The Investigation of Flint.

THE need for a more accurate knowledge of the dynamics of flint, as pointed out by Sir E. Ray Lankester in NATURE of November 21, is very obvious.

Though not so remarkable as the Savernake polished flints, yet some are to be found in the shingle for some miles both east and west of Brighton. Flints, too, with even more glaze than either of these are met with on the arable land of this district. These I assume got at some time the benefit of the vegetable ash resulting from the burning of weeds, being raked up along with them. Originally they came in the chalk from the North Downs for the use of the crops.

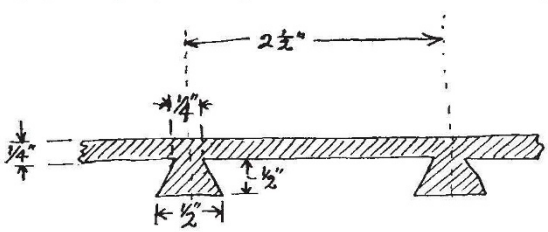
A caution may be useful as to what may be expected as the result of frost action. I have watched many of our Wealden sandstones for about twenty years, chiefly because of my study of the honeycomb weathering. One wall I guess at least 100 yards long, on the west side of Mount Pleasant Hill, has soil behind it nearly to the top. It shows good dusty weathering along a line about 2 ft. from the pavement at the junction of the second and third courses of stone. There are, however, two very distinct patches, each two or three yards wide, where this is entirely absent. Why is this? Merely, I believe, because the places happen to get extra rain-water from two adjoining trees, and are never dry all the winter. Parts, however, which are wet and dry alternately frequently suffer.

Why, I wonder, is it that the small mammilations seen on the squared flints of the churches in the eastern counties are absent in the southern counties? Again, the Norfolk paramoudra deserve more study than they have had hitherto. This year at Seaford I found a 2-in. layer of chert at the top of the chalk, which I was told is usual there. The explanation seemed to be that rain-water had taken up silica from the overlying sands and gravels. On the west of Cuckmere Haven the chalk cliffs have also remarkable rings of chert, sometimes 6 in. thick, surrounding each of the numerous pipes seen in the chalk there. These chert cylinders can be seen lying on the shore owing to the erosion by the sea. For a long time these were great puzzles, but their explanation was discovered last year by my friend, Mr. Hy. Preston, of Grantham. GEORGE ABBOTT.

Tunbridge Wells, November 23.

Remarkable Formation of Ice on a Small Pond.

SOME soil (which is of a heavy nature), being required, had been dug out to a depth of about a foot. The sides and bottom were thus quite irregular. Rain-water lodged in the hole, thus forming the pond, which was about 4 ft. long, 1 ft. 6 in. wide, and 5 in. maximum depth; the major axis was N.E. and S.W.,



and the upper surface of the ice about 8 in. below the general level of the ground.

The ice was first noticed at 0.30 p.m. on Sunday, December 1. Dark sinuous lines about ⅜ in. wide and running about parallel to the major axis were plainly visible. These were seen to be due to the water below touching the ice along these lines, while the bands (about 2½ in. wide) of white between the lines were due to the water not being in contact with the ice at these portions of the under-surface. The water in the pond had gradually percolated away, and had thus left an air space of about ¼ in. between itself and the under-surface of the ice between the dark lines. On breaking the ice and getting a piece out, it was found to have the remarkable cross section shown in the sketch. The ice was quite clean and clear, and the dovetail ribs were well off the bottom of the pond. The ribs were remarkably regular in form and dimensions, and there were about six lines of them running from end to end of the pond.

There was no wind, and the frost on the grass near by was crisp, indicating that the temperature was still below 32° F.

A. S. E. ACKERMANN.

Anthropology at the British Association.

I NOTICE in the article on anthropology at the British Association in NATURE of November 21 a slight misstatement, which I should be obliged if you would correct.

The coloured photographs which I showed to the section were taken partly by my friend Mr. Mellor and myself, and the scenes represent different tombs which I excavated in 1903–05. ROBERT MOND.

Combe Bank, near Sevenoaks, November 25.

ATMOSPHERIC ELECTRICITY.

DURING the last few years a large number of experiments and observations have been made which, instead of solving the central problem of atmospheric electricity, appear to have made it more difficult than ever. It seems desirable, therefore, that a short statement of the present position should be placed before the large body of physicists who have not yet considered this exceedingly interesting subject.

Measurements of the electrical conditions of the atmosphere have now been made over the land from north polar regions through the equator to south polar regions, over the centres of the Atlantic and South Indian Oceans, and on Samoa in the Pacific Ocean. Thus the conditions over both land and ocean areas have been investigated, and everywhere it has been found that the air is a conductor and that the potential gradient is practically the same. The result can be expressed in rather a more objective way by stating that the earth has been found to be a negatively charged sphere, of a nearly uniform surface density, surrounded by a conducting atmosphere. This, however, cannot be a complete statement of the case, for by the laws of electrostatics a charge cannot exist within a conductor, and in consequence the charge on the surface of the earth must be transferred more or less quickly to the outside of the conducting atmosphere. In spite of this, the charge on the earth's surface remains undiminished. Whence, then, comes the negative charge to make this possible? This is the chief problem of atmospheric electricity.

To make it clear that the surface of the earth does lose electricity, it will be as well to state the methods used to determine the loss. The surface of the earth is at a uniform potential, which

for convenience is called zero. If, therefore, a certain area of this is insulated, it can only remain at the potential of the remainder so long as it receives or loses no charge. If it was losing a charge before it was insulated, it can only be kept at zero potential after insulating by supplying it with the charge lost. In 1906 C. T. R. Wilson designed an instrument by means of which an insulated plate could be kept at zero potential while exposed to the atmosphere, and the charge which had to be supplied to do this could be measured. The result proved an actual loss of negative electricity. The amount of this loss was found to be equal to that which can be calculated from a knowledge of the potential gradient and the conductivity of the air.

Realising that the plate in Wilson's instrument did not exactly represent a piece of the ground and that measurements at odd times could always be objected to, a method was developed in Simla by which a continuous record could be obtained of the charge necessary to keep at zero potential a large area—17 square metres—which was to all intents and purposes a part of the surface of the ground. This instrument was in use for nearly a month, and registered a continuous loss of negative electricity. These experiments indicate clearly that during fine weather negative electricity actually passes from the earth into the air. This disposes of the possibility of the lost charge being renewed uniformly over the whole earth by such processes as the fall of charged dust, friction of the air on the earth's surface, or the absorption of ions from the air. The loss over the whole earth is equivalent to a constant current of more than 1000 amperes. As this loss takes place from all regions of the earth, subject to normal or fine weather conditions, it would appear that the return current can only exist in regions of disturbed weather, and it is known that in such regions the potential gradient is often reversed and the rain charged.

A reversed field certainly causes a flow of negative electricity into the earth, but as the time during which the field is reversed in any one place is only a very small fraction of the time during which it is normal, the flow of electricity would have to be enormous if the loss were made good in this way. Such a large flow could not possibly escape detection, and no one has seriously put forward this as a solution of the problem.

There is still the possibility that the electricity comes to the earth in the disturbed area as a negative charge on the rain. For many years this was the most favoured theory for the supply of the negative electricity, but in 1908–9 measurements were made in Simla which showed that there, at least, the rain carried down more positive than negative electricity. Since then many measurements have been made on the electricity of rain, and now we have before us the results of observations made in Porto Rico, Simla, Vienna, Potsdam, Puy-en-Velay and Dublin. In every one of these cases the Simla result is confirmed, and there can be no doubt now that in all kinds of rain, from the intense rain of thunderstorms to the drizzle of a depression, more positive than negative electricity is brought to the earth. Thus rain, instead of solving our problem, has made it more difficult.

It has been suggested that the charge may be returned in the lightning of thunderstorms. Prof. Schuster has discussed this point in his recent book, "The Progress of Physics" (p. 150), and comes to the conclusion: "It does not seem to me, judging by present information, that lightning discharges from cloud to earth can play an important part in increasing or diminishing the charge of the earth," and there are other reasons, not mentioned by Prof. Schuster, for coming to the same conclusion.

We have now discussed the conditions in disturbed areas and have not found the return current, for neither the reversed field, the precipitation, nor the lightning provides it. Thus the science of atmospheric electricity has come to a deadlock, and there is at present no indications of a way out.[1] We may sum up the position in the following statement. A flow of negative electricity takes place from the surface of the whole globe into the atmosphere above it, and this necessitates a return current of more than 1000 amperes; yet not the slightest indication of any such current has so far been found, and no satisfactory explanation for its absence has been given.

GEORGE C. SIMPSON.

PROF. FRIEDMANN'S TREATMENT OF TUBERCULOSIS.

THE announcement of the successful application of any new method of treating tuberculosis must always arouse intense interest and create new hope among those who are suffering from, or waging war against, this disease. For the latest of these, devised by Prof. Friedmann, of Berlin, it appears to be claimed that it acts not only curatively in cases where tuberculosis has already commenced, but prophylactically where there exists a danger of infection to those not already tuberculous. A large number of cases have been treated in Berlin and Vienna, and it is said that where the disease is not far advanced it is cut short, and that in children as yet unaffected the tissues and organs have been protected against the invading tubercle bacillus. This therapeutic agent appears to be some form or preparation of a non-virulent tubercle bacillus or some bacillus nearly allied which has been deprived of its toxic constituents or products.

In view of the outcome of the experiments made by the Royal Commission on Tuberculosis on the immunisation of animals by the use of injections of living tubercle bacilli, it is almost to be desired that the vaccine is of the nature of a prepared proteid and does not contain any living bacilli, however modified. Judging from the accounts we

[1] Prof. Ebert has proposed an explanation, but against it fatal objections have been raised. Those interested might consult the series of articles which appeared in the *Physikalische Zeitschrift* between March, 1904, and December, 1905.