rather large possible errors of the results of such experiments; and for that purpose I used the material nearest at hand. In order, however, to prevent any further misapprehension, I desire to say that I fully concede Dr. Sturtevant's claim to priority; although, owing to the fact that the bulletins of the New-York station are to be had at first hand only through the press of that state, I was not aware, at the time my results were first published (Bulletin No. 3 of the agricultural experiment-station of the University of Wisconsin, June, 1884), that he had anticipated me by three or four weeks.

I fully appreciate his remarks regarding the value of recognition, on the part of science, of scientific work at experiment-stations, and should regret exceedingly to seem to fail of doing whatever in me lies to secure such recognition. The field of agricultural science is too wide, and the workers in it far too few, to justify any professional jealousy.

H. P. Armsby.

Madison, Wis., April 30.

Tertiary phosphates in Alabama.

Since the publication of my two notes in *Science* last year, respecting the occurrence of phosphates in the cretaceous formation of this state, we have found that they occur also at at least two distinct horizons in the tertiary formation.

This formation in Alabama shows the following well-marked subdivisions, given in descending order: —

Vicksburg . . . . . 175 (?) feet,	White limestone of Tuomey		Oligocene.
Jackson . . . . . 60 "			
Claiborne . . . . . 150 "	Claiborne,	Calcareous Claiborne of Hilgard,	Eocene.
Buhrstone . . . . 175–200 "		Siliceous Claiborne of Hilgard,	
Lignitic . . . . . 1,000 "	Lignitic and flatwoods of Hilgard,		

The upper of these two divisions consists mainly of limestones, called throughout the country, and by Professor Tuomey, the 'white limestone.'

The lower division consists of sands and clays, which make up the greater proportion of the thousand feet or more of the strata of this group; but interstratified with these are five or six, and perhaps a greater number, of beds holding marine shells, the aggregate thickness of which may perhaps be given at a hundred feet.

Mr. D. W. Langdon, jun., of the state geological survey, while on a collecting tour for Mr. T. H. Aldrich, made the discoveries to which this note is intended to call attention.

At Nanafalia, on the Tombigbee River, there is a remarkable series of beds, over fifty feet in thickness, made up almost entirely of the shells of a small oyster (Gryphaea thirsae). At intervals throughout this thickness are projecting indurated ledges, holding the same shells, but forming a tolerably compact rock. A specimen from one of these hard ledges, one or two feet thick, has been analyzed by Mr. Langdon, and found to contain 6.7 % of phosphoric acid. Other parts of the Gryphaea beds may be similarly phosphatic, but no analyses have yet been made to show it.

This Nanafalia marl, which occupies a position nearly in the centre of the lignitic subdivision, occurs also on the Alabama River, at Gullette's and Black's Bluffs, and crops out between the two rivers in the lower part of Marengo county, where its presence is indicated by limy spots, or 'prairies,' of very great fertility. This marl contains also a very considerable percentage of greensand, and, apart from the phosphoric acid which it contains, would have become a valuable fertilizer.

The other phosphate-bearing horizon is in the lower or Jackson division of the white limestone.

At the base of the orbitoidal limestone which forms the greater part of the bluff at St. Stephen's, Mr. Langdon finds a hard ledge of rock holding Plagiostoma dumosa, and immediately beneath this, and extending fifteen feet down to the water's edge, a glauconitic marl holding numerous nodules or concretionary masses of phosphate of lime, — an occurrence quite similar to that of the nodules in the cretaceous beds at Hamburg in Perry county, described last year. Mr. Langdon's analysis of the greensand marl holding the nodules shows 0.6 % of phosphoric acid, while a sample of the nodules analyzed contains 22.68 % of phosphoric acid.

On the opposite side of the river, in Clarke county, similar materials have been collected and analyzed. A greenish glauconitic sand, occurring some three or four miles north of Coffeeville, contains 1.76 % of phosphoric acid.

Fifteen or twenty feet above this marl, there is a yellowish-brown loam holding soft yellow nodular masses varying in size from one inch to eighteen inches in diameter, and containing 2.74 % of phosphoric acid. This loam is probably formed by the disintegration of the Jackson limestone, the age of the stratum being indicated by the specimen of Plagiostoma dumosa which it contains.

Again: near Grove Hill, in Clarke county, one of my students, Mr. S. S. Pugh, has collected a number of phosphatic nodules which contain 19.48 % of phosphoric acid.

Where the argillaceous limestones of the Jackson age form the surface, they give rise, in their disintegration, to the rich limy or 'prairie' soils which characterize my 'Lime Hills' region,[1] which occurs over a good part of the counties of Choctaw, Washington, and Clarke. It is more than probable that the exceptional fertility of the soils of this region is in great measure due to the presence of these phosphates. In the upper part of the white limestone (Vicksburg), I have not yet been able to detect any unusual proportion of phosphoric acid.

In this connection it may be interesting to note that Mr. L. C. Johnson, of the U.S. geological survey, has traced the extension of the Alabama cretaceous phosphate beds into Mississippi, along the line pointed out by me in one of my notes above referred to. The occurrences in Mississippi are quite similar to those already described in this state.

Eugene A. Smith.

University of Alabama, April 20.

[1] Report on cotton-production in Alabama, p. 52.