XVI.—*Note on the Phospho-cerite of Mr. Watts.*

BY EDWARD J. CHAPMAN, ESQ.

The object of this communication is to point out the apparent identity existing between the *Phospho-cerite*, so ably analysed by Mr. Watts, and a mineral discovered by Wöhler about three years ago, and named by him *Cryptolite*, from the Greek word *κρυπτος*, *concealed*.

This substance is contained, with several other minerals, in the rose-coloured apatite of Arendal, in Norway, and is obtained, according to Wöhler, in very minute hexagonal crystals, of a wine-yellow colour, by dissolving the apatite in nitric acid. It is associated with microscopic crystals of magnetic-iron-ore, hornblende, and an unknown substance, of a hyacinth-red colour, containing cerium.

The specific gravity of the cryptolite was found to equal 4·6, and its analysis furnished :

Phosphoric acid	. . .	27·37
Peroxide of cerium	. . .	73·70
Protoxide of iron	. . .	1·51
		<hr/>
Total	. . .	102·58

The excess arises from the protoxide of cerium, contained in the mineral, being converted by ignition into peroxide. If we calculate these results after the atomic weight of the mixed metals, cerium, lanthanum and didymium, the cryptolite may be considered a tribasic phosphate of the protoxide of cerium ($3 \text{ CeO}, \text{PO}^6$), and, as such, identical in composition with the phospho-cerite of Mr. Watts, allowing the cerium of Wöhler's analysis to be a mixture of the three metals.

Having stated to Mr. Watts my intention of offering a few remarks on the existing phosphates of these bases in reference to his phospho-cerite, that gentleman kindly presented me with a small quantity of the mineral for examination. It occurs, when separated from the Dannemora cobalt by nitric acid, in the form of a fine powder, consisting of crystalline grains, partly of a pale sulphur-yellow colour, and partly colourless; possessing a degree of hardness equal to 5.0 5.5, and exhibiting in an eminent degree, when examined by the microscope, a peculiar vitreo-resinous or adamantine lustre. The specific gravity, as determined by Mr. Watts, is 4.78.

The greater number of the grains have no definite form, their edges appearing more or less rounded; but here and there may be recognised, although by no means distinctly, certain crystals, of which, after a careful investigation, I have been able to make out the three following forms: first, a more or less acute octahedron, fig. 1;

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

secondly, a combination of that form with a four-sided prism, fig. 2; and thirdly, an octahedron with its apices replaced by apparently a single plane, fig. 3. Figures 2 and 3 shew that the octahedron is not a regular one, as all the edges in the one case, and the angles in the other, are not modified simultaneously; and from the general character of the crystals, I have been led to attribute them to the dimetric or square prismatic system. It must be confessed, however, that they do not present any visible modifications by which this deter-

mination can be rendered certain, and from their extreme minuteness, it is of course impossible to ascertain by measurement whether the prism be a right one or not. These forms, therefore, do not exclude the mineral from either the trimetric or monoclinic systems (prismatic and oblique-prismatic systems of Möhs), but they show incontrovertibly that it cannot belong to the hexagonal or rhombohedral group, as the prisms of that system of crystallization cannot possess four lateral planes.

In this lies the principal difference between the phospho-cerite and Wöhler's cryptolite. If the crystalline form of the latter belong to the hexagonal system, the tribasic phosphate of protoxide of cerium must be dimorphous; but, on the contrary, if it belong to the trimetric or monoclinic systems, the hexagonal crystals of Wöhler are easily accounted for, by the truncation of either the obtuse or acute lateral edges of the primary, giving rise to the two planes h^1 or g^1 (in the nomenclature of Levy and Dufrénoy), and thus forming a six-sided prism. I should here state, also, that on my first examination of the minute grains of the phospho-cerite, I fancied that I detected hexagonal prisms amongst them; but I found afterwards, that this proceeded from my having obtained a strong outline in relief of the little prismatic crystals, as they rested upon one of their lateral planes. If we take the outline of figure 2, for instance, it will present an hexagonal form, appearing thus, when viewed by transmitted light, like the base of a six-sided prism. See fig. 4.

If the phospho-cerite really belong to the dimetric system, it may be considered isomorphous with the tribasic phosphate of Yttria, the phosphyttrite of Berzelius; and I may mention, as a curious coincidence, that this latter mineral has lately been found associated like the phospho-cerite, with some of the Swedish cobalt ores.

Allowing the phospho-cerite and the cryptolite to be identical, the mineral kingdom would appear to possess two distinct phosphates of cerium, one of the protoxide, and one of the peroxide, the monazite or mengite of Mr. Brooke; this latter mineral causing the evolution of chlorine, when decomposed by hydrochloric acid. Considering, however, the fact, that the amount of phosphoric acid in these minerals, from four different analyses, by Mr. Watts, Wöhler, Erdmann, and Hermann, does not exhibit a difference of 1 per cent, and that the protoxide of cerium is very readily converted, by atmospheric causes even, into the peroxide, might we not be tempted to regard the monazite as an altered phospho-cerite, and to look upon the red grains, found by Wöhler with the cryptolite, as forming a transition from one to the other. The monazite, it is true, crystallizes in

the monoclinic or oblique-prismatic system, but this, I have shewn, is not incompatible with the forms assumed by the phospho-cerite, and the more so, as the angle M, M of the monazite, $92^{\circ} 30'$, closely approaches a right angle.

Exposed to the blow-pipe, the phospho-cerite vitrifies partially on the edges and surface, tinging the flame at the same time slightly green. With the usual blow-pipe re-agents, it presents the reactions of cerium, imparting, however, to the borax and phosphate of soda glasses, when cold, a pale violet-blue tint, either due to the presence of didymium, or to an admixture of a minute portion of the cobalt ore. With boracic acid and soft iron-wire, it produces a brittle globule of phosphuret of iron.