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NOTES ON LAND AND FRESH-WATER MOLLUSKS  
OF CHEKIANG PROVINCE, CHINA\*

BY

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## INTRODUCTION

THE PRESENT paper† is based on a collection of land and fresh-water mollusks made by Mr. John T. Wright during 1925 to 1928, in several localities along the Chien-tang-kiang Valley of Chekiang Province, and includes a few lots from Shanghai and Haimen in Kiangsu Province. The material was obtained by the California Academy of Sciences through purchase, and it was partially and preliminarily identified by the late Dr. Bryant Walker. The collector's primary interest was ornithology, but mollusks were taken when seen. However, it is remarkable that numerous species of comparatively minute forms of land snails are present in the collection and some of these are here described as new to science. Mr. Wright deserves credit for the discovery of these small forms. Formal headings and descriptive notes are given for one hundred species. Of these, five are described as new.

The mollusks of Chekiang were first collected from Chowshan Island, ten miles east of the coast of Chekiang, by Theodore Cantor. In early literature, the island was romanized as "Chusan." Cantor's material was studied by W. H. Benson in 1842, who thus contributed the first paper since 1758 on Chinese mollusks with a precise and exact locality. The types of Benson's species are now preserved in the Indian Museum in Calcutta, and most of the land and fresh-water species described by him from Chowshan are included in the present collection. Isaac Lea's paper on new species of exotic Melaniana in 1856 (Proc. Acad. Natural Sci. Philadelphia, 8: 144-145) also includes one species, namely *Melania ningpoensis*, from Chekiang. Lea's specimens were

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collected by S. R. House. From 1882 to 1890, Père Heude recorded a few species of *Clausilia* from Chowshan, and many of his species described from the neighborhood of Chekiang Province are contained in the present collection. B. Schmacker obtained a collection of mollusks from Ningpo and vicinity, and his material was partly recorded by himself jointly with Oscar Boettger in 1890 to 1891.

Early in the present century, Pilsbry and Hirase (1908) published a paper on Chinese mollusks in which a few species of land snails were described from Hangchow, the capital of Chekiang. During his residence in Chekiang, Mr. A. W. L. Oliver collected mollusks in Hangchow, Mokanshan, Yen-chow, Tsao-ngo River, etc. His collection was afterward presented to the Indian Museum in Calcutta. The gastropods were studied and reported by T. N. Annandale and the pelecypods by B. Prashad (Annandale and Prashad, 1924).

The molluscan species of medical importance from Chekiang have received more attention only in recent years. Early records show that a few species of *Oncomelania* Gredler were reported from this province. Dr. F. C. Li in 1934 made a very detailed study of the anatomy, development, and ecology of *Oncomelania*. Li's material was collected from Kashing and its neighboring regions in Chekiang. Paul Bartsch in 1936 also contributed a very comprehensive paper on molluscan hosts of parasites, in which species of *Oncomelania* were recorded from Shaohing, Wuhing, and Kashing; species of *Blanfordia* and *Katayama* from Shaohing and Ling-an. Bartsch's series of specimens were collected at different times by E. C. Faust, Mary Andrew, Y. T. Yao, and F. C. Li.

The present collection represents, as the subsequent pages will show, an important part of the molluscan fauna of this province; however, such common forms as *Cathaica fasciola* (Draparnaud), *Oncomelania schmackeri* Moellendorff, *Oncomelania moellendorffi* (Schmacker and Boettger), *Parafossarulus eximius* (Frauenfeld), *Assimineia scalaris* Heude, etc., are conspicuously absent. The large series of young and adult examples available for some species, such as *Cyclophorus martensianus* Moellendorff, *Cyclopus fortunei* (Pfeiffer), *Mirus cantorii* (Philippi), etc., makes it possible to trace a wider range of shell variation in adult characters as well as in developmental stages.

Among the minute forms, species of *Cyathopoma*, *Carychium*, and *Hawaiiia* are again recorded in this country. *Cyathopoma* and *Hawaiiia* came to my notice for the first time in the molluscan fauna of China when I studied a collection of gastropods from western Szechwan Province. It may be considered as one of the few parallel cases of *Heudiella* Annandale (1924) whose known geographical range up to the present is Yunnan and eastern Chekiang. Further records of these forms to fill the gap of such a long distance depend on future exploration along the Yangtze Valley.

My acknowledgment cannot be completed without mentioning my appreciation to Dr. Robert C. Miller, Director of the California Academy of Sciences, who was for a time Visiting Professor of Zoology at Lingnan Uni-

versity—a missionary institution in Canton—for his kindness and courtesy extended to me during my stay in the Museum of the California Academy of Sciences. I am equally grateful to Dr. G. D. Hanna and Dr. L. G. Hertlein of the Department of Paleontology of the same Academy, for their kindness and for giving me the privilege of studying this collection of Chinese mollusks. The illustrations shown on the plate accompanying this paper were drawn by Miss Helen Winchester. The line drawing of the new species of *Psidium* was made by Dr. G. D. Hanna.

## SYSTEMATIC DESCRIPTIONS

### Family HYDROCENIDAE

#### **Georissa sinensis** (Heude), 1882

*Realia sinensis* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 8, pl. 12, fig. 7; pl. 19, fig. 2.

Collecting stations: Hangchow, Fengshiu, Lanchi, and Chiang-shan.

This species was originally described from Anhwei Province, and has been recorded from various places in the lower Yangtze Valley. Heude described it as “imperforate,” but the umbilical space seems to be well traceable on these specimens, and in adult ones it is covered more or less completely by a columnar callosity.

#### **Georissa nivea** (Heude), 1882

*Realia nivea* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 9, pl. 19, fig. 4, 1882.

Collecting stations: Fengshiu, Lanchi, Wong-kiang, Yenchow, Chekiang.

This species differs essentially from the preceding one by its much smaller size, less elongate outline, and in possessing four and one-third rapidly increasing whorls. The spiral lines are very distant and prominent, except on the basal region where the sculpture is rather faint.

According to Moellendorff this is only a form of *G. bachmanni* (Gredler).

### Family CYCLOPHORIDAE

#### **Lagochilus sexfilaris** (Heude), 1882

*Cyclophorus sexfilaris* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 3, pl. 12, fig. 4.

Collecting stations: Mokanshan, Tunglu, Fengshiu, and Yenchow.

This species was originally described from Ningkuofu and Chechowfu, Anhwei Province.

#### **Cyclophorus martensianus** Moellendorff, 1874

*Cyclophorus martensianus* MOELLENDORFF, Jahrb. Deutsch. Malakol. Ges., 2: 120, Taf. 3, fig. 3, 1874.

Collecting stations: Mokanshan, Tunglu, Lutzepu, Fengshiu, Lanchi, and Cha-yuan-chen.

This is a common species occurring in the lower and middle Yangtze Valley. It was originally described from Kiukiang of Kiangsi Province. The shell is variable in size as well as in color pattern, and such names as *nan-kingensis*, *pallens*, and *ngankingensis*, all proposed by Heude, which were based on differences in size and color patterns, can be retained perhaps only for local races. In the present collection there are several large series of specimens from the above localities, including many forms of the young.

The adult specimens from Feng-shiu represent the typical form, measuring  $24 \times 25$  mm., with  $5\frac{1}{4}$  whorls, and bearing lighter color markings. Those from Tung-lu are smaller in size, the largest of which measures  $21 \times 23$  mm., with 5 whorls, and lighter color pattern. They approach nearly the form *pallens*. The specimens from Lan-chi bear rather dark color patterns which appear almost unicolor in dark brown except the lightly colored peripheral band. The largest of that lot measures  $21 \times 23$  mm. with 5 whorls.

### *Cyclotus fortunei* (Pfeiffer), 1853

*Cyclostoma (Cyclotus) fortunei* PFEIFFER, Proc. Zool. Soc. Lond., 1852, p. 146.

Collecting stations: Hangchow, Fuyang, Mokanshan, Tunghu, Lutzepu, and Fengshiu.

This species is rather variable in size, elevation of the spire, and color patterns. The color band, whenever present, is often infraperipheral. A few examples in the collection are unicolored olive-brown. The peristome is simple in the young and double margined in the fully matured and aged shells. A number of forms were described from various parts of China on the basis of differences in size and color markings such as *C. chinensis* Pfeiffer, 1854, from Hong Kong; *C. approximatus* Heude, 1882, from Ningkuofu of Anhwei; *C. stenomphalus* Heude, 1882, from Hunan; *C. tubaeformis* Moellendorff, 1882, from Canton; and *C. diffillimus* Schmacker and Boettger, 1890, from Wuchang of Hupei Province and Ningpo of Chekiang. It seems that these forms are very closely related to each other, if not identical. They are compared in the following table. The young forms usually consist of about 3 whorls and are small. They appear to be different from the adult forms because the rapid increase in size of the following two whorls changes considerably the general outline of the shell. The measurements are given in millimeters.

	Altitude of Shell	Width of Shell	Number of Whorls
<i>C. chinensis</i> .....	6.5-7.5	13-14	4
<i>C. fortunei</i> .....	7.0	10-12.5	$4\frac{1}{2}$
<i>C. approximatus</i> .....	11.0	13-16	$4\frac{1}{2}$
<i>C. stenomphalus</i> .....	11.0	13-15	5
<i>C. tubaeformis</i> .....	10.5-11.5	17-19	5
<i>C. diffillimus</i> .....	10.0-12.5	14-16	5



**Platyrhappe fodiens** (Heude), 1882

*Cyclotus fodiens* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 5, pl. 12, fig. 9.

Collecting stations: Mokanshan, Tunglu, Fengshiu, Lanchi, and Wongkiang.

This species was originally described from Ningkuofu and Chechowfu, Anliwei. A few of the specimens in the present collection are larger than the typical form, one of which measures 5.1 mm. in altitude, 7.2 mm. in width, with  $4\frac{1}{2}$  whorls. Some examples from Lanchi are decidedly higher in altitude, one of which measured 5.8 mm. in altitude, 6.2 mm. in width, with  $4\frac{1}{2}$  whorls.

**Platyrhappe hunana** (Gredler), 1881

*Cyclotus hunanus* GREDLER, Jahrb. Deutsch. Malakol. Gesell., 8: 113, 1881.

Collecting station: Cha-yuan-chen, Chekiang Province.

This species differs from the preceding one by its more planorboid outline, much larger size, wider umbilicus, and finer sculpture. It was originally described from Hunan, and these examples of Chekiang agree with the typical form except for the slightly greater altitude. A larger specimen in the collection measures 6.2 mm. in altitude, 10.0 mm. in width, with  $4\frac{1}{2}$  whorls.

**Cyathopoma micronicum** Yen, new species

Plate 1, figures 3, 4

Shell minute, subdiscoidal, widely umbilicated. The umbilicus contains one-third of the diameter of the shell. The shell substance is rather thin and subtranslucent. The whorls increase very rapidly in width, are well rounded, and are separated by a deep suture. The first whorl is oblique and high, but the following whorls of the spire are only slightly elevated. The sculpture consists of growth lines decussated by faint spiral lines; the latter are more distinctly traceable on the body whorl rather than on the early whorls. The body whorl is somewhat tubular and has the last one-third to one-fourth free from the penultimate whorl. The aperture descends in front, with continuous circular form. The peristome is simple and thin. The operculum is rounded, consisting of numerous closely coiled lamellose whorls, concave externally, and dark in the center. Measurements: altitude 1.1 mm.; width 1.8 mm.; diam. umb. 0.48 mm.;  $3\frac{1}{3}$  whorls.

*Holotype*, No. 8237, and *paratypes* Nos. 8238, 8239, 8240, Mus. Calif. Acad. Sci. Paleo. Type Coll., from **Yenchow, Chekiang Province, China**. Also found at Mokanshan, Fuyang, Tunglu, Lutzepu, Fengshiu, Chayuanchen, Shunan, and Puchiang.

This species approaches the size and general outline of *Cyathopoma taiwanicum* Pilsbry (Proc. Acad. Nat. Sci. Philadelphia, 57: 724, 1905), and is somewhat larger than *C. micron* (Pilsbry), (Nautilus, 14: 12, 1900), also from Formosa. However, it differs from both of them by having its last one-third of the body whorl conspicuously free from the penultimate whorl.

This genus has been known hitherto from India, Polynesian islands, and Formosa. The present series of specimens was obtained from the lower Yangtze Valley, and gives a second record of this genus from this country, indicating that it probably has a wide range of distribution south of the Yangtze River.

**Cyathopoma planorboides** Yen, new species

Plate 1, figures 8, 9

Shell minute in size, planorboid in form, umbilicated, the umbilicus more than one-third of the shell diameter. The spire is very low, having only the prominent smooth apical whorl obliquely elevated. The whorls increase very rapidly in size, bearing fine but distinct spiral lines which are intersected by fine growth striae and occasionally by coarser lines of growth. The aperture is circular in form, not descending in front, and the peristome is simple and thin. Measurements: altitude 1.2 mm.; width 2.5 mm.; diam. umb. 1.0 mm.;  $3\frac{1}{3}$  whorls.

*Holotype*, No. 8241, and *paratypes* Nos. 8242, 8243, Mus. Calif. Acad. Sci. Paleo. Type Coll., from **Yenchow, Chekiang Province, China**. Also found at Chihlilung near Puchiang, Chekiang Province.

This species is essentially different from the preceding one by its larger size, planorboid outline, and bearing distinct spiral lines of sculpture. It seems to be closely related to *C. taiwanicum* Pilsbry, differing by its larger size, lower altitude, and in the more planorboid outline.

**Chamalycaeus rathouisianus** (Heude), 1882

*Alycaeus rathouisianus* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 7, pl. 12, figs. 12, 12a.

Collecting stations: Tunglu, Yenchow, Chihlilung near Puchiang, and Lanchi.

The present collection contains a series of specimens which are identical with this species except that they are larger in size. The typical form is 2.5 mm. in altitude, 4.0 mm. in width, with 4 whorls, while most of the specimens in this collection measure 3.2 mm. in altitude, 5.0 mm. in width, with 4 whorls. It was originally described from Sungkiang, Kiangsu Province, in the neighborhood of Chekiang.

**Chamalycaeus sinensis** (Heude), 1882

*Alycaeus sinensis* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 7, pl. 12, figs. 13, 13a.

Collecting stations: Mokanshan, Tunglu, and Fengshiu.

This species differs from the preceding one by its smaller size, lower spire, and absence of spiral lines of sculpture. It was originally described from Tung-liu, Anhwei Province. Measurement: altitude 2.0 mm.; width 3.5 mm.; 4 whorls.

**Diplommatina paxillus** (Gredler), 1881

*Moussonia paxillus* GREDLER, Jahrb. Deutsch. Malakol. Ges., **8**: 29, Taf. 1, fig. 7, 1881.

Collecting stations: Hangchow, Wongkiang, Fengshiu, Chihlilung near Puchiang, Lanchi, and Chiangshan.

This species was originally described from Hunan Province, but has been further recorded in lower Yangtze Valley.

**Diplommatina paxillus mucronata** Schmacker and Boettger, 1890

*Diplommatina (Sinica) paxillus* var. *mucronata* SCHMACKER and BOETTGER, Nachrichtsbl. Deutsch. Malakol. Ges., Jahrg. 22, 1890, p. 122, Taf. 2, fig. 4.

Collecting stations: Mokanshan, Tunglu, Lutzezu, and Yenchow.

This subspecies differs from the *forma typica* by its smaller size and more contracted outline. It was originally described from Dalanshan near Ningpo, Chekiang Province.

**Diplommatina confusa** Heude, 1885

*Diplommatina confusa* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1885, p. 97, pl. 24, figs. 12, 12a.

Collecting station: Mokanshan, Chekiang Province.

A few specimens from the above locality agree well with this species but are slightly smaller in size. One of the better preserved specimens measures 3.5 mm. in altitude, 2.0 mm. in width, with 7 whorls. It was originally described from Szechwan.

**Pseudopalanina dautzenbergiana** Yen, new species

Plate 1, figure 1

Shell sinistral, perforate, minute in size, and ovately oblong in outline. The whorls are roundly convex, increasing moderately rapidly in size. The sculpture consists of fine but distinct and close ribs, but the apical whorls appear to be smooth. The suture is well impressed. The aperture is circular in outline, having its peristome continuous, somewhat thickened and double-margined. The columellar lamella is deeply inserted and hardly visible from a frontal view. Measurements: altitude 2.1 mm.; width 1.1 mm.;  $5\frac{1}{3}$  whorls.

*Holotype*, No. 8244, Mus. Calif. Acad. Sci. Paleo. Type Coll., from **Tunglu, Chekiang Province, China.**

Judging by its weakly developed columellar lamella and the sinistral coiling of the shell, this species evidently belongs to *Pseudopalanina* Moellendorff, a genus not hitherto recorded from China. Its general outline approaches that of some species of *Palania* O. Semper, but differs by having a distinct but deeply inserted columellar lamella.

## Family VIVIPARIDAE

**Viviparus chinensis lecythoides** (Benson), 1842

*Paludina lecythoides* BENSON, Ann. Mag. Nat. Hist., (1) 9: 488, 1842.

Collecting stations: Yuyao, Tunglu, Fengshiu, and Lanchi.

This subspecies differs essentially from other forms of *chinensis* Gray, such as *fluminalis* Heude, *ventricosa* Heude, *longispira* Heude, etc., by its smaller size. It was originally described from Chowshan Island, and Annandale in 1924 has designated a lectotype from Benson's original lot of specimens and figured it in reduced size.

This is a very common form in the lower Yangtze Valley, but the present collection contains only a few adult specimens with a large series of young forms, which evidently belong to this subspecies.

**Viviparus quadratus** (Benson), 1842

*Paludina quadrata* BENSON, Ann. Mag. Nat. Hist., (1) 9: 487, 1842.

Collecting station: Tunglu, Chekiang Province.

This is another species of the genus commonly occurring throughout the country. It is easily recognized by its elongate outline, scarcely convex whorls, and obtusely angulated periphery.

**Viviparus quadratus lapillorum** (Heude), 1890

*Paludina lapillorum* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1890, p. 177, pl. 40, figs. 11, 11a.

Collecting stations: Chien-tang-kiang and Lanchi.

This subspecies differs from the *forma typica* by its more ovate outline and smaller size. It was described from Ningkuofu of Anhwei Province, but it has been subsequently recorded from Huchow and other places around Tai-hu (Great Lake).

**Viviparus lithophaga** (Heude), 1889

*Paludina lithophaga* HEUDE, Journ. Conchyl., 37: 49, 1889; Mem. Hist. Nat. Emp. Chinois, 1890, p. 177, pl. 40, figs. 13, 13a.

Collecting station: Tunglu, Chekiang Province.

This species is small, subglobose in outline, and almost rounded at the periphery. The apical whorl is rather obtuse. It was originally described from Ningkuofu, and the typical form seems to be considerably larger than the examples in the present collection; however, they agree well in other features. The typical form is 33.0 mm. in altitude, 20.0 mm. in width, with 5 whorls, while the largest specimen here is only 20.0 mm. in altitude, 15.0 mm. in width, with 4 whorls.

Its general outline, thick shell, and obtuse, apical whorls seem to suggest resemblance to *Viviparus praerosus* (Gerstfeldt) and *Viviparus chui* Yen, which were described from Amur and Kirin, respectively.

## Family HYDROBIIDAE

**Parafossarulus striatulus** (Benson), 1842

*Paludina* (*Bithynia*) *striatula* BENSON, Ann. Mag. Nat. Hist., (1) 9: 488, 1842.

Collecting stations: Siwoo near Yuyao, Baniwoo, Lanchi, and Chiangshan.

This is a very common species occurring throughout the country. The sculpture varies and may be obscure or prominent; however, no smooth form has been recorded. The shell is unicolored but in some cases with a thin, yellowish-brown periostracum. The young form is more conical in outline.

**Parafossarulus longicornis** (Benson), 1842

*Paludina* (*Bithynia*) *longicornis* BENSON, Ann. Mag. Nat. Hist., (1) 9: 488, 1842.

Collecting stations: San-chiang and Lanchi.

This species is often collected together with the preceding one; however, it is less common. It differs from *P. striatulus* by having a much shorter spire, finer sculpture, and ovately globose outline. It is more commonly recorded from the Yangtze Valley and along the canal zone.

**Bithynia misella** Gredler, 1884

*Bythinia misella* GREDLER, Arch. Naturgesch., 50: 276, Taf. 19, fig. 8, 1884.

Collecting stations: Yuyao, Tunglu, Lanchi, and Chiangshan.

The shell is conically ovate in outline, rather thin and translucent. The sculpture consists of fine spiral and growth striae, and the shell is rather variable in size. The whorls of the spire are occasionally marked by lip-margin lines which indicate various periods of resting. A few specimens are larger than the typical form, described from south Hunan Province; one measures 7.0 mm. in altitude and 4.0 mm. in width.

**Katayama fausti** Bartsch, 1925

*Katayama fausti* BARTSCH, Jour. Washington Acad. Sci., 15: 72, 1925.

Collecting station: Lanchi, Chekiang Province.

The single specimen measures 7.0 mm. in altitude, 3.0 mm. in width, and has  $5\frac{1}{3}$  whorls. It was described from Shaohing, Chekiang Province.

**Blandfordia** species undetermined

Collecting station: Lanchi, Chekiang Province.

The single specimen has its apical whorl injured. It measures 6.4 mm. in altitude, 3.0 mm. in width, with  $6\frac{1}{3}$  whorls. It resembles *B. formosana* Pilsbry and Hirase (Proc. Acad. Sci. Philadelphia, 57: 750, 1906), but it appears to be more slender in outline.



**Stenothyra divalis** (Gould), 1859

*Bithynia divalis* GOULD, Proc. Boston Soc. Nat. Hist., 7: 41, 1859.

Collecting stations: Sanchiang, Chekiang Province; Haimen, Kiangsu Province.

This species was originally described from Canton, but it has been subsequently recorded from the Yangtze Valley.

**Stenothyra toucheana** Heude, 1890

*Stenothyra toucheana* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1890, p. 173, pl. 33, figs. 13, 13a, 13b.

Collecting station: Haimen, Kiangsu Province.

This species differs from the preceding essentially by its smaller size, and in that the spiral lines of punctations are more closely arranged.

**Stenothyra decapitata** Annandale, 1918

*Stenothyra decapitata* ANNANDALE, Mem. Asiatic Soc. Bengal, (5) 6: 308, pl. 10, fig. 1, 1918.

Collecting station: Bamowoo, Chekiang Province.

This species is larger in size than either of the above two species, and its apical whorls are almost always eroded.

## Family ASSIMINEIDAE

**Assiminea latericea** H. and A. Adams, 1863

*Assiminea latericea* H. and A. ADAMS, Proc. Zool. Soc. Lond., 1863, p. 434.

Collecting station: Haimen, Kiangsu Province.

This is one of the common species occurring on the coast of China. *Assiminea fluminea* and *A. haematina*, described by Heude from farther interior from the coast, are generally recognized as only forms of this species. The specimens contained in this collection agree well with *A. fluminea* except that they are somewhat smaller in size.

**Assiminea violacea** Heude, 1882

*Assiminea violacea* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 82, pl. 21, figs. 4, 4a, 4b, 4c.

Collecting stations: San-chiang, Chekiang Province; Haimen, Kiangsu Province.

This species was described from the mouth of the Yangtze River. The shell is imperforate, rather solid, elongately conical in outline, usually bearing a sutural band of lighter coloration, and obtusely angulated at the periphery.

The present specimens here are slightly smaller than the typical form, the largest of which measures 6.6 mm. in altitude, 3.7 mm. in width, with 7 whorls.

**Assiminea schmackeri** Boettger, 1887

Plate 1, figure 2

*Assiminea schmackeri* BOETTGER, Jahrb. Deutsch. Malakol. Ges., 14: 201, Taf. 6, fig. 9, 1887.

Collecting station: Haimen, Kiangsu Province.

This species was originally described from Lantao near Hong Kong, but the specimens here are identical with this interesting species, which seems to have a different outline from other Chinese forms of *Assiminea* so far recorded.

The shell is subglobose in outline, rather solid, perforate, but partly covered by the columellar margin. It seems that Boettger's description was based on an immature specimen measuring  $1\frac{7}{8}$  mm. in altitude,  $2\frac{1}{8}$  mm. in width, with  $3\frac{1}{2}$  whorls, while a large specimen in the present collection is 3.0 mm. in altitude, 2.9 mm. in width, with 6 whorls; another 2.0 mm. in altitude, 2.1 mm. in width, with 4 whorls.

## Family THIARIDAE

**Melanoides gredleri** (Boettger), 1887

*Melania tumida* GREDLER, Arch. Naturgesch., 50: 277, Taf. 19, fig. 9, 1884. (Not *Melania tumida* PHILLIPS, 1836).

*Melania (Melanoides) gredleri* BOETTGER, Jahrb. Deutsch. Malakol. Ges., 14: 108, 1887.

Collecting station: Shunan, Chekiang Province.

This species seems to be closely related to *M. ningpoensis* Lea (= *M. cancellata* Benson, 1842), but it differs by having stronger and fewer riblets which are not cancellated by any spiral lines. The species was originally described from South Hunan.

**Melanoides ningpoensis** (Lea), 1856

*Melania cancellata* BENSON, Ann. Mag. Nat. Hist., London, 9: 488, 1842. Not *Melania cancellata* SAY, 1829.

*Melania ningpoensis* LEA, Proc. Acad. Nat. Sci. Philadelphia, 8: 144, 1856.

Collecting station: Bamowoo, Chekiang Province.

This is a common species recorded from different parts of the country. It is characterized by its narrowly oblong outline, convex whorls bearing close riblets, and fine but distinct spiral lines. The base is sulcated with a few rather strong spirals.

**Semisulcospira libertina jacquetiana** (Heude), 1890

*Melania jacquetiana* HEUDE, Mem. Hist. Nat. Chinois, 1890, p. 163, pl. 41, figs. 7-9; pl. 43, fig. 5.

Collecting station: Shunan, Chekiang Province.

These specimens have the early whorls decollated, its sculpture more obscure and of smaller size than the typical form, which was described from

Ningkuofu, Anhwei Province. However, these features, as already pointed out by Annandale, are considered to be rather variable. He has examined a large series of specimens collected from Hangchow.

***Semisulcospira libertina davidi* (Brot), 1874**

*Melania davidi* BROT, Martini-Chemnitz Conchyl.-Cab., 1 (Abt. 24. *Melania* and *Melanopsis*): 62, Taf. 7, fig. 3, 1874.

Collecting station: Shunan, Chekiang Province.

This form occurs in mountain-stream habitats and was originally described from Lushan, Kiangsi Province. After examining the type specimens of *S. libertina* (Gould) and this series of specimens which agree well with *S. davidi* (Brot), I am convinced that *davidi* may be only a subspecies of *libertina*. It is smaller and bears three distinct color bands on the body whorl which are sometimes traceable in the aperture, while *libertina*, also recorded from the Lower Yangtze Valley, is much larger and is usually unicolored.

***Semisulcospira theaeopotes* (Heude), 1888**

*Melania theaeopotes* HEUDE, Journ. Conchyl., 36: 307, 1888; Mem. Hist. Nat. Emp. Chinois, 1890, p. 163, pl. 41, fig. 10.

Collecting station: Chihlilung near Puchiang, Chekiang Province.

This species was originally described from the tea district in Hweichow, Anhwei Province. It is conically turreted in outline, with an acute spire and ventricose body whorl. It differs from *S. libertina* by its obscure sculpture and conical outline.

The specimens in the present collection are somewhat smaller than the typical form; the largest one measures 23.5 mm. in altitude and 10.5 mm. in width.

***Semisulcospira joretiana* (Heude), 1890**

*Melania joretiana* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1890, p. 166, pl. 41, fig. 20.

Collecting station: Lanchi.

This species was originally described from Hoshan of Anhwei, and seems to be related to the preceding species.

***Semisulcospira praenotata* (Gredler), 1884**

*Melania praenotata* GREDLER, Arch. Naturgesch., 50: 278, Taf. 19, fig. 10, 1884.

Collecting station: Tunglu, Chekiang Province.

The single specimen in this collection agrees well with this species, which was described from South Hunan Province, except that it is somewhat smaller in size. It measures 17.0 mm. in altitude, 6.5 mm. in width, with 10 whorls. It is narrowly turreted in outline, bearing fine sculpture on the scarcely convex whorls representing what Gredler described as "suturam inferiorem convexiusculi, supra plane."

**Semisulcospira dolium** (Heude), 1890

*Melania dolium* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1890, p. 166, pl. 41, figs. 24, 24a 25; pl. 43, fig. 6.

Collecting station: Fengshiu, Chekiang Province.

These specimens agree with Heude's Figure 25, except for being of much smaller size. The largest one measures 14.0 mm. in altitude and 12.0 mm. in width. Among the 30 examples, there is only one bearing strong, spiral sculpture and unicolored, while the others bear only faint and fine spiral and growth lines, and most of them are marked with three color bands.

It seems that the sculpture is rather variable in this species, as Heude has figured both the strongly and obscurely sculptured forms. However, he mentioned nothing of the color bands.

**Semisulcospira pacificans** (Heude), 1888

*Melania pacificans* HEUDE, Journ. Conchyl., 36: 305, 1888; Mem. Hist. Nat. Emp. Chinois, 1890, p. 164, pl. 41, figs. 22, 22a.

Collecting station: Fengshiu, Chekiang Province.

This species was originally described from Anhwei Province, and was recorded by Schmacker and Boettger from Dalanshan of Snowy Valley near Ningpo. It is ovately conical in outline, thick, having a small and low spire and inflated body whorl. The sculpture is rather obscure, with spiral lines faintly traceable. In this collection the specimens bear three color bands which are in some cases only traceable in the aperture. These color bands were mentioned in the record noted by Schmacker and Boettger, but not mentioned in the original description for the species by Heude. The largest one measures 18.4 mm. in altitude and 12.0 mm. in width.

## Family ELLOBIIDAE

**Carychium minusculum** Gredler, 1887

*Carychium minusculum* GREDLER, Jahrb. Deutsch. Malakol. Ges., 14: 362, 1887.

Collecting stations: Mokanshan, Fuyang, Tunghu, and Fengshiu.

This species was described from Hupei Province and recently recorded from Pungshan of Western Szechwan. It has not been reported hitherto from the Lower Yangtze Valley.

## Family LYMNAEIDAE

**Radix plicatulus** (Benson), 1842

*Lymnaca plicatula* BENSON, Ann. Mag. Nat. Hist., (1) 9: 487, 1842.

Collecting stations: Hsiaoshan, Yuyao, Sanchiang, Bamowoo, Shunan, Lanchi, and Chiangshan.

This is a very common species occurring throughout the country. It varies

considerably in outline as well as in size. The typical form is elongately ovate but it is not uncommon that some specimens have quite inflated body whorls.

**Galba ollula** (Gould), 1859

*Limnaea ollula* GOULD, Proc. Boston Soc. Nat. Hist., 7: 40, 1859.

*Galba ollula* GOULD, Yen, Proc. Calif. Acad. Sci., (4) 23 (38): 580, pl. 51, figs. 42, 50, 1944.

Collecting station: Lanchi, Chekiang Province.

After examining the type specimen of this species, I became convinced that it agrees well with those specimens hitherto identified as *L. parvia* von Martens and *L. andersoniana* Nevill, which are to be replaced with the earlier name *Galba ollula* (Gould).

This is another common species which occurs in fresh-water bodies throughout the country.

Family PLANORBIDAE

**Gyraulus saigonensis** (Crosse and Fischer), 1863

*Planorbis saigonensis* CROSSE and FISCHER, Journ. Conchyl., 11: 362, pl. 13, fig. 7, 1863.

*Planorbis compressus* HUTTON, 1834. Not *Planorbis compressus* MICHAUD, 1831.

Collecting stations: Hangchow, Yuyao, Sanchiang, Tunghu, Feng-shiu, Shunan, Lanchi, and Chiangshan, Chekiang Province; Haimen, Kiangsu Province.

This species is characterized by its very rapidly increasing whorls, having its apical whorls sunken and the body whorl much dilated. It resembles *G. albus* (Mueller) but it differs by its larger size and by having more whorls.

**Gyraulus zilchianus** Yen, 1939

*Gyraulus zilchianus* YEN, Abhandl. Senck. Naturforsch. Ges., No. 444, p. 68, Taf. 6, fig. 2, 1939.

Collecting stations: Yuyao and Chiangshan, Chekiang Province.

This species is readily recognized by the high altitude of the shell, strong peripheral keel, and dilated body whorl. It is not uncommonly found around the Tai-hu region, and more frequently found near the bank of the Great Canal. The specimens from Yuyao are mostly young and not well preserved.

**Gyraulus membranaceus** (Gredler), 1884

*Planorbis membranaceus* GREDLER, Jahrb. Deutsch. Malakol. Ges., 11: 153, 1884.

Collecting station: Haimen, Kiangsu Province.

This species is much smaller than *G. saigonensis*. Its periphery is very obtusely angulated, the last whorl is not so rapidly dilated, and the peristome is calloused within, which makes the lip-margin appear to be reflected.

This species was described from Hunan, and the type was given as 4.5-



4.75 mm. in width, 1.0 mm. in altitude, with 2-3½ whorls, while the largest specimen in the present lot measures only 4.0 mm. in width, 1.0 mm. in altitude, with 4 whorls.

**Hippeutis distinctus** (Gredler), 1887

*Planorbis (Hippeutis) distinctus* GREDLER, Malakol. Blätt., N.F., 9: 15, 1887.

Collecting stations: Yuyao, Lanchi, Foulanchi, and Chiangshan.

It differs from the closely related species *H. umbilicalis* (Benson), also commonly found in China, by its smaller size, more lens-shaped outline, and in having a less shallow umbilicus.

**Polypylis hemisphaerula** (Benson), 1842

*Planorbis hemisphaerula* BENSON, Ann. Mag. Nat. Hist., (1) 9: 487, 1842.

Collecting stations: Yuyao, Tunglu, Fengshiu, Lanchi, and Foulanchi.

This species was described from Chowshan Island, and the type was given as 0.25 poll. in diameter. Most of the specimens in the present collection are somewhat smaller than the type; one of them measures 6.0 mm. in width, 2.7 mm. in altitude, with 5½ whorls.

Its relationship to the following species as well as to *P. succineus* (Gredler), described from Hunan Province, is not yet clear. They resemble each other in general outline, but differ considerably in size.

**Polypylis largillierti** (Dunker), 1867

*Planorbis largillierti* DUNKER, in von Martens, Malakozool. Blätt., 14: 217, 1867.

Collecting station: Sanchiang, Chekiang Province.

This species was originally described from Hong Kong and at the same time recorded from Amoy. The type was given as 3.5 mm. in altitude, 8.5 mm. in width (diameter), with 5 to 6 whorls. The single specimen in the present collection measures 4.0 mm. in altitude, 8.0 mm. in width, with 5½ very rapidly increasing whorls.

It differs essentially from the preceding species by its larger size with almost similar number of whorls, and having a more concave base.

Family SUCCINEIDAE

**Succinea erythrophana** Ancey, 1883

*Succinea erythrophana* ANCEY, Il Naturalista Siciliano, 1883, p. 270.

*Succinea rubella* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1890, p. 80, pl. 18, fig. 29 (non Pease).

Collecting stations: Sanchiang, Chekiang Province; Haimen, Kiangsu Province.

This species was described from Shanghai, but has been since recorded from different parts of the Yangtze Valley. The type was given as 9.5 mm.

in altitude, 5.0 mm. in width, with 3 whorls. One of the specimens from Sanchiang measures 7.0 mm. in altitude, 4.0 mm. in width, with 3 whorls.

#### Family PUPILLIDAE

##### **Gastrocopta armigerellum** (Reinhardt), 1877

*Pupa* (*Leucochila*) *armigerella* REINHARDT, Sitzungsber. Ges. Naturforsch. Freunde, Berlin, 1877, p. 96.

Collecting stations: Sanchiang and Fengshiu, Chekiang Province; Shanghai, Kiangsu Province.

This species is common along the Yangtze Valley, with its infraparietal tooth being, in some cases, much reduced or even totally absent. One of the examples from Shanghai measures 2.3 mm. in altitude, 1.3 mm. in width, with  $5\frac{1}{2}$  whorls.

##### **Boysidia hunana** (Gredler), 1881

*Pupa hunana* GREDLER, Jahrb. Deutsch. Malakol. Ges., 8: 23, Taf. 1, fig. 5, 1881.

Collecting stations: Wongkiang, Fengshiu, Lanchi, and Chiangshan.

These specimens agree well with this species which was originally described from Hunan Province and subsequently recorded from various parts of the Yangtze Valley. A few shells from Chiangshan show the tendency of the aperture to be almost free from the penultimate whorl and some of them show that it barely touches the preceding whorl.

##### **Boysidia hangchowensis** (Pilsbry and Hirase), 1908

*Hypselostoma* (*Boysidia*) *hangchowensis* PILSBRY and HIRASE, Proc. Acad. Nat. Sci. Philadelphia, 60: 42, fig. 6, 1908.

Collecting station: Hangchow, Chekiang Province.

This differs from the preceding species by its much smaller size and bearing only two palatal plicae.

#### Family VALLONIIDAE

##### **Vallonia pulchellula** (Heude), 1882

*Helix pulchellula* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 20, pl. 13, fig. 17.

Collecting stations. Fengshu and Lanchi, Chekiang Province; Shanghai and Haimen, Kiangsu Province.

This is one of the common species occurring along the Yangtze Valley and also in the northwestern part of China. It was originally described from Shanghai, and at the same time recorded from Ningkuofu of Anhwei Province. Heude's figure was not well done. The sparse and delicate rib lines on the specimens are much more distinctly shown in contrast with the growth striae.

## Family ENIDAE

**Mirus cantorii** (Philippi), 1844

*Bulimus cantorii* PHILIPPI, Zeitschr. Malakol., 1: 165, 1844.

Collecting stations: Hangchow, Fengshiu, Chayuanchen, and Wongkiang.

This species was originally described from "Goldinsel bei Nanking" with specimens collected by Largilliert. The locality apparently means Chin-shan of Chenkiang, about 60 miles eastward from Nanking. Chin-shan was formerly an island situated in the Yangtze River and is now almost connected with the mainland at the south side of the river.

This is a common form occurring in the Lower Yangtze Valley. In the present collection, the specimens agree well with the typical form except that some of them from Chayuanchen are of much smaller size and yet not so cylindrical as to agree with *pallens* Heude, a varietal form of this species.

**Mirus cantorii obesus** (Heude), 1882

*Buliminus obesus* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 51, pl. 17, fig. 7.

Collecting stations: Tunglu, Fengshiu, Yenchow, Lanchi, and Chiangshan.

It differs from the *forma typica* by its much lower altitude and greater diameter. It was originally described from Nanking, and has been recorded around the Tai-hu region. The present series contains specimens approaching the typical form, one of them measuring 17.0 mm. in altitude and 6.0 mm. in width, but a few of them measured 20.0 mm. in altitude and 7.0 mm. in width.

**Mirus minutus** (Heude), 1882

*Buliminus minutus* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 49, pl. 17, fig. 15.

Collecting stations: Tunglu and Chiangshan, Chekiang Province.

This species was originally described from Shanghai, and also "in insulis Magni Laci" which apparently means west Tung-ting-shan of Tai-hu, about 45 miles away from Shanghai. It is characterized by its small size and convex whorls. The typical form is 10.0 mm. in altitude, 4.0 mm. in width with 6-7 whorls, while the examples in this collection range from 10.5 mm. to 13.0 mm. in altitude and 4.2 mm. to 4.8 mm. in width, with 8 whorls.

## Family CLAUSILLIDAE

**Hemiphaedusa cecillii** (Philippi), 1847

*Clausilia cecillii* PHILIPPI, Zeitsch. f. Malakol., 4: 68, 1847.

Collecting stations: Mokanshan, Tunglu, Lutzepe, Fengshiu, and Lanchi.

The original locality was given by Philippi as China, based on specimens collected by Largilliert. Judging by the subsequently repeated records, the

type was probably collected from somewhere in Chekiang Province, where numerous specimens of this species have been found.

**Hemiphaedusa frankei** (Boettger and Schmacker), 1894

*Clausilia (Hemiphaedusa) frankei* BOETTGER and SCHMACKER, Proc. Malacol. Soc. London, 1: 115, pl. 9, fig. 3, 1894.

Collecting station: Wongkiang, Chekiang Province.

The single specimen in the present collection seems to agree well with this species which was originally described from Kiangsi Province. Boettger and Schmacker have already pointed out that it is closely related to the preceding species, differing only by its slender form and smaller aperture.

**Hemiphaedusa möllendorffiana** (Heude), 1882

*Clausilia möllendorffiana* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 60, pl. 17, figs. 31, 31a, 31b.

Collecting stations: Tunglu and Chayuanchen, Chekiang Province.

This species was originally described from Ningkuofu and Kwangtehchow, Anhwei Province. The specimens here are typical, but a few specimens more ventricose in outline and shorter in altitude may belong to the varietal form, *edentula* Boettger and Schmacker 1894.

**Euphaedusa heudeana** (Moellendorff), 1882

*Clausilia heudeana* MOELLENDORFF, Jahrb. Deutsch. Malakol. Ges., 9: 202, 1882.

*Clausilia pachystoma* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 61, pl. 18, fig. 1. Not *Clausilia pachystoma* KUESTER, 1848.

Collecting stations: Tunglu, Lutzepu, Fengshiu, Lanchi, Chekiang Province; Haimen, Kiangsu Province.

This small species is easily recognized by its obtuse apical whorls and small aperture. It was described from the Tai-hu region and commonly found in the Lower Yangtze Valley. *Clausilia obliterated* Hsu, which was described in a subfossil state from Hsia-shu, Kiangsu Province, belongs to this common species. The species described by Hsu was founded upon juvenile specimens of *Euphaedusa heudeana*.

**Euphaedusa aculus** (Benson), 1842

*Clausilia aculus* BENSON, Ann. Mag. Nat. Hist., (1) 9: 487, 1842.

Collecting stations: Wongkiang, Tunglu, Fengshiu, Chayuanchen, Chih-liling near Puchiang, and Chiangshan.

This species was described from Chowshan Island and it is very commonly found along the Yangtze Valley. The shell is rather variable in size, and varietal names such as *shanghaiensis* Pfeiffer, *moellendorffi* Martens, *insularis* Heude, *vinacea* Heude, *fulvella* Heude, *labio* Gredler, etc., have been adopted for different local forms of this species.

## Family SUBULINIDAE

**Opeas gracile** (Hutton), 1834

*Bulimus gracilis* HUTTON, Jour. Asiatic Soc. Bengal, 3: 93, 1834.

Collecting stations: Hangchow, Mokanshan, Fuyang, Sanchiang, Tunghu, and Fengshiu, Chekiang Province; Shanghai and Haimen, Kiangsu Province.

This species was originally described from India and has a wide range in the Indo-Pacific Province. The Chinese specimens approach very nearly the typical form which has a narrowly elongated outline with an obtuse apex, distinct sculpture, crenulations near the suture, and a reflexed columellar margin.

**Opeas filare** (Heude), 1882

*Stenogyra filaris* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 56, pl. 17, fig. 27.

Collecting stations: Sanchiang, Chayuanchen, Lanchi, Wongkiang, Chekiang Province; Haimen, Kiangsu Province.

This species was described from Ningkuofu. It is characterized by its narrow, slender outline and strong sculpture. It differs from the preceding species only by its more slender outline.

**Opeas turgidulum** (Heude), 1882

*Stenogyra turgidula* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 59, pl. 17, fig. 19.

Collecting stations: Hangchow, Mokanshan, Yuyao, Tunghu, Lutzepu, Fengshiu, and Chayuanchen.

This species was described from Sung-kiang, Kiangsu Province. The shell has a swollen outline and bears fine sculpture. This is one of the forms which may belong to *Opeas clavulinum* (Potiez and Michaud).

**Tortaxis erectus** (Benson), 1842

*Achatina erecta* BENSON, Ann. Mag. Nat. Hist., (1) 9: 487, 1842.

Collecting station: Tunghu, Chekiang Province.

This species was described from Chowshan Island. There are 2 specimens in the collection from Tunghu. It is cylindrically turreted with an obtuse apex and convex whorls. The adult specimen measures 2.6 mm. in altitude, 6.2 mm. in width, with  $7\frac{1}{3}$  whorls.

## Family ENDODONTIDAE

**Punctum orphana** (Heude), 1882

*Helix orphana* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 21, pl. 13, fig. 18.

Collecting stations: Tunghu, Chihlilung near Puchiang, Chekiang Province; Haimen, Kiangsu Province.

This species was described from Shanghai and occurs commonly in the Lower Yangtze Valley. Its generic position was rather uncertain. For a time



it was considered to be a species of *Pyramidula*, but Pilsbry in 1935 pointed out that it appears to be a species of *Punctum* because of the presence of microscopic spiral striae on the apical whorl.

The young forms contained in this collection consist of  $3\frac{3}{4}$  whorls, while the adult ones have 4 to  $4\frac{1}{2}$  whorls. The last whorl of an adult shell coils somewhat below the periphery of the penultimate whorl, so that its general outline appears to be more trochoid and the spire more elevated.

#### Family CORILLIDAE

##### **Plectopylis emoriens** (Gredler), 1881

*Helix emoriens* GREDLER, Jahrb. Deutsch. Malakol. Ges., 8: 15, 1881.

Collecting station: Lutzepu, Chekiang Province.

This species was described from Yung-chow, southern Hunan Province, and subsequently recorded from the Lower Yangtze Valley. It seems to be closely related to the following species, but it differs by its larger size, more angulated periphery, and in having a much weaker parietal margin.

##### **Plectopylis diptychia** (Moellendorff), 1885

*Helix diptychia* MOELLENDORFF, Jahrb. Deutsch. Malakol. Ges., 9: 390, Taf. 10, fig. 17, 1885.

Collecting stations: Fengshiu, Tunghu, and Wongkiang.

This species was described from Kweichow Province. It is characterized by its thin and subpellucid shell, bearing distant, membranous ribs in addition to the granulose sculpture. There are 5 to 6 short plicae on the outer wall and 2 approximate vertical lamellae on the inner wall of which the one on the right side is more weakly developed.

#### Family ZONITIDAE

##### **Hawaiiia minuscula** (Binney), 1840

Plate 1, figures 5, 6

*Helix minuscula* BINNEY, Jour. Boston Soc. Nat. Hist., 3: 435, pl. 22, fig. 4, 1840.

Collecting stations: Fengshiu, Shunan, Lanchi, and Chiangshan.

This species was originally described from North America, and subsequently recorded from Hawaii. In the present collection there are several lots of specimens which are hardly differentiated from *H. minuscula* so far as the shell features are available for reference.

#### Family ARIOPHANTIDAE

##### **Kaliella franciscana** (Gredler), 1881

*Hyalina (Conulus) franciscana* GREDLER, Jahrb. Deutsch. Malakol. Ges., 8: 13, 1881.

Collecting stations: Hangchow, Tunghu, Fengshiu, Shunan, Chihlilung near Puchiang, Lanchi, and Chiangshan.

This species was originally described from Hunan Province. The shell is narrowly and shallowly umbilicated, obtusely angulated in the young, but in the adult stage rounded at the periphery, having roundly convex and closely coiled whorls and bearing sculpture of very fine growth striae. The base is quite convex.

**Kaliella franciscana gredleriana** (Heude), 1882

*Hyalina gredleriana* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 19, pl. 19, figs. 11, 11a.

Collecting station: Tunglu, Chekiang Province.

This subspecies differs from the typical form by its smaller size and greater height. This form was also described from Hunan Province, and Moellendorff in 1887 included it as a synonym of *Kaliella franciscana*.

**Kaliella imbellis** (Heude), 1882

*Hyalina imbellis* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 19, pl. 13, fig. 16.

Collecting stations: Hangchow, Mokanshan, Tunglu, Lutzepu, Fengshiu, Yenchow, Launchi, and Chiangshan.

This species was described from Ningkuofu, Anhwei Province. The general outline of the shell resembles that of the preceding species, but it is somewhat larger in size and bears both distinct growth and spiral lines and is obtusely angulated at the periphery. The young forms are less conical in shape and the peripheral angulation is stronger.

**Kaliella depressa** Moellendorff, 1883

*Kaliella depressa* MOELLENDORFF, Jahrb. Deutsch. Malakol. Ges., 10: 368, Taf. 12, fig. 7, 1883.

Collecting station: Chiangshan, Chekiang Province.

This species was described from Canton. The shell has a low, conical outline and is umbilicated and obtusely angulated at the periphery. A medium-sized specimen measures 3.2 mm. in width, 2.5 mm. in altitude, with  $5\frac{1}{2}$  whorls.

**Kaliella euconus** Moellendorff, 1899

*Kaliella euconus* MOELLENDORFF, Ann. Mus. Zool. Acad. Imp. Sci., St. Petersburg, 4: 54, Taf. 2, fig. 4, 1899.

Collecting stations: Chihliling near Puchiang, Fuyang, Hangchow, Mokanshan, Chekiang.

This species was described from Ta-chien-lu, west of Szechwan Province. The shell is umbilicated, conical, elevated, with scarcely convex whorls and strongly keeled periphery. This peripheral keel of the whorls of the spire is visible along the suture. The sculpture consists of distinct growth lines above the periphery of the body whorl and fine spiral striae on the base.

**Kaliella cuneus** (Heude), 1885

*Conulus cuneus* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1885, p. 105, pl. 27, fig. 6.

Collecting station: Mokanshan, Chekiang Province.

The single specimen in the collection seems to be identical with this species, which was described from Szechwan Province. It measures 4.6 mm. in altitude, 3.8 mm. in width, with 7 whorls, and is apparently a young shell; however, it is well characterized by its conical outline, bearing strong ribs on the surface of the whorls and with fine growth striae on the base.

**Kaliella chekiangensis** Yen, new species

Plate 1, figure 10

Shell broadly conical in outline, highly elevated, umbilicated and thin. Apex prominent and obtuse, the whorls roundly convex and closely coiled. The sculpture consists of fine but distinct lines of growth and occasionally of obscure ribs on the later whorls. The body whorl is very rapidly dilated, roundly convex at the base and distinctly keeled at the periphery. The peripheral keel is visible along the suture of the whorls of the spire. The aperture is semicircular with its outer lip margin simple and thin, and parietal margin lightly calloused and well defined, but it is very thin in the young. The columellar margin is short and slightly reflected, and bears a white, but weak, plica on the axis and is somewhat obliquely twisted. This plica is traceable also in the shell of the young. Measurements: holotype, altitude 5.3 mm., width 4.0 mm., with  $7\frac{1}{2}$  whorls.

*Holotype*, No. 8247, and *paratypes* Nos. 8248, 8249, Mus. Calif. Acad. Sci. Paleo. Type Coll., from **Fengshiu, Chekiang Province, China**.

This species resembles in form *Conulus pyramis* Heude 1885 (Mem. Hist. Nat. Emp. Chinois, 1885, p. 105, pl. 27, fig. 9), which was described from Chenkou of Szechwan Province, and according to Moellendorff, 1887, is a species of *Kaliella* Blanford. But it differs from that species by its higher altitude, narrower width, and the presence of an axial plica. The generic position is considered to be uncertain. On account of the presence of the columellar fold, the species does not seem to belong to the typical *Kaliella*, and the general outline of the shell suggests its similarity with some species of *Buliminopsis* Heude. It may belong to an undescribed group, but any definite generic assignment might best be deferred until more morphological information is at hand.

**Microcystina zikaveiensis** (Heude), 1882

*Hyalina zikaveiensis* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 16, pl. 13, fig. 9.

Collecting stations: Fuyang, Fengshiu, Tunglu, Lutzepu, and Yenchow.

The shell is minute in size, having a depressed spire, and bearing sculpture of fine striae. It was described from a suburban district of Shanghai. The

specimens from Tunglu are typical, while the two specimens from Lutzepu are somewhat larger in diameter with one-fourth of a whorl more.

**Macrochlamys microgyra** (Heude), 1882

*Nanina microgyra* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 13, pl. 13, fig. 10.

Collecting stations: Fengshiu, Wongkiang, and Lanchi.

This species is characterized by its low conical outline, closely coiled whorls, and keeled periphery. The specimens in the present collection are typical, except that they are somewhat larger in size. Measurements: altitude 3.8 mm., width 5.2 mm., with 7 whorls; altitude 4.0 mm., width 6.0 mm., with  $7\frac{1}{2}$  whorls.

**Euplecta rathouisii** (Heude), 1882

*Hyalina rathouisii* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 14, pl. 20, figs. 31, 31a.

Collecting station: Hangchow, Chekiang Province.

This is a common species existing in the Lower Yangtze Valley, although the present collection contains only a single lot of four specimens. These are slightly larger in size than the typical form, one of them measuring 4.0 mm. in altitude, 7.0 mm. in width, with  $7\frac{1}{4}$  whorls.

**Sitala turrita** Moellendorff, 1883

Plate 1, figure 7

*Sitala turrita* MOELLENDORFF, Jahrb. Deutsch. Malakol. Ges., 10: 371, Taf. 12, fig. 3, 1883.

Collecting stations: Mokanshan, Tunglu, and Shunan, Chekiang Province.

The figured specimen is from Tunglu. This species was described from Kwangtung Province, with which a few specimens here agree well. It is of minute size, conically turreted and bearing characteristic spiral sculpture. The largest specimen measures 2.8 mm. in altitude, 2.0 mm. in width, with  $6\frac{1}{2}$  whorls, which approaches nearly to that of the type.

**Helicarion sinense** Heude, 1882

*Helicarion sinense* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 11, pl. 13, fig. 4.

Collecting stations: Mokanshan, Tunglu, Yenchow, and Lanchi, Chekiang Province.

This is a common species occurring along the Yangtze Valley. In the present collection, there is only a series of young specimens, the largest of which measures 11.8 mm. in width, 7.0 mm. in altitude, with 5 whorls, while the smaller one measures only 5.0 mm. in width, 3.0 mm. in altitude, with 3 whorls. The measurements of the type were given as 16.5 mm. in width, 10.0 mm. in altitude, with  $5\frac{1}{2}$  whorls. The last whorl increases very rapidly in size, so that a difference of one-half of a whorl causes considerable change in the size and outline of the shell.

## Family PLEURIDONTIDAE

**Ganesella brevibarbis** (Pfeiffer), 1859

*Helix brevibarbis* PFEIFFER, Proc. Zool. Soc. London, 1859, p. 25, pl. 43, fig. 4.

Collecting stations: Fengshiu and Wongkiang, Chekiang Province.

This species is characterized by its trochoid outline with scarcely convex whorls, bearing a color band and spiral rows of hairs along the periphery of the body whorl. The umbilicus is narrowly open and slightly covered by the columellar margin. One of the adult examples measures 11.0 mm. in altitude, 13.2 mm. in width, with  $7\frac{1}{4}$  whorls.

## Family BRADYBAENIDAE

**Bradybaena similaris** (Férussac), 1821

*Helix similaris* FÉRUSSAC, Tableaux systématiques des Animaux Mollusques . . . . , 1821, p. 47.

Collecting stations: Tunglu, Yenchow, Lanchi, and Chiangshan.

This is one of the common species existing throughout the country. It includes unicolored and banded forms. The color band, whenever present, is normally along the periphery of the body whorl. The whorls are angulated at the periphery in the young and almost rounded in the adult.

**Bradybaena ravida** (Benson), 1842

*Helix ravida* BENSON, Ann. Mag. Nat. Hist., (1)9: 486, 1842.

Collecting stations: Fuyang, Hsiaoshan, Mokanshan, Tunglu, Lutzepeu, Yenchow, and Chiangshan.

The specimens from Tunglu are typical and identical with this species; others are of younger stages, so that they appear to be much smaller in size and different in outline. However, it has been noticed that the size of the shell of this species varies considerably, and its last whorl is rapidly dilated, so that the differences of size of one-half of a whorl causes much change in the general outline of the shell.

**Bradybaena fortunei** (Pfeiffer), 1850

*Helix fortunei* PFEIFFER, Zeitsch. f. Malakol., 7: 73, 1850.

Collecting stations: Mokanshan, Tunglutze, Lutzepeu, and Fengshiu.

This species was described from "Shang Hi, Chinae" [Shanghai], based on the material collected by Fortune Magazine. It is a common species of the Yangtze Valley. Its present known range is from Chekiang and Kiangsu provinces in the east to Hunan Province in the southwest. It is usually sinistral, may be either unicolored or single banded, and is sculptured by distinct, fine growth and spiral lines.



**Bradybaena uncopila** (Heude), 1882

*Helix uncopila* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 41, pl. 16, fig. 6.

Collecting station: Mokanshan, Chekiang Province.

This species differs essentially from the preceding one by its more globose outline and its granulose sculpture and hairy surface.

**Bradybaena laeva** (Pilsbry and Hirase), 1908

*Eulota laeva* PILSBRY and HIRASE, Proc. Acad. Nat. Sci. Philadelphia, 60: 39, fig. 3, 1908.

Collecting stations: Tunglu and Lutzepu, Chekiang Province.

This species was described from Hangchow and seems to be closely related to the preceding species, differing only by its smaller size, higher altitude, and narrower umbilicus. One of the specimens in this collection measures 13.5 mm. in altitude, 17.0 mm. in width, and has  $5\frac{1}{4}$  whorls, being slightly larger than the typical form.

**Aegista chinensis** (Philippi), 1845

*Helix chinensis* PHILIPPI, Abbild. Besch. Conchyl., (1) 1: 1, *Helix*, Tab. 6, fig. 1.

Collecting stations: Mokanshan, Fengshiu, and Tunglutze.

One of the two larger specimens from Mokanshan agrees well with Philippi's original figure, while the other specimen is larger and with thin lip margin.

**Plectotropis sedentaria** (Heude), 1885

*Helix sedentaria* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1885, p. 109, pl. 28, figs. 9, 9a.

Collecting station: Chiangshan, Chekiang Province.

This species was described from Kweichowfu of Upper Yangtze Valley. It differs essentially from *P. trichotropis* (Pfeiffer) by its smaller size.

**Plectotropis barbosella** (Heude), 1882

*Helix barbosella* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 38, pl. 16, figs. 3, 3a.

Collecting stations: Mokanshan, Fuyang, Wongkiang, Tunglu, Tunglutze, Yenchow, Chihlilung near Puchiang, and Langchi.

This species was described from the Shanghai and Tai-hu region. The specimens in the present collection appear to be typical, but most of them are slightly smaller than the type. A large specimen measures 8.0 mm. in altitude, 11.0 mm. in width, with 6 whorls.

**Euhadra orientalis moreletiana** (Heude), 1882

*Helix moreletiana* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 38, pl. 16, fig. 1.

Collecting station: Mokanshan, Chekiang Province.

This subspecies was described from Kwangtehchow, Anhwei Province, in the near neighborhood of Mokanshan. It is not uncommonly found in the Lower Yangtze as well as in the southern part of the country.

It agrees well with its *forma typica*, described from Borneo, differing only by its wider umbilicus.

## Family STREPTAXIDAE

**Ennea strophiodes** (Gredler), 1881

*Pupa strophiodes* GREDLER, Jahrb. Deutsch. Malakol. Ges., **8**: 118, Taf. 6, fig. 4, 1881.

Collecting stations: Tunglu, Yenchow, Chayuanchen, Shunan, Chihlilung near Puchiang, and Chiangshan.

These specimens are slightly larger than the typical form, which was described from Hunan Province, but they agree well in other features with the species. Measurements: altitude 4.5 mm., width 2.5 mm., with  $7\frac{1}{3}$  whorls; altitude 5.0 mm., width 2.6 mm., with  $7\frac{1}{2}$  whorls.

**Ennea dolium** Heude, 1885

*Ennea doliolum* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1885, p. 116, pl. 30, fig. 15. (non Morelet).

*Ennea dolium* HEUDE, Journ. Conchyl., **33**: 43, 1885.

Collecting station: Lanchi, Chekiang Province.

This species differs from the preceding one by its smaller size, finer sculpture, and more cylindric outline. It was described from Chen-kou of Szechwan Province. Measurements: altitude 3.2 mm., width 2.0 mm., with  $6\frac{1}{4}$  whorls; altitude 3.0 mm., width 2.0 mm., with 6 whorls.

**Ennea larvula** (Heude), 1882

*Pupa larvula* HEUDE, Mem. Hist. Nat. Emp. Chinois, 1882, p. 75, pl. 18, fig. 23.

Collecting station: Chiangshan, Chekiang Province.

This species differs from the preceding one by its smaller size and in possessing almost one more whorl. It measures 3.1 mm. in altitude, 1.8 mm. in width, with 7 whorls.

**Ennea microstoma** (Moellendorff), 1881

*Pupa microstoma* MOELLENDORFF, Jahrb. Deutsch. Malakol. Ges., **8**: 311; **10**: 278, Taf. 10, fig. 10.

Collecting station: Lutzepeu, Chekiang Province.

This species was described from Kwangtung Province. It is openly umbilicated, bearing rather distant ribs and with the body whorl compressed. The aperture is small, descending in front, having its peristome continuous and bearing one well-developed parietal and one columellar lamella, and one bilobed palatal plica. The columellar lamella is deeply inserted. It measures 2.9 mm. in altitude, 1.6 mm. in width, with 6 whorls.

## Family MYTILIDAE

**Modiolus lacustris** von Martens, 1875

*Modiola lacustris* VON MARTENS, Sitzungsber. Gesell. Naturforsch. Freunde, Berlin, 1875, p. 3; Malakol. Blätt., **22**: 186, 1875.

*Modiolus (Limnoperna) lacustris* VON MARTENS, Lamy, Journ. Conchyl., (4) **80**: 361, 1937.

Collecting station: Fuyang, Chekiang Province.

This species was described from Tung-ting-hu, Hunan Province, and was based on specimens collected by Baron von Richthofen. It has been recorded subsequently from various parts of the Yangtze Valley. The specimens contained in the present collection are much smaller in size than the typical form.

#### Family UNIONIDAE

##### *Anodonta arcaeformis* (Heude), 1877

*Anodon arcaeformis* HEUDE, Conchyl. Fluv. Prov. Nanking, Fasc. 3, 1877, pl. 19, fig. 40.

Collecting station: Bamowoo, Chekiang Province.

A single pair of very young valves is present in the collection. This is a common species, occurring in various parts of the Lower Yangtze Valley. It was described from Sung-kiang of Kiangsu, in the near neighborhood of Chekiang.

#### Family CORBICULIDAE

##### *Corbicula fluminea* (Mueller), 1774

*Tellina fluminea* MUELLER, Verm. Hist., 2: 206, 1774.

*Corbicula fluminea* MÜLLER, Prashad, Mem. Indian Mus., (Calcutta), (2) 9: 51, pl. 7, figs. 1-10, 1929.

Collecting stations: Zahkou, Shunan, Fengshiu, and Chuchow, Chekiang Province.

The specimens from the above localities bear strong and rather distant ribs, and are interiorly tinged with purple. They seem to agree well with this species, except that they are of much smaller size. The species has been recorded previously from this province as well as from other parts of the Yangtze Valley.

##### *Corbicula largillierti* (Philippi), 1846

*Cyrena largillierti* PHILIPPI, Abbild. Besch. Conchyl., (3) 2: 75, Tab. I, fig. 1, 1846.

Collecting station: Hangchow, Chekiang Province.

This species was described from Yangtzekiang. The specimens here agree well with the typical form, except in being much smaller. It differs from the preceding species by bearing much finer and closer ribs.

#### Family SPHAERIIDAE

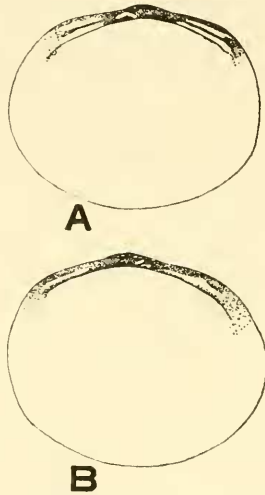
##### *Sphaerium parvium* Yen, new species

Text figure 1

Shell ovate and inflated in outline, subequilateral, small, thin, and yellowish-brown in color. The sculpture consists of concentric and close lines of

growth. Umbones small, slightly projecting, and slightly inclined anteriorly. The anterior end is semi-ovately curved, while the posterior side is subcircular in outline. The hinge is slightly curved and the ventral margin is almost rounded. The interior of the shell is pale brown and smooth. A single, small cardinal tooth in the right valve, rather compressed and slightly curved, but in the left divided, rather straight, and parallel to each other. The lateral teeth are strong, divergent, somewhat projecting, lamelliform, double in the right and single in the left. Measurements: length 6.5 mm., height 5.5 mm., convexity 3.2 mm.

*Holotype*, No. 8251, Mus. Calif. Acad. Sci. Paleo. Type Coll., from Foulanchi, Chekiang Province, China.



TEXT FIG. 1.—*Sphaerium parvium* Yen, new species. Holotype, No. 8251, Calif. Acad. Sci. Paleo. Type Coll., from Foulanchi, Chekiang Province, China. *A*, right valve, *B*, left valve. Length, 6.5 mm.; height, 5.5 mm.

This genus has been recorded previously by Moellendorff in 1902 from Kansu Province and Ordos district, by Annandale in 1918 from Tai-hu, and by Prashad in 1924 from Shang-kuan, on the northwestern shore of Tali Lake in Yunnan Province, but none of the specimens was specifically identified. The two examples that Annandale obtained from the island of West Tung-ting in Tai-hu may probably also belong to this species, but his brief statement mentions nothing of the shell features.

The present lot contains a single pair of valves with three pairs of embryonic valves inside.

This species seems to resemble *Sphaerium inutilis* Pilsbry 1901 (Proc. Acad. Nat. Sci. Philadelphia, 53: 406, 1901) but it differs by its smaller size, less curved hinge-line, lower beak, and stronger sculpture.

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## EXPLANATION OF PLATE 1

FIG. 1.—*Pseudopalania dautzenbergiana* Yen, new species. Holotype, No. 8244, Mus. Calif. Acad. Sci. Paleo. Type Coll., from Tunglu, Chekiang Province, China. Altitude, 2.1 mm.; width, 1.1 mm. P. 75.

FIG. 2.—*Assimineia schmackeri* Boettger. Hypotype, No. 8245, Mus. Calif. Acad. Sci. Paleo. Type Coll., from Haimen, Kiangsu Province, China. Altitude, 3.0 mm.; width, 2.9 mm. P. 79.

FIG. 3.—*Cyathopoma micronicum* Yen, new species. Holotype, No. 8237, Mus. Calif. Acad. Sci. Paleo. Type Coll., from Yenchow, Chekiang Province, China. Altitude, 1.1 mm.; width, 1.8 mm. View of base. P. 73.

FIG. 4.—*Cyathopoma micronicum* Yen, new species. Same specimen as shown in Figure 3. Apertural view.

FIG. 5.—*Hawaiia minuscula* (Binney). Hypotype, No. 8246, Mus. Calif. Acad. Sci. Paleo. Type Coll., from Chiangshan, Chekiang Province, China. Altitude, approximately 1.37 mm.; width, 2.5 mm. View of base. P. 88.

FIG. 6.—*Hawaiia minuscula* (Binney). Same specimen as shown in Figure 5. Apertural view.

FIG. 7.—*Sitala turrita* Moellendorff. Hypotype, No. 8250, Mus. Calif. Acad. Sci. Paleo. Type Coll., from Tunglu, Chekiang Province, China. Altitude, 2.8 mm.; width, 2.0 mm. P. 91.

FIG. 8.—*Cyathopoma planorboides* Yen, new species. Holotype, No. 8241, Mus. Calif. Acad. Sci. Paleo. Type Coll., from Yenchow, Chekiang Province, China. Altitude, 1.2 mm.; width, 2.5 mm. View of base. P. 74.

FIG. 9.—*Cyathopoma planorboides* Yen, new species. Same specimen as shown in Figure 8. Apertural view.

FIG. 10.—*Kaliella chekiangensis* Yen, new species. Paratype, from Fengshiu, Chekiang Province, China. Altitude, 5.2 mm.; width, 4.0 mm. P. 90.

Scales of drawings are indicated by adjacent lines which equal 1 mm. magnified the same as the specimens. All drawings on this plate are by Miss Helen Winchester.

