other Small Objects for Museums,' and the fourth instalment of 'Hygiene as a Subject for Museum Illustration' gives the scheme of arrangement for the domestic, communal and dwelling divisions. There are a description of 'The Stone-Age Gallery,' British Museum, and a note on the 'Transvaal State Museum,' from which it appears that England has granted about £8,000 for its completion. If Great Britain can give this sum for this far-away Museum, it would seem as if the United States with its claim to be the richest nation in the world might provide a new National Museum.

*The American Museum Journal* for March contains an abstract of the annual meeting of its trustees, a note on 'A Fossil Armadillo from Texas,' the program for 'The International Congress of Americanists' and a note on the remarkable beetle, '*Hypocephalus armatus* Desmarest.' The 'Guide Leaflet' accompanying the number is by J. A. Allen and is devoted to 'North American Ruminants.' It comprises twenty-eight pages, an account of the group, containing much information, and is abundantly illustrated from living animals and from the museum groups. The title page and index to Vol. I. of the *Journal* is also issued.

## SOCIETIES AND ACADEMIES.

### BIOLOGICAL SOCIETY OF WASHINGTON.

THE 353d meeting was held on Saturday evening, April 5.

Frank Baker and F. A. Lucas discussed the question, 'Is the Area of Muscle Insertion an Index of Muscular Power?' Frank Baker stated that it had been assumed in discussing the flight of birds that because one bird had a larger area of wing muscle than another it necessarily exerted much more power in flight, while there were other points to be considered, such as the character or quality of the muscle fibers and their nerve supply. Dr. Baker then proceeded, with the aid of numerous lantern slides, to show that the internal structure of muscle varied much, so that one muscle might have vastly more power than another of equal bulk, while again there might be a vast difference in the contractile power of the individual fibers. The rapidity with which a muscle might contract and relax, and the energy or force it might expend in doing this, would be influenced by the manner in which the nerves were distributed, and this, the speaker showed, varied very much. The powerful water beetles were cited as affording an example of peculiar nerve distribution probably correlated with the exercise of great strength, and it was stated that investigation would probably show that there were decided differences of nervation between birds of rapid flight and those slow of movement, and that other factors besides mere area of muscle insertion entered into the question of power exercised by flying animals.

F. A. Lucas, in presenting his side of the question, said that while he agreed with Dr. Baker that the area of muscle insertion was not necessarily a measure of muscular power, in certain cases he thought it might be. In estimating the amount of power expanded by birds in flight, he had used the area of the keel of the sternum as a rough index of the force used. Mr. Lucas explained that in all birds the main muscles that raised and depressed the wings arose from the sternum and acted in the same way. In birds which flew by strokes of the wings, and whose flight was undeniably powerful, the breast muscles and sternal keel were in direct ratio to the apparent force, while the muscle insertions on the humerus were also large. In birds which sailed, like the albatross, the sternal keel and breast muscles were small. In certain birds, such as the tinamous, the quality of the muscle was poor, although the quantity was ample, and in such cases the character of the humerus and its small attachments for muscles showed that such was the case. The speaker illustrated his remarks by diagrams of the humeri of various birds, and one showing the sternum of the albatross as it actually was and as it would be did the albatross employ a force proportionate to that of the humming-bird, concluding that he felt justified in using the size of the sternum in birds as a measure of the power used.

W. P. Hay presented a paper on 'The Subterranean Fauna of the United States,' illustrating his remarks with lantern slides. He showed the areas in which caverns occur, described the manner in which caverns are

formed and showed examples of various types of caves. The cave fauna was discussed in detail and compared with that of Europe. With the exception of one salamander, related to *Proteus* of Europe, and one crustacean the species of cave animals were stated to be related to, or obviously modified from existing forms of the regions in which the caverns are located.

F. A. Lucas.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

The 550th meeting was held March 29, 1902.

Mr. Marcus Baker discussed this geometrical proposition: 'If one corner of a cube be cut off by an oblique plane the sum of the squares of the areas of the three faces adjacent to the corner is equal to the square of the area of the opposite side.' This can easily be proved analytically; but as the relation requires four dimensions, and no geometrical proof is known, the speaker held the relation was merely numerical. Professor Gore concurred in this view.

Mr. G. K. Gilbert presented the geophysical problem of the pressure of a glacier on its bed at a point below the surface of the sea, and the contradictory solutions that had been given.

The first regular paper was by Professor J. H. Gore, on 'The Ambiguity of the Double Sign' $\pm$ occurring in the extraction of roots. He pointed out that ordinarily we determine by experience which of these signs is the true one in a specific case; but in cases outside of experience we have no criterion to guide our judgment. This was illustrated by various examples.

Mr. C. K. Wead then spoke on 'The Theory of some Peculiar Musical Instruments in the National Museum.' The instruments included the globular four-hole whistles from Costa Rica, figured by Messrs. Wilson and Upham in the 'Museum Report' for 1896, and similar less perfect whistles in other museums, and various kinds of primitive flutes. The scales produced on these are only by accident diatonic, and the laws clearly are applicable to the instrument, not to the notes. A new generic principle of primitive scale-making was enunciated, and various specific forms of the principle. The fuller statement of these laws will soon appear in the 'Report of the U. S. National Museum' for 1900.

Mr. Upham then exhibited several of the instruments and performed on them. The type whistle or resonator gave very closely the notes F (690 d. v.), A, C, D, E.

The 551st regular meeting was held April 12, 1902.

The election to membership of Mr. S. W. Stratton, of the Bureau of Standards, and Mr. W. J. Spillman, of the Department of Agriculture, was announced.

The paper of the evening was on 'Liquid Air,' by Mr. G. A. Bobrick, superintendent of the only establishment furnishing liquid air commercially. The consumption is now about 150 gallons per week; the carriers are so well insulated that a gallon will not wholly evaporate under about a month, and recent improvements have largely diminished the loss from their fragility. The well-known experiments were fragility to show the effects of intense cold, —312° F., on various kinds of bodies, and the use of the liquid for explosives and to promote combustion. Apparatus was exhibited showing the production of the lime light by gas and liquid air. The history of the liquefaction of gases during nearly a century was given, with brief description of the three processes used; the bent tube (Davy), the cascade or closed double cycle (as by Pictet), and the self-intensive or regenerative systems. This last in practice yields a pound of liquid air per pound of coal used.

The speaker finds this an ideal source of power, where the expense is not prohibitive: seventeen gallons drives his automobile fifty to sixty miles. While it will never be used for stationary engines, it will be useful for submarine and aerial navigation. It is used in manufacturing chemicals and food extracts, and has already important medical uses.

Charles K. Wead,
*Secretary.*

THE GEOLOGICAL SOCIETY OF WASHINGTON.

At the meeting of the Society on April 9, Mr. S. F. Emmons read parts of an address delivered by Clarence King in June, 1877, on the thirty-first anniversary of the Sheffield

Scientific School, entitled 'Catastrophism and the Evolution of Environment.' This address was a protest against the extreme views held in those days by the British schools of uniformitarians headed by Lyell. With his own peculiar delicacy of touch, Mr. King first sketched the origin of the adverse schools of catastrophists and uniformitarians, and showed that they differed not so much in regard to the facts of geology as to the rate of geological change. He then stated that in his recent 30,000 miles of geological travel on the Survey of the 40th Parallel he found that geological history, as he read it, showed not the often unvarying rate of change of the uniformitarian, but periods of calm interrupted by others of accelerated change that in their effect upon life must have been catastrophic in their nature.

In response to man's questioning as to his origin, he said Nature vouchsafes one syllable of answer at a time. The syllable that Darwin got was the Natural Selection. Biologists consider it necessary to deny catastrophism in order to save evolution and reason only from the continuity of the paleontological record, neglecting the evidence of physical breaks in the geological record; but the latter must have varied the rate of geological change and thus brought a modified catastrophism. Natural Selection resolves itself into two laws: *hereditivity* and *adaptivity,* the latter being the accommodation to circumstances, which is dependent, half upon organism, and half upon the environment. Environment has affected the evolution of life during rapid movements of the crust or sudden climatic changes, either by extermination, by destruction of the biological equilibrium, or by rapid morphological changes on the part of plastic species. At the end of a period of uniformitarian conditions there has been a period of accelerated change in which only the more plastic forms have survived. In the future the geologists must therefore take into account periods of modified catastrophism, King says, and concludes in the following words:

"Moments of great catastrophism thus translated into the language of life, become forms of creation when out of plastic organisms something new and nobler is called into being."

Mr. F. L. Ransome spoke on 'Faulting and Mountain Structure in Central Arizona.'

The district discussed is in the Globe Quadrangle, lying in the sierra region which borders the Colorado Plateau on the southwest. Paleozoic quartzites and limestones rest unconformably on pre-Cambrian schists and granites, and all of these rocks are extensively intruded by diabase. After a long erosion interval, effusive rhyolites were erupted, probably during the Tertiary. The region was then deformed by a remarkably numerous series of normal faults. The rocks are divided into countless small fault-blocks and the prevailing structure is monoclinal, the Paleozoic beds dipping southwest at an angle of about twenty-five degrees. The strata are nowhere folded and the mountains are due to faulting, although the external forms of the faulted blocks have been considerably modified by erosion.

ALFRED H. BROOKS,
*Secretary.*

TORREY BOTANICAL CLUB.

AT the meeting of the Club on March 26, 1902, the first paper was by Dr. L. M. Underwood, entitled 'Notes on *Goniopteris.*' Distinguishing features, found in the venation and in the form of the indusium, were illustrated by figures. Nine species were mentioned, chiefly of the West Indies, including *G. reptans* of Florida, and species recently collected in Porto Rico and in St. Kitts.

The second paper was by Dr. M. A. Howe, 'Notes on the Marine Flora of Nova Scotia and Newfoundland.' Numerous examples were exhibited, illustrating especially the larger Phæosporeæ, including rolls of dried *Laminaria,* rock specimens bearing crustaceous species, and many others preserved in jars or by mounting in sheets. Among noteworthy species or forms found were *Fucus serratus; Fucus vesiculosus* without vesicles on the Nova Scotia coast; *Stipocaulon* at Pictou, the first discovery in North America of this genus of the Sphacelariaceæ. Examples were shown of *Laminaria longicruris* and *L. platymeris* from the Newfoundland coast whence De la

Pylaie first described them. Interesting specimens of *Agarum, Alaria, Porphyra, Gloiosiphonia,* etc., were exhibited, the *Agarum* from a deep tide-pool at Digby covered by thirty feet of water at high tide. Corallines attain great beauty in these northern waters, and with the attendant brown rockweeds and lustrous kelps lend great richness and diversity of color. The dulse gatherers were found to distinguish and prefer the dulse growing on *Laminaria* to that attached to rocks. Dulse gathering at Pictou forms a business of considerable importance; the dried dulse is put up in barrels to be sold in Boston and latterly in New York.

A third communication, by Dr. MacDougal, consisted of the exhibition and discussion of a specimen of *Ephedra,* one of two species collected by him in his recent trip to Arizona. This remarkable leafless relative of the pines produces palisade cells along its stems instead of leaves. A living cutting about three feet high was shown resembling Scotch broom in its multitudes of long green and brown branches.

Dr. MacDougal also exhibited a remarkable Arizona plant, perhaps an *Ipomœa,* with large swollen discoid base about fifteen inches in diameter, to which short roots were still attached. He had also collected there the tree *Ipomœa* known as the 'Palo Blanco' tree, on which deer browse; it bears a few flowers all the year round, but the leaves disappear after the rainy season. Edward S. Burgess,

*Secretary.*

UNIVERSITY OF WISCONSIN SCIENCE CLUB.

At the meeting of the Club held on April 1, Professor R. W. Wood, of Johns Hopkins University, addressed the Club on the subject 'A Suspected Case of the Electrical Resonance of Minute Metal Particles for Light Waves,—A New Type of Absorption.'

Small pieces of sodium, lithium or potassium heated in air-exhausted glass bulbs deposit on the cold wall of the bulb in the form of a film which shows colors by transmitted light as strong as those produced by the aniline dyes. The color does not seem to depend on the thickness, and all attempts to explain it by the well-known principles of interference have been without success. The microscope shows that the deposit is made up of exceedingly minute grains, which are but just barely visible under a one twelfth inch oil immersion objective. Their diameter is not far from .0002 mm. The colors vanish on the admission of the smallest trace of air. They change in a most remarkable manner if the outside of the bulb be touched with a small piece of ice, or if the glass be locally heated. The change of color produced by the application of ice to the outside of the bulb is always in the direction corresponding to a drift of the absorption band towards the red end of the spectrum. A purple film which has an absorption band in the yellow becomes blue-green when cooled, the absorption band moving into the red.

The cause has been found to be a condensation of the traces of volatile hydrocarbons (derived from the metal) on the colored film, thus immersing the particles in a fluid of high dielectric constant, the effect of which would be to increase the capacity of the system, lower the period of vibration, and move the region of absorption towards the red end of the spectrum. This was proved by forming the film in one half of a double bulb and immersing the other half in solid $CO_2$ and ether, thus bringing down all the hydrocarbon vapor. The colored film was found to be no longer sensitive to the local application of ice. It became sensitive, however, as soon as the lower bulb was removed from the freezing mixture and warmed. Sometimes the film becomes nearly colorless when cooled, the absorption band moving out of the visible spectrum entirely. Films originally pale apple green become deep violet when cooled, the color being as deep as that of dense cobalt glass. Various experiments have been tried with polarized light at different angles of incidence.

The paper will appear in full in the *Proceedings of the London Physical Society* and the *Philosophical Magazine.* C. K. Leith.

## *DISCUSSION AND CORRESPONDENCE.*

THE MATHEMATICAL THEORY OF THE TOP.

To the Editor of Science: 'The Mathematical Theory of the Top,' kindly communicated for me by Professor Barus to Science of