on this subject by no means exhaust it; but I think it may be safely asserted that selection has yielded much more than sports.

W. BOTTING HEMSLEY.

Prof. Milne's Observation of the Argentine Earthquake, October 27, 1894.

A FEW days ago I received from Prof. Milne a letter, dated March 15, 1895, in which he sends me a list of earthquake disturbances, compiled from the records he was fortunate enough to rescue from the fire which destroyed his house on February 17. In this list I find no less than three observations of the great Argentine earthquake of October 27, 1894, which was recorded by three different horizontal pendulums. The times given for the beginning of the earthquake—viz. 18h. 0m., 18h. 5m., 17h. 41m.[1]—are not very trustworthy, because they were determined by measuring the linear distance from a break in the curve which was caused regularly every day about noon by taking away the lamp. The exact times of these breaks were noted in a book, which, unfortunately, was destroyed by the fire. Prof. Milne, however, tells me that in the instrument, to which corresponds the first of the above-mentioned times, the lamp was always removed within half a minute or one minute from noon (Japan time). Consequently, the error cannot exceed a few minutes. The duration of the disturbance was between two and three hours in all the three instruments.

If we consider that the error of the first observation is not likely to exceed ten minutes, then we find, by comparing Prof. Milne's observations with those made in Europe, that although the spherical distance between the epicentre of the earthquake and Tokio is *no less than* 17,400 *kilometres*, the earth-motion reached Japan at about the same time, or perhaps even a little earlier, than it arrived in Europe. It is unnecessary to point out the interest which is attached to systematic observations of this kind. Prof. Milne's observation is probably the first in which an earthquake was noticed by seismic instruments at a place so near the antipodes of the earthquake centre. A straight line between the two points is only very little shorter than the earth's diameter; the time required for the motion to pass through the globe was probably less than twenty minutes.

Merseburg, May 1. E. VON REBEUR-PASCHWITZ.

Guanine in Fishes' Skins.

IN a joint paper by Mr. J. T. Cunningham and myself (*Phil. Trans.* vol. clxxxiv., 1893, B, pp. 765–812), we have ventured to question the accuracy of the statement made in many text-books of physiological chemistry, that guanine occurs in combination with calcium in the skin of fishes. We found that the guanine occurs in the free state. In the last number of Hoppe-Seyler's *Zeitschrift für Physiologische Chemie* there is a paper by Herr Albrecht Berthe, dealing with this subject, in which he shows that the calcium so frequently found with the guanine is due to the presence of impurities derived from the tissues and the scales. Its amount depends upon that of the impurities present, and is very variable. Instead of finding 11·76 per cent. required by the formula of "*Guaninkalk*," Berthe finds less than one-third of that percentage present, and even this also varies within wide limits. In the paper referred to above, we found one source of the calcium was due to the presence of comparatively large crystals of calcium phosphate, which are figured on p. 788; but there is no doubt that the bulk of it is derived from the scales.

CHAS. A. MACMUNN.

Oakleigh, Wolverhampton, May 4.

The Oldest Vertebrate Fossil.

NOTICING in your issue of April 11 a reference to the discovery of specimens of *Cyathaspis* in the Silurian of Gotland in strata equivalent to the English Wenlock, and with it the statement that these fossils are "for the present the oldest known vertebrates," I am led to call your attention to the species described by myself from Silurian strata in Pennsylvania in 1885 (p. 48), and again in 1892 (p. 542), in the *Quarterly Journal* of the Geological Society. I forward with this a copy of the paper, from which it will be seen that the Salina (Ononduga) beds that yielded *Palæaspis* are older than the Ludlow (or Lower Helderberg), and that the Clinton are older than the Wenlock (or *Niagara*). Consequently *Onchus Clintoni* of the latter group is thus far the oldest vertebrate. E. W. CLAYPOLE.

Akron, Ohio.

[1] These hours are Japan time, *i.e.* 9h. east of Greenwich, and are reckoned from noon.

TERRESTRIAL HELIUM.

SINCE our last reference to this subject three communications have been laid before the Royal Society. They are as follows:—

HELIUM, A GASEOUS CONSTITUENT OF CERTAIN MINERALS.[1]

An account is given of the extraction of a mixture of hydrogen and helium from a felspathic rock containing the mineral clèveite. It is shown that in all probability the gas described in the preliminary note of March 26 was contaminated with atmospheric argon. The gas now obtained consists of hydrogen, probably derived from some free metal in the felspar, some nitrogen and helium. The density of helium, nearly free from nitrogen, was found to be 3·89. From the wave-length of sound in the gas, from which the theoretical ratio of specific heats 1·66 is approximately obtained, the conclusion may be drawn that helium, like argon, is monatomic. Evidence is produced that the gas evolved from clèveite is not a hydride, and a comparison is made of the spectra of argon and helium. There are four specially characteristic lines in the helium spectrum which are absent from that of argon: they are a brilliant red, the D_3 line of a very brilliant yellow, a peacock-green line, and a brilliant violet line. One curious fact is that the gas from clèveite, freed from all impurities removable by sparking with oxygen in presence of caustic potash, besides other fainter lines, exhibits one, and only one, of the characteristic bright red pair of argon lines. This, and other evidence of the same kind, appears to suggest that atmospheric argon and helium have some common constituent.

Attention is drawn to the fact that on subtracting 16 (the common difference between the atomic weights of elements of the first and second series) from 20, the approximate density of argon, the remainder is 4, a number closely approximating to the density of helium; or, if 32 be subtracted from 40, the atomic weight of argon if it be a monatomic gas, the remainder is 8, or twice the density of helium, and its atomic weight if it too is a monatomic gas.

ON THE NEW GAS OBTAINED FROM URANINITE.[2]

Since my communication on the gas obtained from Uraninite (Bröggerite) was sent in to the Society on the 25th ult., I have been employing the method I there referred to in several directions, among them to determine whether the spectrum of the gas indicates a simple or a complex origin.

I was led to make this special inquiry on account of the difference in the frequency of the appearance of D_3 and the other lines to which I referred in the solar chromosphere. For instance, if we take the lines D_3, 4471, and 4302, the frequencies are as follows, according to Young[3]:—

D_3	100	(maximum)
4471	100	,,
4302	3	

Hence, we might be justified in supposing that D_3 and 4471 are produced by the same gas, and that 4302 owes its origin to a different one.

But further experiment has given me one case in which D_3 shows bright, while 4471 is entirely absent. I may now add that an equally important line to 4471, one at 4026·5, appears, with the dispersion employed, in the spectrum of Bröggerite, and both these lines are wide and fluffy, like the lines of hydrogen, and are apparently reversed.

The line 4026·5 has not been recorded by Young, though, as I have stated, the frequency of appearances of 4471 represents the maximum; still, while this is so, the intensity of both these lines in the spectra of the hottest stars is not surpassed, even by those of hydrogen. Hence, opinion as to their representing the same gas must be suspended. Further, I have photographed a line at 4388 apparently coincident with another important line in the same stars. Whether, coming from one source or two, in these three lines seen along with D_3 in the gas obtained by me from Bröggerite, we have, it would seem, run home the most important lines in the spectra of stars of Group III., in which stars alone we find D_3 reversed. Should these results be confirmed, the importance of the gas or gases they represent at a

[1] By Prof. W. Ramsay, F.R.S. (abstract).
[2] Second note. By J. Norman Lockyer, C.B., F.R.S.
[3] See "Solar Physics," Lockyer, p. 612.