Fig. 4. Portion of *P. linearis*, enlarged to show the cellules.
Fig. 5. Fragment of the stipe of *P. linearis*, showing reproductive (?) tubercles. Enlarged.
Fig. 6. *Diplograpsus Harknessii*, n. sp. The straight line beside it shows the natural size of the specimen.
Fig. 7. Germ, probably of the same. Enlarged.
Fig. 8. Ovarian capsule, or Gonophore, unruptured, showing the strong external border. Enlarged.
Fig. 9. Another, after rupture has taken place. Enlarged.
Figs. 10 and 11. Ovarian capsules, compressed vertically. Enlarged.
Figs. 12 to 15. *Graptolites Sedgwickii* (*Rastrites triangulatus*, Harkn.), with ovarian capsules attached to the cellules. Enlarged.
Fig. 16. Another specimen, where the capsule appears to come from the common canal. Enlarged.
Figs. 17 and 18. Germs of a di-prionidian Graptolite (?). Natural size.
Fig. 19. Ordinary germ of the natural size, introduced for comparison.

NOTICES OF MEMOIRS.

I.—On the probable Duration of the South Staffordshire Coal Field.[1]

By W. Stanley Jevons, Esq., M.A.

FOR some years there had been considerable anxiety concerning the supposed exhaustion of the Coal-fields, but it was only since 1860 when Mr. Hunt published his work upon the subject that the nation seemed to have been aroused to a sense of its importance. But this feeling of interest might be traced back as far as 1789, when John Williams seemed struck not only with the inestimable value of coal as the chief motive power of the country, but he also seemed to understand that it was necessarily of limited quantity. Previous to this time it was supposed that coal was a constant growth, filling up again the vacant places in the strata where it had been taken out. The fallacy of this theory, however, was soon discovered; and from that time the unfortunate circumstance that coal was necessarily limited was known and acknowledged. Mr. Jevons referred to the various writers and speakers who had of late shown so much interest in the great question as to the probable exhaustion of our coal fields, which had aroused the attention of the whole nation, and had now culminated in the appointment of a Royal Commission to investigate it. Mr. Jevons explained the method of proceeding by which this commission are prosecuting their enquiries, referring to each of the sections into which it is divided, and specifying the particular class of information which each section more especially seeks to obtain. On that occasion he did not intend going over the ground which had been trodden by other gentlemen, who were far better acquainted than he was with the resources of this particular locality. He wished, however, to offer some suggestions relating to the more economical use of coal in this country. First, he must notice the results of the inquiry of Mr. Mathews, contained in a paper published in the Transactions of the Society of Mechanical Engineers, which put the geology and the technical data in the clearest possible light.

[1] Being the substance of a Lecture delivered by Mr. Jevons at the Midland Institute, Birmingham, 25th March, 1867.

That gentleman considered that in the eastern part of this field, which lies north of Dudley, the unworked part consisted of only 1,160 acres, and allowing 20,000 tons per acre for the first and second workings, the total remaining in 1860 was 23,200,000 tons. Now the rate at which coal is being drawn annually was stated at 550,000 tons, and a simple division gave the probable duration of this part of the field as only forty-two years. In the western district, which lies upon the opposite side of that range of which Dudley forms a part, there are estimated to be 2,785 acres, which at 20,000 tons of coal per acre gave 55,700,000 tons. The rate of working was $1\frac{1}{2}$ millions of tons per annum, and a simple division gave thirty-seven years as its period of duration, supposing the demand and consumption to remain as it was. Thus it might be fairly said, that in less than half a century the thick coal of South Staffordshire, which is the most perfect store of fuel any nation has ever possessed, will be perfectly exhausted. The question now arises whether pits can be pushed down upon the flanks of this field with a chance of finding the thick coal again. The South Staffordshire field, however, had not the advantage of some other fields, where the strata dip gently and continuously down, and where you may be almost certain of meeting the original beds of coal, but the strata in the South Stafford field were much more irregular. This field is described by Mr. Beete Jukes as a Palæozoic island, pushed up through the Red Sandstone which extends over the larger portion of the centre of the country. The field had been forced up by volcanic power, which alone was a great obstacle to the exploration of coal, since they did not know at what depth down the strata might be found. Thus, in some places 1,000 to 15,000 feet of Permian strata might intervene between the coal, whilst at other times it might be absent. The lecturer went on to remark how greatly this part of the country depended for its industry upon the coal to be obtained in its neighbourhood, and proposed that the sinking of deep shafts for the purpose of discovering coal, should be undertaken at the public expense, when, if the coal was found, the owner of the field should be required to return the money expended, perhaps even with some interest. Mr. Jevons alluded to the shafts which had been sunk in the outskirts of the coal district for the purpose of ascertaining whether coal was to be met with, making special allusion to the workings of Mr. Dawes, at Halesowen, which, however, had not at present proved very successful. The great quantity of coal used in this district was called attention to, and the gradual rise in price of coal, and the iron trade generally, of this part of the country, and its probable decline, were touched upon.

II.—The Coal Resources of India.

By Dr. T. Oldham, F.R.S., F.G.S., Superintendent of the Geological Survey of India. Calcutta, January, 1867.

[Being a Return called for by the Right Hon. the Secretary of State for India.]

VIEWED as a coal-producing country, the British territories in India cannot be considered as either largely or widely sup-

plied with this essential source of motive power. Extensive fields do occur, but these are not distributed generally over the districts of the Indian empire, but are almost entirely concentrated in one (a double) band of coal-yielding deposits, which, with large interruptions, extends more than half across India from near Calcutta towards Bombay. Dr. Oldham has illustrated the areas from which supplies of coal may be looked for with any prospect of success, by a map, on which are marked those parts of the country of which sufficient knowledge is known to enable him to assert, that there is no probability whatever of any deposits of coal being found within their limits, or where, if coal do exist, it must be found at such a depth below the surface that it could not be economized. On the same map he has indicated, so far as the scale will admit, the true limits and outline of those coal-fields which are known. Of a very large portion of these coal areas detailed examinations have been made, and descriptions published by the Geological Survey of India. Until all the fields have been carefully mapped, any estimates of the coal resources and production of British India must be defective. Up to the present time it may be said that little more than surface workings have been carried on in India. The deepest pits scarcely exceed seventy-five yards, while certainly one-half of the Indian coal which has been used up to the present date, has been produced from open workings or quarries. In forming an estimate of the value of the coal before it has been worked to a sufficient extent to admit of its quality being tested by practice, Dr. Oldham has been guided by a series of analyses of specimens obtained from the several coal-fields. The average composition of 74 specimens of the coal gives—Carbon, 52.2; volatile matter, 31.9; ash, 15.5. Now as the relative duty or effective power of coals may be taken to vary directly as the amount of fixed carbon which they contain, Dr. Oldham concludes that, out of the whole series of Indian coals, the very best of them only reach the average of English coals, and that on the whole they are very inferior to them.

III.—The Coal of Russia.

By Lieut.-General G. de Helmersen.

[Des gisements de Charbon de Terre en Russie. 8vo. St. Petersbourg, 1866, pp. 58.]

In this small pamphlet the author discusses the properties, geographical distribution, and present applications of the Russian coal, and points out in what localities it may profitably be worked. Although our knowledge of the geological constitution of Russia is far from complete, yet sufficient is known to determine the extent of the workable coal deposits. They have been met with of Tertiary, Jurassic, and Carboniferous age.

Beds of Tertiary coal occur on the right bank of the Dneiper, near Kier, where they have been worked with profit. Tertiary Lignite beds are found in the neighbourhood of Orenbourg; they are, however, poor in quality.

The Jurassic coal is met with near Koutaïss, in the Trans-Caucasian

region. It is, however, neither sufficiently abundant nor of such a quality as to be worth the cost of working.

Coal of Carboniferous age is developed—

1. On the eastern and western slopes of the Oural mountains.
2. In the governments of Novgorod, Iver, Moscow, Kalouga, Toula, and Riazan. The coal occupies a large elliptical basin, six hundred versts in length and four hundred in width, in the centre of which the town of Moscow is situated.
3. In Samara, a little peninsula formed by the river Volga, near Stavrpool; and
4. In the government of Ekaterinoslav, where the coal-beds form a chain of low mountains called the Donetz, and are associated with abundant deposits of iron, which latter have not at present been worked for economic purposes; though they would well repay the cost.

The Carboniferous beds of Russia all belong to the lower member of the Carboniferous system, equivalent to the "Carboniferous limestone" of Great Britain. The Russian beds, however, are mainly composed of sandstone, with intercalated beds of limestone and coal.

In a map which accompanies the pamphlet, the author has carefully indicated the extent of Carboniferous strata in Russia, and has inserted, also, the railways in order that their respective relations may be understood. It is to the want of railways that the coal and iron resources of the Oural, and of the Donetz mountains, have not been rendered available to anything like the extent to which they are capable.

The author concludes by expressing a hope that before long Russia will not be dependent upon foreign countries for the supply of iron and coal it requires, when it is so largely developed in its own dominions.

REVIEWS.

I.—Physical Geography. By Professor D. T. Ansted, M.A., F.R.S., F.G.S., etc. Wm. H. Allen and Co., 13, Waterloo Place, Pall Mall, London. 1867.

THE well known author of several geological works has recently given to us this highly interesting volume upon Physical Geography; attaching a very wide signification to the name, and entering at considerable length into statements of a multitude of subjects belonging to, or connected with, physical science.

The impossibility of treating this science in such a manner as to render it light reading is noticed in the preface, and the object of the volume is stated to be to enable the general reader to obtain an outline of its main facts, in language as simple and definite as possible. It is further said to involve "not only a statement of numerous facts, but a great classification of facts, and much close reasoning," and also, "it needs an effort on the part of the reader to appreciate the array of facts and observations on which it is based;