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NATURE

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE

VOLUME VI

MAY 1872 to OCTOBER 1872

"To the solid ground
Of Nature trusts the mind that builds for aye."—WORDSWORTH

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INDEX

NATURE

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Of Nature trusts the mind which builds for aye."—WORDSWORTH

THURSDAY, MAY 2, 1872

THE CIVIL ENGINEERS' BANQUET

WE do not grudge our friends the Civil Engineers their annual felicitations, nor Mr. Gladstone his congenial moral reflections. It were hardly worth while to dissect after-dinner rhetoric, however full of fallacies. But those ever-watchful teachers of mankind, the daily press, have pounced upon the speeches delivered on Wednesday week, and have made them an occasion for propounding solemnly what was spoken hilariously; and this deserves looking to.

The *Times*, of course, armed at every point, does battle valiantly for decentralisation of science, because that notion seemed to find favour with the notabilities of the evening. Mr. Hawksley, president of the Civil Engineers' Institute, in toasting Her Majesty's Ministers, complimented them on the "performance of the negative duty of letting his profession alone," adding, with unconscious satire, that what the engineers had done "they had achieved, not through, but in spite of, all Governments." These two sentiments are quite intelligible and quite true; but the conclusion of the speech, which informs us that "the Civil Engineers of this country approached the Government with perfect reliance on its purity," conveyed a needless truism; to the pure all things are pure—to pure engineers even a British Government is pure, of course. But why dwell on so obvious a fact?

Well, this put Mr. Gladstone on his mettle. At once absorbing the tribute to their inaction—rather a novel compliment to his Administration—he evolved out of it this syllogism: Engineering is science; engineering likes being left to its own devices; therefore all science should be left alone. This sort of logic is quite good enough for dinner talk, but not for breakfast reading. What may be excused to convivial excitement in a flattered guest cannot always be permitted to a journalist after an interval for reflection.

The *Times* of the 26th ult., after expatiating on the advantages of non-intervention in things in general, thus disposes of science. "If," it says, "under such conditions of Government, the State does nothing for science, it cannot be helped; nor need it be much lamented, considering how very little science stands in need of the aid. If," it goes on to say, "the Institution of Civil Engineers had been a creation of the State, fostered by State bounties, and favoured by State protection, its members would never have acquired such a position in the country as they justly boast of holding now. As it is, they have fought their way and been the founders of their own fortune; and so their president has the pleasure of telling the Prime Minister of the Kingdom that he and his constituents have been and are independent of all Governments whatever."

We give the sentence entire, because the nonsense it contains does not admit of greater condensation. Let us examine it a little. How is the engineering profession typical, as here asserted, of science? What is that profession? Simply, and without any intended offence, a profession for making money. Men put their sons into it, and have them trained, rather imperfectly in England it must be confessed, and push them forward in it, solely because the contracts, commissions, and fees, are enormous, and the chances of making a fortune pretty fair. We by no means object to this in a broad way. Other professions, held in high honour—the law, for instance—are exactly in the same category. If men possessed, or believed to be possessed, of special knowledge, find that a high price is put on that knowledge in the market, they are of course justified, as long as they perform honestly what they undertake, in demanding the highest price they can get for it. But in this respect how do they differ, not merely from lawyers, but from manufacturers and even from tradesmen? Is there any difference between making and selling so many yards of calico and so many miles of railway, between supplying customers with patent umbrellas and a patent locomotive? All are results of science, and may be products of brains other than those of the vendors. If engineers are able, by vending bridges, railways, and graving docks, to amass in a few years colossal fortunes, as we know they do, what Government help can they need more than the successful cotton lord, or the enterprising grocer, who also manage their business without external aid?

This being granted, why, asks the *Times*, should not the principle of non-intervention be applied to science? Simply because what is generally understood by the term "Science" is not a remunerative occupation. We do

not say that no one ever made money by pure science; some men have done so, as is well known, by means such as telegraphic inventions and chemical processes applied to the arts; but even these, and they are very few, have not become the millionaires, of whom not a small number are to be found amongst engineers and manufacturers. Putting aside these rare exceptions, science does not bring wealth to its cultivators. For instance, who ever made money by astronomy? What did the discovery of Neptune, the highest scientific achievement of this age, bring to Professor Adams but tardy fame? Are investigations of the properties of light, sound, gravity, magnetism, profitable pursuits? Was the inventor of a new calculus ever made rich thereby?

Shall we contend, therefore, that Government should supply the shortcomings of a scientific career, and place those who adopt it on a par pecuniarily with successful engineers? By no means. We must look a little deeper for the reason why State should aid Science. We shall find, if we examine the whole domain of Science, that there are extensive tracts which require for their vigorous cultivation very costly appliances and a long expenditure of time. Poor men cannot afford the one at all, and cannot live if they devote themselves to the other without remuneration. Hence, if such branches of science do not receive aid from without, they must languish, if not be entirely neglected. But this cannot happen without depriving the community of some addition to its material advantages which it might otherwise possess. It is notorious, not, perhaps, to all the writers of the *Times*, but to those conversant with the state of science in England, that this evil is with us in full operation with constantly increasing force. Rich men do, it is true, sometimes devote themselves to science. But no individual can do more than labour during his lifetime; and what is chiefly wanted now, in several of the most important lines of investigations, is uninterrupted continuity during immense periods of time. Will our friends, the Engineers, apply some of that "lavish liberality and unbounded enterprise," of which we have heard so much, in this direction? We suppose not. Whatever may have been the love of knowledge for its own sake which distinguished the first founders of the profession, the modern "leading engineer" knows better than to put his money and time into so unprofitable a business.

England is at this moment behind every other civilised nation in the means afforded for the cultivation of those branches of science which do not yield immediate profit. But there are men, not connected with either the Government, the *Times*, or the Civil Engineer Institute, who are alive to the peril of prolonging this neglect, and who will not rest until they have opened the eyes of their countrymen to its imminence and magnitude, at present beyond the ken of their governors and their teachers. When they have attained their object, the *Times* will proffer them its aid.

THE ERUPTION OF MOUNT VESUVIUS

THE great eruption of Mount Vesuvius, with the telegraphic accounts of which the readers of the daily papers have been familiar for the past week, is undoubtedly one of the most considerable of modern times. Whether the worst is yet over seems still uncertain while we are writing; but even if this be the case, the mass of molten lava ejected, and the amount of damage done, will appear to bear comparison with those of almost any recent eruption. One account speaks of it as the grandest eruption since 1631.

The telegraphic accounts at present received are necessarily vague, and to a certain extent conflicting, and of course it is at present impossible to do more than chronicle. Scientific results must follow afterwards.

The correspondent of the *Daily News* says, under date of Sunday afternoon :—"I have just returned from visiting the spot where the victims of the eruption perished. Streams of lava, thirty metres wide and nearly ten metres in height, were still fiery and smoking. The detonations continue as before. Part of San Sebastiano is entirely destroyed, with everything near. King Victor Emmanuel and Signor Lanza were on the spot distributing money to the sufferers. All the people fled at the time, but some were beginning to return with their goods. The shower of cinders had ceased, the sky was blue, and Mount Vesuvius, with a colossal column of smoke above it, had a grandly imposing appearance."

San Sebastiano is a village on the north-western slope of Vesuvius, almost exactly in the direction of Naples. None of the earlier eruptions extended in this direction, but a stream of lava flowed almost close to the village in one of the early eruptions of this century. The lava is here spoken of as being sixteen feet deep in places, and in other despatches San Sebastiano and the neighbouring village of Masso di Somma are spoken of as having been nearly destroyed. This stream of lava is described as having several times changed its direction, and it is probably a branch of the same which has threatened Portici and Persina (no doubt Resina, almost close to Herculaneum) near the sea-coast, and caused the abandonment of these villages.

It must be a different stream which has partially or entirely destroyed Torre del Greco, one of the beautiful villages which lie on the shores of the Bay of Naples, in a south-westerly direction from the centre of the mountain. This village, or its immediate neighbourhood, has been overwhelmed several times within the last two centuries. The statement that "the lava now reaches from Torre del Greco to within five kilometres of the eastern coast, and threatens several other communes, the inhabitants of which have, in consequence, fled from their homes," is quite unintelligible.

The effect of the eruption at Naples up to Monday night is described as follows :—"Cinders fell all last night, and they still continue to fall at this moment as I send off the present despatch. A thin rain is also falling. Near Cercola the shower of scoriæ has compelled the soldiers to build huts in which they may obtain shelter. The church of San Giordano at Cercola has been destroyed. A number of people have been surrounded by the lava close to San Sebastiano. At Ottoiano a heavy shower of enormous blocks of lava has commenced. The railway is crowded with foreigners and Neapolitans hurrying away from Naples. A fresh eruption is feared, as loud explosions were heard last night even in this city."

The fall of cinders, even at Naples, is spoken of as so heavy that the sky seemed hidden by them, and they fell

everywhere like rain. The plantations were covered with them, and people were walking with umbrellas to protect themselves from the downpour. The rain of burning scoriæ has reached as far as Scafati and Palermo. Readers of Prof. Phillips's work on Vesuvius will recollect that he throws considerable doubt on the correctness of the popular idea that Vesuvius emits *flame* during an erruption, though he thinks there are one or two authentic instances of this rare phenomenon. The accounts at present received do not throw much light on this point. One narrator states "Mount Vesuvius is displaying terrible electric phenomena, marked by flashes of lightning and vibrations of the earth;" and another, that "flames are bursting through several craters." Other accounts speak merely of the eruption of glowing lava and smoke brightly illuminated by it, and this may readily have been mistaken for flame.

Great credit is due to Prof. Palmieri, who has remained at his post at the Observatory to watch the eruption, and from whose observations a great advance of science may be anticipated. On Monday at noon he telegraphed as follows:—"Scoriæ in great abundance have fallen in the direction of the Observatory. The instruments at the Observatory are very much disturbed. The projectiles from the volcano rise to a height of more than a kilometre. The lava has ceased to flow."

It is satisfactory to know that recent letters speak of the first reports of the loss of life as having been somewhat exaggerated. Eighty persons are now stated to be missing; all Italians. Thirteen wounded were taken to the hospital; of these six are dead. No English or Americ ans are reported dead or wounded.

The latest telegrams received at the moment of going to press speak of an enormous column of "fire" being visible from Naples. Explosions, accompanied by shocks like those of an earthquake, were constantly occurring. Prof. Palmieri telegraphed from the Observatory on Tuesday that the roar of the volcano had ceased. Numerous flaming projectiles continued to be launched into the air, but with less force than previously. The smoke had decreased, and the shocks, though frequent, were not of a dangerous character.

SCIENCE PRIMERS

Science Primers: "Chemistry," by Prof. Roscoe; "Physics," by Prof. Balfour Stewart. (London: Macmillan, 1872.)

THESE little books illustrate an imperfectly accepted truth, that systematic elementary teaching is a late and not an early product of educational energy. The best headmasters of our schools have discovered the fallacy latent in our ancient belief that the ablest men are required to teach the oldest boys, and have in one or two famous cases acted on their discovery. It is easy for a young man fresh from University honours to pour his knowledge into minds which have been well prepared, and which approach more or less to the level of his own; but to teach a class of little boys, to realise their difficulties and to appreciate their ignorance, to understand the perplexity which oppresses them in the presence of statements long since axiomatic to ourselves, requires a mature and versatile intelligence, a mind which can communicate childish knowledge as readily and as joyously as it solves recondite problems; a combination of rare gifts with long and conscientious training.

And thus it is that the zeal for scientific teaching and the gathered scientific experience of the last fifteen years have only issued now in the books which form the subject of our notice. Scientific class-books hitherto have been either too difficult or too easy. They have been unavailable for beginners without the intervention of a practical teacher; or in their effort to be popular and simple they have abdicated half their value as instruments of educational discipline. In these books both extremes are avoided. Every stage of their teaching is based upon experiment; no law is enunciated till it has been proved. From first to last the student finds himself in immediate contact with Nature. His empirical knowledge of external things is systematised; simple every-day phenomena reveal to him their principles and *rationale;* he walks forth with a new eye to discern the meaning and the beauty of familiar sights and sounds, and with a mind upon the stretch for fresh discoveries. And, on the other hand, no previous training is essential to the teacher who adopts them as his guide. Any man, ignorant even of the first principles of chemistry and physics, yet fairly dexterous and intelligent, who will patiently master the books, and try each experiment for himself, is in a position to transmit their contents successfully and clearly. The officer may lecture to the soldiers of his regiment, the clergyman to the artisans of his parish, the national schoolmaster to the children of his school. Managers of middle schools, deterred as yet from including science in their course through lack of teachers and of text-books, will find their difficulty removed. The higher schools need no longer confine their scientific teaching to the senior forms, but may place the "Science Primer" along with the Latin grammar, in the hands of their youngest boys.

The expense of apparatus need not be considered formidable. A complete set for the course of Chemistry is set down at 5*l.* 10*s.*, for Physics at 19*l.* 3*s.* 8*d.* This last, however, includes such costly implements as the air-pump, balance, Grove's battery, and electrical machine. Leaving these to be obtained by special donation or borrowed for the occasions of their use, and deducting such further instruments and utensils as a handy man can make or convert at trifling cost, the outlay for the two courses may be bought considerably under 10*l.* And since the apparatus once established will require rare and slight renewal, one may hope that a moderate number of pupils with a moderate scale of fees would always provide this sum, more especially if the South Kensington authorities, in the presence of these manuals and of the revolution they may be expected to work, can be induced to extend the limits under which they furnish educational materials at half-price.

The names appended to the books guarantee their scientific accuracy, and their embodiment of the latest knowledge; but from the teacher's point of view they exhibit some few statements which are not quite clear, and which may deserve reconsideration. In the Chemistry Primer (Experiment 3, p. 7) the caustic soda is left unsupported in the tube. The description is probably compelled to follow the engraving; but most lecturers would, as is suggested in the appendix, use the U tube in such a

case. Exp. 5, p. 10, does not clearly show that the heat due to chemical union is independent of the heat caused by the lamp; while statements 6 and 7, if taken together, produce in the pupil's mind a confusion between cause and effect. In pp. 23, 25, the allusions to acid and alkali, both new names to the student, might easily be accompanied by a marginal reference to p. 65, where the terms are explained. In Exp. 17, p. 27, it is not made evident in words that the hydrogen has passed from the one bottle into the other. Exp. 22, p. 34, and Exp. 40, p. 68, would gain in value if the action of the text, as well as its result, were described, such explanation of the first experiment being actually given later on at p. 87. In Exp. 29, pp. 44, 45, the diction of the first two paragraphs is confused and confusing, and it is doubtful if any lecturer would be able to conduct Exp. 31, p. 48, so as to retain the heated filings on the magnet. In Exp. 35, p. 56, the numbers on the drawing do not tally with those of the description. The explanation of the Davy lamp, p. 57, to which further reference is made in Physics, p. 86, is, to say the least of it, incomplete: and that of the safety matches on p. 72 is quite unintelligible. The definition of an Element, p. 58, and the phrase "difficultly fusible" on p. 99, suggest purely verbal criticisms.

In the Physic Primer, p. 2, force and motion should hardly be called qualities" of dead matter. In Exp. 13, p. 22, the "simple arrangement" for moving the horizontal piston might be indicated. In p. 23 the large and small piston are not lettered in the description. In Exp. 17, p. 26, a shrewd pupil would inquire why the upward pressure should not, from all that appears in the text, expel water from the higher aperture as strongly as the downward pressure expels it from the lower aperture. In pp. 40, 41, some allusion to the Aneroid, if not to the Hypsometer, might fairly be expected, and in p. 46 it is not easy to see why the Syphon is described if its principle is not to be explained. In p. 65 there is an allusion to "the mercury in the bulb of glass," which is, in fact, there mentioned for the first time, and is it not true that in Exp. 52, p. 105, a principle of converse action is laid down on the evidence of a specific and almost a solitary instance?

It is possible that to criticise these points as blemishes suggests stupidity to the critic; if so, his stupidity is probably typical, and the authors would be the first to wish that their explanations should be self-sufficing, even to the obtuse. In any case we tender them our hearty thanks for work which marks a stage in the advance of scientific education. Its lingering progress hitherto has been owing to the want, not of zealous champions, but of united action. The labours of its advocates are now beginning to converge. The leaders of science and the leaders of education are drawing close together—on the one side eager to impart, on the other ready to receive, advice and guidance. By the publication of these books the most serious of the obstacles which have kept them separate is removed.

W. TUCKWELL

OUR BOOK SHELF

Astronomy and Geology compared. By Lord Ormathwaite. (London: J. Murray, 1872.)

THIS little volume is the product of a thoughtful and observant mind. Its main object is to contrast the certainty of the conclusions of astronomy, the exactitude with which eclipses can be foretold, and with which other astronomical phenomena recur, and the vagueness which hangs round many geological theories, as, for instance, those connected with the age of the various strata. A large portion of the volume is directed against the theories of Mr. Darwin in natural science, and Mr. Buckle in morals, theories which the author considers, in consequence of the vagueness of geological conclusions, to rest upon insufficient data. With the general mode in which the argument is conducted, we have little fault to find. Occasionally, however, Lord Ormathwaite's zeal on behalf of orthodox theology betrays him into injustice, as when he says:—"There is one feature common to the writings of Mr. Darwin and Mr. Buckle which is to be regretted—they both of them seem to ignore, if they do not altogether deny, the existence of a First Cause. Secondary causes are always with them the only springs of motion." With this we may contrast the following sentence from the "Origin of Species":—"To my mind it accords better with what we know of *the laws impressed on matter by the Creator*, that the production and extinction of the past and present inhabitants of the world should have been due to secondary causes, like those determining the birth and death of the individual." Lord Ormathwaite pleads bodily infirmities as an excuse for any inaccuracies or mistakes in the book, and we very willingly allow the plea.

The Use and Origin of the Arrangements of Leaves in Plants. By Chauncey Wright. (American Academy of Science and Arts.)

THIS is an elaborate and ingenious attempt to apply the principles of Natural Selection, or the Survival of the Fittest, to the observed phenomena of Phyllotaxy, or the arrangement of leaves on the stems in plants. Stating in the outset very clearly the distinction between this theory, according to which every organ, and every arrangement of organs, must be of some practical (though possibly undiscovered) utility to the plant, and that of "types," which requires no such hypothesis, Dr. Wright proceeds to investigate how the origin of the phenomena under investigation can be accounted for on the former theory. It must be assumed in the outset that the two principal modes of the arrangement of foliar organs, of which all others are modifications, the spiral and the verticillate, are modifications of a single original type. Investigating the actual arrangements on mathematical principles, he finds that the various angular distances of leaves on the stem are resolvable into the general form of the continued fraction

$$\cfrac{1}{a+\cfrac{1}{1+\cfrac{1}{1+}}}, \text{ \&c.,}$$

in which a may have the values 1, 2, 3, or 4. The actual fractions thus resulting are when

$a = 1$ . . $\frac{1}{2}\ \frac{2}{3}\ \frac{3}{5}\ \frac{5}{8}\ \frac{8}{13}$, &c.
$a = 2$ . . $\frac{1}{2}\ \frac{1}{3}\ \frac{2}{5}\ \frac{3}{8}\ \frac{5}{13}$, &c.
$a = 3$ . . $\frac{1}{3}\ \frac{1}{4}\ \frac{2}{7}\ \frac{3}{11}\ \frac{5}{18}$, &c.
$a = 4$ . . $\frac{1}{4}\ \frac{1}{5}\ \frac{2}{9}\ \frac{3}{14}\ \frac{5}{23}$, &c.

each fraction being obtained by adding together the numerators and denominators in the two preceding fractions. Practically it is found, however, that certain only of these fractions occur in nature, while of those that are found some are much more frequent than others. The approximate ultimate value (k) of this continued fraction, when $a = 1$, is 0·6180, k possessing the property that any power is equal to the difference between the two next lowest powers, or $k^n = k^{n-2} - k^{n-1}$. On this peculiar arithmetical property of k depends the geometrical one of the spiral arrangement which it represents, namely, that such an arrangement would effect the most thorough and rapid

distribution of leaves around the stem. The latter part of this valuable paper consists of an attempt to show that the modes of phyllotaxy which result from the use of the different forms of the fraction are either directly serviceable to the plant by affording the best distribution, either for absorbing the sap from the roots or for exposing it to the action of air and light, or have been so at some period of the ancestry of the plant, when its structure was of a simpler character. The typical or unique angle of the theory of phyllotaxy the author regards to be the goal towards which the special forms tend, by the action of the principle of natural selection, rather than as the origin of the spiral arrangements. A. W B.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

The Law of Total Radiation

IN NATURE for April 25 Captain Ericsson attacks the calculation of Pouillet as to the sun's temperature, as being founded on an erroneous law of radiation. Had he contented himself with saying that the extension of Dulong and Petit's law so far beyond its experimental foundation to temperatures approaching that of the sun was "mere theory," and inconsistent with his own experiments, his position might have been impregnable. But not satisfied with this, he goes on to question the applicability of Dulong's law even below the boiling point of mercury, and asserts that Newton's law is much nearer the truth. The only objection that he gives to the method of the French experimenters is that they erroneously confuse the *surface* temperature of their thermometers with the average temperature of the contained mercury. The observed radiation is really due to the first, though attributed to the second. Now, without asserting that the objection is entirely without force, I submit that, if Newton's be the real law of radiation, it is impossible in this way to account for the observations.

In the first place, if the rate of cooling for a body at a variable temperature t, surrounded by another at a fixed temperature t_0, be proportional to $t - t_0$, it follows from the theory of exchange (than which there are few things better established) that the radiation between two bodies at any temperatures t, t', is proportional to $t - t'$. The rate of cooling of the thermometer contained in an enclosure would thus depend only on the *excess* of temperature, in flat contradiction to Dulong's observations. Nor would this result be altered, even though the material of the thermometer were so badly conducting in relation to its size as to allow the surface temperature to fall considerably below that of the interior. Whatever may be the relative temperatures after a given time of a system composed of a conducting mass, originally at a uniform temperature of 100°, surrounded by an enclosure maintained at 0°, the same after the same time will be the differential temperatures of the corresponding parts of another similar system, whose interior mass had originally a uniform temperature of 200°, with a case maintained at 100°. In fact, according to Newton's law, and with a constant conductivity, the superposition of any constant temperature over the whole system alters none of the conditions.

If it be objected that in the interior of a thermometer heat is distributed, not merely by conduction, but is convected by currents in the mercury, even this, I believe, will make no difference. The convection currents are a consequence of differences of density, and these are approximately proportional to the differences of temperature. The addition of a constant temperature to the whole alters nothing.

Judging from the evidence at present before us, it is impossible to avoid the conclusion that within the limits of Dulong's experiments Newton's law of cooling cannot be even approximately true. If Capt. Ericsson, by bringing forward fresh experiments, and by proving the fallacy of old ones, can establish the truth of Newton's law, he will lay Science under a great obligation. Speaking as a mathematician, I could even wish him success.

With regard to high temperatures it seems certain that Dulong and Petit's law fails; for it is impossible to believe that the sun is no hotter than 1,500° Cent., at least if the estimates hitherto made of terrestrial temperatures are substantially correct. It must be remembered, however, that according to Fizeau the sun is only about 2½ times brighter than the electric arc, which does not even imply a higher temperature; because, while the sun must give us nearly the whole radiation due to his temperature, the electric arc is probably transparent.

J. W STRUTT

Terling Place, Witham, April 29

Solar Halo

THIS morning, at 9.20, I observed a strongly-marked halo round the sun. Roughly extemporising a sextant with a post-card and paper-vector, I took three observations on the semi-diameter, and found the mean to be 22°·6. So I conclude this to be the ice-halo, whose deviation is 23°, being formed of hexagonal crystals. Two facts render the halo noteworthy—(1) the morning (after a heavy gale from the south) was exceptionally warm; (2) the halo exhibited the extreme colours in the proper order. I am told halos do not exhibit colours. Surely they ought to; and if not, why not? Let some of your readers answer me this. The halo was visible till nearly 10 o'clock.

Bournemouth, April 26 C. M. INGLEBY

Help us to save our Birds

ALL praise be given to those who have made a stand for the preservation of British birds. With a spirit of patience they have had to encounter the crass prejudice that sometimes saturates even the rural mind, and to prove that if the small bird takes its toll from, it also greatly assists in preserving the store of, the farmer. They have had to combat the sporting instincts of the excited townsman, so joyous with his escape from the smoky labyrinths of his brick-built prison that even a feathered shuttlecock would almost seem like game. Last and greatest feat, they have had to question the right to worship the national idol—gain, and to teach people, that even if, by the wholesale slaughter of feathered tribes, some persons scraped up gold, still that occupation, however praiseworthy, was against the general good. Truth at last dawned on the mind of the people, and so Parliament shielded, amongst other fowl, the pretty kittiwake from destruction, and preserved fashionable women from one more barbarism.

Those who have thus worked to educate the public need not rest on their oars for lack of employment, let them look farther afield, let them fearlessly step across national boundaries, and lend their strength to assist in arresting the impending destruction of many species of the most beautiful and interesting orders of animated nature in any quarter of the globe.

New Zealand, so long left by science to slumber on the calm bosom of the Pacific, has disclosed, amongst her birds, forms that have surprised the naturalist as much as they have excited the speculation of the philosopher. The remains of birds, of orders other than the gigantic Struthiones, giving us hints about strange *lost* forms of animal life that have lingered in these islands, perchance, almost to our own times, are now and then exhumed from the hidden shores of swamp and morass. We raise a cry for help in behalf of the mass of birds that yet remain *near* us (we had almost said *with* us), in the hope that the attention of naturalists in Europe may be called to the peril of extermination that hangs over many interesting indigenous species. For the preservation of our birds we require some assistance from abroad, our time is so crowded with occupations of many kinds, that without some pressure from without, little attention would be likely to be paid to the subject. This is said not without reason, not without some experience; in 1868, in Parliament, the writer tried to secure the conservation of our magnificent forests, a resolution was passed by the House to that effect, official inquiries were made;—*cui bono?* Our forests are now being damaged and destroyed, where not protected by climate, in so ruthless a manner, that no further evidence is needed to prove our wasteful style of settlement. Will not some one having authority in such matters speak a word in due season for our birds? I believe nearly every living species that we number could be preserved with proper care. If that is a fact, is it not interesting enough to naturalists to induce them to stimulate us to efforts more likely to give better results than our present legal enactments?

We encourage planting, the labour and capital therein expended may yield returns after the lapse of generations; we, at the same time, allow timber, the growth of ages, to be swept by fire by any one who owns a box of matches, and looks on firing as the best means of subduing the wilderness. We import with great difficulty insectivorous birds, and allow the Apteryginæ and other insectivorous genera to be destroyed without mercy.

Fearing to occupy too much space, I will only glance at our worst raptorials from which our birds suffer. First, the *bonâ fide* settler in his "new chum" phase, before "he has eaten his tutu" (as we say); next, the digger, who kills kivi, kallapo, kalla, and pigeon, without any respect to season; his dog, like that of the settler, being a more fatal enemy to birds than himself. Lastly, the collector, the provider of rarities for museums, &c. There is no fence month with him; if spring or summer plumage is interesting, so also is that of winter; eggs, young, the adult, alike he preys on all. He is heedless of the Mosaic promise; he cares not to have his days prolonged, so that he gets good specimens.

Could we be persuaded to try and avert what will some day be a great reproach to this country, the destruction of so many species of our feathered tribe, D'Urville's Island might be found most useful. Wingless species, and birds of feeble powers of flight, might there find a refuge for some of their representatives. Resolution Island might be placed under tapu from molestation by dog and gun. THOMAS H. POTTS

Ohinitahi, New Zealand, February 2

The State and Science

FROM the position taken by Mr. Gladstone with regard to the Dublin University Bill, from Mr. Lowe's speech at Halifax, and from other indications, it would appear to be the policy of the Government, not to render accessible to all, without sectarian distinction, the professorships and other endowments of the Universities, and to assign to modern culture a fair share thereof, but to abolish all such endowments, and to withdraw all State aid from both literature and science. In favour of such a policy it has been urged not only that it is in accordance with sound political economy to leave every pursuit to seek for itself its own reward, but also that the system of endowment and artificial aid has proved a signal failure. Now, if by this last argument it is meant that the large rewards which have been given for classical knowledge and for mathematical attainments have not been productive of numerous Bentleys, Porsons, and Newtons, the truth and validity of the argument must be admitted. The rewarding of mere acquired knowledge was little likely to show its results in original work. The capacity for acquisition, literary, mathematical, or scientific, is a very different thing from the power of original production, or of extending the boundaries of human knowledge. Probably in some cases the latent spark of genius has even been stifled and smothered by the load of "cram" necessarily superimposed to meet the requirements of exacting examiners. It would be, however, I think, a mistake not to allow some considerable reward to more exact knowledge. But it is with regard to original work and the proved capacity for doing it that external encouragement and reward is absolutely necessary. Such work, in most departments of literature and science, cannot possibly, in a commercial sense, pay. It is this work, however, which confers especial honour and advantage on the State. Therefore it is in accordance alike with justice and sound policy that the doing of such work should be munificently encouraged and rewarded by the State. Such a policy might be reasonably expected to issue in results very different from those which have attended the endowment of "cram." Previous failure cannot be objected, for the attempt can scarcely be said to have ever been made. It behoves, therefore, literary and scientific men to look to it that, in any redistribution of the University or other endowments, the true interests of both science and literature—and especially the encouragement and reward of original research—are duly regarded by the Government. But a certain superficial political economy may object that such a policy would be of dangerous tendency, inasmuch as it would recognise the existence of the State as a unity, which, being honoured and benefited, should encourage and reward. The man of original thought and the discoverer of Nature's secrets must be left, each for himself, to seek such recompense as he can in the ordinary market. Sir Isaac Newton would not be rewarded by the present Government with the Mastership of the Mint. They have abolished that office. No, they would guard him in his enjoyment of the copyright of the "Principia!" Such, it would seem, according to Messrs. Lowe and Gladstone, is the dictate of common sense, of justice, and of the "sound political economy" of ADAM SMITH

Brilliant Meteor

I NOTICED in your number for last week the account of a brilliant meteor, observed in Cumberland on April 19. Now I had reported to me a very similar meteor at nearly the same time (about 8.40 P.M.), an account of which I forwarded, with my other results of the night's watch, to Mr. A. S. Herschel, who would gladly receive any further report of the same; unfortunately, I have not that number of NATURE at hand, and therefore cannot make a personal application to your correspondent. On the same evening, about 10.7, I myself saw an exceedingly brilliant meteor, which fell to a point just S. of Vega. It is curious that both of these come from the radiant situated about R.A. 155, D + 47, or rather from one of the group of radiants there situated, M_8 of Heis, 56 and 52 of Schiaparelli. It would be an interesting point of investigation whether the meteors from that radiant are of peculiar brightness.

20, Bootham, York, April 30 J. EDMUND CLARK

EXPERIMENTAL ILLUSTRATIONS OF MUSICAL TONE

REFERENCE was recently made in these columns to an educational lecture on "Musical Tone," delivered by me on March 14, at the Taunton College School. Among the experiments, several were specially arranged in connection with this lecture, and these I should be glad to put on record as simple and inexpensive means of illustrating important points.

For the purpose of displaying the relation between the "quality" of musical tones and the kind of vibration producing them, a series of magic-lantern slides were shown. These were prepared in the ordinary way, being smoked glass plates on which vibration-lines were traced by points attached to tuning-forks, piano-wires, &c. Each tone being sounded as its vibration-line was shown, the audience was enabled to appreciate clearly the difference between the simple tone of the tuning-fork and the clangs of a stringed instrument, played on musically and also made to shriek and rasp. For an extreme illustration, to show the relation of an irregularly discordant clang to an irregularly bent and jagged vibration-line, a toy popularly known as a "Bismark's Whistle" was made, larger than the usual size. It consisted of a tin-plate canister, near the centre of the bottom of which a piece of gut, knotted at the end, was passed through a small hole. Well-resined fingers drawn with a tight grip along the gut caused this infernal machine to emit a hideous sound, the vibration-line of which was shown as taken off on the smoked glass from a pointed wire soldered to the bottom of the canister.

The pictorial representation of a beat is of course indispensable to explain Helmholtz's theory of harmony and dissonance. As, however, neither the plan used by Prof. Helmholtz of taking off the beats of two organ pipes by means of a vibrating membrane, nor the splendid arrangement of Lissajou's method employed by Prof. Tyndall, were readily available, I found it necessary to contrive a simpler and coarser method. Accordingly, two stout piano-wires were stretched side by side on a board about three inches apart, and connected near the middle by a bent yoke of thinner wire, terminating upwards in a point. The two wires being tuned so as to give beats at a convenient rate, the alternate phases of addition and subtraction of the vibrations of the two wires, corresponding to the beats, were well

shown by the central pointer, from which pictures of the beats were taken off on the smoked glass, forming admirable slides.

Mr. R. Knight, of Wellington, who superintended the making of the apparatus, devised a neat arrangement for showing the lengths of resonant tubes (See Tyndall, Lecture V.). It consists of a 4-ft. length of 3-inch zinc tube mounted upright on a foot and nearly filled with water, so as to form a cistern in which a 2-in. tube is raised and lowered, answering at the proper height with powerful resonance to a large tuning-fork. This apparatus will, I expect, come into use in future as the most convenient means of demonstrating the principle of lengths of organ-pipes. When the instrument is used for class purposes, it may be recommended that the tube be graduated to quarters of an inch, so that the pupils may be practised in calculating the wave-length, and thence the pitch, of any tuning-fork tested by the resonant tube. Further, with reference to the theory of musical pipes, it may be worth while to mention that an 8-ft. length of ¾ in. iron gas tube serves well to produce the overtones of open pipes. It is best to fit some kind of trumpet mouth-piece at one end, by means of which the most elementary musical scale, that of simple trumpet-music, may be effectively given.

No ready way being found of displaying Sir. C. Wheatstone's kaleidophone experiments on a large scale, they were shown afterwards as table experiments. Since then, however, a Chinese joss-stick has supplied the means of showing to an audience the path of the end of a vibrating rod. A piece of the lighted stick attached to the end of an umbrella rib shows beautifully convoluted figures several inches across. Any other means of attaching a bright permanent spark may of course be used, and the plan serves also to show the path of a point on a long vibrating wire. The experiment of waving a large tuning-fork to and fro while in vibration, which Mr. Sedley Taylor described in NATURE, vol. v. p. 321, had also been noticed by us. For want of means of making the result visible at a distance, it was not shown in the lecture. An inch of lighted joss-stick, however, fixed transversely near the end of one leg, shows well the contrast between the line of light traced by waving the fork in its quiescent state, and the series of dots of light into which this line is resolved when the fork is waved or swung while in vibration, its counteracting movements bringing it to momentary rest.

E. B. TYLOR

*ON THE SULPHUROUS IMPURITY IN COAL GAS**

THE lecturer commenced by stating the origin of the sulphurous impurity in coal gas to be the iron pyrites which is contained in coal, and that in the manufacture of gas, when the coal is strongly heated, the sulphur of the iron pyrites not only combines with hydrogen to form the gaseous sulphuretted hydrogen, but also with carbon, to form the very volatile liquid bisulphide of carbon. Little need be said of the desirability of removing the sulphur from coal gas, for in many of our large libraries, such as that of the Athenæum Club, the injurious effect of the sulphurous and sulphuric acids produced by the combustion of gas containing sulphur, seems to be plainly manifest, more especially on the leather binding of the books. The gas, after leaving the retorts in which the coal is heated, is cooled down, and passed through towers filled with coke, over which water is kept trickling. By these means a considerable proportion of the sulphur is removed in the form of sulphide of ammonium. It was shown by experiment that this washing with water could only be employed to a limited extent; as by excessive "scrubbing," as it is technically termed, the gas is greatly deteriorated as to its illuminating power. The sulphuretted hydrogen remaining in the crude gas is easily removed; but the removal of the bisulphide of carbon is attended with so many difficulties that up to the present time no satisfactory process has been devised to effect this purpose. The lecturer exhibited strikingly the two methods used for the removal of the sulphuretted hydrogen, one by passing the gas over lime, and the second by passing the gas over oxide of iron, and stated that it is comparatively rare to find any of this impurity in the gas as supplied to consumers. Up to the present time no process is used for the removal of the bisulphide of carbon. Mr. Harcourt has, however, found that by heating a mixture of bisulphide of carbon vapour and hydrogen to redness, the former is decomposed into sulphuretted hydrogen. It will be thus seen that the removal of the bisulphide of carbon from coal gas is rendered possible, for by simply heating the gas to redness the sulphur combines as before with hydrogen to form sulphuretted hydrogen, which can be easily removed by passing through a purifier containing oxide of iron. In this way, by passing coal gas, which contained 30 grains of sulphur in 100 cubic feet, through a red hot tube, and then through an iron purifier, the sulphur was reduced to about 5 or 6 grains in 100 cubic feet. It might be imagined that the passage of coal gas through a red hot tube would deteriorate its quality; but Mr. Harcourt's experiments show that the contrary is the case, for by passing gas of 14·91 candles rapidly through a tube heated to moderate redness, the illuminating power was found to be 15·1 candles, and after passing through a tube heated to bright redness, its illuminating power was increased to 16·66 candles. A parallel case to this is seen when marsh gas is decomposed into hydrogen and carbon by a series of electric sparks, the gas which is obtained occupies almost twice the original volume of the gas, but possesses a far greater illuminating power than that of the original marsh gas, owing to the presence of a small quantity of acetylene or some such body. It will be seen that these experiments offer what certainly seems to be a feasible process for the great reduction of the amount of sulphur contained in coal gas.

* Abstract of a Lecture delivered at the Royal Institution on February 19, by A. Vernon Harcourt, F.R.S.

PROPOSED OBSERVATORY IN NEW ZEALAND

ON Dec. 16, 1850, the first ship-load of emigrants, under the auspices of the Canterbury Association, landed at Port Lyttelton and commenced the foundation of the present province of Canterbury. On Dec. 16, 1871, the settlement attained its twenty-first year, and it was felt by a large number of gentlemen here that it would be well to celebrate the majority of the province by some permanent memorial. A meeting was held on that day, attended by a number of the most influential residents; and it was unanimously resolved to form an association for the establishment of an astronomical observatory near Christchurch. It was remarked by several speakers that this province possesses considerable advantages for such an institution. Between the ocean on the east and the great range of the Southern Alps on the west, there stretches an expanse of unbroken plain more than 100 miles in length and 50 in breadth. The remarkable clearness of the atmosphere, joined to this large extent of level land, renders it possible to observe a much larger area of the heavens than is usually the case. The meeting fully endorsed the remarks of the promoters of

the movement ; a temporary committee was formed, and lists of subscribers and donors were at once commenced.

By a curious coincidence, the telegram announcing the formation of the Society no sooner came under the notice of the Colonial Government, than they informed the committee that they had, a short time before, received a communication from the Imperial authorities on the subject. The Astronomer Royal had intimated his desire to form a station in New Zealand for the observation of the Transit of Venus in 1874, and had recommended Canterbury as suitable for the purpose. This announcement was naturally most encouraging to the committee ; steps were immediately taken by them to communicate, through His Excellency the Governor, with the Imperial Government. The Governor and his advisers have informed the Society that they cordially approve of its object, and will assist it as far as possible.

The Provincial Council of Canterbury was in session a few days later. Petitions were presented to it by the Society, praying for a grant of 1,000*l.* towards buildings, &c., and 5,000 acres of the waste lands of the province as an endowment towards the permanent maintenance of the Observatory. The Council, by a majority of twenty-five to eleven, voted the sum of 1,000*l.*, and 200*l.* for a site ; but they declined at present to grant the endowment in land. The money grant of 1,200*l.* was likewise made conditional on the agreement of the Colonial Government to undertake the maintenance of the Institution. The great interest taken in the movement by His Excellency the Governor and his Ministers leads the Society to hope that a satisfactory arrangement may be made, so that before this time next year we may be placed in a position actually to commence operations.

Although only a month has elapsed since the first meeting, the Society has been warmly supported in this province. Additional subscriptions are received every day, and since January 22, when the temporary committee presented their report, the number of annual members has been increased to nearly 200.

I enclose the report of the temporary committee, which details the work actually done by them so far. You will see that the committee have attempted to commence the practical work of founding the Society by asking the Astronomer Royal to send out a gentleman to advise as to a proper site and other initiatory work. It is our hope that our object may receive a cordial concurrence from scientific men at home. We desire to co-operate with similar institutions in the old world by performing work which may not only be of practical use to our community here, but may, if possible, add something, however small, to the results of labours of older workers in the field of science. We trust that even one of England's youngest daughters may be of some assistance in this respect to her more favoured sisters.

W. M. MASKELL, Hon. Sec.
Observatory Society of Canterbury.

A NEW MODE OF TAKING CASTS

MR. BOYD DAWKINS, F.R.S., has recently exhibited to the Manchester Philosophical Society a number of casts in plaster of Paris of various objects of natural history, and explained the process by which any one can make them for himself. The material of the mould is artists' modelling wax, which is a composition akin to that which is used by dentists. And as it becomes soft and plastic by the application of heat, though in a cold state it is perfectly rigid, it may be applied to the most delicate object without injury. As it takes the most minute markings and striations of the original to which it is applied, the microscopic structure of the surface of the original is faithfully reproduced in the cast. The method is briefly this :—1. Cover the object to be cast with a thin powder of steatite or French chalk, which prevents the adhesion of the wax. 2. After the wax has become soft either from immersion in warm water or from exposure to the direct heat of the fire, apply it to the original, being careful to press it into the little cavities. Then carefully cut off the edges of the wax all round, if the under cutting of the object necessitates the mould being in two or more pieces, and let the wax cool with the object in it, until it be sufficiently hard to bear the repetition of the operation on the uncovered portion of the object. The steatite prevents the one piece of the mould sticking to the other. The original ought to be taken out of the mould before the latter becomes perfectly cold and rigid, as in that case it is very difficult to extract. 3. Then pour in plaster of Paris, after having wetted the moulds to prevent bubbles of air lurking in the small interstices, and if the mould be in two pieces, it is generally convenient to fill them with plaster separately before putting them together. 4. Then dry the plaster casts either wholly or partially. 5. Paint the casts in water colours, which must be *fainter* than those of the original, because the next process adds to their intensity. The delicate shades of colour in the original will be marked in the cast by the different quantity of the same colour which is taken up by the different textures of the cast. 6. After drying the cast, steep it in hard paraffin. The ordinary paraffin candles, which can be obtained from any grocer, will serve the purpose. 7. Cool, and polish the cast by hand with steatite. The result of this process is far better than that obtained by any other. The whole operation is very simple, and promises to afford a means of comparison of natural history specimens in different countries, which has long been felt to be a scientific need. It has been already introduced into America and India by Mr. Dawkins, and samples of the casts are to be seen in the British Museum, as well as in that of the Geological Survey, and of Oxford, and of the Queen's College. Casts of type specimens may be multiplied to any extent at a small cost of time and money, and are as good as the original for purposes of comparison, and almost as hard as any fossil.

The modelling wax can be purchased from Messrs. Lechertier, Barbe, & Co., artists'-colourmen, Regent Street.

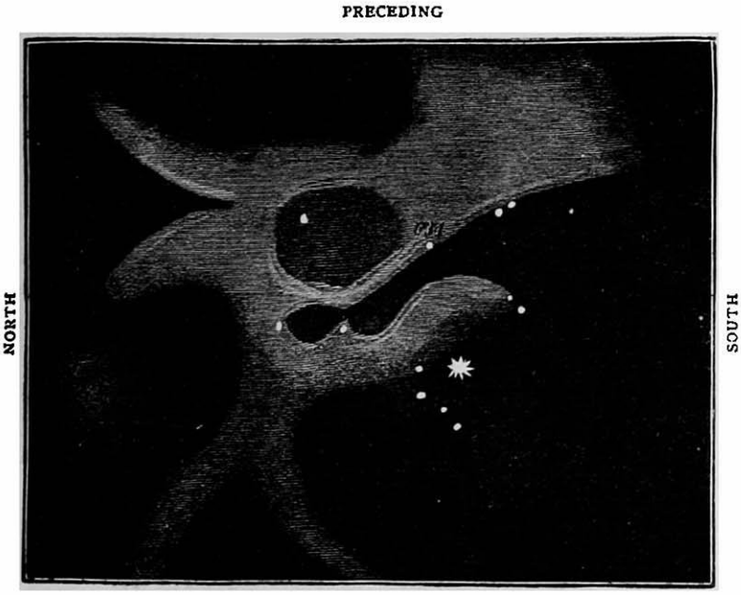
THE NEBULA ROUND η ARGUS

A PAPER, accompanied by five drawings, has recently been read to the Royal Society of Victoria by Mr. McGeorge, on the star η Argûs and the great nebula near it, from which we select a few statements which appear to establish the occurrence of sensible changes in that region of the sky. After noticing the value of Sir John Herschel's drawing and description of the nebula, Mr. McGeorge remarks that from 1838 to 1869 no trustworthy observations of the nebula could be made, for want of instruments of sufficient power; though Mr. Tebbutt and others have contributed valuable information about η itself. A single glance is sufficient to show the complete inapplicability of Herschel's drawing or description to the present appearance of the nebula in the Great Melbourne Telescope. This, however, might be attributed to the great power of the instrument, whose light exceeds that of the 20-ft. reflector as much as that surpassed the other telescopes with which the nebula has been observed.

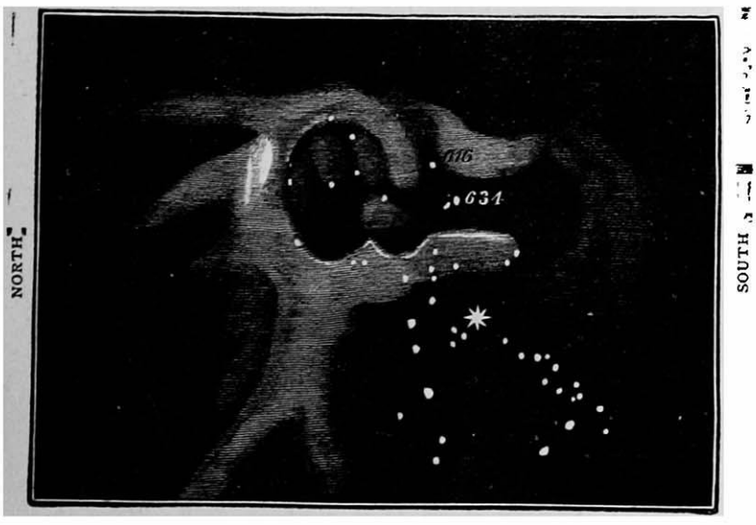
But the changes indicated in the present paper cannot be so explained, for they have nearly all been traced in the *Great Melbourne Telescope itself*, and are described in detail, with reference to drawings and observing notes. A few may be mentioned here.

η, which Herschel saw involved in dense nebula, was in April 1869 seen on the bare sky, the nebula having disappeared for some distance around it. Drawing No. 1, which accompanied the paper and which is here reproduced,

then made, shows that the southern loop of Herschel's Lemniscate had bulged out into the vacuity, forming an isthmus which trended north and joined the northern loop. The *second* drawing, January 1870, shows that within six months this isthmus had detached itself from the north side of the Lemniscate, through 90″, to form a broader peninsula. The third drawing, April 1870, shows the outline of a gulf or cleft, commencing at H 634. This



star is one of the "landmarks" described in 1838 as being "near the margin of the Lemniscate." It is now in mid-channel. These three drawings were made by Mr. Le Seur. No. 4 was made by Mr. McGeorge at the close of December in the same year. It confirms the existence of the Gulf; another of the "landmarks," H 616, is now nearly clear of nebula. A promontory shown in No. 2 has detached itself to form an island of nebula with a starry nucleus. This and the neighbouring outline of the Lemniscate have the same hard definite outline given by



Herschel; at one part, however, the outline seems encroaching upon the Lemniscate, and leaving an oval patch of thinner nebula; southward the outline seems to be curdling and breaking up. A fifth drawing, which is also here given, was made in June 1871, which amongst other changes shows that the island has shifted; the nucleus is now detached from it, and proves to be a triple star.

Mr. McGeorge finds, as Lord Rosse did, that high powers on a good night bring out details of nebula invisible with lower powers. On one occasion he speaks of using 1,300, whose definition, he says, "was magnificent for an hour." He notices a sort of stereoscopic effect which, particularly with the high powers, makes the Lemniscate look "like a huge snowy cave with uneven woolly sides."

In December 1869 the spectrum of η Argûs showed bright lines; but in January 1871 there was no trace of them; but Mr. McGeorge thought that with a wide slit he detected absorption bands in the position of the usual nebular lines. Distinct nebulosity was then visible round the star, most condensed near it, chiefly in the direction of the Lemniscate.

It is perhaps unnecessary to remark that Mr. McGeorge has seen nothing in the way of coloured stars at all to be likened to κ Crucis; one or two are reddish.

It is the intention of the Melbourne astronomers to pursue unremittingly the study of this nebula, which seems already to have given them such remarkable results. But it is evidently a most laborious task which they have imposed on themselves. At present they are confining their attention to the vicinity of the Lemniscate, but even there the field of labour is immense, for already they have noticed three times as many stars as were seen by Herschel.

They have with them the best wishes and sympathy of all astronomers.

T. R. ROBINSON

Armagh, April 21

BRITTANY DOLMENS AND LINES

MR. JAMES FERGUSSON, in his interesting volume on "Rude Stone Monuments in all Countries,"* which will doubtless become a text-book on that section of archæology which pertains to Megalithic structures, has made one or two unintentional misstatements, discrepancies, or errata, which perhaps he will allow me to correct through your columns, in hopes that they may be in time for the second edition, which is probably called for, if not accomplished. I will state them as briefly as possible.

I. Carnac (p. 349): "No stone in the neighbourhood of Carnac is hewn or even fashioned beyond splitting, and *no sculptures of any class have been traced*" (italics are mine). Will Mr. Fergusson forgive me if I point out that the tumulus of Kercado, situate in the grounds of the Chateau of the same name, and marked in the map of the neighbourhood of Carnac given in his volume Fig. 135 as "Kercadio Tums. 2" has well marked sculpture on at least three of its stones, one of the figures, viz. that on the under-surface of the capstone, being evidently of the same type as the *Hatchet (?)* in the roof of Dol-au-Marchand or Table de César, see Fig. 149 (where by-the-bye I never could make out the so-called plume), and is identical with one in Bé-er-groah (Locmariaker). This tumulus, or dolmen-mound, as I prefer to call it, is much nearer to the lines of Kermario and Kerlescant than Mont S. Michel is to the lines of Menec. I should add that M. René Galles figures two of the sculptured stones, but not the hatchet.

But this is not the sole example of sculptured stones in the neighbourhood of the Carnac amorpholiths. In the curiously arranged dolmens called the "Grottes de Kerozille," are distinct traces of former sculpture (in which, if I mistake not, some traces of some coloured pigment have been discovered by W. Lukis), of which M. Galles gives but imperfect representations. Doubtless all the stones were covered with similar ornamentation, which has disappeared from the weathering of the stone surface. The "Grottes de Kerozille" are situate to the north of Menec, about two miles distance, marked Dols. 11 and 12 in MM. Blair and Ronald's map as given by Fergusson. There are in reality three dolmens, the centre one at right

Vide NATURE, Vol. v. p. 386.

angles to the other two, and almost connecting them with traces of a fourth: all have been covered under one mound. In "Les Grottes de Plouharnel," where the gold ornaments were found, are traces of rude sculpture. I need hardly add that none of these archaic markings are in relief, as is the case with the celts shown in Sir Henry Dryden's drawing from Gavr' Innis, Fig. 152. Flowing labyrinthical lines seem characteristic of the Kerozille dolmen-mound, whilst straighter lines forming network are peculiar to Kercado. On the summit of the neighbouring dolmen of Runusto are some cup-markings which bear a very fair resemblance to the constellation of the Great Bear together with the Pole Star. The *tolmen entrances* in the long barrow close to and north of the Kerlescant alignments, one of which is figured (*vide* Fig. 139), were doubtless fashioned artificially, at least I think Mr. W. Lukis, who has described them, will bear me out in this assertion. It is indeed a monstrous pity that the Société Polymathique du Morbihan should have permitted such an interesting structure to be destroyed.

I should not have taken the trouble of bringing the foregoing notes to the notice of the public in your pages had it not been for the great stress laid by Mr. Fergusson on the fact of the marked distinction made by him between

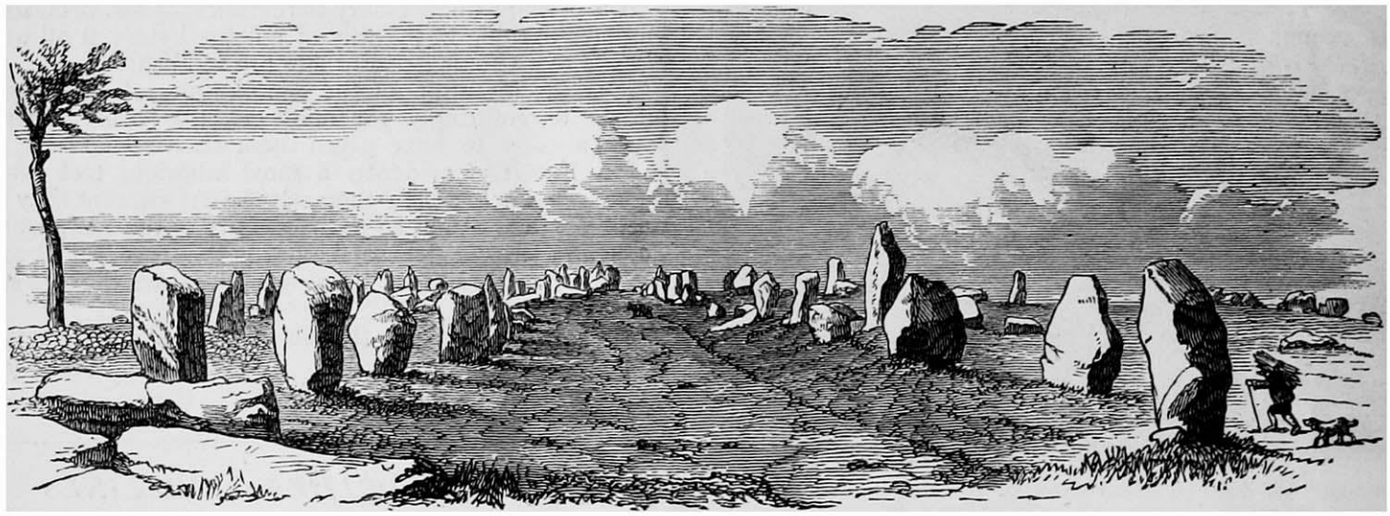


FIG. 1.—ALIGNMENTS OF AMORPHOLITHS, KERMARIO.
From Sketch by Capt. S. P. Oliver, R.A.

the Locmariaker monuments and those in the neighbourhood of Carnac, the latter of which he asserts *cannot* be dissociated from the Carnac alignments.

In a communication addressed to the Anthropological Institute, I endeavoured lately to prove that the hewn and sculptured stones of Locmariaker were of a different type from the rough and shapeless blocks of Carnac, which latter I ventured to distinguish by the name of "Amorpholiths," and for that very reason disassociated the dolmen-mounds, such as Kerlescant, Kercado, and Mont S. Michel, from the lines and avenues, excepting the *unchambered* barrow at the western extremity of the Kerlescant lines which appear to lead up to it. An endeavour to classify the Dolmen-mounds of Brittany is appended herewith.

II. As to the fallen menhir, which Fergusson asserts *belongs to* the dolmen named *Dol-au-Marchand*, and which, in his idea, was in reality two *obelisks* and not one; the accompanying trustworthy plans and elevation of the renowned monolith ought to prove to the most sceptical that the remains in question are without doubt fragments of one huge monolith, which was, moreover, artificially fashioned, and, possibly, originally actually polished.

I confess that I was disappointed when I found that the Carnac lines were summarily disposed of by Fer-

FIG. 2.—PORTION OF THE KERMARIO ALIGNMENTS FROM THE NORTH.
From Sketch by Capt. S. P. Oliver, R.A.

gusson in nine pages, whilst over fifty are devoted to Avebury and Stonehenge! (although he terms the former the most remarkable group of megalithic remains, not only in France, but perhaps in the whole world); also at not finding a single illustration of the said lines beyond the maps, which, valuable as they are, give no idea to the reader who has not actually visited the spot, of the size and style of the amorpholiths. I enclose a view of the Kermario avenues, looking west, premising that the more distant stones are the largest, and that they decrease in size towards the foreground, the perspective diminishing the effect of this difference in the size of the stones.

III. Why does the celebrated dolmen (Fig. 126) of *Kercouno* appear under the name of *Krukenho?* Louis Galles gives the etymology of this place as "*village du souvenir.*"

IV. Not much faith can be placed in Mahé's (not Malé) representation of an *ideal* demi-dolmen, Fig. 129. In his "*Antiquités du Morbihan*," it is ideal, and has no local habitation or name.

V. P. 349. The *Veneti* are styled *Venetes*, and p. 356 *fibrolite* * is printed *tribolite*—printer's errors! With re-

* La fibrolite est un silicate anhydre d'alumine; elle doit par ses caractères être rattachée à la sillimanite (des Cloizeaux). Couleur blanc-laiteuse, souvent jaunâtre et marbrée de veines et de tâches grises ou couleur de rouille. A peu près opaque; quelques échantillons montrent une certaine translucidité.

gard to this last rare mineral substance, to which Fergusson never alludes beyond mentioning its existence, I pointed out some time since that seventy-five per cent. of the celts found in the sepulchral dolmen-mounds of Brittany were composed of this material.* Can Mr. Fergusson inform us how he accounts for the presence of this substance, as well as the significance of its predominance in association with sepulture? It may be noted that all the fibrolite celts are small and nearly perfect, with sharp edges, and show no signs of use; whilst the diorite and other celts of a larger type show evident signs of use and are all *purposely* broken before deposition in the dolmen.

VI. P. 356. More strictly the jade and turquoise should be termed *jadéite* and *callaïs*, respectively. Mr. Fergusson is right in quoting "jade" and "turquoise" if he goes by M. René Galles' account, and I quoted the same materials myself in an article on Dolmen Mounds in the *Quarterly Journal of Science* last January; but these

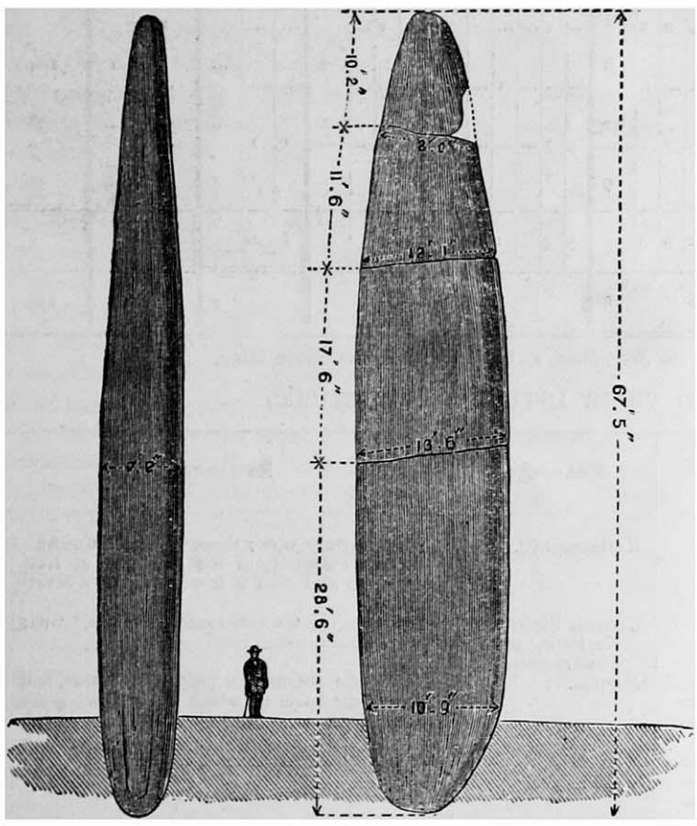


FIG. 3.—LE GRAND MENHIR, Restored by Sir Henry Dryden, Bart., showing its similarity to a Stone Celt.

same articles now in the museum of Vannes are described by the curators Messrs. de Cussé, L. Galles, and D'Ault-dumesnil as *jadéite*† and *callaïs*.‡

Structure à fibres fines, soyeuses, très serrées, contournées, et comme entrecroisées en divers sens; c'est de là que lui vient son excessive tenacité. Raie le verre et le feldspath, rayée par le quartz. Infusible au chalumeau. Les haches en fibrolite affectent plus ou moins la forme d'un parallélogramme allongé, souvent celle d'un trapèze dont la plus grande base offre un tranchant. La fibrolite étant une substance lamelleuse, toutes les haches faites de cette matière n'ont qu'une épaisseur faible et irrégulière.

* See table.

† La jadéite doit être rattachée à la famille des wernérites (silicates anhydres). Couleur de diverses nuances de vert, de gris verdâtre, de gris jaunâtre, structure cristalline, fibro-lamellaire, quelquefois un peu schistoïde, rayant le feldspath et le jade oriental; rayée par le quartz. Très tenace. Facilement fusible. Une mince écaille, exposée à l'extrémité de la flame d'une lampe á alcool, se fond aisément en un verre jaunâtre ou grisâtre, demi-transparent.

‡ La couleur de cette matière est le vert-pomme, se rapprochant du vert de l'émeraude. Quelques échantillons sont comme marbrés de parties blanches et de parties bleuâtres; d'autres sont maculés de veines et de tâches brunes ou noires, par suite d'un mélange accidentel de matières argileuses. Le minéral est translucide, à peu près autant que la chrysoprase. Sa cassure est compacte comme celle de la cire. Il raie le calcaire, mais il est facilement rayé par une pointe d'acier. Sa poussière est blanche, infusible au chalumeau. Cette substance est un phosphate d'alumine hydraté comme la turquoise orientale, mais elle en diffère sensiblement, aussi bien par les proportions de ses principes constituents que par ses caractères. M. Damour, d'après les différences appréciables qui existent entre ces deux matières, les sépare dans la classification des espèces. Il emprunte à pline le nom de *callaïs*, qu'il applique à notre minéral, et réserve celui de turquoise à la pierre précieuse de couleur bleu de ciel si connue en joaillerie.

VII. How the barrow north of Kerlescant lines can be said to be related in any way (p. 356) to Mont S. Michel (which is situate south-east of the Menec lines, and at least a mile distant), either in position, size, or structure, I cannot imagine. The former is, or rather was, a long but small structure with fashioned entrances, covered over with a mound which is only visible a few yards off, whilst the latter is an immense tumulus, visible from afar, covering one if not more kists of insignificant structure.

VIII. Mr. Borlase's late discoveries in the dolmen-mounds of Trevelgie Head, Cornwall, give additional reasons for supporting Mr. Lukis' theory that both dolmens and cromlechs are merely the skeletons of original chambered tumuli.

IX. P. 389. "Only one drawing of a dolmen in Portugal has as yet, so far as I know, been published."

In 1868 M. Da Costa figured twenty Portuguese dolmens, and eight stone implements found in connection with them.*

"In the Peninsula the cromlechs, when denuded, are known under the name of *Antas* (a term about which there has been much disputing, but which, after all, seems to signify ancient altars used as landmarks); those partially enveloped in the tumulus, or on the summit of a mound, are termed *Mamunhas* (corruption of Mamua or Mamôa—tumulus); and when covered in, as the *allées* and *grottes* of Brittany, they are termed *Furnas*.

"In the year 1734 over three hundred of these remains are mentioned as existing in Portugal, but in 1868 M. da Costa could only enumerate forty-two, of which twenty-eight are in the province of Aleutejo, twelve in Beira, two in Traz-os-Montes, two in Minho, whilst none remain either in Estramadura or D'Algarve.

"The largest aggregation of these antas appears to be at Contado d'Alcogulo, the property of M. Le Cocq, where there are five remaining together. The only stone implements described by M. da Costa were found here, and consist of half a dozen rude greenstone celts and a quartzite muller. With the exception of four, all the above are denuded and ruined antas; the exceptions are two furnas near Vizella in Minho, the Mamunha de Mamaltar in Beira, and the Mamunha de Carrazedo in Traz-os-Montes. This last is chiefly remarkable from the curious hollow circular mark, presumedly artificial, on one of its supports.

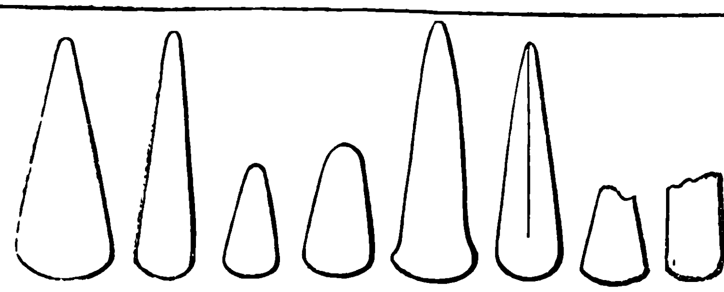
"There is also one curious monument mentioned, as composed of two rows of stones, near a menhir between Cepaes and Fafe, in Minho. As this is the sole description of the monument, and no dimensions are mentioned, it is difficult to judge of its composition. It may be analogous to two rows of small vertical stones in the long barrow at Kerlescant, already mentioned, or there may formerly have existed an avenue of stones. Unfortunately it appears that the monument has been destroyed, and the stones made use of in the construction of the neighbouring convent of Pombeiro."†

The above remarks are not written in a carping spirit, but offered merely as additional information to what Sir John Lubbock aptly terms "a rich and trustworthy storehouse of facts," collected with such labour and care by Mr. Fergusson during the last eighteen years.

I will refrain from analysing Mr. Fergusson's theory that the dolmens date from a post-Roman period in the present paper.

* "Descripçao de Alguns Dolmins ou Antas de Portugal," par F. A. Pereira Da Costa. Lisbon, 1868.

† *Vide* "The Dolmen-Mounds and Amorpholithic Monuments of Brittany," Part I., by S. P. Oliver, Capt. R.A., *Quarterly Journal of Science*, January 1872.



CELTS FROM DOLMEN-MOUNDS IN BRITTANY.

NAME OF TUMULUS.	MATERIAL.																										TOTAL.
	FIBROLITE.					JADEITE.						CHLORO-MELANITE.						DIORITE.				APHANITE.			PROTO-GYNE.		
	Type.*			Irreg.	Total.	Type.					Total.	Type.					Total.	Type.			Total.	Type.		Total.	Type.	Total.	
	A	K	L			A	B	C	E	F		A	B	C	E	F		A	B	D		B	L		B		
Mnané-er-H'roëk (*Locmariaker*).	1	58	31	1	91	4	...	...	2	2	8	...	1	...	...	1	2	...	2	...	2	...	...	...	1	1	104
Mont S. Michel (*Carnac*).	...	15	10	...	25	10	...	1	...	...	11	...	...	...	1	...	1	1	...	...	1	...	...	...	...	...	38
Tumiac (*Arzon*).	...	7	8	...	15	5	2	...	1	1	9	3	3	...	...	...	6	...	...	...	...	1	1	2	...	...	32
Total	1	80	49	1		19	2	1	3	3		3	4		1	1		1	2			1	1		1		
					Total 131						28						9				3			2		1	174

* Types of celts adopted by the *Société Polymathique du Morbihan*, aud alluded to in the above table.

DOLMEN-MOUNDS OF BRITTANY AND THEIR INTERIOR STRUCTURES

		No.	DESCRIPTION OF TUMULUS.	INTERIOR STRUCTURE.	EXAMPLES.	REMARKS.
UNCHAMBERED.		1	Long barrow.	Nil.	Kerlescant (?).	Comparatively rare; there is an erect menhir at west extremity of the examples at Kerlescant, and also a few traces of a revetment.
CHAMBERED.	UNSCULPTURED.	2	Round ditto.	Simple kist. C.*	Carnoet Finistere. Kerlevit, near Douarnenez.	Frequent. In the two examples given, bronze implements were found.
		3	Ditto ditto.	Ordinary megalithic dolmen, consisting of single chamber, with narrow entrance covered way at passage. C.	*Passim.*	This is the commonest type of tumulus, and forms the basis of which the following are variations.
		4	Ditto ditto.	Many-chambered megalithic dolmen, consisting of several chambers with a single narrow entrance. C.	Keriaval. Klud-er-yer.	Most frequent variation of above.
		5	Ditto ditto.	Many-chambered dolmen. Chambers of dry walling, and vaulted narrow entrance, megalithic and ceiled.	Rosmeur.	Not frequent.
		6	Long ditto.	Long, narrow, megalithic chamber, sometimes divided, sometimes with dolmen entrance. C.	Garren-dol. Parc ar Dolmen. Kerlescant. Kerlêarec.	There is a peristalith at Kerlescant. The two latter examples have tolmen entrances.
		7	Round ditto.	Megalithic dolmen, with passage at a sharp angle with chamber. C.	Kergonfals.	A rare example; the entrance passage descends into the chamber, and was found divided by walls of loose masonry.
	SCULPTURED.	8	Ditto ditto.	Megalithic dolmen, with curved gallery or passage. C.	Le Rocher. Pierres Plates.	Le Rocher is yet covered with its tumulus, and is a most unique and perfect specimen. The type of ornamentation (Pierres Plates is denuded) in both is similar.
		9	Ditto ditto.	Two or more megalithic dolmens, either parallel, or at right angles to one another. C.	Grottes de Kerozille. Do. Plouharnel. Kerlan.	At Kerozille, the centre dolmens at right angles to the others; in the other instances the dolmens are parallel to each other.
		10	Ditto ditto.	Square megalithic chamber, and long straight avenue, with elaborate ornamentation. C.	Gavr' Inis.	The most elaborately decorated dolmen known.
		11	Long ditto.	Megalithic dolmen at one extremity, and also other smaller kists, ceiled and vaulted.	Manné-Lud. Le Moustoir.	In the first, besides the large dolmen, is a vaulted kist and curious arrangement of stones. In the latter is one dolmen and three other structures, partially megalithic and partially vaulted.
		12	Immense tumuli, more or less elliptical.	Comparatively insignificant. Kists partly megalithic, partly ceiled, and partly vaulted.	Tumiac. Manné-ér-H'roëk. Mont S. Michel.	Tumiac is conical. Inhumation relics. Manné-ér-H'Roëk longer and more truncated, contained no human relics. M. S. Michel long and narrow mound, showed signs of incineration of human remains.

* C = Ceiled.

The Citadel, Plymouth

S. P. OLIVER

NOTES

THE following lectures in pure Science are being delivered this term in Oxford. Prof. Phillips on the Heat of the Interior of the Earth, Ancient Climate, Earthquakes and Volcanos. Prof. Story Maskelyne two courses of lectures ;—the first course of four lectures "On the projection of crystals, and on the relations of morphological symmetry to the distribution of physical and especially of optical characters ;" second course "On lithology mineralogically considered." Prof. Lawson on Structural and Physiological Botany. He also proposes to make arrangements with his classes for botanical walks. The Professor of Astronomy will give practical instruction in the use of Astronomical Instruments at the Observatory at the Museum. The Chemical and Physical Laboratories are each open as usual, special courses of instruction being given in each. The Professor of Anatomy and Physiology proposes to form classes for practical instruction in Physiology and Anatomy. The Hope Professor of Zoology is engaged in the classification of the Hope, Burchell, and other collections. Dr. Lee's Reader in Chemistry is lecturing on the Non-metallic Elements, the Lee's Reader in Anatomy is lecturing on Comparative Anatomy, and the Lee's Reader in Physics on the Mechanical Theory of Heat, and on Hydro mechanics.

AT the last meeting of the Royal Geographical Society, the President announced the Royal and other awards for the year 1872, made by the Council, as follows :—*Founder's Gold Medal.* —Colonel H. Yule, C.B., for his important geographical works "Cathay and the Way Thither," and "Marco Polo." *Patron's Gold Medal.* —Mr. R. B. Shaw, for his adventurous journey to Yarkand and Kashgar, and his observations for fixing the longitude of the former place. *A Gold Watch.*—Lieut. G. C. Musters, R.N., for his journey in Patagonia. 25*l.*—Karl Mauch, for his discoveries in South-East Africa. *Schools Prizes.*—PHYSICAL GEOGRAPHY.—*Gold Medal*—S. E. Spring Rice (Eton College). *Bronze Medal*—A. S. Butler (Liverpool College). *Honourably Mentioned*—C. Penrose (Haileybury); E. Dickson (Cheltenham); J. R. White (Liverpool Institute); H. De Vere Vane (Eton). POLITICAL GEOGRAPHY.—*Gold Medal*—W. G. Collingwood (Liverpool College). *Bronze Medal*—W C. Graham (Eton). *Honourably Mentioned*—R. H. Sayle (Uppingham); W. L. Kingsford (Rossall); H. E. Dickson (Rossall).

THE *conversazione* of the Royal Society on Saturday evening last was a highly successful one. The company, notwithstanding the counter attraction of the Duke of Edinburgh's reception at the Royal Albert Hall, was a brilliant one, and many of the objects and apparatus exhibited were of great interest. There was a beautiful series of photographs of landscape scenery, the geysers, and mud-springs in the regions of the Yellowstone River explored by Prof. Hayden, exhibited by Mr. A. Tylor ; and some of the early photographs of M. Nièpce de St. Victor, showing effects of colour ; and a collection of Madreporaria dredged up by Count Pourtales from the sea-floor in the course of the Gulf Stream, exhibited by Prof. Duncan. Mr. Browning and Messrs. Elliott Bros. had, as usual, a number of telescopic and spectroscopic instruments.

THE Senate of the University of London has this year re-elected all the old examiners in the Faculties of Science and Medicine, with the exception of the two in Forensic Medicine, the new examiners being Dr. Arthur Gamgee and Prof. Henry Maudsley.

AN Inaugural Meeting of the French Association for the Advancement of Science was held last week at Paris under the presidency of M. Claude Bernard ; when the committee of management was elected as follows : MM. Claude Bernard, president ; Broca, Delaunay, d'Eichthal, de Quatrefages, Wurtz, Cornu, secretary, and G. Masson, treasurer. It is still undecided whether to hold the first meeting, in August next, at Lyons, Bordeaux, or Lille. M. Wurtz delivered an address on the character and objects of the Association, in which he announced that the requisite guarantee fund of 100,000 fr. is already subscribed, and will probably be considerably exceeded. The movement appears to be meeting with a hearty response from all the leading men of science in France ; it is welcomed as an aid in the regeneration of their country, by promoting a spread of scientific knowledge and a love of science throughout the provinces ; and we trust it will also have the effect of cementing a closer alliance between French science and that of the other countries of Europe.

THE *Engineer* announces the death, at his residence near London, on April 15, at the age of 84, of Mr. Augustus Siebe. Born in Saxony, he served early in life against the French in the Prussian army ; and after the return of peace employed himself first in watch-making, and afterwards in engineering. The perfection of the diving apparatus in particular engaged his attention, and to him are due many of the improvements now in constant use. In this capacity he was sole maker to the Admiralty, his apparatus having been used with great success in the removal of the wreck of the *Royal George.*

DR. PETTIGREW, F.R.S., will deliver a course of lectures on the Physiology of the Circulation in the Lower Animals and in Plants, at the Royal College of Surgeons, Edinburgh, each Friday afternoon, at 4 o'clock, during May, June, and July.

PROF. MAX MULLER gave a public lecture on April 24, at the Taylor Institution, Oxford, "On Darwin's View of Language." There was a large attendance.

THE old Ashmolean Society at Oxford, which was revived last term after a lengthened period of quietude, met on Monday last in the University Museum, when communications were made to the Society by Rev. R. Main, F.R S., "On the Breaks of Continuity in the Mean Daily Temperature in the months of April and May," and by Mr. A. G. Vernon Harcourt, F.R.S., "On the Sulphur Compounds in Goal Gas, and the means of removing them."

THE garden of the Acclimatisation Society of Paris, ruined during the siege, is about to be reopened. A great part of the damage has been repaired, the ornamental and horticultural parts have been replaced, and there are already many animals in the park.

AT a recent meeting of the French Acclimatisation Society, M. de Grandmont called attention to the project of the Government to establish a grand piscicultural establishment at Montbéliard, to replace that at Huningue, now passed into the hands of the Germans. Very successful establishments of a similar character are now in operation at La Buisse and at Clermont Ferrand (Puy-de-Dôme) ; the latter, under the direction of M. Rico, furnishing annually not less than 30,000 ova of trout for replenishing the various streams in the department.

THE following excursions are arranged by the Geologists' Association during the present month :—Saturday, May 4, excursion to Erith and Crayford, under the direction of Mr. J. Logan Lobley. The party will leave Cannon Street Station by the North Kent train at 2·10 P.M. for Erith, and will, upon arriving at Erith, inspect the fine section of the Thanet Sands overlying the chalk, exposed at that place. Subsequently the party will proceed to Crayford, and visit the extensive excavations in the Pleistocene Deposits from which have been derived the large collection of Mammalian Remains in the possession of Dr. Spurrel, and inspected by the Association last session.—Saturday, May 11, visit to the British Museum, guided by Mr. Henry Woodward. Members will meet at the Museum, Great Russell

Street, at 2 P.M., and proceed to the Palæontological Department, where a portion of the collection will be described. —Whit-Monday and Tuesday, May 20 and 21, Excursion to Bath (one or two days); directors, Mr. Charles Moore, and the Rev. H. H. Winwood. Monday: Assemble at the Half Moon Hotel (near the Railway Station) at 1 o'clock; proceed to the Museum, the valuable and exceedingly interesting palæontological contents of which will be described by the founder, Mr. Charles Moore; then visit Weston and Twerton, and inspect, under the guidance of the Rev. Mr. Winwood, sections of Lower Lias (*Ammonites Bucklandi* and *A. angulatus* zones). Proceed to Newbridge Hill, where are sections of White Lias and the Rhætic series.—Tuesday: Hampton Down—fine sections of the Great Oolite, and a probable representative of the Bradford Clay; upper beds very fossiliferous (*Terebratula cardium*, *Terebratella Buckmani*, *Crania Antiquorum*, &c., with Corals and Sponges). Dundas in the Bradford Valley —sections showing Marlstone, Upper Lias, and Inferior Oolite. North Bank of Canal—section of Inferior Oolite (*Rhynchonella spinosa* zone), and Fuller's Earth. Cross the Avon to Freshford —Mammiliferous River deposits, yielding *Ovibos moschatus*.

THE prophetic announcements of Prof. Agassiz in regard to the discoveries he intended to make during his proposed deep-sea dredgings in the southern waters continue, according to *Harper's Weekly*, to be realised, as we learn from a letter to Prof. Peirce, dated at Rio on the 12th of February last. The weather had not been favourable for dredging for some time; but a suitable occasion presenting itself, the work was prosecuted for one day, with very interesting results. The first discovery mentioned by the professor was that of a living *Pecten*, very similar in general appearance to a fossil form known as *P. paradoxus*, found in Germany, and which he had been inclined to consider a distinct genus, on account of certain peculiarities which are not shared by any living shells known up to this discovery. The specimen found is, however, strictly referable to the same genus as the *paradoxus*, especially as it has the same prominent radiating ribs arising on the inner surface of the shell valve, to which the fossil is indebted for its specific name. Although of very small dimensions, being scarcely two-thirds of an inch in diameter, it is yet a specimen of very great significance. The second discovery was that of a very remarkable crustacean, and is, in part, the realisation of the expectation of finding "genera reminding us of some amphipods, and isopods aping still more closely the trilobites than *Serolis*." A specimen answering fully to this statement was taken in forty-five fathoms, and at first sight seemed like an ordinary isopod, with a broad, short, flat body. This, however, is not referable to any of the orders or families of Milne-Edwards or Dana, and, for reasons adduced, it has very striking relations to the trilobites, and is, indeed, like them, one of those types combining the structural features of several independent groups. It resembles the trilobites in the fact that the head is distinct from the thoracic regions; and the large faceted eyes and the facial suture across the cheeks connect it so closely that but for the presence of antennæ, which project from the lower side of the anterior margin of the buckler, the resemblance would amount to an absolute identity in structure with the trilobites. The character of the mouth is also that of the trilobite; while the antennæ cause its reference to the isopods. For this new genus the name of *Tomocaris Peircei* is proposed.

DETAILS have been received of the earthquake which devastated Antioch on April 3, to which we referred last week. The Greek church, a strong stone-arched structure, built only a few years ago, and capable of holding 500 or 600 persons, is utterly ruined —one side and the entire roof are gone. The American Protestant church and premises are also greatly injured, and four persons of their small community were killed, though the Mission families are all safe. The number of killed and injured cannot be ascertained with any approach to accuracy, and, of course, flying rumours are abundant, one man saying that he thought there must be 1,000 killed, while another said 500, and a third 250, which is, perhaps, within the truth. There was time from the beginning of the first shock to its close for many to escape the falling houses or walls. Several smaller and lighter shocks occurred for an hour or two afterwards, but not sufficiently strong to shake down buildings. These shocks continued at intervals through the next night; and another, more distinct and wave-like, was felt to shake the house with a loud, hollow, rumbling noise, about half-past six the next morning. The first shock was immediately preceded by a rumbling and creaking of the joints of the window and door frames, to which a louder noise, like thunder, succeeded, and then walls and buildings fell. The old Roman bridge of four arches is rent in several places until the water can be seen through it from above; a part of the parapet wall has also been shaken off, and the arch above the city door at its east end has been hurled down, and lies almost whole. Much damage has been done to houses in the lower part of the town, and many of the inhabitants are now to be seen encamping around in the fields or plain. The shocks appear to have continued, with less severity, for several days. One man declared he counted forty-four shocks within twenty-four hours after the first one. They were all accompanied by a noise like distant thunder or artillery, and produced a tremor of the ground; but no fresh ruin has been made by any of them, except the first great shock about 8 A.M. of the 3rd ult.

EARTHQUAKES are becoming almost as frequent in the Murrumbidgee district in Australia as in New Zealand. The Wagga *Express* reports that recently (in January last) a smart shock was experienced at Crabtree station and several other places on the Upper River. Since June 8—when the first and, with one exception, the heaviest of the shocks was experienced—at least a dozen distinct ones have been felt in this district.

THE Italian Society of Spectroscopists is already doing work which must command the attention of the scientific world. The special object of the Society is to collate the observations of all Italian astronomers, so as to study daily the number, position, size, and form of the protuberances, spots, and faculæ. Three numbers are already published of their *Memorie*, containing the following papers:—An Introduction by Prof. Tacchini, of the Observatory of Palermo, expounding the object and resources of the Society; a memoir by M. Lorenzoni, of the Observatory of Padua, on the spectral analysis of the protuberances; numerical tables to convert into heliocentric coordinates the apparent position of protuberances or spots; a memoir by P. Secchi on a new micrometer for measuring the height of the protuberances; an article by Prof. Tacchini on the comparison of the observations of protuberances made simultaneously in July 1871, at Palermo by himself, and at Rome by Secchi; observations on the solar protuberances and their distribution, by P. Secchi, spectroscopic images of the solar margin, made at Rome, Palermo, and Padua, by Secchi, Tacchini, and Lorenzoni on December 11 and 12, 1871, with a coloured plate. This youngest outcome of solar physics is deserving of the heartiest support of men of science in this country.

ACCORDING to the Sydney *Herald*, the schooner *Surprise* has lately made a visit to the coast of New Guinea, penetrating fifteen miles up the Manoa River. Contrary to the general impression, the natives, who were hitherto supposed to be ferocious in their character and opposed to the visits of strangers, were found to be mild and gentle in disposition. They were of the Malay stock, and had never seen white people before. On the departure of the schooner, under Captain Paget, they exhibited every demonstration of sorrow, the women weeping and the men accompanying the party to a considerable distance

HISTORY OF THE NAMES CAMBRIAN AND SILURIAN IN GEOLOGY*

IT is proposed in the following pages to give a concise account of the progress of investigation of the lower palæozoic rocks during the last forty years. The subject may naturally be divided into three parts: (1) the history of Silurian and Upper Cambrian in Great Britain from 1831 to 1854; (2) that of the still more ancient palæozoic rocks in Scandinavia, Bohemia, and Great Britain up to the present time, including the recognition by Barrande of the so-called primordial palæozoic fauna; (3) the history of the lower palæozoic rocks of North America.

I.—*Silurian and Upper Cambrian in Great Britain.*

Less than forty years since, the various uncrystalline sedimentary rocks beneath the coal-formation in Great Britain and in continental Europe were classed together under the common name of graywacke or grauwacké, a term adopted by geologists from German miners, and originally applied to sandstones and other coarse sedimentary deposits, but extended so as to include associated argillites and limestones. Some progress had been made in the study of this great Graywacke formation, as it was called, and organic remains had been described from various parts of it; but to two British geologists was reserved the honour of bringing order out of this hitherto confused group of strata, and establishing on stratigraphical and palæontological grounds a succession and a geological nomenclature. The work of these two investigators was begun independently and simultaneously in different parts of Great Britain. In 1831 and 1832, Sedgwick made a careful section of the rocks of North Wales from the Menai Strait across the range of Snowdon to the Berwyn hills, thus traversing in a south-eastern direction Caernarvon, Denbigh, and Merionethshire. Already, he tells us, he had in 1831 made out the relations of the Bangor group (including the Llanberis slates and the overlying Harlech grits), and showed that the fossiliferous strata of Snowdon occupy a synclinal, and are stratigraphically several thousand feet above the horizon of the latter. Following up this investigation in 1832, he established the great Merioneth anticlinal, which brings up the lower rocks on the south-east side of Snowdon, and is the key to the structure of North Wales. From these as a base, he constructed a section along the line already indicated, over Great Arenig to the Bala limestone, the whole forming an ascending series of enormous thickness. This limestone in the Berwyn hills is overlaid by many thousand feet of strata as we proceed eastward along the line of section, until at length the eastern dip of the strata is exchanged for a westward one, thus giving to the Berwyn chain, like that of Snowdon, a synclinal structure. As a consequence of this, the limestone of Bala re-appears on the eastern side of the Berwyns, underlain as before by a descending series of slates and porphyries. These results, with sections, were brought before the British Association for the Advancement of Science at its meeting at Oxford in 1832; but only a brief and imperfect account of the communication of Sedgwick on this occasion appears in the Proceedings of the Association. He did not at this time give any distinctive name to the series of rocks in question (L.E. and D. Philos. Mag. (1854) IV., viii. 495).

Meanwhile in the same year, 1831, Murchison began the examination of the rocks on the river Wye, along the southern border of Radnorshire. In the next four years he extended his researches through this and the adjoining counties of Hereford and Salop, distinguishing in this region four separate geological formations, each characterised by peculiar fossils. These formations were moreover traced by him to the south-westward across the counties of Brecon and Caermarthen; thus forming a belt of fossiliferous rocks stretching from near Shrewsbury to the mouth of the river Towey, a distance of about 100 miles along the north-west border of the great Old Red Sandstone formation, as it was then called, of the West of England.

The results of his labours among the rocks of this region for the first three years were set forth by Murchison in two papers presented by him to the Geological Society of London in January 1834 (Proc. Geol. Soc. ii., 11). The formations were then named as follows in descending order:—(1) Ludlow, (2) Wenlock, constituting together an upper group; (3) Caradoc, (4) Llandeilo (or Builth), forming a lower group. The Llandeilo formation, according to him, was underlain by what he called the Longmynd and Gwastaden rocks. The non-fossiliferous strata of the Longmynd hills in Shropshire were described as rising up to the east from beneath the Llandeilo rocks; and as appearing again in South Wales, at the same geological horizon, at Gwastaden in Breconshire, and to the west of Llandovery in Caermarthenshire; constituting an underlying series of contorted slaty rocks many thousand feet in thickness, and destitute of organic remains. The position of these rocks in South Wales was, however, to the north-west, while the strata of the Longmynd, as we have seen, appear to the east of the fossiliferous formations.

In the "Philosophical Magazine" for July, 1835, Murchison gave to the four formations above named the designation of Silurian, in allusion, as is well known, to the ancient British tribe of the Silures. It now became desirable to find a suitable name for the great inferior series, which, according to Murchison, rose from beneath his lowest Silurian formations to the north-west, and appeared to be widely spread in Wales. Knowing that Sedgwick had long been engaged in the study of these rocks, Murchison, as he tells us, urged him to give them a British geographical name. Sedgwick accordingly proposed for this great series of Welsh rocks, the appropriate designation of Cambrian, which was at once adopted by Murchison for the strata supposed by him to underlie his Silurian system. (Murchison, Anniv. Address, 1842; Proc. Geol. Soc. iii., 641.) This was almost simultaneous with the giving of the name of Silurian; for in August 1835, Sedgwick and Murchison made communications to the British Association at Dublin on Cambrian and Silurian Rocks. These, in the Volume of Proceedings (pp. 59, 60) appear as a joint paper, though from the text they would seem to have been separate. Sedgwick then described the Cambrian rocks of North Wales as including three divisions: 1. The Upper Cambrian, which occupies the greater part of the chain of the Berwyns, where, according to him, it was connected with the Llandeilo formation of the Silurian. To the next lower division, Sedgwick gave the name of Middle Cambrian, making up all the higher mountains of Caernarvon and Merionethshire, and including the roofing-slates and flagstones of this region. This middle group, according to him, afforded a few organic remains, as at the top of Snowdon. The inferior division, designated as Lower Cambrian, included the crystalline rocks of the south-west coast of Caernarvon and a considerable portion of Anglesea, and consisted of chloritic and micaceous schists, with slaty quartzites and subordinate beds of serpentine and granular limestone; the whole without organic remains.

These crystalline rocks were, however, soon afterwards excluded by him from the Cambrian series; for in 1838 (Proc. Geol. Soc. ii., 679) Sedgwick describes further the section from the Menai Strait to the Berwyns, and assigns to the chloritic and micaceous schists of Anglesea and Caernarvon a position inferior to the Cambrian, which he divides into two parts; viz., Lower Cambrian, comprehending the old slate series, up to the Bala limestone beds; and Upper Cambrian, including the Bala beds and the strata above them in the Berwyn chain, to which he gave the name of the Bala group. The dividing line between the two portions was subsequently extended downwards by Sedgwick to the summit of the Arenig slates and porphyries. The lower division was afterwards subdivided by him into the Bangor group (to which the name of Lower Cambrian was henceforth to be restricted), including the Llanberis roofing-slates and the Harlech grits or Barmouth sandstones; and the Festiniog group, which included the Lingula flags and the succeeding Tremadoc slates.

In the communication of Murchison to the same Dublin meeting, in August 1835, he repeated the description of the four formations to which he had just given the name of Silurian; which were, in descending order, Ludlow and Wenlock (Upper Silurian), and Caradoc and Llandeilo (Lower Silurian). The latter formation was then declared by Murchison to constitute the base of the Silurian system, and to offer in many places in South Wales distinct passages to the underlying slaty rocks, which were, according to him, the Upper Cambrian of Sedgwick.

Meanwhile, to go back to 1834, we find that after Murchison had, in his communication to the Geological Society, defined the relation of his Llandeilo formation to the underlying slaty series, but before the names of Silurian and Cambrian had been given to these respectively, Sedgwick and Murchison visited together the principal sections of these rocks from Caermarthenshire to Denbighshire. The greater part of this region was unknown to Sedgwick, but had already been studied by Murchison, who interpreted the sections to his companion in conformity with the scheme already given; according to which the beds of the Llan-

* Reprinted from advance sheets of the *Canadian Naturalist*.

dello were underlain by the slaty rocks which appear along their north-western border. When, however, they entered the region which had already been examined by Sedgwick, and reached the section on the east side of the Berwyns, the fossiliferous beds of Meifod were at once pronounced by Murchison to be typical Caradoc, while others in the vicinity were regarded as Llandeilo. The beds of Meifod had, on palæontological grounds, been by Sedgwick identified with those of Glyn Ceirog, which are seen to be immediately overlain by Wenlock rocks. These determinations of Murchison were, as Sedgwick tells us, accepted by him with great reluctance, inasmuch as they involved the upper part of his Cambrian section in most perplexing difficulties. When, however, they crossed together the Berwyn chain to Bala, the limestones in this locality were found to contain fossils nearly agreeing with those of the so-called Caradoc of Meifod. The examination of the section here presented showed, however, that these limestones are overlain by a series of several thousand feet of strata bearing no resemblance, either in fossils or in physical characters, to the Wenlock formation which overlies the Caradoc beds of Glyn Ceirog. This series was, therefore, by Murchison supposed to be identical with the rocks which, in South Wales, he had placed beneath the Llandeilo, and he expressly declared that the Bala group could not be brought within the limits of his Silurian system. It may here be added that in 1842 Sedgwick re-examined this region, accompanied by that skilled palæontologist, Salter, confirming the accuracy of his former sections, and showing moreover by the evidence of fossils that the beds of Meifod, Glyn Ceirog, and Bala, are very nearly on one parallel. Yet, with the evidence of the fossils before him, Murchison, in 1834, placed the first two in his Silurian system, and the last deep down in the Upper Cambrian; and consequently was aware that on palæontological grounds it was impossible to separate the lower portion of his Silurian system from the Upper Cambrian of Sedgwick. (These names are here used for convenience, although we are speaking of a time when they had not been applied to designate the rocks in question.)

This fact was repeatedly insisted upon by Sedgwick, who, in the Syllabus of his Cambridge lectures, published very early in 1837, enumerated the principal genera and species of Upper Cambrian fossils, many of which were by him declared to be the same with those of the Lower Silurian rocks of Murchison. Again, in enumerating in the same Syllabus the characteristic species of the Bala limestone, it is added by Sedgwick: "all of which are common to the Lower Silurian system." This was again insisted upon by him in 1838 and 1841. (Proc. Geol. Soc. ii. 679; iii. 548.) It was not until 1840 that Bowman announced the same conclusion, which was reiterated by Sharpe in 1842. (Ramsay, Mem. Geol. Sur. iii., part 2, p. 6.)

In 1839 Murchison published his "Silurian System," dedicated to Sedgwick, a magnificent work in two volumes quarto, with a separate map, numerous sections, and figures of fossils. The succession of the Silurian rocks, as there given, was precisely that already set forth by the author in 1834, and again in 1835; being, in descending order, Ludlow and Wenlock, constituting the Upper Silurian, and Caradoc and Llandeilo (including the Lower Llandeilo beds or Stiper-stones), the Lower Silurian. These are underlain by the Cambrian rocks, into which the Llandeilo was said to offer a transition marked by beds of passage. Murchison in fact declared that it was impossible to draw any line of separation, either lithological, zoological, or stratigraphical, between the base of the Silurian beds (Llandeilo) and the upper portion of the Cambrian, the whole forming, according to him, in Caermarthenshire, one continuous and conformable series from the Cambrian to the Ludlow. ("Silurian System," pp. 256, 358.) By Cambrian in this connection we are to understand only the Upper Cambrian or Bala group of Sedgwick, as appears from the express statement of Murchison, who alludes to the Cambrian of Sedgwick as including all the older slaty rocks of Wales, and as divided into three groups, but proceeds to say that in his present work (the "Silurian System") he shall notice only the highest of these three.

Since January 1834, when Murchison first announced the stratigraphical relations of the lower division of what he afterwards called the Silurian system, the aspect of the case had materially changed. This division was no longer underlain, both to the east in Shropshire and to the west in Wales, by a great unfossiliferous series. His observations in the vicinity of the Berwyn hills with Sedgwick in 1834, and the subsequently published statements of the latter had shown, that this supposed older series was not without fossils; but on the contrary, in North Wales, at least, held a fauna identical with that characterising the Lower Silurian. Hence the assertion of Murchison in his "Silurian System," in 1839, that it was not possible to draw any line of demarcation between them. The position was very embarrassing to the author of the "Silurian System," and for the moment, not less so to the discoverer of the Upper Cambrian series. Meanwhile, the latter, as we have seen, in 1842 re-examined with Salter his Upper Cambrian sections in North Wales, and satisfied himself of the correctness, both structurally and palæontologically, of his former determinations. Murchison, in his Anniversary Address as President of the Geological Society in 1842, after recounting, as we have already done, the history of the naming by Sedgwick in 1839 of the Cambrian series, which Murchison supposed to underlie his Silurian system, proceeded as follows:—"Nothing precise was then known of the organic contents of this lower or Cambrian system, except that some of the fossils contained in its upper members in certain prominent localities were published Lower Silurian species. Meanwhile, by adopting the word Cambrian, my friend and myself were certain that whatever might prove to be its zoological distinctions, this great system of slaty rocks being evidently inferior to those zones which had been worked out as Silurian types, no ambiguity could hereafter arise. . In regard, however, to a descending zoological order, it still remained to be proved whether there was any type of fossils in the mass of the Cambrian rocks different from those of the Lower Silurian series. If the appeal to nature should be answered in the negative, then it was clear that the Lower Silurian type must be considered the true base of what I had named the protozoic rocks; but if characteristic new forms were discovered, then would the Cambrian rocks, whose place was so well established in the descending series, have also their own fauna, and the palæozoic base would necessarily be removed to a lower horizon." If the first of these alternatives should be established, or in other words, if the fauna of the Cambrian rocks was found to be identical with that of the Lower Silurian, then, in the author's language, "the term Cambrian must cease to be used in zoological classification, it being, in that sense, synonymous with Lower Silurian." That such was the result of palæontological inquiry, Murchison proceeded to show, by repeating the announcements already made by Sedgwick in 1837 and 1838, that the collections made by the latter from the great series of fossiliferous strata in the Berwyns, from Bala, from Snowden, and other Cambrian tracts, were identical with the Lower Silurian forms. These strata, it was said, contain throughout "the same forms of *Orthis* which typify the Lower Silurian rocks." It was further declared by Murchison in this address that researches in Germany, Belgium, and Russia led to the conclusion that the "fossiliferous strata characterised by Lower Silurian Orthidæ are the oldest beds in which organic life has been detected." (Proc. Geol. Soc. iii. 641, &c.) The Orthids here referred to are, according to Salter, *Orthis calligramma*, Dalm, and its varieties. (Mem. Geol. Survey iii, part 2, 335-337.)

Meanwhile Sedgwick's views and position began to be misrepresented. In 1842 Mr. Sharpe, after calling attention to the fact that the fossils of the Bala limestone were, as Sedgwick had long before shown, identical with those of Murchison's Lower Silurian, declared that Sedgwick had placed the Upper Cambrian, in which the Bala beds were included, beneath the Silurian, and that this determination had been adopted by Murchison on Sedgwick's authority. (Proc. Geol. Soc. iv. 10.) This statement Murchison suffered to pass uncorrected in a complimentary review of Sharpe's paper in his next annual address (1843.) In his "Siluria," 1st edition, p. 25 (1854), he speaks of the term Cambrian as applied (in 1835) by Sedgwick and himself "to a vast succession of *fossiliferous* strata containing undescribed fossils, the whole of which were supposed to rise up from beneath well-known Silurian rocks. The Government geologists have shown that this *supposed* order of superposition was erroneous," &c. The italics are the author's. Such language, coupled with Mr. Sharpe's assertion noticed above, helped to fix upon Sedgwick the responsibility of Murchison's error. Although the historical sketch which precedes clearly shows the real position of Sedgwick in the matter, we may quote further his own words:—"I have often spoken of the great Upper Cambrian group of North Wales as inferior to the Silurian system, on the sole authority of the Lower Silurian sections, and the author's many times repeated explanations of them before they were published. So great was my confidence in his work, that I received it as perfectly established truth that his order of superposition was unassailable. . I asserted again and again that the Bala limestone was near the base of the so-called Upper

Cambrian group. Murchison asserted and illustrated by sections the unvarying fact that his Llandeilo flag was superior to the Upper Cambrian group. There was no difference between us until his Llandeilo sections were proved to be wrong." (Philos. Mag. IV. viii. 506.) That there must be a great mistake in Sedgwick's or in Murchison's sections was evident, and the Government surveyors, while sustaining the correctness of those of Sedgwick, have shown the sections of Murchison to have been completely erroneous.

The first step towards an exposure of the errors of the Silurian sections is, however, due to Sedgwick and McCoy. In order better to understand the present aspect of the question, it will be necessary to state in a few words some of the results which have been arrived at by the Government surveyors in their studies of the rocks in question, as set forth by Ramsay in the Memoirs of the Geological Survey. In the section of the Berwyns, the thin bed of about twenty feet of Bala limestone, which (as originally described by Sedgwick) they have found outcropping on both sides of the synclinal chain, is shown to be intercalated in a vast thickness of Caradoc rocks; being overlain by about 3,300 and underlain by 4,500 feet of strata belonging to this formation. Beneath these are 4,500 feet additional of beds described as Llandeilo, which rest unconformably upon the Lingula-flags just to the west of Bala; thus making a thickness of over 12,000 feet of strata belonging to the Bala group of Sedgwick. A small portion of rocks referred to the Wenlock formation occupies the synclinal above mentioned. (Memoirs, III. part 2, 214,222.) The second member, in ascending order, of the Silurian system, to which the name of Caradoc was given by him in 1839, was originally described by Murchison under the names of the Horderly and May Hill sandstone. The higher portions of the Caradoc were subsequently distinguished by the Government surveyors as the Lower and Upper Llandovery rocks; the latter (constituting the May Hill sandstone, and known also as the Pentamerus beds) being by them regarded as the summit of the Caradoc formation. In 1852, however, Sedgwick and McCoy showed from its fauna that the May Hill sandstone belongs rather to the overlying Wenlock than to the Caradoc formation, and marks a distinct palæontological horizon.

This discovery led the geological surveyors to re-examine the Silurian sections, when it was found by Aveline that there exists in Shropshire a complete and visible want of conformity between the underlying formations and the May Hill sandstone; the latter in some places resting upon the nearly vertical Longmynd rocks, and in others upon the Llandeilo flags, the Caradoc proper or Bala group, and the Lower Llandovery beds. Again, in South Wales, near Builth, the May Hill sandstone or Upper Llandovery rests upon Lower Llandeilo beds; while at Noeth Grug the overlying formation is traced transgressively from the Lower Llandovery across the Caradoc to the Llandeilo. These important results were soon confirmed by Ramsay and by Sedgwick. (Ibid, 4, 236). The May Hill sandstone often includes, near its base, conglomerate beds made up of the ruins of the older formation. To the north-east, in the typical Silurian country, it is of great thickness and continuity, but gradually thins out to the south-west. There exists, moreover, another region where not less curious discoveries were made. About forty miles to the eastward of the typical region in South Wales appear some important areas of Silurian rocks. These are the Woolhope beds, appearing through the Old Red Sandstone, and the deposits of Abberley, the Malverns and May Hill rising along its eastern border, and covered along their eastern base by the newer Mesozoic sandstone. The rocks of these localities were by Murchison in his "Silurian System" described as offering the complete sequence. When however it was found that his Caradoc included two unconformable series, examination showed that there was no representative of the older Caradoc or Bala group in these eastern regions, but that the so-called Caradoc was nothing but the Upper Llandovery or May Hill sandstone. The immediately underlying strata, which Murchison had regarded as Llandeilo, or rather as the beds of passage from Llandeilo to Cambrian, and had compared with the north-west passage of the Caermarthenshire sections (Syl. Sys. 416), have since been found to be much more ancient deposits, of Middle Cambrian age, which rests upon the crystalline hypozoic rocks of the Malverns, and are uncomformably overlain by the May Hill sandstone. We shall again revert to this region, which has been carefully studied and described by Prof. John Phillips. (Mem. Geol. Sur. II., part 1.)

T. STERRY HUNT

(*To be continued*)

SCIENTIFIC SERIALS

THE *Revue Scientifique*, Nos. 33—42. The first article in these numbers is by Prof. Huxley, on Yeast.—The conclusion is arrived at of M. de Quatrefages' course of lectures on Anthropology, at the Museum of Natural History at Paris.—M. de Fonvielle contributes an article on Balloon Observations. In No. 34. M. Léon Le Fort, Professor to the Faculty of Medicine at Paris, furnishes an account of military surgery in the Austrian army.—Among the contributions from foreign sources is a report of M. Vogel's spectroscopic observations of the planets made in 1871 at the observatory of Bothkamp.—No. 35 contains an interesting lecture, delivered at the University of Friberg-in-Brisgau, by M. Ecker, on the struggle for existence in the character and in the life of nations.—In No. 36 is commenced a report, continued in subsequent numbers, of M. Claude Bernard's course of lectures at the College of France on Animal Heat. A translation is given of a paper by Prof. Harting, of Utrecht, on the artificial production of organic calcareous formations. There are also reports of the proceedings of English and other foreign scientific societies.—In No. 37 the most interesting paper is one by Dr. Onimus, on the consecutive phenomena attendant on the removal of the brain, and on the movements of rotation, illustrated with drawings of frogs and birds, on which the operation had been performed, to show the action.—No. 38 contains a report of Prof. Virchow's address to the Congress of German Naturalists and Physicians at Rostock, on Science in the national life of Germany. Sir William Thomson's paper on the Size of Atoms is translated from an early number of this journal. M. Papillon has an article in support of M. Wurtz's aphorism, "Chemistry is a French science, constituted by Lavoisier," in reply to English and German attacks.—No. 39 commences with an important article by M. P. Lorain, on Reform in the Higher Instruction. A translation is given of M. R. Wolf's lecture at the University of Zurich on Solar Spots, and of Neumayer's paper contributed to the Vienna *k. k. Geologische Reichsanstalt* on the Jurassic Basins.—In No. 40 M. Le Fort supplements his previous paper by an additional one on Military Surgery in the Prussian army. This and the following number are partially filled with further reports of the Rostock meeting of German naturalists and physicians.—In No. 41 we find also a lecture by M. Lereboullet at the School of Military Health at Montpellier on the Spinal Column.—No. 42 contains a report of M. Blanchard's address to the Annual Congress of the Learned Societies of the Departments at the Sorbonne. M. Paul de Saint Robert contributes a paper with the suggestive title, "Qu'est ce que la force?" There are also a number of reports of the proceedings of foreign societies.

THE *Journal of Botany* for April commences with an interesting article by Prof. Babington on the *Anacharis alsinastrum* or Canadian water-weed. He shows clearly that there are two series of plants closely resembling each other in appearance, of which one series has perfect triandrous flowers, and the other has incomplete dicœcious flowers, of which the males are nearly or quite sessile, and have the curious habit of becoming detached when the pollen is ripe, and floating freely about on the surface of the water, and shedding their pollen there. To the first series belongs the *Elodea* of South America; to the second, *Anacharis* and *Hydrilla*. *Anacharis* would therefore appear to be the true genus to which the English (introduced) plant belongs, as given by Hooker, but not by Bentham and Syme.—Mr. Baker gives one of his useful synoptical revisions of the Cape species of *Anthericum*; and Prof. Thiselton Dyer a history of the substance known as "Australian Caoutchouc," and a valuable account of the mode of germination of *Tropæolum*, which is characteristic rather of endogens than of exogens.

Annalen der Chemie und Pharmacie, January 1872. This number commences with a paper by Max Ascher on the trisubstitution derivation of benzine; this is an attempt to establish the constitution of some of these bodies, but at present, however, it has not been entirely successful.—The next paper is by Linnemann and Zotta "On the reduction of formic acid to formaldehyde and methyl alcohol;" the authors followed exactly the same process as was described by Lieben and Rossi some time since, and which has already been noticed in these pages. The next three communications are by Linnemann "On normal propyl alcohol, its compounds and its conversion into isopropyl alcohol." The author prepared the normal alcohol in two ways—by the action of nascent hydrogen on propionic anhydride, and by obtaining the aldehyde by distillation of calcic

propionate and formiate, and subsequent treatment with sodium amalgam. The normal alcohol was converted into isopropyl alcohol by preparing from it the iodide, and from this the cyanide, which by treatment with potash yields propylamine. Propylamine hydrochloride on heating with argentic nitrate and water yields isopropyl alcohol, having the characteristic properties and reactions of this body.—Hugo Schiff follows "On the constitution of æsculin;" this is an important theoretical paper.—Quinke contributes the second part of his memoir, "On a new class of aromatic hydrocarbons." By the action of benzyl chloride on toluol, benzyl toluol $C_{14}H_{14}$ is formed with elimination of hydrochloric acid. By oxidation, this hydrocarbon yields benzylbenzoic acid $C_{14}H_{10}O_2$; this by the action of nascent hydrogen yields benzhydrylbenzoic acid $C_{14}H_{12}O_2$; and by the treatment with hydriodic acid the latter yields benzylbenzoic acid $C_{14}H_{12}O_2$.—Translations of two papers, which have already appeared in the French journals, and also a paper by Maly, complete this number.

THE *Journal of the Franklin Institute* for February, after the usual editorial paragraphs descriptive of novelties, has an article by Prof. H. B. Thurston, on Experimental Steam Boiler Explosions, containing a report of a series of experiments undertaken by a committee of the Institute, in conjunction with several railway engineers, for the purpose of testing the conditions under which steam boilers explode—Mr. F. A. Genth continues his paper on the Mineral Resources of North Carolina; and Mr. J. P. Cooke his Chemical Theory of the Voltaic Battery, the portion in the present number being devoted to Electricity.—Prof. P. E. Chase gives a Table of Cyclical Rainfalls at Lisbon, in support of the theory already advanced by him of the lunar influence on the weather. The other papers in this number are mostly of a purely mathematical character.

The first original article in the number for March is chiefly of local interest—"The Locomotive Engine, and Philadelphia's share in its Early Improvements," by J. Harrison, jun., the last recipient of the Rumford Gold Medal.—Mr. James Emerson gives a Report of Water-wheel Tests at Lowell and other places, illustrated with plates.—In another paper on Experimental Steam Boiler Explosions, Prof. Thurston discusses the third experiment at Sandy Hook, New York.—Mr. Joseph S. Smith describes the construction of the Keokak and Hamilton Bridge across the Mississippi, connecting the States of Iowa and Illinois.—Dr. Richard Owen, of the Indiana State University, details a series of experiments on Terrestrial Magnetism.—Prof. R. E. Chase gives tables of the Monthly Rainfall at San Francisco.

THE first article in the *American Journal of Science and Arts* for March is a most interesting account, by Prof. Hayden, of the Hot Springs and Geysers of the Yellowstone and Firehole rivers, accompanied by illustrations and maps. The description of these geysers, which throw those of Iceland completely into the shade, will not bear epitomising, but is well worth reading as a whole.—Two other geological articles are by Prof. Dana, on the Quartzite of the Green Mountains, and by Prof. Silliman, Geological and Mineralogical Notes on some of the mining districts of Utah territory.—Prof. A. E. Verril contributes two instalments of his contributions to zoology, from the Museum of Yale College, on the affinities of Palæozoic Tabulate Corals with existing species, and recent additions to the molluscan fauna of New England.—The other article of greatest interest is by Prof. H. A. Nicholson of Toronto, on the genera *Cornulites* and *Tentaculites*, and on a new genus *Conchicolites*.

THE *Quarterly Journal of Science* for April commences with an article by Mr. R. A. Proctor on Meteoric Astronomy. In reference to the researches of Signor Schiaparelli, he gives an account of the meteoric systems through which the earth passes in August and November, and seeks in meteoric phenomena and the associated phenomena of comets the explanation of some of the features presented by the solar corona. The zodiacal light he explains also on the theory of its being the outer portion of the sun-surrounding meteor families.—Mr. James Douglas, of Quebec, gives a description of the copper mines of Chili, and of the geological and mineralogical features of the country where they occur.—An article on Natural and Artificial Flight describes the results arrived at by Dr. Pettigrew in the case of the flight of birds and insects, and consists to a large extent of extracts from that gentleman's memoirs contributed to the Transactions of the Linnean Society and of the Royal Society of Edinburgh.—Mr. William Topley, in an article on the Geology of the Straits of Dover, illustrated by sections, advocates the project proposed by Hawkshaw and Low of a submarine tunnel, to run from near the South Foreland to a point between Sangatte and Calais, which he believes will pass entirely through the chalk, and will not be likely to be attended by any insuperable engineering difficulties.—An article on the Gold Coinage, and a short one by Captain Oliver on Recent Changes in British Artillery Material, complete the original portion of the number.—Only four books are reviewed this quarter, and more than half the space allotted to reviews is occupied by a notice, by Mr. A. R. Wallace, of Mr. Dale Owen's "The Debatable Land between this World and the Next," in which the reasonableness of the alleged phenomena of modern Spiritualism is advocated.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 25.—"On a supposed Periodicity in the Elements of Terrestrial Magnetism, with a period of 26⅓ days." By George Biddell Airy, Astronomer Royal, P.R.S.

In a paper published in the "Proceedings of the Imperial Academy of Sciences of Vienna," vol. lxiv., Dr. Karl Hernstein has exhibited the results of a series of observations which appeared to show that the earth's magnetism undergoes a periodical change in successive periods of 26⅓ days, which might with great plausibility be referred to the rotation of the sun.

It appeared to the author that the deductions from the magnetic oqservations made at the Royal Observatory of Greenwich, and which are printed annually in the "Greenwich Observations," or in the detached copies of "Results of Magnetical and Meteorological Observations made at the Royal Observatory of Greenwich," would afford good materials for testing the accuracy of this law, as applicable to a series of years.

The mean for declination in 1870, and, still more remarkably, the mean for horizontal force in 1870, appear to exhibit an increase about the fourteenth day. But the author does not remark in the other means, either as given in numerals or as projected as curves, anything to support the idea of an inequality periodical in the 26⅓ days. It might almost be suspected that the secular changes used in the period 1850-1852 are too large; but no alteration of these renders the inequality of 26⅓ days more probable. Dr. Hornstein's investigation was limited to observations made in 1870.

Royal Geographical Society, April 22.—General Sir Henry C. Rawlinson, K.C.B., president, in the chair. "On Recent Explorations of the North Polar Region, by Captain Sherard Osborn, R.N. Captain Osborn commenced by alluding to his advocacy of a Polar Expedition *via* Smith Sound, in 1865, and stated that the Duke of Somerset, then First Lord of the Admiralty, though apparently sufficiently favourable to the general proposal of a Government Expedition, urged upon him by a deputation from the Society who waited on him in that year, declined to assume the responsibility of recommending an expedition, owing to the difference of opinion which then reigned with regard to the best route to be followed. The alternate route to Smith Sound was that by the seas of Spitzbergen, advocated by Dr. Petermann and others, on the ground that the Gulf Stream, flowing in that direction, maintained an open sea to the Pole. He (Captain Osborn) and the promoters of the Expedition were content to wait the result of efforts made soon after by the Swedes and Germans to carry out the views of the German geographer. Seven years had elapsed, and we were now in a position to say that the advocates of the Spitzbergen route had been proved entirely wrong, whilst those who believed Smith Sound to be the best route were right. Captain Koldeway, who commanded both the German Expeditions, states, as the result of all his efforts, that "one can hardly resist the conviction that the hope of attaining the North Pole by ship, or of finding an open sea around the Pole, are alike among the most improbable of things. I confess that I myself was misled by representations in Dr. Petermann's 'Geographische Mittheilungen,' and held it to be at least possible by following a line of coast to penetrate by ship far into the central Arctic region, and then certainly to make one's way to the Pole. A winter in East Greenland, the most careful observation of these mighty masses of ice, their movements and formation, and of the whole condition of temperature, have radically cured me and all my companions of this idea. . . . If the principal object be the nearest possible approach to the Pole, I am quite of Osborn's opinion that the best way appears to be through Smith Sound. Here one can penetrate by ship every year to the 78th parallel, and then one has a

continuous line of coast running north, which has been sighted as far as the 82nd parallel. Along this coast one would have to work one's way in spring with dog-sledges. I consider it a wild undertaking to penetrate towards the Pole by ship between Spitzbergen and Nova Zembla." No one could undo the effect of evidence so honest and conclusive as this. The Duke of Somerset rested his decision to delay action on the importance of first being furnished with the results of the Swedish Expedition, then on its way to Spitzbergen. The Swedes during the last seven or eight years had sent no less than four expeditions to the verge of the Polar region; and the conclusion of their scientific leader, Von Nordenskiöld, is that in summer it is not possible to penetrate by ship through the pack, and that an open Polar Sea is a mere hypothesis destitute of foundation. The Swedish authorities further state that the only way to approach the Pole is that proposed by the English Arctic officers, of exploring on sledges in the spring. Here, then, are the results for which the First Lord of the Admiralty in 1865 desired to wait. After a review of the voyage of the Austrian Lieutenants Payer and Weyprecht last summer, in which they found open sea a little to the north and west of Nova Zembla, and which discovery is to be followed up by a second expedition in the present summer, Capt. Osborn concluded by an eloquent appeal to the English people not to allow the final laurels of Polar discovery to be wrung from them by the sailors or explorers of any other nation. In the discussion which followed, Dr. J. D. Hooker spoke of the important questions in the science of botany which a North Polar Expedition alone could elucidate; such as the extension nearer the Pole of fossil plants like those of Disco in Greenland, which indicate a former temperate climate in 70° north. Dr. Carpenter advocated a Polar Expedition as a necessary complement to the one the Government were about to despatch to the Pacific to investigate the deep-sea ocean currents, and so forth. Accurate investigations of current-temperature, &c., of the Polar Ocean were of the highest importance to the right comprehension of the true theory of oceanic movements. Admiral Sir George Back stated that he entirely approved of the Smith Sound route as the one best to be adopted for a North Polar Expedition. Sir Leopold M'Clintock also spoke to similar effect. Admiral Richards explained the interest attaching to the completion of the geography of Greenland, which ought to be achieved by the English. He was strongly of opinion that a Government expedition, and by the English, was alone competent to finish the work of Arctic discovery. Mr. R. H. Scott read a letter from Von Nordenskiöld, in which he stated that a Swedish expedition would start for Spitzbergen this summer, winter in the islands to the north, and attempt a journey towards the Pole in May, 1873, with reindeer-sledges.

Anthropological Institute, April 8.—Sir John Lubbock, Bart., president, in the chair. Mr. Hyde Clarke read a note on the Hamath Inscriptions. The remainder of the evening was occupied by an exhibition and description, by Mr. Edward Charlesworth, of certain objects from the Crag of Suffolk simulating human workmanship. A long and animated discussion ensued, and the question was postponed until such time as Mr. Charlesworth could lay before the Institute, in the form of a paper, his matured opinion based upon reliable evidence.

April 22.—Dr. Charnock, vice-president, in the chair. Mr. Hyde Clarke contributed a further note on the Hamath Inscriptions and their comparison with Himyarite and Lybian.—A paper by Dr. Barnard Davis, F.R.S., was read "On the Hair and some other peculiarities of Oceanic Races." The paper was illustrated by a large and beautiful series of specimens of hair showing all the varieties of dressing, ornamentation, preparation, bleaching, &c., employed by a great number of races and tribes.—Dr. Henry Blanc also exhibited a specimen of long hair from the head of a Hindustanee.—A paper by Dr. Rink "On the Descent of the Esquimaux" was read, in which the author showed from traditionary and historical evidence that that race was truly American, and not Asiatic in its origin, as some ethnologists had maintained.—Dr. Charnock read a paper "On Le Sette Communi." The district lay nearly north of Vicenza. The people were the remnants of those Germans who obtained an asylum in that country after having been vanquished by Theodoric, King of the Ostrogoths, who died A.D. 526. There had been many marriages with the Italians, and the people more resembled the latter than the Germans. There were, however, many with fair hair and German features. The people were simple in their manners, honest, poor, dirty, and superstitious. The author noticed no cases of goître or cretinism. The paper concluded with a vocabulary and ample remarks on the grammar of the dialect, which resembled the Hochdeutsch of the 13th century, still spoken in Southern Bavaria. It had some words from the Italian.

Meteorological Society, April 17.—Dr. Tripe, president, in the chair. A paper was read "On the Temperature of Hill and Valley," by Mr. G. Dines. The observations in the valley were made at Cobham, and those on the hill at Denbies, the difference in height being about 600 feet; both the thermometer stands are those known as "Glaisher's," and the instruments are by Casella. The observations extend over eighteen months. The air on the hill is colder in the day and warmer at night than in the valley; and the daily range of temperature at the higher station is not so great as at the lower, the average being only about 4½° In cold weather it is found that the air on top of the hill is never so cold as that in the valley. The rainfall also on the hill is 40 per cent. greater than in the valley. It has been said that "the air on top of a hill is drier and colder than in the valley," but the results arrived at in this paper show that the contrary is the case. In the discussion which followed, Mr. Glaisher said that he had always found in his balloon ascents that the temperature decreased as he ascended, and was colder and more uniform the higher he went, but at night he found that the temperature was warmer than on the ground, and it was this that led him to place thermometers at the height of 4 ft., 22 ft., and 50 ft. above the ground, and the results obtained show that the air is sometimes 5° or 6° colder at 50 ft. than at 4 ft. in the day time, and 3° or 4° warmer at night time. Colonel Strange said that the temperature was colder on mountain tops both in day and night than in the valley. Dr. Mann thought that the temperature of the air directly above the earth in a balloon, and the temperature on top of a hill at the same height, would be quite different. The Rev. F. W. Stow had made several observations which showed that the air was warmer at the upper station and colder at the lower. Mr. Strachan remarked that unless the thermometers were protected from radiation the readings would be too high. Mr. Gaster said that solar radiation was out of the question, because the air is colder on top of the hill than in the valley when the sun is shining, and warmer at night when it is not shining, and he thought the more abrupt the hill the more would the observations coincide with those taken in a balloon at the same height.—The next paper was by Mr. C. O. F. Cator "On Certain Defects in Anemometric Registration." The author said that correct records cannot be obtained by the present method, that the sheets should be much longer, and made to move more quickly. A correct register of the velocity of the wind is not obtained because the cups cannot take up the motion directly at each gust, and in a lull the cups revolve too quickly on account of the momentum received from the previous gust. In registering the pressure of the wind, the sheets and the scale should be longer, because at present the very small amounts are scarcely shown, and in gales the paper is completely black from the constant movements of the pencil, but if the sheet were moved more quickly each separate pressure might be recorded.

PARIS

Academy of Sciences, April 22.—M. Camille Jordan read a note on the forms reduced from congruences of the second degree.—M. de Saint-Venant presented a paper on a complement to be given to one of the equations presented by M. Levy for plastic movements which are symmetrical around an axis.—A note was read by M. J. Montier on the internal work which accompanies the escape of a gas without variation of heat; and one by M. P. Desains on the reflection of heat at the surface of polished bodies.—Several notices more or less closely relating to auroras were read, namely, a note by M. Fron, presented by M. Delaunay, on the auroral period from the 10th to the 16th April, 1872, and its relations to the movements of the atmosphere; a portion of a letter from M. Donati to M. Delaunay, relating chiefly to phenomena of terrestrial magnetism observed during the time of manifestation of auroras; a claim of priority in proposing the theory of the solar origin of magnetic auroras, by M. H. Tarry; a continuation of M. J. Silbermann's paper on the relations existing between terrestrial meteorology and the movements of celestial bodies; and a note by M. Duponchel, in which that gentleman ascribes the origin of auroras to the modification of the calorific waves after sunset; as these then cease to traverse the atmosphere and become tangential with it, especially in the neighbourhood of the poles, he supposes them to produce there

effects of light and perhaps of electricity.—M. Bellanger forwarded a note on the change which takes place in the boiling point of water when mixed with more volatile fluids.—M. Faye presented a note on the photographic studies of the sun which have recently been undertaken at the observatory of the Infante Don Luiz, at Lisbon.—A letter from Father Secchi on some peculiarities of the constitution of the sun was read; as also a note by M. W. de Fonvielle on the hypothesis of the magnetisation of the sun.—M. V. Raulin presented a note on the pluviometric observations made at Athens from 1859 to 1871, including tables of monthly mean rainfalls and other data.—A note by M. de Lafollye, on a mode of determining copper by means of cyanide of potassium, was read. This is a volumetric process performed by adding a standard solution of cyanide of potassium to a solution of a salt of copper coloured blue by ammonia, until the complete decolorisation of the latter.—M. E. Ferrière presented a note on the action of sulphuric ether upon iodides, in which he states that, by the addition of sulphuric ether to the solution of an iodide, the iodine is gradually entirely set free. He ascribes this action to the slow but continuous formation of an unstable hydriodic ether.—M. Wurtz communicated a note on the synthesis of orcine, by MM. G. Vogt and A. Henninger. This body was obtained by the authors by the action of potash in fusion upon the sulpho-conjugate acid of chlorinated toluene.—M. C. Robin presented a note by M. Rabauteau, on the physiological properties possessed by the various proximate principles of opium.—A note by M. Sanson, on the hybrids produced between the hare and the rabbit, was communicated by M. Milne-Edwards. The author stated that the production of fertile hybrids between these two species had certainly been effected in 1868 by M. E. Gayot, who had furnished him with individuals of the sixth generation, representing two varieties which have been established and called by the breeder the *Léporide ordinaire* and the *Léporide longue-soie*. The former is identical with the rabbit in its specific characters; the latter closely approaches the hare.—M. Milne-Edwards also presented a note by M. A. F. Marion on Rotatoria parasitic upon *Nebaliæ*. The author noticed the occurrence upon *Nebalia straussii* of a *Saccobdella* distinct from that observed by Van Beneden and Hesse on *N. geoffroyi*.—A note by M. H. Sicard on the respiratory apparatus of *Zonites algirus* was also presented by M. Milne-Edwards; as also a note on the termination of the vertebral column in the Pleuronectidæ by M. H. E. Sauvage.—M. de Quatrefages communicated a note by M. E. T. Hamy on the proportional development of the humerus and radius in man, in which the author noticed the relative lengths of these bones at various ages, and gave a table showing the gradual and very considerable diminution in the proportional length of the radius to the humerus on reaching the adult condition.—M. F. Garrigou presented a note on the unity of composition of the Pyrenees proper, and the chain commonly called the *Petites Pyrénées*. He maintained that no distinction can be drawn between them.—M. de Quatrefages communicated an extract from a letter by M. E. B. des Essards on sea shocks.

VIENNA

Imperial Academy of Sciences, March 7.—Prof. E. Hering, of Prague, transmitted a memoir by M. F. Hofmeister, containing investigations upon the connective tissue in the testes of the Mammalia.—Prof. V. Graber, of Graz, transmitted a preliminary report on the propulsory blood apparatus of insects, and on the occurrence of a true elastic fibrous net in the Hymenoptera.—Prof. L. Gegenbauer, of Krems, forwarded a memoir entitled "The Universalised Dirchlet's Integral;" and Dr. A. Boué delivered a discourse upon geological chronology.

March 14.—Prof. L. Gegenbauer transmitted a memoir on Definite Integrals.—Dr. F. Wallentin communicated a memoir on the Serial Development of Functions, and its employment in Algebraic Analysis, as well as in the Integration of Differential Equations.—A paper on the Destruction of the *nervus facialis* and its consequences, by M. Schauta, was presented by Prof. Brücke. The experiments were made on two young rabbits.—Prof. von Lang communicated a note by Prof. Handl, on the absolute intensity and absorption of light.—M. E. Priwoznik presented two communications, of which the first contained a chemical investigation of the coating formed upon an antique bronze implement found in an old Celtic grave, near Hallstatt; and the second the results of a series of experiments made upon the formation of the sulphides of copper, silver, tin, nickel, and iron, to which the former investigation gave rise. The crust which covered the bronze consisted of three layers, of which the outermost and thickest was formed of blue sulphide of copper; the second was blackish-gray, and composed of disulphide of copper with 15 per cent. of tin; and the third, or innermost, was formed of a black powder containing 23·2 per cent. of tin, together with the accidental constituents of the bronze, arsenic, antimony, and nickel.

BOOKS RECEIVED

ENGLISH.—Corals and Coral Islands: J. D. Dana (S. Low, Son, and Co.).—Introduction to Biology: H. Alleyne Nicholson (Blackwoods).—Natural Philosophy: E. Atkinson (Longmans).—Mountaineering in the Sierra Nevada: C. King (S. Low, Son, and Co.).—Lecture Notes to Chemical Students, Vol. ii., Organic Chemistry: E. Frankland. 2nd edition (Van Voorst).—The Principle and Practice of Canal and River Engineering: D. Stevenson. 2nd edition (A. and C. Black).

AMERICAN.—Gateways to the Pole: S. Bent (Studley, S. Louis).

DIARY

THURSDAY, MAY 2.

ROYAL SOCIETY, at 8.30.—On a new Great Theodolite (illustrated by the instrument) to be used on the Great Trigonometrical Survey of India, with a short Note on the Performance of a Zenith Sector employed on the same work: Col. Strange, F.R.S.—On some Elementary Principles in Animal Mechanics—V. and VI.: Rev. Prof. Haughton, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.—Exhibition of Early Christian Rings: C. D. E. Fortnum, F.S.A.—Vortigern, not Hengest, the Invader of Kent: H. C. Coote, F.S.A.—Excavations of Tumuli at Trevalga: W. C. Borlase, F.S.A.

LINNEAN SOCIETY, at 8.—On *Alibertia edulis*: Señor Correa de Mello.

CHEMICAL SOCIETY, at 8.—On the Manufacture of Iron and Steel: E. Riley.

ROYAL INSTITUTION, at 3.—On Heat and Light: Prof. Tyndall, F.R.S.

FRIDAY, MAY 3.

ROYAL INSTITUTION, at 9.—On Optical Phenomena produced by Crystals when submitted to Circularly Polarised Light: W. Spottiswoode.

GEOLOGISTS' ASSOCIATION, at 8.—On Columnar Basalts: J. Curry.—On a Visit to the Diamond Fields of South Africa, with Notices of Geological Phenomena by the wayside: J. Paterson.

SATURDAY, MAY 4.

ROYAL INSTITUTION, at 3.—The Star-Depths: R. A. Proctor.

GOVERNMENT SCHOOL OF MINES, at 8.—On Geology: Dr. Cobbold, F.R.S.

MONDAY, MAY 6.

ENTOMOLOGICAL SOCIETY, at 8.—On the Longicorn Fauna of Nicaragua: H. W. Bates.

ANTHROPOLOGICAL INSTITUTE, at 8.—Peculiarities of the Australian Cranium: Mr. Bradley.—A Scaphoid Skull: Dr. Barnard Davis, F.R.S.—The Basque Race: Rev. W. Webster and Mr. Menteath.—Marm, its Names and their Origin: Mr. Jeffcott.—Queensland Dialects: Mrs. Barlow.—Preservation of Australian Dead: Mr. M'Donald.

ROYAL INSTITUTION, at 2.—General Monthly Meeting.

TUESDAY, MAY 7.

ZOOLOGICAL SOCIETY, at 9.—On Dinornis (Part XVIII.) containing a description of the pelvis and bones of the leg of *Dinornis gravis*: Prof. Owen, F.R.S.—Appendix to a List of Birds known to inhabit the Island of Celebes: Viscount Walden.—On the habits of the Swallows of the genus *Progne*, met with in the Argentine Republic, with notes by P. L. Sclater: W. H. Hudson.

SOCIETY OF BIBLICAL ARCHÆOLOGY, at 8.30.

ROYAL INSTITUTION, at 3.—On the Development of Belief and Custom amongst the Lower Races of Mankind: E. B. Tylor, F.R.S.

WEDNESDAY, MAY 8.

GEOLOGICAL SOCIETY, at 8.—Notes on Atolls or Lagoon Islands: S. J. Whitnell.—On the Glacial Phenomena of the Yorkshire Uplands: J. R. Dakyns.—On Modern Glacial Action in Canada: Rev. W. Bleasdell, M.A.—On a Sea-coast Section of Boulder Clay in Cheshire: D. Mackintosh.

SOCIETY OF ARTS, at 8.—On the Use of a Revolving Rabble in the common Puddling Furnace: F. A. Paget.

THURSDAY, MAY 9.

ROYAL INSTITUTION, at 3.—On Heat and Light: Prof. Tyndall, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.

MATHEMATICAL SOCIETY, at 8.

CONTENTS