Note on the Crystals of Lead described in the preceding communication.

By Allan Dick.

AS Professor Miers has quoted my opinion of the manner in which the lead crystals measured by him were formed, I may state the circumstances under which I gave the opinion.

The etched button of lead was prepared by Mr. J. G. Stead, of Middlesborough, in the course of an investigation into the structure of metals, part of which has been published by the Iron and Steel Institute. The button was sent to a mutual friend, who it was hoped would be able to state exactly the crystalline system to which the hexagons belonged. My friend, finding himself unable to do so, asked me to look at the button, as he knew I had worked at lead during many years. I did so, and recognised the appearance which corroded lead presents under the microscope. As some of the patches showed the minute hexagons rather larger than usual, and well placed for inspection, I thought it a good opportunity to learn more about the hexagons than I knew, for they had long been a puzzle to me. With Mr. Stead's approval I sent the button to Professor Miers, with a request that he would, if possible, measure and describe the crystals, which he has fortunately been able to do.

When lead approaching purity, such as that used in white lead making, is cast in a mould so that the upper surface is exposed to the air, it is found that that surface presents different appearances according to the purity of the lead, the temperature of the mould, and other conditions. The surface is broken up into patches, each of which is a separate crystal. In large castings each crystal may be from an inch to many inches in diameter, and when the skin is stripped from such a solidifying mass it is seen that the skeletal octahedra beneath are differently orientated in each patch. When the facets of the octahedra are parallel to the surface, brilliant large flat planes result. When the points of the octahedra are at right angles to the surface, it presents a fern-like appearance. When the former are corroded, an hexagonal wreckage is produced, whereas the latter gives rise to a rectangular wreckage. The skeletal octahedra are not always parallel or at right angles to the surface, but sometimes variously inclined, giving rise to hexagonal or rectangular wreckage variously inclined.

In nearly pure lead the hexagonal and rectangular etched surfaces are of brilliant lustre, but never, so far as I have seen, present any pyramidal facets. When the lead is rather impure, the surfaces of the etched (negative) crystals are dull and pitted. But on either quality of lead brilliant crystals with pyramidal facets, such as Professor Miers has figured, may be formed, and I think arise from the redeposition of lead on the etched surfaces under certain circumstances.

Any one desiring to see these crystals may easily produce them as follows. Cast a small round button of nearly pure lead so that it resembles a flattened drop. Place it in an egg-cup flat side downwards, and so that there may be only a small space between the bottom of the button and the bottom of the cup. Fill the cup half full of water containing from 5 per cent. to 10 per cent. of nitric acid, and leave the whole at rest from 24 to 48 hours. Wash with water and examine under the microscope, using an inch or a half-inch object glass. Generally, but not always, a few patches of the brilliant crystals will be seen amongst the general patches of rectangular and hexagonal forms. They are easily recognised by their greater brilliance and more complex forms. I have many times seen the corners of cubes modified as Professor Miers has shown in Fig. 2. It is very interesting to see how the cubes and hexagons are related to one another.

I think these brilliant crystals, cubic and hexagonal, are formed by the electrolytic deposition of metal which is being dissolved away from the upper surface, exposed to nitric acid and nitrate of lead, and re-deposited on parts of the lower surface where the lead is exposed only to nitrate of lead; it is an instance of the deposition of metal from a circuit of two liquids and one metal.

I have seen very beautiful examples of the cubic and hexagonal structure in the "blue lead" resulting from the manufacture of white lead by the "Dutch process." In such cases the white lead detached from the blue lead, if examined under the microscope, shows perfect casts of the hexagonal and cubic structure of the corroded surface of the blue lead. They look like opaque crystals of white lead, but are only casts of the corroded surfaces.

Beautifully etched surfaces of lead may be formed by heating cast lead in a rather strong solution of nitrate of lead, and such surfaces generally have the rectangular and hexagonal structure more coarsely developed than I have otherwise seen it. It can then be seen by a $\frac{1}{4}$ inch hand lens.