shows the various causes in operation at the time to instigate such voyages, causes mainly political and commercial. Other influences were however at work, not the least of which was "the total transformation which astronomy and geography had undergone" during the sixteenth century. The narratives here given are those of Hawkins's and Frobisher's three voyages, Drake's voyages of 1577 and 1585, Gilbert's voyage of 1583, Amadas and Barlow's voyage, 1584; Cavendish's first and last voyages, and Raleigh's voyage to Guiana. Prefixed to each narrative is a short historical introduction.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Black Sheep

THE following extract of a letter from Mr. Sanderson of Chislehurst, who permits me to publish it, seems worth placing on record. It relates to the former frequent appearance of spotted or black sheep in the Australian flocks, as long as animals thus coloured were of use to man, although they were never, as far as Mr. Sanderson knows, separately bred from, and certainly not in his own case. On the other hand, as soon as coloured sheep ceased to be of use they were no longer allowed to grow up, and their numbers rapidly decreased. I have elsewhere assigned reasons for the belief that the occasional appearance of dark-coloured or piebald sheep is due to reversion to the primeval colouring of the species. This tendency to reversion appears to be most difficult quite to eradicate, and quickly to gain in strength if there is no selection. Mr. Sanderson writes:—"In the early days before fences were erected and when shepherds had charge of very large flocks (occasionally 4000 or 5000) it was important to have a few sheep easily noticed amongst the rest; and hence the value of a certain number of black or partly black sheep, so that coloured lambs were then carefully preserved. It was easy to count ten or a dozen such sheep in a flock, and when one was missing it was pretty safe to conclude that a good many had strayed with it, so that the shepherd really kept count of his flock by counting his speckled sheep. As fences were erected the flocks were made smaller, and the necessity for having these spotted sheep passed away. Their wool also being of small value the practice soon grew of killing them off as lambs, or so young that they had small chance of breeding, and it surprised me how at the end of my sheep-farming experience of about eight years the percentage of coloured lambs produced was so much smaller than at the beginning. As the quantity of coloured wool from Australia seems to have much diminished, the above experience would appear to be general." CHARLES DARWIN

The Nature of the Chemical Elements

DR. ARMSTRONG'S article in NATURE, vol. xxiii. p. 141, has brought to my mind some calculations I made more than a year ago to test a theory I had long previously entertained. Most of us who have paid much attention to the subject are agreed that the elements are capable, under exceptional circumstances, of profound chemical change. Mr. Lockyer is searching, with success as it appears, for contemporary evidence of this by examining the condition of the solar surface. The other line of evidence is historical, and turns mainly on the classification of the numerical values of chemical symbols. It is of course only with the latter that I have to deal.

The classifications proposed by Newlands and Mendelejeff are comprehensions of much similar preceding work. They appear to me to be faulty in two ways: (1) on account of the seriously large number of elements they wholly fail to include, and (2) because of the strong stress they lay upon arithmetical series of a rough *per saltum* character. As I do not know of any real case of *per saltum* chemical change, I do not think the elements should be classified on such a basis. What is wanted is a system capable of including—with exactness and not mere approximation—the whole of the elementary numbers; that system to be represented in the mathematical symbols of ordinary chemical change, and therefore free from a *per saltum* character. I have to a great extent succeeded in finding such a system, and the results of testing it at many points are as follow:—1. There is probably only one fundamental form of matter; and this, as has been previously supposed, yields our ordinary elements and many others by ordinary polymerisation. 2. Almost all the elementary numbers have been tried, and, with the exception of H and Cl, which are a little troublesome, they fall into order very exactly. 3. This order exhibits no discontinuity, and is similar to a case of ordinary chemical change. 4. There is clearly an upper limit to this order; in other words, elementary numbers of more than a certain magnitude appear to be impossible.

Sir B. C. Brodie's method is really a classificatory one; and I with others had been very desirous to read the Third Part of the Calculus, in which it was promised ampler play. It will be a matter for much regret if his premature death should have prevented this. But what he did publish was sound and sure: the first real symbols chemistry has yet enjoyed, and the only ones hitherto proposed whereby the process and the results of chemical change admit of unitary as well as kinetical representation.

EDMUND J. MILLS

Smokeless London

As I hope soon to have an opportunity of reading a paper on this subject before a scientific audience I need not occupy your valuable space by replying to your correspondents of last week in detail. I may say however that the scheme has been carried out in practice at a gas-work to which I shall afterwards refer. When it was found that the apparatus for making gas on an extraction of six hours was insufficient for supplying the wants of the long winter evenings the distillation was stopped when gas had been removed to the extent of 5000 cubic feet per ton. The larger quantities obtained from the coal per unit of time and the superior illuminating power obtained per unit of volume tided over the difficulty and rendered the existing plant sufficient. No practical obstacles were discovered in discharging the retorts. I do not think the difference between an extraction of 5000 and 3333 cubic feet per ton would make a material change in this respect. Mr. Mattieu Williams points out a much more serious obstruction in the plethoric indifference of the gas companies. In reply to E. R. F. I may say that the fuel resulting from a uniform extraction of 3333 cubic feet per ton is practically smokeless if it is taken hot from the retorts and immediately quenched with water.

Westminster, December 27 W. D. SCOTT-MONCRIEFF

Colliery Explosions and Coal-Dust

ACCEPTING Mr. Galloway's view that in many mines the extent and destructiveness of colliery explosions are due to the distribution of coal-dust in the air, may I suggest the possibility of preventing the explosion from spreading beyond the sphere of the fire-damp by sprinkling the floors throughout, at certain regular intervals, with mineral oil? A shady road, with one such sprinkling, may be kept free from dust for several weeks during the summer, and the corridors of a mine, not being open to wind and rain, would of course remain wet for a longer period. A saucer filled with dust and treated with mineral oil will retain the oil for months even when exposed to sun and rain. The mixture of coal-dust and oil is quite uninflammable. The experiment may perhaps be worth trying in one of the drier coal-mines.

December 27 R. RUSSELL

Geological Climates

PROF. DUNCAN is under the impression that the claim of *Araucaria Cunninghami* to have flourished at Bournemouth during the Eocene, rests on "a bit of a leafy part of a tree," and that this bit is "squashed." The foliage is however abundant there, occurring almost wherever vegetable remains are found, from the east of Bournemouth Pier to half a mile beyond Boscombe. In one place, where a bluff is literally full of it, the disarticulated branchlets are perfect, and not in the least degree compressed. Again, the determination was not made by Prof. Haughton, but rests upon my statement that this foliage and that of *A. Cunninghami* cannot be distinguished one from the other. That it is Araucarian foliage I am perfectly satisfied; but whether the existing Australian species is identical and unmodified, must remain doubtful until other