tention. The spectrum of the Hercules cluster N. G. C. 6205, obtained by Dr. Fath is quite remarkable. He says:

It is composed of a number of parallel strips of different intensities, containing a few faint absorption lines. Each strip is probably the spectrum of a single star, or group of stars. No two strips contain the same set of lines. Four of the strips were strong enough to be measured.

In the following table the first column states the number of the strip, the second the wave-length, the third the intensity, the fourth the corresponding wave-length of radium emanation, the fifth its intensity.

TABLE III

Strip.	N. G. C. 6205		Ra. E.	
	λ	In.	λ	In.
(2)	3935	3	3933.3	3
(1)	3966	3	3971.9	9
(2)	3970	3		
(4)	4118	2	4114.9	7
(1)	4294	1	4308.4	2
(4)	4302	1		
(3)	4340	1	4340.8	50 Ra.
(4)	4463	1	4460.0	10
(2)	4790	1	4796.7	1

It will be noticed that to the single line of strip (3), I have assigned the radium line of high intensity, although an emanation line λ 4340.9, intensity 7, also exists. I think the evidence for the existence of radium emanation in this cluster is sufficient to make discussion unnecessary. It will be seen that for the different strips the lines vary. Difference of excitation, due to the difference of physical state of each star, completely accounts for the variation. In the globular clusters N. G. C. 7078 and 7089, the hydrogen lines are, as Dr. Fath indicates, probably evident from $H\beta$ to $H\theta$. Radium emanation must, however, also claim λ 4102.2, λ 3971.9 and λ 3933.3 in each of these star clusters.

It may not be amiss to venture a few suggestions:

1. Each photograph or observed spectrum of a nebula, star cluster, or bright line star, should be treated as a separate entity in publication; otherwise the successive changes in given lines are averaged out of existence.

2. If possible, the spectrum of the nebula of Andromeda should be repeatedly photographed.

3. It should be the aim to photograph as soon and as effectually as possible the spectra of the short-period variables in globular star clusters even if at first integrated results, both as to stars and as to periods, are obtained.

In conclusion, I must state that I am quite conscious of the incompleteness of this discussion. Indeed, it is the manifest complexity of the subject that has made me, hitherto, recoil from a preliminary application of the theory for publication. Radium has been known for at least ten years as a terrestrial element, its spectrum has been repeatedly determined and compared with the spectra of the heavenly bodies, and yet up to the present moment there has been published, so far as I know, no demonstrative evidence concerning its existence in the heavens. On the contrary, careful comparisons made by chemists, physicists and astronomers, have apparently shown that the spectra of radium and radium emanation, the element into which radium is at once transformed, are not identifiable with stellar spectra. It is, therefore, significant that the identifications here made were suggested by the theory of radioaction.

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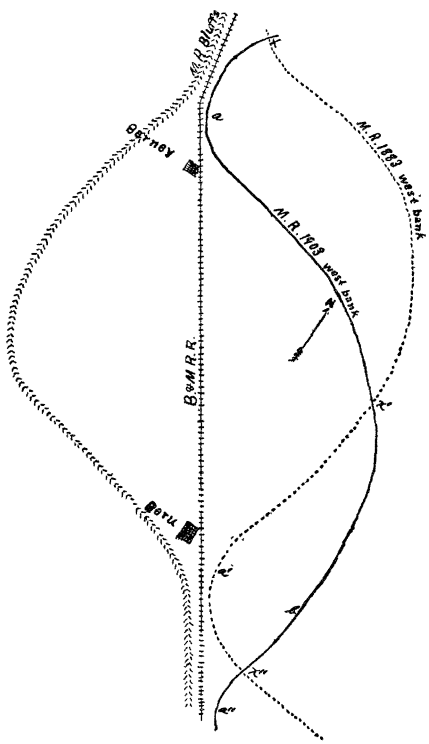
OBSERVATIONS ON THE SHIFTING OF THE CHANNEL OF THE MISSOURI RIVER SINCE 1883[1]

THE radical changes which annually take place in regard to the position of the Missouri River channel and the great loss of property occasioned by the same have presented a problem worthy our careful consideration. In addition to the scores of farms which are washed out annually the railroads suffer greatly by having their roadbeds destroyed. Hence, this becomes an economic problem of vast proportions.

In the following chart we have represented a portion of the river valley near the village of Peru, including ten or twelve miles of the river bed. The upper dotted line represents

[1] Read before the Nebraska Academy of Sciences.

the position of the western bank of the river in 1883 and the continuous line represents the position of the western bank in 1903. Locating the letters X, X' and X'' at the intersections of the old and new channels; then, all the territory between the old channel and the new and between X and X' has been washed from the Nebraska side, while the corresponding territory between X' and X'' has been



added to the Nebraska side. From the point a' to the point b is 5,000 feet, all of which has accumulated in twenty years, or an annual increase of 250 feet. The actual increase has varied, however, from 50 to 500 feet annually. At no time during the twenty years has the channel between X' and X'' encroached upon the Nebraska shore. On the other hand, the river has annually encroached upon the Nebraska shore between the points X and X' for the same period of time.

The river, at Peru, has a descent of about eleven inches per mile and the rate of flow varies greatly. During high waters, in the spring months when the principal washings take place, it is found that at the points a and a'' the water along the western shore has an elevation of 20 to 50 inches above that of the eastern shore, directly opposite. This piling up of the water along the western shore causes a part of the water to turn up stream, producing immense eddies at times a mile or more in circumference. The principal part of the water, however, is directed down the stream diagonally toward the opposite shore where the water is at a much lower level.

The most rapid erosion usually takes place in early spring at the time the ice breaks in the river; frequently, however, the June freshets play great havoc with the banks. The rate of erosion at the upper half of the curve is not the same as the deposition at the lower end of the same curve. For example, in twenty-four hours there may be from ten to twenty-five acres washed from the shore aX', while the accretion to the shore line $X'a''$ is very gradual. As the channel encroaches upon the upper portion of the curve it shifts farther from the lower portion. As the main channel recedes from the shore the space is usually transformed into eddies which supply the necessary conditions for depositing large quantities of detritus. In the shifting of the channel the symmetry of the curve is usually quite well preserved with reference to upper and lower halves.

Another factor enters our problem: the general direction of the river is southward and it is gradually flowing over larger and larger circles of the earth. Hence, the water piled up at a starts off in the direction of X' with the impetus given it from the piling up of the water. This rebounding force is counteracted by the influence of the rotary action of the earth by the time the water reaches X'; so, beyond the point X' the rotary action of the earth becomes the dominant factor and the water gradually falls behind until it again cuts the western bluffs at a''. Furthermore, the height to which the water is elevated at a determines, in a large measure, the distance aX' while the distance $X'a''$ determines the height to which the water is piled up at a''.

Hence, by locating the points a, a' and a'' one can determine, with almost mathematical precision, the land next in order to be removed and the location of the new deposit. Again, sooner or later points a and a' will coincide and lines aX' and $a'X''$ will coincide.

The dotted line yy' represents the manner of washing since this article was first prepared. The railroad and station at Barney have been washed out and a new station has been located farther to the southwest as indicated on the chart.

We have taken simply one section of the river as an illustration; but, after studying in detail a large number of these curves and after studying in a general way the entire river bed from Sioux City to the southern border of Nebraska we believe no exception to the chart can be found. In applying these principles to the washings of the eastern bank of the river all positions would be reversed.

The effort to hold the channel of the river under the bridges at Omaha and Nebraska City has greatly influenced the recession of the series of curves below each bridge.

We may, therefore, summarize the following points:

1. That the Missouri River channel is methodical in its shiftings.

2. The location of the new channel and the new deposit may be determined beforehand with mathematical precision.

3. There is a recession of the series of curves down stream.

4. The channel cuts the western bluffs at more or less regular intervals.

5. At no point does the river encroach upon the eastern bluffs.

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THE PROPER NAME OF THE AMERICAN EEL ANGUILLA ROSTRATA (LE SUEUR)

THROUGH an error in recording the date of publication the common American eel has been given a later-bestowed technical name and the author of a prior name and description has been denied the honor of first naming the American species.

In the *Journal of the Academy of Natural Sciences,* Philadelphia, No. 5, Vol. I., p. 81, C. A. Le Sueur described the common American eel under five specific names, viz.: *rostrata, Bostoniensis, serpentina, argentea* and *macrocephala,* all of which he erroneously placed under the genus *Muræna* of La Cepede.

Several months later C. S. Rafinesque, in *The American Monthly Magazine and Critical Review,* No. II., Vol. II., p. 120, described this eel under the name *Anguilla chrisypa* and *A. blephura,* and his note after the descriptions, "These two species of eels appear different from all the new species lately described by Mr. Lesueur, under the old name of *Muræna,* which belongs properly to a very different genus without pectoral fins," led me to look into the matter of the proper name for the American eel.

Rafinesque's name *chrisypa* has of late years been applied to this eel, authors citing 1821 as the date of publication of the journal in which Le Sueur's descriptions occur notwithstanding the fact that the numbers are plainly marked, No. 1, May, No. 2, June, No. 3, July, No. 4, August, and No. 5, September, 1817. From the dates and other marks on these numbers it was evident that they were promptly printed, but having been informed that the journal had not been printed and published, as dated, I addressed a note to Mr. Witmer Stone, of the Philadelphia Academy of Natural Sciences, and quote his courteous and satisfactory reply, written March 17, 1909.

My dear Mr. Bean: Such data as I have accumulated on dates of issue of our publications relate to our Proceedings only & I had little hope of solving the problem contained in your letter. Fortunately I asked Mr. Wm. J. Fox our Asst. Librarian if he knew of any clew and he suggested looking in a bound volume of manuscript letters from Thos. Say to Rev. J. F. Melsheimer, from which he had published extracts some years ago in Entomological News, as he thought there was some allusion to sending parts of the Journal to Melsheimer. Curiously enough the first mention of the matter that we found was as follows, in letter dated November 6, 1817, "yesterday I sent you the *Fifth* part of the Academy's Journal and tomorrow I will send you the *sixth.*"