and that it is very advantageous greatly to reduce the amount of grass land and instead to grow crops intensively cultivated, as in this way a given amount of land can be made to produce a much larger yield.

Sulphate of ammonia is a particularly good fertiliser for the purpose of growing sugar beet, and here again it is probable that the availability of large quantities of this fertiliser at a very much lower price than at present prevails would enable us to produce the whole of our sugar at home, especially as the by-product, obtained in the form of crushings from the beet, is a very valuable food for cattle raising, and also as the crop is a very suitable one for growing alternately with wheat.

If it was found that a larger amount of fertiliser than the 3 million tons of sulphate of ammonia, which would be the principal by-product from 60 million tons of coal turned into electricity, could be advantageously used, this would be very economically produced from the electrical station by the oxidation of atmospheric nitrogen, giving a valuable fertiliser in the form of nitrate of lime. This could be made intermittently by means of current filling up the load curve, and would not necessitate the expenditure of any more money on plant for generation or transmission of the current. It would, however, require the burning of additional coal, and this in itself would add to the sulphate of ammonia available.

It is assumed by many people that the climate of this country is largely unsuitable for the purpose of growing food, and for this reason it is thought that we can never grow the food which we require. This is largely a misconception, as crops both large in quantity and of good quality can be produced in this country. Nevertheless, it would be a desirable thing if, instead of the dark weather that we now often experience owing to cloud obstruction, we could have continuous sunshine at certain times of the year. The amount of sunshine would, no doubt, be largely increased by the abolition of all smoke in the air, as not only does the smoke itself obscure the sun, but also it seems to have the effect of assisting the formation of cloud, which greatly diminishes the light and heat which we receive.

At present it is considered quite right and reasonable to canalise rivers and make great works for adding to the fertility of countries by means of irrigation, but I believe that in the future the time will come when it will be thought no more wonderful largely to control our weather than it is now thought wonderful to control the water after it has fallen on the land. I think that it will be possible to acquire knowledge which will enable us largely to control by electrical means the sunshine which reaches us, and, in a climate which usually has ample moisture in the atmosphere, to produce rainfall when and where we require it.

It seems to me that it may be possible, when we know a great deal more about electricity than we do to-day, to set up an electrical defence along our coasts by which we could cause the moisture in the clouds to fall in the form of rain, and so prevent these clouds drifting over the country between ourselves and the sun which they now blot out. It also seems to me that it will be possible, when more water on the country is required, to cause the falling of rain from the clouds passing over the highest part of the country, and so produce an abundance of water which, properly used, would greatly add to the fertility of the country.

Of course, it may seem that these are only mad visions of the future, but I think we can hardly consider these results more improbable than anyone would have considered wireless telegraphy or flight in heavier-than-air machines fifty years ago. My excuse for mentioning these matters here is that they might constitute another great use of electricity, and their useful consummation would certainly be facilitated by an abundant supply of electrical energy.

At present, although the using of our coal may mean commercial activity, it certainly means the desolation of the country in parts where it is largely used. Instead of this harm being done to the country by our coal, we should fertilise the lands by its means, and might even, as I have indicated, use it in the future to increase our sunshine.

Of course there are many things which at present stand in the way of realising such a scheme as I have outlined. There are many technical details which nothing but an immense amount of work can solve satisfactorily. There are also political and legislative difficulties standing in the way, but these, when the time arrived, would have to be got rid of rather than allow them to handicap the advance of the country. The more, however, that I have considered these ideas in detail, the more certain am I of the fundamental soundness underlying them, and that it is only a matter of time before such a scheme is carried out in its entirety.

What interests us most, perhaps, is the question of how long it is likely to be before the all-electric idea becomes possible. At present there is so much required to be done to make it workable in all its details that it seems as though its realisation would be long deferred. It must, however, be remembered that knowledge is continually being acquired which brings us nearer to its realisation, and that things engineering, and especially in electrical engineering, now move very rapidly. It may therefore come to pass that the all-electric idea, with its far-reaching changes and great benefits, will become an accomplished fact in the near future.

MATAVANU: A NEW VOLCANO IN SAVAII (GERMAN SAMOA).[1]

THOUGH not the seat of government, Savaii is the largest of the Samoan Islands in the Central Pacific Ocean. It has a backbone of volcanic mountains, some of which rise to a height of more than 4000 feet; most of them are extinct or dormant, but there have been several small eruptions within the last 200 years, and one as lately as 1902.

The volcano of Matavanu was formed in 1905 to the north of the main ridge, and near the centre of the island. The early part of the eruption was characterised by explosions, and the ejecta were mainly solid, but later on

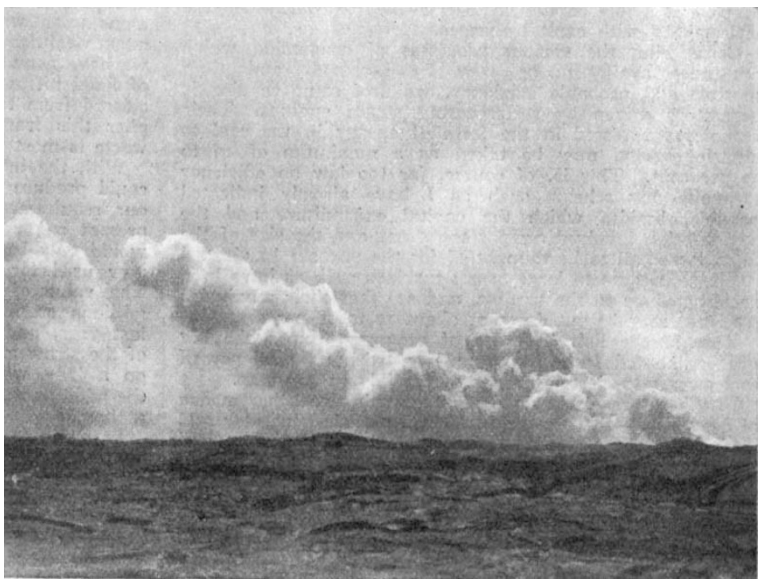

Photo.] [*T. Anderson.*

FIG. 1.—Steam Clouds from Lava falling into the Sea.

[1] Abstract of a Discourse delivered at the Royal Institution on Friday, April 29, by Dr. Tempest Anderson.

an enormous quantity of very fluid basic lava has been discharged. This has flowed by a sinuous course of about ten miles into the sea, devastated some of the most fertile land in the island, and covered it up with lava fields probably not less than twenty square miles in area.

The crater contains a lake, or rather river, of molten lava so fluid that it rises in incandescent fountains, beats in waves on the walls, and rushes with great velocity down into a gulf or tunnel at one end of the crater. The lava, still liquid, runs in a passage, or perhaps system of passages, under the surface of the lava field, its course being traceable by a line of large fumaroles until, still in a fluid condition, it reaches the sea, into which it flows with energetic explosions and the discharge of large volumes of steam, black sand, and fragments of lava. Where the action is less violent a structure resembling that of some varieties of pillow lava is produced.

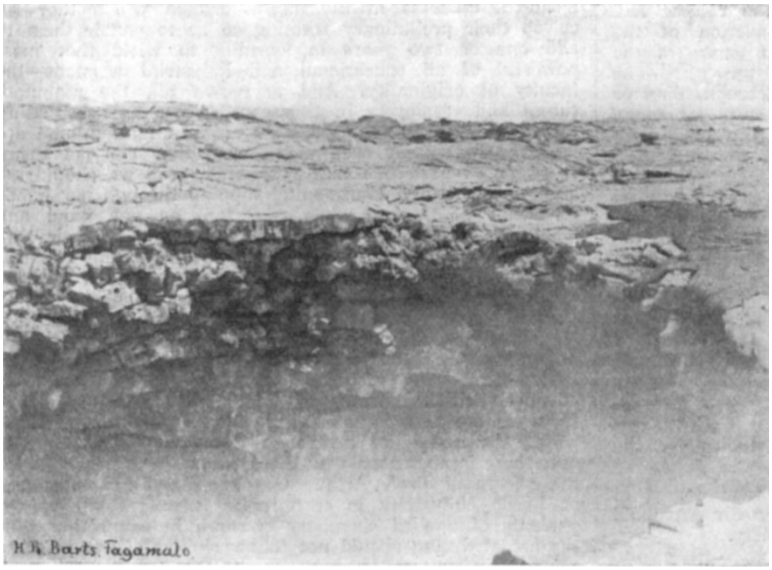

FIG. 2.—Pit Crater in Lava Field, on the line of the Lava Tunnel to the Sea.

Photo.] [*T. Anderson.*

FIG. 3.—Lava in Lagoon corced above high water-mark: Pillow Lava below.

The term pillow lava, originally applied to the results of a peculiar form of spheroidal weathering, is now extended to various smooth-surfaced lobular masses, which have been considered by Teall, Cole, and Gregory to be formed by lava flowing into water. This view has been combated by others; but Dr. Anderson watched the process actually going on, and photographed the results.

The formation of ordinary "corded lava" or "pahoehoe" takes place by a local quiet outflow of lava which forms a pool or lobe. The surface, being slowly cooled by the air, forms a more or less tenacious, treacly scum, which is pushed forward by the liquid mass underneath, and is puckered up into a cord or festoon. While this is taking place the new surface is becoming treacly, and in its turn is pushed forward into another fold, and so on until the whole surface is solidified, often with a very regular pattern.

Dr. Anderson said he had seen this taking place on Vesuvius, and had watched the same process going on at the sea-level at Matavanu. The surface of the lobes, however, being in that case exposed to the waves, was rapidly chilled, and solidified before it had time to be pushed forward to form "corded structure." A photograph of a recent flow into the lagoon showed corded structure above high-water mark, while lower down there was every transition into typical pillow lava.

The surface of the lava field shows several large pits along the line of the lava-conduit to the sea, out of which steam and vapours escape. They are larger than ordinary fumaroles, and appear to be formed by the remelting and falling in of the crust owing to the heat of the lava which flows beneath. The sections exposed in their walls show the lava field to consist of numerous very thin beds, partly surface flows, but probably in many cases intrusive sheets. This structure is very similar to that of the "pit craters" in Hawaii, the mode of formation of which is still unsettled. Possibly they may have been formed in the same way.

Other interesting points noticed were the formation of moulds by lava flowing round living tree trunks. The trees were, of course, killed, and when they decayed hollows were left corresponding to their former shapes. Occasionally, after the lava had solidified round a tree the remainder had flowed away; when the tree decayed a sort of hollow pillar was thus left, in which smaller plants sometimes grew.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The Huxley lecture will be delivered on November 23 by Prof. Percy Gardner, professor of classical archæology in the University of Oxford. The subject of the address is "Rationalism and Science in Relation to Social Movements."

BRISTOL.—In connection with the faculty of engineering provided and maintained in the Merchant Venturers' Technical College, a course of five monthly lectures on "Aviation" has been arranged. The selected lecturers are Prof. W. Morgan, Mr. A. R. Low, Mr. E. S. Bruce, Mr. L. Blin Desbleds, and Mr. Joseph Clarkson.

A new wing erected for the chemical and physiological