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The following Communications were read :—

1. *On the GOLD-FIELDS of BALLARAT, EUREKA, and CRESWICK CREEK, VICTORIA.* By M. HENRIQUE ROSALES.

[Communicated by W. W. Smyth, Esq., F.G.S.]

DURING the voyage to Australia I carefully studied the Government Reports on the gold-fields; and on my arrival I was greatly disappointed to find that the same regulations were still in force, which entirely precluded the establishment of a regular gold-wash work. I had five men, miners and others, bound to me for two or three years; and all that remained for me to do was to follow the example of others, and try my luck in the gold-lottery, for success under the present system of claims is a mere chance.

We first entered the gold-field of Eureka; but finding that, from the exhaustion of the shallow works, there was only deep-sinking, we proceeded to Creswick Creek, about twelve miles north of Ballarat, where between November and March I have sunk many a hole, some of which proved blanks, others were too poor to pay.

Ballarat*, Eureka, and Creswick Creek, although not one gold-

* [See also Mr. Wathen's paper on the Victoria Gold-fields, *Quart. Journ. Geol. Soc.* vol. ix. p. 74; and Mr. Selwyn on Mount Alexander District, *ibid.* vol. x. p. 299.]

field "in law," belong to the same auriferous tract, geologically speaking.

[On a MS. sketch-map accompanying this memoir, the author has laid down the principal water-courses and ranges for several miles round Creswick Creek, and also Eureka, but not the intermediate country, on account of the distance.]

In the following description I shall confine myself to the auriferous region of the "Ranges," for the basalt which hems it in on the east and west may be regarded only as a frame to the picture.

The general character presented by the gold-fields is an undulating surface, with steeper slopes where the slaty rock protrudes, and gentler slopes in the low lands, where the soil is composed chiefly of quartz debris, and is covered by the monotonous vegetation of the gum-tree. The features of the gullies and hills are so much alike, that when the traveller has seen one portion he knows the appearance of all. This tract is watered by creeks, which in summer generally dry up entirely unless they spring from the basalt: near Creswick Creek all the springs flow from that rock; and you can tell their position from a distance if you see a tea-tree. The basalt forms plateaux, not thickly timbered, but producing excellent grass; hence most of the squatters have picked out this ground for their "run." The general aspect of the vegetation enables you to draw the boundary of the basalt; for on this rock the "white gum-trees" are predominant, whilst on the auriferous ground the "stringy bark gum-trees" are almost exclusively seen.

The general geological character of this tract is "quartz-schistose," which is covered in the plains by drift or alluvial soil. "Quartz-schistose" is the misapplied term employed here to signify an indefinite succession of strata of clay-slate and of argillaceo-arenaceous micaceous slates, interstratified apparently, as regards their strike, with quartz-veins of all sizes. These veins, however, appear to traverse the slates on their dip (figs. 1 and 2), as at Black Hill near Ballarat, where the quartz-veins are regular lodes.

Figs. 1 & 2.—*Quartz-vein in slates at Black Hill, near Ballarat.*

The strike or bearing is, as far as I have observed, generally north and south, dipping very commonly 85° and more to the east, but

sometimes curved, and sometimes to the west, as towards Spring Hill, Creswick Creek.

It is these quartz-veins which form the matrix of the gold.

Quite unconformable to the slaty rocks is a conglomerate of pebbles of white quartz with a rust-coloured cement. This (the "iron-cement" of the diggers) is the only solidified rock belonging to the alluvial soil, and is found at varying distances, 10 to 20 feet, from the bottom of the alluvium, being sometimes only 1 or 2 feet thick, at others as much as 12 feet.

Where the slate-rock is covered by drift-deposits, it is generally decomposed into silicate of alumina; but not so much disintegrated as to prevent your distinguishing the "pipe-clay," which has been formed of the clay-slate, from the sandy pipe-clay ("sandstone bottom" of the diggers) resulting from the decomposition of the arenaceo-micaceous slates. Where the strata are decomposed but unmoved, the strike and dip are a sufficient index to distinguish a "true" from a "false bottom," *i. e.* whether the digger has reached the slate, or has still to penetrate more of the alluvial deposits. For want of observation of this kind, some holes have not been "bottomed" at once, whilst one at Bendigo penetrated 200 feet down into the slate in a vain search for another bottom. Although the "pipe-clay" consists principally of silicate of alumina, it retains sufficient potash mechanically mixed with it to render brackish the water which filters through.

The drift or alluvial deposit sometimes includes two "bearing beds" (charriages), containing gold. The lower of these—beginning from the base of the whole—consists of large quartz-boulders, sometimes of 4 or 5 cubic feet volume, which always indicate the run of the auriferous ground; and these are covered by gravels, sands, and clays, without any regular order of superposition.

From the absence of basaltic boulders, and from my observation of basalt overlying the auriferous detritus at Clark's Diggings, I consider the gold-bearing beds to be older than the eruption and flow of the basalt, although this is followed up by the detrital beds of more recent date.

Hence results the important fact, that the gold may sometimes be found beneath the igneous rock.

The alluvial deposits may thus be divided into,—

I. Older than basalt ..	{	A. Before the eruption of basalt and the "charriage" of basalt-boulders.
	{	B. Contemporaneous with charriage of basalt-boulders.
II. Newer than basalt. .	{	C. Newer beds covering the basalt-boulders, but older than the formation of the existing valleys.

At Creswick Creek the "charriage" seems to come from the east and south-east; but my endeavours to trace it have been foiled in approaching the Ranges, where it splits up into many branches. When thus tracked up, the bed of the charriage shows signs of

having been disturbed, as for instance on "Flour-bag," Creswick Creek, where the auriferous layer sometimes crops out on the top of a hill, and is separated from the next depression by a ridge of slate,

Fig. 3.—*Superficial auriferous deposits at Flour Bag, Creswick Creek.*

whilst on both sides it is found at a depth of 30 and 45 feet below the bottom of the existing gullies, which run nearly north and south. See fig. 3.

A great portion of these inequalities of the gold-charriage are so covered by the more recent alluvium, that the relief of the present surface does not in the least correspond with that older bed. In direction also, or strike, it differs entirely from the modern water-courses, as for example at Creswick Creek, where the auriferous run crosses the flat formed by the present creek, and proceeds to "Flour-bag," "White Hill," the "New Rush" (a place which I opened, and which has turned out the richest in this locality), "Hard Hill," "Little Hard Hill," "Iron Hill," and down to "Large Point." In practice it is therefore useless to put down a hole according to the relief of the soil, although I am informed it is not so at Forest Creek, on the Bathurst side.

The inequalities above described I am inclined to ascribe to a disturbance at the period of the eruption of the basalt, although I must admit that I have not observed proofs of it in the slaty rock, and I should infer that its beds had been raised and sunk like wedges in the direction of its cleavage.

Thus far I have only spoken of one gold "charriage;" but in Ballarat, I believe, we may distinguish two:—1st, the deep bed, with boulders of moderate size; 2nd, the shallow bed, with large boulders.

The deep bed of Ballarat is formed of several "lines" (as the diggers say), or ancient water-courses, of no great width, which, although they crop out on the Ranges, attain a depth of 120 and 130 feet, and have acquired for Ballarat its great celebrity.

The course of this "deep-sinking" charriage is as follows:—1st line, the Eureka, which I believe will join with that near Pennyweight Flat; 2nd, the New Chum, Canadian, Donald's Flat, and Gravel Pits, this being the furthest point at which deep-sinking has

proved the "run of the line." My impression is, that it would be found proceeding further to the north-west, under the basalt.

The shallow bed is found across Pennyweight Flat, Golden Point, and Ballarat Flat, whence I believe it would pass, like the other, under the basalt. It is distinguished from the former by its insignificant depth, its width, sometimes amounting to a full half-mile, and its much larger boulders; and, whilst in the former the gold runs in gutters, here it occurs in patches.

In conclusion, regarding the future prospects of the gold-field, the diggers will continue, as at present, to follow up the alluvial beds, until after a time they are prevented by the great expense of labour required to reach them; and then the gold regulations will have to be altered, and companies may be established and go to work in a proper way. It is only then that the deeper beds and the auriferous veins can be fairly opened on with due prospects of success; but how many changes must take place before this! Laws, wages, roads, &c., all must change!

2. *On the GEOLOGY of part of the PEEL RIVER DISTRICT in AUSTRALIA.* By FREDERICK ODERNHEIMER, Esq.

[Communicated by Sir R. I. Murchison, V.P.G.S.]

NEAR the Dividing Range of Australia, to the east and to the west, igneous rock and metamorphosed sedimentary rocks prevail, together with breccias and conglomerates, composed of both of the preceding kinds. At a greater distance from the Dividing Range, slates, shales, limestone, and grits, belonging, as it appears, to the older carboniferous system, predominate; these are much traversed by, or sometimes regularly interstratified with igneous rocks, and are overlaid at some distance from the Dividing Range by coal-bearing beds, the age of which is yet a matter of controversy.

In the Peel District, of which I shall exclusively speak in the following remarks, true granite occurs but rarely. By becoming much charged with hornblende, it passes into syenite, and this latter, assuming a fine-grained or compact structure, passes into diorite. Porphyritic rocks appear in different places, and have either a granitic base-, felspar- and hornstone-porphyry (felsit-porphyr of the Germans),—or a syenitic or dioritic base. Serpentine is also vastly developed, especially on the Crow-land, or east side of the Peel. Trap or basalt is of less frequent occurrence in the Peel District, and is partly in the form of veins, partly intruded between the strata of sedimentary rock and forming beds parallel to the strata.

In contact with the igneous rocks is a great extent of metamorphosed sedimentary rocks, especially silicified slate. The silicification of the sedimentary rocks is a remarkable and very obvious fact, and will nowhere be found to greater amount than in this locality, and all along the Dividing Range; only in rare cases some insulated masses of soft slate are observed, enveloped in the metamorphosed rock. Not only has the slate partaken of the silicification,