

REPORT

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UPON

THE MINERALS OF MIDIAN,

BY

CAPTAIN RICHARD F. BURTON

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BY CAPT. RICHARD F. BURTON.

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**THE GOLD-MINES OF MIDIAN
AND THE RUINED MIDIANITE CITIES.**

A FORTNIGHT'S TOUR IN NORTH-WESTERN ARABIA.

With Numerous Illustrations.

LONDON : C. KEGAN PAUL & Co., 1, PATERNOSTER SQUARE.

ALEXANDRIA. — FRENCH PRINTING-OFFICE A. MOURÈS.

THIS Report consists chiefly of the Preface to my second book, "The Land of Midian, Revisited". It is a plain unvarnished tale of the travel in North-Western Arabia, undertaken by the second Expedition, which, like the first (1877), owes all to the liberality and the foresight of his Highness Ismail I., Khediv of Egypt. During the four months between December 19, 1877, and April 20, 1878, the officers employed covered some 2500 miles by sea and land, of which 600, not including by-paths, were mapped and planned; and we brought back details of an old-new land which the civilized world had clean forgotten.

The public will now understand that one and the same subject has not given rise to two books. I have to acknowledge with gratitude the many able and kindly notices by the Press of my first volume ("The Gold-Mines of Midian," etc.) But some reviewers succeeded in completely misunderstanding

the drift of that *avant courier*. It was an introduction intended to serve as a base for the present more extensive work; and,—foundations intended to bear weight must be solid. Its object was to place before the reader the broad outlines of a country whose name was known to “every schoolboy,” whilst it was a *vox et præterea nihil*, even to the learned, before the spring of 1877.

The purpose of the last Expedition was to conclude the labours begun, during the spring of 1877, in a mining country unknown, or rather, fallen into oblivion. Hence its primary “objective” was mineralogical. The twenty-five tons of specimens, brought back to Cairo, were inspected by good judges from South Africa, Australia, and California: all recognized familiar metalliferous rocks. The collection enabled me to distribute the mining industry into two great branches — (1) the rich silicates and carbonates of copper smelted by the Ancients in North Midian; and (2) the auriferous veins worked, but not worked out, by comparatively modern races in South Midian, the region lying below the parallel of El-Muwaylah. It is, indeed, still my conviction that “tailings” have been washed for gold, even by men still living. We also brought notices and specimens of three several deposits of sulphur; of a turquoise-mine behind Zibà; of salt and saltpetre, and of vast deposits of gypsum. These are sources

of wealth which the nineteenth century is not likely to leave wasted and unworked.

In geography the principal novelties are the identification of certain ruined cities mentioned by Ptolemy, and the "Harrabs" or plutonic centres scattered over the seaboard and the interior. There is little doubt that when properly examined they will prove metalliferous. The first Expedition brought back a lump of porous basalt threaded by a single vein of "electron" — gold and silver mixed.

Some of the principal sites were astronomically determined by Commanders Ahmed Musallam and Nàsir Ahmed, of the Egyptian navy. The task of mapping and planning was committed to the two young Staff-lieutenants sent for that purpose. With the able assistance of Mr. William J. Turner, of the Royal Geographical Society, who found the work harder than he expected, their sketches have been reduced to tolerable shape. Still, the map is purely provisional; and, when mining operations shall begin, a far more careful survey will be required.

As regards archæology, the second Expedition visited, described, and surveyed eighteen ruins of cities and towns, some of considerable extent, in North Midian, besides seeing or hearing of some twenty large *Mashghal*, apparently the *ateliers* of vagrant Gypsy-like gangs. This total of thirty-eight is not far short of the forty traditional Midianite

settlements preserved by the mediæval Arab geographers.

My private collection of mineralogical specimens was deposited with Professor M. H. N. Story-Maskelyne. The spirit-specimens of zoology filled three large canisters : and the British Museum also received a hare and five birds (Mr. R. B. Sharpe); four bats (*Rhinopoma*) and a mouse; six reptiles, five fishes, thirty-five crustaceans, and about the same number of insects; five scorpions, six leeches, sixty molluscs, four echinoderms, and three sponges. Dr. A. Günther determined and named two new species of reptiles. Mr. Frederick Smith took charge of the insects. Mr. Edward J. Miers, F.L.S., etc., described the small collection of crustaceæ (*Annals and Magazine of Natural History* for November, 1878). Finally, Mr. Edgar A. Smith examined and named the shells collected on the shores of the 'Akabah Gulf and the north-eastern recess of the Red Sea.

The main interest of the little *hortus siccus* was the Alpine Flora, gathered at an altitude of five thousand feet above sea-level. The plants were offered to Sir Joseph Dalton Hooker, of Kew; and Professor D. Oliver, of the Herbarium, has kindly furnished me with a list of the names. Mr. William Carruthers and his staff also examined the spirit-specimens of fleshy plants.

Mr. Reginald Stuart Poole, Keeper of Coins and Medals, and Mr. Barclay V. Head were good enough to compare with their rich collections the coins of ancient Midian found, for the first time, at Maghàir Shu'ayb. My collection dates from between the first century B. C. and the first century A. D.; this can be gathered from comparison with the coins of Alexander Jannæus and his successor, Alexander II. The tetradrachm may belong to the reign of Alexander the Great, or the ages preceding it.

Finally, the skulls and fragments of skulls from Midian were submitted to Professor Richard Owen, the Superintendent of Natural History. The whole was carefully described by Dr. C. Carter Blake, Ph. D., before the *séance* of the Anthropological Institute of London, December 10, 1878.

The tons of specimens brought to Cairo were, I have said, publicly exhibited there, and created much interest. But the discovery of a mining-country, some three hundred miles long, once immensely wealthy, and ready to become wealthy once more, is not likely to be accepted by every one. Jealous and obstructive officials "did not think much of it." Rivals opposed it with even less ceremony. A mild "ring" in Egypt attempted in vain to run the Hâmâmât and Dâr-For mines against Midian. Consequently the local Press was dosed with rumours,

which, retailed by the home papers, made the latter rife in contradictory reports. To quote one case only. The turquoise-gangue from Zibà was pronounced, by the Citadel, Cairo, to be carbonate of copper, because rich silicates of that metal abounded. No one seemed to know that the fine turquoises of Midian have been sold for years at Suez, and even at Cairo.

There was, indeed, much to criticise in the collection, which had been made with a marvellous carelessness. But we must not be hard upon M. Marie. He is an engineer, ignorant of mineralogy and of assaying : he was told off to do the duty, and he did it as well as he could. He neglected to search for alluvial gold in the sands. Every Wady which cuts, at right angles, the metalliferous maritime chains, should have been carefully prospected ; these sandy and quartzose beds are natural conduits and sluice-boxes. But the search for "tailings" is completely different from that of gold-veins, and requires especial practice. The process, indeed, may be called purely empirical ; it is not taught in Jermyn Street, nor by the *École des Mines*. In this matter theory must bow to "rule of thumb : " the caprices of alluvium are various and curious enough to baffle every attempt at scientific induction. Thus the "habits" of the metal, so to speak, must be studied by experiment with patient labour ;

the most accomplished mineralogist may pass over rich alluvium without recognizing its presence, where the rude prospector of California and Australia will find an abundance of stream-gold. Evidently the proportion of "tailings" must carefully be laid down before companies are justified in undertaking the expensive operation of quartz-crushing. Hence M. Tiburce Morisot, a practical digger from South Africa, found a fair opportunity of proposing to his Highness the Khediv (October, 1878) a third Expedition in search of sand-gold.

The samples brought to England, by order of his Highness the Khediv, were carefully assayed. The largest collection was submitted to Dr. John Percy, F. R. S. Smaller items were sent to the well-known houses, Messrs. Johnston and Matthey, of Hatton Garden, and Messrs. Edgar Jackson and Co., Associates of the Royal School of Mines (fourteen samples). Finally, special observations were made by Mr. John L. Jenken, of Carrington, through Mr. J. H. Murchison, of "British Lead Mines," etc., etc., etc., by Lieut.-Colonel Ross, the distinguished author of "Pyrology;" and by Lieut.-Colonel Bolton, who kindly compared the rocks with those in his cabinet.

The following is the text of Dr. Percy's report :—

U. S. G. P.

Metallurgical Laboratory, Royal School of Mines,
Jermyn Street, London, Dec. 13, 1878.

DEAR SIR,

I now send the results of the analytical examination of the specimens which you submitted to me for that purpose. The examination has been conducted with the greatest care, in the metallurgical laboratory of the Royal School of Mines, by Mr. Richard Smith, who, for the last thirty years, has been constantly engaged in such work; and in whose accuracy I have absolute confidence. It is impossible that any one should have taken greater interest in, or have devoted himself with greater earnestness to, the investigation. I have almost entirely confined myself to a statement of facts, as I understand that was all you required for the guidance of his Highness the Khedive.

SECTION I.

Examination of the mineral specimens contained in the boxes marked as under.

(An average representative sample of each specimen, of about six pounds in weight, was prepared for examination from portions broken off, or other-wise taken, by Mr. Richard Smith at the Victoria Docks.)

No. 1. "Box 22," *Quartz from Mugnah (Maknà)*. Quartz coloured black and red-brown with oxides of iron. These were of two varieties, marked 22a and 22b respectively.

No. 2. The magnetic ironstone (22a) was examined and found to contain of —

Peroxide of iron (per cent.) . . .	85.29
Protoxide " " . . .	9.83
Silica (quartz) " " . . .	3.28

The oxides of iron together contain of metallic iron 66.8 per cent.

No. 3. The micaceous ironstone (22b) was examined and found to contain of —

Peroxide of iron (per cent.) . . .	91.0
Silica	5.52

The peroxide of iron contains of metallic iron 63.7 per cent.



No. 4. "Box No. 14," *Quartz from Mugnah*, gave no results.

No. 5. "Box No. 27," *Iron from Mugnah*, proved to be hæmatite (which is magnetic), with some red-brown oxide of iron and quartz. It was found to contain of —

Peroxide of iron (per cent.) . . . 75.46

-Protoxide " " . . . 4.69

The oxides of iron together contain of metallic iron 56.4 per cent.

No. 6. "Box No. 7," *Conglomerate from Mugnah*, yielded no results.

No. 7. "Box No. 25," *Quartz from Mugnah*. This quartz, veined and coloured black and red-brown with oxides of iron, was assayed with the following results : —

Gold and Silver None.

Messrs. Edgar Jackson found in the same box : —

Silver (per statute ton). 2 oz. 17 dwts. 11 grs.

Nos. 8. and 9. "Boxes Nos. 50 and 37," *Quartz and red dust from Mugnah*, yielded no results. "Box No. 37" yielded (Jackson) silver, 13 dwts. 1.6 grs.

No. 10. "Box No. 37a," *Sulphur from Mugnah*. Lumps of sulphur, crystallized and massive, irregularly distributed through a white, dull, porous rock. The latter was examined and found to be hydrated sulphate of lime (gypsum), with a small quantity of magnesia; some of the lumps of rock were coloured with oxides of iron, and others intermixed with sand.

Nos. 11. and 12. "Boxes Nos. 3 and 6," *Black quartz and white quartz from the Jebel el-Abyaz*, gave no results except a small portion of copper pyrites in a lump of quartz (Box No. 6).

No. 13. "Box No. 47," *Quartz from El-Wedge (El-Wijh)*, gave only oxide of iron. "Box No. 47," yielded (Jackson) 12 dwts., 1.6 grs.

No. 14. "Box No. 5," *Red quartz from El-Wedge*, a quartz with red brown oxide of iron and earthy substances, was assayed with the following results : —

Gold (per statute ton = 3240 lbs. . . 2 dwts. 15 grs.

Silver Traces.

No. 15. "Box No. 16," *Mica schist from El-Wedge*. This mica-schist undergoing decomposition from weathering action, mixed with small lumps of quartz, was assayed with the following results : —

Gold (per statute ton) 6 grains.

Silver Traces.

No. 16, "Box No. 32," *White quartz from El-Wedge*. This

quartz coloured with red-brown oxide of iron, mixed with mica-schist, was assayed with the following results : —

Gold (per statute ton) 3 dwts. 22 grs.
Silver Traces.

No. 17. "Box No. 48," * *Red sulphur from Sharm Yáharr*, was found to have the following composition, while it was free from "native sulphur" : —

Peroxide of iron (per cent.)	44.36
Sand, clay, carbonates and sulphates of lime and magnesia	14.90
Salts soluble in water, chiefly alkaline chlorides and chlorites, and sulphates of lime and magnesia.	29.70
Water.	11.40
	100.00

No. 18. "Box No. 48a," *Gypsum from Sharm Yáharr*. Partly semi-transparent and granular, and partly dull white and opaque. It was found to be hydrated sulphate of lime, or gypsum, with carbonate of lime, and some sand, magnesia, and chloride of sodium.

No. 19. "Box No. 35," *Dust and stones from Sharmá*, yielded no results.

SECTION 2.

Examination of the mineral specimens contained in a box sent from Egypt. As the specimens were unlabelled, they were marked A, B, C, D, E, F, G, H, and I, respectively.

No. 21. A. "Copper ore." A fair average specimen was prepared for examination from the several lumps of ore and marked *a*.

a. It was submitted to analysis, and found to contain carbonates of lime and magnesia; silica, alumina, and oxides of iron; and of —

Copper (metallic) 5.72 per cent.

b. A portion of the copper mineral, from which the rock or vein-stuff had been detached as far as practicable, was found to consist of impure hydrated silicate of copper (bluish-green chrysocolla) and carbonate of copper. It was assayed and found to contain of —

* In boxes Nos. 48 and 51 Mr. Jenken found silver 2 ozs 13 dwts. 8 grs.; and 4 oz. 5 dwts. 12 grs.

Copper (metallic) 23.14 per cent.

No. 22. "B." A lump of soft, ochrey red-brown ironstone, coated with a thin layer of greyish white substance. A fair average sample, inclusive of this external layer, was prepared for examination, and was found to consist of —

Peroxide of iron (per cent)	81.14
Water	11.50
Silica	3.07
Sulphuric acid, lime, magnesia, alumina.	4.29
	100.00

The peroxide of iron contains 56.8 per cent. of metallic iron. The greyish white substance was found to consist of silica, alumina, sulphate of lime, and a little oxide of iron and magnesia

No. 23. "C." Lump of red ironstone associated with sand and earthy substances, containing

Peroxide of iron (per cent.)	68.09
Water " "	1.93
Silica and Sand	18.17
Lime, magnesia (in small quantity), alumina carbonic acid, sulphuric acid (traces)	11.81
	100.00

The peroxide of iron contains 47.66 of metallic iron.

No. 24. "D." Lump of white quartz said to contain visible gold. I did not observe any, but found a few minute specks of pyrites, and partially resembling mica.

No. 25. Lump of quartz associated with red-brown oxide of iron. It yielded no results.

No. 26. Lump of rock in which the "turquoise" occurs. There was a thin layer of greenish blue turquoise mineral on one surface, and minute seams of a similar substance throughout the specimen.

a The layer of turquoise mineral, from which the rock or vein-stuff had been detached as far as practicable, was found to contain phosphoric acid, alumina, oxide of copper, oxide of iron, and water; which occur in turquoise.

b. After the layer *a* had been separated, a fair average sample of the rock was found to contain 1.69 per cent. of metallic copper. It was also assayed and found to be free from silver and gold. In a fragment of similar "turquoise rock," from the same site (*Zibá*), Dr. L. Karl Moser, of Trieste, found silver.



No. 27. "G." A variety of jasper, having a somewhat polished, and irregular and deeply indented surface, the result of sand-action. The fractured surface was red, with patches of yellow. It was found to consist chiefly of silica, coloured with oxides of iron.

No. 28. "H." Lump of "sard," of a pale-red flesh colour. A variety of chalcedony. It was found to consist almost entirely of silica. In a fragment of similar chalcedony, from the same site (Abà'I-Marù), Dr. Moser found specks of "free gold."

No. 29. "I." Lumps of pure ironstone

A small lump of metal, supposed to contain antimony and platinum, was brought for examination by Captain R. F. Burton. It was submitted to analysis, and found to be iron and combined carbon, or white cast-iron, containing small quantities of lead, copper, and silver, and free from antimony, platinum, and gold. It is evidently the product of a fusion operation. A few "shots" of lead were attached to the surface of the metal. In "box No. 4" Messrs. Jackson found rough crystals of corundum; and a qualitative analysis of this sample and "box No. 7" yielded quartz, carbonate of lime, alumina, and oxide of iron.

Dr. Percy concludes the assays in these words:—

Three of the specimens (Nos. 14, 15, and 16) from the same locality contain gold. The amount of gold, however, is small. I consider these indications of the presence of the precious metal not altogether unsatisfactory; and certainly to justify further exploration. My conviction is, that the ancients were adepts in the art of extracting gold, and that, owing to the small value of human labour, they could get out as much of the metal as could now be done. They knew perfectly what was worth working and what was not; and *I think it likely that what you have brought home, had been rejected by the ancients as unworkable.**

* The italics are mine. Mr. Mathey remarks of the specimen containing 48 grains of gold per ton, "It would be worthless in its present condition; if, however, it could be enriched by proper washing and



Further search may lead to the discovery of workable stuff; but would doubtless require a good deal of time, unless lucky accident should intervene.

The specimens Nos. 2, 3, 5, 22, and 23 contain sufficient iron to render them available as iron ores, provided they occur in large quantity. The copper present in No. 21a is too small in amount to render it available as a source of that metal. † If it is practicable on a large scale, by hand-labour or other means, to separate the "copper mineral" (as in *b*), it would be sufficiently rich in copper, provided the cost of the transit were not too great.

The specimen No. 17 is only of scientific interest, as it gives off an acid vapour when heated; and this substance may have been used by the ancients in the separation of silver from gold by the process termed "cementation".

I remain, dear Sir, yours very truly,

(Signed) JOHN PERCY, M.D., F.R.S.

Lecturer on Metallurgy at the Royal School of Mines, London.

Capt. R. F. Burton, etc.

Upon this cautious and conscientious report I would offer the following observations. We, who have travelled through a country like Midian, finding everywhere extensive works for metallurgy; barrages and aqueducts, cisterns and tanks; furnaces, fire-bricks, and scoriæ; open mines, and huge scatters of spalled quartz, with the remains of some eighteen cities and towns which apparently fell to ruin with the industry that founded and fed them;

dressing, and the cost in labour, etc., be not too great, it might be made to give fair returns."

† Analyses of copper ore from Midian at the Citadel, Cairo, gave in certain cases forty per cent.



— we, I say, cannot but form a different and a far higher idea of its mineral capabilities than those who determine them by the simple inspection of a few specimens. The learned Dr. Percy at once hits the mark when he surmises that worthless samples were brought home; and this would necessarily occur when no metallurgist, no practical prospector, was present with the Expedition.

I therefore expect that future exploration will develop Midian as it has done India. The quartzose outcrop called the “Wynaad reef” (Madras Presidency) produced only a few poor pennyweights per ton, two and seven being the extremes, while much of it was practically unproductive. Presently, in February, 1878, the district was visited by Sir Andrew Clarke, of Australian experience, member of the Viceregal Council. He invited Mr. Brough Smyth, of Victoria, to explore and test the capabilities of the country; and that eminent practical engineer discovered, in an area of twenty-five by thirteen miles, ninety outcrops, some yielding they say, two hundred ounces per ton of gold, fine and coarse, “with jagged pieces as large as peas.” And British India now hopes to draw her gold coinage from Wynaad.

RICHARD F. BURTON.

SHEPHEARD'S, CAIRO,

January 30, 1880.

