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THE NEW GEOLOGICAL MAP OF PENNSYLVANIA.

BY J. B. WOODWORTH, HARVARD UNIVERSITY.

THE *chef d'œuvre* of a *geological survey* is the map. It is a graphic story of the results achieved by the corps engaged in its construction, and shows by a glance wherein progress has been made in defining the limits of the natural resources of a state, in interpreting the age of its rocks, and in establishing the relations of these rocks one to another. It is a bird's-eye view of the geological history of the area, and is an indispensable adjunct of the accompanying report.

The Second Geological Survey of Pennsylvania, under the direction of the venerable geologist, Prof. J. P. Lesley, has brought its results together in the form of a final report of which the first volumes and the map have appeared. The map, dated 1893, is in four sheets on the scale of six miles to the inch, and was made by A. D. W. Smith, assistant geologist, under the direction of Professor Lesley. It is drawn on a polyconic projection, and the data were the county maps published between 1874 and 1892, together with other special maps of particular areas. The original map, so it is stated in marginal notes, was drawn on a scale of two miles to an inch and reduced by photography by Julius Bien & Co. to six miles to an inch.

The legend contains twenty-two blocks of color, two of which have overprints to indicate trap and a limestone bed, respectively. The formation column is as follows:

POST-TERTIARY.	
	Alluvium.
	Terminal moraine.
CRETACEOUS.	
	Potter's and Fire Clay and Sands.
TRIASSIC (Mesozoic).	
	Trap, Red Shales and Sandstones.
CARBONIFEROUS.	
XVII.	Greene County Measures.
XVI.	Washington County Group.
XV.	Monongahela River Coal Measures.
XIV.	Pittsburgh Measures.
XIII.	Allegheny River Coal Measures.
XII.	Pottsville Conglomerate.
XI.	Mauch Chunk Red Shale.
X.	Pocono Sandstone.
DEVONIAN.	
IX.	Catskill.
VIII.	Chemung. Portage. Genessee. Hamilton. Marcellus. Corniferous.
VII.	Candagalli Grit. Oriskany Sandstone.
VI.	Lower Helderburg Limestone.
SILURIAN.	
V.	Salina. Niagara. Clinton.
IV.	Medina. Oneida.
III.	Hudson River. Utica.
II.	Trenton Limestone. Chazy Limestone. Calciferous Sandstone.
CAMBRIAN (including lower Calciferous).	
I.	Quartzite.
	Slate. Phyllite. Serpentine. Gneiss.
LAURENTIAN.	
	Gneiss.

The coloration is very similar to that employed in the "Geological Hand Atlas, Report of Progress X.," which appeared in 1885, and, as in the case of that set of maps, the topographic base is omitted. While this omission leaves the colors without the variable shading of contour-lines, which is an obvious advantage where many shades of color have to be used, it detracts from the value of the map since the student cannot infer from the breadth of outcrop alone the relative thickness of a given formation. Where the outcrop is contoured, the inclination of the surface affords the trained map-reader more satisfaction.

The mother geological map of this state was published in 1858 by H. D. Rogers, from surveys made between 1836 and 1857. The eccentricity of the nomenclature applied to the rocks makes this map well-nigh unintelligible to geologists of the present day. From this first general map to the hand-atlas of 1885 was a great step, embodying the results of the first ten years of the second survey. It is interesting to note that in the present final map many minor changes in the limitation of formations have been introduced.

It is always fair to test a map by matching its boundaries with those of adjacent areas, surveyed under different auspices. The geological map of New York on the north is by no means a contemporary of the present high-grade map of Pennsylvania, and be it said, to the chagrin, not of the geologists and palæontologists of the Empire State, but of the legislators and the people, the state has no map comparable to that of the coal commonwealth. New Jersey has a geological map the matching of which with the state across the Delaware is attested by the map under discussion, on which the Palæozoic and Archæan rocks of northern New Jersey adjacent to Pennsylvania are shown in continuous bands. Of Delaware little can be said, but Maryland on the south has, through the enterprise of Professors G. H. Williams and W. B. Clark, a geological map which, when matched along the Pennsylvania-Maryland line, brings out the single glaring defect in the beautiful chart of Pennsylvania's banded terranes. Where, between the meridians of 77°20′ W., and 77°30′ W., on the northern map the legend reads "Quartzite," the southern more accurate map shows broad fields of ancient basalts (diabase) bordered by a little Cambrian sandstone.

The three maps, of New Jersey, of Pennsylvania and of Maryland, should be in the outfit of every school where geology is taught. The student who would know how a great mountain range is constructed needs to make out a section of Pennsylvania from the ancient crystallines near South Mountain westward across the folds and faults of the Appalachians and the Alleghenies to the shores of Lake Erie. The sheets of this map brought together and mounted form an instructive wall map for class use. Both the teacher and the field student of geology must thank the author of that other memorial of Pennsylvania's history, "The Manual of Coal and its Topography," for this latest contribution to the literature of the science.

THE SYNTHETICAL POWERS OF MICRO-ORGANISMS.—II.

BY O. LOEW, UNIVERSITY OF TOKIO, JAPAN.

WE have in a former communication considered the sources of carbon for the formation of proteids, *i.e.*, for the increase of protoplasm and multiplication of microbes. The sources of nitrogen for the microbes are just as manifold. Not only salts of ammonia and nitrates, but also organic compounds of the most different structure may serve; thus: amines, amides, derivatives of urea and guanidin amidoacids and organic cyanides, *e. g.*, methylamin, acetamid, hydantoin, kreatin, glycocoll, leucin, asparagin, methylcyanide. Of inorganic combinations ferrocyanide of potassium is but a poor source of nitrogen, whilst hydroxylamin and diamid are entirely unfit for use, being very poisonous.[1] Nitrites are less favorable sources than nitrates, and the nitrates are more quickly reduced to ammonia than the somewhat poisonous nitrites.[2]

It seemed to me an interesting question how this reduction of nitrates to ammonia is carried on without the aid of nascent hydrogen; in chemistry this process could thus far not be properly explained. Evidently the living protoplasm, with its atomic motions, was engaged in this process, and I succeeded finally in applying platinum black with an aqueous solution of glucose and potassium nitrate, heating the mixture several hours upon the water-bath, in bringing about this transformation,[3] which may be expressed by the following equation:

$$\underbrace{C_6H_{12}O_6}_{\text{glucose}} + \underbrace{NO_3K}_{\substack{\text{potassium}\\ \text{nitrate}}} = \underbrace{NH_3}_{\text{ammonia}} + C_6H_7KO_8 + H_2O.$$

The peculiar kind of molecular motions in the platinum black transferred upon the molecules of sugar and nitrate brought about an exchange of hydrogen and oxygen atoms, ammonia being formed on the one hand and an organic acid (which was not closely examined) on the other. We call such processes katalytic.

The action of light is not necessary for the reduction of nitrates by bacteria or by any other plant cell. That the nitrogen is not taken as such from the nitrates for the synthesis of the proteids, but that it must be connected first with hydrogen, is shown by the nature of the ordinary proteids which contain about one-third of their nitrogen in form of amido groups.[4]

The different nitrogenous compounds in serving for assimilation of nitrogen (as methylamin, leucin, kreatin, etc.) must evidently be decomposed first with production of ammonia before the synthetical work can begin. This decomposition by the aid of the living protoplasm can take place either under reducing influences or under oxidizing ones, or by the action of water, according to the chemical nature of the nitrogenous substance; as for example:

$$\underbrace{H_2N-CH_2-COOH}_{\text{glycocoll}}+H_2=NH_3+\underbrace{CH_3-COOH}_{\text{acetic acid}}.$$

or:

$$\underbrace{CH_3-NH_2}_{\text{methylamin}}+3O=CO^2+H_2O+NH_3$$

An interesting fact in regard to the assimilation of nitrogen is the faculty of assimilating atmospheric nitrogen, of the leguminous plants, after their roots entered in symbiosis with certain kinds of bacteria, as was shown by Hellriegel. Also in this case, however, the gaseous nitrogen is not directly used for the synthesis of proteids, it must be first converted into an ammonia compound, most probably into ammonium nitrite by those bacteria.

$$N_2+2H_2O=NO_2.NH_4$$

Also this process may be imitated, as I have demonstrated, if platinum black in presence of gaseous nitrogen or air is moistened with caustic lye.[5]

In regard to the assimilation of sulfur it is also found that very different combinations can be used; thus sulfates and sulfites, methylsulfide, sulfonic acids, as, for instance, taurin, sulfones like sulfonal, etc. Evidently there must be also here formed at first a suitable group before the sulfur can enter into the forming albuminous molecule. If we consider that the sulfur can easily be split off from proteids (in part at least) in the form of sulfuretted hydrogen and that the entire character of proteids leads us to the conclusion that the sulfur is contained in them in the shape of the hydrosulfyl group, then it becomes highly probable that H_2S is the combination first formed from all the different sources of sulfur. The sulfates must be therefore *reduced* for the assimilation of sulfur. I have shown, also, here, how such a process can be performed katalytically:[6] if we heat a solution of oxymethyl sulfonate of sodium with platinum black and carbonate of sodium we can soon observe the formation of sodium sulfide. This process is certainly a very interesting sort of reduction, and may be expressed by the following equation:

$$2\ (CH_2OH-SO_3Na)+Na_2CO_3=Na_2S+SO_3Na_2+ \\ CH_2O_2+2\ CO_2+2\ H_2O$$

Our considerations have led us to the conclusion that formic aldehyde, ammonia and sulfuretted hydrogen are the immediate material for synthesis of albuminous matter or proteids. A clue what way the synthesis may take is furnished by the decomposition of proteids taking place under certain conditions in the higher plants, whereby asparagin is formed in very large quantities. On the other hand we find that asparagin is rapidly converted into albuminous matter in presence of sulfates and glucose. Therefore the most probable conclusion is, that the asparagin is first converted into a substance, capable of yielding albumen by a so-called condensation process and that this substance must be the aldehyde of asparaginic acid. Albuminous substance would thus be formed in a nearly analogous process to the formation of sugar from formic aldehyde. I have demon-

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[1] Compare O. Loew, "A Natural System of Poisonous Actions," Munich, 1893.

[2] O. Loew, Biol. Centralblatt, vol. x., p. 588.

[3] Berichte der D. Chem. Ges., vol. xxiii., p. 675.

[4] O. Loew, *Journal f. Prakt. Chem.*, vol. xxxi., p. 134.

[5] Berichte d. Deutschen Chem. Ges., vol. xxiii., p. 1443. The assertion of Schoenbein, that ammonium-nitrite is formed in small quantities, on evaporation of water in contact with air, was shown to be erroneous by A. Baumann and Neumann.

[6] Ber. d. D. Chem. Ges., vol. xxiii., p. 3125.