

CLXIII. *On Struwite, a new Mineral.* By G. L. ULEX.

NUMEROUS crystals were found in digging out the ground of St. Nicholas church, in the middle of our town; the largest of which are about one inch long, and weigh from 1·4 to 1·8 grm. Their primary form is a right rhombic prism. [The admeasurements were made by Prof. Marx.]

M on M . . .	95° 10'
M on O . . .	132° 25'
O on P . . .	138° 25'
s on s . . .	63° 30'
h on t . . .	143°
h on h . . .	57° 10'

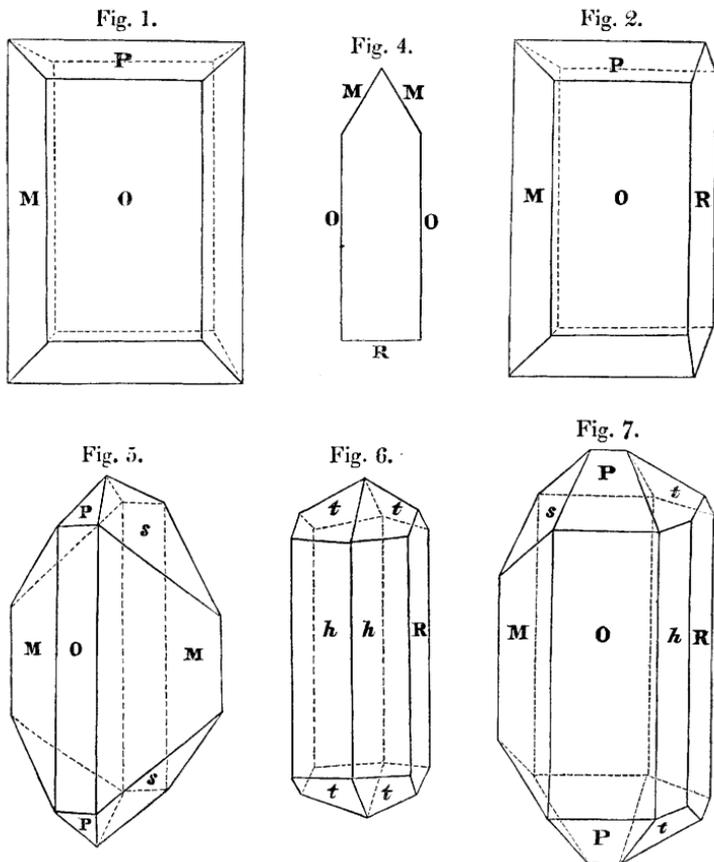


Fig. 1. Represents a crystal of struvite in its simplest form.

Fig. 2. The crystal as it most frequently occurs.

Fig. 4. A segment.

Figs. 5, 6. Crystals with some secondary planes, but generally only segments occur; the plane *s* on both sides large and distinct: the planes *h* and *t* very small.

Fig. 7. A view of the planes collectively as exhibited by some crystals.

They cleave parallel to the plane of *O*. A peculiarity in these crystals is, that they occur almost always in halves, and appear to have rested or been formed on planes which would have passed through the centre of the entire crystal. One of these natural segments is shown in fig. 2.

The crystals are transparent, and of a somewhat yellow colour; most of them inclose organic matter, and are thereby

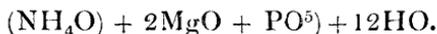
rendered more or less dark and opaque. They are harder than talc, but are scratched by gypsum. Their specific gravity is 1.7.

They are very sparingly soluble in water, and in consequence tasteless. When heated in a tube they give out much water and ammonia (the black crystals empyreumatic water and ammonia) without flying into pieces. When heated to redness, they exhibit the phenomenon of phosphorescence: the passing of *c* into *b*, phosphoric acid. Heated before the blowpipe they melt into a colourless glass, which on cooling forms a white enamel.

The constituent parts of the salt are phosphoric acid, magnesia, ammonia and water.

Dissolved in hydrochloric acid and precipitated by ammonia, they yield a sandy powder, which under the microscope exhibits the well-known form of the phosphate of ammonia and magnesia.

The salt loses by ignition 54.7 to 55.5 per cent. (the difference is caused by the small quantity of organic matter). The ammonia was estimated by means of the chloride of platinum; by dissolving the salt in hydrochloric acid, 6.9 to 7.1 per cent. of ammonia were found. The residue of 44.5 to 45.3 per cent. should be the same combination of phosphoric acid with magnesia as is contained in the phosphate of magnesia and ammonia, because if the crystals are dissolved in hydrochloric acid and precipitated by ammonia, the fluid which is filtered from the precipitate gives no reaction either with sulphate of magnesia or with phosphate of soda. It consists therefore of



The crystals are the same salt which is found in many animal secretions, and in putrifying urine.

The salt is not altered by the air. Mr. Graham has informed us, that if the artificial salt is heated to 212° F. it loses 10 at. of water and no ammonia. The natural crystals can bear a temperature of 248° F., and they give out the same quantity of water and no ammonia. The products of distillation were conducted into a solution of the nitrate of the protoxide of mercury, which was not blackened.

Concerning the locality where the crystals are found, we perceive below the upper strata, at a depth of 6 to 12 feet, a large quantity of cattle-dung mixed with straw, in a state of putrefaction. This passes by degrees into a black peat earth, which extends to a depth of 26 feet and rests upon gravel. The peat earth, of a thickness of 10 to 12 feet, consists of a homogeneous impalpable mass, mixed here and there with

small parts of vegetable remains (parts of grasses; *Sphagnum* and other mosses could not be detected). This is the true matrix of the crystals, in which here and there blue iron earth (protophosphate of iron or vivianite) is also found.

By drying in the air it loses 40–50 per cent. of water, and is not to be distinguished from the heavy black turf.

Water dissolves very little from it. The solution is of a light brown colour, without any reaction upon litmus. Heated, it gives off at first some ammonia; in other respects it smells and burns like turf, with a bright flame. The ashes which remain vary in weight from 20–30 per cent.; moistened with water it does not act upon litmus.

A quantity dried at 212° F. was subjected to analysis; 100 parts of it gave—

2·0	per cent.	soluble in æther (principally chlorophylle).
1·5	...	alcohol (principally resinous matter).
1·5	...	water (principally salts of humous acids).
36·0	...	liquor potassæ (principally humous acids).
36·0	...	organic residue (principally humine and vegetable fibrine).
23·0	...	inorganic residue, consisting of—
0·3	...	soluble in water (sulphate of potass and chloride of sodium, no phosphates of alkali).
11·5	...	soluble in hydrochloric acid (principally alumina and phosphate of magnesia and lime, less peroxide of iron and sulphate of lime).
12·2	...	insoluble in hydrochloric acid (sand; calcined with soda and decomposed by hydrochloric acid, it gave 11 silica, 1·2 alumina, and peroxide of iron).

The analysis shows that we have a humous mass, which has been formed from organic matters by putrefaction and decay. It is probable that these matters were principally the excrements of Herbivora; a presumption which is supported by the analysis of the ashes, from the quantities of phosphate of magnesia and lime.

The solid excrements of the Herbivora are characterized by abundance of phosphate of magnesia, and the deficiency of ammoniacal salts; the fluid excrements (urine) have, on the contrary, abundance of ammoniacal salts (from the decomposition of urea) and are deficient in earthy salts; relations which make it probable that the formation of such large crystals in such quantities (they occur in thousands) was caused

by a reaction of the urine upon the solid excrements, where the first gave the ammonia, the latter the phosphate of magnesia.

The locality where the crystals are found confirms this assumption. The place where St. Nicholas's church is built was occupied 800 years ago by the New Castle (Neue Burg), which was burnt and destroyed with the whole city of Hamburg, in 1072, by Kruko, tyrant of the Wenden. Now it is most probable that the ditch of the castle was used as a reservoir for rubbish and manure by the inhabitants of the new-built city, who preferred trade, as more profitable, to agriculture. So by degrees the ditch was filled, and covered partly with houses, and a small part of it formed till a late period an open dung-pit, which was emptied from time to time. The crystals are found principally below the dung-pit, and appear to be formed by the infiltration of urine through a soil consisting of vegetable matters.

The crystals forming a mineral which has never yet been described, are named *Struvite*, in honour of the minister Von Struve, well known to mineralogists, and highly meritorious from the great interest he takes in the advancement of science in the town of Hamburg.
