seum comprise "Gros Ventre Myths and Tales," "Religion of the Arapaho" (the latter in the series of the Mrs. Morris K. Jesup Expedition), both by A. L. Kroeber, and "The Shasta," by Roland B. Dixon, under the results of the Huntington California Expedition.

L. P. GRATACAP

SOCIETIES AND ACADEMIES

THE AMERICAN CHEMICAL SOCIETY
NORTHEASTERN SECTION

THE eighty-fourth regular meeting of the section was held on Friday, April 24, at eight o'clock P.M., at the Tech Union, Boston. About fifty members were present. Professor W. H. Walker, of the Massachusetts Institute of Technology, presented a paper on "The Corrosion of Iron and Steel," with illustrations. Pure iron is very rare, but has been prepared by the reduction of pure ferrous oxalate in a vacuum furnace. Small amounts of sulphur, carbon, phosphorus, etc., have marked effects upon the properties and corrosion of iron. Iron and steel as made at the present time appear to corrode more rapidly than products made forty years ago. (A sample of iron known to have been exposed to the weather for thirty-four years was shown with little corrosion, while a sample of steel fence wire exposed only six years was very much corroded.)

The theories of corrosion were outlined as follows:

Carbon dioxide theory: this was the earliest and has been supported by many authorities and appears in the text-books. The reactions proposed are: $4(Fe + H_2O + CO_2) = 4FeCO_3 + 4H_2$, and $4FeCO_3 + 6H_2O + O_2 = 4Fe(OH)_3 + CO_2$. This theory appears to account for the facts that corrosion is accelerated by the presence of carbon dioxide, and that alkalies inhibit corrosion. Certain experiments of G. T. Moody appeared to show that no corrosion occurs if carbon dioxide is absent.

Electrolytic theory proposed in 1903 by W. R. Whitney was based on the following experiments: Iron immersed in copper sulphate solution became plated with copper, since the copper ions with positive charges have a less electrolytic solution pressure than the iron. Since water is slightly dissociated, its hydrogen acts as a metal, and hence iron, when put into water, dissolves at a rate proportional to the concentration of hydrogen ions in the water, and to the relative ease with which hydrogen can be liberated upon the iron. Any acid which increases the concentration of the hydrogen ions will thus accelerate corrosion, while alkalies which decrease the hydrogen concentration will inhibit corrosion.

A repetition of Moody's experiments in detail established his observed facts but not his conclusions. Using phenolphthalein, it was found that alkali dissolved from the glass apparatus was sufficient to account for the slow action at first. Immersion of the iron in chromic acid renders the iron passive. But using Jena flasks carrying capillary tubes through the stoppers, and boiling the water, then quickly introducing a piece of iron and boiling again, all oxygen and carbon dioxide was expelled. While still boiling the capillary was sealed. After several days no corrosion could be observed, but on concentrating the water in a platinum dish, a good test for iron was obtained in each case, using sulphocyanate. Numerous repetitions of the experiments with elaborate precautions to prevent occlusion of gas in the iron, showed that iron went into solution every time. This supports the electrolytic theory. When bits of iron were immersed in water containing a little potassium ferricyanide and phenolphthalein, surfaces of opposite polarity on the iron soon became manifest; points at which hydrogen is liberated, *i. e.*, cathode points, became red, since hydroxyl ions are there set free. The anode points became blue, owing to the iron going into solution. The rate of solution of iron in water depends upon the electrolytic solution pressure of the iron and the hydrogen, upon the osmotic pressure of the iron ions in solution, and upon the "over-voltage" which must be overcome before the hydrogen ions pass from the ionized to the free state. The solution of iron in water becomes con-

tinuous if the cathode portions are depolarized. By using hydroxylamine or potassium dichromate as depolarizers it was found that the iron dissolved from the anode was equal to that added to the cathode portion. Oxygen acts as a depolarizer, as was shown in an experiment with a porous cell filled with, and surrounded by, water containing both ferricyanide and phenolphthalein, and connecting a piece of iron in the cell with a platinum plate in the outside liquid. The platinum showed a red color and the iron colored the liquid blue. But if the platinum were dipped in pyrogallol solution to remove oxygen from its surface, no action appears for some time until oxygen is absorbed from the air. Various experiments proved the rate of corrosion of iron in water to be a linear function of the partial pressure of the oxygen in the atmosphere above the water.

The passive condition of iron caused by chromic acid may be due to a film of oxygen formed on the iron. If heated in a vacuum this oxygen is removed: also the presence of small amounts of electrolytes destroy the inhibiting effect, and the method is of doubtful industrial value.

The more homogeneous the iron, the better it resists corrosion, since there is less opportunity for local currents to be set up. The segregation of phosphorus, sulphur, manganese, etc., in steel ingots, necessitates discarding 5 to 20 per cent. of the top of the ingot, to produce a uniform and homogeneous product. Presence of much manganese in steel indicates also much sulphur and phosphorus and hence much segregation.

Considerable discussion followed the paper and the view was expressed that both iron and steel of high degree of purity and homogeneity should be reasonably resistant to corrosion. Numerous specimens of corroded and uncorroded old iron and steel were shown, and also solutions containing phenolphthalein and ferricyanide made solid with agar-agar and containing bits of iron, to demonstrate the progress and phenomena of corrosion.

Frank H. Thorp,
Secretary

THE GEOLOGICAL SOCIETY OF WASHINGTON

At the 204th meeting of the society, on April 8, the following papers were presented informally:

A Wolframite-topaz Ore from Alaska: Adolph Knopf.

At the Oregon claim, Lost River, Alaska, an argentiferous ore, consisting of wolframite, galena and stannite embedded in a gangue of radial topaz with subordinate fluorite, forms a stringer lode 1 foot wide. The mineralization has taken place along a line of faulting in a dense-textured limestone of Ordovician age. Topaz is regarded as distinctive of cassiterite veins, and this occurrence of topaz as a carrier of sulphide minerals, therefore presents a number of novel features.

Mr. F. E. Wright exhibited informally three contact minerals—gehlenite, hillebrandite and spurrite, from Velardeña, Mexico, collected by Messrs. J. E. Spurr and G. H. Garrey and examined by the speaker. Of these, gehlenite appears not to have been observed before on this continent, while hillebrandite and spurrite are new species.

Regular Program

Studies in Mechanics of Allegheny Structure: Mr. Geo. H. Ashley.

A brief review of Appalachian structure as a whole, the recent theories as to the causes therefor, and some figures from the structure west of the Allegheny front in central Pennsylvania were presented. A study of the Chestnut Ridge anticline southwest of Punxsutawney shows that with a chord of 14 miles and a rise of 740 feet, the folding involved a shortening of 4.9388 + feet. If the arch were self-supporting it would exert a tangential thrust of about 290,000 tons per square foot, or about 1,000 times the crushing strength of the materials, so that it must always have been supported from below. Furthermore, had the segment of the arch been filled by the excess matter due to a crustal shortening of 4.938 + feet, a wedge 2,244 miles deep would have been required, an impossibility if isostatic adjustment be true. It would seem, therefore, that the segment was

probably filled by material moved out from the adjacent synclines so that the structure from one syncline to another actually approached a convex arch between two concave arcs. The total structural shortening northwest of the Allegheny front was between 35 and 40 feet.

The faulting in the Allegheny tract from Alabama to Pennsylvania shows remarkable parallelism in lines approximately 45° from the strike of the folded structure or from the direction of the force causing the folding. These faults were always of the type known as "normal"; but the fault faces showed striæ running from 37° to 65° from the horizontal, indicating a large horizontal element in the motion. Although entirely normal, the dislocations were evidently due to the yielding of the rocks under high tangential pressure along stress planes.

Secondary Enrichment in Granite-Bimetallic mine, Philipsburg, Montana: W. H. EMMONS.

The Granite-Bimetallic lode is a tabular body of silver ore from 1 to 20 feet wide which has been stoped for 4,500 feet along the strike and 2,600 feet in depth. The vein fills a fissure in monzonite along which there has been but little movement. The primary ore has a gangue of quartz and rhodochrosite inclosing a large quantity of pyrite, arsenopyrite, tetrahedrite, and tennantite, with some galena and zinc blende. Sparingly scattered through this ore are small specks of pyrargyrite, realgar and orpiment. This ore carries from 20 to 30 ounces of silver and from $1.50 to $3 in gold. Above the low grade sulphides extending from 500 to 1,000 feet below the surface is a zone of enriched oxide and sulphide ore in which the primary ore is cut by veinlets of ruby silver, argentite, native silver and horn silver. This ore carries over 100 ounces silver and $5 gold. Above the rich oxide and sulphide zone is a zone of leached oxides which extends to the surface. This ore carries less than 40 ounces silver and $2 gold.

An analysis of the mine water from a long drainage adit shows that it contains .000,147 SO_4, .000,160 iron with traces of silver and gold. These figures indicate that about .6 of a ton of iron and sulphate compounds are carried out of the mine every twenty-four hours. It is well known that iron sulphate solutions will dissolve silver and that these are precipitated again by the action of sulphides which carry an excess of sulphur. Enrichment was favored by a relief which furnished an ample head; by fracturing of the vein subsequent to the deposition of the primary ore; and by abundance of sulphides in the primary ore.

Revision of the Age of Niagara Falls: Mr. J. W. SPENCER.

From the now partially buried remnants of the river banks Mr. James Wilson, C.E., and the writer were able to locate the position of the falls at the time of Father Hennepin's visit (1678). It was thus found that the rate of recession in 227 years had been substantially the same as during the 63 years between the survey of Hall (1842) and of the writer (1904–5), namely, an average rate of 4.2 feet a year. The recession of the American Falls is very slow, and this water added to the main falls would increase them by only five per cent.

Through soundings it was found that the present mean rate of recession of 4.2 feet a year has obtained only since the Falls passed a point 1,100 feet below the apex, with an effective height in recession taken at 180 feet. The time required was 260 years. Thence, northward, for 6,200 feet, the mean effective height (on account of the absence of the barrier at the Whirlpool Rapids) was 240 feet, with the rate of recession thereby increased to 5.6 feet a year. Beyond, for 10,200 feet, to near Sinclair Point, the effective height was 260–280 feet, increasing the rate of retreat to 6.5 feet a year, with the necessary time ratio of 1,570 years. As the Whirlpool only required the clearing away of the drift material, no time allowance is made for its opening. From its outlet to the head of Foster Flats (3,200 feet), with the water descending 240 feet, the rate was 5.6 feet a year, requiring 570 years. Thus, the Falls have receded about four miles, with the full volume of the

river (except for a slight diversion, noted by Taylor) in 3,500 years.

From the head of Foster Flats to the end of the canyon is a distance of about three miles, and in the retreat of the Falls throughout this section only the Erie waters supplied the river (15 per cent. of the present). While receding 600 feet past the upper end of Foster Flats the height of the Falls was 240 feet, with rate of recession 15 per cent. of 5.6 feet. The proportional time allowance was 700 years. Below this point, for a distance of 13,300 feet, there were two and three falls, but the work of the upper one is now so well established that it alone furnishes the data necessary for computations. The mean height was 105 feet, and with the volume of 15 per cent. of that of the present day, the proportional rate of recession was reduced to 0.42 of a foot. This increased the time required to 31,600 years. There still remain 450 or 500 feet of the gorge to its end. Here the height of the Falls was 35 feet, so that their recession, with the small volume of water, was very slow, or proportionally only an eighth of a foot a year, at which rate 3,200 years were required. Thus, the formation of this lower and older stretch of the gorge required 35,500 years, or 39,000 for the total recession. The above figures are based on the assumption that the rainfall has been secularly uniform, with no greater increase of the drainage basins than at present.

Philip S. Smith,
Secretary

The Torrey Botanical Club

The meeting for April 29, 1908, was called to order at 3:45 P.M. by Vice-president John Hendley Barnhart. Fourteen persons were present.

The following abstracts were submitted by the authors of the papers presented:

The Boleti of the Forest Herbarium: William Alphonso Murrill.

This paper will shortly be published in full in one of the periodicals of the club.

Suggestions for Future Work on the Flowering Plants of the Local Flora: Roland M. Harper, chairman of the Phanerogamic Division of the Committee on the Local Flora.

There is probably not another spot in North America which has so many different kinds of country within a short distance of it as New York City. In consequence of this geographical diversity there are found within one hundred miles of here over one half of the species of flowering plants credited to the northeastern United States and adjacent Canada.

The earliest botanists in this region had their hands full with merely collecting, classifying and describing the plants. After nearly all the species had been described the next step was to record the known localities for each, and to prepare "floras" of certain limited areas. Since the middle of the nineteenth century a great deal of attention has been paid to anatomy, physiology, pathology and cryptogamic botany. Nomenclature was a leading topic for discussion among botanists a decade or two ago, and a little later ecology came into prominence, but for various reasons the latter has not proved very attractive to amateurs, at least here in the east. Experimental evolution is now attracting considerable attention, but there are very few persons qualified for this kind of research.

At the present time amateurs seem to be doing very little to advance our knowledge of the local flora, but there is no good reason why this should always be so. Notwithstanding the inroads of civilization, and the vast amount of botanical work that has already been done in this vicinity along certain lines, there are still awaiting solution here innumerable problems which can be successfully attacked by any one possessed of a fair knowledge of plants and a little spare time.

Very little of the vegetation of this vicinity has been described, still less photographed, our natural habitats have hardly been classified, and some of them have never even been adequately defined. Our dunes, marshes and Palisades, the pine-barrens of Long Island and New Jersey, and various other easily accessible places have been little damaged by civilization, and offer a fertile field for study, but the

opportunities for ascertaining their natural condition are growing less every year, so no time should be lost.

We have very little definite knowledge of the flowering periods, modes of dissemination, natural habitats and boundaries of the ranges of some of our most familiar plants. To illustrate some of the many taxonomic, geographical, ecological, phænological and statistical problems which now confront us, a list of about twenty illustrative questions was submitted, and recommended to the consideration of the members of the club. Answers to them, or suggestions of similar questions, were earnestly invited.

The paper will be published in full in a future number of *Torreya*.

Exhibition of Specimens recently collected in Jamaica, with Remarks: N. L. BRITTON.

A specimen was exhibited of the nest of the Jamaica swift made from the downy seeds of species of *Tillandsia*, and presented to the New York Botanical Garden by F. B. Sturridge, Esq., of Union Hill, Moneague, Jamaica.

Fruits were also shown of the Jamaican species of *Hernandia*, preserved in formalin, together with herbarium specimens from the same tree, found by Mr. William Harris and myself on the wooded hill near Dolphin Head, a mountain near the western end of Jamaica, and collected March 21, 1908. This tree is one of the largest of the Jamaican forests and apparently either very rare or very local in its distribution. It attains a height of at least 30 meters and a trunk diameter of over a meter. It has not been very definitely known to botanists, inasmuch as Patrick Browne in the "Civil and Natural History of Jamaica," published in 1756, knew of its occurrence there only by rumor, and it is not recorded for Jamaica by Grisebach in the "Flora of the British West Indian Islands." In the treatment of the genus in De Candolle's "Prodromus," Meissner attributes it to Jamaica on the authority of Patrick Browne, but Mr. Harris, in his extensive exploration of the forests of the island, had not been able to find much of it until this discovery near Dolphin Head, where a tree some 20 meters high was cut down and fine fruiting specimens obtained. An examination of these specimens in comparison with those of the other species indicates that the Jamaican tree differs from those of the other West Indies and of the East Indies, and should be defined as a species new to science.

C. STUART GAGER,
Secretary

DISCUSSION AND CORRESPONDENCE

THE ADAMS FUND

IT is needless to repeat in this paper what the Adams Act is, except to emphasize that the appropriation was made for the purpose of conducting original investigations in all branches of agricultural science, and that those institutions and investigators that draw from the funds keep before them the obligation under which they are placed when they accept the conditions of the funds. There is, I think, a certain class of workers in the experiment stations who fear that the work under the Adams Fund will prove too technically scientific, and therefore seem to think that greater latitude should be accorded each station in the use of its pro rata of the funds.

During the many years that experiment stations have existed in this country, with few exceptions, they have done mostly demonstrative work, and results have necessarily been empirical, and admitted only of local application. Many of them have spent their time and energy farming, and making special experiments with fads, trying to eradicate "fogy notions" about the effect of the dark and light nights on planting ordinary farm crops, or satisfying any popular belief. The demands that have arisen from time to time among the farmers, especially the southern farmers, have been of this nature, and have determined in a great measure the progress of some of the stations. Even now, we sometimes hear arguments to the effect that experiment station work should never overshoot the heads of the average farmers, and even in scientific work we should try to simplify the work so the farmer can understand it.

I am by no means a favorer of anything