opinion as to the nature of the latter fraction. The efforts to isolate it for detailed study have not been successful thus far, but the work in this direction is continued.

The volatile acid given off, of which acetic is the more predominant constituent, does not represent a component part of the molecule. It is a decomposition by-product of the glucose. It is possible to lower greatly the yield of sugar by hydrolyzing chitin with strong acid or by raising the temperature or increasing the duration of the hydrolysis. A great evolution of volatile acid from the chitin will occur simultaneously. The very small quantity of acid formed even in the cold must be likewise attributed to the slow oxidative action of the strong sulphuric acid which must be used in order to dissolve the chitin.

Assuming that the empirical formula for chitin is correct (elementary analyses are in progress now to verify this) we may interpret the above facts in its light, without recourse to the hypothesis that the chitin molecule contains an acetyl group. If we assume that the chitin is a polymere of eight $C_6H_{15}NO_6$ molecules, this should yield on hydrolysis seven molecules of glucosamin, $C_6H_{13}NO_5$, one molecule of glucose, $C_6H_{12}O_6$, and one molecule of the yet unidentified nitrogenous fraction. As the amino groups are cleaved off in the hydrolysis, we get altogether eight glucose molecules to seven ammonia nitrogens and one residual nitrogen. Theoretically, then, the chitin molecule should yield 81.1 per cent. of glucose, and 87.5 per cent. of amino nitrogen and 12.5 per cent. of nitrogen in a stable combination. The facts obtained by hydrolysis agree remarkably with these theoretical expectations.

I could hardly enter here upon a discussion of the bearing of these results further than to say that monoacetylglucosamine, or for that matter monoacetyldiglucosamine, have no relation to chitin. They are secondary products, and are formed after the chitin molecule has been broken down by the action upon it of the sulphuric acid.

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OUTLIERS OF THE MAXVILLE LIMESTONE IN OHIO NORTH OF THE LICKING RIVER[1]

IT is well known to those familiar with Ohio geology that the Maxville limestone is the uppermost formation of the Mississippian System found in the Ohio scale, that its outcrop is limited in extent, patchy in character, and that the overlying Pennsylvanian beds rest upon it unconformably. Up to the present, all the known outcrops of this formation occur south of the Licking River in central Ohio and they lie in a belt ten or twelve miles wide, which extends from the above river on the north to the Ohio River on the south.

It has long been supposed that the formation once extended northward to northern Ohio and was removed by late Mississippian erosion. The supposition was based upon the presence of lime cobblestones more or less silicified which are found in places in the bottom of the Coal Measure basal conglomerate, and which were said to carry Mississippian fossils. Since no other Mississippian limestone was known to occur in the state, it was concluded the cobble stones must have been derived from the Maxville.

It is the purpose of the writer to (1) point out the northward extension of this limestone, to (2) throw further light on the origin of the cobble stones, and to (3) emphasize a reason for the absence of the limestone in northern Ohio.

Beginning at the Licking River various outcrops of this limestone were found as far as forty miles north of the city of Zanesville in a belt ten to twelve miles wide. They invariably occur in isolated patches, are unconformable with superjacent beds, vary in thickness from two to nine feet, and are clearly erosion remnants of a former continuous stratum. Where it is not weathered it presents the same blue-gray, fine-grained, compact character found far to the southward. In places it is fairly fossiliferous, and when fully weathered there remains a residual ocherous earth of deep yellow to chocolate color, mingled with silicious concretions. The latter weather

[1] Read before Section E, A. A. A. S., Columbus meeting, 1915.

nearly round, are usually yellowish to white in color, and generally carry fossils of coral, brachiopods, and bryozoans common to the limestone.

At many places between outcrops of the limestone occur beds of limestone cobbles which are more or less silicified and in all respects identical with those found in the disintegrating limestone. Furthermore, upon noting their elevations, these isolated beds of cobble stones are found to lie in the plane of the limestone—never above it, and only scattered or displaced cobble stones are found below the plane. These facts point unmistakably to the limestone as the source of the cobbles and bear evidence of the former presence of the limestone at all points where these beds occur.

Wherever the Mississippian-Pennsylvanian contact dips much below the plane of the Maxville limestone, little or no trace of the limestone was found. Where the contact is not far below this plane, silicified cobble stones are often found in the base of the Coal Measure basal conglomerate which are identical with the residual cobbles of the limestone. Within the belt considered the contact sometimes falls 100 feet or more below the Maxville plane and all such places have been found to be clearly defined valleys which trenched the Mississippian surface.

It is now known that the Maxville limestone is found two thirds of the distance across the state with strong probability of still further extent formerly.

The Berea sandstone, lying at or near the base of the Mississippian system, is an excellent datum plane. Using it for this purpose in the general direction of the Maxville outcrop, it is found that the Berea-Maxville interval increases northward. In Vinton County, in the southern part of the state, the interval between the top of the Berea and the top of the Maxville is about 650 feet; at Rushville, in the eastern Fairfield County, about 800 feet; at New Castle, in Coshocton County, about 840 feet; near Killbuck, in southern Holmes County, about 870 feet; and twenty miles north of the last point in central Wayne County east of Wooster a thickness of 900 feet of shale and sandstone above the Berea does not quite reach the Maxville horizon. Northward from Wayne County the total thickness of the Mississippian strata decreases notably, due to greater erosion in late Mississippian time. In northeastern Ohio the Pennsylvanian beds lie, commonly, only about three to four hundred feet above the Berea, and in the old Mississippian river valleys, so clearly defined in this area, the Sharon conglomerate sometimes lies but 100 feet above the Berea. These thicknesses are clearly far below the Maxville horizon.

Central Wayne County is about fifty miles from Cleveland and 150 from Portsmouth on the Ohio River, the region of the southern outcrops of the Maxville. If the plane of the Maxville be projected northward to Cleveland with the slowly increasing interval between it and the Berea, the Maxville would lie about 1,050 feet above the Berea.

In the light of these facts it is apparent that the Maxville will not be found in northern Ohio, and that outcrops may not be expected beyond northern Holmes, or central Wayne County.

It will be noted further that these figures reveal the interesting fact that the Mississippian system thickens northward, although thinnest in the north now as a result of erosion.

Mount Union College G. F. Lamb

A METHOD FOR MAINTAINING A CONSTANT VOLUME OF NUTRIENT SOLUTIONS

With plant experiments involving the use of various nutrient solutions it is important that there should be no undue loss of solution due to evaporation or the taking up of the solution by the plant, as it has been shown that an increase in concentration due to a loss of water by evaporation or transpiration may seriously impair results.

To save time in refilling the culture vessels to a constant volume the following simple method has been devised. It works automatically and keeps the solution at a constant level, and the only attention required is to refill the reservoir when empty.

A drawing will show the arrangement of the device, which consists of a flask or bottle of