ABSTRACT OF THE PRINCIPAL MINES OF THE BURNLEY COAL FIELD.

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In a paper prepared for, and read before, the British Association, Mr. Whitaker and myself entered pretty fully into detail respecting the Burnley Coal Field. We have since thought that the following abstract (with extensive additions) of its principal features, might not be unworthy of the notice of this Society. On examining the whole of the strata lying between the surface and the limestone, it will be found that the coal measures range themselves into three natural divisions; each series being separated from the next by a thick mass of strata almost, if not entirely, devoid of coal. We shall adhere to this natural division in what follows.

Burnley Upper Series.

At a distance of about 30 feet from the surface, we have—I. The Dogholes Mine, 6 feet thick, strata 21 feet. II. The Kershaw Mine, 3 feet thick, strata 81 feet. III. The Shelly Bed, 2½ feet thick, strata 19 feet. IV. The Old Five Feet Mine, or Main Coal, 5 feet thick, strata 33 feet. V. The Higher Yard Mine, 3 feet thick, strata 162 feet. VI. The Lower Yard Mine, 3 feet thick, strata 75 feet. VII. The Low Bottom Mine, 4 feet thick, strata 21 feet. VIII. The Cannel Mine, 2½ feet thick, strata 22 feet. IX. The Full-edge Thin Mine, 2¾ feet thick, strata 66 feet. X. The Byng Mine, 4 feet thick, strata 240 feet. These form the *first* natural division, and may be appropriately termed the "Upper Series." The roof of No. 1 contains *Ferns* in great abundance, *Lepidodendra, Calamites, Sigillaria, Stigmaria*, &c. A bed of *Anthracosia* overlies No. VI, which is probably identical with that in the Wigan Series. The roof of No. VII contains abundance of vegetable forms, to which *Spirorbis*

Carbonarius occasionally adheres. Another band of *Anthracosia* overlies No. VIII. The roof of No. IX is exceedingly rich in ichthyological remains. Jaws, teeth, scales, and vertebræ of *Megalichthys*, teeth of *Ctenoptychius Pectinatus*, *Hybodus*, and *C. Apiciales*; and rays of *Gyracanthus*, *Pleuracanthus*, &c. A curious attenuated bivalve (*unnamed*) is also found here. The "byng" portion of No. X contains *Trigonocarpi* in abundance, as also *Lepidostrobi* and *Anthracosia*.

THE ARLEY, OR HABERGHAM SERIES.

Omitting several minor seams, we have here:—XI. The China Mine, 2 feet thick, strata 99 feet. XII. The Dandy Mine, 3 feet thick, strata 141 feet. XIII. The Habergham, or Arley Mine, 4 feet thick, strata about 675 feet. These form the Habergham Series, and give about 9 feet of coal to 445 feet of strata. From the "bone bed," in the black shale roof of No. XIII, fine specimens of remains of *Megalichthys*, *Rhizodus*, *Diplodus*, &c., have been obtained. The depth of strata below this mine, almost devoid of coal, forms the *second* natural division of the Burnley field.

THE GANNISTER, OR SPA CLOUGH SERIES.

Again, omitting several minor seams, many of which may be seen in the fine section in Dulesgate, near Todmorden, we have:—XIV. The Foot Mine, 1 foot thick, strata about 21 feet. XV. The Spa Clough Top Mine, 2½ feet thick, strata 140 feet. XVI. The Spa Clough Bottom Mine, or Bullion Mine, 4 feet thick, strata about 320 feet. This forms the *third* natural division; and, probably, in the above must be included:—XVII. The Salts Mine, and XVIII. The Spanish Juice Mine, which were identified during the Manchester Geological Society's recent visit to Gawthorpe Hall (*Trans. Man. Geol. Soc.*, vol. 2, p. 50), and are those so named in Mr. Binney's general section (*ibid*, vol. 1, p. 77); but their position in this locality is, perhaps, not yet accurately known. The roof of No. XV contains rays of *Gyracanthus*, teeth of

Rhizodus, Megalichthys, Holoptychius, &c. That of No. XVI is very rich in fossil remains. Specimens of the genera *Buccinum Pyramis, Catillus, Bellerophon*, &c., are found in abundance, as are also *Pectens, Goniatites*, and *Orthoceratites*. The usual coal plants abound.

THE GRIT SERIES.

This series naturally forms itself into three subdivisions—the *Upper, Middle* and *Lower Grit Beds*. The "Upper Beds" consist of XIX. The Boaredge Mine, 9 inches thick, strata about 38 feet. XX. The Featheredge, or Sand Mine, $2\frac{1}{4}$ feet thick, strata about 420 feet. The "Middle Beds" comprise—XXI. The Brooksbottom Top Mine, 6 inches thick, strata 6 feet. XXII. The Brooksbottom Middle Mine, 8 inches thick, strata 42 feet. XXIII. The Brooksbottom Bottom Mine, $1\frac{1}{4}$ feet thick, strata about 320 feet. The above distances and thicknesses of beds, &c., are taken from Mr. Binney's general section; but they must not be considered as uniform throughout the locality. The whole of the mines, however, exist in the Burnley Field, as also the following from the same section. The "Lower Beds" are, XXIV. The Thin Grit Mine, 4 inches thick, strata about 45 feet. XXV. The Thick Grit Mine, 8 inches thick, strata about 400 feet. The last two seams, with some others, are to be seen at Gauxholme, near Todmorden; and also in various places near Newchurch, in Pendle. A bed of shale occupies a middle position between the Upper and Lower Grits, and contains specimens of *Phragmoceras, Goniatites, Aviculo-pectens, Posidonia*, and *Orthoceratites*.

The Yoredale Rocks succeed the Millstone Grits, and average in depth, between Pendle and Clitheroe, at least 900 feet. These are succeeded by the Carboniferous Limestone strata which pass into the Old Red Sandstone and Devonian rocks, as noticed by Mr. Hull in his excellent work on "*The "Coal Fields of Great Britain.*" Various faults traverse this Coal Field in the direction of N. W. by S. E. One of these

throws up the Arley, or Habergham Mine, to very near the top of Hambleton, a vertical height of over 300 yards. This coal again occurs, near Thorney Bank Farm, at a lower level of over 40 yards; whilst at Habergham itself its depth below the surface is at least 200 yards. A throw of about 100 yards in vertical height brings the same mine, at Fulledge, to within 240 yards of the surface, notwithstanding the presence of the Upper Series; and this has been taken advantage of by Mr. George Wild, the well-informed manager of these collieries, who, by driving a drift from one of the Upper Mines, has won the Arley Coal by a vertical shaft of only 40 yards in depth. A vein of lead ore of fair quality occurs amongst the strata above Hambleton Quarry; it occurs again near Thieveley Farm, in Cliviger; and, again, on the hill side, near Cross Stones, Todmorden. Its direction is consequently nearly N.W. by S.E. There are many good natural sections of the strata in different localities; the one at Heysand Ford, near Burnley, gives two of the Mines in the upper series, and also an accompanying bed of *Anthracosia*, &c. In an artificial section at Habergham Quarry, the sandstone rock is covered by a layer of shale, almost wholly composed of *Calamites*, *Lepidodendra*, &c., and above this are about 20 feet of dense blue clay, containing boulders of grit, waterworn masses of encrinital limestone, portions of cannel much waterworn, coal, &c.; the *debris* of strata which have been long exposed to a powerful denuding action. From the presence of the rounded masses of encrinital limestone, &c., it may be inferred that the currents in the old seas set from N. E. towards the S. W., or from Craven towards the estuary of the Ribble. To these and glacial action may be attributed all the denudations evident in the district; and, when standing on the crest of Hambleton, and looking down the valley of the Calder, and up that of the Hodder, it is not difficult to trace, at least in imagination, the terraces which have successively formed the margins of these ancient seas.