

perhaps two in the West Indian Islands, and hope there still further to investigate the theories of geographical distribution, especially endeavouring to see if they can in any way be regarded as having been connected with this submerged continent of Atlantis.

G. R. CROTCH

#### The Coronal Rifts

WILL Captain Tupman kindly explain what he means by "actinic rifts"? I should have supposed that the rifts are evidence of the absence of actinism at the places where they occur.

I am not at all surprised that anyone observing through a telescope should fail to notice the rifts. The eye would naturally be attracted by the bright light of the corona and the red prominences. It may be observed, also, that there is in the photographs a considerable amount of bright corona at the places where the rifts occur, so that Captain Tupman might have had the telescope pointed at the very places where the rifts were, and yet they would escape his notice. The rifts are *there*, unquestionably, in the two photographs taken (after the lapse of nearly an hour) at Cadix and Syracuse, and the sketches taken in Spain also show the gaps. The evidence appears to me to be conclusive against Captain Tupman.

A. BROTHERS

#### Spectrum of the Aurora

THERE is one point in Mr. H. R. Procter's letter in NATURE, vol. iii. p. 468, which I do not agree with. He says the bands of the auroral spectrum are seldom visible, with the exception of that whose wave-length is 557; whereas I have found two bands, doubtless Winlock's 464 and 431, to be invariably visible when the aurora is bright enough to show them. Also, I suspect the red line is always present when there is any red colour in an aurora, although our instruments do not show it unless the luminosity is considerable. Of the thirty-four auroras in whose spectra I have seen the line 557, fourteen showed the bands 46 and 431, and three others at least one of these, while eight showed the red line. In five auroras, all more or less red, I have seen a faint band, whose wave-length, I believe, is 500 or 510. I have never seen the line 532 (the coronal line), unless it be once; probably from want of instrumental power.

As regards the zodiacal light, I have looked at its spectrum several times when it has been at its brightest, but have never seen anything but a continuous spectrum. I am satisfied therefore that if the line 557 exists in it, it must be much fainter in proportion to the rest of its light than is the case with the aurora.

T. W. BACKHOUSE

Sunderland, May 16

#### Science for Farmers

As the independent and powerful advocate of scientific education, will you allow me to draw your attention to the object of the enclosed letter?

Within a short period I have seen such remarkable results attended with such an enormous saving of money arising from a limited knowledge of science amongst a committee of farmers, that I am desirous the future generation should have at least a common sense idea of some of the laws of nature which more immediately concern their business and pecuniary interests.

I have the more faith in the success of what I am advocating, because the kind and amount of scientific instruction I propose is really a business necessity. I have not forgotten the results of the Great Exhibition of 1851, how the members of each particular profession or trade were interested, especially in such stalls or departments that concerned this main object of their lives, how to make their own calling more successful or profitable.

I believe therefore in the teaching of science a much greater prospect of success exists when it can be combined with a practical business pursuit. I have read with much interest your article "The Hope of France" on the paper read by M. Deville before the Academy of Science.

The advantages arising from scientific culture, in other words, the study of nature and her laws, are beyond appreciation, and for this reason a student of science must reason and think for himself; he must do his own thinking, and not allow any other person to do this duty for him; and it is my conviction that the real power of any State is exactly in proportion to the number of independent reasoners and thinkers that go to constitute it; and I

know of no means so powerful to promote this as the extension of technical teaching applied to business pursuits.

May 18

W. LITTLE

"TECHNICAL EDUCATION FOR THE SONS OF FARMERS

"To the Members of the Lincolnshire Farmers' Association, and other Agricultural Associations in Great Britain

"Gentlemen,—Will you allow me to ask your earnest consideration and reflection on a subject which I believe is of vital importance to the future generation of farmers? The question I would put to you is this: Do you wish your sons whom you destine to the pursuit of agriculture to be entirely ignorant of such of the simple elements of chemistry as would give them a complete knowledge of the application and properties of the various materials used in the manufacture of artificial manures, when such knowledge may be acquired with little trouble, in a short time, and at small expense?

"I cannot for a moment believe that any intelligent farmer, with the costly and bitter experience of the past few years in relation to the tricks and impostures of the artificial manure makers, can be so indifferent to the future success of his child as not to give him, by a brief course of practical scientific education, not only the power of protecting himself against fraud, but also the knowledge that will enable him to apply the gifts of science to the greatest possible advantage, and at the same time liberate himself from the large and plausible army of manure compounders.

"Why should the business and pursuit of agriculture be an exception in the rules of guidance for the successful pursuit of any other business or profession? For the practice of medicine, law, engineering, architecture, &c., a special course of study is required, and is really necessary. Agriculture as a business pursuit offers abundant occupation for the highest order of intelligence, and stands second to none in its claim to scientific skill and sound practical sense, and has therefore an equal claim with other professions, that those engaged in it should be properly qualified by a special form of education.

"What can be more embarrassing to the present generation of farmers than the reading of the reports of chemical analysts on the composition of soils and manures? What can they understand by 'water of combination' other than that it may have too near a relation to a pump; or the term 'organic matter,' which may mean flesh or bread, woody fibre, peat, sawdust, or coal dust, most likely a large proportion of the latter elements; or that very intelligible term 'soluble phosphate equal to bone earth or tribasic phosphate of lime made soluble;' or alumina, silica, alkaline, salts, &c., which generally mean clay, sand, and common salt, concluding with earthy matter as the dirty foundation upon which all the other perplexities stand.

"Is it not worth while, by a brief course of practical study, to rid one's self of the influence of all this chemical necromancy? The days of alchemy, witchcraft, and astrology have passed away, and so must the charlatanism and quackery of the inferior order of manure compounders.

"What would be the history of many of these occult persons if it could be traced? Should we find that they have at any time been diligent students under such guides as Liebig, Ville, Voelcker, and other honourable and distinguished chemists? No! I do not hesitate to say that many of them have been mere wandering vagabonds having no disposition or ability to get an honest living by ordinary industry, and as a last resource trade on the credulity of farmers as artificial manure makers. A case in point was recently reported to me. Two discharged lackeys, a butler and footman, embarked, for want of honest employment, in this trade. They are now millionaires; one is an M.P. and the other has received the honour of knighthood. Recently I was over the works of a large and respectable manufacturer of phosphatic manures, who was also a maker of sulphate of ammonia. He informed me that he mixed these two ingredients in such proportion that he could well afford to sell it for 6*l.* per ton. The mixture went in immense quantity to Liverpool, where it was christened under the name of phospho-guano, and was actually returned, more than a hundred miles, near to the original works, and sold for 12*l.* per ton. Are not such cases, and a thousand others, sufficient to make every farmer ask himself if one object of his being born into this world was to feed and fatten knaves?

"A first-class tailor, hatter, shoemaker, butcher, or baker, desires before all things that his customer should thoroughly understand the composition and quality of the goods he has for sale. Can the same be said of the manure compounders? The