

In conclusion, I may add that there is nothing improbable to my mind in peoples even so distant from each other as the Polynesian Islanders and the Gauls retaining in their traditions a name which had been applied to their mythical common ancestor, nor unreasonable in supposing that they and other peoples mentioned in my paper were alike derived from some region in Central Asia. My argument is simply cumulative, as there are many facts of a different kind pointing in the same direction.

I am sorry my communication has reached such an inordinate length; but having replied to "M. A. I.'s" objections, which, after his first letter, forcibly remind me of the mountain in labour bringing forth a mouse, I shall not trouble you with further correspondence on a subject which I fear is far from interesting to a majority of your readers.

C. STANILAND WAKE

Meteor

As I was going along the road towards Greystoke Castle at half-past eight P.M. on Friday last, April 19, I noticed a very fine meteor in a south-east direction. It was about the size of a common hand-ball, its centre being of an exceedingly brilliant white colour, surrounded by a circle of a bluish tinge, while short flickering radiations were distinctly visible on its circumference in all directions, reminding me of the spherio-stellate spiculæ of certain sponges. It was falling in a perpendicular direction, but I was not fortunate enough to see it at the beginning of its course. Its downward motion was slow and quite gradual, apparently not swifter than an ordinary india-rubber ball would fall by the gravity of its own body. There was no trail whatever left behind in its course. After two or three seconds it suddenly disappeared, before reaching the ground, without any explosion or expansion of its body. The night was very close and still, a muddiness covering the whole sky, interspersed here and there with long stratus clouds, and a beautiful halo surrounding the moon.

THOMAS FAWCETT

Blencowe School, Cumberland, April 22

A Waterspout

ON Saturday last, April 16, whilst fishing in the river Elwy, at a point about two miles above the well-known Cefn caves, and five from St. Asaph by the river, I witnessed a very singular phenomenon. My attention was suddenly called up-stream by a remarkably strange hissing, bubbling sound, such as might be produced by plunging a mass of heated metal into water. On turning I beheld what I may call a diminutive waterspout in the centre of the stream, some forty paces from where I was standing. Its base, as well as I could observe, was a little more than two feet in diameter. The water curled up from the river in an unbroken cylindrical form to a height of about fifteen inches, rotating rapidly, then diverged as from a number of jets, being thrown off with considerable force to an additional elevation of six or seven feet, the spray falling all round as from an elaborately arranged fountain, covering a large area. It remained apparently in the same position for about forty seconds, then moved slowly in the direction of the right bank of the river, and was again drawn towards the centre, where it remained stationary as before for a few seconds. Again it moved in the former direction, gradually diminishing and losing force as it neared the bank, and finally collapsed in the shallow water. Strange to say, its course was perpendicular to the bank and not with the current.

At the time of the occurrence the river was still high, from the recent heavy rain, though the depth of water at the spot where I first observed it was not more than four feet. The current, of course, was stronger than usual, but presented a comparatively smooth surface. The day was fine and sunny, with a slight breeze from the S.E. The event occurred about 12.15, and lasted seventy or eighty seconds, as well as I could judge. The atmosphere in the immediate vicinity seemed, from the way in which the spray was scattered, to be somewhat agitated; but my impression was that such agitation was the result of the phenomenon, rather than its cause. I had fished over the spot a few minutes previously, and examined it afterwards with great care, but saw nothing to account for the wonder.

St. Beuno's College, St. Asaph, April 9.

J. GRAY

Cuckoo's Eggs

THE discussion raised by Prof. Newton on the coloration of cuckoo's eggs has been very interesting doubtless to many readers

of NATURE; a mite of information from New Zealand, concerning one species of the Cuculidæ, may not be out of place.

The German theory that "the egg of the cuckoo is approximately coloured and marked like those of the birds in whose nest it is deposited, that it may be less easily recognised by the foster parents as a substituted one," does not hold good in respect to our *Chrysococcyx lucidus*, Gml., pipiwharaupa, the whistler or small cuckoo.

The dupe is the pipiriri, or gray warbler, *Guygone flaviventris*, Gray, its eggs are white, dotted with red spots; the egg of the whistler of much larger size, is of a greenish dun.

However, I think it should be stated that the nest of the dupe is somewhat of a pear-shaped structure, firmly and thickly built, with a small entrance near the middle, well sheltered with feathers. Here discrimination betwixt eggs may be difficult for the foster parent, if it possesses the faculty and uses it. In the Trans. N. Z. Institute (vol. ii. pp. 58 and 65) reasons have been advanced by the writer for the selection of the warbler's nest by our brightly-plumed cuckoo; may "the dim obscure" of its interior supply another reason?

THOMAS H. POTTS

Ohimitahi, Feb. 5

Sun-spots and the Vine Crop

As the connection of sun-spots with terrestrial phenomena is now largely occupying the attention of scientific men, the following facts may be of some interest. The years in which the vine crop in Germany was unusually good seem (in this century, at least) to have returned at regular intervals. The close coincidence of these years with the years of minimum sun-spots is shown by the following table:—

Minimum of Sun-spots.	Wine-years.	Minimum of Sun-spots.	Wine-years.
1784.8 ...	1784	1833.8 ...	1834
1798.5 ...	(?)	1844.0 ...	1846
1810.5 ...	1811	1856.2 ...	{ 1857
1823.2 ...	1822	1856.2 ...	{ 1858
		1867.2 ...	1868

I may add that the gentleman who first remarked the regular recurrence of wine-years at intervals of about eleven years was not aware of the periodicity of the sun-spots, and could not therefore have been in any way prejudiced. The years given in the above table are the only ones known in Germany as good wine-years.

These facts agree with the results of Messrs. Piazzzi Smyth and Stone, who found that the mean temperature on the surface of the earth was subjected to a period of eleven years.

ARTHUR SCHUSTER

Owens College, Manchester, April 23

Tide Gauge

IN NATURE of the 18th is a letter from Mr. Pearson respecting Tide Gauges. As very little appears to be known of such instruments, we beg to inform you that we have made them for many years, and have now two finished, one for the Indian Government, and the other for the Australian Government, and we shall be happy to show them to any one wishing to see them. We think they could be made self-acting at a much less cost if the exact time of high water is not required.

449, Strand, W.C., April 19

ELLIOTT BROTHERS

Colour of the Hydrogen Flame

IN a communication from my zealous science-master, which I find in your issue of Thursday the 11th, it is stated that pure hydrogen has no tinge of blue in its flame (that colour being due to the presence of sulphur), and he concludes his note with a gushing tribute of his own, and the younger boys' gratitude for the "simply delightful Science Primers of Prof's. Huxley, Roscoe, and Balfour Stewart." Let me call his attention to the fact that on page 26 of his Chemistry Primer, Prof. Roscoe distinctly states that "Hydrogen is inflammable, and burns with a pale blue flame."

A GRATEFUL PUPIL OF MR. BARRETT

The "Cheironectes pictus"

SINCE I communicated to you an account of a fish which I caught in the Gulf weed during the homeward voyage of H.M.S. *Charybdis*, I have seen, in the February number of the *American*

Journal of Science and Arts, a description of a fish-nest which Prof. Agassiz obtained from the seaweed of the Sargasso Sea in December last.

In this interesting paper Prof. Agassiz identifies the embryos which he acquired from the nest as the young of the *Cheironectes pictus*, which, as its name implies, has fins like hands. From the description given I have no doubt but that my specimen is the *Cheironectes*, and I lose no time in forwarding to you the result of my reading.

J. E. MERVON

H.M.S. *Duke of Wellington*, Portsmouth

OCEAN CURRENTS

IN the *Philosophical Magazine* for October 1870 and 1871 I have examined at considerable length the arguments which have been advanced in favour of the theory that Oceanic Circulation is due to differences of specific gravity between the ocean in equatorial and polar regions. Since then a point in reference to the influence of the earth's rotation has suggested itself to my mind which appears to be wholly irreconcilable with the gravitation theory of currents.

It is one of the properties of a fluid that the resistance which it offers to motion is equal in all directions. It follows, therefore, that when an ocean current is flowing in any particular direction, the forces acting on the moving water must be greatest in the direction of motion. According to the theory that oceanic circulation is due to difference of specific gravity, resulting from the difference of temperature between the equatorial and polar waters, the direction of motion at the surface of the ocean is from the equator to the poles, and at the bottom from the poles to the equator, subject to a deflection caused by the earth's rotation. According to this theory gravity tends to impel the water from the equator towards the poles along the line of meridian; while rotation tends to deflect the water towards the east. If the total amount of work performed on the moving water by these two forces were equal, then the water on the northern hemisphere would take a north-easterly direction, and that on the southern hemisphere a south-easterly direction. But owing to the way in which the two forces vary in relation to each other, the path taken is not a straight line but a curve, the particular character of which has been determined with great labour by Mr. Ferrel.

But whatever view we may adopt in regard to the influence of rotation on the moving waters, whether it be that advocated by Dr. Colding and others, or that propounded by Mr. Ferrel, it is evident that if we assume the amount of the impelling energy of gravity to be not greater than the deflecting energy of rotation, we shall be led to the conclusions that there can be no such general interchange of equatorial and polar water in the Atlantic as Dr. Carpenter maintains. For under such conditions water leaving the equatorial regions for the Arctic seas would move as rapidly eastward as northward, and would consequently be deflected against the western coast of the old continent, and arrested in its progress before it reached even the latitude of England.

I need not, however, dwell further on this point, for I do not suppose there are any advocates of the gravitation theory who will not freely admit that the impelling energy is at least equal to the deflecting energy, and if this be admitted, it is all that is necessary for my present argument.

What proportion then does the impelling energy of gravity bear to the deflecting energy of rotation?

The velocity of rotation at the equator is about 1,526 feet per second, and at lat. 60°, about 773 feet per second. Were water frictionless, and did it offer no resistance to motion, then a pound of water flowing from the equator in the direction of the pole would, on arriving at latitude 60°, have, according to hitherto received ideas, an easterly velocity relative to the earth's surface of 763 feet per second. Mr. Ferrel has, however,

shown that the relative velocity would be much greater. But not to run the risk of over-estimating the velocity, I shall be content to take it at 763 feet. Water flowing from the equator towards the poles, instead of having an actual velocity of 763 feet per second on reaching latitude 60°, has, at the utmost, a velocity not over one or two feet. If we suppose the velocity to be, say, 3 feet per second, then 760 feet per second of velocity derived from rotation is consumed by friction and other resistances in the passage of the water from the equator to that place. A pound of water moving with a velocity of 760 feet per second possesses in virtue of that velocity 9,025 foot-pounds of energy. This enormous amount of energy is all consumed, not in impelling the pound of water from the equator to latitude 60°, but in simply deflecting it to the east during its motion. Consequently 9,025 foot-pounds is the amount of energy required to perform the work of deflection. But since the resistance offered by a fluid to motion is equal in all directions, the resistance offered to the impelling force must be as great as that offered to the deflecting force. It is, I trust, admitted that in the passage of the pound of water from the equator to latitude 60°, the distance traversed by the water under the influence of the impelling force is as great as the distance traversed under the influence of the deflecting force, or, in other words, the distance from the equator to latitude 60°, measured along the meridian, is as great as the distance to which the water is deflected to the east during its passage. Then, if this be the case, 9,025 foot-pounds of energy of the impelling force must be also consumed in overcoming the resistance to the motion of the pound of water; that is, the impelling force requires to perform 9,025 foot-pounds of work before it can convey a pound of water from the equator to latitude 60°. Can gravitation, therefore, be the impelling force? Can gravity, according to Dr. Carpenter's theory, perform 9,025 foot-pounds of work on a pound of water in impelling it from the Equator to latitude 60°?

Taking Dr. Carpenter's own data as to the temperature of the ocean at the poles and equator, and the rate at which the temperature at the equator decreases from the surface downwards, I have shown* that 9 foot-pounds is the greatest amount of work which gravity can perform on a pound of water (placed under the most favourable circumstances) in carrying it from the equator to either pole. Assuming the slope from the equator to the poles to be uniform, 6 foot-pounds will be the total amount of work that gravity can perform upon a pound of water in its passage from the equator to lat. 60°. But this is only $\frac{1}{1500}$ part of the amount of energy required. Hence, if there is any circulation of water between the equatorial and polar regions, it must be produced by a cause 1,500 times more powerful than the one to which he appeals.

But in reality the amount of energy impelling the water must be far more than 1,500 times greater than what can be derived from gravity, for the water moves more in the direction of the impelling force than in the direction of the deflecting force, thus proving that the impelling force is greater than the deflecting force.

Although it will be admitted that the resistance offered by fluid friction is equal in all directions, yet it may be urged that, owing to the influence of the winds or some other cause or causes which I have not taken into account, the actual resistance to motion may be greater in some directions than others. This no doubt may be the case, but it cannot possibly affect the conclusion at which I have arrived, unless it be shown that the resistance to pole-ward motion is 1,500 times less than the resistance to eastward motion.

But these results are as conclusive against the theories of Maury, Colding, Ferrel, and in fact against every possible form of the gravitation theory, as against the theory of Dr. Carpenter. And I need hardly add that they are equally fatal to the theory that ocean currents are caused

* Phil. Mag., Oct. 1871.