

a means of enabling mines to be worked, which from their greater explosive tendencies, would otherwise have been deemed inaccessible. Thus while the Davy lamp has been of great benefit both to the public and the proprietors of coal, it has been the means of leading the miners into more perilous workings, and the frequency of accident by explosion has in consequence not been diminished to the extent which was originally expected. The Davy lamp is a beautiful application of a scientific principle to effect a practical purpose, and with fair treatment its efficiency is indisputable; but where Davy lamps are entrusted to hundreds of men, and amongst them too many careless and reckless persons, it is impossible to guard entirely against gross negligence and its disastrous consequences. In coal mines where the most perfect system of ventilation prevails, and where proper regulations are, as far as practicable, enforced in regard to the use of Davy lamps, deplorable accidents do occasionally occur, and it is impossible at present to point out what additional precautions would secure immunity from such calamities. The only gleam of amelioration is in the fact that the loss of life in relation to the quantity of coal worked is on the decrease, from which we may infer that it is also on the decrease taken as a percentage on the number of miners employed.

The increase of the earth's temperature as we descend below the surface is a subject which has been discussed at previous meetings of the British Association. It possesses great scientific interest as affecting the computed thickness of the crust which covers the molten mass assumed to constitute the interior portions of the earth, and it is also of great practical importance as determining the depth at which it would be possible to pursue the working of coal and other minerals. The deepest coal-mine in this district is the Monkwearmouth Colliery, which reaches a depth of 1,800 feet below the surface of the ground, and nearly as much below the level of the sea. The observed temperature of the strata at this depth agrees pretty closely with what has been ascertained in other localities, and shows that the increase takes place at the rate of 1° Fahr. to about 60 feet of depth. Assuming the temperature of subterranean fusion to be $3,000^{\circ}$, and that the increase of heat at greater depths continues uniform (which, however, is by no means certain), the thickness of the film which separates us from the fiery ocean beneath will be about 34 miles—a thickness which may be fairly represented by the skin of a peach taken in relation to the body of the fruit which it covers. The depth of 4,000 feet, which has been assumed as the limit at which coal could be worked, would probably be attended by an increase of heat exceeding the powers of human endurance. In the Monkwearmouth Colliery, which is less than half that depth, the temperature of the air in the workings is about 84° Fahr., which is considered to be nearly as high as is consistent with the great bodily exertion necessary in the operation of mining. The computations, therefore, of the duration of coal would probably require a considerable reduction in consequence of too great a depth being assumed as practicable.

At the last meeting of the British Association in this town, the importance of establishing an office

for mining records was brought under the notice of the Council by Mr. Sopwith, and measures were taken which resulted in the formation of the present Mining Records Office. The British Association may congratulate itself upon having thus been instrumental in establishing an office in which plans of abandoned mines are preserved for the information of those who, at a future period, may be disposed to incur the expense of bringing those mines again into operation. But more than this is required. Many of the inferior seams of coal can be profitably worked only in conjunction with those of superior quality, and they will be entirely lost if neglected until the choicer beds be exhausted. Although coal is private property, its duration is a national question, and Government interference would be justified to enforce such modes of working as the national interests demand. But to enable Government to exercise any supervision and control, a complete mining survey of all our coal-fields should be made, and full plans, sections, and reports lodged at the Mining Records Office, for the information of the legislature and of the public in general.

Before dismissing the subject of coal, it may be proper to notice the recent discovery by Berthelot of a new form of carburetted hydrogen possessing twice the illuminating power of ordinary coal-gas. Berthelot succeeded in procuring this gas by passing hydrogen between the carbon electrodes of a powerful battery. Dr. Odling has since shown that the same gas may be produced by mixing carbonic oxide with an equal volume of light carburetted hydrogen, and exposing the mixture in a porcelain tube to an intense heat. Still more recently, Mr. Siemens has detected the same gas in the highly-heated regenerators of his furnaces, and there is now every reason to believe that the new gas will become practically available for illuminating purposes. Thus it is that discoveries which in the first instance interest the philosopher only, almost invariably initiate a rapid series of steps leading to results of great practical importance to mankind.

In the course of the preceding observations I have had occasion to speak of the sun as the great source of motive power on our earth, and I must not omit to refer to recent discoveries connected with that most glorious body. Of all the results which science has produced within the last few years, none has been more unexpected than that by which we are enabled to test the materials of which the sun is made, and prove their identity, in part at least, with those of our planet. The spectrum experiments of Bunsen and Kirchhoff have not only shown all this, but they have also corroborated previous conjectures as to the luminous envelope of the sun. I have still to advert to Mr. Nasmyth's remarkable discovery, that the bright surface of the sun is composed of an aggregation of apparently solid forms, shaped like willow-leaves or some well-known forms of diatomacea, and interlacing one another in every direction. The forms are so regular in size and shape, as to have led to a suggestion from one of our profoundest philosophers of their being organisms, possibly even partaking of the nature of life, but at all events closely connected with the heating and vivifying influences of the sun. These mysterious objects,