solar outbursts in 1872, which were each accompanied by sharp fluctuations in the magnetic tracings at Kew and Stonyhurst. Since the experiments began, volcanic explosions have produced such ether waves, which have been simultaneously recorded over the continents of Europe and America.

Mrs. Eliza McMillan and Mr. Wm. Northrop McMillan, the donors to the academy of a home, as noted elsewhere, were elected patrons of the academy.

William Trelease,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

THE FIRST USE OF THE WORD 'BAROMETER.'

To the Editor of Science: I quite agree with Dr. Bolton's conclusion that Robert Boyle introduced the word 'barometer' into our language about the year 1665 (Science, p. 548). Although Dr. Bolton finds that the first use of the word by Boyle was in the *Philosophical Transactions* of 1666, yet he suspects him to be the author of an anonymous communication to that journal the previous year, in which the 'suspended Cylinder of Quicksilver' was called a 'Barometer or Baroscope.' For conclusive proof that Boyle really used these terms in the year 1665, I would cite a work that appears to have escaped Dr. Bolton's notice, viz., 'The General History of the Air * * * by the Hon. Robert Boyle, Esq.,' published in London in 1692, which contains 'A short Account of the Statical Baroscope, imparted by Mr. Boyle, March 24, 1665.' In this letter to Mr. H. Oldenburgh, Boyle describes the instrument as some large and light glass bubbles, counterpoised in a pair of scales, and placed near a 'Mercurial Baroscope' (also called a 'Barometer' in the same letter), from which he might learn the present weight of the atmosphere. The same work contains probably the earliest systematic register of thermometer, barometer, hygrometer, wind and weather in England, viz., that kept by J. Locke, the philosopher, at Oxford and at London, between 1666 and 1683, with interruptions. The reading of the mercurial barometer, designated at first 'baroscope,' was recorded in inches and tenths, but in another register, kept at Townley, in Lancashire, during a portion of the years 1670 and 1671, it was recorded to hundredths of an inch.

Professor G. Hellmann, the eminent German meteorological bibliographer and historian, although cognizant of Boyle's 'General History of the Air,' seems to be unaware of the letter quoted, since he also states in the introduction to No. 7 of his 'Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus' that the word 'barometer' was first used by Robert Boyle in 1666, whereas it is certain, from what I have shown, that Boyle had already employed it the year before.

A. Lawrence Rotch.

Blue Hill Observatory,
April 13, 1903.

SHORTER ARTICLES.

A PRELIMINARY ACCOUNT OF THE EXPLORATION OF THE POTTER CREEK CAVE, SHASTA COUNTY, CALIFORNIA.

The Potter Creek cave lies in a belt of gray Carboniferous limestone, about a mile southeast of the United States Fishery Station on the McCloud River at Baird, Shasta County. The mouth of the cave is situated in a bluff on the north side of Potter Creek, at an elevation of 1,500 feet above sea level, and about 725 feet above the McCloud.

The existence of bones in the cave was first discovered in 1878 by Mr. J. A. Richardson, who found there the skull of a large extinct bear afterwards described by Professor Cope as *Arctotherium simum*.* This specimen is now in the Cope collection at the American Museum of Natural History, New York.

The cave was rediscovered by Mr. E. L. Furlong, of the University of California, in July of the past year. Mr. Furlong penetrated the deposit on the floor of the main chamber, with the result that a large number of bones representing a Quaternary fauna were found in a series of stratified deposits of pebbly clay, cave breccia, stalagmite and volcanic ash. On Mr. Furlong's return to

* Cope, *Am. Nat.*, XIII., p. 791; XXV., pp. 997–999, Pl. XXI.

Berkeley the exploration was continued by the writer.

The work of excavation has been generously supported by Mrs. Phoebe A. Hearst as a part of the investigation being carried on with a view to determining the antiquity of man in California, and has been conducted under the direction of Professor J. C. Merriam. Through the kindness of Dr. W. C. Bruson and Mr. D. P. Doak, the controllers of the property, a lease has been secured, and the deeper portion of the cave will be explored during the coming summer.

The system of galleries which comprises the Potter Creek cave extends in a northwest-southeast direction, in a general way parallel with the strike of the limestone. The floor of the principal chamber is 42 feet beneath the opening communicating with the winding passage leading to the exterior. It can be reached only by a vertical rope ladder secured above to a convenient stalagmite pillar. This chamber has a length of 106 feet and is 29 feet wide at its widest part. It narrows to a width of four feet at the extreme northwest end. Both walls slope toward the west, the west wall overhanging. The vaulted roof rises at least sixty feet above the floor. Numerous massive pendants ornament the hanging wall.

The floor of the large chamber was of pebbly clay and cave breccia. The main deposit was in the form of an alluvial fan with its apex in the narrow northwest end. The surface of the fan was in general convex, flattening somewhat toward the center of the chamber. A thin superficial layer of stalagmite was present on the margin of this deposit adjoining the west wall. In the southeast end there is also a fan, rising almost as high as the one just described. The surface of this slope down almost to the lower edge is covered with a firmly compacted cave breccia and is strewn with large fallen blocks of limestone and broken stalactites.

Work was begun in the clay about the middle of the main chamber, near the margin of the northwest fan, and was carried toward the northwest end. The surface of the deposit was staked out in four-foot squares, and each of these sections was worked in ten-inch levels, all the specimens from each level being labeled with the number of the section and the depth at which they were found.

The structure of this fan was as follows, in descending order:

A. Pebbly clay with gravel lenses, 4 to 13½ feet.

B. Persistent gravel stratum, 6 inches to 1½ feet.

C. Volcanic ash, up to 1½ feet.

D. Clay with fallen limestone blocks, up to 3 feet.

E. Stalagmite cementing angular blocks of limestone (false floor), 18 inches or more.

The pebbly clay (stratum A), is a reddish clay similar to that produced by the subaerial decay of the limestone and intrusive diabase. It contains abundant angular fragments of blue limestone and occasional pieces of stalactite from the roof. This deposit varies in thickness from four feet to thirteen and a half feet. A layer of stalagmite partly capping this reddish earth on the west margin rarely exceeds a few inches in thickness, usually averaging from half an inch to an inch. It is closely associated with the pendants fringing the west wall, and has been largely deposited by water dripping from them.

Beneath the capping stratum of clay, two main gravel lenses are distinguishable. These roughly parallel the surface of the fan and feather out toward the northwest margin. The gravel strata, so called, are composed of angular, drip-washed limestone fragments, and could readily be formed by water falling from the roof and washing the small limestone fragments out of the clay. These strata vary from three or four inches to a foot and a half in thickness. On approaching the west wall, the gravel lenses were in some cases found to coincide with sheets of stalagmite. The gravel strata are separated by beds of clay, similar in every respect to the first clay stratum described. On the disappearance of the gravel all these clay strata blend.

Beneath the persistent gravel layer (stratum B) is a deposit of fine particles of volcanic glass (stratum C), which appear to have drifted into the cave by wind action in Qua-

ternary time and to have been deposited in a small body of standing water. The prevailing color of the ash is an ocherous yellow, but some samples have a brownish tint. The deposit varies from a fraction of an inch to a foot and a half in thickness, thinning out toward the northwest and southeast margins. At the former margin it is seen to dip about five degrees toward the southeast. Throughout it is well stratified and shows little mixture with foreign material. Chemical analysis shows the glass to contain 63.69 per cent. of silica. This indicates that the ash is either andesitic or trachytic, with the probability in favor of the former. Its source has not been determined. It was probably derived from some of the volcanoes of the Cascades, perhaps from Lassen Peak or Shasta.

Stratum D, beneath the volcanic ash, is a clay layer varying from a small fraction of an inch to three feet in thickness. It commonly contains angular boulders of limestone and large pieces of stalactite. More or less stalagmitic cementation is locally present.

Excavation ceased temporarily at the surface of a hard sheet of breccia (stratum E), which lay beneath the last-mentioned clay. This breccia sheet was penetrated at one point, where it was found to be eighteen inches thick.

During the excavation there was discovered a circular series of chambers not before visible. The opening leading to these chambers was in the west wall of the main cave and was buried beneath about eleven feet of stratified deposits. The northwest gallery of this new series contains a stream of earth derived from that in the main cave. The top of this fan, at the entrance, is level with the top of the hard breccia floor (stratum E). It slopes steeply to the west and has the greater part of its surface covered with white crystalline stalagmite. Near the entrance the stalagmite contains imbedded bones. Bones were also scattered at irregular intervals down the slope.

The materials forming the various deposits above the hard breccia floor (stratum E) have been derived largely from external sources. The stratigraphy of the fan excavated shows that the greater part of its material entered the cave from the outside through a narrow fissure in the limestone, which can still be seen, choked with earth, forty feet above the apex of the fan. From this fissure, earth and bones fell through a chute-like opening to the floor below. The earth in the westerly lying series of galleries has entered from this same source, sliding to the west as the bottom of the main chamber filled. All the bones in the west galleries are older than those occurring above the stratum of volcanic dust in the main room. The volcanic material, in undisturbed position, lay about two feet above the entrance to these galleries. The fan in the southwest end has also been derived largely from external sources, entering through an opening similar to that already described. In addition to these openings and the existing entrance to the cave, there have probably been others which are more or less completely closed by the formation of calcite growths.

Although the cave seems to have been formed along a fissure by percolating water removing the limestone in solution, so far as explored, nothing approaching a residual cave earth has been found in place in the lower chambers. There is no evidence to prove that the cave has been excavated by stream action. A few stream-worn pebbles have been found in the lenses of drip-washed limestone fragments, but, like the majority of the bones, these pebbles have fallen into the cave from without, and have not been rounded by water action in the cave.

Bones were found in all the strata explored excepting the volcanic ash. In all cases they have lost their organic matter completely. In the superficial layers of the clay stratum they are commonly blackened, but at deeper levels they are white and quite brittle. In the gravel lenses scattered teeth and small bones of various rodents are particularly abundant. A large percentage of the material collected consists of fractured bones which it is usually impossible to identify. The edges of the fractures are quite sharp, except where they have been gnawed by rodents before entombment. Apart from these fragments, over four

thousand determinable specimens in an admirable state of preservation were collected. This material requires no preparation, excepting to wash off the adhering clay. Few of the large bones are broken and none are crushed or distorted by pressure. The majority of the specimens collected are dissociated limb bones, jaws and teeth. Few complete skulls were found. Connected skeletons of single individuals are exceedingly rare. Associated parts of the skeletons of several squirrels and of the large bear *Arctotherium simum* were the only ones found. Remains of the latter were particularly abundant along the east wall, some of the best material occurring in loose earth at depths of from four to six feet. At this place complete limbs with all the elements in their natural position were found. The fact of the association and better state of preservation of the remains of *Arctotherium* suggested to Mr. Furlong that these animals lived in some part of the existing cave, or possibly in some gallery which has been destroyed by subsequent erosion. If these animals really lived in the cave, many of the angular fragments of bone already referred to may be the relics of bears' feasts. Associated with the bones are shells of a land mollusc referable to the genus *Epiphragmophora,* and of a fresh-water form allied to *Margaritana falcata* living in the McCloud River.

Traces of man's existence have been diligently sought, and a number of polished and pointed bones have been found which might serve as rude implements. So much depends on the determination of these as artifacts that it is deemed best to reserve judgment and await fuller exploration.

The following is a provisional list of species identified. Professor Merriam and the writer are much indebted to Dr. C. Hart Merriam for valuable assistance in determining the rodents and carnivores:

Arctotherium simum Cope.
Ursus sp. nov. Merriam, J. C.
Felis sp. nov. Merriam, J. C.
Felis near *hippolestes* Merriam, C. H.
Lynx fasciatus Rafinesque.
Lynx fasciatus subsp. nov. (?).
Urocyon townsendi Merriam, C. H.
Vulpes cascadensis Merriam, C. H.
Lupus sp. nov. Merriam, J. C.
Taxidea (?) sp. nov. Merriam, J. C.
Bassariscus raptor Baird.
Mephitis occidentalis Baird.
Spilogale sp. nov. Merriam, J. C.
Putorius arizonensis Mearns.
Sciurus hudsonicus albolimbatus Allen.
Spermophilus douglasi Richardson.
Lepus californicus Gray.
Lepus sp. nov.
Lepus klamathensis Merriam, C. H.
Lepus near *audoboni* Baird.
Teonoma sp. nov.
Neotoma fuscipes Baird.
Arvicola sp.
Thomomys sp. nov.
Thomomys near *leucodon* Merriam, C. H.
Aplodontia either a new species or a new subspecies of *A. major.*
Scalops cf. *townsendi* Bachman.
Odocoileus columbianus Richardson.
Odocoileus sp.
Camelops (?) sp.
Megaloynx sp.
Mastodon americanus Kerr.
Elephas primigenius Blumb.
Tapirus sp.
Equus occidentalis Leidy.

In addition to the species listed, there are a large number of birds which have not yet been studied, a snake, a tortoise, a bat and one or more fishes.

Associated with species characterizing open country, the list shows a considerable proportion of mountain and forest types. Seventeen of the thirty-five species and subspecies listed are extinct. So far as known there is no difference between the species from the various strata, although the remains of *Arctotherium* are perhaps more numerous in the deeper layers. No Pliocene forms have been found, although such may occur at deeper levels in the unexplored portions of the cave.

The accumulation of the portion of the cave deposit which has been studied took place during middle or later Quaternary time. Nevertheless, the cave fauna indicates that great changes in the topography of the region have taken place. The present mountainous character of the country, and especially the

ruggedness of the limestone belt in which the cave lies, are entirely out of harmony with the existence of mastodons, elephants and tapirs. Stream-worn pebbles occur in the cañon of the McCloud, at Baird, as high as 750 feet above the river. The deposit in the cave dates from a time when the river flowed at a higher elevation than it does now, but not at the 750-foot point, otherwise the cave would have been flooded, and of this there is no evidence. At this time the cave was, in part at least, an open fissure receiving material washed in during the wet season.

There are three well-defined terraces in the cañon of the McCloud. The lowest of these is about 25 feet above the mean low-water level of the river. A second terrace occurs about 30 feet higher. The best-developed terrace is about 75 feet above the stream. The cave deposit was probably formed before these terraces were cut, since a comparatively short time has been required for the river to cut down to its present level from the level of the upper terrace. This terrace is rock cut with a thin veneer of gravel on its surface. When the river flowed at the level of this terrace, it is not believed that the region was topographically adapted to the existence of tapirs and the large proboscideans, except perhaps along the stream.

A full report embodying the results of further work on the cave and descriptions of new species will appear later, in the Publications of the University of California.

Wm. J. Sinclair.

University of California,
Berkeley, California.

CURRENT NOTES ON METEOROLOGY.

HELM CLOUD IN THE BLUE RIDGE OF NORTH CAROLINA.

When wind is forced to cross a mountain ridge, standing waves may be produced in the air currents to leeward of the ridge. If the involuntary ascent of the air is sufficient to bring about condensation, clouds are formed in the ascending portion of these waves. The best known of these clouds is that called the *Helm Bar*, which is frequently observed when a damp easterly wind blows over the Cross Fell range, in northwestern England. Attentive observation in mountainous districts ought to bring record of the occurrence of many such clouds in different parts of the world. W. M. Davis (*Bull. Geogr. Soc. Phila.*, III., No. 5, 1903) calls attention to a similar cloud which he observed during a recent field trip to the Blue Ridge in North Carolina. On a morning with a clearing northwest wind, while standing on Mt. Mitchell, he noted that a rolling helm cloud was formed above the Blue Ridge escarpment. The cloud held its place, continually forming and dissolving, for more than an hour, while many detached fragments of the cloud floated away and disappeared during this time. This is the first mention of the occurrence of helm clouds in this section.

METEOROLOGICAL PHENOMENA OF VOLCANIC ERUPTIONS.

An ascent during an eruption of the volcano Puracé, near the city of Popayan, the capital of the Department of Cauca, in the Republic of Colombia, is described by R. B. White in the *Scottish Geographical Magazine* for February. The eruption occurred in October, 1869, and Mr. White was requested by the natives to ascend the mountain during the eruption, in order that he might report to them regarding the danger that threatened the neighborhood. A number of interesting phenomena were noted, one of which was the sudden tremendous flood which came down the river Cauca, produced by the almost instantaneous melting of 'at least 8,000,000 cubic feet of snow that lay on the mountain.' The column of steam reached a height of three miles, having the appearance of immense cumulus clouds, and spreading out at the top like the crown of a great tree. (Similar mushroom-shaped clouds were noted, and photographed, during the Mont Pelée eruptions of last summer). During the night frequent torrents of mud and rocks rushed down the mountain sides. These, Mr. White believes, came from the melting of the heavy snow which had resulted from the condensation of the great volumes of vapor thrown up from the crater. This snow melted rapidly on the