cineum (Pursh.) A. Gray, *Pentstemon* sp., *Artemisia frigida* Willd., *Brauneria pallida* (Nutt.) Britton, *Grindelia squarrosa* (Pursh.) Britton and Rusby, *Astragalus* sp., *Psoralea floribunda* Nutt., *Erigeron* sp., *Kuhnistera purpurea* (Vent.) MacM., *Lithospermum* sp., *Ratibida columnaris* (Sims.) D. Don., *Antennaria campestris* Rydb., *Verbena hastata* L., *Verbena bracteosa* Michx., *Helianthus scaberrimus* Ell., *Carduus altissimus* L., *Bœbera papposa* (Vent.) Rydb., *Solidago* (two species, unidentified), *Aster* sp., *Solanum carolinense* L., *Rosa arkansana* Porter.

Charles E. Bessey
The University of Nebraska

PALEOLITHIC MODELERS IN CLAY

The discovery, on July 20 last, by Count Bégouen and his two sons, of a new French cavern with paleolithic mural decorations has already been noted in Science.[1] This cavern, called Tuc d'Audoubert, situated near St. Girons (Ariège), was visited by the writer five days after its discovery, but did not even then yield up all its secrets. We noted certain small openings leading apparently to other galleries then closed against us by deposits of stalactite and stalagmite. At Geneva in September Count Bégouen informed me that he had entered one of these and found additional parietal engravings. In a communication to me dated October 23, he announces that at the end of still another long and difficult upper gallery, reached only after breaking away stalagmite pillars, he and his sons have found two clay statuettes intact, representing the *Bison,* male and female 63 and 61 centimeters long respectively. In an antechamber as well as the upper gallery these Magdalenian artists also left their footprints on the soil superimposed on footprints of the cave bear, whose skeletal remains were strewn upon the cavern floor. All the canines were missing, however, from the jaws, having evidently been removed as Magdalenian trophies. A perforated tooth (Bovidæ) and several flint implements were found on the cavern floor.

The artist races inhabiting southern Europe in later paleolithic times were sculptors of real merit. They worked laboriously in stone, ivory, bone, and horn with excellent results and without the use of metal tools. That paleolithic man had realized any of the possibilities of clay as a plastic medium has always been denied. Absence or presence of pottery has been universally invoked as a chief factor in distinguishing paleolithic and neolithic horizons. The clay figures found by Count Bégouen are unbaked, to be sure; but they prove that only the accident of firing stood between the Magdalenian races and one of the great inventions of all time. These figures were never wholly separated from the matrix out of which they were fashioned. They seem to stand out of a clay talus slope that flanks a fallen rock, the male following the female. For the present no attempt will be made to remove them from this shrine.

George Grant MacCurdy
Yale University

[1] August 30, 1912, p. 269.

THE PROGRESS OF MOUNT ROSE OBSERVATORY, 1906–1912

Mount Rose Observatory, although the youngest of the meteorological observatories in America, has an environment so unique that its staff has not only obtained a series of problems of prime importance to pure science and to agriculture but has also found such abundant material that rapid progress has been possible in their solution. A brief statement of plans and progress at this observatory may, therefore, not be without interest to workers in the meteorological field.

Mount Rose is a peak of the Sierra Nevada Mountains at the western edge of the Great Plateau. The observatory on the summit, which is 3,292 meters above sea level, at present is the highest meteorological station in the United States, and was established privately for the purpose of ascertaining the winter minimum temperatures at the summit of the Sierra. Later it was made a department of the University of Nevada and the Agricultural Experiment Station and through these institutions has received financial aid from the state and from the Adams Fund of the Office of Experiment Stations.

The observatory is very favorably situated for the study of mountain and desert meteorology, the relation of topography to the occurrence of frost, and the influence of mountains and forests upon the conservation of snow. Most of the instruments and methods employed in the work of the observatory have been devised by its staff.

In the study of mountain meteorology, the observatory has the advantage of occupying a virgin field, and thus being placed in a position to supplement the work done at Mount Royal by McGill Observatory, in the Appalachians by the Mount Washington, Blue Hill and Mount Weather observatories, in the Rocky Mountains at Pikes Peak, and in the Coast Range at Mount Tamalpais. Mount Rose Observatory is unlike its predecessors in that no observer is maintained continuously on the summit, and most of the instruments in use have been constructed to work without attention for long periods of time.

After much experimenting there has been devised a meteorograph that is impervious to the wild storms that rage in winter on mountain summits, and a shelter has been constructed for it that clears itself of accumulated snow. Six elements are recorded, viz.: pressure, temperature, direction and velocity of the wind, humidity and sunshine. The records are made upon a band of metric cross-section paper 270 mm. wide, which moves 2.5 mm. an hour or 1.8 meters a month. The recording mechanisms are adjusted to the ruling of the paper so that one millimeter equals one degree of temperature, two per cent. relative humidity, and one millimeter of atmospheric pressure. The meteorograph is actuated by springs placed within a motor drum. Two auxiliary drums serve to hold and receive the paper as it passes over the motor drum against which the recording pens rest. This instrument will run for at least two months with one winding of the clock. The resetting of the meteorograph is readily accomplished by disconnecting it from the shelter and removing it to the observatory building.

Some defects that occasionally cause failure to obtain satisfactory records have been partially corrected in the following manner: To prevent slipping of the record sheet, a double series of tiny needle points has been fitted into the motor drum with v-edged pressure wheels running astride of them to force the sheet close to the drum. To detect possible inaccuracy in the motor clock, a standard pendulum clock actuated by weights has been installed in the observatory building and connected by electric cable with a pen in the meteorograph to record the twelve o'clock hours each day. Excessive vibration has been eliminated in the shelter by the use of heavy braces and rock on the sills.

Mechanical registration is employed in all elements except sunshine, and the performance of electrical devices tried thus far has been so unsatisfactory that probably a mechanical sunshine recorder will eventually replace the electrical one. Dry batteries have been made worthless by freezing, and the efficiency of wet batteries is so reduced in cold weather that it seems improbable that any system depending on electricity will be successful.

The great problem is the prevention of the formation of fins of ice and frost upon the instruments. The sunshine recorder has been safeguarded by a heavy bell-jar. The tail of the anemograph vane has been made of wood and the arrow so shortened that the vane will swing into the eye of the wind irrespective of ice accumulations on the arrow. The masts have been enlarged in size and made self-sustaining without guy rods, which invite the formation of festoons of heavy ice with consequent wrecking of the masts. The only serious problem of equipment still unsolved is the protection of the cups of the anemometer from ice. This can be accomplished in part by removing the portion of the supporting arms that pass through the cups and thus expedite the dropping of the accumulated slugs when the cups are warmed by the returning sun. However, there may be some material, such as vulcanized rubber or papier mâché, of which cups can be made, which will be less attractive to frost and ice than the metals used at present. The wind record has usually been

complete between the months of May and October.

This meteorograph on the summit (elev. 3,292 meters) is flanked by two similar instruments, one on the west at Truckee (elev. 1,798 meters), thirty miles distant, and the other on the east at Fallon (elev. 1,208 meters), fifty miles distant, thus affording a base line eighty miles long and an apex approximately one mile high. Kite flights have been inaugurated to determine the meteorological error of the summit station. By means of this vertical triangle of stations, data are now being actively gathered on the changing phases of passing storms, and their possible relation to the weather of the valleys beneath.

A station with instruments of great precision is being established on the university campus. The study of the movements of air currents will be made by pilot balloons, for the plateau is too sparsely settled to permit the use of ballons-sondes. A share will also be taken in the international kite flights.

In the realm of applied science, the forecasting of frost from mountain tops is one of the two main problems through which it is desired to make the observatory of practical service. This problem is still in the stages of data-gathering; however, some relationship is evident between the passing of storms and the occurrence of frost.

This problem has given rise to two others: the relation of topography to the occurrence of frost, and a temperature survey of the agricultural lands of the state of Nevada. For the study of the first problem, two stations with delicate apparatus for detecting minute changes in humidity, temperature and air movements are under preparation to be placed near the surface on typical slopes in conjunction with a free air station at the university.

The temperature survey has now been in progress for two seasons. The purpose of the survey is the delimiting of large areas suitable for fruit raising under all forms of economic frost prevention, and the further division of these areas into thermal belts according to the following classification:

(*a*) Belts where the minimum temperature never falls below 28° F. and fruit raising would be highly profitable.

(*b*) Belts where the minimum temperature is between 24° and 27° and frost can be combated at a reasonable expense.

(*c*) Belts where the temperature falls between 18° and 23° and fruit raising as an industry would not be profitable.

In belts where temperatures of 17° or lower are encountered fruit raising is not advisable.

Eighteen stations equipped with thermographs and standard thermometers are now being employed in the work. The number may finally be increased to twenty-five. These stations are distributed at strategic points from the highest land under irrigation canals to the lowest parts of the valley. It is planned to obtain continuous records at each station for three years before removing the station to a new point. The survey at present covers the basin of the Truckee River, on which is situated the metropolis of the state. Owing to the hearty cooperation of ranchers, who act as voluntary observers, the expense of the maintenance of the survey is slight.

In the spring of 1911, when frosts were heavy and frequent, the observatory staff, in conjunction with others, demonstrated the feasibility of orchard heating even under strenuous conditions, with the result that where only one farm corporation was heating its orchard that season, the present year between fifteen and twenty owners of fruit trees were engaged in the work. To give the orchardists assurance of support in their effort, a night telephone service was maintained for emergency frost-warning and two automatic frost alarms were installed. To further aid the isolated orchardists in making their own forecasts of frost, an analysis of the fluctuation of temperature under semi-arid conditions is now being made. To this will soon be added the determination of the quantitative effect of cloudiness and wind on the retardation of falling temperatures.

The second problem to which special attention is being devoted is the influence of mountains and forests on the conservation of snow.

This problem is of vital importance to irrigationists and power companies wherever streams are fed by snow.

The data for the study of this problem are very abundant. Mount Rose is situated between the heavily forested main chain of the Sierra Nevada and the scantily forested ranges of the semi-arid Great Basin, and forms the natural headquarters for the study of both. On the flanks of Mount Rose and its subjacent range are also wide areas long since deforested and now in various stages of reforestation, while the apex of the mountain furnishes abundant opportunity for studying the snow where it falls deepest and longest. The observatory building on the summit has now been supplemented by a headquarters camp, made of sandbags, at Contact Pass (elev. 2,744 meters) and another camp at the base of the mountain. By means of this chain of stations, measurements of snow depth and density, the evaporation of snow, and temperatures within the snow have been conducted on the mountain for limited periods.

Adjacent to Mount Rose is the basin of Lake Tahoe, where a coast line seventy miles long has furnished ready access throughout the winter, by means of motor boat and explorer's camp, to forests of various types and densities, and to all the typical slopes and elevations found in the Sierra Nevada.

The study of the conservation of snow was begun with camera in the winter of 1906, and in the spring of 1909 there was designed a snow sampler by means of which cores can be obtained from snow-fields of all depths and densities, the water content of the sample being determined by weight. Soon after, a spring balance was devised that would indicate without any computation the equivalent water in the sample irrespective of variation in the length or weight of sampler used. By means of these instruments thousands of measurements have been made, and the quantitative value of forested areas and their superiority over unforested was early established.

The minute investigation of the various phases of the problem has proceeded more slowly, but considerable progress has now been made toward their solution. The general principle underlying the conservation of snow is that of protection against evaporation and melting by wind and sun. Snow lies longest where it falls deepest. Cliffs and lee slopes are large gatherers of snow. Yet wherever forests crown such slopes the capacity of these slopes to gather and conserve snow is increased. In wind-swept regions, timber screens have a snow-gathering capacity varying according to their height and imperviousness to the wind. They also, by checking the wind, reduce the evaporation of snow, which under the influence of a wind movement of 33 miles per hour, despite the fact that the snow was frozen, has reached in a single night the total of .10 in. moisture content, or one one-hundred-twentieth of the total snow on the ground.

The action of unbroken forests upon the snow is unlike that of timber screens, particularly on the lower slopes where the wind is less violent. These forests catch the falling snow directly in proportion to their openness, but conserve it, after it has fallen, directly in proportion to their density. This phenomenon is due to the crowns of the trees, which catch the falling snow and expose it to rapid evaporation in the open air, but likewise shut out the sun and wind from the snow that has succeeded in passing through the forest crowns to the ground.

The most efficient forest, therefore, from the point of view of conservation is the one that conserves the largest amount of snow to the latest possible time in the spring. This has been found by measurement to be the forest with a maximum number of glades, which serve as storage pits into which the snow can readily fall but the wind and the sun can not easily follow. One such forest was found to have conserved at the close of the season of melting three and one half times as much snow as a very dense forest adjacent to it.

The most efficient type of forest found at levels below 8,000 feet is the fir, whose foliage is much more impervious to the rays of the sun than that of the cedar or pine. At 8,000

feet or higher, the mountain hemlock is most efficient, for not only is its foliage dense, but its tapering spire-like crown offers but little resistance to falling snow.

In the light of the above facts forests may be too dense as well as too thin for the maximum conservation of snow. The ideal forest seems to be one filled with glades whose area bears such proportion to the height of the trees that the wind and the sun can not reach the bottom. These glades can be produced by the forester by judicious pruning and cutting as well as by proper planting. However, the mountain hemlock requires little or no pruning to attain its maximum efficiency.

In the field of hydrology, surveys of snow on the Mount Rose and Lake Tahoe watersheds have been made since the beginning of 1910 to indicate to ranchers and power companies in the basin below the amount of water to expect during the season, and thereby to assure the better control of the reservoirs. This work will be extended to include a study of the behavior of snow on typical slopes during rising temperature and wind with the view of forecasting the probability and extent of floods. For the purpose of offering foresters in the national forests and others the advantage of the investigations in snow a course is now planned at the University of Nevada on the relation of mountains and forests to the conservation of snow, including the improvement of the storage of snow by the planting and pruning of forests to assure the control of stream flow and the increase of irrigation and power resources. Other courses in general meteorology have already been provided.

The staff of the observatory consists of Professor S. P. Fergusson, formerly first assistant at Blue Hill Observatory, who is associate meteorologist, Mr. Arthur L. Smith, observer in Lake Tahoe Basin, and the writer, who is in charge.

Besides annual reports and news bulletins, the more important recent publications are Experiment Station Bulletin No. 79, "The Avoidance and Prevention of Frost in the Fruit Belts of Nevada," and an article on the "Conservation of Snow: Its Dependence on Forests and Mountains," in *Scientific American Supplement*, Vol. LXXIV, No. 1914 (September 7, 1912), pp. 152–55. A bulletin containing an elaborate presentation of the relation of mountains and forests to the conservation of snow is now being prepared.

J. E. CHURCH, JR.

RENO, NEVADA

SPECIAL ARTICLES

THE CULTIVATION OF AN ECTOPARASITIC NEMATODE OF A GUINEA-PIG ON BACTERIOLOGIC MEDIA[1]

ON May 6, 1912, while examining a guinea-pig which had died of an unknown cause, it was noted that the skin around and just anterior to the external genitalia was excoriated and covered by a yellowish, cheesy exudate. On examining the exudate under the low power, a large number of actively motile embryonic and adult nematodes were found. On May 7 a second guinea-pig exhibiting a similar, but less extensive, lesion and harboring the same ectoparasitic nematodes was discovered. Lately, a third guinea-pig was encountered, harboring the same nematode not only around the external genitalia, but also on the normal skin of the abdomen and thorax. Careful examination of these and of a number of other guinea-pigs has failed to reveal the presence of the nematode in the gastro-intestinal tract or in any of the internal organs.

A little of the caseous material from the first two guinea-pigs was inoculated onto moist earth and slants of Musgrave's amœba agar and kept at room temperature (about 24° C.). In a few days, a large number of actively motile nematodes were found in these cultures. The amœba agar cultures have, since then, been carried through five subcultures and the worms have also been successfully carried through several subcultures on slants of plain agar and ascites agar. The plain agar and the amœba agar have proved to be the best media, because the accompanying bacterial growth is relatively limited in amount. In several of the above subcultures

[1] A preliminary note, from the laboratory of the Cincinnati Hospital.