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ART. XVIII.— *Wardite: a New Hydrous Basic Phosphate of Alumina;* by JOHN M. DAVISON.

[Read before the Rochester Academy of Science on April 28, 1896.]

IN the number of this Journal for April, 1894, Mr. Packard describes and gives the analysis of massive variscite from Utah. Since then a considerable quantity of this mineral has been received by Ward's Natural Science Establishment, of Rochester, N. Y. It is in form of nodules and shows the mineral in several shades of green, and one specimen of pure milk-white color. Nearly all have the firm brownish-yellow outer coating and some show the variscite, altered to a softer whitish mineral, as described by Mr. Packard.

Occasionally decomposition of the variscite has left cavities in the nodules, and encrusting these cavities is an hydrous basic phosphate of alumina, which does not appear to have been hitherto described. It is of light green or bluish-green color, with vitreous luster, concretionary structure, hardness greater than variscite,—about 5—and specific gravity 2·77. Its concentric habit has, in places, developed an oolitic structure, resembling clusters of fine shot with rough surface. Tiny balls are found on the surface of the larger masses. A thin section shows that they have been buried in the mineral at all stages of its growth, giving a mottled appearance to the section.

Analysis of this mineral gave:

P_2O_5	34·46
FeO	0·76
CuO	0·04
MgO	2·40
Na_2O	5·98
K_2O	0·24
H_2O	17·87
Al_2O_3 (by difference)	38·25
	100·

The formula may be written: $P_2O_5.2Al_2O_3.4H_2O$, or $Al_2(OH)_3PO_4 + \frac{1}{2}H_2O$, or perhaps $AlNaPO_4.Al(OH)_3.\frac{1}{2}H_2O$.

This mineral, to which I would give the name of *Wardite*, in honor of Prof. Henry A. Ward, of Rochester, N. Y., would seem to come in series with

Peganite, $Al_2(OH)_3PO_4 + 1\frac{1}{2}H_2O$
Turquois, $Al_2(OH)_3PO_4 + H_2O$
Wardite, $Al_2(OH)_3PO_4 + \frac{1}{2}H_2O$

Before the blowpipe it swells, cracks open, rounds and turns white, giving a sodium flame. Yields water in the closed tube; gives hydrogen phosphide with the magnesium test; turns blue with cobalt nitrate. With borax in O. F. gives a clear bead; yellow, hot; colorless when cold, with perhaps a tinge of green if highly charged; opaque by flaming if saturated. When ignited it sinters. Partly decomposed by acids. Finely powdered and strongly heated with con. HCl or HNO_3 about 20 per cent. remained undissolved. This residue on ignition was pure white and entirely dissolved on further treatment with acid. But if the mineral was first ignited and then heated with acids, about 11 per cent. remained undissolved. This residue, on ignition, was white with a pinkish tinge and resisted further action of acids.

In course of this investigation analyses of variscite were made which closely agreed with those given by Mr. Packard. They did not, however, confirm the statement that, before ignition, variscite is insoluble in acids. When finely powdered and strongly heated for some time, it completely dissolved in either $HCl.HNO_3$, or H_2SO_4,—perhaps most easily in the last. Heated in fine powder for 40 hours to 100-130 C. variscite gave off 22·22 per cent. water, then over the blast-lamp for 30 minutes lost 0·50 more.

One interesting specimen shows the green variscite with its lower surface changed to a yellow alteration-product. On top, and seemingly running into the green, is a colorless radiate rosette, strongly resembling wavellite, but with rather stouter prisms. Imbedded in this rosette is a concentric mass of wardite, differing in form and color from both the variscite and the radiate mineral. Attached to another piece of superficially altered variscite was a nodule of the size and shape of a pea, itself covered with the same alteration product. Detached, it was found concentric in structure, having both white and colorless layers and hard enough to defy the point of a knife. It looked like chalcedony, but the alteration zone showed that it probably was amphithalite.