states, particularly the sylva, with the intention of illustrating a work on the indigenous trees of California. He must have left a large and valuable series of figures, if not a completed monograph, of the botanical forms of the region referred to.

The published results of his various and prolonged investigations have appeared from time to time in the Proceedings and bulletins of the California academy and elsewhere; and his name holds a conspicuous place in all of the principal works relating to the botany of the western coast of North America.

In 1867 he visited the then Russian territory of Alaska in the capacity of surgeon and botanist to the special expedition of that year, having received the appointment from Prof. George Davidson, who had charge of the scientific division on that occasion.

Of his personal qualities, all who knew Dr. Kellogg will bear testimony to his simplicity, genuineness, and purity, and his invariable kindly disposition. His was altogether a rare and most lovable character. It may properly be said that his nature was in many ways as attractive as the beautiful forms he studied. Considering the period of his arrival in California, and the ruling passion and influences which governed the community at that time, as compared with his refined tastes and quiet ways of life, a most extraordinary contrast is presented. In the light of ordinary experience, it is hardly conceivable of a human being, among human beings of the same race, more absolutely out of place than he. However incongruous the surging tide and rush of affairs about him, he held the noiseless tenor of his way. His gentle life has passed. He will be affectionately remembered by many. R. E. J. S.

U. S. nat. mus., April 16.

The barometer during thunder-storms.

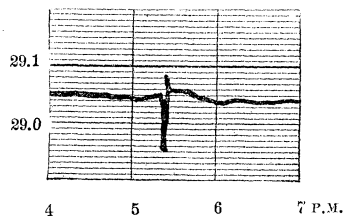
A sudden increased height of the barometric column lasting a short time, which almost invariably occurs with thunder-storms, has recently attracted considerable attention. German writers claim that notices of the phenomenon can be traced back to various observers in that country for more than one hundred years. Dr. Hellman finds a notice of it in the work of Herr J. J. Planer in the last century, and Dr. Ferrari finds a notice of it in the writings of Toaldo of Italy in 1794.

Mr. M. J. Johnson spoke of it in a paper read before the British association for the advancement of science in 1855. Since the somewhat general introduction of barographs, it has been so frequently and so widely noted, that I think it is now accepted as a characteristic phenomenon of thunder-storms.

Dr. Cirro Ferrari, however, claims that the little ridge of increased pressure attending the thunder-storm is only a part of the phenomenon. In front of this ridge he claims that there is a small trough or area of diminished pressure, and the most violent part of the thunder-storm falls between the two.

There are, however, a number of well-authenticated cases in which the barometer showed no indications of a diminished pressure preceding the passage of the storm, but showed an increased pressure during its passage. One of the most marked cases is given in the *American meteorological journal* (vol. i. p. 156), where it is shown that during the passage of a thunder-storm the barograph at Ann Arbor, Mich., rose .13 of an inch; but for ten hours preceding, and for twelve hours following, the storm, the recorded pressure did not vary perceptibly from 28.94 inches.

No marked thunder-storm has passed over Blue Hill since the starting of the barograph at the observatory, without giving indications of an increased pressure during the storm; but only a few have given indications of a diminished pressure preceding the storm, except the slow, steady fall of pressure in a general storm, or broad secondary, within which the thunder-storm occurred. There have, however, been a few marked cases of a decided diminution of pressure attending certain storms. So far as the records show, all of these storms were attended by very high winds. In a few of the cases the sharp depression of the barometer lasted fifteen or twenty minutes, and was followed by a rise lasting slightly longer. One of the most marked cases occurred on July 21, 1886, and the depression lasted only a few minutes. A copy of the barograph trace during this storm is given in the following diagram.



This thunder-storm, which was characterized by very vivid lightning, lasted from about 5 to 5.45 P.M. It was attended by a most violent squall, lasting from 5.12 to 5.17 P.M., during which a large dog-kennel was taken up and smashed to pieces, rain-gauges were overturned, and other damage done. During this squall the barograph pencil fell about .10 of an inch, giving the trace as seen on the diagram. Overlooking this sudden fall, it is seen that there was a gentle upward swell of the barograph curve, lasting thirty or forty minutes, during the passage of the thunder-storm.

I am led to infer that the sudden fall of pressure was due to the dynamic effect of the wind in sucking the air out of the building, while the rise in pressure was due to other causes. It has been found that a greatly increased wind-velocity usually precedes or accompanies the immediate beginning of a thunder-storm; and it is suggested that the diminished pressure which has been found by Dr. Ferrari in front of thunder-storms is due to the dynamic action of the wind on the barometer or its environment, something like the action of a Sprengel air-pump.

There yet remains, however, to be explained, the rise in pressure during thunder-storms. There are a number of reasons for believing this not due to a lower temperature or falling rain. Professor William Ferrel, in conversation, suggested that this also was a dynamic effect of the wind, and was due to a reactionary effect of the sudden expansion of the air ascending in thunder-storms, something like the recoil which takes place from the sudden expansion of ignited powder. There are undoubtedly very rapid moving currents of air in thunder-storms, and it may well be that their sudden expansion or collision produces the effect in question.

According to the view here presented, the following are some of the actions and reactions taking place in thunder-storms: —

1°. There exists above the earth's surface strong currents of air moving inward toward the central line or area of the thunder-storm. This is attested by balloon observations and by observations of clouds.

2°. There arises from the sudden expansion of air entering the vortex of thunder-storms from beneath a reaction which produces a compression of the air near the earth's surface, and a rise of the barometer.

3°. This compression causes the air near the earth's surface to tend outward in all directions from the centre of a thunder-storm; but the outflow in moving storms is only felt, or attains its greatest strength, on the front of the storm, where the direction of the outflow is combined with the progressive motion of the storm. In tornadoes the vortex usually reaches to the earth's surface, and there is no place for a vertical reaction; but where the vortex is some distance above the earth's surface, there is the same evidence of a straight outblowing wind moving in the direction of the tornado, as there is in a thunder-storm.

4°. This rapidly outflowing current, by its dynamic action on the barometer or its environment, frequently or generally causes a depression of the barometer in the front of thunder-storms, where the outflow is most violent. H. HELM CLAYTON.

Blue Hill meteor. observ., April 10.

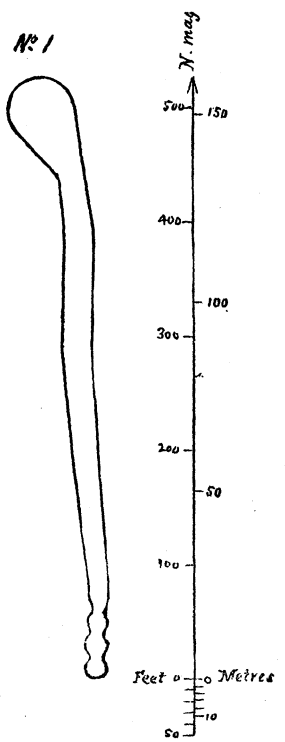
Snake and snake-like mounds in Minnesota.

From time immemorial a certain mythical or superstitious interest has attached itself to the serpent — the wisest of the beasts of the field — amongst most nations, whether civilized or barbarous, and his pictured or sculptured delineations have been the occasion for much writing on the part of antiquarians. In North America the creature has been depicted by the ancient inhabitants in various ways; as, for instance, by carvings on rocks, by outline arrangements of stones or bowlders placed on the ground, and, more sparingly, by mounds of earth. The latter belong to the class of earth-works known as 'effigies,' of which the 'Great Serpent' of Adams county, O., stands an unequalled representative. Indeed, with the exception of this one, no mounds representing snakes have hitherto been delineated and published, except one or two somewhat dubious specimens in Wisconsin.

In the course of my surveys in Minnesota, I have met with at least two such effigy-mounds, which, with some others looking suspiciously like tadpoles, I have drawn in plan for the engraver. They are numbered and described as follows: —

No. 1 is situated on the west side of St. Croix Lake, on the town-site of Afton, Washington county. The land here slopes toward the lake, and the Rattlesnake lies just above high-water mark. The head is 5½ feet high, 88 feet long, and 56 feet wide at the broadest point, which is also the highest, from which it gradually descends to the body. Where the head joins the body the embankment is 22 feet wide and nearly 2½ feet high. The body is but slightly curved. In the next 160 feet the width increases to 26 feet, but the height drops to 2 feet. From this point it gradually diminishes to 18 feet in width and 1 foot in height. Connected with the extremity or tail, there are three small mounds whose bases interlock, thus forming the rattles. The last of these mounds is 20 feet long and 18 feet wide, and the two between it and the tail are each 18 feet in diameter, and all three are of the same height as the end of the tail. The total length of this effigy is 534 feet. On June 25, 1883, when this survey was made, in addition to the snake, there were four round mounds and one embankment in the group. Formerly there were other mounds, but they had been demolished.

No. 2 is on the east side of Spring Creek, some three miles westward from Red Wing. It has a perceptible head, which is 8 feet wide and 1 foot high; the neck is nearly 7 feet wide and 10 inches in height. From the latter point the body gradually increases its width until the middle is reached, where it is 14 feet wide and 2 feet high: thence it decreases to the



end of the tail, which is 8 feet wide and 1 foot high. Its total length following the curves is 430 feet. The mound which covers the body near the head is 52 feet in length, 36 feet wide, and 5 feet in height. From general appearances it would seem that it was built after the snake was constructed; for the slope of the mound where it strikes the body of the snake is somewhat irregular, and indicates that its builders were at a loss to know how to join them symmetrically. These irregularities are not caused by the dirt washing down from the top of the mound, for otherwise it is perfectly symmetrical and the base well defined.

No. 3 is in another group of mounds about 250 yards down the same creek from the preceding one. The head is circular in form, being 40 feet in diameter and 3½ feet high. The body at the junction with