

of comparison free from the danger of systematic error. There is little doubt that if the telescopes and operators practise together, either before or after the transit, data may be obtained for a satisfactory solution of the problem in question.

To attain the object of the present paper, it is not necessary to enter into details respecting choice of stations and plans of observation. I have endeavoured to show that no valuable result is to be expected from hastily-organised and hurriedly-equipped expeditions; that every step in planning the observations requires careful consideration, and that in all the preparatory arrangements we should make haste very slowly. I make this presentation with the hope that the Academy will take such action in the matter as may seem proper and desirable.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS—MEETING AT GLASGOW

AFTER having had an existence of some fifteen or sixteen years, during which it has done a large amount of scientific and thoroughgoing practical work, this North Country Institute has just deviated from its usual practice of holding its meetings in Newcastle-on-Tyne, and, with the co-operation of the Scottish Engineers and Shipbuilders' Association, has held a very successful meeting in Glasgow, the centre of the great Scottish coal-field, and the head-quarters of the mining and engineering industries of Scotland, and of the shipbuilding industry of the United Kingdom. The meeting began on Tuesday, the 9th of August, and extended over four days. On the opening day the Lord Provost of the City of Glasgow received and formally welcomed the members of the North of England Institute in name of the citizens and the Institution of Engineers and Shipbuilders; and thereafter the chair was taken by Mr. E. F. Boyd, President of the North of England Institute, and the business of the meeting commenced.

There were set down for reading and discussion no fewer than eighteen papers, the subjects treated of being all directly connected with mining and mechanical engineering. Only three papers were overtaken on the first day, when it was found that the time for adjournment had arrived. The afternoon was spent by the members in visiting various engineering and shipbuilding works, and other manufacturing establishments, which were freely thrown open to inspection by their respective proprietors.

We shall here briefly indicate the nature of the papers read and discussed at Tuesday's sitting of the Institute.

1. "On the Geology of the Coal Measures of Scotland," by Mr. James Geikie, district surveyor of the Geological Survey of Scotland. The author described, first, the calciferous sandstone series, which, when typically developed, consists of two groups of strata, the lower pointing to the prevalence of marine conditions during the deposition of the red sandstones and conglomerates, and the upper showing that during its accumulation marine and brackish water conditions alternated with the occasional appearance of land surfaces. Volcanoes were somewhat prevalent during the deposition of both groups. Second: The carboniferous limestone series, consisting of a lower group indicating marine conditions and occasional old land surfaces; a middle group indicating frequent land surfaces, and alternate brackish water and marine conditions; and an upper group pointing chiefly to lower marine conditions, with occasional brackish water deposits and a few old land surfaces: both submarine and subaerial volcanoes very active during the deposition of the whole series. Third: The millstone grit, deposited under almost exclusively marine conditions. Fourth: The coal measures, showing a prevalence of brackish or freshwater conditions, with abundant land surfaces, and speaking also of occasional inroads of the sea. No igneous rocks contemporary with the coal measures or millstone grit. Fifth: Intrusive rocks of three classes, namely, intrusive sheets, referable to close of "coal measures" group; bosses or pipes of tuff or agglomerate, probably of Permian age; and dykes of dolerite of Miocene ages. Sixth: Two systems of faults of different ages; the oldest striking N.E. and S.W., and the other, a double set, striking approximately E. and W. and N. and S. Mr. Geikie, in concluding, referred to the exceeding richness of the variety shown by the phenomena of the Scottish carboniferous formation, and said he had no hesitation in affirming that, when the palæontological and geological history of the carboniferous rocks of Scotland were worked out, there would be prepared one of the most important chapters in the physical history of the country.

2. "On the Magnetic Ironstone of Rosedale Abbey, Cleveland," by Mr. John Marley, M.E. This paper treated of the extraordinary deposit of magnetic ironstone which occurs at Rosedale West, and forms a very peculiar feature in the famous Cleveland ironstone, regarding which various papers have been published since 1857, when Mr. Marley first drew the attention of scientific men to it. The magnetic stone occurs quite isolated in two troughs, one of which is 90 feet deep, and it contains, in the best specimens, from 42 to 50 per cent. of metallic iron. In 1857 its extent was unproved, but it was believed to be very great, but this is now known not to be the case, from the results of recent borings and explorings which Mr. Marley fully detailed. The author explained the curious geological relationship which the magnetic stone bears to the top bed of the lias ironstone of Cleveland. The troughs lie east and west. Icebergs and glacial action were, in his opinion, in no way connected with the induction of the magnetic state, nor yet with the formation of the troughs. The deposits are not two beds of regular strata, nor are they veins, as no fissures have yet been found in the bottom of the troughs, although they have been diligently looked for. Mr. Isaac Lowthian Bell supplemented Mr. Marley's description by giving the results of a visit which he had paid to Rosedale, and stated that the magnetic ore could not be the result of volcanic action, as carbon was always contained in the analysis, as also water of hydration and a notable quantity of carbon.

3. "On the Duty of Cornish and other Pumping Engines," by Mr. J. B. Simpson. This paper was of especial interest on account of the subject treated of in it having a most intimate connection with the economy of fuel and the duration of the coal supply. After describing fully a Cornish engine recently erected in the Newcastle district, the author entered upon an examination of the details of twelve different kinds of engines, and compared their merits with those of the Cornish engine. In conclusion, he said that taking those engines into consideration, their average duty corresponded to a consumption of 14lb. of coal per horse-power per hour. Were a duty of 4lb. obtained, the saving in these engines alone would represent 40,000 tons of coal per annum, or, at 3s. per ton, 6,000*l.* The assumed total horse-power of pumping-engines in the Newcastle district is about 10,000, and from this the amount of the possible annual saving may easily be calculated. In many places coal may not be worth 3s. per ton at the pit mouth, but in the majority of cases its value is much greater. It is too much the practice to regard coal at the colliery as of little or no value, and that the extra 10lb. or 12lb. per horse-power per hour is not worthy of consideration. But fuel is not the only pecuniary part of the question, as extra consumption of coal means additional water, additional repairs, additional wear and tear, and additional manual labour—and these in the aggregate are very serious items of cost. The time does not seem far off when, in pumping and other colliery engines, the effective duty of 2lb. or 3lb. of coal per horse-power per hour will be considered as important as in the engines of London water-works and ocean steam-ships.

In the evening of Tuesday a *conversazione* was held in the Corporation Galleries. The east and west halls were occupied by numerous collections of objects—geological, palæontological, mineralogical, metallurgical, chemical, mechanical, engineering, mining, &c., together with a magnificent display of photographs, by Annan, of the Old Glasgow College, and various engineering works and Clyde-built ships. This exhibition was of immense scientific and industrial interest, and was at once the most extensive and valuable that has been held in Glasgow for many years. Advantage was taken of this evening's meeting to perform an interesting ceremony, namely, the presentation of a marble bust to Professor W. J. Macquorn Rankine, C.E., F.R.S., first president of the Institution of Engineers in Scotland, as a token of the appreciation and esteem of the members. A duplicate copy of the bust was also presented to the institution as a memorial of the Professor's labours in promoting the success of the institution. In the Large Upper Gallery there was an exceedingly interesting exhibition by means of the oxy-hydrogen light, of sections of fossil corals, by Mr. James Thomson, F.G.S., a gentleman who has of late years gone most extensively and enthusiastically into the study of fossil corals, and made it almost entirely his own; and so fully persuaded are palæontologists of the great value of his investigations, that Mr. Thomson is assisted by a grant from the British Association, at the forthcoming meeting of which he is to present a second report and exhibit his wonderful series of specimens.

On Wednesday morning the reading of papers was resumed, Mr. E. F. Boyd again presiding. The following is a brief notice of the papers overtaken :—

1. "On the Economical Advantages of Mechanical Ventilation," by Mr. D. P. Morison. The author stated that tabulated results of experiments recently made showed that the saving effected in the consumption of fuel varied in most cases from 40 to 80 per cent. in favour of mechanical ventilation as compared with furnace ventilation. The latter had other disadvantages, such as (1) the danger of an open fire in a fiery seam; (2) in order to avoid that danger, the necessity and serious cost of constructing a dumb drift to convey the return air to the upcast shaft, and the fact that a large amount of fresh air is required to feed the furnaces, while it is of no value in the workings themselves; (3) the serious fact that the upcast shaft, being usually heated to nearly its practical maximum, cannot, in cases of necessity (such as a sudden fall of the barometer, an unexpected occurrence of a large discharge of fire-damp, or a block in the air-ways), be made at once available for an increased duty; (4) the inordinate wear and tear upon furnaces, arches, bars, and the shaft lining, whether brick-casing or tubbing, and in case of a coal-drawing upcast shaft, the deterioration of the ropes, guides, cages, and other plant. In no case could the furnace compete successfully with mechanical ventilation. Even in the deepest of English mines the advantage of mechanical ventilation is shown by the economy in fuel being from 35 to 40 per cent. over that required for furnace ventilation. Mr. Morison described various mechanical ventilators, including those of Struve, Nasmyth, Lemielle, Waddle, Guibal, and others. He expressed himself as most in favour of the Guibal ventilating fan, the one most in use both on the Continent and in this country. An interesting discussion followed Mr. Morison's paper, remarks being made by Messrs. Lupton (Leeds), Steavenson (Durham), William Cochrane and Simpson (Newcastle), Barclay (Kilmarnock), Marley (Darlington), Harvey (Glasgow), and others.

2. "On J. Grafton Jones's Coal-getting Machine," by Mr. Arnold Lupton, Leeds. After describing the machine in question, and specially dwelling upon its involving the use of the hydraulic wedge and a drilling apparatus, Mr. Lupton claimed for it the following advantages:—1st, The safety with which mines can be worked by it as a substitute for gunpowder; 2nd, The superior shape of coal got by the wedge as compared with that got by blowing, and the less amount of slack made; 3rd, The improvement in the health of the miners likely to ensue on the disuse of gunpowder; 4th, The saving in labour by using the hydraulic wedge instead of hammer-driven wedges; 5th, The saving in labour and diminution in the amount of slack made by using the hydraulic machine to push the coal out of the solid, in working those seams whose nature is such as to render it possible. Mr. Lupton stated that Jones's powerful machine is now in use, pushing coal out of the solid without any holing or natural breaks in the seam, at Kiveton Park Colliery, in South Yorkshire. The seam is five feet thick, and the coal is very hard, but by the use of the hydraulic wedge blocks are got four yards long and four feet wide—each about eight tons weight—at one application of the machine. In the course of the discussion which followed various other important and interesting facts were evoked.

3. "On an Expansive Double-cylinder Pumping Machine," by Mr. Andrew Barclay, Kilmarnock.

4. "On an Expansive, High-pressure, Cut-off Slide Valve," by the same.

5. "On a New Coal-getting Machine," by Mr. George Simpson, Glasgow. The author of this paper dwelt at some length on the working of coal on the "long-wall" system by machinery, and then explained the nature of the machinery which he thought most suitable for it. The essential feature of the machine, exhibited and described by Mr. Simpson, is a somewhat saw-like blade which works into the face of the coal seam in a horizontal manner. Mr. Simpson said it was indispensable that the tool to be used should be durable and easily removed and replaced in case of blunting or breakage, and he claimed that his cutter possessed those qualifications. He also showed an application of an endless chain for driving the proposed machinery, and which might be worked by an engine on the drawing road at the face of the coal, or from the bottom of the shaft or other convenient point.

6. "On the Utilisation of Blast Furnace Gases, Coal being used as the Fuel," by Mr. William Ferrie, Monklands, Iron and Steel Works, Lanarkshire. The author stated that it had occurred

to him that if raw coal could be coked in the blast furnace as in a common gas retort, the difficulty of withdrawing the furnace gases for use would be overcome, and he immediately commenced experiments with a small blast furnace, one-fifteenth of the capacity of a 50-foot furnace. The upper part was divided into two compartments or retorts into which the coal, ores, and limestone flux were charged; and the top of the furnaces was closed in by the ordinary bell and cone arrangement, as in the Cleveland district. The gases passed off into a main which communicated by two pipes, one to each side of the furnace, to the entrance of the flues at the bottom of the retorts, and were ignited by the aid of atmospheric air. These flues were spiral, in order that the heat from the burning gases might permeate the materials inside the retorts, while the exhaust gases were thrown off by chimneys at the top of the retorts. This small furnace was worked for about two months with raw coal only as fuel, and the results were highly satisfactory, notwithstanding that the furnace was so small in size. Being convinced that this plan of working a furnace was practicable, Mr. Ferrie had forthwith commenced the alteration of one of the ordinary furnaces at Monkland Works, which he said would be ready for operating with at the end of the month of August.

7. "On Mineral Oil Works," by Mr. David Cowan. The author referred to the manufacture of mineral oils as one of the leading industries of Scotland; to the nature and extent of the oil yielding materials, namely, bituminous shales and cannel coals, distributed throughout the Scottish coal measures; and to the quantity and quality of the produce from those materials. He afterwards described the mode of treating the raw materials, referring to the horizontal and the vertical retorts used in Scotland, comparing their advantages and disadvantages, and then described an arrangement of apparatus designed to combine the advantages of both kinds of retorts, and which would at the same time admit of improved facilities of workings. In order to improve the mode of firing, Mr. Cowan suggested that instead of coal the retorts should be heated with gas flame, and further, that the system of first converting the fuel into gas (as successfully worked out by Siemens) should be adopted. He estimated that the mode of heating by gas in this way would effect a saving of from 40 to 50 per cent. of the fuel.

The time allotted for reading and discussing papers having now arrived, the president announced that those papers which had not been overtaken, would become the joint property of the two institutions. They will doubtless be published along with the others in the transactions to be issued by each institution. The afternoon was spent in the same way as that of the preceding day; and in the evening a grand banquet was held, at which the members of the North of England Institute were the principal guests. Thursday was occupied in visiting collieries, iron-works, engineering, ship-building, chemical, and other manufacturing establishments at a distance from Glasgow; and on Friday there was an excursion on the saloon steamer Chancellor down the Clyde to Dunoon, and thence up Lochlong to Arrochar, from which the party walked or rode over to Tarbet, on Loch Lomond, a distance of about two miles. The visitors were then conveyed by one of the Loch Lomond Company's steamers to the top of that loch, "The Queen of Scottish lakes," where dinner was served. In the afternoon the whole length of the loch was traversed by Balloch, where the party took train and returned by the Dumbartonshire Railway to Glasgow. All the visitors were greatly delighted with the magnificent scenery along this route, as well as with the kindness, attention, and hospitality shown to them during their four days' sojourn in the "land o' cakes." Altogether, a very great degree of pleasure was experienced both by the members of the North of England Institute and by the members of the Scottish Institution. Not unlikely a return visit will soon be paid to the "Coaly Tyne."

JOHN MAYER

SCIENTIFIC SERIALS

THE *Revue des Cours Scientifiques*, for August 13, commences with a translation of Dr. Carpenter's lecture on the Temperature and Animal Life of the Deep Sea. This is followed by a report of Prof. Milne-Edwards's address in *comité secret* of the Academy in favour of the election of Mr. Darwin as corresponding member, the substance of which we gave last week. The last paper is M. Ed. von Beneden's very important and interesting article on *commensalisme*, or "fellow-boarding," as it has been termed, in the animal kingdom, extracted from the proceedings of the Bel-