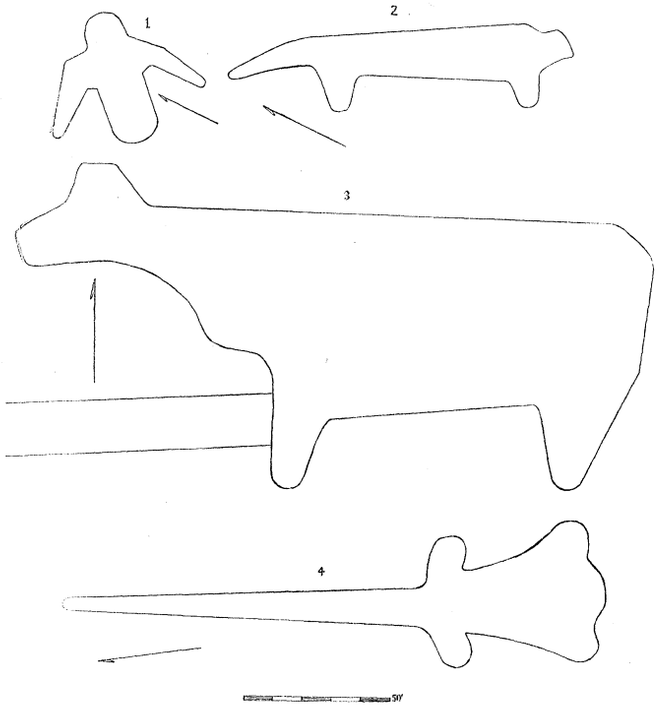
connecting point, it is very evident that the animal was constructed last. This overlapping of mounds is by no means uncommon in the North-West, and probably may account for the 'amalgamation mounds' of some writers. Besides the animal, there are in the same group twenty-three round mounds and ten embankments, as well as four other round mounds which have 'approaches,' or a low embankment, running from each.




A much less bulky animal (4) is on the S.E. ¼ of Sec. 13, T. 27, R. 9, E., some ten miles east of Freeport, Stephenson County, and on the north side of Pecatonica River. Its greatest length in an air line is 116½ feet, and the average height of the body 1½ feet. In the same group with it there is one embankment and seven round mounds, three of which are partially demolished. In one of the latter a fine hematite 'plumb-bob' was unearthed, in connection with a human skeleton which was badly decayed. Hematite relics in this region, and especially plumb-bobs, are exceedingly rare.

Near these mounds, but at the foot of the slope, there is a fine boiling spring of pure cold water.

Very few of these Illinois effigy mounds are in a good state of preservation; but I looked around long enough to find ten of them worth surveying, of which the four now given are the best suited for publication as types.

In surveying mounds of this class it has been a special object to get their true outlines as near as possible, without any preconceived ideas or fanciful imaginings as to what animal or other object they were intended to represent. To do this it is necessary to determine where the artificial ground ends on the natural surface. It is hardly possible, however, for the reader, even with the aid of faithful diagrams, to form an adequate idea of the beauty and symmetry of the effigies as they appear to the eye when in their undisturbed state.

T. H. LEWIS.

St. Paul, Minn., July 31.

### The Coal-Measures of Kansas.

THE drilling of a 2,000-foot well at Emporia, Kan., has furnished an excellent section of the coal-measures of this State. The location of the section, unfortunately, can be given but approximately. Beginning somewhere in the upper half of the upper coal-measures, it ends in the lower third of the lower coal-measures. The section is very interesting, however, independently of its position in the formations.

In the depth of nearly 2,000 feet there are 112 strata with an average thickness of nearly 18 feet. Of these strata, 50 are shale, 50 limestone, and 12 sandstone. The limestone strata average 9¼ feet in thickness; the shale, 25 feet; and the sandstone, 24 feet. In the upper thousand feet are ¾ of the shale strata, $\frac{7}{10}$ of the limestone, and $\frac{5}{12}$ of the sandstone strata; but in the first thousand feet are $\frac{7}{12}$ of the shale, nearly ½ of the limestone, and ⅓ of the sandstone. The total thickness of the shale is 1,242 feet, limestone 465 feet, and sandstone 286 feet. Mingled with the shale are three beds of coal in the first 500 feet, and one bed in the last 500. The thicknesses average less than one foot.

The section teaches that the conditions under which the coal-measures were deposited were exceedingly variable, and that the tracing of the strata through eastern Kansas will not be a holiday task.

These deposits, even including the limestone, are mostly shallow-water accumulations, and are quite rich in fossils, especially the limestone. Incrusting corals, crinoid joints, and brachiopod and conchifer shells are especially abundant. Trilobites are rare.

L. C. WOOSTER.

Eureka, Kan., Aug. 31.

### Radiant Energy.

IN your issue, Aug. 17, Prof. S. P. Langley, in his presidential address at the late meeting of the American Association for the Advancement of Science, puts his case a little too strongly in favor of Draper, I think, when referring to Melloni's statement of the relation between light and heat forms of radiant energy, made in 1843. He says, —

"So far as I know, no physicist of eminence re-asserted Melloni's principle till J. W. Draper, in 1872. Only sixteen years ago, or in 1872, it was almost universally believed that there were three different entities in the spectrum, represented by actinic, luminous, and thermal rays."

As a student at Dalhousie University, Halifax, Nova Scotia, before Draper's publication of 1872, I found Melloni's principle not only "re-asserted," but accepted. I fail to understand how it could be otherwise in the United States, when Tyndall's lectures and demonstrations in the Royal Institution were published in 1863, a quarter of a century ago; when the Smithsonian Report of 1868, twenty years ago, published Tyndall's Rede Lecture before the University of Cambridge in 1865, with translations of articles by Cazin and Magrini bearing on the same subject. But, more than that, Tyndall's lectures were published in a neat volume of some five or six hundred pages, by D. Appleton & Co. of New York, in 1870, two years before Draper's publication. I thought Professor Langley might have eminent "American physicists" in his mind; but his reference to the English cyclopædia of 1867 immediately before, suggests no such limit to his statement.

A. H. MACKAY.

Pictou Academy, Nova Scotia, Aug. 22.

[Mr. MacKay's letter may elicit more information on an interesting point, but attention should be drawn to the fact that he offers no evidence (i.e., cites no passages) to show that the lectures he mentions *do* quote any "physicist of eminence" in plain support of the doctrine in question. A statement as explicit as Melloni's or Draper's is what is wanted. Statements which might mean this (or any thing else) are plenty. —ED.]

### The Laws of Corrasion.

UPON opening my copy of *Science* this morning, I am greeted with your note on Major Powell's "first formal announcement of a new law in the hydraulics of rivers" upon the relation between their corrading power and sedimentary load. I think you will find this principle fully stated by Major Powell in his 'Report on the Geology of the Uinta Mountains' (Government Printing-Office, 1876); but my object in writing is to draw your attention to the recognition of this "new law" in Chapter XVI., and especially p. 226, of the new 'Physical Geography' of Van Antwerp, Bragg, & Co. The law as enunciated in the first paragraph of *Science* (No. 290) is only true within certain limits, for the sedimentary load of a stream may become so great that it requires all the energy of the current to simply transport it, and hence there is little or no corrasion. The rivers of the Great Plains, — as Platte, Republican, Arkansas,

Red, etc., — which have a steep declivity, but flow in broad, shallow valleys, are examples.

This matter is fully discussed by Powell in the report above cited (1876), and by Gilbert in his report on the Henry Mountains (1880). RUSSELL HINMAN.

Cincinnati, O., Aug. 27.

[Our esteemed correspondent misapprehends the scope and specific limitations of this "new law in the hydraulics of rivers," as he also does those of the law announced by Major Powell in his report on the Uinta Mountains, in 1876. In neither case is the law stated as a general one. Major Powell has never said, and does not now say, that in *all* rivers, and under *all* circumstances, "corrasion of every kind is increased by increase of load," although it may be true. But that is what our correspondent seems to suppose Major Powell's law of 1876 meant. Stated in its simplest form, the law of 1876 is as follows: "*In a region of degradation, vertical* corrasion is increased by increase of load, *in a diminishing ratio.*" He never dreamed at that time that this law could be generalized, or even that any similar law would explain lateral corrasion by a river flowing through a flood-plain. The new law which he now proposes as the result of subsequent study is, "*In a region of sedimentation* [and it must be noted that the flood-plain of the Mississippi is a delta region, and therefore a region of sedimentation] an increase of load increases *lateral* corrasion *in a geometric ratio.*" We did not emphasize this distinction in the brief editorial reference which we made to Major Powell's paper, assuming that any reader who had given especial attention to the study of the hydraulics of rivers would make it for himself, certainly if he read Major Powell's paper printed in the same number of *Science*, and beginning on the same page with the editorial paragraph referring to it; for all others the law was stated in the least confusing, although perhaps not in the most comprehensive language. — ED.]

## A Notable Evolution.

THE remarkable power of the catbird as a singer is known to all those who give it a safe and welcome retreat. Yet I find even such writers as Baird describing it after this manner: "An American bird of the thrush family, whose cry resembles the mewing of a cat." In reality it is the mocking-bird of the North, possessed of ability to sing whatever notes he hears. I have them so perfectly at home in my grounds, that their delicious music is heard at all hours of the day, and often in the middle of the night. It is very curious to hear one of them warble in a low key to himself what some other bird is singing loudly. A few days since I heard one mimic a red squirrel, and he did it to perfection. If he had not enjoyed the fun so well that he could not keep from hopping about, I should not have known which was squirrel.

I did not, however, intend, except incidentally, to write about the catbird, *Mimus Carolinensis*. It, however, makes it easier for us to conceive the possibility of an evolution of superior vocalization in his relatives, when we consider his masterly ability. What I wish to record is a remarkable development in the case of his cousin the common robin, or migratory thrush. Every one knows what a clumsy singer he is, having a rough, see-saw note, that he repeats with little variation. For some reason the other birds give him precedence in the morning song with which daylight is greeted about half-past three in June. The first note comes always from the east, — a faint, far-away cry; then another cry leaps out of a tree nearer you, and then another and another. So the wave of robin-melody moves westward, over the house and over the land, preceding the rising sun, probably from the Atlantic to the Pacific. This song is peculiarly adapted to constitute a matin cry, being clear, strong, and cordial. But it is not musical. In June of 1887, crossing one of my lawns, I heard a cry so peculiarly like articulation that I was startled: "Hear this birdie! Hear this birdie! Hear this pretty birdie!" the last notes being exquisitely rendered, with a wave and upward bend. I had never heard such a song before, and imagined a new species of bird must have arrived; but after careful examination, I found the singer to be a veritable robin-redbreast, and not a new-comer at all. The song was repeated all the summer, to the delight of myself and friends. Of course, I awaited the opening of spring with anxiety, to know if our birdie would return. Almost the first song of spring, sure enough, was one morning in April: "Hear this birdie! Hear this birdie!" But, better yet, it was apparent that the babes of this family were singing, not the old robin's see-saw, but the new song. And now about my place are three or four of our birdies. What was notable was not only the remarkable evolution of musical power, but a love for music; for our birdie, unlike the robins in general, sang all day, like the catbirds. I could hear one or more at almost any hour. This drew my attention to the cause of the unexpected variation. John Burroughs suggested that it might be the song taught to one that had been caged and afterwards escaped; but I am more inclined to think that it is a natural variation or evolution, and that the robin has great and undeveloped power. It is a phlegmatic bird, that takes the world easy, and is not likely to exert itself in new directions. The catbird is fond of notice, likes to be whistled to, and enjoys answering back. He is likely to develop all sorts of new vocal accomplishments. But the robin is really lazy, and does as little hard work as possible. His nest is a clumsy affair, a mere daub of mud and sticks. Why has he begun this new song? Is it from being so constantly with catbirds, grosbeaks, orioles, etc.? for my nine acres are the paradise of birds. They are covered with fruits, hedges, trees. I do not know, but believe, some such cause to be at the bottom of the affair, and that we may look for other developments quite as remarkable. Within the month of June, while driving about five miles from my home, I saw a robin sitting on a wayside fence, and singing a set of notes most charmingly unlike any thing I had ever heard; neither was it at all like our birdie. It was as complex as a catbird often sings, but not apparently imitative. This has led me to a very decided conviction that an evolution in robin-music is now going on, and that some very delightful results may be looked for. I shall be glad to get notes from observers in different parts of the country. Of this I am certain, that our common thrush has a vast vocal power undeveloped. Evolution with birds must move, as it has moved, in the line of music, plumage, and flight, and nest-building. Nothing in these directions need surprise us.

I subjoin a note taken from a paper published near New York City, over two hundred miles from here: "Thomas O'Donnell of Rondout has a robin which whistles like a mocking-bird. This is probably due to the fact that it was raised in company with a mocker. The robin whistles 'Johnny, get your Gun,' and 'Don't leave your Mother, Tom!' Its powers of mimicry are wonderful. In the early morning, when things are quiet, the whistle of the bird has been heard a quarter of a mile. One day recently a man went into a saloon over the door of which the robin hung. The bird gave a sharp, quick whistle, which a man across the way, seeing his friend enter the saloon, considered a call to get a free drink. The man who first entered the saloon denied having whistled, but he nevertheless stood treat." I am confirmed by such reports in the belief that we shall see a remarkable evolution of robin-music. Our homestead pet and universal favorite will then be all the more dear. E. P. POWELL.

Clinton, N.Y., Aug. 28.

## Queries.

36. DOUBLE FRUIT. — Last May a gentleman brought into my office a peach-tree branch quite thickly covered with small green peaches, most of which were double; that is, consisted of two (in several cases three) peaches, more or less completely fused into one. Some of the members of these doublets were hardly distinguishable as such, except by the fact that they had two stones; while others were scarcely united, and a few were entirely distinct from each other, but had only a single stem. Later I learned of such peaches being common in two other widely separated localities in this State this year, but no one had ever seen them in any previous year. I have also a collection of ripe cherries doubled in a similar way, and gathered this year from a tree in this city. Is this a common phenomenon? What is the appearance of the flower which gives rise to this double fruit? J. L. H.

Louisville, Ky., Aug. 7.