new elements. This objection would be much weakened by using Hp, Hd for *H. protium, H. deuterium.* It could be entirely overcome by using $H^p$, $H^d$, or better by the simpler symbols $H\pi$, $H\delta$. These would at the same time make a clear and obvious distinction between the genus or element symbol H and the species or isotope symbols $\pi$, $\delta$. Still simpler would be $\Pi$, $\Delta$. Their use would not seriously violate ideal (2), since the Greek letters would make it clear that we were dealing with isotope, not element symbols. $\Pi$ and $\Delta$ would be easy to pronounce, and would ordinarily add little or nothing to the cost of typesetting, either in ordinary or in structural formulas.

Returning to nomenclature, one wonders whether such names as ammonia, methane, benzene should refer to $N\Pi_3$, $C\Pi_4$, $C_6\Pi_6$, or to $NH_3$, $CH_4$, $C_6H_6$. This is of importance because we expect soon to be able to experiment rather freely with mixtures of varied isotopic composition. It would seem logical (ideal 2) to use "benzene" as a generic name for all the isotopes and their mixtures. On the other hand, a simpler nomenclature (ideal 1) can be developed if we regard $C_6Hp_6$ as the orthodox benzene, from which isotopes can be obtained by various substitutions of Hd for Hp.

It seems likely that the two view-points may be combined in a practicable way somewhat as follows. The terms benzene, ammonia, *m*-dinitrobenzene, etc., will be used in a generic sense, covering the ordinary present-day materials as well as other isotopic mixtures. At the same time a more specific nomenclature, somewhat as follows, will be used in cases where the isotopic composition is known and is important: $N\Pi_3$, protiumammonia; $N\Pi_2\Delta$, deuteroprotiumammonia; $N\Pi\Delta_2$, dideuteroprotiumammonia; $N\Delta_3$, trideuteroprotiumammonia. In order to avoid constant repetition of the word protium, the brief letter $\Pi$ or $\pi$ could be used instead: $\Pi$-ammonia, deutero$\Pi$-ammonia, etc. Complete omission of the word protium or $\Pi$, while allowable if the context leaves no doubt as to what is meant, would in some cases lead to confusion or at least make understanding more difficult, and should therefore not be indulged in too freely.

Just as logical as the preceding would be the scheme $N\Delta_3$, deuteriumammonia; $N\Delta_2\Pi$, protodeuteriumammonia, and so on (abbreviations $\Delta$-ammonia, proto$\Delta$-ammonia, etc.). In these schemes, there seems to be no danger of confusion between the prefixes protium- and proto-, or deuterium- and deutero-, if each is used consistently in a definite way. It is entirely natural to use proto-, deutero-, like nitro- in nitrobenzene, in order to refer to substitutions made in an initial or standard substance. The nouns protium, deuterium, on the other hand, are used descriptively in much the same way as "house" or "sheep" in houseboat or sheep-ranch. Protiumbenzene means all-protium benzene (no deuterium) just as sheep-ranch, strictly interpreted, means all sheep (no cattle).

Both the above schemes might be used interchangeably, but it would probably be wiser to keep to a single set of standard names. Preference would naturally be given to the first scheme, except that perhaps one might adopt deuteriumammonia, etc., from the second, for the pure $\Delta$ compounds.[4]

Thus we should have: $\Pi$-ammonia (*i.e.,* protiumammonia), deutero$\Pi$-ammonia; $\Pi$-benzene, deutero$\Pi$-benzene, *o*-, *m*- and *p*-dideutero$\Pi$-benzene, . . . hexadeutero$\Pi$-benzene or deuteriumbenzene ($\Delta$-benzene). Further: chloro$\Pi$-benzene, *m*-deuterochloro$\Pi$-benzene; $\Pi$-methyl chloride, deutero$\Pi$-methyl chloride: *cis*-dideutero$\Pi$-ethylene; $\Pi$-chloroform, deutero$\Pi$-chloroform or $\Delta$-chloroform. The use of $\Delta$- as a prefix may be open to some objection because $\delta$- is frequently used for another purpose in organic chemistry.

It has been proposed[5] that "deuton" be replaced by "diplon" for the $H^2$-particle, and deuterium by diplogen for the $H^2$ atomic species. Although a close relation between particle and species names (*cf.* proton and protium) has advantages, it does not seem essential, especially since the names are used in quite different fields of research. Moreover, strong objections exist to diplogen, since its ending could suggest oxygen or nitrogen just as well as hydrogen. The set of names hydrogen (H), protium ($\Pi$), diplogen ($\Delta$) is recommended by no good systematic argument. Better would be hydrogen, (hydro)protium, (hydro)diplium. There seems, however, to be no sufficient reason for giving up "deuterium" even if deuton is replaced by diplon, H2-particle, or some other name.[6]

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## TALUS SLOPES OF THE GASPE PENINSULA

THE Syracuse University Museum of Natural Science maintained a group of scientists in the field during the months of July and August. The members carried on collecting activities for the museum in the various branches of natural science and pursued scien-

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[4] Another scheme would be to use hexaprotiumbenzene, deuteriumpentaprotiumbenzene, and so on, but it seems unnecessary to go to such lengths for the sake of ideal 2. In some cases, *e.g.,* diprotiumwater, protiumdeuteriumwater, diprotium, this scheme would be fairly simple, but it would nevertheless make less confusion if it were avoided, especially since the alternatives ($\Pi$-water, deutero $\Pi$-water, $\Pi$-hydrogen) are also simple.

[5] *Cf.* SCIENCE, 79, 26, 1934; Lord Rutherford, *Nature,* 132, 955 (1933).

[6] A simple although meaningless name would be delton; the corresponding species name (hydro)deltium would also be not unpleasant.

tific studies in their respective fields. The area selected for field study was the Gaspé Peninsula in the northeastern portion of the province of Quebec, Canada. It was my privilege to carry on a part of the geological studies in conjunction with Dr. E. T. Apfel, of the geology staff of Syracuse University, and curator of geology in the Syracuse University Museum of Natural Science.

The talus slopes of the northern coast of the peninsula presented an interesting study. The angle of rest of coarse materials does not usually exceed 35 degrees. However, the slopes along the north coast of the Gaspé Peninsula exceeded this dip generally.

The best-developed slopes were in the section of the northern coast between the villages of Mont St. Pierre and Rivière Madeliene. Through this section, the towering cliffs of the Ordovician limestones, shale and sandstones, attaining altitudes of more than 300 feet, rise abruptly from the highway bordering the St. Lawrence River. The talus slopes at the base of these cliffs have angles of slope from 36 to 40 degrees. The lesser angle was only encountered once, all other slopes ranged in dip from 38 to 40 degrees.

The material comprising the slopes was for the most part made up of angular, elongated calcareous slate fragments. They were sufficiently stable so that the slopes could be walked upon, with but little disturbance of the material comprising them.

At Cap Gros Morue, fifteen miles west of Rivière Madeliene, the slope assumed an angle of repose of 36 degrees. This particular slope was limited to about 20 yards along the road. Immediately adjoining this part, the slope increased to 38 degrees. In both instances the height of the slope was approximately 70 feet. A hundred yards east, the slope displayed had an angle of 40 degrees and a height of 150 feet. This particular slope was exceedingly firm. Walking across its surface, very little material was disturbed, other than that on the immediate surface. The talus consisted in the main of particles of calcareous shale with slate, ranging in size from ½ inch to 5 inches in length with the intermediate sizes, 1 to 3 inches, predominating.

Two hundred yards west of Cap Gros Morue, the slope measured 39 degrees and the same characteristics prevailed as at those noted farther to the east. About 200 yards west of Mont St. Pierre, a talus slope borders the road for 400 yards and rises 175 feet above it. The angle of rest here was 39 degrees. Readings were taken at several points over the surface of the slope and carefully checked.

Other slopes were studied along the face of the cliffs on the northern coast and all were found to have angles of repose of 38 to 39 degrees, including the smaller slopes. The locations of the smaller slopes are not given here, as the most significant portion of the northern coast, in as far as the talus slopes are concerned, has been described.

It seems singular that an area in which so many talus slopes occur should contain so many with an unusually high angle of rest; also the absence of slides in an area of this nature commands attention.

A close examination of the slopes disclosed the fact that each fragment, resting with its long axes parallel to the dip of the slope, was overlapped by the preceding one forming an end drag on each piece. The arrangement was so orderly that, viewed as a whole, it gave the appearance of having been laid by hand. The enechelon arrangement of the fragments and the elongated manner in which the rock weathers apparently accounts for the compactness and rigidity of the slopes.

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## FURTHER EVIDENCE ON THE AMAZING LONGEVITY OF BACTERIA

IN 1931[1] I published an account of experiments which demonstrated the existence of living bacteria in anthracite coal from Wales and from Pennsylvania. Shortly thereafter[2] there appeared an article by the distinguished German bacteriologist, R. Lieske, in which results of similar studies by him (antedating mine but unknown to me when my work was in progress) give complete concordance with my results and important supplementary data besides. Lieske and I differ only in regard to the explanation of how the bacteria have survived in the coal for untold ages. He believes that the coal bacteria carry on a weakly vegetative existence there, whereas I believe that they exist in a resting stage in the coal and either do not respire at all or only with extreme slowness. I still believe that my hypothesis is correct. But the purpose of this note is not to discuss hypotheses which I shall treat more adequately elsewhere, but to call attention to a great mass of additional experimental data which I have obtained by another method of attack on the problem of longevity of bacteria. Since it may be some time before my extensive data on these newer studies can be published I give a few of the results herewith.

One of the objections made to my work on anthracite coal and on other ancient rocks is that the small numbers of bacteria which I found in such materials always suggest the question of possible invaders or contaminants. I have, I think, shown this criticism to be invalid, but to strengthen my position and render more plausible my contention respecting the

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[1] *Jour. Bact.*, 22: 3, September, 1931.

[2] *Biochem. Zeitsch.*, 250: 1–6, July, 1932.