

Fe_2O_3 , but at the same time a base is formed, the compounds of which are totally different from those of the ferrous oxide, but which resemble in their chemical properties the salts of alumina, Al_2O_3 , with which they are isomorphous. Here there is evidently a change, not merely of composition, but of constitution; the addition of oxygen has not only altered the relative weight of the constituents, but has completely changed the structure of the molecule in a definite direction, and impressed on it a constitution analogous to that of the molecule, Al_2O_3 , with which it is isomorphous. Now, when I had shown that this change in the constitution of the salts of iron was attended by a marked change in their physiological action, when I had proved that the physiological action of the ferrous salts was analogous to that of the salts of the other members of the magnesian group, which they resemble in chemical constitution, and that the physiological action of the ferric salts was analogous to that of the salts of alumina with which they are isomorphous, and when it was proved that an analogous connection existed between the chemical constitution and physiological action of the compounds of the elements of all the more important isomorphous groups, I think nothing but a complete misapprehension of the meaning of the terms chemical constitution and isomorphism could have led Dr. Brunton to allude to my researches as an "attempt to show that a connection exists between the form in which various bodies crystallise and the mode in which they act on an animal body." The same error as regards the meaning of the term chemical constitution has led Dr. Brunton to fail to comprehend the bearing of the experiments of Crum Brown and Fraser on the question, on which, in fact, they throw no light, although evidently regarded by him as a beacon for subsequent observers. These gentlemen found that by the addition of an ethyl or methyl molecule to strychnia its physiological action was profoundly modified, and concluded that this was owing to the chemical constitution of the substance being changed. As they worked with a reagent, strychnine, of the chemical constitution of which we are still ignorant, it was impossible for them to know if the addition of an ethyl or methyl group had made any change in its chemical constitution. The probabilities are that no such change had taken place, as the new compounds were addition and not substitution compounds. It is not merely for asserting a claim to priority that I make this communication, although I think *suum cuique* a very good rule; but I wish to point out the causes which in my opinion are not only retarding the progress of physiology in this direction, but which are tending to throw it back to where it was before the publication of my earlier experiments nearly fifty years ago.

October 6

JAMES BLAKE

Relation of Coal-Dust to Explosions in Coal-Mines

It is a stubborn and grievous fact that the loss of life by explosions in coal-mines has risen in the last decade, although the number of explosions has fallen. This points clearly to some essential defect in the remedies adopted. The remedies in use apply apparently to one class of explosions only, hence the decrease in the number of explosions. But, unhappily, there are many to which they do not apply, and those the worst; hence the larger number of lives lost. Some research, which has much engaged me of late, and which I hope soon to make public, has led to the conclusion that possibly the reason of this is about to be, or is even already, detected.

Many, well competent to judge, have thought that too much attention has been given to *gas*, and too little to *dust*. This is a growing conviction, both in Germany and in England, and of late years the dust has had considerable attention. A work, recently published (September 1886) by Messrs. W. N. and J. B. Atkinson (Government Inspectors of Mines), entitled "Explosions in Coal-Mines," strives, and I think fully succeeds in establishing that many of the most disastrous colliery explosions in the last six years have been practically "*dust explosions*." My conclusion, from certain simple physical and chemical experiments, and from a most careful microscopic examination of coal-dust from various seams worked in this field, is that the Messrs. Atkinson's view is right, and, moreover, that the attention hitherto given to coal-dust has not only been useless, but absolutely pernicious, since it has lulled into a state of false security.

I have been down several typical coal-pits in this district (the Durham field), such as Seaham, Murton, Silksworth, Pelton, &c., and in some of them I have seen the water-pipes along the main haulage roads supplied at convenient distances with

stop-cocks, and have found the dust on such roads so damp as to be rendered harmless, if it had not been so already, but the fine dust which coats the upper faces of the roof-timbers was there untouched, lying often to the depth of half an inch. Now, the *bottom dust*, as we may call the former, I am prepared to prove is almost if not quite universally harmless; and the *upper dust*, as we may call the latter, I am equally prepared to prove is in the highest degree dangerous, and especially a certain portion of it, which I propose to call "*flocculent dust*." Lastly, I claim to be able to establish that the main source of the really dangerous dust is that portion of the coal called variously "*dant*," "*mother of coal*," and "*mineral charcoal*." The upper, and especially the flocculent dust, possesses physical and chemical properties wanting, or existing in the most shadowy form, in the bottom dust; and the microscopical aspect emphasises these differences, as well as shows the relation of the former to what is very appropriately called "*mineral charcoal*."

It would pass beyond the limits of a letter to enter into particulars, but the observations and opinions of others may be hereby evoked, and this good work of saving life and property be materially furthered by your kindly admission of this letter to your pages. I will now only add that this ordinary upper dust and this flocculent dust removed, or rendered innocuous, it is my firm conviction that the number of explosions will rapidly fall, and also the loss of life be greatly reduced. This is the goal of my effort. Some practical men may indicate means, and perhaps I, who am a student, may be permitted to suggest that keeping the ventilating air-current saturated with aqueous vapour, rather than direct watering, would, if it be practicable, both lessen the amount of this dangerous dust, and also facilitate its removal.

ARTHUR WATTS

Bede College, Durham, October 12

Volcanic Ash from New Zealand

A SAMPLE of the ash ejected during the recent eruption in New Zealand has just reached me through the kindness of Mr. W. Ferguson, Harbour Engineer, Wellington. It was collected sixty miles from the seat of the volcano.

The ash is of a gray colour, of a somewhat darker shade than that from Krakatō. The dark-coloured constituents of the New Zealand ash consist principally of black scoriaceous fragments and ferruginous particles of indefinite character; those of Krakatō consist mainly of magnetite and hypersthene, well defined. The following minerals are contained in the New Zealand ash:—

Plagioclase Feldspar, very fragmentary, limpid, showing polysynthetic striations in the polariscope, and sometimes medial twinning line. The few well-formed crystals observed recall the tabular forms from Krakatō (described in my paper, *Proc. Roy. Dublin Soc.*, vol. iv. p. 291). There is a notable absence of the cellular vesicular covering observed in the Krakatō feldspar, and so suggestive of the pulverisation of a ready-formed pumice.

Hornblende, in elongated prisms, sometimes fibrous longitudinally or striated; colour dark green, pleochroic green longitudinally to brown; extinction makes a small angle, less than 15° , with the prism axis; occurs occasionally included in the feldspars. It is scarce.

Biotite and a golden-coloured mica are common in well-formed crystals of hexagonal outline, remaining dark between crossed Nicols.

Iron Pyrites, free and in embedded grains; striated pale yellow octahedral forms. Scarce.

Magnetite, in lustrous black octahedral forms. Not abundant.

Sulphur, in small broken pale-yellow fragments; burns with the characteristic smell, held over a lamp. Scarce.

Glass, remaining dark between crossed Nicols; variously coloured and often containing crystallites arranged fluxionally. Common.

Of these minerals, mica, hornblende, and sulphur are, so far as my observations go, not present in the Krakatō ash. Comparing it with samples from Krakatō gathered at a comparable distance from the scene of eruption, the New Zealand ash suggests a more hastily formed material, the minerals in common being less perfectly developed in the New Zealand ash. I have not noticed as yet in this ash the hypersthene conspicuous in that of Krakatō. There are some organic remains, calcareous fragments of shells.

J. JOLY

Physical Laboratory, Trinity College, Dublin, October 18