It has been felt that the characteristics of these geographic areas can best be illustrated by the use of mammals and birds, so that but few invertebrates and no fishes or reptiles have been used in these displays.

The great systematic mammal hall has been considerably rearranged and plate glass has been substituted for the older small panes in many cases.

In the gallery of this hall an entirely new synoptic collection of birds has been selected to show the principal representative types of the several groups with their skeletons in many cases. Mr. Griscom has prepared excellent descriptive labels for each family.

The old hall devoted to corals has been entirely rearranged as an Alexander Agassiz Memorial Coral Reef room, in which Mr. George Agassiz has placed a tablet with this wording:

To
ALEXANDER AGASSIZ
1835–1910
who developed this museum
founded by his father
and
who devoted much of the latter portion
of
a varied and preeminent
scientific career
to the study of Coral Reefs and their faunae
this room is dedicated

Here are to be found the beautiful models of the coral islands, Borabora and Funafuti, and a selection of fish and invertebrates characteristic of the coral reefs.

In one room, by assembling all the mounted reptiles formerly scattered about in several exhibits, it has been possible to make a reasonably adequate synoptic collection of reptiles and a less adequate synopsis of the amphibia. No alcoholic reptiles remain on exhibition.

The same thing has been done with respect to the fishes. By this means it has been possible to remove all the myriad bottles of shrunken and discolored alcoholic fishes from exhibition. The species formerly exhibited have been discarded and those which were valuable have gone to the study collection.

The last hall of this floor is devoted to a carefully selected synoptic series of all the invertebrate groups. Since nearly every member of the staff joined in selecting types for this collection it is probably unrivaled for completeness and is especially adapted to the use of undergraduates taking the introductory courses in zoology.

The paleontological collections are still in process of rearrangement and much new vertebrate material, useful for teaching, will be installed during the next few months. In the meantime these collections are as yet only in part open to the public. When completed the most striking exhibit will be the Pleistocene group from the Argentine Pampas. This will consist of three of the large ground sloths, a glyptodon and toxodon. They are all perfect specimens and no restoration of any part has been made. Other noteworthy exhibits will include a group of saber-tooth tigers, two of them complete skeletons, the large collection of Paleozoic, Mesozoic and Tertiary fish, and a nearly complete specimen of *Dinichthys terrelli* now being reconstructed. There will be a systematic invertebrate room in which the collections of trilobites and cephalopods are particularly complete.

SPECIAL ARTICLES

A DETERMINATION OF THE ATOMIC WEIGHT OF NITROGEN OCCLUDED IN FERGUSONITE

IN 1890, while working on the occurrence of nitrogen in uraninite, Hillebrand[1] made complete analyses of many samples of the mineral. From the data furnished, it is interesting to calculate the strikingly constant ratio between nitrogen and uranium oxide (UO_2) in the various samples. That Hillebrand was aware of this constant ratio is made evident by a brief reference to it in the article cited; however, he attempted no explanation of it.

Calculations made on uraninite from Norway:

Place	% N	% UO_2	Ratio N/UO_2
Annerod	1.23	48.25	.0255
Elvestad (a)	1.28	50.97	.0251
Elvestad (b)	1.28	50.83	.0252
Skraatorp	1.05	44.57	.0236
Huggenaskilen	1.08	43.56	.0248
Arendal	1.26	44.71	.0282

Because of the constancy of the ratio shown here, it occurred to us that there might be some relation between the origin of the nitrogen and the other elements present.

The periodic table was examined, and it was observed that there was a possibility for a relationship between potassium and nitrogen, potassium undoubtedly being one of the radioactive elements.

So far none of the alkali metals have been found to emit α-particles; however, it may be that α-particles are emitted but are too slow for detection. At any rate, R. J. Strutt[2] found that several beryls had a helium content far greater than that expected from the

[1] U. S. Geo. Sur. Bull., 78: 43, 1891.

[2] *Proc. Roy. Soc.*, A, 80: 587, 1908.

content of radium or thorium compounds; so it seems quite possible that the alkali earths may emit α-particles which have not yet been detected.

Evidence for a possible relationship between potassium and nitrogen: There is a difference of twelve in their atomic numbers, which might indicate six α-ray changes between the two, and a difference of approximately twenty-five in their atomic weights, while six α-ray changes would call for a difference of only twenty-four in the atomic weights. The question which then comes up is: might not this discrepancy in the atomic weights indicate the existence of an isotope of nitrogen which would have the atomic weight fifteen, and be a decomposition product of potassium? It might be argued that it is just as likely that nitrogen is a decomposition product of an isotope of potassium of atomic weight thirty-eight. The objection to this is that, so far, all indications of positive-ray work show that the isotopes of potassium are above forty. Then there seems to be a possibility for the existence of isotopic nitrogen which is a decomposition product of potassium, six α-ray changes having occurred between the two.

(Because of the availability of a sample of natural ammonia alum, atomic weight determinations of the nitrogen present were made. The method of making these determinations will be described a little later. A control sample was run in parallel. Four determinations each of the alum-NH_4Cl and of the control-NH_4Cl indicated a variation of only 0.05 per cent. in the atomic weights of the two, a variation well within the limits of experimental error.)

Several nitrogen-containing minerals were obtained in which it was thought that the nitrogen might be of radioactive origin. Apparatus essentially like that employed by Hillebrand[3] was used to extract gas from these minerals, with the following results:

(Gas volumes are at standard conditions; CO_2 removed)

Mineral	Origin	Cc of gas found per gram of ore
Uraninite	Pribram, Bohemia	1.30
Fergusonite	Arendal, Norway	3.00
Samarskite	Mitchell County, North Carolina	3.68
Uraninite	Yancy County, North Carolina	2.26
Fergusonite	Near Bluffton, Texas	3.44
Fergusonite	Madagascar	1.33
Uraninite	Saxony	1.38
Uraninite	Kristianaford, Norway	3.32

It was decided to use the gas for nitrogen atomic weight determinations which was found in the Fergusonite from Arendal, Norway. This was found on analysis to contain 12.67 per cent. of helium. 1,800 cc of gas were obtained.

The method of fixing the nitrogen in the gas was similar to that described by Maquenne,[4] in that hot metallic calcium was used to absorb the nitrogen, forming calcium nitride, Ca_3N_2. Maquenne suggests that pure calcium oxide with three fifths its weight of metallic magnesium be heated together in a stream of the gas to be fixed. The calcium oxide and magnesium will react together to form metallic calcium; however, the authors had better success when they used metallic calcium directly. This was sealed into a combustion chamber through which a stream of the gas passed as described in the article by Maquenne.

At the completion of the reaction, the tube containing the calcium nitride was cut open and the nitride placed in a *dry* distilling flask, water was added a few drops at a time, and the ammonia hydrolyzed off. This ammonia was distilled into a little less than the calculated amount of hydrochloric acid necessary to neutralize it, in order to make certain that there would be no excess of hydrochloric acid left. The solution of ammonium chloride thus obtained was made alkaline, and the ammonia distilled off once more, in order that the sample might be further purified. Because of the losses attendant on sublimation, it was decided to let these two distillations serve in purifying the sample. This decision was reached only after repeated trials, and comparisons with samples which had been sublimed indicated that these two distillations would be satisfactory. The solution was then evaporated down, and crystals of ammonium chloride were obtained. These were dried slowly in an oven at 80° C. It was necessary to make this drying slowly and carefully at a low temperature, otherwise sublimation would have taken place before complete drying; in that case decomposition would have occurred, and the ammonia being more volatile would have passed off, leaving an excess of hydrochloric acid. This would have invalidated completely the atomic weight determinations.

One and one half grams of the pure ammonium chloride were obtained, the chlorine determined gravimetrically, and the atomic weight of the nitrogen calculated from this. Corrections were applied in order to obtain weight *in vacuo*. Nitrogen for a control sample was prepared by passing vapors of liquid ammonia mixed with air over a mixture of hot copper oxide and metallic copper; this nitrogen was then fixed and purified as described above.

Because of the smallness of the sample of "Norwegian" ammonium chloride, it was necessary to recover the ammonia from the filtrates from the silver chloride, repurify and reanalyze it.

[3] U. S. Geo. Sur. Bull., 78, 1891.

[4] *Comptes Rendus* 121: 1,147, 1895.

The following results were obtained.

Atomic weight of nitrogen from "control" NH_4Cl	Atomic weight of nitrogen from "Norwegian" NH_4Cl
1. 13.983	5. 13.987
2. 13.994	6. 13.983
3. 13.981	7. 13.991
4. 13.974	8. 13.953*
Average 13.984	Average 13.987

* Analysis No. 8 was not included in the average. The analysis of this was unavoidably made a day later than the others; it was feared that the sample had taken up moisture from the air in the weighing bottle. The result would indicate this.

The "Norwegian" ammonium chloride gave an atomic weight of the nitrogen only 0.02 per cent. greater than that of the control. Since this is well within the limits of experimental error, the possibility of the existence of an isotope of nitrogen of atomic weight fifteen is disposed of here.

Conclusion: Although no indication of an isotope was found in the samples of nitrogen examined, it is hoped that the search can soon be extended to nitrogen from other sources.

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THE NATIONAL ACADEMY OF SCIENCES

THE National Academy of Sciences held its autumn meeting at Schenectady, New York, on November 19, 20 and 21.

The academy was welcomed by Dr. Charles Alexander Richmond, president of Union College, and Dr. Willis Rodney Whitney, vice-president and director of research of the General Electric Company, and response was made by Dr. T. H. Morgan, president of the academy. The following papers were presented:

Note on C. S. Peirce's experimental discussion of the law of errors: EDWIN B. WILSON and MARGARET M. HILFERTY.

It is shown that the series of 24 runs of approximately 500 observations each which C. S. Peirce had made for the purpose of checking the normal curve of errors (and for other purposes) and which he interpreted as a satisfactory check of the theory do not on the modern theory of frequency functions of Pearson and others substantiate his claim because in every single series of the 24 the departures from the normal curve exceed the probable values of those departures and in many cases exceed them many times.

The occurrence of melezitose in honey: C. S. HUDSON.

The relation of chemical structure to the optical properties of some simple organic compounds: P. A. LEVENE. The configurations of several series of secondary carbinols and of a series of hydroxyacids have been correlated with that of a simple reference substance, namely, of lactic acid. From the data obtained in this manner, general relationships between structure and optical rotation have been formulated. The rotations of these substances are the resultants of two factors, namely, of the respective weights of the groups attached to the asymmetric carbon atoms and of their respective polarities.

The normal velocity of sound in free air: DAYTON C. MILLER. In 1918 Colonel R. A. Millikan, in charge of the Department of Science and Research of the Council of National Defense, requested the writer to undertake a study of the pressure effects produced in the vicinity of large guns in action, the effects which were supposed to be the cause of the malady commonly called "shell shock." The Case School of Applied Science granted a leave of absence from teaching duties from April, 1918, to November, 1919, and experiments were undertaken, at first in the laboratory and later at Sandy Hook Proving Ground under permission and authority of General C. C. Williams, Chief of Ordnance. The commanding officers were very sympathetic with these scientific experiments, and made literally all of the facilities of the proving ground available with only the restriction that the regular work of the proving ground should not be interfered with. Colonel Millikan assigned several enlisted scientific men as assistants, and at the proving ground any required help was provided. All conditions combined to provide a most extraordinary outfit for the study of sound effects of various kinds. The conditions could hardly be reproduced at any cost upon orders. Taking advantage of this remarkable situation, the researches were extended beyond the first purpose and led to four distinct sets of results. These relate to: (1) the pressure effects in the air around large guns in action; (2) the velocity of an explosion wave of great intensity; (3) the form and physical characteristics of the sound waves from large and small guns; (4) the normal velocity of sound in free air. After many months of laborious calculation on the large mass of observational data, the final reduction of the observations relating to the normal velocity of sound are now nearing completion, and this paper refers to this phase of the work. The observations were made by means of twelve microphones specially constructed for this purpose by the Western Electric Company. There was one set of microphones of very rugged construction, capable of recording sounds close to the largest gun, and a second set of six microphones of the greatest sensitivity, all of them made as nearly aperiodic as possible. Six microphones were used at one time, distributed over the field in any desired fashion, and the records were made by means of a six-string recording galvanometer of the type developed for the use of the American army in sound ranging. With this apparatus were combined va-