through autumn and winter, if it be mild. With regard to *Trifolium subterraneum*, as it was about thirty years ago when observed it, I cannot now be certain that it was actually cleistogamous; but it grew with just the same habit as the above, and was most probably self-fertile as they are.

GEORGE HENSLOW.

Nose-Blackening as Preventive of Snow-Blindness.

I BEG to send you an extract from a letter just received from my son, of the Indian Geological Survey Department, and who is at present engaged by the Maharajah of Kashmir in exploring and reporting on his sapphire mines. Since it refers to former communications in NATURE (vol. xxxviii. pp. 7 and 101), upon a subject of interest to travellers, it may be of use.

I may here mention that my son speaks of having found the Eocene Nummulitic limestone in Zanskar at a height of 18,500 feet above the sea. Sir J. D. Hooker tells me that he has previously observed the Nummulites in Tibet, at a height of 18,000 feet.

J. D. LA TOUCHE.

Stokesay, Craven Arms, November 20.

"Some time ago there was a letter in NATURE describing a method of protecting the eyes from sun-glare, when crossing snow, by blackening the nose and cheeks under the eyes. I tried the dodge the other day, when I was crossing the snow-fields and glaciers from Zanskar, and found it very successful. My shikari and some of the other natives were much amused when I produced a piece of charcoal, and proceeded to blacken my face; but they also tried it, and said that it relieved them very much. I do not know how the effect is produced, but it was much the same as when one went off the snow on to a patch of moraine or rocks clear of snow. The blackening seemed to stop the reflected rays in some way. The natives expressed the feeling by saying that it cooled their faces. I found it quite possible to walk over the snow for many miles without glasses, which are a nuisance, especially on rough ground; but without the blackening I had to put them on. The sun at these high altitudes has much greater effect than in England when the ground is covered with snow."

Amber.

IN NATURE (vol. xxxvi. p. 63), I find the following note:—"The largest piece of amber ever discovered was recently dug up near the Nobi's Gate, at Altona. It weighed 850 grammes." I beg to state that a piece of amber, weighing 5·6 kilogrammes, is in the possession of Messrs. Stantien and Becker, in Königsberg, and that pieces weighing 6·5 and 9·5 kilogrammes can be seen in the Berlin Mineralogical Museum, both discovered off the sea coast of North Germany. Even as far inland as Silesia, a piece of Baltic amber, weighing 3 kilogrammes, has been found in the bed of the River Oder, near Breslau. Baltic amber occurs in Silesia also as high as 1400 feet above the level of the sea.

A. B. MEYER.

Royal Museum, Dresden, November 19.

ON THE MECHANICAL CONDITIONS OF A SWARM OF METEORITES.[1]

II.

THE next point to consider is the mass and size which must be attributed to the meteorites.

The few samples which have been found on the earth prove that no great error can be committed if the average density of a meteorite be taken as a little less than that of iron, and I accordingly suppose their density to be six times that of water.

Undoubtedly in a meteor-swarm all sizes co-exist (a supposition considered hereafter); for even if originally of uniform size they would, by subsequent fracture, be rendered diverse. But in the first consideration of the problem they have been treated as of uniform size; and, as actual sizes are nearly unknown, results are given for meteorites weighing $3\frac{1}{8}$ grammes. From these, the values for other masses are easily derivable. It is known that meteorites are actually of irregular and angular shapes, but certainly no material error can be incurred when we treat them as being spheres.

The object of all these investigations is to apply the formulæ to a concrete example. The mass of the system is therefore taken as equal to that of the sun, and the limit of the swarm at any arbitrary distance from the present sun's centre. The theory is of course more severely tested the wider the dispersion of the swarm, and accordingly in a numerical example the outside limit of the solar swarm is taken at $44\frac{1}{2}$ times the earth's distance from the sun, or further beyond the planet Neptune than Saturn is from the sun. This assumption makes the limit of the isothermal sphere at a distance 16, about half-way between Saturn and Uranus.

In this case the mean velocity of the meteorites in the isothermal sphere is $5\frac{1}{3}$ kilometres per second, being $\sqrt{\frac{6}{5}}$ of the linear velocity of a planet revolving about a central body with a mass equal to 46 per cent. of that of the sun, at distance 16. In the adiabatic layer it diminishes to zero at distance $44\frac{1}{2}$. This velocity is independent of the size of the meteorites. The mean free path between collisions ranges from 42,000 kilometres at the centre, to 1,300,000 kilometres at radius 16, and to infinity at radius $44\frac{1}{2}$. The mean interval between collisions ranges from a tenth of a day at the centre, to three days at radius 16, and to infinity at radius $44\frac{1}{2}$. The criterion of applicability of hydrodynamics ranges from $\frac{1}{60000}$ at the distance of the asteroids, to $\frac{1}{3600}$ at radius 16, and to infinity at radius $44\frac{1}{2}$.

All these quantities are ten times as great for meteorites of $3\frac{1}{8}$ kilogrammes, and a hundred times as great for meteorites of $3\frac{1}{8}$ tonnes.

From a consideration of the tables in the paper it appears that, with meteorites of $3\frac{1}{8}$ kilogrammes, the collisions are sufficiently frequent even beyond the orbit of Neptune to allow the kinetic theory to be applicable in the sense explained. But if the meteorites weigh $3\frac{1}{8}$ tonnes, the criterion ceases to be very small at about distance 24; and if they weigh 3125 tonnes, it ceases to be very small at about the orbit of Jupiter. It may be concluded then that, as far as frequency of collision is concerned, the hydrodynamical treatment of a swarm of meteorites is justifiable.

Although the numerical results are necessarily affected by the conjectural values of the mass and density of the meteorites, yet it was impossible to arrive at any conclusion whatever as to the validity of the theory without numerical values, and such a discussion as the above was therefore necessary.

I now pass on to consider some results of this view of a swarm of meteorites, and to consider the justifiability of the assumption of an isothermal-adiabatic arrangement of density.

With regard to the uniformity of distribution of kinetic energy in the isothermal sphere, it is important to ask whether or not sufficient time can have elapsed in the history of the system to allow of the equalization by diffusion.

It is shown therefore in the paper that in the case of the numerical example primitive inequalities of kinetic energy would, in a few thousand years, be sensibly equalized over a distance some ten times as great as our distance from the sun. This result, then, goes to show that we are justified in assuming an isothermal sphere as the centre of the swarm. As, however, the swarm contracts, the rate of diffusion diminishes as the inverse $\frac{5}{2}$ power of its linear dimensions, whilst the rate of generation of inequalities of distribution of kinetic energy, through the imperfect elasticity of the meteorites, increases. Hence, in a late stage of the swarm, inequalities of kinetic energy would be set up, there would be a tendency to the production of convective currents, and

[1] Abstract of a Paper read before the Royal Society on November 15 by Prof. G. H. Darwin, F.R.S. Continued from p. 83.