depth of working. It will, therefore, be for mining and mechanical engineers to bring all the resources of their science to bear upon this difficult problem of counteracting terrestrial heat, at depths where it approaches the limit of human endurance. The Commissioners adopting 4,000 ft. as the probable limit of practicable depth, came to the conclusion that there exists in this kingdom an aggregate quantity of about 146,480 millions of tons of available coal. If we assume that the future population of this country will remain constant, and that the consumption for domestic and manufacturing purposes, including exportation, will continue uniform at the present quantity, or merely vary from year to year without advancing, then our stock of coal would represent a consumption of 1,273 years. But if, on the other hand, we assume that population and consumption will go on increasing at the rate exhibited by the statistics of the last fifteen years, or, I might probably say, of the last fifty years, had accurate statistics been so long recorded, then the whole quantity of coal would, as shown by Mr. Jevons, be exhausted in the short space of 110 years. It will be generally admitted that the truth is likely to lie between these two extremes. The Commissioners refrained from expressing an opinion as to what the period of duration would actually be, but they presented certain alternative views of the question, resulting in periods varying from 276 to 360 years. But, all these estimates of duration have reference to the time required for absolute exhaustion of available coal, and leave untouched the important question of how long we are likely to go on before we become a coal-importing instead of a coal-exporting country. The computation of quantities made by the Commissioners, includes all coal seams exceeding 1 ft. in thickness, whatever the quality may be, and it is obvious that vast quantities of such coal can never be worked, except at a price which would render it more advantageous to purchase coal from abroad than to work it from such unfavourable beds. If, at the present time, while working our best and most available coal, our markets will barely exclude the coal of Belgium, what will be our position when driven to inferior coal more costly to work? If we look to cheaper labour for enabling us to work less valuable coal, I fear we shall look in vain; but there is one hope for a longer endurance of our prosperity as dependent on our coal, and that hope rests on the skill and perseverance of mining and mechanical engineers, who, even now, are called upon to lessen, by all the resources of mechanical science, the amount of human labour required in coal mines.

SCIENTIFIC SERIALS

THE *Monthly Microscopical Journal*.—The first paper is one of Mr. Parker's excellent studies, being on the osteology of the head of the sparrow-hawk. The first paragraph contains a generalisation which will surprise many ornithologists, for the Cariama is included among the raptorial birds; is this a result of the study of the skull? The accompanying drawings are excellent.—Dr. Royston-Piggott gives two articels, "On an Aërial Stage Micrometer," and "On the Spherules which compose the Ribs of the Scales of the Red Admiral Butterfly, and the Lepissna Saccharina."—An ingenious method of obtaining an equal illumination in both tubes of a binocular is contributed by Mr. W. R. Bridgman; and Mr. Stewart endeavours to prove that the hair follicles of the negro's scalp are curved instead of straight; he also describes clearly the framework of the sucking feet of the Echinus.—These papers are followed by abstracts of interest, including several from the American journal, the *Lens*.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Feb. 6.—"Memoir on the Osteology of Hyopotamidæ." by Dr. W. Kowalevsky. The paper is intended to fill a deficiency in our knowledge of the extinct creation by giving a complete osteology of one family of the Paridigitate Ungulate. It has been supposed that fossil representatives of this family would exhibit a less reduced skeleton and a more complete number of digits than recent genera; yet such is not the case. The genera *Anoplotherium* and *Liphodon* present in their feet the same degree of reduction as in recent Ruminants, save the confluence in a canon-bone. Notwithstanding this, they have been considered the progenitors of the Ruminantia, from a deficiency in other forms. The present paper introduces a new form, known only by the teeth till now; these, the *Hyopotamidæ*, vary considerably in specific and generic form, ranging from the Lower Eocene up to the Lower Miocene period, and in size from a rabbit to a hippopotamus. The Eocene species, except one termed *diplopus*, have not lost the lateral digits, and are included in the genus *Hyopotamus*. The division of the Ungulata into *Paridigitata* and *Imparidigitata* must have occurred about the cretaceous period, as shown by the diversity exhibited by both groups from the lowest Eocene. The former, the *Paridigitata*, split very anciently, perhaps in the chalk, into those with tubercular, and others with crescentic teeth. These groups, once separate, kept entirely apart, but frequently followed parallel lines of descent. Following these two divergent lines of descent, both groups culminate at the present time in such forms as *Phacochœrus* and *Dicotyles* for one group, and the *Bovidæ* for the other, links between these being absent. The Paridigitata with crescentic teeth will be termed *Par. selenodonta*, and those with tubercular *Par. bunodonta*. To the first group belong *Anoplotherium*, *Liphodon*, *Hyopotamus*, and others, together with the existing ruminants, whilst the second embraces the *Suina*, *Hippopotamina* and *Entelodon*. There is in some cases difficulty in deciding whether the teeth are tubercular or crescentic, the lobes being so thick.

It is important to find some osteological characters to confirm the above division, and the hand and foot from their variations suggested probable data. In tracing the Paridigitata in time, there is a marked tendency to the gradual reduction of the manus and pes, and an advantage to the individual apparently arises from the simplification. By comparison of all forms, a simple structure of the manus and pes may be obtained, such as was probably possessed by the common ancestor, and such a type is nearly retained by *Hippopotamus*, and was possessed by *Hyopotamus*. In none of these forms is the limb pentadactylate. Supposing the feet to be pentadactylate, the following is the disposition of the digits in the type:—The two outer digits (the fourth and fifth) are always supported by one bone, the unciform in the manus, and the cuboid in the pes; the three succeeding inner digits are supported each by a separated bone, the third, second and first cuneiform in the pes, and the os magnum, trapezoideum, and trapezium, in the manus. In the latter the third digit touches the unciform, and the second the magnum; the second digit of the pes touches the third cuneiform. The first digit being lost in all Ungulata, the trapezium and first cuneiform support the second digit.

Beginning with this type, which was probably exhibited by the progenitors of the Paridigitata, the reduction along both lines of descent may be followed, and in doing so a series of parallel modifications may be obtained, though it is found among the crescent-toothed line that the reduction is much more rapid than along the tubercular toothed. By reduction of the foot is meant that locomotion is carried on by the two middle toes instead of by the original four; and this seems to be an advantage to the organism, as it is exhibited by all descending lines of Ungulata. Going further into detail, it is found that both in Selenodont and Bunodont Paridigitata, a two-fold method of reduction of the manus and pes, a simple or *inadaptive*, and an elaborate or *adaptive* method is observed. In the first or *inadaptive* mode of reduction, the foot, whilst losing its lateral digits, acquires no better adaptation to altered circumstances of locomotion than is derived from the mere thickening of the remaining digits. The relation between the carpal and tarsal bones, and the remaining two metacarpal and metatarsals, remains unaltered, and the remaining digits do *not* enter into any modification by which they can receive more ample support from the carpal and tarsal bones, by taking the place formerly occupied by the reduced digits. *Anoplotherium*, *Liphodon*, and *Hyopotamus*, are examples of this method of reduction.

In the second or *adaptive* method of reduction, the middle digits grow larger and thicker than in the first mode; but while broadening transversely they do not adhere to the ancestral type, but tend to gain a support on *all* the bones of the carpus and tarsus, pushing the lateral digits to the side and thereby gaining a better and more complete support for the body. The lateral digits, being rendered useless, tend to disappear, and the remaining digits, being pressed from both sides by the carpal and tarsal bones, tend to coalesce to form the *canon* bone of recent ruminants, or of the hind foot of *Dicotyles*. In this, the *adaptive* method, modification keeps pace with inheritance, and examples of it may be seen in *Sus*, *Dicotyles*, *Hyæmoschus*, and the Ruminants.