

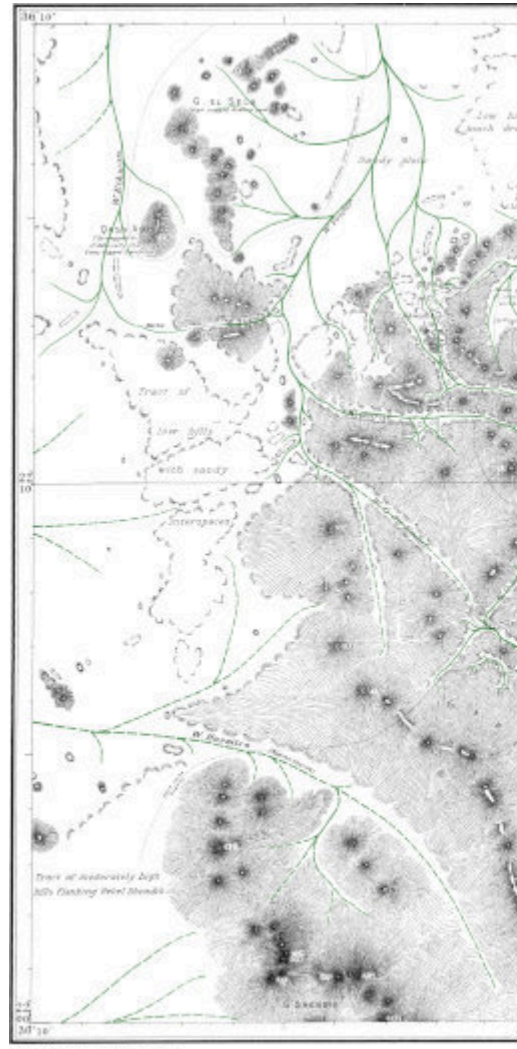


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

Gebel Elba,[111] the most northerly mountain of the mai
can be made, although from almost any aspect Elba appears
light-coloured granite peaks, flanked on the south and west

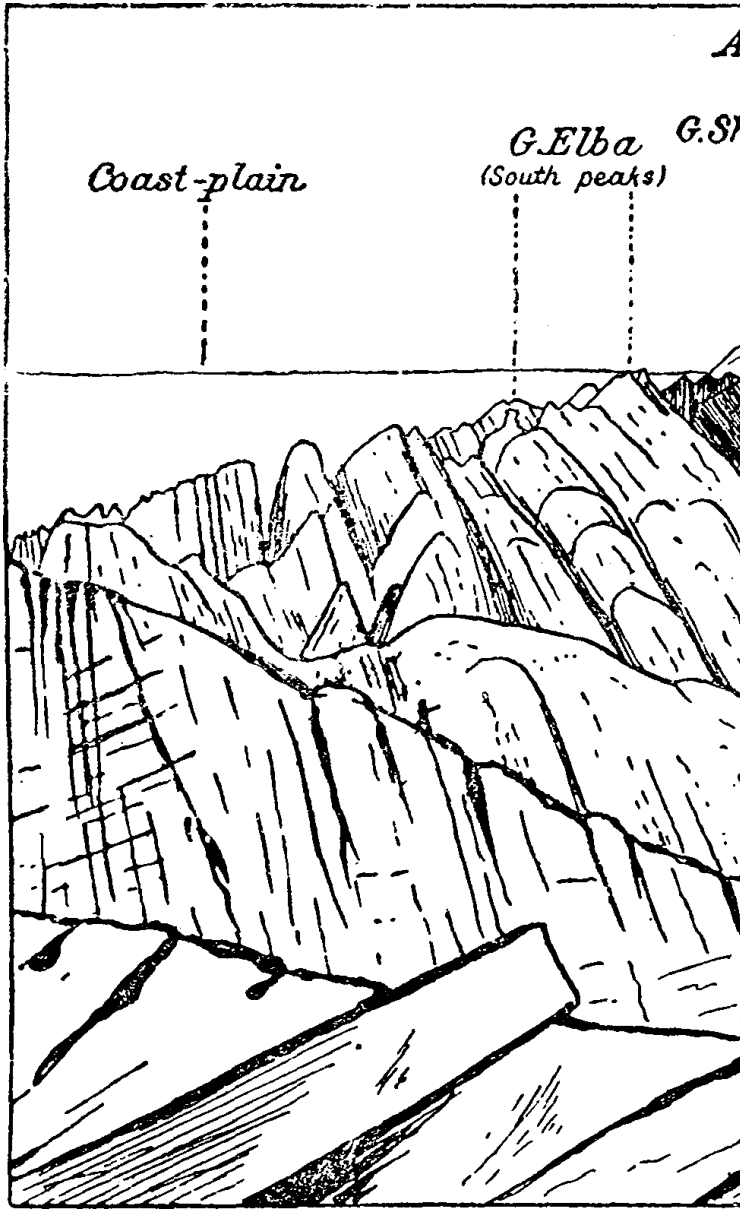
slightly lower, but more conspicuous and nearer the centre c
The peak which bears the triangulation station forms a cent
Kansisrob drains the north faces of the mountain, and unites
to the sea; and the Wadi Yoider, which drains the western pa

The approach to Gebel Elba by the coast-plain from the
expedition reached the mountain by marching eastward fron
on turning eastwards just after leaving Bir Meheriqa. Skirtin
again we entered some low hills and dropped by an easy pas
we reached Bir Akwamtra, where we found a fairly large Bis

I had hoped to ascend the mountain by way of Wadi Akv
progress for camels was very difficult owing to the closenes
followed a very winding track leading over the Asut Duk pa
clearing at the foot of the mountain, three and a quarter kilo

The climb to the summit was a long and tiring one, but v
is 1,093 metres above sea. About half way up to the neck, an
dropped down to a level of 984 metres in crossing the head
whole climb was through a thick growth of trees, very green
trees cease about 350 metres above sea, and new forms tak
with thick woody looking trunk and branches, the foliage be
as big as a pea, very hard.[112]

The top of the mountain is narrow and very rough, but n
outlook southwards from the beacon. But, as already remark


Coast-plain
G. Elba
(South peaks)

The phenomenon of "glories," or rainbow-coloured rings April 26, and I was able to measure the diameters with ar arithmetical progression. The shadow cast by one's head and

The temperatures experienced on the summit were rema a cold north-west wind set in, which soon cleared the air; b shelter behind rocks from the biting blast, and though we w 4, when we descended the mountain to be half roasted in th

As already remarked, Gebel Elba is well supplied with w of the mountain are two other wells called Bir Salalat O Sir,

Karam Elba is a granite hill rising to 586 metres above s side is another small granite hill called **Mikeriba**.

To the east of Karam Elba are some granite hills which, **Ara**, **Kreishim**, **Abai Sis**, and **O Wota**, the last-named being

Qash Amir ("Scragged Hill" of the Admiralty Charts) is a Admiralty surveyors, for it is a mass of sharp granite spikes latitude 22° 14′ 31″, longitude 36° 12′ 20″. I had intended t built, and that it would be impossible to set up a theodolite t

Gebel el Sela is a straggling group of high rugged granit

Gebel Sul Hamid is an extensive tract of low dark hills, part by the Wadi Eikwan, while the southern drainages pass

Gebel Balatitda is a group of high hills lying between G of Gebel Balatitda are swathed in blown sand.

Gebel O Sir Eirab is really the south part of Gebel Elba names to the wadis first, and the adjacent Wadi O Sir Eirab l

Gebel Hanquf is a range of mountains some twenty kilo peaks, is of granite, while the north-western portion consist range reaches 1,397 metres. The northern part of Gebel Ha between Gebel Hanquf and Gebel Shendib westwards to join

Gebel Shendib, which lies close south-west of Gebel Ha above sea, is in latitude 22° 0′ 48″, longitude 36° 16′ 30″. S metres in height; one of these, some two kilometres south-ea

The north portion of Shendib is drained by the Wadi Har

Gebel Shendodai ("Castle Hill" of the Admiralty Charts) 31″, and rises to 1,529 metres above sea-level. Gebel Shendo

Gebel Shellal, situated close south-east of Gebel Shendo Shellal and Aqilhoq, the latter containing a good well, calle plain between them and the shore. One of the foot-hills of name).

Gebel Hadarba is a little range of felsite hills with many 47′ 23″, at an altitude of 217 metres above sea. Gebel Hada of the Hadarba range bears the special name of **Wiekorei**, w

[106] The exception is El Shayeb, in

[107] Each of the last three vowels is

[108] The position of this cairn is lat

[109] The position of the cairn is lati

[110] By measurement with the theo

[111] The word *Elba* (Bishari) means

[112] Prof. Schweinfurth informs me the Erkowit district of the Sudan (latitu

The sources of water in South-Eastern Egypt, as in the Eg

(1) Springs;

(2) Wells;

(3) Rock basins.

As springs are classified those water sources where wate
250, springs are less common than wells and rock basins, bu
use this word, calling springs and wells alike *Bir*, which prop

Springs may occur in any kind of rock, but the rock mus
body of the rock, while the springs of Meneiga occur in a
consequence of the non-porosity and the comparative fewne

The collecting areas of the Eastern Desert springs are m
surround them, while those of Meneiga are supplied by the r
The yield of the springs is usually small, rarely exceeding te
thus springs may go on yielding supplies when, after a succe

As a rule, spring waters are very clear and potable. The
fairly considerable, but there is no known spring in this part
desert water sources.

Springs are mostly on or near the main camel roads, for
is more or less difficult of access. The springs of Abu Saafa a
At large springs the Arabs generally dig out a series of basi
detritus; this sand is scooped out and the water is baled fr
obtained; the small trickling spring of Sikait, for instance, wa

Megals are more likely to run dry than the larger springs,
the throttling of the efflux is doubtless in many cases the chi

The wells of South-Eastern Egypt are mostly shallow exc
frequent in the districts near to the mountain ranges than i
points remote from the mountain ranges are of immense imp

On an average, water is reached at a depth of eight to te
generally wide and very crooked, in order to permit of a ma
masonry, and rough timbers may be stretched across the mo
caravan uses its own rope and skins. Occasionally, the shaft
sinking a narrow pit, throwing out the excavated material i

Frequently there are high *hods* for camels and low ones for s

After every considerable rainfall the wells become fille conditions this circumstance. To the Arab, wells are a last r safe from loss by this cause. He therefore draws his supplies Arab is sore indeed. The Bisharin do not drink much water, feed on.

The quality of water from the wells varies enormously abundance of sodium, calcium, and magnesium salts from t present; the figures give milligrammes per litre (parts per mi

Total solid matter in solution
Cl
SO_3
CaO
MgO
Equivalent of Cl as NaCl
Equivalent of SO_3 as Na_2SO_4
Alkalinity to methyl orange calculated as $NaHCO_3$

All the above waters were quite drinkable, though that o

An analysis of the water of one of the Halaib wells in 18

Cl	336
SO_4	449
CO_3	48

Dr. Natterer records that the sample, which was clear, taste drank regularly of the local well-water; I found it very hard Sudan.

As a rule, it is the magnesium salts which are the most h the coast to the south of Halaib, where the wells of Ti Kure very basic igneous types, such as gabbros and serpentines, t

clayey strata within the region here treated of, but Bir Qole
clayey matter so finely divided as to be unfilterable through
from infiltration of sea water. As a rule, the very salt wells, s
milk with it, and I have found it wise to imitate them in this

Wells are generally named after the wadi in which they
well in Wadi Seyet.

Questions are often asked as to whether it is not possibl
fresh well near an existing salty one in order to obtain a dri
the present Arabs may be lazy, the older tenants of the dese
day, and with the cheap convict labour then available we m
road, so that it is likely that most of the wells in the wadis
new wells sunk at considerable cost in likely-looking places,
or on the site of existing wells, as for instance near the temp
sinking new wells near to old salty ones, no success can be
same wadi, because the alluvium everywhere in the wadi co
resulting from stagnation, that very fact shows that it is not

In the south parts of the country, where the rainfall is gr
arise.

The typical rock basin, called a *galt*[120] by the Arabs, is
so that one has to tramp often over miles of steeply rising st
varies very much; some hold millions of litres. Often there i
generally due to pot-holing action on a large scale. Galts ma
el Aguz near Gebel Um Harba, which from the inscriptions
for feeding by percolation and underground flow the adjacer

The water supply of galts depends firstly on the rainfall
basin, and, lastly, on the degree of exposure to evaporation.
system most favourable to galts is one formed by the union
much crushed, galts are very unlikely to occur. Again, if th
gorges galts only receive the sun's rays for a few hours of the

The quality of galt water varies very much with the inte
magnesium and other salts, and as the loss by evaporation c

A galt is frequently accompanied by a small spring (*meg*
small quantity by scooping out sand-filled rock cavities close

Galts are generally named after the mountain in which th

As will be gathered from the map on Plate III, water sup
cases, where it is desired to camp for any purpose remote f
camels can always be detached from a caravan to fill their s
day to be ample, including water for cooking and for one's p
light camel load, and on the march one can add a little in
vertically, a pair forming a camel load; but I have found ther

In the following list I have summarized all the water sou
basins of the mountain areas for two reasons. Firstly, the Ar
supplies entirely on comparatively recent rainfall around th
point out a dry basin, even if in some other year it may have

With regard to the accuracy of the positions given in the
wells not actually seen but whose positions were pointed out

It must not be assumed that water supplies can *always* b
supplies for a year after rainfall, but the smaller ones last o
wells are filled with downwash, and digging must be resor
statement "*el bir hena*" (the well is here). The explanation i
digging out of the well until the basins are empty again. In
supply.

The notes in the column headed "Remarks," on the quali
rain has fallen, the better are the supplies, both in quantity a

Name.	Latitude N.			Longitude E.			
	°	′	″	°	′	″	
Galt Um Tundeba	24	55	25	34	45	53	Rock basin in rav
Galt in Gebel Ghuel	24	54	0	34	39	0	Large rock basins
Bir Muelih	24	51	35	33	59	52	In Wadi Muelih.
Hangalia well	24	50	27	34	35	40	Modern well in W
Galt Um Karaba (Migif)	24	48	48	34	27	55	Large rock basins
Bir Ghadir	24	48	25	34	47	0	Well in Wadi Gha
Megal el Harami	24	47	34	34	34	15	Small spring in ra
Bir Sibrit	24	43	0	33	58	0	Well in Wadi Sibı
Bir Murra	24	41	0	34	11	0	Well in Wadi Sha
Hamish mine	24	41	0	34	6	0	Water in mine sh
Sikait, spring	24	40	50	34	47	10	Tiny trickling spr
Sikait, north well	24	40	12	34	46	0	Modern well, sun
Sikait, south well	24	39	38	34	47	45	Similar to last; bc
Bir Um Gubur	24	37	0	34	5	0	Well in Wadi Sha
Bir Abu Had	24	34	0	34	36	0	Well in Wadi Abu
Bir Masur	24	31	0	34	13	0	Several wells in f
Bir el Ranga	24	26	0	35	13	0	Very salt well, cl
Galt Um Gerifat	24	22	55	34	40	20	Rock basin in gor
Bir Metawit	24	17	0	34	31	0	Well in Wadi Met
Bir Khashab	24	16	0	34	23	0	Well in Wadi Kha
Bir Shadli	24	12	3	34	37	55	Spring or well ne
Bir Abu Hamamid	24	12	0	34	29	0	Well sunk about
Amar Spring	24	10	0	35	9	0	Spring of good w
Well in Wadi Abu Hamamid	24	7	0	34	26	0	Wells sunk in wa
Bir Helie	24	5	0	34	32	0	Well in Wadi Hel
Megal Um Gunud	23	58	50	35	10	50	A smaller rock ba
Galt Um Gunud	23	58	10	35	11	20	Rock basin, in Ge
Megal el Selaia	23	56	55	34	52	50	Small spring in sa
Galt Batoga	23	51	20	35	21	30	Rock basin at foo
Galt Um Maiyat	23	50	2	35	18	15	
Galt in Gebel Dahanib	23	44	45	35	9	50	Rock basin in rav
Bir Shenshef	23	44	0	35	23	0	Several small wel
Bir Abu Hashim	23	41	56	34	4	26	Several wells in a
Bir Betan, west well	23	38	0	35	3	15	Well in floor of W

Bir Betan, east well	23	37	55	35	3	35	Well in floor of W
Galt near Gebel Abu Dahr	23	37	0	35	5	20	Rock basin in nor
Bir Rahaba	23	33	30	35	9	54	Well in alluvium
Bir Abu Reye	23	33	0	35	9	0	
Galt el Aguz	23	32	30	34	35	0	Large rock basin
Bir el Gahlia	23	31	0	35	8	0	
Bir Abu Beid	23	31	0	34	58	0	Well in Wadi Abu
Bir el Sunta	23	25	50	34	47	40	Spring forming p
Bir Abu Dibesat	23	25	6	34	47	10	Spring forming sr
Bir Abraq	23	24	56	34	47	20	Spring forming p
Bir Gumbit	23	24	0	34	49	0	At edge of sandst
Bir Orga	23	21	0	35	3	0	Well stated to exi
Megal near Abu Saafa	23	19	30	34	48	40	Spring? in small
Abu Saafa Springs	23	18	9	34	47	45	Four springs yield
Galt in Wadi Gihab	23	17	5	34	48	10	Large rock basin
Bir Um Reit	23	13	36	34	35	3	Well sunk in floo
Bir Dif	23	12	42	34	49	55	Spring forming tv
Bir Shalatein	23	8	5	35	36	28	Very salt well nea
Bir Beida, north well	22	58	6	35	18	10	In Wadi Beida, ab
Bir Beida, south well	22	57	53	35	18	10	In Wadi Beida, cl
Bir Madi	22	47	46	35	1	48	Well sunk in allu
Bir Meneiga, north spring	22	47	8	35	12	20	Similar to Bir Me
Bir Meneiga, south spring	22	46	55	35	12	15	Tiny pool in rock
Bir Korbiai	22	46	55	35	10	35	Two wells of exce
Bir Muqur	22	42	26	35	18	5	Trickling spring v
Bir Sararat Seyet	22	41	10	35	1	59	Deep well in Wad
Bir Diqdib	22	41	0	35	13	0	Spring? high up i
Bir Adal Deib	22	40	30	36	4	30	Salt well, close to
Ti Dabei Hamra Dom	22	39	55	35	38	40	Shallow excavatio
Bir Baaneit	22	39	30	35	18	40	Spring? situated a
Bir Bint el Dreb	22	34	0	35	9	0	
Bir Um Rasein	22	29	10	35	20	20	Near Gebel Um R
Bir Nabit	22	26	50	36	21	50	Close to sea. Prob
Bir Um Bishtit	22	26	33	35	33	45	In narrow windin
Galt Osnei	22	25	35	35	50	40	Rock basin in sma
Meis-heit-ar, north galt	22	22	4	35	35	12	Galt in rocky gor
Bir Abu Hodeid	22	22	0	35	17	0	Large and import

Bir Odis Maaleq	22	22	0	35	16	0	Large and import
Bir Meisah	22	21	8	35	35	50	Well-known well
Bir Qidmib	22	21	0	35	29	0	
Bir Abu Ramad	22	20	40	36	26	50	Close to sea. Prob
Bir Shinai	22	20	0	35	15	0	
Meis-heit-ar, south galt	22	21	15	35	35	20	Galt in rocky gor
Megwel Adar Aqdeib	22	17	50	35	38	40	
Megwel Um Edwa	22	16	50	35	32	45	Chain of rock bas
Megwel Didaut	22	16	25	35	37	10	
Megwel Akau	22	14	50	36	21	10	Small spring? on
Bir Kansisrob	22	14	35	36	22	0	Large well; water
Megwel Hamida	22	14	25	35	47	0	A tiny trickling sp
Halaib wells	22	13	25	36	38	40	Several wells in v
Bir Akwamtra	22	13	1	36	17	58	An excellent well
Bir Hilwit Hasium	22	13	0	35	14	0	
Bir Nubitra	22	12	50	35	46	20	Said to yield only
Megwel Um Ein	22	12	30	35	39	40	
Bir Meheriqa	22	12	10	35	56	35	Spring on east sic
Bir Kagog	22	11	0	35	16	0	Small well in Wa
Galt in Wadi Kirir	22	10	0	35	19	0	
Bir Sararat Serimtai	22	8	50	36	24	15	
Bir Mashushenai	22	8	30	35	49	30	
Megwel Aqwem	22	8	0	35	41	0	
Bir Guqub	22	8	0	34	27	0	Galt and spring?
Bir Salalat O Sir	22	7	23	36	19	0	
Ti Kureitra	22	5	50	36	46	40	Four wells sunk i
Bir Egat	22	5	0	34	54	0	
Bir Frukit	22	2	0	36	36	0	Well in Wadi Aqi
Bir Himeitra	22	0	0	35	15	0	
Bir Qabatit	21	57	55	36	51	17	Well in Wadi Qab

[113]Part of this chapter is taken fr

[114]I except the tiny spring called

[115]Samples collected on two diffe

[116]Not determined.

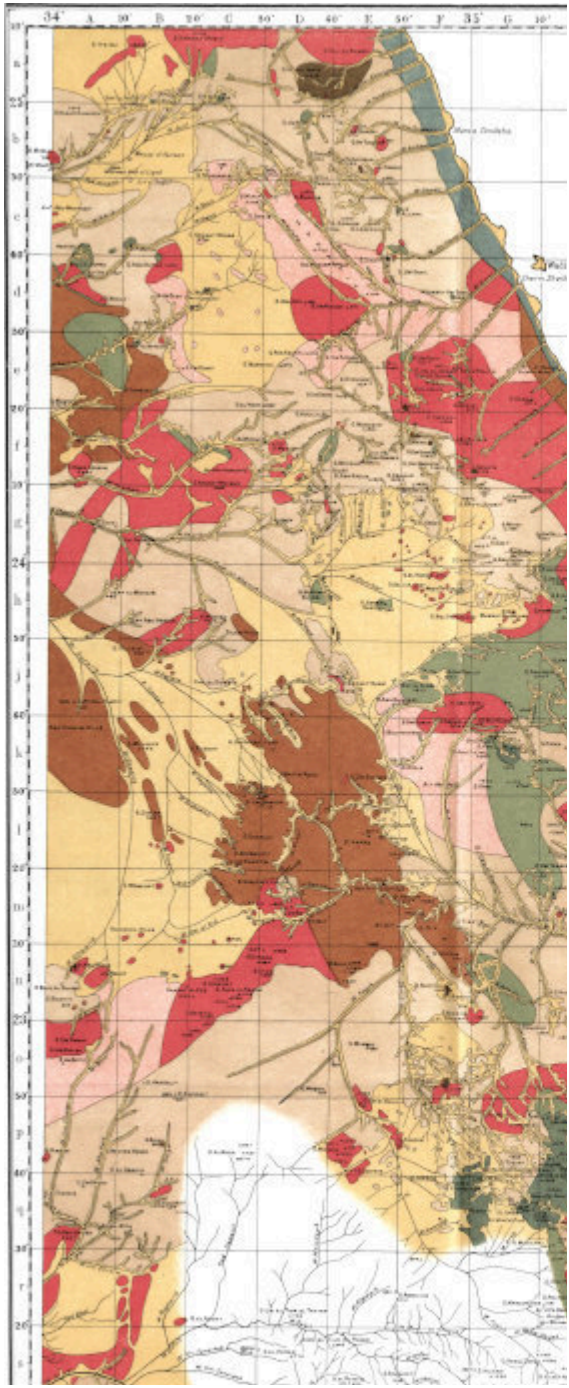
[117]*Berichte der Commission für Oce*

[118]Cf. the *Marah* of the Israelites,

[119]This is in latitude 27° 35′ N., a

[120]Pronounced to rhyme with the

[121]The map of the roads and wate



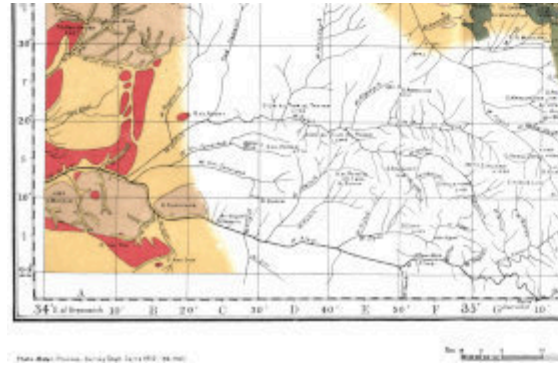


Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

(*Lar*

Only a small proportion of South-Eastern Egypt is covere
where the Nubian sandstone which covers so much of the c
gypseous limestones and coral reef occur. The oldest rocks
Quaternary deposits are represented by Pleistocene and Rece

The sedimentary deposits may thus be classified into:—

(1) *Recent Deposits* (coral reefs and raised beaches, blown

(2) *Gypsum and Gypseous Limestones* (of uncertain age, po

(3) *Nubian Sandstone* (Cretaceous).

Coral reefs fringe almost the entire coast-line of South-Ea
metres above the sea; but in general it is not met with on the
the sloping coast-plain. At low water great expanses of near
parallel to the coast at a distance of a kilometre or more fr
water between the outer reefs and the shore. Openings in th

reef forms a tough, hard, and very porous limestone, with a
it were anciently employed for building at Berenice, as well

In close association with coral reefs are beach deposits o
banks of very white aspect occur near the sea further nort
abundant casts of lamellibranchs and gasteropods, mostly in

The dune-forming sand in South-Eastern Egypt is exactly
yellow colour, owing to their being coated with a thin super

The only area where sand dunes are of any considerable
Balatitda, Sul Hamid, and El Sela. The north faces of all t
accumulation at this particular place is that the north-west
from the Nubian sandstone areas by the north-west wind. T
them.

Sand accumulations of less magnitude occur in and abo
extensive as to cause a serious hindrance to travel.

Besides transporting the ordinary dune-forming sand, the
coarse sand, in angular grains as large as peas, is blown abou

The degradation of the mountain and hill masses which i
in immense accumulations of alluvial material (sand and gra
suffered during the process of folding and mountain formati
for a place where the rock is sufficiently free from cracks to
powerful aid to disintegration, and here the diurnal tempera
the constant differential motion of its component grains, res
kaolinisation of the felspars, we find as a rule that the alluvi

In material, the alluvial accumulations are of the same
relative proportions of the different materials in the alluvial
more rapidly disintegrated by temperature-changes than a
fragments resulting from the breaking up of felsites, schists,

rocks. In approaching a mountain composed of about equal
seen in abundance in the higher parts of the drainage chan
Azrak, because its alluvium consists of dark rock fragments,

In size, the fragments composing alluvial detritus vary fr
wadis, and the finer sands in their lower reaches and on the
produce for short periods such immense rushes of water do
well in a wadi fifty kilometres or more from the mountains t

In shape, the alluvial fragments vary very much, accordi
high degree of rounding; the same is true of serpentines
considerable distances. The larger blocks are generally rou
rapidly at the corners, and the block eventually becomes mo
can be noticed in certain dolerites, where portions of the r
schists, and slates, do not show much of this rounding *in sit*
the lower reaches of the wadis and on the plains, of course,

Of the thickness of the alluvial sands and gravels very li
borings made in the maritime plain near Port Sudan have be
formed streams, though violent in the mountainous tracts,
denudation and transport have gone on, we can well imagin

In some wadis there are high banks of old detritus throu
these terraces, which are about two kilometres lower down t

At the east foot of Gebel Hamra Dom are some well strat
contain ferruginous scales and show sun-cracks in places, wh

It is to the alluvial material in the wadis that the Eastern
the higher drainage lines, and may last for many months
precarious source of water supply because they are liable t
excavating in it at suitable places to depths of a few metres.
derive their nourishment from the water conserved in the all

Small deposits of calcareous tufa of recent origin have be

At Um Tundeba the deposit occurs in a little gully close t
rocks. The tufa (10,374) is a pale brown rock of rather poro

The calcareous tufa of Gebel Ghuel is a more impressive one is confronted with a great curtain-like mass of tufa cove floor.

Fragments of tufa were also seen round about Gebel Alla many other places.

The occurrences of gypsum and gypseous limestone beds 188 metres above sea-level. Further north, gypseous deposit It appears probable that the gypseous strata form a continu distribution of the beds is somewhat different from that ind wells of Ti Kureitra.

At Ras Benas, where the beds have been studied in most of the rocks are very soft, and the disintegrated material for the gravel of the coast-plain and form low banks; the gypsu exposures contain much crystalline selenite, blocks of this m

No fossils have been found in the gypseous strata, and t regard them as having been formed after the Red Sea occu certain. It is noteworthy that at Ras Benas, where the gypsec



Photo-Metal-Process. Survey Dept. Cairo 1910. (60-190)

The Nubian sandstone covers a comparatively small port
which stretch eastward from the Nile towards the igneous
deposition of the sandstone was not confined to the western

The most northerly exposure of Nubian sandstone in the
Wadi Garara, forming the hills of Felieiti and Abu Hashim.
the Nubian sandstone forms an extensive high broken platea
broken sandstone plateaux bears various names in differen
separated by wadis from each other. Small outliers of Nubia

On the eastern side of the watershed, Nubian sandstone
been met with in the area is a small outlier in latitude 22° 3

In petrographical characters the Nubian sandstone is re
black, according to the amount of iron present. It is generall
are generally pebbly, forming conglomerates in some places.
the interior is filled with a powder of snow-white chalky m
crocodile scales and various shells. From these and the fossil

Intrusions of igneous rock into the sandstone have only b
Dr. Hume has found andesite interbedded in the sandstone.

In thickness, the Nubian sandstone attains a maximum
denudation, and are not capped by younger rocks.

Some interest attaches to the maximum altitude reached
rock on the great plateau round about Wadi Hodein is Gebel

In contradistinction to the same beds which form the pla
a rule greater and more variable the nearer one approaches

[122] *Geol. Mag.*, Decade V, Vol. VI (

[123] The numbers in square bracket

[124] Wadi Abu Rahal is a small fee
mine, a well was sunk by the Mines D
alluvium, then thirty-seven metres of s
which Mr. Bullen Newton compared to
Report on the Geology of the Eastern Des
abandoned.

Igneous rocks cover about one-third of the entire area c masses and also underlying a large portion of the areas cove

Regarded broadly, the igneous rocks of this portion of th acid and ultra-basic rocks, but these are less abundant, and large portions of the main mountain tracts, with acid rocks a to the enormous denudation which has taken place in the c altered or devitrified till their original volcanic nature has l igneous group, or classed as metamorphic rocks.

For purposes of classification, the igneous rocks of South·

1. *Ultra-acid rocks,* containing over 80 per cent of silica.
2. *Acid rocks,* containing from 65 to 80 per cent of silica.
3. *Intermediate rocks:*—
   (*a*) *Sub-acid rocks,* with from 60 to 65 per cent of sili
   (*b*) *Sub-basic rocks,* with from 55 to 60 per cent of sil
4. *Basic rocks,* containing from 45 to 55 per cent of silica.
5. *Ultra-basic rocks,* with less than 45 per cent of silica.

The classification is based on silica percentage, for altho chemical composition, and the specific gravities of the differ the five main classes.

The five classes are not all of equal importance. As alrea series which occur in great abundance; the rocks of the sub-l field with those of the basic group. The district is so large, statements are merely those of the facts of observation, so fa

The scheme tabulated above differs from established cla igneous in origin. These rocks are almost pure silica, and t

grounds of symmetry of classification it appears justifiable to

Ultra-acid.	A
Quartz-rock.	*Granite.* Normal pink granite. Red pegmatitic granite. Aplite. Biotite-granite. Muscovite-granite. Hornblende-granite. *Granite-porphyry.* *Quartz-felsite.*

Quartz-rock of igneous origin occurs in the form of intru sun renders it very conspicuous in the field. The shape of ma accompany vein-quartz deposited from solution, and the o representing its ultra-acid portion.

The most conspicuous occurrence of quartz-rock is in th form landmarks visible from great distances. The largest an two hills are somewhat smaller; they lie respectively two ki hills, which was occupied as a triangulation station, is comp and the faces of the separated blocks frequently show a sligh

Another remarkable boss of quartz, similar to that just de on to the coast-plain. A third occurrence, of much less size, i

Of igneous quartz veins, the best example is the huge dyl a height of ninety-five metres above the wadi, and can be tra

weathered to a sintery appearance in places [10,362],[126] solution, but it is difficult to assign other than an igneous so

Going south-west from Erf el Fahid, down the Wadi Mue veins seaming diorite in all directions on either side of a hor

It is significant that there are no traces of mine working gold-seeking prospector. Though the loose crystals found at other ores.

Granites are the most abundant and most widely distril Hamata, Faraid, Um Reit, Mishbih, Adar Qaqa, Adar Aweib, which covers most of the plain.

In point of geological age, the granites appear to be the y

Though sometimes occurring as rounded bosses, as at Ge in spiky peaks, while Qash Amir, the “Scragged Hill” of the the blocks being brought about by jointing and the more rap Ababda country, all mountains named *Hamrat*, as for instan Adar Aweib, has the same significance, both the names mea derived from the weathering of the rock. This sand is quite f (the redness of the felspars having largely disappeared in th possessing the common characteristic of draining from grani

Besides the great mountain-forming masses, granites also

Viewed as a whole, the granites of South-Eastern Egypt a yet on the whole the rocks approximate to the aplitic and pe

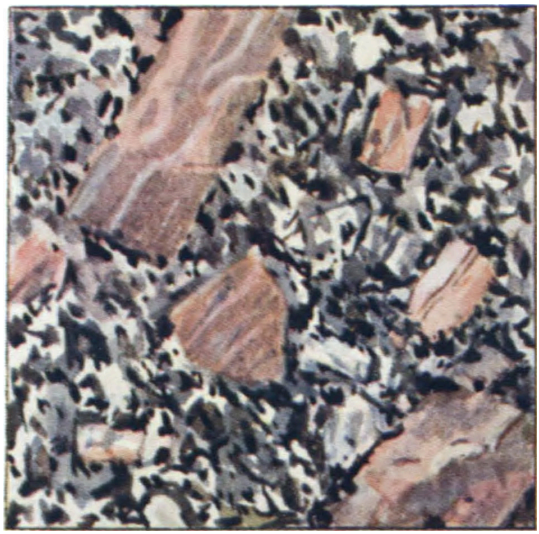
We may consider the granites as falling mainly into the fo

1. Normal pink granite.

2. Red pegmatitic granite.

3. Aplite.

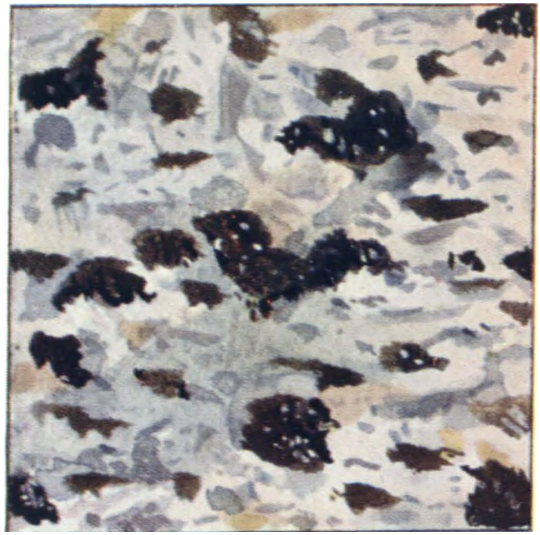
4. Biotite-granite.
5. Muscovite-granite.
6. Hornblende-granite.



PORPHYRITIC GRANITE.
Gebel Fereyid.



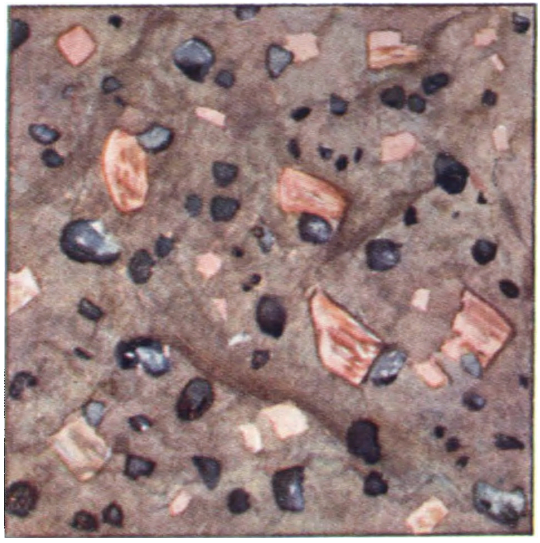
PEGMATITIC RED GRANITE.
Wadi Gemal.



BIOTITE-GRANITE.
Gebel Abu Hegilig.

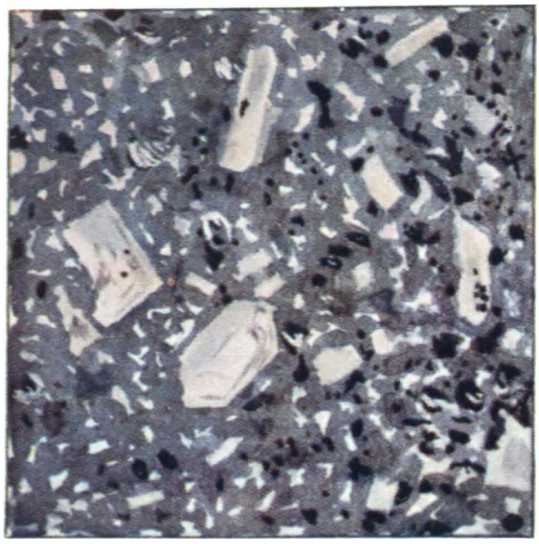


HORNBLENDE-GRANITE.
Gebel Elba.



QUARTZ-FELSITE.

Near Gebel Kolaiqo.



QUARTZ-FELSITE.
Near Gebel Kolaiqo.

Normal pink granite is the form of granite most comm
Dom, and also covers large expanses of low hill country, a
composed of pink orthoclase, white oligoclase, quartz, and b
of about the same size as those of the quartz, *viz.*, two to fou
occasionally sparingly present. The oligoclase is white, and
specimens the felspars are fresh, in others [12,133] they s
millimetres in diameter. The biotite is frequently the only fe
brown to nearly black when a crystal is rotated over a nicol
either absent or present only in a very subordinate amount
present, and are only visible on microscopic examination. In

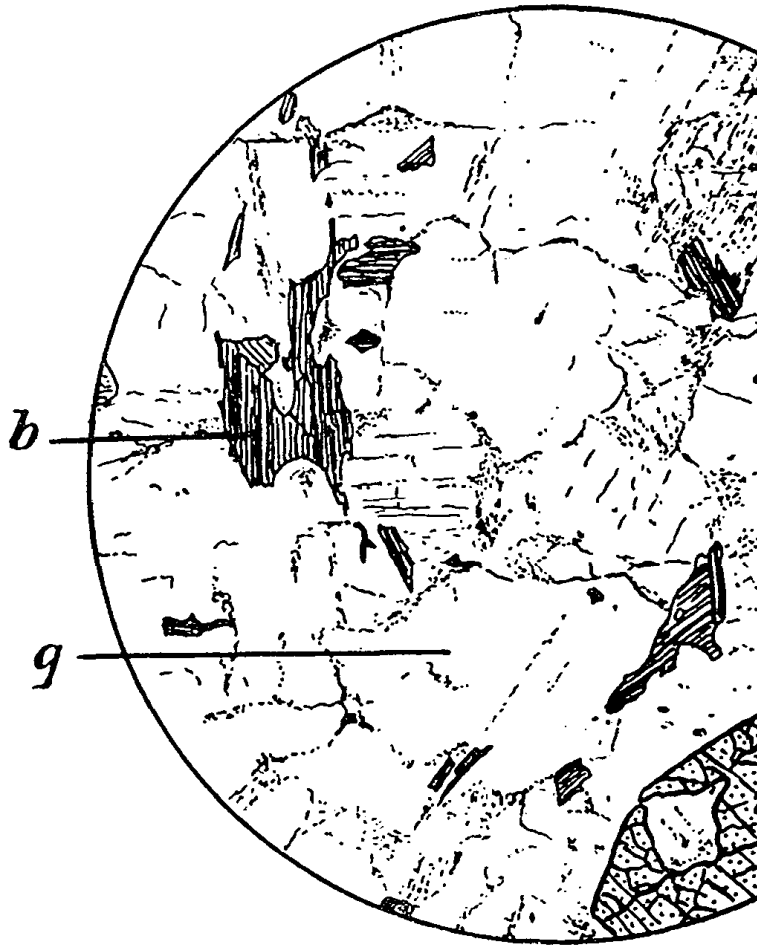


Fig. 4.—Granite, Gebel Fereyid [11,505], × 10. *f*, felspar (mostly orthoc
decomposition; *q*, quartz; *b*, biotite; *s*, sphene.

The principal variation in mineral composition of the rc
absent, its place being taken by green hornblende, now larg
the great intrusions, they vanish almost entirely, and the roc

Variations in appearance of the rock are also conditioned
have been subjected. Where the rock has been crushed, or
gneiss. The microscopic sections from these places show fur

bleaching of the orthoclase, and sometimes exhibits green sp

It is the pink granite which by its disintegration gives ris
in the process. Change of the felspar to kaolin goes on under

Red pegmatitic granite is closely associated with the n
Kreiga. The red pegmatitic granite is in fact simply an extre
dykes is probably a consequence of its peripheral position r
dykes are off-shoots from the main mass. There is, therefore
pegmatitic granite as simply a coarse grained mica-free gran

The pegmatitic granite is usually of a far more pronoun
colour. The rocks about the lower parts of Wadi Gemal and
near the sea; this idea is supported in some measure by the s

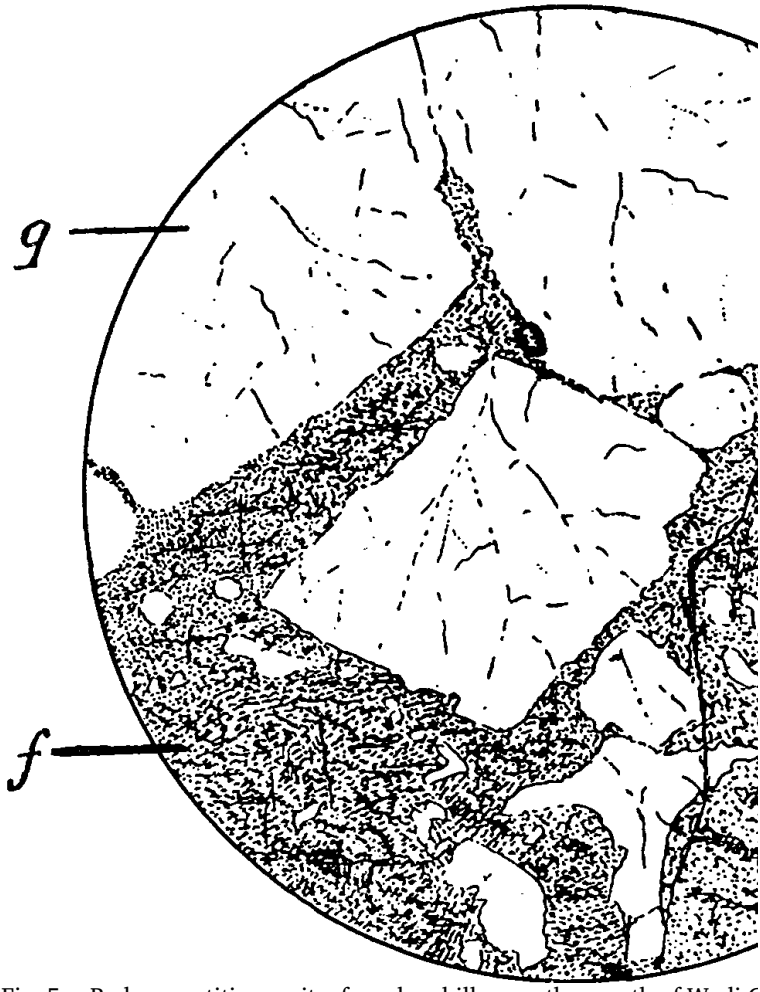


Fig. 5.—Red pegmatitic granite, from low hills near the mouth of Wadi C
quartz; *f*, felspar (orthoclase) turbid and full of finely disseminated red

In the hand specimen (*see* Plate XXII), the red pegmatitic rock usually breaks easily into irregular pieces under the ha strikes fire very easily under the hammer. Under the micros shows sharply defined angular forms, and appears to have g so that a first glance at the slide suggests a quartz porphyry

also present in addition to the orthoclase. Crushing of the ro

Dykes of pegmatitic granite are very frequent in the neig

In ascending Gebel Migif, the gneiss slopes of the mount
form, measuring about one to two centimetres in length, son

Aplite, or fine-grained binary granite consisting essentia
than pegmatitic, the two main minerals being both in allotri
the presence of small quantities of hornblende or biotite. As
that of Gebel Elba for instance, as an aplite with a little hor
than about one or two per cent of the rock. When the definit

Gebel Abu Hireiq consists of a red granitic rock; I did no
felspar, with sparsely scattered specks of hornblende.

The dykes [11,536] which seam the granite and diorite n
the latter visible only with a lens. The microscopic slide sh
alteration of felspar and hornblende, the latter in very small

The hill called Marwot Rod el Ligaia, near the head of W

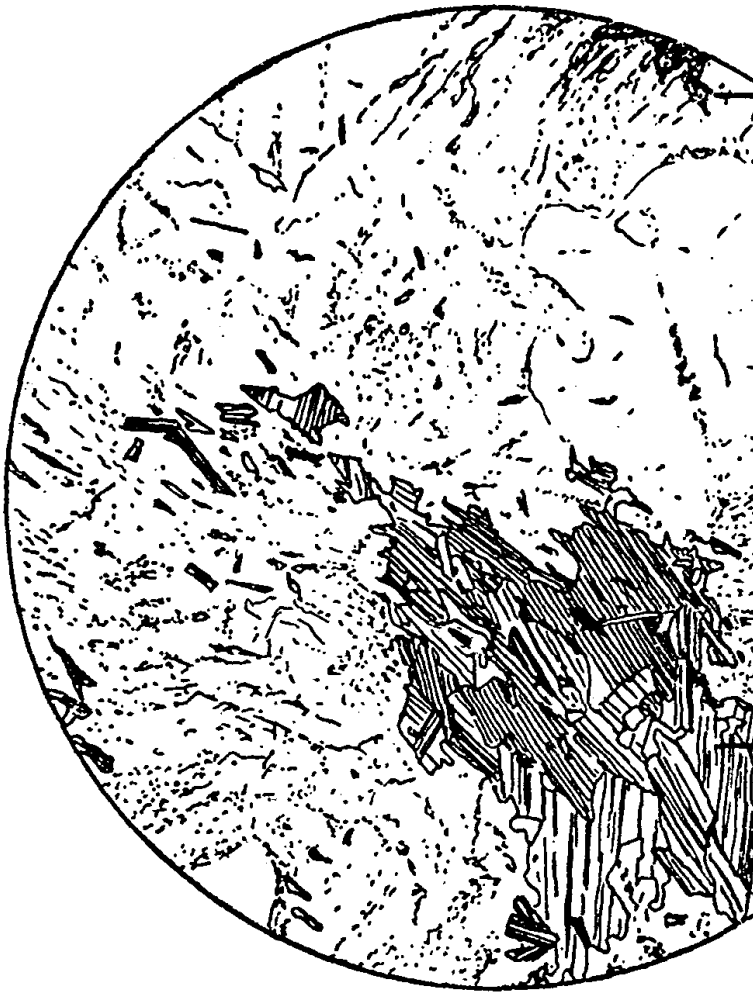


Fig. 6.—Biotite-granite near Gebel Abu Hegilig [10,390], × 17. *q*, quartz oligoclase), somewhat turbid by decomposition; *b*, biotite; *s*, sphene.

Biotite-granite of a well-defined type [10,390] occurs so rock consists of quartz and felspar; the dark spots are biotite more uniformly scattered, giving the rock a grey aspect. At s

felspars, which are somewhat more abundantly present tha clusters of ragged-looking crystals, but it also occurs in tiny ranging from pale yellow to deep olive-green in different po in the altering felspars, and there are a few small irregular g

A much more acid type of biotite granite [11,507] occu white rock, very fresh-looking, with dark spots; in hand spec microscopic slide shows quartz, orthoclase, and oligoclase w

Muscovite-granite is rarely met with in South-Eastern E

A very coarse-grained variety of muscovite-granite, in wh

Hornblende-granite occurs in several forms, giving rise

The most important and widely distributed form of hornl a faintly pink or greenish cast, of medium to fine grain, witl Hamrat Mukbud, and a gneissose variation of it forms the gr



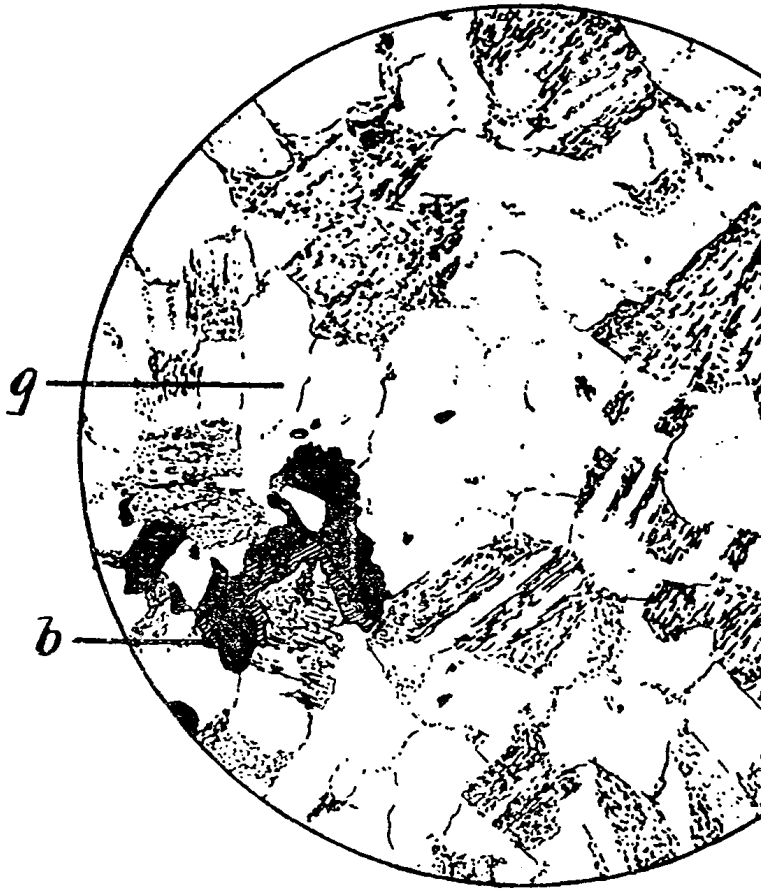


Fig. 7.—Hornblende-granite, Gebel Elba [12,118], × 17. *q*, quartz; *f*, fels clouded by kaolinisation; *h*, hornblende; *b*, biotite, altering with separa

Under the microscope the rock from Gebel Elba [12,118] of the crystals. The hornblende is in irregular grains of sharp

The rock of Gebel Muelih [10,355] is similar to that of G it might be mistaken for biotite, which latter mineral appear



Fig. 8.—Hornblende-granite, Gebel Hamata [10,405], × 10. *q*, quartz (tl
percentage of quartz than appears in the drawn portion of the slide); *f*,
clouded; *h*, hornblende, altered.

Another type of hornblende-granite, differing from that l
of Gebel Hamata and the surrounding mountains. This rock
clouded by separated iron oxides and epidote.

A third type of hornblende-granite is formed by the varia
which passes by insensible gradations into a syenite.

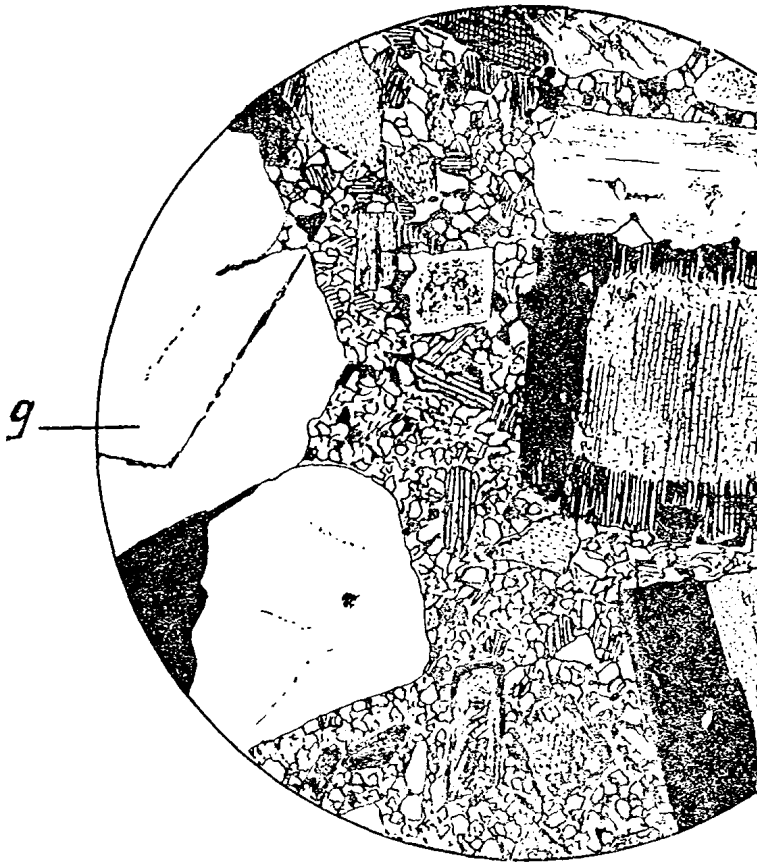


Fig. 9.—Granite-porphyry, Kreishim Hill [12,150], viewed between cross
(the dark triangular area to the left of figure is also a quartz crystal in
felspar (oligoclase); *g*, micro-granitic ground mass.

Under this heading are comprised rocks of granitic cor
porphyritic granites in the much finer grain of the general

occurs at the hill called Kreishim, sixteen kilometres west c
microscope (Fig. 9) the porphyritic crystals are seen to consi
crystals of quartz, felspar, and biotite.

Dykes of granite-porphyry also occur traversing the gran
are of a greyish-white or greenish-white colour, strongly re
characteristic structure of granite porphyry, but the felspars
Gebel Kahfa contains a small amount of muscovite.

Though covering only small areas, quartz-felsite is of v
masses. Felsite dykes are specially abundant in the neighbou

Felsites are frequently met with in a highly altered cond
granite of Um Reit, a bleaching action has reduced the felsit
(latitude 22°), where extensive hill-tracts consist of felsitic ro

The quartz-felsites are in general among the youngest of

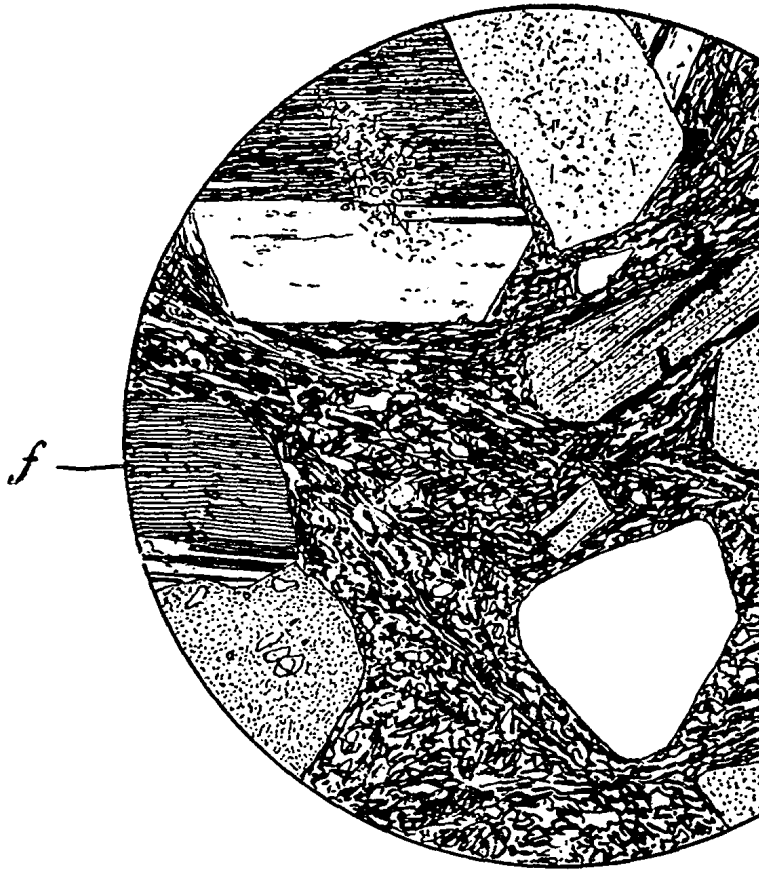


Fig. 10.—Quartz-felsite, Wadi Huluz [10,394], × 10. *q*, quartz; *f*, felspar *g*, ground mass, showing flow structure round the porphyritic quartz a

The quartz-felsite of Wadi Huluz [10,394] occurs in cons diameter plentifully scattered in a light greyish ground mass approximating to idiomorphic shape (*see* Fig. 10). The porp granules of epidote and fairly large specks of iron oxides. Th alteration, the felspar crystals being clouded and full of tiny

The quartz-felsite which forms the upper part of Gebel H hard rock which rings under the hammer and weathers into irregular shape, and a few crystals, of still more irregular fo

mass shows a matted texture between crossed nicols; there
like those of the quartz, are often cracked, and thus show th

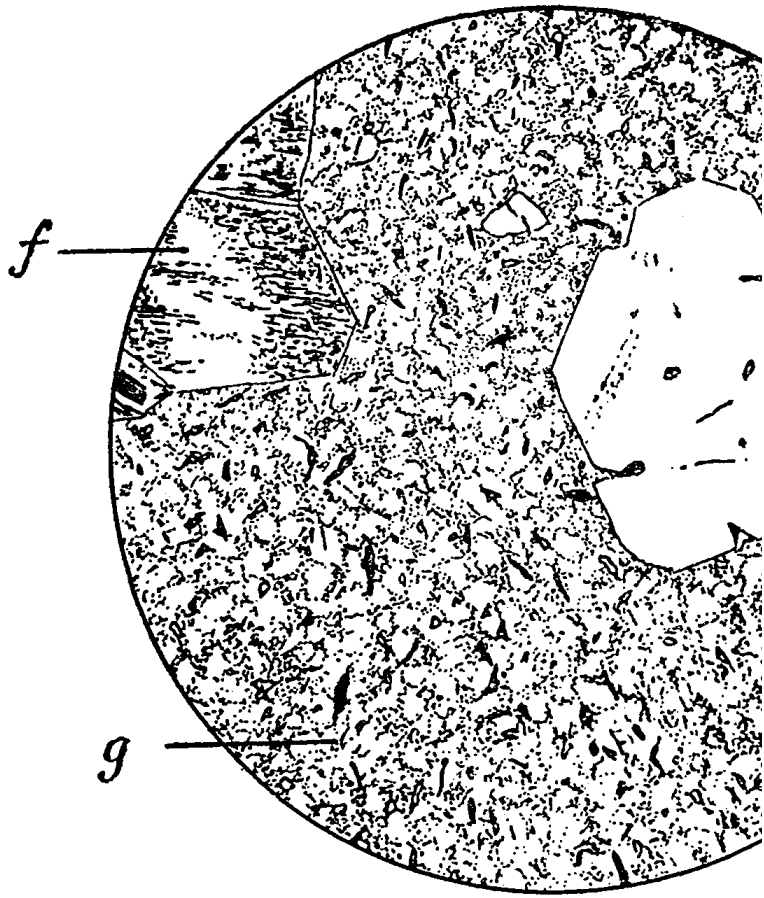


Fig. 11.—Quartz-felsite from dyke at Gebel Kolaiqo [12,145], × 10. *q*, q
crystals); *f*, felspar (mostly orthoclase); *g*, microgranitic ground mass o
wisps of hornblende.

One of the quartz-felsite dykes traversing the schists at G
(*see* Plate XXII), and the porphyritic crystals are partly pink
instead of being of a matted structure, is microgranitic, with

Another quartz-felsite dyke at Gebel Kolaiqo [12,135] ha grey to black ground mass (*see* Plate XXII). Its quartz crysta decomposition products. The ferro-magnesian mineral here i biotite. The ground mass is crystalline, and appears to consis

A peculiar type of quartz-felsite [10,377] occurs associa specks. At first the rock was taken for a granulite, which it v quartz can be seen. Under the microscope the rock is four straggling irregular patches of opaque iron oxide, often mixe oxide is doubtless the product of alteration of a ferro-magnes of quartz, felspar, a colourless hornblende, and sericite.

The quartz-felsite dykes [10,356] which cut through the marbling in places. The microscopic slides show quartz and ground mass.

The highly altered quartz-felsite [12,158] which forms G can usually be made out with the unaided eye. The sp. gr. seen, the crystals, if they existed, having been decomposed an arrangement suggestive of their having been derived from

The specimen [12,121] brought back from the summit o and brecciated felsite.[130] The slide shows quartz and altere

The felsite dykes [11,538] which seam the granite of Ge rapidly than the granite around them, leaving vertical-sided slides cut from the rock show a confused and clouded ser decomposed as to be hardly distinguishable from the ground

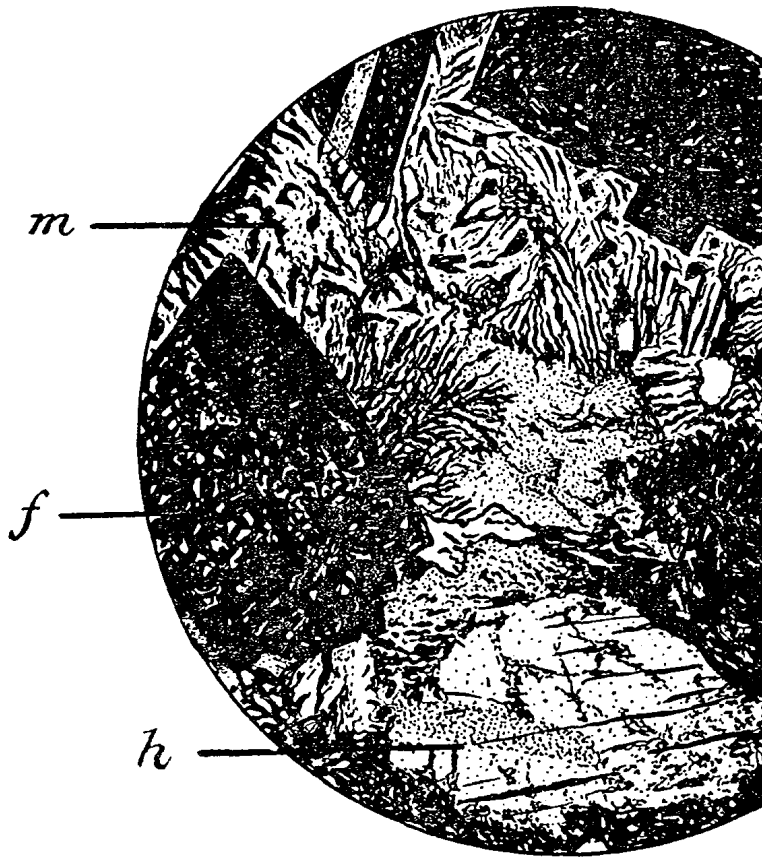


Fig. 12.—Altered quartz-felsite, Gebel Igli el Iswid [10,372], as seen betv
felspar (mostly orthoclase in the position of extinction); *h*, a crystal of
crystalline ground mass; *m*, micropegmatitic intergrowth of quartz and
porphyritic crystals.

In the rocks of Gebels Igli el Iswid, Mahali, and Hadarba,
a brown to nearly black colour, with white spots measuring
corroded by the ground mass; while the black ground mass
hornblende. The micro-pegmatitic material has possibly ori
gradually into a hornfels [10,371]. The slide from Gebel Mal
ground mass. The ground mass contains some calcite and iro

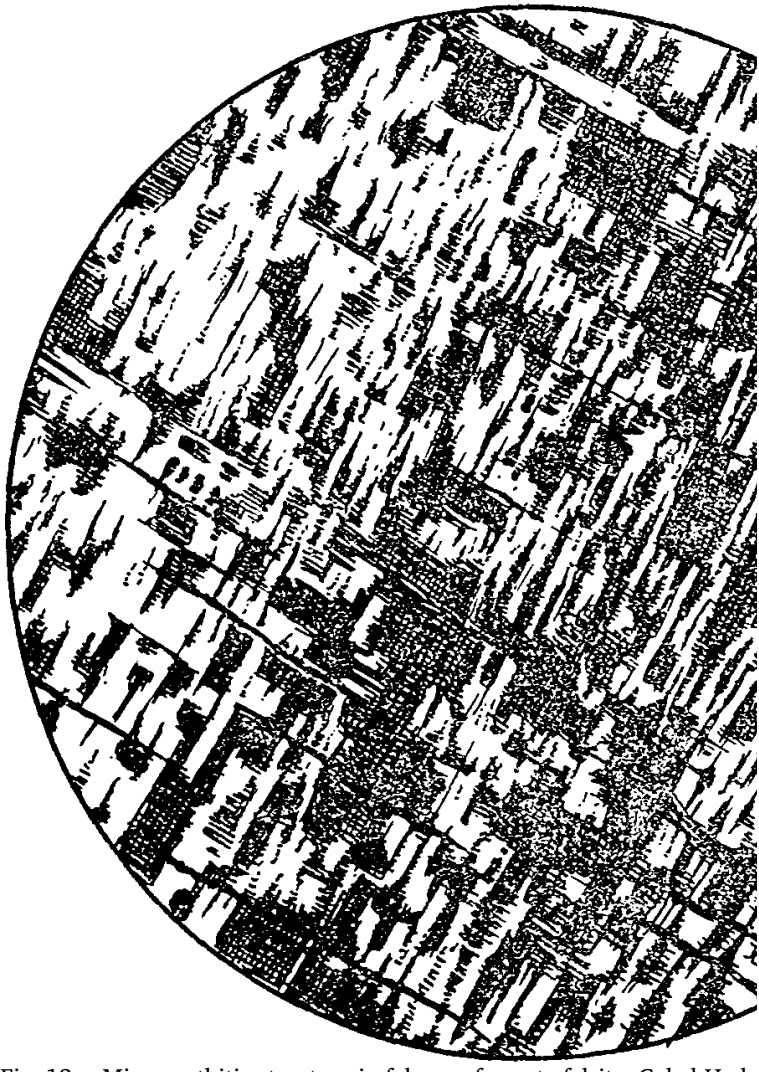


Fig. 13.—Microperthitic structure in felspar of quartz-felsite, Gebel Hada between crossed nicols, × 40.

The rocks of Gebel Hadarba [12,146-12,149] are essentia look as though they had been streaked with melted sealing- The ground mass sometimes contains granules and strings of



Fig. 14.—Crushed oligoclase crystal in quartz-felsite, Wadi Huluz [10,40
nicols, × 40.

An altered and crushed quartz-felsite [10,404] which oc
It is a jaspery looking rock of dark colour with red and gree
grained ground mass. The porphyritic crystals are mostly in

felspar, and some glassy matter, with abundant epidote in ne

The east-and-west dykes which traverse the syenite of C [11,525] shows the rock to be a highly indurated felsite. Th of alteration by siliceous solutions. These altered felspars are

No volcanic rocks of acid type have been with certainty suggestive of intruded masses and sheets. It is also quite like intense metamorphism to which they and the surrounding ro

Though hornblendic varieties of granite are fairly comme Bir Masur), in the two remarkable conical hills called El Na surrounding rocks.

The specimens from near Gebel Nazla [10,625] and from

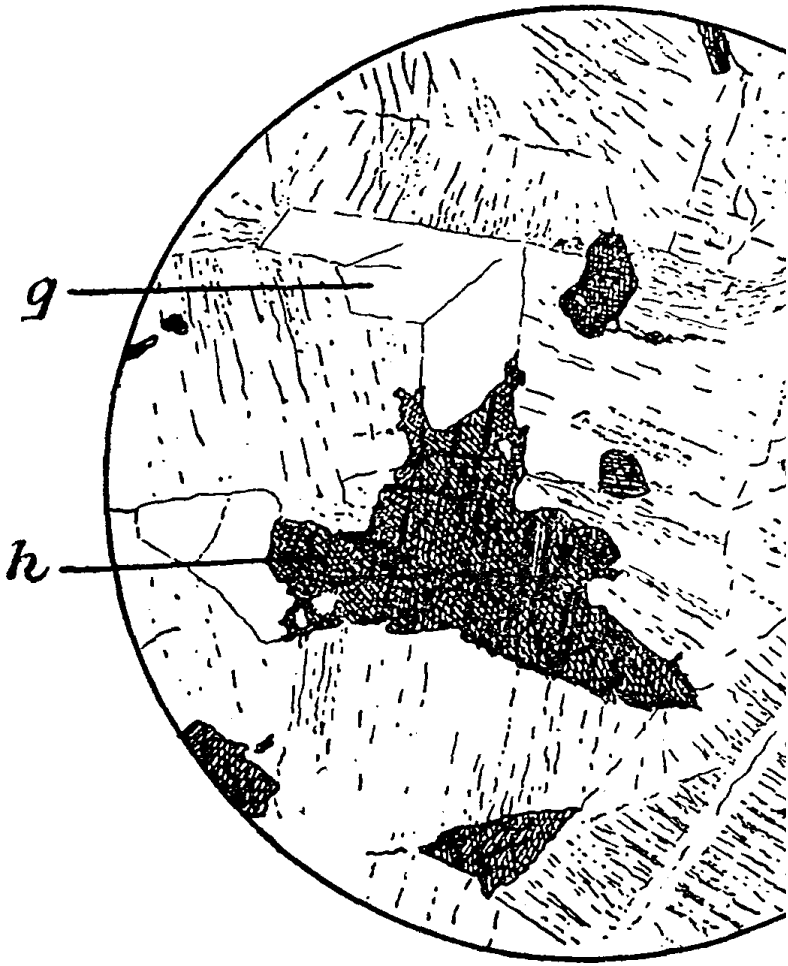


Fig. 15.—Syenite of Gebel Zergat Naam [11,515], × 10. *o*, orthoclase felspa
parallel to the basal planes; *h*, hornblende deep green in colour; *g*, interst

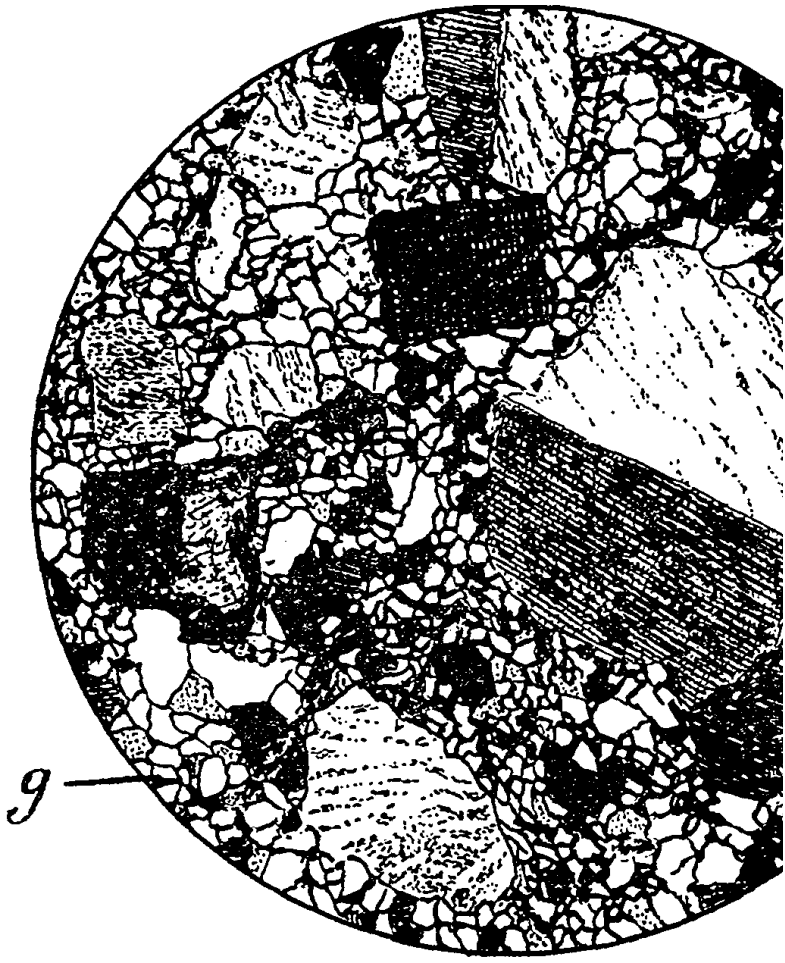
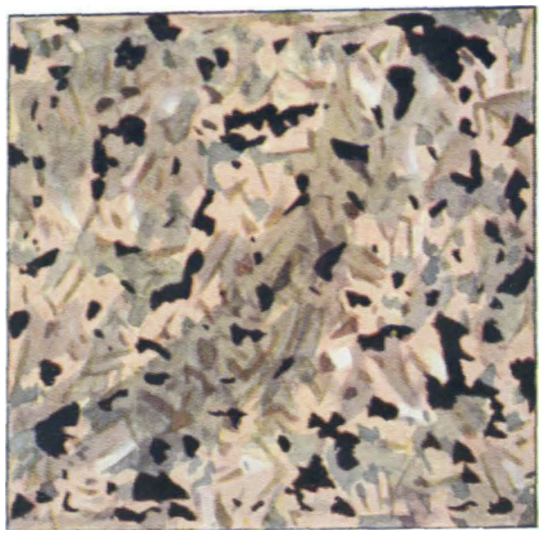


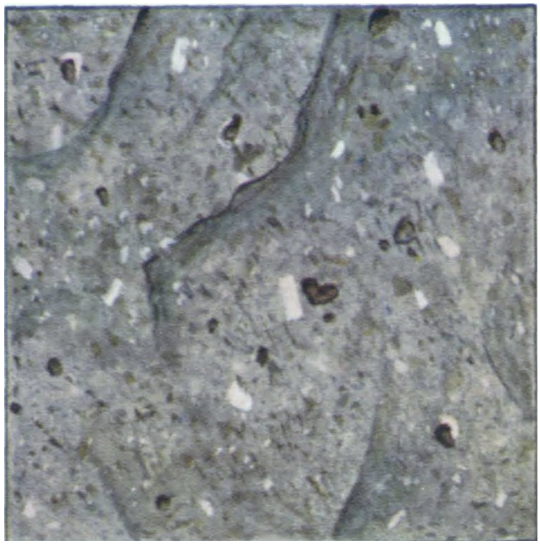
Fig. 16.—Syenite-porphyry, Gebel Zergat Naam [11,512], as seen between
porphyritic felspar (orthoclase); *h*, hornblende; *g*, microgranitic ground m
hornblende, and some quartz.

The syenite of Gebel Zergat Naam [11,515] rises as a gr
millimetres long, of pink orthoclase, and specks of dark horn
of hornblende and a little interstitial quartz. The felspar is fa
so that even in ordinary light a faint herring-bone structure
strongly marked, and is evidently due to a perthitic interg
continuous across the half of the crystal. The lamellæ exting

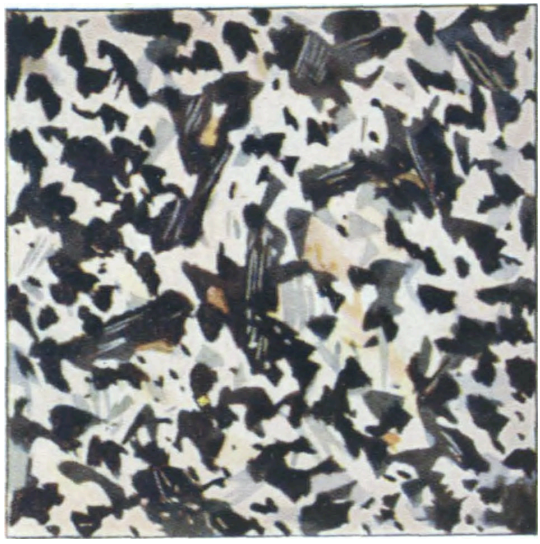
but as the nicols are turned they appear as well marked dar
iron oxide. Accessory minerals, other than the clear interstiti



PINK SYENITE.
Gebel Zergat Naam.



TRACHYTE.
Gebel Kahfa.



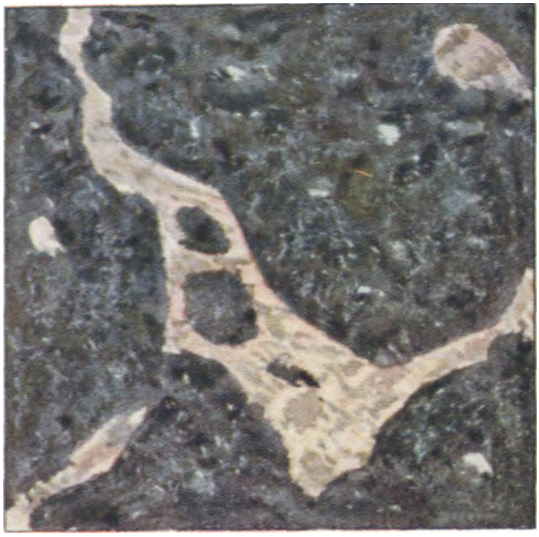
DIORITE.
Gebel Allawi.



DIORITE WITH PRISMATIC HORNBLENDE.
Wadi Muqur.



BANDED ANDESITE.
Gebel Sufra.



VEINED KERSANTITE.
Gebel Fereyid.

In places, the rock of Gebel Zergat Naam takes on a finer felspar and hornblende. The rock thus passes into syenite-po

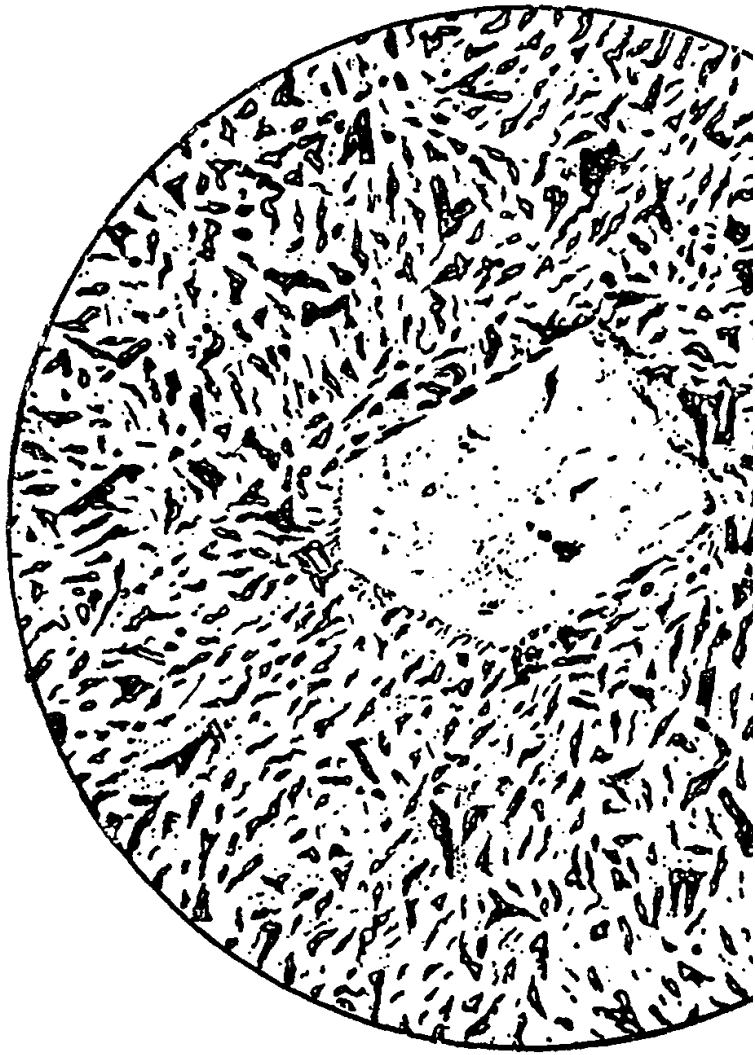


Fig. 17.—Trachyte, from a dyke at Gebel Kahfa [11,537 A] × 10. A clea
is seen in the centre of the field, surrounded by a finely crystalline gro
felspar.

Trachyte, the volcanic representative of syenite, occurs i
porphyritic crystals of orthoclase (*see* Plate XXIII). The sp. g

the ground mass are usually in more elongated forms than t
plentifully among the feslpars of the ground mass. Accessory

A rock which occurs in a hill at the head of Wadi Amba
This rock is in a highly altered condition, the felspars being

Though not forming such conspicuous features as the gr
marked-off from the granites, being generally closely conne
diabase, gabbro, and hornblende rock; the finer-grained type
other dark rocks, it is no easy matter to trace the limits of th
the intermediate stage of augite-diorite to diabase and gabbr

Diorite typically forms low hill country of dark aspect. T
somewhat dangerous, the effect being like one would imagir

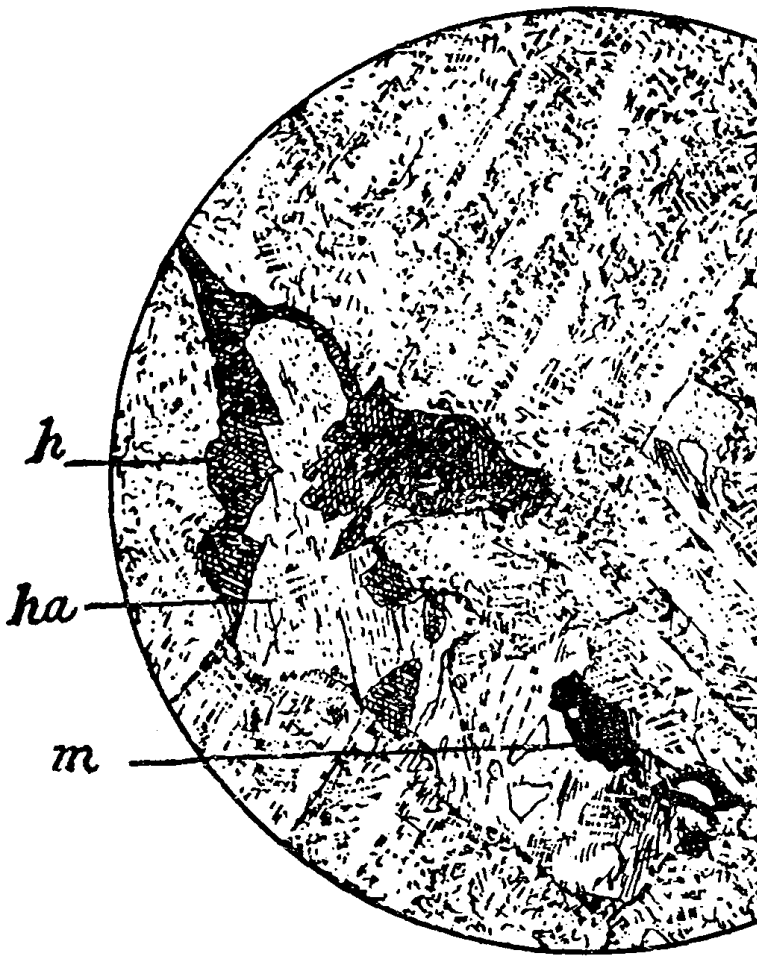


Fig. 18.—Diorite of Gebel Allawi [10,313], × 10. *pl*, plagioclase felspar, products; *h*, hornblende, olive-brown in colour; *ha*, hornblende alterin magnetite.

Diorite in the narrowest sense of the term (plagioclase-h it was employed by the ancient miners for their crushing pa microscope the milk-white material is seen to be plagioclas hornblende is considerably altered; in places it has lost near

In a slide from the last-named locality, granules of ilmenite
colourless, showing only a trace of green colour in thin secti

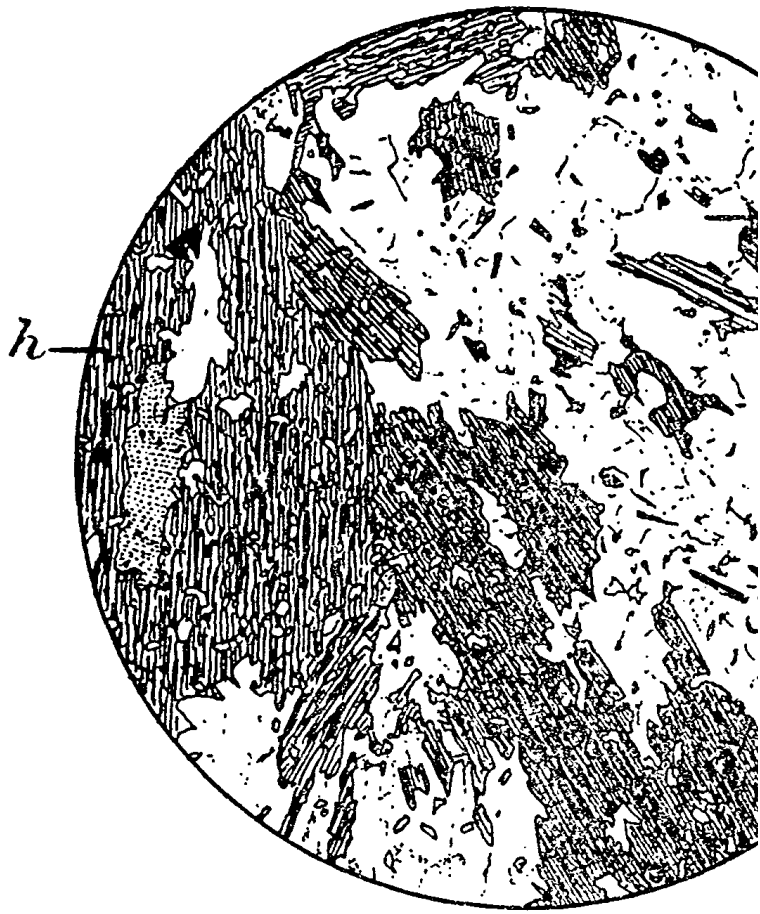


Fig. 19.—Diorite, Wadi Baaneit [12,151], × 10. *h*, hornblende; *pl*, plagic
accessory quartz.

A form of diorite which occurs in and about the Wadi Ba
is in patches varying from mere specks to eight millimetres i

A more highly specialised type of diorite [12,103] occur
felspars (*see* Plate XXIII). Microscopic examination reveals th

Where the alteration of diorite has been very intense, as
mineral, instead of being black and shining, has a dull green
the hornblende is all replaced by chlorite, with little strings
quartz of the original rock, while others are clearer and are p

Fine-grained varieties of diorite are found much more ab
coarser-grained rocks, but are generally even more altered. T
separated iron oxide along the cleavage planes of the hornb
abundant little granules of epidote.

The main rock of Gebel Beida [12,160] may also be class
abundant strings of a greenish yellow mineral. The sp. gr. is
this, though clouded, has resisted alteration better than the
origin, while the greenish-yellow strings are other alteration

Under the head of augite-diorite are classed holocrystalli
the diabases or plagioclase-augite rocks.

The presence of augite along with the hornblende is diff
darker aspect than normal diorites in the mass, owing to a le

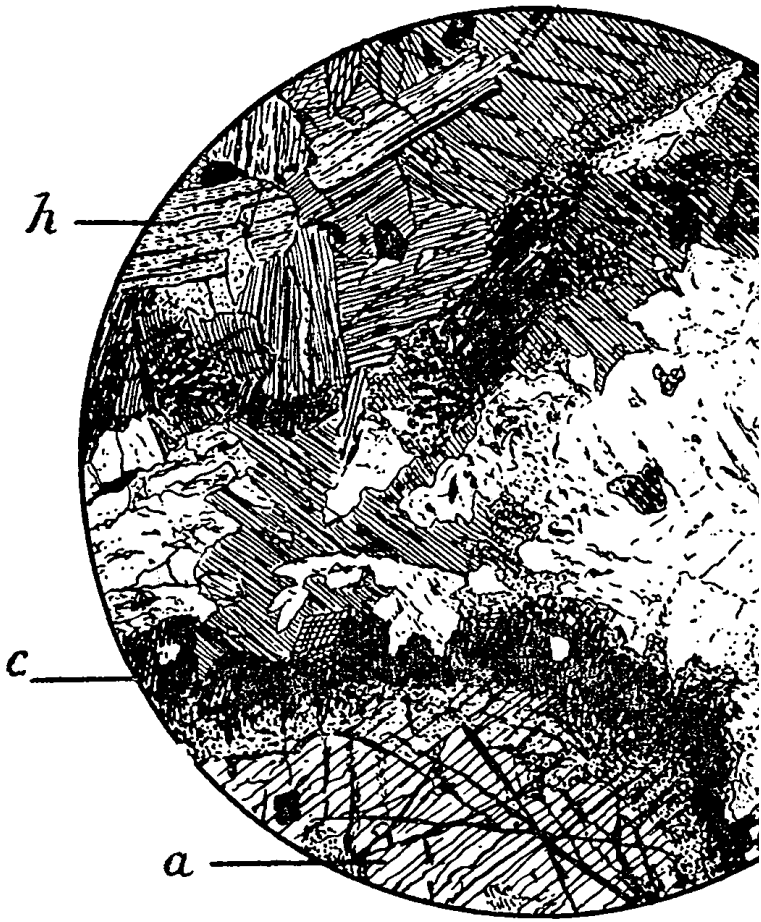


Fig. 20.—Augite-diorite, Wadi Um Hargal [11,535], × 47. *h*, hornblende border *c*, of hornblende and iron oxide; *f*, felspar (labradorite); *ap*, apa

An augite-diorite [11,535] which occurs on the pass at tl small quantity of white felspars. In thin section, hornblend irregular granules of iron oxides. The augite, which is prese pleochroism, and higher extinction angles (about 40°); some flakes and strings of iron oxide, probably representing a ma labradorite. The rock contains considerable amount of magn

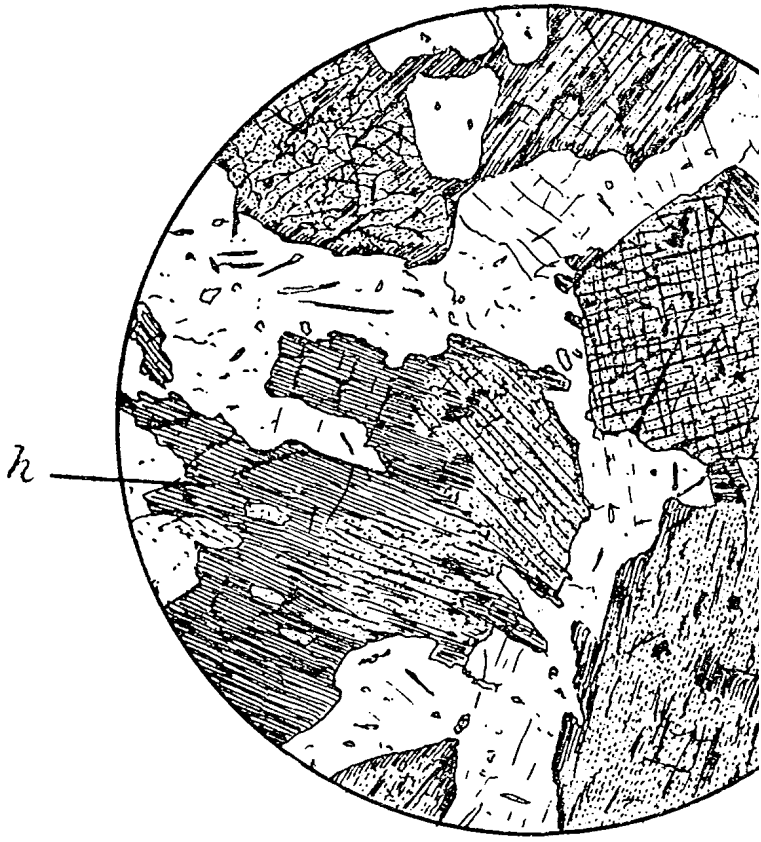


Fig. 21.—Augite-diorite, Gebel el Anbat [10,411], × 40. *pl*, plagioclase f
hornblende, arising from alteration of augite.

The rock [10,411] which forms the dark hills called Ge
covered with a blackish-brown skin. The sp. gr. is 2·97. Mic
hornblende as to suggest even more strongly an alteration of

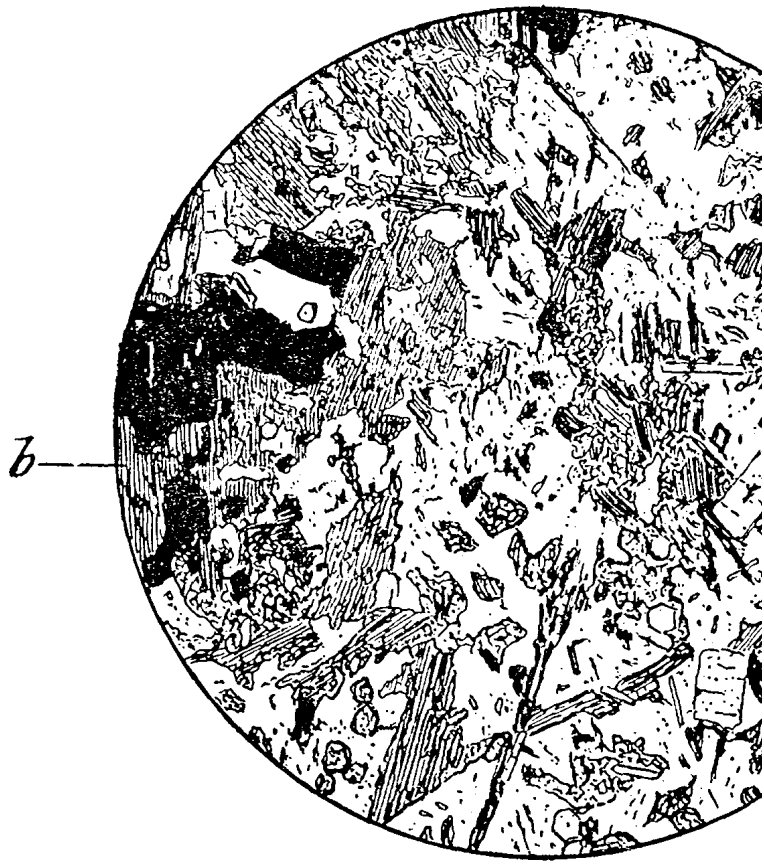


Fig. 22.—Mica diorite, from a dyke at Gebel Abu Hegilig [10,391], × 17
plagioclase); *b*, biotite altering with formation of limonite; *h*, hornblen

Most of the diorites of South-Eastern Egypt contain little
Hegilig, and which contains more biotite than hornblende. T
one, made up of plagioclase, biotite, hornblende, apatite an
are very much altered, but appear to be mainly plagioclase.
shaped crystals, which show very little trace of cleavage an
through the rock. From the abundance of biotite and the fin
it should rather be placed with the diorites.

Rocks which may be somewhat doubtfully classed as alte



Fig. 23.—Diorite-porphyrite, Gebel Abu Hodeid [12,143], × 40. *f*, porph
hornblende; *b*, biotite; *g*, ground mass, consisting chiefly of plagioclase

The triangulation point on Gebel Abu Hodeid not being
grey rock with tiny glistening specks. The sp. gr. is 2·88. Th
little biotite and a plentiful sprinkling of tiny granules of ir

they are considerably clouded by decomposition, but still sh
cleavage is not very strongly marked. The plagioclase of the
more or less decomposition and clouding, and contain a fairl

The diorite-porphyrite of Um Eleiga [11,527 B] occurs a
are somewhat sparsely scattered in a fine-grained ground m
The plagioclase of the ground mass is partly in little laths,
clouded by kaolin and other decomposition products.

The summit rock of Gebel Um Heshenib [10,392] appea
patches, more or less rounded in form, scattered through it.
high double-refraction colours; while the ground mass is a v
porphyritic areas and of the ground mass to the decompositi

A dyke of fine-grained brown rock which occurs in the g
microscopic slide shows the main constituent to be plagiocl
calcite and flakes of limonite, the alteration products of a fer

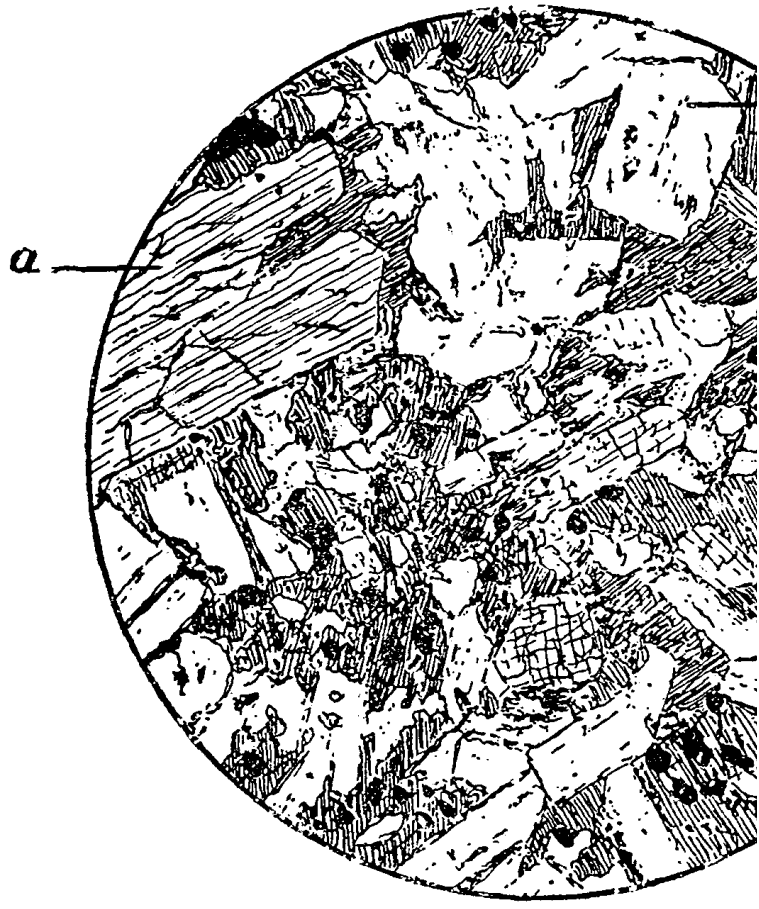


Fig. 24.—Augite-porphyrite, Wadi Muelih [10,359], × 40. *a*, augite; *pl*, p
much clouded with iron oxides. The rock contains large porphyritic pl
crystals not shown in the figure.

A dyke of augite porphyrite [10,353] occurs in the Wadi
to two centimetres in length) and other smaller porphyritic
miniature. The microscopic slide reveals the dark porphyri
granules. The felspars of the ground mass are mostly lath-sh
rounded grains; it is altered in places to chlorite, becoming t

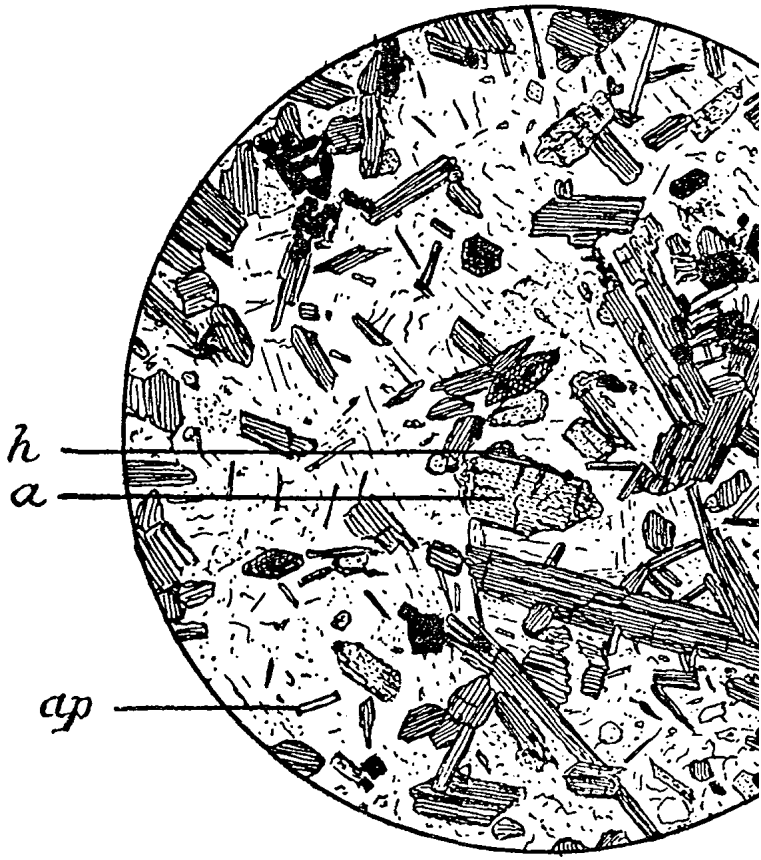


Fig. 25.—Kersantite, from a dyke at Gebel Fereyid [11,504], × 40. *f*, fels
biotite; *a*, augite, with a border of hornblende (*h*); *ap*, apatite.

Only one occurrence of a rock which can be with certain
the granite of Gebel Fereyid. In the hand specimen (*see* Plate
up to three millimetres in diameter. The sp. gr. is 2·81. Und
and magnetite. The biotite, the most conspicuous constituer
dark reddish-brown. The felspar, which has undergone some
be mainly oligoclase; but there are also some crystals which

tiny forms of a deep emerald or bluish-green colour, with ve

Andesites, the volcanic representatives of the diorites, a
belonging certainly to the class of andesitic lavas. Some oth
that they are more properly classed as hornblende-basalts. It
example, are rocks which in thin section present a ground r
forms, and the same action can be traced in the hornblendes

The andesite of Gebel Sufra [10,597] occurs as a columr
weathering to a brown colour on exposed surfaces, often sh
leave little doubt of its being an andesitic lava. The slides sh
made out, but a little calcite is visible in their decompositic
grains of green hornblende and wisps of brown biotite, both
strings down its cleavage planes. The nature of this single c
the appearance of quartz or clear felspar under crossed nicol



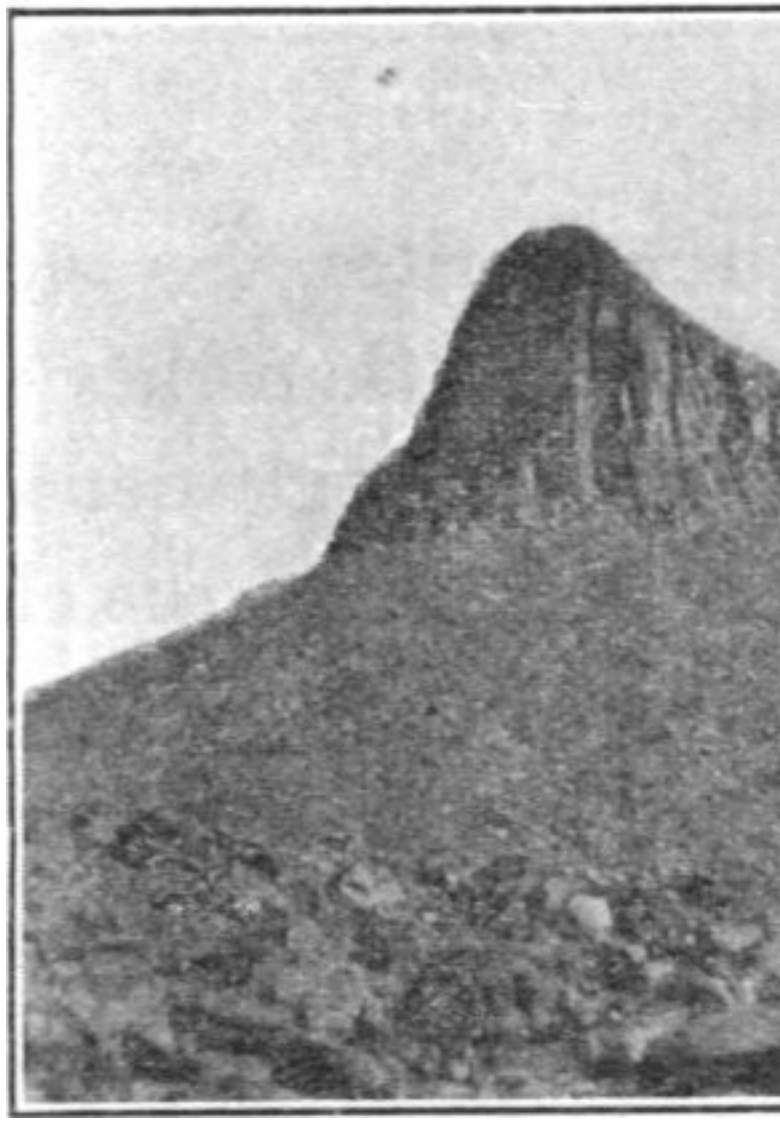


Fig. 26.—View near the top of Gebel Sufra, showing the columnar structure



Fig. 27.—Andesite of Gebel Sufra [10,597], as seen between crossed nicols, crystals in a cryptocrystalline ground mass.

Gabbros (or plutonic plagioclase-pyroxene rocks with o
Gunud, Um Bisilla, Dahanib, Gerf, and Hadal Aweib Meisah,

Though they are all dark-coloured, tough and heavy roc
gradation from the coarse-grained gabbros such as those of
to the granulitic gabbro of Kolmanab hill, of which the grai
are lighter both in colour and in weight than others in whic
while others, such as the rocks of Gebel Dahanib, do not. T
hypersthene occur. A further variation is the presence of h
troctolite, a form of gabbro in which there is no pyroxene bu

In the field, mountains and hills formed of gabbro are ty
marked in the olivine-bearing varieties of the rock; it is very
surfaces and summits are covered with a debris of rusty-look

Though sometimes sharply marked-off from the adjacent
easy in the field to distinguish between augite or diallage a
strongly resembles a rather fine-grained diorite in appearanc
in the same rock mass, as for instance at Gebel Gerf.

Almost all the gabbros contain a considerable amount o
readings in the neighbourhood of large masses of gabbro a
concentration of the ferruginous matter has gone on to such

Perhaps the most striking feature evident in the microsc
consider the basic rocks as probably on the whole amongst
when they are embedded in, or in contact with, the surrounc

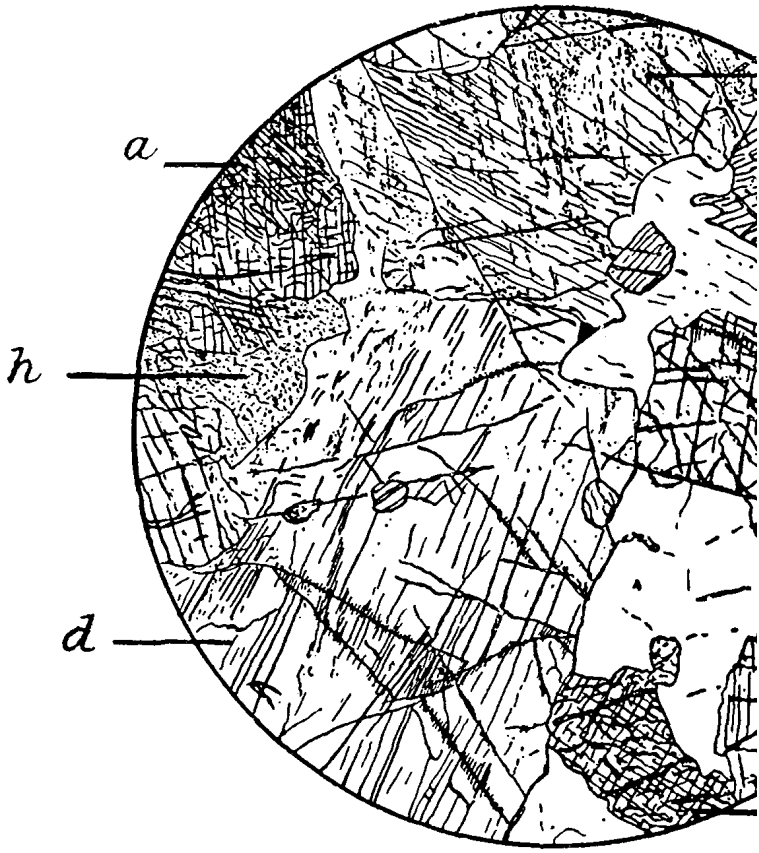


Fig. 28.—Gabbro, Gebel Dahanib [11,509], × 17. *f*, felspar (labradorite) bronzite; *h*, hornblende, probably produced by alteration of augite.

A typical olivine-free gabbro [11,509] forms the main ro of a mixture of dark dull-looking mineral with shining wh proportions. About half the pyroxene is in the form of dialla crystals are much cracked, and frequently show signs of alte be products of alteration. One or two elongated crystals in There are only a few very tiny grains of iron oxide, and olivi

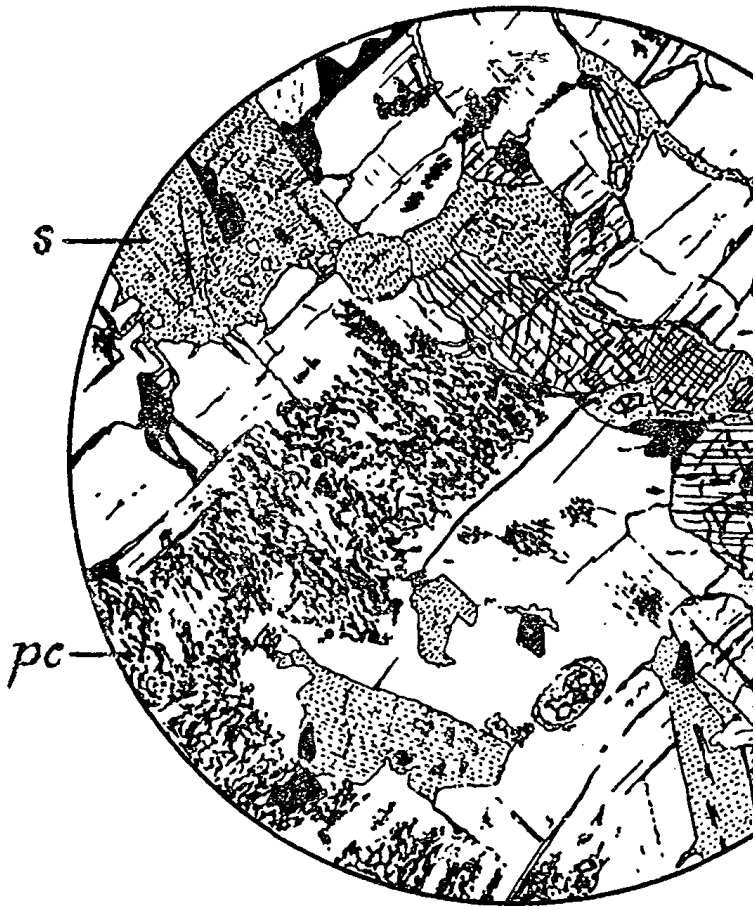


Fig. 29.—Gabbro, Um Eleiga [11,527 A], × 17. *pl*, plagioclase; *pc*, cloud
magnetite; *s*, serpentinous matter probably from alteration of augite ar

A fine grained gabbro free from olivine occurs associated
sp. gr. is 2·93. On microscopic examination the rock is found
kaolinic matter, especially near the centres of the crystals, l
prismatic forms; it is nearly colourless, but much cracked an
and greys as a confused serpentine-like aggregate of minute
sometimes augite, but in many cases they polarise in lower
thin shell of hornblende or of the clouded alteration product

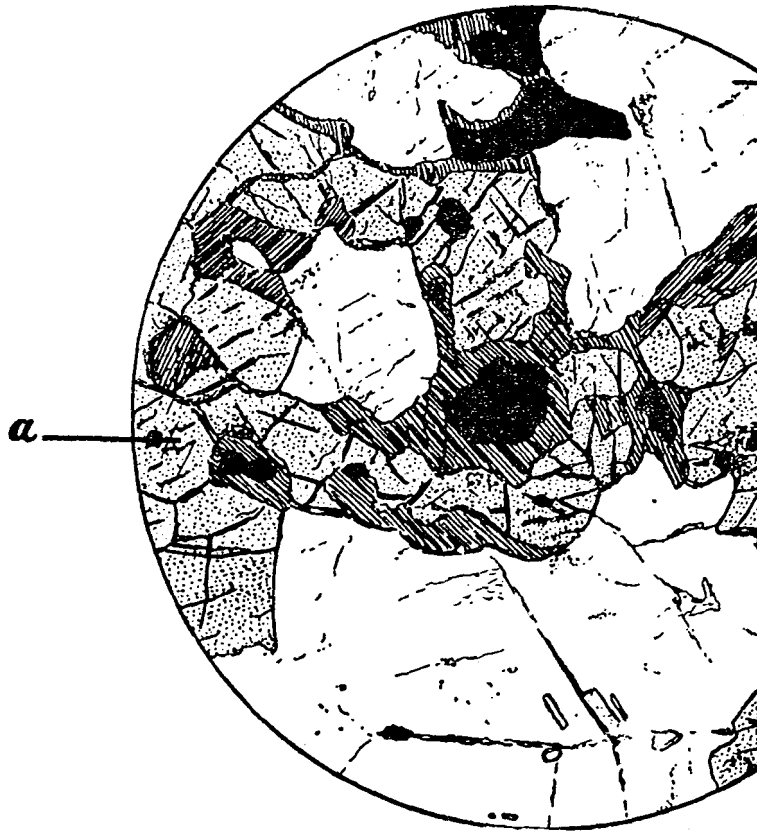
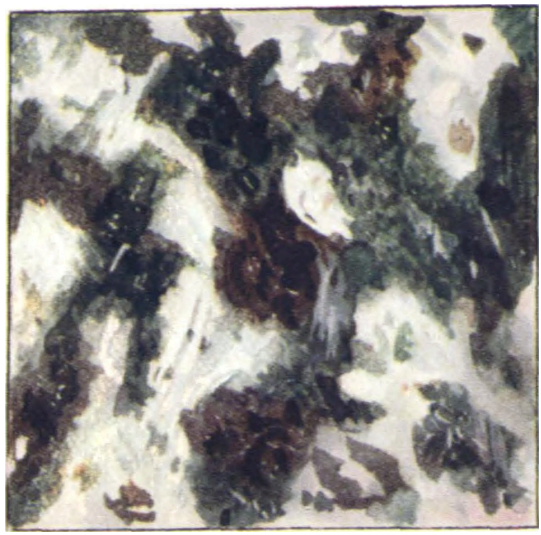


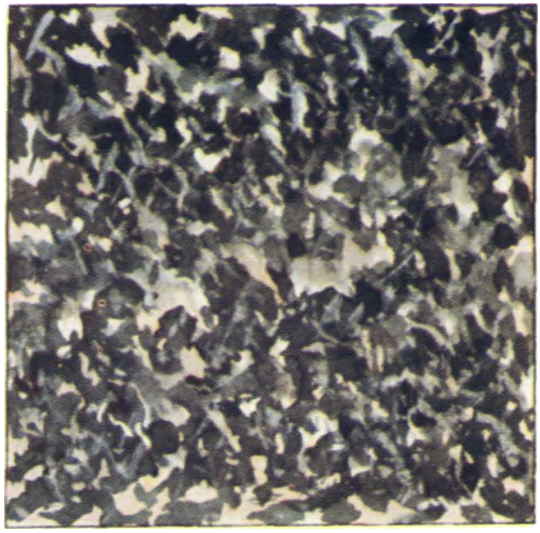
Fig. 30.—Hypersthene-gabbro, Hadal Aweib Meisah [12,126], × 4. *f*, fel
hy, hypersthene (the augite and hypersthene have the same appearanc
magnetite; *hb*, hornblende, forming celyphitic borders round the augit

Another variety of fine-grained gabbro, likewise free fr
kilometres south-south-west of Marwot Elemikan. The rock
needle in its neighbourhood. The hand specimen shows a m
hornblende and magnetite. The plagioclase, which forms ab
mixed with hypersthene and magnetite. Only in a few cases
in addition the crystals are irregularly cracked. Twinning is
not easily discriminated; but it can be picked out by its mo
occurs in subordinate amount to the other minerals, and is
greenish-brown to very pale yellowish-brown), and where su

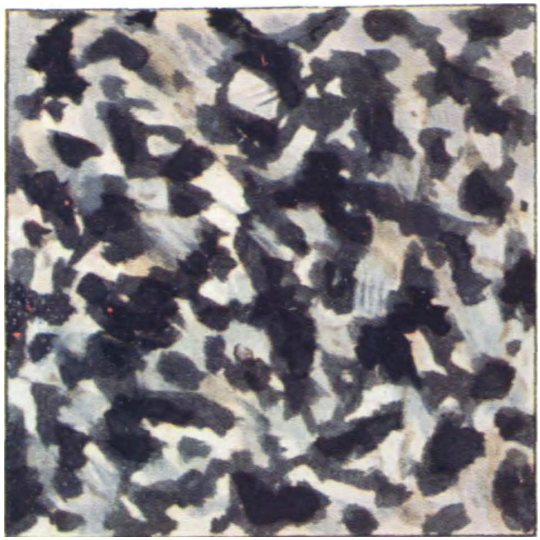
Ball.—Geography & Geology of South-Eastern Egypt.



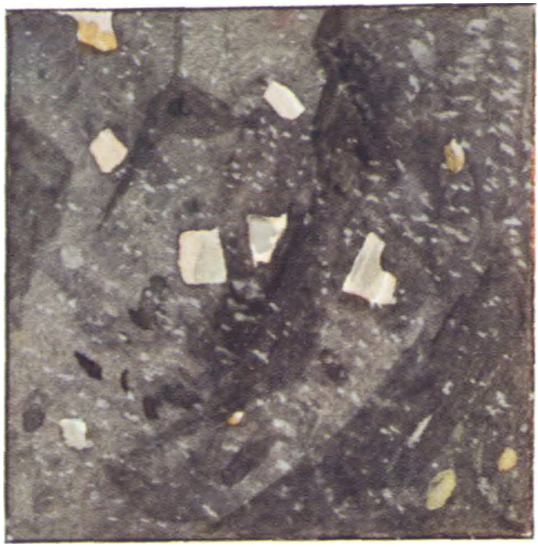
OLIVINE-GABBRO.
Gebel Um Bisella.



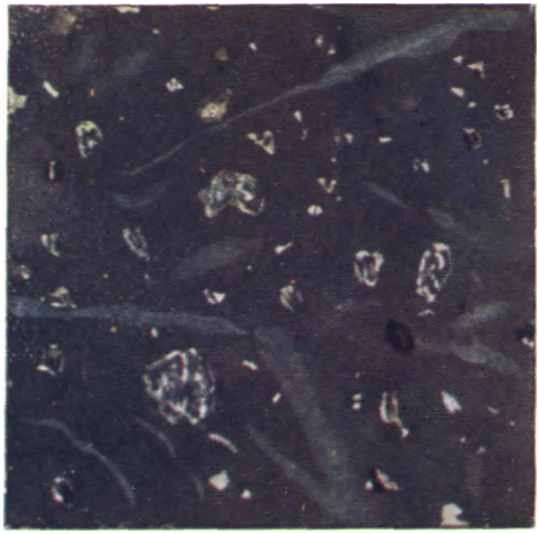
FINE-GRAINED GABBRO.
Hadal Aweib Meisah.



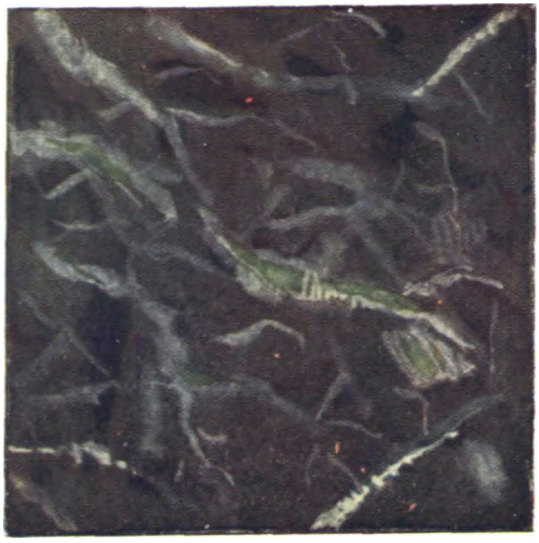
TROCTOLITE.
Gebel Um Bisella.



DIABASE.
Rod el Nagi.



OLIVINE-BASALT.
Einiwai Hill.



SERPENTINE.
Gebel Korabkansi.

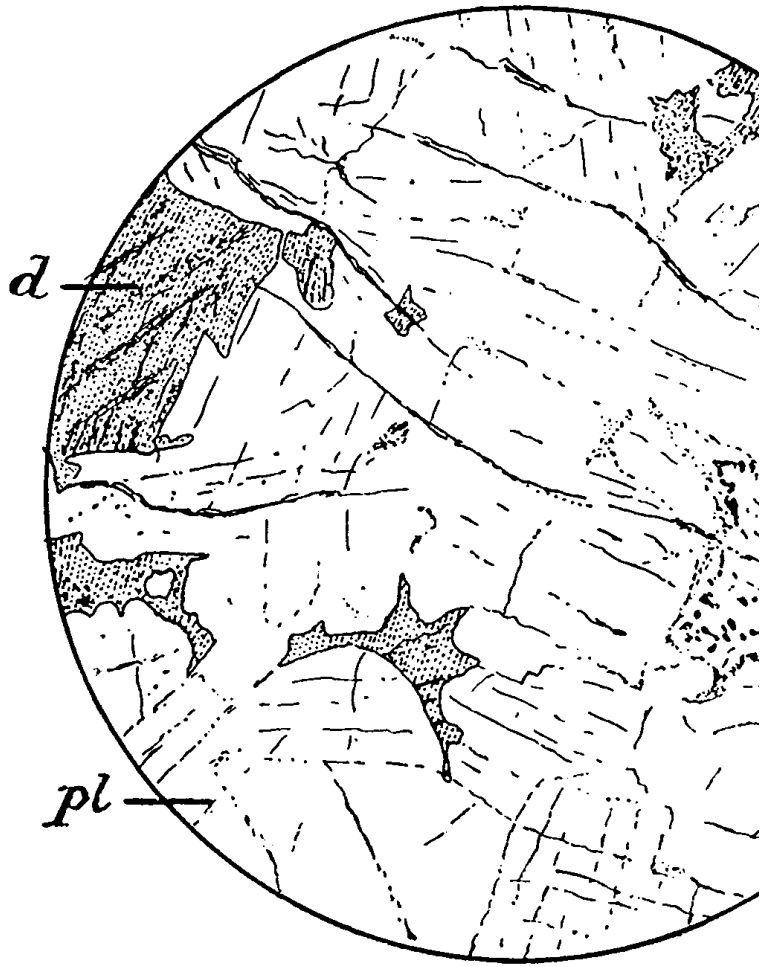


Fig. 31.—Olivine-gabbro, Gebel Um Bisilla [11,514], × 10. *pl*, plagioclas
altered diallage; *o*, olivine, altered in places to serpentine (*s*), with sep
oxide.

The main portion of Gebel Um Bisilla is formed of a gabl
felspars, showing plagioclastic twinning with the lens, with
whole, is very fresh, but is here and there decomposed wi
appears to have been originally diallage, but is in an advanc
The olivine is in large rounded grains, nearly colourless whe

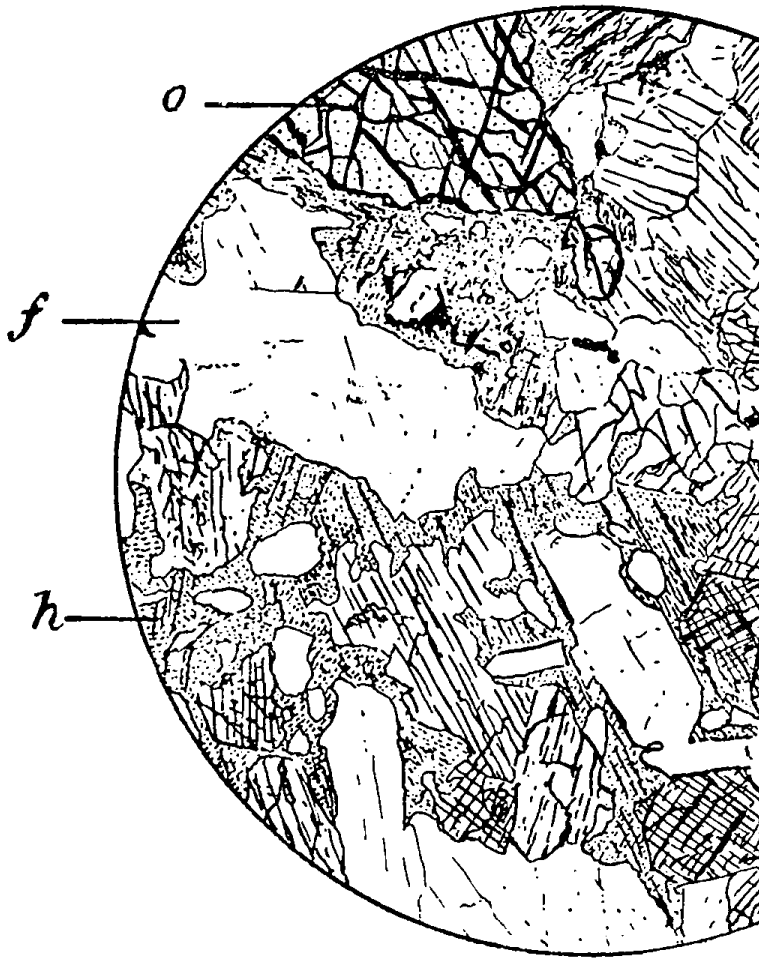


Fig. 32.—Olivine-gabbro, Gebel Atut [10,365], × 17. *o*, olivine; *a*, augite (labradorite).

Of the fine-grained olivine-gabbros, one of the principal hammer. On a fresh fracture, it is seen to be made up of wh 3·01. Microscopic examination shows the rock to be a holoc large crystals which frequently show a tendency to idiomor colourless grains with well marked cleavage and numerous strong pleochroism, while in others it is more strongly colo

suggest that much of the hornblende in the rock originated
into nearly colourless serpentine with separation of numerou

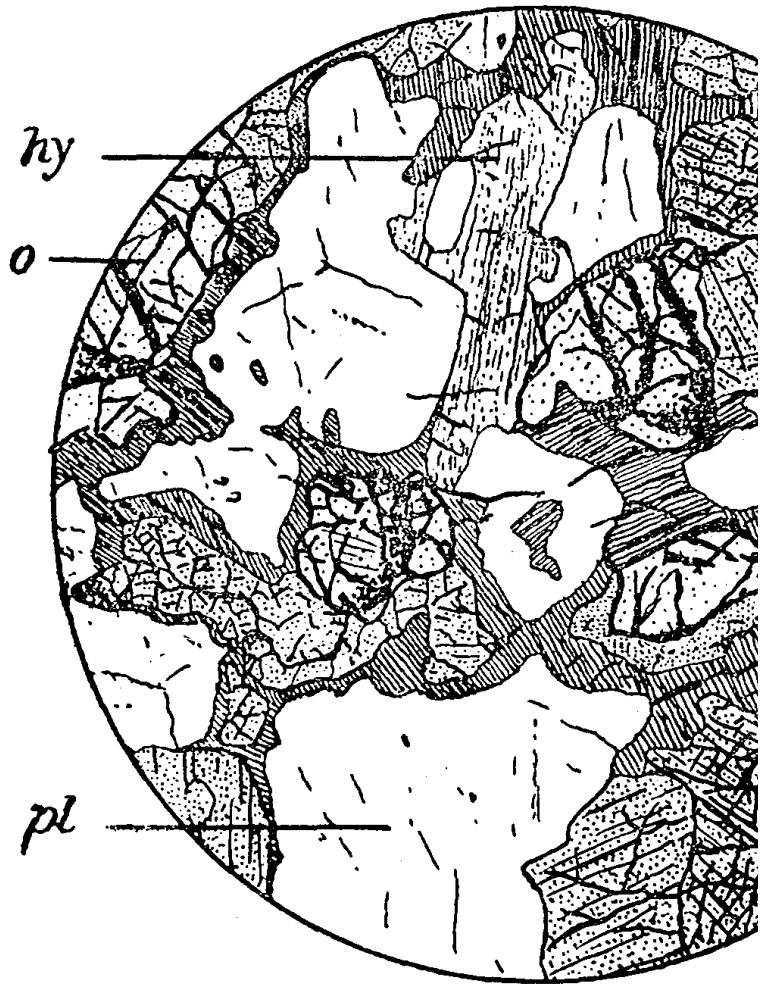


Fig. 33.—Olivine-gabbro, from a hill eleven kilometres east of Gebel Sela
plagioclase felspar (labradorite); *a*, augite; *hy*, hypersthene; *o*, olivine,
by separated magnetite; *h*, hornblende, enclosing the other minerals ar
pseudocelephytic border round the olivine and augite. The rock typica
greater proportion of hornblende than appears in the figure.

Another olivine-gabbro [10,412], which forms a hill ri
hornblende, and probably a little accessory hypersthene. I
plagioclase with a few tiny grains of pyrite. Under the micr
hornblende occurs very abundantly as larger irregular green
Augite is somewhat less abundant than the hornblende, with
are usually under 30°. A few crystals which show slightly st
augite, in large irregular grains, much cracked, but otherw
magnetite, but iron ores are not nearly so conspicuous as in



Fig. 34.—Troctolite of Gebel Um Bisilla [11,522], × 17. The crystals wit
are olivine (*o*), altering to serpentine (*s*); the resulting expansion has c
plagioclase crystals (*pl*), forming large numbers of curved cracks into v
serpentine project.

If the gabbro of Gebel Um Bisilla is followed towards tl
composed essentially of plagioclase and olivine [11,522]. It
like a diorite in the hand specimen; it weathers to rusty look

but the usual alteration to serpentine has gone on along ir occasionally much cracked, labradorite. Both the constituent

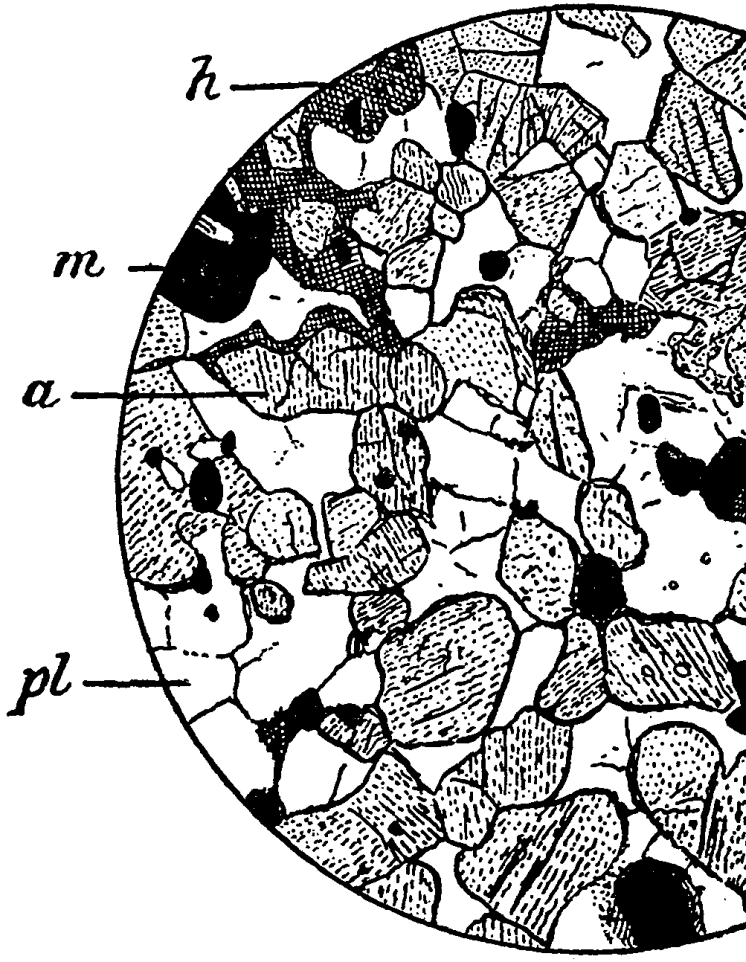


Fig. 35.—Pyroxene-granulite, Kolmanab Hill [12,132], × 40. *a*, augite; *h* *m*, magnetite.

The rock [12,132] forming the hill called Kolmanab, whi
pyroxene-granulite. The rounded form of the grains has prol
regarding this particular granulite as other than an igneous
example of this tendency extending to the other constituents
about in the hand. Its sp. gr. is 3·13. Microscopic examinatio
in rounded grains about a tenth of a millimetre in diameter
however, it is easily distinguished by its high extinction ang
crystals, there are others which show no trace of this featur
olive-green colour. Magnetite is scattered through the entire

Under the heading of diabase are included plagioclase-au
in the augite, and in the more or less porphyritic nature of tl
diabases of South-Eastern Egypt are more closely allied to th

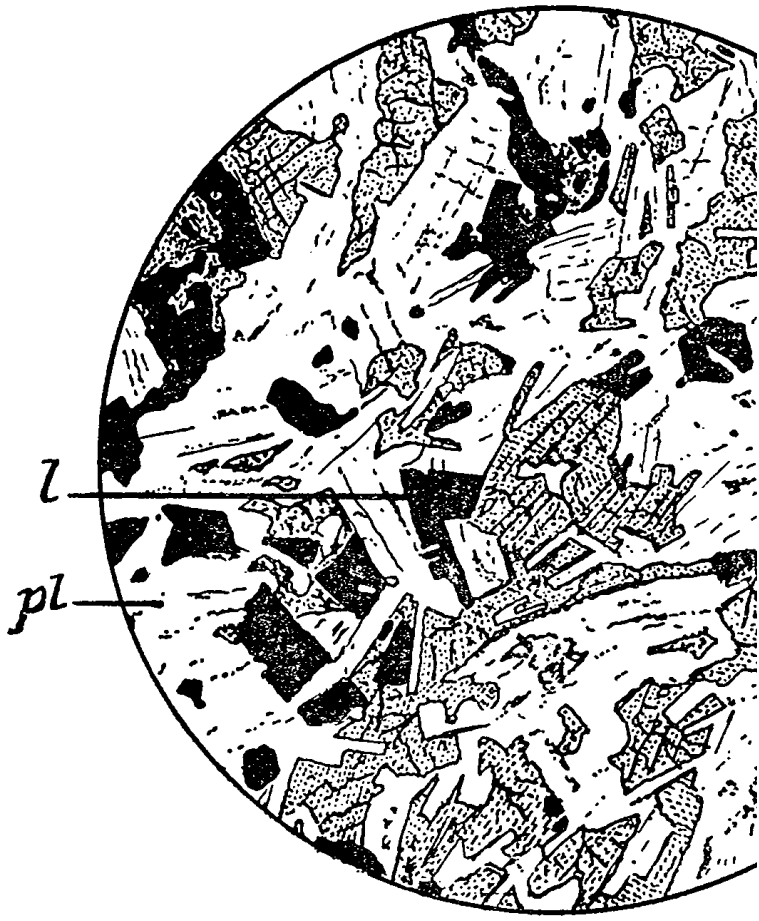


Fig. 36.—Diabase from under the Nubian sandstone, Rod el Nagi [10,417
felspar, ophitically intergrown with *a*, augite; *l*, limonite. The rock also
felspars, not shown in the figure.

Perhaps the most interesting occurrence of diabase in th
the scarp, it is cut obliquely by the meridian of 34°, and con
road follows the foot of the scarp for a long distance. The th
to get a fair-sized specimen. Below the diabase, at a few po
impression I got, when I passed the exposure on the two oc
down on the undenuded diabase. The diabase is thus probab

to glassy porphyritic felspar crystals, frequently in lath-sha
specimen about in the hand one can catch a rather dull flash
of the crystals show simple twinning and may be orthoclase.
colourless, with a very pale brownish or greenish tinge, ge
extremely abundant, scattered through the ground mass in
limonite is doubtless an alteration product of other minerals

Besides forming the sheet under the Nubian sandstone, d
balls." Altered forms of diabase are associated with peridoti
the foot of Gebel Awamtib, a dyke of diabase is even found

It is probable that these diabases are of very different
serpentines are not vastly older; for though they are obviou
which suggests that they antedated the folding which forme

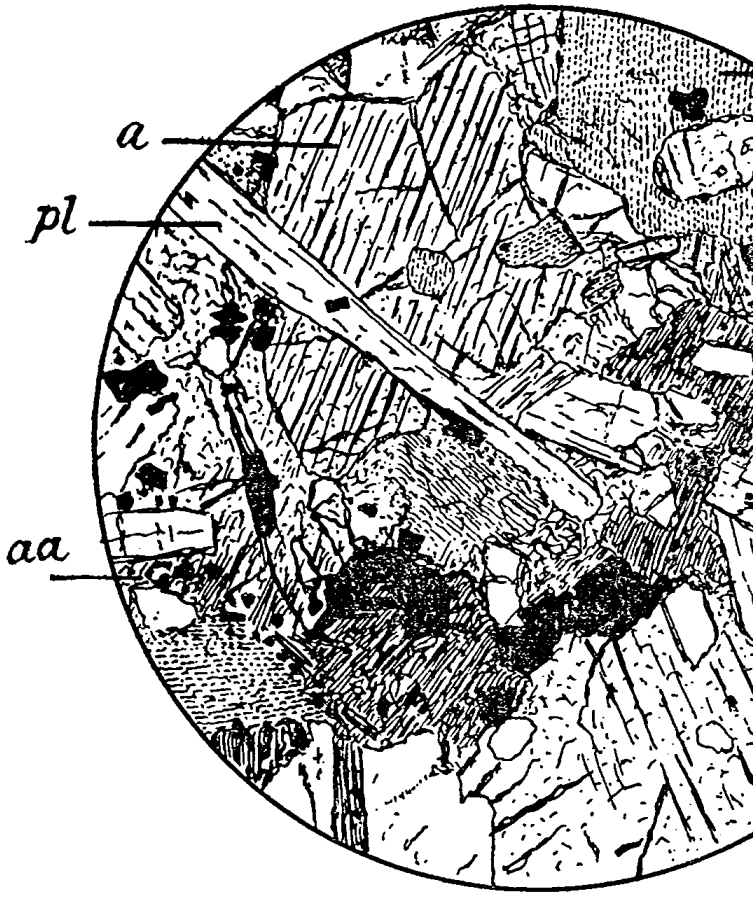


Fig. 37.—Diabase, Gebel Abu Hamamid [10,400], × 40. *a*, augite; *aa*, au
of iron oxide; *pl*, plagioclase, often ophitically intergrown with the aug
mineral; *m*, magnetite.

As an example of a diabasic intrusion with “cannon ball”
be a dark grey rock of very fine grain. The sp. gr. is 2·93.
isotropic clear yellow-green mineral, and scattered grains of
mineral is somewhat uncertain; it polarises generally in ve
colourless mineral, possibly olivine; but there is a remarkab
olivine, the olivine must have been a variety poor in iron.

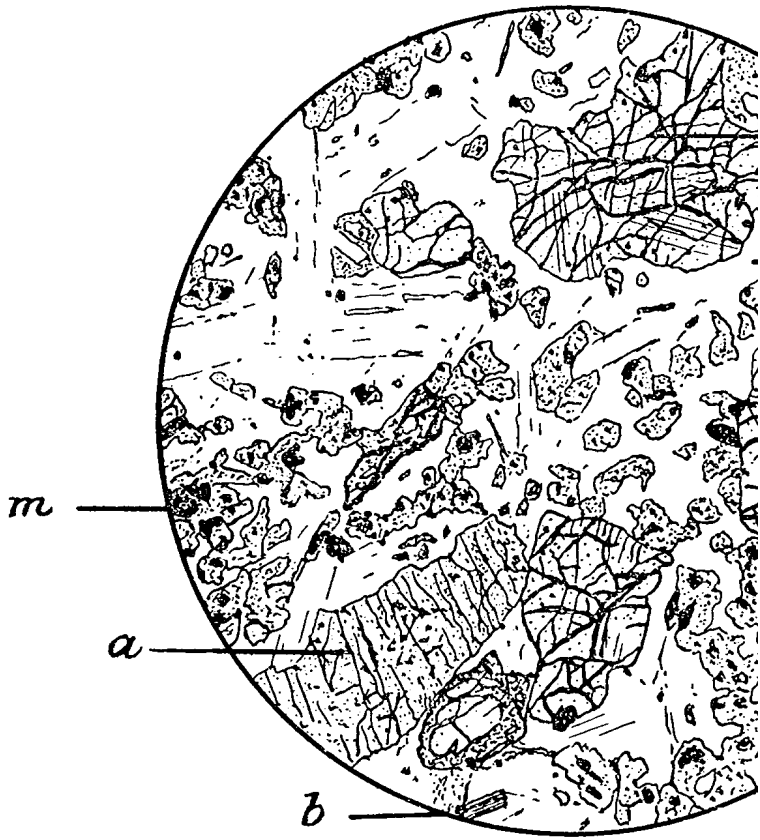


Fig. 38.—Olivine-diabase, from a dyke at the junction of Wadis Huluz an
olivine; *pl*, plagioclase.

Turning now to the occurrence of diabase in dykes, a lar
brown platey mineral is mixed with grey and white matter.
have formed in two generations, for while the bulk of it is in
tending to hexagonal outline with the usual strongly marke
felspars. The augite is slightly pleochroic, of a purple to bro
biotite is very sparingly present in small flakes. Magnetite is



Fig. 39.—Diabase, from a dyke in Wadi Kreiga [12,110], × 17. *pl*, plagic
hornblende; *l*, limonite strings.

The diabase dykes which penetrate the granite in Wadi I
porphyritic felspar crystals here and there. The sp. gr. is 2·9
minerals are very much clouded, and contain plentiful strin
ground mass, the augite and hornblende practically filling al

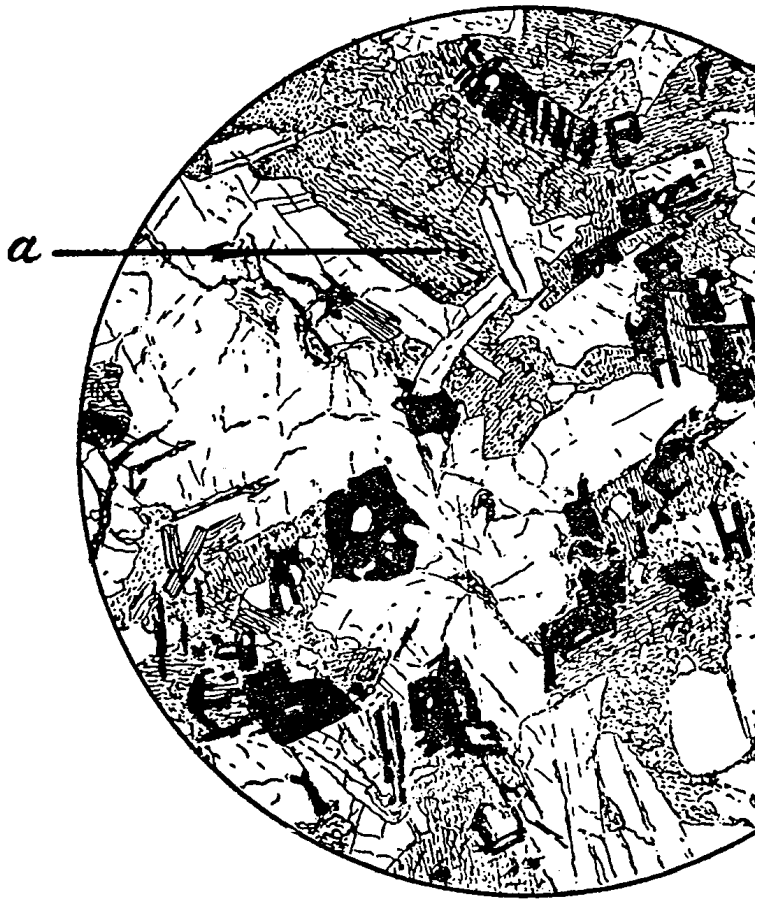


Fig. 40.—Mica-diabase, Gebel Um Khariga [10,373] × 17. *pl*, plagioclas
separated opaque flakes of magnetite, often in geometric forms; *a*, clou
altered augite, with which the felspars are ophitically intergrown.

The rock which forms the top of Gebel Um Khariga [10,
off the rock showed strong polarity, some parts attracting ar
which in the mass looks like an altered dolerite. Microscopic
forms; scattered grains of magnetite, and some secondary ca
intergrown, but is in too highly altered a state for certain id
of magnetite.

Basalt, the volcanic representative of the gabbros and d
conspicuous low hills near the coast called Gimeida and Ein
of Gebel Hamata; while an amygdaloidal rock which forms a

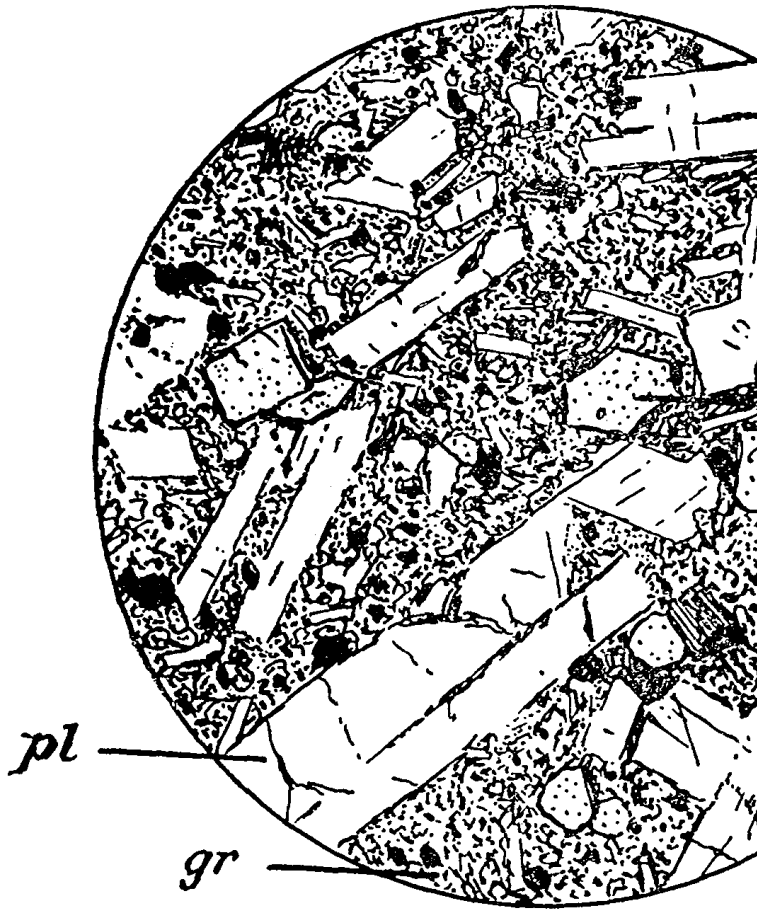


Fig. 41.—Basalt, Gimeida Hill [12,156], × 40. Porphyritic crystals of pla
in a hemicrystalline ground mass containing tiny crystals of plagioclas
and magnetite (*m*).

The basalt of Gimeida Hill [12,156], is a hard heavy bloc

and some greenish glassy-looking grains of olivine. The mic
plagioclases, with granules of pale brown augite, and abund

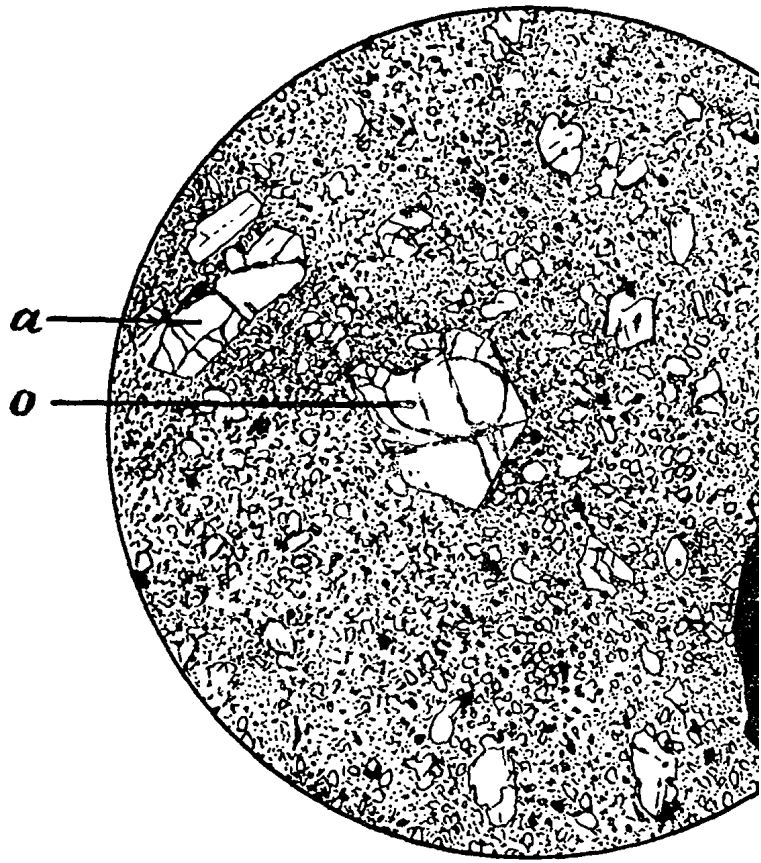


Fig. 42.—Basalt, Einiwai Hill [12,144], × 17. *o*, olivine; *a*, augite; *p*, pic
chromite; *gr*, hemicrystalline ground mass.

The basalt of Einiwai [12,144] differs from that of Gime
glassy colourless to pale green crystals plentifully scattered t
tiny laths of felspar and grains of augite and magnetite. The
doubtless accounts for the minerals all showing relatively lo
common, and some of the crystals are broken in two and th
absence of serpentinisation or magnetite-separation along th

others, however, showing straight extinction and very low p

A peculiar basaltic rock [10,408] occurs at the top of W practically nothing can be made out with a lens. It is rema cryptocrystalline ground mass of greenish colour, full of sp cleavages, high extinction-angle and fairly high double refra largely of chloritic nature, with small fibres of hornblende a

The basalt of the Wadi Huluz [10,410] is a close grained plagioclase crystals, around and between which is green m original mineral which has been largely chloritised. There is

The hill mass of Ti Keferiai is largely made up of a fine-g broken into a coarse breccia and cemented with rose quartz zeolites. The amygdules seem to indicate that the rock is a circumstance perhaps in part due to the crushing it has unde

The ultra-basic igneous rocks (*i.e.*, rocks practically free very large proportion in the igneous masses of South-Easter —

(*a*) *Pyroxenites* (rocks composed essentially of pyroxenes

(*b*) *Amphibolites* (rocks composed essentially of hornbler

(*c*) *Peridotites* (rocks composed essentially of olivine, wit

All these ultra-basic rocks are easily altered to

(*d*) *Serpentines*, in which the original minerals may or m

A characteristic of the ultra-basic rocks here, as in othe differences in composition or in the physical conditions unc basic diorites and amphibolites, nor between basic gabbros a in the field. Moreover, being typically coarse-grained rocks necessity each embrace at most but a few square centimetres

In the field, the appearance and cohesive strength of the hard heavy crystalline rock of such toughness that they are c

which might almost be taken for granite from a distance, ar
The brown or pink colour just referred to is of course only s
dark brown, or black, with more or less crystal structure v
typically of dull aspect. The specific gravity is high, ranging

The process of serpentinisation is of course a chemical cl
by a parallel physical deformation. Serpentines are almost a
that the shattering of the rock is in all probability due to the
which are frequently seen in thin sections of olivine rocks, s
masses. It is thus not necessary to infer great tectonic move
accentuation of folding or crushing by general crust-crumpli
into an arch having a height of about two and a quarter kil
expansion on hydration may produce dynamical effects not
and full of slickensided surfaces in areas where the surround

Heavy dark green rocks, of medium to coarse grain, and
Gunud and elsewhere. From the diallagic appearance of thes
hornblende, and the rocks must therefore be placed in the d
from augite to hornblende in the gabbros has already (p. 302

Some parts of the great ultra-basic mass of Gebel Gerf co
serpentine, such as forms the main portion of the mountain
serpentines.

Rocks consisting almost entirely of hornblende occur in
east of Erf el Fahid. In the field, especially with the coarser
suggestive of diallage; the mass east of Erf el Fahid, for inst
always very heavy and extremely tough; they weather comm

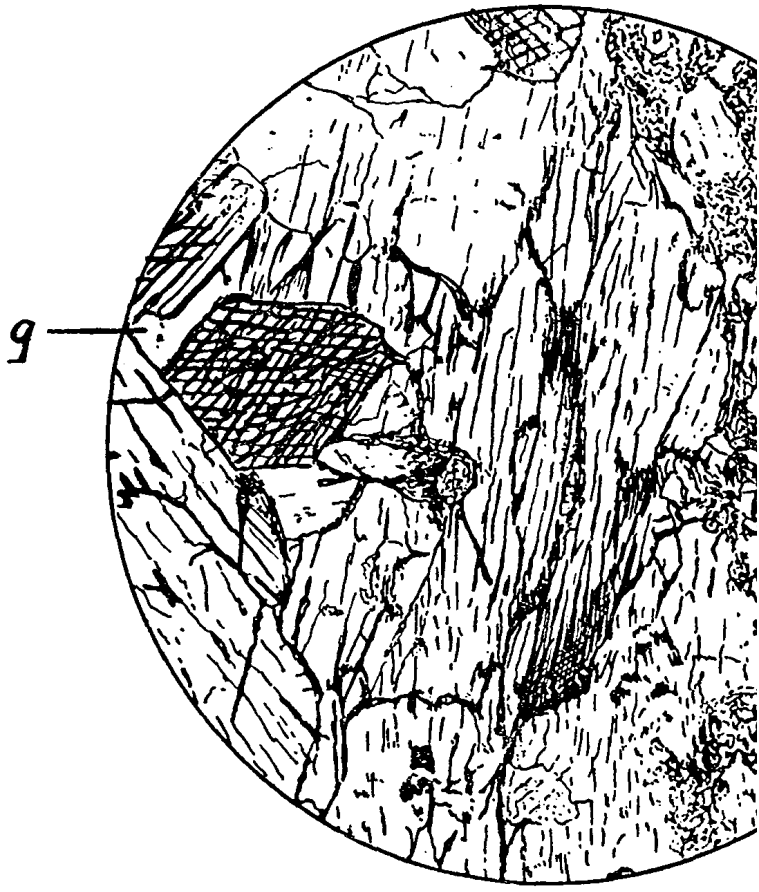


Fig. 43.—Amphibolite, from hills near Gebel Um Gunud [11,511], × 30.
figure is occupied by hornblende, which is seen clouded and altering t
of a large grain of calcite, bordered and streaked with iron oxide, is se
crystal of interstitial quartz. The slide also contains a small proportion
shown in the figure.

The amphibolite of the hills about Gebel Um Gunud [11,
and breadth. The sp. gr. is 3·08. The microscopic slide show
show strong pleochroism, from pale olive-brown to moderat
has resulted in the formation of much epidote. The plagiocl
mostly interstitial. Calcite is fairly plentiful in large rounded
possibly be the result of alteration of a lime olivine.

A specimen of amphibolite [11,528] obtained from a hill small fibrous crystals of hornblende and chlorite. Its sp. gr idiomorphism except in the smaller crystals, which are cor Prismatic cleavage is well marked. Extinction angles are ofte Except for a few specks of magnetite, and the alteration proc

The hornblende-rock or amphibolite of Gebel Um Ein [1 hornblende inclining to idiomorphism, set in a sort of groun iron oxides, and often full of lighter-coloured patches which Between crossed nicols many of the crystals are full of small possibly actinolite.

The amphibolite which occurs three kilometres east of G interstitial felspar. The sp. gr. of the rock is 2·98. The section appearance. The interstitial plagioclase (probably labradorit crystals of plagioclase and quartz.

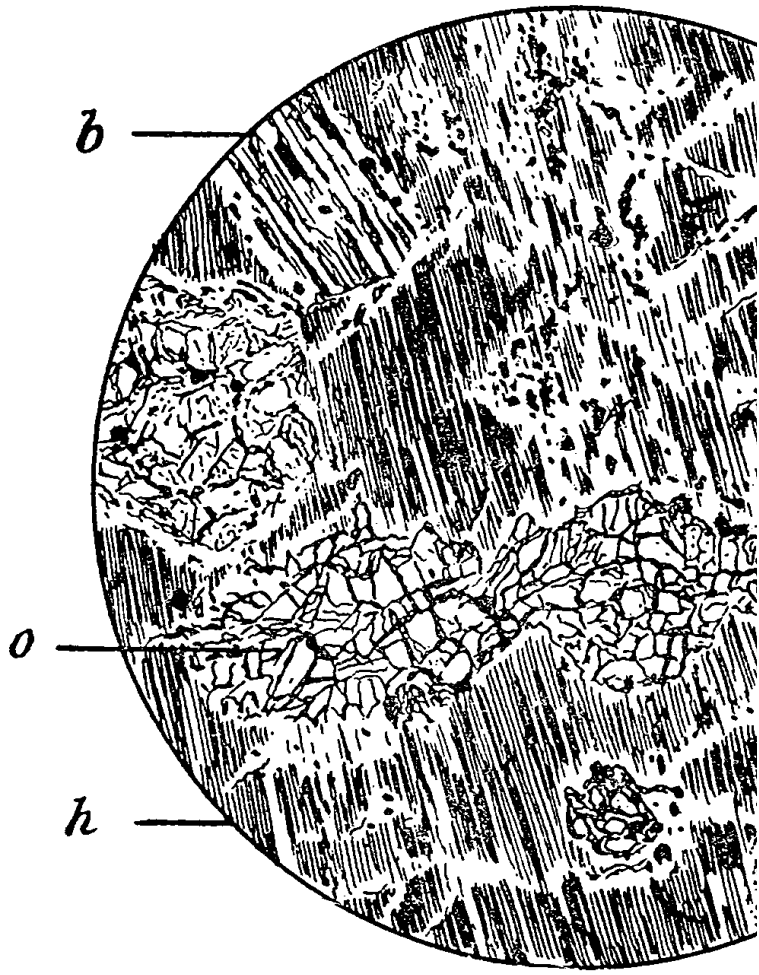


Fig. 44.—Amphibolite of Qrein Salama [12,157], × 17. *h*, hornblende, s
chlorite; *o*, olivine, and *b*, bronzite, both passing into serpentine.

The rock [12,157], of the hill called Qrein Salama, to th
peridotites; but as about three-quarters of the rock is hornb
strongly marked by patches of shading of extremely fine
pronounced striation and faint colour of the crystals are m
rounded grains and strings of iron oxide. The olivine is mos
bronzite, which is present in about equal proportion with t

mainly along the direction of the vertical axis instead of alor

The peridotites, or felspar-free rocks consisting largely of

(*a*) *Dunites*, consisting entirely of olivine.

(*b*) *Harzburgites*, consisting of olivine and enstatite or br

(*c*) *Wehrlites*, containing olivine and diallage.

(*d*) *Lherzolites*, containing olivine, diallage, enstatite or l

(*e*) *Hornblende-picrites*, containing olivine and hornblend

(*f*) *Mica-peridotites*, containing olivine and biotite.

Most if not all of these classes are represented in South-E indeed, careful search is often required to obtain even specir

Serpentines cover about 400 square kilometres of South-E

The largest occurrence is that of the great mountain mas while the breadth of the tract from east to west is some fift north, south, and east, the serpentine is bounded by gabbros

Other remarkable serpentine masses are Gebel Abu Dah Wadi Shait, in Wadi Um Khariga, near Gebel Kalalat, and on

The foxy red colour of exposed faces of serpentine hills, debris flanking the hills is of a darker aspect. The slopes of s

Any attempt to map out in the field the precise limits of and partly because the different peridotites pass gradually o always very clear; for where the associated rock is gabbro, a can be seen running through the rock at many places, and oc

The serpentines are nearly always more or less magnetic, short distance, and all estimations of direction from compass

In a strictly petrographical sense it would be most syste
amphibolites into another, those from dunites into a third, a
of one and the same mass; at Gebel Gerf, for example, we
which follow, therefore, the serpentines of each locality will

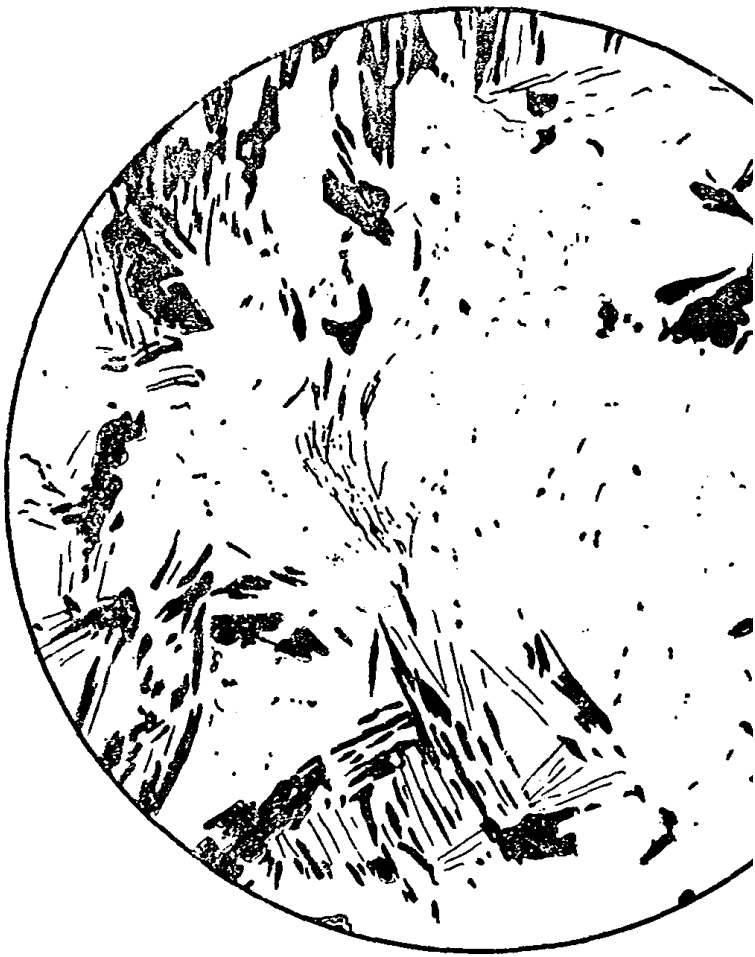


Fig. 45.—Serpentine, probably derived from a mica-peridotite, east of Er
cm, chlorite and magnetite from alteration of biotite; *s*, clear serpentin

A serpentine which occurs associated with amphibolite a

aspect with greenish patches, and shows marked magnetic
magnetite. The arrangement of the magnetite (*see* Fig. 45)
serpentine by its slightly higher polarisation-colours (low ye
strings of magnetite are also most likely due to alteration
perhaps a variety of chlorite poorer in iron, owing to the p
which it has been formed; but between crossed nicols it shov

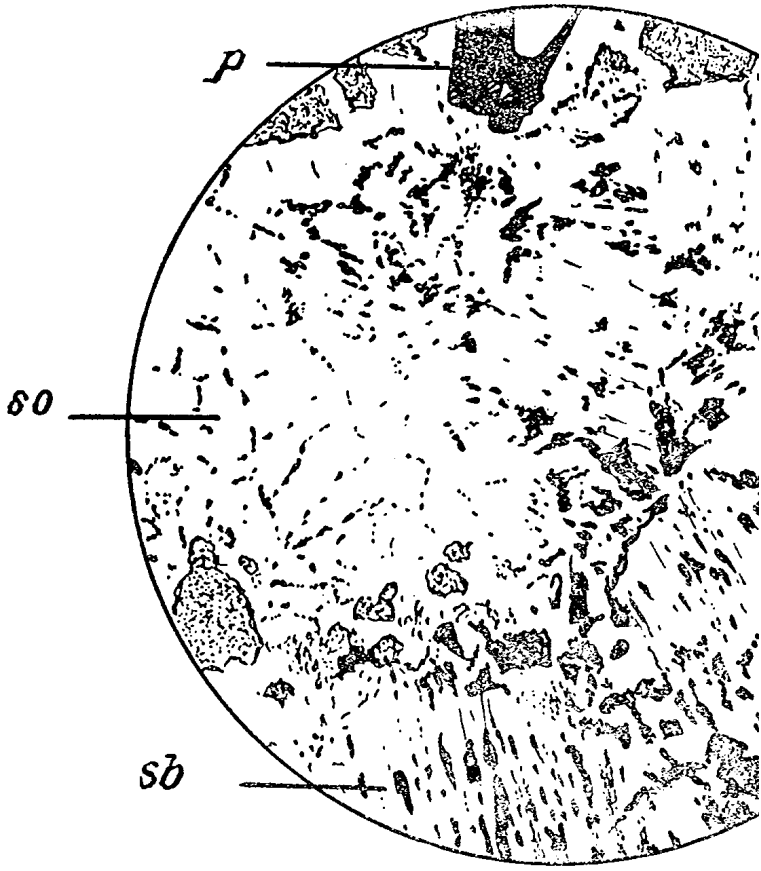


Fig. 46.—Serpentine, probably derived from lherzolite, Wadi Um Kharig
serpentine derived from olivine; *sb* and *sd* serpentine probably derived
c, calcite; *p*, picotite; *m*, magnetite.

The serpentine of the hills on the west side of the Wadi U
can be detected in it. The slide shows colourless to yellow se
the serpentine shows an irregular mesh structure between c
clear greys with a fibrous aspect, and the magnetite is arran
represents the alteration-products of both rhombic and mon

In the hills on the east side of the Wadi Um Khariga, ab

same clear fibrous-looking patches as the specimen last des
clearer fibrous patches may represent diallage or bronzite, w

A serpentine approaching an ophicalcite [10,376] forms
calcite; surfaces of the debris are often covered with a brilli
translucent deep-brown chromite or picotite. Between cross
original mineral remains there is not much doubt that the r
solution and redeposition.

The serpentine forming the hills on the north side of the
rock consisting almost entirely of olivine. The slide [11,51(
irregular cracks in the olivine, each crack being generally m
have themselves become changed to serpentine, they are nea
strings, and in polarised light by the way in which the serp
extinction of its unaltered portions. The diallage, like the ol
between crossed nicols. Where the diallage has become enti
unless kernels of the original mineral are left one cannot be
little original felspar, or from the diallage.

Near the head of Wadi Arais, to the south of Gebel Um E
traversed by parallel strings of opaque and brown transluc
structures, but containing here and there little nests of cloud

The highly crushed and rotten serpentine which forms th
brown serpentine with little strings of olive-green matter, a
kernels of the original mineral. Associated with the olivine
colours, the flakes extinguishing with slight obliquity; the se
parts of the mass the rock has a blacker colour and a slightly
no olivine whatever, practically the whole slide being comp
likely that the rock of Gebel Abu Dahr is essentially an alte
alteration of hornblende here is not a purely serpentinous or
from olivine the change to tremolite preponderates, and the
serpentine in the hornblende, perhaps by actual forcing of se

In the serpentine from some low hills on the plain a little
nearly colourless serpentine with strings of magnetite mark
remarkable appearance; most of the polygonal spaces betwe
aspect of an aggregate of cells with dark nuclei. Besides oliv
grains in the serpentine derived from this mineral is typically

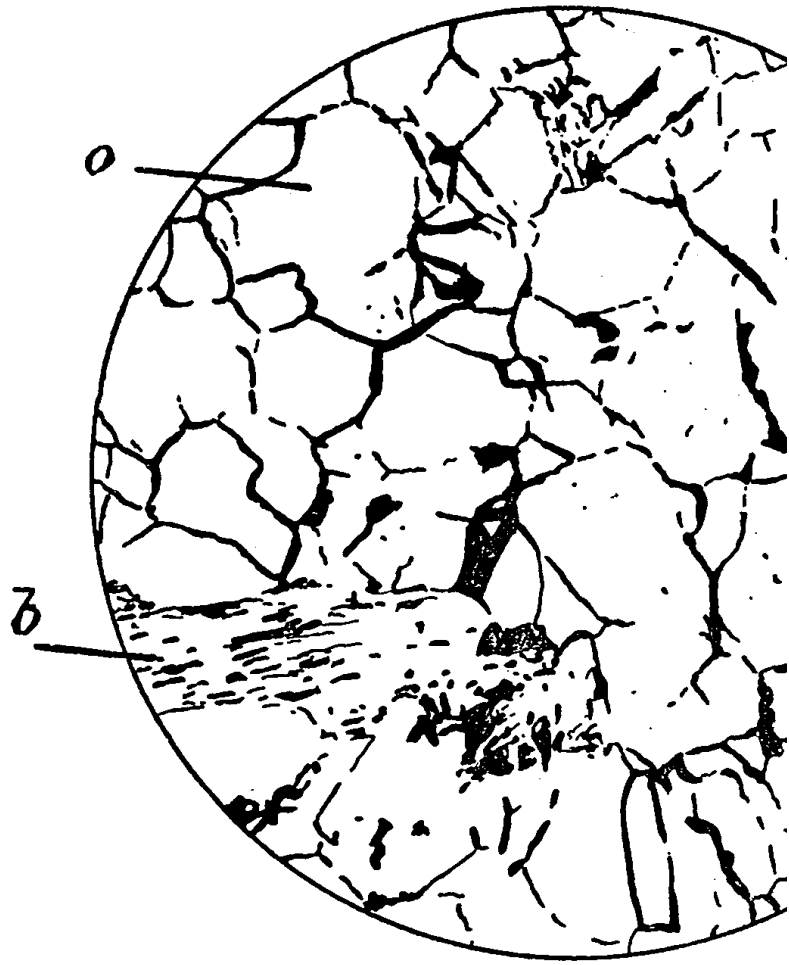


Fig. 47.—Serpentine derived from an almost pure olivine-rock, from a low l
[11,506], × 17. The outlines of the original olivine crystals (*o*) and the c
by granules and strings of magnetite. A serpentinised crystal of bronzite i

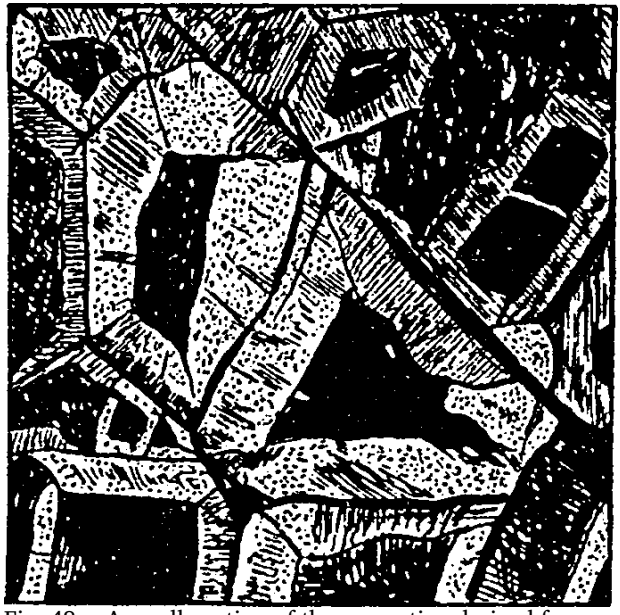


Fig. 48.—A small portion of the serpentine derived from olivine in the same slide, viewed between crossed nicols under a higher power, showing the cellular structure.

A serpentine rock found associated with fine-grained dio less schistose. In a slide cut from the serpentine of the lower it consists of serpentine with fairly distinct mesh structure ir areas, usually free from iron oxide grains and mostly consis areas is nearly filled with little brushes of the substance just

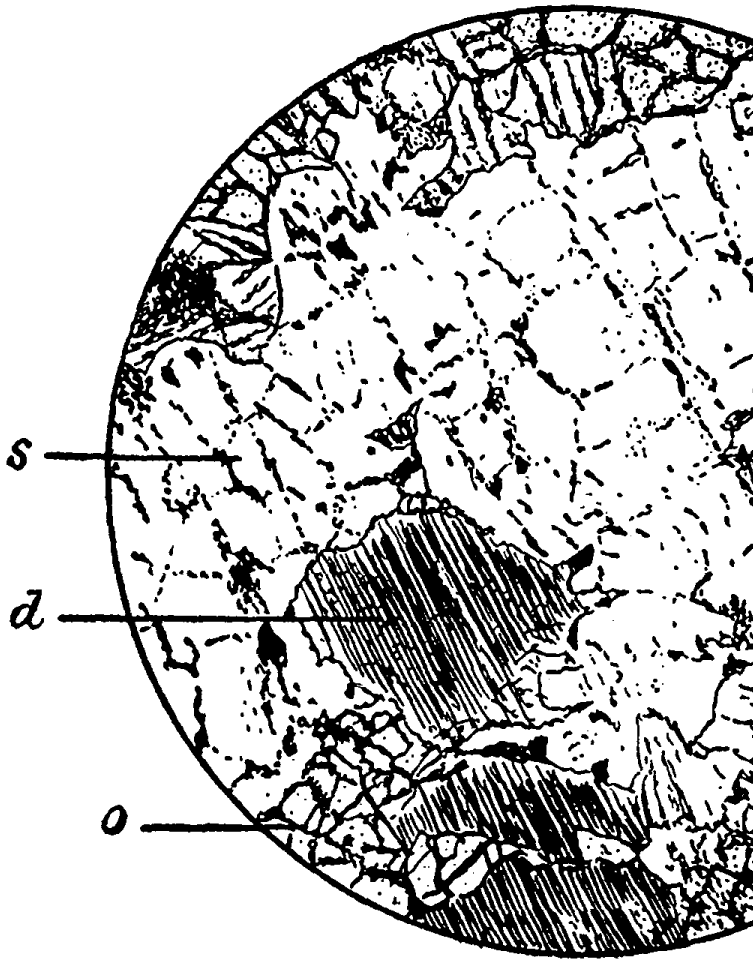


Fig. 49.—Serpentine, derived from wehrlite, Gebel Gerf [12,128], × 17.
olivine, with strings of magnetite); *o*, unaltered olivine, mixed with gra

The predominant rock of the mountain mass of Gebel Ge
a few small bronzy and glassy looking crystals here and ther
remain, especially aggregated, together with augite granule
always very easily distinguishable from the unaltered olivine

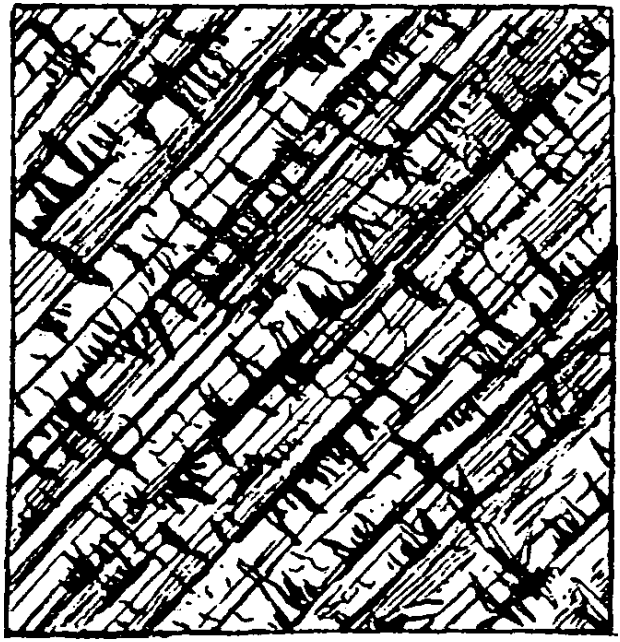


Fig. 50.—Serpentinisation of bronzite, as seen in a serpentine derived from bronzite-rock, Gebel Gerf [12,119], under a high power between crossed nicols. The clearer portions of the figure are unaltered portions of a single large crystal of bronzite; the serpentine is seen forming mainly along the cleavages of the original mineral, with subsidiary cross-fibres.

At many points the serpentine of Gebel Gerf contains a g
serpentine. The sp. gr. of this portion of the mass is 2·81. Th
bronzite has proceeded mainly along the fibres of the origin
by the production of tremolite. In another slide [12,127] the
olive-brown fibrous crystals show extinction-angles of a few

Though the greater part of the Gerf serpentine has beer
essential constituent. One of the specimens brought back fro
to greenish glaze which is characteristic of shattered serpen
spots of greenish matter and scattered shining specks. But a
deal of iron oxide. The plagioclase is tolerably fresh, in lath-
separate this rock from the rest of the mass, which it resemb

this material, shattered and serpentinised on all the fracture
same plutonic mass which has given origin to the main bulk

Other variations in the serpentine which point to parts o
grained rock full of little white and greenish specks and strin
serpentine with pronounced knitted structure in places, as th
often mixed with extremely coarse fibres or plates of serpent

The specimen from the mountains round Bir Meneiga [12
grey matter has in places something of a resemblance to sa
parallel arrangement along the planes of schistosity, but ex
augite; while scattered through the slide are abundant patch

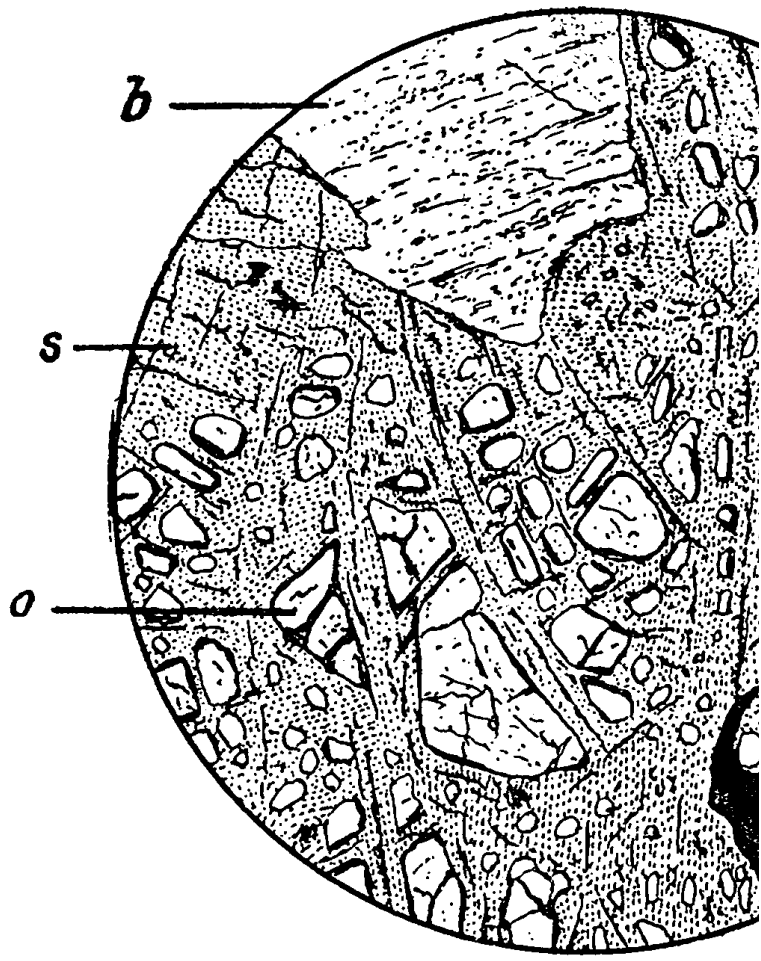


Fig. 51.—Serpentine derived from alteration of harzburgite, Gebel Korab
serpentine, mostly formed from olivine; *o*, unaltered olivine; *b*, alterin
magnetite, enveloping olivine.

The serpentine of Gebel Korabkansi, to the west of Gebel
to have been the most abundant constituent; it is largely se
confused mass of tremolite fibres; in the few cases where an
the olivine. The pyroxenic mineral is easily picked out in th
Another slide from Gebel Korabkansi [12,112] exhibits in pl

ragged-looking crystal of dark green fibrous hornblende, alt
there are a few irregular crystals of chromite, generally enve

In many of the serpentine-masses the effects of solution
about Bir Meneiga [12,142] and Bir Muqur, while asbestos l
of the serpentine, and appears to be preceded by the formati
into hard fibres often reaching ten centimetres or more in le
finer and more flexible fibres of white asbestos. The quality
quantity seen was too small to justify working, though of co

[125]From *Marwa*, the Arabic term

[126]The numbers in square bracket

[127]I may here recall that the quai
See *A Description of the First or Aswân C*

[128]This specimen was brought ba
case.

[129]From a specimen brought back

[130]I did not visit Gebel Shendib, b

[131]There is another Gebel el Anba

[132]Preliminary Report on the Geo

[133]This fibrous green substance is

Metamorphic rocks, comprising a great variety of gneiss
rocks alternate with those of the igneous and sedimentary g

of igneous and sedimentary deposits which were laid down
in succeeding ages the metamorphosed complex was penetra
part submerged beneath the waters of the Cretaceous sea
metamorphism of the rocks; but it is most probable that the
older rocks as having been for the most part impressed on th
earth, while the clay schists may be the remains of the very

Besides the evidences of dynamo-metamorphism above-
compression of the masses has obliterated these traces, and t

The metamorphic rocks occurring in this part of Egypt m

Granite-gneiss (crushed granite).

Diorite-gneiss (crushed diorite).

Highly foliated gneisses (in which all traces of primitive s

Quartz-schists (in some cases probably metamorphosed s

Clay-schists (metamorphosed clays).

Hornblende-schists and crushed volcanic rocks.

Hornfels (metamorphosed acid lavas).

Mica-schists (sometimes containing beryl and tourmaline

Chlorite-schists.

Talc-schists.

Calcareous schists and marble.

Graphite-schists.

Fluidal breccias, in which broken fragments of solid rock

Breccias proper, formed by fracture and recementing tog

Quartz veins (sometimes containing gold and traces of cc

Calcite veins (with more or less chalybite).

Magnesite veins (in serpentine).

Asbestos veins (in serpentine).

The most conspicuous occurrence of gneiss in South-East mass is closely connected another stretch of gneiss to the sc where it is penetrated by the syenitic cones called El Nahud.

Other gneissose areas of less extent occur round Bir Abu Um Rasein, and to the north of Bir Um Bishtit.

Gneiss typically forms bold scenery of precipitous hills, foliation-planes of the rock, while to the south these are cut

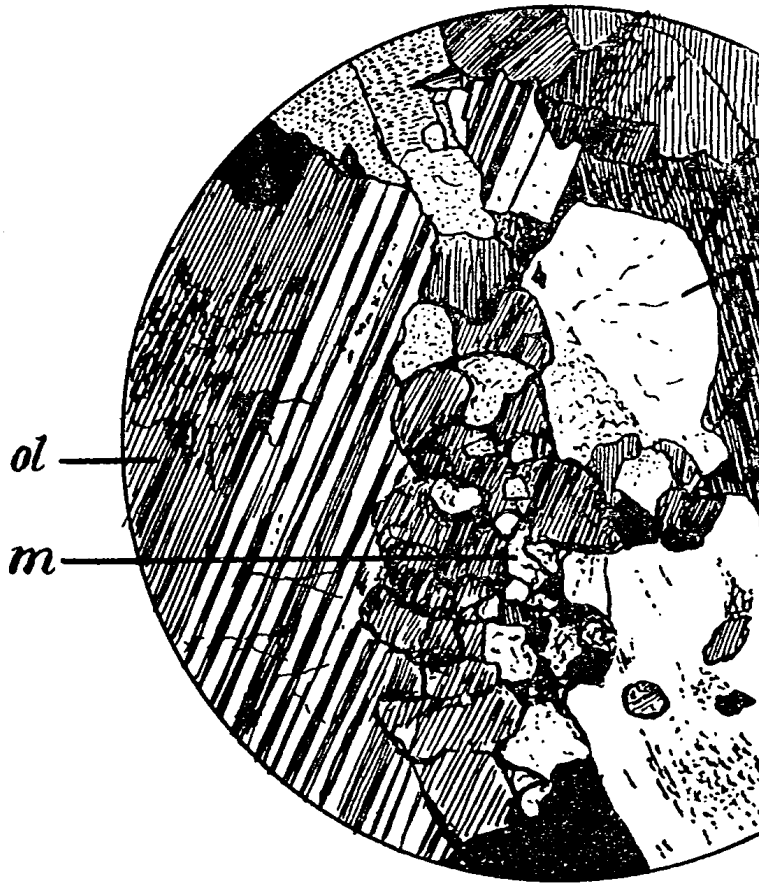


Fig. 52.—Granite-gneiss, Gebel Um Rasein [12,108], viewed between cro
ol, oligoclase; *or*, orthoclase; *h*, hornblende; *m*, "mortar" of crushed qu
larger crystals. The black areas are quartz in the position of extinction.

Of gneisses evidently produced by the deformation of gra
granite of Gebel Elba in appearance, except that here the da
pure biotite, and these are often thrown into sharp contorti
north-east, but the strike swings round to about south at t
centimetres to a metre or more in diameter and depth. A mi
between the larger crystals, and the larger where unbroken f

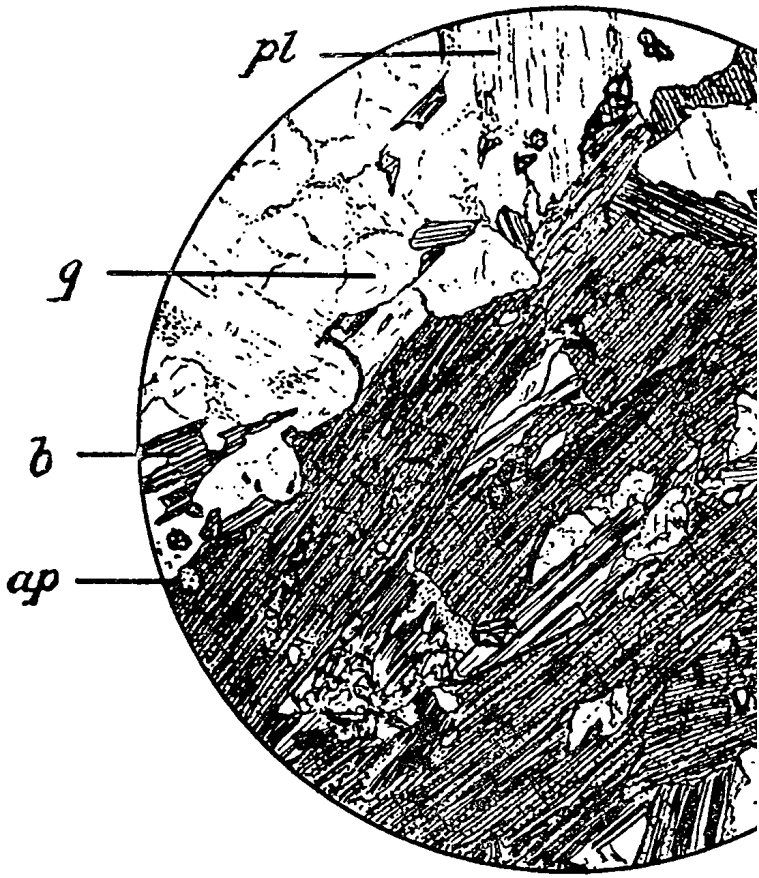
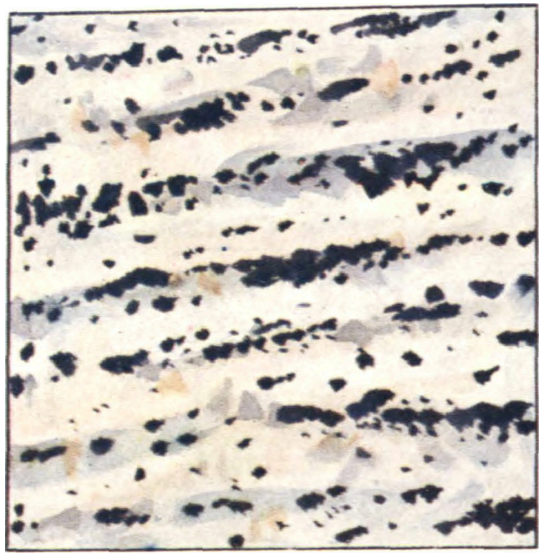


Fig. 53.—Diorite-gneiss, Wadi Nugrus [10,386], × 17. *h*, hornblende, wi
and sphene; *pl*, plagioclase felspar; *b*, biotite; *q*, quartz; *ap*, apatite; *sp*,

In the Wadis Nugrus and Gemal there is a great deal of s
given on Plate XXV. The sp. gr. of the rock is 2·88. The mic
very fresh-looking, in strongly pleochroic (yellowish to dee
foliation. A very striking feature of the slides is the abunda
smashed up, forming with the quartz a mosaic between the
small rounded grains, mixed with, and sometimes containir
grains of apatite are enclosed in the felspars, but this minera



GRANITE-GNEISS.
Gebel Um Rasein.



RED GNEISS.
Gebel Abu Beid.



DIORITE-GNEISS.

Wadi Nugrus.



GREEN BRECCIA.
Gebel Hamata.



EMERAL

As an example of gneisses in which the foliation is so int
given on Plate XXV. In this rock, which has a sp. gr. of 2·6
strong resemblance to the well-known red gneiss of the Erzg

Grey gneisses, equally intensely foliated with the Abu Be
been made of the Egyptian rocks, the absolute similarity to t

About ten kilometres south of Gebel Abu Gurdi is a trac
measuring some eight or ten kilometres, pointing east and
resemble rather friable white to brown fine-grained sandsto
black rods which are apparently hornblende. Traced further
the appearance of foliation-planes. The harder quartzite ban
contains “eyes” of minette-like composition. To the south th
with the rocks, and dykes of diorite and pegmatite, as well
hornblende-schist, has hardened and altered the quartzose r

These quartz-schists may have arisen from the metamor
portion of the tract is due to weathering; the rock is certain
consideration of all the evidence I was able to gather in a ra
gave rise to the clay-schists of Zabara and elsewhere. The r
with schists and veined and altered to a degree which is no
series show-considerable folding and faulting near Gebel Zer

A quartz-schist which is certainly derived from the meta
medium-grained diorite. The quartz-schist is a greyish-white
also for lintels over doors and windows.

Clay-schists cover extensive areas in the South-Eastern D
Gebel Um Goraf, in the hills on the east side of Gebel Abu D
flanks of the serpentine mass of Gebel Meneiga, and in the l

Clay-schists are typically of a grey colour, though greeni
often of considerable size, while in other localities, as for i
crushed diorites and hornblende and mica-schists. The dire
there are numerous local variations, and the number of obse
irregularities, though knotted varieties, doubtless the result

The clay-schists have probably for the most part been

conglomerate, while in other places they pass into quartzites that in most cases the traces of bedding have been entirely present I am inclined to regard them as most likely of Arch required before one can be certain that they are of so great a

Under the heading of hornblende-schists and crushed vo schistosity is barely evident in the hand specimen, but all d microscopic examination to be altered fine-grained syenites, crushed volcanic rocks in one great group is the difficulty c contain little or none of that mineral, its place being taken b

Schists of the types above defined occur probably more a Abu Hamamid and Abu Gurdi, besides covering great expar Plate VII. In the lower hill country we have typically a drea occurrence of parallel dykes harder than the schists which th

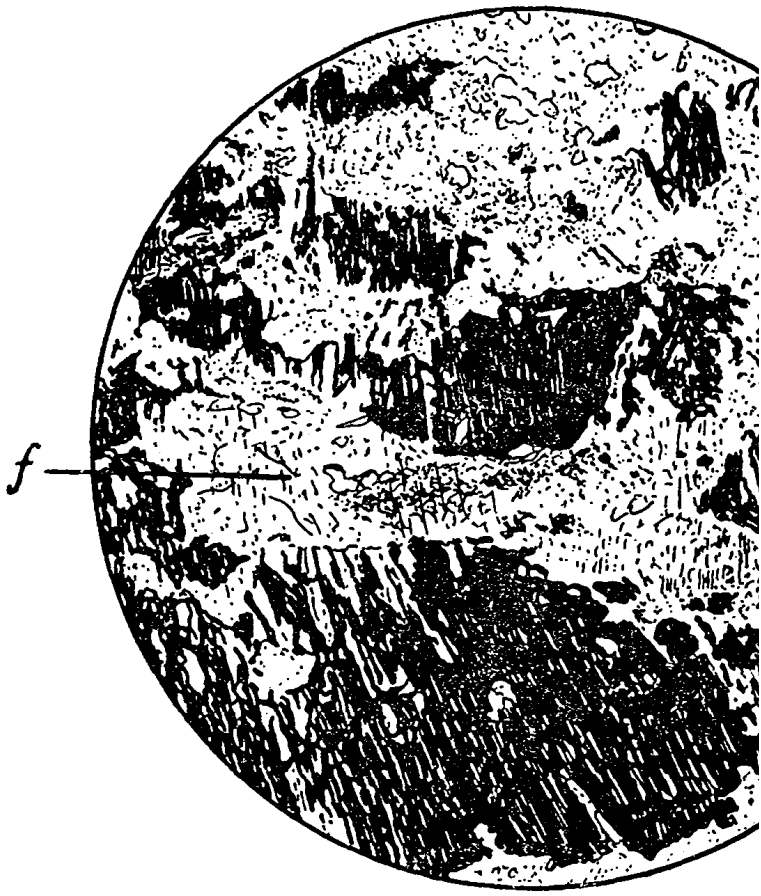


Fig. 54.—Schist produced by crushing of syenite, near Gebel el Anbat (W
30. *f*, crushed and clouded felspar, probably orthoclase; *lc*, mixture of
produced by alteration of hornblende, no trace of which remains.

Schist derived from Syenite.—Among the schists occur
fracture, of sp. gr. 2·92. The slide [11,532 B] shows a rath
irregular bands and is seen to be much crushed. The ferrug
planes of the parent mineral, while a clouded calcite fills up
its silica entirely removed, while the aluminous silicate of th

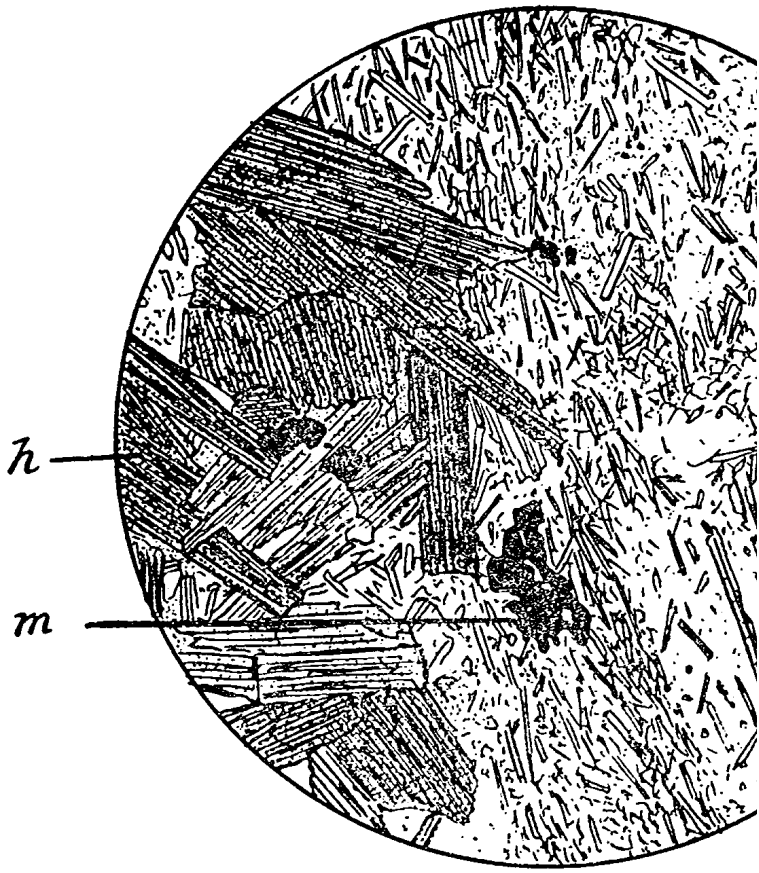


Fig. 55.—Hornblende-schist (probably a metamorphosed fine-grained dio
× 40. *h*, pale green hornblende; *f*, mass of decomposed felspar, contai
acicular hornblende and some little patches of quartz mosaic; *m*, magn

Schists derived from Diorites.—Hornblendic schists wh
mass of Gebel Abu Gurdi. A specimen of the less altered roc
microscopic slide shows pale green hornblende in ragged fi
Hornblende fibres are often enclosed in the decomposing fel

The schist which forms the summit of Gebel Abu Gurdi
material and dark hornblende; the felspar is mostly dull, wh
large irregular crystals, often including felspars. The felspa

kaolin. Some rather large straggling crystals of a dark brow
apparently composed of altered felspar and hornblende.

The crushed dioritic dykes already mentioned as cutting
these dykes, is a fine-grained grey rock, of sp. gr. 2·93, with
irregular grains which are frequently aggregated into nests a



Fig. 56.—Schist composed of fragments of various volcanic rocks, summi
[10,397], × 30.

Schists formed by crushing of Volcanic Rocks.—Schis
Hamamid [10,397] are hard green to grey rocks, of sp. gr.
slides show the rock to be a breccia rather than a simple c

decomposed hornblende in a glassy brown ground mass. Ot
strained, are scattered in a cryptocrystalline ground mass cc
biotite or hornblende, but which now consist of chlorite. In
strings of chlorite and epidote. Whether the rock is a tuff, c
about the Wadi el Sheikh, the schists look like crushed congl

The hornblende-schists which surround Gebel Zergat Na
skin on exposed surfaces. The microscopic slide shows little
amount of kaolinic matter and a few grains of magnetite. Th

To the metamorphism of andesitic lavas, too, are somewl
a very fine-grained clouded rock, apparently a mosaic of qu
considerable amount of calcite.

Hornblende Schists of doubtful origin.—In the more
crystallization has been so complete that no trace of the ori
narrow bands associated with gneisses and mica and talc sch
hornblende, quartz, and felspar. The density is usually abo
separated by clear granules of quartz and a little felspar, wit

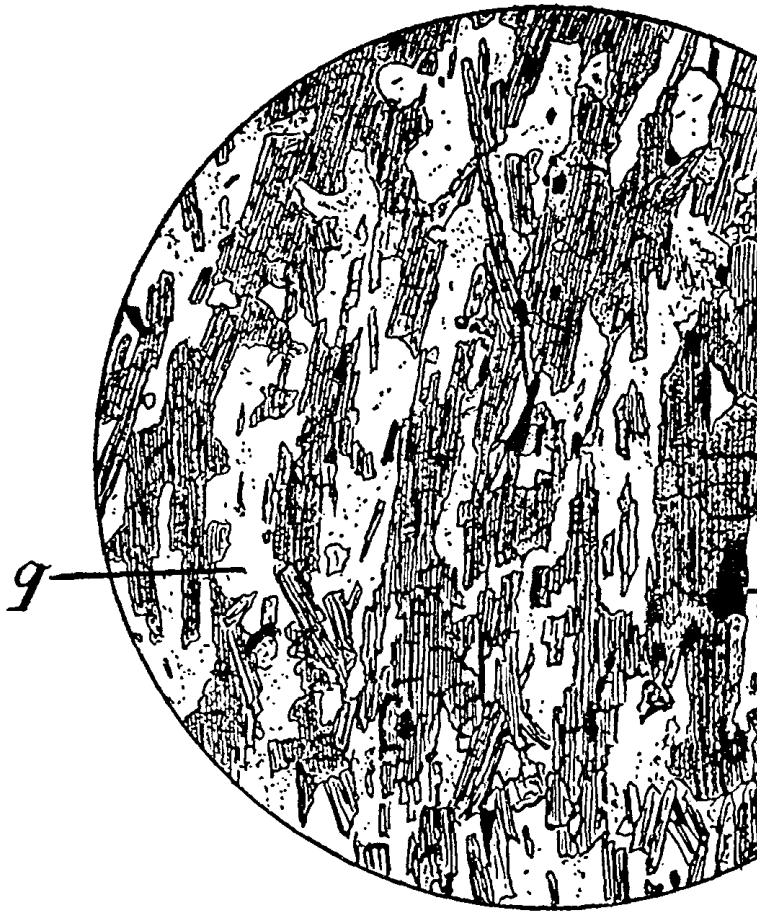


Fig. 57.—Hornblende-schist, near Gebel Eqrun [12,117], × 30. *h*, hornb
magnetite. A little felspar is present mixed with the quartz, from whicl
polarised light.

Near Gebel Eqrun are found hornblende-schists which ex
cut from this variety shows little trace of the banding, the l
compression in a direction perpendicular to the original one

Actinolite-schists.—Very beautiful bright green schists,
actinolite fibres, which often reach two centimetres in leng
actinolite polarising in the most brilliant tints; associated wi

Associated with the schists of Gebel Abu Hamamid and t
as to appear homogeneous even with a strong lens. The pyra
in the mountain faces the rock looks red, but this is only c
alternating with each other, and often contains tiny cubes of
and altered felspar, together with a little sericite, the latter e
a lens in the hand specimen; the appearance is that of a quar
of the Abu Hamamid district are mostly crushed volcanic roc

A yellowish horny rock with grey streaks [10,379], whic
2·52. Examination with a lens shows the grey streaks to be f
and felspar, with scattered larger felspar crystals, much brok

Mica-schists, composed mainly of golden-brown lustrous
associated with gneiss, and appear to form irregular bands, a



Fig. 58.—Beryl and quartz, from a lenticle in mica-schist near Sikait [10, idiomorphic hexagonal crystals; *q*, quartz, allotriomorphic.

Emeralds (Beryl).—At Zabara and Sikait the mica-schist quartz which occur in the mica-schist, but sometimes they c XXV will give a good idea of the usual appearance of the mi those of quartz. Both at Zabara and Sikait there are numerou of schists. It is commonly believed that gem emeralds were stones of considerable value were obtained. The Zabara min recent (1904-5) vigorous attempt by Mr. James, acting on abandoned, Mr. James concluding that either the ancient r

jewellers. The dull forms of beryl are in our own day of very

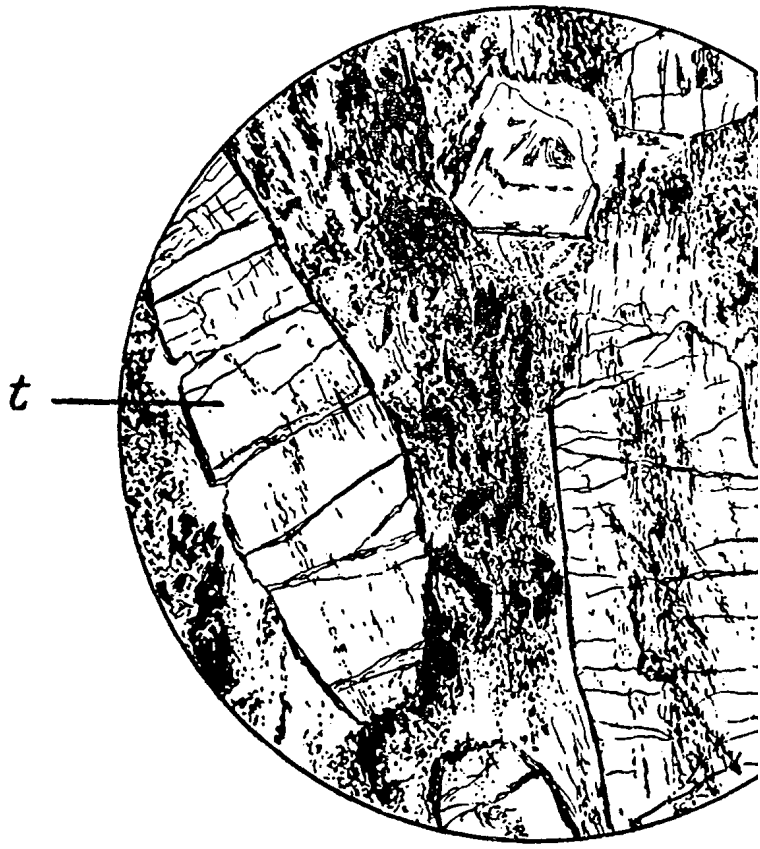


Fig. 59.—Tourmaline crystals in graphitic talc-schist, Sikait mines [9,908
crystals, irregularly cracked and clouded; *g*, talc-schist, heavily cloude

Tourmaline.—Besides beryls, the mica and talc schists
[10,395]. In thin section [9,874 and 9,908] the tourmaline
beryl, however, tourmaline is only of value as a gem when it

Calcite, in rhomb-shaped crystals of a brown colour due

Though many of the decomposed hornblende-schists con
in the hills of Um el Huetat (latitude 25°), where typical cl
peculiar appearance but also by its strongly magnetic charac
to consist essentially of an aggregate of elongated plates ar
chloritic mass. The rusty spots visible in the hand specimen
hornblende. Mixed with the foxy red material are aggregate
appearance except that they sometimes show well-marked ve

Typical chlorite-schists occur in the Wadi Salib Abiad, ar
were at work in the Wadi Salib Abiad, I sent a guide to fin
sample. I did not get an opportunity of visiting the locality
some little quartz and talc besides the chlorite, and there ar
been reported by Mr. Charteris Stewart, who also records a r

Talc-schists, though not widely distributed, are abundant
this district there are immense masses of talc-schist of remar
occur which can be easily carved into pipes, and these are fr
earthy variety of talc-schist [10,396] was met with near the
the talc-schists are decidedly subordinate to the mica-schist i

To the class of talc-schists is also probably best referred a
microscopic slide of the Romit specimen [12,139] shows th
plentifully embedded perfect little cubes of limonite. The lim

Some very curious calcareous schists are found in Gebel
rocks of varying colour, chiefly brown and reddish, often pu
composed of grains of calcite, with here and there larger irr
been already described (p. 339) as probably an altered syeni

A hard close-grained reddish-brown rock of sp. gr. 2·91, v
Gebel Beida, resembles a quartzite in appearance, but turns
oxide. The origin of this rock is uncertain; it may be a metan

The summit of a high hill rising to 686 metres above sea,

rock [10,369] is seen to consist mainly of dark crystalline c
kaolinic and serpentinous matter, with a very pronounced sc
a guess as to its origin; but the slide contains some granules

White crystalline marble has been found only at one pc

A considerable mass of graphite-schist occurs associated
from the summit it appears to run out westward for miles as
a knife, and mark paper easily. Analysis shows that the gra
Pollard was found to contain only a trifle over one per cent.

A similar graphite-schist occurs associated with mica-sch
Garaiart, both of which localities, however, lie outside the li

The origin of the graphite-schists is uncertain. Perhaps t
association of dioritic rocks suggests that the great of igneo
formation of the rock. But the absence of any associated roc
been produced from quite another source than that of plant

A very curious rock [10,385] which from a distance loo
measuring five centimetres in diameter, embedded in a dark
diorite, and then the whole mass has been subjected to the s

More normal breccias are found at various points. One w
hornfels, all cemented into a very hard rock which breaks a
themselves almost as much fine breccias as schists.

To the west of Gebel Zergat Naam the stones in the wadi

In the hill called Ti Keferiai, a little below the triangula
quartz.

A remarkable green breccia is found in Gebel Hamata, w
ornamental “breccia verde antico” of the Wadi Hammamat
ground mass, the whole of very fine grain and barely scratc

whole of the slide is clouded by decomposition products.

Fault-breccias, produced by differential movement of t
which stand up like dykes; they are very calcareous and high

Quartz veins deposited by solutions[136] in cracks and fi
metres or more in thickness; they cut the rocks in every dire

The principal interest attaching to the quartz veins is t
dwellings and stone grinding pans are found at numerous pl
found these ruins of ancient mining camps and grinding pa
they could for that reason afford to work ores which are too
prospecting licences and mining leases now in force is given

Besides gold, some of the quartz veins contain traces of
in fact being mere stains due to oxidation and carbonatisatio

Calcite veins are much more rarely met with than those
crystalline calcite is found mixed with chalybite, limonite, a
up for iron ore, especially in view of the expense of transpor

Magnesite and asbestos veins occur in the serpentines of

[134] The figures in square brackets

[135] *See* Barron and Hume's "Easte

[136] Other quartz veins which prob

[137] The copper smelted in ancient
latitude 22° 47′, longitude 33° 44′, whe
p. 34.

Given a sufficiently long period for their activity, the d
rainless, and within a decade most of the dry valleys have b
rock does not occur on any large scale; the diurnal variation
transported towards the Nile or the sea by the streams whic
the mountains are slowly being lowered, and the rocky valle

But when we look at the great wadis, often hundreds of
conceive that rainfall and denudation have not in the past
before the end is reached; erosion nowadays is practically c
thus driven to believe that what is now a very dry area was
Africa had a temperate one; the effect, whatever its cause, b
Egypt may be slowly changing at present; but the change wi

If the 200-metre contour of the bottom of the Red Sea,
which mimics the present Ras Benas. Some of the indentatio
that the sea has encroached on the land since the drainage-
thus this sea was a great and deep one even when the level
contours is that the *present* extent of the Red Sea has been ca

The subsidence just referred to was even greater than w
sea-borders, and the natural deduction is that the gypsum b
formed the Red Sea must have covered a much greater area
knew the age of the gypsum beds, which unfortunately is no

Eocene rocks are entirely absent from the district, and th
plateau face of Gebel Garra, where there are exposed thick
their present limits, and we may ask whether they ever reac
and even a very gradual thinning of the beds eastward woul
and the Nile may well have done the same further east.

The Nubian sandstone is found on both sides of the wate
it laid down on either side of a great island ridge? In other
question it may be stated at once that no certain answer can

Evidence from Volcanic Intrusions.—That the Nubian sand
of the region and a small basic dyke near Gebel Awamtib, th

Evidence from Present Distribution.—Coming now to the
denudation would be most active among the peaks and in c
watershed, but a reference to the orographical map (Plate
masses into north and south groups. The presence of the san

Not only is the sandstone absent from the main mounta
overlooks a broad tract of low country between it and the n
patches considerably removed from the main summits, and e

Evidences from Structural Features.—With regard to the st
their deposition antedated the mountain formation or no.

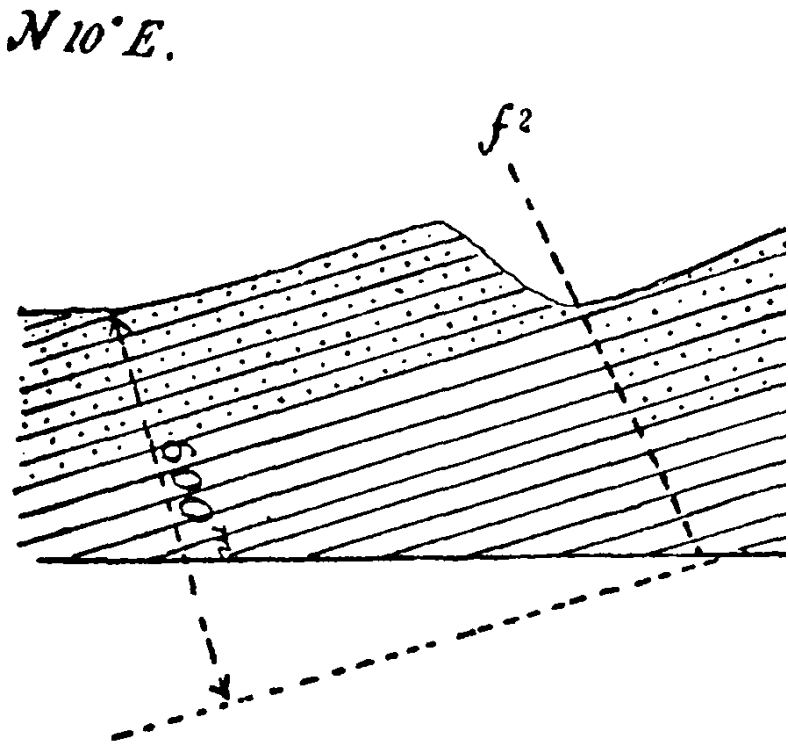
To the north of latitude 24°, the eastern edge of the sand

Further south, near Gebel Zergat Naam, much more deci
fault, for here on the south-west of the wadi we have sandst
brecciated schists. Going further west, in the sandstone hill
south-west slope; this, with the preceding observation, seem

Where the Wadi Garara cuts through the sandstone hills
faces show granite and schists at their base.

Further west, on the way to Gebel Um Harba, the sandst
beds having approximately the same inclination.

At Gebel Um Khafur, the dip is 13° to 14° to the north-n
horizontal distance of 2·9 kilometres (measured perpendicul
total thickness of Nubian sandstone here is over 450 metres.
the hill-mass into ridges.



In approaching Gebel Awamtib from the north-west, I cr
The beds of Awamtib itself dip pretty uniformly a little nortl

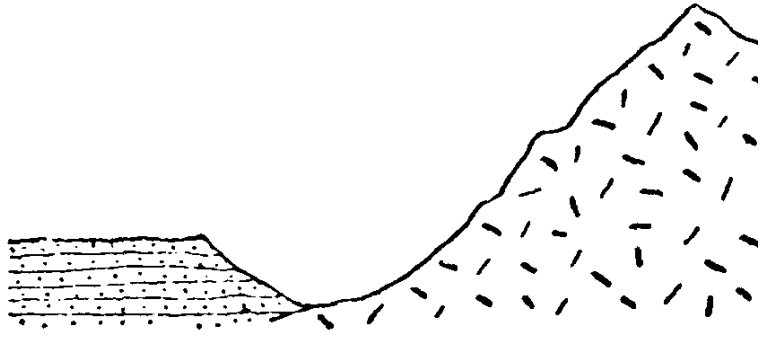
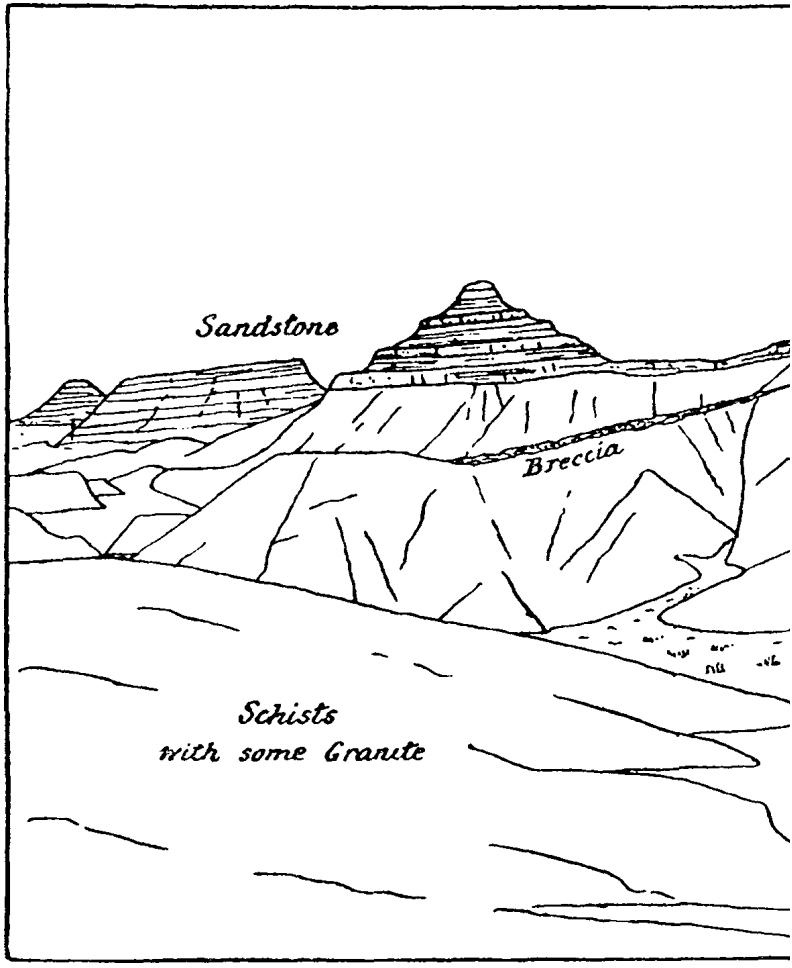


Fig. 61.—Sketch section of junction of sandstone with granite, west of G

About nine kilometres to the south of Gebel Awamtib, a s
All along this route there was no suggestion of sharp folding

From the top of Gebel Um Reit, which itself is granite, t
considerable disturbance, but the sandstone is too far off for



Going northwards from Um Reit across the Wadi Saalek a
is a distinct overthrust, with a north-easterly strike, and ther

From the Wadi Muegil northwards past the Galt el Aguz
but this appears to be due to fall of over-hanging beds.

At the pass from Wadi Um Arta into the head of Wadi Sil

Round Bir Abraq and the triangulation station on Gebel
Sunta, a little further north, appears to lie in a syncline, the

Approaching the sandstone from the east by Wadi Hodeir

The beds of Gebel Dif and Gebel Anfeib have a prevalent
north-westerly strike (*i.e.*, a strike roughly parallel to the ma
masses near the head of Wadi Edunqul show no reversal, the

The sandstones on the east side of the watershed ranges,
Kolaiqo, separated by hills of red aplitic granite; these hills
brought back by guides sent to the place.

Summing up the dips and disturbances of the sandstone
Ranga are so far in favour of the view that the sandstone m
Um Reit, where the folding and faulting are often in directio
as observations on the sandstone itself go, therefore, the qu
clear proof that considerable earth movements have taken pl

Turning now to the main mountain-forming rocks, we fi
groups are quite distinct, and we find typical igneous masses
be the younger.

The igneous masses are divisible geologically into the thr

Lavas.—Amongst the igneous rocks, the lavas are those r
area, a circumstance which is easily explained by the enorm

Dykes.—Dykes seam the schists and igneous rocks, frequ
dykes vary from extremely acid rocks like aplites and quart
Nubian sandstone has been observed in the district. Another

dykes; this suggests that the basic plutonic rocks may be on

Plutonic Rocks.—The plutonic rocks include granites, syer and basic groups, which are tolerably well marked off from granites are on the whole of a very acid type; syenite is very rocks are almost always closely associated with gabbro. Wh forms.

The much greater abundance of dykes in the plutonic ro greater frequency with which a tendency to gneissose struc greater ease with which their constituents undergo weatheri the expansion of the rocks on serpentinisation.

Though we may be fairly sure that the basic plutonic roc are both older than the Upper Cretaceous, but we cannot sa back as Palæozoic times.

Gneisses and Schists.—The gneisses and schists which cov an Archæan age. They exhibit a wonderful variety of comp instance the clay-schists, graphite-schists, and marble, have have been formed.

Having in the foregoing pages discussed the evidences fo gathered. In this process we shall reverse the order of consid

The schists and gneisses probably represent, not the orig mountains which were subsequently denuded and worn dow igneous rocks.

The first igneous intrusions into the schists and gneisses fissures, up which came later intrusions, mostly of basic rock

A long interval now followed of which the rocks contain denudation which surely took place before the Upper Creta elevated. Nor do we know whether the area remained whol folding and faulting, especially in the areas now occupied by this same period. The depth of the sea is of the same order (

In the succeeding Oligocene period the land was being sc

About the Miocene epoch there was a sinking of the crus
post-Pliocene times raised these deposits along the present sl

In geologically recent times a further gentle elevation ha
the great wadis received almost their final sculpturing. Afte
place, partly owing to wind transport, and partly owing to t
silt-laden water; for the coral animal flourishes only where t

[138] SUESS, in *The Face of the Earth*

The Bedouin tribes[139] inhabiting South-Eastern Egypt a

North of the administrative boundary (Ababda tribes):-

Ashabab.

Meleikab.

South of the administrative boundary (Um Ali Bisharin

Hamedorab

- Aliab
  - Kurbeilab
  - Balgab
  - Sarrarab
    - Koatil
    - Mallak[140]
    - Mohammad Omerab[140]

I had hoped, in surveying the country, to be able to plac

men of the different tribes who accompanied me over the g
definite idea of the various claims made at the time, and as
claims.

On the small scale map[142] which forms Plate XXVI, I l
frequently concern somewhat small wadis, it will in some ca

I would remark that there did not appear to be anythin
amicably together. It was only when I attempted to lay dov
sufficiently abundant, in proportion to the population, for tl
would resent any statement as to ownership of its traditiona
at Halaib, Sheikh Batran Ali Tiut (of the Hamedorab) told m
by going to the place and hearing the evidence of the oldest

Boundary between the Ashabab and Meleikab.—Thi
difficulty in laying down this line on the map is in deciding

With regard to Gebel Abraq (*see* the large scale map on
Meleikab area, and as these lie further north it is obviousl
interpretation would be to regard the triangulation point, m
outs the Wadi Abraq, and thence the boundary line would li
on the ground.

As to the two Gebels Um el Tiur, I have already mentione

Before leaving the subject of the Meleikab boundaries, it
along the coast southward than the mouth of Wadi Hodein,
result is that the Meleikab area ends in a point on the coast,
the impossibility of defining boundaries without either going

The Hamedorab Boundary.—The Hamedorab claim the
Kilia Arib, thence to the hill of Eqrun, thence to the pass of
thence eastward along the south side of Wadi Di-ib.

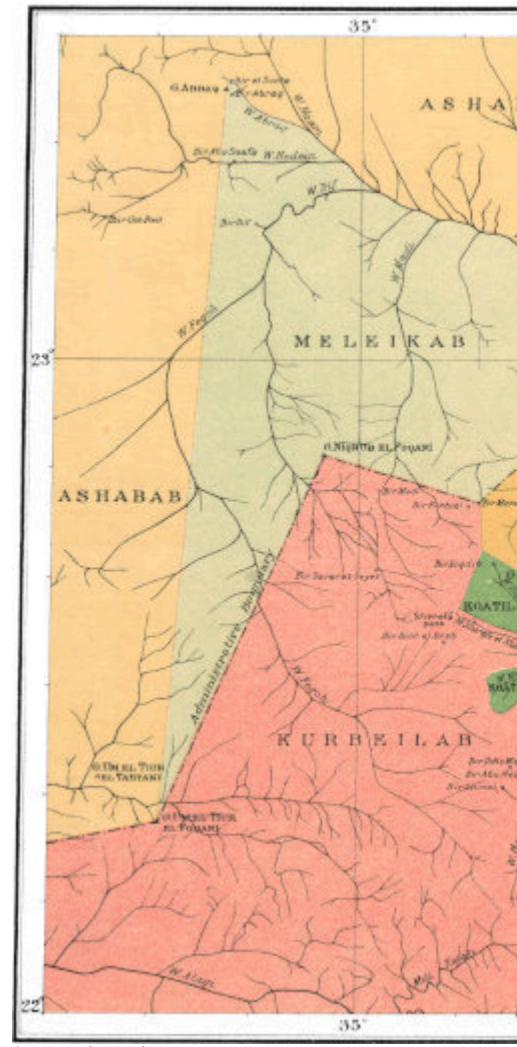


Photo-Metal-Process. Survey Dept. Cairo 1911. (60-190)

The Hamedorab state that much of the country included the coast (in latitude 23° 42′) and to pass north of Wadis Kł *Egyptian Sudan*, Vol. I, p. 93) mentions that on the other ha rival claims.

The Kurbeilab Boundary.—The Kurbeilab claim their e
el Sharqi on to the small hill called Tibashoi Tomokolat, the
From Bani Sana southward to Gebel Warabeit, thence along

The Balgab Boundary.—The Balgab boundary coincides
From Kulet Tinasal the boundary runs east-south-eastward a
the heads of Wadi Miatit, eastwards across Wadi Aqwem, alc

The Koatil Boundary.—The Koatil claim their boundary
Dom. From Hamra Dom, west-south-westward to Tibashoi T

The Koatil further claim as their territory the upper porti

The Koatil also own the well called Bir Um Rasein, thoug

Overlapping of Claims.—When the boundaries of the di

(1) A tract south and east of Bir Baaneit, claimed both by

(2) A tract extending southward from Gebel Hamra Dom
Osnei, Megwel Hamida, Bir Nubitra, and Bir Mashushenai.[1

(3) A narrow tract including the Wadis Qurat and Di-ib, c

Ownership of Water Sources.—With the exception of t
are partly enumerated in the *Arrêté* of 1902, but as the list t
the various water sources reference should be made to Chap

Wells, etc., of the Ashabab.

Bir Muelih	Bir Helie	Igli Galt
Bir Ghadir	Bir Abu Hashim	Galt Um Tundeba
Bir Murra	Bir Shenshef	Zabara Galts
Bir Abu Had	Bir Betan	Ghuel Galts
Bir Um Gubur	Bir Rahaba	Galt Um Karaba (Migif)
Bir Masur	Bir Abu Reye	Megal Harami
Bir Ranga	Bir Abu Beid	Galt Um Gerifat
Bir Khashab	Bir Gahlia	Galt Um Gunud
Bir Abu Hamamid	Bir Orga	Galt Batoga
Bir Metawit	Bir Um Reit	Galt Um Maiat

Bir Shadli	Amar Spring	Galt el Aguz
		Galt Seiga

Wells, etc., of the Meleikab.

Bir el Sunta	Bir Gumbit
Bir Abu Dibesat	Bir Abu Saafa
Bir Abraq	Bir Dif
	Bir Beida

Wells, etc., of the Hamedorab.

Bir Shalatein[147]	Bir Meheriqa	Bir Salalat O Sir
Bir Adal Deib[147]	Bir Nabit	Bir Sararat Serimtai
Bir Meneiga[148]	Bir Abu Ramad	Megwel Akau
Bir Muqur	Bir Kansisrob	Ti Kureitra
Bir Baaneit	Bir Akwamtra	Bir Frukit
	Halaib Wells	Bir Qabatit

Wells, etc., of the Kurbeilab.

Bir Madi	Bir Shinai	Meis-heit-ar
Bir Korbiai	Bir Kagog[149]	Megwel Adar Aqdeib
Bir Meneiga[148]	Bir Guqub	Megwel Um Ein
Bir Sararat Seyet	Bir Himeitra	Megwel Um Edwa
Bir Bint el Dreb	Bir Um Bishtit[150]	Megwel Didaut[151]
Bir Odis Maaleq[149]	Bir Qidmib	Megwel Aqwem
Bir Abu Hodeid	Bir Meisah[151]	Galt Hilwit Hasium
		Galt Kirir

Wells of the Koatil.

Bir Diqdib
Bir Um Rasein

[139]*See* notes by Mr. W. E. Jenning

[140]Of these two sub-tribes (Mallal which I did not visit. The Mohammad (Sheikh who accompanied me.

[141]The men were Sheikh Isa Ali T

[142]In order to render it easier to f general orographical map on Plate I.

[143]Jennings Bramly Bey, the Seni his own boundaries and that those idea Disputes of course do arise as to the po: is more strictly defined."

[144]Bir Shenshef and Bir Beida are north of the Sudan administrative boun

[145]This water source is recorded i

[146]Mr. Bramly (*Anglo-Egyptian Su* mentioned above.

[147]The *Arrêté* of 1912 ascribes the

[148]Joint Hamedorab-Kurbeilab.

[149]Bramly Bey, in his MS. list of v well outside the Hamedorab boundary a

[150]Bramly Bey informs me that th

[151]I have included these two wat Bramly (*Anglo-Egyptian Sudan*, Vol. I, p.

On the completion of the survey work at Halaib in May 1

on an average thirty kilometres a day. This rate of travel dic
Handbook, I give here the notes I made. The distances are es

I would mention that from Mohamed Ghul onwards to l
followed, as my guides informed me that while it was only s

In the sketch maps on Plates XXVII and XXVIII, I have sh
Sudan Survey Department, for the position of Port Sudan an
and Port Sudan, agree pretty well with those scaled from th
rough estimations.







Photo-Metal-Process. Survey Dept. Cairo 1911. (190)

Ball—Geography & Geology of South-Eastern Egypt.

Photo-Metal-Process. Survey Dept. Cairo 1911. (190)

Place.	
Halaib	
Wadi Shellal	
Wadi Aqilhoq	
Wadi Aqwai	
Kreit-reit-or	

Ti Kureitra

Bir Qabatit

Bir Ma-arob

Wadi Na-akreib
Wadi Hamsiat
Wadi Waseb
Hibi Kwan
Bir Delaut

Megwel Shumab

Wadi Qumat Yawab
Dungunab

Tribal boundary

Wadi Hukeib

Wadi Yameinai

Mohamed Ghul

Place.

Mohamed Ghul

Bir Di-it	
Bir Salalat Aseir	
Bir Eit	
Low gravel hills Tower	
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Bir Ta-amai	
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11 line 9 from top, *for* “Modellin” *read* “Modellim.”
21 footnote, line 2 from bottom, *for* “watershed” *read* “westward.”
24 line 2 from top, *for* “figures” *read* “fingers.”
47 in heading of last column of table, *for* “observed-computed” *read* “com
49 line 7 from top, *for* “area” *read* “sea.”
49 footnote, line 3 from bottom, *for* “k = of 0·13” *read* “k = 0·13.”
49 footnote, bottom line, in the denominator of the fraction, *for* “2—r” *re*
51 line 12 from bottom, in last column, *for* “0” *read* “—.”
52 line 12 from top, in last column, *for* “0” *read* “—.”
54 line 12 from top, the latitude of point No. 353 *is* “23° 47′ 37″” *not* “23
57 line 14 from top, *for* “Fokani” *read* “Foqani.”
58 line 14 from top, *for* “Mukur” *read* “Muqur.”
59 line 9 from bottom, *for* “Un Rasein” *read* “Um Rasein.”
60 line 2 from bottom, in last column, *for* “highest” *read* “high.”
61 line 3 from top, delete “minor.”
63 line 8 from top, *for* “G. Di-ib” *read* “W. Di-ib.”
72 last line, *for* “as” *read* “if.”
75 line 10 from top, *for* “added of” *read* “added to.”
76 the observed compass-variation near Halaib Fort *was* “2° 18′,” *not* “3°
77 the yearly decrease of declination (in three places) *should be* 6′·3 *instea*
82 line 22 from top, *for* “Wani” *read* “Wadi.”
83 line 18 from top, *for* “Um Selim” *read* “Um Sellim.”

88 line 11 from top, *for* “Feleiti” *read* “Felieiti.”
98 line 2 from top, *for* “Serimtay” *read* “Serimtai.”
99 lines 4 and 7 from bottom, *for* “Sabaia” *read* “Sabahia.”
101 line 25 from top, *for* “Um Heram” *read* “Um Heran.”
103 line 9 from top, *for* “The one” *read* “The upper one.”
104 line 17 from top, *for* “heap” *read* “head.”
105 line 11 from top, *for* “42° 34′” *read* “24° 34′.”
109 line 18 from top, *for* “35° 47′ 10″” *read* “35° 47′ 13″.”
118 line 11 from bottom, *for* “curved” *read* “carved.”
144 lines 10 and 22 *for* “Meisa” *read* “Meisah.”
145 top line, *for* “Meisan” *read* “Meisah.”
152 line 8 from top, *for* “Akwantra” *read* “Akwamtra.”
153 line 8 from top, *for* “aad” *read* “and.”
159 line 5 from top, *for* “Mikreiba” *read* “Mikeriba.”
159 last line, *for* “22° 13′ 24″” *read* “22° 13′ 25″.”
159 last line and footnote, *for* “Qosier” *read* “Qoseir.”
160 top line, *for* “36° 38′ 54″” *read* “36° 38′ 56″.”
162 line 7 from top, *for* “to” *read* “or.”
162 line 5 from bottom, *for* “Qubit” *read* “Qubet.”
167 line 10 from top, *for* “1099 metres” *read* “1199 metres.”
167 line 15 from bottom, *for* “Krug” *read* “Khrug.”
173 line 8 from top, *for* “Itelma” *read* “Iteima.”
173 line 10 from bottom, *for* “34° 44′ 35″” *read* “34° 41′ 35″.”
176 line 4 from top, *for* “24° 14′ 44″” *read* “24° 14′ 41″.”
183 line 4 from bottom, *for* “Mukhtatat” *read* “Mukhatatat.”
186 last line, *for* “east” *read* “west.”
188 line 9 from top, *for* “24° 54′ 18″” *read* “24° 54′ 14″.”
188 footnote, *for* “23° 57′ 67″” *read* “23° 57′ 46″.”
189 line 8 from top, *delete* “respectively.”
194 line 9 from bottom, *for* “these” *read* “there.”
204 line 16 from top, *for* “western” *read* “southern”
206 line 13 from bottom, *for* “34° 50′ 49″” *read* “34° 56′ 49″.”
211 line 12 from bottom, *for* “which” *read* “while.”
212 line 20 from top, *for* “Um Rassin” *read* “Um Rasein.”
213 line 14 from bottom, *for* “Kirwaw” *read* “Kirwau.”

223 line 11 from top, *for* “exit” *read* “exist.”
223 line 2 from bottom, *for* “Hashushenai” *read* “Mashushenai.”
224 line 18 from top, *for* “jugged” *read* “rugged.”
228 last line, *for* “masses” *read* “mosses.”
233 line 3 from bottom, *for* “in” *read* “on.”
235 footnote, *for* “Megwal” *read* “Megwel.”
238 line 9 from top, *for* “aad” *read* “and.”
242 line 3 from bottom, *before* “vary” *insert* “they.”
245 top line, *for* “Wadi Sikait” *read* “Wadi Shait.”
246 the latitude of Galt el Aguz *is* “23° 32′ 30″” *not* “23° 31′ 30″.”
248 the latitude of Bir Muqur *is* “22° 42′ 26″” *not* “22° 41′ 26″.”
253 top line, *for* “Mesah” *read* “Meisah.”
259 line 17 from bottom, *for* “Dib” *read* “Dif.”
263 line 8 from top, *for* “section” *read* “sections.”
273 top line, *for* “sprinking” *read* “sprinkling.”
278 last line, *for* “XXI” *read* “XXII.”
304 line 11 from bottom, *for* “pale” *read* “free.”
304 line 9 from bottom, *for* “forms” *read* “form.”
306 line 7 from top, *for* “44°” *read* “34°.”
310 line 11 from top, *for* “dolorite” *read* “dolerite.”
317 in the description of the figure, insert the word “to” between “altering
333 line 2 from top, *for* “Modergeg” *read* “Mudergeg.”
339 line 13 from top, *for* “resemblance” *read* “semblance.”
341 line 14 from top, *for* “ericite” *read* “sericite.”
342 line 18 from top, *for* “dentritic” *read* “dendritic.”
342 line 5 from bottom, *for* “on” *read* “in.”
346 line 8 from top, *for* “ancient” *read* “ancients.”
351 line 13 from top, *for* “p. 441” *read* “p. 341.”
353 line 12 from top, *for* “Magnetite” *read* “Magnesite.”
358 line 4 from top, *for* “XV” *read* “XX.”
360 line 16 from top, *for* “XX” *read* “XV.”
366 footnote, line 5 from bottom, *for* “Megwell” *read* “Megwel.”
367 footnote, line 3 from bottom, *for* “or” *read* “of.”
387 line 18 from top, *for* “Mitab” *read* “Mitba.”
390 line 14 from bottom, *for* “Balamhandeit” *read* “Belamhandeit.”

392 line 18 from top, *for* “Mokhatatat” *read* “Mukhatatat.”
392 line 25 from top, *for* “Kukhit” *read* “Mukhit.”
393 second column, line 16 from top, *for* “Kalabat” *read* “Kalalat.”
394 last line, *for* “Zebeged” *read* “Zeberged.”

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the Geological Museum, Public Works Ministry Gardens, Cairo, wh

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Khedivial Observatory, Helwân, Bulletins. Nos. 1, 2, 3, 4, an

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Work of the Laboraries.—A Report on the, by A. Lucas, F.I.

- Changes in the Corrigenda have been made.
- The Corrigenda has been moved from: before the frontispiece to
- pg xi Changed: Hadal Aweih Meisah to: Aweib
- pg 30 Changed: very greath depth to: great
- pg 33 (Footnote 58) Changed: Upsala, 1188-1885 to: 1881-1885
- pg 49 (Footnote 72) Changed: the altitude of the ines to: lines
- pg 60 in the row of Field point 472 Changed: Wdi Abu Hireiq to:
- pg 67 second table, first row, second column Changed: 36″ 38′ 5
- pg 91 Changed: the ruins of Darabib to: Darahib
- pg 107 Changed: about latitude 24° 15 to: 24° 15′
- pg 121 Changed: Gebel Balamhandeit to: Belamhandeit
- pg 142 Changed: to joins Wadi Hasium to: join
- pg 194 Changed: longitude 34″ 40′ 34″ to: 34° 40′ 34″
- pg 204 Changed: latitude 23″ 25′ 19″ to: 23° 25′ 19″
- pg 205 Changed: longitude 34″ 59° 19′ to: 34° 59′ 19″
- pg 206 Changed: object in the lanscape to: landscape
- pg 228 Changed: foot of the mountian to: mountain
- pg 254 Changed: formed of while granitic sand to: white
- pg 292 (caption of Fig. 23) Added: *g*, before: ground mass
- pg 300 (caption of Fig. 30) Changed: *nb*, hornblende to: *hb*
- pg 300 (caption of PLATE XXIV.) Changed: **FINE-QRAINED GA**
- pg 311 (caption of Fig. 41) Changed: + 40 to: × 40
- pg 312 (caption of Fig. 42) Changed: + 40 to: × 40
- pg 326 Changed: are belived to represent to: believed
- pg 327 (caption of Fig. 49) Changed: [12,123] to: [12,128]

- pg 353 (Footnote 137) Changed: sometimes missspelt to: missp
- pg 380 Changed: [Bir] „ Qababit to: Qabatit
- pg 391 removed a duplicate entry of: "[Wadi] „ [Kreiga] „ diabase
- pg IV Changed: to the Pacific por-s to: ports
- Minor changes in punctuation have been done silently.
- Other spelling inconsistencies have been left unchanged.
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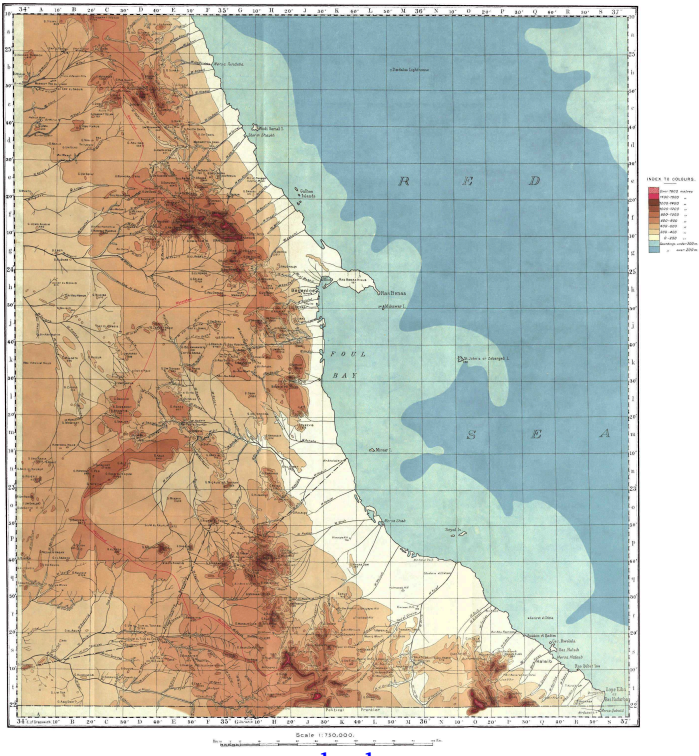
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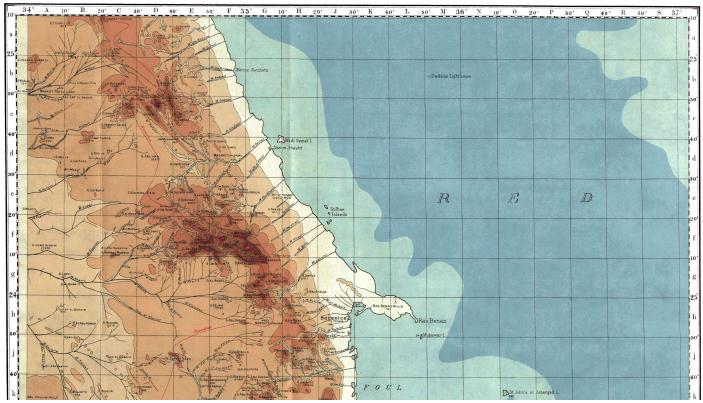
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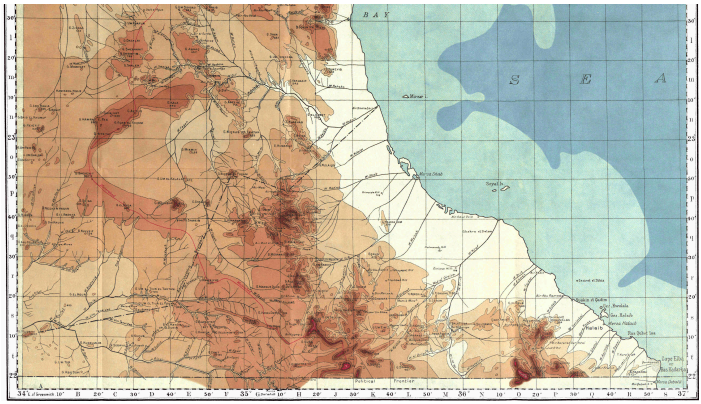
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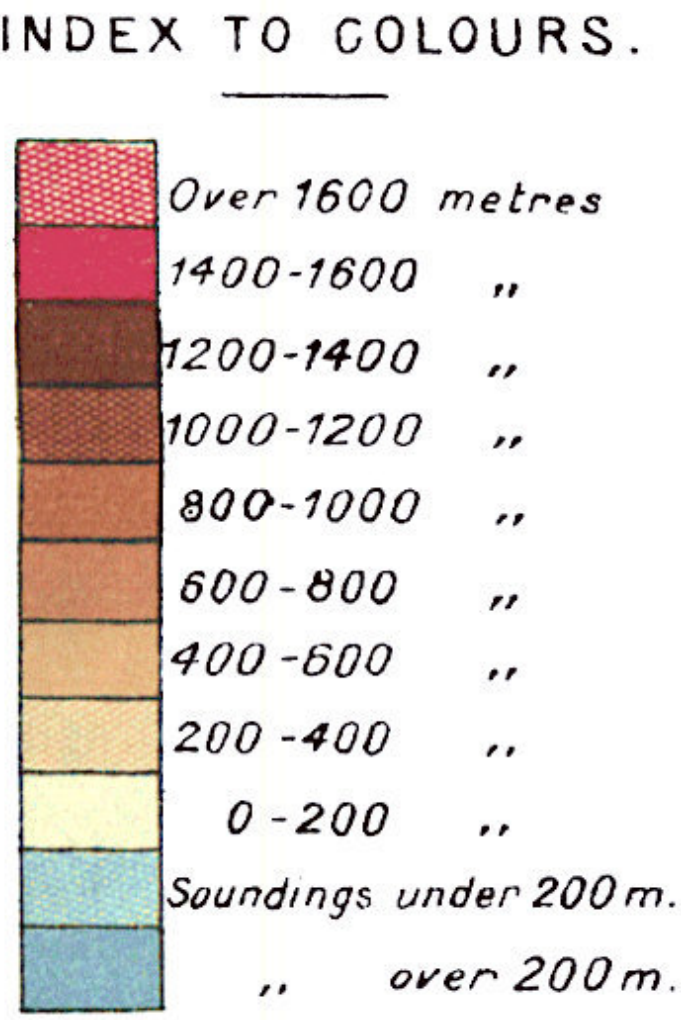
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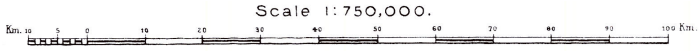
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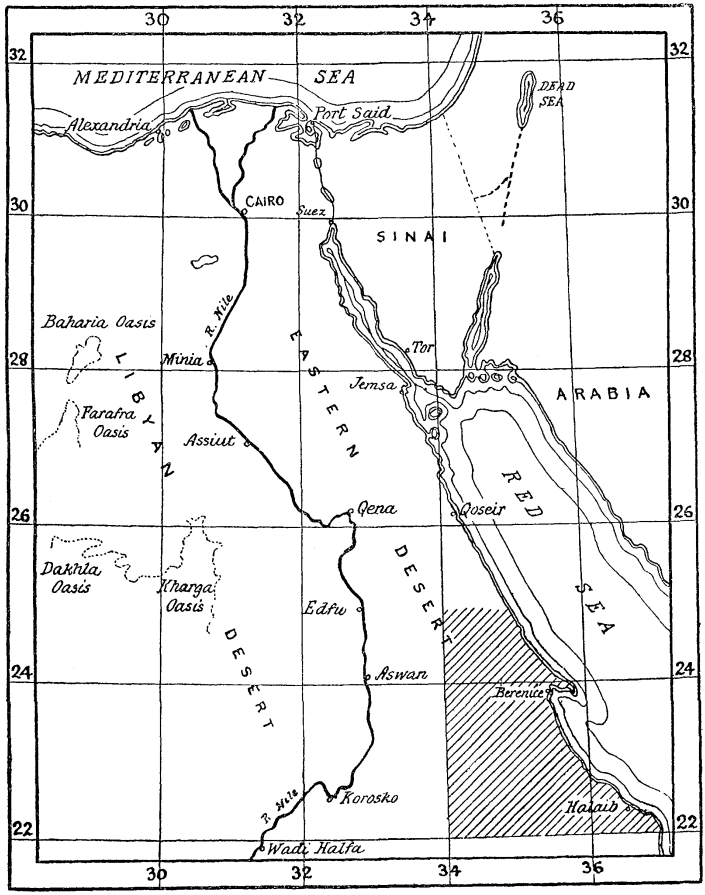
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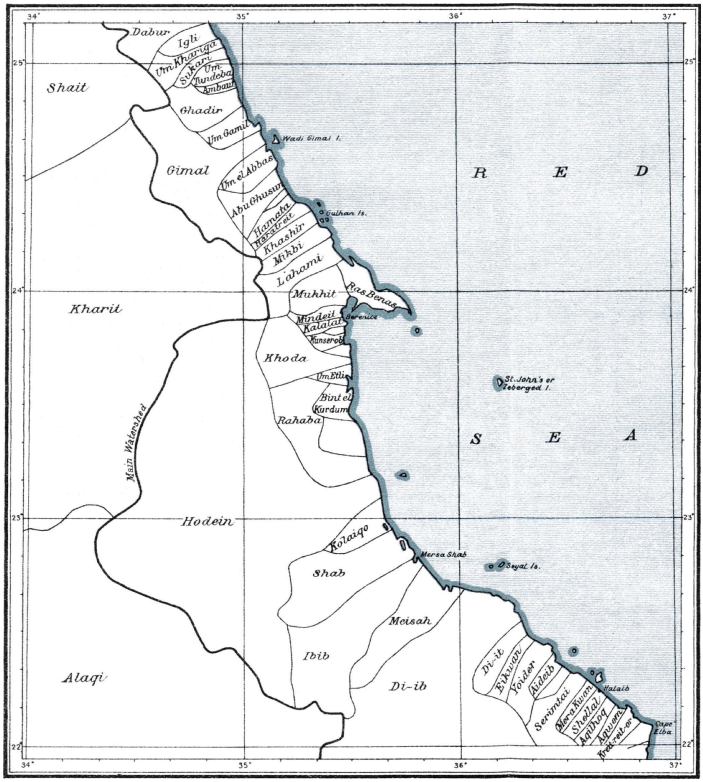
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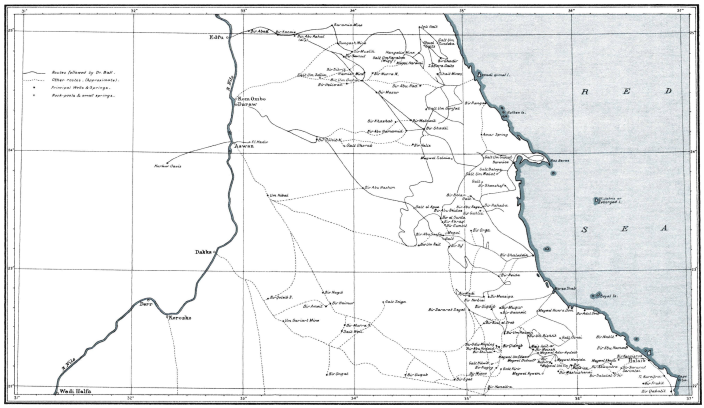
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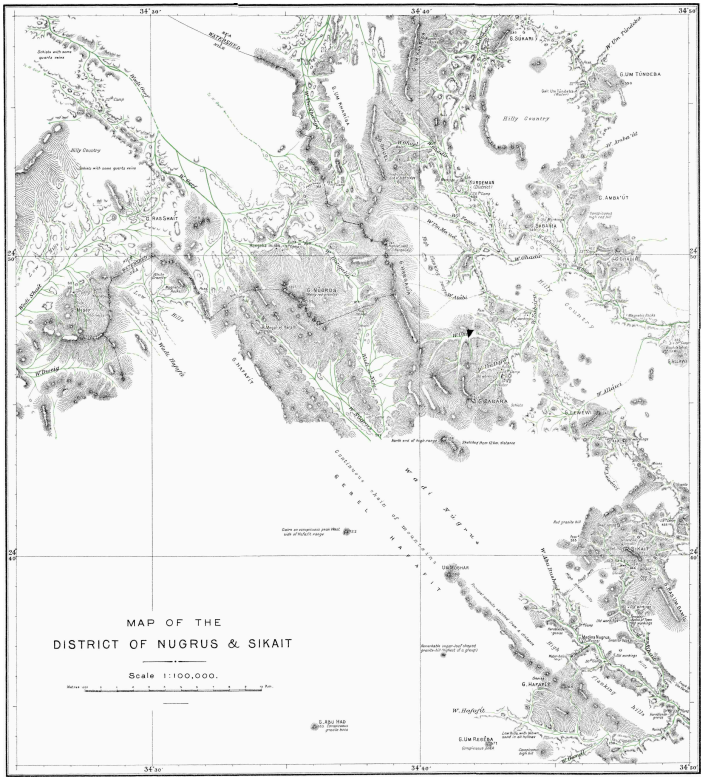
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Abu Ghusun
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Meisah
Ibib
Di-ib
Alaqi
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Foudeh
Abdeh
Sennatai
Mersa Kuwai
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Um Dwig
Agaiera
Wadi Abu Ramad
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Ras Elba
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S E A
St. John's or Zebergad I.
Seyal Is.
Sulphan Is.

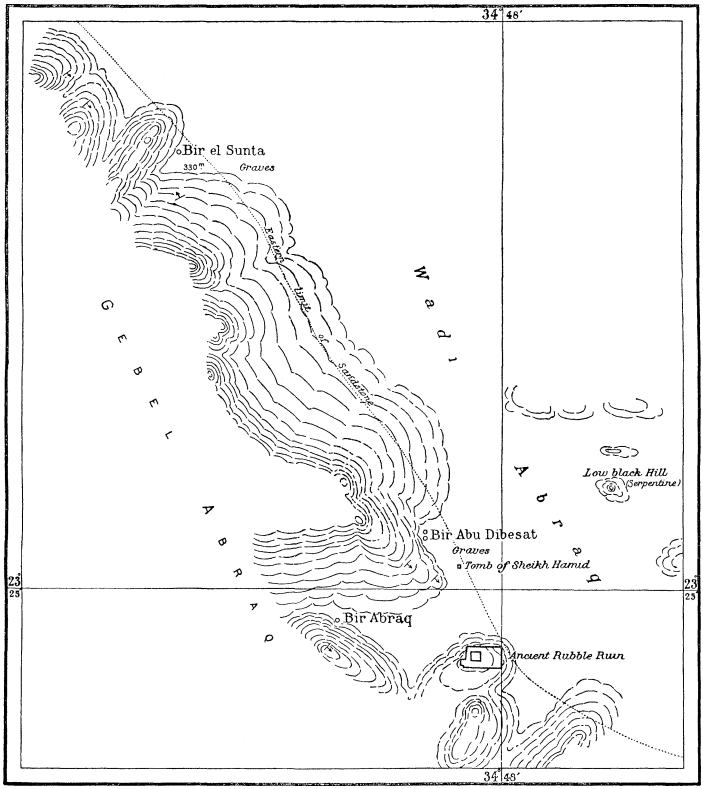
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Edfu
Kom Ombo
Aswan
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Kharga
Farafra
Wadi Halfa
R E D
S E A

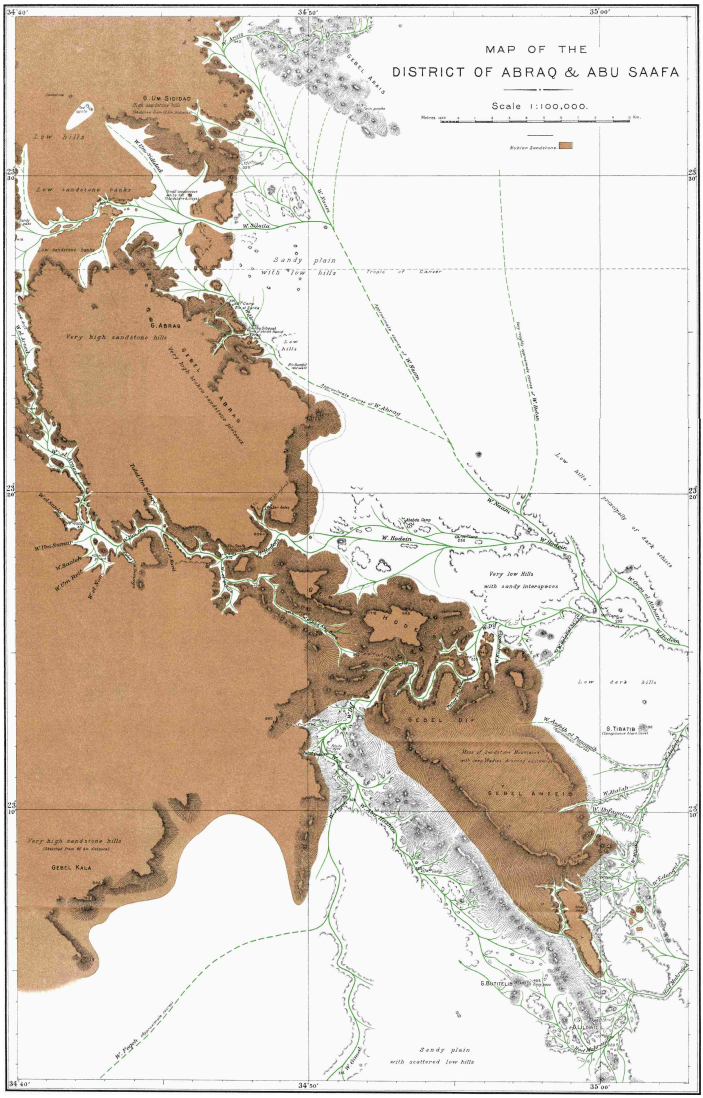
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MAP OF THE
DISTRICT OF NUGRUS & SIKAIT
Scale 1:100,000.
Hilly Country
G. NUGRUS
G. SIKAIT
G. GARARA
G. AMBUT
G. HASHAIT
G. MARAFIQ
G. ABU HAD
34°30'
34°40'
34°50'
24°
24°10'

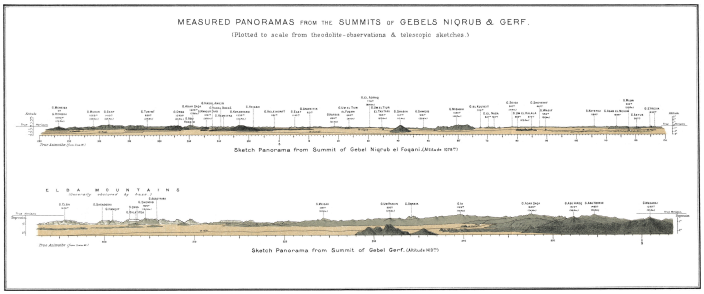
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34° 48'
Bir el Sunta
330m
Graves
Eastern Limit of Sandstone
Wadi
Abrad
Low black Hill
(Serpentine)
Bir Abu Dibesat
Graves
Tomb of Sheikh Hamid
GEBEL ABRAD
Bir Abraq
Ancient Rubble Ruin
23° 23'
34° 45'

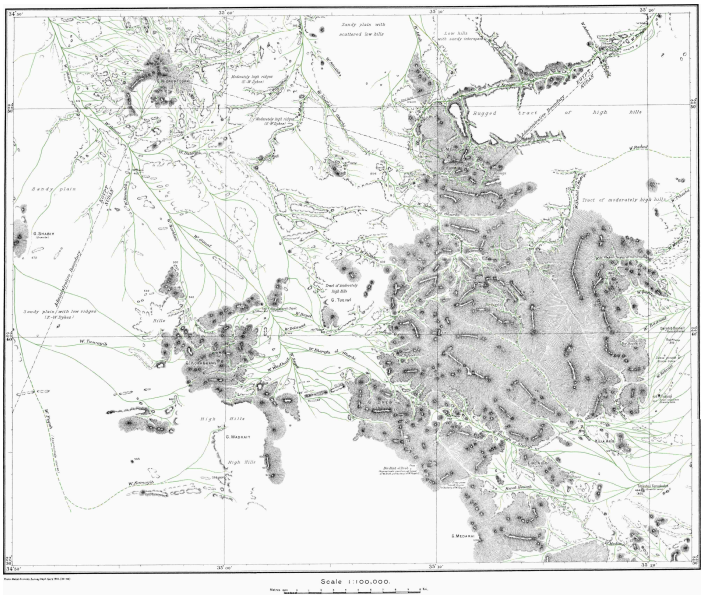
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MAP OF THE
DISTRICT OF ABRAQ & ABU SAAFA
Scale 1:100,000.
Nubian Sandstone
G. Um Sidiqad
Low hills
Low sandstone banks
Sandy plain
with low hills
G. Abraq
Very high sandstone hills
Very low Hills
with sandy interspaces
Gebel Kala
Gebel Amreig
Sandy plain
with scattered low hills

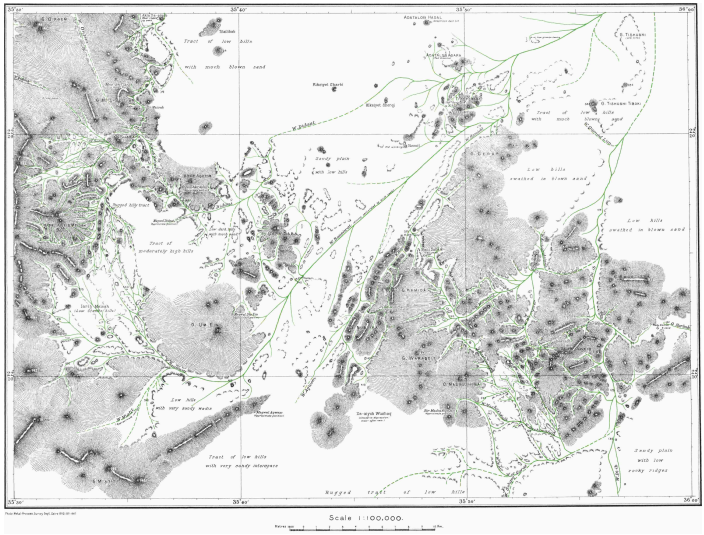
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MEASURED PANORAMAS FROM THE SUMMITS OF GEBELS NIQRUB & GERF.
(Plotted to scale from theodolite-observations & telescopic sketches.)
Sketch Panorama from Summit of Gebel Niqrub el Foqani.
ELBA MOUNTAINS
Sketch Panorama from Summit of Gebel Gerf.

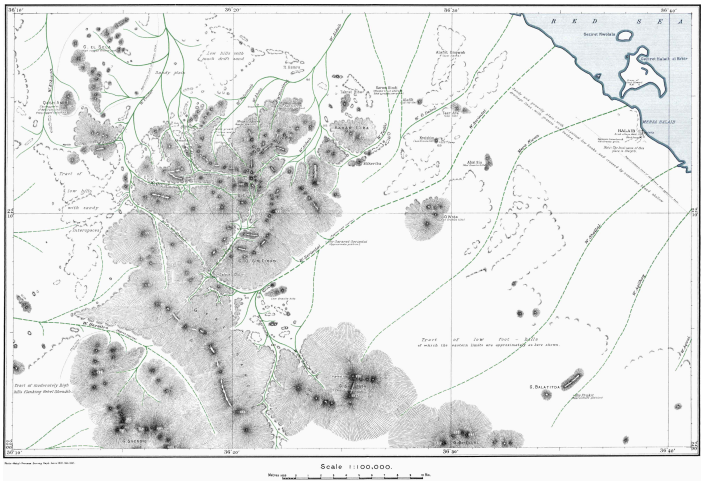
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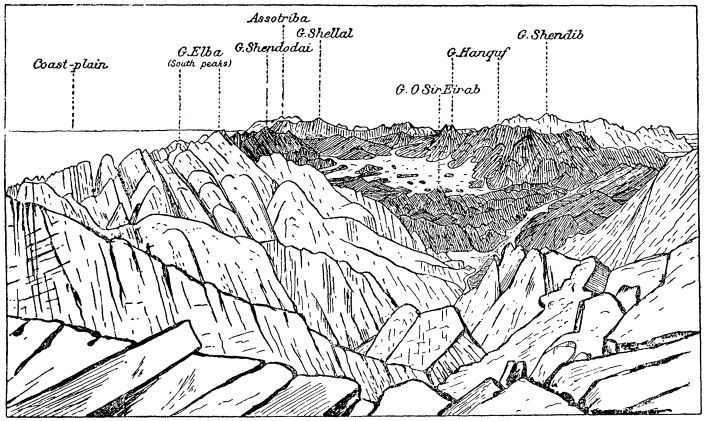
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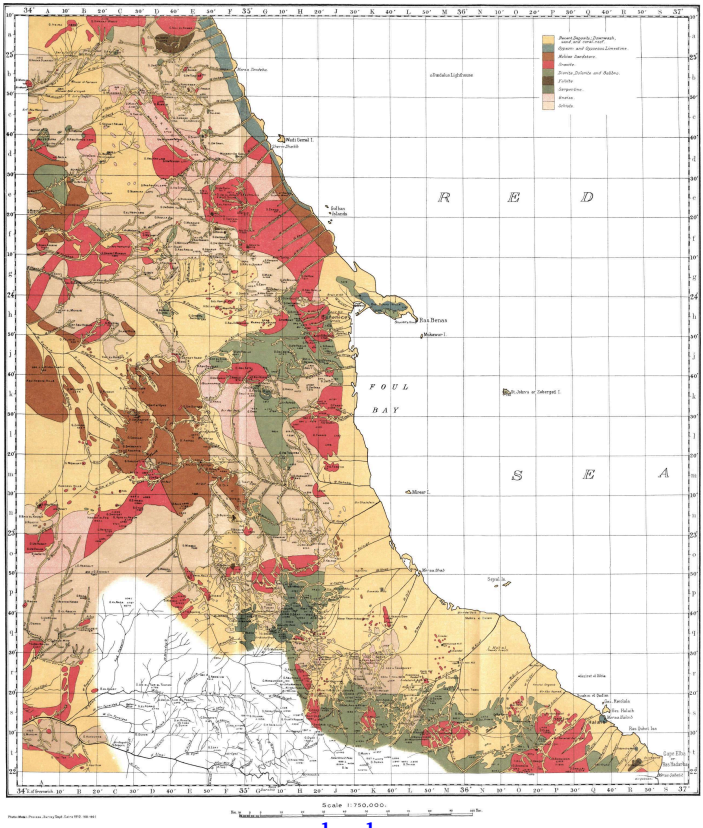
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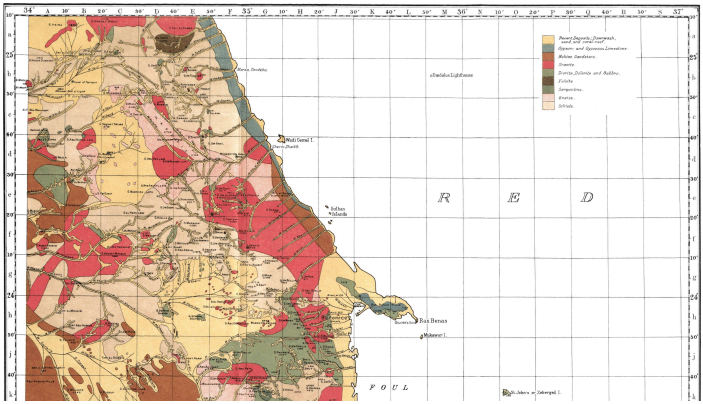
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Assotriba
G. Shellal
G. Elba
(South peaks)
G. Shendodai
G. Hangif
G. Shendib
Coast-plain
G. O Sir Eivab

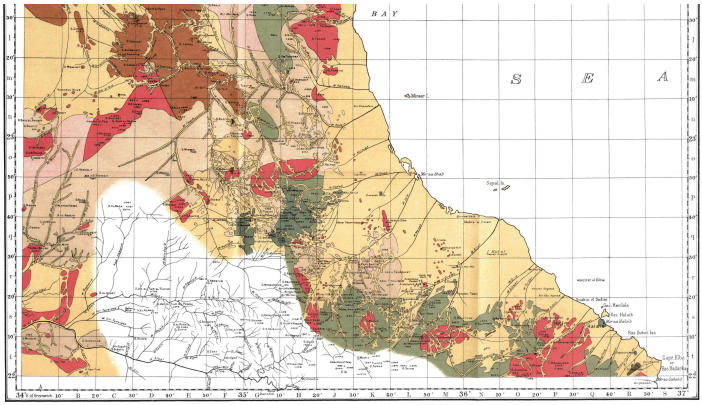
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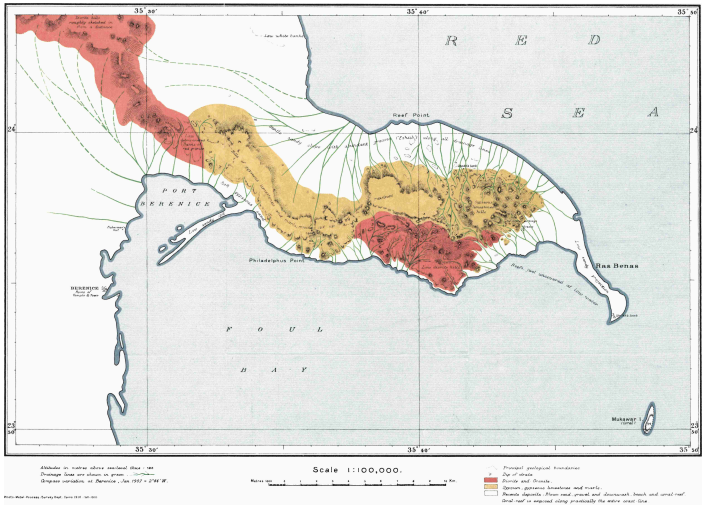
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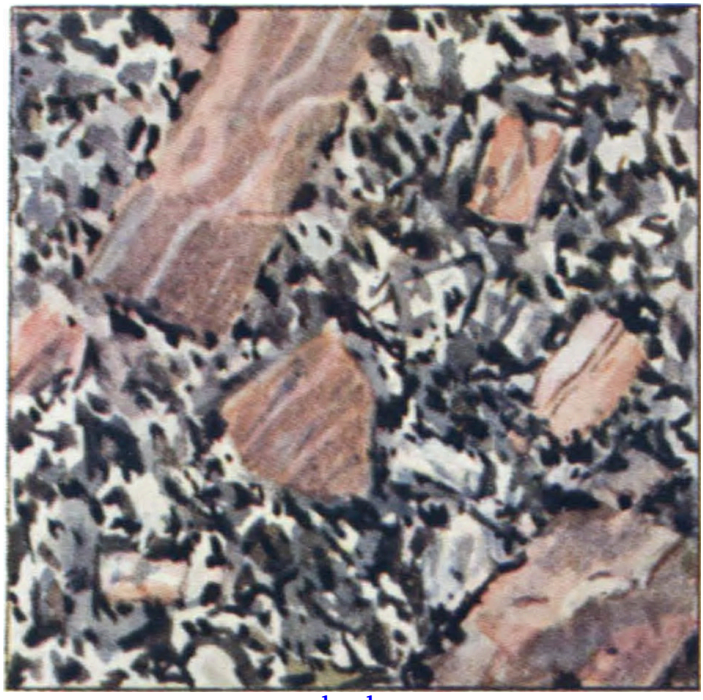
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R E D
S E A
Reef Point
PORT
BERENICE
Philadelphus Point
Ras Benas
F O U L
B A Y
Scale 1:100,000.

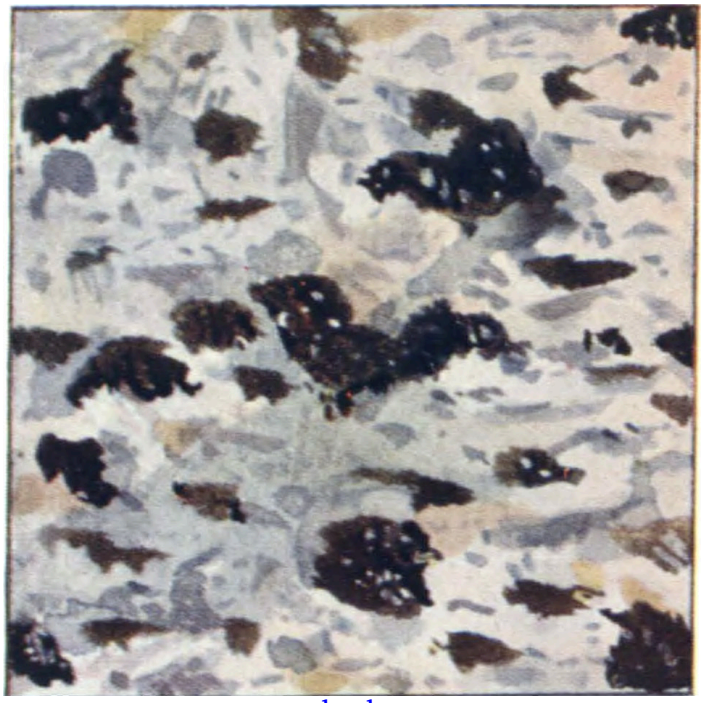
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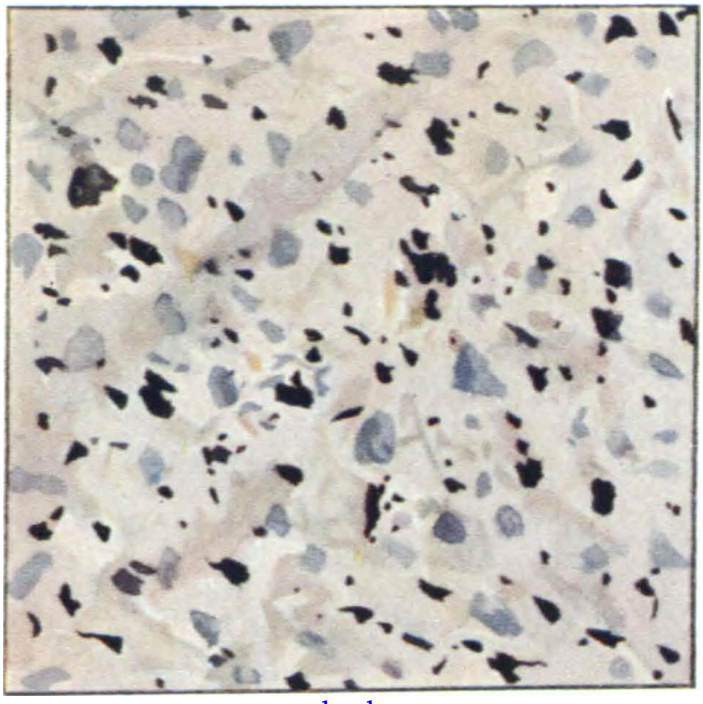
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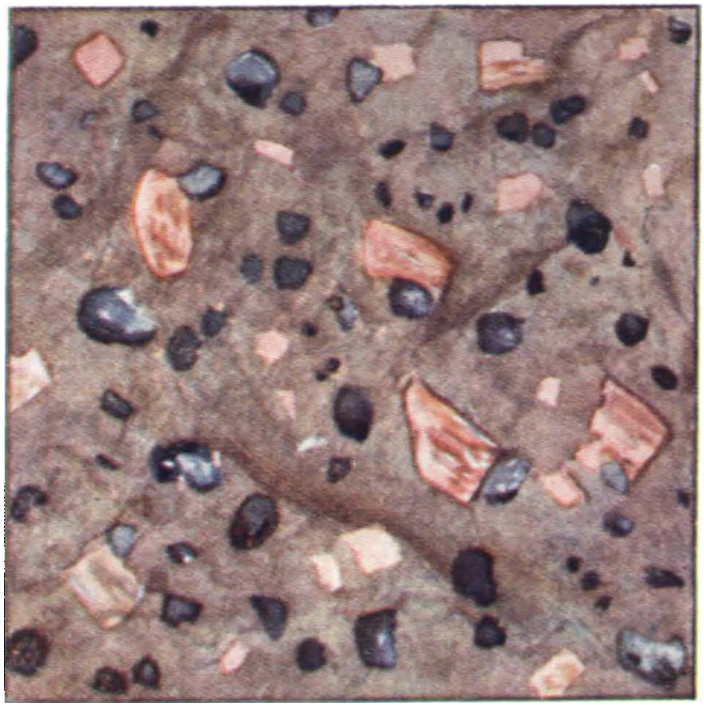
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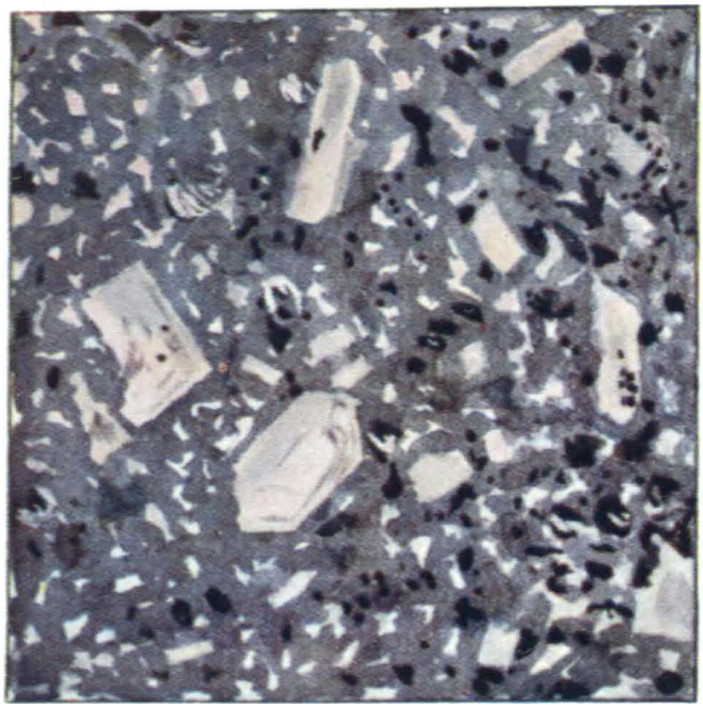
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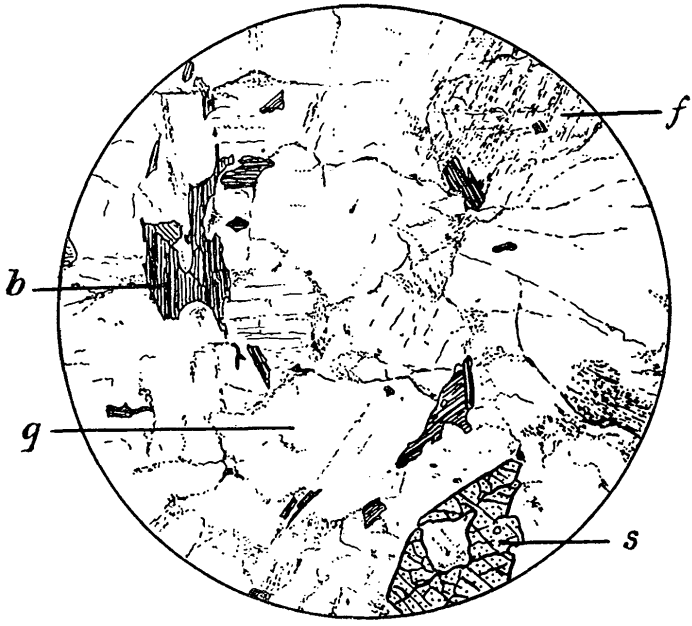
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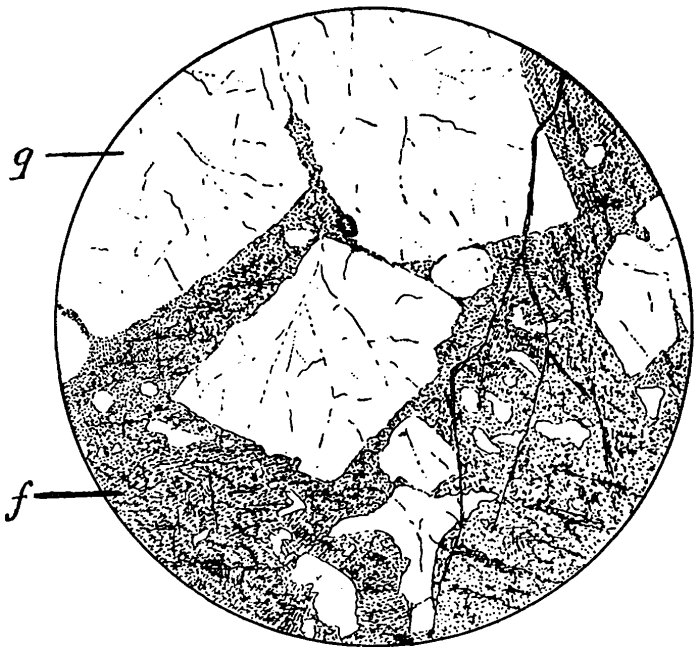
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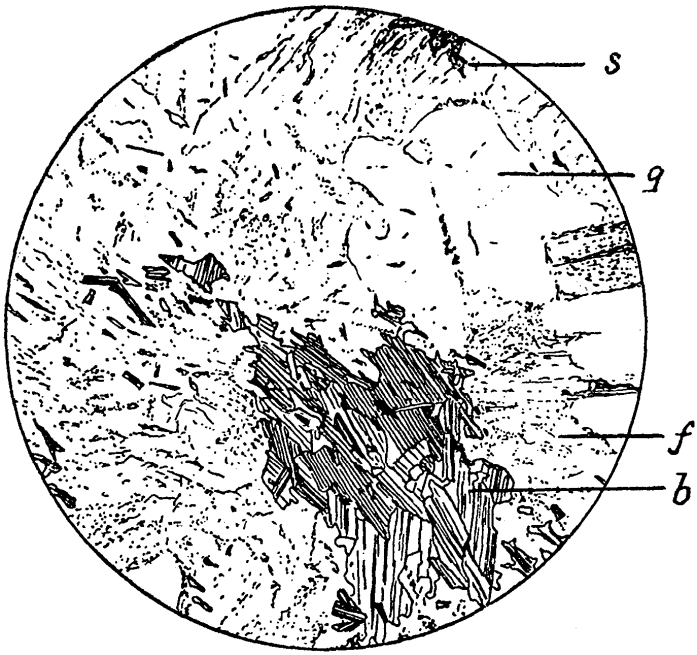
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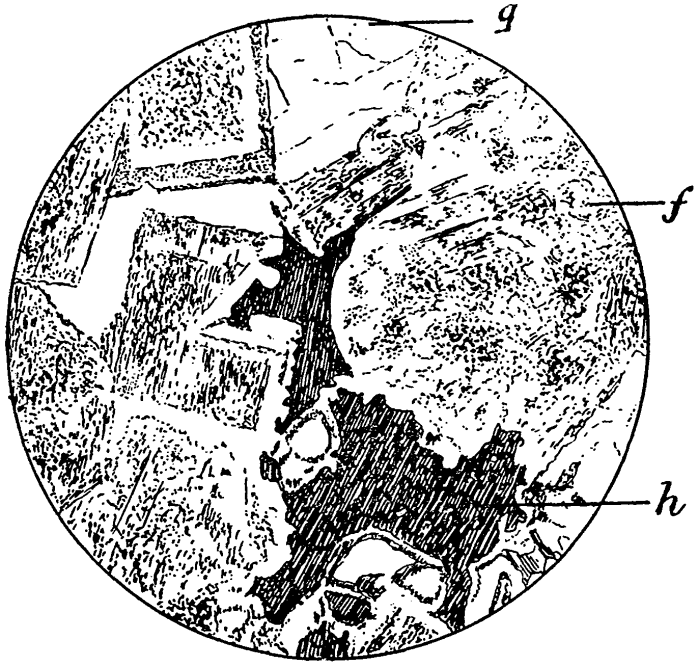
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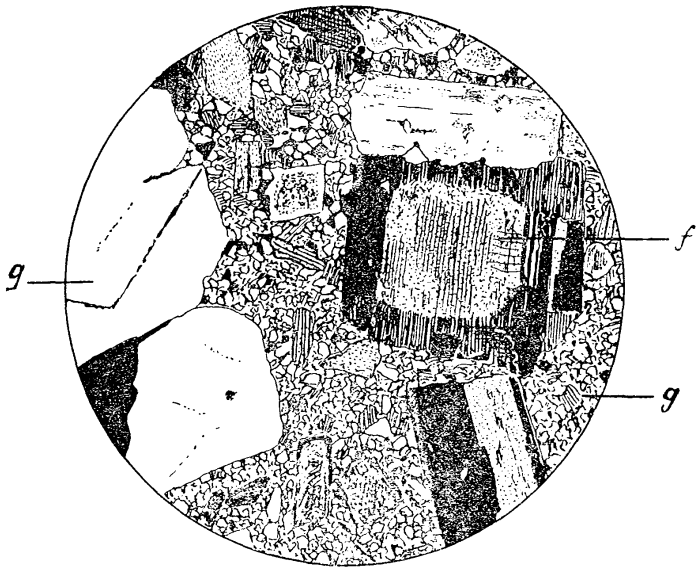
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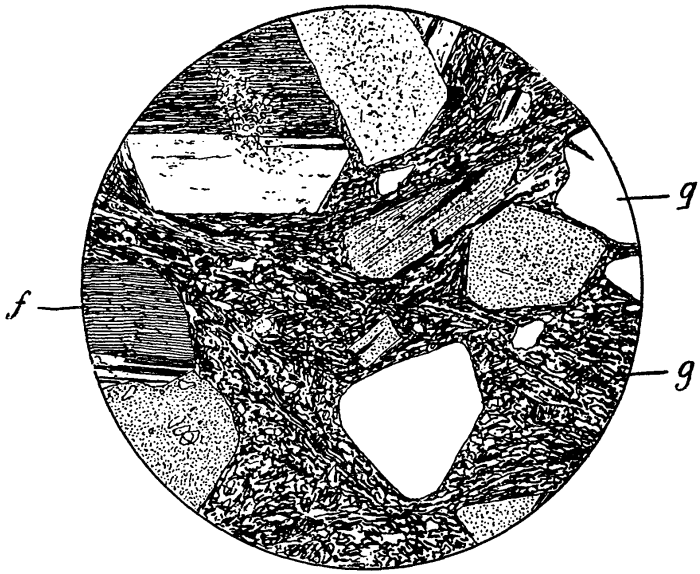
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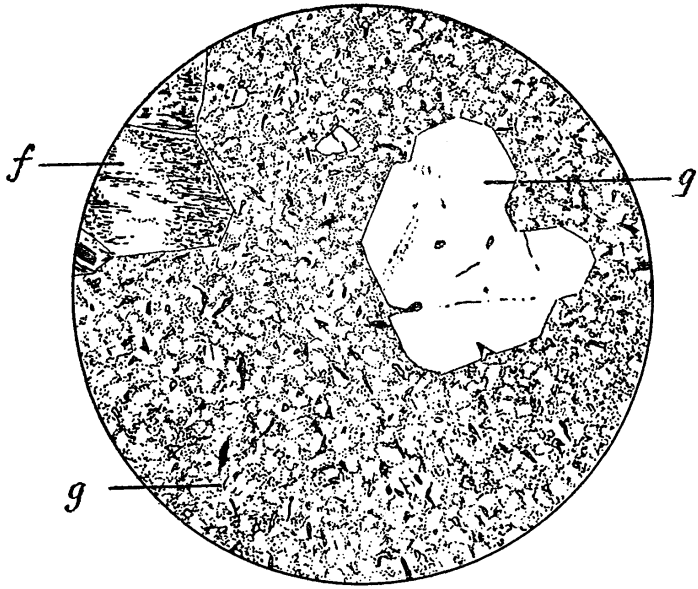
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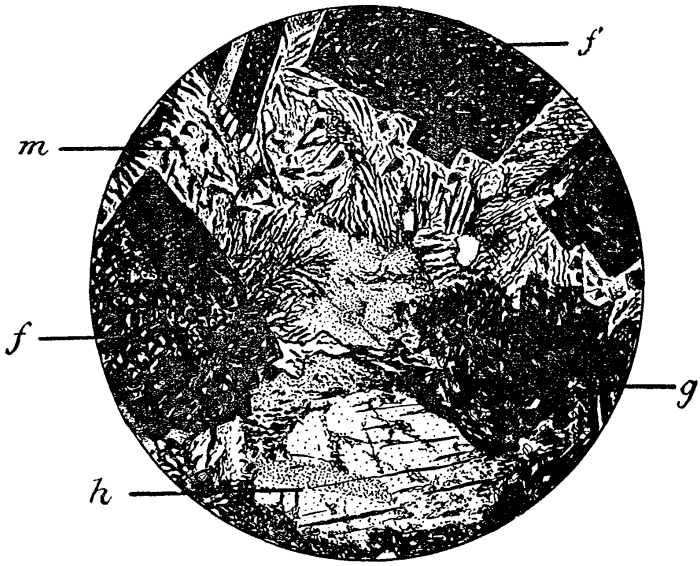
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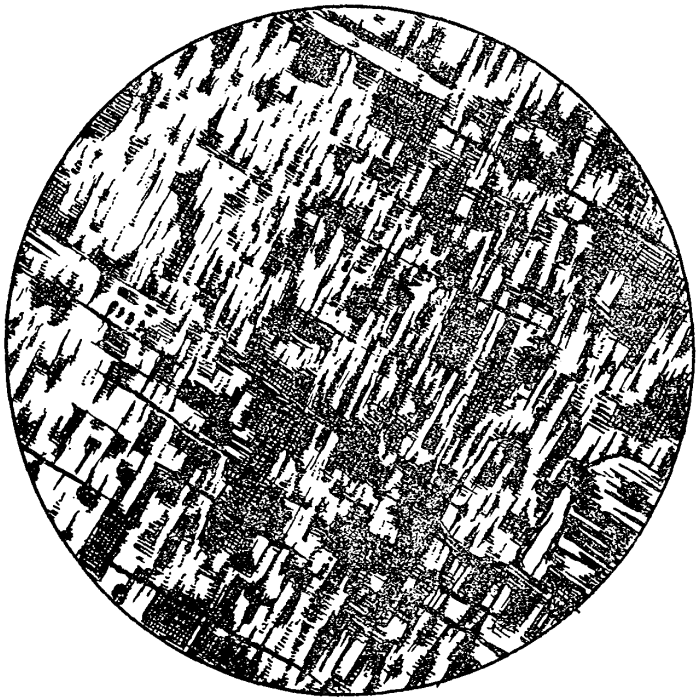
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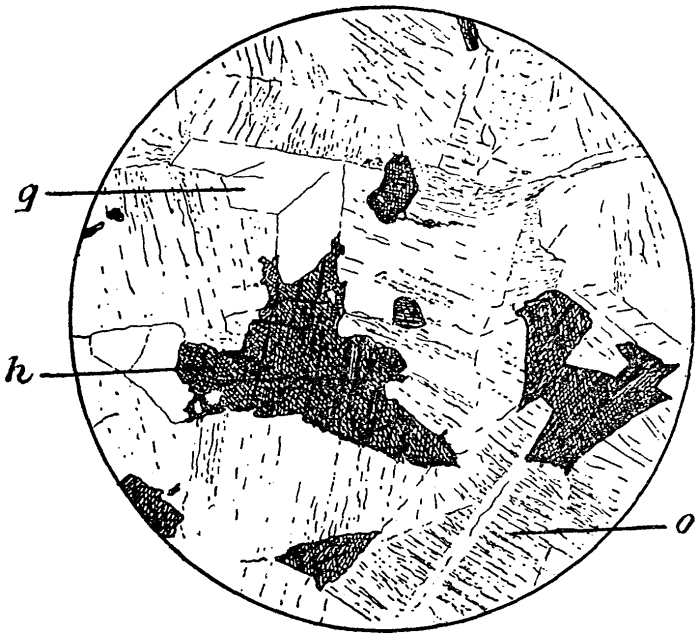
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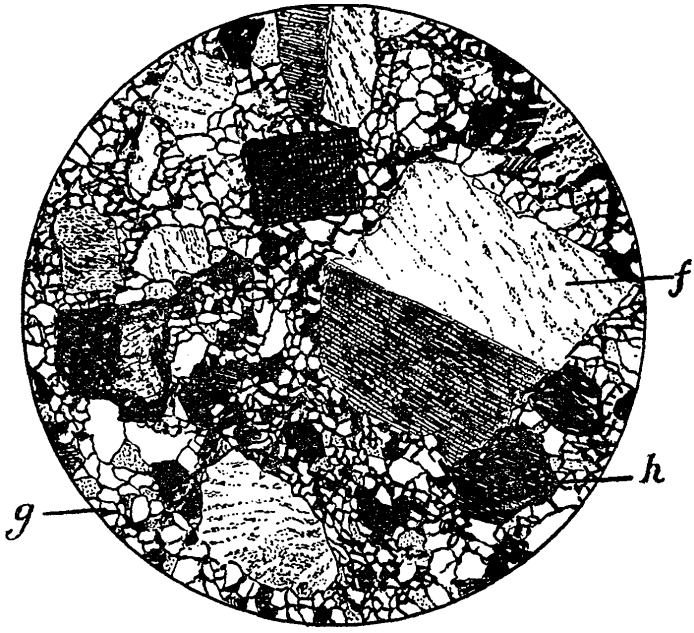
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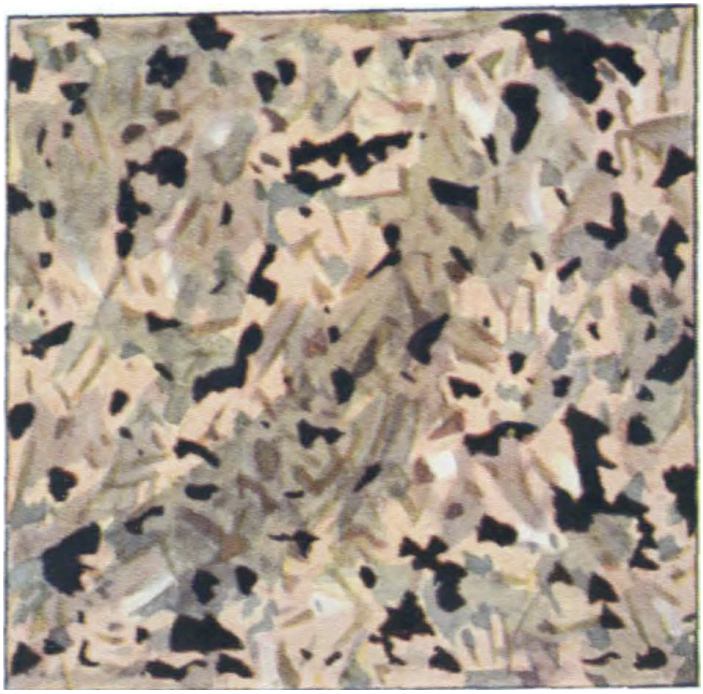
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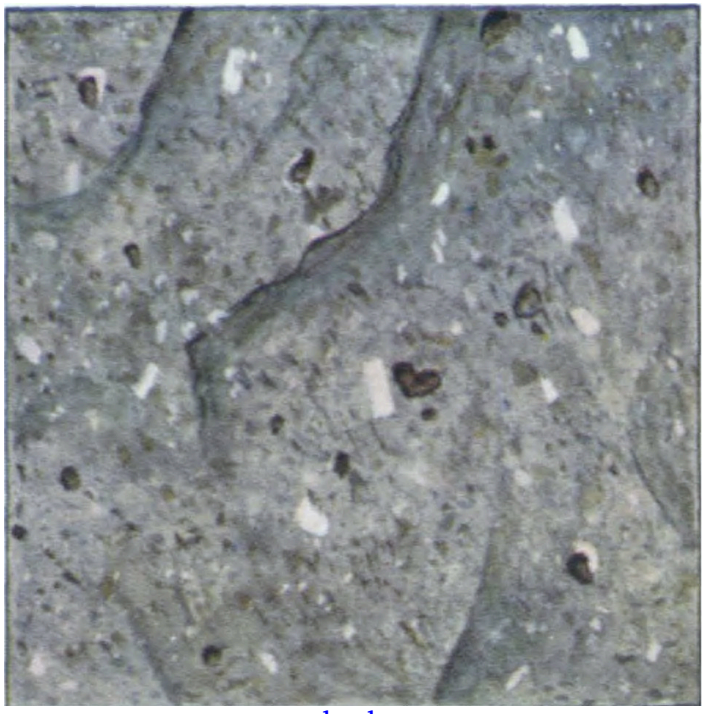
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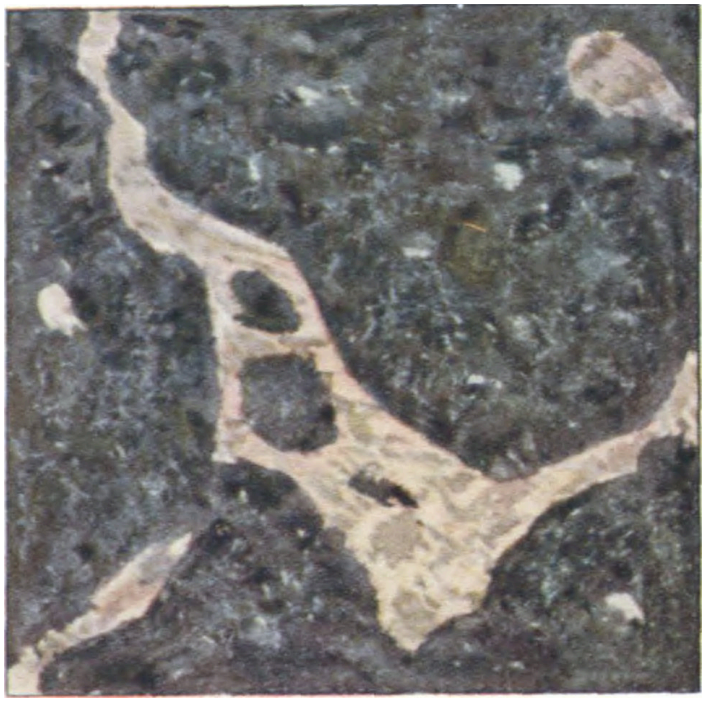
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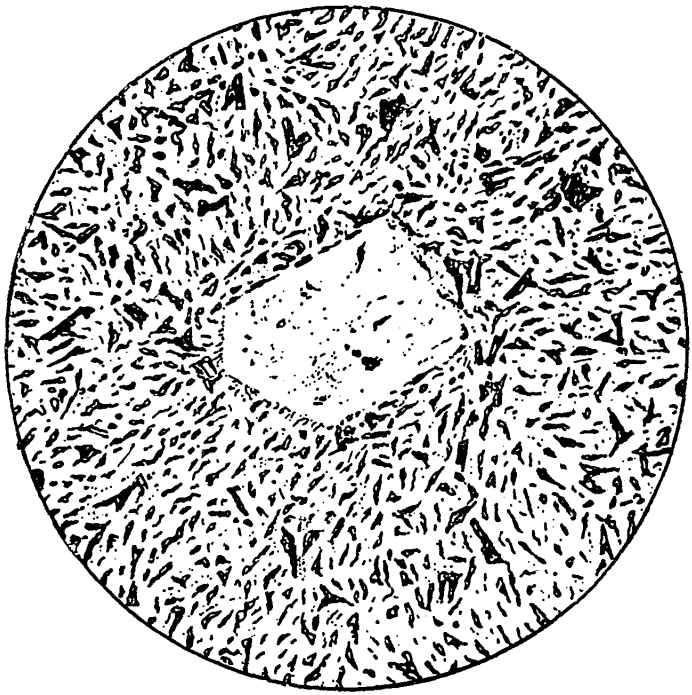
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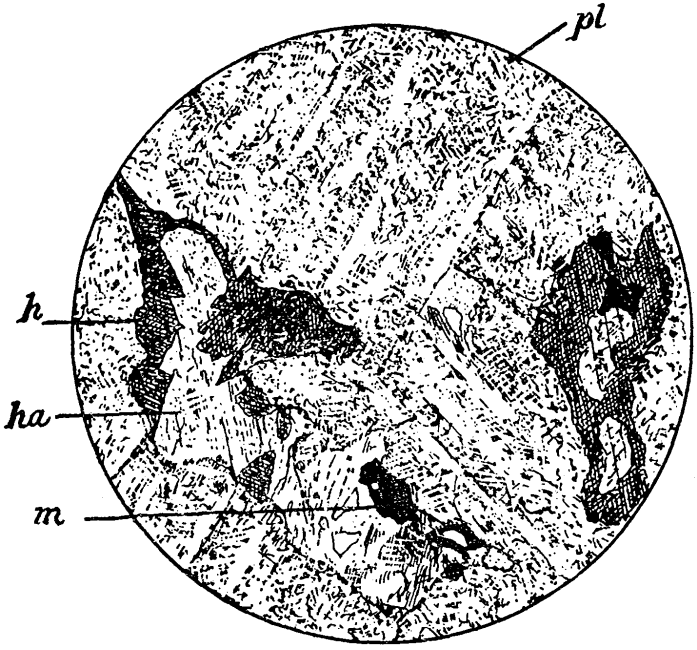
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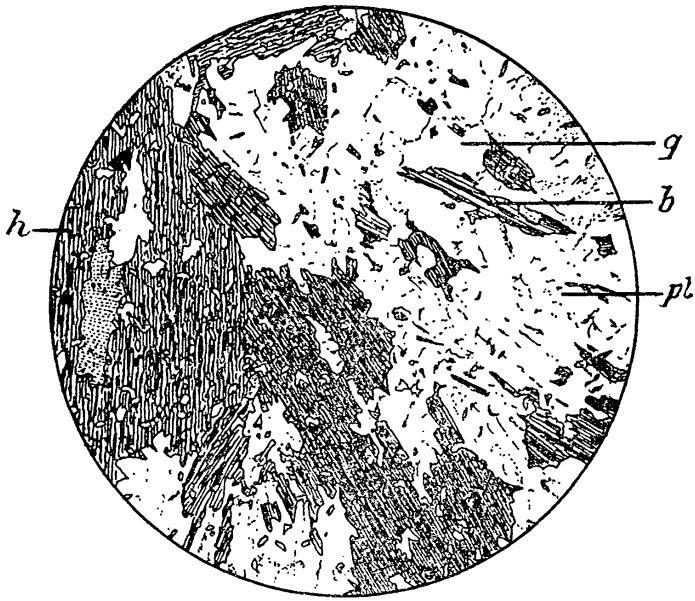
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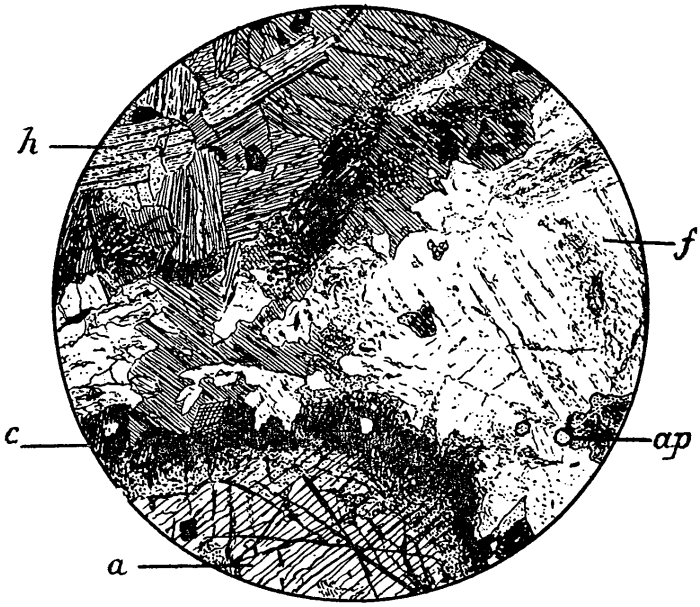
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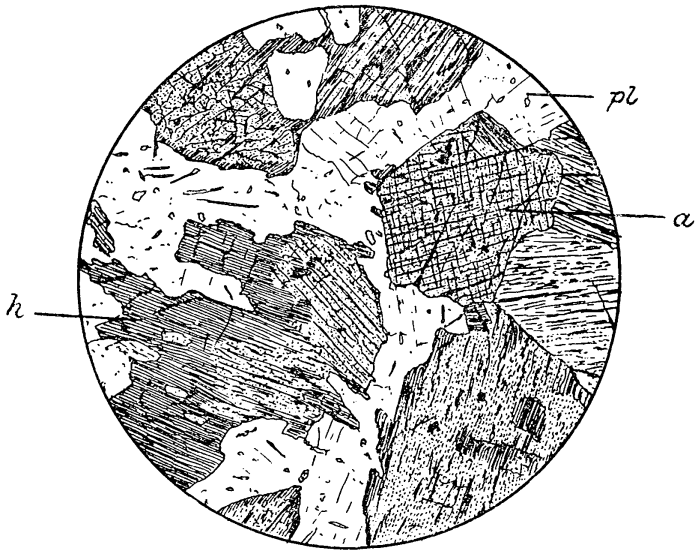
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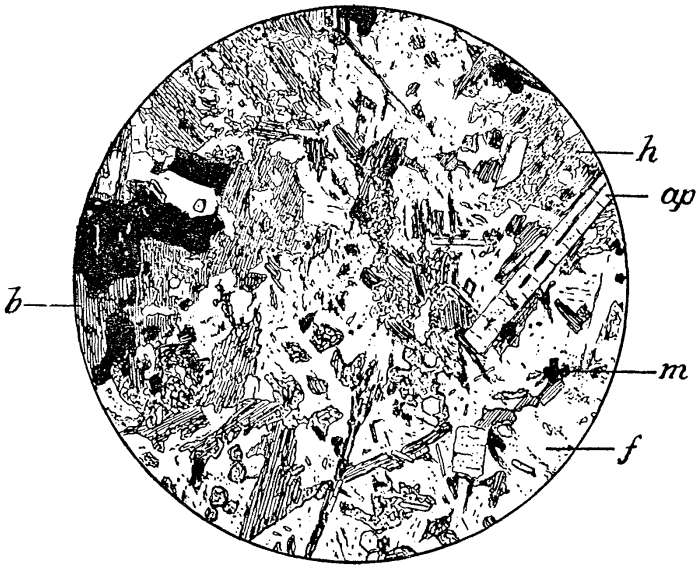
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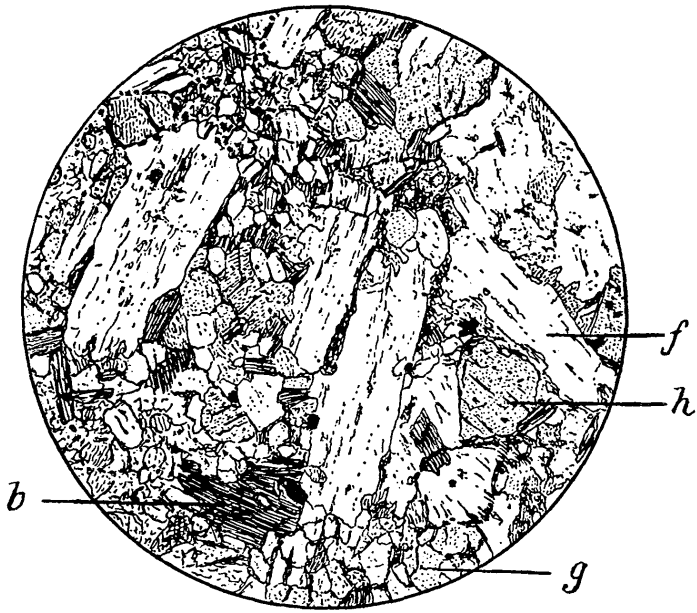
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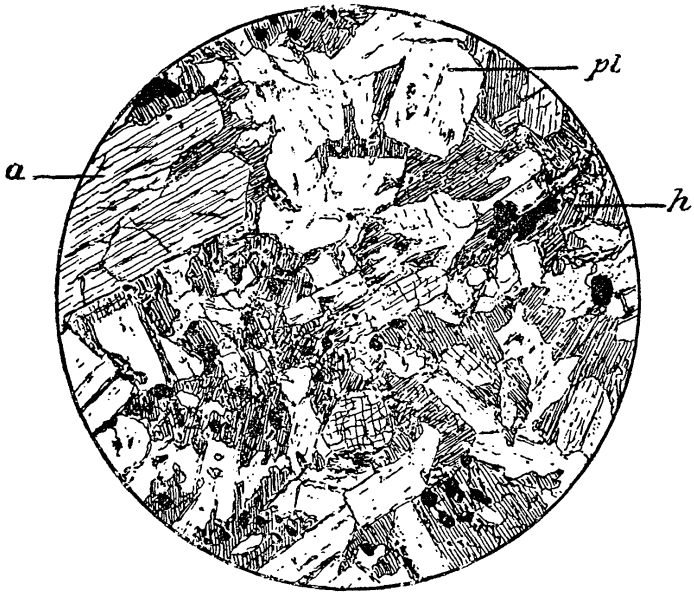
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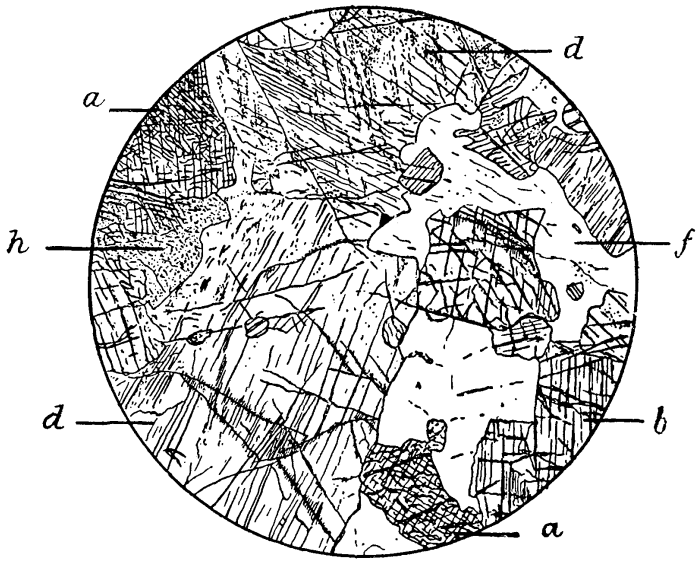
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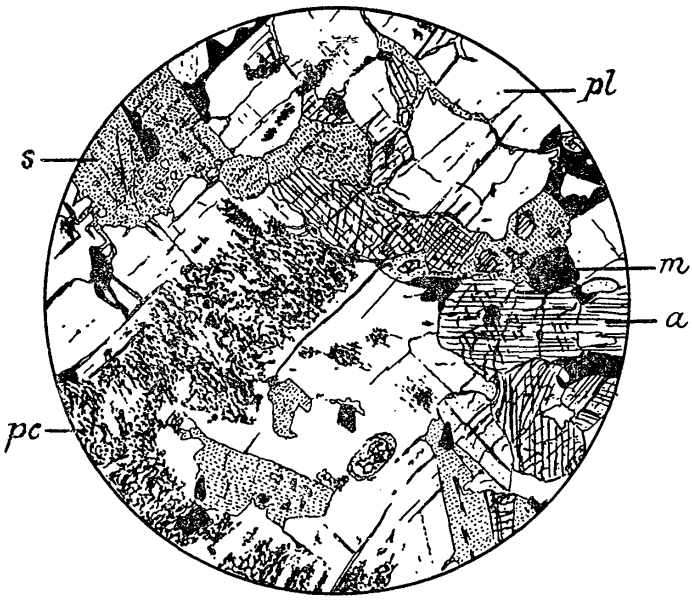
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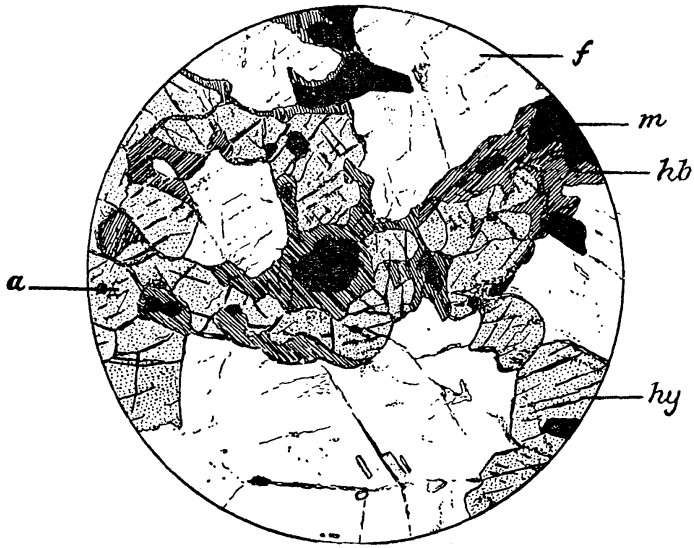
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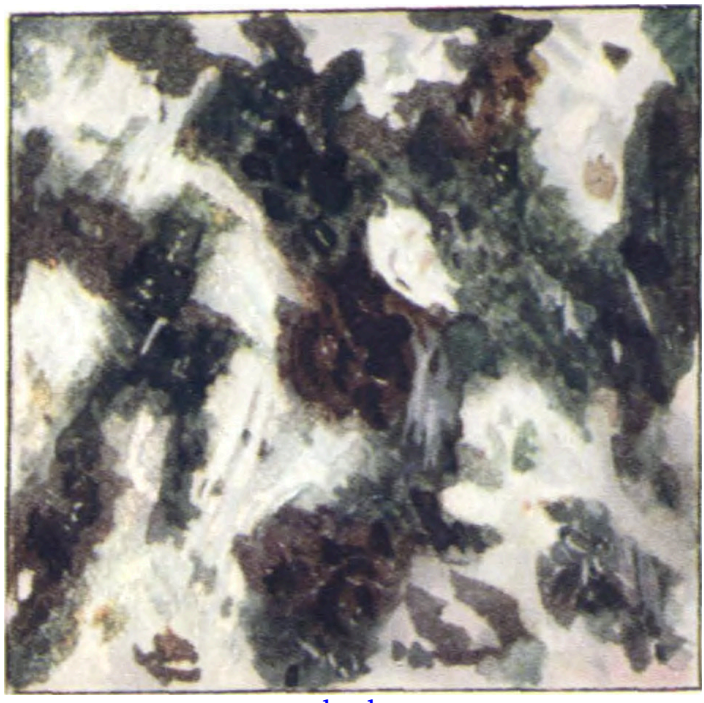
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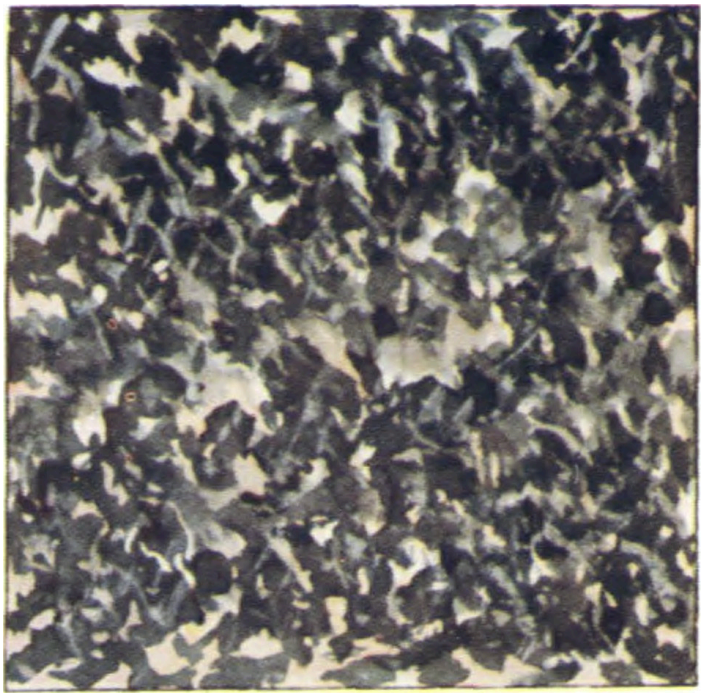
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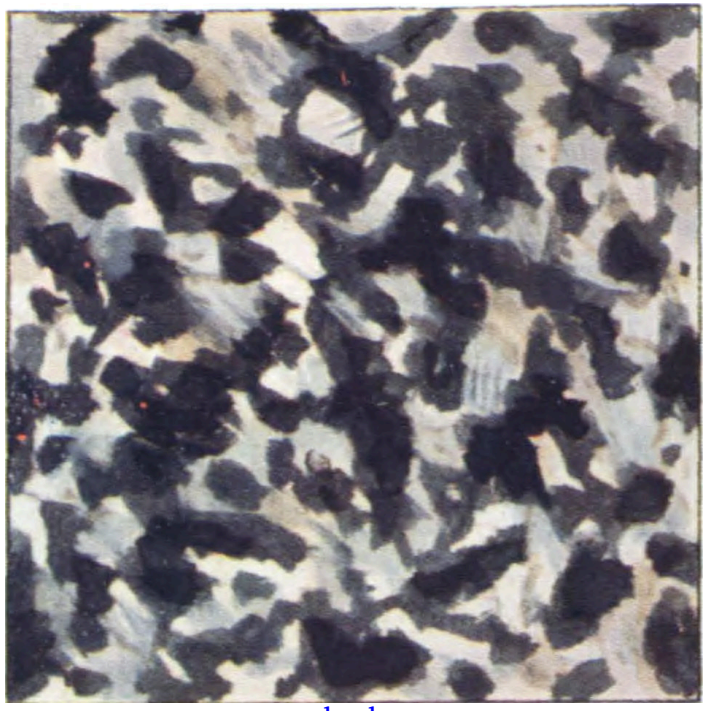
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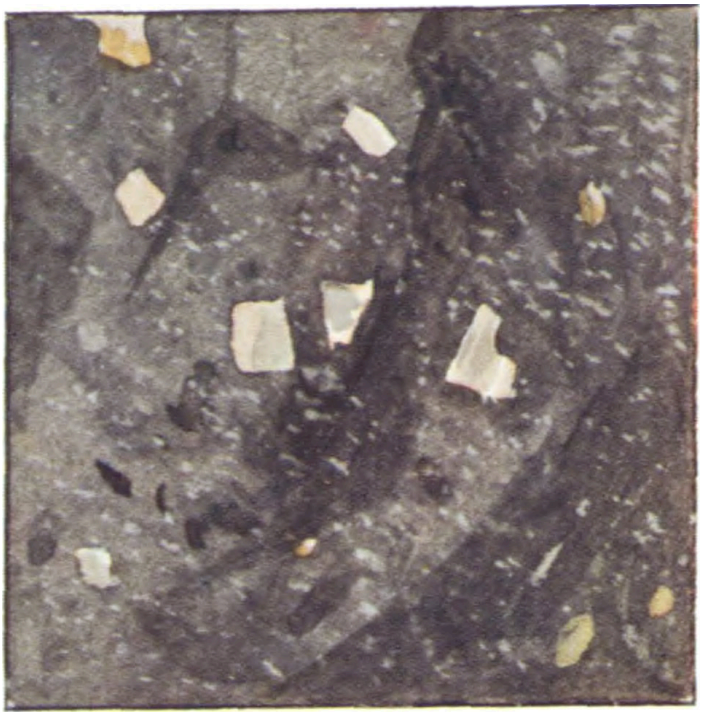
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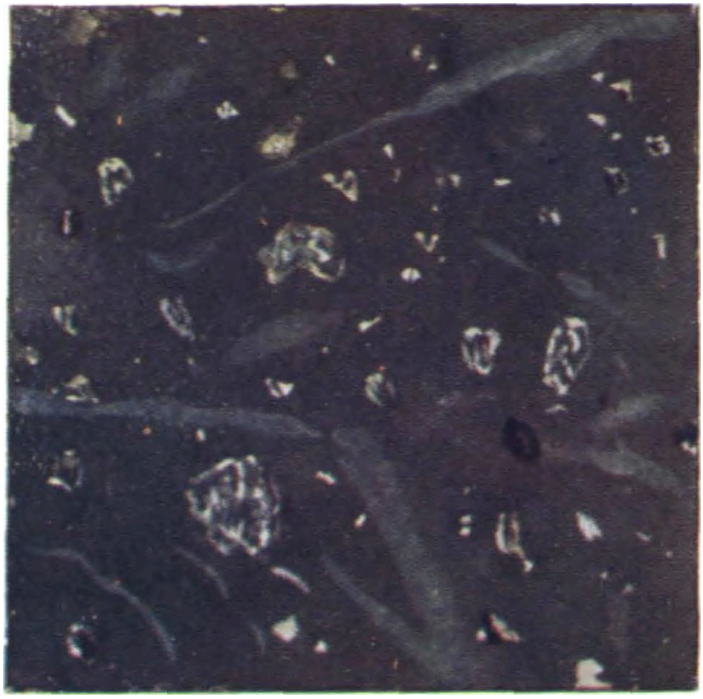
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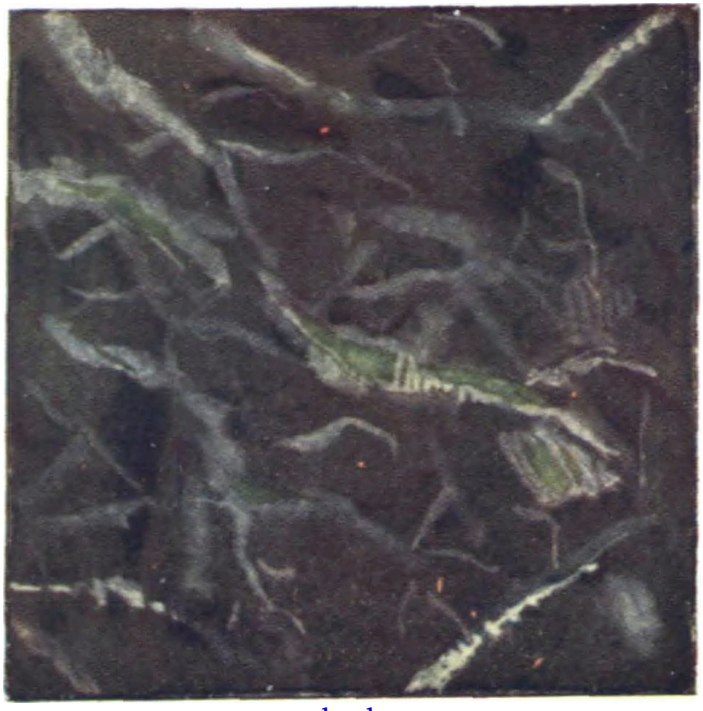
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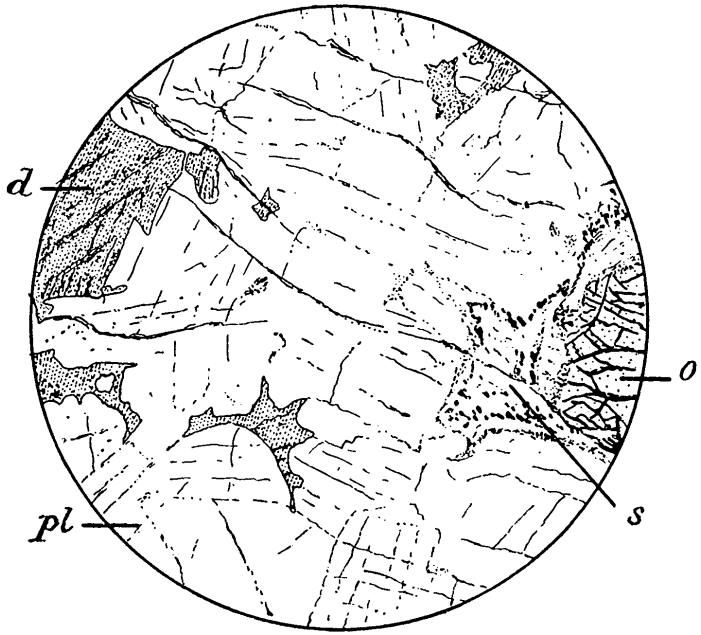
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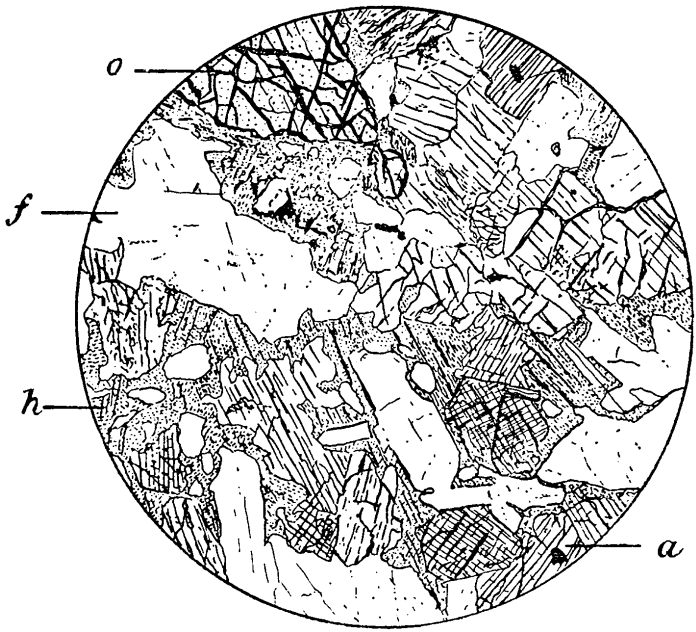
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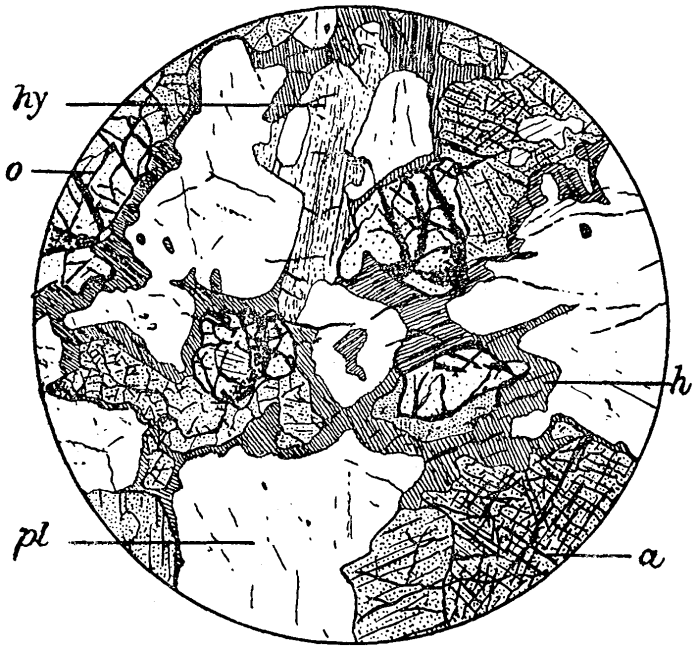
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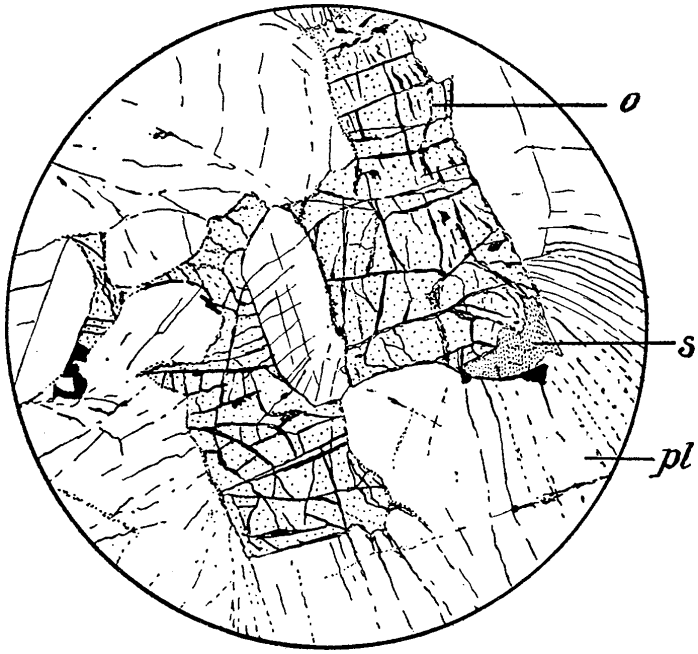
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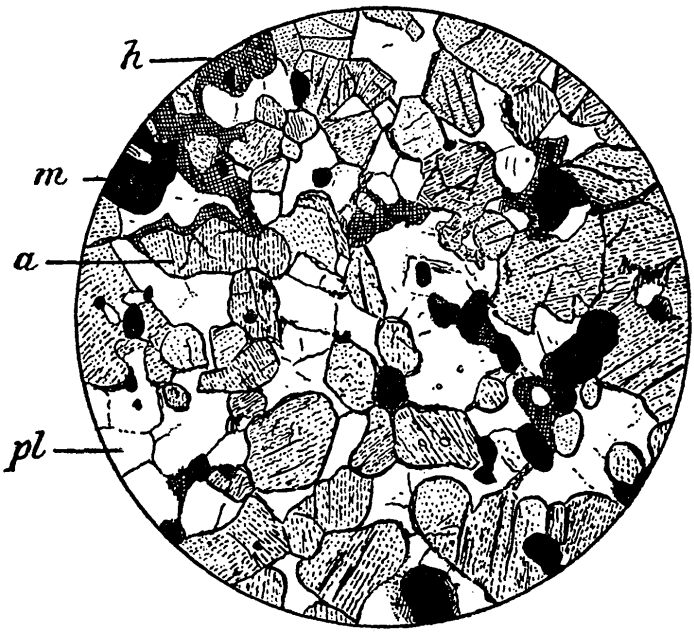
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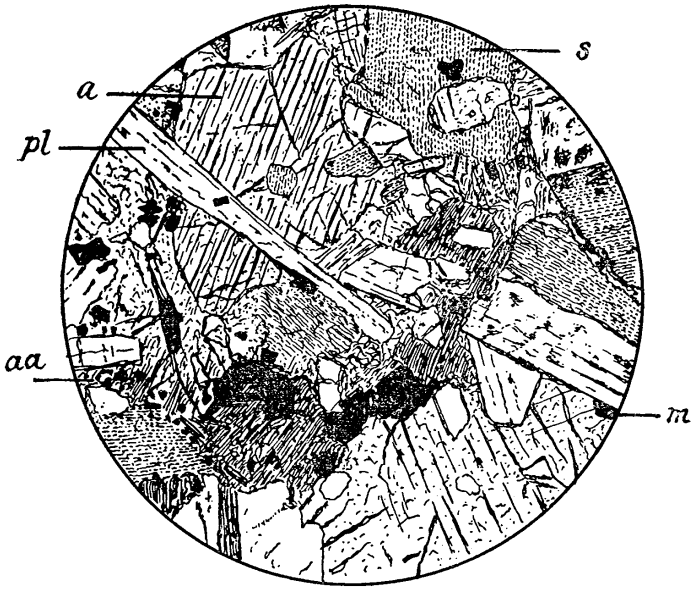
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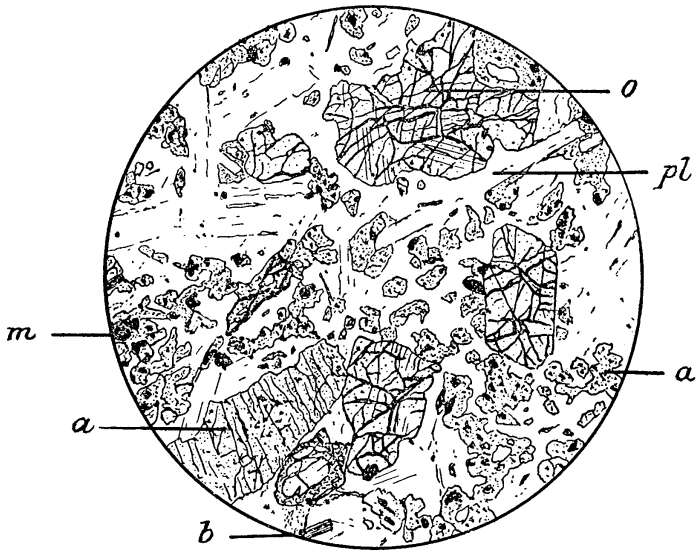
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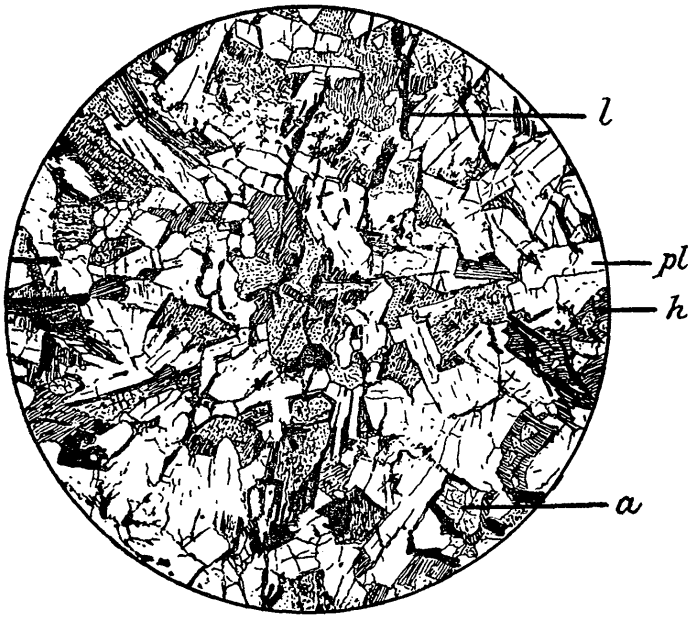
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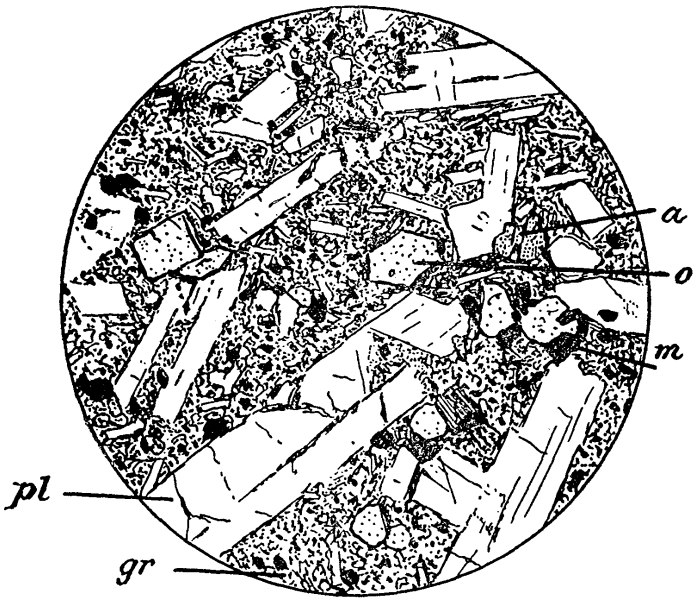
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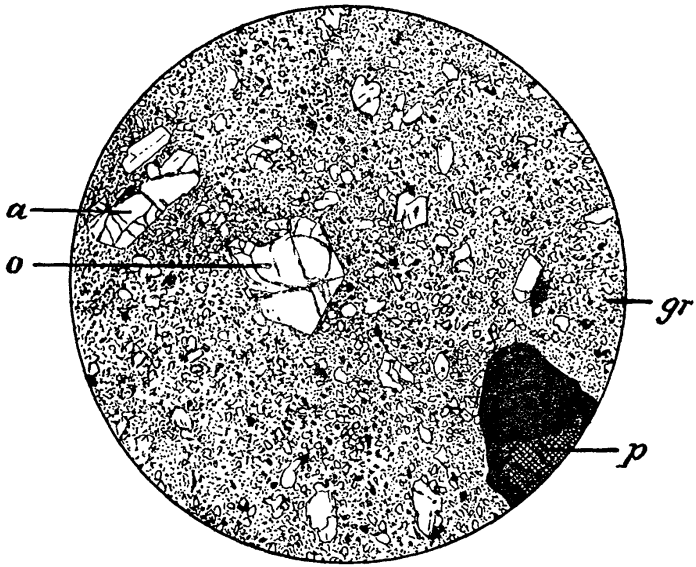
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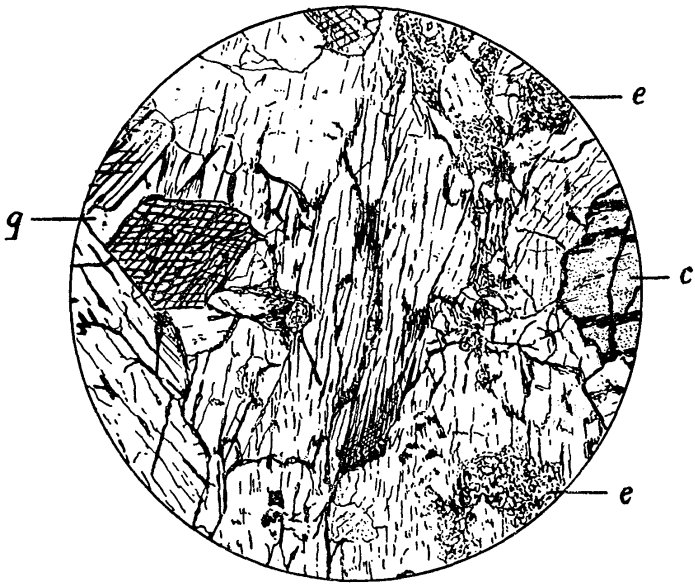
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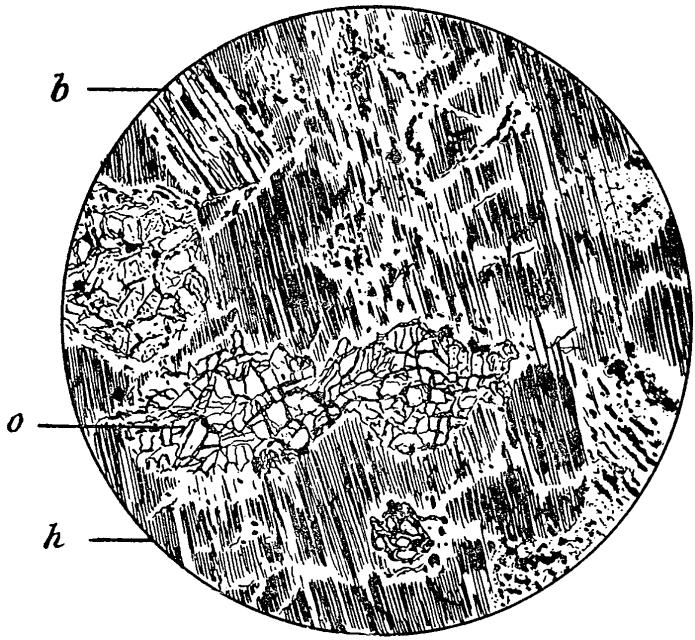
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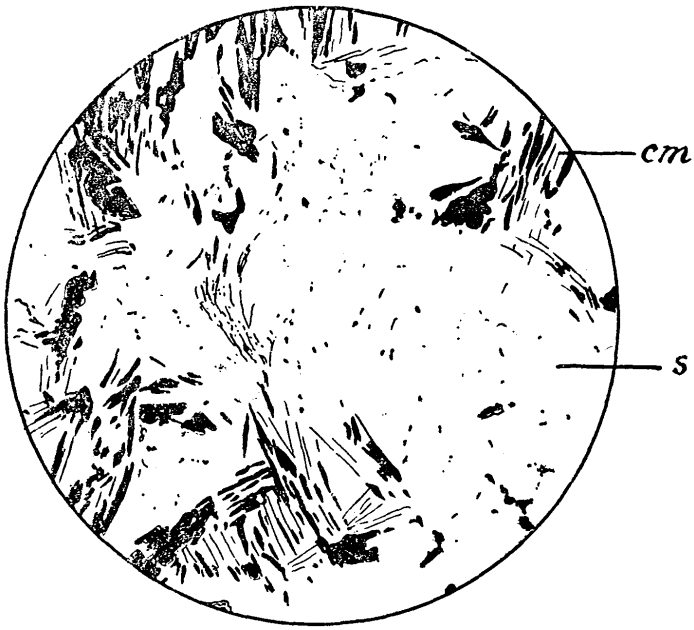
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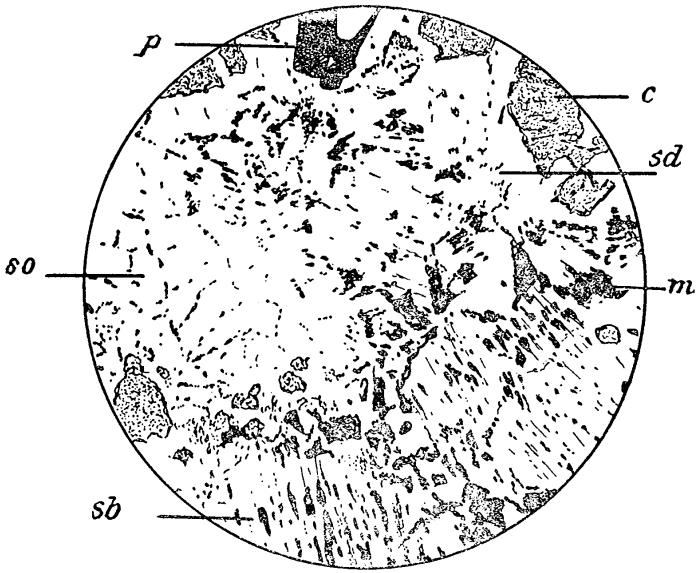
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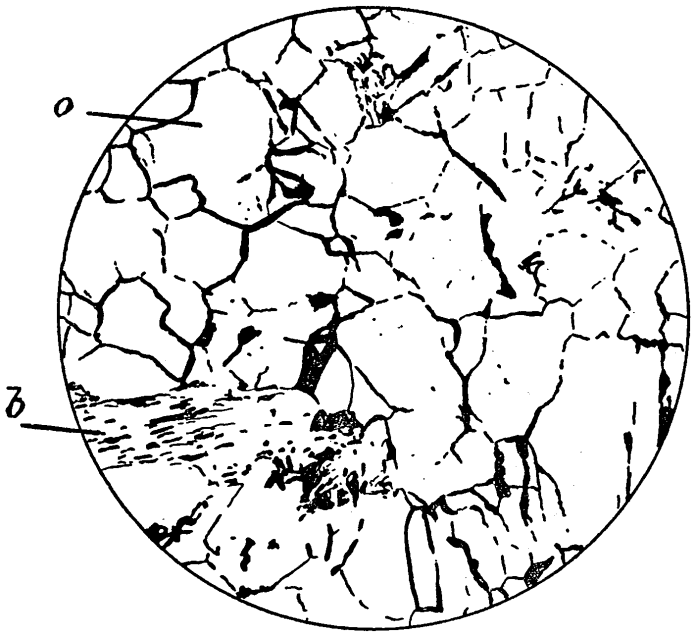
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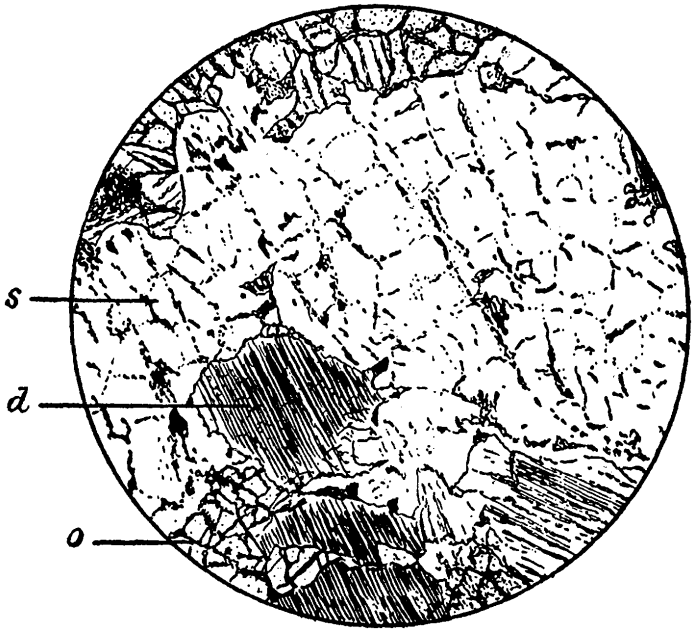
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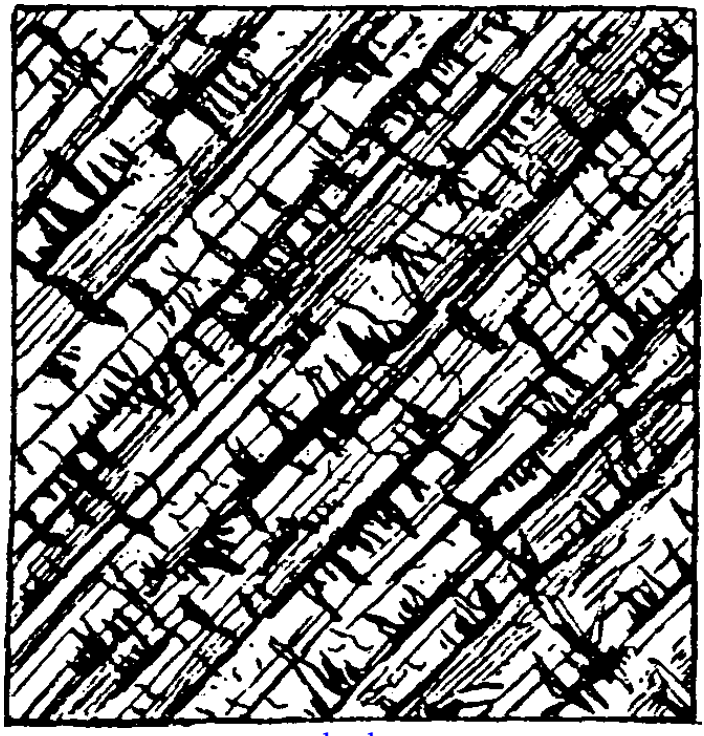
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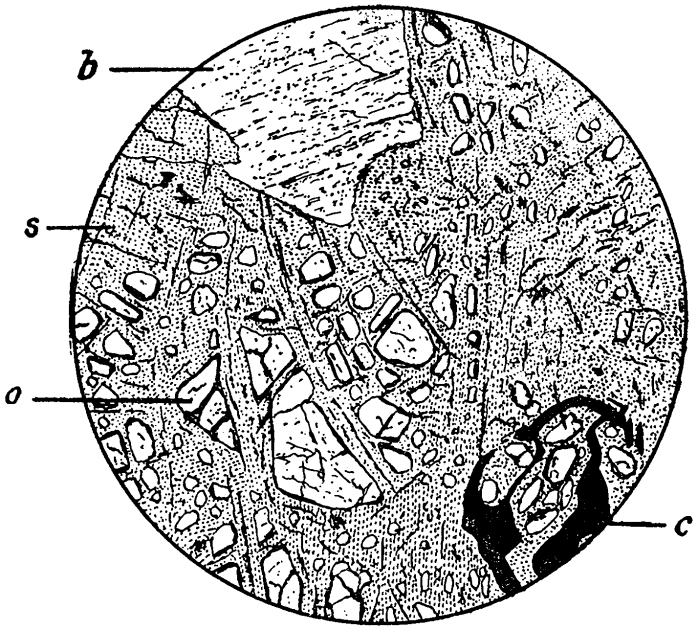
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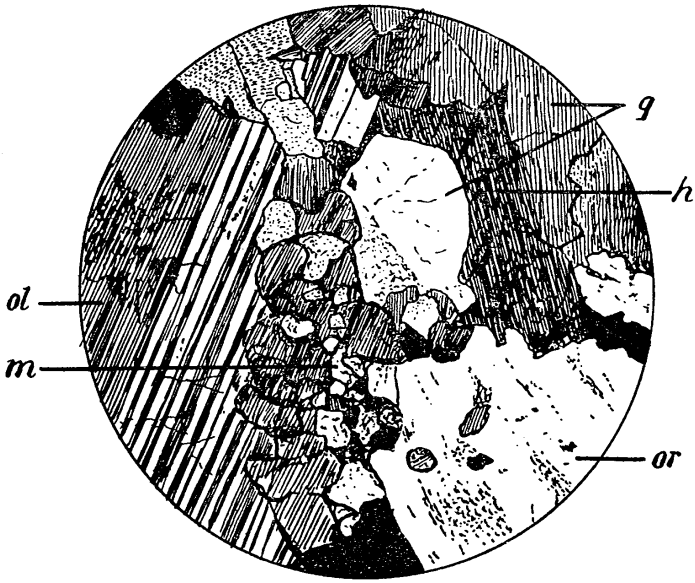
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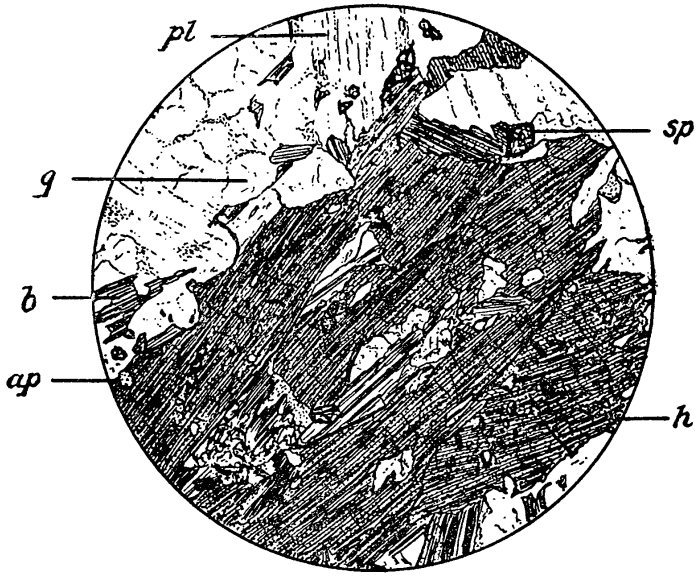
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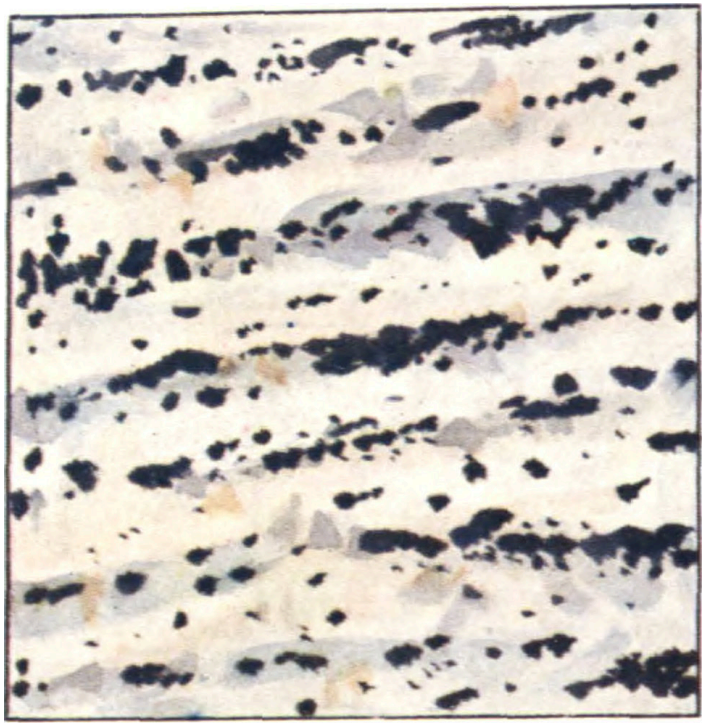
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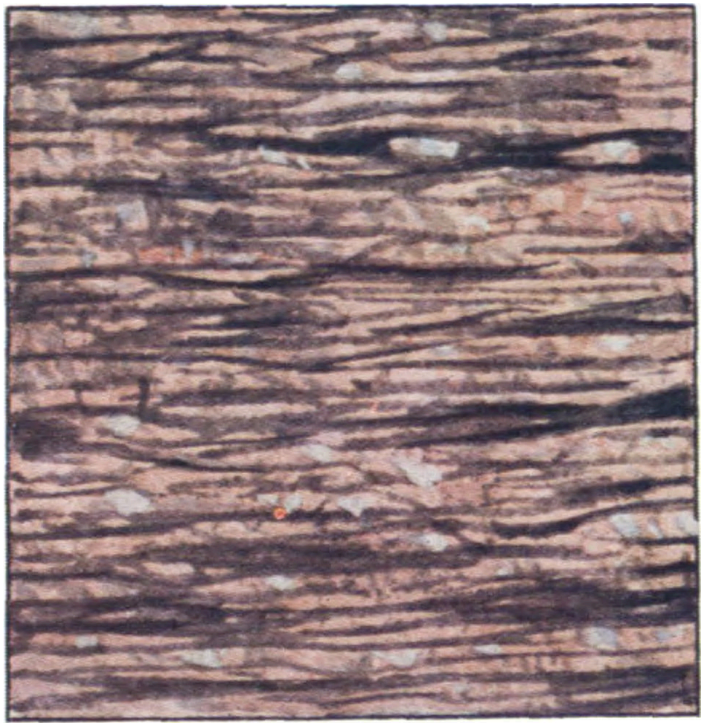
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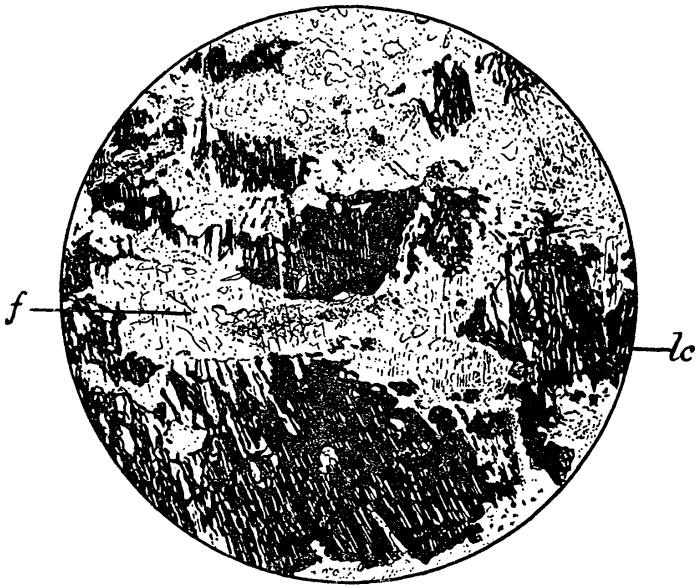
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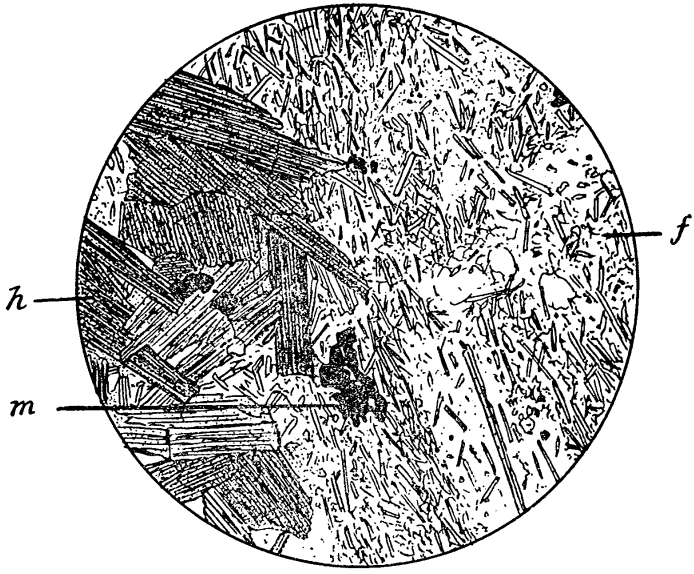
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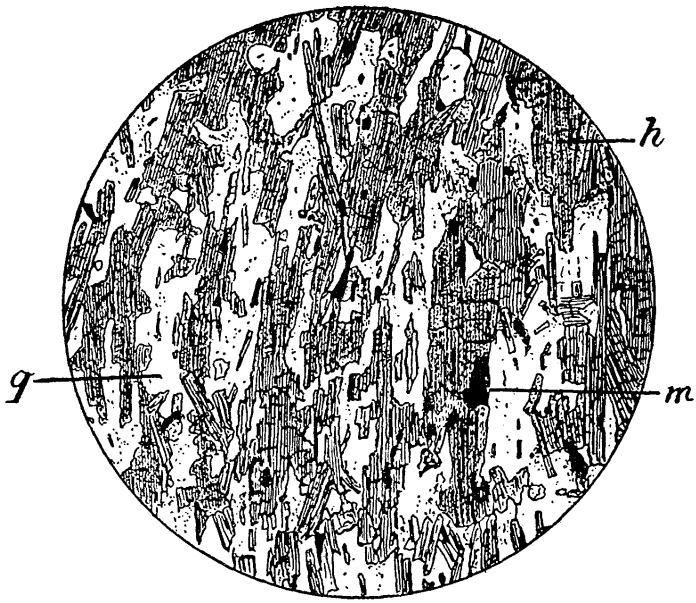
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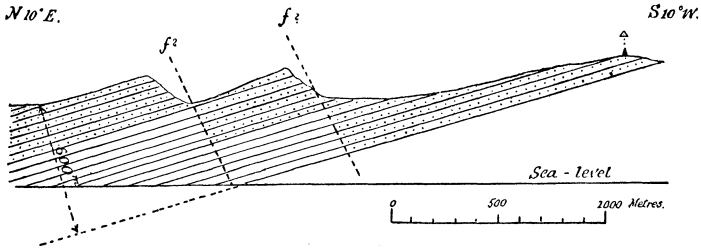
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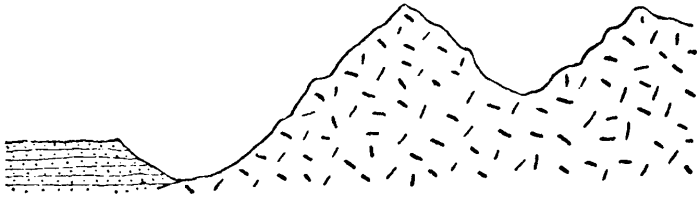
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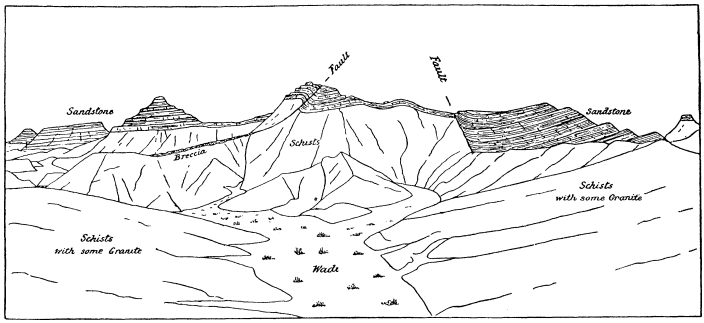
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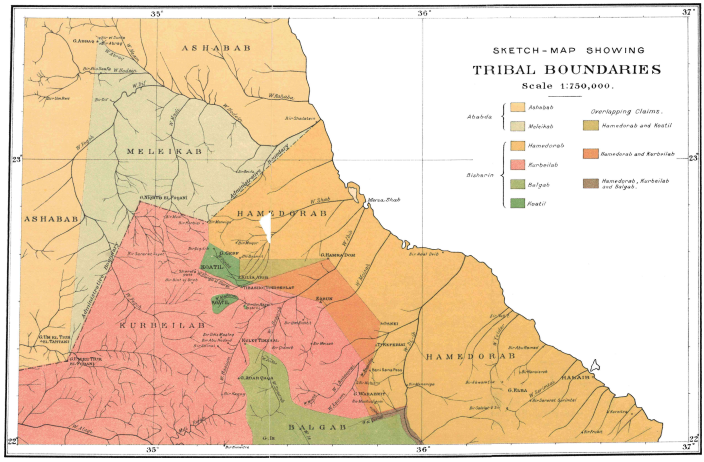
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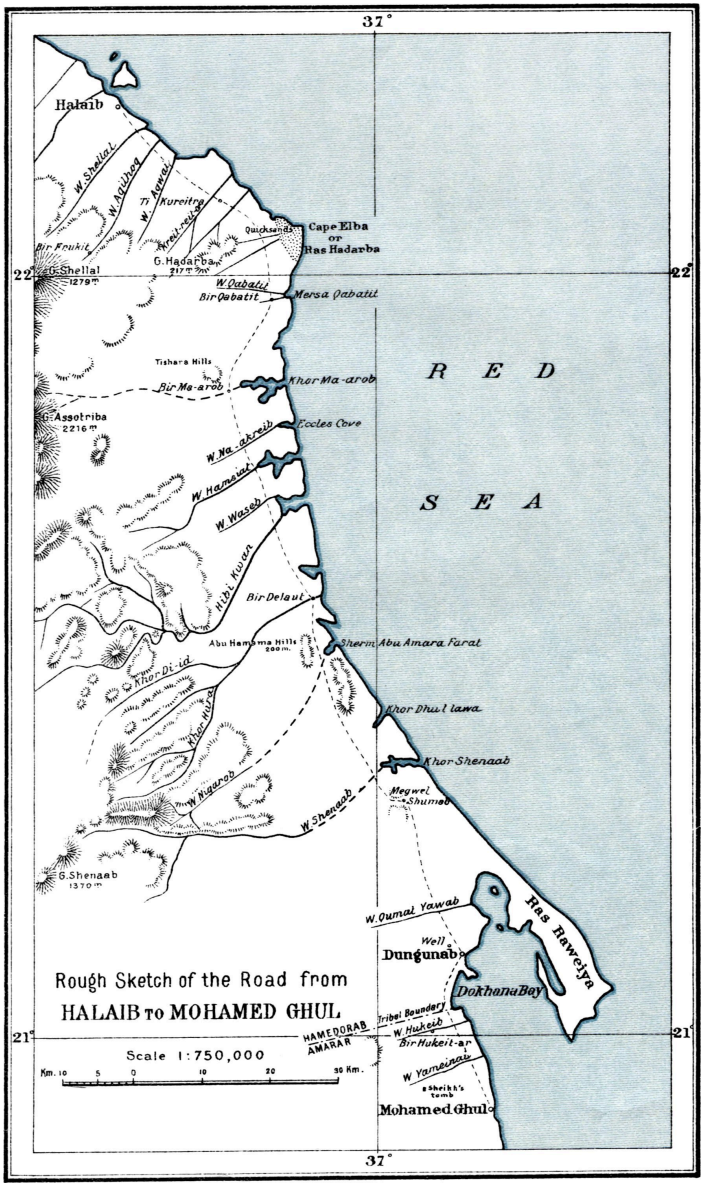
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Fault
Fault
Sandstone
Sandstone
Breccia
Schists
Schists
with some Granite
Schists
with some Granite
Wadi

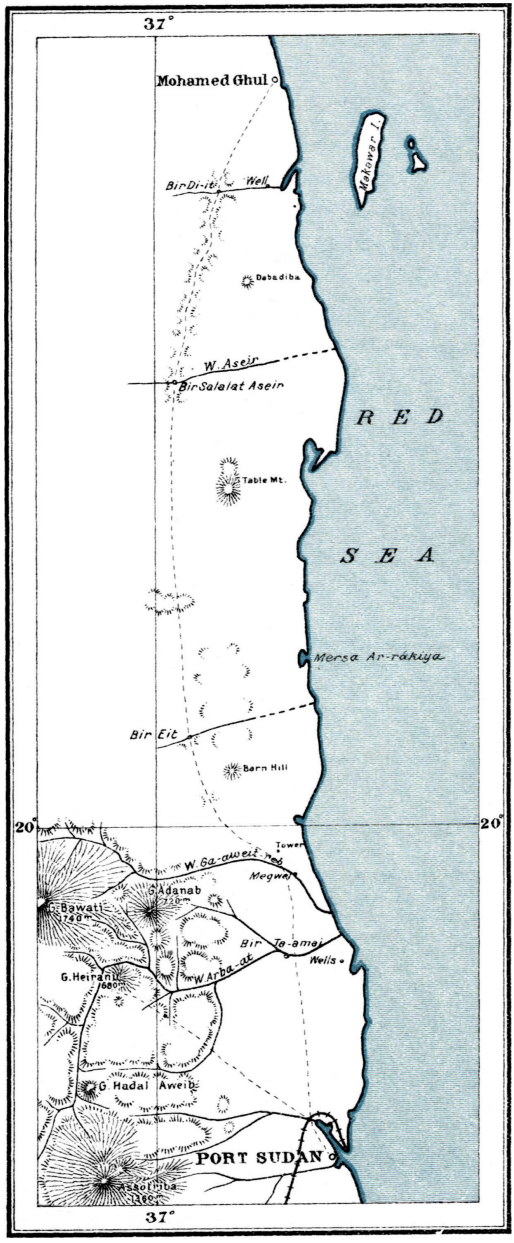
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SKETCH-MAP SHOWING
TRIBAL BOUNDARIES
Scale 1:750,000.
Ababda
Ashabab
Meleikab
Bisharin
Hamedorab
Kurbeilab
Balgab
Reatil
Overlapping Claims.
Hamedorab and Reatil
Hamedorab and Kurbeilab
Hamedorab, Kurbeilab and Balgab.
ASHABAB
MELEIKAB
HAMEDORAB
KURBEILAB
BALGAB
35'
36'
37'
23'
22'

back


37°
Halaib
W. Shellal
W. Aigibeg
W. Agreiat
Kureitra
Quicksands
Cape Elba
or
Ras Hadarba
Bir Foukit
G. Hadarba
217 m
22°
G. Shellal
1279 m
W. Qabatit
Bir Qabatit
Mersa Qabatit
Tisbara Hills
Bir Ma-arob
Khor Ma-arob
R E D
G. Assotriba
2216 m
Eccles Cove
W. Ng.-abreib
W. Hamaiat
S E A
W. Waseb
Khor Kuran
Bir Delaut
Abu Hamama Hills
200 m.
Sherm Abu Amara Farat
Khor Di-Ud
Khor Dhul lawa
Khor Shenaab
Megwel Shumab
W. Rigaraa
W. Shenaab
G. Shenaab
1370 m
W. Qumal Yawab
Ras Hawelya
Well
Dungunab
Dokhona Bay
Rough Sketch of the Road from
HALAIB to MOHAMED GHUL
Tribal Boundary
HAMEDORAB
AMARAR
W. Hukeib
Bir Hukeit-ar
21°
Scale 1:750,000
Km. 10 5 0 10 20 30 Km.
W. Yamaiaab
Sheikh's tomb
Mohamed Ghul
37°

back


37°
Mohamed Ghul
Kataweer I.
Bir Di-ib Well
Daba diba
W. Aseir
Bir Salalat Asein
RED
SEA
Table Mt.
Mersa Ar-rakiya
Bir Eit
Barn Hill
20°
20°
Tower
W. Ga-aweis
Megwa
Bawati
1149 m
G. Adanab
Bir Ta-amai
Wells
G. Heiran
1680
W. Arba at
G. Hadal Aweib
PORT SUDAN
Saolmba
1180
37°

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