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RESEARCHES

ASSYRIA, BABYLONIA, AND CHALDÆA

FORMING PART OF THE RESULTS OF

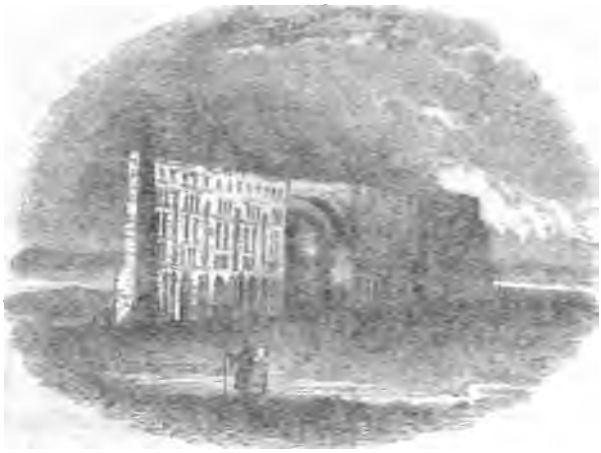
THE EUPHRATES EXPEDITION

BY

WILLIAM AINSWORTH F.G.S. &c.

SURGEON AND GEOLOGIST TO THE EXPEDITION

CORRESPONDING MEMBER OF THE GEOGRAPHICAL SOCIETY OF BERLIN, HONORARY MEMBER OF THE ASIATIC SOCIETY OF BENGAL, AND OF THE ROYAL PHYSICAL AND STATISTICAL SOCIETY OF



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LONDON:
JOHN W. PARKER, WEST STRAND.

M.DCCC.XXXVIII.

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IN

ASSYRIA, BABYLONIA, AND CHALDÆA;

FORMING PART OF THE LABOURS OF

THE EUPHRATES EXPEDITION.

BY

WILLIAM AINSWORTH, F.G.S., F.R.G.S.

SURGEON AND GEOLOGIST TO THE EXPEDITION;

CORRESPONDING MEMBER OF THE GEOGRAPHICAL SOCIETY OF PARIS, MEMBER OF THE GEOLOGICAL SOCIETY OF DUBLIN, HONORARY MEMBER OF THE LIMERICK INSTITUTION, LATE PRESIDENT OF THE ROYAL PHYSICAL AND PLINIAN SOCIETIES OF EDINBURGH.

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BIBLIOTHECA·BODLEIANA·

TO

LIEUTENANT COLONEL

FRANCIS RAWDON CHESNEY, R.A., F.R.S.,

&c. &c. &c,

THIS WORK IS DEDICATED,

IN HUMBLE TESTIMONY OF THE HIGH SENSE ENTERTAINED BY THE AUTHOR (AFTER SERVING THREE YEARS UNDER HIS COMMAND), OF HIS ZEAL, JUDGMENT, AND PERSEVERANCE, DISPLAYED IN THE SUCCESSFUL CONDUCT OF A MOST ARDUOUS ENTERPRISE;

AS WELL ALSO OF HIS NOBLE AND ENLIGHTENED ARDOUR IN THE CAUSE OF SCIENTIFIC AND PHILOSOPHICAL RESEARCH.

CONTENTS.

LIST OF ENGRAVINGS, &c.

PREFACE.

THE present work, containing a very small portion of the scientific labours of the Euphrates Expedition, owes its existence to the approaching departure of the Author on a new exploratory journey to the East. It was judged advisable on many accounts that he should see it through the press, although other portions of the same labours not being yet completed, the disadvantages were entailed of his not having so accurate, or so general a map of the country, as if the materials of the Expedition had been already laid down. It may also be expected to cause some sacrifices in consistency, between the opinions of the different parties engaged in the same great work; but this is, perhaps, the less to be regretted, as the points in historical geography are mostly theoretical; while those embodied in the survey under Colonel Chesney, will be all of a positive character.

The objects which the Author proposed to himself (after an introductory sketch of the physical features and natural history of the included districts,) were, first, the description of the formations of the river Euphrates; in which it will be found that the deposits above the chalk, hitherto generally supposed to be confined to basins or circumscribed localities, assume in these countries an extent of geographical developement which gives to them

the same geological importance that belongs to any of the other rock formations of the crust of the globe: the division of the gypsum deposit into two great portions, characterized by a different association of beds, and separated by a great deposit of marine limestones: and lastly, the geological relations of the bitumen and naphtha springs in Babylonia, he hopes will also prove of interest.

The second object has been to describe the indices of the Deluge of Scripture, which are found to exist in the land supposed to have been tenanted by Noah and his descendants, and to have been the seat of the Tower of Babel. The Author was fully aware here, both of the magnitude and the delicacy of the inquiry which he had entered upon, but approaching it, as he did, with a firm belief that there is nought in the physical world but will lend, if correctly understood, its evidence in testimony of the Holy Writ; he had not a momentary apprehension, but by adhering, to the best of his power, to the limits of a severe induction; the physical phenomena would be found not only to correspond with, but also to illustrate, the truths of the Sacred Records.

It is, indeed, the duty of every student of natural laws to vindicate the evidences of Scripture; as it is, of those who make the moral world the field of their inquiry. And if the results of the investigation of the Diluvian vestiges in Shinár, corroborate what some geologists have before opined, from researches carried on in other countries, that the latest formation by transport

(not belonging to causes at present in operation,) is not, in the country of the Deluge itself, as it is not in other countries, the index of that catastrophe; there is nothing in the opinion previously entertained of the connexion of the two, nor in that now suggested by these Babylonian researches, but which equally give force to the same great facts contained in the sacred history of the earth. Geology has hitherto suffered much more from the unphilosophical zeal of, it is to be regretted, an often factious opposition, than it has done, although so seductive to theory, from the speculative boldness of its own followers; and the Author is hence desirous of allaying at the outset the fears of the most scrupulous.

The third object has been the investigation of the progress of the alluvia of Babylonia, Chaldæa, and Susiana, an investigation which is replete with the deepest interest both to history and to science. The most ancient records in the history of man are here brought directly in contact with the more modern periods of geology. The foundations of kingdoms and the progress of nations are traced in accordance with the changes which took place in the physical aspect of the country; and the succession of monuments of past times, is so associated with indices of changes in the soil itself; that science loses its ruggedness in wandering in almost untrodden districts over which, religion, tradition and history, have long shed a halo of glory.

The chief novelties contained in this part of the inquiry, are the positioning of Rehoboth, of Calah, of

Resen, of the Pylæ of Xenophon, of Sitace, of Accad, and of Opis,—the division of Babylon into towns with distinct appellations,—the position of the Wall of Media, and of the different canals of Babylonia; the unravelling of the various questions connected with the old course of the Euphrates, the various level and different mouths of Euphrates, Tigris, and Eulæus, and the extent of the Pallacopas; the situation of the lakes of Chaldæa and that of Susiana; and the positioning, in these latter districts, of Erech, of Urchoe, of Teredon, of Ampe, and Aginis.

The other objects of the work are of a more purely scientific nature; and it is to hoped will be found to comprise, as far as the topographical distribution of rock formations is concerned, the description of a large extent of new country, which the extraordinary advantages of the Euphrates Expedition, and the encouragement given to research by the commanding officer, in instituting subsequently to the breaking up of that Expedition an exploratory excursion into Kurdístán and in Taurus, have been the means of first gaining over to science.

It was, it may also be mentioned here, the same anxiety to promote discovery, and the judicious disposal of the time of the officers of the Expedition, that led to the exploration of the country south of Antioch, and the Amanus to the north,—which induced Colonel Chesney to join in a laborious journey through the Cilician Taurus to Mar'ash, which brought about the examination of the districts of 'Urfáh and Harán, and secured a first investigation of the mountains of Farsistán.

The Author is, however, too deeply sensible of the want that there exists, from the absence of sufficiently detailed and close examination, more especially of the organic remains, of a correct determination of many of these deposits. Over so wide an extent of country, the labours which he presents to the public, can only be looked upon in the light of scientific pioneering, which is all that they deserve, and all that they lay claim to.

The section of Taurus is chiefly interesting, from the approximate knowledge, which structure, outline, and elevation best afford, of the various groups of which that country of mountains is composed, and which presents a variety of hilly ranges and of rock formations, that have hitherto been too much generalized into a common whole, or even still more rudely so, into one or two parallel and linear chains. It will, however, require a prolonged research before this system can be reduced to order. The geognostic character of the primary rocks varies frequently; the periods of elevation are also different, and the history of the deposition and the tilting up of the modernse dimentary deposits, is almost unknown.

The structure of the Durdún Dágh, as compared with the Amanus, assists in this kind of topographical knowledge of Asia Minor, more particularly as connected with the course and distribution of its mountain-chains.

The country to the south of Antioch presents us with the interesting feature of a tertiary basin broken up, or indeed, almost comminuted into small fragments, by igneous rocks.

The principal interest of the Section of the Persian Apennines is centered in the dynamical evidences of a gradual elevation of rocky strata upon linear and circular axes, denoting, according to Mr. Hopkins, the uniform elevation of elongated or circular areas; and the ranges of hills so origiuating, are at the limit of the alpine districts, only interrupted by occasional transverse cracks or fissures, constituting mountain passes; while in the centre the same unequal disturbances have given origin to the irregular outline of a mountain chain. This subject is here interestingly illustrated, but the principle obtains in precisely the same manner in Taurus, and has lately received an extensive generalization, as applied to the Andes, by Mr. Darwin.

The ranges which constitute the Persian Apennines present remarkable distinctness in the anticlinal lines, and that uniformity in physical features,—range after range, plain after plain,—rising one above the other, which gained to them the antique title of Κλιμακες, and leave them still among the more interesting districts, in point of phenomena of structure, which exist on the surface of the earth.

It is well worthy of remark, also, that the chemico-thermal actions which give birth to fountains of petroleum and naphtha; exhibit themselves at the extreme lateral limits of the area of elevations in the Persian Apennines, exactly as the fountains of Hít are geologically situated with regard to Taurus; occurring at nearly the extreme point of the termination of a series of rock formations which

become more and more modern from the mountains to the alluvial deposits.

Southern Kurdístán has not fewer objects of high interest; the low but continuous Hamerún rising out of the great plains, the outlying fountains of naphtha and petroleum, and the peculiar phenomena of burning flames near Kerkúk, are subjects such as the geologist does not meet with at every step, to exercise his ingenuity upon; and which, from that very circumstance, more particularly demanded a careful investigation.

In the interior, the parallel ranges of hills belonging to the same district, present similar general features in arrangement and structure as the mountains of Farsistán; thus establishing their connexion with the same great system, which the Author has designated as that of the Persian Apennines.

The carbonaceous measures of the same districts formed a particular subject of inquiry. It was part of the injunctions given to the Author to search for evidences of coal or of mineral combustibles, and he was thus led into the heart of a mountain district previously unvisited by Europeans.

Geologists will suppose at once, from the nature of the formations which occupy these great extents of country, that little is to be expected, by analogy, from the coal measures of Western Asia, as Russegger ("Athenæum," No. 549,) has also remarked of Egypt. But analogy must be received here with caution; for as the gypseous and other deposits of the supra-cretaceous formations

exceed so much in developement, anything that the same formations present us with, in European countries: so we may expect equal promises from any well-established lignite deposit occurring where there is greater continuity of beds, than in Europe, or in the deposit at present wrought in the countries, now under consideration, in the neighbourhood of Baïrút.

In Northern Kurdístán, the disturbed state of the Kurdish tribes confined the Author's investigations to the western border of the mountain districts; but it is to be hoped that the central portions will be explored in the ensuing Expedition.

The Barometrical admeasurements were made under different circumstances. In Casius and Amanus, comparative observations were made at the base and at the summit or acclivities of hills, and the observations so made were compared with contemporaneous observations made at the mouth of the Orontes; but in Taurus and Kurdístán the possession of a single instrument gave to the observations chiefly a comparative value among themselves, and which, corrected for temperature and latitude as well as for the deficiencies of the instrument, still gave results which may be considered only as very good approximations. Some remarkable examples of this occurred; for example, at 'Osmanjík, at the level of the Kizíl Irmák, the barometer indicated for that river an elevation of 918 feet; after carrying the instrument over a rocky and hilly country, the river was again approached at Hájí Hamzah at a distance of 21 miles, and it gave an

indication of an elevation of 916 feet. So close a result to what must have been the inclination of the river, must, however, be looked upon as partly accidental; for in a far more extensive series of bi-horal observations, made on the river Euphrates during the descent of Her Majesty's steamer, although the rise of the barometer was constant from Bír to the Persian Gulf, still the regularity of that rise, not only from accidental causes and changes in wind and weather, but also from the extent of the horary oscillations of the instrument increasing towards the equator, often baffled (in the small number of local observations) all attempts to obtain even the means of correction. Results, in which all the altitudes (however promising in a comparative point of view) can be expected to coincide with the truth, must be founded upon a prolonged series of observations; and if such discrepancies were met with in latitudes where the irregular oscillations are almost null, as on the river Euphrates—where at least eight observations a day were made—how many errors must have crept into the results, as indicated by a barometer carried in variable weather, and under many adverse circumstances, across Kurdístán and Taurus!

It is very much to be regretted that, the barometer having been detained at Basráh for the necessary corrections in the pendulum experiments, the section of the Persian Apennines is founded upon merely estimated elevations, and, owing to a similar omission, a section of the Durdún Dágh has not been introduced into the work.

It is scarcely deserving of mention, that the Author has been once subjected to no sparing criticism for the adoption of scientific names, which are not in common use in this country. Although anxious not to introduce continental terms that are not imperiously demanded, he abides by his original determination, of endeavouring to unite the good of one school with that of another. The progress of European, as well as of British, geology, is no longer so much in its infancy, that we may tremble at using words familiar to the educated of every country. An able French geologist says upon this subject, "Il n'y a plus que les Anglais, on l'école de Londres qui s'ecartent souvent du langage classique;" and what is equally true and just, "Comme on juge l'éducation d'un individu, par son parler, de même on peut-être tenté de prendre le style du géologue comme thermomètre de son savoir." (Boué, "Voy. Géologue," t. i. p. 419.)

It remains now to acknowledge the numerous obligations under which the Author has been put in collecting his materials; the greatest amount of which are due to the gallant officer to whom this work is inscribed, and who always placed all the papers, maps, &c., belonging to the Expedition, at his disposal, besides assisting him with whatever was available from his former journeys in the same countries. To Colonel Taylor, of the Baghdád Residency, the Author is indebted for the use of a MS. translation of Abú-el-Fédah, and for the positioning of several antique sites in Babylonia and Chaldæa. To Dr. Ross, also of the Residency, the Author is obliged

for the first details of his exploration of the 'Athím or Physcus, of the Dijaïlah, or old bed of Tigris, and the Síd Chali, or Wall of Nimrúd, and for many points observed during a journey made by the same gentleman and Mr. Baillie Fraser, in the marshes of Lemlún and the plains of Chaldæa.

The Wall of Nimrúd was subsequently seen, and bearings taken by the Expedition, which also ascended the river Tigris, to beyond Dokáláh. The systems of the Náhr-wán, explored on Tigris, was also visited, near the 'Athím, by the Author, with Mr. Rassam, on his tour in Kurdístán. The old, as well as the existing, beds of canals in Babylonia were explored during excursions made from Felujáh to Baghdád, from Baghdád to Aker Kúf and to Babylon. The lower parts of Euphrates, Tigris, and Karún, are derived from the labours of the Expedition. A small party explored Ka'bán, and reached Búnd-i-Kil, another from Basráh visited Zobeïr and its environs; and another the Zarágiyáh to the east. The coast at Bunáh Derí was approached in a country boat, and Ghoreïn and Kharíj were visited in the schooner attached to the Hon. East India Company's Residency at Abú Shéhr.

The Author is indebted to the Rev. R. Sheepshanks, of Trinity College, Cambridge, for the calculation of the observations made by the lamented astronomer of the Expedition, Lieut. Murphy, R.E., more particularly the positioning of Basráh, Felujáh, Hilláh, Súk-el-Shuyúk, and Kurnáh. Lieut. Cleaveland's observations furnished

the positions of Hawáz, Ismaëli, Mo'ammeráh, Kut-'amáráh, and Baghdád; and to Mr. J. Arrowsmith he is indebted for reducing these to form, and for the map which accompanies the memoir.

The Rev. Mr. Renouard revised the greater part of the Oriental names, and, where this is not the case, the system followed by that gentleman has been adopted as nearly as possible; but notwithstanding every attention to this, some inconsistencies have escaped correction, which, it is to be hoped, will be dealt with mercifully. The vowels have their Italian sounds, the consonants the English, and the same letters (with a few exceptions) mark the correspondent letters in the Eastern characters. The long syllables are accented. It was necessary to adopt some uniform system, and one of higher authority than that used by the Royal Geographical Society could not have been found.

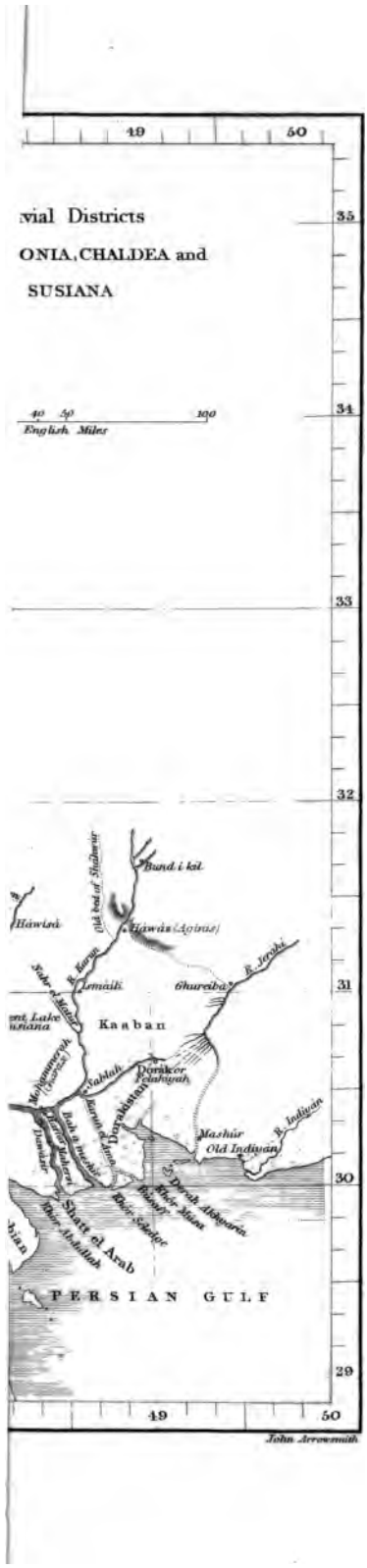
Mr. A. A. Staunton, of the Expedition, and now of the Royal Artillery, politely furnished the drawing of the plain of Babylonia, which forms the frontispiece to the volume, and gives a good idea of the uniformity of these level tracts, to which interest is here added by the Euphrates river, with its groves of date-trees, the mounds of the Kasr and Amrám to the left, and the lightning-struck Bírs Nimrúd in the distance, by many identified with the Tower of Babel, and illustrating the effect of these antique mounds, as seen over the plain on the horizon's verge. Her Majesty's steamer, named after the river which she first (after the melancholy loss of her

consort) navigated, is there,—suggesting strange notions of the triumph of British art and of British perseverance, in thus approaching, in a manner that ought to have deserved more from a nation's pride; the nursery of mankind, and the cradle of human knowledge.

The Author is indebted to the same pencil for the sketch of the Hall of Chosroes (Ták Késráh), which is on the title-page,—the only remnant, besides mounds of ruins, of the antique Ctesiphon; in jealousy, by the side of Seleucia, and, not improbably, at or upon, the remains of the Chalne of earlier nations.

The Kasr, a fragment of the palace of Semiramis, with its supposed remaining offspring of the Hanging Gardens, taken from the top of the ruins, amid which the figures in the foreground stand; and the mound of Babel, as viewed from the river, with its Kúfáhs or asphaltic coracles, dating from a most remote antiquity; are from the same quarter.

Jebel Akrá, or Mount Casius, taken at a distance of upwards of 30 miles, and from beyond the lake of Antioch, with some disrupted volcanic rocks, above a powerful spring which constitutes the "Gúl Bashí," or "Head of the Lake," is from the portfolio of Lieut. Cockburn, R.A., another of the much regretted losses or the Expedition.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John Arrowsmith

ASSYRIA, BABYLONIA, AND CHALDÆA.

The general Physical Features of Taurus, and of the Plains of Mesopotamia and Syria.

Assyria or Aturia, in the days of one of the fathers of geography, Strabo, comprised all those Asiatic countries, south of Taurus, which were not included in Ariana (Persia), Arabia Proper, and Palestine.

Assyria, including Taurus, is distinguished by its structure, its configuration, and its natural productions, into three zones, or districts. By structure, into a district of plutonic and metamorphic rocks; a district of sedimentary formations, and a district of alluvial deposits. By configuration, into a district of mountains, a district of stony or sandy plains, and a district of low watery plains. By natural productions, into a country of forests and fruit-trees, of olives, wine, corn, and pasturage, or of barren rocks; a country of mulberry, cotton, maize, sesame, tobacco, or of hardy labiate and composite plants, or barren clay, sand, pebbly or rocky plains; and into a country of date-trees, rice and pasturage, or a land of saline plants, liquorice, reeds, sedges and rushes.

The First District comprises the country of mountains and hills commonly called Taurus, and which is

composed of many different chains. Strabo (lib. xvii., p. 520,) described Taurus as beginning to rise from Pamphylia, and in advancing to the east, to send off two branches; on one side, Amanus (Jáwúr Dágh), and on the other, Anti-Taurus (Aghá Dágh).

That part of Taurus which is above the plain of Tarsus and Adanah, commonly known as the Rámádán Oghlu mountains, is continued by the Durdún Dágh to the Jáwúr Dágh or Amanus; but the direction of the two chains is different, as is also their structure and their geognostic relations.

The southerly prolongation of Amanus is Rhossus (Jebel Akmá), which terminates in the Jebel Kásserík, above Rás Khanzír, and Jebel Músáh (Mons Pieria) above Seleucia.

Taurus stretching east of Commagena (district of Aïn Táb), separates Sophena (Kharpút Dawássí), which is contained between Taurus and Anti-Taurus, (Strabo, lib. xi., p. 521,) from Osroene (district of Urfáh), and then divides itself into three portions. The most northerly and highest are the Niphates (Así Kúr), in Acilicene. The central chain comprises the Azárâh Dágh and mountain country around the mines (Ma'den Gomúsh, or Kapán, and Ma'den Kapúr). The more southerly is the antique Masius, and includes the Karádjía Dághli, the Jebel Túr*, and Baärem hills, extending to the Jezírah. To the south of these are the Babel and Sinjár ranges of hills, united by the isolated hill of Kúká, to the hills of Abdel Hássiz.

* *Túr* is a true Syriac and Chaldaic word. It was the name given to the whole of that country of mountains, and which, as modified by the Romans, became Taurus. The word, significative of mountain, is

Structure.

Taurus consists of a central nucleus of granite, gneiss, and mica shist, associated with limestones and diorites (Ma'den Gomúsh), and diallage rocks (Dumbú-Dágh); of lateral formations of diallage rocks, serpentines, actynolite rock, steashists and slate clays, and of outlying sandstones and limestones.

The Baärem hills are entirely composed of feldspathopyroxenic rocks (dolerites and basalts), and the Jebel Túr, of limestones with nummulites, limestones with pectinides and ostracea, and the chalk formation.

Taurus, at Arganáh and Ma'den Kápur, is composed of diallage and actynolite rock, with serpentines, steashists, red and black slate clays, with fossils; and superimposed, alternating or outlying limestones and sandstones.

Taurus at Azárâh Dágh and Dawah Boïní, which forms

now only preserved in a small district, the inhabitants of which are Chaldeans, called Turai. The word has been confounded with ترك *Turk* and *Turkomen*, where the initial letter is different, as in طور *Tāur*. The Arabs call Mount Sinai طور *Túr*. The Persians have also تار *tár*, a ridge of mountains.

In connexion with the eastern progress of Celtic nations, there is much probability that Túr has been propagated among western nations in a variety of modifications, which may be traced in Túrán in Caucasus; Tauric Chersonesus; the Sarmatian Tauri; Thurgau; Thuringian Forest; Die Tauren, the Higher Alps; Tyrol; Tours and Touraine, France; Mam Tor in Derbyshire; and the Tor or Tur in Wales, a heap or pile. It is the same in the philosophy of the various denominations of well-known ruminants of various countries derived from the Taurine or Bisontine groups, as Thúr, Túr, Toor, Deer, Stier and Steer, in the northern dialects of Europe, names for the Urus of Cæsar.

the watershed of Tigris and Euphrates, and is immediately above the sources of the first river, is formed of diallage rock, serpentines, steashists, and limestones.

Taurus, in the Gúl Dágh, near Arab-kír, and at Ayelí, near Divrigí, consists of feldspatho-pyroxenic rocks, alternating with or superimposed upon chalk.

The Karà Bel mountains are composed of diallage rock and serpentines, with steashists and sandstones.

The Chamlú Bel consist of mica shist, actynolite and diallage rock, steashists, and limestone.

The Kushanlí Dágh, of mica shist, serpentines, and limestone.

The Akló Dágh, north of Tókát, is a country of mica shist, succeeded at Amásiyah by indurated chalk.

The elevation of the crest of Taurus, or the summit-level, viewed as the mean between the height of the culminating points and that of the cols, ports, or passes, is at Ma'den Gomúsh, 5053 feet, at Dawah Boïní 4453 feet, at Khútel (limestone and basalt,) 3379 feet, at the Gúl Dágh 4808 feet; Ayelí mountain 5650 feet; Seliskí (gypsum formation) 4250 feet; the crest of the Karà Bel attains an elevation of 5790 feet; that of the Chamlú Bel 5260 feet, and the Akló Dágh 2900 feet.

Between these mountain-chains are valleys or plains variously characterised. Between Masius and Ma'den Kapúr is the plain of Diyár-Bekr, at an elevation of 2500 feet, composed of feldspatho-pyroxenic rocks, above which rises the bold range of Karà Dághli, having a similar geognostic structure.

Ridges of indurated chalk separate this plain from the mountain district of Arganáh and Ma'den Kapúr.

Between the latter and the Dawah Boïní is the culti-

vated valley of Alendáh, and the upland lake called Górjik Gólí, at an elevation of 4453 feet.

Beyond the Dawah Boïní is a fertile valley, with tributary to the Múrad Sú, at an elevation of 3260 feet, and bounded to the west and north-west by limestone rocks, on the summit of a knoll, amidst which, at an elevation of 5032 feet, is Kharpút, the Roman Carcathiocerta. Beyond is a plain of feldspatho-pyroxenic rocks, terminated by the chalk-hills of Khútel (3379 feet.)

Between Ma'den Gomúsh or Kapán, and the Gúl Dágh, is an upland of chalk and feldspatho-pyroxenic rocks (2280 feet.) Arab Kír is in a narrow valley (3530 feet). Beyond the Ayelí, (a country of feldspatho-pyroxenic rocks and chalk,) is the narrow valley of Berástik (4295 feet,) while the wide and fertile plain of Divrígí is only 3116 feet.

From the Karà Bel mountains to Suáz is an undulating country of sandstones, marls, and gypsum; at Kótní 4050 feet, at Suáz, 3894. Beyond Suáz or Sívás is an upland of fresh-water limestone, out of which rises the isolated cone of Yúldús Dágh. The valley of Kárím (3328 feet) leads the way to the Chamlú Bel (5260), beyond which is the cultivated plain of Báúlús (3338), bounded by the Kushanlí Dágh to the north, at the foot of which is the deep valley of the Kisil Irmák, and the town of Tókát, at an elevation of only 1577 feet.

The mica shist country rises again in the Akló Dágh to 2900 feet, and upwards, and sinks at Amásiyah (valley of Kisil Irmák) to 1048 feet.

The structure of the Así Kúr, or Niphates, which are probably the highest chain of Taurus, rising above the line of perpetual snow (10,000 feet?) remains yet undetermined.

The Cilician Taurus, or mountains above Tarsús, present us with a rock composed essentially of limestone, but containing mica as an essential constituent, (the cipolin of Alex. Brongniart,) of indurated or compact hard granular chalk, and a variety of tertiary deposits. The flanks of the Rámádán Oghlu, between the pass called Kulé Bogház and the district of Sís, are composed of tertiary sandstones. At Sís, limestones and slate clay are succeeded, near Karâ Sís, by serpentines and steashists.

On the plain are isolated rocks of indurated chalk, with castles (Sís, Anázárba, Túm, Shah Máran, etc.)

The Dúrdún Dágh is composed of towering and pointed mountains of mica shist, quartz rock, and quartz shist, with outlying formations of clayslate, steashist, chlorite slate, hornblende rock, and hornblende shist, limestones, and sandstones.

The Aghá Dágh above Mar'ash consists of diallage rocks and serpentines, capped by chalk and sandstone.

The subalpine country between Taurus and the plains of Syria is composed of feldspatho-pyroxenic rocks, which occur in the valley of Aksù, and in other places between Mar'ash and Aïn-Táb; also at Ufá Jaklay, and in the valley of Békir Karású, ultimately crossing Euphrates between Rum-Kal'ah and Someïsát. The same formations are also largely developed at Killís. The remainder of the country is occupied by indurated or soft chalk and sandstones.

The subalpine country between Taurus and the plains of Mesopotamia presents us with the same features. Feldspatho-pyroxenic rocks, rising in cones between Someïsát and Urfáh; forming black and stony deserts north-east of Urfáh; constituting hilly ranges at Karádjia Dághli; forming plains at Diyár-Bekr, and at Jezírah,

low hills at Serúj, and ultimately sweeping round to Euphrates south of Bír; the remainder of the country being for the most part occupied by chalk formations.

Amanus and Rhossus are composed of diallage rocks and serpentines, associated in the north with diorites and quartz rock, and having upon the flanks chalk and sandstones, and feldspatho-pyroxenic rocks (valley of Karású and of Afrín).

Jebel Músah is of similar geognostic structure, and is separated, like Rhossus (Jebel Akmá), from Casius (Jebel el Akrà) by the valley of the Orontes, amidst which, however, towers the rocky hill of St. Simon, effecting a near junction of the several ranges of hills. St. Simon, the hills of Antioch, and Casius, are similarly composed of diallage rock, supporting conide limestones, siliceous limestones, gypsum, and other tertiary rocks; but in the valley of the Orontes, at Swedíyah, are pliocene deposits, tilted up by the same plutonic formations.

Climate.

The climate of Taurus presents us with cold winters*, with much snow, and hot summers. In some of the valleys the natives themselves complained of excessive summer heats; more particularly at Amásiyah and Kapán. Diyár-Bekr, which is on an upland, is also said to be very hot.

The influence of warm days and cold frosty nights in spring is to forward vegetation, and yet preserve the snow. In crossing the Mar'ash hills (February 26, 1836,) the snow was from two to three feet deep, and so hard

* At Aïn-Tab, January 15, 1836, the thermometer, at seven o'clock in the morning, in a sheltered situation, fell to 5° Fahr., or 27° below freezing point.

as to bear a horse, yet in occasional bare spots, crocuses were in flower, and arachnides running about. At the same time of the year, in sheltered valleys, Daphne, Euphorbiæ, and bright and various coloured anemones, were in full bloom. In March, the almond-tree, pear, medlar, and laburnum, are in blossom in the valleys. In May 1837, roses blooming at Amásiyah (1048 feet) were an object of surprise to people living at a day's journey from that spot.

Vegetation.

The most remarkable feature in the vegetation of Taurus is the abundance of trees, shrubs, and plants, in the northern, and their comparative absence in the southern, districts.

The Masius is woody in parts; such, for example, are a few districts in the Baärem, and in the Jebel Túr, near Nisíbín, from whence, it has been supposed, Trajan drew the wood for the construction of his fleet. In the valleys of the hilly country north of Márdín, there is also some, but not much, wood. Around Arganáh and Ma'den there is none. The Kirtchú and Gúl Dágh hills are equally barren. From the summit of Ayelí, pine and fir forests are first visible in the distance, and they ultimately cover the Karáa Bel and the Chamlú Bel, as the latter name would indicate.

Amanus, Rhossus, and Casius are, however, well wooded, and it is the same with regard to the Rámádán Oghlú and the Dúrdún Dágh.

The forest trees are, for the most part, Pinus pinea (Kulé Bogház, Chamlú, and Karáa Bel), Pinaster Halepensis (Amanus, Dúrdún Dágh), Quercus cerris, pedunculata and sessiflora, Castanea vesca, Ornus Europæa, O.

rotundifolia, Alnus cordifolia, Corylus coturna, Cicer monspessulanum, Quercus ilex, suber, ægilops, conifera, infectoria, Acer pseudo-platanus, Fraxinus parvifolia, F. lentiscifolia.

On the flanks of forests or isolated, are, Ceratonia siliqua, Cercis siliquastrum, Mespilus pyracantha, Prunus laurocerasus. By the banks of streams, Tamarix gallica, Nerium oleander, Platanus orientalis (frequent at springs), Alnus cordifolia; and in shrubberies and low woodland, Cupressus sempervivens, Juniperus Phœnicia, J. macrocarpa, Myrtus communis, Pistacia terebinthus, Genista scoparia, G. tinctoria, Viburnum minus, Arbutus unedo. Ilex aquifolium, Ostrya vulgaris, Daphne Pontica, D. sericea, Buxus sempervivens, spiny Eleagnus, Bryonia Cretica, Dianthus arboreus, Clematis orientalis, C. vitalba, Cistus incanus, Jasminum fruticans, Lonicera periclymenium, Rhamnus alaternus, R. paliurus, Poterium spinosum. The Phillyreæ (*P. latifolia* and *P. angustifolia*) only show themselves on the north side of Taurus, and the Rhododendrons (*R. Ponticum*, and *R. maximum*) first appear beyond the Chamlú Bel. The Heaths are rare; Erica arborea flourishes near Sís, and E. scoparia in the vale of Antioch, etc.

Among the useful and cultivated plants of Taurus may be noted the vine, the fig-tree, almond-tree, the olive, wheat, Triticum spelta, Hordeum hexastichon, H. distichon. Gall-nuts are gathered chiefly from Q. infectoria, Q. ægilops, and Q. conifera. Pears, apples, apricots, are abundant. The roots of Astragalus christianus and Crambe orientalis are eaten. The Rhus coturnus is used for tanning skins red, the Rhamnus catharticus and Valantia articulata for yellow.

To have rendered this physical sketch of the various regions of Taurus more complete, it would have been necessary to introduce a notice of its animals, both wild and domestic, and also of its various inhabitants; but the facts that I have hitherto obtained upon those subjects are so scanty compared with so vast a field of inquiry, that I willingly postpone it to a future time, hoping to be more satisfactory in these general indications, when applied to the plains.

THE SECOND DISTRICT includes all the territory which extends from 37° North latitude to 34°, and comprises the plains of Syria, of Mesopotamia, and of the country east of Tigris extending to the Kurdish mountains.

STRUCTURE.

The whole of this country consists of cretaceous and supra-cretaceous deposits, here and there interrupted by plutonic rocks of the feldspatho-pyroxenic family.

The chalk is indurated, compact, granular, or saccharoidal, at the foot of Taurus, as far as the parallel of Rúm'kalah on Euphrates to Urfáh in the west and Márdín, in the east of Mesopotamia, to the hills of Rabbá Ormúz and Báziyán, east of Tigris, and to Kilís and Aïn-Táb in Syria. It is succeeded by soft white chalk with flints, and upper yellow fissile chalk, which extends along Euphrates to the parallel of Bális, where marles and gypsum are superimposed by flint breccia and siliceous sandstone. I do not know the exact western boundary, but indurated limestones, belonging to the supra-cretaceous series, and associated with feldspatho-pyroxenic rocks at Jisr Sogheïr, and at Mar'ash, form

the whole of the hills coursing by Armanás as far as to Kal'át el Mudík.

To the east, the hills of Rabbá Ormúz, which limit the plains, are formed of indurated supra-cretaceous limestones. It is the same with the Maklúb and Aïn el Safrá hills near the Záb river, with the hills at Bomaspán, and with the Khálkhalán, bounding the district of Koï Sanják, and continued to the south by the Báziyán and the forest-clad Kará Dágh.

In the southern part of the Persian Apennines, the Zagros and Avromán chain (diallage and serpentines) are succeeded by the Azmír or Jiozéh hills, of which the culminating point is the Pír Omár Gúdrún. The valley of Suleïmániyeh (2278 feet) separates the Azmír Dágh from the Dágh Masarágh (supra-cretaceous limestones), and this again is separated by the valley of Aley (2490 feet) from the Baziyán. Beyond this is a country of red sandstones, with conglomerates, attaining an elevation of 2246 feet at Khán 'Ishr, and flanked near Kerkúk, by the Karáchúk Dágh, which leave the Tigris at the parallel of Erbíl, and passing by Altún Kupri and Kerkúk, join the Kufrí hills at Dakúk or Táók. Their structure presents fresh-water limestones, gypsum, calcareous gypsum, and sands and sandstones, with bitumen, naphtha, sulphur, and salt deposits; and they contain the burning fountains of Abú Géger or Kerkúk Bábá, at an elevation of 543 feet.

The Táók and Kufrí hills are succeeded by the Zengabád range of red sands and sandstones, capped with limestone breccia, and this by the Hamerún hills, uniformly from Tigris to the Karún at Haváz, composed of red saliferous and gypsiferous sands, and sandstones.

On Tigris, the limestones of Rabbá Ormúz are succeeded by red sands and sandstones, which occupy the plains, to near Músul, where they are succeeded by calcareous gypsum and gypsum, and cerithia and fresh-water limestones, with sulphur (Músul), and bitumen and sulphur (Hamám Alí), and at Uslán and Selámí marles and coarse gypsum, superimposed on a coarse pectinide limestone.

At Karâ Chúk, the prolongation on Tigris of the Karâ Chúk Dágh are, limestones, sandstones, and gypsum, and at the prolongation of the Hamerún, red sand and sandstones; beyond which is a pebbly, clayey, or sandy alluvium.

On Euphrates, at Abú Bárá and Ja'ber (25 miles), gypsum and marls supersede the chalk of Bális. At Suríeh and Thapsacus (33 miles), these are succeeded by fresh-water limestones; and on the right bank, below Rakkah and opposite to the forest of 'Arán (24 miles), gypsums regain their original developement.

At the Bushír hills, at Zenobia or Zélebí (79 miles), the marles and gypsum are covered by breccia and selenitic sands, upon which are superimposed feldspathopyroxenic rocks. These hills extend to Palmyra, and give origin to those contrasted configurations which furnish springs, and afforded a site for a city in the desert.

At Ráhabáh, or Rehoboth (101 miles), the marles and gypsum are covered by sands, marles, breccia, fossiliferous marles, and brecciated limestone. 44 miles below, at Saláyíah, the same limestone, superimposed upon numerous beds of gypsum and marles, forms a dry and stony wilderness.

At Irzáh (59 miles), polypiferous clays and bituminous marles are associated with the gypsum formation, and at 'Anah (70 miles), compact pectinide and cerithia limestones separate this great formation of gypsum and marles from a superior one, which extends from Haddisa to Mesjid Sandábíyah, a distance of nearly 150 miles. In this great extent, it is associated with sandstones and ironstones, chloritous and green marles, feroxidated or red marles, bituminous marles, and saliferous clay. At Hít it is associated with yellow magnesian limestone, and furnishes the celebrated fountains of bitumen and naphtha; and is finally succeeded beyond the Mesjid Sandábíyah on the one hand, and the Pylæ of Xenophon on the other, by the low land of pebbles, clay, and soil which constitute the third region.

Physical Characters.

The character of the plains in the second zone, varies with the altitude and latitude; as well as with the quality of the soil, and the presence or absence of moisture.

The upland of feldspatho-pyroxenic rocks which extends from Jezírah to Tel Sakhán near Nísíbín, and which has a mean elevation of 1550 feet, is a stony wilderness, amidst which there is little or no cultivation, and where nevertheless numerous flocks of sheep and cattle obtain a scanty support during a large portion of the year. Villages tenanted chiefly by Kurds, but some by Chaldæans, are not infrequent. Wolves are numerous.

The great plains of northern Syria, averaging a mean elevation of 1300 feet, as determined by Mr. Thomson's line of levels, the plains of northern Mesopotamia, from Urfáh to Rakkah, and from Nísíbín to El Háthr, and the

Chaldean plain east of Nineveh, that of Erbíl and of Altún Kuprí, present pretty nearly similar characters, a nearly uniform level, with a soil possessing good agricultural qualities, but barren from want of irrigation.

The exceptions to the general rules are where the plains are intersected by hills, or ranges of hills, as in the Maklúb and Aïn el Safrá on the Chaldean plain, the Karà Chúk Dậgh on that of Erbíl and Aïn el Safrá. The hills round Músul, the Hamerún at El Háthr, the Babel mountains south of Jeziráh, the Sinjár hills inhabited by tribes of robber Kurds, the Abdel Hássiz, the residence of the Míllis Turkomen, the hills of Serúj, and those north of Aleppo. The hills of Karà Bambúch, and the Bushír range in Palmyrene.

The other differences are the comparative fertility of some places, which, exposed to temporary inundations, at the head of rivers or rivulets, on the banks of the same, or artificially irrigated, are by these advantages of position, the permanent abode of agricultural tribes, and the seat of cultivation and prosperity, or the repair of the nomadic Arab and Turkoman, where at certain seasons, he leads his flock, sometimes from very distant spots. It is no uncommon thing for the Shamár Arab tribe to pitch their tents in winter in the plains of Seleucia, and in summer to overrun the fertile district of El Háthr.

Examples of these fertile localities are abundant. Such, in north Syria, are the plains watered by the Koweïk or Chalus, by the Sajúr and the Kesrín, and east of Aleppo by the Aïn el Zéhéb.

Such, in Mesopotamia, are the plains of Urfáh and Harrán, watered by numerous streams. The plain of Serúj is hill enclosed, and watered and inundated like

Harrán, by various rivulets, designated as the Rás el Aïn el Arab, and contains, over an area of twenty square miles, upwards of forty large villages, which are abandoned during a part of the year. With the true Rás el Aïn, the Ressaina of the Romans, I am not acquainted. but it is from all reports, a similarly fertile spot, as are many situations in the yet unexplored Sinjár. The rich lands of Nísíbín are at the head of the Khabúr, and in the district of El Háthr, the waters of the same river were led by an artificial canal into the Tigris. This was at the time and posterior to when riches and power brought against the Atrenians the armed bands of Trajan and of Severus. The plains of the east of Tigris are watered by the Khozár, the Záb, the river of Altún Kuprí, and many others; Erbíl, at an elevation of 742 feet, is supplied by artificial channels brought from a rivulet, which flows to the south-east of the town.

Climate.

The climate of these plains is characterized by great dryness, combined with very great variations in the temperature of the air*. From the Mediterranean to the Tigris, there is an increase of cold in the same parallels, from west to east; or as De Humboldt would express it, the curves of isocheminic lines bend to the south in the east, and to the north in the west. This is not the case, however, in the plains east of Tigris, which, sheltered by the Kurdish mountains, have a more temperate winter. The influence of Taurus, clad for so many months with snow, is considerable in reducing the winter

* In summer, in the month of August, the thermometer of Fahrenheit was observed as high as 115° in the shade, and in winter as low as 12°.

temperature, and on the plains of North Syria, and of Mesopotamia, from the want of protecting hills, causes the vegetation to be in reality less southern than that of Sicily and of Andalusia. At the same time, the long extent of littoral mountains, Amanus, Casius, and Lebanon, add to these unfavourable circumstances by impeding the passage of mild air from the Mediterranean. Notwithstanding these circumstances, the direct heat of the sun, increased by radiation and equality of level, is almost without a moderating influence, for evaporation is nearly null, and hence where the winter temperature is so low, the summer heats are intense. It is on this account that there are few annual and tender plants, while the woody and tough stems of vivaceous species resist better to such opposite influences.

Vegetation.

In the steppes of Russia and Tartary, vegetation is characterized by Robinia frutescens, Hedysarum grandiflorum, Astragalus Austriacus, A. sulcatus, Oxytropis caudata, O. pilosa; several species of Artemesia, Prunus cerasus, and P. nana. In the plains of Bokharâ, the genera Astragalus and Robinia predominate; after these, Tamarix, and the family of Borragineæ, which furnishes Anchusa, Myosotis, Onosma, Echium, and Lithospermum; and that of Cruciferæ, which furnishes species of Hesperis, Cheiranthus, Sinapis, Arabis and Raphanus.

In both, liliaceous and bulbous plants occur in spots favourable to their propagation. They belong chiefly to the genera Hypoxis, Iris, Tulipa, Anthericum, Allium, Ornithogalum, Asphodelus, &c.

Isolated among these are species of Sedum, Sempervivum, and Euphorbiæ, while over the sand, the Calligonum

of Pallas, like the Gallenia of Africa, throws its rampant stems.

Under similar circumstances of atmospheric vicissitudes, and with similar characters of soil, analogous forms of vegetation are scattered over large geographical tracts, or are repeated at great distances from one another. The reeds, sedges, and rushes of our own climates have their generic representatives in the marshes of Babylonia, of India, and Guyana; and still more closely allied, is the vegetation of the plains of Assyria with that of Bokhará and Russia.

The Astragalus austriacus, and A. sulcatus of the steps, and the Astragalus christianus and A. dumetorum of Asia Minor, are represented by the Astragalus tragacantha and A. poterium, the Oxytropis caudata and pilosa by O. uncata, and the Robinia frutescens by the Mimosa agrestis, among the most general and frequent plants of the plains.

For two months in the year, namely, October and November, vegetation is at a stand still, every thing is burnt up, and no new forms appear; but after this period, the *Nile* clouds from the Lebanon in Syria, and reverses in the mountain temperatures to the north and the east over Mesopotamia and Adiabene, bring down moderate but refreshing rain. The brown and fallow colour of the soil changes, Graminæ begin to spread and increase, and notwithstanding the subsequent frost and storm, some Compositæ bud, but do not flower. But the succession of vegetation is kept up by those families which have succulent roots, nodes, or bulbs, which preserve moisture so as to ensure life even amidst the most arid soil. Sleeping during the summer heats, they awake to activity with

the first rains, and some send forth prematurely their leaves, or even their buds, in October. Among these are a Colchicum, a Tulipa, a Crocus, an Ixia, and an Arum. They are soon, however, enveloped in snow, or blasted by the wintry winds; till early in spring, when the same precocious plants make their appearance with all that vivid beauty of colour and variety of forms which have lent to the poet and the painter, their not always fabulous pictures of the East.

The species which constitute the flora of spring, belong mostly to the families Amarylloideæ, Asphodeleæ, Liliaceæ, Melanthaceæ, and an Orchida.

The plants of summer are particularly distinguished by woolly, thorny, prickly, and aculeated species. Among these the Compositæ are most numerous in individuals and species. The most frequent genera are Cnicus, Carduus, Centaurea and Calcitrapa, which cover whole plains.

Papilionaceæ are also frequent, although their small forms render them less striking. But the Labiatæ furnish the true aromatic plants of the plains; the most numerous species belong to the genera Stachys, Thymus, Sideritis, Satureja and Origanum. The absence of trees on these plains is a phenomenon difficult to account for, but originates possibly in an only occasional supply of moisture, and the great similarity of condition of such extensive tracts of land by which, had one form been propagated, its diffusion would have been so great as to make a continuous forest of Northern Mesopotamia and Syria. Hence on these great plains, there are but succulent and herbaceous biennials, or an ephemeral vegetation. A Pyrus grows in fallow. One species of Salix, and one of Rubus. Sumac (*Rhus coriaria*) grew on the banks of Euphrates.

The most common plants on cultivated lands were Glycyrrhiza glabra and G. echinata, Mimosa agrestis, Euphorbia pyrrhus?

The Platanus orientalis, near springs and tombs, attains an enormous size. One at Bír measured thirty-six feet in circumference; and one at Daphne, near Antioch, measured forty-two feet in girth, and was probably upwards of a thousand years old.

The useful plants which occur in this zone, either cultivated or not, are still very numerous. Among the grains are wheat (*Houta*), barley (*Shaeïr*), addes (*Ervum lens*), húmmes (*Cicer arietanum*), túl (*Vicia faba*), jilbán (*Lathyrus sativus*), kíshná (*Vicia nissoliana*), maäsh (*Phaseolus maximus*), dúra (*Holchus sorghum*), fúsa (*Medicago sativa*). The Arabs also eat Holchus bicolor.

The quantity of pot-herbs now cultivated where European plants have been much introduced, is considerable, but as more or less characteristic, I may notice, jibbes (*Cucumis citrullus*), bátéch (*Cucumis melo*), baydinjam (*Solanum melengena*), bámíyah (*Hibiscus esculentus*), kúrráh, kúsa 'sífr, and squash, species of cucurbito, &c.

Among the fruits are, zeitún (*Olea Europea*), fistúk (*Pistacia officinarum*), tút (*Morus alba*), tút shamy (*Morus niger*), román (*Punica granatum*), tín (*Ficus carica*), kírráz (*Prunus cerasus*), mísh mísh (*Prunus armeniaca*), Amygdalus persica; azáz, hough, kulb al taïr, three varieties of plums; túffa (*Pyrus malus*), nijáz (*P. communis*), sfírgle (*Pyrus cydonia*), kírrási (*Cornus mas*), luz (*Amygdalus communis*), juz (*Juglans regia*), bíndúk (*Corylus avellana*), anáb (*Rhamnus ziziphus*), abú furwa (*Fagus castanea*), sinnuber (*Pinus cembra*), nuts, etc.

Among cultivated plants, Nicotiana tabacum (*tuttún*),

símsím (*Sesamum orientale*), khúrwá (*Ricinus communis*), kimbís (*Cannabis sativa*), hulby (*Trigonella fœnum græcum*), kurtím (*Carthamus tinctorius*), kútn (*Gossypium herbaceum*).

Among the useful vegetables furnished by the fields are, kibbár (*Caparis spinosa*), al sarrál túr (*Borago officinalis*), hubeïsi (*Malva rotundifolia*), hornaid (*Rumex acetosa*), rishad el moï (*Sysimbrium nasturtium*), kímmaï (*Lycoperdon tuberosum*), zábre (*Satureja hortensis*), húrdle (*Sinapis orientalis*), shik akúl (*Tordylium syriacum*), sús (*Glycyrrhiza glabra*), hillcún (*Asparagus officinale*). The leaves of the *Arum colocasio* (kolcás), are used as paper. On the Chaldæan plain, east of Músul, a species of scorzonera abounds, and affords a plentiful nutriment. Gum tragacanth is obtained from several species of Astragalus, in Persia according to Olivier from A. verus, but at Aleppo it is obtained from A. tragacantha, A. alopecuroides, A. guttatus, A. poterium, and apparently from other species, for twelve are met with in the neighbourhood. Henna is obtained from the Lawsonia inermis.

On the Euphrates, the Arabs eat leaves of several species of Lactuca, Sonchus, and Cardui, and the roots of Cepa allium, a Scilla, and an Ixia, also the bulb of a crocus, which is as sweet as an almond. The Expedition often used a species of wild atriplex as a vegetable; it eats like spinach.

Zoology.

The zoology both of Taurus and of the plains, although known in its leading features, is quite unexplored in some of its most interesting departments, more particularly in those peculiar forms of Rodentia

which are most characteristic of the animalization of the latter.

The monkey, whose country begins about 38° N. lat., is unknown in Assyria and Babylonia; but it is not certain if it is not an extinct animal, for an able Hebrew scholar has stated to me, that the doleful creatures which are prophetically announced as tenanting fallen Babylon, ought to be read as monkeys or baboons.

The bat tribe are numerous. The genera Rhinolophus and Nycterix have their representatives. In the "Castle of Stars," on Euphrates, the Rhinolophus was particularly abundant, and fed on two species of Tenebrio, T. molitor and T. obscurus, and a Dermestes like our vulpinus.

Among the Insectivora were only found, Erinaceus auritis of Pallas, and Sorex pusillus.

The Carnivora form, it may be said, on some accounts, the most important family in these countries. The lion is met with in the lower part of Euphrates and Tigris. The foot-prints were first observed at the Khabúr, but Lieutenant Lynch, I. N., met with one as far north as Bális. A lion from the banks of Tigris, in the possession of Colonel Taylor, resident at Baghdád, had not the fur of the Isabella yellow colour attributed to the Arabian and Persian species, but was as brown as the Bombay lion.

A maneless variety of the hunting tiger, and distinguished by some natural historians from the Felis jubata by the title of F. venatica, the Fááhd of the Arabs, is not uncommon in the lower districts of Tigris and Euphrates. A specimen, exhibiting all the docility of the Persian Yúse, also existed at Baghdád, and notwithstanding the want of retractile claws, climbed trees with facility. But the most common of the cat tribe was the Felis chaus of

Guldenstad, figured in Jardine's "Naturalist's Library," (Mammiferæ, vol. ii.,) and which the author has approached, when hunting, to within a few paces. He has also seen near Mar'ash a larger animal of the same family, which may have been the Felis pardus, said to inhabit Amanus and Lebanon. It is called nímer by the mountaineers. The Felis pardina of Oken and Temminck inhabits Amanus and Taurus. On Tchokúr Ovah, near Missisáh, Colonel Chesney, Mr. Staunton, and the author met, in hunting, in one day, eight individuals of this species.

The lynx, (wúshák) inhabits the woody districts. The striped hyæna is a most common animal in all kinds of countries, sheltering itself behind either a wall or a shrub. A white variety was also observed. The wolf (díb or tíb), is most frequent in Taurus. It is replaced in the plains by the Tartarian wolf, and both are rare in the south. The black wolf (*Canis lycaon*), was seen on the banks of Sajúr. The jackal (*Canis aureus*), so frequent an animal in the East, appears to present some differences in Syria, on Euphrates, and in Persia, which have not yet been well determined. Foxes (taäleb) are common. On Euphrates, the species was always *Canis corsac*, but in Taurus, it was our common *Canis vulpes*.

Bears are not uncommon in Taurus and in the Persian Apennines. In Kúrdistan, a black bear is called Mangá Már. Another species is called Gamésh. At Músul, a brown bear called Dúbá, is also brought from the mountains. The black-eared lynx (Kárá Kulák) is also an inhabitant of the same hills; and a village in Amanus, between Kará Kapú and Missisáh, is named after the same animal. The Herpestes ichneumon of Olivier is

an interesting quadruped of the same family. The polecat abounds near Aleppo. It is called eben aarse.

Cats, kúth, or kútta, are of three kinds, the common domestic cat, a mixed breed, and the Persian cat (kútta Ajemy). The dogs are the bazaar, or town dog, Turkoman dog, with long ears and long soft hair, and shepherd's dog. There are also crosses of dog and wolf, and dog and fox.

The ratel, the sable, and the genet, are met with in Taurus and other mountain districts. The otter (*Lutra vulgaris?*) occurs on Euphrates, Tigris, Karún, &c.

The order of Rodentia presents us with the common beaver (*Castor fiber*), found by the Expedition in Euphrates and Khabúr. Spermophilus citillus, Arctomys marmotta, Cricetus vulgaris, and the great and common dormice, are tenants of the mountain forests.

Different jerboas inhabit the plains; the most common are, Dipus gerboa, D. jaculus, D. sagitta, and D. pygmæus, besides other undetermined species. The Aspalax typhlus (*Georychus typhlus*), the mole of the ancients, abounds more especially in the plains of Kúrdistán. There is a mustela, perhaps M. Sarmatica, on the plains, and several species in Taurus, and Mustela martes in Chamlú Bel and Karà Bel mountains.

The forest of 'Arán, on Euphrates, furnished the author with a new species of Gerbillus, differing from the G. tamaricinus of Pallas, in being with tail seventeen inches in length.

The common rat of the country appears to be the Mus decumanus. Mice are numerous and various. The mouse observed at Bír was an undescribed species.

Squirrels are abundant in the woods, the species

not determined. Porcupines, called kimfúd, are also frequent. There are two hares, the Turkoman hare, which haunts the plains, and the hare of the desert, with long hair and ears. Rabbits (arneb) are rare.

The order of Pachydermata is represented by the wild boar, common in every spot at all adapted for its existence; and by the wild horse of Mesopotamia, supposed to be the Equus khur, or Eq. hemionus, but the Expedition could not obtain a skin or specimen.

The chief domesticated horses are of two breeds; the Arab, finely limbed, slender, hardy, and fleet; and the Turkoman, of a larger size, and stronger make.

The asses are of a common breed, but larger than in Britain; an improved breed, tall, delicately limbed, swift and easy in pace; and lastly, the Damascus ass, with very long body, long ears, smooth skin, and dark colour.

At the head of Ruminantia is the camels, of which the first in point of importance and utility is the Arabian camel (*Camelus dromedarius*), with one hunch, and pale fawn-coloured brown fur. The second is the Bactrian or Persian camel (*Camelus Bactrianus*), with two hunches, and plentiful hair on the upper part of the neck. The common Turkoman camel is a mule, the produce of the Arab and Bactrian camels, and found to be of great utility. It is larger, stouter, and more hairy than the others. Its common load is about four hundred pounds on each side, but there are some capable of carrying a much greater weight. It is less tractable, and less capable of enduring heat, than the Arab camel.

There are two varieties of the Arab camel. 1st, the dromedary; the highest breed, slight make, cleanly limbed, hunch smaller, ambles with great agility, used

for war and expresses, and anything requiring haste or fatigue.

The common Arab camel is of light dun colour, seldom carries more than two hundred and fifty pounds on each side, and is content to browze along on thistles and prickly shrubs, and can bear the want of water to the greatest extent.

Among the Cervidæ, the fallow-deer (*Cervus dama*), is common in some parts of Taurus, more especially in the Karâ Bel and Chamlú Bel. It is said that the stag (*Cervus elaphus*), occurs in the same districts. The roe-buck (*Cervus capreolus*), is not uncommon. Of antelopes there are several species; one, of the mountains, back and neck of a dark-brown colour, bounds with surprising agility. The limbs of the Gházál (*Antilope dorcas*), the antelope of the plains, are not so cleanly turned, it is of a lighter colour, is not so active, but is very fleet, and gregarious. They are so tame as often to feed in flocks with sheep. On Tigris, near Kút Aamárah, A. subgutterosa replaces A. dorcas.

There are many varieties of goats. The goat of Syria has long brown hair, short black horns, bent downwards, and pendulous ears. The goat of Taurus, commonly called Angora goat, is generally white, with buff-coloured ears and yellow horns, hair fine and curled. The Kúrdistán goat has long black hair, curled and silky, horns bent downwards, pendulous, black ears tipped with brown, as are also sometimes the legs. Among the wild species of this tribe, the Capra ibex, and I believe, from some horns seen at a forester's, the Capra Caucasicus, inhabit Taurus.

The sheep are of two kinds; the common Tartarian

sheep, with enormous pendulous tail, weighing generally fifteen pounds, but sometimes much more; the second is the Bedowin sheep (runnám), in which the tail is only somewhat larger and thicker than in our domestic breeds. The Ovis Ammon was observed at Azáz.

The Bovidæ present us with forms belonging to the Bubaline, the Bisontine, and the Taurine groups. The first is represented by the common buffalo (*Bos bubalus*), most cared for by Turkomen and by the Arabs on Euphrates; the second by the bull and cow with hunch, also frequent on Euphrates; and the third by the common bull (al táur) and cow (al búkr), of which there are two varieties: the first of a large size, with a thin belly and long slender legs, the second smaller, and with short hams.

Birds.

The extensive subject of the ornithology of the plains can only be treated of cursorily; that of the northern parts of the plain associates itself with the ornithology of Taurus, and that of the southern portion is remarkably scanty. The type also in the northern parts is European, but the European birds of passage do not remain long, and the summer birds of passage take their departure in October.

Species of the order Accipitres are particularly abundant. The Vultur percnopterus is common in almost all towns, where it lives in the shambles or the burial ground. The Vultur fulvus was shot by Dr. Helfer at Bír. Falco ossifragus is not uncommon. F. milvus sweeps across the plains. F. tinnunculus and F. gentilis (shahín) are brought up for the chase.

Owls are frequent both in Taurus and in the chalk cliffs of Euphrates; the species were, Strix bubo (búmi), S. flammea, S. passerina, S. uratensis. The crows were Cervus corax, C. corone (zagr), C. cornix, C. monedula,

> The green birds that dwell
> In radiant fields of asphodel.

Garrulus pica came in October, Oriolus gracola departed same month. Besides these European species, there were some that were peculiar but undetermined. Coracias garrula (shikrak), and a Sturnus (zúrzúr), more brilliant than ours.

Among the Insectivorous birds were Turdus musicus (dudge), T. merula (shahrúr), and three other European species, besides T. rufus, T. saxatilis, and T. roseus (smurmúr), the celebrated locust-bird of Pliny. Cinclus aquaticus, and one species of Edolius.

There were few opportunities of studying the interesting group of Motacilla and Silvia. The Bulbul of Syria is our nightingale, but that of Persia is a Turdus. The Becafico is called Asfúr el Tín, or fig sparrow. The Regulus is here a bird of passage; Troglodytes Europæus (*fistís*), and two species of Taxicola, are met with.

Among the Granivorous birds, the genus Alauda furnished many species, among which A. arvensis (dullan) was the most rare, and A. cristata (kembr) the most common. There were also A. alpestris, A. calendra (calandra), and A. Tartarica; Parus major and P. ater; Emberiza hortulana (Ortulan) E. citrinella. The common sparrow follows even tents. Fringilla furnishes four or five species, among which Sukakía, the goldfinch.

The Zygodactylous birds afford Cuculus canorus (húmám); the Scansoriæ are rare, except in the woods.

The Yunx torquilla, and two species of Picus, constitute almost all. The Upupa epops (shibúbúk), is common every where.

Among the Alcyones, Merops apiaster (wúrwár), and M. cærulo cephalus, whose holes in the earth are dug after by jackals. Of three species of Alcedo, none are European. The Chelidones furnish two species of Hirundo, and the Caprimulgus Europæus. The Columbæ furnish about fourteen species, among which are C. risona (sit el rúm) and C. testaceo incarnata of Forskahl.

Among the game birds are, one species of Lagopus, shot by Colonel Chesney near Bír. The most common on Euphrates and Tigris was Perdix Francolinus; on plains, Pterocles arenarius, in flocks of millions; on rocks in plains, Perdix petrosa; in Taurus, Perdix cinerea, P. rufa, P. græca, also the black partridge. I have shot the Syrrhaptes Pallasii as far south as Kút Aamárah on Tigris. The quail is not common. In the woods are Phasianus Colchicus (djáge), and another called dík busráuwy.

The Cursores are forms peculiarly of the desert; the most remarkable bird of this group, the Struthio camelus (naämey), is now rare in western Asia. Not so with the Great Bustard (*Otis tarda*), which is still very common. The bustards of Arabia and of Southern Mesopotamia are, however, suspected to be different birds from those of the first zone.

The order of Grallatores affords many species of Charadrius, among which are several with spines to the wings, Tringa, Squatarola, and others; four species of Scolopax, seven species of Ardea, two species of Rallus. Fulica porphyris was common on Euphrates, as was also Machares pugnax.

Among the Palmipedes are, Pelecanus onocrotalus, about ten Anseres, including Kárá buttík (*Anas nigra*), Abú málák (*A. clypeata*), Bútt búrri (*A. boschas*), and A. Sirsæir of Forskahl. Mergus merganser, Colymbus auritus; on Euphrates, were two species of Larus, one of Procellarius, and a cormorant.

Fish.

Among the more remarkable fish are, the Aleppo eel (simmák Inglíz), described by Gronovius, ("*Zoophylacium*, No. 402, Lugd. Bat. 1781,") by Dr. Solander and Sir E. Home, called Ophidium masbacambelus, two Siluri (babúge), Cobitis barbatula (kebúdy), Barbus vulgaris (kirsín), the most common fish of Upper Euphrates and of the pond of Djamí Ibrahím at Urfáh; Cyprinus cephalus (búrak), several binnies, one at Aleppo, one of Forskahl, and the kellórí of the natives, Muræna anguilla (simmák keïát), lake of Antioch; two species of carp, and one Cobitis, from the same. The celebrated black fish (Simmák el Aswád) is a Macropteronotus. Trout are common in Taurus.

Reptiles.

Reptiles are numerous in this zone. There occur two species of Testudo on the plains, one of which resembles T. græca; two species of Emys were found in Euphrates, and two of Trionyx, one in Euphrates and one in Orontes. Among ruins were three different species of Gecko, and the common chameleon in woody and sheltered districts. The Amphibia of the plain vary in their characters, according to the means of subsistence to which they are

reduced; they are chiefly Iguanidæ and Lacertinidæ, with not unfrequent Ophidia. Wherever rock, clay, or sand has the slightest tendency to vegetation, there insects prosper, and lizards make their appearance. The fundamental forms assumed on the plains are large bodies and big heads, with a skin lubricated and defended from the burning sun by a natural exudation, The narrow, smooth, and long forms of lizards, do not prosper on sterile and arid spots. Agama, of the same species, reappear at intervals over large tracts of country, and they furnish on these plains nourishment to various Mammiferæ and birds. It appears also that the numerous large non-venomous serpents which frequent these plains are fed by these insectivorous lizards. Vipers (*Coluber*) confine themselves more to small Rodentia.

On the more fertile and productive banks of Euphrates large species of Ameiva are common, and are even met with in the adjacent plains and among ruins, as at Rakkah*; and it is not certain if one of the tribe of Crocodilidæ does not occur in Upper Euphrates. The Batrachia, which furnish seven species in the rivulets of the upper districts, are unknown in the plains and on Lower Euphrates and Tigris.

Insects.

The Entomology of these extensive districts presents many features of great interest, but which yet demand

* "Lacerti Arabicæ cubitales," says Pliny, lib. viii. 60; upon which Cuvier remarks, the monitor is known to surpass that length. A specimen, captured at Bális, was, with the tail, two feet six inches in length.

much investigation. Dr. Helfer made a considerable collection, more particularly on Euphrates, which will probably present entomologists with some new forms.

The most characteristic during the dry months are, Truxales, Locustæ, and Acridium; some striped Lepidopteræ, chiefly of the genus Maniola, also still flutter about. Four kinds of Pimeliæ occur on the most arid spots, two species are most common. After the rains, Dr. Helfer obtained two hundred Coleoptera, among which many genera, supposed to be exclusively proper to the temperate and northern parts of Europe, or which have only some representatives in a southern region, occur here. Such are the Brachyletrous beetles, of which seven hundred species belong to Britain, and of which forty species were found, and five species of Pselaphon, of which the type was considered Swedish. The Rev. Dr. Hope had questioned if there was a true Carabus on these plains; Dr. Helfer considered as such Carabus Hemprishei, one of the most common insects of the plains. Melasomæ and Pimeliareæ are very numerous. The Curculionides furnished sixty species; Coccinellæ were in abundance; Crysomellinæ rare; the Lamellicornes also furnished a bad harvest. Aphodiæ were particularly common, at certain seasons in flights like locusts. The types of spring are the Heteromera, amongst these Pimelariæ.

Euphrates.

The remarkable features in descending Euphrates from the higher plains is the absence of all perennial shrubs on the hills. The chalk cliffs are covered with species of Sinapis and Brassica; Accipitres, numerous in species in different places, are not so in the same loca-

lities. The Anas Nubica, a bird common on Euphrates, migrates from Dongola and Nubia in spring. The vegetation of spring was found to be generally a few days in advance, on the eastern bank of the river, of that on the western.

The hills of Karâ Bambûch furnished an Amygdalus, and on the highest part a scanty Prunus, also an Astragalus, and the Mimosa agrestis. The meadows afforded Gramineæ, Adonis, chamomile, Chrysanthemum, Erysmium, and other Tetradynamous species. Truffles are dug up at the foot of hills five inches in depth.

On the plains of Bâlis, the circumscription of a peculiar vegetation to different spots was remarkable; some tracts were covered with Cochlearia, others with chamomile, some with pansies, and others with Anthoxanthum odoratum. Twenty-three new plants, first met at Bâlis, followed 140 miles down the river. The tamarisk began at Bâlis.

Jungle, to the south of Bâlis, was formed of a species of poplar (Gharâb of the Arabs), with lanceolate leaves, and which has been mistaken for a willow. A Lygeum and a Rubus, a Clematis and two Asparaginæ, with the tamarisk, were the only other plants. In these jungles, far away from the habitations of men, sparrows build their nests in dense congregations. The Merops apiaster builds near, or in roads; the earth being trod upon is harder, and less easily turned up by their enemies the jackals; for the same reason they build on the vertical banks of rivers.

South of Rakkah, in the forest of 'Arân, the mulberry (*Morus alba*) first appears. At Zenobia, Umbelliferæ begin to predominate. 'Anah is the most southern point

of olive-trees, and the most northern for the date, with the exception of isolated trees, which are met with in the shelter of the bay of Iskenderún. At Jubbah and Hadísah, the Graculus and turtle-doves nestle on groves of the same tree.

The desert of Xenophon, extending from the Khabúr or Araxes to Rehoboth, is still what it was in the Greek general's day, "full of wormwood; and if any other kind of plants grow there, they have for the most part an aromatic smell."

The tomentose and spiny plants were in part dismissed on the alluvial plains of the third zone, and give way to crassulated and succulent genera; but the physical features of this interesting country, including Babylonia, Chaldæa, and Susiana, will be described hereafter.

Rock Formations of the Basin of Euphrates, from Taurus to the alluvial Districts of Babylonia.

Foot of Taurus.—The sedimentary deposits, which repose upon the plutonic and metamorphic rocks of Taurus, are, to the south, limestones, which belong to the cretaceous series, and present, in the neighbourhood of the mountain-chain, a compact subcrystalline limestone, of a mostly uniform hard texture, sometimes saccharoidal, but, generally speaking, compact or granular. The characteristic fossils belonged to Terebratulæ, Ostreæ, Ananchytes, and Crinoidea.

Formations along the course of Euphrates.—The course

of Euphrates, is pretty nearly from the north-east to south-west, as far as to Rum-Kal'ah, where the river takes a direction to the east of south. From Somïesát southward, the rocks consist of soft cretaceous and marly beds, with a local formation of feldspatho-pyroxenic rocks; but in a straight line from Taurus to Rum-Kal'ah, the succession of formations is as follows.

Formations from Taurus to Rum-Kal'ah.—Subcrystalline limestone, compact, uniform, or slightly granular and splintery, in thin strata, the upper beds fossiliferous, having a high angle of inclination, much curved and contorted, and dipping in various directions, but most generally to the south-east.

Granular Chalk.—This formation occupies the greater part of the country between the territory of Aïn-Táb and Mar'ash, and is accompanied by feldspatho-pyroxenic rocks. In the present line it occupies the range of hills which divides the valley of the Sinjár, at foot of Taurus, from that of Karású Bekír.

Plutonic Rocks of Bekír Karású.—The valley of the Bekír Karású is about thirty-six miles long by seven broad, and is shut up at its western extremity by feldspatho-pyroxenic rocks, and the same rocks form a narrow band at the foot of the northern range of hills, the limits of which are very easily defined.

Mineralogical Characters.—Mineralogically speaking, the rocks consisted of dolerites, or a rock of hornblende and augite, with occasional crystals of olivine; and of

compact, uniform, petrosiliceous, or gray basalt and basanite, or basalt with crystals of augite.

Metamorphic Rocks.—The plutonic rocks at the head of the valley are separated from the chalk by altered rocks, consisting of calcareous spilites, red spilites, and earthy basalt (wackite), coloured blue with the phosphate of iron.

Aspect of the Valley of Bekír Karású.—The valley of Bekir is occupied by alluvia; it is for the most part cultivated, and contains numerous villages, being remarkably well peopled. The river soon leaves the valley, in which the retreat of the waters has left several Tells or conical hills, one of which is castellated (Altún Dash, the castle of the golden rock), and enters into the rocky country to the south, flowing between low mural precipices until it joins the Euphrates, at a point where the latter river is also hemmed in, on both sides, by lofty walls of rock.

Foliated Chalk.—The next country of hills to the south, and at the north foot of which courses the Bekír Karású, consists of subcrystalline highly granular and foliated limestone, with abundant organic remains, chiefly ostracites. The foliated structure communicates a remarkable appearance to this limestone, and its beds every where present a curved and waved stratification, having a general southerly dip at a high angle of inclination.

Character of the Country.—The country occupied by this formation is extremely desolate; it is for a great part

covered with forests of deciduous oaks on the western side of the Euphrates, but is quite bare on the east. The culminating point to the west of the Euphrates is marked by the remains of a Roman arch, visible both from the river and from the line of the present section.

Friable Chalk.—The foliated limestone is observed, in the deep sections afforded by the Euphrates (which flows in a bed three hundred feet below the level of the country around), to repose upon friable chalk, sometimes marly and laminar, containing hydrated flints, but more generally uniform, with horizontal layers of dark-brown flints (*Silex pyromarque*).

Relation of the granular and compact Chalk with the friable soft Chalk.—At Rum-Kal'ah, where the river is joined by a small tributary, the lower chalk occupies the surface soil in strata nearly horizontal, but the upper beds are always more indurated and compact than the lower. The castle is built upon a promontory of friable chalk, which is below the hard rock, and hence cut into steep precipices, surrounded by the tributary river, and at the same time cut through, in its southerly connexion with the main rock.

Character of Country at Somïesát.—In arriving at the same point from Somïesát, we find a difference in the physical features of the soil and in the general character of the cretaceous formations. The Euphrates at Somïesát runs through a valley from eight to ten miles in width, consisting of plains of slightly different altitudes, left at successive periods by the river as it has deepened

its course,—a common phenomenon of configuration along the river's course.

Contrasted Configurations.—The plains are for the most part cultivated, well provided with villages, and are surrounded to the west by ranges of rounded hills following a direction pretty nearly parallel to that of the river. The direction of the river is from north-east to south-west: to the north and east is a long table-land and rounded hills; to the south-east, the hills are deeply intersected by ravines which cut the uplands into table-lands or flat summits, rounded hills, and some few conical points. The acclivities are always remarkable for their regularity, and the outline is generally soft and rounded.

Chalk Formations.—The formations consist entirely of chalk, varying in its appearance from buff-yellow and fissile, to white, friable, and light-blue marly. This formation is covered with a breccia of transported pebbles of diallage rocks, hornblende rocks, and quartzes.

Non-existence of a great Bend of the River at Somïesát.—Mela and Pliny having spoken of the combat which took place between Euphrates and Taurus at Elegia, an error (transmitted in modern times by D'Anville), has propagated itself among geographers and historians, of the occurrence of a great elbow or bend in the river at Somïesát (the Zeugma of Commagena of Strabo); Mr. Beke, in his "Origines Biblicæ," has gone so far as to trace the extent of journey easterly of the fathers of the human race to this curvature, to which point they followed the course of the Euphrates; and in the plains of

Somïesát, and at the foot of Taurus, was, in his idea, the first home of our forefathers, and the land of Shinar. The fact is, that the river does not curve to the east of south until it has reached Rum-Kal'ah.

Character of the Country which opposes Euphrates.—The opposition offered to the progress of a river by a chain of mountains, and those loftier elevations of the surface of the earth which strike the eye of the casual observer, is not greater than that which is presented by the prolonged developement of an uniformly massive and hard rock, rising, however, little above the level of the river's bed. It is through formations of this character that the Euphrates has to force its way not only at Somïesát, but in a continuous line, extending to the south of Rum-Kal'ah. And its passage through these rocky portals to the country of the south, is accompanied by much that is picturesque in scenery, and instructive in science.

Compact Chalk.—The indurated chalk first shows itself in the neighbourhood of the plutonic rocks, at a place called *Jemjemé;* the contortions and flexures in the rock, which forms high cliffs above the river, are very remarkable. The whole system rises more than 1200 feet above the bed of the latter. It consists of friable, buff-coloured marles and chalks, which on the south support hard limestones, dipping at a high angle of inclination to the south. The river curves from N. 80 W. to N. 25 E.

Mineralogical Characters.—To the south of this upland, the plutonic rocks show themselves in the form of

shistose dolerites, with abundant garnets, and some augite and titaniferous iron. There is some basalt, but very few spilites and altered rocks.

Developements.—This great band of plutonic rocks is almost continuous in a circular developement from Karamania by Commagena to the Karádjia Daghli, beyond Urfáh, and to Jezirah by the foot of Masius.

Ostracite Sandstone.—About a mile and a half to the south-west of Idlebazár, (where is a ferry on the river,) ostracite sandstone and old breccia show themselves superimposed upon the chalk series, and occupying only a small extent of territory. The whole space occupied by the sandstone on the banks of the river is not more than three hundred yards.

Grottoes and Ledges in the Precipices of Euphrates.—The cliffs below Nar-Sís, formerly an Armenian place of importance, are dotted with excavated grottoes, not sepulchral, but probably the retreat of persecuted Christians in early times. Hyanha is a remarkable village, built on successive ledges of rock, artificially wrought on the side of a mural precipice, between four and five hundred feet high; and the road is carried up by successive ledges to reach the plain of Dibbin, where Armenians cultivate vineyards, which afford a tolerable wine.

Subsidences.—Subsidences are not uncommon along the river side; they often give rise to secondary valleys higher than the bed of the Euphrates; a good example

of one occurs opposite to Rum-Kal'ah, which presents the accompanying peculiarities of disposition.

Here should be the Apamea of Isidore of Charax, but not the slightest vestiges of it are observable.

Character of Euphrates below Rum-Kal'ah.—At Káffre-bég, two miles below Rum-Kal'ah, the valley of the river Euphrates begins to widen, although the territory continues rocky, and presents pretty nearly the same characters to the plain north of Tel Bálkis, which resembles in its appearance, and the disposition of its alluvia, that of Somïesát. Tel Bálkis is of chalk, and being a remarkable point in the general outline, was once the seat of a Grecian or Roman temple. The name would assign to it a worship of still more ancient times.

From Bálkis to Bír, the river is bounded on the one side by a low plain, on the other by cliffs of white chalk, about 150 feet in height, and capped by a deposit of pebbles and soil, and in one spot of transported huge masses of limestone; the probable origin of which is given in the report upon the latest deposits by transport of the basin of the Euphrates.

Chalk Formations of Bír.—The town of Bír is built upon a similar chalk formation, only that it is now distinguishable into two portions, the lower of which consists

of white and pure chalk in thick beds, and contains flints, as in the rock on which the castle of Bír is built.

The upper beds, which are often separated from the lower by light blue and argillo-calcareous beds, as in the cliffs to the north and south of Port William, are fissile and of a yellowish colour, varying from buff to straw yellow. These beds, which form cliffs of from two to three hundred feet in height to the south of Bír, are for the most part non-fossiliferous, and do not contain flints.

They at the same time are characterized by considerable deposits of iron in nodules or layers irregularly disseminated, or in beds contemporaneous with the limestone strata. This iron is an hydrate of the peroxide, with some manganese (*Limonite of Beudant, hematite*), and it is met with crystallized in cubical or rectangular crystals, these being sometimes further covered on the surface with small octahedral shining crystals.

It occurs, however, most commonly as a pseudomorphous product, chiefly in the botryoidal form borrowed from various polypiferous structures. It also occurred as a mammellonated product, having a fibrous structure.

The ferriferous beds of the upper chalk are remarkable for containing in one spot near a *ziaret*, or tomb, one mile and a half south of Port William, certain varieties of sulphate of alum, where there is a cave of artificial construction. These aluminous substances do not contain potash or soda, and consequently do not belong to the alkaline sulphates of alum (*Alumite*), but to the pure sulphates (*Katherite*), of which there occur several varieties, the ferriferous katherite (*Alum de Plume*), and fibrous katherite in two varieties, the scaly and the radiated.

Stratification.—The chalk formation, in regard to its stratification, is generally nearly horizontal in this neighbourhood. When the inclination of the beds becomes decided, the general dip is to the south-west, at an angle of from five to fifteen degrees.

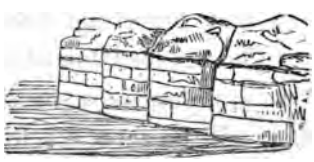
Contrasted Configurations.—The contrasted configurations give a certain degree of interest to the surrounding scenery, consisting chiefly of table-lands, round summits, cones, and deep and narrow valleys.

Theory of different Forms.—The circumstances under which this variety in configuration is given birth to, are the occurrence, at a little distance to the east, of the indurated chalk formation capping the yellow and white friable varieties. In the valley of the river Euphrates, these beds, when abruptly cut through by the waters, form table-lands and plateaux, and when the upper or indurated beds are wanting, cones and round summits or domes. Cones where the action of the waters has been great, round summits when more gentle. This is represented in the accompanying outline.

It is evident that the current must have been more powerful in the vicinity of its circumscription by the precipitous termination of the table-land, than more in the centre of the stream. It is the same with regard to the succession of contrasted configurations at Somïesát

and other points lower down the river. The table-land of Mesopotamia extends hence to the plain of Serúj, where it is interrupted by plutonic rocks.

Supra-cretaceous Rocks.—The members of the supra-cretaceous series only show themselves in one spot in the neighbourhood of Port William. This is on the summit of the hills which border the right bank of the river Kersín in a south-westerly direction from Bír. The deposits here are a flinty conglomerate, cemented by a calcareous paste and a coarse limestone rock; but they do not attain any great thickness except at the Sajúr, where they form the basis of formations immediately superimposed on the chalk, and lying between it and other limestone rocks of the tertiary epoch.



Headlands of Chalk.—The character of the successive headlands, consisting of chalk precipices, surmounted by a formation of flint breccia, as they occur to the south of Bír, is attempted to be given in the above cut of the headland of the Zïáret, with a valley immediately beyond. Three miles further south, and on the east side, the plutonic formations make their appearance on the summit of the hills, the extreme south-westerly point of the Serúj effusion.

The Whirlpool of Gurlúk.—At the village of Gurlúk, "that which sounds like thunder," Kiará of the Arabs, a

low promontory of hard rock advances from the right bank into the river, throwing an impediment in the way of the current, and causing the waters to return upon themselves, they sweep up from beneath the caverned mass, forming several whirlpools, which, from their great rapidity, are dangerous to the navigation of small boats.

Chalk Formations and Plutonic Rocks at Zehereh.—On the eastern bank, in the same parallel, and in the vicinity of the village of Zehereh and of Tell Adráh, are, to the north, ranges of table-lands of indurated chalk capped by basalts; behind Zehereh, rounded hills of friable chalk, and to the south, table-summits of indurated chalk capping friable chalk. From Tell Adráh, which is a small but characteristic mound upon the last table-hills, to the headland at Moghár, is a succession of cliffs composed of indurated limestone and limestone breccia, alternating with friable chalk. The explanation already given of the origin of contrasted configurations in the chalk formations applies itself, it will be seen, forcibly to the present appearances.

Formations at Sarisát, or Ceciliana.—From Gúrlúk to the Sajúr the country on the right bank is low, and only succeeded in the distance by undulating hills of tame outline. Beyond the Sajúr, the cliffs of Sarisát advance in a bold headland into the river. They consist of friable chalk, wrought into extensive caverns or dwelling-places, with subterranean communications, in one part, capped by indurated chalk, mostly in waved and contorted stratification. There is a Greek inscription at this headland, and a pleasing recess, where a small stream fell over a

natural circus of rock, near which, and upon the hill side, are the ruins of the antique Ceciliana.

Formations at Nesjm Kal'ah, (The Castle of the Stars.) —Alternations of indurated and of friable chalk continue to give their character to the country as far as to Nesjm Kal'ah, eighteen miles and a half below the Sajúr, a noble castellated building, on a mound of white chalk, surrounded by cliffs of the same rock, mostly indurated. The latter soon begins to lose its developement. The country becomes less abrupt and more uniform in aspect. The valley of the Euphrates widens, and in the re-entering angles of the rock-formations, plains of alluvium begin to be deposited. These features, however, are entirely changed by the hills of *Karâ Bambúch,* which cross the river about eighteen miles below *Nesjm Kal'ah.*

Formations of Karâ Bambúch.—These hills, of a rounded and flat tame outline, rise at least 1200 feet above the bed of the river, and consist entirely of indurated chalk or limestone, alternating with friable chalk. Their appearance is rather more interesting when the river forces its way through them, giving birth to fine mural precipices, and causing local subsidences, by which the strata are observed, at the entrance of the pass, to dip in the two opposite directions at the opposed sides of the river. The first small and rugged rock on the right bank presents the remains of a causeway or bridge. The site of Karâ Bambúch, which was probably connected with the metropolitan Bambúch, Mambege or Hierapolis, situated in the middle of a great plain, sixteen miles to the

east, is upon two separate hills' summits, divided by a deep ravine, with sepulchral grots and caves.

Organic Remains.—The lower white chalk on the east side abounds in Echinodermata, Zoophytes, and small Ostracites. The nidus of the Zoophytes are sometimes filled with Limonite. There are no flints.

Rhombic Cleavage.—In the cliffs on the same side, on approaching the pass, the whole mass of the rock is divided by rhombic cleavage into thin masses about an inch thick. This is one of those cases where structural changes have occurred since the period of the first deposition and consolidation of the rock. In 1835, in a small work descriptive of the same appearances as observed upon a magnificent scale at Ballybunian, on the coast of Ireland, I attempted to point out the sub-crystalline character of this mode of cleavage. Since that period, a discussion has originated between two eminent geologists, Professor Sedgwick (" Geol. Trans.," 2d series, vol. iii., p. 3,) and Dr. Boase, (" Phil. Mag.," 3d series, No. xlii.,) upon the same point; whether the change undergone since the deposition is structural or not. There cannot, as far as my opinion goes, be the slightest doubt that it is not. The researches of Dr. Clarke, and more lately of Sir David Brewster, upon the crystallization of snow and ice, have tended to show, as was anticipated from the examination of certain crystalline hailstones, that the primitive form of solid water is the rhomboëdron. Ice forms a continuous surface, like certain clay-slates, argillolites, and calcareous rocks, which are capable of assuming the rhombic form. That this is not a structure superin-

duced, but only an original structure developed by cleavage, is proved in calcareous rocks by the primitive form of calc-spar being a rhomboëdron. Ice, in the same manner, fractures with a rhombic cleavage, the hummocks of ice in the Arctic Regions present rhombic planes,—yet who would think of considering this as a superinduced structure?

Valley of Euphrates, south of Karâ Bambûch.—To the south of Karâ Bambûch, the valley of the Euphrates begins to widen, the banks are occupied by extensive alluvial plains, which feed the flocks of the errant Arabs; while low hills of transported pebbles, with huge fragments of limestone superimposed, diversify the level. About fifteen miles from the pass, hills composed of alternating indurated and friable beds, advance to the river side from the east, where they attain an elevation of about 800 feet. On the opposite, or western side, is a lofty, isolated hill, of similar characters, and capped by a stratum of indurated chalk, called Sheïk Harûdi, from a tomb on its summit.

Source of Daradax.—On the left bank, the country lowers gradually towards the great plains opposite to Bâlis, occupied by the populous Arabs of the Béni Feckahal tribe. On the right bank is the low country, supposed to contain the sources of the Daradax, which is only interrupted fifteen miles lower down by the abrupt cliffs which dominate over the ancient Bâlis.

Formations near Bâlis.—The cliffs, when they approach the water's edge three miles north of Bâlis, are 143

feet in perpendicular height, of which the upper twenty are occupied by flint breccia and siliceous sandstone, beneath which is a bed three feet thick, of pseudo-columnar chalk, of a deep-red tint, dark-red veins, white chalk two feet two inches, brown marles and chalk three feet, fifty-five feet of bare precipice of chalk, and sixty feet of rubbly acclivity.

Cliffs a mile north of Bális.—About a mile north of Bális, the breccia is no longer so prominent in the sections. The upper portion of the cliffs is occupied by a deep formation of uniform white chalk, somewhat fissured vertically, but every where in nearly horizontal stratification. At the foot of this portion of the precipice are cretaceous marles, alternating with brown laminar marles and cretaceous beds, and below these again, the usual chalk formation.

Hills around Bális.—Lastly, in the environs of Bális are low hills, which present in their upper parts the same brown laminar marles and cretaceous marles, and which contain crystalline and laminar gypsum, or selenite, in thin beds of from two to six inches in depth, and granular gypsum several feet in thickness.

Headland south of Bális.—The same formations advance in low cliffs as far as a headland about seven miles south of Bális; to the west there is only an alluvial plain, succeeded by a low undulating country.

First appearance of Gypsum.—This first appearance, where the formations are upon so large a scale, of a ten-

dency to the existence of a new order of circumstances, by which the lime is made to enter into new chemical relations, is of a very remarkable character: the same formation which we shall soon find assuming an almost prodigious developement, is here thrown into a most circumscribed compass; it also, at its first occurrence, although accompanied by its usually associated marles, presents no traces of lacustrine or of fresh-water shells, although in its subsequent developement we shall find the same order of phenomena attendant upon the formation, as have been observed in other countries.

Háwí.—Plains of alluvium, such as now occupy a great portion of the valley of the river Euphrates to the south of Bális, are designated by the natives as háwí. It is not until we arrive at the hills of Abú Bará, renowned for the battle plain of Siffín beyond, that we meet with ranges of marles capped with gypsum. On the east bank, a little further on, a mound of similar structure, on which Ja'ber's castellated ruins are nestled, stands in advance of hills of the same formation.

Formations of Abú Bará and of Ja'ber Castle.—The range of Abú Bará, marked by towers and other ruins, is flat, and presents at its summits strata of gypsum, for the most part horizontal, but which at the south-eastern extremity dip at a high angle of inclination to S. 80 E., but I am inclined to look upon this as a local subsidence. The formations on the left bank present similar irregularities; the castle stands upon a basis of solid gypsum, which itself reposes upon alternating marles and gypsum. The marles now present abundant Cyclades and other

fresh-water shells. In the rear of the castle many irregularities of stratification present themselves.

Mineralogical Characters.—The mineralogical characters of the gypsum in its solid beds are dirty-white, coarse-granular, and even saccharoidal, as at Ja'ber. At Abú Bará it is granular, coarse-grained gray, and small-grained gray, ash-gray, white, and very friable and sandy; and decomposes in rough uneven cliffs, exhibiting a peculiarly weathered appearance.

Mineral Contents.—The mineral contents are, a variety of menelite or hydrated flints in nodules, separate, and not conjoined as in the menelites of Montmartre; arrow-headed gypsum; laminated gypsum, sometimes in beds; and siliceous gypsum, brown colour, scratched with the knife, semi-conchoidal and splintery fracture, lustre shining in one direction, dull, cerous in the other, in veins or beds six inches deep in the granular gypsum.

Marles.—The marles were straw-yellow, buff-yellow, salmon-yellow, and cream-coloured. There also occurred a deposit of cretaceous or marley conglomerate, containing angular masses of chalk in a paste of cretaceous marles.

Hilly Ranges south of Ja'ber.—To the south of Ja'ber, a level range of marles, capped by gypsum, about two miles long and 300 feet high, extends on the right bank of the river N. 60 E. to S. 60 W. At the northern end, the gypsum is about 20 to 25 feet in thickness, and reposes upon buff and salmon-coloured cretaceous marles

150 feet deep; soon the gypsum attains a thickness of upwards of 40 feet, till at the next southerly headland it occupies the whole depth of the cliff, forming rounded hills about 80 feet high, of peculiar aspect, and a very cribbly and weather-worn appearance.

In the same district, on the left bank, the formations of a similar character retreat to a greater distance from the river. The hills, scarcely 100 feet in height, are composed, to the north, of mural precipices of gypsum, reposing upon yellow marles, but the gypsum begins to occupy the whole cliffs as these approach the river bank about four miles to the south of Ja'ber, when they are much cavern-wrought and picturesque, with subterranean passages and overhanging foliage.

Stratification.—The strata in both ranges are nearly horizontal at first, and subsequently obtain a gentle inclination, where the increased developement of the gypsum beds brings the latter, in a distance of about four miles, from an elevation of 100 feet above the soil to the level of the river.

Character of country between Ja'ber and Thapsacus.—From the termination of these hills to Al Hamám (Thapsacus), the interior country is occupied by low hills and undulating ground, of breccia of crystalline rocks, and coarse sandstone; and the banks of the river by a jungle of tamarisk, poplar, and briers. The hilly mounds of Aff Díen are composed of the same breccia; Sura, "*Flavia, firma Sura,*" is upon a plain of the same character. From the latter town, a low range of hills leads to the riverside, at the foot of which is an ancient causeway, These

hills consist of marles and cretaceous conglomerates, with white saccharoidal gypsum; superimposed, are breccia, with huge masses of crystalline transparent dihedral gypsum.

Hadjár Rasas.—A plain or háwí, about three miles in extent, and tilled by the Weldah Arabs, separates this last group from another, which is also composed of cretaceous marles, with abundant cyclades and cretaceous conglomerates, with occasional flints and beds of snow-white saccharoidal gypsum. The cretaceous conglomerates are of a hard and coarse nature, and advance in huge masses into the torrent, whose force they have long resisted. An isolated mass of this kind, of no great dimensions, rises out of the water—a rather uncommon sight in the Euphrates—about 500 yards from the shore, and is known by the name of the Hadjár Rasas, or Dásh í Surieh.

Range of Sophena.—To the south from hence, a long headland of precipitous cliffs, about 200 feet high, consisting of marles and gypsum, stretches to the east at a distance of from two to three miles from the river, and then curves round to south-east and south, forming a low range of hills, in which gypsum predominates over the marles, and which are deeply intersected by ravines and precipices. This range stretches in a southerly direction beyond the supposed site of Sophena.

Plain of Rakkah.—To the north from Thapsacus is a continuous and level plain, only diversified by the ruins of a castle (Aragla), lying upon the road trod by the

followers of Cyrus to Calah, by those of Alexander to Nicephorium, and by those of Trajan to Callinicus, names by which, at those times, the Callinicum of the ecclesiastical notices and the Rakkah of Harún al Raschíd were known.

Forest of 'Ardn.—The river Euphrates bends to S. 85 W. at this point, and flows through plains bounded to the west by the hills of Sophena, and to the east, beyond the course of the river of Belichá, the banks are occupied by the forest of 'Arán, consisting entirely of tamarisk, poplar, and white mulberry, and which extends to the confines of the horizon.

Developement of the Gypsum.—From Bális to Rakkah is a distance of 70 miles, of which 60 are occupied by the gypsum formation, and no alteration in geognostic characters are met with till the river passes through the prolongation of the Jebel Bushír at Zenobia, a further distance, by the river, of 91 miles.

Character of the Country from Rakkah to Zenobia.—Throughout this extent of country there is little variety of contrasted configurations. The banks of the river are occupied by an eternal jungle of tamarisk; the river winds very much. The gypsum and marles form low hills, and a slightly undulating territory at various distances from two to eight miles from the river, the intervening space being occupied by alluvium, more particularly on the right bank pastured by the Sebkal Arabs. On the left bank, arid plains, covered with aromatic shrubs and sturdy composite plants, advance more fre-

quently to the river-side. These plains are tenanted by the Afádel Arabs. At the same time the rock formations also approach the river-banks in a few places. The first of these is to the north of Mohaïla, where they form cliffs about 100 feet high, and 300 yards from the river, of alternating marles and gypsum. At Mohaïla, the same formations are only about 300 yards from the river, and a little beyond, the rocks come to the water's edge, constituting the precipice and whirlpool of Rauwolf.

Nature of Soil and Vegetation.—In the notes of Physical Geography, which I have made of the river in this course of 91 miles, there are two háwí, four forests or groves of poplar, two sandy points, five tracts of graminæ or pasture, with villages, twelve marshy districts, chiefly about Abú Saïd, twelve cultivated spots, four quarters of low jungle, eight tracts of Artemisia, and twenty-seven of Tamarix.

Scenery of the Bushír Hills.—The hills of Bushír, where the Euphrates enters the range, are neither lofty nor striking in their form, nor covered with wood, yet it is difficult to imagine what relief they afford to the eye, wearied with monotony of scenery and similarity of objects; but when entering into the land-locked pass, the river gradually expands its silver bosom, and displays the alabaster walls and noble edifices of Zenobia, stretching from the hill-side down to the water's edge, the banks fringed with groves of poplar and mulberry, and the turrets and broken arches of ultra-Euphratic Zenobia occupying the summit of the hills to the left, beauties begin to crowd upon the spectator, and he no longer

wonders that the Palmyrean queen should have made this a favourite residence.

Geognostic structure of Bushír Hills.—The formations at Zenobia consist of marles and gypsum, covered by an overlying formation of plutonic rocks and of crystalline breccia. The plutonic rocks are basalts and basanites, or basalts of a bright dark-coloured basis, with disseminated augite. These rocks are spathose in their structure, and in some localities present regular polyhedral divisions; they are accompanied by spilites, or the same rock with disseminated nodules of calc spar and amygdaloidal cavities. These formations do not attain a great thickness, seldom more than from five to ten or twelve feet.

Breccia and Selenitic Sandstone.—The plutonic rocks are superimposed upon breccia and selenitic sandstone; the breccia consists of pebbles of quartz, jasper, serpentine, diallage, heliotropes, and other rocks; the sandstone was the same as the indurated sand of the river-bed, an argillo-siliceous sand, with abundant scales of diallage, and cemented by sulphates and carbonates of lime. It contained regular concretions, like fulgorites, and some recent coleopterous insects, but no shells. The most curious circumstance was the alternation of thin selenitic sandstone, in a more crystalline form, with the plutonic rocks near the ultra-Euphratic Zenobia. It not only divided the formation of basanites into two portions, but occurred in filtrated vertical veins.

Marles.—Beneath these beds were marles, green, gray, and coloured by the oxides of iron. They were friable,

imbibed moisture freely, seldom laminar, and contained few fossils. They alternated in their upper part with the crystalline breccia.

Gypsum.—The gypsum, which at first alternates with the marles, soon assumes a predominating developement. It occurs snow-white and saccharoidal, also small grained, granular. It is also met with in the same districts, transparent, laminar, in thin beds, and in small masses variously arranged, like brick tiles.

Theoretical Deductions.—It is obvious that the chief inferences to be deduced from the important fact of the superposition of the plutonic rocks on the crystalline breccia, the alternation of the selenitic sandstone with the basanites, and the breccia and sandstone with the marles of the gypsum formation, affect the history of the latest formations by transport belonging to the basin of the Euphrates; and I have, in consequence, although I repeat the description of the leading peculiarities here, given the deductions where they would have the advantage of being studied consecutively with the other phenomena presented by the same formations, and thus rest upon sure and unquestionable principles.

Character of Country south of Zenobia.—To the south of Zenobia, tracts of clayey alluvium are covered with grasses and jasmin shrub; groves of poplar adorn the river banks. The clays sometimes rise in precipices 40 feet high, superimposed upon crystalline breccia. They are observed to contain fragments of gypsum; the strata for the most part are nearly horizontal; the dip southerly,

and the greatest angle of inclination observed 15°. There occurs an intermittent spring at this point. The plutonic rocks crop out further to the south, about eight miles north of Deïr; they are chiefly iron-shot basalts and basanites, and scarcely cause any undulation in the soil. Between this and Deïr are cliffs of gypsum, bounded by a clayey district, which forms the sunburnt and arid country around the "Monastery." The first date trees make their appearance here, but the barrenness and uniformity of vegetation is as great as the simplicity of the soil.

Character of Country between Deïr and the Khabúr.—The distance from Zenobia, or Zelebí of the Arabs, to Deïr, by the river, is 50 miles, the distance from Deïr to the Khabúr is 30 miles; the country a nearly uniform and level plain. The tenacious clay formation does not allow the water to percolate, and gives origin to extensive marshes; the remainder is occupied by tamarisk or pasture. There are several Arab forts or villages, and some cultivation. Breccia and sandstone are seen in one place. At the termination of this country, and at the mouth of the Khabúr, is Cercusium, now called Kerkisíyah, and Abú Seraï.

Xenophon's description of Country south of Araxes.—To the east, beyond the Khabúr, or Araxes, the country is, as previously mentioned, as it was in the days of Xenophon, full of wormwood. Wild asses, or horses, are still met with. Ostriches are rare, as also are roe-deer. Bustards abundant. The formations consist of transported pebbles, and the country is all but even as the sea. Zaita of Ammianus Marcellinus is still Zeït, an

olive grove. Beyond is the modern town of Maïardín, in a plain of clay, but irrigated and cultivated; and three miles to the east, cliffs of mountain rock, about 100 feet high, domineer over the Assyrian Rehoboth. The modern castle of Rahabáh is built upon a cliff-environed knoll, and defended as much by art as by nature.

Formations at Rahabáh.—The lower beds at Rahabáh consist of gypsum and marles, above which are coarse sands and sandstones, upon which again are superimposed cretaceous marles, often coated with bitumen.

Above this group is a breccia of crystalline rocks, then compact gray laminar sandstones, and again the usual breccia. Then a formation of selenitic sandstone, gypsum and sand sometimes agglutinated, at others rudely crystalline. Above this, a rock of less indurated and compact texture, and more pebbly, also containing masses of white chalk and clay in septaria, also numerous bones, among which I obtained the head of a jerboa, in every respect similar to those of an existing species (*Dipus gerboa*), numerous bones of birds, and of larger quadrupeds, which appeared to be those of domestic animals, but from the comminuted state of the fragments, this is mere conjecture. There is not, however, in Western Asia, a formation more worthy of exploration than this. I am not certain if fragments of pottery which I obtained from it had not got imbedded by accident in the superficial soil. But there is a promise of great reward to a carefully-conducted examination, which the want of time alone prevented me giving to so interesting a formation. Lastly, the ossiferous breccia is covered by a deposit, in thin beds, of a very hard flesh-

coloured limestone breccia, with pebbles of quartz, and a few diallages and serpentines, and frequent fragments of bones. The castle of Rahabáh is built of this ossiferous limestone breccia, which occupies the surface soil of all that portion of the wilderness (and a wide and lone expanse it is) which is to the west, and above the valley of the Euphrates in these parallels.

Character of Country between Maïadín and Saláhíyah.—In the interval of country between Maïadín and Saláhíyah, the valley of the Euphrates is occupied by districts of tamarisk, marshes, low level plains, some cultivated tracts and villages, with occasional mounds, and Arab forts and ziarets, (Chiblí, Sheïk Arret, el Asháretí). Low hills of uniform outline occupy the horizon to the east, hilly ranges rather more lofty and distinct, bound the plains to the west. The former consist, for the most part, of transported deposits, the latter of rock formations. These approach the river bank in two or three places; at El Ashár they form cliffs of cretaceous marles and red clays, and below these the rocks, consisting of gypsum and marles, capped by red clay and ossiferous limestone breccia, advance in a bold headland into the river bed. This is the Carteron mountain and precipice of a former navigator.

Formations at Saláhíyah.—At Saláhíyah, where are undescribed and extensive ruins, cliffs 200 feet high domineer over the river, on whose very verge, a massive castellated building towers with almost the stability of rock. The formations at the base of the cliffs are constituted of the usual gypsum and marles. There are no

less than twenty-four beds of the former, from two to four feet thick, alternating with marles; some of the latter were divided by veins of laminar transparent gypsum, which may be easily obtained here for optical purposes, or to be used as glass. Superimposed upon these formations, is the red ossiferous limestone breccia, but here developed to many feet in thickness. It gives origin to a very level and uniform plain, stony, and exceedingly destitute of vegetation. It stretches to the extreme verge of the horizon, and it would be difficult to imagine the cheerless desolation of such a scene.

Character of Country between Saláhíyah and Irzah.—Immediately beyond Saláhíyah, the banks of the river are occupied by the customary low plains, in part inundated. Opposite to Saláhíyah is a country of tamarisk, with pastures beyond, and the tents of Jebúl Arabs, and the same character of country, alternating tracts of tamarisk. Low plains of inundation, only diversified by the occasional mud ramparts of an Arab fort, and clay mounds with ziarets, extend as far as the town of Irzah, the Corsoti of Xenophon, or a distance of 59 miles. The ruins stand upon cliffs upwards of 150 feet high, on the east bank. The river, after approaching the cliffs, makes a great westerly bend, at the same time that a branch goes along the foot of the cliffs. This is the river Masca of the Greek historian, and the great bend, by keeping the ruin constantly in sight, is the cause of the astounding statements of Balbi and Rauwolf regarding the time occupied in navigating round the ruins of Irzah, and which would give a very inaccurate notion of their extent, which is, in fact, very insignificant.

Formations at Irzah.—The formations at Irzah consist chiefly of a variety of gypsums and marly beds, sometimes bituminous. A great clay formation, with polypiferous structures, and the ossiferous limestone breccia, is here covered by a gypsum formation, which occupies the surface soil on the plain where stood the antique colony of Jews. This is the first appearance of a maritime formation intercalated in the gypseous series, since it, at its commencement, was developed coeval with the geographical termination of the chalk formation; a distance of 144 miles, the character of the fossils in the gypseous marles continues the same.

Superposition.—The succession of formations is, white saccharoidal gypsum at top, red limestone breccia, gypsum, marles, clays with polypifers, marles with cyclades and melania, marles with bitumen, gypsum. The beds average from 15 to 25 feet in thickness; but this, as well as the order of succession, varies much with the inclination of the beds, which is also variable.

Character of the Country fram Irzah to 'Anáh.—From Irzah to 'Anáh is a distance, by river, of seventy miles, and in this interval, an undulating country of small rounded hills and transverse valleys, exhibit all the evidences of a country of denudation. The gypsum and marles show themselves in a variety of places, but in general covered with breccia, and causing very little difference to the usual configuration of the soil. Near El Kayím, the gypsum is wanting, and cretaceous marles, at first superposed by breccia, are soon observed to alternate with it in nearly horizontal beds. The whole extent of

these deposits seldom rise more than 40 feet above the level of the river. In one spot only on the left bank, the marles and gypsum, upwards of 80 feet deep, are observed to alternate with red clay and marles in contorted strata.

Character of Country at Rawah and 'Anáh.—On approaching 'Anáh, the character of the country changes, bare rocky hills shut in the river on both sides, and stretch across the bed, giving origin to the rapids of Karáblah, and forming an island, picturesque from its oriental buildings and acquired verdure; they then advance in a bluff promontory on the left bank beyond the small town of Rawah. Turning the promontory, 'Anáh, enclosed amid groves of date trees and pomegranates, shows itself stretching in a long line between the river bank and low cliffs of white rock,—a fringe of soil upwards of three miles in length, and not above 300 yards in depth. Eight different islands divide the river like a continuous strip of land, clothed with a luxuriant vegetation, and ornamented with the ruins of a castle, which has had an adventurous history. On the left bank, the hills are barren and bleak, and continue to domineer with an altitude of from 600 to 800 feet, as far as the site of old Anatha, about two miles below the modern town.

On the brow of the hills between Rawah and 'Anáh, is El Gumán Castle, and a little beyond, the tomb of El Karín. On the hills above 'Anáh, the remains of the castles of Abdhallah and Zahón, and on the left bank, nearly opposite to the Jews' quarter, and north of ancient Anatha, is the castle of Hebondíah.

Formations at 'Anáh.—The formations at 'Anáh consist superiorly of coarse limestone and limestone marles, with abundant bivalve shells, all of marine origin.

Below, a hard compact limestone, abounding in polypiferous lithophites, radiating and branched species.

Beneath this, a formation of limestone more particularly abounding in large cones and abundant cerithiæ.

These limestones were superimposed upon red talcose marles, with cream-coloured streaks, becoming more cretaceous towards the limits superiorly and inferiorly. This deposit attained a thickness of 20 feet.

Beneath this was a formation of limestone, with cerithiæ, generally dolomitic, or like the marles, containing magnesite, having a cerous lustre, even, but conchoidal fracture, and very sharp edges; and the lowest formation met with was a cerithia limestone, cellular and cavernous, with a hard splintery fracture.

Superposition and Distribution.—The relations of superposition in these formations are not evident in any one locality, but are deduced by the customary investigation of dip and direction. The hard cavernous limestone is seen to best advantage opposite to Rawah; the cretaceous marles in quarries west of 'Anáh. In the plains, and at the summit of the round hills scattered over these, two and three miles south-west of the town, the coarse limestone with abundant bivalves must be sought for; the cerithia limestone lies over the cretaceous marles, and the conide and polypiferous limestone occupy the whole depth of the cliffs immediately behind the straggling edifices of this interesting spot. In the rear

of old 'Anáh, or Anátha of Ammianus, a highly fossiliferous limestone is met with.

Character of Country between 'Anáh and Hadísah.—To the south of 'Anáh contrasted configurations become more common in a country hitherto remarkable for uniformity of aspect, and the soil is enlivened by ranges of hills, expanded valleys, and fine alluvial plains, while the river boasts its numerous islands, its copses of wood, and flourishing, although unprotected, villages.

Ranges of Hills.—On the left bank the Jebel Abú stretches in uniform summits above cultivated plains and villages, when the country to the west is occupied by the low hills designated as the Jebel Tel Antah, followed by the Jebel Kaïfel Rusájah and the Jebel Bajân. To the east the hills of Rechanah are followed by an interval of low, cultivated, and fertile country, to the districts of the Lagadah hills and the Moherá, with expansive plains and tamarisk woods stretching down and occupying the banks of the river, which are sheltered by lofty cliffs (Dágh Faäzet) on the opposite or right side.

Beyond the Moherá, are the Julébah and Habíb Nadjár mountains, backed by the desert of the Nasaríya, a degenerate Sinjár race of robbers, who are only separated by the Brelímmáh mountain from the fertile plain of Hadísah. To the west the country is occupied by the Isk Hambár, the Us Joyá, and the mountains of Susah. The distance from 'Anáh to Hadísah, by the river, is 66 miles, but on foot, without a guide, I reduced it to 50 miles. Although the term mountain is used in these

designations in accordance with their Arabic acceptation, none of these hills attain an elevation of upwards of 500 feet above the bed of the river.

Contrasted Configurations.—These are not groups of hills with distinct acclivities, and great intervening longitudinal valleys, but almost always fragments of the interior high country, cut off by the action of ordinary or extraordinary powers of denudation, into distinct ranges; sometimes with precipitous acclivities and abrupt terminations; where, being connected with a particular portion of the river, and having villages and cultivated land at their feet (for on the summits there is no cultivation whatsoever), they obtain a different designation; oftentimes, as in the Mohérah hills, a great number of circumscribed valleys, like inlets or indentures in the uplands, become so complex in their relations as to constitute real hilly groups; in others, as the Lakadahr hills, a long range is sent off to the south-west, bordered to the west by the river Euphrates, while another branch goes to the south-east under another name, to join the Mohérah range, leaving a great plain deeply intersected by tributary rivulets to the south, or in the angle contained between the two. In a geological point of view, they are everywhere hills and valleys of denudation, and in no case mountains of elevation, or valleys of subsidence: as a further proof of which, the formations present everywhere a nearly horizontal stratification, and the beds, which afford sections and precipices in the valleys, or wherever there is solution of continuity, are continuous in the uplands above, the highest rock or deposit of the

hilly districts forming the surface soil of the territorial and highland plains beyond.

Formations of the Hilly District.—The formations that are met with in this district, arranged according to the constant order of succession, are, Sandstone and ironstone, breccia and gravel, chloritous or green marles, perferoxidated or red marles, gypsum, proto-feroxidated or yellow marles, bituminous or black coarse marles, rude bituminous rock, limestone, saliferous clays.

Order of Superposition.—The different members of this series are nowhere developed altogether, they may therefore be the representatives of one another, or varieties produced by local causes, in the same formation. The order of succession in the Mohérah is gypsum, ironstone, shale, marles, and saliferous clays, from above downwards. In the same range ironstone, marles, and saliferous clays. In the Julíbah hills, rude bituminous rock, marles, saliferous clays, and gypsum, upon bituminous rock, clay, rubble, and marles, more frequently sandstone, gravel, marles, gypsum, bituminous rock, and saliferous clays.

Influence of Structure on Form.—These different features in the constitution of the hilly ranges, affect materially the contrasted configuration; the sandstone caps the gravel in rounded hills with steep summits; the gravel forms simply rounded hills; the ironstone, interrupted or rocky summits; the gypsum, table-lands; marles, low cliffs, with a level outline.

Alternations of Members of the same Series.—The sandstone alternates with the gravel; the breccia and sandstone alternate with the gypsum; the bituminous beds with all three; the ironstone is always superposed, but as, mineralogically speaking, it is only a character given to the sandstones, which also belongs in the same series to the marles; it may be considered in the same light as the bituminous products, viz., as newly-developed members, in a superior portion of a known series. The already inferior position of the saliferous clay; also, only recently developed as a superior member of the same series; would, at the same time, lead to a strong inference that the gypsum, which is superior to it, belongs to a more recent formation of that mineral mass, than has as yet been met with; and thus its occurrence among these new ferruginous and bituminous formations must be looked upon like the propagation of a social plant out of its own territory—a vagabond among new forms—a kind of emigration of the gypseous formations amid rocks of a more recent date.

Theory of the Origin of Gypsum.—Considerations of this kind force themselves upon the mind still more strongly, when we contemplate the position and the geological history of the bituminous products of these districts. The order of circumstances attendant upon the secondary developement of gypsum, has always been supposed to be actions of an igneous, if not an actual volcanic, nature. The prodigious horizontal developement of this formation in these countries appears at first almost to shake the foundation of such an hypothesis. The first bituminous products, however, in the same district, manifest them-

selves at the junction of the plutonic rocks and the gypsum; they there present characters of antiquity, by which they approximate more to certain lignite coals, than to the fluid or indurated bitumen of existing fountains; the second line at which they again appear is where thermal actions, certainly not of a simply chemical nature, are in full play, accompanied by the developement of products as sulphuretted hydrogen, one of the ingredients of which is necessary for the production of gypsum. These actions are going on at once at nearly the geographical and geological limits of the formations, and where the only remnants of former actions, if such should possibly exist, could be sought for; and the faith in an old yet philosophical theory returns with more than pristine force.

Character of the Country between Hadísah and Jubbah.—The village of Hadísah is upon an island, as is that of Jubbah, but there is also a portion of the latter upon the right bank of the river. The distance from the one to the other is 20 miles, and the intervening country is occupied in part by cultivated plains, and by hilly ranges of calcareous rocks and gypsum, among which the Sínjí mountains to the west, and the El Kurráf to the east, distinguish themselves. A well-cultivated and extended low district on the left bank, is designated as the Wadey Harrún.

Character of the Country from Jubbah to Hít.—From Jubbah to Hít is a further distance of 28 miles, throughout which the country preserves pretty nearly the same characters; but the hilly ranges become lower, are less

frequent, at a greater distance apart, have less abrupt slopes, and are consequently verging off to an undulating country. The Abúl 'Us mountains to the east present us with sandstone and gravel, chloritous and ferruginous marles, gypsum, calcareous rock, and saliferous clays. The Jaal district of hills to the west present merely marles and gypsum, and it is the same with the Sheïk Rufah hills to the east, with occasionally intervening, and sometimes superimposed, transported deposits of breccia and gravel. The Altah Salí country is the last low gypseous district that occurs to the north of Hít.

Antiquity of the Fountains of Hít.—Hít, the ancient Is, has been celebrated from all antiquity for its never-failing fountains of bitumen, and they furnished the imperishable mortar of the Babylonian structures. They were visited by Alexander, by Trajan, and by Julian. They now only cover the Geïser (or Gopher) boats of the Euphrates, and the asphaltic coracles of the Tigris. There is, however, yet considerable trade in salt obtained by the evaporation of the waters.

Position of Fountains.—The fountains are several in number, but at some distance from one another; two of the largest occur about a mile in the rear of the country, between which, and the springs, the soil is converted into rude salt-pans or reservoirs, constructed with little care, to allow the waters to evaporate: a prodigious quantity of fine salt is nevertheless obtained by this simple proceeding.

Formations in which they occur.—The formations in

which these springs make their appearance, are argillaceous limestones, often magnesiferous, with a sub-conchoidal fracture, a dull lustre, cerous or waxy when magnesiferous, imbibing moisture with rapidity, and containing Hallite or earthy aluminite. Upon this formation a rudely-crystalline gypseous deposit is superimposed in all the country around, but not in the immediate vicinity of the fountains. I could not detect any organic remains.

Mineral Accompaniments.—The mineral substances which occurred in the neighbourhood of the fountains, chiefly imbedded in the rocks; were limonites or brown hematites, bituminous shales, and sulphur crystalline, greenish, shining, and earthy-yellow, pulverescent.

Natural Historical Properties.—The temperature of No. 1 was 88° Fahr., of No. 2, 98°. Taste, bitter-sweet. Water, clear transparent. Odour, ammoniacal sulphureous. Evolving gases in abundance, and emitting bitumen as a floating product; the estimation of the natives was many gallons per hour. Saline matters coated the sides of the fountain.

The red Byssus thermalis (*Embeida thermalis?*) occupied parts of the bottom and stones at the exit of the waters, which were also sometimes coated with sulphur.

Antiquity of Natural Historical Properties.—These natural historical properties appear to have remained unchanged for a great period of time. The historian Xiphilinus (vol. ii., p. 117) describes it as a lake of sulphur, and Dion Cassius (vol. ii., p. 86) relates that the

exhalation from the springs is so strong, that no animal nor bird could breathe it without dying.

Qualitative Analysis.—The chemical properties of the water examined according to the principles of Berzelius, and afterwards of Gustavus Rose, were extremely simple. The first evidences obtained were of the existence of an acid, and of hydro-sulphuric acid or sulphuretted hydrogen in excess; which circumstance established, excluded a whole body of substances from being in a state of solution, more particularly feroxides and the oxides of most metals, and the ferro-cyanates of potassium; and a suspended nut-gall corroborated the first of these facts. The solution being neutralized by the addition of carbonate of ammonia to excess, an hydro-sulphuret of ammonia was obtained, without being accompanied by any precipitate, and alumina and some other products were thus excluded. Subsequently, the presence of chloride of sodium, and of the sulphates of sodium, of calcium, and of magnesium, were ascertained by the usual procedure in qualitative analysis. I regretted not to have it in my power to test for iodine and bromine.

Theory of Chemical Actions and Geological Origin.—It might, from the nature of the circumstances above detailed, be considered by some, that the elevated temperature of the waters was owing to the continuity of chemical actions, by which new affinities were brought into play: the waters loading themselves with certain salts, while the sulphur of the sulphate of lime, united in part with the excess of hydrogen in compounds of carbon and hydrogen, probably existing in the form of naphtha, and

evolving them in the form of bitumen, from an excess of carbon; while the remainder passes off as a gaseous sulphuretted hydrogen. I cannot but consider it much more consonant with the duration and constancy of so interesting a natural phenomenon, to suppose that the waters still retain the temperature of the inferior earth, or still more likely, of rock strata, where even superficial refrigeration has not yet arrived at an equality with the ambient air, being in this case, a remnant of the same action which gave birth to the gypseous formation. The circumstances by which a large developement of sulphureous gases from below would give origin to the decomposition of carbonate of lime to form a sulphate, would also act upon the solid or liquid form of carbon and hydrogen; sulphuretted hydrogen would be given off from an excess of hydrogen, and contained in solution in the water, would render it capable of dissolving carbonates of lime. Sulphur would be deposited on contact with the air, and the product of carbon and hydrogen, rendered solid by an excess of carbon, would remain in the form of bitumen or petroleum. It is obvious that in the chemical affinities brought into action under either circumstance, the changes are more numerous than I have here ventured to detail; my object being simply to give distinct conceptions of the nature of the phenomena in question, and not to pretend to grasp at a perfect and minute explanation of all the circumstances attendant upon that phenomenon; and which, by multiplying words, might only appear what Locke (Sect. xxix.) calls an artifice of learned vanity to cover a defect in an hypothesis or our understandings.

Synonyms of Hít.—Hít has been designated as Is,

Izzanesopolis, Ozogardana, in Ammianus; and Zaragardia, in Zosimus; also Eiopolis. It is probably the site of the *Caramanda* of Xenophon, but this is one of the few cases in which distances are not given by that historian, and it is indeed only spoken of retrospectively. It is celebrated in modern times among the Persians, Turks, and Arabs. The Turks, to distinguish bitumen from naphtha, call it *Karák Sakíz* (black mastic), the Arabs Geïser.

It has been long admitted that by translating kopher, as has been done in the Septuagint version of the Bible, asphaltum, and in the Vulgate version, bitumen, that the ark was protected by mineral pitch; and the circumstance is of interest from the assistance which it lends as a corroborative testimony, towards determining the country of the Noachian deluge.

Extent of the Rock Formations.—The rock formations which terminate in the west at the hills of *Mesjíd Sandabíyah*, and to the east at the hilly district north of Felújah, and which include the Pylæ of Xenophon, cannot be considered as extending above 60 miles in a direct line, or 87 by the windings of the river. Everything characteristic of solidity and durability has disappeared. The plains are wide, the hills low, and the rock formations coarse, non-crystalline, and friable. To the east, the *Méridj Suáb* hills exhibit nothing but the straw-yellow limestones, and they are succeeded by sand-hills in steps called *Lagóbah;* a little beyond, sections are afforded, which furnish green marles, gypsum, rudely laminar indurated marles, gypsum and marles in beds of a few feet in thickness. Gravel and mud repose upon these deposits. To the west is already an extended

country of level pasture and fertile plains, backed by hills of marles and gypsum; at the foot of which occur springs of naphtha; and ultimately by low cliffs of clay, forming afterwards a low level and continuous territory. The alluvium is about six miles in extent to the west, and ten miles to the east. The alluvia to the east are interrupted by a low continuous upland, exhibiting rock gypsum at the summit, and finally terminating at the plains to the south. To the west, the alluvia are bounded by a low level upland, which ultimately curving round, bears the minaret of Mesjíd Sandabíyah forward upon the Euphrates, constituting a remarkable point, which is visible from a great distance, from the uniformity of the country in almost every direction.

General Results.—The principal object of contemplation in the structure, deposition, and developement of the rocks, of the basin of the river Euphrates, are the extent of the cretaceous and supra-cretaceous deposits, indifferently called tertiary formations, superior order, clysmian rocks, and supra-cretaceous group. These formations occupy a space in a straight line of six degrees and a half of latitude, and among them the cretaceous and gypseous deposits assume by far the most extensive developement.

The second fact is, the intercalation at the limits of the chalk formations; of marles and gypsum, although not yet provided with lacustrine shells, in the cretaceous deposits. In this case, the intervening plastic clays and cerithia-limestone appear to be totally wanting, and gypseous deposits to have taken their place, a fact also illustrative of the passage of the cretaceous into the supra-cretaceous formations.

The developement of a great band of polypiferous and shelly limestone at 'Anáh, between the gypsum of Jáber and that of the Mohérah hills near Hít, would appear to assign a difference of age between the two, and a greater antiquity to the former, which is corroborated by other circumstances.

The most striking peculiarities in the inferior gypsum, are the eruption of plutonic formations; which eruption has evidently occurred at a period posterior to the elevation of the Taurian chain, as the plutonic formations are superimposed upon the last deposit by transport, which contains pebbles from those regions.

The next peculiarity of interest is the uplifting, subsequent to this, or coeval with the eruption of the igneous rocks, of limestone-breccia and gravel containing the bones of existing tribes of animals; and consequently beneath the sea previous to that cataclysm.

The tendency to a new order of things first manifests itself in the developement of a polypiferous marine clay, in the gypseous formations of Irzah. The latter deposit loses its pre-eminence, and is ultimately succeeded to the south by a formation of marine marles and limestones.

But in the hilly districts, to the south of 'Anáh, we observe a recurrence to the old order of things in the tendency to the production of sulphate of lime, but with new and different associations, ironstones and sandstones, but more particularly bituminous formations soon destined to feed fountains dating from a remote historical antiquity, although so recent among the formations of the globe.

It is singular in contemplating this vast developement of tertiary or supra-cretaceous formations, to think that

so late as in 1827, we find geologists, (Leonhard, "Man. of Geol.," cap. 103 and 104,) then first admitting that these deposits can no longer be considered as a local formation, but must take their place in the general series of the formations of the earth's crust, and in the "Geological Manual" of Mr. Delabèche, published in 1832, the deposition of gypsum is accounted for by the springs of the districts in which that mineral rock occurs, becoming loaded with sulphate of calcium. It is quite evident that such a theory is not adapted either to the nature of the present country, or still less to the area, exceeding eight hundred square miles, that is occupied by this formation in that part of Asia which neighbours the lower Euphrates.

Researches on the latest Deposits by Transport (commonly called Diluvium); and on the Physical Evidences of the Noachian Deluge, contained in the Basin of the Euphrates, and in the Plains of Babylonia.

General Characters of the Formation.—There occurs throughout the course of the Euphrates, from Someïsát to Felujah, not continuous, but re-appearing at intervals, and occupying more or less extensive spaces, a formation of transported gravel, pebbles, and rock; which, by its position, its extent, its developement, and general associations, manifests itself as the latest deposit by transport which occurs in the territories through which the Euphrates flows, and which does not belong to actions at present in operation.

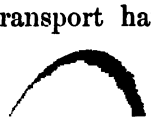
Mineralogical Characters.—In the upper part of the river, this formation consists of pebbles of crystalline rocks; comprising serpentine, serpentine and albite, diallage rock, diorites, jade, basalts, and abundant quartzes and jaspers. In the central districts, the pebbles consist almost entirely of flints, and in the lower portions of the river, and at the head of the alluvial plains of Babylonia, they are also flints, with small fragments of gypsum.

Whence derived.—The characters of this deposit as it occurs in its upper portions, would indicate a formation which must have derived its origin from the chain of the Taurus, to which chain, and the outlying formations con-

upwards of fifteen feet square, is excavated, and has an entrance into the interior, like the monolithic temples of Egypt and Hindostán. Not far to the north of this, and on the right bank, there is a low formation of masses of similarly indurated limestone, (the country around being composed of chalk, with interposed beds of limestone,) superimposed on crystalline breccia, and running upwards of a mile in a line as straight as a wall; and which gives a first and strong impression of being artificially constructed.

Changes in Mineralogical Characters.—At Bális, the breccia consists of pebbles of flint in a calcareous, but more frequently, a siliceous cement. The pebbles are often of a considerable size, and the nodular portions of botryoidal alcyonic masses, being converted into so many separate spheroids, they do not appear, as usual, as if they were formed upon organic products, which is probably owing to a modification in the original form. They are often hydrated, and are then brown and gray externally, sometimes striped. Where this breccia commences, about three miles to the north of Bális, it is a real siliceous grit, becoming, at times, a slaty sandstone; and at other places, beds of grit, alternate with beds of conglomerate. It occupies the summit of the high cliffs which occur on the right bank of the river at this place, and spreads over the wilderness, forming the surface-soil of the level tracts from hence by the Aïn el Zeheb to the neighbourhood of Aleppo.

Whence derived.—Hitherto the superior formations by transport have been derived from the Taurian chain;



but they now, in their propagation southward, present a predominance of substances which result from the disruption of the chalk, and subsequently of the supra-cretaceous formations.

Mineralogical Characters.—Opposite to the ancient Roman town of Sura, the breccia presents a predominance of quartz pebbles, jaspers of various hues, and some rocks of the silico-magnesiferous series, becoming inland a sandstone often cavernous, and presenting cliffs of the same, alternating with breccia.

Large Masses of Gypsum.—At El Hamán (the adopted Thapsacus of the Expedition), on the right bank, a formation of breccia of similar nature contains huge masses of crystalline transparent gypsum, consisting of di-hedral crystals irregularly disposed, the masses, often six feet in diameter, were inferiorly smooth and convex; superiorly concave and rudely crystalline. This breccia reposes upon fresh-water marles and gypsum.

Basalts superposed to the Formation of Transport.—A very long tract of level country is interrupted in the descent of the river, at the site of the city of Zenobia, by a range of hills forming the continuation of the Jebel Bushír, and which are composed of gypsum and marles, breccia and sandstone, and superimposed basalts.

The lower beds of this formation alternated with the upper beds of the marles of the gypsum deposit.

Evidence of recent Changes.—There is, in these cir-

cumstances, the distinct evidence of the production, on the surface of the Arabian plain, of a great formation of Plutonic rocks, extending from Palmyrene, to which they give fertility by breaking up the continuity in the level of the soil, hence bringing water, to beyond the Euphrates at Zenobia; and which are superior to the last change that has taken place in the configuration of the soil to the north of the Bushír hills, and which extends between them and Taurus.

Whether accompanied by a Cataclysm.—The manner in which these rocks were produced or given birth to, will be considered by many geologists as being still a theoretical question; but the question as to whether or not their appearance on the surface of the Arabian plain was attended not only by a change in aspect and configuration of the soil, but also by a cataclysm more or less partial, more or less general, according to the circumscribed nature, or the universality, of the formation; will be answered by the further detail of the geological monuments of this phenomenon; while the question whether the elevation of the land, produced by the same cataclysm, did not extend in a particular direction, will also be answered by the simple investigation of the nature of the next transported deposits in succession.

Breccia has no superposed Deposits to the North.—It has already been observed, that to the north of the Bushír hills, the breccia on which the rocks of the feldspatho-pyroxenic series are there deposited, have no formations superimposed upon them, excepting such as are traceable to the action of local causes.

Has superposed Formations to the South.—But to the south of the Bushír hills, and in the neighbourhood of Deïr, there occurs an extensive clay formation, often argillo-calcareous, and sometimes coloured with fer-oxides; which is new in its characters, and communicates to the soil a degree of aridity and barrenness that surpasses anything presented by the higher Euphrates.

Ossiferous Breccia of Rahabáh.—At Rahabáh (Rehoboth), the clay formation is red-coloured argillo-calcareous, with argillaceous septaria, and contains the bones of quadrupeds and birds, among which I obtained the head of a jerboa, identical, in its dentition, with one of the present species inhabiting the plains of Arabia. This formation is covered by a bed of hard limestone breccia, of a red colour, and somewhat similar aspect, but more compact than the ossiferous breccia of Gibraltar.

Selenitic Sandstone of Rahabáh.—These two beds repose upon the crystalline breccia, which here presents the usual characters, but alternates with selenitic sandstone, or sands impregnated with sulphate of lime, and rendered solid and subcrystalline. Below the selenitic sandstone, is an ordinary grit sandstone and pebbly deposit; and beneath these, cretaceous marles, with some bitumen; coarse sands, and sandstones; marles, and gypsum.

Proofs of Formation by Transport.—We have here then, by the superposition of the red ossiferous breccia upon the breccia of siliceous and silico-magnesiferous rocks, decided evidence of the existence of waters, in the

lands south of the Bushír hills, posteriorly to the deposition of the last-mentioned breccia. From its occurrence to the south of these hills, and not to the north, it would appear that the elevating influence upon the land was communicated chiefly in a southerly direction; and from the contained pebbles, and peculiar organic remains, it would appear that that elevation was attended by a catyclysm, somewhat like a flood, or the sudden retiring of waters.

Ossiferous Breccia independent of Tauric Breccia.—That this catyclysm was posterior to, and not contemporaneous with, the flood which bore the fragments of the Taurus to the remote extremities of Irák Arabia; is demonstrated by the circumstance of the basalts being superimposed upon these transported deposits, and by the similar superposition of a transported rock of different characters and of different origin, upon the Tauric breccia in its furthermost propagation.

Period of the Building of Rehoboth.—In the remote, but yet interesting relation which we may venture to make between the certainties of Scripture, and the uncertain indications of natural phenomena; it may be observed, that Rehoboth was built, according to the authorized version of the Bible, by Asshur; but, according to the marginal reading, by Nimrod, who went out of the land of Shinar into that of Asshur, and builded Nineveh (Musúl), the city Rehoboth (Rahabáh), and Calah (Calanicum, Rakkáh;) and between Nineveh and Rehoboth, Resen; (the Larissa of Xenophon, the modern Nimrúd.) The proximate determination of these four sites, by

limiting the country of Asshur, are of equal interest to geology, and to historical geography. Hence, confining ourselves at present to Rahabáh, it was only after this secondary (speaking geologically) catastrophe, as indicated in the succession of formations, that Rehoboth had its existence.

Non-contemporaneity of Tauric Breccia and Deluge.—It is presumable, then, from the facts detailed above, that the formation by transport, extending nearly from the sources of the Euphrates to its mouth, was not produced by the Noachian deluge; because there are evidences of the existence of a cataclysm, subsequent to that which gave origin to said formation. Further, there is proof in the positioning of the land of Asshur, that such a secondary cataclysm has also not occurred at a period subsequent to the Noachian deluge, or after the building of Rehoboth; while, on the contrary, physically, there is every reason to suppose that this cataclysm, characterised by its ossiferous breccia, was, like that which is characterised by Taurian pebbles, anterior to the Deluge of Scripture; nor is it likely, that had so important an event happened between the period of the journeying of the sons of the patriarch, or of the building of Babel, and the inhabiting the land of Asshur; it would have been omitted in the sacred records.

Red Limestone Breccia.—At Saláhíyah, the soil is occupied by a formation of red limestone breccia, which is exceedingly hard and compact. This formation extends far and wide over the terrestrial expanse, which is in consequence everywhere but a naked and stony soil, level as

an alluvial plain, and silent in its boundless solitudes, as a desert of moving sand.

Tauric Breccia awanting.—The Tauric breccia is here awanting, and the limestone conglomerate reposes upon fresh-water marles, with veins of crystalline and lamellar gypsum, themselves superimposed on compact cretaceous marles and contemporaneous beds of saccharoidal gypsum.

Transported masses of Gypsum.—The ruins of the Israelite city of Irzah are perched upon a ridge of cliffs, which interrupt the continuity of the plain between Salá-híyah and El Kayím. Here the ossiferous breccia again manifests itself near the summit of the cliff, but it is in part covered by a deposit of masses of crystalline gypsum cropping out on the surface-soil like a figured floor or pavement.

At El Kayím, the Tauric breccia, 20 feet in depth, is observed reposing on fresh-water marles; and between El Kayím and 'Anáh, low cliffs of marles are covered by a thin deposit of red clay.

Brown Sandstone and Ironstone.—A very hilly country, which extends from 'Anáh to Hadísah, and the features of which are described in the Report upon the Basin of the Euphrates; presents us with a sandstone of new characters, and with a formation of rubbly ironstone rock, capping the more extended deposits of gypsum and marles, which first began to alternate with clays, containing marine polypiferous lithophytes, at Irzah; which clays now assume a maximum developement, and become highly saliferous: while various bituminous products

begin to show themselves amid the same variable and numerous beds.

Alternations of these Rocks.—At the same time, the Tauric breccia shows itself upon the steep summits of the generality of hills, having sandstone or ironstone superimposed; beneath are chloritous marles, gypsum, coarse rock, deeply impregnated with bitumen, marles and gypsum, saliferous clays. The sandstone alternates with the breccia or gravel, and the same with the ironstone, and both again are found alternating with the upper marles of the gypsum. The coarse bituminous rock is found sometimes associated with the ironstone, more frequently in the gypsum, more or less proximately to the saliferous clays.

Geological Relations.—It is obvious, from the position and alternations of these brown sandstones and dark-coloured ironstones, that their relation to the deposits of transport, is the same as that of the ossiferous breccia and clays with septaria of the upper country; and that consequently their origin is connected with questions of topographical geology which it would be out of place to discuss here.

Last Deposits by Transport.—No deposit by transport occupies the surface-soil around the bituminous fountains of Hít; but at a very short distance to the south, a formation of clay and gravel, with fragments of gypsum, reposes upon, and alternates with, chloritous and fer-oxidated marles of the gypsum formation. This is the last of the

deposits by transport that is met with in that portion of the basin of the Euphrates which presents a rocky soil.

Amount of Time.—In the connexion which remains to be established between the Scriptural records of the Noachian deluge, and the physical evidences of that catastrophe; it is necessary to remark, that although the period at which the fathers of nations arrived in the land of Shinar, is nowhere expressly mentioned in Scripture; still it is generally admitted that this occurrence took place at no great distance of time after the Flood. According to all the versions of the Scriptures, the death of the patriarch Noah happened in the 350th year after the Deluge. Now, whether or not the building of the Tower of Babel—the immediate cause of the dispersion —commenced during Noah's lifetime or not; still we are certain that it had proceeded to its ultimate extent in the lifetime of Péleg (Gen. x. 25), whose birth, if we follow the Samaritan and Septuagint versions, occurred in the 401st year after the Deluge. If, on the contrary, we follow the chronology of the Hebrew text, the distance of time between the Flood and the dispersion is still less.

Extent of Alluvium.—It is to be regretted that, in the most careful manner in which abstracts can be made on questions in history, they always entail more diffuseness than questions of science; but having premised the above facts, it remains to point out that if the site of Babylon is admitted to be that of the Tower of Babel, a theory for which there is no direct proof, but very strong presumptive, as well as circumstantial, evidence; then as the site is separated by a wide extent of deposits of a different

nature from the latest deposits of transport which belong to the basin of the Euphrates; it is evident that it is impossible to reconcile the supposition of these latest deposits by transport being identical with the Noachian deluge, and of the deposits which intervene between them and the soil of the Tower of Babel, having been deposited in the short interval of time between the Deluge and the dispersion of mankind.

Incompatibility of Amount of Time.—For, as there occurs, at a rough calculation (and the boundaries of the alluvium and of the latest deposits by transport are not traceable to within a mile,) a distance equal to, at the least, 70 miles, between the limits of the latter and the plain of Babylon; then, if we grant the utmost latitude of time, or 400 years, as having elapsed between the period of the Deluge and that of the erection of the tower, there would have been an increase of land, averaging 298 yards per annum,—a quantity by far surpassing the calculations of those who have computed the advance of the alluvium of the basin of the Euphrates and the Tigris at their highest estimate (Beke, "Origines Biblicæ," and "Phil. Mag.," vol. vi., No. 36), and, besides, inconsistent altogether with the rate of progress of the alluvium of that basin at the present day, and which, under all the favourable circumstances of an united delta, does not, as will be shown in treating upon the alluvia, exceed 30 yards per annum.

Characters of the Euphratic Alluvium.—Already, from the neighbourhood of Zenobia, the valley of the Euphrates is here and there occupied by clays, remarkable

for containing an excess of chloride of sodium, or marine salt, which effloresces by solution and evaporation. This deposit gradually increases in extent till it occupies plains often of 10 to 12 miles deep along the borders of the river; at length, at Mesjíd Sandabíyah, it extends itself on both sides of the horizon, to the exclusion of all other formations, as far as the eye can reach.

Isolated Mounds.—The only exception to this, is the occasional occurrence of isolated and circumscribed elevations of land, which rise scarcely more than 20 feet above the level of the plains in which they occur, like islands in a lake or sea, and to which appellation they were, probably, strictly entitled at one period of their existence. These mounds are found to consist of transported material, chiefly flint, pebbles, and fragments of gypsum, and to underlie the alluvium which has not been deposited in sufficient quantities to cover them, whether their summit was or was not above the level of the waters. They are remarkable as being spots which most frequently furnish a little brackish water in the desert, and hence become the site of caravanserais, as Khán Iskendíriah on the Babylonian plain, which is an example of this formation.

Recapitulation.—It has then, to a certain extent, been demonstrated, by a reference to Scriptural authority and to physical evidences, that the latest deposits by transport do not owe their existence to the Noachian deluge; and it appears that, between the period of the cataclysm which accompanied these last deposits and the erection of the Tower of Babel, there has been a period of time sufficient

to allow of the deposition of a superimposed alluvium of considerable extent.

Ante-Noachian Alluvia.—The alluvium of the Euphrates divides itself, then, distinctly into that which was ante-Babylonian (being also ante-Noachian) and that which is post-Babylonian; and the comparatively large extent of ante-Babylonian alluvium contains whatever matters the great cataclysm, which occurred when "all the fountains of the great deep were broken up, and the windows of heaven were opened," deposited upon the surface of the earth. Mr. Beke (op. cit.) has, from a novel interpretation of the Hebraic, strengthened by illustrations from Scriptural authority, read *fountains* of the great deep as *clouds;* whether this version is the correct one or not, the physical evidences traceable, of this great event, have been sought for and detailed in the present report.

Description and Progress of the Alluvial Districts of Babylonia, Chaldæa, and Susiana.

Part I.

PHYSICAL GEOGRAPHY AND GEOLOGY.

Geography of the Alluvial Districts.—The alluvia of the plains of Babylonia, Chaldæa, and Susiana, to which may be added Sitacene and Mesene; include all the river, lake, and newer marine deposits, at the head of the Persian Gulf. They are comprehended in entity under the ancient geographical divisions, while, under the modern, they occupy portions of Arabia, Irák Arabia, Jezirah, Turkish Arabia, Khusistán, and the country of the Ka'b Sheïk or Ka'bán.

Extent of Alluvia.—These deposits occupy an extent of about 32,400 square geographic miles, and the rivers from which they are derived, with the exception of that portion of the ante-Babylonian alluvium which may have been in part deposited by the Noachian deluge, are the Euphrates and its tributaries, the Tigris and its tributaries, the Kerákh or Karású, the Karún and its tributaries, the Jerákhi, and the Indiyán.

Extent of River Basins.—The extent of the hydrographical basin of the Euphrates, notwithstanding the great length of the river, cannot, on account of the narrowness

of the band of territory from which its few tributaries flow, or which is covered by the residue of its floods, more particularly in the southerly or lower portion, be estimated at more than 108,000 geographic square miles. The basin of the Tigris may be considered as enclosing an area of 36,000 geographic miles. The united systems of the Shat el Húd and Keráh occupy a territory equal to 18,000 miles. The basin of the Karún may be estimated at 16,400 geographic miles, and that of the Jerâhi and Indiyán at 10,800 square miles, and thus the Euphrates, Tigris, and Susianic systems constitute altogether a vast hydrographical basin of 189,200 geographic square miles, containing within itself a central deposit of 32,400 miles of alluvia, almost entirely brought down by the waters of these various rivers, and which have been accumulating from periods long antecedent to all historical records.

Nature of Country through which the Rivers flow.—All these rivers present the peculiarity of flowing, for a great part of their course, through supra-cretaceous formations of a very friable nature, easily disintegrated by the action of the elements, and still more so by that of running waters when swollen by flood, and carrying down pebbles.

Comparative Inclination of Rivers.—The bed of Euphrates at Bír, a distance of 1197 miles by water, from the Persian Gulf; is, according to the results obtained by the carefully-executed levelling of Mr. Thomson, of the Expedition, 628 feet 4 inches above the level of the Mediterranean. The average inclination would appear, from this, to be 6·354 in. a mile; but this is much influenced by the occurrence of rapids, as at 'Anâh, and

probably by the difference of level between the Persian Gulf and the Mediterranean, which cannot be supposed to be less than that of the Red Sea and the Mediterranean, or about 30 feet.

The river Tigris, which has its sources at a proximate elevation of 5050 feet, and is at Musúl, by barometrical observation, about 353 feet above the level of the Persian Gulf; has a moderate current below Baghdád, but passes over several ledges of rock in its course from Musúl to that city, forming rapids of greater or less importance. It is the same with regard to the Karún, which, tolerably swift in the mountain districts, and with rapids at Haváz, is a remarkably slow river on the alluvial plain.

Force of Current.—The rapidity of the stream of Euphrates varies in different places; in the depressions of the alluvial plain it is often not a mile an hour, but over the dry ground, as at Kal'at Geráh, it runs nearly three miles an hour; at Hilláh, where the stream is confined, it flowed four knots through the bridge; the Upper Euphrates averages from three to four miles. The current of Tigris, notwithstanding its hereditary fame for swiftness, is in the alluvial plain often less than a mile an hour, and averages one mile and a half throughout; at Musúl, during the time of the flood, it averaged not more than four miles. The current of the Karún, in the alluvial plain and as far as Bund-i-Kíl, averaged one mile and a half an hour.

Quantity of Mud brought down.—The period at which the waters of Euphrates are most loaded with mud, are in the first floods of January; the gradual melting of the

snows in early summer, which preserve the high level of the waters, do not at the same time contribute much sedimentary matter. From numerous experiments made at Bír in December and January, 1836, I found the maximum of sediment mechanically suspended in the waters to be equal to $\frac{1}{80}$th part of the bulk of fluid, or every cubic inch of water contained $\frac{1}{80}$th part of its bulk of suspended matters; and from similar experiments, instituted in the month of October of the same year, at the issue of the waters from the Lemlúm marshes, I only obtained a maximum of $\frac{1}{200}$th part of a cubic inch of water (mean temp. 74°). The sediments of the river Euphrates, which are not deposited in the upper part of the river's course, are finally deposited in the Lemlúm marshes. In navigating the river in May, 1836, the water flowing into the marshes was coloured deeply by mud, but left the marshes in a state of comparative purity, and this is equally remarkably, the case in the Chaldean marshes below Omú el Bák, "the Mother of Musquitoes."

The maximum afforded by the river Tigris was also, on the occasion of a sudden rise on January 8th, 1837 (mean temp. 49°), found to be equal to $\frac{1}{100}$th part of a cubic inch, or by weight 2·6 grains in 240 grains of fluid. Hence in the river at Baghdád, which averages 200 yards in width, and four feet in depth, the current flowing at the time five inches an hour, the quantity of mud borne past in that time amounts to about 7150 pounds. The mud of Tigris is not carried into marshes as in the river Euphrates, but in great part deposited in banks, shoals, and islands, which, from their frequent occurrence in the lower part of the bed of the river, communicate to it a very different character from the river Euphrates, which, in

its lowermost reaches, is almost uniformly deep. The river Tigris probably contributes, from the same circumstances, more alluvial matters to the Delta of the Persic Gulf than the river Euphrates.

Physical Geography of the Alluvial Districts.—It is unnecessary here to recapitulate the numerous tributaries of the rivers Euphrates and Tigris in the higher regions, but upon the actual physical geography of the alluvial districts, it will be necessary to enter a little into detail, as the ancient condition of the territory, and consequently the progress of changes still in action, can only be ascertained by determining, as nearly as possible, the relation of their past and present condition, which involves us in questions of descriptive and historical geography. It is in order to avoid the confusion which would be entailed by treating all these subjects at once, that I have divided the present memoir into two parts, reserving the first solely for physical descriptions, and the second for those considerations which have, for the most part, an artificial or historical origin. It has, at the same time, been my endeavour to keep the bearing of these two orders of considerations with one another constantly in view, and, I hope, as clearly as could be done without having recourse to unnecessary detail and repetitions.

Circumscription of the Alluvia.—In the line of the river Euphrates the limits of the alluvia are met with, to the north in low hills and undulating land of tertiary rock formations, which advance to the banks of Euphrates at Mesjíd Sandabíyah, cross the river about eight miles above Felújah or Anbár, and at the Pylæ of Xenophon

rise in low hills above the plain of Babylonia, and towards Tigris are lost in the plains traversed by the Median wall.

Limits to the West.—The westerly prolongation of the alluvial formations is circumscribed by a line of rock and sand, which stretches beyond the Rumíyáh or Báhr Nesjed (whither tradition carried the sea in ancient time), a very little to the west of the Shát el 'Utchán, and the Samowát branch of Euphrates. The Pallacopas of Alexander was, according to Arrian, in part hewn in solid rock. Springs of clear water flow from the rock districts west of Samowát. Hills of maritime sands and of transported pebbles flank the great plain occupied by the Múntifík Arabs in the neighbourhood of Orchoe and of Kúsrah, and lastly the marine formations underlie moving sands at Ghoreïn, near the ancient Gerrha, and at Zobeïr, near the site of old Basráh.

Limits to the East.—The same formation is everywhere limited to the east by the low range of Persian subapennines, designated as the Hamerún hills, composed of tertiary sandstones, with salt, gypsum, and limestones, and which stretch, with few interruptions, along the plain at the foot of the Persian Apennines, or loftier ranges of Kurdistán, Súsistán, and Baktíyarí, from the Persian Gulf to Tigris, which they cross a little to the south of the parallel of Erbíl, and ultimately mingle themselves with the undulating country of tertiary rock formations belonging to the district of El 'Hathr, the antique Atra.

It is natural to suppose that the extent inland of the alluvia of the Keráh, Karún, Jeráh and the Indíyán should give to those territories in the province of Khusistán a

greater developement eastward than occurs in the basin of Tigris; but the confines of the alluvia are in reality circumscribed. On the Kerâh, above Hawísah; and at Hawáz, on the Karún; the supra-cretaceous rocks rise above the level of the modern fluviatile or lacustrine alluvia; and so closely are the deposits circumscribed by the prolongation southward of the Persic subapennines, that, not far from the mouth of the Indíyán, the Zeïtún, or olive-tree hills (as that portion is designated), advance into the bay of Derí Búnah by the rocky islets of Búnah and Akiyarín, and ultimately supersede the recent deposits to the very shore, at Shat el Sheïk and Búnd i Delím.

Physical Features of the Persian Subapennines.— The hilly ranges variously denominated Hamerún, Hamríne, and Hamerín, according as the Arabic or Persian orthography has been used, and which I have designated as the Persian Subappenines, form, for the most part, long and continuous low ranges of hills, which course from the north-west to south-east, with some deviation in the angle of direction, or strike of the rocks, as to the north of the little Záb, where the westerly range stretching about 20° more to the west of north than the easterly one, the two ranges, thus separated, leave between them the plain of Erbíl.

They are also sometimes not portions of a continuous range, but local elevations upon lines of greater or less extent. The thinness of the beds, the great regularity of the stratification, the friability of the rock, and the infrequency of vegetation, give to these ranges the character of walls on the desert. In some places, there is a total

solution in continuity, as in the plain of Hawísah, where no rocks rise up above the level of the surrounding surface; but in these cases, it not unfrequently happens that the formations may be traced by the alternating seams of different nature and various colours which are observed upon the naked ground.

Geological Characters.—At Delí 'Abbás, at the Bund upon the 'Athím or Physcus, and along the rocky boundaries of the great plain east of Baghdád, the hilly ranges, always distinct, form narrow bands, parallel to one another, and rising to an altitude of about 500 feet. The strata dip almost constantly to the east a little north, presenting abrupt acclivities to the west, sloping more gently to the east. The same direction of dip and of strata is observed at Hawáz, but where the rocks cross the river Tigris at Shírgat, and effect an union with the tertiary formations of Mesopotamia, there is much irregularity of stratification.

At 'Uslan on Tigris, the formations consist of coarse limestone, underlying yellow and red marles, and cavernous gypsum, which are again sometimes covered by red and gray sandstones. At Shírgat, the sandstones predominate to the exclusion of the calcareous deposits, and the gypsum is reduced to thin beds. At the Physcus, blueish sandstone, with cream-coloured veins, is succeeded by coarse red sandstone and sandstone conglomerate, with occasional thin veins of gypsum and brown earth-coloured beds; these formations are covered by a non-contemporaneous pebbly deposit, which occupies the summits of the highest hills, always reposing horizontally upon rocks

inclined at various angles. At Hawáz, the rocks are sandstones of various colours, non-fossiliferous, alternating with red clays, which contain thin seams of gypsum.

Physical Characters of the Babylonian Alluvia.—The physical characters of the alluvia of Babylonia are best studied in their progress from the north to the south, or from the hills to the embouchure of the rivers. Thus, in the alternating low and high territory at the foot of Pylæ of Xenophon, and along the course of the Median wall towards Opis, the plains have a slight but well-defined southerly inclination, with local sinkings above Felújah, near Aker Kúf, and at Sitace. The territory undulates in the central districts, and then lowers into mere marshes and lakes.

In the most northerly portion, the soil is pebbly, the pebbles consisting almost solely of variously-coloured flints, and occasional small fragments of gypsum. This is succeeded by a continuous formation of clayey soil, in part humus, in part argillaceous and argillo-calcareous, but covered with mould, dust, or sands, or the more tenacious clay of frequent inundations. It is rare that the pebbly deposits show themselves to the south of a line drawn across from Felújah to Aker Kúf; but small circumscribed deposits by transport are occasionally met with, islanded amidst these vast tracts of alluvium, as at Khán Iskundíria, and in other spots, the geological relations of which have been pointed out in that portion of the work which treats upon the diluvium of these countries.

Ante and Post Babylonian Alluvia.—In the portion here noticed, in discussing the connexion of the physical

characters of the soil with the Scriptural records of the Noachian Deluge, I have distinguished, for the sake of accuracy, the alluvia of Babylonia into those which are anterior to the congregation of the first post-diluvian families on the banks of the Euphrates, and those which have been deposited at a period subsequent to that earliest of migrations. It is evident that the first of these divisions comprises all the deposits which are north of the recognised site of Babel, or Babylon, extending in a straight line a distance of 70 miles, and which distance suggested the great improbability of such a vast deposit having had its origin between the period of the Deluge and that of the building of the Tower, or during a space of less than 500 years, and obliged me to admit that the Ante-Babylonian alluvia were, in part, the physical monuments of the Deluge of Scripture, if not also ante-Noachian alluvia.

Moving Sand-hills.—In one spot near Bushíyah, and about ten miles beyond the south-east quarter of ancient Babylon, a curious phenomenon presents itself, which is also met with upon a larger scale at a spot denominated El Aïyat (آيه), a miracle, or Iyád (اياد), large heap of sand, and Wílayat (ولايه) Beni Ismaël, dominions of the sons of Ismaël, between the 'Athím or Physcus and Tigris, and also south of El Háthr. It consists of a number of hills of sand, occurring upon a level plain, which are constantly shifting their place and number, and yet always remain in the same general locality. They appear to owe their existence to the presence of springs, which moisten the sand, and cause its accumulation, allowing, at the same time, the prevalent winds to alter the form and

number of the hills, while their bases have a fixed point of attraction. They are objects of superstition to the Arabs, who often look upon them as the sepulchral pall of brethren fallen in battle, as in the " dominion of the sons of Ismaël."

Geographical Botany.—The woolly and spiny plants of the plains and rocky tracts of Arabia and Mesopotamia are in the alluvial plains dismissed, to make way for succulent species. The genera Crassula, Salicornia, Salsola, and Tragia, with certain Mesembryanthema and Asters, cover with their representatives the plains of Babylonia, and spread themselves wherever the alluvial soil, impregnated with nitre or marine salt, occupies, as it so constantly does, the great level tracts of Babylonia, Chaldæa, and Susiana.

Efflorescences of Nitre and of Sea-salt.—It is of importance to distinguish between the efflorescences of nitrate of potassium, and of chloride or hydro-chlorate of sodium, both of which are common on these plains, for the one is most probably derived chiefly from the decomposition of vegetable matters, and consequently peculiarly characteristic of humus, or of alluvium of fluviatile or lacustrine origin, while the other is no less strongly indicative of depositions from the sea or bays, unless when they are local deposits produced by springs or otherwise, as is so often the case with formations of salmarite, or rock-salt in the supra-cretaceous rocks.

The efflorescences of nitre, which are also frequently accompanied with other salts, more particularly natron (carbonate of soda,) and the sulphate of soda, were most

abundant in December; although there had been no rain, still the dews were increased in quantity, and many tracts in the lower Tigris became almost snow-white. Is a low temperature favourable to the crystallization of nitrate of potassium, or is the phenomenon connected with the increased amount of dews? Evaporation is certainly not increased, nor are the relations of radiated and ambient caloric much more opposed than in summer.

A curious exudation of moisture, generally accompanied with saline efflorescences, which become visible when that moisture is evaporated by the sun, is frequently to be observed after long-continued dry weather upon the alluvial plains. It appears towards the evening, and causes the surface-soil to rise up as in bubbles; these dry again, and break up in crackling fragments. Marine salt, which absorbs moisture freely, renders plains, which, as in Ka'bán, are covered with it, moist in the morning, but dry in the day time.

Annual Inundations and Canals.—The modern accumulations of soil in Babylonia, from annual inundations, is still very great. The canals which, in the present day, carry water from one river to the other at certain seasons of the year, are, to the north, the Isá, which originates from Euphrates to the north of Felújah, and inundates, for six months, the whole country around Aker Kúf and Sitace, and leaving marshes which are perpetual in the same districts, part of its waters are carried off by a canal dug by Dawad Pashá, and bearing his name; other canals of irrigation are drawn from the same source, as the 'Sgáyer Elkher and the Tíber Elkher. The Isá is known to the Dilaïm Arabs by the name of Abu Gheraïb.

The Dawadhíyah canal empties itself into Tigris three miles south of Baghdád. The Nahr Zimberáníyah is another canal, about four miles north of Seleucia, which, in the period of flood, inundates the whole country to the west of that site, and bears to the Tigris a body of water averaging three feet in depth, and twenty in width. The Muhawíl and the Níl canals, are the only other canals containing water that I am acquainted with in Babylonia Proper, unless under that head was introduced the description of the various smaller canals of irrigation which water the country of Mússáïbáh, celebrated for its tobacco called Hassaní, and those still in existence in the neighbourhood of Hilláh, and which overflow the lands west of the Bírs Nimrúd.

The quantity of recent mud deposited even at the mouth of the Dawadhíyah canal is considerable, and the bricks of Seleucia are found often in strata by the river-side, covered by four feet of alluvium. In general, the alluvium that is brought down by canals and rivulets, and deposited at their mouths, is a fine clay. It is easily distinguishable from older alluvia by its dividing during the summer heat into polyhedral masses, which are the more regular as the substance of the clay is finer.

Changes effected by Art.—The great extent of the plain of Babylonia is everywhere altered by artifical works; mounds rise upon the otherwise uniform level; walls, and mud ramparts, and dykes intersect each other; elevated masses of friable soil and pottery are succeeded by low plains, inundated during great part of the year; and the antique beds of canals are visible in every direction. There is still some cultivation and some irrigation,

Flocks pasture in meadows of the coarse grasses (sedges and Cyperaceæ)—the Arabs' dusky encampments are met with here and there—but except on Euphrates' banks, there are few remains of the date-groves, the vineyards, and the gardens, which adorned the same land, in the days of Artaxerxes; and still less of the population and labour, which must have made a garden of such a soil, in the times of Nebuchadnezzar.

Boundaries of Babylonia.—The plain of Babylonia, strictly so called, extends from Pylæ on Euphrates, to the district of Accad or Sitacene, on Tigris; and is bounded on the south by the marshes of Lemlúm. These present on their eastern side, and near to Tigris, some dry land tenanted by the Zobeïd Arabs, and occupied by the Babylonian mounds of Uffrín, Nimaláh, Jerrah Súplí, 'Itháhr, and Mizisíthah, which formed the link between the territories of the north and the south,—the Babylonia and Chaldæa of the Roman ages.

Physical Characters of the Marshes of Lemlúm.—The soil of the marshes of Lemlúm consists, for the most part, of a soft alluvial clay and mud, containing only river and lacustrine shells. The greater part of the basin is, however, occupied by water or by vegetation, in which the preponderance of Cyperaceæ and Typhaceæ, and of large Gramineæ, announce, as in the temperate zone, the aquatic character of the country, and a comparatively cold and humid climate. The shallow sheets of water which are dispersed amidst this marsh of reed and rush, like the tarns of Scotland, the meres of England, and the mares of France, are generally invaded by a host of Alismaceæ,

Nymphaceæ, and Ranunculaceæ. These marshes feed large floçks of buffaloes, and the mud that is not covered by vegetation, or which is dried by the summer heat, becomes, during the season, clothed with luxuriant crops of rice. The wild and robber inhabitants of these districts, celebrated for their fine forms; appear, like wading birds, to have, from constant living in mud and water, long and graceful limbs. They belong to the tribe of Khezaïl, are Shiites, and descendants of a Persian race. They live in reed huts, temporarily erected on isolated dry spots, like islets in a wilderness of waters; but these are very frequently flooded, and it is no uncommon thing to see the children swing in cradles attached to the roof, while the waters are flowing through the arched cottage, in an uninterrupted stream.

Geographical Extent.—These marshes extend in latitude from above the town of Lemlúm to Kalát el Geráh (Gerah) in the parallel of Samowát, a distance of about 40 miles; and their longitudinal extent is probably almost equal to their length, being only limited on the west by the slightly undulating lands above the Sámowat branch of the Euphrates, and stretching to the east to the country of the Chaldæo-Babylonian mounds of Ziblíyah, Seleïni, and Jayíthah.

Various origin of Alluvia.—In traversing great tracts of alluvial country, where everything presents almost the same aspect,—uniformity of level, continuity of plain, similarity of vegetation, and identity of living forms,—the eye fatigues itself with seeking for distinctions and differences which are scarcely supposed to exist, because they

are not apparent by contrasted configuration,—a varied outline, the succession of hills and valleys, or the relief of the most gentle undulation are not to be observed; and a rigid perseverance alone discovers, that among these tracts of so much similarity of character, there is, in reality, often the greatest difference in nature and origin.

Plains of Chaldæa.—There is very little indication of change on quitting the Lemlúm,—a gradual elevation of the soil, so gentle as to be scarcely perceptible, but affording a territory which is the seat of cultivation, during the dry months,—leads to plains of wide extent, which dominate by only a few feet over the marshes; and which are by position and history, and in the "ruinous perfection" of their monumental remains, identified with the territory of Chaldæa.

Geological Features of the Soil.—A closer inspection of the territory of Chaldæa shows that at the northern end, or immediately beyond the marshes, the soil presents many peculiarities; it is a strong tenacious clay, of a deep-blue colour, argillo-calcareous, and very uniform in its characters; it further abounds with shells, and these belong to a very few genera, which are almost entirely marine.

Organic Remains.—These mollusks belonged chiefly to the Trochoidal and Buccinoidal tribes of the Pectinibranch and aquatic-lunged Gasteropods; also to the tribes of Mytilaceæ and Cardiaceæ among the Testaceous Acephala.

The most abundant shells in the lower argillaceous

beds were a well-defined species of Venus, and a Cyrena, associated with certain turretted univalves, and a Mytellacea with a fine pearly lustre internally, and apparently closely allied to the sub-genus Mytiloidea of M. Brongniart (Cuv. "Oss. Foss.," t. ii. p. iii. f. 4.) (Cuv. "Règne Animal," t. 3, p. 186.)

The upper and more sandy beds were characterized by the Trochoidal and Buccinoidal forms of turretted univalves, apparently a littoral formation, and the species bore a perfect identity to what are met with in the present day on the shores of the Persian Gulf. The shells of this formation, which it is to be regretted have not reached home, were collected in part at the head of the Chaldæan territory near Gerah, and in part at El Kadder in the parallel of Irák.

Eminences of Drift Sand.—The sandy deposits belonging to the Chaldæan marine formation rise in the neighbourhood of Gerah, at Abú el Fír, O'mú el Múshábét, and at the castle of Báshí Agha, only lately destroyed by Sheïk Adjíl, (brother to Isá, chief of the Múntefík Arabs,) and lastly at Grayím Inlet, in gentle undulations which may be mistaken in these level plains for Assyrian mounds or heaps resulting from accumulated ruins. They are, however, distinguished from these, by the total absence of bricks or pottery, which are uniformly met with in the neighbourhood of Chaldæan or Babylonian cities or monuments.

Geographical Botany.—The vegetation of these tracts is characterized by the usual saline plants, the river banks being fringed by shrubberies of Tamarisk and Acacia, and

occasional groves of a poplar (Gharab), with lanceolate and cordate leaves on separate parts of the same branch, and which has hence been mistaken for a willow. The weeping willow (*Salix Babylonica*) is not met with in Babylonia. The common tamarisk of the country, the Athleh or Atlè of Sonnini, is the Tamarix Orientalis of Forskahl ("Flora Egyptiaca-Arabica," p. 206.) The solitary tree "of a species altogether strange to this country" (Heeren, "Asiatic Nations," vol. ii., p. 158,) and which Rich calls Lignum Vitæ, found growing upon the ruins of the Kasr at Babylon, and which has been supposed to be a last remnant or offspring of the sloping or hanging gardens, that appeared to Quintus Curtius like a forest; is also a tamarisk, but it differs from the athleh in its size, being a tree, in having scaly branches and long slender petioles, which are less burdened with leaves, both of which may have been produced by a scanty supply of water and great age. A tamarisk exactly resembling the Babylonian tree is, however, frequently observed overshadowing the wells of Farsistán, and is common in the country of the queen, for whose solace the Hanging Gardens are said to have been created.

Assyrian Mounds.—No monuments in Babylonia and Chaldæa appear to be more valid regarding the antiquity and Assyrian origin of sites, than the lofty artificial mounds, of which the present degenerate hordes of the tent and the spear narrate so many fabulous tales; but which almost everywhere present themselves where there are also other strong grounds of presumption of an Assyrian or Chaldæo-Babylonian origin. Thus at Irkáh or Irák, at Wasít, Tel 'Síphr, Seleïní, Jayíthah, Ziblíyah,

and Secheríyah in Chaldæa; at Teredon, and at Urchoe on the Pallacopas; at the Bírs Nimrúd, the Mujaílbah El Heïmár, and Shi Shubár in Babylonia; and at Aker Kúf in Sitacene; these colossal piles are found domineering over the dreary waste, to the uniformity of which they offer a striking contrast; being visible at great distances, and although thrown by the *shráb* or mirage into strange and contorted shapes, yet they always appear, when seen upon the verge of the horizon, as if possessing colossal dimensions, and produce an effect, in point of grandeur and magnificence, which cannot be imagined in any other situation.

The absence of these mounds is an equally strong objection to the determination of sites as Assyrian or Chaldæo-Babylonian, more particularly where the other sources of identification do not rest upon grounds of an unexceptionable character. Such, for example, are the scholastic dreams of St. Jerome, and the positioning, by Abú el Fáraj, of Erech, Accad, and Chalne, at Urfáh, Nisíbín, and Márdin. Upon less data than that of the relation of the Sinjár of the Romans, and the Shinár of Scriptures, noticed but not advocated by the sagacious Niebuhr, and corrected by D'Anville ("Comp. Anc. Géog.," p. 433,) Mr. Beke ("Origines Biblicæ," p. 66,) has identified the land of Shinár with the Kharpút Dawassí, misled by a bad interpretation, and unaided by a single monumental or traditionary evidence.

Chaldæan Mounds.—High and extensive mounds, monuments of a laborious and an aspiring people of former times, present themselves on the eastern and western banks of Euphrates on various parts of the great plain of

Chaldæa. About 30 miles from the head of the plain a deep channel of artificial construction, called by the natives Grayíno, takes its departure from the river Euphrates, bearing its waters to several distinct mounds, amidst which one towers in superior magnitude and height. The site itself preserves the name of Irkáh, Senkerah, and Irák, and is also called Asayíyah "the place of pebbles."

The gigantic mound designated as the Mogeïyer, or place built of bitumen, rises upwards of 200 feet above the level plain which bounds the horizon to the west of the Euphrates, accompanied by other mounds of less dimensions, and less precipitous acclivities, but over which are everywhere strewed the remains of bricks cemented by bitumen, and of antique pottery and constructions. The appearance of the Mogeïyer surpasses in boldness the ruins of Bírs Nimrúd. It is situated a little north of the parallel of Kút, the residence of the Sheïk of the Múntifík Arabs, and in the plain about 12 miles west of the river Euphrates upon the ancient bed of the Pallacopas.

The other larger mounds of Chaldea are Tell 'Siphr, Atláh, Tell Medinéh, Jerra Súplí, 'Itháhr, Mizisíthah, Jayíthah, Abú Ghurút, Wasít, and a great number of others of less importance.

Hydrography of Chaldæa.—The rivers and canals of Chaldæa, which contain water in the present day, are the Shat Bazúl, close by the old bed of the Hatúl, the numerous canals of irrigation near Geráh, designated as the Mejílah, the Jemílah, the Antár, the Jamídah, and others; a similar system opposite to Samowát, including the Bushínaker, the Dúb, and the Bunder, and the extended

line of the Shatráh canal, having numerous offsets to Euphrates, and uniting with the Shát el Hïe, near its embouchure.

Shát el Hïe.—The river of Hïe, which traverses the plain of Chaldæa from Tigris to Euphrates, takes its departure from the former river at Kút Aámárah, at a distance of 241 miles from Kúrnah. It courses at first through extensive marshes to Kút Hïe, beyond which are the mounds or Núsháyet Wasít; at this point the river divides itself into two branches, the most northerly of which, the Bu Jí Heïrat, follows a circuitous course by the old fort of Tesaïní to Teli Tendhíyah, where it unites with the other branch, which, from not being navigable, is designated as the Shát ul Amáh, or the Wanderer, flowing past the modern Wasít or Wasít el Hïe. The united streams form the Sub Bíl, which, after sending off the canal of Bú Dukau, and another to Shatráh, divides at the tombs of Hamzáh into two branches, the most northerly of which is called Argáf, and is the only one navigable, having its outlet into Euphrates, 14 miles north of Kút, and upwards of 90 miles by Euphrates from Kúrnah.

Inundations of Súk el Shuyúkh.—While the dry land on the banks of the Euphrates stretches beyond the Shat el Hïe, protected by the date plantations, the rampart-enclosed reed huts, and the more stable habitations of the Múntifík Arabs, from Kút by Súk el Shuyúkh to Omú el Bák, the "Mother of Musquitoes." The inland country to the east, and to the west in the parallel of the "Sheik's Market-town," becomes already occupied by an

almost perpetual inundation, and at Omú el Bák, the waters spread from the banks of the river in every direction, like a great lake; extending to the extreme verge of the horizon, and only here and there interrupted by groves of date-trees, and occasional huts islanded in the desert of waters. On the ascent of Her Majesty's steamer "Euphrates" in the latter end of October, and the descent of the same vessel in the beginning of November, 1836, the extent of this great inundation had undergone very little diminution from what it had been in the month of June, nearly at the period of the great floods.

Reed Marshes of Chaldæa.—To the south of these great inundations, and to the point of union of Tigris and Euphrates; the land is occupied by perpetual waters, and hence covered with an aquatic vegetation, which derives its chief, if not its sole, characters, from a species of agrostis; which, like the canebrake (*arundinaria*) of North America, has the port and aspect of the true reed (*arundo*) of the North of Europe. These tracts present hence, in every direction, great uniformity of feature; a boundless growth of plants of the same aspect; only here and there, interrupted by lakes and ponds, or intersected by artificial canals.

Hydrographical Features.—The waters of these reed marshes are derived chiefly from the river Tigris, towards the banks of which is some higher land, although still marshy, and which contains the rice-grounds of the Múntifík Arabs, and also those of Kúrnah. The Brashíyah, the Yuwár, and the Bú Bariyah system, consisting of three

canals flowing into a common channel, may be considered as the most northerly of these. The remainder are below the point to which spring-tides extend in Tigris, and comprise the Akúshí, the Dervishes' canal, the Shírah, the Dákower, the Demáhah, the Buchál, and a great many more less important.

These marshes empty themselves by almost as many outlets as there are inlets; among these few have names; and between the Shát Hamam and Kúrnah, are 15 different channels which pour their waters into Euphrates.

The Jesayír of the Bení Lám Arabs. The Samárgah and Samídah.—There are two other marshes, of a little less extent, but of importance in considering the ancient geography and the progress of the alluvia in these territories, which remain to be described. The first are on the left or eastern bank of Tigris, and occupy all that country which extends from the Keráh, or Hawísah river, northwards to the Shát el Húd. This district is called the Jesayír, or islands (plural of Jeziráh), by its inhabitants, who belong to the Arab tribe of Bení Lám. The waters are derived in part from Tigris by the canals called Shát el Húd, Nahrawán, and Deráheïm, but in much greater proportion from two derivatives of the Keráh, the Náhr Josém, which flows from above Hawísah, and the Bú Jamús, three miles below that town; both flow into the marshy ground extending between them and the Shát el Húd, the Nahrawán, and the Deráheïm. These marshes are called Samargáh; part of the waters flow, however, to the southward, and cover the land, which advances as a promontory between Tigris and Keráh.

The latter marshes are called Samídah, and have, as outlets, the Jehayít, the Hamyán, and other canals.

Abú-el-Fidah mentions that, when the dams of the Bú Jamús and of the Nahr Josém break down, the Keráh is left almost dry. All these marshes are traversed, and even navigated, by boats through channels of various dimensions. As terms in physical geography are most abundant in countries characterized by peculiarities in contrasted configurations; so the Arabs are as rich in names for their picturesque marshes, as the Norwegian is for his variously-formed mountains. Thus, a river flowing in a narrow channel through reeds is called Jahíyah, while one which spreads out, and has islands or clumps of reeds in the bed, is called Burjháh or Búrj.

Reed Marshes of the Nahr Saléh. The Jesayír of the Múntífik Arabs.—This is the next marshy tract, and occupies the right or southern bank of the river Euphrates, from below Omú el Bák to near Basráh, and extends from that river to the ancient Pallacopas. The marshes are fed by a number of canals and derivatives (mostly artificial) from Euphrates, few of which are distinguished by names; among them, however, are the celebrated Nahr Saléh, the Nahr Antár, the Nahr Sautah, and Nahr Sebíyah.

District between the Hawísah and the Karún.—The districts, which we are now led to, are such as extend to the south from the point of junction of Euphrates and Tigris to the embouchure of the united rivers, or the Shát el Arab, into the Persian Gulf. The tract of land which is comprised between the Suáb or Hawísah branch

of the Keráh, and which occupies the left or eastern bank of the river, as far as to the Mo'ammerah mouth of the Karún, is characterized by a fringe of date-trees on the river side, a band of reed and rush marshes, some pasturage, and still less cultivation; and beyond, a level and uniform plain, sprinkled with occasional tamarisk, Ononis, Acacia, and saline plants; but, for the most part, bare and naked; and inundated during nearly one half of the year.

The whole line of this district is traversed near to and parallel with Euphrates by the large and deep canal called Zeragíyah, which is derived from the Suáb giving off a number of small canals to Euphrates in its course, and mingling its waters above Basráh with the Shát Shitíyabán and the Nahr Hássain.

Territories dependant upon Basráh.—The territories upon the Shát el Arab, to the north and south of the city of Basráh, are designated, according to their geographical position in relation to that commercial mart, the Shemál and the Junúb.

The Shemál, or North.—The Shemál, like the opposite bank of Euphrates, is also, for the most part, fringed on the river side with date-trees. This district is pierced by many canals, among which are the Nahr Omár and Deïr; it also contains some villages, as Robát Dán and Shireh; also the ruins of Deïr, celebrated for its tower of colossal dimensions, now fallen, and of Ableh, of still greater antiquity. The band of vegetation is very narrow in this district, often confined by ranges of sand hills to a few hundred yards; beyond this verdant band, an inundation

of from six to eight months veils the earth from sight, which, during the remainder of the year, is a level plain, without a moss or lichen to feed the piping sand-grouse (*Pterocles*).

According to Abú-el-Fidah the canal of Maägál, in the district of Shemál, joins the Nahr el Aballáh (Obolah), which is 11 miles below it, at Nimíah, near Basráh.

The Junúb, or South.—The district of the Junúb, or south, presents similar characters, for the most part a fringe of date-trees, and inundation at one season, and a naked plain at the other. This district has many villages and canals dispersed along the date groves, or on the river banks. The canal of Ashár flows past the fort of Nimíah to the city of Basráh, and twice a day, with the flowing tide, waters the gardens of that unhealthy spot. The canal of Nimíah contains the ruins of Turkish ships of war. Sarrají is a mere creek. There are many villages scattered along the date groves, or on the river banks between Basráh and the sea.

The Dauasír, or "Water Country."—The extensive level tracts from the Junúb to the confluence of the river and the sea are, the Jezirát Kháder of Thevenot, the Dauasír, or Water Country, of Niebuhr, and the Choá-bedeh of Sir W. Jones. It is interiorly the same barren and desert country of mud and sands, bounded by the pebbly deposits of the Pallacopas, and inundated during nine months of the year. The banks of the river are lined with woods of the graceful date, and at times afford a rich pasturage for buffaloes. Villages are numerous, but the population rather scanty.

Geographical Botany.—The extreme limits of the alluvial soil, the points where land is first gained from water, at the mouth of the Shát el Arab, and on the littoral expansions alike of the Ka'ban and the Dauasír, the soil is clothed with an uniform vegetation. A solitary plant, uniformly propagated over these great tracts, acts as umpire between the liquid and the solid world, and first reclaims new territories to the latter. It is a species of Mariscus, approaching very closely to the M. elatus of the East Indies, of which it is perhaps but a variety, but differing from it in the marked elongation of the spikelets. It may be designated as follows:

Genus *Mariscus*. Species *elongatus*. Umbel compound; spike cylindrical; spikelets elongated, numerous, spreading; bractes longer than the spikelets; from nine to eighteen rows of flowers in each spikelet.

The sheath at the base of the leaves is shut up, and the average length of the culm or stem is about two feet. It flowers in May at a mean temperature of 84°, but under great atmospherical vicissitudes, and a range sometimes of 24° between the temperature of night and that of day. It presents a rich green carpet and a fine verdure, in the flowering season, relieved by the glistening aspect of the spikelets, which are nevertheless sombre in their colour, like the other species of the same family.

The roots of this plant are fibrous, and take a firm hold of the soil; by this means, in their propagation, they give solidity to whole masses of alluvium, and thus assist in repelling the invasion of the waters at spring-tides, during storms, and in periods of inundation; there is no combat here, as when the Arundo arenaria or the Carex

of similar specific name, are endeavouring to climb above the perpetually-accumulating sands; where the Mariscus has once spread itself, the land may be said to be almost irrecoverably gained. The importance of this plant in physical geography will be thus at once felt in all its magnitude.

Date-tree Cultivation.—These tracts of mariscus, which, named after their vegetation, Humboldt would call Cyperitæ; are interrupted on the west banks of Euphrates, at the village of Fúeh, about 15 miles from the embouchure of the river, by plantations of young date-trees and the foundations of the latest village that has approached the sea. A short distance more to the north, and on the east side, the inhabitants of Mashannák or Bukshír are also engaged in a similar manner in reclaiming the new grounds to cultivation, or at least to arboriculture; for the plantation and growth of the date-tree, can scarcely be looked upon in the same light as tilling the ground—corresponding with the character of the country over which its stately form first dominates—it partakes of the primitive simplicity of the earliest conditions of man, as a social being.

Ichthyology.—The mud-banks on the Shát el Arab, which are left bare by the ebbing tide, and are immediately below the Cyperaceæ; are the abode of a species of Gobius, which by burrowing the ground, prepare it for the reception of plants; and thus ever perform their part in the ultimately great effects which are produced by an allwise Providence, from apparently small causes. This species, like other Acanthopterygoid fish to which the

labyrinthiform gills give the property of living out of the water, delight in basking in the most powerful sun of summer, lying in myriads upon the banks, and moving with great agility on the approach of birds. The principal powers of locomotion, are derived from a peculiarity in the arrangement of the operculum, by which three of its portions are united to form an osseous plate superadded to the thoracic fin; and from the reunion of the same fin into a hollow disk, it thus becomes a gasteropod organ, or a foot placed beneath the stomach.

Marine Shells.—To the north of Fúeh is an extensive plain inundated like the rest of the Dauasír during a great portion of the year, and composed of soil almost entirely of marine origin, and furnishing abundant recent marine shells. The vegetation on this tract consists of saline and crassulated plants. Cyperaceæ also become more abundant in species, but Mariscus elongatus still predominates. In the date forests, the Glycyrrhiza glabra, forms the most frequent vegetation.

Physical Characters of the Ka'bán and Dorakstán.—The tract of alluvium contained between the Karún and the Jerahyí and that river and the sea, extending to the Bahámshir, is called in its northern part Ka'bán, and in its southern Dorákstán, or Dorghestán,—the Margastana of Arrian. The whole district is a nearly uniform plain, for the most part inundated during one-half of the year; for the rest; brown, even, desert and dead, without a moss or blade of grass to enliven its uniformity, and scarcely a living thing excepting now and then a stray herd of gazelles, or a skulking hyæna, to be seen. Some parts

of the plain are, however, covered with a scanty vegetation of dispersed Salsola and Salicornia, with some Ononis; but where the inundation extends to nearly nine months in the year, and along the coast in every direction; the surface is covered with a continuous growth of Cyperaceæ (*Mariscus elongatus* a *Luzula* and *Cyperus conglomeratus*,) and lastly, where the inundation continues throughout the year, or where the rivers or canals lose themselves in the plains constituting perpetual marshes, there is a deep growth of reeds, rushes, sedge grasses, and gramineæ, amidst which the buffalo herd, delights to wander. In the Dorghestán, and at the mouth of the Bahamshír, there is a greater variety of soil and aspect, more particularly derived from the great plains of salt, which in some places cover the soil like a field of snow. Sometimes the earth is a compact argillo-calcareous cement, with a few plants of Salsolæ; in other places the soil is divided into irregular polyhedral and imperfect circular figures, and then again broken into a loose soil, full of saline particles.

In the plains of salt, the incrustation lies from a depth of one-fourth of an inch to an inch; in the interior the incrustation is quite continuous and unbroken, but on the verge of the plain there are bubbles of thin soil elevated by the evolution of gaseous matters which sometimes break through the saline crust.

Burning the Vegetation.—It is a common practice, during the few months that the districts of Cyperaceæ are dry, to fire the desiccated and earth-brown vegetation; when, if there is the slightest breeze, the flames spread with fearful rapidity. On these occasions, numerous birds of prey, kites, vultures, and large gray crows, are seen hovering in

the air, and sweeping through the dense piles of smoke which curl above the region of devastation like clouds; in the train of which they are ever and anon seen to alight, where an abundant destruction of animal life, attends the progress of the fire. Small quadrupeds, such as the jerboa and shrew-mice, hurried out of their holes, fall victims to the kites and falcons; while an abundant harvest of half-broiled snakes and lizards, await the vultures and the crows.

Causes of Infertility.—Although there is no vegetation upon those tracts which are only inundated during six or seven months of the year, or upon others that are covered with water during a longer period, as between Basráh and Zobeïr; or even where the period of time is less, as between Moham'rah and Hawísah; this appears to be more connected with the chemical nature of the soil, than with the climate. When irrigated, the same soil at Dorák, produces abundant crops of rice; and what is now barren plain at Hawáz, was formerly the seat of large sugar-cane plantations; the cultivation of which extends from 35° to 40° on each side of the equator. A proof that the desert (a term which I use as expressive of *deserted*, and not as incapable of productiveness,) character of the soil, is connected, most probably, with its saline nature, as well as with a want of irrigation; is the abundant vegetation of those spots in the alluvial districts, which are overflowed by fresh-water tributaries. In the same way we observe the bed of the ancient Karún, composed of a band of fluviatile soil about 200 yards in width, is covered with the Cynodon linearis and other grasses; while beyond the bed are a few tamarisk shrubs overrun with termites, and

then some saline plants, succeeded by a lifeless plain. The ancient bed of the Shawúr, presents also a paucity of graminous plants, which appear like the agreeable verdure of a greensward when compared with the plains around.

Modes of Deposition of Alluvia. — The difficulties which present themselves to too extensive generalities upon the graduated depositions of alluvia are often of an almost insuperable character. In the Shát el Arab it is a very common thing to observe the river actively at work carrying away ancient alluvia from some change in its course, of which the causes are sometimes difficultly appreciable; but which are generally connected with the balance which is always throwing itself in the scale, between the general and the detailed course of a river. The geographical direction of its bed, influencing its return from old sinuosities when carried too far in one direction, causes a constant change of action from the salient angles of one side to that of the other, yet always terminating in favour of one more than another, from causes that are connected with the configuration of the land, as in the gentle slope upwards towards a mountain-chain in the Tigris, or with geological changes, as in the Shát el Arab, where the alluvia brought down by the Kerâh and the Karún are perpetually assisting in throwing the bed of the river to the westward.

But in the river Tigris these changes are to be seen in full operation upon alluvia of the most recent origin, frequently of the last flooded season, cutting them down in sandy cliffs, which having little tenacity, are perpetually giving way, and hurried down to other places; while the

river itself repelled by the mountains which it approached too closely on leaving the walls of Seleucia, (where it has twice changed its course, now wooing Ctesiphon, now the city of the Greeks;) its constant tendency remains the same of flowing to the westward.

How insignificant are the calculations which can be made on the quantity of adventitious matter suspended in a river, to effect changes so numerous and so frequent; and how little dependance can be placed in results that are derived from these, when the phenomena of deposition become so complicated in different parts of the river, and throughout different seasons of the year; if we did not judge by the general rather than by the particular or merely local effects produced.

Various circumstances of Origin of Alluvia.—It is obvious that, in order to form even an approximative opinion upon the amount of time which the alluvial formations of Babylonia, Chaldæa, and Susiana, have occupied in their deposition; all the various circumstances of their origin, must be taken into account.

The first and most important of which, is to obtain as many data, historically established, as possible; such as the changes which have occurred subsequently to the erection of towns, castles, or buildings; the digging of canals; the march of conquerors; and the solitary path of travellers.

The second are the geological features of the soil which enters into the composition of so vast a basin, and which must cause a great difference in the changes which are locally undergone by the bed of the river, and the quantity of detritus which is carried away from one place

only to be deposited in another, or borne onwards towards the delta of the united rivers which form that basin.

Thirdly, the physical character of the soil, the contrasted configuration, or superficial structure of the land, and the extent of vegetation which influences so much in retarding both the disintegration of rocks, the action of running waters, and the modifications effected by art.

Fourthly, the quantity of mud discharged by the same river in various parts of their course, and at different seasons of the year.

Fifthly, the nature of the waters which receive these alluvial deposits. The rise and fall of the tide at the head of the Persian Gulf, is as much as nine or ten feet in spring-tides. There is, besides, a constant current which sets across the head of the gulf from east to west; the accumulations at the mouth of the rivers hence meet with a check, and a portion of the alluvium is carried to the westward and southward, and dispersed over the bottom of the Gulf; that such is actually the case, is shown by the chart of the Gulf lately constructed by the officers employed in the survey by the Honourable the East India Company, from which it appears that whilst along the north-eastern or Persian side of the Gulf, the depth, in great part, exceeds 40 fathoms, along the whole of the Arabian or north-western side, it varies from 16 fathoms to shallows which are unnavigable, and which, to all appearances, will soon rise altogether above the level of the sea.

General Equality of Level in the Alluvial Districts.— It is not, as Mr. Carter ("Phil. Mag.," vol. vii., No. xxxix., p. 199,) advances, because that part of the basin of the

Euphrates which lies below Felújah, comprising the Babylonian and Chaldæan alluvia, is geologically modern, and was a part of the desert, that that district preserves a nearly uniform level. Sandy deserts have, according to this gentleman, been all once covered by the ocean; but although the sea has left abundant evidence by the organic remains which it has left behind it, of its waters having dwelt, far higher up the river, than Felújah, still, in the acceptation which Mr. C. gives to sandy deserts, there are none such neighbouring the Euphrates, except perhaps at the ancient mouth of the Pallacopas; but in the Babylonian and Chaldæan alluvial districts, there are no actual sand deposits, nor are there in Arabia, upon the Euphrates, or in Mesopotamia, any other sandy deserts but what result from the decomposition of rocks containing silica or other substances, capable, under the circumstances in which they are found, of a hot sun, and the absence of moisture and of vegetation, of a minute division of their particles.

The surface of the desert tracts of Arabia and of Mesopotamia, which are not alluvial, is very far from being level; but from the absence of any considerable hills or mountains; in many parts, the minor irregularities become overlooked; the undulating and unequal rocky ground is described, as it appears, in a comprehensive and undetailed survey, as a vast continuous plain; and the awakened imagination pictures a sea of sand, as level as a lawn or terrace.

But supposing these irregularities continued over the basis of the districts of the alluvial deposits, to have been, in reality, but inconsiderable, as they appear to have been; the degree of level which will be attained by a formation

slowly deposited as a sediment in waters covering those irregularities, will be exactly as the quantity and depth of that deposit exceeds the height of those irregularities. Before a basin can be brought to a level with its rim, it must be filled with alluvium, which will naturally be deposited in the cavity before it will gain upon the heights. Under these circumstances, all the concavities would go on filling till they reached the level of the banks, when the same operation continuing, mud would be deposited on the latter, and a level plain thus formed; and it appears that this has been so much the case, with regard to the formations which now occupy the ancient prolongation of the Persian Gulf; that a remarkable level has been the result; one produced, however, from the circumstance of the deposition of the alluvium in oceanic waters, rather than from those waters occupying the surface of a desert. At the same time, the level has been modified in two ways.

1st. By the existence of hills or mounds, being deposits of transported detritus, to the level of which, the alluvia did not rise as at Khán Iskenderia.

2dly. By the formation of inland cavities, produced by the accumulation in lines, of alluvia deposited in a tidal sea; and the consequent formation of lagunæ, of lakes, then marshes, and last of all, of concavities, which are only the abode of waters at the time of the annual inundations.

Difference of Level between Euphrates and Tigris.—From the circumstances of this contrasted configuration of the soil, along the fringe of the pre-existing formations, and the post-Babylonian alluvium; the undulating figure

of the surface of diluvial gravels refined into diluvial mud, and shaded off by centuries of alluvia, deposited before the period when man began, with waste and pigmy efforts, to erect the feeble semblance of mountains, on the plain; a various level of alluvium had been established in the interfluviatile space; by which, in one part, the waters of the Euphrates find a higher level than the Tigris, into which they flow at the high season; while at another place, the Tigris sends its waters to the Euphrates, and restores the flood by which it had been previously enriched, from the "Great River."

It is necessary, to understand the circumstances under which such hydrographical phenomena could take place; to remark, in the first place, that the longer course, the more abundant waters, and the geognostic nature of the soil through which the Euphrates flows, cause it to be loaded with a predominance of alluvium over its territorial sister, the Tigris.

Further, although the tributaries to the Euphrates from the Arabian Desert are few and insignificant, the hydrographical domination of that river over that country is extensive, and supposing, on the retiring of the waters of the Deluge, the configuration to have been pretty nearly what it is now, the quantity of space from which the retreating flood would have made its exit by the valley of the Euphrates extending from the Anti-Lebanon to the Sinjár, is altogether disproportionate to anything that is presented by the territorial relations of the Tigris, confined by the high lands of Mesopotamia on one side, and the long chain of Kurdistan on the other.

Further, the southerly extension of the supra-cretaceous rock-formations which occupy the districts of

Arabia and of Mesopotamia to the north of the alluvia, is greater upon the Euphrates than the Tigris; and the detritus of the latter, or the transported matters of the Scriptural Flood, have had a greater inlet to fill, than those of the Euphrates; and hence accumulating at the embouchure of the rivers beyond the hilly country, they have given a superiority of elevation to the bed of the Euphrates, at the line of the commencement of the diluvial deposits; which, from an accurate levelling by theodolite, performed by Corporal Greenhill of the Engineers, (a careful observer, and practised in the use of that instrument,) amounts to about five feet.

The action of a tidal sea would cause the accumulation of silt in a bar, which at the period of the first gain of land in the ante-Babylonian era, and in the interfluviatile territories above the site of Babel, would be in advance of the then embouchure of the rivers; as is the case with the actual bar of the present day; and would have given origin to the high land and sandy downs, in that country, to which the Chaldæans more particularly repaired, on the downfall of the Chaldæo-Babylonian dynasty; while the same bar leaving behind it a depression of greater or less extent, the saline waters would, with the further accumulation of land, and the progress of evaporation, become brackish and then fresh; although, owing to the peculiar circumstances in which that depression remained in regard to the river Euphrates, never dry; and hence, what in the earliest historical times, constituted the Paludes Babyloniæ, exist in the present day as the marshes of Lemlúm.

But Tigris, repelled by the approach of the supra-cretaceous formations of the hills of Hamérún, began, by the operation of the same causes, to throw her

alluvia upon her left bank, while the river itself had a constant tendency to the right, leading ultimately to the union of the rivers below the territory of Chaldæa; which junction, in ancient times, took place in the valley now occupied by the Shát el Hïe, although not in the same bed, and along which valley, the waters still flow from the Tigris into the Euphrates.

It is probable that the united rivers emptied themselves into the Gulf at this period by several distinct mouths, of which the first or greatest was at Teredon, the Ostium Tigris Occidentale of Ptolemy, and the mouth of the Euphrates, according to Nearchus; the second was the Pasitigris of Pliny, probably the Shát-el-Arab, and the Ostium Tigris Orientale of the Alexandrian geographer.

The bar which was now given origin to, in the progress of the alluvia, included the territory of Old Basráh, or Zobeïr; of Apamea, or Kurnah; and of Suáb, or Ampe; and the Chaldæan lake which took its origin at the same period, is, in the present day, represented by the reed-marshes of Súk-el-Shuyúkh, by the Jesayír of the Múntifík, and the Samárkah and Samídah of the Beni Lam, Arabs.

The time was now arrived when the alluvia of Euphrates and Tigris became united with those of the Keráh and the Karún, and new and more complicated relations were established; in which, however, we always observe, whether studied in detail or on a larger scale; the same causes in action, and similar effects produced. These periods approach, however, more intimately within historical times, and their discussion will, therefore, be better deferred till forced upon us by the progress of the inquiry.

It is the absence of all philosophical inquiry into the condition of the two great rivers of the Eastern world, that has so long caused clouds to hang around a subject equally interesting in a scientific and an historical point of view, and bound to us, indeed, by ties and associations of an almost sacred character. Throughout the writings of ancient as well as of modern geographers, there is an obscurity which nothing could tend so far to remove as actual survey, but that only when combined with the application to ordinary observation, of those means which the progress of knowledge, and the order and method of science, have placed at our disposal.

THE ALLUVIA OF CHALDÆA AND BABYLONIA.

PART II.

HISTORICAL.

Nature of History.—All history is traditionary, documentary, or monumental. The most ancient historical evidences of the antique geography of the plains of Babylonia, Chaldæa, and Susiana, are almost solely monumental. At the same time, the earliest pages of written history have preserved some records of those who stood among the first dominant nations of the earth. Tradition alone has not preserved a home in countries swept by successive conquerors, aliens to the land; and which, from the days of the Dispersion to the rise of the Khalífat, have been the seat of a changing religion, and an ever-varying language

Lingual or Oral Monuments.—Under the head of monumental records, are included not only all fabrications and works of art, but also the preservation of antique names or denominations, which are not only traditions, but also the lingual or oral monuments of a country, handed down almost without a people's volition; and by the mere force of pristine integrity, and general acceptation. It is evident, that the degree of credit which is to be given to evidences of this description, must be regulated by circumstances; but to neglect them altogether, as Mr. Beke has done in the "Origines Biblicæ," is to close our eyes to what constitute remarkable and valuable resources in the primeval history of mankind.

Nature of present Inquiry.—It is evident, that, in a discussion which has solely in contemplation the comparison of the ancient with the present condition of the alluvial districts of Babylonia, Chaldæa, and Susiana; that it is quite unnecessary to enter into the detail of the vast mass of material which is furnished to us by the Scriptural records, as well as by profane history, upon the geography of these countries; but rather to confine ourselves to those details which affect immediately the object in question; and which, while they illustrate the subject of discussion, being applicable to these countries alone, and meeting in them with their only explanation; must, at the same time, bear with a twofold power of evidence, upon the more remote question of the chorography of the land of the first nations of men; and thus the space and the time, is saved, which it would be necessary to spend in the examination of those few first questions; to throw doubts upon which, in the present day, and that upon grounds of a mere hypothetical

nature, is to impede, in the most direct manner possible, the progress of human knowledge.

Difference in the Chronology of Geology, and that of Historical Events.—The monuments of these altered conditions in the geography of the same countries, is strictly contained in the configuration of the soil and the physical indices of changes, both of which belong to geology; but while that science determines the succession of deposits, and consequently the relative period of their origin: the chronology of the formations, or the actual time occupied in their deposition, can only be determined by a reference to historical records, which may be of every kind that have been accepted in the illustration of the history of nations. In this consists the difference between geological and historical chronology: the one regards mere succession, the other preserves the dates of those successions.

Lands of Chaldæa, of Shinar, and of Ashur or Assyria.—The positioning of the land of Chaldæa, of Shinar, and of Ashur or Assyria, upon which rose the Babylonian, the Chaldæo-Babylonian, and the Assyrian monarchies, is an essential preliminary to the inquiries which we at present propose to ourselves.

Land of Chaldæa.—It may be satisfactorily collected from the amplitude of the Sacred text, that the heads of the renovated race of mankind, conducted by the waters of the Euphrates, came to the land of Shinar, or Senaar, towards the west, according to the Vulgate version of the Bible; towards the east, according to Genesius, followed

by Heeren; and according to the tradition of Berosus, by a circuitous route; further, that the members of the human race brought with them knowledge of all kinds; and lastly, that the dispersion took place from the banks of the Euphrates,—according to Sir William Jones and Sir William Ousely, not westward only, nor eastward, as it might, with equal reason, be asserted, but in all directions.

This brief but strictly comprehensive account of the earliest migrations of the post-diluvian races, has been read by some as having reference to "the whole earth," and that all the inhabitants journeyed towards "the plain," in the land of Shinar. Others have considered, on the contrary, the narrative only to refer to a portion of the then existing people of the earth, but that the most powerful, and those who were more immediately under the eye of God. I prefer the last mode of viewing the subject, on several grounds, among which is more particularly, a natural belief, from other portions of Scripture, from the history of the various emigrations of mankind, and from the strong natural inferences which are to be drawn from the position of the parties; that all the children of Noah did not descend along the course of the rivers, but that some remained in the country of the preservation of the ark.

After the divine institution of a visible covenant between the Creator and the protected of God, the history of Noah is succeeded by that of the sons of Ham, each destined to be the head of a great race: Cush of Babylonia, Mitzraim of Egypt, and Canaan of the future Palestine: and Cush, who is identical with the Bel of the Babylonians, begat Nimrod, the beginning of whose kingdom was the territory held from his father, but who went

forth and built four great cities, and laid the foundation of a new empire.

But the children of Shem left in part their names, and their memory is connected with, the country of the north. Thus Haran died before his father Terah, in the land of his nativity, in Ur of the Chaldees; a name which most Oriental scholars now agree in looking upon as belonging rather to a district or country, than to a city; while the names of Haran and of Seruj are still attached in the present day in the same country to the ruins of Haran, the Charrhæ of the Romans; and to Seruj, on the plain.

Ur of the Chaldees.—The city of Ur, which was in Ur of the Chaldees, and the seat of the nativity of Abraham and of the death of Haran, is, to the present day, denominated by the Syrians Urhoi, by the Arabs corrupted into 'Urfáh or 'Orfáh. It is at the foot of the mountains of Osroene, and at the head of the same great and fertile plain, which contains the seats of the patriarchs of the family of Shem; Haran, and Seruj. Tradition has consecrated 'Urfáh as the birth-place of the father of Isaac, and the Bírket el Ibrahím el Khalíl is still supposed to contain the descendants of the fish loved by the Prophet. 'Urfáh is also celebrated as the residence of Akbár, commonly called Agbarus, by Herodotus Ἀνγαρος, who is said to have written a letter to our Saviour.

Ur was not only "Ur of the Chaldees," (Gen. xi. 28, Aben Ezra in Gen., Bochart, lib. i., Phaleg, x., and Hugo Grotius in Gen.) but is more particularly described as in the land of the Chaldæans (Josephus, lib. i.; Antiq. vii.), and by Eusebius as "Ur oppidum regni Chaldæorum,"

that is, of the kingdom founded by Chesed; the same author also says, "In urbe Camarina, seu Urie, quæ Græcis dicta Chaldæopolis." Oriental historians conduct the patriarch Abraham, in his migration to the land of Canaan, from Haran to Berza, or Beroe, the modern Aleppo; and 'Ahméd Ibn Yusúf, and Abu Mohamméd Mustáfah, identify Ur with Roha, the modern 'Urfah. From the records of the Holy Writ we gather (Gen. xi. 31) that Terah and Abraham, with others of the family, went out of Ur to go into the land of Canaan, and they came into Haran, and dwelt there. It is evident, that, had the Ur of the Chaldees been identical with the Ur of Babylonian Chaldæa, the Orchoe of Ptolemy and Pliny; that the way of the patriarchs did not lie through Haran in Mesopotamia; but even the direction of the journey is preserved in the amplitude of the Sacred text, for we are expressly informed (Gen. xii. 9), that the patriarch "journeyed, going on still towards the south."

Ur, in the progress of corruption, became Urhoi, Roha, 'Orfah or 'Urfáh, and, with change of masters, Chaldæopolis, Antiochea, Callirhoe, and Edessa. Mr. Buckingham has apparently mistaken what Benjamin of Tudela says of Dakia, or Rakkah, as belonging to 'Urfáh, and hence he makes Haran two days' journey from that city, from which it is in reality visible at almost all times, and a ride of only eight hours, or about 20 miles, in direct distance.

Chaldæans.—It has been averred that the nation of the Chaldæans had their origin and name from Chased, son of Nahor. (Gen. xxii. 22; Cellarius, lib. iii. c. xvi.) Hieronymus, in "Questions on Genesis," c. xxii., says the same

thing: "Chased, son of Nahor, from whom Chasdim, afterwards called Chaldæi." It appears, however, that Chased only united the scattered tribes of a pre-existing race, or else, by founding a dynasty, created a nation for the land of Ur, which existed in the first years of Abraham, and was only emphatically distinguished by the Hebrews as "Ur in the land of the Chaldees," subsequently to the times both of Abraham and of Chased.

A question, which had not been decided upon by the ancients, has only lately been revived among historiographers. Herodotus has only noticed the Chaldæans (Clio, 181) as a tribe of priests; Diodorus (lib. i. 28) as a separate caste under Belus, an Egyptian priest; while the book of Daniel ever refers to them as astrologers, magicians, and soothsayers; but there can be little doubt, as laid down by Gesenius in Isaiah (xxiii. 13), that it was the name of a distinct nation, if not, as Heeren ("Man. of Ancient History," p. 28) has advocated, the name of the Northern nomades in general. Strabo, who had treated of them as philosophers (xvi. 739), knew them also as a nation, "Est et Chaldæorum natio;" and Cicero (de Deo Divinitate, lib. i. c. i.), "Chaldæi non ex artis sed ex gentes vocabulo nominati."

In this connexion with Babylonia, the Chaldæans are to be regarded as a conquering nation, as well as a learned people; they introduced a correct method of reckoning time, and began their reign with Nabonassar, 747 B. C. It is during the brilliant period of the Chaldæo-Babylonian empire, which extended until 538 B.C., when the great city was, in accordance with the prophecy of Daniel, sacked and destroyed; that the inspired writings of the Hebrews and the profane narratives of Herodotus and Diodorus, unite

in always regarding these interluders, merely as the wise men of Babylonia.

Chaldæo-Babylonian Empire.—From this period, however, Babylonia became the land of the Chaldæans, the same as that to which the children of Judah were carried away into captivity (Jer. xxiv. 5,) and which contained Babylon (Jer. L. i.; Ezekiel xii. 13); was the seat of the king of Babylon (Jer. xxv. 12); and contained the house of the god of Nebuchadnezzar (Daniel i. 1, 2.)

The profane historians lend their testimony to the same effect. (Diod. Sic. lib. ii. cap. xi. xii.; Ptolemy, lib. v. cap. xx.; Strabo, lib. xvi.; Josephus, lib. i. cap. v.; Eusebius, lib. ix. cap. xv.; and Pliny, lib. v. cap. xii.) Cellarius, the valuable recorder of the opinions of antiquity in geography, asserts the same identity.

There is another scriptural reference to this proud period in the history of the Chaldees, when learned men filled the streets and the temples of Nineveh and Babel: —"Behold the land of the Chaldeans; this people was not, till the Assyrian founded it for them that dwell in the wilderness: they set up the towers thereof, they raised up the palaces thereof; and he brought it to ruin."—(Isaiah xxiii. 13.)

Chaldæa Proper.—But on the overthrow of the Chaldæo-Babylonian dynasty, when Nebuchadnezzar had founded the city of Teredon upon the borders of the sea of Persia, and at a time when the Chaldæans exulted in their ships (Isaiah xLiii. 14,) the same people appear to have founded, on the confines of Arabia, and not far from the sea, a great city which was called after their father-land,

Ur, and which subsequently became the Orchoe of the Greeks, and Urchoe or Orchoe of the Latins. To this country they retired in the period of oppression, and it was called after them Chaldæa, although many who were attached to the peaceful arts still dwelt in Bursíf, or Borsippa, which was a quarter in the city of Babylon; and hence Strabo (xvi. 739) notices the Orchenian and Borsippean Chaldæans.

This was now the Chaldæa of Ptolemy, which was that part of Babylonia which tended towards Arabia Deserta, and still more specifically defined by Strabo, to be that part of Babylonia which tended towards Arabia and the Persian Gulf; and it is this new country of the Chaldeans, combined with the territory of Babylonian Erech (Irák), that most modern geographers have satisfied themselves with considering not only as Chaldæa Proper, but as Chaldæa solely.

The cities which belonged to this new district, besides Orchoe and Teredon, were, according to Cellarius; Chuduca, Bethana, Biramba, and Thelme.

Land of Shinar or Senaar.—Independently of the great and fundamental fact, as conveyed to us by the testimony of the Holy Writ, that it was in the land of Shinar that the children of Noah congregated in their first emigration after the Deluge; the same evidence which has been adduced to establish the identity of the Chaldæa of Scriptures and of Babylonia; satisfies us with regard to that of Shinar, and of the land of the Captivity. Profane historians have almost universally agreed to the identity; Hieronymus speaks of Senaar as a plain of Babylonia; and Cellarius (lib. ii. 722) regards the same identity as resulting from the evidence of all antiquity.

The most ancient record (Gen. xi. 1—7) that refers to Babylon, represents them as a nation possessing fixed abodes and political institutions. Every one is familiar with the accounts which the Mosaic narrative gives us of the first empire founded by Nimrod, and of the celebrated building of which Jehovah prevented the completion. These traditions are among the foundation-stones of our religious belief. The comparison of them with the Babylonian mythology of Berosus satisfies us with regard to their truth; and, to use the words of Heeren, "there is, perhaps, nowhere else to be found a narrative so venerable for its antiquity, or so important in the history of civilization: in which we have at once preserved the traces of primeval international commerce, the first political associations, and the first erection of secure and permanent dwellings."—("Asiatic Nations," vol. ii. p. 146.)

Tower of Babel (see Vignette).—The idea entertained by the first of the nations of men, of preventing their being scattered abroad upon the face of the earth (Gen. xi. 4,) by building a lofty tower which should reach to the high heavens; is applicable, in the most remarkable manner, to the wide and level plains of Babylonia, where scarcely one object exists different to another to guide the stranger in his journeying, and which in those days, as in the present, were a sea of land, and the compass unknown. The effect of these high places, characteristic almost everywhere of some Babylonian or Chaldæan site, remains as striking as ever.

> Chaldæan beacons, over the drear sand
> Seen faintly from thick-towered Babylon
> Against the sun-set,

or rising from the horizon's verge like giant pillars, deceiving the weary traveller in their distance, and contorted by a lake of light (Shráb) into a hundred fantastic forms; yet still faithfully guiding him, to one point in his destination. Such is the pile of Aker-Kúf, such the memorable Bírs, and the still more colossal mounds of Urchoe, of Teredon, and of Irák.

How limited is the criticism of man, when he supposes the Deity to have regarded with jealousy these impotent attempts, although so fair in our eyes, to rival the mountains which He has reared upon the earth's surface! It was evidently not the building, but the object, which was not agreeable in the eyes of the Almighty; and hence the families of future nations were hurried, by a new dispensation, to their several destinations.

Identity of Shinar and of Babylonia.—The positioning of the land of Shinar, is of the highest importance towards determining the geography of the Basin of the Euphrates and the Tigris at the period of the post-diluvian emigration. The identity of this territory with that of Babylonia is made evident at the outset of such an inquiry, and the identity of the Babel of Nimrod with the Babylon of the Captivity and the Babylon of Herodotus and of Diodorus, is not only forced upon us as resulting from this first step in the investigation; but in every subsequent one which we take, the more we enter into detail, the more it will be found that, in the positioning of the various cities of the land of Shinar, the configuration of ancient Babylonia, and the historical events which belong to these countries, at a period subsequent to the existence of traditionary and documentary records; this identification becomes further strengthened,

till it may be said to possess all the certainty which can be desirable for an inquiry referring to times of such a remote antiquity. The physical characters of the country,—the ineffable impress of the hand of nature,—every existing monument, and all traditionary and valid records which have been saved from the scythe of time, unite in determining the position of the land of Shinar and of Babylonia on the alluvial plains of the Euphrates and the Tigris.

Notwithstanding the force of this cumulative evidence, there have been no want of dissentients from opinions almost generally received. The identity of Shinar and Senaar with the Sinjár of modern times, has been advanced upon the unphilosophical and distant analogy of name. Benjamin of Tudela calls the whole of Mesopotamia by the name of Senaar, and even the judicious Niebuhr has remarked upon, but not advocated, the relation of Sinjár with the Senaar of the Bible. St. Jerome, according to Cellarius (p. 441, 448), speaks of Arach or Erech as identical with Edessa, and Accad with Nisíbín; and by a still more remote approximation, Abu-el-Faraj, educated in the monasteries of the Masius, identified Erech, Accad, and Chalne, with 'Urfah, Nisíbín, and Mardín. Independently of the objections against such an identification which exists in the correct positioning of Senaar, the country of Sinjár does not correspond at all with the physical description of the land of Senaar as contained in the Holy Writ, and which describes it as a plain. Sinjár is a rocky, hilly, and stony district,—a country of uplifted tertiary formations, and of pseudo-volcanic rocks, and its name is indicative of a country "oppressed with stones like teeth," and amidst this wild district there are no monuments, nor are there any tradi-

tions preserved, which in any way assist in the determination of the sites of the great cities of the kingdom of Nebuchadnezzar.

A modern writer, Mr. Beke, in his "Origines Biblicæ, (1834, p. 66,) has argued that Noah and his family, journeying from the east, descended the valley of the Euphrates from the mountains of Ararat to the point where that river turns nearly at right angles to the southward, and passes through the chain of Taurus, and that the spot to which they were thus brought, which is the very centre of a mountain district, may be "considered to be that plain in the land of Shinar which became the first fixed residence of the progenitors of the human race."

Land of Ashur, or Assyria.—The importance, in the next place, of determining the position of the land of Ashur, is to distinguish it, with the land of the Chaldees, and the Chaldæa of subsequent times, from that of Shinar. If the Chaldæans can be shown to have inhabited three different territories, the Ur of the Chaldæans, the Chaldæo-Babylonian kingdom, and Chaldæa Proper; in the same manner the land of Ashur can be identified with Assyria and Aturia, and thus it is at the same time evident, that the plain of Shinar was not in the mountains of Sophena, the hills of Sinjár, or the more level country of Osroene, in Mygdonia or Corduene, or any of the adjacent districts.

It has been a matter of discussion, concerning the true reading of the Biblical text, whether we should understand in Gen. x. 11, that Nimrod went out of the land of Shinar into Ashur, or that Ashur, the son of Shem, *v.* 22, went forth from that land and builded the cities of Nineveh, of Rehoboth, of Calah, and of Resen. I prefer

the former version, because Ashur is not mentioned in Holy Writ, except in connexion with Shem; who not improbably, although not necessarily, remained in the land of the Chaldees, when Ashur became the founder of that country of which Ninus or Nimrod was subsequently the conqueror or consolidator, and perhaps the earliest monarch. Thus, Hieronymus says, "Apud Assyrios, Ninum sui nominis condidit urbem."

Be this as it may, it appears indubitable that Assyria owes its name to Ashur, and was also called Aturia, by the transmutation, according to Dion Cassius (xviii. 26), of the *s* into *t* by the barbarians. Benjamin of Tudela corroborates the fact that the great Nineveh was called "the great Asur." Hyde, p. 41, says that Assyria was first named from Ashur, and Abú-el-Fédah notices Nineveh as the capital of the domain of Atúr.

Under the common appellation of Assyrian monarchy, the Greeks continued to designate the ruling nations about the Euphrates and the Tigris, to the times of Cyrus. With the Jews, on the contrary, it always signifies a distinct nation of conquerors, and the founders of an empire. (Heeren, "Man." p. 25.) The Aturia of the Romans, was, however, only a province of ancient Assyria. According to Strabo, Aturia was separated from the territory of Arbeles (Erbíl) by the river Lycus (Zab). In Musúl, "the city of destination," (a name which, at the period of the Mohammedan conquest, was transferred from Eskí Musúl to the Chaldæan town of Atúr,) each Christian church still takes pride in its old MS. Bible, written in the language, or rather dialects, of the Syro-Chaldæans; and which, in their title-pages, uniformly declare the year and time when, under Divine Providence,

that copy of the Holy Scriptures, was undertaken or completed, in the city of Atûr.

Babylonia.—That part of the territory of Babylonia which is comprised between Pylæ of Xenophon and Paludes Babyloniæ, now marshes of Lemlûm; appears to have remained, physically speaking, nearly in the same condition since the deluge of Noah, up to the present time. It was the spot to which the early descendants of the patriarch attached themselves; and its history involves the fall of empires, and the destruction of cities; and not a few changes have ensued in the features of the soil, by the new circumstances which originated from these; in the direction and number of its canals; and the efforts that were made to regulate and constrain the floodings of the Euphrates.

Canals of Babylonia.—The antiquity of the canals of Babylonia, dates from the most remote periods of the Chaldæo-Babylonian monarchy. The ancient kings of Assyria, and of Babylonia, understood the value of canals as well as the Egyptians, Indians, Chinese, or the modern commercial states of Europe; and the great empire of Babylonia rose upon the alluvial plain of Western Asia, amid a system of irrigation and draining which spread like a net-work over the land. The Babylonian district, says Herodotus (Clio, cxciii.) like Egypt, is intersected by a number of canals, which facilitated the intercourse of peace and commerce, and which, in the language of Gibbon, armed the despair of the Assyrians with the means of opposing a sudden deluge to the progress of an invading army.

Náhr Isá.—The first and most northerly of these canals was the Náhr Isá, derived from Euphrates, at a place called Dehmah, opposite to Kúfah, and near Anbár. On reaching Muhawíl, many smaller streams were given from it. In the time of Abú-el-Fédah, it lost itself in Tigris, in the heart of Western Baghdád. This canal is the same as the Barax or Baia Malcha of Ammianus Marcellinus. It got its modern name from Isá Ibn Abdúlláh Ibn Abbás, an uncle of Mansúr. Anbár was the Macepracta of Julian.

Náhr Sarsár.—The Náhr Sarsár or Sersér, had its sources below the Isá, and flowed into the Tigris above Madayn. This corresponds to the present Zimberaníyah. Al Edrissi notices it, " unam pergit ad Tsarsar." This is the city of which Abú-el-Fédah says there was one on each of the canals. Ammianus notices a canal between Macepracta (Anbár) and Perisabor, on the Náhr Malíkah. Hence this is the same as the Sarsár. He calls it Maogamalcha, and mentions a city of the same name: Lindenbrogius writes it, Maiogamalcha.

Náhr Malíkah.—The canal most generally known by the name of Náhr Malíkah, the Flumen Regium, and Royal Canal, of authors, dates from the most remote periods of Babylonian antiquity. The fact that it is attributed by common tradition to Nimrod, and is by Tabari, in Chap. " de Morte Sarae," described as the work of Cush, king of Babel; attest that its origin is coëval with the earliest period of the Babylonian monarchy. Abydenus attributes it, however, to Nebuchadnezzar. Polybius, lib. v. cap. 21, calls it βασιλικη διωραξ, the royal

ditch; Ptolemy dignifies it as βασιλειος ποταμος, the royal river. Isidore of Charax calls it Narmaka; Zosimus, lib. iii. c. xxiv., Narmalakes; Abydenus, apud Euseb. Præp. ix. c. xli., writes Armalakes; Pliny, lib. vi. c. xxvi., Armalchar; Scaliger calls it Harmacales and Aracanas; but its real name, says the admirable Cellarius, ii. 741, is Nahrmalcha.

Ammianus notices it at Perisabor, beyond the Macepracta. It is the Náhr Malíkah of Abú-el-Fédah, the second canal from the sea, the third in Babylonia. It is also the third of the four canals of Xenophon; which, however, the Greek general makes only one farsang distant from one another, while Abú-el-Fédah gives two. Rennell had already remarked upon the improbability of four such great bodies of water being extracted from either river within so short a distance as that given by the historian of the Anabasis. Ptolemy says, "Sub Apameam, miscitur Regium Fluvius, cum Tigri," which would make it the same as the Euphrates, unless Apamea was here Seleucia, which is the more probable, as Pliny has recorded the same fact, when he says that Seleucia was built "in confluente Euphrates, fossâ perducte, atque Tigris." The Perisabor of Ammianus was in a similar manner, "ubi funditur Euphraten et trajecto Náhr Malcá amno." There is no doubt, from these various testimonies, that up to a period of no very remote antiquity, the river Euphrates was drained by the Royal River on the one hand, and, as we shall subsequently see, by the Kúfah Canal on the other side; while the natural continuation of the river, designated as the Náhr Sares, and Narraga, or Fetid River, flowing by Susa, was lost in the Babylonian marshes. The outlet of the Royal

River was at Seleucia; that of the Kúfah, at the Pallacopas; flowing by Orchoe into the sea at Teredon. Abú-el-Fédah says, that the Náhr Malíkah flows into the Tigris, below Madayn. The Royal Canal at this period was, on the authority of Herodotus, of sufficient breadth and depth to be navigable for merchant vessels. It is not surprising that some theological writers have considered it as the ancient bed of Euphrates.

Kúthah Canal.—The fourth of the canals of Xenophon and of Abú-el-Fédah, was the Kúthah or Kúlbáh; which, according to the latter of these authors, was derived from Euphrates, two farsangs below the Náhr Malíkah, and watered the territory of Irák. 'Ahmed Ibn Yúsuf also speaks of the canal on the road to Kúthah. It is the same as the Kawá of Rennell.

Dr. Hyde, in his able work, "Historia Religionis Veterum Persarum," first obtained from antiquity the evidence of the former existence in Babylonia of a city, by name of Cush or Kutha. The seat of the territory of Cush was in Babylonia, from whence his posterity were translated into neighbouring Arabia, and thus the land, which was afterwards designated after Yaráb, the son of Jocktán, was primarily called the land of Cush, afterwards that of Havilah, and ultimately Arabia (2 Chron. xxi. 16). "The Arabians, who lived near the Cushites;" in the Vulgate, "the Ethiopians."

The great city, which bore the name of the patriarch, was by the Hebrews called Kuth or Cutha. Abu Múhammed, in his "Universal History," also calls it كوثا Kutha, and it was situated near Babel, in the province of Irák. The text of the Talmud, in Bava Vathra, 91. 1, says,

that Abraham was imprisoned three years in Kutha. Cuth is mentioned in connexion with Babel in the Holy Writ: "And the men of Babylon made Succoth Benoth, and the men of Cuth made Nergal," (2 Kings xviii. 30,) and these were the idolators who went out from among the Samaritans. According to Saphioddin, in his Lexicon; Kutha exists in two places in Irák; one of which was Kutha al Taric, the other Kutha Robah, in which is the sepulchre of Abraham. Hyde says, "Kutha al Taric is the same as Kutha viæ, while Kutha is Robah, Kutha colliculorum seu tumulorum." It is the Kutha Rabba of Kissos ul Ambia (Art. "Kush and Nimrod,") and the Mesjíd Ibrahím el Khalíl of the present day, neighbouring the Bírs Nimrúd.

In the time of Abú-el-Fédah, Kúthah, on the canal of the same name, was approached by a bridge, and was a Mohammedan city ornamented with mosques. The ruins appear in the present day to be represented by the mounds of Towíbah, often considered as the north quarter of ancient Babylon.

Canals of the City of Babylon.—In the time of Abú-el-Fédah, when the Náhr Malíkah no longer carried off a main part of the waters of the Euphrates; the Orientalist describes the river as dividing after passing the Náhr Kúlbah by six farsangs, into two streams, but previous to this it parted with more canals, which belonged to the city of Babylon proper.

Quarters of the City.—Like other great cities in the East,—as Ctesiphon and Seleucia became Coche and Al Madayn; Opis became Apollonia and Babelín, and Nine-

veh was Ninus, Mespila and Atúr,—so the great Babel was, in the lapse of time, known by different names, and ultimately subdivided into various parts. The materials are scarcely sufficient for a thorough understanding of the progress of these changes, the scattered records of history only afford an occasional glimpse at when such a new state of things were in existence, and an acquaintance with the great revolutions which had affected all orders of men in these countries, serves to diminish the otherwise total obscurity in which we should be left with regard to the cause and progress of these metropolitan disorganizations.

El Bírs.—The first quarter that appears to have been separated from the mother city, if indeed it was not originally distinct, was that on the west side of the river, and which contains the Bírs Nimrúd. The word Bírs, as applied to this mound or ruin, cannot be satisfactorily explained in Arabic as a derivative of that language; and it would appear that all attempts to deduce it from the Hebrew or Chaldaic tongues have failed, as they are founded on a change of the radical letters. The Kamus gives Bírs as the name of a town or district between Hillah and Kúfah. In the Chaldaic, Sidra Rablia of the Sabbæans, it is mentioned under the name of Bursíf, whence the Borsippa of Strabo, and other old writers, directly proceeds. Strabo describes the city as being 15 miles below Babylon, and a famous manufacturing town. Josephus in "Apion." Op. p. 1045, relates that Nabonnedus, flying from Cyrus, shut himself up in the town of Borsippa, which Heeren ("Asiat. Nat.," vol. ii., p. 202,) reads, was imprisoned there by Cyrus. Ptolemy notices

the town under the name of Barsita. Cellarius considers the Hipparenum of Pliny as Borsippa.

Like all the quarters of Babylon, Borsippa, or Bursíf, had its canal. Marudi, in his "Universal History," notices it under the name of Náhr al Bírs. It was from Bírs, or Bursíf, that the produce of the Birsæan looms, the cloth of Bírs, derived its name. The almost only remnant of Borsippa, probably the temple of a national worship performed in high places; one of which belonged to each Babylonian city, and to each of the quarters of Babylon itself; still preserves its ancient name, Bírs, to which a superstitious tradition has coupled that of Nimrúd; as Resen and Larissa are now lost in the reverence given to the founder of the early homes of the Assyrians. This Bírs Nimrúd has been generally looked upon as the remnant of the great pile of Babel, but from what has been detailed, it will appear much more probably to have belonged to the city of Bírs, Bursíf, and Borsippa; which was perhaps one of the quarters of the Babylon of Herodotus.

Babel.—The distinction between Kútah, probably the north quarter of the Babylon of Herodotus, and the original Babel, has been alluded to. Marudi, in his "Universal History," mentions Babíl, the capital of Aferadún, and one of the climates of the earth; so named from the name proper to one of its towns. This town is situated on both banks of one of the canals derived from the Frát in the province of Irák, one hour's journey from the city called Jisr Babíl, and the canal of Al Bírs.

The quarter of Babel itself appears, to have, at one period, changed its name, and to have received that of *Níl.* The mounds of Babel and the Mujalíbah are nearly sur-

rounded by two canals, which bear that name in the present day. Abú-el-Fédah describes the main stream of the Frát as flowing to the city of Níl, and giving off the canal of Níl, after which it is called Náhr Sirát. D'Anville also notices a town called Nilus, without having a definite idea of its position.

The square superficies of the mound of Babel is 49,000 feet; its elevation at the south-east corner, 64 feet. To the south of it is the Mujalíbah, having a square superficies of 120,000 feet, and a height of only 28; beyond them again, the Amrám Ibn Alí, having an area of 104,000 feet, and an elevation of 23. The Mujalíbah has been read as if it were Mukallíb, from Kílba, "the overturned, or overthrown," whereas a much nearer affinity exists to Mujalíbah, plural of Jalíb, a slave or captive, "the House of the Captives," and not improbably the residence of the Israelites who remained in Babylon. This version is favoured by the name of Harút and Marút, given to the mound by the natives, from a tradition, that near the foot of the ruin there is an invisible pit, where D'Herbelot relates that the rebellious people are hung with their heels upwards until the day of judgment.

The Kásr, or palace, is a mound of about 700 yards in length and breadth. Its moulded bricks ornamented with inscriptions, and its glazed and coloured tiles, added to the sculptures that have been found there, speak of its importance, and have led to its being generally looked upon as the eastern, and the largest of the palaces of the Babylonian monarchs, renowned for its sloping gardens.

Between the Kásr and the Amrám, there is every probability the river Euphrates once flowed, where the

subaquatic tunnel of Semiramis may have also existed, and where quays lined the banks, at the time Alexander was carried over during his last illness. Heeren has, almost alone, endeavoured to identify the western palace of Diodorus, with existing mounds on the west side of the actual bed of the Euphrates.

The Amrám Ibn Alí, so called from a son of Alí, has been more generally, and with probably a greater degree of plausibility, identified with the western palace. It is surmounted by ridges or mounds of ramparts, which were the defence of this large space, and of all the establishments which it contained.

In the same manner, the Mujalíbah, the Kásr, and the Amrám, were all enclosed by two lines of defence which formed a triangle, of which one solid angle was at Mujalíbah, the other beyond the Amrám, and the third to the east.

Al Heïmár.—The fourth quarter of Babel is marked in its central space by the mound of Al' Heïmár or Hamír, an isolated eminence having a superficies of 16,000 feet, and an elevation of 44, with a ruin on the summit 8 feet high. Of the history of this quarter I know nothing; its modern name is derivable from the Arabic root حمر Hamará, "to be or become red," denoting the red mass or ruin on the summit. Alhambrá, one of the four wards of Granada, was also so called from the red colour of the materials of its buildings.

Kúfah Canal.—The Euphrates, on the authority of Abú-el-Fédah, after passing the Náhr Kúlbáh by six farsangs, and giving off the Níl, was divided into two streams, the southernmost of which passed into Kúfah, and going beyond it, was lost in the marshes of the Rumíyah. This was in the time of Abú-el-Fédah; for at a period anterior to that, it flowed by Ur or Orchoe; being joined in the parallel of Diwaníyeh by the Pallacopas of Alexander; and ultimately emptied itself into the sea, in the neighbourhood of Teredon. "Quartam denique ad Kufam juxta Pallacopas," says Al Edrissi; and the same author, p. 204, says, "Euphrates in universam ditionem Kufa residuum ejus aquis in lacus influentibus."

Náhr Sares.—Abú-el-Fédah describes the prolongation of the larger branch of the river Euphrates, as taking beyond the Kásr Ibn Hobeïráh the name of Náhr Sarah, or Sares. The name of Náhr Sares (*Naαρσαρης* of Ptolemy,) meaning fetid river, appears to have been given to that portion of Euphrates, which lay below the

Royal Canal, at a time when that derivative carried away a great part of the waters of the "Great River." The remainder, flowing sluggishly onwards by Babel and Sura, to lose itself in the marshes of Babylon, became, from its stagnant characters, impure and fetid, and was hence so designated. Pliny calls it Narraga. "Flumen Fœtidum (says Hyde) quod ad Paludes ducat per Babeleen." "Aliud etiam ad Sura," says Al Edrissi, "Judæi autem multarum frequentiam et synagogas laudant in quibus sunt Sura et Pombeditha." Cel. vi. xvi. Salomo Van Tilius places Pombeditha on the canal called Saocorae; hence the same as the Náhr Soora or Sura. According to the Peutingerian tables, Volocesias was 18 Roman miles from Babylon, and on the Naarsares; hence it must have been at or near the division mentioned above. Vologesias was a city much noticed by Tacitus, and also in the times of Nero and Vespasian; Pliny calls it Vologescerta; Stephanus writes it Bologesias; Ammianus, Vologessia. Between Vologesias and Barsita, according to Cellarius, was Duraba, another Babylonian city; and nearer to the desert, Idacara.

Other Canals.—To complete this detail, it only remains to notice some canals of more modern date, of which the most northerly was that of the Rehoboth of Scripture, upon the authority of Al Edrissi; upon the same authority, and that of most oriental geographers, the canal Al Kádder, called by Al Edrissi, Alcator. The Kerbélah canal, called by Ockley ("Hist. of Saracens," vol. ii. p. 222) the Kerbelaï river. Kerbélah, in Abdúl Khurrím's time, was a very populous town. The Persians having retreated to the tomb of their prophet, from the exactions of Nadír

Sháh, the Kerbélah canal was opened by Hassán, Pashá of Baghdád, at an expense of 20,000*l.*, and trade revived. (Vincent, p. 511.) Lastly, the Nesjeff canal, constructed by Nadír Sháh. Nesjeff is, according to Abdúl Khurrím, 16 farsangs from Kerbélah, and 1 farsang from Kúfah. The mosque where Alí received his death-wound was here, and Meshíd Alí rose upon the spot; hence its modern name. Nesjeff was, further, the ancient Hira, which was the first place beyond the limits of Arabia, occupied by the Moslem, under the Abú Bín Khalifat.

Median Wall.—The Median wall, extended across the northern portion of the plain of Babylonia; but as the latest deposits by transport occupy a much more northerly prolongation in the valley of the river Tigris, than they do in that of Euphrates; and this wall,—the Chalí or Síd Nimrúd of the Arabs,—follows pretty nearly the line of the most northerly extent of the alluvia; so its course is nearly from south-west to north-east; starting from the Macepracta of Julian, and stretching, upon the authority Strabo, as far as Opis; near which it was first met with by Dr. Ross. It was, according to Xenophon, 58 miles in length. According to the same author, the Ten Thousand were on their fourth day's march from Pylæ, or at a direct distance of 43.5 miles, at a trench which extended 12 par., or 34.8 miles, upwards to the wall of Media. The Pylæ I have determined approximately to have been situated at the termination of the hilly country at the head of the alluvial plain, 8 miles north of Felújah. The Median wall being, from the statement of the same historian, at a distance of 34.8 miles from the Greeks, or 8.7 less than that of the Pylæ, it is thus brought to the

site of Anbár, the capital of the Mondár Arab dynasty, and the Macepracta of Julian.

Opis.—Passing from below the Median wall through an alluvial or diluvial soil of little tenacity, the Tigris has, in modern times, changed its course. The great canals derived from that river, in the flourishing times of the Khalífat, were the Náhrwán to the east, and the Dijel, to the west, both described by Abú-el-Fédah, as having dependant upon them, a considerable district of towns, villages, and cultivated lands, no longer in existence; but the ruins of Harbah, of Shirat el 'Apt, of Wuzún, and a host of others, upon the Dijel; attest its former importance. Between it and Tigris is the ancient bed of the river, now designated as the Shútïte. At the point where the Physcus would, in its prolongation to the ancient Tigris, have poured itself into that river, are ruins called Babalín (the second Babel), and which most probably belonged to Opis, for we know, from the authority of Xenophon, that Opis was situated at the confluence of the river Physcus with Tigris. There are also extensive ruins observable at the present junction of the 'Athím with Tigris, but that these are not the relics of Opis, is proved by the fact, that the ruins of Akbaráh, a flourishing city in the time of the Khalífat, and known by name, and by tradition, to be upon the bed of the old Tigris; and yet upon the authority of the Labat and of Abú-el-Fédah, they were in their time, upon the actual bed of the river. Unless the river has twice changed its course, it is only in modern times that it has recoiled to the east, and Opis and Akbaráh were upon the same river.

Sitace.—The Greeks, after marching 69.6 miles from Cunaxa to the Median wall, turned off 23.2 miles to Sitace, in order to gain the bridge on Tigris. The town itself is described as being 15 stades, or 1 mile 813 yards, from the river, and 58 miles from Opis. The ruins in a position thus fixed, are very extensive; they consist of mounds, embankments, and canals, and commencing from Sheríat el Beïtha, or "the place where you go down to the water," above Kathmén, they extend northwards for some miles, and westward almost to the colossal tower of Aker-Kúf, from which they are, however, separated during a great part of the year, by inundations from the Euphrates. There cannot, therefore, be many reasonable doubts thrown upon the position of Sitace, whatever may have been the extent of Sitacene.

Sitacene.—It is more difficult, notwithstanding the devious testimony of Pliny, to fix the extent of the latter country, than that of Mesene. We cannot, however, but admit the territory subject to Sitace to have comprised, if not the total, at least the centre of the district, and was not improbably contained within the Median wall on the one hand, and the Isá canal on the other. Cellarius and Bochart cite the Psittake of Stephanus, with little more information than that it is on Tigris.

Accad.—It is in the territory of Sitacene, that the remarkable pile of buildings called Aker-Kúf, is still met with. It is 125 feet in height, and the brick-work is about 400 feet in circumference. The bricks vary constantly in size, which has caused every traveller to give a different account of their dimensions. This monument of ancient

times was considered by Niebuhr as an artificial mountain, on which a Persian king sought for cool air. Tavernier viewed it as a beacon, and a modern traveller proclaims it the residence of a powerful monarch. Its structure of sun-burnt bricks and layers of reeds, announce it, however, to be a Babylonian relic, not improbably one of the temples of a worship performed on high places, which were common to all Babylonian towns. The embankments of canals and of reservoirs, and the remnants of brickwork and pottery, occupy the surface of the plain all around, while the name bears a close affinity to that of the Accad of Scriptures. President de Brosses sought for the position of Chalne in Ctesiphon, a site of much probability. Babel and Erech are known, and Accad ought, by the force of circumstances, to be in the same neighbourhood. Its appellation varies. Thus, in the text of the Talmud, it is called Aggada; and even its age might be determined. Maimonides in Jud. Chaz. Tract. Madee, fol. 25, as quoted by Hyde, says, "Abraham xl. annos natus; cognovit creatorem suum," and immediately adds, "Extat Aggada tres annos natus." It is important to remark, that the Aker-Kúf of the Arabs is designated as the Aker-i-Nimrúd and Aker-i-Babíl by the Turks.

Paludes Babyloniæ.—The first great depression met with in going to the south is now occupied by the Lemlúm marshes, and although in the time of Abú-el-Fédah, the river Euphrates still lost itself in these marshes, yet we have the authority of Diodorus and of Arrian, that even in the time of Alexander it was a country of marshes, and not a lake, and generally designated as the Paludes Babyloniæ. One of the latest useful works in which the

Macedonian hero was engaged previous to his death, was in constructing a canal at a distance of 76 miles to the south of Babylon; for the express purpose, as stated by his historians, of preventing the waters being drained from the marshes in the low season, and at the same time of guarding against too great an overflow during the floods. After founding the city of Alexandria upon this new branch of the Pallacopas, (which was in part opened through solid rock,) the emperor resolved upon sailing in the Paludes; upon which occasion many of the galleys lost their way, and during a gust of wind the imperial tiara was carried away, the fillet being blown upon one of those antique monuments, which were said at that time to abound even in these aquatic districts.

Territory between Babylonia and Chaldæa.—The easterly extent of the valley of the Lemlûm marshes, leaves a narrow band of soil between the marshes and Tigris, which is everywhere covered, like the plains of Babylonia and of Chaldæa; with the monuments of antique industry and enterprise. Thus the words of Arrian ("Exp. Alex." cxxii.) receive confirmation from existing mounds and ruins. This territory, inhabited by the Zobeïd Arabs, contains the great mounds of Mizísíthah, 'Ithâhr, Uffrín, Jerráh Súplí, Nimálah, and many others of minor importance, situated between the more massive, lofty, and extended system of ruins which belong to Ziblíyah in the north, and to Jáyíthâh Tel 'Síphr, and Irák, or Erech, on the south. On some of these monumental mounds, Messrs. Frazer and Ross found glazed earthen coffins, still more corroborative of the descriptions of Arrian, who says the monuments or tombs of the kings of Assyria are said to

be placed among these marshes. As in the present day the reed tombs, of a sheïk, or holy man, are often to be seen islanded amidst a wilderness of water and of aquatic vegetation.

Territory of Chaldæa.—Jayíthah and Tel 'Síphr (the hill of copper) lead the way, into the territory of Chaldæa proper; while on the western confines is Geráh, now Kal'at Jeráh; recorded in the history of Abraham. To the west of 'Síphr, and having communication with the river Euphrates by the canal now called Grayhím, are the great mounds of Erech, indifferently called Irák, Irká, and Senkerah, by the nomade Arabs; and sometimes El Asayíáh, " the place of pebbles." This interesting ruin, identified by Colonel Taylor with the Erech of Scriptures, was passed on the east by Messrs. Frazer and Ross, and by the Euphrates Expedition on the west; but, surrounded by almost perpetual marshes and inundations, was visited by neither of the parties on the spot.

Territory of Cybate.—To the south, the territory of Chaldæa has been observed in the physical descriptions to gradually lower; and this valley, now occupied by the Shát el Hïe, was formerly the bed of the river Tigris, which, crossing the country above Filafít, a Parthian sepulchre of remote antiquity; is still marked out by the natives as Dejaïlah, the old Tigris, as far as to the ruins of Nushayít, or Wasít, about four miles to the south-east of Hïe, and the seat of the ancient Cybate. The termination of the Náhr Wán, which left Tigris near Samárah, into Euphrates, after coursing by Baghdád and Kút Aamárah, is in the same valley.

Ancient Difference of Level.—The principal consideration which presents itself here, of the relative level of Euphrates and Tigris, has been discussed in treating of the actual physical aspect of the soil; and there can be no doubt, from what has been detailed of the Náhr Malíkah; notwithstanding the evidence of Xenophon to the contrary, and the existence of this ancient bed of the Tigris; that the circumstances of configuration and disposition which occur now, also obtained in ancient times. The superior level of the river Euphrates at its issue into the alluvial plain, allows it to pour its waters into Tigris; while losing that superiority in the marshes of Lemlúm; the river Tigris more than returns its previous charge, beyond the next delta deposit. Hence came the Ostium Tigris Orientale of Ptolemy, the Pasitigris of Pliny; Nearchus considering the Ostium Occidentale of the same geographer as the then mouth of the river Euphrates.

Road of Semiramis.—Beyond the mounds of Serút and Filafít, upon the river Tigris; and below Kút Aamárah, and not at Mumíllah, the site given by Mignan; the Expedition met with the ruins of a bridge, which was most probably on the line of the great road, which ranks among the apocryphal labours of Semiramis; and which Alexander followed in proceeding from Babylon to Susa. At Teïb it is a causeway of considerable length, at Serút it crossed the river Tigris by a bridge of masonry, and it probably ascended by Ziblíyah to terminate at or near Tel Heïmár.

Territory of Urchoe.—A little north of the parallel, of the antique mouth, of the river Tigris; we have observed the gigantic mounds, designated as the Múgeïyer, first

observed by Pietro DellaValle in 1625, and determined by Rennell to be identical with the Urchoe of the Greeks. It was the Ur of the Chaldæo-Babylonians, the Urchoe of Ptolemy, and placed by Arrian, Salmasius, and Cellarius, near the Pallacopas. From what has been previously proved from historical references, of the river Euphrates being drained on the one hand by the Náhr Malíkah, and on the other by the Pallacopas, it will be understood why Pliny said, "Euphraten præclusere Orchœni nec nisi Pasitigrï defertur in mare." The Euphrates was carried off by the Kúfah canal to the west, also by the Pallacopas of Alexander, and by the canal which previous to that had been kept open by the Persian satraps, at great expense and labour. Flowing by Ur or Orchoe, it was still questionable if it emptied itself into the sea at Teredon alone, or united with the canal called Jarrí Zaïd; till Colonel Chesney, on his last passage across the desert, met with the bed of a canal several miles west of Zobeïr, and which evidently flowed past Jebel Sinám, and which has been identified with the antique Teredon. Certain it also is, that the present bed of the river Euphrates was then the Fetid River, losing itself in the Paludes Babyloniæ, and which, joining the river Tigris in the territory of Cybate, became the Ostium Tigris Orientale of Ptolemy, while the Pallacopas, thus filled with the waters of Euphrates, was by Nearchus, by Strabo, by Arrian, and by Pliny, looked upon as the real bed of that river.

As late as in 1784, Suleimán, Pashá of Baghdád, threw a bank across the river Euphrates at Diwaníyah; with an intention of throwing the river into the old channel of the Pallacopas, in order to attack the Khezaïl Arabs; but the effort appears to have had no important result.

The Náhr Saléh, or Jarrí Zaïd, continued navigable as late as the beginning of the Mohammedan era, as Zobeïr, or old Basráh, was still inhabited, when Ayíshah fell before the victorious Alí.

Chaldæan Lake.—The second great depression which occurs after the territory of Chaldæa Proper, we have observed to be, in the present day, the seat of an almost perpetual inundation; and, there is every reason to believe, was known to antiquity, as the Chaldæan lake. Pliny (lib. vi. c. 27), says, "Vicus ad Chaldaicum lacum vocatur Aphle;" and at another place, "Tigris inter Seleuciam et Ctesiphontem, vectus in Lacus Chaldaicos, refundit. Eosque lxx. M. pass. amplitudine implet." Pliny places Aphlé at the end of the lake. Herodotus places his Ampé at the mouth of the Tigris; hence the locality of the embouchure of the Tigris, and of the termination of the Chaldæan lake, must be sought for in the west, in the district of the Múntifík Arabs. Ibn Haukal has, notwithstanding, an Ableh, which he places opposite to the mouth of the Keráh.

Progress of Alluvia.—Certain it is, that the sites of Ampé or Aphlé, and of Apamea, rose upon the new and less defined lands which separated the lake of Chaldæa from that of Susiana in the east, while, on the littoral confines of the ocean, Nebuchadnezzar had founded Teredon, subsequently Diridotis, and which was succeeded by Zobeïr; as Alexander afterwards called an Arabian colony by his name, which was afterwards Tospasinus, Spasinus Charax, Charax, Haffar, and now Mo'ammerah; while in still more recent times the sites of 'Abadán and

Al Shasíyabat have led the way to the actual condition of the mouths of these great rivers.

Territory of Mesene.—The new lands contained between the lake of Chaldæa and that of Susiana, constituted a portion of the Mesene of antiquity. Strabo (xvi. 739) places Mesene south of Chaldæa, and between Babylon and the Persian Gulf. Pliny gives a similar description. Dion Cassius calls it Mesene of Tigris (lxviii. 28).

But it appears also, that all the territories to the east that lay between the Susian lake and the Persian Gulf, were comprised in this denomination. Thus in the narrative of Xiphilinus we learn, that "after Trajan had taken Ctesiphon, he determined to navigate the Red Sea, that is, the Gulf of Persia. . . . . There is an island there formed by the Tigris, called Messana, under the government of Athambilus; this Trajan reduced without difficulty, but was himself brought into great hazard from the season of the year, the violence of the stream, and the inundation of the tide. The inhabitants of the fortress of Tospasinus relieved him, however, by their friendly reception of him into the place. This fortress is in the territory of Athambilus."

It only remains, then, to know the site of Tospasinus, to be acquainted so far with the extent seawards of Mesene; and Pliny has spoken definitely upon this subject: "Charax habitatur in colle manufacto inter confluentes, dextra Tigris læva Eulæus." (lib. vi. c. 27). Vincent has already shown, that the Sinus Mesanius of Ptolemy was undoubtedly the channel which led from the mouth of the river at Teredon, by the island of Mucan to the ancient Gerrha. It was in consequence of his being mis-

led by the position of this gulf, that D'Anville placed Mesene on the west side of the Shát el Arab, considering it as Dauasír of Niebuhr, while he puts the fort of Spasinus, which is expressly described as being in Mesene, to the east of the Shát el Arab. Pliny speaks of "Circa Apameam Mesenes oppidum;" and in another place of the Tigris, "Seleuciam petit Mesenem perfundens." Cellarius, on the authority of Josephus and of Stephanus, has no hesitation in fixing Mesene at the mouth of the Tigris, and Ammianus Marcellinus (lib. xxiv. p. 399) evidently considers Mesene as a tract neighbouring the sea. From all these authorities we ascertain, that the Mesene of antiquity comprised all those marshy and half-islanded tracts which were at that period comprised between Tigris and the sea, below the Chaldæan lake; including the territories of Apamea, or Kúrnah, of Hawísah, and of Spasinus Charax, or of Mo'ammerah. This latter district, extending between the Shát el Arab and the Bahamshír, is in the present day called Músah, or Mahersí, corresponding with the bay of Mahruin, which is the same as the Sinus Pelodes and Steloas of Ptolemy and of Marcian. The Orientals read Músah for Moses, and the name of the prophet was too current in the East, that we should be surprised at finding it here. Ptolemy's Moseus is the Bahamshír which Vincent mistook for the Karún. Cellarius said, "Moseus intervenit Tigrim et Eulæum" (lib. iii. p. 19.)

Spasinus Charax. — Vincent read Σπασινου Χωμα, Spasinus being "in colle manu facta." Pliny (lib. vi. c. 27); but Cellarius, vol. ii., 448, reads το Τοσπασινου. D'Anville calls it, "une bande de terre isolée par un

canal," which appears to correspond precisely with what it must have been in that time. It appears from Pliny, (lib. vi. c. 27,) " Prius fuit a littore stadius 10 et maritimum etiam ipsa inde portum habuit, juba vero prodente 1 mill. pass. hunc abesse a littore cxx. mil. legati arabum nostrique negotiatores qui inde venere affirmant." There is nothing in the physical configuration and geological relation of Charax which would militate against the first statement made in the preceding, of its having been, in the time of Alexander, only 1693 yards, or scarcely a mile, from the sea. On the contrary, the statement coincides with every other circumstance which has been brought to illustrate the former condition of Delta of Susiana. Nearchus must have sailed near it in crossing to Diridotis. It was in fact the then Delta of the rivers Tigris and Karún. If in Juba's time it was already 50 Roman miles from the sea, it had already attained its greatest distance, for it is not at the present day more than 47 English miles. With regard to his statement, that in his own day it was 120 miles from the sea, it is impossible not to feel, that it would be exorbitant to demand that a writer who has recorded so many errors and superstitions in natural history, should always be correct in his geography.

'Abadán and Al Shasíyabat.—The progressive emergence of the territory of Mesene, now Mahersí, is contained in a note of Marcian's, who says, " near this part (Spasini Charax) of Susiana, lies an island called Apphadana, which some attribute to Arabia." This already shows an emergence to have taken place between the time of Alexander and of Marcian. The connexion of

this island with the main land can be traced. Al Edrissi says (p. 121), " 'Abadán is a small fort, situated near the sea, and on the western bank of Tigris, in a part where that river particularly spreads itself over the land." The only error here is, that it ought to be eastern bank; 'Abadán still exists, but on the eastern bank of the Shát el Arab. The same author says, " six miles below 'Abadán lies Al Shasíyabat, which signifies a stage raised upon piles in the sea, where there is a watch kept, and those who are appointed for that service repair to the stage in boats." Al Shasíyabat is now at a distance from the sea; but that distance, amounting to several miles, has not been well determined.

Voyage of Nearchus.—One of the most valuable records of ancient time, by which we can form an idea of the former condition of the Delta of Euphrates, and of Susiana, is undoubtedly the narrative left to us by Arrian of the voyage of Nearchus. This record contains a testimony of a change in the configuration of the soil, and of the hydrographical relations of the great rivers of Chaldæa and Susiana; as irrefragable as that contained in the physical indices of the soil itself.

Standard of Measurement.—The greatest difficulty which occurs in the way of a correct interpretation of the Macedonian navigator, is that which exists in determining the value of the stadium used in the narrative, more especially as transmitted to us by Arrian. Two able commentators, Dr. Vincent and D'Anville, have used the small Aristotelian stade, Rennell has adopted the Greek Itinerary stadium, and Dr. Falconer the Greek Olympic.

From many various comparisons made between the actual distance of known positions, and the distance as recorded by Nearchus, I have been led to adopt the same as Major Rennell.

Navigation of the Delta.—The first point which will occupy our attention is the navigation from the Arosis, uniformly recognised as the Oroatis and Indíyán, across the Delta of Susiana to Teredon or Diridotis. The following table will express the distances, according to the various standards of measurement:—

	Stades.	Olympic.	Itinerary.	Aristotelian.
From Arosis to Kataderbis	500	56m	48m	30m
From Kata. to Night Station	600	68	57	37
From Station to Diridotis	900	102	86	56
	2000	226	191	123

Margastana.—Nearchus sailed from the Arosis, and after a passage of 500 stades, the fleet came to an anchor at the mouth of a lake rather than an harbour, where there was an abundance of fish. The place was called Kataderbis, and an island which lay at its mouth Margastana.

The actual distance from the mouth of the Indíyán River to the island of Búnah, according to the survey of Lieuts. Brucks and Haines, is 22 miles, so that all the values given above to the stadium, will carry the navigator beyond the island, which at present exists at the mouth of the bay of Derí Búnah, and which has been generally looked upon as the Margastana of Near-

chus; while, if we take either the Olympic or Itinerary value, we shall bring the navigator upon the land now occupied by the country of the Ka'b Arabs, and designated as Dorákstán, to which Margastan bears a remote resemblance. Dorákstán is still annually flooded, and is navigated over in boats during a great part of the year.

Stake Bay, Sinus Pelodes, Sinus Steloas.—On quitting Kataderbis, they sailed, as soon as it was light, and forming a line, by single ships, each followed in order, without deviating to the right or left, through a channel marked out with stakes, in the same manner as the passage between Leukas and Acarnania in Greece. Through this passage Nearchus conducted his fleet 600 stadia, and then came to an anchor, without being able to approach the shore.

That portion of the Gulf which extends between the Khór Músah and the Bahamshír, is at the present day occupied by the great bank called the Meïdán Alah; but there is no further reason for assuming that Nearchus navigated across the Meïdán Alah to the mouth of the river Euphrates, than that in the present day he would have to follow such a course. There is no channel, nor could there ever have been one marked out by stakes on the Meïdán Alah. Further, the distance from Dorákstán to the Shát el Arab, or even from Búnah Derí, is so small, that 600 stadia, in every standard, would have brought the boats into deep water, which was not the case; wherefore the fleet must have taken a diagonal or north-west course across the country, which now forms part of Dorákstán and Mahersí, and which we have previously recognised as the stake bay of Marcian, the

mud bay of Ptolemy, and the bay marked out by stakes of Nearchus. This district is now occupied by the marshes and inlet, at the mouth of the Karún el 'Amah, and the embouchure of the Bahamshír.

Teredon or Diridotis.—From this anchorage, the fleet weighed in the night, after allowing a short respite from fatigue; but they had no longer a shoal to cross, they sailed in deep water all night and the following day, till past noon, when they finished their course at Diridotis, a village at the mouth of the Euphrates. The distance accomplished was 900 stadia.

The distance of the Babylonian mound, called Jebel Sinám, which rises over the plain of the Zobeïr Arabs, from the Charax Spasinus, may be valued at upwards of 30 miles, which leaves a distance of 56 miles for the navigation across Mesene to Dorákstán, a distance which in a straight line would carry the fleet to the bay of Búnah Derí; and the excess must therefore be sought for in the sinuosities of the then existing coasts, if Diridotis existed at the point it is placed by some; viz., at the mouth of the Khór Abdúlláh, the excess would be still greater by any standard that is adopted.

It so happens that there are two other numerical statements for ascertaining the position of Diridotis. We learn from Strabo (lib. xvi. p. 766), that "Gerrha was 2400 stadia (230^{m}) along the coast from the mouth of the Euphrates, and 200 stades in the interior." The ruins of this city are now approximatively known to lie near El Katíf, on the Persian Gulf, a distance of about 180 miles from the Khór Abdúlláh, or supposed ancient mouth of Euphrates or Pallacopas; and which would still leave a

surplus of 50 miles, pointing to the necessity of seeking for the position of Teredon, considerably to the north of the present embouchure of Euphrates, or of the Khór Abdúlláh, and at or near the site of the Jebel Sinám.

Secondly, the Macedonian navigator reckoned it 3300 stadia from the mouth of the river Euphrates to Babylon. The distance of Zobeïr from Babylon may be estimated at 310 miles, and that of the mound to which we would attach the Babylonian ruin of Teredon, about 10 miles further. The distance given by Nearchus, calculated upon the Olympic stade, would give 375 miles, or nearly the distance of the Khór Abdúlláh; upon the Itinerary, 320, the distance of Jebel Sinám; and by the small Aristotelian, 207 miles, or less than that distance. It is very evident then, from the same standard that has been used before, that the approximation effected between the estimated actual distance, and that given by Nearchus, is as close as could be expected, and lends its corroborative testimony, with the position of Gerrha, for determining the Jebel Sinám to be at or upon the ancient site of Teredon or Diridotis.

The learned Dr. Vincent has preserved a valuable fragment of history from Abydenus, Scal. Emend. Temp. Frag. p. 13, and Eusebius apud Grotium lib. iii. c. 16, which relates that Teredon was founded by Nebuchadnezzar, as a fortress against the Arabs, and Heeren supposes that it afterwards became a Phœnician colony. The relation of Diridotis with Hid Dekel or Duglath דִּקְלָה of Moses, so variously corrupted Diglidoth, Diglito (Pliny), Diglath (Josephus), the Oriental Dejela, from whence the Greeks made Deger and Teger, and the Romans Tigris, is important; as the interchange of forms in Diridotis or

Diglidotis, and Teredon or Tenedon, is constant, and accords with the genius of the languages in which they were first adopted.

Tavernier had first the boldness to distinguish the modern Zobeïr as the site of the Chaldæo-Babylonian Teredon: this he evidently obtained from the Sabæans, as he gives no reason for his statement. The identity established between the same site and the Tschábde or Tschwábde of Niebuhr, and of Tschábde with 'Abadán, is incorrect. The site of the Tschábde of Niebuhr is now occupied by the village of Fúeh, where I sought in vain for ancient ruins. Vincent says in the text (vol. i. p. 437), that the channel which passes by Zobeïr is the Euphrates of Strabo and Arrian; and in notes to p. 436 he confounds it as the continuation of the Obóleh of Abú-el-Fédah, or the canal of New Basráh. Vincent also supposed Jebel Sinám to be at Zobeïr; it is three hours from it. D'Anville identified the same Babylonian mound with Orchoe. The natives preserve the tradition of the first and most ancient Basráh being at Jebel Siuám; the second (to which Ayíshah was taken prisoner), near the present Zobeïr (and the site of which, attested by existing monuments, was ingeniously determined by Niebuhr by a reference to the Mohammedan saints buried there); and lastly, the present Basráh founded by Omár.

Dr. Vincent and D'Anville consider the small Aristotelian stade as that used by Nearchus, and yet place Teredon at the head of the present Khór Abdúlláh, or about 400 miles from Babylon, instead of the 207 which would result from calculations founded on that stade. Mr. Beke, taking the 207, has, on the other hand, been led to suppose, that there has been, since the days of

Nearchus (B.C. 325), an actual increase of land, which, in a straight line, may be taken as about three-fourths of the measurements along the course of the river, or of 113 miles, during a period of 2160 years.

As it is, in great part, a question of the value of the stadium, the statement of Pliny, which is acknowledgedly founded upon that of Nearchus, as well as that of Onesicritus,—"Eufraten navigari Babylonem e Persico Mari ccccxi M. pass.,"—might be advanced as a corroborative proof of the standard used on the present occasion; and which (411 Roman miles being equal to about 388 English) would give an excess of the maximum equal to the excess of the Olympic stade over that of Xenophon and Strabo. If the distance given is calculated upon the Olympic stadium of 600 feet of Dr. Falconer, the result would be 375 miles. If the quantities of 604 used by D'Anville, 606 by Bishop Horsley, or 625 of others, are taken, the excess will be still greater. The value given by Jomard to the Olympic stade, founded upon the measurement of the Pyramids, as astronomical monuments, is of only 598 feet; and it would require the maximum of these results, to bring the site of Teredon as low as the Khór Abdúlláh*. It cannot be objected too strongly to the reconciliation of apparent discrepancies in the works of ancient writers by varying the standard of measurement, a case that can never be permitted, but in establishing correctly at the outset the value of the standard used by each different author; no pains or trouble ought to be spared; and such investigations have been one of

* The distance of Basráh to Babylon, by the windings of the river, which Pliny's statement, if not founded upon that of Nearchus, would appear to include, is equal to 348 miles.

the prominent causes of the progress given to historical geography in modern times.

Lake of Susiana.—"While Nearchus lay at anchor, according to his historian, at the mouth of the Euphrates, intelligence was received that Alexander was on his march to Susa; he determined, therefore, to return back, and then, by pursuing his course up the Pasitigris, to join him in the neighbourhood of the capital." . . . . . "Wherefore, passing along the coast, and keeping the country of Susa on their left hand, they passed through the lake by which the Tigris empties itself."

We have here a distinct Pasitigris from that of Pliny, and which can only be one of the rivers flowing from the neighbourhood of Susa. From the relation in which the Karún stands in regard to Jebel Sínám, or Teredon, it is evident that, to reach that river, they must, as is related, retrace their steps, which, however, they only did for a short distance, soon crossing a lake, which they passed through, keeping Susiana on their left hand. This can only apply itself to a sheet of water contained between the district of Apamea and that of Charax, or Spasinus.

There are other authorities for the existence of this lake besides Nearchus. Polycletus asserts that the Eulæus, the Choaspes, and the Tigris, empty themselves into a lake. In the same manner Strabo (lib. xv. p. 729), says that all the interval between the coast of Arabia at Diridotis, and the extreme of the coast of Susiana, is occupied by a lake which receives the Tigris; and lastly, Pliny speaks (lib. vi. c. 23), of the "Lacus quem faciunt Eulæus et Tigris juxta Characem." Nothing can be more satis-

factory; and we have observed in the physical descriptions, that this territory is still the seat of annual inundations.

Hawáz, or Aginis.—The distance from the lake to the mouth of the river itself, according to Nearchus, was 600 stades; the river itself here evidently means that which the navigator was designing to sail, and not Tigris, last alluded to; if so, the distance given of 600 stades will carry the navigator across the country nearly to the site of Hawáz. "And at the river," says the narrator, "is Aginis, a village of Susiana, which is 500 stadia, or 48 miles, from Susa, which corresponds with the position of Hawáz. Subsequently we find, that when Alexander was at Susa, the fleet was also there; although the historians have not preserved any account of the journey. Hence it may be deduced, that there existed at that time a communication between the river of Sús and that of the Pasitigris or Karún.

Dr. Vincent, from a reading furnished to him by Schneider, in which it is rendered, "they passed in their course a lake," instead of "they passed through the lake," as it is given by Rooke and others, concludes that Nearchus has described the lake without going into it, and that he retraced his passage across the shoals, returning by the Lusbah river into the Pasitigris, which he thus identifies with the Jeráhí.

The points established by these topographical references, compared with the physical indices of the soil, have assisted me in determining, so far, the outline of the Sea of Oman, or Gulf of Persia, at the earliest times of authentic history, as to trace it from the territory of

Ghoreïn, by Jebel Sinám or Teredon, Zobeïr, Spasinus Charax, and the Vallum Pasini, in an undefined line across Dorákstán or Ká'bán, to the Arosis or Indíyán. The same relations have furnished evidence of the former existence of a lake, formed by the junction of the Tigris and the Choaspes or Eulæus, and extending from the neighbourhood of Diridotis to that of Aginis (Haváz), and bounded to the north by the territory of Ampé, Aphlé, and Apamea, and to the south by that of Mesene and Charax.

Progress of Alluvia.—The distance of Charax from the sea in Alexander's time, as recorded by Pliny, gives a rate of progress for the Susianic Delta of about 30 yards per annum. The positioning of Teredon at Jebel Sinám would give a rate of progress which would not much exceed that average, for the shore trended thence rather to the west of south; and the intervening space of the Dauasír and the Máhersí were almost coevally taken from the domain of the waters, by the changes which took place in the hydrographical relations of the different waters.

If the same ratio of the rate of progress of the alluvia since the days of Alexander, be applied in a retrospective manner to the progress of the alluvia in times anterior to that, we should find that at earliest post-diluvian periods, or about 4200 years ago, these alluvia ought to have extended to within about 70 miles of the sea.

Now, it has been seen by previous historical researches, that the foundation of Teredon dates from an early period of the Chaldæo-Babylonian empire, and that Ampé, noticed by Herodotus, was also a site in nearly

the same parallel of the most remote antiquity; and connecting these facts with what is known of the comparative geography of Mesene, the outline of coast obtained by this retrograde process corresponds, as nearly as can be obtained, with what would be deduced from historical facts.

It has been further shown, by physical, and historical, inquiries united; that Chaldæa, which contained the city of Erech, coeval with Babel; the Gerah of Abraham, and the antique Ur or Orchoe, was evidently not a country of post-Babylonian alluvia; and hence all circumstances unite in lending their testimony to the same great facts of the antique existence of the alluvia of Babylonia, while the rate of the progress of the same alluvia, approximatively obtained, is further illustrated by the more modern rate of advance, since the building of 'Abadán and Al Shasíyabát.

Rivers of Susiana.

The rivers which may be considered as forming the Hydrographical Basin of Khusístán are, the Keráh, the Ab-i-Zál, the Karún, the Jeráhí, and the Indíyán.

The Keráh.—The Keráh, Kiérki, Kerkhah, and Karású, is said by Sir John Macdonald Kinneir to originate from the province of Ardilán in Irák Ajemi. The various tributaries unite on the plains of Khawah and Alister, a little below Khurrímabád, to form the Keráh which flows by Hór-Kúb, to the parallel of Sús, past which it passes one day's journey to the west, receiving there the Ab-i-Zál, which flows immediately by the site of Sús. The river then flows onwards towards Hawísah, parting three miles above that town with a canal called the Náhr Josah. The main channel is then called the Hawísah, till it loses a second stream, called the Abú Jamú, which also flows, like the Náhr Josah, into the marshes called Samídah and Samárkah, which lie between the Keráh and the Tigris, and are inhabited by the Bení Lám Arabs. The main channel, after losing the Abú Jamú, is designated as the Saheb or Suáb, to its embouchure into the Shát el Arab, only a few miles below the junction of Euphrates and Tigris.

The Ab-i-Zál.—The existence of a tributary to the Keráh flowing past the ruins of Susa, was made known to us by the natives on the Karún, but it is to Major Rawlinson that we are indebted for the information that this tributary is the Ab-i-Zál of Orientalists.

The Shapúr.—The Shapúr, or Sháwúr, as it is pronounced by the Arabs, was first made known to us by a native of Felahíyah, or Dorák, as flowing near Sús, and being in part lost in marshes, while the remainder found its way into the Ab-i-Díz. From information subsequently obtained at Hawáz, we learnt that this river emptied itself formerly into the Karún. At Búnd-i-Kíl we also learnt that it had an outlet into the river Díz, and the same thing was delineated for us in chalk, by an intelligent pilot who accompanied the steamer Euphrates on her journey up the Karún to Hawáz. The fact of the existence of this river was derived from too great a variety of sources to admit of any doubt, although the misbehaviour of the Arabs at Búnd-i-Kíl prevented our personal exploration of its course. This difficulty did not exist at Hawáz, where we were successful in tracing its bed into the Karún immediately below the last ledge of rocks. Colonel Chesney also met with several streams of water between the canal of Shúster and the Ab-i-Díz, flowing to the south-west.

It would appear, from information derived from the natives, that while the tomb of Daniel, and part of the ruins of Susa, are to the east of the Ab-i-Zál, the other portions are to the west of it. There is a passage in Daniel (viii. 16), which has an obvious reference to this circumstance, when the prophet says, "between the Ulaï," which is rendered in the Vulgate, "between the banks," a thing impossible. Strabo (lib. xv. p. 729) also says, "the *rivers* which pass by Susa," a passage which Gosselin explains as having reference to the Khoaspes and Eulæus as different streams.

The Ab-i-Díz.—The Ab-i-Díz, or river of Díz, is said to have its source on the western side of the Persian Apennines, from whence the united tributaries flow by Dízfúl, where is a bridge of 32 arches, (or 350 yards, Chesney,) constructed by Shapúr Zulectáf, who also built those of Shúster and of Rhajián, and empties itself into the Kerák west of Susa.

The Karún.—The Karún has its sources in the Bakhtíyarí mountains. After receiving several tributaries, it flows to the west of Shúster, giving off, previously to its arrival there, two canals to the west, which apparently go to form the Sháwúr or Shapúr river, which Ibn Haukal crossed at Júnd-i-Shapúr, one day's journey west, and probably lost by irrigation at certain seasons, for Colonel Chesney met in the same neighbourhood with streams of small dimensions. To the east are given off four canals, which unite to form the Ab-i-Shúster, the Ab-i-Gúrgúr, Shatíte, or Mushíkrán, for they appear to be the same.

Twenty miles below Shúster the Karún receives back the waters of the canal, which is, in fact, now the real bed of the river, and also the waters of the river of Hassmanníyah, which flows ten miles to the south of Shúster. The junction takes place at Búnd-i-Kíl, the Benhoüdel of the Arabs, which Hammer erroneously considered as the Deïr-i-Hazikíl, the convent of Ezekiel of Bakú, which tradition places at Shúshán.

From Búnd-i-Kíl the united waters flow in nearly a straight line to south 10° west, by the town of Waïs, where the river begins to assume a tortuous direction onwards to Haváz. At this place the bed of the river is crossed by seven ledges of sandstone rock, over which

the water falls, having a depth of scarcely more than 18 inches at extreme low water, but having from three to four feet during the season of flood. The rocks dip at an angle of 22° to the north, and cross the river in a direction from N. 85 W. to S. 85 E. Below the last ridge is an islet, and opposite to it a river bay, beyond which was the ancient bed of the Sháwúr. A búnd or dam, constructed of stones cemented by mortar, crossed the river in a diagonal direction a little above. Several channels are cut through a ledge of rock, about 20 feet high, which allowed the obstructed waters to flow into a canal, which was joined by another passing the city under a bridge of two arches, the remains of which are still extant. The course of the canal, as continued after irrigating the soil, is traceable as far as to Ghuraïbah on the Jeráhí.

Fourteen miles below Hawáz, by the river, but scarcely eight by land, the Karún receives, in the season of high waters, a contribution from the Hawísah or Kerah river, by a canal called the Náhr el Maktúah, or "cut river."

At the untenanted village of Sablah, or Samaíyah, is an ancient bed of the river called Karún el 'Amah*, the blind or filled up, Karún. It now only contains the waters of high tide and of flood. About a mile and a half from the actual Karún it receives the waters of the Ka'ban canal, which are supplied by the Dorák branch of the Jeráhí. This canal, although very narrow, is navigated by boats.

The Karún flows onwards by Kisbár, amid villages and date groves, fourteen miles; to where it divides into two channels, one of which flows past Mo'ammerah and

* Mr. Renouard queries Amáh, the wanderer.

old Haffár fort, into the Shát el Arab. This channel is little more than a mile in length; the other constitutes the Bahamshír, a channel extending to the Gulf, and partaking of the characters of a river, and of an inlet of the sea.

The Jeráhí.—The Jeráhí originates from several rivers, which flow from the Bakhtíyarí mountains. The united streams flow past Ghuraïbah in the longitude of Hawáz, into the territory of the Sheïkh of Ka'b. Here the waters begin to be drained by numerous canals, which take their departure from the right bank, while the main river flows onwards to Asáyí, within about eight miles of Dorák, or Feláhíyah, and where the waters flowing from the east sweep round to the south-east. From this convexity six various canals take their departure: the most southerly loses itself in rice-grounds and marshes. The next unites with two other canals, after their waters have been much diminished by irrigation, to form the canal of Dorák. The others lose themselves in the marshes of the same place, called Hór Dorák. The sixth, or most northerly, divides into two branches, forming seven canals in all. On these various canals are many villages surrounded by date-trees, the inhabitants cultivating rice and grain, and pasturing cattle. The Jeráhí, in its continuation, loses itself in marshes, from which part of the waters are said to reunite, to form the Lusbah river, which empties itself into the Gulf.

The Dorák canal flowing past Feláhíyah, sends off a canal of irrigation at about a mile from the town, while the main channel, after losing itself partly in marshes, continues its course as previously mentioned, into the

Karún el 'Amah, by which it empties itself into the Karún.

Questions in Comparative Geography.—Few inquiries in historical geography have presented greater diversity in their results, than those which affect the reconciliation of what is known to the moderns, with what has been handed down to us by the ancients, concerning the rivers of Susiana. The identity of Sús and Susa has been supported by Rennell, Ousely, Gosselin, Barbié de Bocage, Kinneir, and Hoeck, while the identity of Shúster and Susa has had for advocates D'Herbelot, D'Anville, Vincent, and Mannert; and still more lately, we have had the excellent memoir of Mr. Von Hammer, upon the same subject, and a notice in the Journal of the Royal Geographical Society, by Mr. Long, founded upon the researches of Colonel Chesney.

The question is one of high interest, for not only does it involve the site of one of the most celebrated cities of antiquity, but it forms an integral part of the study of the progress of the alluvia in those districts, and of the changes which have taken place in the configuration of the land since the earliest periods of recorded history.

Teredon.—The Babylonian mound of Jebel Sinám, near Zobeïr, has been adopted as the site of the Teredon of Nebuchadnezzar, and the Diridotis of Nearchus, from the fact that the Náhr Saleh, or canal of Zobeïr, which communicated with the Khór Abdúlláh, could never have contained the body of the waters of the Euphrates; from the fact that Colonel Chesney met with the bed of the

Pallacopas, pursuing the route where it might be expected, from Urchoe towards Jebel Sinám; from the recorded distances of Teredon from Babylon and Gerrha, and from the local tradition of the Jebel Sinám being an older port than Zobeïr, or old Basráh, which was anterior to the modern Basráh.

Lake of Susiana.—From Zobeïr to the river Keráh, and eastwards by Mo'ammerah, for a considerable distance inland, the country north of the Karún, as well as that to the south of it, is the seat of extensive and prolonged inundations. This country was probably formerly occupied by the lake by which Nearchus proceeded from Diridotis, when, according to his historian, "passing along the coast, and keeping the country of Susa on their left hand, they passed through the lake by which the Tigris empties itself." There are other authorities for the existence of this lake besides Nearchus. Polycletus asserts, that the Eulæus, the Khoaspes, and the Tigris, empty themselves into a lake. In the same manner Strabo (lib. xv., p. 729,) says, that all the interval between the coast of Arabia at Diridotis, and the extreme of the coast of Susiana, is occupied by a lake or marsh (λίμνη) which receives the Tigris. And, lastly, Pliny speaks (lib. vi., c. 23,) of the "Lacus quem faciunt Eulæus et Tigris juxta Characem." This lake of Susiana must not be confounded with the Chaldæan lake, which was to the north of it.

Aginis.—The distance, from the lake to the mouth of the river itself, according to Nearchus, was 600 stades: "the river itself," here evidently means that which the

navigator was designing to sail up, and not the Tigris, although the last alluded to in the text. If so, the distance given of 600 stades, using the Greek Itinerary, as adopted by Major Rennell, will carry the navigator across the country to the site of Hawáz. And at the river, says the narrator, is Aginis, "a village of Susians," which is 500 stadia, or 48 miles from Susa, corresponding with what may be supposed to be the actual distance of Hawáz from Sús. Subsequently we find that when Alexander was at Susa, the fleet was also there, although the historians have not preserved any account of the journey. It is also recorded, that at Aginis there were falls or impediments on the river,—impediments which, in the present day, are both natural and artificial.

Junction of Kerâh and Karún—Having admitted these preliminaries, I shall advert in a few words to the Kerâh. According to the Djihan Núma, this river flowed into the Karún previous to the latter joining the Shát el Arab*. Gosselin says the same thing in his notes to the Paris edition of Strabo (1819); and the Euphrates Expedition found a communication still existing, during the season of flood, between the two rivers. It is evident, then, that we have here a means of explaining the descent made by Alexander of the Eulæus to the sea direct, although the present line of junction is only a modern condition of the river, which originated subsequently to the existence of a lake, and into which, on the authority of Polycletus and others, the Khoaspes or Kerâh poured its waters.

* Arab is properly 'Aráb, but is too common to admit of a new orthography.

Gyndes.—Otter (vol. ii., p. 51.) first noticed that Hór-Kúb* was on the Gyndes. Ibn Haukal makes the town one merhilah or caravan day's journey from Sús, and a similar distance beyond is Teïb. If Hór-Kúb is on the Keráh, which is one day's journey from Sús, it is a proof that it is the Ab-i-Zál, and not the Keráh, which flows past that city, although Kinneir does not mention such a river; but Colonel Chesney, by his ascent of the Shuster river, established the fact that the western branch at Búnd-i-Kíl is not the river flowing from Sús, or the Ab-i-Zál, as generally designated, and which, like D'Anville and Rennell, he supposed to empty itself into the Keráh.

It is well known that Herodotus (Clio, lib. i., 89,) relates that Cyrus, in leading his army against Labynetus, son of Nitocris†, lost one of the consecrated horses in the Gyndes or Keráh, which he was accordingly led to reduce by a number of canals from exasperation, according to the historian; but, as Larcher has remarked, it might have been from prudence—exasperation does not endure a whole summer. Rennell, who considers the Keráh as the Khoaspes, is necessitated to convert the Díyalah into the Gyndes, a system of which Vincent has already pointed out the difficulties; for if Cyrus came from Ecbatana, it was not necessary to cross the Díyalah, and if from Susa, it was also out of the way. Others

* Hór, *marshes;* Khór, *an inlet or passage of the sea.*

† Labynetus is identified by Larcher with Nebuchadnezzar, a name supposed by Hardouinus (Chron. Veteris Testamenti), to be common to the kings of the Chaldæo-Babylonian monarchy, like Pharaoh to the Egyptians, and Syennesis to the Syrians. A better authority, Heeren, identifies him with Nabonadius, the Chaldæan Belshazzar.

have sought for the Gyndes in the Mendelì, which they have made a tributary to the Keráh, whereas it is a fluent into the Díyalah, the true position of which may be seen in the late work of Mr. Rich, on Nineveh and the Tigris. Voltaire (Art. *Babel*, "Encyclopédie,") is witty at the expense of the whole transaction: "What should we say," he inquires, "of Mezerai, had he related that Charlemagne had divided the Rhine into 360 canals?" The orientals, in the same language of exaggeration as Seneca (de Irâ, lib. iii. cxxi.) has used towards Cyrus, assert that the Jesáyir is pierced by 300 canals.

Identity of Khoaspes and Eulæus.—The identity of the Khoaspes and the Eulæus is demonstrated by the positioning of Susa, which the Scriptures place on the Ulai; Arrian and Pliny on the Eulæus; and Herodotus, Strabo, and Quintus Curtius, on the Khoaspes. The connexion of the Khoaspes and the Eulæus with the Ab-i-Zál must depend upon the identity of Sús and Susa, or Shúshán, and a more general evidence of an accumulated geographical and hydrographical detail.

Position of Susa.—The principal arguments for the identity of Sús and Susa have been derived from the similarity of name; the existence of extensive and characteristic ruins, while Shúster has none; the legend of the prophet Daniel, whose tomb is at Sús; and the necessity of adopting a site that is upon a river which comes from Media; to which has been objected, in favour of the identity of Susa and Shúster, that the name of Shúster approaches as near to Shúshán as that of Sús does. Independently of the little value of such an argument, it

has been neglected to mention that Shúster is the diminutive of Sús or Shús, having at an early period of its history been designated as the Small Sús, to which city it ultimately succeeded, and outstripped in population and in power. Vincent lays much stress upon the superior antiquity given by Oriental writers to Shúster, but it is always their custom to honour existing capitals, which they do without always preserving that regard for truth which is so essential in history. In the present case, to say that Shúster was founded by Húshenk immediately after the flood, possesses the same historical value as the statement made by Strabo, of the building of Susa by Tithonus, son of Memnon. The argument, which is founded upon the closer analogy of the name of the province Susiana with Shúshán, is as valueless as the analogy of its modern name with the Kissei, Kussei, and Kossei of the Greeks, for Sús or Shús was as much in Susiana as Shúster, and more closely connected with the province of Susiana than the Kossei are with Khusístán; for the ancients considered only the tribes to the west of the Pasitigris as the Kussii or Susians, and those to the east as Uxii or Uxians. The statement of Ibn Haukal, that there is not in all Khusístán any mountain or sand (if the translation is correctly given), except at Shúster, Júnd-i-Shapúr, and Aïdej, is extremely erroneous; for where there is not rock, as at Hawáz, Hawísah, Ram, Hormúz, &c., there is almost generally sand; at all events, no argument can be founded on such slender data. The learned Dr. Vincent, who comments upon Nearchus, thinks that, as far as regards the legendary tradition of the prophet Daniel's tomb, little more respect is due to it than to the legends of the Church of Rome. Von

Hammer has lately advanced upon this subject what he considered as a triumphant argument, a passage from 'Ahméd of Sús, which states, that formerly the tomb of Daniel was at Shúster, and that it was on the occasion of a great famine, which desolated Sús, that it was removed there. This may be compared for authenticity with the monkish legend of the transposition of the domicile of the Virgin Mary from Jerusalem to Ravenna; and if Oriental writers were of any avail, when legends are concerned, the assertion made in the Djihán Númá, that the tomb has existed at Sús since the days of Nebuchadnezzar, might be advanced as contradictory evidence. The argument, that the Kerâh cannot be the Susa river because it empties itself into the Shát el Arab, only applies itself to the present condition of that river. Von Hammer acknowledges that this was his chief reason for subscribing to that view which supports the identity of Susa and Shúster.

Identity of Eulæus and Ab-i-Zál.—In comparing the Ab-i-Zál with the Khoaspes and the Eulæus, it is well to mention that Herodotus, on the authority of Aristagoras, says that the Khoaspes must be crossed to arrive at Susa, and that Quintus Curtius (lib. i. p. 323) says, in the same manner, that Alexander passed the Eulæus on his road to Susa. This is important, for although Strabo only says (lib. xv. p. 728), that Susa lies inland upon the Khoaspes, it is evident, from the above, that it was on the eastern side of the river, which it is of the Kerâh, and in part of the Ab-i-Zál, to the present day.

It is related by Herodotus, Strabo, and Quintus Curtius, of the Khoaspes, and the same thing is told by

the Scriptures of the Ulaï, and by Arrian and Pliny of the Eulæus, that the waters of these rivers are so pure and salutary, that the kings of Persia would drink no other.

> There Susa, by Choaspes' amber stream,
> The drink of none but kings.

Upon which Jortin critically remarks that it is not proved, that none but kings drank it; and another commentator discusses the subject at length, adducing fifteen authorities against the poet. Such captiousness about an expression, which is perhaps only a licence, has more of vanity or of love of detraction in it, than of literary humanity. Milton, however, meets with support in Agathocles, who avers that there is in Persia a river called "Golden," that it consists of 70 streams, that none drink of it except the king and his eldest son, and that if any person does, death is the punishment. What I was anxious however to show was, that the fame of the purity and excellence of the waters of the Karún is also proverbial among Turks, Arabs, and Persians, to the present day, and that as the Ab-i-Zál flowed into it, the identity, so far as regards this silk-wove argument, is unimpeachable. Von Hammer has also recorded the virtues of the Shúster river, as derived from an Oriental MS., but an incorrect deduction is drawn from it of the identity of that river with the Khoaspes.

Identity of Eulæus and Pasitigris.—The union of the Eulæus and the Pasitigris is proved from a number of circumstances, but an important question presents itself, —by which of the two names was the resulting river designated? Von Hammer understands Arrian as im-

plying that the Eulæus flowed into the Pasitigris, and that Alexander descended the former on his way to meet Nearchus, when the latter ascended the Pasitigris with his fleet; but I have been unable to get satisfactory evidence of this reading. Ptolemy puts the question out of all doubt, for his Eulæus, emptying itself into the sea between the Mosæus (Bahamshír) and the Arosis or Indiyán, is the same as the Karún el 'Amah. The historians of Alexander also make the Macedonian hero descend the Eulæus to the sea. The junction was, however, effected by the lake of Susiana, and it is from this circumstance that Alexander is made to descend to the sea by the Eulæus, while Nearchus is made to ascend from the same by the Pasitigris. Of similar nature is the acceptation given by Strabo of the latter name, which, according to him, would mean "the union of all the rivers."

Identity of Ab-i-Zál and Ab-i-Díz.—The Ab-i-Díz, or river of Díz, has been identified with the Ab-i-Zál by Sheriff Iddín, who places Dizfúl on the river of that name. The Ab-i-Zál was regarded by Ibn Haukal (p. 74), by Abú-el-Fédah (Otter, ii. p. 55), and Petit de la Croix ("Hist. de Timúr," t. ii. p. 168), as the river of Susiana, which received all the others, and most of the Oriental geographers regard it in the same light; so that, while the Greeks esteemed the Khoaspes as the chief river of Susiana; in the middle ages, the Ab-i-Zál usurped that pre-eminence, which, in the present day, is given to the Karún, not from superiority of size, but because it flows near the capital of the province. In a country of moral, as well as of physical, vicissitudes; Susa on the Ab-i-Zál,

Haw̱áz on the Pasitigris, and Shúster on the Karún, have been successively the metropolitan cities.

Identity of the Karún with the Kopratas.—That the Karún is identical with the Kopratas we have abundant proof from Strabo, who says, after the Khoaspes comes the Kopratas and the Pasitigris; and there is a valuable passage in Arrian, which says that the Kopratas joins the Pasitigris before the confluence with the Eulæus.

The Pasitigris was also the second river east in Alexander's journey against the Uxii; the Shawúr and Shútïte, or Ab-i-Shúster, not existing in those days.

According to Diodorus Siculus (lib. xix. c. 11), Eumenes marched with his army in one day from Susa to the Pasitigris, which the same historian often negligently calls Tigris, and which he describes as emptying itself into the sea. The time occupied in this journey is in itself an unexceptionable proof that Susa was not at Shúster, for if so, the Pasitigris, being the second river in succession, must be sought for in the Jerahí, or the Indiyán, the former and the nearest being three days' journey off. Alexander took four days, but Timúr, who was more rapid in his military movements, was only three days. Ibn Haukal makes it three days' journey.

When Antigonus left Susa, in pursuit of Eumenes, his army was forced to march by night, and it encamped near the river (Ab-i-Zál), before sun-rise. From thence he came to the Kopratas (Karún), said to join the Pasitigris. Eumenes, having intelligence by his scouts of the enemies' designs, passed over the bridge of Pasitigris with 4000 foot and 1300 horse, and found about 3000 foot and 300 horse of Antigonus' army, which had passed

the Kopratas. These he suddenly set upon and routed. Antigonus, thus forced to retreat, and finding it impossible to pass the river, marched back to the city of Badaca, situated on the river Ulaï. This fragment of a campaign would be quite inexplicable on the supposition of the identity of Susa and Shúster, of the Eulæus and the Karún, and the Jerahí and the Pasitigris.

The Persian geographer Sheriff Iddín relates, that Shapúr threw a búnd, or dam, called Sháhdurván, across the Karún, above Shúster, from whence four canals took their departure to the east, called Tchar Dánk, or four ditches, and two to the west. The construction of the Shútïte, or Ab-i-Korkúr, which appears to have resulted from the junction of the four easterly canals is attributed by Otter (t. ii. p. 55), to Azád-úd-Dúlet, and, as before said, it is not impossible that the two westerly formed the Shawúr or Shapúr, crossed by Ibn Haukal at Júnd-i-Shapúr. An identity might be established between the Shútïte and Mushíkrán of the Djihan Númá, which mentions it as the canal which goes from Shúster to Asker Múkrem. Shúster, according to Colonel Chesney, is upon the Mushíkrán, while upon the eastern branch of the Karún, and ten miles east of Shúster, is the town of Hassmaníyah. Ibn Haukal says, that one may go from Asker Múkrem to Haváz, a distance of eight parasangas, by a river, on which, at the former place, is a great bridge. The appellation is here given to the Karún, which appears to have had a bridge, from very remote periods, immediately below the junction of the Shútïte with the Karún, where ruins are still traceable. Sheriff Iddín, in his relation of the expedition of Timúr (t. ii, lib. iii. c. 22,) makes the Tatar conqueror

commence his expedition from Khurrún'abád in March 1403 or 1393, there being an error of ten years in the chronology of his historian; and in eleven days, he reached the bridge of Dizfúl, on the Ab-i-Zál. He crossed the Ab-i-Zál, on the 16th of March; the Tchar Dánk or Shawúr, on the 18th, when he commenced the siege of Shúster, which employed him till the 19th of April, on which day he passed the Dú Dánk, on his march to Persis. The other rivers which Timúr passed, before he reached the Táb, are the Khorú-Khán-Kendi, the northern tributary to the Jerahí, on the 22d; on the 23d the river of Ram Ormúz; and the river Feï on the 24th. The town of Díz is placed on the Ab-i-Zál, and there is only one difficulty in this record, the Tchar Dánk and the Dú Dánk, have changed place with the position given to them in the Djihán Númá.

Ibn Haukal has contributed a valuable fragment of geography in an Itinerary from Rhajíyán to Teïb.

	Merhíleh, or camel's day journey.
To Bazár on the river Feï	1
Ram Ormúz on the Jerahí	2
Shúster, on the Ab-i-Korkúr	3
Júnd-i-Shapúr, on the Shawúr	1
Sús on the Ab-i-Zál	1
Hor Kúb, on the Keráh	1
Teïb	1

Identity of the Pasitigris with the Karún and Keráh united.—The Karún, considered as the gerent of most of the rivers of Susiana, in accordance with the feelings of the present day, as well as the records of history, yields precedence only to the Euphrates and the Tigris, for the

rich territories which its waters fertilize; and its extended navigability and numerous intercommunications, give to it a real importance, which is only detracted from, by the fierce cupidity of the robber dwellers on its banks. The policy of the general government, when one has been in existence, and of local chieftains, from the most remote times, has always been directed towards the same object, that of canal irrigation, and inter-communication, and these efforts have at times rendered the province a miniature Egypt. But how different the perfection attained in the flourishing days of Azád-úd-Dúlet, when the Kerâh communicated with the Karún, the Karún with the Jerahí, and the Jerahí with the Karún el 'Amah, to the misdirected efforts of petty Sheïks, erecting búnds across the Karún, as at Sáblah, and across the Bahamshír, to fertilize the antique Mesene. One exception exists to this in the labours of the Sheïk Suleïman of Dorák. By his exertions the Jerahí is rendered to the industrious Arabs of Ka'ban, entirely tributary to the purposes of agriculture and pasturage.

The name of the Dijel-i-Shúster, the Tigris of Shúster, offers a corroborative testimony of the identity of the Karún with the Pasitigris of Arrian; yet Von Hammer, who admits this as an irrefragable proof of that identity, still views the Shúster river as the Khoaspes, and the Jerahí as the Pasitigris. But it is in the marches of Alexander, and the campaigns of Eumenes and Antigonus, that we find the testimonies overflow with unexceptionable inferences.

Strabo reads Pasitigris, from its being the union of all the rivers; Pliny, whose Pasitigris is the river resulting from the union of Tigris and Euphrates, as far as the

tide ascended, admits the same etymology; Vincent thinks that the appellation may be derived from Pasa or Phasa, signifying eastern or north-eastern; and Falconer (Notes to Strabo) reads Parsitigris, or Persian Tigris.

The Pasitigris, according to Arrian, ("Hist. Indica," xl.,) and "Anabasis," iii. 17, separated the Uxii from the Susians or Kissei. That the town, and now village of Haw̆áz, may have been in the remote days of the conquests of the son of Philip, also a village under the name of Aginis, there is all the probability of a nearly conclusive evidence. Strabo's account of a place of commerce, *on the Susian lake*, from whence goods were transported by land 800 stadia, or 50 miles, to Sús, agrees also in a most remarkable manner with the identification as derived from Nearchus. The distances are correct; and at the present Haw̆áz there are rocks which prevented goods being taken up the river. These remnants, are in the present day part artificial and part natural; but it is probable that the τους κατορακτας σπιτηδες γεμενους could scarcely mean purposely constructed, although Mr. Long has read it as such. Arrian also uses the same expression.

Both Rennell and Vincent have confounded Haw̆áz on the Karún with Hawísah on the Keráh. They are both Arabic forms of the same root, Húz, "people," or "bodies of men," whence Haw̆áz, and its diminutive Hawísah, which means a small collection of people. Sir Harford Jones says, "Ahouáz Ahw̆áz, or Havisa, more noticed by Oriental writers than Shúster." The búnd across the river was called Híndús; Azád-úd-Dúlet, built a noble mosque, the ruins of which are simply indicated by a mound. Kinneir supposes also the existence of a palace

of Artabanes. Mignan, who was one of the few Europeans who have visited the Karún, mistook the rocks and hills of Hawáz for mounds of ruin*. It was under the earlier Khalifs of the house of Abbas, that it obtained its highest prosperity, until it revolted under Ali Ibn Muhammed, surnamed Prince of the Zangíz. From this moment the power and prosperity of the city fell, and the place gradually sank to its present degradation. The country around was celebrated for its sugar plantations.

Sáblah, or Zablá, is a deserted fort and village, inhabited when the waters of the Karún flowed by their old bed. Sheïk Suleïman constructed a búnd across the river, to turn the waters into their old channel, and fertilize Dorákstán, but the attempt failed. It was the interval between Sáblah and the Bahamshír, which was formerly called the Haffár canal, and not the Mo'ammerah channel, for the Djihan Númá expressly says that this channel, which now drains the Karún, was four parasangas (12 miles) in length.

To resume, then, the tendency of the evidence collected in the foregoing pages, and compared with data historically obtained, is to make it appear that, that evidence is in favour of the identity of the river of Hór-Kúb, with Gyndes of Herodotus; of the Ab-i-Zál, and the river of Díz, with Khoaspes and Eulæus; both the Hór-Kúb and

* Among innumerable quotations to this effect that might be made, I select the following. "Let me not be supposed to exaggerate, when I assert, that these piles of ruin, irregular, craggy, and *in many places inaccessible*, rival in appearance the Baktíyarí."—p. 308. "I could not find any person who had been to the end of these *ruins;* according to the inhabitants, their extent would occupy a journey of two months." —p. 303.

the Ab-i-Zál flowing into Eulæus, and Eulæus into a lake which emptied itself into the sea by Pasitigris.

Of the further identity of Sús and Susa, or Shúshán; of that of the Karún with the Kopratas; of the Shútïte or Múshikrán with the Ab-i-Shúster; the last uniting with the river of Hassmaníyah at Búnd-i-Kíl, to form the Karún, or Pasitigris, which formerly also received the waters of the Shawúr, and beyond the lake, those of Eulæus.

It is not to be omitted, however, that Major Rawlinson, who has personally surveyed the country for a considerable extent, and from whom much is to be expected on the comparative and descriptive geography of these interesting districts, considers the westerly tributary at Búnd-i-Kíl, to be the river of Díz, which corresponds also with the information obtained by the Expedition when at Búnd-i-Kíl. The question is certainly very far from satisfactorily settled yet, and this chapter remains the most theoretical in the work.

Researches on the Geology of the Head of the Persian Gulf.

The researches instituted into the nature of the formations at the northern extremity, or head of the Persian Gulf, were made with a view to establish the circumscription of the alluvial Basin of the Euphrates, the Tigris, and the Karún, or the Delta of Susiana, or of Khusístán.

This inquiry presented the double interest of furnishing new materials in that branch of geology, which more particularly concerns the study of recent formations, and also of illustrating some questions of importance in historical geography.

The examination afforded everywhere a great uniformity of characters, both in what regarded the nature and origin of the formations, their structure and composition, and also the fossils which they contained imbedded in them.

The utmost variety presented, were sandstone conglomerates, sandstones, calcareous sandstones, sands, shelly beds, and beds of aggregated polypiferous lithophytes. Of these, the calcareous sandstones were by far the most predominant.

All these deposits belong to the Pliocene group of the supra-cretaceous rocks, and all contain fossils which for the most part are met with at the present day in the waters of the neighbouring Gulf, and yet these deposits are found to present among themselves evidences of distinct periods of elevation.

The sandstone conglomerates are alone non-fossiliferous They occur in thin slaty beds, on the western side of the

island of Khárij, reposing sometimes on shelly sands, unconformable to the older calcareous sandstone, and comparable to the breccias with pottery (Ceramic formations) of the coast of Karamania, or the shelly deposits raised by earthquakes on the coast of Chili, and described by Dr. Meyen, and by Mr. Darwin.

Another formation, of greater interest, which is met with on the western coast of Khárij, and which is also unconformable to the older Pliocene rocks of the island, consists of three kinds of deposits:—

Upper Beds.—Calcareous conglomerates, with congeries of shells.
Middle Beds.—Compact calcareous sandstone, very shelly.
Lower Beds.—Lithophytic or coral rock. An uniform aggregate of polypiferous lithophytes belonging to the family of Madrepores, and including the genera Caryophillæ, Madrepora, Astrea, and Meandrina.

If this arrangement is compared with the natural historical features of the adjacent shore and sea, we obtain the following results:—

Shore. *Maritime Sands*, with shells and fragments of lithophytes, chiefly ground down and rounded by attrition.
Maritime Sands included in the line of flood and of spring tides. Some shells, lithophytes ground down into powder, and cementing to form a calcareous sandstone.
Water. *Shallow Water.*—Numerous shells and Echini. Some Crustaceæ, numerous Ascidiæ, and a few Actiniæ.
Water of from three to four Fathoms, covered with a uniform growth of lithophytic Polypi in their various structures, the genera the same as above.

In the collections made for the Expedition, the identity of genera and species, more particularly in the conchiferous Mollusks, and lithophytic Polypi, has been illus-

trated by collecting, wherever possible, the living representatives of the fossil species. Such a collection at once establishes the very recent character of this formation, while the circumstances which are essential to the production of another and similar formation, are found to be in actual existence in the same locality, should the same unknown but appreciable forces of elevation, direct themselves upon the same point.

The natives of the island preserve the memory of rents and dislocations effected in their rocky territory by earthquakes, but have no knowledge nor tradition of any portion of the coast having been elevated by a similar agency.

Of a somewhat similar character, though formed, in fact, by the mere agency of high tides and storms, and afterwards covered by sand floods, are extensive beds of pearl oysters (*Margarita*, Leach; *Pintadines*, Lam.; *Avicula*, Cuv.; *Mytilus margaritiferus*, Lin.) in sands on the eastern shore. The pearl fishery of Khárij at one time rivalled that of Bahreïn.

There occur in every part of the coast examples of marine formations that are in actual progress. Among the most striking of these is a strip of lowland due west of Ghoreïn, about two miles in width. The sands consist of particles of transparent quartz and comminuted shells, which dissolving, cause a constant aggregation to be going on, and hence there is no sand flood. It is curious to remark how, owing to peculiar circumstances, shells of one species are observed grouped together in particular localities: large Cones and Strombi are the most common. There are no Madrepores. Another example is the island

of Korgó, where sands almost entirely composed of comminuted shells and Madrepores are daily agglutinating with the other zoological products of the coast.

The other formations of the island of Khárij consist of hard calcareous sandstones, intercalated sand, and soft friable calcareous sandstones, which divide the island into three terraces, of which the western averages about 300 feet in elevation above the level of the sea, and the lowest and easterly terrace about 60 feet.

The upper and hard beds are everywhere nearly horizontal, but repose upon beds of similar rock, dipping often in opposite directions at a high angle of inclination. There are here evidences again, in the Pliocene formations, of different periods of elevation—evidences which are also corroborated by the existence of caves, as are observed in the rock formations of Malta, hollowed out by the action of waves, and occurring in tiers, which must have been successively elevated above the water, or left at separate times by the latter, and that in a more or less sudden manner.

Although the term Pliocene is used here, it is only relatively to the more modern lithophytic rocks; the evidences to be deduced from the relative proportion of living and extinct species, cannot be established without a careful examination of the fossils, compared with the best collections; but almost all the species appear to be recent.

The upper and harder beds, more particularly abound in Echinodermata, Zoophytes, and shells. The sandy beds contain sometimes a vast congeries of Balani, Ostracites, and Pectenidæ, as perfect as if taken out of the sea. The softer rock abounds in a great variety of shells, among

which, the most common on the coast at the present day (certain Trochi, Cypræa Arabica, a Strombus, and an Arca), are also most common in their fossil condition.

The characters which belong to this Khárij deposit have been described with the more minuteness, as they appertain also, with a little variety in the local grouping of fossil remains, to all the formations which occupy the low coasts of the Persian Gulf on its eastern and western sides.

Nothing can be more uniform or uninteresting than the low sandy coast around the harbour of Ghoreïn; it is a desert, void of vegetation and animal life; and, upon examination, is found to present the same calcareous sandstones, sands, and coarse coral conglomerates. To the south of the harbour, these naked tracts do not rise above 200 feet above the level of the sea, and are generally lower; but in the west they give origin to a slightly-undulating country.

The Pallacopas passes through a sandy country in its northern part, but, at its lower portion, and near the site of Zobeïr or ancient Basráh; the sands are found to repose upon this modern marine formation, which is there very compact and fine-grained. This is the present south-western limit of the Basin of the Euphrates.

The islands of Felíchi and 'Ohár are not of alluvial origin, but consist of low beds of coarse marine deposits. The islands seen by Archias would appear not to have been these, but alluvial deposits, which now form part of the mainland. Heeren advocates the identity of Bubíyán with the Icarus of Alexander ("Asiatic Nations," vol. ii. p. 229); there is, however, a total disproportion of distance in the 120 stadia given, which is increased by

bringing the present Khárij into the category. There appears, also, little probability that there was ever population or cultivation sufficient to have rendered any of the islands off Ghoreïn the prominent seat of a worship, which the Macedonians transmitted to us by their own mythological nomenclature.

That part of Farsístán which occupies the coast near the head of the Persian Gulf, and is distinguished as the Dúshistán, is, for the most part, low; and composed, with some exceptions, of marine deposits of similar characters. On this great territorial tract of so much uniformity in contrasted configuration and physical aspect, these deposits form capes, head-lands, and peninsulas, which were often formerly islands, as Abú-Shéhr (Bushire), Rú-el-Shéhr, Báng, &c.; interior tracts, slightly undulating; and even low ranges of hilly ground. The exceptions are, when the sea has deposited more modern alluvia, covered during one season of the year with water, and during the other with saline efflorescences, and generally cementing islands of Pliocene origin, to a mainland of no greater antiquity.

The peninsula of Abú-Shéhr, the Mesambria of Arrian, was formerly an island, bounded by cliffs of little elevation, to the east and to the west. At Rúhílah, at the south-west extremity, there are sandstones abounding in shells; at Rú-el-Shéhr, the Portuguese Bushire, hard calcareous sandstones, with beautiful Echini, and sands which disintegrate with rapidity. At Abú-Shéhr are two beds, of little elevation, of fossiliferous calcareous sandstone. The rest of the peninsula, which is about 15 miles in length, resembles Khárij in its geological characters.

The water furnished by these marine formations is rarely good; there is one spring near Rú-el-Shéhr loaded with hydrosulphuric acid, which, if not resulting from the decomposition of marine organic products, may tend to establish some affinity in the causes of recent elevations with those which belong to the Miocene formations of central Fars, and other districts in the east, which are characterised by deposits of marine salt (*Salmarite*) and sulphur, and by decompositions probably closely related, as evidenced in the production of extensive deposits of sulphate of lime, and the sudden diffusing over the surface of the Persian Gulf, after storms or earthquakes, of naphtha or bituminous products.

The marine formations of the Dúshistán propagate themselves as far as the banks of the Indiyán (Arosis, Oroates, Araxis, or Táb river,) on the coast line; and by Hawáz into the province of Khusístán (Susiana) to the north; and to the west, as far as the islands of Derí and Akiyarín, or Búnah Derí (Dera of Ptolemy?). The circumstance of these islands not being alluvial, which I ascertained in a journey made in a native boat along these coasts, is of much interest, inasmuch as the evidences of geology go to prove the durable character of that part of the coast, putting a fragment of historical geography beyond a doubt, in which all that extends to the westward is more or less involved in obscurity. The recent marine formations (in geognostic chronology) which bound the Delta of Susiana to the east, repose upon the supra-cretaceous rocks of the Persian Apennines, the Lúristan and Baktíyarí ranges, and the mountains of Farsístán.

Structure of that Part of the Persian Apennines designated as the "Ladders," or the Κλιμακες of Diodorus Siculus.

The province of Farsístán, which formerly constituted the whole of Persia Proper, has, from time immemorial, from the distinctness of its contrasted configurations, been divided into high and low country. The Climax megale and Syrtibale of Pliny, are preserved in the present day in the distinctive designations of Sírhád and Gurmisír, or hot and cold climate, although the latter is more generally known as the Dúshistán*, or stony district. The passes by which central Fars is approached "from the plain," were by Diodorus denominated, after the historians of Alexander, Κλιμακες, or ladders; according to Malte-Brun, because they were cut in steps, but in fact, because they consist of a series of defiles, and of terraces or plains, each elevated above the other†.

* The *ú* is pronounced like *a* in *ask*.

† The opinion has been embraced by many writers, that the Kotúl-i-Súkráb, near Kal'at Sífín, one of the longest and most difficult passes in Persia, corresponded to the Ladders of Diodorus, but Sir John Macdonald Kinneir, in his "Geographical Memoir," identified it with more critical correctness, with the straits, called Persian, by Arrian. The circumstances in their description, which decide upon the locality given in the text, are the passage of a plain to reach the Ladders; the occurrence of many passes to constitute *ladders*; the fruitful character of the country, corresponding so well with the former condition of Shapúr, Káserún, and Abduí, particularly noticed by Ibn Haukal, and in the Djihan-Númá; and the circumstances attendant upon the choice of a passage as detailed by Diodorus; this being the only road in the district in which it occurs.

In proceeding eastward from the Dúshistán, to the ancient city of Persepolis, by Shiráz; there are seven distinct plains to be reached by as many, more or less abrupt and difficult, passes or defiles.

Of these plains, two, viz, that of Káserún and that of 'Abduí, are subsidences upon linear axes, and the two lateral chains of hills have each separately an opposed dip, the anticlinal lines of which are parallel to the line of the axis of the intervening valleys or plains,—more correctly plains, as they have no valley path or *thalweg*, or any central stream or rivulet. One plain, that of Dúsh 'Arjún, is a subsidence upon a central axis, and contains a lake; the plain of Khaïst is an elevated table-land or plateau; the plains of Kumárij and Shiráz are of a compound nature, and that of Merdúsht is continuous with the great central levels of Kermán.

The defiles or passes* are sometimes artificial roads, carried up the more or less perpendicular face of a rock, as in the Kotúl-i-Kumárij and the pass called the Dóchter; at times they are roads carried over the minimum of crest of a hilly or mountain range by a summit level, as in the Kotúl-i-Pír-a-Zún; and at others they are lines of division between rocks of a different nature, as at the Dalakí pass and the Tenk-i-Túrkán. The Kotúl-i-Mullú is a gradual ascent by a river-side, till the road is carried up a precipitous rock to gain the plain of Khaïst. The Tenk-i-Allah-i-Akbár is a line of separation between two hills.

* The defiles are called, in Persian, Tenk or Tenkí, and Púl, as in πυλαι, and Kotúl, Kothul, or Cothul. See also Baron de Merciat's Analysis of Von Hammer's Memoir on Persia, in the "Recueil de la Société de Géographie de Paris," vol. ii.

The mountain rocks that are met with in this district consist of sandstones, limestones, gypsum, clays, marles, and saliferous deposits (*Salmarite*), which all in their zoological characters appertain to the Palæotherian epoch, and in their geognostic position are superior to the chalk formation.

Immediately on leaving the Dúshistán by the pass of Dalakí, a formation of coarse rubbly limestone, containing beds of Ostracites, of the genera Ostrea, Perna, and Avicula; of Chamaceæ, and other testaceous Acalepha, which have for the most part *generic* representatives in the existing waters of the Gulf of Persia; has superimposed upon it a formation of brown slaty sandstone, apparently non-fossiliferous. Above this again in the hills to the north are straw and buff-yellow, compact, uniform, limestones; blue, green, and red marles; and gypsum, in thin beds. The strata are very flexuous and contorted, but the general dip ranges from N. 40° W. to north-east.

In the valley of the Shapúr the brown sandstones are succeeded, on the northern banks of the river, by red sandstones, red sandstone conglomerates, and red clays, generally saliferous, which rise in cliffs upwards of 600 feet above the river-bed. The pass of Kotúl-i-Mullú, figured in that admirable work, Frazer's "Persia," is in red sandstone and conglomerate.

The plain of Khaïst, at the top of this ascent, has a soil composed of lacustrine and fluviatile clays, for the most part cultivated, or covered with plants of the genera Glycyrrhiza and Ononis.

Low hills of gravel lead from the latter plain into another country of rocks and defiles. The Shapúr river

is found flowing between high precipices of sandstone, limestone, and blue and earth-coloured clays and marles. The last are frequently traversed by thin veins of fibrous gypsum. The clays are strongly impregnated with saline matters, which, dissolved in numerous streamlets, coat the rock with efflorescences, sometimes pure and white, but more frequently discoloured by the presence of iron in different states of oxidation, and other adventitious matters. The Kotúl-i-Kumáríj, which leads from this district to the plain of the same name, is carried up the precipitous face of a rock about 600 feet in elevation above the foot of the pass. The rocks consist of limestones, marles, clays, and gypsum, which have an inclination from the horizon of upwards of 60°, and hence rise almost vertically to near the summit of the pass, where they curve suddenly round to an horizontal stratification. A small hilly district of limestone, gypsum, and limestone breccia, occurs between the summit of the pass and the plain.

The plain of Kumáríj is about eight miles in length, and five and six in width; it is surrounded by rocks of different characters; to the north, the prolongation of the high limestone ridge which borders the plain of Káserún, descends a short distance, when the beds rise again, to form lofty precipices which front the south-west. In a southern direction the valley terminates by a ridge of limestone breccia, which dips beneath the limestone, gypsum, and saliferous clays, that occupy the whole of the western portion of the valley.

A nearly circular hollow, about 200 feet in depth, occurs in the hills immediately above the village of Kumáríj, at the bottom of which is a fine deposit of rock

salt (*Salmarite*), upwards of 40 feet in thickness, remarkably pure, in homogenous, vitreous masses, which cleave with facility into cubes (*Salmare compacto-clivable*, Beudant). It is generally transparent, but rarely coloured red or gray; it also contains small quantities of crystalline sulphur. It effloresces in stringy fibres, and the excavations are replete with pendulous stalactites and cauliflower excrescences. The beds dip to S. 10° E. at an angle of 17°. They are associated with a brown argillaceous clay, which contains marine salt and bituminous matters.

The Tenk-i-Túrkán, or Turks' Pass, leads from the plain of Kumárij to that of Káserún; it is less precipitous, but equally rocky with the former ones. It is not of great extent, nor is its elevation or descent considerable, It is most interesting, as occupying the line of division between two different rocks, limestone to the south, and gypsum to the north.

It is to be remarked, that the gypsum of the tertiary or supra-cretaceous formations of Fárs differs entirely in its mineralogical characters from that of the same group near Paris; it is homogeneous, crystalline, and transparent.

The valley of Káserún is about 30 miles in length, and seven in breadth, but its southern boundary must be arbitrary. It is shut up on both sides by high ridges of limestone, which dip inwardly on both sides at almost right angles towards the centre, and then, sweeping round at the summit, dip externally in an opposite direction. There occurs, at the southern extremity, a solution in the continuity of this arrangement, by which the strata dipping outwards are separated by a deep rent from those which dip inwards, leaving thus an intermediate space between them.

The northern part of the valley is occupied by low hills of gypsum, a continuation of the Kumárij formation; and the Shapúr river, issuing from the easterly limestone ridge, after flowing past the mountain-environed and antique capital of the Sassanian dynasty, sweeps along this portion of the plain; according to Persian historians, once the seat of culture and of pleasure gardens; but now converted into bog, or occupied by plantations of rice.

The rocky pass, in which the Shapúr bas reliefs are sculptured, is about 30 yards in width at its narrowest parts, and consists of limestone strata, which dips with an inclination of from 32° to 38° to the N. 15° W.*

The same rocks then curve round to the north and to the south in a semicircular manner, so as to encircle a deep vale about two miles in diameter, with mural precipices averaging from 400 to 500 feet in height, and reposing upon a steep slope, which descends double that distance into the valley below.

The celebrated cave of Shapúr, which contains, with the exception of the mutilated remains at Ták-i-Bostán, the only specimen of statuary sculpture in Persia (Frazer's "Persia," p. 204; Balbi, "Abrégé de Géographie," p. 678), is nearly in the centre of the northern semicircle; the outer entrance is about 30 feet above the base of the mural precipices, following in its ascent and descent the

* Morier says the valley is scarcely 30 yards across; Colonel Johnson makes it 200; "truth undoubtedly lies between," says Fraser (p. 201). The intervention of a river impedes a correct measurement. I obtained my data by a base of 200 yards—a rough method at the most; but crossed the river a little below, to copy the sculptures on the right bank, which have not yet been described. Probably Colonel Johnson meant feet.

slope of the beds, which here, as on every side, dip away from the middle of the valley as from a central axis. This cavern, which I succeeded in exploring to its most remote ramifications, is 464 paces in extent, and replete with stalactites and stalagmites, assuming the usual variety of bright and beauteous forms which render such caves so attractive and remarkable*.

At the south-eastern extremity of the valley of Káserún, the ridge of rocks lowers considerably, and terminates in an abrupt rock, from the side of which flows a subterranean stream†, which there is strong presumptive evidence, as well as local tradition, for believing to be the exit of the waters of the plain of Dúsh 'Arjún. These waters also empty themselves into a lake at the southern extremity of the plain.

A little beyond this, the Kotúl-i-Dóchter, or Girls' Pass, (of which a drawing is given in Sir W. Ouseley's travels,) is carried up the perpendicular face of a rock of compact limestone, of a buff and straw-yellow colour, about 600 feet in height; and a road leads over the hills to the plain of Abduí, remarkable for its fine forests of oak, which cover the plain and clothe the slopes of the mountains. The physical circumstances in which this plain is placed are similar to that of Káserún, with the

* Colonel Johnson deprived himself of a magnificent sight by not pushing his explorations a little farther. Mr. Morier does not appear to have been interested in the inquiry; yet the fame of the cave has not been greater for its colossal sculpture than it has for its unfathomable recesses. Fraser and Balbi have alluded to these as first given by Sir W. Ouseley, after Sheïk Zarkúb.

† At this point are some painted sculptures, representing the Prince Timúr (lately a visiter in London), with attendants, a lion, &c.

exception that, to the south, the opposite ridges with an opposed stratification, instead of continuing their parallelism, are prolonged in a curved line, and ultimately meet together.

It is evident that a disposition of this kind throws difficulties in the way of determining the direction of the line of elevation which has prevailed in mountain chains, and may also be said to be more or less incongruous with a constancy of positional developement as affected by the geognostic age, and the attendant phenomena of elevation belonging to these formations; but there is, in fact, nothing that at all suggests difficulties to understand how elevations, which will always take place in the line of the least resistance when formed upon a linear axis, and follow the direction of the upheaving force, may also be modified by altered circumstances of resistance into a more or less curved developement. In such a disposition, we only perceive a transition from a linear to a curved system of elevations, and which may be carried in an extreme case to a developement upon a central axis, or into circular and annular systems more or less continuous, or broken up into segments of a circle, still all co-related by position and by stratification.

It is thus with regard to the relation of the Dûshtistán, with the Κλιμακες of Fárs. In the primary developement of the mountain-land, there are ridges of mountains and hills of the most distinct physical characters, propagated along an easily-determined axis of elevation, as at Kâserûn; these are succeeded at Abduí by a new disposition, in which the operation of powers of resistance equal to those of elevation, or of a diminution in the efficiency of the latter, are observable in the tendency to

a curved developement, which, as might be thus theoretically anticipated, is but the preliminary of the same action circumscribed almost to a point, or to a central axis, in the plain of Dúsh 'Arjún.

There are two passes over the mountains, from the plain of Abduí to that of Dúsh 'Arjún. The southerly one, called the Kotúl-i-Pír-a-Zún, or the Old Woman's Pass, is a road simply carried over the lower part of the crest of the range, being upwards of eight miles in length, and leading directly into the plain. The northerly pass is above the village of Abduí, and is carried in part through a fissure in the rocks, and after surmounting the ridge, leads to the south along a narrow rugged valley, about eight miles in length, and flanked by high and precipitous rocks of lithophytic limestone, reposing upon coloured marles, clays, and thin limestone beds.

This central limestone district is not wanting in fossils. They are Mollusks in the generality of beds, but Zoophytes predominate in others. The most characteristic of the former are Ostracites, Cardiaceæ, and Buccanoideæ, more particularly gigantic specimens of Pernæ and Cones; at Shapúr, Cerithiæ occur, with Turrulites, Belemnites, and Ammonites. Ammonites are also met with above Dalakí. The yellow limestones of the Dóchter furnished most Pectens and Arcæ. It will be impossible to determine the exact age of the supra-cretaceous rock of Fárs, without an accurate comparison of the species with the collections of an efficient cabinet; but from everything that I have observed, I should be strongly inclined to consider them as belonging to the Miocene epoch. There is, however, a chance of error in this deduction, inasmuch as, although the species assimilate uniformly more with the existing

species of the neighbouring seas, both in the Lithophytes and the Mollusks, than they do in the Eocene formations of Europe, this is probably what might be anticipated where the change of climate has not been so great, and where the genera of the European Eocene epochs continue to propagate themselves to the Pliocene and to actual times.

The plain of Dúsh 'Arjún contains a small lake, which is supplied by a subterranean river flowing from the rock by many abundant springs, but the lake has no perceptible outlet.

This plain is succeeded by a country of low hills, composed almost entirely of limestones, marles, and gypsum, until a more lofty range supervenes to the plain of Shiráz, which is composed of sandstones and red saliferous clays, alternating with limestones. Several rivulets with saline water intersect this country, and a fine stream of water that is not saline, flows past the Khán-i-Zenúnd.

The plain of Shiráz is chiefly formed of silt and mud, deposited by waters of inundation, purposely brought over the land for the cultivation of rice, gourds, cucumbers, and other vegetables. I, in consequence, was not enabled to detect either lacustrine or marine shells.

The pass of Tenk-i-Alláh-i-Akbár, from the pious exclamation of countrymen on first seeing Shiráz at this point; is at its commencement entirely composed of limestone, from which flows the streamlet of Ruknabád; but this is succeeded, a few miles further to the east, by sandstones, which are again, in the progress forward, superimposed by limestones;—the same compact rock of coarse limestone, and containing the same shells as that which constitutes the ranges of naked barren hills which here

and there diversify the plain of Merdúsht,—which also form the high and isolated mounts, with castellated remains; of Istakúr, Sheïk 'Usteh, and Shemkarí; by Persian writers called the Seh Gumbedán, or Three Domes. In the Royal Mountain at Persepolis*, the same rock is more homogeneous, and uniformly compact. It is also dark-coloured, from the presence of carbon; and being capable of assuming a good polish, becomes the Persepolitan marble. At the Nák-i-Rustám it is again granular and gray, but often compact.

The banks of the Cyrus†, a name still preserved in Kúr-'Ab, and those of the Búnd-Emír, consist of alluvia deposited during the floods of these waters. The only vegetation the latter can boast of, in the Persepolitan districts, are, certain saline plants (Salicornia and Salsola), much Glycyrrhiza, and an occasional tamarix shrub‡; but the greater part of the plain, when not cultivated, is covered either with Glycyrrhiza or with saline plants, denoting a marine origin to the soil, which was only probably from

* Heeren and Von Hoëk confounded the Double Mountain of Ctesias with the Royal Mountain of Diodorus. Von Hammer called attention to this fact from an investigation of the Oriental geographers.

† Strabo (xv. p. 160) says the name of Cyrus was altered from the original one of Agrodates, by Cyrus himself. Agrodates is not Persic nor Pehlvic. The Agrodates of Strabo is, however, the Búnd-Emír, of which Kúr 'Ab is a tributary. Búnd-Emír is a modern name, indicative of a búnd or dam, by which the waters are arrested about ten miles to the south of Persepolis, and which the author visited in company with Colonel Shee.

‡ "Le Bend-emir renommé par ses rivages verdoyans et ombragés." (Malte-Brun, p. 230.) "There's a bower of roses by Bend-emir's stream." (Lalla Rookh.) A French geographer, probably better acquainted with the Gazels of Hafíz than the Memoir of Kinneir, speaks of "Shiraz sur le Rocknabád."

want of time not corroborated by the discovery of recent marine shells.

This point, referring the formations of the upper part of the plain, whose lowest axis is still occupied by the salt lake of Baktegán, to the recent existence of the sea in that neighbourhood, may serve to illustrate some important points in the ancient history of these remarkable localities.

It is well known that Passargadæ (Strabo), Pasargada (Ptolemy and Solinus), but by Q. Curtius in one place (v. vi. 16), denominated *Persagadum urbs*, and in another (x. l. 22), Persagadæ, and the tomb of Cyrus; have been identified by Sir Robert Ker Porter and Mr. Morier with the Mesjíd-í-Madreh Suleïyman on the plains of Murghâb; but a difficulty still remains, and which the critical acumem of Heeren, Ritter, and Von Hammer has not dispelled. If, as it would appear, Pasargada and Persepolis were not the same place, what was the name of the latter previous to its Greek baptism? certainly not Istakúr, nor Tácht-i-Jamshíd. In nomenclature, Pasargada, Persarum Castra, according to Pliny and Stephanus, is synonymous with Persepolis; the city of the tribe which founded the Kayanian dynasty. Again, if the two places were identical, yet distinct, as regards city and palace, or city and ecclesiastical structures; where is the gulf,—"quo Pasargadas septimo die navigatur," by the Sitiogagus of Pliny, the Agrodates of Strabo? This is the point to which the geological structure of the Merdúsht has reference.

The distances of places mentioned are, according to an Itinerary published in Sir John Macdonald Kinneir's "Geographical Memoir on Persia."

			Miles.
Abú-Shéhr,	or Bushire,	to Alkhanjí - - -	12
,,	,,	Borázjún - -	24
,,	,,	Dalakí - - -	12
,,	,,	Khaïst - - -	15
,,	,,	Kumáríj - - -	11
,,	,,	Káserún - -	21
,,	,,	Dúsh 'Arjún - -	18
,,	,,	Khán-i-Zenúnd -	12
,,	,,	Baghi Shírgah - -	24
,,	,,	Shiráz - - -	3
,,	,,	Zergún - - -	14
,,	,,	Persepolis - .	15
			181 miles.

The synonymes of some of the places mentioned in in this chapter are as follows:—

Dalakí,—Dolaki of Morier.

Khaïst,—Khist of Fraser; Keucht, Dupré; Hicht, Von Hammer.

Shapúr,—Mehaver of Dupré.

Borazjún,—Booruzzoon, Col. Johnson; Baradjoon, Dupré; Berasdjan, Von Hammer.

Dúsh-i-'Arjún, or Dúsh-'Arjun,—Desht-e-Argun, Morier; Desht-i-Erjen and Dustarozoon, Johnson; Dill Stardgin, Dupré; Desh-i-Arzhen, Sir W. Ouseley.

Khán-i-Zenúnd,—Khouné-Zinioune, Dupré; Khoné Zungun, Johnson; Khone Zenioun, Morier; Khan-i-Zenian, Ouseley.

Hamerún Hills.—The western outliers of the hills, at Delí Abbás, consisting of red friable sandstones, with pebbles of quartz, dip 30° to the south-west. All the remaining ridges of the same hills, dip to the south-east. The general direction of the beds, and that of the chain of hills itself, is from S. E. to N. W. The second ridge, in going from west to east, is a gray or blueish sandstone, containing red nodules of a silico-magnesian substance, bearing the same relation to these beds, that the cream-coloured silico-magnesian nodules and veins do to the new red sandstone in England. Beyond are some beds of sand. The third ridge is composed of red sandstones, with occasional thin veins of gypsum, and brown earth-coloured argillaceous beds. The fourth ridge culminates over all the others, and is capped by a deposit of pebbles, which alternate with the upper sandstone beds, and have a contemporaneous dip. This pebbly deposit becomes more abundant on the eastern acclivities, beyond which they are strewn over part of the plain of Karâ Tepeh. The whole of these beds are non-fossiliferous. The greatest elevation is 500 feet above the plain.

Plain of Karâ Tepeh.—The plain of Karâ Tepeh is wide and level. It is for the most part covered with Gramineæ and Artemisia; occasionally cultivated; sometimes gravelly.

Karâ Tepeh Hills.—The Karâ Tepeh hills are composed of sandstones, and red earth, everywhere covered

with limestone gravel. They do not rise more than 300 feet above the plain. The direction of the range is from S. E. to N. W. To the west, the ridges of sandstone are more developed.

Valley of the Náhr-rán.—The valley of the Náhr-rán is for the most part covered with grass or flowering plants, in some parts gravelly. The Náhr-rán, a tributary of the Diyallah, flows through the centre.

Zen-Kabád Hills.—The Karà Tepeh hills are separated by the valley of Kíyor-derk from the Zen-Kabád hills; these do not rise more than 300 feet above the plain, and are composed of coarse sandstone, and sandstone conglomerates, with a slight dip to the east, and everywhere capped with limestone gravel.

Kifrí Hills.—The valley or plain of Kifrí, not above a mile in width, separates the Zen-Kabád from the Kifrí hills, which front the valley, with nearly perpendicular cliffs, rising upwards of 300 feet above the plain.

This chain is composed of alternating powerful beds of gypsum, and red sandstones and clays. The gypsum is transparent, crystalline, laminar, or snow-white and fibrous.

About eight miles to the north-west, a fresh-water limestone makes its appearance; hard, sonorous, with frequent vesicular cavities of a grayish-yellow colour, and with softer beds containing Cyclades. This rock soon supersedes the gypsum, and is at first accompanied by coarse brown sandstones and saliferous sands, but ultimately occupies nearly the whole of the cliffs. The dip

of the strata is generally to the north, a little east, but local variations occur.

The Kifrí hills course, in a remarkably straight line, in a direction N. 70 W. to S. 70 E., for 15 miles, when they curve round to N. 25 W. There is break in the chain behind Kifrï, through which the road to Suleïmániyah passes. Another is four miles to the N. W., through which passes a winter torrent, called Kurí Chaï. Twelve miles from Kifrí a road is carried over the hills to springs of naphtha. Lastly, at Túz-Khurmá-tu, the river 'Athím passes through a fissure in the rocks.

Alí Dágh.—A monument erected on the crest of the hills to commemorate a tradition of Alí having tied his horse to that spot, has given its name to the range to the east of Túz-Khurmá-tú. Below this monument, and on the summit of a knoll, overhanging the river, are also the ruins of a castellated building; and immediately opposite to this, on the south side of the river, are wells, from whence naphtha and petroleum are obtained.

A section on the right bank afforded: 1st, Low hills of limestone gravel, alternating with, or capped by, coarse sands and marles, with beds of variously-coloured red and ochre-brown; yellow, and pink, by feroxides, and hydrated feroxides. Dip 14° N. E.

2ndly, Another ridge of coarse sandstones and marles; Cyclade limestone; granular and fibrous gypsum; and argillaceous shales, sometimes nodular, and blue or black when carbonaceous, or red and brown with feroxides. Dip 26° N. E.

These beds, from which the naphtha springs issue, were abundant in various mineral products, among which were:

Earthy Lignites, black and brown, not fibrous, in thin seams, in saliferous marles and gypseous marles; *Selenite*, in lenticular masses, of a darkish tint; *Salmarite* (chloride of sodium), in efflorescence, and coarsely granular; *Celestine* (sulphate of strontian), in radiated balls; *Sulphur*, small crystallized fragments in Celestine; *Katherite*, pure aluminous earth, non-alkaline, white, in efflorescences; earthy (Websterite); *Malachite*, pulverulent; *Feroxides*, red (peroxide), brown (protoxide), yellow (hydrate of the protoxide), ochre (hydrate of the peroxide); *Phosphorite*, (earthy blue phosphate of iron).

3rdly, A ridge with castellated ruins. Gypsum, opake, granular, and fibrous, in a bed from 10 to 12 feet in thickness. Cream-coloured marles, red saliferous sands and clay, and pebbly deposit, from three to four feet. Gypsum from 12 to 14 feet, succeeded by a powerful bed, about 30 feet, of cream-coloured marles. Dip 19° N. E.

Beyond these hills is a country of tertiary red sandstones, cropping out of the soil in parallel ridges, and alternating with red sand and coarse brown or blueish sandstones.

The general direction of the beds in Alí Dágh, or Jebel Alí, and of the parallel ranges of sandstone beyond, is from S. 50 E. to N. 50 W. That of the hills themselves is N. 25 W.

The naphtha well is 15 feet deep, and filled 10 feet with water, holding various saline substances in solution, but amidst which, chloride of sodium is so abundant, that the water is evaporated during the summer months in shallow pans, and the residue used, without refining, as culinary salt. Sulphuretted hydrogen, or hydrosulphuric acid, is evolved in considerable quantities. About 30

pints of naphtha and petroleum may, it is said, be skimmed off the surface in 24 hours, and the produce of the salt is valued annually at 20,000 piastres. The well is cleaned once a year.

Owing to the difference existing in the direction of the Alí Dágh, and that of the beds, which enter into its composition, about two miles beyond Túz Khurmá-tú, red sandstones, alternating with gypsum, occupy the cliffs, which previously consisted of Cyclade limestone, marles and gypsum.

The hills gradually diminish in height, and are ultimately lost in the plain, about 10 miles beyond Túz Khurmá-tú.

*The Karáchúk-Dágh**, form tolerably lofty hills, on Tigris, south of the Záb; from thence they course by Altún Kuprí to Kerkúk, and are continued to Táók. They consist throughout of Cyclade limestones, gypsum, marles, saliferous sands, and sandstone, having a general dip from 5° to 30° to the eastward. The general direction is from S. 70 E. to N. 70 W.

Two ranges of low hills course to the east of Kerkúk, in a direction N. 70 W. The first rises scarcely 200 feet above the plain, the second about 500. They are separated by a rocky plain, about four miles in width. The westerly range consists of Cyclade limestone and gypsum, the plain of red and brown sandstone, and red saliferous sands; the upper range of the same sands, and sandstones with gypsum.

* The *ú* here is pronounced by the peasants as our *o*. Rich spells it Karáchúk.

The Cyclade limestone varies much in its mineralogical characters; at times a mere calcareous marle; it passes from a friable limestone to a compact, hard, sonorous rock; which again becomes cellular, hemi-crystalline, and concretionary; not unlike an ancient travertino, where masses of slowly-deposited calcareous spar have aggregated in little crystalline centres, leaving cavities between, while the globular portions have a radiated crystalline structure.

This is the character of the limestone deposit at the Abú Géger of the Arabs, the Korkúk Babá of the Turks, both meaning the father of boiling, a place remarkable for the exhibition of flames, which appear to have been in existence from the most remote periods, as they are noticed by Strabo.

Flames of Abú Géger, or Korkúk Babá.—The limestone at this point has entirely superseded the marles and gypsum, and the fires occur in this formation in a little central depression upon the summit of the ridge. The strata do not preserve the general dip, but incline more or less from the same point as a common centre, leaving no distinct anticlinal line.

The spot whence the flames issue has a dull, dusky, and cinereous aspect in broad daylight, and the flames are only visible upon near approach. The evolution of sulphureous acid was so distinct, that many natives could not bear it for many seconds. The thermometer held in the evolved gases rose to 220°. Wherever a spear was thrust into the ground, a new flame burst forth, nor was it the pale, waving, lambent flame of carburetted hydrogen, nor the unsustained light of hydrosulphuric acid in com-

bustion, but a fierce and ardent fire, like that which would be produced by the mingled burning of sulphur, coal, or bitumen.

The examination of the mineral substances scattered around, furnished little variety; but the indications were of a highly speculative character. They consisted almost entirely of altered and calcined limestones; of coke from bitumen, that has undergone semi-combustion; of sulphur, pulverulent and crystalline; and of coarse bituminous products.

The rarer minerals were sulphate of iron, pulverulent phosphates of the same metal, and pulverulent red cinnabar.

A few facts are proved by this investigation. 1st, That the phenomenon of the Abú Géger is not allied to, or connected with, the great volcanic phenomena which act through fissures or rents, or through open canals of communication; from the deep or central portions of the earth's crust, to the circumference. 2ndly, That it therefore belongs to some peculiar and local chemical action. 3rdly, That from the nature of the mineral substances, occurring in and around the site of the phenomenon, various bituminous products, sulphur and moisture, are concerned in its production; and lastly, it does not depend for its existence, to having been accidentally set fire to, for the combustion is subterranean; and, open the soil in any direction within the compass of the same actions, flames will follow.

The phenomenon is closely allied to the combustion of bituminous shales, and carburetted alum slates, as on the coast of the county of Kerry ("History of Kerry, 1752"). At Charmouth in Dorsetshire, at Aubín on the Aveyron, and Dutivielle in Prussia; and as in these cases, the agents

recognised as producing the phenomenon came under actual cognizance, (Humboldt, " Personal Narrative," vol. vi., p. 106.; " Caves of Ballybunian," p. 16,) so in the one at present under consideration; many of the products are simple and compound combustibles, which, as they are observed *in sitú* in neighbouring localities, leave no doubt as to the origin of the flames. The peculiar features in the present case are, the extent of the phenomenon, its exceeding duration, and that it is continued during the most arid weather, according to report.

Not far from the Abú Géger are several wells, from which petroleum is obtained in large quantities. The wells were seven in number, although constantly varying; for, dig where they will, the same mineral oil oozes out, over an area of about 300 square yards.

The formations consist of coarse bituminous beds below, intercalated with Cyclade limestone, accompanied in the upper surface by marly sands; containing granular sulphur. The wells are dug to a depth of from 12 to 15 feet, occupying, in fact, the same position, which it may be supposed is the level of the focus of igneous action in the Abú Géger. The petroleum oozes out from the sides, and from eight to ten gallons are collected from each pit per day. The thermometer indicated in these wells 71° Fahrenheit, which is above the mean annual temperature. White naphtha is called by the Arabs naphtha 'Abiát; black naphtha, or petroleum, Karâ naphtha.

The first ridge east of Kerkúk is low; direction N. 70 W.: consists of gypsum and calcareous gypsum, and sandstone, dipping north somewhat east. The second of these rocks, which I first saw developed at this place, becomes an important formation in these countries, more

especially at Músul, from its application to architectural purposes, being almost as easily worked, and much more durable than gypsum. It is largely quarried at this place, for slabs, pavement-stones, tomb-stones, &c., and is generally designated as Músul marble.

The second ridge consists of brown and blueish-coloured sandstones, sometimes micaceous, alternating with red sands, and rising in low successive ridges, only a few feet above the soil; some of these sandstones are fissile, and other beds slaty, and are quarried for building stones. This country extends over a space of about four miles.

The third district is a country of red sands, reposing on red and brown sandstones, divided into separate rounded hills, or cut by the waters into a system of small valleys, of the customary simple relations, where their formation depends upon denudation solely. Towards the upper part of the district, limestone gravel begins to show itself upon the top of the highest hills.

The fourth district rises out of the sandstone country, and consists of bolder and loftier, but rounded hills, of limestone conglomerate, not cemented, but loose, and the acclivities of the hills are covered with greensward, in the centre of which is Khán 'Ishr.

Beyond, to the Bazíyán hills, is a country of red sands and sandstones, which, towards the centre, dip to the S. 40 W., and after to the N. 40 E., which latter dip to the hills. The sandstones were often conglomerates, sometimes blueish, with white quartz.

Bazíyán Mountains.—To the north of Derbend-i-Bazíyán, or the Pass of Bazíyán, the direction of the hills

is to the west of north about 20°. They are called the Khalkhalán, and bound the plain of Koï Sanják* to the south.

To the south of the Derbend, the ridge is continued in a straight line S. 20° E., and crossed by the Derbend-i-Basterrah, beyond which the ridge continues in the same line, assumes the name of Karà Dágh, and becomes well wooded. Karà Dágh increases in height as it goes south. It is crossed by a third pass, called Sejhírmeh, or Ladders. The Zengheneh comes out west from the Karà Dágh, below the pass of Basterrah, but, turning south, becomes as lofty as the Karà Dágh, to which it forms a parallel ridge.

The Baziyán rises as a bold and rocky mass, about 400 feet above the plain. The strata consist of hard compact limestone, containing species of Trachelipoda, more particularly Conus, Voluta, Pyrula, Fusus, and Cerithium; and of Conchifera; Pectenides, Ostracea, and Cardiacea. From the preponderance of the genera Cerithium, Conus, and Pecten, although specimens were with difficulty obtained, it is probable that this limestone was the representative of the Calcaire grossier of Paris; at all events that it is a tertiary formation.

The beds dip on the west to the S. 40° W. On the east, the hills are cut off abruptly, in some places in a rude escarpment, but in others the beds have an opposed dip, and become afterwards curved and contorted.

The parallel of the Derbend-i-Bazíyán is the line of watershed, between the waters flowing into the 'Athím and Diyálah rivers, and the Altún Kuprí river; and the

* Rich spells the Koï of Mr. Renouard, Keuy; it is more generally written Coït, or Coit.

opening through the chain which forms the Derbend is a break, or solution in continuity, occurring at the point where the chain would have been exposed to the greatest tension, and which forms the culminating point of the base of the range.

The valley of Tabbespí is separated from that of Aléh by another range of limestone, of similar character, which presents bold acclivities to the east, with some caverns. Beyond this is the Mazarágh Dágh, bounded by the plain of Derghezín, or of Suleïmániyah, to the west.

Mazarágh Dágh.—This chain is composed of tertiary limestones, presenting the same fossils, and the same mineralogical characters, as that of Bazíyán, only on the eastern side of the hills, they become argillaceous, somewhat bituminous and non-fossiliferous. The Mazarágh Dágh to the north becomes the mountain of Se'rt, broke through by the river of Altún Kuprí, or Little Záb, and continued above Kalká Simmák towards Koï Sanják, under the denomination of Káshkar.

Derghezín Plain.—The plain of Suleïmániyeh is covered with humus, greensward, or pebbles; where rock can be detected, however, it is an argillaceous limestone, or, as near the town of Suleïmániyeh, a sandstone, remarkable for its tendency to a rhombic cleavage.

Azmír Dágh.—The hills immediately west of Suleïmániyeh are called Azmír Dágh, or Jiozeh hills. The culminating point is to the north, and is called Pír Omár Gudrún, a hill remarkable for its height, and for its rudely pointed or conical form. The formations consist of indu-

rated limestones, apparently chalk. Fossils are very rare, bnt impressions of Ammonites are common, and Belemnites not infrequent. I also obtained some Terebratulæ, and large Ostracea.

Sháhrazúr Plain.—The plain of Sháhrazúr, Sheribazár, or Surojík, is between Azmír Dágh and the Avromán hills, which latter also bound the district of Suleïmániyeh and Sháhrazúr, to the south.

Avromán Mountains and Zagros.—The Avromán mountains are remarkable for their altitude, and their bold rocky and conical forms, and are, during a large portion of the year, capped with snow. They are composed of rocks of diallage, serpentine and eupotide, with some actynolitic and hornblendic formations. The serpentines stretch down into the plain of Sháhrazúr, which is hence uneven and broken up, presenting many varieties of metamorphic rocks, but much disintegrated, or covered with wood.

To the south, the Avromán and Zagros of the ancients appear to be the same; but to the north, the plain or valley of Shamiyán, having a direction of from N. 10 W. to S. 30 E., separates the western from an eastern chain, which preserves its altitude and alpine characters, to the sources of the little Záb, where it is called Kandíl.

At the same time, at the head of the Sheribazár country, a group of mountains called Sersír, advances from the Avromán to the Azmír range, consisting of serpentine rocks, which tilt up, and bear upon their summits or acclivities indurated chalk formations.

District of Altún Kuprí River.—In proceeding northward from Suleïmániyeh, the Mazarágh Dágh, becoming the Abdherám Dágh, exhibits at its base a formation of carburetted marles, accompanied by thin seams of ironstone, which soon attain a considerable developement, and occupy the head of the valley beyond the Pír Omár Gudrún, which forms the line of watershed parallel to the Derbend-i-Bazíyán.

The Se'rt mountain succeeds to the Abdherám Dágh, and is composed of limestones, beneath which are red sandstones and jasper rock, reposing upon the carbonaceous marles, dipping 15° to the west. The latter formations occupy the whole of the base of the mountain, and the plain between it and the Kamshúkah hills, which form the continuation of the Pír Omár Gudrún, and consist of limestone, dipping at a very slight angle of inclination to the west, and hence towering almost perpendicularly above the plain.

Kamshúkah.—The carbonaceous measures consist, near Kamshúkah, of blue and blueish-green marles, brown sandstones, often rhomboidal, with impressions of monocotyledonous plants; of marles, ironstone, and sandstone, and of carburretted marles and ironstones, with veins of carbonate of lime. The dip is variable, but generally westerly, at a slight angle of inclination.

In the valley of the Altún Kuprí river was a conglomerate of serpentine, diallage, and hornblende rocks, with pebbles of quartz, Lydian stone, jasper, limestones, and others.

The mountain of Kamshúkah loses its rugged grandeur, as it approaches the Altún Kuprí river, and is

prolonged to the north-west by a low undulating ridge of marles. Beyond the village of Kal'at Khán, it again becomes a lofty and bold mountain, which throws out ridges that advance across, and ultimately shut up the valley.

The valley of Kal'at *(par eminence*)*, and Kal'at Khán, is occupied by ironstones, bituminous marles, with powerful veins of calcareous spar, and green-coloured and ferruginous marles.

The hills are formed of indurated limestones, which, to the north-east, tower up in needles and fantastic forms.

Kashkár Hills.—In the Kashkár, beds of coarse sandstones, marles, and red sands, alternate on the east side, twice between the base and the summit of the range, where a calcareous freestone forms vertical cliffs. The red sands are sometimes calcareous, forming marles; at others, siliceous and aggregated, as a coarse red sandstone.

On the western acclivity of the Kashkár, the sandstones predominate, and are covered, in a second and lower ridge, by cretaceous marles, which again alternate with a remarkable brecciated rock; and a little beyond, this contain beds of snow-white granular gypsum, 12 to 20 feet in thickness.

Koï Sanják.—This leads the way to an expansive country of red sands and sandstones, containing occasionally beds of gypsum, and which extends to the west as far as the Khalkhalán, the north-westerly prolongation of the Bazíyán.

* A sorry village, where is now a Tell, but no castle.

On this plain, the brown sandstones are often seen to decompose in spheroids, which are very much flattened in their smaller diameters, and are often of vast size.

Little Záb River.—In our latest maps of Western Asia, the little Záb is made to join the Tahití of Kinneir (Tayíat) at Koï Sanják, while another tributary flows into the same river at Altún Kuprí. This system is erroneous. The Tayíat is the only river, strictly so speaking. All the rest are mere rivulets, and the rivulet of Koï Sanják flows into the Tayíat at Altún Kuprí. Throughout its course, the Tayíat is called after the inhabited places it flows past; as Tayíat Chaï, Serúk Chaï, Koï Chaï, and Altún Chaï.

Hamám Múk.—The rude mountain of Hamám Múk bounds Koï Sanják to the north. It is composed, on its southern acclivities, from below upwards, of limestones, red sandstones, conglomerate, red sands, red sandstone, and limestones in powerful beds, dipping at an angle of from 20 to 30° to the south-east.

On the summit of the mountain is a formation of coarse brown sandstone, or grit, containing abundant Ostracites, and some marine bivalves, also serpulites in cylindrical bundles, which, when fractured, presented the interior cavities of the serpulæ, lined with small pyramidal crystals of quartz. In the same rock, there occurred flattened masses, like a congeries of fronds of Algæ, covered with the tubes of a Spio.

On the northern side of the range, and beneath the Ostracite sandstone, was an extended formation of car-

bonaceous marles, in which, after a patient research, I for the first time detected a shell, which belonged to a fresh-water genus, namely, Cyrena.

To the north of Hamám Múk, the country consists of sandstones and limestones, forming two parallel ridges of hills, which course from S. E. to N. W., and generally display at their base carbonaceous marles, while the intervening valley is occupied by ridges and hills of cretaceous marles.

The author's journey through Kurdistán extended to the pass of Bomaspán, in the parallel of Erbíl, by which he left the mountain-country, to descend upon the plain; and at this parallel, as in that of Bazíyán, and at Al'kosh, the outliers are formed of red saliferous sands, gypsiferous red sandstones, and coarse brown sandstones, with occasional local assemblages of hills of circumscribed deposits of pebbly conglomerates.

General Features.—The most remarkable feature in the rocks of Kurdístán is the invariable compactness and hard texture of the limestone rocks, but this only obtains in the mountain districts; for as the indurated limestone of Rum-Kal'ah, on Euphrates, becomes a soft chalk, with many fossils, so the limestone of the westerly ranges of the Persian Apennines becomes, on the plain of Músul, soft, pliable, and redolent with the shells of Trachelopodous Mollusca, and Monomyairous and Dimyairous Conchifera.

Connexion with European Rocks.—In effecting an approximation between the rocks of Kurdístán and the

supra-cretaceous formations of Europe, we shall find a few points presenting very remarkable analogies, where there is so much geographical remoteness.

Swiss Lignites.—Thus, for example, we have in Kurdistán two distinct carbonaceous and bituminous formations; one associated with sandstones, slate-clays, and ironstones, and intercalated between the chalk and the cretaceous limestones; and another affording earthly lignites, petroleum, and naphtha, and associated with fresh-water limestones, marles, and gypsum. The first appears to be represented by the *Terrain marno charbonneux* of Alex. Brongniart, the geological position of which is between the Clastic Thallasic, or plastic clay; and the Tritonian Thallasic, or limestone, with shells of Trachelopodous Mollusca (*Calcaire grossier*, London clay). The second appears, equally distinctly, to be a formation analogous to, although by no means identical with, the Swiss lignites of the Palæotherian group of rocks. This lignite, according to Mr. Voltz, is associated with gypsum in the Sundgau; and the piciform, or pitchlike lignite of Heeren, in the Tyrol, which is still more closely analogous, is associated with marles, and bituminous limestone, containing Cyclades, Lymnæ, Planorbes, &c.

It is a rather curious fact, however, that the minerals of the Soissonnois lignite, which belongs to the Tritonian group, but which alternates with the Palæotherian formations, (Weissenau, near Mayence,) and which are, according to Brongniart, succin, gypsum, Websterite; earthy-brown phosphorite, celestine, hyaline quartz, and pyrites; are almost all met with in the formations of Túz Khurmá-tú, and which belong to the Palæotherian group.

Cyclade Limestone.—The Cyclade limestone is generally known on the Continent, as the Lymnic limestone; but on Euphrates, and in Kurdístán, where it occupies tracts of country, which are as continents compared with the lake-like extent of the same formation in Europe. The almost only prevalent and general shells belong to the genus Cyclas.

Tubular Cavities.—The multitude of tubular and cylindrical cavities, always sinuous, which abound in this limestone in Europe, as well as in the East, appeared to Al. Brongniart to indicate the passing of gas through a soft and viscous mass. It is curious that this structure should be particularly remarkable near the Abú Géger, and would appear to give to the phenomena of local chemical actions producing flames, an antiquity as great as to the deposition of the Cyclade limestones. Brongniart, however, had circumscribed this peculiarity in structure too much, when he supposed it to belong only to truly lacustrine Palæotherian formations, and not to those in which bivalve fresh-water shells are met with.

Protean Sandstones.—The sands and sandstones of the Hamerún, the Zenkabád, and the plains west of the ranges of Palæotherian and Tritonian rocks, appear to belong to the Protean group. There is here a great want of fossil remains, but they were not to be found. The sandstone of the Protean group is often, in Europe, red and yellow, or ferruginous, as at Meudon, near Paris. The Swiss *Knauer* contains calcareous nodules, as do the Hamerún. Near Vevay, the same formation contains selenitic gypsum, as is the case at Delí Abbás and Haváz. The

beds are often argillaceous, as in the eastern Pyrenees, or, as in the Macigno molasse, are composed of sand, lime, a little argil, and mica; and the same is the case in the formations east of Kerkúk; but, as in the sub-apennine hills, the Tritonian rocks, from the absence of the fresh-water Palæotherian formations, confound themselves with the superior Protean rocks; so it appears, that in Kurdístán, the lower Protean formations alternate with, or anticipate, the Palæotherian group.

ROCK FORMATIONS OF THE TERRITORY OF MŪSUL, OF 'URFÁH, AND OF NORTH KURDISTAN.

Formations of the Territory of Mūsul.

Chaldæan Plains.—The plains covered with the villages, and, for the most part, cultivated by Chaldæan Christians, to the east of Músul, are chiefly composed of red sands and gravel, which, when not cultivated, are covered with Graminæ, spiny Compositæ, and Leguminosæ, or scented Labiatæ (Artemisia, Thymus, Origanum, &c.)

Pebbly Deposit.—There occurs on the banks of the Záb, and for one to two miles on the plains on both sides, a deposit of rolled pebbles of limestone, diallage rock, serpentine, hornblende rock, quartzes, jaspers, and Lydian stone. This formation, so extensive, and at an elevation in places of 200 feet above the present bed of the river, appears at first scarcely to be of fluviatile origin; other circumstances, however, point out this to be the case. Thus the pebbly formation on the banks of the Khazír, the sources of which lie much to the west of the central group of the Kurdistán mountains, and arise, indeed, chiefly from the Maklúb and Aïn-el-Safráh hills, are composed of limestone, and their associated flinty slates, only. It is the same with regard to the conglomerates on which repose the walls of Nineveh, which contain, like the pebbly deposit of Tigris, only one pebble of diallage or hornblende rock, to one thousand of lime-

stone. Now, had the local pebbly deposits of the Chaldæan plain owed their origin to any general catastrophe, a conglomerate of similar characters would have occurred in each various position.

The conglomerate on which the walls of Nimrúd (the Larissa of Xenophon, and noticed by the Greek general as having the plinths of the wall of stone,) are built, is like that of the Záb, which, from the elevation it occurs at, may not improbably have owed its origin to the breaking-down of a dyke, or of some natural resistance in the Kurdistán mountains.

Músul Marble.—To the west of Músul the country is occupied by rocky formations, which rise in a gently-undulating territory out of the plain of Mesopotamia. The formations in the immediate vicinity of Músul consist of solid beds of massive, compact, and granular calcareous gypsum, in horizontal strata, and non-fossiliferous. This is the rock which is so extensively quarried as Músul marble. The colour is blueish-white, but sometimes snow-white, and sometimes blueish-gray. The gypsum is not separated by fissures, like that of Paris, and is less slaty than that of Kerkúk.

Cerithia Limestone.—Superimposed upon the gypsum is a thin formation of coarse friable limestone, abounding in shells, among which the genera Cerithium, Murex, Fusus, Pleurotoma, Pecten, Pectunculus, Cardium, Venus, Cytherea, Lucina, and Tellina, have their representatives. This is the most shelly limestone I have met with in the East; it is the common building-stone of Músul. The walls of Nineveh (the Mespila of Xenophon, 17 miles

from Nimrúd, which is the same as Resen, and Larissa,) and of Yarúm Jah (castle near Mespila, where the Greeks halted,) were by the general and historian said to have been constructed, as far as regards the plinths, of a stone full of shells. Leunclavius having opined that these shells might have been sculptured on the walls, a deal of learned trifling has been wasted upon this subject.

Marles.—Above the fossiliferous limestone is a bed, nine inches in thickness, of non-fossiliferous argillaceous marles, highly dendritic, and resembling the shiste happante of Montmartre. Above this is a coarse mass of green-coloured marles.

Sulphur Springs.—On the banks of Tigris, and at the foot of the cliffs of Mar Gabriel, belonging to the same formation as described above, are several thermal springs, giving off hydrosulphuric acid, and depositing sulphur in abundance. They are six in number, of which three are large and copious. The united streams form a rivulet, the waters of which are milk-white from the quantity of precipitated sulphur. According to Saussure, 100 cubic inches of water can absorb 253 cubic inches of hydrosulphuric acid gas. In this case, the superabundant gas is constantly given off from the water; the decomposition of the gas by the oxygen of the air, combining with the hydrogen, causes the precipitation and deposition of sulphur, which extends to many hundred yards beyond the springs.

The temperature of No. 1, was 77°; No. 2, 77.5°; No. 3, 77.5°; No. 4, 78° Fahr. in the soil; air, in the shade, 57°. The temperature iu the well of Dámlámagáh

in Nineveh (Thisbe's well of Mr. Rich) presents, from Mr. Rich's observations, compared with my own, a pretty constant temperature, of 66°, which corresponds closely to what the mean of the summer heats and winter extremes might be supposed to be, and gives to those springs an excess of 11° over the mean annual temperature. They are much resorted to for cutaneous diseases, and considered as warm springs, although in summer time their temperature is often inferior to that of the ambient air. A red byssus was common in some of the basins.

Seramúm Hills.—The gypsum formation extends in a direction of south 10° west, across the plain of Mungúbah, south of Músul, and forms an undulating territory, crowned by the church of Al Ghelani, or of the Antelopes, and beyond which rise the low hills which reveal the monastery of St. Elias, and Seramúm, a country palace of the Pashá of Músul.

The section of these hills at the river-side exhibits, superiorly, the limestone or crag similar to that near Músul, but here attaining a great thickness, whereas at Músul it is only from nine inches to a foot deep; here it occurs in beds of from three to ten feet, and is extensively quarried. Beneath are powerful beds of gypsum, which again repose upon marles of very variable character, being chiefly argillo-bituminous, but also sablonous and ferruginous; springs depositing sulphur, bitumen, and carburet of iron, in small quantities, occur at the base of the cliffs.

Sulphur Mines.—Eight miles from Músul are the

sulphur mines; deposits of that mineral, wrought by galleries worked in open day in the face of cliffs. The rocks consist of crag, or marly and friable fossiliferous limestone, of coarse gypsum, and of hemi-crystalline and nodular marles, containing a bed of granular and hemi-crystalline sulphur, about seven feet in thickness.

The stratification is very indistinct, superiorly curved by faults and fissures, but in the mines the rock dips 5° to the south-west.

The sulphur is compact, fine, granular, and hemi-crystalline; or blueish-gray with calc spar intermixed. It occurs also crystallized in rhombic octahedrons, of a beautiful citrine or of a rich olive-green colour. There also occurs sulphate of strontian, in acicular prisms, and in terminal rhombic prisms.

Hamám Alí.—To the south, the gypsum predominates, but is accompanied by the inferior bitumino-argillaceous marles, from which apparently issue the fountains evolving petroleum and hydrosulphuric acid, at Hamám Alí.

'Uslán Hills.—Nearly opposite to the sulphur mines, and between Nineveh and Nimrúd, at a place called 'Uslán, rocky formations are denuded from the Chaldæan plain. They consist of coarse limestones, dipping from 5° to 10° to the south-west, and support marles and coarse cavernous gypsum; and further to the east these beds are covered by red sandstones and sands. In no cases are these gypsums so coarsely granular and friable as at Montmartre near Paris, or at Abú Bará on Euphrates.

Territory of 'Urfah (Osrhoene).

City of 'Urfáh.—The city of 'Urfáh, so interesting in an historical point of view, is not less so from its geological relations, being built at the point where the hilly and rocky regions terminate, at the rich and fertile plains of Harán in Mesopotamia; and in the hills themselves, the thirsty but not ungrateful chalk soil, is succeeded by black and barren rocks of plutonic origin.

Plains of Plutonic Rocks.—The feldspatho-pyroxenic rocks, consisting of basalts, dolerites, and spilites, with some vesicular and cineritious rocks, form to the east and north-east an extended country of stony masses with rocky ravines, but so distributed, that when looked upon on a large scale, they appear to form almost a continuous upland, but in reality they constitute a rocky and difficultly-accessible country.

Cones of Pseudo-Volcanoes.—In the chalk plain to the north, about 10 to 15 miles from 'Urfáh, the same formations rise in several distinct cones, having an altitude of from 500 to 800 feet above the surrounding country, out of which they arise in almost total geological and geographical isolation: with these are also associated some flat-summited hills of the same formation.

Hilly ranges of Volcanic Rocks.—The rocks of the feldspatho-pyroxenic series again make their appearance on approaching Serúj, and form low ranges of undulating hills, stretching nearly north and south, and extending

in a south-westerly direction to near the banks of the river Euphrates.

Chalk Formation.—With these exceptions, the whole of the country extending between Euphrates and 'Urfáh, from Bír to the south, and Someïsát to the north, including the Nimrúd chain of hills, is composed of the upper and lower chalk formation.

Banks of Euphrates.—Along Euphrates to the east, a few miles north of Bír, the soft white chalk is succeeded by a formation of indurated chalk or compact limestone, which reposes upon soft chalk, and rises on a table-land about 800 to 1000 feet above the bed of the river. This table-land extends, with some, but not extensive, interruptions, by Rumkal'ah to Narsís.

Narsís and Eïdlebazár.—Five miles north of Narsís, a breccia deposit covers the chalk formation, and at Eïdlebazár, a mile beyond this, the feldspatho-pyroxenic rocks form a band of about a mile in width, slaty in their structure, and abounding in garnets and titaniferous iron. To the north, the soft and hard chalk beds alternate in strata of a few feet in thickness, rising at high angles of inclination in hills about 600 feet above the bed of the river.

Someïsát.—From this point to Someïsát, low and regular hills of soft and fissile chalk, formed chiefly by denudation, occupy the banks of the river to the west, with occasional low alluvial plains to the east. The hills are rounder, and the acclivities present a remarkably

uniform slope near the river; while in the interior, conical and round summits are ultimately succeeded by flat summits, which only form successive parts originating by denudation from a plateau or table-land, such as in this case extends to the east at an altitude of about 500 feet above the river from Someïsát to within nearly 12 miles of 'Urfáh. The beds are, however, in some places slaty and argillaceous, and in others deeper and more uniform, compact. The former alternate also with fossiliferous beds, which are more rare in the softer chalk.

'Urfáh and Harán.—Proceeding from Someïsát to 'Urfáh, the country loses its simple undulatory character, being broken up by volcanic ridges and cones, after which there are deep valleys, producing olives, grapes, and cotton, divided by long parallel ranges of hills, composed of chalk, capped by basalts, until, to the east, the basalts predominate, and occupy the whole surface-soil of the upland, as far as to the plains of Mesopotamia; to the south, the valleys open to receive the city of 'Urfáh; while to the east, the chalk formation becomes in the hills of Nimrúd once more a compact limestone formation, at the foot of which extends the rich plain of Harán, composed of ancient alluvia, so fertile, and, although well covered with villages, yet so inadequately populated, that the felláhs cultivate the same piece of ground often only once in three years. The season for harvest is, however, short, and the locust much dreaded.

Geology of Northern Kurdistan.

Rábah Ormúz Hills.—The hills of Al Kósh and Rábah Ormúz are composed of indurated limestone, of similar mineralogical characters, and zoological and geological relations, as the Bazíyán range; and they outlie the ranges of Northern, as the Bazíyán do those of Southern, Kurdístán.

The general direction of the chain is from south-east to north-west. The summits are rounded, and the acclivities gentle to the south, and precipitous to the north; the only exception to this is in a break in the hills, where the monastery of Rábah Ormúz is built, and which renders that spot remarkable from a distance on the Chaldæan plain. The strata are exceedingly flexuous and contorted on the acclivities, although more horizontal at the summit. The chain does not rise upwards of 500 feet above the plain.

At the foot of the Rábah Ormúz hills, are red sandstones in low parallel ranges, having a similar direction as the chain, and dipping to the south-west. These sandstones came across the plain to Tigris, at Bashák, 29 miles north of Músul.

At Bahdínán*, 37 miles from Músul, the chain of Rábah Ormúz lowers to the level of the soil, and is separated by the plain of Kireï-pa, about six miles in width, from the Jebel 'Abíát (Arabic), or Chiá-spi (Kúrd), both

* "Men of good faith," the name of a tribe of Yezidi Kurds, who have many propitiatory monuments, erected to the evil spirit, in this neighbourhood.

signifying white hills, and which at this point is formed of very curved and contorted beds of limestone.

Duleïb Hills.—Opposite to the Rábah Ormúz hills, and as a prolongation of these, from which they are separated by the bed of the Rúbah Ták, are the hills of Duleïb, formed of sandstones and of limestone conglomerate, with a sablo-ferruginous cement, dipping at a very high angle of inclination to the south-west, and supporting red sands and sandstones, which extend southward to the banks of Tigris.

Chiá-spi Hills.—The pass of Turk Sháh, which leads from the plains to Zákhó, through the Chiá-spi, furnishes a good section of that chain. The rocks on the southern side of the hills dip to the south, on the northern to the north. The succession of strata is, to the south, from below upwards, limestones, marles, limestone conglomerate, a breccia of siliceous pebbles and limestone pebbles; limestones, and finally sandstone rocks, which occupy the base of the hills, and stretch into the plains below.

On the north side is the same succession of rocks, only that the siliceous breccia is much more extensively developed, and the sandstones which succeed at the foot of the Chiá-spi form a distinct range of hills, covered with wood, and dip to the north, till near Zákhó, where they are succeeded by hills 200 feet high, composed of powerful beds of sandstone conglomerate, with pebbles of various characters

Zákhó.—Zákhó is built on a similar conglomerate, and is islanded by the Khabúr; and the bridge called Jisr

Delí-sú, or mad river bridge, is carried over the river upon the same conglomerate. The rivulet of Zákhó itself flows through the pass, coming from the Chiá-spi, over successive ledges of rock, till it is received in a small channel, scarcely three feet in width, from which it precipitates itself over a fall, upwards of thirty feet in height.

The Khabúr and the Házil rivers both bring down rocks of serpentine and diallage from the central nucleus of the Kurdish mountains.

To the north-west, the Chiá-spi terminates in a ridge of nearly horizontal sandstone, which advances to Tigris, and reappears on the western side of the river.

Jebel Judí.—The plain of Zákhó, north of Chiá-spi, is bounded by the Jebel Judí, which consists of two lofty ranges, the northern of which advances upon Tigris, north of Jezírah. As the Chiá-spi, to the south-east, amalgamate themselves with the Rábah Ormúz hills, so the Jebel Judí, approaching the Chiá-spi, block up the valley of the Khabúr, and enclose the country of the Nestorian Christians, which, with the Jebel Judí themselves, remains yet to be explored.

At the western foot of Jebel Judí, where the hills approach Tigris, sandstones, and limestone conglomerate with coarse marles, come down to the water's edge, and are, on the western side, capped (at an altitude of 698 feet above Jezírah) by feldspatho-pyroxenic rocks, chiefly basalts and augite rock.

Rock Formations of Taurus.

Plain of Jezírah.—Jezírah on Tigris* appears, by barometrical admeasurement, to be 842 feet above the level of the Persian Gulf, and the plain above averages a mean elevation of 1540 feet, or 698 feet above Jezírah.

The acclivities of the hills are occupied by sandstones and conglomerates, up to within about a hundred feet of the summit, when a formation of feldspatho-pyroxenic rock exhibits itself in stony masses, and with an approach to a spathose structure.

These feldspatho-pyroxenic rocks occupy the whole extent of the plain hence to Tel Sachín, a distance of 39 miles, and consist of basalts, basanites (basalts with regularly-disseminated augite), titaniferous basalt, and dolerites.

The Baarem Hills.—The plain is bounded to the north by the Baarem hills, of which the culminating point rises about 800 feet above the plain. These hills are formed of the same series of rocks, admitting probably of much diversity; but the author had not an opportunity of exploring them.

Beyond the parallel of Tel Sakhán, the feldspatho-pyroxenic rocks disappear, and give place, in the hilly range, to compact limestones, on an advancing knoll of which stands the castle of Hallílah, a predatory chieftain of Kúrds; while the plain lowers, and is occupied by a fertile limestone soil, for the most part cultivated, and covered with vegetable humus of considerable depth in the neighbourhood of Nisíbín.

* Also called Jezírah Ibn 'Omar, or Jezírah 'Omaníyeh, "The Island of the Sons of Omar."

The Baarem, or mountains of Masius, advance in a westerly direction to the parallel of Nisíbín; they then curve to the northward by Dárá, to Márdín, when they turn again to the westward, and bound a very level and low plain (having an average elevation of 1300 feet), to the north. These hills consist of granular and indurated limestone, in curved and contorted beds, and dipping in various directions, but for the most part to the south and south-west; to the north-east they border the country of Jebel Túr, yet unexplored.

Sinjár Hills.—To the south the plain is bounded, first by the Babel hills, low rounded hills, apparently of tertiary sandstones, which appear to form the Mesopotamian continuation of the Chiá-spi, or Jebel 'Abiát, in Kurdistán. Further westward and a little to the south, are the hills of Sinjár, which appear to have somewhat similar geognostic relations; and lastly, these are united by the isolated hill of Kúká to the range of Abdel Hássiz, advancing a little to the north-west, and tenanted by the Míllis Turkoman tribe. These districts are yet unexplored.

Dárá.—At Dárá (an interesting ruin of ancient times), the limestones are fossiliferous, and presented numerous shells, belonging more particularly to the genera Ostrea, Conus, and Pecten, but also Fusus, Pleurotoma, Venus, Cytherea and Cardium.

Márdín.—At Márdín the same sandstone is capped, for about a hundred feet, with a straw-yellow, friable limestone, abounding in Nummulites, and which also occupies the summit of Kal'at Maráh, and the Deïr-i-Yacúb* hills,

* Monastery of St. James.

in the same neighbourhood. In the valley of the Deïr-i-Saffrán, or the Yellow Monastery, the residence of Abú-el-Faráj, three miles east of Márdín, all the limestones present, however, nearly the same deep-yellow tint, but it is only on the hills above, that a predominance of peculiar forms of Cephalopodous Mollusca are met with.

To the north of Márdín, the next range of hills displays carbonaceous marles at the foot of the hills; and below, the Dárá and the Nummulitic limestone.

Crossing this range, the upper formation of chalk is met with, immediately beyond the carbonaceous measures. It presents a friable laminar rock, of a buff-yellow colour, and is remarkably redolent with botryoidal hæmatites. These hæmatites are frequently hollow, when the cavities are filled with calcareous spar; they are in some places so abundant as to form beds.

At Khán Kajúrín (25 miles), the yellow fissile and upper chalk comes in contact with white cretaceous and lower chalk, and contains flints and Echinides, and which occupies the country to the north, as far as to within a few miles of Khán Aghpúr. The country of the lower chalk presents less lofty hills, and the acclivities are more gentle, and the valleys more open, than in the country of the upper chalk series.

Plateau of Diyár-Bekr.—Beyond Aghpúr, and the artificial mound and village of Tóspen Tepeh, a table-land of feldspatho-pyroxenic rocks extends 12 miles to the north, to Diyár-Bekr*; and 16 miles beyond this, to Sherbet Khán. The plateau has a mean elevation of

* The tents of Bekr.

1900 feet, and undulates very little, being for the most part an uniform flat, cut up to the east by Tigris; somewhat irregular near Diyár-Bekr, intersected by two or three tributaries (Charokí-sú, &c.) to Tigris, and rising in the west, in the lofty hills of Karâ-djiâ Dágh, which appear to present a nearly similar constitution.

The rocks on the plain exhibit the same mineralogical characters as the table-land of Jezírah; basalts, basalts with disseminated augite, basalts with titaniferous iron, dolerites, and some spilites, or rocks with nodular cavities of calcareous spar.

To the south of Charokí-sú, the basalts exhibit some low façades, which present an irregular and imperfect columnar structure. These rocks appear to abound also in Iserine (titaniate of iron and uranium), as the mud and sands on the banks of Tigris are almost covered with this black magnetic iron-sand.

Limestone Ranges south of Arganáh.—Two miles beyond Sherbet Khán, the doleritie rocks are succeeded by compact granular limestones, which rise in low hills, forming at this point three distinct ranges; the two southerly ranges following a direction of from S. E. to N. W., while the northerly range sweeps round to join with the second range. The limestones present few shells, chiefly Cones and Ostracites, and some impressions of Pectenides. They also abound in large veins of calcareous spar, and have generally an anticlinal line, the strata being much contorted.

District of Arganáh. The town of Arganáh stands upon a bluff mountain, almost isolated from the sur-

rounding country, having steep acclivities, and capped by a still more precipitous rock. Behind it, or N. 3° W., is another mount of similar forms, called Alí Dágh. That of Arganáh is called Kal'at Dágh, and both attain an elevation of nearly 3500 feet. The town being, by barometrical measurement, 3074, and the chapel of Dúl Kaphál is nearly 400 feet above it.

The valley between Kal'at Dágh and the first ridge of limestone to the south, is occupied by brecciated and quartzose sandstones, alternating with marles, and above this formation are marles, which are yellow and cream-coloured on the acclivity of Kal'at Dágh, but become carbonaceous on the Alí Dágh. On both hills, the marles are covered by a limestone, containing Ostracea, Cones, and Nummulites.

From Kal'at Dágh, a low range of hills, consisting of red-coloured marles and limestones, stretches east.

District of Carbonaceous Marles and Sandstones.—To the north of Arganáh, as far as to the banks of Tigris, the country is occupied by sandstones, marles, and limestones, disrupted and altered by dikes of diallage rock. The sandstones are earthy, friable, often rhomboidal, and in their beds dipping mostly to the south; they contained beds that were highly carbonaceous, and others that were ferruginous.

Between Alí Dágh and Tigris, there are four dykes of diallage rock, the first three not above 20 feet in width, the fourth upwards of 300 feet. These dykes course from west to east. Throughout, they have broken up the beds of the surrounding rocks, and altered their character where in contact. The sandstones are converted

into jaspers, which were of three kinds, one very beautiful, red and green; the second, a porcelain jasper; the third, fissile and ferruginous. The carbonaceous beds were converted into a stone coal, with a vitreous fracture, dark shining surface, but non-bituminous; these deposits of carbonaceous measures, in contact with diallage rocks, are so frequent in this district, more especially to the north of Tigris, that they lend to it one of its peculiar features, often occurring high up, on the steep acclivities of hills, or in deep ravines, which are here very frequent, and from their jet and glossy blackness, visible and remarkable at great distances. The ferruginous sandstones are converted into iron-gray or red rock, and the limestones are also metamorphic. Beyond the fourth diallage dyke, capped with tilted-up carbonaceous beds, is a formation of shistose argillaceous limestone, and of flagstones, forming a small group of hills, which extend to Tigris.

Beyond Tigris, a mountain country is composed of powerful dykes of diallage rock and euphotides, sometimes altered in their characters. The diallage rocks are also often crumbly or ferruginous, generally compact and crystalline.

Traversed, disrupted, and tilted up, or overthrown by these dykes, are powerful beds of altered limestones, of jaspers, and sandstones, and of anthracitous measures; one of these diallage dykes, coursing nearly from west to east, occupies the summit of the first hill north of Tigris, and extends about 200 feet down the acclivity; another occupies a nearly equal extent of the central part of the hill, leaving between them about six hundred feet of limestones, sandstones, and carbonaceous measures. There is little diversity in these formations, till near Ma'den Kapúr.

Ma'den Kapúr, or Copper Mines.—The mountains around the copper mines may be estimated to have a general elevation of from 4000 to 4500 feet; Ma'den being, by barometrical measurement, 3408 feet, and Tigris flows about 800 feet below. These mountains are, Mihráb, west of Ma'den; Mághárát, "the hill of caves," east of Ma'den, containing the principal mines; Puléah Dágh, north; Korás Dágh, N. E.; Zïáret, or Músah Dágh, N. E.

Arganáh Dágh (Kal'at Dágh) bears, from summit of Mihráb, S. 40 E., and Karâ-djía Dágh due south.

From Kal'at Dágh, the snow-clad summits of Dágh Bosmáh bore west; Korás Dágh, N. 8 W.; Sakús Dágh, N. 35 E.; Hosseïn Dágh, N. E.; Zïáret Dágh, or Músah Dágh (Mount of Moses), N. 55 E.

Mineralogical Details.—Mineralogically, the rocks at Ma'den Kapúr consist of, Primarily, A rock of actynolite and quartz, fissile and veined. Secondly, A rock of actynolitic hornblende, (blackish-green, from external characters, apparently a mixture of tremolite or calcareo-magnesian hornblende, with calcareo-aluminous do.), with cerous quartz, or quartz with a waxy lustre. This rock is compact and uniform, like basalt, fine-grained, distinct, or large-grained and crystalline, like some diorites. It is also frequently a spilite, and contains nodules of calc spar, of quartz, or barytes. Thirdly, Diallage rock; an aggregate of crystals of diallage; Serpentine, uniform, compact; Ophiolites, diallage and serpentines, and diallage and steashist or talc shist, intimately mixed; and Euphotides, a basis of serpentine steashist or talc shist, with regularly-disseminated crystals of diallage.

The presence of silicate of magnesia gives a character to all these mountain rocks. The hornblende is tremolitic, the quartz is cerous, the diallage asbestoid; and these are associated with rocks having a basis of silicate of alumina, but in which the rival silicate is always more or less developed. The most frequent and abundant of these is an argillaceous or slaty and sandy steashist, or talc shist, which varies in its colours according to the predominance of iron, of carbon, or of silicate of magnesia, or their absence. The most abundant are the Feroxidated varieties, chiefly brick-red, like the red rock of Killarney; sometimes ochre-red. Next in frequency are the carbonaceous beds, black, and more steatitic; and after these come green varieties, and brown, when argillaceous, or gray, with paillettes of mica, and spilitic, or amygdaloidal, with nodules of chlorite (silicate of iron) of barytes, or calc spar. Veins of barytes, quartz, and calc spar, are also not uncommon, in the various forms of argillaceous and sandy steashists.

These rocks appear all to be metamorphic; the miners frequently meet with fossils, and on the Mihráb are beds containing abundant Cardiacea and Pectenides. They are also associated with sandstones and limestones.

Geological Details. In the topographical details of the distribution of these rocks, the Zïáret, or Músah Dágh, is found to be composed superiorly of limestone strata, which inferiorly alternate with red and black steashists, dipping to the north at an angle of from 30° to 45°.

The hill of Mághárát is composed of red and black steashists, with veins of quartz, barytes, steatite, and

asbestos*; beds of limestone, sandstone, and of copper pyrites†, which latter dip at an angle of from 30° to 40° and upwards to the south 10° east.

These formations are disrupted, and broken up by dikes of actynolite rock, diallage rock, and euphotides.

In the mountains east of Ma'den, four miles, the silico-magnesian rocks are accompanied, superiorly, by an indurated argillaceous limestone, containing abundant bivalve and univalve shells, more particularly Cytherea and Venus, and some Cones and Cerithia, and below by sandstones, containing large Ostracea and Pectenides.

The mountain of Mihráb is composed, on the acclivities, of red and black steashists, which contain several beds of compact copper pyrites, dipping N. 20° W., at an angle of 32°: one of these beds is 40 feet thick. Above these are spilites and ironshot rocks, near the summit, beds of limestone coursing N. 80° E., succeeded by steashists, chlorite slate, and shelly brecciated rocks. The summit is composed of limestone rock, which stretches

* Asbestos is common in these rocks. It occurs in several forms: first, tremolitic or calcareo-magnesian; secondly, actynolitic or calcareo-ferruginous; thirdly, diallagic. The first occurs in long fibres, flexible and elastic, unctuous to the touch, with a silky or pearly lustre, and white or greenish colour, and melts into a white glass. The second is ligniform, of a brown colour, opaque, sectile, friable, easily disintegrated, and often feroxidated. The third occurs in masses or fibres more or less distinct, and of various shades of green, not flexible, and giving a grayish-black glass in the blow-pipe.

† There are upwards of fourteen different galleries carried into the rock, to work these beds of copper-ore, and the annual produce was said to be 150,000 maunds, or 2,250,000 lbs., upon which there is a further loss in the refining furnaces of from 25 to 35 per cent.; 1721 maunds of raw metal yield at Ma'den 154 maunds of metal.

far down the southern acclivity, where it reposes upon carbonaceous steashists and highly ferruginous diallage rocks. The limestones contain few shells, but Cones and impressions of Pectens are easily procured.

Azárdh Dágh, and Lake of Gorjík Gólí.—These details will serve to give a tolerable idea of the general geognostic relations of this part of Taurus, and which is composed of mountains variously grouped, which open beyond Khán Oják (family inn), 10 miles north-west of Ma'den; into the plain of Alendáh, cultivated, and covered with alluvial soil. Almost the last of these mountains in this direction is the Azárah Dágh, which rises upwards of 1000 feet above the lake called Gorjík Gólí, which is, by barometer, 3546 feet above the level of the sea.

The Dawah Boïní Mountains.—Beyond the lake of Gorjík Gólí, a range of hills, called the Dawah Boïní, courses from south-west to north-west, and separates the former country from the district of Kharpút. The crest of this range attains, by barometrical measurement, an altitude of 4246 feet, or about 700 feet above the lake. The geological structure of this chain is precisely similar to that of Taurus around Ma'den Kapúr. The waters which flow from the western acclivities of the Dawah Boïní are the last north-easterly tributaries of the Diyár-Bekr branch of Tigris, and the waters which flow from the eastern acclivities of the same chain fall into the Múrád Sú, a branch of Euphrates.

The District of Kharpút.—The Kharpút Dawássí, or district of Kharpút, the Carcathiocerta of the Romans,

succeeds to the Dawah Boïní, by a fine, large, and cultivated plain, extending south by west, and is bounded to the north-east by the hills of Kosh, composed of limestone rocks, which, near the Múrád Sú, are bold and precipitous, rising about 600 feet above the plain, which is itself 2553 feet above the level of the sea. To the south, the Kosh hills diminish in height, and descend almost into the plain, leaving a low undulating country, by which another and more circumscribed plain is approached, which extends itself, cultivated and populously inhabited, before a bold and almost isolated rock, bearing the town and castle of Kharpút upon its summit, at an altitude of 4125 feet, and about 1200 feet above the plain. The rock of Kharpút consists of hornblendic rocks, steashists, and steatitic quartz rock, supporting nearly horizontal strata of limestone.

Plain of Kúlwensh.—The plain of Kúlwensh is approached by a low undulating country of limestones and sandstones, reposing upon serpentine and diallage rocks, but the greater part of the plain is occupied by dolerites and spilites, which stretch from hence to the north-westward, and rise up to the north of Kharpút into a plateau about 600 feet above the plain.

A small river, coursing from south-west to north-east, runs through the middle of the plain, which is 13 miles in width, and is bounded by the hills of Khútel, composed of limestones, dipping at a gentle angle to the south-east, and reposing upon serpentines; the general direction of the chain being north-east and south-west.

Hills of Khútel.—The hills of Khútel exhibit to the

north, saccharoidal and granular limestones, reposing on ferruginous and decomposed serpentines and diallage rock, which are succeeded by a district of diorites (consisting of white lamellar feldspar and black hornblende), which, highly crystalline in parts, becomes in others much more intimately aggregated and mixed, so as to become almost a basaltic rock. The formation, which is of very little extent (about a quarter of a mile), alters the limestones into a spotted friable rock, and itself decomposes into a sandy product*.

Hills of Kapán Ma'den.—Immediately beyond this, a range of high hills, rising nearly a thousand feet above the plain, course in a direction of from south-west to north-east. On the south side they are composed of white saccharoidal or granular limestone, dipping at a very high angle of inclination to the south-east. This limestone reposes upon a formation of blue, compact, or granular, but slaty, limestone, which has a contemporaneous dip.

The two limestone formations repose upon mica shist (mica slate), which appears in the valley about a mile to the south of the town of Kebbán, and, tilted up by granitic rocks, rises to near the summit of the hills to the south-west, separating there also the superincumbent limestone from the granitic rocks which occupy the acclivities of the hills below. The most productive metallic veins that are wrought in this district, occur at or near the point of junction of the mica shist and the limestones, and the veins, which pursue devious directions,

* This rock contains disseminated gold.

are carried through both formations, and sometimes wrought in extensive natural caverns, from which they branch off in various directions.

Ma'den Gomúsh, or Silver Mines (Kapán Ma'den).—The granitic rock upon which the town of Kebbán (attached to the mines) is built, extends downwards to the banks of Euphrates, and northward rises in mountain masses beyond the river. Near Kebbán, more particularly to the south, the formations are very various, The fundamental rock is a highly-crystalline aggregate of quartz, feldspar, and mica, but in other places there occur a crystalline aggregate of large crystals of white feldspar (albite), upon which is superimposed an ordinary gneiss rock, capped by chlorite shist, through which the feldspathic rock protrudes in dikes, or in unconformable and non-contemporaneous beds. The mica shists are also accompanied in localities by carbonaceous and ferruginous talc shists, and by chlorite schist.

Mineralogical Details.—The first metalliferous product that is met with, is a mineral of a horny texture, massive, often botryoidal, and disseminated through the limestone. It appears to be a corneous silver (chlorure of silver), with an admixture of iron or lead, and occurs in dark-coloured irregular masses, like a formation of the same kind which overlays mines of native silver in Peru.

Between the mica and chlorite slate and the limestones are numerous veins of argentiferous galena, a metallic sulphuret, containing lead, silver in small proportions, antimony and iron; and of a sulphuret of antimony and silver, commonly called red silver, often pulverulent

and earthy, but sometimes compact, with an iron metallic lustre, of a reddish-brown and yellowish colour.

The veins of galena and those of the antimonial polysulphuret are never in juxta-position, or commingled, but succeed or alternate with one another. The direction of the veins is also devious, both in themselves and with regard to one another. The preponderating course is from north-east to south-west, or parallel to the direction of the mountain rock, but the veins also traverse the beds at various angles. The antimonial polysulphuret is most often conformable, and occurs frequently in extensive deposits, probably bellies of veins. No pipe veins were observed. Both minerals become unproductive in contact with limestone, and hence the present mines appear to be nearly exhausted.

The metallic minerals are accompanied by no constant veinstones, but by some minerals. Among these are steatitic clays and carbonaceous shists, which render the working of the mines exceedingly dangerous; for, as the roof is seldom propped up, and when so, in a careless and inefficient manner; this soft material yields to the superincumbent weight, and has entailed the loss of many lives. The next are white steatitic clays (porcelain clay), sulphate of lime, lamellar, in beds and veins, and highly crystalline in large drusic cavities also, diffused as a veinstone; Sulphate of copper in acicular crystals, fibrous, and amorphous, and in efflorescences; Arseniates of lead and of silver, white Carbonate of lead, and Fluate of lime, the white variety.

The antimonial polysulphuret abounds in this district, and to the south of Kebbán, is met with on every hill at the point of junction of the crystalline rocks and the

limestones. It is very unproductive, and yet is wrought both to open day, and by galleries, one of which, at a low level, has been carried to a depth of nearly a thousand yards. This is the only mine that is troubled with water.

Produce.—The mines are now said to yield 13,000 maunds, or 195,000 lbs. of lead; and 400 okas, or 1000lbs. of silver, annually; 130 maunds, or 1950 lbs. of galena, now yield only six to seven lbs. of silver. The same quantity formerly gave as much as 20 to 24 lbs.

District of Kírtchú.—The first hills north of Kapán Ma'den, are composed of granite at the base, with superimposed gneiss and chlorite shist. And on the northern acclivities, limestones, at first compact, granular, afterwards slaty.

This first range is succeeded by the cultivated plain of Modálí, beyond which the limestones are interrupted by basaltic dikes, in contact with which the limestones are compact and hard, but become fissile at a short distance.

Stretching up to Kírtchú, at an elevation of 2284 feet, are nothing but chalk formations,—the same formation having become soft, cretaceous, and containing flints, large Pectenides, and some Echinides.

The valley is much intersected by deep ravines and water-courses, and to the north-west is bounded by hills, composed of alternating chalk and feldspatho-pyroxenic rocks, the chalk not much altered in its characters. A little to the north of this, the doleritic and spilitic rocks predominate, and occupy the summit of a table-land

stretching to near Gúl Dágh. A similar connexion of sedimentary and Plutonic rocks shows itself on the eastern side of the valley.

Gúl Dágh.—The chalk formation becomes an indurated limestone north of Kírtchú; but a deep valley separates these hills from the Gúl Dágh*, a high, almost conical, mountain, whose summit rises much above the surrounding country, and is composed of felspatho-pyroxenic rocks, basalt and augite rock, with spilites and chalk at the base, often much altered.

District of Arab Ké or Arab Kír. (Catch Arab.)—The town of Arab Kír is situate in a narrow valley, almost a ravine, at the eastern foot of Gúl Dágh, and is also backed by high mountains. These hills consisted at their base of mica shist, sometimes anthracitous; and above this a powerful mass (booft) of chalk, alternating with feldspatho-pyroxenic rocks, but in the next range north-east, compact and indurated limestones rise in rugged and precipitous boldness, and stretch over a large extent of country.

Hills North of Arab Kír.—The summit-level of these hills attained an elevation, by barometer, of 4808 feet, and the rocks are composed of indurated chalk, altered rocks, and rocks of the feldspatho-pyroxenic series. The strata, often nearly vertical, present various striking alternations, with some picturesque detail of rocky scenery.

* Lake mountain.

Mountain of Ayelí.—The last hills are separated from a lofty hill called Ayelí, by a tributary to Euphrates, beyond which the rocks rise gradually for a distance of from five to six miles towards the mountain; and consist of feldspatho-pyroxenic rocks, compact, uniform (basalt), earthy and fragmentary (trap), and distinct crystalline, (dolerites,) accompanied by red earth and spilites. The beds of trap are very regularly superimposed in nearly horizontal stratification, and vary from three to ten feet in thickness,—sometimes they are in juxta-position, at others separated by thin beds of red earth, and nearer to the acclivities of Ayelí they terminate with chalk, and the same formation in various degrees of alteration. The mountain itself, however, is composed entirely of the Plutonic rock, and rises up in two distinct summits, the south-western round; the north-eastern, with a remarkable isolated rock, on its top.

The decomposition of the rocky strata below, produces often a curious effect. The angles of the cliff terminate in rude pinnacles of hard rock, isolated by the decomposition of the softer and more friable beds; and these pinnacles diminish in frequency towards the upper part of the cliffs, where sometimes one or two alone, are left, in ruinous isolation.

Valley of Berastík.—The Plutonic rocks stretch beyond the northern foot of 'Aielí several miles, to the valley of Berastík, where they are underlaid by buff and straw-yellow and fissile chalk, with blueish beds, from the presence of small quantities of bitumen, and also with ferruginous beds.

Mountains North of Berastík.—The yellow fissile chalk, probably belonging to the upper chalk formations of the valley of Berastík, is again covered to the north by feldspatho-pyroxenic rocks, presenting more compact and uniform characters than in 'Aielí, and rising to a considerable height; the summit level of the hills beyond Berastík being 4295 feet. To the north, the upper chalk formation shows itself again, and the district is separated by the valley of Kársí, with a mountain torrent, from a lower range of hills, with a very tame outline, which borders the plain of Divrígí to the south.

Territory of Divrígí.—These hills are composed of the same fissile straw-coloured chalk, but occasionally traversed by dikes of basaltic rock, one of which contained a large vein of mesotype, apparently that variety designated as Thomsonite.

The chalk dipped to the S. E. on the southern side of the hills, and north-west on the northern; and, at the east end of the plain of Divrígí, exhibited itself again, as a compact, hard, and granular rock, as in the castle hill.

The river which flows through the plain of Divrígí, is called Ekmáh Chaï. It is a mere rivulet, and flows into a larger tributary of Euphrates, which comes from the north, (forcing its way through the Dumbú Dágh mountains, which bound the plain to the north,) and passes amidst perpendicular cliffs behind the castle hill.

The mountain N. E. of the castle hill is called Castígán, and beyond it is the Gólí Dágh, or Lake Mount. The mountain beyond the castle hill, which separates the Divrígí river from the Ekmáh Chaï, is called Erumbát Dágh. Beyond, to the south, rise the snow-clad hills,

called Yamáh Dágh. All these mountains appear to be composed of indurated limestones, with occasional Plutonic rocks.

The valley of the Ekmáh Chaï, and the soil of the plain of Divrígí, are remarkable for containing boulders of native iron, some of which were three feet long, and one foot and a half in thickness.

The Dumbú Dágh Mountains.—The south-eastern acclivities of Dumbú Dágh are composed of coarse ferruginous limestones, irregularly stratified, and intersected, and broken up, by protruding masses of diallage rock and serpentines; but having a general dip to the S. E.

The limestone is succeeded by serpentines and steashists, which contain abundance of disseminated nodules of oligiste or specular iron. The steashists are sometimes carbonaceous. These formations occupied the crest and summit of the chain, as far as to the north-western acclivities, where compact serpentines, containing white talc, asbestos and steatite, are succeeded by fine-grained granular granite, of a light pink colour.

The granites form at least two separate mountains to the north-west, coursing from S. E. to N. W., with circular precipices, so common in granite countries; fronting the north, on the banks of the Divrígí river, the granite became syenitic, from the absence of mica, and the presence, and gradual preponderance, of hornblende*.

Beyond the bridge by which the Divrígí river is crossed, are some rocky hills of red ferruginous limestone,

* This granite abounds in interesting minerals, more particularly topaz, beryl, schorl, and disseminated gold.

alternating with carbonaceous steashists, and ophiolite rocks, both dipping to the west. The ophiolites here also occurred, as masses intercalated in the limestone. These formations shut up the river in a ravine, which expands beyond, to receive the village of Seliskí.

The hills to the north-east of Seliskí consist of carbonaceous and talcose steashists, with dikes of diallage and of actynolite rock, and compact beds of dark-green and light-green serpentine, regularly alternating; associated with these were a breccia of sandstone, with nodules of jasper and serpentine, red rock, and pink and gray limestones. Specular iron was not infrequent in these rocks, and a very spare vein (one-eighth of an inch) was met with of sulphuret of silver, in a curious mineral of pisolitic chalcedony.

Gypseous Formation.—To the north-west of Seliskí, the limestones and ophiolite rocks are succeeded by powerful beds of gypsum*, which rise into a lofty hill-district, and ultimately alternate with coarse brown sandstones and sandstone conglomerate. These two rocks, the gypsum always predominating, occupy the country to the valley of Sinján, and beyond that to Yárbassán, a distance of thirteen miles. Siliskí is elevated, by barometer, 3352 feet; the crest of the gypsum hills rises to

* The mineralogical characters of this gypsum were, to the south, a compact, uniformly granular rock, of a snow-white colour. In places it is a congeries of crystals, irregularly aggregated; and to the north, a friable coarse-grained gypsum, of a light-brown colour, and easily disintegrated. Rivulets meet with little obstruction from this rock, and often course in subterranean channels, passing beneath rocky precipices, and reappearing at short distances.

4250, and the culminating point of the same formation does not attain an elevation exceeding 300 more. Yárbassán on the acclivity of the Karâ Bel mountains, has an elevation of 4219 feet.

Karâ-Bel Mountains.—The Karâ-Bel mountains are among the first of the woody chains north of Taurus. The crest attains an elevation of 5790 feet, and the culminating ridges rise from 800 to 1000 feet above that. The range is composed of serpentines and carbonaceous steashist, with dikes of euphotides and ophiolites; and outlying formations to the south, of sandstones, argillaceous, slaty, and shining, near the magnesian rocks; slaty and rhombic in the plains, as at Yárbassán. To the north, are gypsum, marles, and sandstones.

District of Kotní.—This is, territorially speaking, an extensive district, formed of level plains, covered with greensward, or cultivated, and traversed by low ranges of gypsum, sands, and marles, with occasional sandstones and conglomerates, as near Suáz (Sívás). These hills are remarkably uniform in outline, scarcely rising 400 feet above the plain, and have a tame continuous outline, with slightly precipitous fronts facing the north to N. E. and N. W. The sands are sometimes saliferous, and near Sívás, contain rock salt*.

District of Suáz, or Sívás—Suáz is built upon a rock

* This district appears to correspond in its geological characters with that around the salt lakes of Kodj-hissár, and through which Mr. W. J. Hamilton traced several volcanic erruptions to have occurred, in modern times, more especially at the foot of Hassan Dágh.

of travertino, which is still observed forming in a ravine among gypseous and limestone hills to the north. A few miles from Suáz are rocky masses of gypsum, indistinctly stratified, and calcareous marles, and limestones, very cavernous; and succeeded by fresh-water limestones, with Cyclades and Paludinæ, in horizontal strata, which give origin to a level table-land, about five miles in width and fifteen in length; and cut at its confines into deep ravines by water-courses. A culminating mountain point, of some altitude, called *Yuldús Dágh*, or *Mount of Stars*, rose out of the plain to the north-west. Its structure was not determined.

Chamlú Bel (Mountains of Fir.)—The crest of these mountains, which, as their name indicates, are covered with pine forests, attains an altitude of 5260 feet, and the culminating point, scarcely rises above 500 to 1000 feet higher. The chain is composed of ophiolites, serpentines, steashists, often carbonaceous, traversed by dikes of actynolite rock, often decomposed, and then friable and ferruginous. On the southern acclivities are limestones and sandstones; and on the northern side these form massive rocky ranges, through one of which a rivulet finds its way by a magnificent rocky arch.

Beyond the Chamlú Bel is the cultivated plain of Báúlús, which separates the last-mentioned chain from the Kushanlí Dágh, which may, however, be looked upon as a portion of the same system.

Kushanlí Dágh.—Kushanlí Dágh, like the Chamlú Bel, is covered with wood, and the crest scarcely rises 800 feet above the plain of Báúlús, which is 3338 feet

above the sea. The northern acclivity of the same range, however, descends abruptly into the valley of the Kisíl Irmák at Tókát, where it flows at an elevation of about 1400 feet; Tókát being 1577 feet. The Kushanlí Dágh is composed of mica shists, serpentine, green talc shist, and limestones, that are compact, granular, and slaty dendritic. A rocky knoll at the foot of these hills, and upon which the castle of Tókát (the Eudoxiaria or Eutochia of the Romo-Cappadocian territory,) is built, consist of a base of mica slates, upon which repose indurated and non-fossiliferous limestones. Gariyás Kal'ehsí, a ruin of more modern times, is built on a knoll of limestone in the ravine which leads from the Kushanlí Dágh down to the city.

Territory of Gatán, or Akló Dágh.—This is an extensive district, composed entirely of mica shists, and covered with wood. It lies north of Tókát, and was visited on account of the report of a mine having been discovered there, which turned out, after penetrating 15 miles into the forests, to be merely a formation of decomposed mica, with a glistening metallic lustre. The mica shist also contained common garnets and cubical pyrites. The mean elevation of this country averaged 4000 feet above the sea. Between the village of Serpín in this country, and the valley of Túrkhál, a high conical mountain exhibits clayslate in its structure, and afterwards roofing-slate becomes frequent, and is succeeded by a country of limestones, which extends to Túrkhál, the old castle of which (Sebastopolis) stands upon a knoll of limestone, superimposed on mica shist, which does not, like that of Tókát, shut up a valley, but towers out of the centre of the plain, through which flow the waters of the Kisíl Irmák.

Túrkhál Hills.*—The hills of Túrkhál, attaining an inconsiderable elevation, are composed of tertiary sandstones and limestones, reposing upon mica shists. They are succeeded by an extensive plain, beyond which rise up the hills that lead to Amásiyah. These hills have on their southern side a similar geognostic structure, limestones, with pectens and cones, and coarse friable sandstones reposing upon mica shists.

District of Amásiyah.—The Yeshíl Irmák, or Green River †, forces its way through the hills by a narrow pass, in which stands the town of Amásiyah, and above which the limestone rocks tower in precipices nearly a thousand feet in height. When any stratification is visible, there is a slight dip about 30° to the west and north-west. The mica shist shows itself at one or two points. The rock with the castle and tombs, is called Jebel Jiyamík; that opposite, Feráhád Dágh. The limestone hills which separate the valley of Amásiyah from the plain of Merzífún, are less indurated and granular, and the hills are of a very inconsiderable height.

Merzífún Hills.—The range of hills which bound the plain of Merzífún to the north, are immediately behind Merzífún, about 10 miles from the southern hills, and

* Túrkhál, or Túrhál, (Terhál, Otter, ii. 333,) also called Keshán Kal'ehsí; Jehán Numá, p. 623, was the ancient Kal'ehsí.

† The Kisíl Irmák, the antique Halys, appears to owe its name to the red colour given to its waters by the earth which in another form (a silico-magnesite,) became the Bol of Sinope, or Armenian red. From the absence of colour the Amásiyah river was designated as the green river.

rise scarcely 800 feet above the plain. They course from east to west, and are composed of alternating strata of chalk and of feldspatho-pyroxenic rocks. A more lofty range to the west presents mica shists and limestones, with mines of argentiferous galena, which are said to produce 350lbs. of silver annually.

Menzil 'Ashiki.—This name, meaning Inn Lovers' Stage, belongs to a post and guard-house, at a pass through the same hills. The rocks consist of limestone, tilted up by and reposing upon mica shists, which form the axis of the Merzífún hills. In proceeding through this pass, the limestone begins to predominate; and gives origin to some fine alpine scenery.

'Osmánjik.—Beyond the pass, another range of hills is traversed, which exhibits chalk and altered rocks in contact with feldspatho-pyroxenic rocks and trachytes. This was the only spot in which that rock had hitherto been observed. Beyond are some low undulating hills of yellow fissile chalk, carbonaceous marles, sandstones, and clays, stretching down into the cultivated plain of 'Osmánjik, or Little 'Osmán, out of which rise two or three isolated rocks, composed of sandstones reposing upon trachytic rocks, one of which is pierced with sepulchral grots; a second bears the ruins of a castle, and two or three obelisk-like masses, towering above surrounding houses, are made the homes of birds, protected by a wise superstition.

Territories of Aïn-Táb, Kilís, and Antioch.

General Features.—The hilly district of Aïn-Táb (the Roman Commagena) is a country of denudation, composed of low rounded hills, with deep transverse valleys. The formations consist almost everywhere of the upper chalk formation associated at spots or broken up by feld-spatho-pyroxenic rocks.

Nizíb Hills.—The Nizíb hills, north-west of Bír, and celebrated for their olive-groves, are composed of fissile yellow chalk, often dipping in an opposite direction; for example, in the ravines west of Tel Bálkís to the north-west; in the valley of the Kersín to the south-east.

Valley of Kersín.—The chalk formation in the valley of the Kersín, where it flows through the hills, becomes argillaceous, and forms round clayey hills, sometimes, as at Rás-hild, capped by a chalk conglomerate.

Káfér Dágh.—On the Káfer Dágh, or Hills of Unbelievers; a formation of limestone superior to the chalk, first shows itself upon the summits of the hills, which, being of a harder nature than the underlying fissile chalk, it causes to terminate often in abrupt cliffs. This limestone contains Cones, Ostracites, and Pectens.

Aïn-Táb.—The rocks around Aïn-Táb consist entirely of the chalk series, and here the upper beds, reposing upon the yellow chalk, are white, cretaceous, but slaty and fissile. There were some large caverns in this formation,

the roofs of which were covered with large Crinoidea. The rock is also deeply fissured, and the clefts are sometimes filled with flint and argillaceous iron ore.

Karák Weyú.—To the west of Aïn-Táb the rocks of the feldspatho-pyroxenic series show themselves, first at Karák Weyú, and consist of calcareous spilites, trap, and basalts, occupying low rounded hills or isolated knolls, and stretching nearly due north and south. The valleys of the fissile chalk, now mostly indurated, extend at nearly right angles; the valleys become narrower, the acclivities steeper. At Kavís the basaltic and metamorphic rocks make their appearance again, and keep reappearing at intervals, till they finally predominate over the chalk formation several miles to the west of Kilís, where they are superimposed upon and alternate with the chalk formation, and rise in cliffs of from two to three hundred feet above the plain below.

Kilís.—The hills of Kilís consist of trap and basalts superiorly. These decompose often in round masses, or are sometimes spathose in their structure, having a tendency to columnar arrangement.

Beneath this is a formation of chalk, slightly altered in characters, and dipping with the feldspatho-pyroxenic rocks to the north.

Below the chalk are trap rocks, calcareous spilites, and thermantides, passing again into chalk, of a greenish-yellow colour, and argillo-calcareous nature, generally compact and hard, and forming an excellent building stone, used in the erection of barracks by the architects of Ibráhím Pashá.

At the foot of the hills of Kilís, and to the south and south-west, the plains are occupied by an extensive formation of calcareous spilites, which vary somewhat in their characters, as they neighbour or distance the hills.

Red rocks, presenting fractures with vitreous surfaces of oxidated iron, also abound in nodules of calcareous spar, distributed however in various quantities, and differing very much in size, from a pea to a hen's egg.

In the spilites of the plains, the calcareous nodules are uniformly disseminated, and preserve nearly the same magnitude throughout.

If the chalk and accompanying Plutonic rocks had dipped to the south, the chalk formation might have been expected to prolong itself also in that direction, but this is not the case, and beyond the calcareous spilites, the territorial surface is occupied by limestones superior to the chalk.

Plains of Northern Syria.—The upper chalk formation of Bír extends westward as far as the Sajúr river; here it is succeeded by a formation of limestone conglomerate, dipping westward, and separating from the chalk an upper formation of coarse calcareous limestone, particularly characterized by a predominance of shells belonging to the genera Conus and Voluta, and also containing species of Ostrea, Cardium, Cytherea, Lucina, Cerithium, Fusus, and Pyrula.

This formation occupies the whole extent of the plain of North Syria, for the most part cultivated, and averaging, according to the geodesic levelling of Mr. Thomson, a mean elevation of 1300 feet.

Cyrrhestica.

Territory of Azáz.—To the west of the plain of the Chalus, and immediately beyond Azáz (the Arsace of the Itinerary), the Conide limestone rises in bluff cliffs, stretching from north to south, about 500 feet above the plain, while to the south they extend in an indurated form.

This ridge, in its northern prolongation, is called the Lelín-Dágh, extending in a south-westerly direction by Sheïk Barákát, as far as to the district of Armanás, and sending off to the west the Angulí Dágh, which ultimately flanks the valley of Orontes to the east.

These limestones are much broken up and altered, in the valleys to the westward (at Basúl and north of Ghindáris), by feldspatho-pyroxenic rocks, and their accompanying spilite formations.

The valley of the 'Afrín, which flows past Basúl and Ghindáris at an elevation of 500 feet and less, is separated from the valley of the Karà-sú by a range of chalk hills, of uniform outline, and which contain at their foot local formations of feldspatho-pyroxenic rocks, as at Al Hamám, in the plains to the westward, and at Murád Pashá.

Al Hamám (Thermal Waters).—The basalt of Al Hamám* has a basis of blueish-grey colour, dull lustre,

* Al Hamám is so called from its thermal springs, which are of recent origin, and, according to a local report, obtained by an European medical officer in Ibráhím Pashá's service, and who had been employed by the Pashá in the construction of a suitable bathing-house, had ap-

and contains crystals of augite. That of Gúl Báshí, or Murád Pashá, has a similar basis, and contains bottle-green olivine, transparent chrysolite, and light greenish-brown garnets. Sometimes they are dark-coloured and ironshot, sometimes earthy (trap) and vesicular, approaching almost to common cinereous lava.

Territory of the Upper 'Afrín.—To the west of Kilís are trap conglomerates and calcareous spilites, breaking through a formation of indurated limestones, dipping generally to the south-east. About six miles from Kilís the limestone is succeeded by Ostracite sandstone, which occurs in thin beds. An argillo-siliceous rock, of friable structure and coarse texture. This formation also dips to the south-east at an angle of about 7°.

The sandstone enters into the composition of a double range of low rounded hills, which extend to the banks of the 'Afrín.

Beyond the 'Afrín the chalk makes its appearance, rising into a hilly but not barren country, and as it approaches the vale of the 'Afrín, is cut into deep ravines and valleys. The dip is very various, but the most general inclination is to the south-east.

In crossing over this sub-alpine country, which is, for the most part, covered with wood, more particularly gall-

peared during different earthquakes. The spring which was pointed out as having occurred at the latest shock, exhibited a temperature of 99.5°, and contained Confervæ, frogs, and tortoises; another, which had appeared at an antecedent date, was 98.7°, evolving much hydrosulphuric acid; a third presented a temperature of 98°, and a fourth 77°, emitting no gaseous matters. The elevation of these springs above the level of the Mediterranean is about 400 feet.

bearing oak-trees, and between the villages of Karkín and Kursíslí, the chalk varies much in its characters, becoming frequently argillaceous, with a slaty structure, and at other times highly anthracitous, with veins of Lydian stone and flinty slate. The hill of Kursíslí is thus formed of argillaceous limestone at the base, and compact limestone at the summit. Near Rajú Koï, in the same country, is a small lake and rice-grounds.

Valley of the Karâ-sú.—This hilly country terminates at the valley of the Karâ-sú, which separates it from Amanus, or Jáwúr Dágh; and in the parallel of Rajú Koï, the valley is occupied by feldspatho-pyroxenic rocks, the river marking the line of division between these and the argillaceous limestones, which form one or two isolated hills at Karâ Bábâ.

Feldspatho-pyroxenic Rocks.—The remarkable district of feldspatho-pyroxenic rocks, which presents itself at this point, does not rise to any height, but, on the contrary, when viewed upon a large scale, appears like a plain.

These rocks consisted of basalt, with a light, blueish-coloured basis, with vesicular cavities, occasionally filled with mineral substances. These basalts contained, disseminated, bottle-green olivine, transparent chrysolite, and light greenish-brown garnets.

The predominant structure was the amorphous, often running in streams, overflowing in superimposed, unconformable beds, or elevated in irregular ridges. The next dominant structure was the spathose, but in general there was rather an approach to regular polyhedral forms, than any perfect and continuous developement; but in every

direction, the plain presented continuous surfaces, which exhibited polyhedral divisions like a great tessellated pavement.

The third kind of structure, the circular or concentric, was also not uncommon. This structure did not show itself in the present case as in other basaltic districts, by the developement of balls, or masses of rock in concentric layers, but in a general tendency to a circular disposition of the beds themselves, and also in the formation of great circular cavities in the rock itself. In the first case, the concentric layers were often observed to be repeated over considerable spaces, the completeness of the circle being interrupted not only by waving lines, but also by basaltic dikes, and ranges of imperfect columns, the pillars dipping at a slight inclination to the north-west. Sometimes the surface was occupied by one uninterrupted convex bed, but more frequently the latter are broken in the line of the axis of the greatest convexity, forming fissures of greater or less extent.

Isolated hills, or groups of hills, with a rounded outline, rise out of this plain to a height of from five to eight hundred feet. These hills are composed of diallage rock, and red steashist, in a state of decomposition, and much disintegrated at the surface.

Plain of Chateli.—The feldspatho-pyroxenic rocks are separated from Amanus, by a rich and fertile plain (Chateli); but they reappear under other forms, on the acclivities of that chain, at the village of Ada-búrn, where they are associated with quartz rock. The basalt is siliceous, of a light blue colour, and glistering lustre. This basalt occurred in vertical dikes in a spilite, with cavities incrusted with chalcedony.

Territory of Antioch. (Antákíyáh.)

Circumscription.—The territory of Antioch includes the plain designated as 'Umk, or Valley, *par excellence*, and sometimes 'Umk of Uerem, inhabited by Nomadic Turkomen, and the lower valley of Orontes.

The Plain, or 'Umk.—The plain, or 'Umk, is in part occupied by the lake called Denghíz Agá, and the remainder by lacustrine deposits, forming a nearly level plain, at an elevation, according to Mr. Thomson, of about 365 feet above the Mediterranean. This lacustrine deposit is everywhere characterized by the Melania costata (fig. 1), a shell not common in European cabinets. Species of Bulimus (*Bulimus labrosus*, fig. 2,) Paludina, and Succinea, are also not uncommon in the upper parts, and the genus Helix (*Helix cariosa, &c.*, fig. 3,) has many representatives on the plains. The lacustrine deposit may be judged to be 200 feet in thickness.

Fig. 1.

Fig. 3.

Fig. 2.

Valley of Antioch.—The lacustrine deposits are tilted up, and occupy a various inclination, but never excessive;

at the gorge of the valley of Antioch, and on the plain north of the city, the character of the deposit is no longer the same, but presents blue clays, and sandy and marly beds like silt. The fossils are chiefly agglomerations of Carditæ, associated with lacustrine shells now more rare, and the formation is one which indicates an estuary or inlet of the sea.

Pebbly Deposit.—This formation becomes, on proceeding westward, covered by a deposit of pebbles, often consolidated into breccia, and consisting of diallage rocks, euphotides, serpentines, quartzes and jaspers, and metamorphic rocks, which belong to the surrounding mountains. This deposit is elevated 400 feet above the Mediterranean.

Sandstone Formation.—The valley of the Orontes, still more closed up by mountains, presents to the westward an undulating territory, with rounded and conical hills, composed of coarse sandstones, earthy and friable, which alternate with pebbly beds and coarse non-fossiliferous marls. In a hill beyond a ziáret, (whose white-washed walls render it remarkable on the road,) the beds are nearly horizontal, and to the westward, dip at an angle of 5° to the north, 30° east.

Mount St. Simon.—Beyond the Great Karâ Chaï, a tributary to Orontes, the mountain of St. Simon, with a ruined church and convent, and called Bín-Eklisí, or the Thousand Churches, has protruded itself upon the valley to the north of Orontes, and on the plain beyond this, sedimentary formations are covered by a powerful bed of

transported pebbles, at an elevation of 400 feet, till descending into the fertile district of Swedíyah, a formation of marine marles and limestones, often however covered with gravelly deposits, manifests itself, extending in low hills and undulating country as far as to the plain which extends from Seleucia Pieria to the rock south of the embouchure of Orontes.

Organic Remains.—This rock was found to contain several shells that are still to be met with in the Mediterranean, among which were:—Clavagella aperta, Solen candidus, Mactra triangula, Tellina planata, Lucina divaricata, L. lactea, Venus verrucosa, Cardium sulcatum, and C. edule, Pecten operculum? Natica glaucina, Trochus fagus, Turritella tornata, Cerithium vulgatum, Pleurotoma vulpecula, another unknown, Fusus lignarius, F. strigosus, Cypræa rufa. And among those not known in the Mediterranean, were:—Triton intermedium, Pyrula ficoides, Fusus subulatus, Cerithium tricinctum, and Pecten scabrellus; and there still remained a large number of undetermined species.

Plain of Orontes.—The plain of Orontes is composed of mud-silt, which lies in horizontal beds, and is probably at its western extremity upwards of 300 feet in depth, and contains marine shells, such as are common to the neighbouring shores, with the actual river-shells of the Orontes, and the land-shells of the neighbourhood.

General Results.—From these facts we gather that the territory of Antioch was most probably, at one period, an inlet or estuary, if not an inland bay of the Medi-

terranean, in which the formations tranquilly deposited were tilted up at the gorge of the valley, while the formations which were carried down to the sea with more quickness and irregularity, were raised up (as they also would have been deposited) beyond the point of gradual sedimentary accumulations; while beyond all these, pure marine deposits have also been raised up from the deep sea. A formation of transported pebbles has at the same time, from some local circumstance of drift, been thrown over two separate portions of these formations, and lastly, since that event, the salt waters of the bay of 'Umk have been gradually freshened, and ultimately converted into a fresh-water lake, which itself has been progressively diminished in size, during the progress of which the bay formations have been covered and supplanted by lacustrine deposits; while at the mouth of Orontes are river and marine deposits, which have in a similar manner been increasing since historical times*.

* Pococke found the ruins of the ancient port of Antioch, at a distance of nearly two miles from the sea. Nearly a mile to the west of the basin which constituted that port, is the site of the ancient port of St. Simon, near which are the ruins of a small church and khán. The present port is a little further to the west, and about a quarter of a mile from the bar of the Orontes.

Casiotis, and Territories of Ladikíyéh and Upper Orontes.

Jebel Akrá, or Mount Casius, seen from Gúl Bashi, the "Head of the Lake," with the Hills of Antioch in front.

Casiotis.—The hilly or mountain district south of the valley of Orontes is composed of the Jebel Akrá, with an outlying summit to the west, continued by the Jebel Chaksínah, and the hill of Antioch, to the east, as far as to the southern valley of Orontes.

This district comprised the Casius of the ancients and Anti-Casius of Strabo, (lib. xvi. p. 751), which extended to Cœlo Syria.

To the south the hills of Antioch, of which Casius forms a part, are continued by the Jebel Kráád to the Nosaïrí mountains, which again are continuous with the Lebanon or Libanus. Casius only terminates to the

south with the plain of Ladikíyéh; it is, however, a part of the Antioch system, by structure, and by its topographical relations; and Casius, and Anti-Casius, are brought into connexion with Rhossus and Amanus, by the hill of St. Simon.

The celebrity of Casius dates to a very remote antiquity; and it was, from its height and remarkable appearance, long the seat of superstitious rites, as it afterwards concealed the proselytes of a true religion.

Seleucus Nicator having invited the descendants of Triptolemus to Antioch, the inhabitants of that city used long afterwards to give heroic honours to Alexander's general, and to celebrate a festival on the summit of Mount Casius*; even so late as the time of Julian the Apostate, sacrifices were made by the monarch on the summit of the mountain†. Pliny (lib. x. 39, 27,) relates that Jupiter, yielding to prayers addressed to him on Mount Casius, sent birds, called the Seleucidæ, to destroy the locusts. So great a number of birds live on locusts in Syria, that it is difficult to say what species is so nobly designated by Pliny; Cuvier considered it to be the Turdus Roseus, the Smurmur of the Syrians. In the island of Lemnos, the Graculus (Choucas) was formerly venerated on the same account. At the Cape of Good Hope the locust-bird is also a species of Turdus.

Casius appears to have derived its appellation from Kás, with the customary Latin termination, as Kóh Kás, became the Caucasus of the Romans. Pococke looked upon the western summit as the true Casius, but without reason; and Parisot, with equal incorrectness, called it

* Strabo, lib. xvi. p. 750.

† Ammian. Marcell., lib. xxii. cap. xiv.

" le pic le plus septentrional de la petite chaine qui court septentrionalement de Laodicea à Antioche*."

Burckhardt, Volney, Adrien Balbi, and others, have looked upon Casius, and the Nosaïrí hills, as effecting a

* Pliny relates of Casius (lib. v. xviii.) " Super eam mons eodem, quo alius nomine Casius cujus excelsa altitudo quarto vigilia orientam per tenebras, solem aspicit: brevi circumactu corporis diem noctemque pariter ostendens ambitus ad cacumen xix. pass. est altitudo per directem iv." Aristotle originally notices the fact (Meteor. lib. i. p. 16). Ammianus Marcellinus repeated it (lib. xxii. chap. xiv.), and Pomponius Mela and Lucian (xv. 34), by inadvertence, relate the same of the Phœnician Casius. The results given by the barometer, as observed by the author on the summit, and at various heights, compared with a register kept at the same time by Lieut. Eden, R.N., at the foot, coincided closely with the results obtained trigonometrically by Lieut. Murphy, R.E., and which latter gave for the elevation of Casius above the sea, 5318 feet. At an elevation of about 1000 feet the rising of the sun commences about one minute sooner than at the level of the sea,—hence rather more than five minutes would be gained by an ascent of Casius.

By observations similarly carried on, the following results were obtained:

	Feet.
Village in valley west of Casius - -	1338
Summit of Pass—(minimum of crest, summit-level of a road) — region of yellow asphodel - - - -	2460
Zone of Pyrus and Anethum fœniculum	3494
Zone of birch-trees, violets, and pansies -	5012
Summit of Mount Casius,—	
First observations, first day, -	5361
Second observations, second day -	5322
Mean - - - -	5341
Bivouac station—forest of birch and larch -	5206
Ruins of Christian church - -	4068
Village of Beshkír - - -	2513
Myrtle districts - - - -	1548

connexion between the Lebanon and Amanus, and hence geographically connecting the systems of Taurus and Libanus; and this view of the subject is further supported by the geognostic structure of the chains.

Diallage Rocks.—The diallage rocks, and their associates, which form the basis of Amanus and Rhosus, show themselves immediately behind Antioch, at the foot of the hill, and to the east of that point; to the west still more frequently, as in the valley of the Aqueduct, from Daphne, and at Babílúr. The same formations advance into the valley of Orontes, at the foot of Bín-Eklisí, or Mount St. Simeon. They do not show themselves at the northern foot of Casius, but occur in the deep valley to the south-west, where they are accompanied by altered rocks.

They also occupy an extensive district at the south-eastern foot of Casius, and rise into a subalpine chain, covered with forests, which extends to the valley of Náhr el Kebír, in the parallel of Ladikíyéh, advancing also in narrow dikes across the river, at the extreme north-easterly termination of the plain of Jebilí, and also crop out to the west in a ridge that advances over the bed of the stream two miles to the south-west of the village of Vatíro.

Chalk Formations.—The chalk formation shows itself at the south-western foot of Casius, in the proximity of the sea, immediately beyond the cape, called Rás Basít. It occupies about eight miles of the shore, forming cliffs from 30 to 80 feet in height.

To the east, the chalk is met with more extensively

developed, forming two ranges of hills, about 700 feet in elevation, coursing nearly from north to south along the valley of the Náhr el Kebír. The westerly of these ranges consists of alternating beds, of compact chalk and of cretaceous non-fossiliferous marles, and is oftentimes abrupt, fronting the river, with naked precipices. The village called Bilat is singularly situated at the summit of the hills, and is approached by a tortuous and difficult path.

At the termination of this valley the river turns to the west, and is separated from the plain of Ladikíyéh by an upland, composed likewise of chalk, which terminates to the north, generally in an abrupt escarpment, but sometimes in a low sub-range.

The river of Ladikíyéh, called Náhr el Kebír, or Korásh river, issues from the Jebel Kráád, a country of chalk, consisting, for the most part, of hills of tame and rounded outline and barren aspect.

Beyond the mountain of Okabí*, the river is seen flowing along high cliffs of the same formation, prolonged to the north until they come in contact with the diallage rocks, where they form abrupt escarpments.

At the head of the valley, the Korásh descends from the mountains by a deep and narrow ravine, which, in its deepest part, probably exceeds 60 feet, and is scarcely eight feet in width. Maundrell, who travelled along this road in 1697, gives it a depth of 30 yards, and tells a legend in connexion with the natural phenomenon.

Jebel Kráád.—The mountains which occur at the

* See Maundrell's Tour.

head of the Ladikíyéh river, and form the watershed between it and the Orontes, are called the Jebel Kráád. They constitute the northern prolongation of the Nosaïrían hills, which they thus unite with the outlying ranges of Casius and Anti-Casius.

Nosaïrí Hills.—The crest and acclivities of the Nosaïrí hills are nearly uniformly barren, and void of forests; differing much in this respect from the diallage ranges of the north. Their outline is tame, and two sub-conical hills, surpassing by a very small quantity the general elevation of the chain, which hardly exceeds 1000 feet, form the culminating points. The chain is steep towards Orontes, or the east; while to the west it descends in low irregular hills into the plain of Jebilí. As far as the author had an opportunity of examining, it was a continuous range of chalk.

Valley of Bedámí.—In the Jebel Kráád, hard and soft beds of chalk, alternate pretty regularly in strata, dipping in different directions at slight angles of inclination. Sometimes, the softer beds being denuded and carried away, the harder rock is strewed, in huge masses, over the valley. In the plain of Bedámí, the soft and hard beds are separated, by considerable intervals, and in consequence of this, give rise to differences in the contrasted configuration of the soil. Above Jisr Shúgher the chalk formation is succeeded by gypseous marles, but beyond this it forms a long and remarkably continuous range, which stretches almost beyond the reach of vision, bounding the valley of the Upper Orontes, to the west, with a great rampart of rock.

Tertiary Sandstones.—The valley of Cœlo-Syria, or southern valley of Orontes, at its northern termination, is for the most part level, but is also interrupted by rising ground and low ranges of hills, which are generally found to be composed of clays, frequently indurated, and disposed in nearly spherical masses, but still more frequently in thin argillo-calcareous strata, more or less horizontally disposed.

To the west, the same valley is bounded by a range of hills, which extend in nearly a straight line towards Jisr Shúgher. The acclivities are for the most part gentle, but at times they break off abruptly into shingly escarpments. The beds consist of sandstones and clays, distinctly stratified, and containing abundant Ostracea.

This formation immediately reposes upon the chalk formation of Jebel Kráád, and the diallage rocks, which extend southward from Casius to Bedámí. In the interval it forms low ranges of hills, often more or less circularly disposed; and these are succeeded, on the opposite of the valley of Orontes, by the supra-cretaceous limestones of Armánás, and by the same limestones above, or south of Orontes, at Antioch.

Supra-cretaceous Limestones.—The supra-cretaceous limestones of Casiotis occupy the summits chiefly of the hills to the north, commencing not far from the west of the vale of Cœlo-Syria, forming the crest which bears the ancient ramparts of Antioch, and extending from thence, by Daphne and Jebel Chaksínah, or Ordú Dágh, to Casius, which is composed, from its base in the sea, to its conical summit, 5318 feet high; of indurated limestones, containing occasional Cones, and impressions of Pectens.

Mineralogical Characters.—The mineralogical characters of the Conide limestone, are those of a compact hard rock, with an uneven, often sub-conchoidal, fracture, a close-grained, uniform texture, and a dirty-white or yellowish-white colour. It is sometimes slaty, and of a softer and less uniform texture.

Its stratification is generally distinct on the plains, and is also generally so, on the acclivities of hills and mountains, and on the face of cliffs and precipices. But sometimes, in isolated mountain masses, more especially when these assume a conical form, all stratification becomes obliterated; and as, under similar circumstances, quartz shist becomes quartz rock, so the limestone becomes compact, massive, and uniform.

The organic remains of this formation were not abundant in Casiotis, where it is chiefly an altered limestone, and are therefore described where they occur in a softer rock, more abundant, and more distinct. There are, however, fossiliferous and marly beds in this limestone, as at Náhr el Djé, east of Antioch, and to the north of the fountain of Zoïba.

Breccias and Shelly Limestones.—In proceeding southward from Antioch, the next valley is occupied by marly fossiliferous limestones, upon which is superimposed a cretaceous or limestone breccia; and over this again are strewn boulders of siliceous limestone, cavernous and water-worn, like the meuliére of Paris, but not forming a continuous rock. To the south, the Conide limestones form another ridge, beyond which are low hills with flat tops, formed of a soft, very shelly limestone, reposing on marles and brecciated rocks. The shells were chiefly

Pectenides, Ostracea, Cardiacea, belonging to the genera Cardium, Venus, Donax, Lucina, Tellinides; also Cerithia, Pyrulæ, and numerous Echinodermata.

Pass of Beït al Moïe (Daphne).—At the pass of Beït al Moïe, the Conide limestones are succeeded, by red and white coloured cretaceous breccias, alternating with cretaceous marles, which sometimes rise into low rounded summits, and at other times have superimposed upon them a deposit of siliceous limestone.

Sheïk Guí.—To the east and west of the village of Sheïk Guí, the siliceous limestone (resembling precisely, in mineralogical characters, the formation of similar age in the basin of Paris,) assumes a considerable importance, and forms independent ridges and hilly ranges.

The siliceous limestone, from its great hardness, occurs in very stony ridges and acclivities; or in rocky precipices, presenting a diversified and fantastic appearance. Some miles to the south of Sheïk Guí, (which itself is built on the inferior cretaceous marles,) the siliceous limestone is met with, tilted and broken up by the diallage formations.

Gypsum Deposits.—Local and circumscribed deposits of gypsum are met with first at the north-eastern foot of Casius, not far from Orontes, where the gypsum is transparent and highly crystalline, and associated with cretaceous marles, with Cyclades, and other fresh-water shells. Another formation of gypsum, with marles of a less crystalline character, occurs in the hills north-west of Jisr Shúgher. In these marles, no shells were detected during a very cursory examination.

General Results.—The hilly district of Antioch, commonly called Casiotis, appears, then, to have consisted of a great tertiary basin, which has been disrupted and broken up, and its various formations confusedly mingled, and topographically removed from their former sedimentary associations, to a degree that occurs in no other tertiary basin that has hitherto been described.

Territory of Apamene.—The valley of Cœlo-Syria, or southern valley of Orontes, is bounded to the east by the hills of Armánás, which stretching south, form the hills of Sháhshabú, and the Isáwí or Ber'ímí hills of Burckhardt; names confirmed to the author by the Sheïk of Kal'at el Mudík.

These hills form abrupt cliffs, on the side which fronts the valley of Orontes; but on the other side descend gently towards the plains of the great Syrian desert, the mean level of which is above that of the upper valley of Orontes. They send out several spurs, as at Reïha; the hills of which are separated from those of Armánás, by the valley of Howásh. The plains are also cut by ravines, as at Mar'ash and Edlíp. The hills of Armánás are continuous to the north with the Amgulí Dágh, or hills of Sheïk Bárákát, the mountain of St. Simeon Stylites.

Felspatho-Pyroxenic Rocks.—Rocks of this series, presenting little variety in mineralogical characters, exhibit themselves in this latter district, on the plain northwest of Mar'ash, and in Cœlo-Syria south of Jisr Shúgher.

Jawur Dagh and Akma Dagh.
Amanus and Rhosus.

Direction.—The direction of Jáwúr Dágh* is from S. 20° W. to N. 20° E., and that of Akmá Dágh is from W. 10° S.E. to 10° N. The two chains are nominally separated by the pass of Beïlán†, but they are, in reality, continuous with one another. The Jáwúr Dágh attains a greater altitude than the Akmá Dágh, the culminating points being to the north. The average elevation of the Akmá Dágh is a little more than 5000 feet above the Mediterranean; that of the Jáwúr Dágh is from 5000 to 6000 feet.

Contrasted Configuration.—The culminating points of the Jáwúr Dágh are more pointed and peaked than most of the other parts of the range, which, however, is frequently serrated, and also presents, at times, bluff precipices of limestone; the general outline being nevertheless rounded. The Akmá Dágh, in their northern prolongation, consist also chiefly of rounded hills, which are more continuous, above the valley of Antioch, than on the side of the Gulf of Iskenderún; and the range becomes more peaked and serrated in its prolongation towards the sea, in the Jebel Kaïserík, or Kaïserík Dágh.

* Jáwúr, commonly Giaour Dágh, "Infidel Mountain."

† The pass of Beïlán is, by barometrical admeasurement, 1584 feet above the Mediterranean; a Christian church in ruins, zone of Valonea, Quercus ægilops, and other oaks, 2698 feet; Kúrtlú, or Village of Wolves, 4068 feet (this village terminated over an abrupt precipice); summit of the Beïlán mountain, 5337 feet.

Músah Dágh.—The Jebel Músah, or Músah Dágh, the mountains of Moses, which occur at the south-western extremity of the Akmá Dágh, are composed of a detached mass of limestone and their upheaving rocks, and at the maritime termination reach the ruins and excavations of Seleucia in Pieria; while an imperfect junction is effected with the mountain district of Casiotis, by the upheaved mass of Jebel Símán, or Mount St. Simeon.

General Structure.—These chains are composed, elementarily, of talc shist, quartz shist, quartz rock, and felspatho-pyroxenic rocks, of diallage rocks, euphotides, ophiolites, serpentines, and steashist, uplifting metamorphic rocks, and tertiary sandstones and limestones.

Talc Shists.—Talc shist is not a common rock in Amanus, but occurs in the centre of the mountain masses, and in the midst of extended formations of serpentines and diallage rocks, passing into a variety of adjunct rock formations. For, as rocks with a predominance of silicate of alumina (felspar rock, clay-slate, &c.,) will generally be found developed to a greater or less extent at the base of hilly or mountain ranges, chiefly composed of clinkstones (phonolite), claystones (argillolite), slate-clay, and associated amygdaloids (spilites) and porphyries, as in the Pentland and Cheviot ranges of hills in Britain; so rocks with a predominance of silicate of magnesia, form the mineralogical as well as geognostic basis of districts, in which there is an extended developement of serpentines, ophiolites, euphotides, diallage rocks, and earthy or slaty steashists.

If, as some modern mineralogists think, the green

diallage or smaragdite of the Verde di Corsica is only an Uralite, a mineral which effects a transition between hornblende and augite (pyroxene), it is easy to understand how also, minerals, in which, in their normal condition, there is a preponderance of silicate of lime (tremolite, hornblende, augite,) and which form one series of rocks, when associated with felspar; may form another, when associated with talc and serpentine; and assume the mineralogical characters of actynolite, diallage, and Uralite. In Taurus of Sophena, acicular crystals of green actynolite are common, grouped as an actynolitic rock, or porphyritic in serpentine; and in Cyrrhestica, between Azass and the valley of Karâ-sú, there occurs a formation of green hornblende (lamellar, and in imperfect oblique, rhomboidal prisms,—Uralite?) in a basis of flesh-coloured and gray felspar. The green colouring matter of serpentines, steatites, etc., appears to be variable, at times owing to the presence of oxide of chromium (noble serpentine), at others of chlorite; according to Berthier, an oxide of iron and manganese; and hence, in some places, associated with chlorite shists and chloritous spilites (Ma'den Kapúr, Durdún Dágh*).

* In connexion with this order of ideas, it is worthy of remark, that talc, considered as a simple substance; laminated, scaly, or compact; gray, green, or white; not elastic; easily scratched; infusible; with a composition, M. Si^3 en M. Si, according to Berthier; is generally mixed with M. Aq., the composition of native magnesia or Brucite, according to Dr. Fyfe. It is associated with serpentine in the mineral called Marmolite, a gray or greenish substance, with a foliated texture, and not flexible; and which, by its composition, would appear to be an hydrated olivine; a circumstance which has been admitted by Beudant as strengthening the opinion of that substance being nothing but a talcose matter, strongly calcined or melted. Talc is further associated

Diallage Rocks.—The rocks which contain diallage most frequent in the mountain chain, are, Diallage rock, an aggregate of crystals of diallage, chiefly metalloid diallage, but sometimes green-coloured, lamellar; Ophiolite, an intimate mixture of diallage and a green-coloured, horn-like basis, with a cerous lustre, which may be in various places; talc, steatite, serpentine, or jade or euphotide; in which latter a similar silico-magnesian basis contains disseminated crystals of diallage; and hence it becomes the porphyritic rock of the series.

Various Rocks.—In addition to the above-mentioned crystalline rocks, a number of different aggregates were met with in pebbles in rivulets, river banks, and on the sea shore, which apparently came from the same mountain chain, which was only very partially explored in its higher districts. Among these were rocks of serpentine and quartz; of serpentine and limestone (Ophicalce, Al. Brongniart); of serpentine and hornblende; the two latter are abundant in the bed of Issus river. The pebbles on the shore at Iskenderún, consist almost entirely of limestone and syenites, serpentine and hornblende, heliotropes, jaspers, and quartzes.

to substances containing silicate of lime, in Wollastonite (Tafelspath). It also passes into steatite, of which, from Vauquelin's analysis, it may only be a shistose variety; or rather, steatite should be considered as a compact, fine, scaly, and cerous varicty of talc. It is the same with regard to the pagodites, or figure-stones of China, which have not yet been fully examined. Nacrite, a substance consisting of white grains, each divided in little unctuous scales, of a pearly lustre, and met with in the micaceous and talcose rocks of the Alps, has similar mineralogical relations.

Metamorphic Rocks.—This is a subject of considerable difficulty, and upon which the details, from want of prolonged researches, can only be approximative. Serpentines becoming slaty or shistose, are generally designated as steashists, to distinguish them from talc shist, which is a more perfect rock (one which preserves its normal characters through large tracts intact). The steashists of Amanus and Rhosus become anthracitous, and, on Jebel Kaïserík, contain beds of anthracite and pitchstone, at an elevation of 5000 feet; but the most important change, in a geological point of view, is their passage into argillaceous shists, from the preponderance of silicate of alumina, and into sandstones, which belong to the tertiary period. At such a point of junction, as is well exhibited, for example, in the deep sections of the town of Beïlán, in the pass of the same name; the most common rock is a slate-clay, or argillaceous shist, with veins of calc spar; the next in succession is the same shistose or slaty rock, with disseminated paillettes of mica; and these finally pass into coarse arenaceous, but slaty, sandstones. The slate-clays present two additional varieties: being of a light-greenish colour, where associated with steashists; and still more frequently in the same associations, anthracitous, and varying in colour from blueish-black to indigo-black.

When the same deposits are in contact with diallage rocks, as in the valley, west of Casius, they are converted into jasper, thermantides, and porcellanites.

Formations at the Eastern Foot of Amanus.—It has already been shown, that at Adá-búrn, in the parallel of Baïás, but on the opposite side of Amanus, quartz rocks are associated with siliceous basalt and chalcedonic spilites.

The quartz rocks along the eastern acclivity are sometimes granular and compact, at other times become granular and loosely aggregated, and finally pass into arenaceous and sandstone rocks. As they approach Pagras, these sandstones are associated with conglomerates and indurated limestones, which are beneath the sandstones.

Formations at the Southern Foot of Rhosus.—These are also chiefly limestones, conglomerates, and sandstones, which have contemporaneously tilted up on their sides, the bay formations of Antioch, the sandstones of the valley of the two Karâ-sûs, and the Pliocene marles of Swedíyah, which latter rise high up upon the acclivities of the Músah Dágh.

At Seleucia Pieria, the rocks consist of indurated limestones, tilted up by diallage rocks, which latter rise up to the north, nearly to the summit of the range; but are overtopped, by a few hundred feet, by the limestones. This is in the Músah Dágh; for to the north, the Plutonic rocks rise to the summit of Jebel Kaïserík, according to Captain Beaufort, 5550 feet above the sea*.

Formations at the Northern Foot of Rhosus.—The plain of Arsûs is almost everywhere occupied by a conglomerate of pebbles from the neighbouring mountains. But on the shore, about three miles to the south-west of the village, there is a formation of coarse sandstones, containing gypsum in thin seams, fibrous, and transparent,

* By barometrical observations, which can only be approximative, Jebel Kaïserík was 5326 feet in elevation; the first cone westward, 5216; the second, 5091; limit of pine-forests, 2750 feet; bivouac station, 2975 feet.

from a quarter to three-quarters of an inch in thickness; and also large and small nodules of the same mineral, lamellar or opaque, snow-white, and radiated. The sandstone beds are from two to three feet in thickness.

A country of low hills extends at the foot of Rhosus, from Arsús to the plain of Iskenderún, which the author had not an opportunity of examining.

Formations at the Western Foot of Amanus.—Marshes of Iskenderún.—The marshes in the neighbourhood of Iskenderún, of such melancholy celebrity, for their fatality to Europeans; appear to occupy a spot taken from the bay, by the gradual accumulation of gravelly detritus; causing a gradual increase of land, ultimately filling up the inlet, and shutting out the sea; while, at the same time, the interior being lower than the bank of detritus on the shore, has caused the waters of abundant springs (Jacob's well) to spread themselves over the land. These have, however, in later times, been much drained. At present, the marsh is formed of a boggy soil, containing much iron and mud, with Anodontæ and other fresh-water shells; while below, beds of sands and marles, with recent marine and littoral shells, were turned up in digging the drain.

The building of Godefroy de Bouillon's Castle, would indicate a change in the condition of the soil; and in an old Italian chart, the author has seen it marked as close to the shore, from which it is now nearly a mile distant. Major Rennell proposed an examination of the state of the castle, in order to compare its height from the present level, as compared with that reported by Mr. Drummond about 70 years ago. The difference of level, however, in

alluvia deposited in a scarcely tidal sea, does not, in the intervening valleys, indicate the increase of new lands, so much as the difference in horizontal distance.

Sak'al Tután, "Gates of Syria."—The hills, of little elevation, which approach the sea, just as they were described in the time of Alexander; are formed of a coarse limestone conglomerate, apparently a mere mass of detritus; the ancient road, which passed through the gate, called erroneously Jonah's pillars, is now carried away, and the causeway has to be carried about 100 yards higher up the hill side.

Plain of Kersús, or Merkets Sú.—The plain of the river Kersús, backed by the Mons Crocodilus of Pliny, and washing the walls of the Gates of Xenophon, consists in part of marsh, and the remainder of alluvial deposits, which encroach little, if anything, upon the sea.

Plain of Baïás.—The plain of Baïás is more elevated, and advances in two separate headlands; the present Rás Baïás, and the Eskí Rás Baïás. Between the northern river (for there are two) of the plain of Kersús and the first headland, there is, on the shore, a formation of slaty conglomerate, which consists of pebbles, from the size of a pin's head to that of a pigeon's. The cement is calcareo-siliceous, and the pebbles are quartzes, jaspers, and serpentine. The rock lies in nearly horizontal beds, which are fissured like a tesselated pavement, and are much sought after, for tomb-stones.

This rock appears to have been formed in the sea, towards which it has a slight inclination; and being newer

than the recent formations of Swedíyáh, may not unlikely have been raised up by earthquakes, even since historical times.

A limestone conglomerate, consisting of angular-shaped masses, as well as rolled pebbles, of limestone and other rocks, forms almost all the plain of Bayás, and the country of Issus. At the head of the Delí Chaï, or Issus, this deposit rises into hilly ranges, and forms a lofty country at Koï Chaï and Ursílí.

At Eskí Rás Bayás, the limestone breccia is covered by a calcareo-arenaceous and slaty conglomerate; and at Arsús, in a similar manner, a deposit of limestone breccia reposes, in the hills south-west of the harbour, upon a breccia of serpentines and diallage rock, in a calcareo-siliceous cement.

Formations with recent Shells and Pottery (Terrains Céramiques). Captain Beaufort has already remarked, that on some parts of the coast, "the gravel beach was found to be petrified into a solid stratum of pudding-stone." ("Memoir of a Survey of the Coast of Karamania. By Francis Beaufort, F.R.S., Capt. H. M. S. Frederickstein, 1820.") At the headland west of the basaltic districts, on the west side of the bay of Iskenderún, there occurs a breccia formed of pebbles of argillaceous sandstones, with shells of the shore and sea. On the shore, about five miles east of Ayás, Madreporites had become cemented by calcareous matter, with numerous Trochi, and other of the most common littoral shells, and various pebbles, into a hard breccia. Between this and the town of Ayás, there occur some recent deposits, which stretch in continuous beds, for the distance of half a mile at a

time, and consist sometimes of pebbles of sandstone, encased in a limestone cement, full of recent shells, but more frequently of calcareo-arenaceous cement, full of the shells of the shore, and of species thrown up from the shallows or the deep sea, and containing in one place fragments of tile and earthenware vessels, derived from an old pottery in the neighbourhood.

Issus.—An alluvial plain separates the village of Ursílí from the ruins of Issus, or Nicopolis, which is built upon the edge of a dark and barren district of felspatho-pyroxenic rocks. This district, at first level, but very stony afterwards, rises into hills, and presents massive and vesicular rocks, basalts, basanites, dolerites, trap, and trap tufa.

Ridge of Castabalum.—The felspatho-pyroxenic rocks are succeeded by long low ridges of sandstone, remarkable for their regularity and parallelism, as also for the regularity and symmetry of the beds, and coursing nearly east and west as far as to the Karà Kapú, or Cilician Gates.

These sandstones are quartzose, and, like a millstone grit; or argillaceous, and of a light and friable texture, and a deep-brown colour. The beds dip at a slight angle to the north, and the basseting edges crop out naked to the south. This sandstone in contact with the Plutonic rocks becomes an indurated claystone, and very often assumes a globular developement, as on the plain of Orontes near Armánás.

Beyond Castabalum to near Ayás, the country is occupied by low hills of felspatho-pyroxenic rocks, associated with sandstones and limestones.

Cape Karâ Dâsh.—In contact with the limestones, the sandstone becomes marly, and is penetrated by thin veins of calc spar, as is particularly observable at Karâ Dâsh. At the same point, parallel ledges of sandstone project in a south-west direction into the sea, while others alternate with marly limestone, in beds that vary in thickness from two to three feet. The strata are at times very flexuous and contorted, and these bendings in the rock are so frequently repeated, within a short distance, as to bring the beds at right angles to one another thrice within the space of 40 yards. The sandstones succeed to the felspatho-pyroxenic rocks a few miles to the east of Ayâs.

Sandstones East of Ayâs.—These sandstones extend in low ranges of rounded hills, with wide and flat intervening valleys, and advance irregularly to the sea-side, where they form cliffs, sometimes precipitous, or headlands and bays of a sweeping and circular disposition.

In these cliffs there occur, about a mile to the east of Ayâs, thin beds of compact limestone, of a chestnut and ash-brown colour, with an even fracture, from two to three inches in thickness, and redolent with species of Cerithium. In the same neighbourhood were thin beds of lignite, and some of the more argillaceous beds were covered with efflorescences of Katherite or earthy aluminite.

Deposits of the Pyramus (Jihûn Sû).—The chief causes of the rapid progress of the alluvial deposits at the mouth of the Pyramus, and particularly noticed by Strabo, are to be sought for in the friable and earthy character of the rocks and soil through which the river in a great part flows.

The operations by which these accessions of land are made, are very simple. The streams bring down trees, torn by their roots from shingly banks, and even cane rafts, which fix in the mud, and thus assist in causing a further accumulation. Numbers of these lay at the embouchures of the river. A bar is ultimately formed, which increases also on the outside by sands rolled over by the sea, and it is found, in wading from the shoals to the shore, that the line of inner currents is marked by mud on a clayey sub-soil, while the outer currents set over banks of sand. At the extreme of the bars two currents meet; one caused chiefly by the wind acting on the sea, the other by the waters of the river stopped by the bars that lie before them. Hence, at the point of jnnction is another cause of accumulation, which, acting at a fixed distance from the mouth of the river, (which has an open passage for its central stream,) throws up banks to the right and left with a semi-circular disposition. These operations have a natural tendency to continue, till the lateral streams come in juxta-position with the shore, and the main stream is confined to its central course. Banks, such as are alluded to, occur two or three in succession; but when the mud by any cause accumulates round trees or other points of resistance in the interior of these semi-circular ranges, they generally assume a nearly circular form, from the acting forces being pretty nearly similar in all directions.

The land thus once formed, the principal agent in the vegetable kingdom, which gives firmness and solidity to the new soil, is a species of Calamus, which sends out sub-ligneous creepers over the sands, some of which were 22 feet in length, while new plants spring up two to

each knot, or sometimes only one; the knots being at first 18 inches apart, towards the end only 12 or 13. In some spots, more especially at the mouths of the river, some Cyperaceæ assist in this early stage of reclaiming the soil. In other respects, there were not more plants —trailers or creepers with long roots—than are observed in similar circumstances in Britain, or in the Landes of Gascony.

The vegetation of these great alluvial tracts also consisted in spots of Cyperaceæ, amid which grew an Euphorbia, the Apium graveolens, one or two Cruciferous plants, while an occasional Oleander flowered above. On the downs between the mouth of the river and Cape Karâ Dâsh, the hills of moving sands were sometimes covered with wild vines of luxuriant growth, with honeysuckle, myrtle, Poterium spinosum, and other shrubby plants, while, in the interior, the Tamarix Gallica formed groves of antique-looking trees, 20 feet high, and beyond were plains of Salicornia and Salsola. Extensive salt lakes lie beyond the sand-hills, and occupy a great portion of the interior low lands to the east and west of Cape Karâ Dâsh, and at the westerly ancient mouth of the Pyramus.

Cilician Taurus.

Karâ Kapú (Black Gates).—In proceeding towards the felspatho-pyroxenic rocks of Issus, the Ostracite sandstone becomes an indurated rock, and often assumes a globular developement, as in the plain of Orontes near Armánás.

Kúrd Kulák.—The Kúrd Kulák hills are composed of limestones, which belong to the supra-cretaceous series, and course from N. 30° E. to N. 30° W. Single isolated hills of the same formation advance into the plain to the north.

Jebel Elnúr, or Mount of Light.—The Jebel Elnúr is separated from the Kúrd Kulák hills by the plain of Tchokúr Ováh (Valley of the Ditch). It is composed of diallage rocks and Euphotides, with veins of asbestos supporting limestones, and sandstones. The limestone rocks, which preponderate by much over all other formations, rise in rude peaks, or form bold precipices, which, near the termination of the chain, in the plain to the north, form sometimes isolated hills, one of which bears the castle of Sháh Marán, or Elám Kalát. The direction of the chain is from south-east to north-west. The limestone reposes upon the sandstone, and is therefore probably a supra-cretaceous formation.

Plain of Missísáh.—The plain of Missísáh, from the foot of Jebel Elnúr to within a few miles of Adánáh, is

occupied by a coarse rubbly limestone, containing large Ostracea, and a limestone conglomerate of a red and white colour.

Plain of Tarsús.—From within three miles of Adánáh to beyond Tarsús, in a westerly direction, the plain is composed of humus and alluvia, which have an average depth of from 20 to 30 feet, and repose upon rubbly limestone. These plains are mostly cultivated, and covered with villages.

Falls of the Cydnus.—The country to the north of Tarsús rises gradually up towards the alpine region of Cilician Taurus, remarkable at this point for its bold precipices and rugged grandeur of scenery. The falls of the Cydnus, and the Grotto of the Seven Sleepers, are in an outlying range of supra-cretaceous limestones and limestone conglomerate.

The river issues through deep ravines, with perpendicular walls of limestone, and, on entering the plain, falls over a ledge of rocks of limestone breccia, about 40 feet in width and 18 in height.

First lowest Range of Hills.—Proceeding to the north-east, the outlying and lowest range of hills is composed of marles and gypsum, in the lower beds; and superimposed upon these, are beds of brecciated rocks. The gypsum is snow-white, granular or lamellar. This range is divided from the second by low, level, and often marshy plains.

Second Range of Hills.—The upper beds are composed

of coralline limestone, gray, friable, fracture uneven, almost entirely composed of stony polypiferous masses, with stelliform lamellæ, or waved laminar furrows.

The lower beds consist of green marles, and greenish-white calcareous marles; the first are argillo-calcareous, earthy, friable, greenish, brownish-green, and yellow; the second are compact, even, and non-fossiliferous.

This second range consists of low hills, rounded or of a conical form, frequently cultivated, with little wood, but often villages on the summits.

Third Range of Hills.—The upper beds consist of Ostracite sandstones, compact, earthy, friable, frequently divided on the surface into polygonal and rhombic masses like a tessellated pavement. Ostracea; (Ostrea and Avicula) are very abundant. An Ostrea, probably not different from Ostrea gigantea, attains sometimes from a foot to eighteen inches in length.

The lower beds are composed of ferruginous sands, yellow and red, and sometimes of pink-coloured sandstones.

Beneath these are argillaceous limestones, alternating with marles (valley of Yená Kushlá), and with slaty beds (hill of village of Yúrúk).

Fourth Range of Hills.—The upper beds consist of blue anthracitous limestones, compact, fine granular, glistening fracture, blue and dark-blue colour. The lower beds are white limestones, compact, fine granular, or more cretaceous, with chalk fossils. Both beds appear to belong to the chalk formation.

Mica Shist with Limestone. (Cipolin of Alex. Brongniart.)—On the summit of this range, not far from an ancient Roman arch, and by an antique causeway; a formation is met with of mica, and argillo-calcareous shist, sometimes forming a solid shistose rock.

The limestones after this begin to form a truly alpine country, sometimes towering up in lofty and perpendicular precipices, upwards of a thousand feet in height, at others forming lower and rounded hills, covered when not lofty with shrubbery and forest trees, but when lofty, with pine and fir alone. Sometimes the cliffs are tomb-excavated, as above the brook of Mésérlúk; at other times, isolated knolls of limestone bear ruined castles, mostly Genoese.

Kulé Bogház.—The formation of the Kulé Bogház, the pass which carries the great Constantinopolitan road through the Cilician Taurus, presents pretty nearly a similar succession of deposits as above Tarsús.

Tertiary Deposits.—At Khán Katláh Oghlú a travertine formation covers a marly, and limestone deposit.

At the village of Durák, granular gypsum in ferruginous sand and common clay.

The sand and clay alternate beyond with sandstones, slaty, ferruginous, coarse-grained, in thin strata, and very determinate rhombic cleavage.

Polypiferous or coralline limestone succeeds to the rhombic or Ostracite sandstone. The lithose polypi occurring isolated in groups, or at other times forming the whole mass of the rock. This formation also contains botryoidal hæmatites.

The coralline limestone, or coral rag, alternates in its

lower part with dark-coloured clays, which are replete with bivalve shells, belonging to the genera Tellina and Lucina.

At Khán Kúsál Oghlú, ferruginous sandstones and sandstone conglomerate underlie the clays and polypiferous limestones.

Below Khán Saráshí, Cerithia and Conide limestone succeeds to the central chalk formation, and between the two formations is a deposit of limestone, breccia, and argillaceous shale.

In the valley of Khán Kúsál Oghlú, the Conide limestone descends in high precipitous cliffs to the south-east, which cliffs are deeply fissured and wrought into fantastic forms. To the north the limestone is capped by ferruginous sandstones, above which, again, are coralline limestones; while to the south, beneath the coral rag and sandstones, are sandstone conglomerates. The friable nature of the three last formations has given rise to many curious effects of denudation; tall columns and masses, in various fantastic forms, rising up from the side in picturesque profusion.

The chalk formation of the Kulé Bogház is almost everywhere the same,—a hard and compact limestone containing few organic remains, and rising up in bold precipitous rocks, with castles on their summits; or sweeping circularly, as if to block up the road with their gigantic gates. When the acclivities are gentle, they are generally well wooded with fir, pine, and cedar; and in the lower parts, the chalk becomes a pink-coloured limestone, sometimes argillaceous and slaty.

Antiquity of Pass.—The pass through the Cilician

Taurus is of the most remote antiquity, and dates as far back as the Assyrian and Babylonian empires, having by some been referred to the great oriental road-maker, Semiramis. It is certain that both Xenophon and Alexander passed through it, and they did much for its improvement. In the present days, Ibráhím Pashá has rendered the pass still more formidable by numerous batteries. The author's researches did not extend beyond the summit-level of the pass, beyond which the Plutonic rocks probably make their appearance.

Names of the Cilician Taurus.—The chain of mountains which extends, in a more or less circular manner, to the north-east from Kulé Bogház to Sís, is in the country itself variously designated, according to the tribe of Turkomen who inhabit the districts, or the name of the chieftain who rules over them. The Ashirát, or tribes among the Turkomen, are generally designated as the sons (Oghlú) of a certain father of the tribe; and the chief of the Ashirát assumes that title peculiarly to himself. Hence a traveller having heard in one district that the name of the mountains was Rámádám Oghlú, that designation has been given to the whole range, whereas, as far as the author could ascertain, there are between Kulé Bogház and Sís five different territorial possessions, which are Melangínáh Oghlú, Karsán Oghlú, Mustáphá Aghá, Tekelí Oghlú, and Kúsín Oghlú, north of Sís.

Rock Formations.—The whole of this district consists, upon a large scale, of ranges of limestone, indurated cretaceous or supra-cretaceous limestones in three distinct

ridges, consisting chiefly of conical or rounded summits, linearly disposed, and of nearly the same elevation and magnitude. The most southerly ranges are divided by great ravines, like fissures with vertical precipices on the sides, which form remarkable solutions in the continuity of a rampart of rock, and allow of the passage of the feeders of the Sihún, or river of Adánáh.

The country at the foot of the mountains is a low hilly district of sandstone, forming a girth of low rounded hills, almost everywhere covered with wood, about 20 miles in width, and 70 in extent. The sandstones are red arenaceous or argillaceous slates, forming good flag stones, and sometimes tessellated or rhombic. The hills are low, but increase in height as they approach the central chain.

The sandstone hills being chiefly formed by denudation, were ranged in a direction of from north to south, as are also the intervening valleys, The valleys of the Urlínjáh, of the Sihún, and the Soláklát, contained large deposits of rude conglomerate, which denoted that these rivers came from a country of crystalline and Plutonic rocks, beyond the outlying limestone ridges.

Territory of Sís.—At Sís, the country of tertiary sandstones ceases, and an uniform and level plain approaches to the foot of the mountain districts, here formed of limestone; and the plain is only interrupted by occasional rocks of the same rock indurated, which rise suddenly and in perfect isolation from the surrounding level; such are more particularly the hills of Túm, of Anazárbá, and of Sís, and that of Sháh Marán, all of which bear on their summits castellated buildings.

Territory of Karâ Sís.—Karâ Sís, or Black Sís, is a ruined castle, upon a high hill in the alpine country north of Sís. In approaching it, the formations consist of indurated limestones in which I did not detect any fossils, but which appear to be the same as the limestone of Sís, —a supra-cretaceous Conide, or Cerithia, limestone. Travertino abounds on the acclivities.

After crossing the first summit-level, the inner ranges of limestone, instead of being, as usual, prolonged in continuous uplands, were broken into disjointed parts, which formed bluff precipices, or towered up in bold conical or sharp-backed mountains, more or less isolated. The two most remarkable points of this kind were the seats of ancient castles; to the north, Andâl Kal'at, and to the north a little east, Karâ Sís Kal'at.

The limestones which formed the summit of these hills, reposed upon sandstones and altered rocks, through which the crystalline formations made their appearance at one or two places.

The sandstones were coarse, arenaceous, and blue argillaceous, and argillo-calcareous beds, with lignites.

The metamorphic rocks were:—talcose slate clay, and the same rock with disseminated mica; a fissile uniform slaty red rock, and white rubbly calcareous rock.

The Plutonic rocks were serpentines and steashists, fissile and slaty, with veins of asbestos, and a brecciated rock of bottle-green fragments, in a cream-coloured, talco-argillaceous paste.

Some lofty hills of limestone, called Karâ Bogház, stretch out to the east of north; the sandstone districts are much cultivated, and abound in villages, the chief of which is called Mantár. The latter formation assumes a

considerable developement to the east, where it extends itself between the Sís mountains and the limestone ranges of the interior. The sandstones, being for a time wanting on the southern acclivities of Cilician Taurus, appear to be thrown inwards, but soon make their appearance again in the hilly country north of Anazárbá.

Territory of Kárs.—In approaching the hills near Kárs, the alluvium of the plain is succeeded by coarse rubbly limestone, and at Kárs, by an arenaceous conglomerate with pebbles of limestone.

Beyond this a country of sands and sandstones, which reposed upon a conglomerate rock. This country is cut up into ravines from five to eight hundred feet deep. The sandstones often formed high precipices of rock, dipping near Ajám Boïají to the east, and on the other side of the ridge to the north-west.

North of Ajám Boïají is a further country of sandstone and sandstone conglomerates, which led to a plain traversed by the Jihún, and interrupted by three different knolls of limestone, which rose to the height of from 50 to 200 feet above the level.

Territory of Kurtálí.—North of the plain is a rocky district, which presents at first anthracitous argillo-calcareous beds, associated in curved and contorted strata, with other beds, sometimes of a dark, and at others of a light-green colour; and above this formation are white and blue compact limestones and shales, alternating in regular stratification with coarse arenaceous sandstones. A breccia or grit of siliceous nodules in a calcareous cement, also accompanied the same formations.

The sandstones are inferior to the limestones, which, from researches made the ensuing day, turned out to belong to the supra-cretaceous deposits.

Dúrdún Dágh.—Beyond the village of Kurtálí the country begins to rise considerably, and in the immediate neighbourhood anthracitous steashists are observed cropping out of compact limestones, and soon afterwards through the inferior sandstones. A ravine, in compact limestones, associated with occasional steashists and talc shists, occurs beyond, and from this is an ascent over a white limestone shale belonging to the chalk formation.

At this point a magnificent scene presents itself to the spectator. To the east four different valleys,—extending almost at his feet, their steep acclivities clothed with forest-trees,—meet nearly at the same point, and at nearly a thousand feet below; while to the north, lofty and nearly vertical cliffs of limestone appear to present an almost impassable barrier, above which rise the pointed and serrated peaks of the Dúrdún Dágh.

Geology of Dúrdún Dágh.—Geologically speaking, the Dúrdún Dágh consisted of quartz rock and quartz shist, which formed the loftiest summits, reposing upon mica shist and talc shist. The talc shist and quartz shist passed into one another by insensible gradations and a variety of rock products.

The mica shist and talc shists were accompanied by Ampelites, red slaty rocks, clay slates, steashists, chlorite slate, and slate clays; and talc shists and quartz shists, and their various resulting compounds, were broken up and altered by serpentine and actynolite rock.

Mineralogical Characters.—The mica shists and clay slates were among the most uniform rocks in their mineralogical characters, but the other rocks presented great diversity. The talc shists occurred in their Normal form, as crystalline and shistose; of a pearly-white and silver-white colour. When Anormal, they were, from the presence of serpentine rocks, grayish-green, asparagus-green, and apple-green; from the presence of various feroxides and hydrated feroxides, different hues of yellow, brown, and red; from carbon, various hues from blue to black; and from carburet of iron, a shining metallic black.

Talc and mica rock in its normal colour was light-coloured, with a semi-metallic lustre, but in its anormal colours, green, blue, and black.

Talc and quartz rock in its normal colours was grayish-white, but was also coloured green, pink, and red.

Quartz rock occurred in a crystalline, compact, and shistose form, and in its normal colour was gray and grayish-white; but in its anormal colours, brown, reddish-brown, yellowish-brown, pink, yellow, blue, green, dark-coloured.

Mica shist passed into quartz rock, forming two rocks, one with a predominance of mica, the other with a predominance of quartz. It is the same in the relation of mica shist and of quartz shist, and also of mica shist and talc shist, forming together six normal varieties, which are infinitely multiplied when we take into consideration the varieties produced by the anormal admixtures.

The talc shist, both in its compact (serpentine) and shistose variety, passes into quartz rock and quartz shist, forming in the normal conditions a compact green-coloured rock, uniform, with a cerous lustre, and a rock of nearly

similar appearance, but with a foliated or shistose fracture in one direction, and an uneven splintery fracture in the other.

The Pashá at Mar'ash had in his possession a specimen of Gadolinite, which would appear to indicate the presence of Cerium or a Yttro-cerite in these rocks, from whence the mineral (preserved as a charm) was said to have come.

Anábát.—At Anábát the rocks begin to change their characters; blue and dark-coloured slaty rocks still predominate, but were much decomposed, and over a wide extent of surface presented nothing but brown, dark-coloured, and ironshot shingle. The rivulet still bore down from the higher summit, quartz rocks and serpentines.

Dún-Kal'at.—In continuing to the district of Dún-Kal'at the shales presented the same appearances, almost everywhere decomposed superficially; a diminished inclination of the acclivities was one of the results of this, and the country became more cultivated.

The castle of Dún-Kal'at reposes upon blue and black shales, with vertical and transverse veins of quartz, and also veins of graphite or plumbago, which mineral more particularly abounded in the vicinity of Anábát.

About a mile from the castle, the quartz rock, which everywhere alternates with the Phylladic rocks, reaches down to the water's-edge. The same rock occupies the summits of most of the surrounding mountains.

Half a mile further, quartz shist was succeeded by serpentine (quartz and silicate of magnesia) with pyrites, and this again is succeeded by dark-blue limestones,

with chert, forming abrupt rocky walls rising out of the soil.

Quartz shists, with mica and occasionally lepidolite, which latter passed into a light red and pink-coloured shist, were not uncommon.

Beyond this limestone ridge, mica shist, much decomposed, but waved and contorted, showed itself, with large veins of milk-white quartz, and was followed by shistose rocks as before.

Dún-Kal'at, No. 2.—The country at the second Dún-Kal'at becomes low and cultivated; north of the village are low hills of sandstone, abounding in large Ostracea, and dipping at slight angles of inclination (5° to 15°) between the points of north and west; and this sandstone formation extends over the whole of this tract of country as far as to the foot of Aghá Dágh, or the mountain of Mar'ash.

Territory of Mar'ash.—On the western side of the Aghá Dágh, and on the banks of the Jihún, near the bridge, sandstones and conglomerates, alternating with one another, may be observed in nearly vertical strata, supporting nearly horizontal beds of breccia and sandstones. The author had not an opportunity of exploring the organic remains of these interesting deposits.

The Jihún has two great tributaries: one, west of Mar'ash, has its source at the Gúl Bashí Dágh in the Bostán country; the other is to the east, and flows from Taurus, north of the Jáwúr Dágh, till it enters the territory of Mar'ash, and joins the other river to pass through Dúrdún Dágh. It is called 'Ak-sú.

Aghá Dágh.—The Aghá Dágh, in the line of its greatest extent, courses from south-west to north-east; but, itself by its colossal magnitude almost isolated, is continued in a low line of hills to the north-east and to the north-west, in which latter direction the hills curve round to the west to join the Cilician Taurus.

This mountain consists of sandstones and cretaceous marles that are very little indurated, and that repose upon steashists and diallage rocks.

The valley or plain east of Mar'ash contains a tributary to the Jihún, which expands to the southward into several small lakes. Between this plain and the valley of the 'Ak-sú is a country of low hills, mostly covered with fir-forests, and which is composed of steashists and diallage rocks, not supporting any extent of limestones and sandstones; and hence probably its little elevation.

Relation of the Jáwúr Dágh to Dúrdún Dágh.—The Jáwúr Dágh or Amanus, curves round to join the Dúrdún south of the 'Ak-sú, but the rocks of elevation of the Jáwúr Dágh (diallage rocks and serpentines) are prolonged, as we have just seen, in the hills east of Mar'ash, in a direction similar to that of Amanus, or from south-west to north-east, while the Dúrdún Dágh, with which, from the tilting-up of sedimentary formations, they appear to unite, differ in structure (mica shist and quartz rock), and have a different direction, viz., from south-east to north-west and west.

Limestone District.—The valley of the 'Ak-sú separates, to the east, the hills of diallage rocks from a country of indurated limestones, with occasional tracts of fel-

spatho-pyroxenic rocks, which extend, in rocky and hilly barren districts, to the south as far as the territory of Kilís; to the south-east to the territory of Aïn-Táb; and to the east as far as Euphrates.

The hills present a remarkable uniformity of elevation and of forms, generally flat-topped, with occasional steep acclivities, and open valleys and plains.

The limestone is an indurated chalk, sometimes friable, cretaceous, and fossiliferous, and containing Ammonites, Belemnites, Terebratulæ, Crinoidea, and large lithose Polypi. In the lower beds it was compact, splintery, and non-fossiliferous. The beds were generally thin, often waved and contorted, and dipping in various directions, sometimes at high angles of inclination.

The felspatho-pyroxenic rocks sometimes manifest themselves upon the summit of the ridges without altering the configuration of the country, as about four miles east of the valley of 'Ak-sú, or sometimes occur in the low plains, as at 'Ufá Jaklí, rendering the plain rocky and unprofitable, and in the valley of the Bekír Karáa-sú, where they are accompanied by altered rocks (thermantides and calcareous spilites).

The structure of the ranges north and south of the Bekír Karáa-sú is included in the geology of Euphrates, extending from Taurus southward.

GLOSSARY OF SOME OF THE LESS DEFINED GEOLOGICAL TERMS.

Actynolite Rock.—See *Tremolite Rock.*

Aphanite.—(Haüy, Leonhard, Brongniart); Corneene (Dolomieu); Hornstone (Phillips). Earthy; massive, solid; texture half-hard; difficultly broken.

Argillolite.—Thonstein; Claystone (Jameson). Earthy; soft texture; massive structure; rough feel.

Argillophyre. — Thon Porphyr (Werner); Claystone Porphyry, (Jameson); Paste of argillolite, with crystals of felspar; dull or vitreous, basis of uncrystallized almost earthy felspar (Phillips).

Basalt. — Black, sublamellar, granular; nearly compact texture; massive structure; difficultly frangible; fusible into a black glass. According to Boué, an intimate mixture of compact felspar and pyroxene.

Dolerite.—Pyroxene and lamellar felspar; Augite Rock (Macculloch); Mimose (Haüy); Greenstone (Jameson); Felspar and Titaneous Iron (Rose); Lamellar Albite and Augite (Beudant).

Diorite.—(Haüy and Brongniart); Grünstein (Werner); Ophite (Palassou). Essentially composed of hornblende and compact felspar. Lamellar and compact albite, and black or green hornblende (Rose). Orthose and hornblende (Beudant).

Diallage Rock.—An aggregate of crystals of green diallage, or of metalloid diallage, distinguishable from hornblende, and pyroxene, or augite, by scratching calc spar, and being fusible into a yellowish-gray scorium.

Eclogite.—Green lamellar diallage and garnets (Cordier, Brongniart); Green Uralite and Garnets (Haidinger, Mohs, Rose, Haltzmann, Walchner).

Euphotide.—Verde di Corsica, Gabbro (De Buch, Leonhard). Basis of serpentine, of talc, of steatite, of jade, of petrosilex, of felspar, or even of ophiolite, with crystals of diallage. Basis of tenacious felspar (Labradorite) and diallage (Rose). Uniform porphyritic, with green or metallic diallage (Brongniart). Diallage Rock of Phillips.

Felspar.—(Feldspar, Felspath, Feldspath). Compact Felspar. Uniform, compact. I have admitted, *pro tempore*, the Petrosiliceous compounds of Brongniart with the Felspathic rocks, but the addition of a portion of silex in the constitution of the basis of Igneous Rocks, more especially Dolerites and Diorites, not only materially affects their characters, but is also connected with distinct geognostic relations.

Felspar Rock (Phillips).—Basis of compact felspar with crystals of felspar imbedded.

Hornstone.—Basis of compact felspar with augite and chlorite (Boué).

Hypersthene Rock. — Texture lamellar; structure fissile; black; iridescent.

Hypersthene Porphyry.—Basis of white or red felspar, more or less crystallized, with green or purple crystals of hypersthene. Hypersthene Syenite of Phillips.

Hornblende Rock.—Amphibolite; Hornblendegestein. Lamellar texture; structure either massive or fissile,—varieties, fissile or slaty. Hornblende Slate, Amphibole shisteuse; Hornblende schiefer. With green serpentine, bronze diallage, &c.

Jade.—An intimate mixture of compact felspar and talc.

Melaphyre.—Black paste of petrosiliceous hornblende with crystals of felspar. Basis of black augite with crystals of felspar (Phillips).

Ophiolite.—An intimate mixture of jade and diallage, serpentine and diallage, steashist and diallage, talc shist and diallage, felspar and diallage, or of petrosilex and diallage. Fine-grained, uniform, green colour; texture slaty. Felspar and diallage uniformly disseminated, fine-grained, soft, with indistinct traces of crystallization (Brongniart). Paste of serpentine, or of talc, and diallage, with oxide of iron. Serpentine (Leonhard); Crystallized Diallage and Felspar (Phillips).

Ophite.—Green Porphyry; Serpentine; Grün Porphyr. Paste of greenish hornblendic petrosilex, with crystals of green felspar.

Petrosilex.—Compact, fine texture; translucid, different colours; scaly fracture: harder than steel; fusible into a white glass.

Serpentine.—Compact, uniform, hard; even texture; green colour; including rocks of compact serpentine, talc, steatite, jade, or Saussurite. Felspar and diallage, fine-grained and soft, with indistinct traces of crystallization (Phillips).

Spilites.—Paste of basalt, dolerites, diorites, trap, wacke, thermantides, melaphyres, porphyries, &c., with nodules of calc spar, semi-opal, chalcedony, agate, &c., or cavities lined with crystals of zeolite, mesotype, quartz, calc spar, &c., &c.; contemporaneous with, or posterior to, the paste.

Steashist and Talc Shist.—Steatitic or talcose base, with a shistoid structure. Steatite is distinguishable from talc, inasmuch as the first is homogeneous, earthy, soft and unctuous to the feel; the second, shistoid or sublamellar, with a silky lustre.

Trap, or Trapp.—Earthy; almost compact texture; structure fragmentary.

Tremolite Rock.—Actynolite rock. Lamellar texture; structure sometimes fissile, sometimes massive.

Var. a. With compact felspar and garnets. Amphibolite actinotique (Brongniart).

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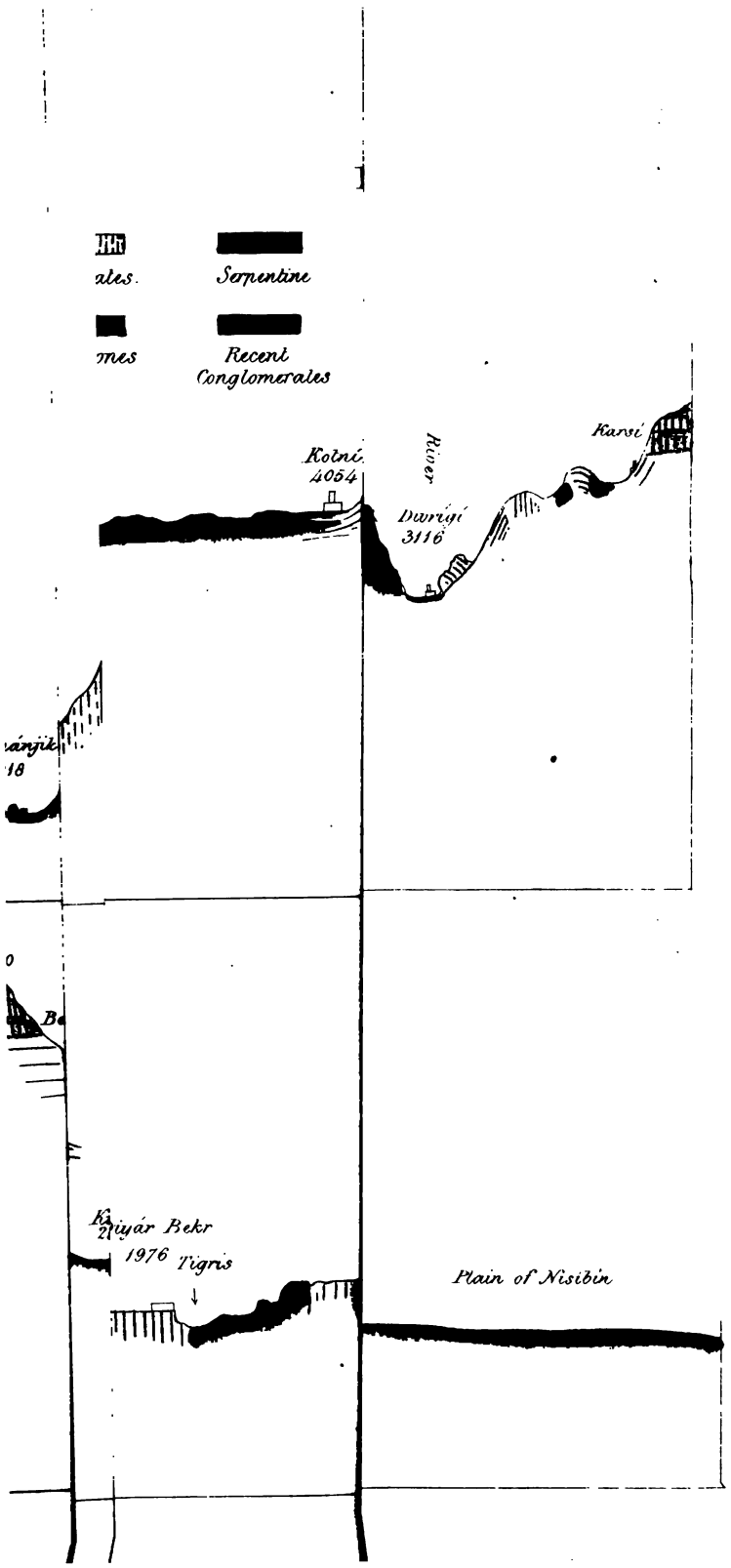
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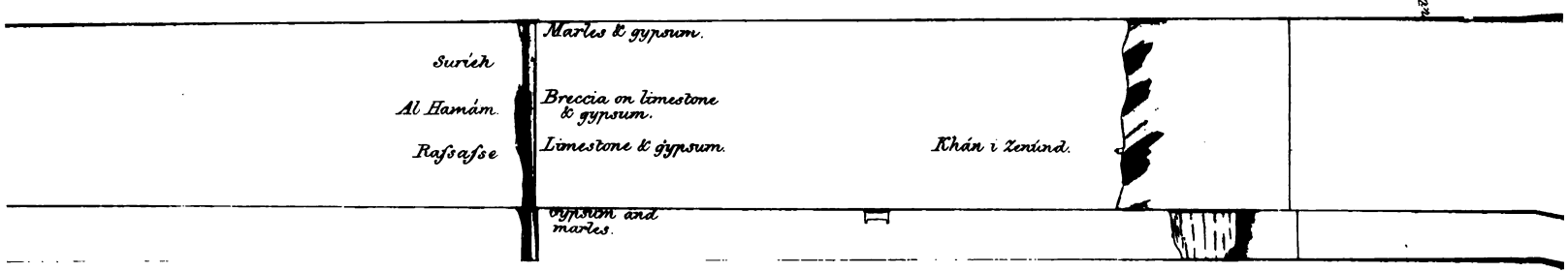
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