fore Wiener's law is not true of this zone taken apart. If we subtract the sun-heat received in this zone where glacial conditions never existed, we shall find that the proportions in the temperate and polar zones combined are not 63 to 37, but 38 to 12. So that Wiener's law is not true of these zones where glacial conditions alone existed. If, instead of taking the tropics, we take the area limited by the parallels of 45°, which is a better boundary for the district displaying glacial phenomena, the disparity is still greater. At Edinburgh, as Croll long ago said, the proportions are about 3 to 1. Does Mr. Hobson dispute this?

(4) Dr. Ball nowhere connects Wiener's law as a cause with the Glacial age as an effect *by proof of any kind*. He merely offers us certain *obiter dicta*, and argues that if the present proportions of sun-heat were distributed over a winter of 199 days and a summer of 166 days, we should have a glacial climate in Britain. Since the proportions of sun-heat actually recorded in Britain at this moment in our 199 coldest and 166 warmest days respectively show a far greater disparity than that represented by these figures, I may, I think, ask if Mr. Hobson admits this *reductio ad absurdum* of Sir Robert Ball's argument to be valid?

(5) Lastly. For the first time, Mr. Culverwell has applied numerical tests and methods to the problem of discovering the actual and not the hypothetical results on climate caused by a varying eccentricity of the earth's orbit. He has done so by comparing the actual sun-heat received by each latitude now, and contrasting it with the actual sun-heat received by the same latitude in the time of greatest eccentricity, and has shown that the limits of variation do not amount to more than can be measured by removing a parallel of latitude from 3½ to 4 degrees. This to some of us is absolutely conclusive, not only against Dr. Ball's arguments, but against all astronomical theories, including Croll's.

The real point and meaning of my letters is that in regard to the astronomical theory of an Ice age all the kind of reasoning employed by Sir R. Ball and its consequences are fallacious. They have been swept away and shown to be worthless by Mr. Culverwell's method of solving the problem, which is inductive and decisive, and which rigorously proves that Sir Robert Ball's results are as extravagantly baseless as his method is unfruitful. This being so, it is most clearly incumbent upon the Lowndean Professor either to answer his accomplished critic or to withdraw his book, which is only misleading the unwary by having its mistaken and shattered arguments sheltered under the Astronomical Chair at Cambridge. It ought certainly to have no place in a series entitled "Modern Science," where ascertained results and not ingenious fallacies ought to find a place. Nor ought Mr. Kegan Paul's name to appear on its title-page as a guarantee of its scientific soundness.

The Athenæum Club, October 29. HENRY H. HOWORTH.

Curious Aerial or Subterranean Sounds.

PROF. G. H. DARWIN, in NATURE for October 31, p. 650, asks for information as to the "Barisàl guns." The name is derived from Barisàl or Burrisal, a town in the eastern part of the Gangetic delta, and the best and most recent account of the sounds known as the "Barisàl guns" is to be found in the report of a sub-committee of the Asiatic Society of Bengal, published in the *Proceedings* of that Society for 1889, p. 199.

The great difficulty in the way of accepting the suggestions of Messrs. Meldola and Davison (NATURE, November 7, p. 4), that earthquake shocks are the cause of the sounds, is the restriction of the "Barisàl Guns," so far as is known, to a comparatively small area, where earthquakes are of rare occurrence, and to a particular season of the year.

W. T. BLANFORD.

[*Translated by Prof. G. H. Darwin.*]

AN article, by Prof. G. H. Darwin, on "Barisàl Guns and Mistpouffers" appeared in NATURE for October 31. Summarising a letter in which I drew his attention to this phenomenon, he mentions two sources for these mysterious sounds, which my friend M. Rutot and I have considered as possible, namely that the origin is entirely terrestrial, or that it is a special phenomenon of atmospheric electricity. It is as well, perhaps, also to point out another purely atmospheric source, viz. that it may arise from the abrupt displacement of a mass of superheated air in unstable equilibrium, which rises suddenly in the atmosphere.

This was the explanation given to M. Lancaster by the late M. Houzeau, the astronomer, on the former sending him my first notes on this phenomenon, in about 1881. M. Houzeau also stated that he had himself observed the noises, but that he could not suggest any more plausible explanation than the above.

In confirmation of this hypothesis, I would remark that *this year* the mysterious detonations were heard up to the end of September, and even up to the beginning of October, not only by me but by several of my friends and correspondents; this is much later in the year than usual. Now great and unusual heat prevailed this year during the whole autumn, and this coincidence affords a strong support to the theory of an origin arising from certain conditions of rise of temperature.

Sailors of the port of Ostend assert that "Mistpouffers" prevail over the whole of the North Sea as far as Iceland, and they consider them to be a sign of fine weather, with calms and heat.

The mysterious noises, mentioned to me by Mr. Clement Reid, which are heard on Dartmoor and in Scotland near the Highland Fault, are not perhaps exactly comparable with "Mistpouffers"; for Mr. Reid writes to me that these sounds are probably associated with those incessant tremors of the earth's crust, which are well known in these districts. With respect to sounds of this peculiar kind, readers of NATURE will find an interesting note by Mr. Charles Davison, entitled "On Earthquake Sounds," in the *Geological Magazine* for May 1892.

I might add many interesting data concerning "Mistpouffers," but I have promised to reserve them for the Belgian magazine *Ciel et Terre*, edited by M. Lancaster. In that journal, the readers of NATURE who are interested in this subject, will shortly find a complete account of the papers which have come to my knowledge; to which they will doubtless be able to add a number of facts and observations, which will prove of great service for the scientific study of the question.

ERNEST VAN DEN BROECK.

39 Place de l'Industrie, Brussels.

I HAVE heard many queer noises in lonely spots, and wish I had made note of the time and place and circumstances. But though I have few exact facts and figures, I have a very distinct recollection of many such observations, some of which are a direct answer to the question asked by Prof. Darwin in your number of October 31, while others seem to have a bearing upon it.

I have sometimes heard on the mountains north of the great Craven Faults, from which I looked over low ground towards Morecambe Bay, what I always took to be the sound of heavy guns somewhere out seaward. They were not, however, repeated at such intervals, nor for so long a time as to support the view that it was the sound of artillery practice; and, when I made inquiries from friends who resided in the district, I never learned that there was anything of the sort going on. The sound struck me as peculiar, but I could not find any satisfactory explanation of it. I considered many possibilities. First, there was the general question of the different transmission of such sounds according to the state of the atmosphere. Fog, for instance, affects it. In the particular case I have mentioned, I knew there were great quarries in various places within a few miles, and I had always before me the possibility of my having heard the sound of blasting echoed by some combination of cliffs to where I was.

The noises I heard were just such as are produced by the thud of the wave as it fills a cave. The muffled sound of the impact of water is heard a long way off. An idea of its force may be gained from cases in which the air, instead of being compressed in the hollow of the rock, finds an opening to the surface of the ground above, and rushes out, sometimes followed by a spout of spray. Its recurrence is irregular, and it lasts only for the short time when the rise and fall of the waves just fills and empties the cave. The direction of the transmission of this sound to long distances is still more uncertain.

In the case of the air-thuds on the Yorkshire Fells this explanation is extremely improbable, and the "guns of Barisàl," so named from the town and river of that name, boom across the flat delta of the Ganges, where there can be no cliffs or caves. What is really common to the two areas suggests another possible explanation.

The sound of the first blow of the curled wave upon the shore or on the sea, and of the outburst of the great volume of air included in its fold, is carried an immense distance. I have heard it much resemble heavy guns. It is exceptional and irregularly intermittent. It is only when the tide has reached one part of