

RATE OF DEPOSITION.

The time required for deposition of the sedimentary rocks must greatly exceed that required for removal. For, the ocean being so much greater than the land, any quantity of soil removed from the land becomes very thin when spread out over the floor of the ocean. However, the rate of deposition is always very unequal, according to the varying conditions; and we know not what the conditions may have been during deposition of any of our older strata.

Evidences are abundant, showing that at various periods of the earth's development, portions of this continent were elevated above the surface of the sea, and removal of deposits continued, often until a greater depth of rock was removed than we have considered in this article, requiring either a greater time or more violent forces at work; and again, the land would become submerged, and remain buried until additional great depths of deposition had taken place, and new rocks were formed; thus showing repeated formation and removal of vast thicknesses of solid rock. If this be true of other parts, why not of Kansas?

AGE.

Counting time necessary for such successive deposits and removals, not counting varying conditions, can we safely estimate that, since disintegration and deposition first began on the igneous foundation rocks of Kansas, less than several hundred million years could have elapsed? Indeed it was probably very far beyond that toward eternity.

Time is long, and life is fleeting.

CLOSE.

In closing this paper, let me urge upon scientists in different parts of the State that they make occasional note of the following points: Breadth and depth of streams near where they live, at stated times; velocity of current, found by throwing in a chip, and noting time taken to pass a given point whose distance is known; amount of sediment obtained from a measured quantity of water; weight of residue obtained on boiling the water away; length of time the stream runs during the year, and time of year. Such observations, faithfully taken and recorded, will be very interesting and valuable.

SECOND CONTRIBUTION TO THE HERPETOLOGY OF KANSAS, WITH
OBSERVATIONS ON THE KANSAS FAUNA.

BY F. W. CRAGIN, SC. B.

The list herewith given includes recent additions to my "Catalogue of Kansas Reptiles and Batrachians,"* together with further notes on certain species embraced in that catalogue.

For the identification of several of the species herein reported, I am indebted to Prof. E. D. Cope.

The remarks following the list are a revision and extension of notes, originally drawn up in the winter of 1880-81, to accompany the catalogue above mentioned, but finally withheld in order that the conclusions set forth in them might be made both more accurate and fuller. They make, even now, no claim to completeness.

Lack of time prevents me from entering here upon a full discussion of the details upon which these conclusions are based; but this I hope soon to be able to do in another paper.

*Transactions Kas. Acad. Sci., Vol. VII, p. 114.

Cistudo ornata, Ag.: Western Box-tortoise.—This little land tortoise is so abundant in some sections of southern Kansas, (e. g., Harper and Barber counties,) as to amount to a nuisance as a cumberer of the ground.

It will probably have to be reduced to the rank of a variety, under *C. Carolinensis*, Linn. (= *C. clausa*, Gm.)

Chrysemys Belli, Gray: Bell's Tortoise.—Although this species, under the name of *Chrysemys Oregonensis*, was included in my "Preliminary Catalogue of Kansas Reptiles and Batrachians," (Transac. Kas. Acad. Sci., Vol. VII, 1881,) on the ground of its known general distribution, I was then unable to present any actual record of its occurrence within the State. I now find it to be the common *Chrysemys* of the streams in Shawnee county. It has also been submitted from Neosho Falls by Col. N. S. Goss, and I have taken it in Lake Farland, McPherson county. Through the kindness of Prof. Popenoe, of the State Agricultural College, I have also been able to examine specimens collected in the vicinity of Manhattan. In Dr. Yarrow's "Check-list of North-American Reptilia and Batrachia," I find the species recorded from the Republican river.

Chrysemys picta, Herm.: Painted Tortoise.—It now appears that the *C. Bellii* recorded by Agassiz (Contrib. Nat. Hist. U. S.) as abundant in western Missouri, and so quoted in the "Preliminary Catalogue" under the name *C. picta*, was probably the preceding species. But among the specimens from Neosho Falls, Kansas, submitted by Col. Goss, is one of the true *C. picta*, enabling me to retain the species as an undoubted member of the Kansas fauna.

Malacoclemmys Le Sueuri, Gray: Le Sueur's Map Turtle.—This is a common species in the Kansas river at Topeka. I have seen also, by favor of Prof. Popenoe, a specimen collected near Manhattan, and the species occurs in the collection from Neosho Falls from Col. N. S. Goss.

Pseudemys elegans, Pr. Max. Wied.: Red-Eared Terrapin.—A large specimen of this superb tortoise, "alive," though decapitated, and showing the marks of sharp teeth, was recently found by the writer upon the bank of Shunganunga creek near Topeka. It shows that even the best equipped specimens of these armor-clad reptiles sometimes fall a prey to the minks or other carnivorous mammals of our western streams. A young living specimen collected near Geuda Springs, has been received from Messrs. Harry and Walter Vrooman; and a third specimen is in the collections of the Kansas Academy of Science, contributed from Neosho Falls by Col. N. S. Goss.

Cinosternum Pennsylvanicum, Bosc.: Eastern Mud Turtle.—Through the courtesy of Prof. Popenoe, I have been able to examine the tortoises in the cabinet of the State Agricultural College. Among them I find a single specimen of this species. It was taken in Trego county by Mr. S. C. Mason.

Sceloporus undulatus, Harl., var. *Thayeri*, B. & G.: Thayer's Alligator Lizard.—Received from McPherson county through Dr. John Rundström.

Sceloporus consobrinus, B. & G.: Marcy's Alligator Lizard.—In my former list I could quote only a Nebraska and an Indian Territory record as evidence that this lizard belonged to the Kansas fauna. A specimen from central Kansas has since been contributed to the Washburn zoological cabinet by Mr. Jerry B. Fields. It is a female, and represents, *vide* Prof. Cope, *S. Garmani*, Boul.

Cnemidophorus tessellatus, Say: Tessellated Swift.—The occurrence of this species in Kansas was hardly expected; but a specimen of the typical variety has been sent me from McPherson county, by Dr. John Rundström.

Eumeces fasciatus, Linn: Blue-tailed Skink.—A considerable number of specimens from Neosho Falls, presented by Col. N. S. Goss to Washburn College and the Kansas Academy of Science, includes the *erythrocephalus*, *quinquelineatus* and *fasciatus* phases, or rather ages, which were mistaken for distinct species by Dr. Holbrook.

Eumeces multivirgatus, Hallowell.—Neosho Falls; collected by Col. N. S. Goss. This skink was included in the supplement of my preliminary catalogue only as one rather likely to be found in Kansas.

Tropidonotus leberis, Linn., var. *Grahamii*, B. & G.: Graham's Queen Snake.—Neosho Falls; collected by Col. N. S. Goss.

Storeria lineata, Hallowell: Line Snake.—This is the *Tropidoclonium lineatum* of my preliminary catalogue. It proves to be one of the commonest serpents of Kansas. Every State has its "School-boy's Snake," a snake of small size and meek demeanor, though a horror to the uninitiated, which the untamed urchin of school and field carries about in his pocket or fist for purposes of terrorism. This "School-boy's Snake" of Kansas is the Line Snake.

Eutania sirtalis, Linn., var. *Pickeringii*, B. & G.: Pickering's Garter Snake.—McPherson county, from Dr. John Rundström.

Eutania sirtalis, Linn., var. *obscura*, Cope MSS.—Dr. Yarrow's Check-list shows that this variety of the Garter Snake ranges over the entire area of the United States. Eight of the specimens appear to have come from Kansas, the following localities being recorded: Cimarron river, a point between the Cimarron and the Arkansas, Republican river, and Little Blue river.

Eutania proxima, Say: Long's Garter Snake.—Dr. Yarrow records a specimen from Fort Riley, Kansas.

Pituophis catenifer, Blainv., var. *bellona*, B. & G.: Western Bull Snake.—This species also is recorded from Fort Riley in Dr. Yarrow's Check-list.

Elaphis quadrivittatus, Holbr.: Chicken Snake.—Dr. Yarrow's record, "Kansas" for this snake, adds another southern species to a fauna which, though a prairie fauna, has already shown that it has much in common with the Austroriparian.

Cyclophis cestivus, Linn.: Southern Green Snake.—Among the specimens submitted by Col. N. S. Goss is one of this species. It is from Neosho Falls. A second specimen of uncertain locality in the collection of the Topeka Free Library was presented with other Kansas specimens, and was probably taken in Kansas. A third specimen seems to have been taken at Great Bend by Messrs. E. G. Buckland and H. B. Torrey. This is another Austroriparian species.

Tantilla Hallowellii, Cope: Hallowell's Tantilla.—This species was originally described in 1856 as a variety of *T. gracilis* by Dr. Hallowell from a specimen collected in Kansas by Dr. Hammond, (Proceed. Phila. Acad. Nat. Sci., 1856, p. 246,) and afterwards named as distinct by Prof. Cope. (Proceed. Phila. Acad. Nat. Sci., 1860, p. 77.) Mr. Garman, of the Cambridge Museum of Comparative Zoölogy, in his excellent account of the *Ophidia* of North America, "North American Reptiles, Part I," reduces it to a variety under *T. gracilis*. As it does not appear that any of the allusions to this species have been based upon more than one or two specimens, it seems necessary to await the accession of further material before the specific identity of *Hallowellii* with *gracilis* can be either asserted or denied.

Sistrurus catenatus, Raf.: Massasauga.—Taken in Ford county by the writer. It is recorded from the Verdigris river [Kansas?] in Dr. Yarrow's Check-list. The Ford county specimen is typical, and the locality is the most westerly known for the species. This is the *Caudisona tergemina* (erroneously printed "tergermina" in my "Preliminary Catalogue.") Mr. Garman's substitution of a fourth generic name in the stead of either of the three to which the plated-headed rattlesnakes had previously been referred, seems to have been the proper and indeed the only logical remedy for the confusion that existed, inasmuch as no new genus, nor even sub-genus, had previously been created for those forms, the generic names previously used for them being preoccupied and long used with a very different signification.

Amblystoma microstoma, Cope: Small-mouthed Salamander.—A specimen of this sala-

mander occurs in Col. N. S. Goss's contribution. Its locality is, not quite certainly, but probably, Neosho Falls.

Necturus maculatus, Raf.: Water Puppy.—Several specimens from Neosho Falls, in the collection submitted by Col. Goss, are the first Kansas specimens that I have seen. The species was previously reported to me in letter by Prof. F. H. Snow, who stated that it had been taken in Allen county, near Iola, by Mr. Bert Casmire, a student of the State University.

The minuter details of the relations of Kansas to the four great faunal regions—Central, Eastern, Austroriparian, and Sonoran—that enter or approach its borders, are yet to be ascertained.

In problems of faunal relations, we can direct our attention to no department of zoölogy more profitably than to that of herpetology, the intimate relations of reptiles and batrachians to their climatic and topographical surroundings (partly dependent on the fact that they do not migrate), rendering them exceptionally important factors in all problems of faunal relations.

This fact has constantly been kept in mind in my studies of the reptilian fauna of Kansas, and the conclusions primarily derived from the study of that fauna have been frequently reviewed in the light of observations made in the course of my studies upon other groups of Kansas vertebrates and invertebrates, and further tested by the published writings of the various naturalists who have studied portions of the Kansas fauna.

While Kansas embraces features of each of the four faunal regions above mentioned, no part of its territory is the exclusive property of one. Faunal regions are rarely sharply defined. They cast their shadows beyond them, and beyond each shadow is spread a penumbra. To a mingling of faunal shadow and penumbra from the regions above mentioned this area owes the heterogeneous aspect of its fauna.

In its flora, too, we see mingled with the dominant vegetation of the Central and Eastern regions varying shades of the Austroriparian, and a few faint flecks of the Sonoran.

Of reptiles and batrachians, whose distribution corresponds nearly with a single one of the four regions concerned, or with a part of such region, we find in Kansas of the Austroriparian 14, Central 11, Eastern 10, and Sonoran 3.

This observation might seem to point to the Austroriparian as the dominant factor, but it by no means represents the true faunal relations of the State. It plainly asserts that the fauna of Kansas is deeply shaded with Austroriparian. But when we consider the ratio of each of the above numbers to the entire number of species peculiar to the corresponding region, and take into account species common to two or more regions, we see at once that the herpetological aspect of Kansas is mainly Central and Eastern.

Two or three, only, of the many reptiles characteristic of the Sonoran region, together with a few which that region shares with the Central on one hand, or with the Austroriparian on the other, extending into Kansas, show its distant Sonoran relationship.

The above observations pertain to the Kansas fauna as a whole, all Kansas species being viewed as common to the entire State. But comparatively few species range over the entire area of Kansas in upland and valley alike, and to gain an adequate conception of the Kansas fauna, even in its relations to natural faunæ, we must consider its intralimital relations, and take into account other groups than those of reptiles and batrachians.

Full details of distribution have as yet been made out for but few species of Kansas animals; but enough has been done to warrant the following conclusions as to the special relations of the Kansas fauna:

1. That Kansas cannot, as a whole, be included in any single faunal region of the four that enter or approach its borders.

2. That it possesses some faunal features in common with each of these regions.
3. That the only faunal region that contributes a considerable majority of its characteristic species to any portion of Kansas, is the Central.
4. That the plains of Kansas, west of the ninety-seventh meridian, possess a large majority—in reptiles and batrachians, perhaps all—of the characteristic species of the Central region, and that while the Central fauna cannot be regarded as extending in full force, except locally, over the plains east of that meridian, many of its characteristic forms occur abundantly further east, some of them ranging to the Missouri river.
5. That even in the purest portions of the Central fauna in Kansas, appear slight manifestations of Sonoran, and others of Eastern and Austroriparian affinities.
6. That the prairie fauna of Kansas, east of the ninety-seventh meridian, is a heterogeneous assemblage of Central, Eastern, and Austroriparian forms, among which the Central predominate.
7. That it is on the “bottoms” and wooded bluffs, and their immediate vicinity, that the constituency of the Eastern fauna in Kansas is mainly expressed, and that this constituency includes comparatively little that is really characteristic of the aquatic phase of that fauna, while representing fairly well the terrestrial aspect of the same.
8. That the lacking elements of the Eastern fauna in these low and wooded tracts, are largely replaced, in valleys of the Missouri drainage, by Central, and in those of the Arkansas drainage, by Austroriparian and Central elements.
9. That the constituency of the Eastern fauna in Kansas diminishes westward, and is nearly or quite lost in the Central ere it reaches our western border.
10. That the Kansas constituency of the Austroriparian fauna lacks numerous characteristic forms of that fauna, and is constantly intermingled with Eastern and Central elements.
11. That this constituency is fullest in the valleys of the lower Arkansas drainage—notably of the Spring, Neosho, Verdigris, and Fall rivers—and represents only the Louisianian and Texan districts.

PRELIMINARY NOTE ON THE ORIGIN AND MATURATION OF THE OVUM IN PORCELLIO.

BY F. W. CRAGIN, SC. B.

The early history of the ovum in *Arthropoda* is of peculiar interest in relation to Balfour's theory of polar globules.

In the winter and spring of 1881-2, I undertook an investigation regarding the fate of the germinative vesicle in *Porcellio*, two writers (whose names now escape me) having claimed to have witnessed a polar globule in this or an allied isopod genus, but their statements being not sufficiently detailed to inspire confidence that the phenomenon witnessed was actually what they inferred it to be.

While the results of my studies were far from conclusive (and I have since been unable to resume the investigation), they indicate that events at least *potentially equivalent* to the formation of polar globules—viz., degradation and partial elimination of the germinative vesicle—*probably* take place in the maturation of the ovum in *Porcellio*.

The ovary in *Porcellio* is a subcylindrical sac, constituting a conspicuous anatomical feature on either side of and parallel to, the alimentary canal. When not distended with eggs, its diameter parallel to the axis of the upper oviduct is contained seven or eight times in its length. Its wall is a thin, transparent and colorless membrane, apparently syncytial, though perhaps really a pavement epithelium with delicate and but slightly differentiated cell-walls.