path was five miles long, and 250 yards wide at the point of greatest destruction. The funnel-shaped cloud 'had a phosphorescent glow.' Debris from Moundville is reported to have been carried nineteen miles to the northeast. The tornado occurred on the southeast side of a well-marked barometric depression, according to the usual habit of these disturbances.

Concerning lightning rods, Professor W. S. Franklin, in the same number of the *Review*, states that, 'given a good ground connection, then directness of path to ground from the region which is to be protected is so important that the matter of insulating the rod from the building, either by air spaces or by glass, is of no importance whatever in comparison. If the path is direct, there is no need of insulation, and if the path is roundabout, effective insulation is not practically feasible.'

A short article on 'Paths of Storm Centers' brings together a few essential facts regarding the tracks and velocities of cyclones.

NOTES.

It is stated (*Bull. Amer. Geogr. Soc.*, XXXVI., 39) that the front of the Muir Glacier has retreated two and a half miles in four years, which is a higher rate of retrogression than has been observed before. The present indications are that the glacier will before long cease to reach tide water.

During 1903 Mr. W. G. Black, of Edinburgh, collected in an open dish, 8½ inches square, 17 ounces of 'dust and soot.' This would give a fall of 32 ounces per square foot.

R. DeC. Ward.

WILLIAM HENRY PETTEE.

The senate of the University of Michigan has adopted the following memorial as offered by the committee, Professors Prescott and Demmon:

Again the university senate has been sorely stricken, and we are called to record the loss of another of our beloved members. For nearly thirty years he has sat with us in all our deliberations, scrupulously attentive to every official duty, thoroughly informed on all university affairs, courteous, firm and wise. Possessed of a genial and kindly nature, of refined sensibilities and a wide culture, he early won the respect and affection of his colleagues and held these steadily to the end. He has gone from us honored by many years of valuable service to the university, and his loss must continue to be felt in many ways for a long time to come. It seems peculiarly fitting that the senate should come together and spread upon its records some expression of the esteem and love with which we cherish his memory and of our high regard for his services in the great cause of learning, services to which his life was devoted without reserve.

Professor Pettee died at his home on May 26, 1904. He was engaged in his regular duties in the university up to the last evening before his death, but his health had been impaired for nearly a year and his physician had informed him of the uncertain tenure of his life.

William Henry Pettee was born in Newton Upper Falls, Mass., January 13, 1838, of representative New England parentage. His father was a manufacturer of cotton fabrics and of mill machinery. In boyhood his studious tastes had to be restrained and his college preparation delayed out of regard to his somewhat slender bodily frame. He entered Harvard College at nineteen years of age, took high rank in the required classical course of that period, was selected to deliver a Latin oration in the junior year, and graduated with distinction in the class of 1861. He continued in graduate studies in the same university for over three years, receiving the degree of master of arts in 1864, studying at first in the engineering work of the Lawrence Scientific School and then in the college, where at the same time he was an assistant in chemistry under Professor Josiah Parsons Cooke, Irving professor of chemistry and mineralogy and then well known as an author. Mr. Pettee had taken chemistry as his elective subject in his junior year. Of his remaining opportunity for election he had chosen Spanish, in this having the pleasure of reciting for a year and a half to James Russell Lowell. As a chemical assistant, 1863–65, he taught the required chemical physics to the sophomore class and had charge of the elective section of the

juniors in the laboratory. His period of study and travel in Europe was one of three years, from 1865 to 1868. Here his main work was in the Royal Mining Academy of Saxony, at Freiberg, with vacations in the mining regions of Germany.

In 1868 Mr. Pettee returned to Harvard University as a teacher in the school of mining and practical geology then established under the direction of Josiah D. Whitney, the Sturgis-Hooper professor of geology, the director of various geological surveys, including the Lake Superior region and California, and author of works upon the sources of metallic wealth, widely circulated in this country. Mr. Pettee's appointment in 1869 was that of instructor in mining. He was advanced in 1871 to the rank of assistant professor in the same branch, with plans for his work upon the geological surveys to be carried on under the auspices of the Harvard School of Mining.

In the summer of 1869 Professor Pettee made a geological and topographical survey of the South Park of Colorado, a district which had not been covered by the United States geological surveys. In the year 1870–71 he was granted leave of absence for the California State Geological Survey. Besides making a study of gold-bearing gravels, he undertook systematic work in correction of the determination of altitudes by the barometer. Some of the results of this investigation, collected from the detailed reports of the survey, were published by authority of the California State Legislature in 1874, entitled 'Contributions to Barometric Hypsometry,' with Tables for use in California, and a Supplement with Additions in 1878. The work embraced comparisons of the observations taken with the accumulated results of observers in Europe and these could be collected but slowly from scattered publications. A library was formed on the subject. Professor Whitney's estimate of the onerous labor, the accuracy and perseverance of Professor Pettee's work in this undertaking appears in the prefatory note to the volume above mentioned.

From 1871 to 1875 in addition to other duties Professor Pettee gave instruction to an elective section of undergraduates in physical geography, geology and meteorology. Before 1875 the conditions of the gift supporting a school of mining at Harvard were altered and the special instruction in this subject was withdrawn. It was in 1875 that Professor Pettee was appointed to a professorship of mining engineering and related subjects in Michigan. How the turn of events here again released our friend from the limits of a professional specialty has been well stated by his honored colleague, Dean Green, of the engineering department, to whose article on the 'Life of Professor Pettee' this memorial is very much indebted.

In the first semester of 1879–80 Professor Pettee was granted leave of absence from this university to continue his investigation of the auriferous gravels. His report of that work was published as an appendix to the first volume of Whitney's 'Contributions to American Geology' from the Museum of Comparative Geology at Cambridge. It has been adjudged to show that careful examination of phenomena, weighing of evidence, and painstaking accuracy, which those best acquainted with Professor Pettee always expect in papers prepared by his hand.

In the meetings of the faculty Professor Pettee was rarely absent and in them he has naturally served as the undoubted arbitrator upon questions as to previous or conflicting legislation. A member of three faculties, in each he was equally serviceable, and his judgment was asked for more often than offered. He has been annually and inevitably reelected as the secretary of the university senate, and this body owes much to the form he has given to records and reports, both in the making of history and through immediate publication.

It is not possible in this memorial even to enumerate all of the duties, important in administration, to which Mr. Pettee has been assigned. The files of university publications, in college libraries and everywhere, give evidence of the safeguard afforded by his editorial ability. In the organizations affiliated with the university he has been equally helpful.

The annual transactions of the American

Institute of Mining Engineers have been submitted to him for many years, from the publication office in New York, for critical proof-reading and correction. Of this extensive society he is a life member, his election dating from 1871, and he has been a co-worker with its secretary, Rosater W. Raymond. He was one of the original fellows of the Geological Society of America; a fellow of the American Association for the Advancement of Science; in which he was general secretary in 1887; a member of the American Academy of Arts and Sciences during his residence in Massachusetts; and a member of the American Philosophical Society of Philadelphia.

To his colleagues no characteristic of Mr. Pettee was more impressive than his fidelity to truth. Overstatement, exaggeration, disproportionate display were impossible to him. 'True of word and tried of deed' may well be inscribed to his memory as a Christian gentleman.

Your committee beg leave to recommend that the sincere and profound sympathy of the senate be extended to the bereaved family of our departed friend, and that a copy of this memorial be transmitted to them.

Albert B. Prescott,
Isaac N. Demmon,
Committee.

EXCAVATIONS IN TURKESTAN.

Professor Raphael Pumpelly, who is engaged in explorations in Russian Turkestan under the auspices of the Carnegie Institution, has written a letter to Dr. D. C. Gilman, the president of the institution, in which he says:

The streams that rise in the high mountains of northern Persia emerge on to the Turkoman plains forming fans, or sub-aerial deltas, covering many square miles and each making an oasis. The water is all used in irrigating these fertile spots. Beyond them is the desert. Anau, where we have excavated, is on one of these fans.

Here at Anau, about seven miles east of Aschabad, there are two great tumuli, and the ruins of a city—Anau—surrounded by moat and wall, and occupied till within the last century. The two tumuli, nearly half a mile apart, are nearly equidistant from the city at a distance of less than a mile. We have explored both of these tumuli and I have done some work in the city.

The northern and older tumulus rises 40 feet *above the plain;* the southern and younger tumulus rises 52 feet *above the plain.* Both of these start with their lowest culture strata on slight elevations in the same original plain-surface—more than 20 feet below the present surface of the surrounding plain. That is to say, the plain has grown up more than 20 feet since the settlements began. I will show, further on, the different phases of this growth.

In the older tumulus, we find a culture occupying the lower 45 feet, and distinguished by the technique and decoration of its wholly handmade and interesting pottery. This is succeeded in the upper 15 feet by a more advanced culture in which the finding of some remnants of bronze implements and lead beads (all wholly altered to salts of the metals) show a beginning acquaintance with bronze, while the still handmade pottery has changed and become more developed. Throughout this tumulus we have found nothing recognizable as a weapon of offense in either stone or metal, though flint knives abound.

The southern, younger tumulus, starts with a developed wheel-made pottery, unpainted and of a technique wholly different from that of the older tumulus—though some hand-made pottery occurs not unlike some of the younger products of the older tumulus.

From its base under the plain to its summit this tumulus has 74 feet of culture strata. There are evident here at least two sucessive cultures. Of these, that of the lower 62 feet is wholly in the bronze stage (but with survival of flint implements), while the upper 14 feet are marked by decided changes and by the introduction of iron, of which the wholly oxidized remnants of some implements were found.

We have thus at least four distinct cultures occupying 136 feet, with a break in the column between the end of the old and the beginning of the new tumulus. We do not know how great this gap may be, but the presence of