

# **Newly Discovered Small Mammals from the Nihewan Beds**

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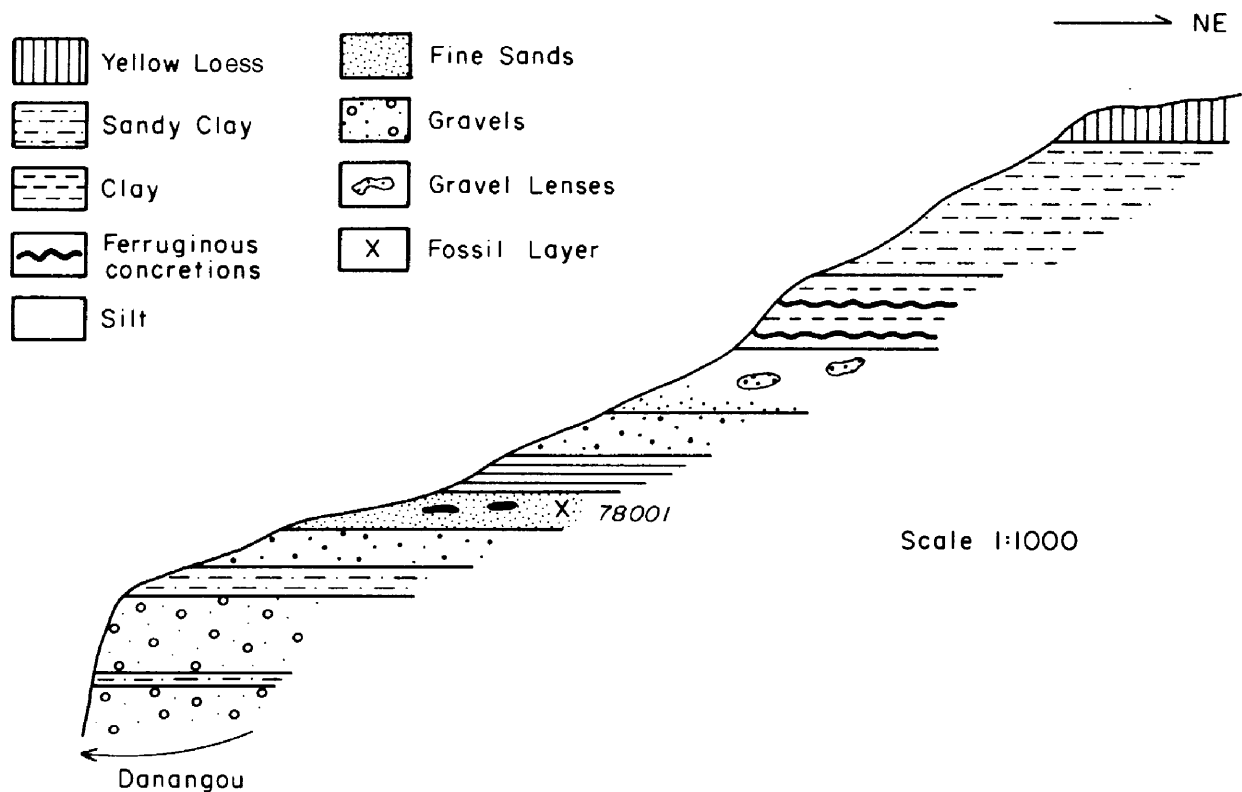
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## Introduction

In the summer of 1978, the author undertook a study of the regional paleontology and stratigraphy at Nihewan, where several small mammal fossils were collected from two different stratigraphic horizons. These include *Microtus brandtoides* Young, *Orientalomys nihowanicus* sp. nov., and *Ochotona lagrelii minor* Bohlin. These discoveries supplement the abundant Nihewan Fauna and are also significance toward a more advanced and detailed subdivision of the "Nihewan deposits."

## Stratigraphy

The fossil locality that produces *Orientalomys nihowanicus* and *Ochotona lagrelii minor* is on a slope approximately 1 Km from the public road in the arroyo called Danangou at the village of Dongyaozitou, on the east bank of the Huliuhe River in the Yuxian Basin. (IVPP Loc. 78001). A generalized stratigraphic cross section is presented in Figure 1.



**Figure 1: Cross section at Locality 780001, Danangou, Dongyaozitou Village.**

A brief description of the stratigraphic sequence is as follows:

- 9. Brown-yellow silty soil (Yellow Loess).....5 m
- 8. Interfingering gray-green, gray-yellow, and light red silty soils containing fossil gastropods and bivalves.....21.1 m
- 7. Lower section as gray-white argillaceous soil interbedded with thinly stratified marls which have a rather heavy clay content. Upper section as interbedded gray-white, light red, argillaceous soils. This unit is a relatively extensive and continuously traceable member of the Nihewan deposits.....10.5 m

6. Upper section with light red silt, lower section with yellow-green silts containing small grained gravel lenses with fragments of *Equus sanmenensis* and *Coelodonta* ..... 10.0 m
5. Interbedded sands and gravels containing gastropods and bivalves. A piece of proboscidean cervical vertebra was collected from the gravels.....7.0 m
4. Homogeneous thinly bedded almond-yellow and gray green silts.....5.5 m
3. Light red fine sands interbedded with gravel lenses and carbonate concretions. *Orientalomys nihowanicus* and *Ochotona lagrelii minor* was produced from the carbonates.....5.7 m
2. Interfingering yellow silts and gravels.....21.8 m
1. Interfingering red silty soils and gravels. Silts and soils are relatively pure but occasionally grade to fine gravels. Gravel sorting and rounding is relatively poor....10.0 m

Fragmentary material of *Proboscideipparion sinensis*, *Gazella sinensis*, *Lutra* sp., and other taxa were found in Unit 3, allowing a biochronologic correlation to the Nihewan Fauna. *Microtus brandtoides* Young, described later in this text, was discovered on the south slope at this locality within the gray-white carbonates generally equivalent to Unit 7.

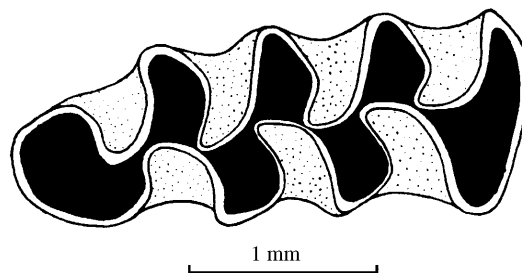
### Arvicolidae Gray

#### *Microtus* Shrank, 1798

#### *Microtus brandtoides* Young, 1934

**Material:** Two left m1 (V6292 and V6292.1).

**Description:** There are five enclosed salient angles between the anterior and posterior loops. A conspicuous accessory fold is present at the anterolingual aspect of the obliquely oriented anterior loop. Tooth roots are absent. This morphology is consistent with the same specimens produced from Zhoukoudian Locality 1 (Young 1934, p. 95), Locality 3 (Pei 1936, p. 71), Locality 9 (Teilhard 1936, p. 17), Locality 13 (Teilhard and Pei 1941, p. 52), the Upper Cave (Pei 1940, p. 46), and other middle to Late Pleistocene localities. Most recently, Qi (1978, p. 136) reported this species from a Late Pleistocene cultural site at Xuyaojia, Yanggao Co., Shanxi Province.\*



**Figure 2:** Occlusal view of *Microtus brandtoides* Young left M/1 (V6292).

\* In 1977 the author of this text and others documented this species at several Early to Middle Pleistocene localities in the Gonghe Basin, Qinghai.

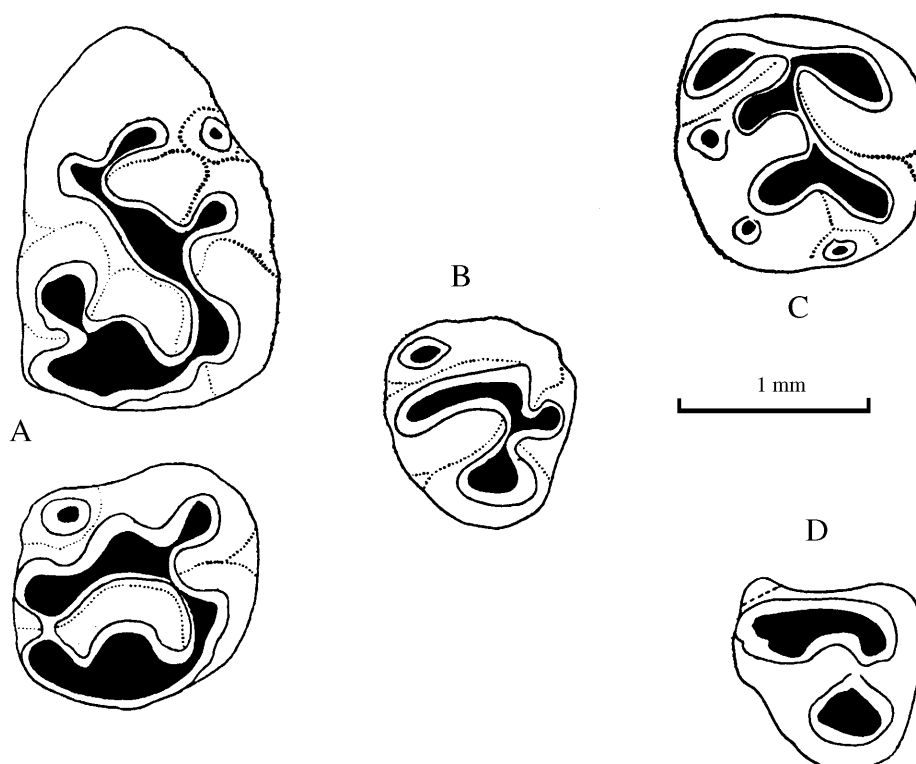
**Muridae Murray**

***Orientalomys de Bruijn and van der Meulen 1975***

***Orientalomys nihowanicus* sp. nov.**

**Type:** One right M1-2, V6293 (Fig. 3A)

**Hypodigm:** One right M3, V6293.1 (Fig. 3B); one right m2, V6293.2 (Fig. 3C); one right m3, V6293.3 (Fig. 3D).



**Figure 3:** Occlusal view of *Orientalomys nihowanicus* sp. nov.

**Diagnosis:** The M1 maintains a small and isolated t1, the t4 is small and lies distant from the t1, and the t5 and t6 are not connected. Six roots are present. The M2 has lost the connection from the t1 to the t4-t5-t6 and possesses a c1 and c3.

**Description:** Muridae tooth cusp nomenclature follows Sen (1977, p. 94, Fig. 1) (Figure 4). The occlusal surface of the M1 is spatulate. Six roots are present. The t1 is low, small, and lies distant from the t2 and t4, but the t2 and t3 are in close proximity. The t3 is connected to the t5 posterolingually. The t4 is close to the t5 but the t5 is not connected to the t6. There is a small spur projecting off the posterior t5 that contacts the t7. The t6 and t8 are confluent. The three connections t1-t2-t3, t4-t5-t6, and t7-t8-t9 are parallel and oriented obliquely posterolabially.

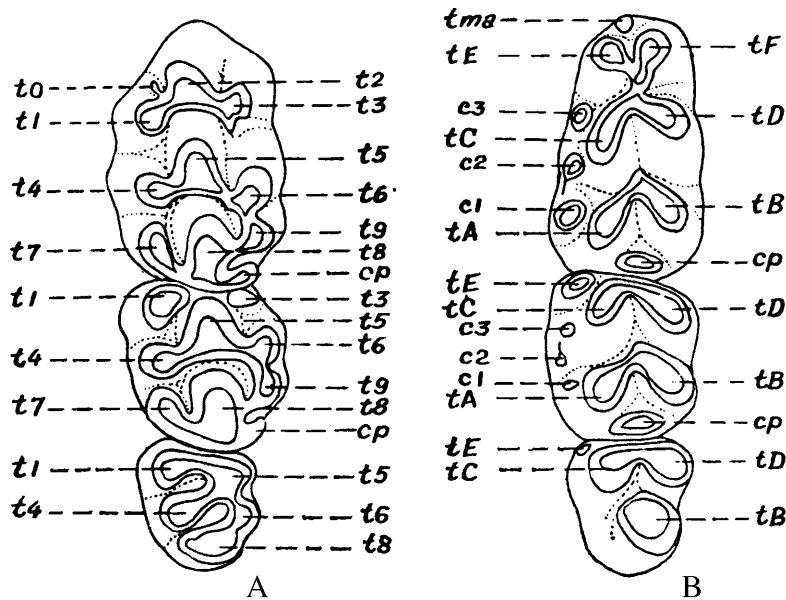
The occlusal surface of the M2 is nearly circular. Five roots are present. The t1 and t2 have become lost and the t3 is isolated. The cusps t4 through t9 are all confluent, or stephanodont.

The M3 has a triangular occlusal surface. Three roots are present. The t1 contacts the anterior cingulum. The t4 and t5 are connected to form a transverse beam. The t8 is well developed with its anterior region passing through a small spur to contact the t6.

The m2 occlusal surface is nearly circular. Three roots are present. There is an accessory cusp c3 on the labial side of the protoconid (tC). There is also an accessory cusp (c1) on the labial side of the hypoconid (tA). A c2 has become lost between these two accessory cusps. The posterior cingulum (cp) is relatively weak and is present only as a small cusp.

The m3 has lost the tE. The tC and tD are connected to form a transverse beam. The tB is isolated.

**Comparison:** This genus has been recognized at the localities of Tourkobounia 1, Greece (Early Pleistocene); Calta, Turkey (Late Ruscinian); Odessa, Russia (Early Pleistocene); Etermte, Inner Mongolia ("Late Pliocene"); and Locality 18, Zhoukoudian (Early Pleistocene). *O. pusillus* from Ertemte (Schaub 1938, p. 29) is based on a mandible fragment with m2-3. It is slightly smaller than the Nihewan specimen. The tE on the m2 is isolated, the C1 is absent and the Cp is relatively well developed. The tE on the m3 is well developed, and the tB and tD are connected. *O. schaubi* from Locality 18, Zhoukoudian, (Teilhard 1940, p. 59) is rather small. The M1 has lost the t7 and the t1 is relatively well developed in addition to being connected to the t2 and t5. The t6 is placed anteriorly and in contact with the t5. The M2 t4 and t8 are relatively small. The tooth cusps are oriented along two parabolic rows consisting of the t1-t2-t3 and the t4-t5-t6, which is quite unlike the Nihewan specimens in which the cusp rows are oriented obliquely posterolabially.



**Figure 4:** Tooth cusp nomenclature of the Muridae (after Sen 1977). Explanation: A. Right upper molar - t0 style; t1-t9 principal tooth cusps with t5 as the protocone, t6 as the paracone, t8 as the pseudohypocone, t9 as the metacone, and Cp as the posterior cingulum. B. Left lower molar configuration tma-antero-stylid; tF-principle anterolingual cusp; tE-principal anterolabial cusp; tD-metaconid; tC-protoconid; tB-entoconid; tA-hypoconid; CP-posterior cingulum; C1-C3 ectostylid.

*O. galaticus* from Calta, Turkey (Sen 1975, p. 317) is relatively large, but the M1 has an isolated t1 that lies distant from the t2, although it possesses a t7 as well as a t1-t2-t3, t4-t5-t6, t7-t8-t9 cusp configuration similar to the Nihewan specimens. Moreover, the t6 is connected to the t5

Table 1. Comparison of *Orientalomys* dental measurements (mm).

	M <sup>1</sup>		M <sup>2</sup>		M <sup>3</sup>		M <sub>1</sub>		M <sub>2</sub>		M <sub>3</sub>	
	L	W	L	W	L	W	L	W	L	W	L	W
<i>O. nihowanicus</i> sp. nov. Wei County, Hebei	1.98	1.20	1.23	1.20	0.90	0.96			1.14	1.20	1.17	0.90
<i>O. pusillus</i> (Schaub, 1938) Ertemte, Inner Mongolia					..		1.20	1.20	1.00			
<i>O. schaubi</i> (Teilhard, 1940) Choukoutien, Loc. 18	1.80	1.20	1.10	1.10	0.80	0.70						
<i>O. similis</i> (Arg. et al. 1939) Soviet Union, Odessa	1.80	1.40	1.20	1.30	..	1.71	1.10	1.20	1.20	0.90	1.00	
<i>O. similis</i> (deBruijn et al. 1975) Greece, Tourkobounia-I	1.80	1.29	1.29	1.29	0.94	0.93	1.78	1.17	1.31	1.28	1.08	0.98
<i>O. galaticus</i> (Sen, 1975) Turkey, Calta	1.92	1.36	1.23	1.35	1.17	1.11	1.78	1.16	1.22	1.14	0.96	0.92

while the t7 is not connected to the t5 which is inconsistent with the Nihewan specimens. Its M2 possesses an extremely well developed t3 that is connected to the t5 and unlike the same cusp on the Nihewan specimen which is isolated. The M2 has lost the C1 and the posterior cingulum (CP) is extremely well developed.

*O. similis* from Tourkobounia 1, Greece (de Bruijn and van der Meulen 1975, p. 318) maintains tooth morphologies on the M1-3 and m2-3 that are fundamentally consistent with the Nihewan specimens; however, the M1 possesses a t1 connected to the t5 and a t5 connected to the t6. The M2 t3 is connected to the t6 and the t4 is connected to the t7. The M3 t5 is relatively well developed. The m2 has lost the C1 and moreover has a very well developed talonid basin. The m3 protoconid on the anterolabial side possesses an accessory cusp. These and other characters distinguish the species from the Nihewan specimens.

### Ochotonidae\* Thomas

#### *Ochotona* Link, 1795

#### *Ochotona lagrelii minor* Bohlin, 1942

(Plate 1, Figure 1A, 1B, 2, Text Figure 5)

Schlosser, 1924, p. 49, Plate IV, Figure 19

Teilhard 1926, p. 47, Figure 22

Bohlin, 1942, p. 143, Figures 14 15.

**Material:** A nearly complete skull with complete dentition (V6294), and a left and right mandible with complete dentition belonging to the same individual.

**Description:** With the exception of damage on the occipital region, the basioccipital, and the post occipital tuberosities, the skull is basically complete. The mandible is complete.

**Skull:** Cranial material of *Ochotona lagrelii* has only been documented from the locality of "Shiashiang 22", Shouyang, Shanxi Province (Young 1935, p. 7, Plate I, Fig. 4) representing the "Pontian Stage" *Hipparion* Red Clays. According to the description of Young (1935), the orbit is circular or elliptical with the interorbital region constricted. There is a shallow ridge running along the lateral margin of the nasal and medial margin of the orbit. The infraorbital foramen is large and solitary. The oral region is relatively thin and clearly recurved ventrally. Although the Nihewan specimen is smaller with a broader its interorbital region (nearly as broad as the nasals), its remaining characters conform to the description made by Young (1935).

The nasals are slightly longer than *Ochotonoides* with the anterior breadth narrower than the posterior breadth which is also not as large as the latter. The suture of the nasal and frontal is posterior to the anterior margin of the orbit which is also distinct from *Ochotonoides* in which it lies upon the same plane as the anterior margin of the orbit.

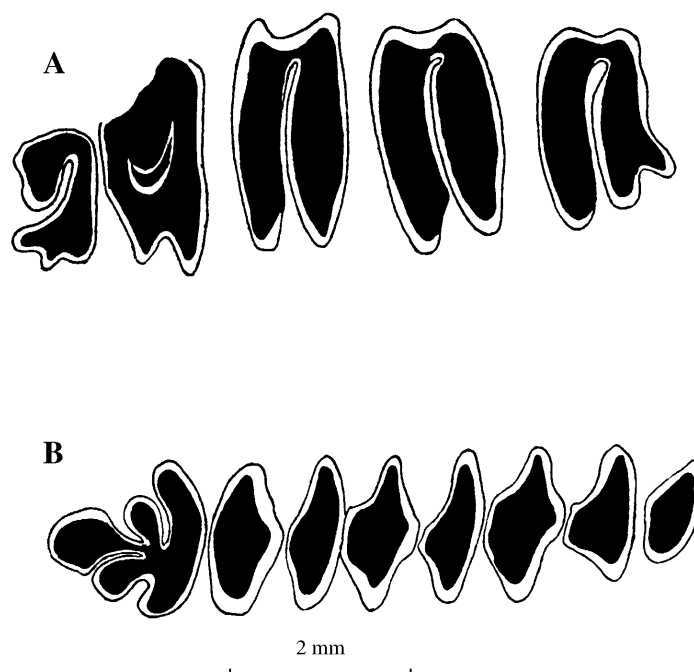
The frontal projects dorsally upward, unlike *Ochotonoides* in which both sides depress medially toward the frontal suture. The medial margin of the orbit is also unlike *Ochotonoides* which posteriorly passes through the frontal-parietal suture, reaching directly to the projected ridge at the midpoint of the parietal and is moreover a broad and tabular. This is a character shared even closer with the extant *Ochotona* and a significant cranial character distinguishing the two genera.

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\* Translator's note: For the most recent revisions of the Ochotonidae see Qiu, Z.D., 1987; The Neogene mammalian faunas of Ertemte and Harr Obo in Inner Mongolia (Nei Mongol), China. - 6. Hares and kikas - Lagomorpha: Leporidae and Ochotonidae. *Senckenbergiana lethae*, **67** (5/6), pp. 375-399.

The parietal is projected and laterally oblique to contact the temporal. The intersection of the oblique surface with the temporal forms vague sagittal crests, which consequently forms a square sagittal region on the dorsal parietal. This is somewhat like the extant *Ochotona* and unlike the absence of crests on *Ochotonoides*. Even more significant is the absence of a pair of crests, such as on *Ochotonoides*, that originate at the mid-parietal, bifurcate, and extend directly to the medial margin of each orbit.

There is a very well developed jugal process at the base of the zygomatic arch that, in dorsal view, appears to exceed the breadth of the zygomatic arch. On both *Ochotonoides* and the extant *Ochotona* this feature is smaller than, or equivalent to, the breadth of the zygomatic arch base. The zygoma on *Ochotonoides* on the extant *Ochotona* have an anteroposterior diameter smaller than their lateral diameter such that the external margin of the orbit tends to be circular. But on the Nihewan specimen the anteroposterior diameter exceeds the lateral diameter causing the orbit to be elliptical. In *Ochotonoides* there is a well developed posterior glenoid process that is usually fused to the base of the bulla. However in the Nihewan specimen and extant *Ochotona*, the posterior portion of this process is tapered and isolated from the bulla.



**Figure 5:** Occlusal view of *Ochotona lagrelii minor* Bohlin upper and lower dentition. A. Left upper P2-M2, V6294; B. Right lower P3-M3, V6294.1.

The premaxilla is extremely short whereas the maxilla is correspondingly long. The premaxilla maxilla suture line is situated along the anteromedial point of the diastema but on *Ochotonoides* and *Ochotona* this suture is posterior to the diastema.

**Upper Incisors:** The I1 is straight, small and elliptical in cross-section. The left incisor is situated posteriorly and the right incisor is situated anteriorly to contact the I2. The I2 is strongly recurved with a vertical anterolingual groove. The incisive and palatal fenestrae are confluent, resembling extant taxa.

**Upper Dentition:** The P2 occlusal surface is rectangular, being narrow anteroposteriorly and broad laterally. It maintains a rather complicated morphology. In addition to a deep reentrant groove at the extreme anterior that extends posterolabially, there are four additional shallow accessory inflexions. Deep stria lie anteriorly on both sides of the groove and there is one on each of the lingual and labial sides. These characters are quite close to *Ochotonoides complicidens* (Teilhard 1940) from Locality 18 of Zhoukoudian, and differ from extant *Ochotona* which does not have small inflexions.

**Table 2. Cranial measurements of *Ochotona lagrelii minor* from Nihewan (mm).**

Skull	<i>O. lagrelii minor</i> This text	<i>O. lagrelii</i> (Young, 1935, p. 7)	<i>O. complicidens</i> (Teilhard, 1940, pp. 48-49 mean)
Posterior width	34.0		64.0
Ventral length	29.5		53.0
Parietal length	13.0		27.0
Frontal length	12.0		21.0
Nasal length	10.7		21.0
Rostral length (to frontal)	12.0		23.0
Incisor to posterior M2	16.2	26	--
Incisor to anterior P2	9.5	15.0	
Neurocranium breadth	14.8		23.0?
Postorbital constriction breadth	4.5	7.5	8.0
Zygomatic arches breadth	18.2	24.0	32.0
Infraorbital fenestra breadth	5.9	9.0	10.0
Zygomatic arch length	11.0		15.0
Postsquamosal process length			15.0
Foramen magnum to palatine	16.5		28.0
Incisor to posterior palatine	14.5		24.0
Palatine breadth at M1	11.7		18.0
Dentition length	7.1	10.0	11.8
M1 breadth	2.5		3.0
Mandible	<i>O. lagrelii minor</i> This text	<i>O. lagrelii</i> (Schlosser, 1924,p. 50)	<i>O. complicidens</i> (Teilhard, 1940, pp. 48-49 mean)
Dentition length	6.7	11.0	11.8
Breadth of m1	1.7	3.0	2.9
Diastema length	4.8	7.0	9.7
Incisor to m3	13.2		23.5
Incisor to angular process	25.5	38.0	44.0
Mandible height at m1	5.0	9.0	11.0

The P3 occlusal surface is trapezoid, the lingual side is anteroposteriorly compressed while the labial side is anteroposteriorly broadened. The anterior lobe is narrow with a breadth generally consistent with that of the P2. The posterior lobe is broader with a width generally consistent with the anterior lobe of the P4. In the center of the premolar there is an enamel ringlet slightly inclined toward the lingual side. This is consistent with the morphology of extant *Ochotonoides*.

P4/-M2/: The anterior lobe of the P4 has a breadth smaller than that of the posterior lobe. The M/ and M2 maintain anterior lobes wider than their posterior lobes. There is a weak accessory

projection at the posterolingual side on the posterior lobe of the M2 which is a feature present on both *Ochotona* and *Ochotonoides*.

**Mandible:** The morphology of the mandible is similar to the general lagomorph condition but the diastema is relatively shorter. The masseteric crest is relatively conspicuous. The inferior dental foramen posterior to the m3 is extremely small, with a small clear projection inside it. The inception of the ascending ramus is labial to the m3. There is an extremely small mental foramen at the anterolabial side of the p3. The breadth of the symphysis corresponds to the breadth of one of the rami.

**Lower Incisors:** The cross-section is a rounded triangle with a lingual anteroposterior breadth greater than the labial anteroposterior breadth. The incisor terminates beneath the p3.

**Lower cheek teeth:** The p3 occlusal surface is triangular with both the lingual and labial sides maintaining two reentrants. The anterior pair of reentrants invade the crown to generally equivalent depths. The second labial reentrant is the deepest while the second lingual reentrant is the shallowest. The size and morphology exactly resemble the specimens described by Teilhard (1926, p. 47, figure 22) from the Pliocene *Hipparion* Red Clays of "Choe Tong Keou," Qingyang, Gansu Province.

**p4-m3:** The anterior wall of the first lobe has a broad anterior projection which becomes progressively more conspicuous posteriorly on the molars. The posterior wall of the anterior lobe has a posteriorly projected angle. The m3 is a single column.

**Discussion:** When Schlosser (1924) described *Ochotona lagrelii* he assigned a number of specimens with a large size discrepancy to the same genus, believing extremely small specimens to represent juveniles (Plate IV, Fig. 19). Bohlin (1942, p. 143) noted that a small specimen possessing only a single M1, possessed all the alveolae, the m1 was worn extremely deeply, there were no vestiges of deciduous teeth, and the p3 and p4 were fully well developed. Consequently, he recognized two species or subspecies based upon this single small illustrated specimen and to two other fully developed specimens of the same size, subsequently revising the nomenclature by erecting the small *O. lagrelii minor*. He moreover proposed that this small subspecies differed from *O. lagrelii*, in addition to being smaller, by displaying a relatively large diastema between the I2 and P4 alveoli. From the statistics of Bohlin and the present discovery of the current specimens, the presence of a rather small ochotonid in the Pliocene to Early Pleistocene deposits of North China is verified. There are extremely minor distinctions in dental morphology between the small form and *O. lagrelii* as it is only the size that varies. This is illustrated by Teilhard (1926, p. 47, Fig. 22) who noted *O. cf. lagrelii* from the Pontian Stage of Qingyang, Gansu, being intermediate in size (p3-m3 length 8.7 mm) between *O. lagrelii* (p3-m3 length 11.0 mm) and the specimen described in this text (p3-m3 length 6.7 mm). However, the morphology of the P3 is basically consistent with the specimen described in this text.\* Although *O. lagrelii* displays a variable morphology, as described by Bohlin (1942, p. 144, Fig. 14) in which one p3 possesses a relatively conspicuous posterolingual reentrant fold that does not exist on other specimens, it was nevertheless assigned to the same large species. From the perspective of the Nihewan and Qingyang specimens, the presence of the posterolingual reentrant fold does not necessarily indicate a juvenile and is possibly be the result of individual variation.

With regard to the temporal range of *O. lagrelii*, it is currently recognized as the only member of the genus *Ochotona* from the Pontian Stage of North China. This is principally the

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\* In addition, the current author has recently discovered a specimen of *O. lagrelii minor* from the *Hipparion* Red Clays in the Tianzhu Autonomous Region, Gansu Province, that is even smaller (p3-m3 length 5.2 mm) but has a p3 morphology consistent with *O. lagrelii*.

result of different interpretations of faunal ages by various workers, as exemplified by Bohlin (1942), who believed *O. lagrelii* from Ertemte was Pontian in age, while later workers believed it to be Late Pliocene in age. The so called "Pontian Stage" in North China (or age of the *Hipparion* Red Clay) is currently restricted to the Middle Pliocene\* by a majority of workers (Chiu et al. 1979). Regardless, in the Middle to Late Pliocene of North China, *O. lagrelii* occupies a predominant position. By the description in this text in addition to its presence in the late Early Pleistocene Wucheng Loess found by this author and others in Ning County, Gansu, it is evident that *O. l. minor* survived into the middle and late stages of the Early Pleistocene. Most recently, Ji et al. (1980, p. 27; Plate IV, Fig. 1) described *O. guizhongensis* from the Gyirong (Jilong) Basin of Tibet, equivalent in age to the *Hipparion* Red Clays of North China. The data consists of a fragmentary maxilla containing left and right P2-M2. Its size (P2-M2 length 9.5 mm) approaches that of *O. lagrelii* (10 mm); however, the P2 is extremely small (with a width of 1.7 mm, merely one half the width of the P3 which is 3.24 mm), it is simple in morphology (with only a single anterior reentrant), and the P3 degree of molarization is even higher, as expressed by the nearly equivalent width of the anterior and posterior lobes, both of which reach the breadth of the posterior dentition (P4-M2). These are characters clearly distinctive from the complex P2 and narrower anterior lobe of the P3 possessed by *O. lagrelii*, such that this species is clearly a unique taxon from the Middle Pliocene of China.

### **Microsubdivision of the "Nihewan Deposits" from a Local Perspective**

The Nihewan deposits are a composite set of complex sedimentary units. Not only are these sediments thick, but moreover at different localities there also occurs lateral facies variation, such that there have long since been controversial opinions regarding the recognition of the Nihewan deposits (see Qi, 1978). However, it is possible to make a fundamental diagnosis of the so-called "*Hipparion* Red Clays" (seemingly intermittently distributed) underlying the "Nihewan deposits" that contain several characteristic mammalian fossils such as *Hipparion* and *Chilotherium* (see Nihewan Cenozoic Stratigraphic Team, 1974). There is not much doubt that the aforementioned lithologic distinction illustrates the geologic age of the Red Clays to be fundamentally Pliocene (obviously there is a need to recover more data). There currently appears to be a consensus assigning the overlying "Yellow loess" to the Late Pleistocene.

Barbour et al. (1928), recognize the "Nihewan" system itself to be divided into four relatively consistent zones. From bottom to top these are the basal sandy gravel zone, the middle sandy clay zone, the upper sandy gravel zone, and the white carbonate zone. This subdivision system is basically consistent with the cross-sections in this text. Teilhard and Piveteau (1930) as well as this author's personal observations, determine the Nihewan Fauna to be principally produced from the aforementioned middle sandy clay zone, which should be generally equivalent or slightly higher than the fossil zone recorded in this text. However, the thickness of this text's cross-section is less than the latter sections in the vicinity of Shagoucun and Nihewan Village. It is therefore possible to conclude that *Orientalomys nihewanensis* and *Ochotona lagrelii minor* recorded here are two additional members to be added to the Nihewan Fauna. The genus *Orientalomys* occurs in the Chinese so-called "Late Pliocene" Ertemte fauna (Schaub 1938, p. 29) as well as the Early Pleistocene Locality 18, Zhoukoudian (Teilhard 1940, p. 59). However, de Bruijn and van der Meulen (1975, p. 317), hypothesize that *O. pusillus* from Ertemte, the oldest species of this genus, possesses characters that indicate its age to be very possibly equivalent to the European Ruscinian Stage.\* The discovery of this genus Calta, Turkey; Odessa, Soviet Union; and Tourkobounia 1, Greece, all constrain this chronological stage. Therefore, the discovery of this genus in the Nihewan deposits is at the very least an additional link to these contemporaneous

\* Translator's note: Now Miocene.

\* Translator's note: Currently latest Turolean. See Storch, 1987; The Neogene mammalian faunas of Ertemte and Harr Obo in Inner Mongolia (Nei Mongol), China. - 7. Muridae (Rodentia). *Senchenbergiana lethae* 67 (5/6), pp. 403-431.

Eurasian faunas. The second element, *Ochotona lagrelii minor*, is also a member of the Ertemte fauna, adding to the archaic complexion of the Nihewan Fauna, as in the past this taxon has been recovered only from Pliocene deposits. The objective of the detailed description of this taxon in this text is to provide evidence that the small form of *O. lagrelii* is not only extremely abundant in the middle to Late Pliocene of North China, but moreover persists into the Pleistocene.

As to the lower sandy gravel zone in the lower section of the "Nihewan deposits," it is very possible the age is earlier than the aforementioned sandy clay zone. In 1977, Tang et al.\* the following mammals from the same section: *Lynx* sp. nov., *Zygodon* sp., *Coelodonta antiquitatis*, *Hipparion* sp., *Paracamelus* sp., *Antilocapra* sp. nov., *Gazella sinensis*, ?*Axis* sp., and more. These taxa clearly express a different complexion than the Nihewan Fauna and it may represent a slightly older phase. However, in the same stratigraphic position in the neighboring locality of Niutoushannangou in Tanangou, the current author made the discovery of an *Equus* cannon bone, a tooth of *Bos*, and an *Elephas* tooth plate, indicating the age to still be Early Pleistocene.

Currently, reliable taxa to correlate the age of the white carbonate zone is absent, but the record of *M. brandtoides* Young in this text, in addition to the concurrent discoveries of this species in the "loess deposits" of the same basin in the vicinity of Nihewan Village and at Xujiayao (Qi 1978, p. 141, 146) assists in this problem. This species is relatively abundant in the Middle Pleistocene faunas of Zhoukoudian Localities 1, 3, 9, 13, and the Upper Cave. It is also not found in Europe earlier than the middle Pleistocene. Therefore, it is difficult to correlate white carbonate zone to the lower sandy clay zone. However, there seems also to be an even greater deficiency of fossil evidence to correlate it to the Xujiayao cultural site, which is clearly more contradictory in view of the Nihewan stratigraphic sequence. It is very possible that the age of this zone is equivalent to the middle Pleistocene fauna of Zhoukoudian, but this is still merely conjecture, as more fossil evidence is required.

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\* Liu, D.S., Tang, Y.J., Huang, W.P., 1979; A discussion of the Lower Quaternary Boundary in China. Symposium on Quaternary Research in China. Collected Papers from the third Quaternary Research Group, Session of Vertebrate Paleontology, Paleoanthropology and Culture, and Paleoenvironment.

### Bibliography

- Barbour, G.B., E. Licent and P. Teilhard de Chardin, 1928: Geological study of the deposits of the Sangkanho Basin. *Bull. Geol. Soc. China*, Vol. V, no. 3-4, pp. 268-278.
- Bohlin, B., 1942: A revision of the fossil Lagomorpha in the Paleontological Museum, Upsala. *Bull. Geol. Institut. Upsala*, Vol. 30, pp. 117-154, 21 figs.
- Boule, M. and P. Teilhard de Chardin, 1928: Le Paleolithique de la Chine (Paleontologie). *Archives de l'Institut de Pale ontologie Humaine (Paris)*, Mem 4, pp. 1-102, 20 pls, 29 figs.
- Bruijn, H. de and A.J. van der Meulen, 1975: The Early Pleistocene rodents from Tourkonounia 1 (Athens, Greece). I and II. Konink. *Nederl. Akad. Wetensch. Amsterdam Proc., Ser. B* **78**(4), pp. 314-338, 1 fig, 6 pls.
- Chiu, Chan Siang, Li, Chuan kuei and Chiu, Chu ting, 1979: The Chinese Neogene A preliminary review of the mammalian localities and faunas. *Ann. Ge ol. Pays Hellen., Tomehors serie, fasc. 1*, pp. 263-272.
- Dawson, M.R., 1961: On two ochotonids (Mammalia, Lagomorpha) from the later Tertiary of Inner Mongolia. *Amer. Mus. Novit.*, No. 2061, pp. 1-15, 7 figs.
- Dawson, M.R., 1967: Lagomorpha history and the stratigraphic record. Essays in paleontology and stratigraphy, Raymond C. Moore Commemorative Volume. pp. 287-316, 6 figs.
- Ji, Hongxiang; Xu, Qinqi, Huang Wanpo, 1980: Hipparion Fauna from the Woma Commune, Gyirong, Tibet. *Paleontology of Tibet*, Vol. 1, pp. 18-32 (in Chinese).
- Nihewan Cenozoic Stratigraphic Team, 1974: Investigations upon several stratigraphic sections in the Late Cenozoic Nihewan Basin. *Vertebrata PalAsiatica*, Vol. 12 (2), pp. 99-110 (in Chinese).
- Pei, W.C., 1936: On the mammalian remains from Locality 3 at Zhoukoudian. *Pal. Sin. Ser. C.*, Vol. 7, fasc. 5, pp. 1-121. 59 figs, 6 pls.
- Schaub, S., 1938: Tertiare und Quartare Murinae. *Abh. Schwiz. Palaont. Ges.*, Basel, 61, pp. 1-38, 18 figs, 1 pl.
- Schlosser, M., 1924: Tertiary vertebrates from Mongolia. *Pal. Sin., Ser. C*, Vol. 1, fasc. 1, pp. 1-134, 6 pls.
- Sen, S., 1975: *Euxinomys galaticus* n.g., n. sp. (Muridae, Rodentia, Mammalia) du Pliocene de Calta (Ankara, Turquie). *Geobios*, Lyon, **8**(5), pp. 317-324, 8figs.
- Sen, S., 1977: La faune de Rongeurs Pliocenes de Calta (Ankara, Turquie). *Bull. Mus. Nat. Hist. Natur. 3rd serie* No. 465, Sciences de la Terre 61, pp. 89-172, 14 pls, 5 figs.
- Teilhard de Chardin, P., 1926: Mammiferes Tertiares de Chine et de Mongolie. *Ann. de Paleont.*, Vol. 15, pp. 1-52, 25 figs, 5 pls.
- Teilhard de Chardin, P., 1936: Fossil mammals from Locality 9 of Zhoukoudian. *Pal. Sin., Ser. C*, Vol. 7, fasc. 4, pp. 1-71, 30 figs, 4 pls.
- Teilhard de Chardin, P., 1940: The fossils from Locality 18 near Peking. *Pal. Sin., New Ser. C*, No. 9, pp. 1-101, 51 figs, 3 pls.
- Teilhard de Chardin, P., 1942: New rodents of the Pliocene and lower Pleistocene of North China. *Public. Inst. Geo-Biologie*, No. 9, pp. 1-101, 61figs.
- Teilhard de Chardin, P. and Pei, W.C., 1941: The fossil mammals of Locality 13 in Zhoukoudian. *Pal. Sin., New Ser. C*, No. 11, pp. 1-119, 78 figs, 6 pls.
- Teilhard de Chardin and J. Piveteau, 1930: Les mammiferes fossiles de Nihowan (Chine). *Ann. de Paleont.*, Vol. 19, pp. 1-154, 42 figs, 23 pls.
- Teilhard de Chardin and C.C. Young, 1931: Fossil mammals from northern China. *Pal. Sin., Ser. C*, Vol. 9, fasc. 1, pp. 1-87, 23 figs, 10 pls.
- Wei, Qi, 1978: New discoveries from the Nihewan deposits and their stratigraphic significance. *Collected Papers on Paleoanthropology*, Engles Symposium, pp. 136-150 (in Chinese).
- Young, C.C., 1934: On the Insectivora, Chiroptera, Rodentia and Primates other than *Sinanthropus* from Locality 1 in Zhoukoudian. *Pal. Sin., Ser. C*, Vol. 13, fasc. 3, pp. 1-89, 23-figs, 10 pls.
- Young, C.C., 1935: Miscellaneous mammalian fossils from Shansi and Honan. *Pal. Sin., Ser. C*, Vol. 9, fasc. 2, pp. 1-57, 13 figs, 7 pls.