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THE GEOLOGICAL SURVEY OF CHINA
IN COOPERATION WITH
THE NATIONAL RESEARCH INSTITUTE OF GEOLOGY OF THE
ACADEMIA SINICA,
THE SECTION OF GEOLOGY OF THE NATIONAL ACADEMY OF PEIPING,
THE GEOLOGICAL DEPARTMENT OF THE NATIONAL
UNIVERSITY OF PEKING,
THE GEOLOGICAL SURVEY OF KWANGTUNG AND KWANGSI, AND
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Palæontologia Sinica

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Series C, Volume X,
fascicle 1.

ON THE FOSSIL PISCES, AMPHIBIA AND
REPTILIA FROM CHOUKOUTIEN
LOCALITIES 1 AND 3

BY
M. N. BIEN

PLATES II-III AND 9 TEXT-FIGURES

Published by the Geological Survey of China



PEIPING (PEKING) 1934
For Sale at the Following Offices:

Peiping: Geol. Surv. Library, 9 Ping Ma Sze, West City; French Bookstore, Grand Hotel de Pékin; Shanghai: Kelly & Walsh, Ltd., 12 Nanling Road; London: Edward Goldston, 25 Museum St. (W. C. 1); New York: A. G. Seiler & Co., 1224 Amsterdam Ave; G. E. Stechert & Co., 31-33 East 10th Street; Leipzig: Max Weg, Königstrasse 3; Buchhandlung Gustav Fock, Postschliessfach 100; Tokyo: Maruzen Company.

*Palæontologia Sinica
Verteb. Reptil.
Bijdr. Geol. Surv.
Choukoutien, local.
1934*

9.58
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Series C.

Vol. X, Fascicle 1

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On the Fossil Pisces, Amphibia and Reptilia
from Choukoutien Localities 1 and 3

By

M. N. BIEN

Cenozoic Research Laboratory of the National Geological Survey of China

With III Plates



Published by the Geological Survey of China
Peiping (Peking), March 31, 1934

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ON THE FOSSIL PISCES, AMPHIBIA AND REPTILIA FROM CHOUKOUTIEN LOCALITIES 1 AND 3*

BY
M. N. BIEN



INTRODUCTION

The fossil remains of frogs, toads, lizards and snakes were either sorted out by the writer himself from the large amount of fossils generally labelled as "micro-fauna" of the *Sinanthropus* site (Locality 1) and from the collection of Locality 3 or collected in the field during the Spring season of 1933 from Locality 3. During the same season, the pharyngeal tooth of a carp was recovered from the mixture of smaller forms of Locality 3 by Mr. W. C. Pei. The fossil turtle is the same as that previously described by Dr. C. Ping in 1930 (16), which was recovered from Locality 3 by Dr. B. Bohlin in 1927, but the carapace with more fragments pieced together is cemented to the plastron along the sutures instead of being in separate pieces.

Descriptions of the mammalian fauna from Locality 1 have appeared in various fascicles of *Palaontologia Sinica*, Volume VIII, Series C. The fossil mammals of Locality 3 are, at present, being studied by Mr. W. C. Pei and the results of his study will be published later.

For the general geological conditions of the Choukoutien fossiliferous deposits, one has only to refer to the preliminary report by P. Teilhard de Chardin and Dr. C. C. Young (21), and recently published Memoir on Fossil Man in China (1).[†]

The writer wishes here to express to Dr. W. H. Wong and Dr. Davidson Black, Directors of the Geological Survey of China and of the Cenozoic Laboratory respectively, his thanks for the privilege of studying these materials. He is much indebted to P. Teilhard de Chardin, Dr. C. C. Young and Mr. W. C. Pei for their helpful suggestions and kindly criticisms; to Dr. A. M. Boring and Mr. C. T. Hsiao of the Biology Department of Yenching University, Peiping, for counsel regarding the study of the Salientia, and their kindness in loaning the writer materials for comparison; to Dr. T. L. Tchang and Mr. C. Ho of the Fan Memorial Institute

* From the Cenozoic Research Laboratory of the National Geological Survey of China. Received for publication December, 1933.

† It should be noted that Locality 3 is still in process of intensive study and may eventually prove to be of slightly later age than Locality 1.

of Biology, Peiping, for loaning the writer valuable books and materials for comparison; to Mr. T. H. T'ang of the Biology Department of the University of Amoy, who kindly sent the writer the museum specimen of a young *Ocadia sinensis*; to Mr. T. C. Chow for his help during the printing of this paper; to Messrs. K. H. Hsü and M. S. Lee, who are responsible for the photographs; to Mrs. O. H. Gowen for having the photographs printed by the Photographic Bureau of P.U.M.C.; and to Mr. S. Y. Wang for retouching the plates.

DESCRIPTIONS OF THE FOSSILS

Class **Pisces**

Sub-class **Teleostei**

Order **PHYSOSTOMI** Müller

Family **CYPRINIDÆ**

Genus **CTENOPHARYNGODON**

Ctenopharyngodon idellus (Cuvier and Valenciennes)

Pl. I, Fig. 34.

An isolated pharyngeal tooth indicates the presence of this form at Locality 3. Dr. T. L. Tchang of the Fan Memorial Institute of Biology has kindly compared it with the pharyngeal teeth of carps and found it to agree exactly with that of *Ctenopharyngodon idellus* to the last

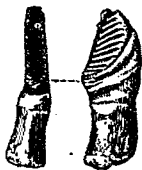


Fig. 1. Pharyngeal tooth of *Ctenopharyngodon idellus*. Medial and anterior views. $2/1$ nat. size.

details. This living form is found in rivers and lakes and is widely distributed over an extensive range which stretches from Sungari River in the North down to Hongkong in the South.

HORIZON AND LOCALITY: Upper Polycene of Locality 3; Choukoutien. Cat.

C.L.G.S.C. No. $\frac{C}{C 1750}$.

Class **Amphibia** Blainville

Order **SALIENTIA** Cope

Sub-order **PROCOELA** (Nicholls) Noble

Family **BUFONDÆ**

Genus **BUFO** Laurenti

Bufo bufo cf. **asiaticus** Steindachner

Pl. I, Figs. 2-23.

This form is represented by an incomplete vertebral column with vertebræ from the third to the eighth inclusive; the scapula, humerus, and radio-ulna of the left side; and the right humerus, all belonging to a single individual from Locality 1. Isolated bones as squamosals, parasphenoids, pterygoids, mandibular rami, scapulæ, coracoids, vertebræ, coccygea, tibiales, fibulares, and phalanges are few, while humeri of both male and female individuals, radio-ulnæ, ilia, femurs and tibio-fibulæ are numerous from both Localities 1 and 3.

It is referred to the eastern Asiatic sub-species *bufo asiaticus* of *Bufo bufo*, the common European toad, because its bone elements when compared with those of this sub-species are found to agree exactly. If one disregards sub-species of this species which, according to the modern herpetologists themselves, is not well defined, the fossil form of Choukoutien could be regarded as *Bufo vulgaris* itself.

This common toad is very widely distributed throughout the palearctic region and the sub-species referred is common in Eastern Siberia, Manchuria and North China.

DESCRIPTION

Vertebral column (Pl. I, Figs. 2-8a)

Judging from the incomplete vertebral column and the isolated vertebræ and coccygea, it is evident that the vertebral column is uniformly procoelous, with nine vertebræ anterior to the coccyx; the sacral vertebra with diapophyses moderately dilated, and two condyles for the articulation with the coccyx; the coccyx has no transverse processes; its dorsal bony plate does not extend far back to the posterior extremity and the dorsal furrow is quite open.

An incomplete vertebral column, 32 presacral vertebræ, 8 sacral vertebræ and 14 coccygea from Locality 1; 23 presacral vertebræ, 3 sacral vertebræ, and 10 coccygea from Locality 3.

Squamosal (Pl. I, Fig. 9)

With large, expanded, and ear-shaped supra-temporal portion; post-orbital process slightly inwardly curved.

1 complete squamosal from Locality 1; and 2 fragmentary ones from Locality 3.

Parasphenoid (Pl. I, Fig. 10)

Very convex at the cross; lateral arms slightly expanded laterally.

1 from Locality 1; and 2 from Locality 3. . . . all fragmentary.

Pterygoid (Pl. I, Fig. 11)

Anterior arm strongly curved; medial arm long.

3 from Locality 3.

Mandibular ramus (Pl. I, Fig. 12)

3 from Locality 3.

Clavicle (Pl. I, Fig. 13)

1 from Locality 3.

Coracoid (Pl. I, Fig. 14)

Anterior margin, very concave; posterior margin, slightly concave; lateral extremity wider than medial extremity and nearly circular in cross-section.

4 from Locality 1; and 5 from Locality 3.

Scapula (Pl. I, Fig. 15 and Fig. 18, part)

Glenoid process, though dorsal to acromion process, does not overshadow the latter process.

17 from Locality 1; and 19 from Locality 3.

Humerus (Pl. I, Figs. 16-20; text fig. 2)

Humerus of male individual with strongly developed medial crest, the wing-like structure above the ulnar condyle; none in female individual (true in all forms). Medial tubercle not strongly developed. Shaft curved and portion just above cubital fossa is small compared to proximal and distal ends, hence distal end appears to be greatly expanded [a character attributed to *Bufo* by Lydekker (11, part iv, p. 128).]

56 and 73 humeri of male and female individuals respectively, from Locality 1; 11 of males and 42 of females from Locality 3.

Radio-ulna (Pl. I, Figs. 21-24)

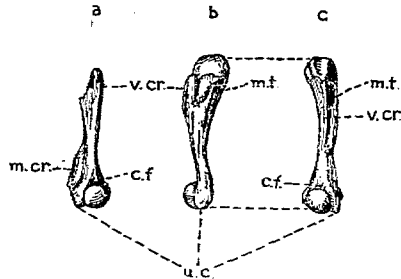


Fig. 2. Humeri of male and female individuals of *Bufo bufo* cf. *asiaticus*.

a, humerus of male from below; b, humerus of female from medial side; c, from below, 1/1. Abbr. c.f., cubital fossa; m. cr., medial crest; m.t., medial tubercle; u.c., ulnar condyle; v. cr., ventral crest.

Distal expansion varies; some with bony encrustations on medial and lateral surfaces (occur in recent specimens of *B. bufo asiaticus* also).

103 from Locality 1; and 24 from Locality 3.

*Ilium** (Pl. I, Figs. 25 and 26; text fig. 3)

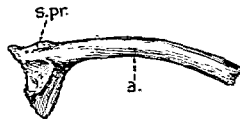


Fig. 3. Ilium of *Bufo bufo* cf. *asiaticus* from lateral side, 1/1. Abbr. a, ala; s. pr., superior process.

With no vexillum; ala not dorso-ventrally flattened anteriorly, but stout when viewed from the side; superior process, small and slightly projected laterally and dorsally.

109 from Locality 1; and 34 from Locality 3.

* Terms denoting the structures on the ilium adopted from Schaefer's work (19) on The Classification of German Anura by the Skeleton.

Femur (Pl. I, Figs. 27-29)

With well developed ventral ridge, but does not extend far below the middle portion of the shaft.

95 from Locality 1; and 25 from Locality 3.

Tibio-fibula (Pl. I, Figs. 30-32)

Stout, with proximal and distal extremities expanded; lateral surface more concave than medial surface which is almost straight in some individuals.

116 from Locality 1, and 47 from Locality 3.

Tibiale and fibulare (Pl. I, Fig. 33)

1 specimen of tibiale and fibulare with epiphyses and few isolated ones from Locality 1; and few from Locality 3.

Phalanx

Few from Localities 1 and 3.

HORIZON AND LOCALITIES: Upper Pliocene of Localities 1 and 3, Choukoutien.

Cat. C.L.G.S.C. Nos. $\frac{C}{C 1715}$ — $\frac{C}{C 1730}$.

COMPARISONS

All the bones described or listed above agree exactly with the corresponding bones of *Bufo bufo asiaticus* Steindachner. Compared with the individual bones of the skeleton of a large recent female *B. bufo asiaticus* collected from Choukoutien which measured 120 mm. in body length, most of the bones agree even in size and some are even larger. Of course, bones of smaller size, representing those of younger individuals, also occur. This shows that the common toads which occurred as fossils in Choukoutien were mostly of giant size and comparable to those reported by A. M. Boring and C. C. Liu in their joint paper on the Giant Toads in China (3), in which the males are reported to be 100-112 mm. and females 105-140 mm. in body length, measured from tip of snout to vent.

B. raddei Strauch differs from this form in its small squamosal which does not have an expanded supra-temporal portion; its more dorsally and laterally projected superior process of the ilium; its farther distally extended ventral ridge of the femur; its very strongly developed medial tubercle of the humerus; and its smaller size.

B. melanostictus Schneider differs from this form in having the post-orbital, medial and posterior processes of the supra-temporal portion of the squamosal dorsally ridged which comprise

part of the strongly developed bony crests of the head. Two imperfect humeri from the Pleistocene cave-deposits of Karnul, Madras, were provisionally referred to this species by Lydekker (10, p. 56, 11, pt. iv, p, 128).

Bufo raddei Strauch

Pl. II, Figs. 1-9.

19 humeri of male individuals and 13 of females, 43 ilia, 37 femurs and 96 tibio-fibulae from Locality 1; 2 humeri of males and 1 of female, 6 ilia, 6 femurs and 11 tibio-fibulae from Locality 3 are attributed to this species.

This species is widely distributed in eastern Siberia, Manchuria and North China.

DESCRIPTION

Humerus (Pl. II, Figs. 1-4; text fig. 4)

With strongly developed medial tubercle. Other characters essentially the same as *B. bufo asiaticus*, except its smaller size.

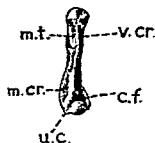


Fig. 4. Humerus of male individual of *Bufo raddei* from below, 1/1. Abbr. c.f., cubital fossa; m. cr., medial crest; m. t., medial tubercle; u. c., ulnar condyle; v. cr., ventral crest.

Ilium (Text fig. 5)

With more dorsally and laterally projected superior process than that in *B. bufo asiaticus*.

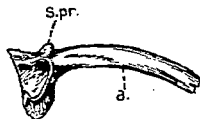


Fig. 5. Ilium of *Bufo raddei* from lateral side, 2/1. Abbr. a, ala; s. pr., superior process.

Femur (Pl. II, Figs. 5 and 6)

Ventral ridge more blade-like and extends farther below the middle portion of the shaft than in *B. bufo asiaticus*.

Tibio-fibula (Pl. II, Figs. 7-9)

The lateral surface is almost as concave as the medial surface.

HORIZON AND LOCALITIES: Upper Polycene of Localities 1 and 3, Choukoutien.

Cat. C.L.G.S.C. Nos. $\frac{C}{C 1731}$ — $\frac{C}{C 1739}$.

COMPARISONS

These bones agree with the corresponding bones of *B. raddei*. Their differences from those of the other *Bufo* have already been mentioned.

Sub-order **DIPLASIOCOELA** (Nicholls) Noble

Family **RANIDÆ**

Genus **RANA** Linnæus

Rana nigromaculata Hallowell

Pl. II, Figs. 10-15.

This species is represented by 1 humerus of male and 2 of females, 4 ilia and 15 tibio-fibulæ from Locality 3. This form is widely distributed, "being recorded from 'Vladivostok to Bangkok'" (3, p. 45).

DESCRIPTION

Humerus (Pl. II, Fig. 10; text fig. 6)

Shaft, very slightly curved and portion just above cubital fossa, not much smaller than proximal and distal ends.

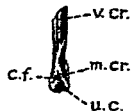


Fig. 6. Humerus of male individual of *Rana nigromaculata* from below, 1/1. Abbr. c.f., cubital fossa; m. cr., medial crest; u.c., ulnar condyle; v. cr., ventral crest.

Ilium (Pl. II, Figs. 14 and 15; text fig. 7)

With well developed vexillum; superior process, strongly projected dorsally and laterally.

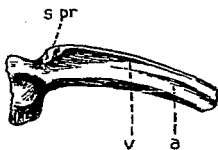


Fig. 7. Ilium of *Rana nigromaculata* from lateral side, 2/1. Abbr. a, ala; s. pr., superior process; v, vexillum.

Femur (Pl. II, Fig. 13)

With no distinct ventral ridge.

Tibio-fibula (Pl. II, Figs. 11 and 12)

Flat, with slightly convex medial surface and concave lateral surface; proximal and distal expansions, not great as compared with its length.

HORIZON AND LOCALITY: Upper Pliocene of Locality 3, Choukoutien. Cat.

C.L.G.S.C. Nos. $\frac{C}{C 1740}$ — $\frac{C}{C 1745}$.

COMPARISONS

The above mentioned bones agree exactly with the corresponding bones of *R. nigromaculata*. They also resemble those of *R. plancyi*, the other common pond-frog of North China. The bones are not unlike those of *R. esculenta* of Europe and the fossil *Rana* of Ertemte, Mongolia, described by Schlosser (18, p. 96) as *R. hipparionum* (sp. nov.).

Rana asiatica Bedriaga

Pl. II, Figs. 16-20.

16 humeri of male individuals and 12 of females, and 31 tibio-fibulae from Locality 3 are attributed to this species. This form is found in eastern Siberia, Kansu, Ordos, Shansi, Shensi and Hopei (near Mongolia).

DESCRIPTION

Humerus (Pl. II, Figs. 16 and 17; text fig. 8)

Shaft slender and almost straight; proximal and distal ends, very slightly expanded; and ventral crest with a peculiar medial projection in male individual.

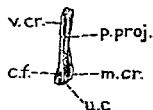


Fig. 8. Humerus of male individual of *Rana asiatica* from below, 1/1. Abbr. c.f., cubital fossa; m. cr., medial crest; p. proj., peculiar projection; u.c., ulnar condyle; v. cr., ventral crest.

Tibio-fibula (Pl. II, Figs. 18-20)

Very slender and long; proximal and distal extremities very slightly expanded.

HORIZON AND LOCALITY: Upper Polycene of Locality 3, Choukoutien. Cat.

C.L.G.S.C. Nos. $\frac{C}{C 1746}$ — $\frac{C}{C 1747}$.

COMPARISONS

The humerus and tibio-fibula are very characteristic and agree exactly with those of *Rana asiatica*.

Class **Reptilia** Blainville

Order **SQUAMATA**

Sub-order **LACERTILIA** Owen

Family **LACERTIDÆ**

Gen. et sp. indet.

Pl. II, Figs. 21 and 22.

The Lacertid is represented by ten fragmentary dentaries from Locality 1 and 1 from Locality 3. It is pleurodont. The dentary is deep dorso-ventrally with a convex lower border.

The teeth are obtusely conical and the posterior ones have their anterior edges moderately serrated. It agrees with the dentary of *Eremias argus* Peters and differs from that of *Gekko swinhonis* Günther, because the dentary of the latter form is slender with a straight lower border and the teeth are acutely conical with no serrations. The above mentioned two common forms of lizard of North China occur abundantly in the Choukoutien area.

HORIZON AND LOCALITIES: Upper Polycene of Localities 1 and 3. Cat. C.L.G.S.C.

No. $\frac{C}{C 1748}$.

Sub-order **OPHIDIA**

Dr. C. C. Young (24) has already mentioned about the presence of a small snake in the deposit of Locality 2 of the Choukoutien fossiliferous deposits which is represented by a lower mandible with teeth. The presence of snakes in Localities 1 and 3 is indicated by numerous trunk and caudal vertebræ. The vertebræ are uniformly with broad laminæ to the arches, long zygapophyses, and hatchet-shaped neural spines. The trunk vertebræ have long hæmal spines. The vertebræ resemble very much those that belong to the snakes of the genus *Elaphe* Fitzinger, found in the Choukoutien area, viz: *Elaphe schrenkii* Strauch and *E. dione* (Pallas). The other living form of snake found there is *Masticophis spinalis* Peters.

HORIZON AND LOCALITIES: Upper Polycene of Localities 1 and 3, Choukoutien. Cat. C.L.G.S.C.. No. $\frac{C}{C 1749}$.

Order **CHELONIA** Macartney

Sub-order **CRYPTODIRA** Dumeril

Superfamily **TESTUDINOIDEA** Baur

Family **EMYDIDÆ** Gray

Genus **GEOCLEMYS** Gray

Geoclemys reevesii (Gray)

Pl. II, Fig. 27, Pl. III, Figs. 1 and 1a.

1855 *Geoclemys reevesii* Gray, Cat. Shield Rept. Brit. Mus., 1, p. 18, pl. v.

1869 *Damonia reevesii* Gray, Proc. Zool. Soc. London, p. 194.

1870 *Damonia reevesii* Gray, Suppl. Cat. Sh. Rept. i. p. 44.

1873 *Damonia reevesii* Gray, Mag. N. H. (4) xi, p. 148.

- 1889 *Damonia reevesii* Gray, Boulenger, Cat. Chel. Brit. Mus., p. 95.
1907 *Geoclemys reevesii* (Gray), Stejneger, Bull. 58, U. S. Nat. Mus. p. 497-500, pl. xxx.
1930 *Polyechmatemys pekinensis* Ping, Bull. Geol. Soc. China, Vol. IX, No. 3, p. 205-212 with three plates.

The specimen which consists of a fragmentary carapace and an almost complete plastron was recovered by Dr. B. Bohlin from Locality 3 of Choukoutien in 1927. It has been described as *Polyechmatemys pekinensis* (gen. et sp. nov.) by Dr. Chi Ping (16), Director of the Fan Memorial Institute of Biology, Peiping. The generic name *Polyechmatemys* proposed by Dr. Ping is derived from *Echmatemys*, an Eocene genus, which was created by O. P. Hay (8) for the large group of Emydids of the Bridger beds of North America. According to O. P. Hay the genus *Echmatemys* resembles in many respects the Chinese genus *Ocadia* which has only one living species, but differs from it in the probable absence of a well developed longitudinal ridge on the triturating surface of the upper jaw and the width of the hinder lobe of the plastron. It is worth while to note here that the generic diagnoses of the shell for *Echmatemys* given by Hay (8); *Ocadia*, *Damonia* (*Geoclemys*) and *Bellia* given by G. A. Boulenger (4) and R. Lydekker (11, pt. iii) are essentially the same, though the four genera could be readily distinguished from each other by such skull characters as the forward or backward positions of the choanæ, the difference of breadth of the triturating surfaces of the upper and lower jaws and the presence or absence of the longitudinal ridge on the triturating surface of the upper jaw. As the present specimen does not possess any skull parts, minor characters of the carapace and the plastron have to be resorted to. Leaving aside the genus *Echmatemys* which is an Eocene genus of North America and created for the large group of Emydids of the Bridger beds, and *Bellia*, because the specimen studied which is an adult form does not possess any decidedly balloon-shaped vertebral scutes and is distinctly carinated, there remain only *Ocadia* and *Geoclemys* to consider. Fortunately the genus *Ocadia* has only one living species *sincensis*, though some fossil Emydids from Europe and one from Mongolia are referred to this genus, and the genus *Geoclemys* has two species *hamiltoni* and *reevesii*. The comparisons of *Ocadia sinensis* and *Geoclemys hamiltoni* with *G. reevesii* are given in the section on comparisons after the description.

No *G. reevesii* is found in the Choukoutien area at present, but it is reported to be widely distributed from Shantung to Canton. The common soft-shelled turtle of China, *Amysda tuberculata* (Cantor), is found in Choukoutien, but did not occur as a fossil.

DESCRIPTION

Carapace (Pl. III, Fig. 1; text fig. 9a)

The carapace lacks the first and fourth neural bones; the suprapygal and pygal bones; the left sixth peripheral; the right first peripheral; the right ninth to eleventh peripherals; and portions of costals. Although with parts wanting and the left posterior portion slightly crushed, yet the general form of the carapace could be recognized. It is oblong oval; with a length of at least 160 mm. and a width of 110 mm.; moderately elevated (depth of shell is 66 mm.) and

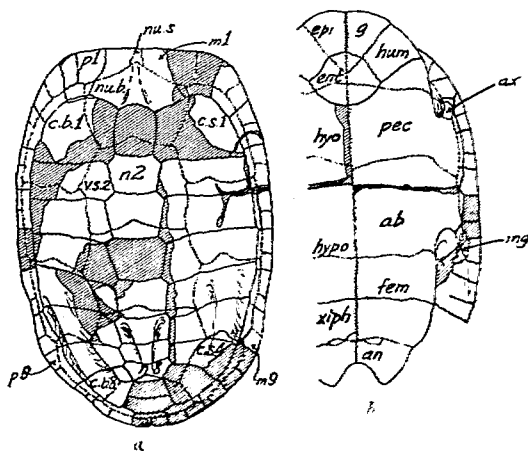


Fig. 9. Carapace and plastron of *Geoclemys reevesii*, 1/2 natural size. Abbr. ab, abdominal scute; an, anal scute; ax, axillary scute; c.b.1, c.b.8, costal bones one and eight respectively; c.s.1, c.s.4, costal scutes one and four respectively; ent, entoplastron; epi, epiplastron; fem, femoral scute; g, gular scute; hum, humeral scute; hypo, hypoplastron; ing, inguinal scute; m¹, m⁹, marginal scutes one and nine respectively; n2, n8, neural bones one and eight respectively; nu. b., nuchal bone; nu. s., nuchal scute; pec, pectoral scute; pl, p9, peripheral bones one and nine respectively; v.s. 2, vertebral scute two; xiph, xiphoplastron.

tricarinate. The keels are not very prominent on the anterior portion of the carapace, though the nuchal bone is distinctly carinated. On the posterior portion, the sixth to eighth neural bones are strongly carinated and from the level of the anterior sulcus of the third costal scute to the posterior sulcus of the fourth costal scute, the lateral keel is very prominent.

The nuchal bone is 31.4 mm. long and 36.0 mm. wide; hexagonal in shape. Judging from the concavity of both the posterior and anterior borders of the nuchal and the second neural bones respectively, the first neural must have been either oval or subrectangular [both shapes occur in *Geoclemys reevesii* (Gray)]. The following neurals are all broader than long, hexagonal, with short antero-lateral surfaces. Their dimensions are given in the following table.

Measurements of Neurals (in mm.)

Neural	Length	Width
1	21.0 ±	—
2	15.5	19.0
3	18.0	21.0
4	15.5	25.0 ±
5	15.5	24.0 ±
6	11.0	24.0
7	9.0	22.0
8	10.0	19.0

The costals do not present considerable differences in the length of their neural and peripheral borders. The free peripherals have acute edges and gradually thicken toward their costal borders. They are slightly recurved. The bridge peripherals are obtusely angulated.

The sulci on both the carapace and the plastron are not deeply cut, but plainly impressed. The nuchal scute is small, narrower in front, emarginate behind, with the greatest length of 8.0 mm. and the greatest width of 5.5 mm. The sulci of the first, second, third and fourth vertebral scutes are complete, but it could be seen that the first vertebral is broader in front and pentagonal in shape; second to fourth vertebrals are broader than long and hexagonal. Each vertebral has a middle projection on the anterior border along the line of the median keel. The right second and third costal scutes are complete and broader than the second and third vertebrals, but narrower than the fourth vertebral. Each costal scute has an anterior projection along the line of the lateral keel. Their dimensions are given in the table below.

The marginal scutes are all subquadrangular except the ninth marginal which is pentagonal, with the medial border projected in an angle where it joins the posterior sulcus of the third vertebral scute above the general level of the costo-marginal sulcus. The costo-marginal sulcus is below the costo-peripheral suture with an average distance of 5 mm.

Measurements of Vertebral and Costal Scutes (in mm.)

Vertebral	Length	Width	Costal	Length	Width
1	—	40.0	1	—	—
2	—	39.8	2	35.0	46.0
3	30.0	43.0	3	31.4	44.0
4	29.4	46.0	4	—	—
5	—	—			

Plastron (Pl. III, Fig. 1a; text fig. 9b)

The plastron has a total length of 154 mm. and a width of 97 mm. with obtusely angulated lateral sides. The anterior lobe is 46 mm. long and 72.5 mm. wide at the base, thus the length being 63% of the width. It is somewhat semi-circular in shape. The epiplastral lip has a width of 37.4 mm. at its base and projects only slightly beyond the general curvature of the lobe. The greatest length of the posterior lobe is 53 mm. and the width at base is 66 mm., thus the length being 80% of the width. It is slightly constricted at the level of the sulcus between the femoral and anal scutes and is deeply notched at its posterior extremity. The posterior notch of the plastron has a width of 18.5 mm. and a depth of 11.5 mm.

The sternal bridge is 56 mm. in width, a little over one-third the total length of the plastron, and is extensively united with the carapace by suture.

The entoplastron is ovoid in shape, with a length of 22.2 mm. and a width of 26.6 mm. It is intersected by the humero-pectoral sulcus at a level a little above its posterior third.

The epiplastra occupy 18 mm. of the midline; the hyoplastra, 31.2 mm.; the hypoplastra, 44.5 mm.; and the xiphiplastra, 27 mm.

The gular scutes are 26 mm. in length; the humerals, 6 mm.; the pectorals, 31 mm.; the abdominals, 37 mm; the femorals, 33 mm; and the anals, 11 mm.; all measured along the midline.

The sulci of the axillary and inguinal scutes on the left side of the plastron are preserved, though they are very faint. (Not clear in the plate figure; emphasized in the text figure). The axillary scute is smaller than the inguinal scute and joins the third and fourth marginals while the latter joins the seventh and eighth marginals.

The axillary and inguinal buttresses are well developed. The latter is ankylosed between the fifth and sixth costal bones.

HORIZON AND LOCALITY: Upper Pliocene of Locality 3, Choukoutien. Cat. C.L.G.S.C. No. $\frac{C}{C 9}$.

COMPARISONS

The shell of *G. reevesii* (Gray) differs from that of *Ocadia sinensis* Gray in having: three distinct keels on the posterior portion of the carapace in the adult form; the anterior projections on the vertebrae and costals along the lines of the median and lateral keels, while in *O. sinensis* only the vertebrae possess anterior projections [Lydekker (11, pt. iii, p. 108) mentioned this as a character for the genus *Ocadia*]; the less recurved peripherals; and the less projected epiplastral lip. From the fossil Emydid of the Pliocene of the Siwalik Hills, India, which was at first described as *Clemmys palaeindica* by Lydekker (9, p. 178) and later revised by the same author (11, pt. iii, p. 105) as *Damoniu* (*Geoclemys*) *hamiltoni*, a living Indian Emydid, it differs in not having three interrupted nodose keels and the serrated posterior border; and in having a distinct pentagonal first vertebral scute which is wider in front than behind. Comparing with the recent specimens of *G. reevesii*, the fossil under consideration differs from them only in size and the prominence of the keels, but these characters do not justify a specific separation of the fossil from the living species, since specimens of *G. reevesii* attaining the length of 125 mm. or more have already been reported and the keels are usually more prominent in young specimens.

DISCUSSION AND SUMMARY

The discoveries of fossil remains of existing species of carp (*Ctenopharyngodon idellus*); toads and frogs (*Bufo bufo* cf. *asiaticus*, *B. raddei*, *Rana nigromaculata*, *R. asiatica*); and hard-shelled turtle (*Geoclemys reevesii*) in the fossiliferous deposits of Choukoutien are interesting, because they are all widely distributed forms and their occurrence as fossils is not unexpected. Among the fossil mammalian fauna of Choukoutien, there are numbers of existing species aside from the truly extinct forms, especially those of Carnivores and Rodents. Some of the forms, though determined as new species at present are by no means to be considered extinct, because the present knowledge of the living mammalian fauna of China is quite imperfect.

The occurrence of semi-aquatic forms such as toads in the cave deposit of Locality 1, and of truly aquatic forms such as fish, and semi-aquatic forms such as hard-shelled turtle, frogs

and toads in the fissure deposit of Locality 3, is accidental. They might have been either washed in by brief flood action or brought in by other animals as suggested by P. Teilhard de Chardin and Dr. C. C. Young in their preliminary report on the Choukoutien fossiliferous deposits for the probable origin of the bones of some of the animals which are not cave-dwellers (21).

Records of fossil fishes, amphibia, lizards and snakes are rather rare from the Cenozoic deposits of North China and Mongolia. The fossil remains of a Cyprinid from the lake-beds near Taiku, Shansi, which have been referred to the Upper Pliocene, has been determined by Dr. T. L. Tchang (20) as *Carassius auratus* Linnæus, an existing species which is very widely distributed over the palearctic region of Asia. Recently great numbers of fossil fish remains have been recovered from Locality 14 at Choukoutien but these are as yet unprepared. Schlosser (18) has recorded the occurrence of fish remains which according to him belong to at least four species, if not four genera, in the Pliocene deposits of Ertemte, Mongolia. He also recorded the occurrence of amphibian (*Triton* sp., *Rana hipparionum* Schlosser) and snake remains from the same locality. *Rana hipparionum* also occurred in the deposit of Olan Chorea, Mongolia, of the same age. The oldest record of fossil Salientia so far known in China is the spade-foot toad (*Macropelobates osborni* Noble) from the Oligocene deposit of Hsanda Gol, of the Tsagan Nor Basin, Mongolia (13).

A summary of the fossil turtles so far known from the Cenozoic deposits of North China and Mongolia is given in the following table.

NORTH CHINA			MONGOLIA**	
Age	Formations	Fossil Turtles	Formations	Fossil Turtles
Pleistocene	Choukoutien	<i>Geotemys reevesii</i> (Gray). Syn. <i>Polyechmatemys pekinensis</i> Ping. (Choukoutien, Fangshanhsien, Hopei).		
Pliocene	Hipparion red clay (Pontian)	<i>Testudo sphaerica</i> Wiman, <i>Clemmys schansiensis</i> Ping. (Chichiakou, Paotehsien, Shansi). <i>Testudo hypercosta</i> Wiman, <i>T. schansiensis</i> W. (Nanshawa, Hoch'hsien, Shansi). <i>Testudo hipparionum</i> Wiman. (Huashenmiaokou, Wuhsianghsien, Shansi). <i>Testudo</i> sp. B and C. Wiman. (Haochiangcheng, Wuhsianghsien, Shansi). <i>Testudo honanensis</i> Wiman. (Shangyinkou, Hsinanhsien, Honan). <i>Testudo shensiensis</i> Wiman. (Wulankou, Fukuhsien, Shensi). Testudinids, Emydid, gen. indet., Trionychids, ? <i>Amyda</i> sp. (Homu*, Yuehsien, Shansi.) Testudinid. (Shiashang*, Shouyanghsien, Shansi.)	Hung Kureh (Middle Pliocene)	Emydid, gen. indet., Testudinid, gen. indet.
Miocene			Tung Gur	? <i>Ocadia perplexa</i> Gilmore, <i>Trionyx sculptus</i> G. (complete specimens as yet un-studied).
Oligocene			Ardyn Obo	<i>Testudo insolitus</i> Matthew and Granger, <i>T. kaiseni</i> Gilmore, <i>T. demissa</i> G., Emydid, gen. indet., Trionychid, gen. indet.
			Ulan Gochu	<i>Testudo nanus</i> Gilmore. <i>Testudo</i> sp., <i>Palaeochelys elongata</i> G., <i>Sharemys hemispherica</i> G.
Eocene	Sichuan Sandstone	<i>Sinohadrianus sichuanensis</i> Ping. (F. an. chuan, Sichuanhsien, Honan).	Shara Murun	<i>Testudo</i> sp., Trionychid
			Ulan Shireh	<i>Anostira mongoliensis</i> Gilmore, <i>Testudo ulanensis</i> G., ? <i>Amyda</i> sp., Trionychid, gen. indet., Dermatemydid, gen. indet.
			Irdin Manha	<i>Anostira mongoliensis</i> Gilmore, <i>Adocus orientalis</i> G., ? <i>Amyda johnsoni</i> G., <i>Testudo</i> sp., Trionychids.
Palaocene			Gashato	Chelonian

* Fragmentary materials such as isolated pieces of peripherals, costals, hyo- and hypoplastra of Chelonians were collected by P. Teilhard de Chardin and Dr. C. C. Young from these two localities during their trip in S. E. Shansi, 1932 (22). These specimens are too fragmentary for specific determination.

** The summary of the fossil turtles from Mongolia is taken from Gilmore's work on the Fossil Turtles of Mongolia. (5).

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EXPLANATION OF

PLATE I.

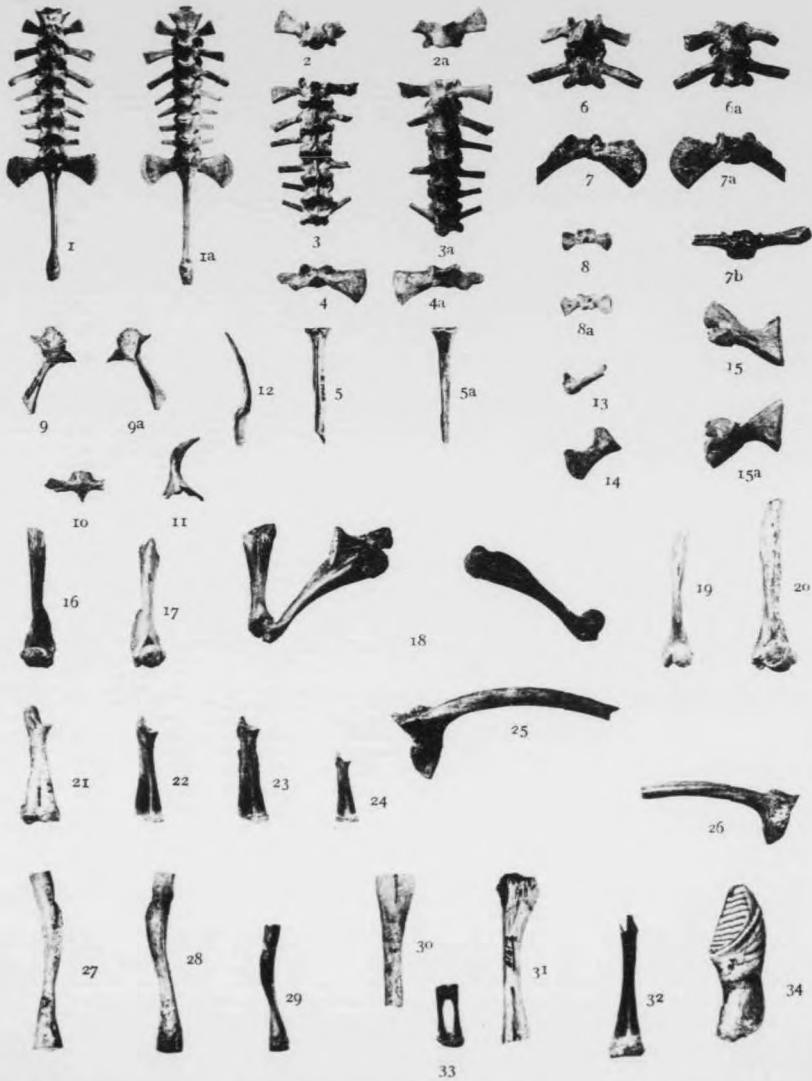
PLATE I

- Fig. 1. *Bufo bufo asiaticus* Steindachner (Recent specimen). Vertebral column from above, 1/1 nat. size; 1a from below, 1/1 nat. size. For comparison.
- Fig. 2. *Bufo bufo* cf. *asiaticus* Steindachner (Fossil). Second vertebra from above, 1/1 nat. size; 2a from below, 1/1.
- Fig. 3. —————. Incomplete vertebral column from above; 3a from below, 1/1.
- Fig. 4. —————. Sacral vertebra from above; 4a from below, 1/1.
- Fig. 5. —————. Coccyx from above; 5a from below, 1/1.
- Fig. 6. —————. Second and third vertebra of a larger individual from above; 6a from below, 1/1.
- Fig. 7. —————. Sacral vertebra of a larger individual from above; 7a from below; 7b from behind, 1/1.
- Fig. 8. —————. Sacral vertebra of a small individual from above; 8a from below, 1/1.
- Fig. 9. —————. Right squamosal from above; 9a from below, 1/1.
- Fig. 10. —————. Parasphenoid from below, 1/1.
- Fig. 11. —————. Right pterygoid from above, 1/1.
- Fig. 12. —————. Right mandibular ramus from above, 1/1.
- Fig. 13. —————. Right clavicle from below, 1/1.
- Fig. 14. —————. Right coracoid from above, 1/1.
- Fig. 15. *Bufo bufo* cf. *asiaticus* Steindachner (Fossil). Right scapula from above; 15a from below, 1/1.
- Fig. 16. —————. Right humerus of a male individual from above, 1/1.
- Fig. 17. —————. Left humerus of a male individual from below, 1/1. Ulnar condyle, medial crest and cubital fossa better shown.
- Fig. 18. —————. Left scapula from above; left and right humeri from outside; and left radio-ulna from above. These bones belong to the same individual whose incomplete vertebral column is shown in fig. 3, 1/1.

PALÆONTOLOGIA SINICA

M. N. Bien:—Fossil Pisces, Amphibia, and Reptilia from Choukoutien.

Plate I



- Fig. 19. —————. Left humerus of a female individual from below, 1/1.
- Fig. 20. —————. Left humerus of a large female individual from below, 1/1.
- Figs. 21, 22, 23, 24. —————. Four right radio-ulnæ from above, 1/1, showing variation in general outline and size.
- Fig. 25. —————. Right ilium from outside, 1/1.
- Fig. 26. —————. Left ilium of a smaller individual from outside, 1/1.
- Fig. 27. —————. Left femur from outside, 1/1.
- Fig. 28. —————. Right femur from outside, 1/1.
- Fig. 29. —————. Right femur of a smaller individual from outside, 1/1.
- Fig. 30. —————. Proximal portion of right tibio-fibula of a large individual from below, 1/1.
- Fig. 31. —————. Right tibio-fibula of a smaller individual from above, 1/1.
- Fig. 32. —————. Left tibio-fibula from above with proximal end broken of a slenderer individual, 1/1.
- Fig. 33. —————. Left tibiale and fibulare with epiphyses from above, 1/1.
- Fig. 34. *Ctenopharyngodon idellus* (Cuvier and Valenciennes). Anterior view of pharyngea tooth, 2/1.

EXPLANATION OF

PLATE II.

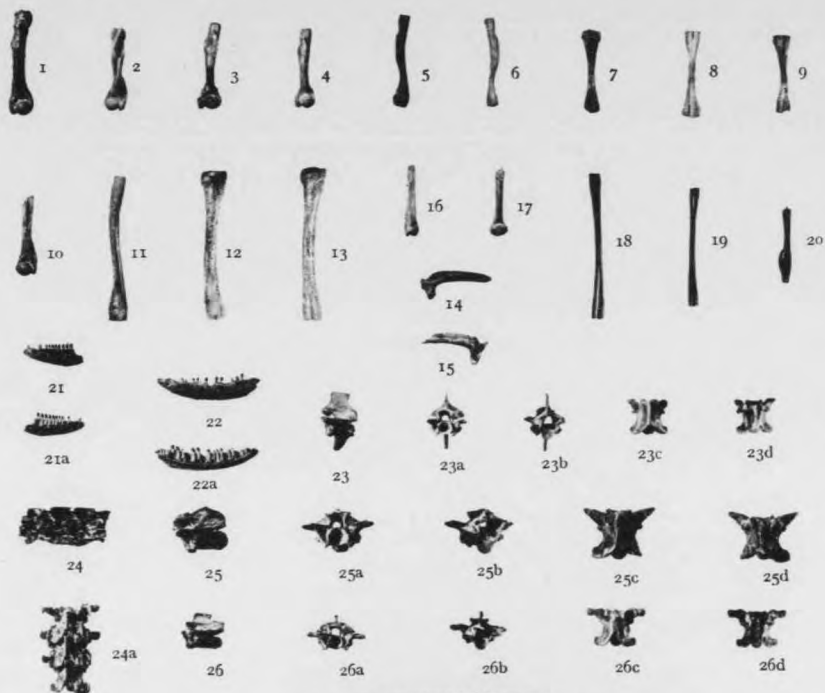
PLATE II

- Figs. 1 and 2. *Bufo raddei* Strauch. Left and right humeri of male individuals from below, 1/1.
- Figs. 3 and 4. —————. Two left humeri of female individuals from below, 1/1.
- Figs. 5 and 6. —————. Right and left femurs from medial side, 1/1.
- Figs. 7, 8 and 9. —————. Two left and one right tibio-fibulæ from above, 1/1.
- Fig. 10. *Rana nigromaculata* Hallowell. Right humerus of male individual from below, 1/1.
- Fig. 11. —————. Right femur from inside, 1/1.
- Fig. 12. —————. Right tibio-fibula from below, 1/1.
- Fig. 13. —————. Left tibio-fibula from above, 1/1.
- Figs. 14 and 15. —————. Incomplete left and right ilia from outside, 1/1.
- Figs. 16 and 17. *Rana asiatica* Bedriaga. Humeri of male and female individuals from below, 1/1.
- Figs. 18 and 19. —————. Right and left tibio-fibulæ from above, 1/1.
- Fig. 20. —————. Incomplete right tibio-fibula of a diseased individual from above, 1/1.
- Fig. 21. Lacertid. Anterior portion of dentary from outside; 21a, from inside, 3/1.
- Fig. 22. —————. More complete specimen of dentary from outside, 22a, from inside, 3/1.
- Fig. 23. Ophidian. Trunk vertebra from left side; 23a, from before; 23b, from behind; 23c, from above; 23d, from below, 1/1.
- Fig. 24. —————. Three caudal vertebræ from left side; 24a, from above, 1/1.
- Fig. 25. —————. Caudal vertebra of a large individual with broken neural spine from left side; 25a, from before; 25b, from behind; 25c, from above; 25d, from below, 1/1.
- Fig. 26. —————. Caudal vertebra from left side; 26a, from before; 26b, from behind; 26c, from above; 26d, from below, 1/1.
- Fig. 27. *Geoclemys reevesii* (Gray). Carapace and plastron from left side, 1/1.

PALÆONTOLOGIA SINICA

M. N. Bien:—Fossil Pisces, Amphibia, and Reptilia from Choukoutien.

Plate II



EXPLANATION OF

PLATE III.

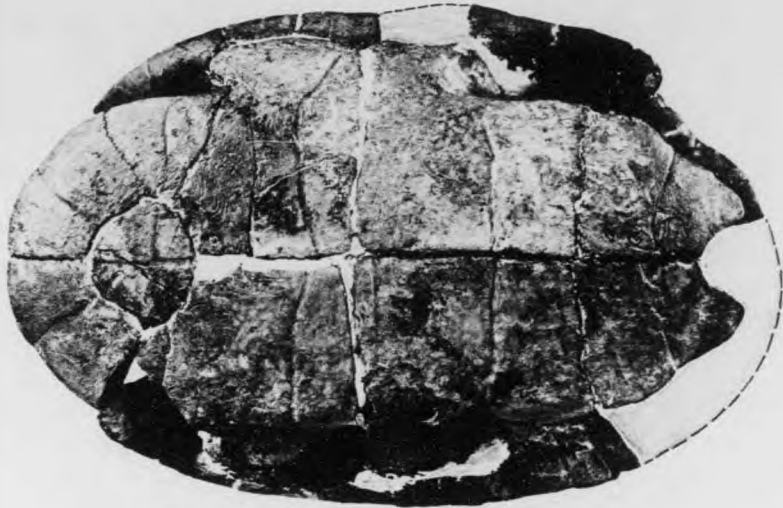
PLATE III

Fig. 1. *Geoclemys reevesii* (Gray). Carapace from above; 1a, plastron from below, 1/1.
nat. size.

PALÆONTOLOGIA SINICA

M. N. Bien:—Fossil Pisces, Amphibia, and Reptilia from Choukoutien.

Plate III



第三地點所產之化石如下：

魚類 (Pisces)

鯉科 (Cyprinidae) 一種

Ctenopharyngodon idellus (Cuvier and Valenciennes) (爲北平靜生生物調查所張春霖先生鑑定)

兩棲類 (Amphibia)

蟾蜍科 (Bufonidae) 兩種與第一地點同

蛙科 (Ranidae) 兩種

Rana nigromaculata Hallowell

Rana asiatica Bedriaga

爬行類 (Reptilia)

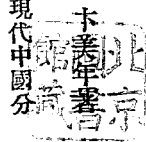
蛇舅母科 (Lacertidae) 一種與第一地點同

蛇類 (Ophidia) 與第一地點同

龜科 (Emyidae)

Geoemyys reevesii Gray (Syn. *Polychelonemys bekiensis* Ping)

周口店第一第二地點之魚類，兩棲類，爬行類化石



周口店第一及第三地點所產之魚類，兩棲類，爬行類之化石，其能鑑定者，皆為現代中國分佈較廣而尚生存之種屬，故其發現為化石，並不足為奇。

洞穴（第一地點）及縫隙（第二地點）沉積中發現棲止水中或水畔之動物，想必偶為他種動物所帶進或被水所沖入者。

第一地點所產之化石如下：

兩棲類 (Amphibia)

蟾蜍科 (Bufonidae)

Bufo bufo cf. *asiaticus* Steindachner

Bufo raddai Strauch

爬蟲類 (Reptilia)

蛇舅母科 (Lacertidae) 一種，與麻蛇子 (*Lacertis argus* Peters) 相似。

蛇類 (Ophidia) 一種。

古生物誌

中國古生物誌丙種第十號

卞美年著

第一冊

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中華民國二十三年三月

實業部地質調查所
國立北平研究院地質學研究所印行

(學術研究與國立中央研究院國立北京大學兩廣地質調查所湖南地質調查所合作)



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(學術研究與國立中央研究院國立北京大學
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