

straight length of fine wire. One end of the wire was connected by platinum foil with the liquid in an insulated glass bottle, from which one of the jets was fed. The glass bottle supplying the second nozzle was similarly connected with a moveable point on the stretched wire. The electromotive force necessary to cause union, as measured by the distance between the two fine wire contacts, though definite at any one moment, was found to vary on different occasions, possibly in consequence of forces having their seat at the surfaces of the platinum oil. From one-half to three-quarters of the whole force of the Daniell was usually required.

With a view to further speculation upon this subject, an important question suggests itself as to whether or not there is electrical contact between colliding and rebounding jets. To solve this question it was only necessary to introduce a fine wire reflecting galvanometer into the arrangement just described, taking care that the electromotive forces employed fell short of what would be required to cause the union of the jets. Suitable keys were introduced for more convenient manipulation, and sulphuric acid was added to the water, in order to make sure that absence of strong galvanometer deflection could not be due merely to the high resistance of the thin columns of water composing the jets. Repeated trials under these conditions proved that so long as the jets rebounded their electrical insulation from one another was practically perfect.

As to the explanation of the action of electricity in promoting union, it would be possible to ascribe it to the additional pressure called into play by electrical attraction of the opposed water-surfaces, acting as plates of a condenser. But it appears much more natural to regard it as due rather to actual disruptive discharge, by which the separating skin is perforated, and the equilibrium of the capillary forces is upset. A small electromotive force, incapable of overcoming the insulation of the thin separating layer, is without effect.

XIV. "On a Collection of Rock Specimens from Socotra." By Professor T. G. BONNEY, M.A., F.R.S., F.G.S. Received June 12, 1882.

(Abstract.)

In the spring of 1879 the island of Socotra, which lies off the north-east corner of Africa, about 140 miles from Cape Gardafui, was visited by Professor Bayley Balfour. Landing at the north-west extremity, he traversed the northern side of the island up to the eastern end, then returning by a more central course to the sea, he

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crossed the Haggier Mountains to the southern coast, and returned again to Hadibu, on the north side, by a route lying further to the west. During this journey, in addition to extensive botanical and zoological collections, Professor Balfour obtained about 500 rock specimens illustrative of the geology of a considerable portion of the island. These were sent to the author for examination. A considerable number of them, as was to be expected, were more or less weathered, and so were not in a very favourable condition for precise description; but about eighty of the best preserved specimens have been examined microscopically; from the study of which, and of the remainder the following sketch of the geology of the island may be given.

The north-west, inland from Gollonsir Bay, consists of a plateau of limestone resting unconformably upon a group of highly crystalline gneisses, associated with diorites, which correspond in general character with the Hebridean series of north-west Scotland. The latter group is frequently exposed in the beds of the valleys, the uplands on either side being formed of the limestone. The elevated district traversed between Gollonsir and Kuhmeh Bays is similarly constituted, but it is probable that some true granite also exists among the older series; the limestone extends all along the coast of the latter bay, having its usual foundation, and there is evidence that felsites occur somewhere in this district, most probably inland from the eastern shore. In this part are basalt dykes, which cut the limestone as well as the older rocks.

Near the coast of Hadibu Bay, west of that town, we have limestone, conglomeratic at base, resting on an indurated shale or argillite, together probably with an intrusive rock approaching kersantite in character. The argillite is also found inland beneath the limestone, south-east of Hadibu. The Haggier mountains, a fine chain forming a sort of backbone to the island, consist of feldspathic granites, varying from coarse to fine, the former containing little besides quartz and felspar (the variety pegmatite), through which have broken minette, basalt, and felsite; the limestone may be traced some distance up their flanks. East of the Haggier, the granite rock continues, but quartz-felsites, and even rhyolites, appear to become more common, and an epidotic quartzite gives an indication of the occurrence of the metamorphic group. Granite and felsites form the inland district traversed by the river which passes Maaber, as well as the eastern half of the Haggier mountains.

The district in the neighbourhood of the coast between this and the next river to the east, consists of granite cut by felsites, rhyolites, and diorites, or dolerites. Possibly the gneissic series reappears here. Further east yet we obtain clearer indications of the latter, overlain as before by an extensive capping of limestone. Thus, the main axis of

the northern part (if not of the whole island), appears to consist of granitoid gneiss, replaced towards the centre by granite.

The granitic, felsitic, and rhyolitic rocks must occupy a considerable breadth of the island from north to south, for there are many specimens from districts traversed on the return journey from the eastern promontory, in which Prof. Balfour, after keeping parallel to the southern coast for some miles, struck inland in a north-west direction. Thus measured, there must be an area some ten miles across occupied by these rocks; and judging from the specimens, one would say that this was one of the chief centres of ejection of rhyolitic lavas; this is near that part of the island covered by the final A in SOKOTRA on the map. In crossing back to the north shore along the course of the Haggier river granites, basalts, felsites, and rhyolites, as might be expected, were collected. The conglomerates of felsite and rhyolite pebbles picked up on the Nowkad Plain, approaching the southern coast, show that there must be a large mass of these rocks somewhere on the south flank of the Haggier range.

The limestone is generally of a yellowish or whitish colour, compact in structure, and often not unlike the dolomites of the Italian Tyrol, in the hand specimen. Microscopic examination shows that it is sometimes partially dolomitized. It contains numerous foraminifera *amphistegina*, *globigerina*, *textularia*, *rotalina*, &c. The first of these shews that it is probably of Middle Tertiary age, and thus rather later than the limestone of the Sinai Peninsula.

The author's investigations lead then to the following conclusions: That the oldest rocks in Socotra are gneisses, hornblendic, and granitoid, belonging, like those of the north-west of Scotland, of North-east America, &c., to the earliest Archæan age. That these, as at Sinai, are broken through by granites, some of which resemble much those of Serbal and Jebel Musa, and that these are cut by later granites, felsites, and greenstones, together with basalts, the last probably of rather recent date. On the southern flank of the Haggier range, there must have been a rather extensive volcanic disturbance, from which rhyolitic lavas, often showing marked fluidal structure and scoria were ejected. The date of these eruptions cannot be fixed, but it was prior to the deposition of the limestone, and may be much older, except locally, where there is a little sandstone possibly representing the Nubian sandstone (Carboniferous) of Sinai, and the argillite. What is now Socotra, would appear to have been a land surface from very early times, until the submergence in the Miocene period, when the great masses of limestone were deposited. It is, however, quite possible that the peaks of the Haggier range may have remained above water even during that time. Since its elevation, great denudation has doubtless taken place, including the definition of the island, and the sculpturing of the valleys in the limestone

district. During this period, there have been some disturbances of a volcanic nature, as the limestone is cut by dykes of basalt, and of compact trachytes which, however, differ considerably from the purplish rhyolites already mentioned. As there is a possibility of this island having remained above water from a very remote antiquity, the investigation of its flora and fauna will possess a peculiar interest.

XV. "On the Photographic Spectrum of Comet (Wells) I, 1882."

By WILLIAM HUGGINS, D.C.L., LL.D., F.R.S. Received June 15, 1882.

On the evening of Wednesday, May 31, I obtained a photograph of the spectrum of this comet with an exposure of one hour and a quarter. A spectrum of *a Ursæ Majoris* was taken through the other half of the slit, on the plate, for comparison.

The photograph shows a strong continuous spectrum extending from about F to a little beyond H. In this continuous spectrum I am not able to distinguish the Fraunhofer lines. In this comet therefore, at this time, the original light giving a continuous spectrum must have been much stronger relatively to the sunlight reflected than was the case in the comet of last year. It should be stated that the greater faintness of the present comet made it necessary to use a more open slit, which would cause the Fraunhofer lines to be less distinct; but the lines G, H, and K are to be clearly seen in the star's spectrum taken under the same conditions.

Eye observations by several observers on the visible spectrum of the comet had already shown that this comet for the first time since spectrum analysis was applied to the light of these bodies in 1864, gives a spectrum which differs essentially from the hydrocarbon type to which all the comets previously examined spectroscopically (about twenty) belong.

In the visible spectrum bright lines, presumably of the vapour of sodium, and some other bright lines and bright groups of lines have been seen. The hydrocarbon bands in this part of the spectrum have been suspected to be present by some observers.

The photographic spectrum differs greatly from that of the comet of last year.* I am not able to see the cyanogen group in the ultra-violet beginning at wave-length 3883, nor are the other two groups between G and *h* and between *h* and H to be detected.

The continuous spectrum which extends from below F to a little distance beyond H, contains at least five brighter spaces, which are doubtless groups of bright lines, though it is not possible in the pho-

* "Proc. Roy. Soc.," vol. 33, p. 1.