REVISION OF THE ASIATIC SPECIES OF THE GENUS *CORBICULA*.

III.—The species of the genus *Corbicula* from China, South-Eastern Russia, Tibet, Formosa, and the Philippine Islands.

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(Plates VII, VIII.)

This paper, as the title indicates, deals with the species of the genus *Corbicula* found in China, Korea, the Ussuri Basin in south-eastern Russia, Tibet, Formosa and the Philippine Islands. This area is by no means a zoogeographical unit, but the species of the genus found in this area are closely allied, and for the sake of convenience I propose dealing with them all together.

(*a*) China including Korea and South-eastern Russia.

The Chinese species of the genus *Corbicula*, as was pointed out in my revision[1] of the Indian species, have been a stumbling block for all work on this genus. The main difficulty in this connection has been the uncertainty regarding the three species of the genus described under the generic name *Tellina* by O. F. Müller in 1774; this is dealt with in detail (*infra* pp. 53-56). Large numbers of species have also been described by other authors, for instance, Philippi, Prime, Morelet and, above all, Heude. In several cases no figures of the species have been published, while in others the published figures do not show the distinguishing characters of the species. In the absence of authentically named material for comparison and in consequence of the poor descriptions, the species of the earlier authors have been variously interpreted by the later workers. The authors in the early days of conchological work did not take into consideration the great variation exhibited by most species of the genus *Corbicula* both in regard to shape and the sculpture of the shells, and their descriptions were often based on single shells. During the process of growth from shells about 15-20 mm. long, as were named *C. fluminea* or *C. fluminalis* by Müller, to a full-grown shell, about 80-82 mm. long, as in the case of *C. woodiana* of Lea, species are liable to extraordinary changes in form, outline and sculpture. With age and as a result of living in marshy areas the shells become greatly eroded, particularly in the umbonal region, and the greatly prominent and tumid umbones of the younger shells appear depressed and almost insignificant in the adult shells. The sculpture on the older parts of the shells is never the same as on the younger parts; the regular, finely cut striae are developed irregularly on the older parts of the shells, and in most cases are so low that the shells appear almost smooth to the naked eye. All shells of the same species even from the same locality, further, do not have identically the same sculpture, nor is the thickness of the shell valves

[1] Prashad, B.—*Mem. Ind. Mus.*, IX, p. 16 (1928).

the same in specimens from the same or different localities. These differences are no doubt correlated with the surroundings in which the species live, and even though we are not fully acquainted with all the factors and their influence on the secretion and formation of the shell, it would be wrong to ignore them in a systematic revision of the species. All shells of the same species, further, are not of identically the same shape, some are distinctly trigonal, others, which are greatly elongated in an antero-posterior direction, are ovate, while the posterior region in many old shells becomes distinctly rostrate. The shells also vary in reference to their being depressed or greatly inflated. The colours of the outer periostracum and the inner nacre of the shells, which have been used for the discrimination of species, vary greatly even in different individuals of the same species, and are of no value for specific distinction. Measurements of large series of specimens from the same locality and undoubtedly belonging to one species have shown that the relative indices of the measurements of the thickness to height and length, to which Lindholm[1] attaches so much importance, are of no value whatsoever for the separation of different species. Under these circumstances and when the specific characteristics are not distinctly marked in this genus, it is a matter of no small difficulty to correctly identify the various species described by the earlier authors, and still more to lay down the limits of variation of these species ; this is particularly the case when only a few specimens of a species are available for examination. Species with very wide ranges of distribution and living in different types of habitats varying from small ponds, pools, lakes or sluggish streams to rapid running hill torrents, with varying quantities of aquatic vegetation and mud in suspension and with very different types of bottoms, differ greatly in form, texture, sculpture and colour of shells. Several of these forms, which can not even be recognised as local varieties or forms, have been described as distinct species. Thanks to the courtesy of the authorities of the various European Museums, I have had very extensive collections including the types or authentically named specimens of different species of the earlier authors for my revision. I find that most of the species are based on slightly different shells and in the large series before me connecting links between the so-called species are invariably to be found. I have not recognised any species as distinct unless I found a fair series of shells differing in well-marked characters from other allied species, as it is no use describing species which are not constant, and which can not, from descriptions and good figures, be recognised by other workers. In all cases I reproduce photographs of typical shells of each species, and have also, as far as possible, included photographs of shells of various ages.

The species of the genus *Corbicula* in China, from the large collections which I have had for study, appear to be distributed along the south-eastern part only. This area begins with Yunnan in the south-west, and includes Szechuan, Hupé, Honan, Shansi, and the Manchurian region roughly to the east of Khingan Mountains. The area of distribution also embraces Korea and the basin of the Ussuri River in the eastern part of Asiatic Russia. This area roughly corresponds to the area of distribution of the recent Viviparidae[2] as shown in the sketch-map recently published by me.

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[1] Lindholm, W.—*Compt. Rend. Acad. Sci. Russie, Leningrad* (A), pp. 29, 30 (1925), and *Ann. Mus. Zool. Acad. Sci. Urss*, XXVIII, pp. 550-554 (1927).

[2] *See* Prashad, B.—*Mem. Ind. Mus.*, VIII, p. 159 (1928).

Corbicula fluminea (Müller).

(Pl. VII, figs. 1—10).

1774. *Tellina fluminea* and *T. fluviatilis*, Müller, *Verm. terr. fluv.*, II, p. 206.

1779. *Tellina fluminea* and *T. fluviatilis*, Schröter, *Gesch. Flussconch.*, pp. 193, 195 (not figs. 2, 2*a*, on pl. iv).

1783. *Venus fluminea* and *V. fluviatilis*, Chemnitz, *Martini Conch.-Cab.*, VI, pp. 320, 321, pl. xxx, figs. 322, 323 (not fig. 321).

1786. *Venus fluminea* and *V. fluviatilis*, Schröter, *Einleit. Conch.*, III, pp. 158, 159 (German names of the species with Müller's names).

1788. *Tellina fluminea* and *T. fluviatilis*, Gmelin, *Linne's Systema Naturæ* (13th ed.), p. 3243.

1798. *Cyclas* (in part), Brugiere, *Encycloped. Méthod.*, pl. cccii, figs. 2*a*, 2*b*.

1806. *Cyclas Chinensis*, Lamarck, *Ann. Mus. Hist. Nat. Paris*, VII, pp. 420, 421.

1817. *Tellina fluminea* and *T. fluviatilis*, Dillwyn, *Descr. Cat. Rec. Shells*, I, pp. 106, 107.

1818. *Cyrena Orientalis*, *C. fuscata* (*nec* var. from Levant) and *C. fluminea*, Lamarck, *Hist. Nat. Anim. sans Vertèb.*, V, pp. 562, 563.

1827. *Cyrena fuscata a.* Lam. (*T. fluviatilis*, Müll.) and *C. fluminea*, Menke, *Synop. Method. Moll.*, p. 67.

1828. *Venus fluminea* and *V. fluviatilis*, Wood,[1] *Ind. Test.*, pl. viii, figs. 114, 115.

1830. *Cyrena fuscata* and *C. fluminea*, Menke, *Synop. Method. Moll.*, p. 111.

1830. *Cyrena cor* (in part) and *C. fluminea*, Deshayes, *Encycloped. Méthod.*, II, pp. 49, 50.

1832. *Cyrena Woodiana*, Lea, *Trans. Amer. Phil. Soc.*, V, p. 110, pl. xviii, fig. 55.

1834. *Cyrena Woodiana*, Lea, *Observ. Gen. Unio*, I, p. 222, pl. xviii, fig. 55.

1834. *Cyrena* (C.) *fuscata* (in part) and *C. fluminea*, Voigt,[2] *Das Thierreich*, III, pp. 522, 523.

1835. *Cyrena Orientalis* (*nec* var. Ex Oriente), *C. fuscata* (*nec* var. from the Levant) and *C. fluminea*, Deshayes in *Lamarck Anim. sans Vertèb.* (2nd ed.), VI, pp. 273-275.

1841. *Cyrena Orientalis*, Delessert, *Rec. Coq.*, pl. vii, figs. 8, *a-c*.

1842. *Corbicula fuscata*, Benson, *Ann. Mag. Nat. Hist.*, IX, p. 490.

1843-44. *Cyrena Orientalis*, *C. fuscata*, *C. Fluminea* and *C. Woodiana*, Hanley, *Cat. Rec. Biv. Shells*, p. 92, pl. xiii, fig. 15, pl. xiv, fig. 58.

1845. *Cyrena fluminea*, *C. fuscata* and *C. Woodiana*, Catlow & Reeve, *Conchologist's Nomenclator*, pp. 30, 31.

1847. *Cyrena orientalis*, *C. fluminea* (in part) and *C. fluviatilis* (in part), Philippi, *Abbild. Beschreib. Conch.*, II, pp. 75-77, pl. i, fig. 2.

1854. *Corbicula grandis*, Deshayes, *Proc. Zool. Soc. London*, p. 344.

1854. *Corbicula Woodiana*, *C. grandis*, *C. fluminea* (in part), *C. fluviatilis* (in part) and *C. orientalis*, Deshayes, *Cat. Conch. Brit. Mus.*, II, pp. 225-227.

1855. *Cyrena fuscata* (in part), Berge, *Conchylienbuch*, p. 52.

1855. *Corbicula fuscata*, Benson, *Journ. Asiat. Soc. Bengal*, XXIV, p. 138.

1856. *Venus fluminea* and *V. fluviatilis*, Hanley in *Wood's Index Test.*, p. 51, pl. viii, figs. 114, 115.

1857. *Corbicula fluminea*, *C. fluviatilis*, *C. grandis* and *C. Woodiana*, Adams, H. and A., *Gen. Rec. Moll.*, II, pp. 447, 448.

1860. *Corbicula fluminea*, *C. orientalis* and *C. Woodiana*, Prime, *Proc. Acad. Nat. Sci. Philadelphia*, XII, pp. 270, 272, 274.

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[1] In the list of plates at the end of the work the species are listed as *Cyrena fluminea* and *C. fuscata*.

[2] This work is a translation of Cuvier's *Le Règne Animal* with additional descriptions of species; *c. f.* Disciples' Edition of the latter work, Mollusca by Deshayes.

1861. *Corbicula Primeana*, Mörch (*non* Morelet), *Journ. Conchyliol.*, IX, p. 347.

1864. *Corbicula pexata* and *C. Chemnitziana*, Prime, *Ann. Lyc. Nat. Hist., New York*, VIII, pp. 57, 60, figs. 1, 5.

1866. *Corbicula Woodiana*, Prime, *Ann. Lyc. Nat. Hist., New York*, VIII, p. 226, fig. 59.

1867. *Corbicula Pfeifferiana*, Prime, *Ann. Lyc. Nat. Hist., New York*, VIII, p. 417.

1869. *Corbicula Chemnitziana, C. fluminea, C. fluviatilis, C. fuscata, C. orientalis, C. Pfeifferiana* and *C. Woodiana*, Prime, *Amer. Journ. Conch.*, V, pp. 129,131-135, 137.

1875. *Cyrena (Corbicula) fluminea*, Moellendorff, *Jahrb. Deutsch. Malakozool. Ges.*, II, p. 134.

1877. *Cyrena orientalis, C. fluminea, C. Woodiana* and *C. grandis*, Sowerby, *Conch. Icon.*, XX, *Cyrena*, pl. xii, figs. 54, 56, pl. xiii, figs. 63, 64, pl. xiv, fig. 71.

1877-79. *Corbicula Woodiana, C. Chemnitziana, C. orientalis* (*nec* var. *javanica*), *C. fluviatilis* (in part), *C. fluminea* (in part, not var. *Moussoni*), *C. ovata, C. inflata, C. fluviatilis* var. and *C. Pfeifferiana*, Clessin in *Martini-Chemn. Conch.-Cab.* (n. f.), *Cycladeen*, p.129, pl. xxiii, figs. 8, 9 ; p. 146, pl. xxvi, fig. 7 ; p. 150, pl. xxvii, figs. 1, 2 ; p. 153, pl. xxviii, figs. 1-3 ; p. 167, pl. xxix, figs. 15, 16 ; p. 179, pl. xxxi, figs. 15, 16 ; p. 189, pl. xxxi, fig. 4 ; p. 199.

1877. *Corbicula yunnanensis* and *C. andersoniana*, Nevill, *Journ. Asiat. Soc. Bengal*, XLVI, pp. 40, 41.

1878. *Corbicula yunnanensis* and *C. andersoniana*, Nevill, *Anat. Zool. Res. Exped. Yunnan*, pp. 902, 903, fig. 32.

1883. *Corbicula Obtruncata, C. Adunca, C. Gentiliana, C. Bezuariana, C. Foukiensis, C. Astronomica, C. Cordieriana, C. Bicolor, C. Leleciana, C. Diminuta, C. Aquilina, C. Uncinulata, C. Colombeliana, C. Vicina, C. Conica* and vars. *a, b, C. Porcellanea, C. Concinna, C. Ingloriosa, C. Gravis* and var. *a, C. Indigotina* and var. *a, C. Rathousiana, C. Scholastica, C. Montana, C. Cheniana, C. Gryphaea, C. Polychromatica, C. Lapicida, C. Portentosa* and vars. *a, b, C. Ignobilis, C. Bilineata, C. Grilloana, C. Sphaerica, C. Ferruginea, C. Iridina, C. Praeterita, C. Aurea, C. Squalida, C. Variegata* [1], *C. Subquadrata, C. Iodina, C. Fluitans, C. Delavayana*, Heude [2], *Conch. Fluv. Nanking et Chine Centrale*, Fasc. X, pls. i-viii, figs. 2-22, 25-34, 37-41, 43-47, 50.

1885. *Corbicula Crebricostis*, Westerlund, *Land-Och Sötvatten Mollusken Vega-Exped. Vetensk.* IV, p. 218, pl. vi, fig. 32.

1901. *Corbicula fulgida*, Bullen, *Proc. Malacol. Soc. London*, IV, p. 224, pl. xxii, fig. 2.

1905. *Corbicula elatior* and *C. producta*, v. Martens, *Zool. Jahrb.* Suppl. Bd. VII, pp. 65, 66, pl. ii, figs. 5, 6 and 8.

1915. *Corbicula fluminea* and *C. fluviatilis* (in part), Preston, *Faun. Brit. Ind. Freshw. Moll.*, pp. 211, 212.

1918. *Corbicula sandai*, Annandale (*nec* Reinhardt), *Mem. Asiat. Soc. Bengal*, VI, p. 317, pl. x, figs. 10-13.

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[1] The name of this species was changed by Fischer (*Bull. Soc. Autun*, IV, p. 240 (1892) to *C. vespertina* owing to *C. variegata* being preoccupied by *C. variegata* (d'Orbigny) —*Mag. Zool.* V, p. 44 (1835).

[2] I have not included references to the various Chinese species in Paetel (Catalogues, 3 editions, 1873, 1883, 1888-90), as the names of the species alone are included in these lists. It is of interest, however, to call attention to references to Heude's species in the last edition as " Pet. J. 1883, p. 269 ", meaning thereby *Journ. Conchyliol.* XXXI, p. 269 (1883) where a review of Heude's work is published by Crosse. I have also not included references to Morlet's record of some of Heude's species from Tonkin (*Journ. Conchyliol.* XXXIV, pp. 267, 268 (1886), as I do not think that the species are correctly identified with the Chinese species.

The vars. *fluviatilis* (Müll.) Cless. and *orientalis* Lam. of *C. fluminalis* recorded by Westerlund (*Faun. Paläarct. Reg. Leb. Binnenconch*, VII, p. 2 (1890) are not the same as the Müllerian and Lamarckian species of these names and which in the present account are considered as synonyms of *C. fluminea* (Müller).

1922. *Corbicula fluminea*, Haas, *Abhandl. & Ber. Mus. Natur. & Heimatk. Magdeburg*, III, p. 290.

1923. *Corbicula yunnanensis*, *C. andersoniana*, *C. ferruginea* and *C. præterita*, Prashad, *Journ. Asiat. Soc. Bengal* (*n. s.*), XIX, pp. 425-427, pl. xvi, figs. 10-13.

1924. *Corbicula fluminea*, Prashad, *Proc. Malacol. Soc. London*, XVI, p. 41.

1925. *Corbicula suifuensis*, Lindholm, *Compt. Rend. Acad. Sci. Russie, Leningrad* (A), pp. 29, 30.

1926. *Corbicula fluminea*, Kennard and Woodward, *Proc. Malacol. Soc. London*, XVII, pp. 100, 101, pl. ix, figs. 2, *a-d*.

1927. *Corbicula suifuensis* and subsp. *finitima*, Lindholm, *Ann. Mus. Zool. Acad. Sci. Urss*, XXVIII, pp. 550-554, pl. xxxii, figs. 1, 2.

In view of the great confusion which exists in literature regarding the first described species of the genus *Corbicula* it would be useful to include here a short history of the Chinese species.

Müller in 1774[1] described three species as *Tellina fluminalis* from the Euphrates and *T. fluminea* and *T. fluviatilis* from China. No figures were published, and the original descriptions are too meagre for the identification of the species. Schröter in 1779[2] republished Müller's descriptions of these species, and in the case of *T. fluviatilis* gave an amended description and published a crude figure of the species. Chemnitz in 1782,[3] however, remarked that this figure and the description of Schröter are applicable more to Müller's *T fluminea* than to *T fluviatilis*. This view appears to me to be unjustified, and in spite of its wide acceptance, I am of opinion that the figure is that of *T. fluminalis* of Müller. Chemnitz. in the work cited, gave short descriptions and published poor figures of the three species, and included them in the generic division *Venus*. The main interest of Chemnitz's work, however, is that he started a confusion in our knowledge of these species, which has been perpetuated in one form or another ever since. This confusion was due to Chemnitz considering the three species as very closely allied and probably having a very wide distribution. In the case of Müller's *T. fluviatilis* which he called " Eine Flussmuschel von Malabar oder der Küste Coromandel " he gave figures and description of a species from Pondicherry, Peninsular India ; this as I have shown elsewhere is *Corbicula striatella* Deshayes, and has nothing to do with the Müllerian species. In 1786 Schröter[4] published short descriptions of the three Müllerian species and accepted Chemnitz's interpretation about his own figure and description of *T. fluviatilis*. He included the species under the generic name *Venus*, and added that *fluviatilis* and *fluminea* appear to be closely allied to Müller's first described species or *fluminalis*. Gmelin in 1788[5] transferred the Müllerian species to *Tellina* following the descriptions and distribution of the species as given by Müller. In 1801 Lamarck[6] referred to Müller's species *T fluminalis* under the new name *Cyclas Euphratica*, and it was included under this name by the same author in 1806,[7] while a figure of it had been published in Brugiere's *Encycloped. Méthod.* in 1798.[8] Müller's *Tellina fluminea* with the reference to

[1] Müller, O. F.—*Verm. Terr. Fluv., etc.*, II, pp. 205-207 (Havniae & Lipsiae, 1774).
[2] Schröter, J. S.—*Gesch. d. Flussconch*, pp. 193-196, pp 16, 20, 21, pl. iv, figs. 2, *a*, *b* (Halle, 1779).
[3] Chemnitz, J. H.—*Martini Conch.-Cab.*, VI, pp. 319-323, pl. xxx, figs. 320-323 (Nürnberg, 1782).
[4] Schröter, J. S.—*Einleit. Conch.*, III, pp. 158, 159, nos. 11-13 (Halle, 1786).
[5] Gmelin, J. F.—*Linne's Systema Naturae*, ed. 13, pp. 3242, 3243 (Lipsiae, 1788).
[6] Lamarck, J. B.—*Systema Anim. sans Vertèb.*, p. 124 (Paris, 1801).
[7] Lamarck, J. B.—*Ann. Mus. Hist. Nat. Paris*, VII, pp. 420, 421 (1806).
[8] Brugiere, M.—*Encycloped. Méthod.*, pl. cccl, figs. 2, 2a, 2b (Paris, 1798).

the description and figures of this species by Chemnitz was given the new name *Cyclas Chinensis* by Lamarck in 1806, but this name has never been recognised since. Bosc in 1802[1] had included references to the Müllerian and Lamarckian species under their respective names. Dillwyn in 1817[2] gave descriptions of the Müllerian species and references to the works of the earlier authors. He gave the correct localities according to Müller, but made no reference to Lamarck's *Cyclas Euphratica*. He agreed with Chemnitz that Schröter's figure of *T. fluviatilis* was probably that of *fluminea* of Müller, and that as Schröter suggested, *fluminea* and *fluviatilis* were probably only varieties of *fluminalis*. Schumacher's species *Cyclas laevigata*[3] appears to me to be the same as Müller's *fluminalis*, though Mörch[4] placed it in the synonomy of *Batissa inflata* Prime.

In 1818[5] Lamarck included in his genus *Cyrena* a number of closely allied generic forms of " Conques fluviatiles ", and from amongst the Asiatic species of the genus *Corbicula* described *orientalis* Lam. from China with a variety from Brugiere's collections—" Ex Oriente "; *cor* Lam. from specimens without definite locality but presented by Olivier and probably collected during his voyage in the East, and which apparently was the same as his species *euphratica* or the still earlier *fluminalis* of Müller, a figure of this species was later published by Delessert ;[6] *fuscata* Lam. from China and a variety of it from the Levant ; and *fluminea* Lam. from China.

Caillaud[7] in 1827 described *Cyrena consobrina* from the Nile, but this species owing to the uncertain provenance of Lamarck's *Cyrena cor* was included in the synonomy of the latter species by most of the later authors.

Menke[8] appears to have been the first author to unearth Megerle von Mühlfeldt's generic name *Corbicula* even though he included it as a synonym of *Cyrena* Lam. in his list of species ; his specific names were based on Lamarck's work.

In his account of the genus *Cyrena* in the *Encycloped. Méthod.* Deshayes[9] included only *C. cor* and *C. fluminea* , and relegated to the synonymy of the former *C. consobrina*, *C. fuscata* and *C. orientalis*. Later Deshayes[10] in the second edition of Lamarck's work, while including the species as described in the first edition, doubted the validity of the Lamarckian species, and considered them as probably being some of the earlier Müllerian forms.

Philippi[11] in 1847 introduced further confusion. In his account he included a species *C. largillierti* which he had described in 1844[12] from the Yangtse-Kiang, *C. orientalis* Lam. from China, *C. nitens* also described by him from the Yangtse-Kiang in 1844, *C. fluminea* and *C. fluviatilis*, the two latter species as of Müller. In the case of *C. fluminea* he extended

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[1] Bosc, L. A. G.—*Hist. Nat. Coq.*, III, p. 37 (Paris, 1802).

[2] Dillwyn, L. W.—*Descr. Cat. Rec. Shells*, I, pp. 106, 107, nos. 78-80 (London, 1817).

[3] Schumacher, C. F.—*Essai Nov. Sys. vers. Testacés*, p. 170, pl. xii, fig. 1 (Copenhague, 1817).

[4] Mörch, O. A. L.—*Journ. Conchyliol.*, XX, p. 327 (1872).

[5] Lamarck, J. B.—*Hist. Nat. Anim. sans Vertèb.*, V, pp. 562, 563 (Paris, 1818). The pagination of this work in volume V, as Germain has pointed out, is incorrect, pp. 561-622 are wrongly printed as 551-612 ; I give the references to the pages as they should have been printed.

[6] Delessert, B.—*Rec. Coq.*, pl. vii, fig. 7 (Paris, 1841).

[7] Caillaud, F.—*Voy. Méroé*, IV, p. 263, t. ii, pl. lxi, figs. 10, 11 (Paris, 1827).

[8] Menke, C. T.—*Synop. Method. Mollusc.*, p. 111 (Pyrmonti, 1830).

[9] Deshayes, G. P.—*Encycloped. Méthod.*, II, pp. 49, 50 (Paris, 1830).

[10] Deshayes, G. P.—In *Lamarck Hist. Nat. Anim. sans Vertèb.* (2nd edit.), VI, pp. 273-275 (Paris, 1835).

[11] Philippi , R. A.—*Abbild. Beschreib. Conch.* II, pp. 75-77 (Cassel, 1847).

[12] Philippi, R. A.—*Zeitschr. Malakzool.*, p. 163 (1844).

its range to Java, while in the case of *C. fluviatilis*, in addition to accepting Chemnitz's record of its occurrence in Peninsular India, he extended the range to the Philippine islands on the authority of some specimens brought by Largilliert from Manila. Mousson[1] in 1849 was responsible for recording *C. orientalis* and *C. fluminea* from Java.

Deshayes in his paper[2] of 1854 and in his detailed Catalogue [3] dealt with the species, which he now assigned to the genus *Corbicula* Meg. von Mühlfeld from separate areas, but did not clear the confusion to any material extent. He was followed by Prime, Clessin and other authors, who dealt with the species of the genus, but none of them tried to clear up the confused synonymy of the Müllerian species. In his memorable work on the freshwater and estuarine shells of the Dutch East Indies, von Martens [4] pointed out that *C. orientalis* is probably nothing more than *C. fluminalis* as it occurs near Ismailia, while *C. fluminea* is a Chinese species and does not occur in the Dutch East Indies.

In the large number of species of *Corbicula* described by Heude [5] from China practically no notice was taken of the earlier work, these and the few new species from the area added by Prime, Morelet and the earlier authors are considered in the respective account of the species.

In the twelfth edition of Systema Naturae, Linnaeus [6] included the description of a species which he called *Cardium virgineum*; the species had also been included in the tenth edition (p. 682, 1758). In the manuscript notes in the personal copy of Linnaeus the species was, however, according to Hanley, transferred to the genus *Mactra*. Philippi, in his valuable paper [7] on the more doubtful molluscs described by Linnaeus, believed the Linnaean *Cardium virgineum* to be based on the Müllerian species *Corbicula fluminalis* or some closely allied form, a conclusion in which Hanley[8] fully agreed with him. Salisbury and Woodward,[9] however, in their recent paper have pointed out that this conclusion is not justified and that the identity of the Linnaean *Cardium virgineum* remains " not proven"

Before closing this introductory section a reference to the work of Kennard and Woodward[10] on the so-called types of Müller is necessary. These authors published photographs of the three species of Müller as received from the collections of the Zoological Museum, Copenhagen, and gave a useful summary of some of the earlier work. According to them the three species are distinct, and Deshayes was mistaken in associating *fluviatilis* with *fluminalis*. While in Europe and in ignorance of the note published by Kennard and Woodward, I wrote for the loan of the Müllerian types, and on plate VII reproduce photographs of two specimens received through the kindness of Dr. R. Spärck, the Custodian of the Mollusca collections in the Copenhagen Museum.

In order to understand the position about the supposed types of Müller in the Copenhagen Museum it would be useful to quote from a letter which I received from Dr. Spärck

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[1] Mousson.—*Moll. Java*, pp. 86, 87 (Zurich, 1849).
[2] Deshayes, G. P.—*Proc. Zool. Soc. London*, pp. 342-345 (1854).
[3] Deshayes, G. P.—*Cat. Conch. Brit. Mus.*, II, pp. 220-228 (London, 1854).
[4] Von. Martens, E.—*Weber's Zool. Ergebn. Niederland. Ost.-Ind.*, IV, pp. 111-115 (Leiden, 1897).
[5] Heude, P. P.—*Conch. Fluv. Nanking et Chine Centrale*, Fasc. X (Paris, 1883).
[6] Linne, E. C.—*Systema Naturae*, ed. XII, p. 1124, sp. 93 (Holmiae, 1767).
[7] Philippi, R. A.—*Archiv. Naturgesch.*, VII, pt. i, p. 262 (1841).
[8] Hanley, S.—*Ipsa Linnaei Conch.*, pp. 53, 54 (London, 1855).
[9] Salisbury, A. E. and Woodward, B. B.—*Proc. Malacol. Soc. London*, XVII, p. 102 (1926).
[10] Kennard, A. S. and Woodward, B. B.—*Proc. Malacol. Soc. London*, XVII, pp. 100, 101, pl. ix (1926)

with the specimens :—" Further the type specimen of Müller's *Tellina fluminalis.* We have in our Museum one specimen of T. fluivatilis which can with certainty be stated to belong to Müller's collection. This specimen is, however, so large that it cannot be the type specimen of Müller's description. I am sending you a specimen of T. fluvialis (*sic* fluviatilis), originating from Spengler's collection, which is the original specimen used for the illustrations in Martini-Chemnitz's Conchylien Cabinet. Finally we have several specimens of T. fluminea, originating from Müller's collection, and I hereby send you one of these."

There is no difficulty about *Tellina fluminalis*, as I agree entirely with Kennard and Woodward's statements about it, and it is, therefore, not necessary to go into further detail. Of *Tellina fluminea*, the specimen which I had for examination was apparently out of the same lot as, if not identical with, the one figured by Kennard and Woodward ; it was from Müller's original collection but curiously bears the locality label " East Indies or China" It is a small shell corresponding in measurements to the figures given by Müller, and in spite of the doubtful locality may, as Kennard and Woodward have done, be accepted as the co-type of the species. The chief difficulty is with reference to *Tellina fluviatilis* of which no real type seems to exist, the specimen from Müller's collection, as mentioned above, being " so large that it cannot be the type specimen of Müller's description" Kennard and Woodward figured a specimen from the " Galathea " Expedition and called it the plesiotype of the species. The Galathea Expedition came over to the East about 80 years after the appearance of Müller's work, and the specimen figured by Kennard and Woodward and which I have seen is one of a series marked 76, from Manilla Philippines ; these specimens all belong to the species *C. squalida* [1] Desh. and have nothing to do with the Chinese *C. fluviatilis.* I would, therefore, take Spengler's specimens from Canton, China, which were sent to me for examination, and which probably Müller also had before him when he described the species, as the topo-types of the species.

It may also be noted that Dr. Spärck is wrong in stating that the specimen of *T. fluviatilis*, which he sent me for examination, is the original of the illustration in Martini and Chemnitz, as Chemnitz's figure is of a shell from Pondicherry, Peninsular India, and which, as I have already shown,[2] is to be referred to *C. striatella* Deshayes.

The very extensive synonymy of *C. fluminea* given above is based on a careful examination of large series of shells in the Indian Museum, and those from the various European Museums and private collections which have been lent to me for this work.

The species is very variable, and all my remarks in the introductory chapter (*antea* pp. 49,50) in reference to the variation of shells in form, outline, sculpture and colour are fully applicable to it. Even in a single large collection from one locality one finds specimens which if constant and unconnected by intermediate forms would normally be taken as distinct, but connecting links are invariably present in large collections, and the different forms have to be considered as variations only. It is this variation to which the earlier authors paid no attention that is responsible for the large number of species which have been described. Müller's two species *C. fluminea* and *C. fluviatilis* are undoubtedly synonymous, and the former of these, having been described earlier, will have

[1] *See postea*, p. 67.

[2] Prashad, B.—*Mem. Ind. Mus.*, IX. p. 18 (1928).

precedence over the latter. Lea's *Corbicula woodiana*, which I also refer to *C. fluminea*, is based on full-grown shells of this species. Full-grown shells attain the largest size of all the species of the genus so far known; they are very thick-shelled, ponderous and very oblique, with moderately prominent forwardly directed and greatly eroded umbones, and the sculpture consists of somewhat irregular and not greatly impressed striae on the older parts of the shells. Such shells appear very different from the shells usually assigned to *C. fluminea*, but the connecting forms, which I figure on plate VII, leave no doubt that *C. woodiana* is only the adult of *C. fluminea*. Lamarck's *C. chinensis*, *C. orientalis* and *C. fuscata* are undoubted synonyms of Müller's species, and so are *C. primeana* Mörch (*non* Morelet), *C. pexata* Prime, *C. chemnitziana* Prime, *C. pfefferiana* Prime, *C. yunnanensis* Nevill, *C. andersoniana* Nevill, *C. crebricostis* Westerlund and *C. fulgida* Bullen; this latter was wrongly supposed by the author to have come from the Philippines. The paratypes or cotypes of Heude's species included in the synonymy above, from the collections of the British Museum (Natural History), London, which I have examined, leave no doubt whatsoever about their being typical specimens of *C. fluminea*. From an examination of the Korean species *C. elatior* and *C. producta* of von Martens in the Berlin Museum, I am of opinion that they are also to be referred to here; these records apparently point the route along which *C. fluminea* has migrated northwards from south-eastern China to the Ussuri Basin in Russian territory. The species *C. suifuensis* and its subspecies *finitima*, recently described by Lindholm from the latter area, are synonymous with *C. fluminea* and represent the northernmost limit of the distribution of the species.

In view of the great variation exhibited by shells of different ages of this species I propose giving short descriptions of young, half-grown and adult shells separately.

Young shells corresponding to what have been described as *C. fluminea* and *C. fluviatilis* of Müller are ovoidal-trigonal, subequilateral or almost equilateral, thin-shelled, not greatly inflated, almost evenly rounded anteriorly and posteriorly or in some specimens subtruncate posteriorly, ventral margin only slightly arched, umbones small, slightly inflated, and the surface sculpture consisting of concentric, closely or distantly placed, fine ridges.

Half-grown shells corresponding to *C. orientalis* and *C. fuscata* of Lamarck and most of Heude's species are ovate-trigonal or sub-trigonal, almost as long as high or much longer, thick-shelled, greatly inflated, broadly rounded anteriorly, rostrate and subtruncate to truncate posteriorly, ventral margin usually greatly arched, umbones prominent, somewhat acuminate, often eroded, surface sculpture consisting of either quite regular, concentric, strong ridges or with distantly placed regular or irregular ridges; the ridges become more and more irregular on older shells and even on the older parts of the shells. The colour of the periostracum varies from yellow or some shade of brown to shining black. The nacre is whitish to light blue, or even lilac. The hinge is normal, moderately strong, with the anterior cardinals greatly impressed near the lower extremity by the muscle scars strongly impinging on them. The nymphs vary in outline, and may be almost smooth or minutely roughened.

Still older shells, which connect the half-grown shells to *C. woodiana* of Lea, are trigonal-ovate, markedly rostrate posteriorly, with the anterior side much shorter than

the posterior. The shells as a result become very oblique, with umbones more forwardly directed. The sculpture is less regular, indistinct and consists of coarse striae. The shells are greatly thickened, and are of a shining, dark black colour.

The adult shells corresponding to *C. grandis* Deshayes and *C. woodiana* Lea are sub-ovate, trigonal, greatly inflated, very much longer than high, very rostrate posteriorly and greatly compressed in the region of the beak, the anterior side much shorter than the posterior which is almost one-and-a-half times longer, ventral margin very greatly arched, umbones prominent, greatly inflated, curved inwards and forwards, always eroded, shell sculpture consisting of irregularly developed, distantly placed wrinkles or ridges with in some cases finer ridges in the irregular interspaces ; traces of the regular sculpture of the younger shells are sometimes to be made out on the younger parts of the shells. The colour of the periostracum varies from brownish black to jet black. The nacre is dull white.

Measurements (in millimetres).

	1	2	3	4	5	6	7	8	9	10	11	12
Length	19·2	16·5	19	25	31	35	37·8	42	41	49·4	68	83
Maximum height ..	17	15	16	22	29	34	32·5	35·6	37·5	43	60	77
Thickness	10·8	11·4	12	16	18·8	22	22·6	22·3	25	28·5	42	50

Specimens 1, 5, 6, 11 and 12 are from Canton, 2, 3 from Swatow, 4 from Chusan, 7, 8, 9 from Central China and 10 from Hongkong.

Distribution.—The species has a wide range in south-eastern China, Korea, and is also found in the Ussuri Basin in south-eastern Russia.

Remarks.—*C. fluminea* is apparently the central species of the genus for south-eastern Asia, and is represented in Japan by species like *C. leana* Prime, in French-Indo-China by *C. baudoni* Morlet and in India by *C. striatella* Deshayes.

Corbicula largillierti (Philippi).

(Pl. VII, figs. 11-14.)

1844. *Cyrena Largillierti*, Philippi, *Zeitschr. Malakozool.*, I, p. 163.

1847. *Cyrena Largillierti*, Philippi, *Abbild. Beschreib. Conch.*, II, p. 75, pl. i, fig. 1.

1854. *Corbicula sulcatina*, Deshayes, *Proc. Zool. Soc. London*, p. 354.

1854. *Corbicula Largillierti* and *C. sulcatina*, Deshayes, *Cat. Conch. Brit. Mus.*, II, pp. 225, 233.

1857. *Corbicula Largillierti* and *C. sulcatina*, Adams, H. & A., *Gen. Rec. Moll.*, II, pp. 447, 448.

1860. *Corbicula Largillierti* and *C. sulcatina*, Prime, *Proc. Acad. Nat. Sci. Philadelphia*, XII, pp. 271, 273.

1864. *Corbicula Largillierti* and *C. sulcatina*, Prime, *Ann. Lyc. Nat. Hist. New York*, VIII, pp. 78, 79, figs. 27, 28.

1866. *Corbicula vulgaris*, Prime, *Ann. Lyc. Nat. Hist. New York*, VIII, p. 223, fig. 55.

1869. *Corbicula Largillierti*, *C. sulcatina* and *C. vulgaris*, Prime, *Amer. Journ. Conch.*, V, pp. 132, 136.

1877. *Cyrena Largillierti* and *C. sulcatina*, Sowerby, *Conch. Icon.*, XX, *Cyrena*, pl. xiii, fig. 61, pl. xiv, fig. 70.

1877-78. *Corbicula vulgaris, C. Largillierti* and *C. sulcatina*, Clessin, *Martini u. Chemn. Conch.-Cab.* (n. f.), *Cycladeen*, pp. 134, 152, 183, pl. xxiv, fig. 8, pl. xxviii, figs. 6-8, pl. xxxii, fig. 3.

1883. *Corbicula Largillierti*, Heude, *Conch. Fluv. Nanking et Chine Centrale*, Fasc. X, pl. i, figs. 1, 1*a*.

1924. *Corbicula largillierti* (misprinted *lagillierti*), Prashad, *Proc. Malacol. Soc. London*, XVI. p. 42.

A careful comparison of the descriptions and figures and the examination of a fairly large series of specimens leaves no doubt that *C. sulcatina* Deshayes and *C. vulgaris* Prime are both synonyms of *C. largillierti* (Philippi).

Philippi's descriptions and figure are rather poor, but Prime's description renders a redescription of the species unnecessary ; his figures also show the distinguishing characters of the species. I reproduce photographs of some shells which show the variation exhibited by this species.

C. largillierti is a fair sized species, trigonal, inequilateral, with a moderately thick shell, prominent, inflated and forwardly inclined umbones, and the sculpture consisting of fine, closely placed, concentric ridges.

Distribution.—*C. largillierti* was described from the river Yangtse-Kiang, and the majority of the specimens, which I have seen, are from the same river. I have also seen a series of specimens of all ages from Macao in the collections of the Museum d'Histoire Naturelle, Paris.

Remarks.—This species is distinguished from all other Chinese species by its sculpture, and the very inequilateral shell in which the umbones are forwardly placed and curved and make the shell appear very oblique. I have also seen a specimen of this species from Heude's collection labelled *C. indigotina*, but the specimen is quite different from Heude's figure of this species which is that of a typical *C. fluminea* (Müller).

Corbicula nitens (Philippi).

(Pl. VII, figs. 15-19).

1844. *Cyrena nitens*, Philippi, *Zeitschr. Malakozool*, I, p. 163.

1847. *Cyrena nitens*, Philippi, *Abbild. Beschreib. Conch.*, II, p. 76, pl. i, fig. 4.

1854. *Corbicula nitens*, Deshayes, *Cat. Brit. Mus. Conch.*, II, p. 227.

1857. *Corbicula nitens*, Adams, H. & A., *Gen. Rec. Moll.*, II, p. 447.

1860. *Corbicula nitens*, Prime, *Proc. Acad. Nat. Sci. Philadelphia*, XII, p. 271.

1862. *Cyrena (Batissa) Primeii*, Morelet, *Rev. Mag. Zool.* (ser. ii), XIV, p. 480.

1864. *Corbicula Primeana* (*nec* Mörch) and *C. Mülleriana*, Prime, *Ann. Lyc. Nat. Hist. New York*, VIII, pp. 58, 59, figs. 2, 3.

1869. *Corbicula Mülleriana, C. nitens* and *C. Primeana*, Prime, *Amer. Journ. Conch.*, V, pp. 134, 135.

1877. *Cyrena nitens* and *C. Mülleriana*, Sowerby, *Conch. Icon.* XX, *Cyrena*, pl. xvi, fig. 89 ; pl. xvii, fig. 95.

1877. *Corbicula Primeana, C. Mülleriona* and *C. nitens*, Clessin, *Martini u. Chemn. Conch.-Cab.* (n. f.) *Cycladeen*, pp. 145, 154, pls. xxvi, figs. 3-6 ; pl. xxviii, figs. 9-11.

1883. *C. Papyracea, C. cantatoris, C. Borealis, C. soriniana,* Heude, *Conch. Fluv. Nanking et Chine Centrale,* Fasc. X, pls. vii, viii, figs. 35, 36, 48, 49.

1905. ? *Corbicula papyracea* and var. *colorata,* von Martens, *Zool. Jahrb.* Suppl. Bd., VII, pp. 66, 67, pl. ii, figs. 9, 10.

The incomplete description and the poor figure of the species by Philippi are apparently the reason of its having been confused with other forms. I have no doubt about the synonymy given above except for the form described by von Martens from Korea. Of Heude's species unfortunately no specimens of *C. borealis* and *C. soriniana* have been available in any collection, but the descriptions and figures of these and the co- or paratypes of *C. papyracea* and *C. cantatoris,* which I have examined, leave no doubt that they are all synonyms of *C. nitens.*

The species may be redescribed as follows :—Species of a moderate size, rather thin-shelled, transversely oval, moderately inflated, of a yellowish to dark brown colour, young shells usually much lighter. Upper slope not greatly arched ; anterior side relatively short but in some subequilateral shells almost of the same length as the posterior side, which is usually longer and narrowly arched, lower margin not much arched. Umbones small, not very prominent, somewhat inflated, often eroded. Shell surface with low, concentric, sharp striae, with the interspaces much broader. Hinge moderately developed, not very strong, normal ; laterals evenly and narrowly arched, posterior somewhat longer than anterior ; nymphs narrow, almost smooth ; ligament not very prominent but thick ; muscle scars not at all impressed.

Measurements (in millimetres.)

Length ..	28·5	27	26	19	18·5	17·8
Maximum height	25·2	22·7	21	14·4	14·2	14·4
Thickness	15	14·4	13·8	9	8·7	8·5

Distribution.—*C. nitens* was described from the river Yangtse-Kiang. I have seen a fair series of specimens from Eastern China, and if my reference of von Marten's form from Korea to *C. nitens* is correct, the species has a wide distribution in Eastern China and Korea.

Remarks.—The species is allied to *C. lamarckiana* Prime, but is distinguished by the shell being thinner, more rounded posteriorly, more inflated, the umbones less prominent, and the sculpture consisting of finer striae with broader interspaces.

Corbicula lamarckiana Prime.

1929. *Corbicula lamarckiana,* Prashad, *Mem. Ind. Mus,* IX, p. 43, pl. vi, figs. 20, 21.

In the paper cited above I have recently dealt in detail the synonymy and the distribution of *C. lamarckiana.* The species was originally described from the Laos Mountains in French Indo-China, but there can be no doubt that the form found in Lake Tali in Yunnan and the area round about is identical with it.

Corbicula lutea Morelet.

(Pl. VIII, figs. 1, 2.)

1862. *Cyrena* (*Corbicula*) *lutea*, Morelet, *Rev. Mag. Zool.* (ii ser.), XIV, p. 481.
1864. *Corbicula lutea*, Prime, *Ann. Lyc. Nat. Hist. New York*, VIII, p. 61, fig. 6.
1869. *Corbicula lutea*, Prime, *Amer. Journ. Conch.*, V, p. 133.

This species was described by Morelet under the name *Cyrena* (*Corbicula*) *lutea* owing to its shape and the texture of the shells differing very greatly from the other known species of the genus *Corbicula*. I have recently described a closely allied species from Tourane, French Indo-China as *C. luteola* and a third species of the same group from Formosa (Taiwan) is dealt with further on under the name *C. subsulcata* Clessin. It is also of interest to note that two shells in the collections of the Museum d'Histoire Naturelle, Paris, are labelled *Corbicula Chinensis* Férrusac, but the species was never described under this name.

Morelet's description is sufficiently detailed to need redescription, and I, therefore, give below its distinguishing characters and reproduce photographs of two shells.

The species is of a fair size, with a thick but delicate shell, it is subtrigonal-rounded in outline, the shell is fairly tumid, and full-grown specimens are somewhat rostrate posteriorly. The upper margin is greatly arched, the posterior side is somewhat longer than the anterior, and both are equally arched. The sculpture of the shells consists of very feebly impressed, delicate, concentric striae; the striae are more impressed and irregular on the older parts of the shells. The umbones are prominent, greatly curved forwards and inwards. The shell is of a lemon-yellow colour, and the nacre is dull white.

Measurements (in millimetres.)

Length	37·3	37	49·5	47
Maximum height	33	33	42·4	42
Thickness	19	19·2	24·6	23·8

Distribution.—I have seen several specimens from Macao, China, and others from China without definite locality. The relationships of the species have been noted above.

(*b*) TIBET.

Corbicula tibetensis, sp. nov.

(Pl. VIII, figs. 3-5.)

No species of the genus *Corbicula* has so far been recorded from Tibet. I have before me two specimens from Tibet from the collections of the Indian Museum and two valves collected by Abbé David in 1868 from the collections of the Museum d'Histoire Naturelle, Paris, which I am unable to refer to any known species.

The species may be described as follows:—

Species of moderate size, fairly thick, triangular oval; inequilateral, of an olive brown colour, surface somewhat shiny with low, concentric, regular ribs; interspaces much broader than the ribs, not at all impressed, no lunule or escutcheon. Upper slope very convex; anterior side somewhat shorter than posterior; evenly rounded anteriorly and posteriorly;

ventral margin greatly arched. Umbones prominent, tumid, curved inwards and forwards, almost meeting in the middle line ; eroded. Hinge strongly developed ; laterals compressed below by the muscle scars impinging on them ; nymphs narrow, slightly rugose ; muscle scars not at all impressed. Nacre light blue, near the lower margin dark lilac.

Measurements (in millimetres.)

	Holotype.			
Length	23	14	24*	24·1*
Maximum height ..	21·4	11	21	20·5
Thickness	14·8	7	..	..

Holotype.—No. M $\frac{12837}{2}$ in the collections of the Zoological Survey of India (Indian Museum), Calcutta.

Distribution.—All the examples of the species which I have seen are labelled Tibet without any more detailed locality.

Remarks.—The species appears to be allied to *C. fluminea* (Müller) from China on the one hand and *C. cashmiriensis* Deshayes from Kashmir, India, on the other.

(*c*) Formosa.

Only 3 species of the genus *Corbicula* are known from Formosa (Taiwan). Of these, *C. insularis* Prime is closely allied to *C. fluminea* (Müller), and, as is discussed further on, is probably derived from it. *C. subsulcata* Clessin belongs to the same group as *C. lutea* Morelet, from China, and with it has probably been developed from a common ancestral type. *C. formosana* Dall, the third species, occupies a unique position, and with the present state of our knowledge it is impossible to be certain about its relationship or affinities with other species of the genus. Considered as a whole, the affinities of the Formosan species are with the Chinese forms and they probably represent extensions of the Chinese species in this island.

Corbicula insularis Prime.

(Pl. VIII, figs. 6-8.)

1867. *Corbicula insularis*, Prime, *Ann. Lyc. Nat. Hist. New York*, VIII, p. 414, fig. 67.

1869. *Corbicula insularis*, Prime, *Amer. Journ. Conch.*, V, p. 132.

1877. *Corbicula insularis*, Clessin, *Martini u. Chemn. Conch.-Cab.* (n. f.), *Cycladeen*, p. 147, pl. xxvi, fig. 9.

The two series of shells, which I assign to this species, differ from Prime's description in the shells being more elongate-trigonal, more inflated, with the posterior side longer than the anterior, the shells being somewhat rostrate, the sculpture consisting of regular ribs, which are not very raised and the colour of the shells varying from olive-yellow to brown. These series of shells, however, show that the species is very variable, and I have no hesitation in assigning them to *C. insularis* Prime.

* Single valves only.

Measurements (in millimetres.)

Length ..	..	..	27·8	26·6	17	30·2	28·3	28
Maximum height	..	..	26	25	16	25·5	26·2	25·4
Thickness	..	..	21·9	22	12	18·7	..	..

The last two shells are represented by single valves only.

Distribution.—*C. insularis* was described by Prime from Formosa (Taiwan). One of the series before me from the collections of the British Museum (Natural History), London, is marked Formosa, while the other bears the locality label—" Lake Tsaisia, over 3,000 feet high, Central Formosa " The shells from this lake are more elongate and rostrate.

Remarks.—The species appears to be allied to *C. fluminea* (Müller) from China, and may have been derived from it.

Corbicula subsulcata Clessin.

(Pl. VIII, fig. 9.)

1878. *Corbicula subsulcata*, Clessin, *Martini u. Chemn. Conch.-Cab.* (n. f.), *Cycladeen*, p. 164, pl. xxix, figs. 5, 6.

Clessin refers *Corbicula subsulcata* as a species of Dunker, but so far as I can find from the literature Dunker neither described nor figured the species. I have a specimen before me from Formosa—the type-locality—and give below its full description and figure the two valves.

Species fairly large, moderately thick but delicate for the size of the species; subtrigonal, inequilateral, fairly tumid, particularly in the umbonal region; of a dirty brownish-yellow colour, much lighter in the umbonal region. Upper margin moderately arched; anterior side much shorter than posterior, nearly straight; posterior side regularly curved; rounded anteriorly, somewhat pointed posteriorly; ventral margin greatly arched, running insensibly into the rounded anterior end and curving up suddenly about the posterior third to end in the pointed posterior beak; no distinct lunule or escutcheon. Umbones prominent, large, inflated, greatly curved forwards and inwards, almost meeting in the middle. Shell surface with concentric, close striae, not equally developed all over the shell, less strongly impressed on the umbones which appear almost smooth to the naked eye. Hinge normal, moderately strong; anterior laterals shorter than posterior; nymphs elongate, narrow, almost smooth; ligament prominent, elongated, thick. Nacre white with traces of bluish bands shining through.

The measurements (in millimetres) of the single shell before me are:—46·4 × 41 × 27.

Distribution.—Clessin described the species from Formosa (Taiwan), and the only shell, which I have seen, is also from the same island.

Remarks.—*C. subsulcata* is allied to *C. lutea* Morelet and *C. luteola* Prashad from China and French Indo-China respectively. It is, however, distinguished from both these species by the shell being thicker, more inflated and more inequilateral. Clessin described his specimen as having " sehr unregelmässig gerippter oberflache "; apparently this refers to the unequal development of the striae on the different areas of the shell surface.

Corbicula formosana Dall.

1903. *Corbicula (Cyrenodonax) formosana*, Dall, *Tans. Wagner Free Inst. Sci. Philadelphia*, III (vi), p. 1450.

1925. *Corbicula (Cyrenodonax) formosana*, Dall, *Proc. U. S. Nat. Mus. Washington*, LXVI, art. 17, p. 15, pl. xxix, fig. 3.

I have not seen any specimens of this species, but to make the present account complete I give below the description of the section *Cyrenodonax* Dall, and its only species *formosana* from the above cited work.

Section *Cyrenodonax* Dall :—" Shell small, thin, delicate, donaciform, with three very oblique, slender cardinals in each valve, the middle one feebly bifid, the others nearly parallel with the hinge-line ; the anterior end of the shell much longer than the posterior ; the laterals elongate, sharply crenate ; the pallial line entire, the margins smooth. This recalls *Donacopsis*, but is inflated, entirely without any sulcate radiation or crenulation of the valve margin, has better developed teeth and an entire pallial line."

C. formosana Dall :—" Shell plump, polished, with low but turgid beaks, covered with an olivaceous periostracum, sometimes with violet rays or with darker zones ; the interior violet. The beaks at the posterior third. Length 12, height 8, diameter 6 mm." Recent in Formosa, at the mouth of the Tamsui River.

In the form and texture of the shell *C. formosana* appears to resemble *C. lutea* Morelet and *C. luteola* Prashad, but the situation of the umbones in the posterior third and the form of the shell as a whole is very characteristic ; in these respects the species is quite unique.

(*d*) The Philippine Islands.

From the Philippine Islands I am able to recognize as good species, *C. manilensis* (Philippi), *C. similis* (Wood), *C. recurvata* Eydoux, *C. squalida* Deshayes and *C. elongata* Clessin. All these species, with the exception of *C. elongata*, of which no form has so far been found in China, are allied to the Chinese species, and I have little doubt that the species of the Philippine Islands are to be derived from those found in China.

Corbicula manilensis (Philippi).

(Pl. VIII, figs. 10-12.)

1841. *Cyrena Manilensis*, Philippi, *Zeitschr. Malakozool.*, p. 162.

1847. *Cyrena fluviatilis* (in part), Philippi, *Abbild. Beschreib. Conch.*, II, p. 77, fig. 5.

1860. *Corbicula Manillensis*, Prime, *Proc. Acad. Nat. Sci. Philadelphia*, XII, p. 271.

1869. *Corbicula Manillensis*, *C. Sayana* and *C. venustula*, Prime, *Amer. Journ. Conch.* V, pp. 133, 136, 137.

1877. *Cyrena Manillensis*, Sowerby, *Conch. Icon.*, XX, Cyrena, pl. xv, fig. 74.

1878. *Corbicula Sayana*, *C. venustula* and *C. manillensis*, Clessin, *Martini u. Chemn. Conch.-Cab* (n. f.), *Cycladeen*, pp. 172, 187, pl. xxx, figs. 14-19, pl. xxxii, figs. 15, 16.

1901. *Corbicula subtriangularis*, Bullen, *Proc. Malacol. Soc. London*, IV, p. 223, pl. xxiii, fig. 1.

C. manilensis is a very variable species and none of the published descriptions is complete. I, therefore, reproduce photographs of shells of different ages and give a complete description below :—

Species of a large size, thick-shelled, not much inflated, triangular, subequilateral, of a dark-brownish colour, with lighter transverse bands. Upper margin arched, much more so anteriorly than posteriorly ; anterior side shorter than posterior, narrowly arched, posterior nearly straight, rounded anteriorly, subtruncate and somewhat rostrate posteriorly. Umbones full, inflated but not very raised, curving inwards and almost meeting in the middle. Shell surface glossy with raised concentric and regular ridges ; interspaces much broader than the ridges and sometimes with finer striae on them. Hinge strongly developed, anterior cardinals longer and more arched than posterior, greatly impressed by the muscle scars impinging on them ; nymphs prominent, somewhat broad, almost smooth ; ligament prominent, broad and thick ; muscle scars not greatly impressed ; pallial line with trace of a sinus. Nacre whitish with traces of light blue, lilac in the hinge region.

Measurements (in millimetres.)

Length	37·5	35·5	31·4	22·3	20	18	
Maximum height	34·4	33	30	18·8	17·7	16·3	
Thickness	22·3	20·6	21·4	14·6	12	12	

Distribution.—*C. manilensis* was described by Philippi from Manilla, Philippines. I have seen in addition to other specimens, two good series of shells from Manilla in the collections of Museum d'Histoire Naturelle, Paris, presented by Eydoux and Souleyet.

Remarks.—The species was wrongly referred to *C. fluviatilis* by Philippi ; it is allied to *C. fluminea* (Müller) from China, but appears to me to be distinct.

Corbicula similis (Wood).

(Pl. VIII, fig. 13.)

1828. ? *Venus similis*, Wood, *Index Test. Suppl.*, pl. ii, fig. 5.
1834. *Cyrena similis*, Griffith & Pidgeon, *Animal Kingdom*, XII, pl. xx, fig. 2.
1854. *Corbicula similis*, Deshayes, *Cat. Conch. Brit. Mus.*, II, p. 225.
1856. *Venus similis*, Hanley in *Wood's Index Test.*, p. 203, suppl. pl. ii, fig. 5.
1857. *Corbicula similis*, Adams, H. & A., *Gen. Rec. Moll.*, II, p. 448.
1877. *Cyrena similis*, Sowerby, *Conch. Icon*, XX, *Cyrena*, pl. xiii, fig. 64.

This species was first figured by Wood from the collection of the British Museum (Nat. Hist.) London, as of Gray, and later by Griffith and Pidgeon as a species of the same author but it was never described or figured by Gray himself. Descriptions of the species were, however, published by Deshayes and Sowerby. There is some doubt about the provenance of the species. Wood and Griffith and Pidgeon give China as its habitat and Deshayes gives the same locality, but with a query. Sowerby from a specimen in the British Museum collection gave the habitat of the species as the Philippines. I have seen this specimen and another in the Dautzenberg collection which is labelled as being from the Philippines, and am of opinion that the species is from the Philippine Islands and not from China.

The description of the species by Deshayes is fairly complete and I, therefore, only note its distinguishing characters from *C. fluminea* (Müller), the adult stage of which was named *C. woodiana* by Lea and with which this species has been confused by Prime and later by Clessin. Compared with *C. fluminea*, *C. similis* is more trigonal, not so oblique and not so rostrate. It is much more inflated with the umbones more prominent, fuller and more recurved inwards and forwards. The anterior side is longer and the ventral margin is more arched. The sculpture of the shells consists of more regular and close set striae than in *C. fluminea*. The hinge is similar, but the cardinals are more delicate and the anterior laterals much longer; the nymphs are longer and narrower.

Measurements (in millimetres.)

Length ..	70	49·5
Maximum height	62·5	47
Thickness	39·3	30

Distribution.—As is discussed above, *C. similis* in my opinion is found in the Philippines and not China as was believed by some authors.

Remarks.—The species is undoubtedly allied to *C. fluminea* and is probably derived from it. It may be the adult of some species like *C. manilensis* (Philippi), but I have not sufficient material before me to clear up this question.

Corbicula recurvata (Eydoux).

(Pl. VIII, fig. 14.)

1835. *Cyrena recurvata*, Eydoux, *Moll. Voy. Favorite*, in *Mag. Zool.*, p. 11, pl. cxix, figs. 2, 2*a*, 2*b* (wrongly labelled *C. Gaudichaudii*).

1839. *Cyrena recurvata*, Eydoux, *Voy. Autour du Monde La Favorite*, V, p. 191, pl. lx, figs. 2, 2*a*, 2*b* (reprinted from above).

1854. *Corbicula recurvata*, Deshayes, *Cat. Brit. Mus. Conch.*, II, p. 226.

1857. *Corbicula recurvata*, Adams, H. & A., *Gen. Rec. Moll.*, II, p. 448.

1860. *Corbicula recurvata*, Prime, *Proc. Acad. Nat. Sci. Philadelphia*, XII, p. 273.

1869. *Corbicula recurvata*, Prime, *Amer. Journ. Conch.*, V, p. 136.

Eydoux in describing this species noted that it is found commonly in the rivers and lakes of Manilla, Philippines, and that the species is also very common at Canton in China. Deshayes and Prime, therefore, gave the distribution of the species as the Philippines and China, but later Prime restricted the distribution to China alone. In the collections of the Museum d'Histoire Naturelle, Paris, I found a shell from the Philippines presented by Eydoux in 1832, which appears to be the original of the figures and description of *C. recurvata* by Eydoux, and may be taken as the type of the species. The Chinese specimens from Canton, confused with *C. recurvata*, are only deformed shells of *C. fluminea* (Müller).

I have seen only the unique shell referred to above, and reproduce photographs of it for future reference. The species has been described in detail by Eydoux, but the following points may be noted :—It is a thick-shelled species, somewhat triangular or heart-shaped in outline with a very convex upper margin. The umbones are not large, but are prominent

and moderately inflated, and very much curved inwards and forwards. The sculpture of the shell consists of close-set regular, concentric, somewhat raised ridges; these become irregular and rather indistinct on the inwardly recurved posterior part of the shell. The ventral margin is not greatly arched. The hinge is normal with the lateral teeth only slightly curved; the nymphs are broad and almost smooth. The measurements (in millimetres) of the unique shell are :—27 × 28·5 × 20.

Remarks.—I am not quite certain about the relationships of *C. recurvata.* It may be based only on deformed shells of *C. manilensis* (Philippi), but with the single specimen before me it is impossible to be certain.

Corbicula squalida Deshayes.

(Pl. VIII, figs. 15-17.)

1854. *C. squalida,* Deshayes, *Proc. Zool. Soc. London,* p. 342.
1854. *Corbicula Cumingii* and *C. squalida,* Deshayes, *Cat. Brit. Mus. Conch.,* II, pp. 228, 233.
1861. *Corbicula notata,* Prime, *Proc. Acad. Nat. Sci. Philadelphia,* XIII, p. 127.
1864. *Corbicula Crosseana,* Prime, *Ann. Lyc. Nat. Hist. New York,* VIII, p. 72, figs. 20.
1866. *Corbicula Cumingii,* Prime, *Ann. Lyc. Nat. Hist. New York,* VIII, p. 217, figs. 46-49.
1869. *Corbicula Crosseana* and *C. Cumingii,* Prime, *Amer. Journ. Conch.,* V, pp. 130, 137.
1877. *Cyrena Cumingii* and *C. squalida,* Sowerby, *Conch. Icon.,* XX, *Cyrena,* pl. xii, fig. 53 and pl. xvii, fig. 99.
1878. *Corbicula Cumingii, C. Crosseana* and *C. venustula,* Clessin in *Martini u. Chemn. Conch.-Cab.* (n. f.) *Cycladeen,* pp. 164, 185, 173, pls. xxix, figs. 9, 10, pl. xxxii, figs. 7-11, pl. xxx, figs. 18, 19.
1926. *Corbicula fluviatilis,* Kennard & Woodward (*nec* Müller), *Proc. Malacol. Soc. London,* XVII, p. 100, pl. ix, fig. 3.

I have seen what appears to be the types of *C. cumingii* in the Cuming collection in the British Museum (Nat. Hist.), London, but have not found any specimens labelled *C. squalida.* From the description, however, there can be no doubt that Prime was right in assigning *C. squalida* Deshayes and *C. notata* Prime to its synonymy.

Deshayes did not describe *C. cumingii* in *Proc. Zool. Soc., London,* for 1854, as he states in his " Catalogue of Conchifera in the British Museum ", and as *C. squalida* of unknown habitat was described earlier [1] it will have priority over it.

I have also no doubt that *C. crosseana* Prime is based on shells of this species, while the plesiotypes of *C. fluviatilis* (Müller) as selected by Kennard and Woodward are also shells of this species.

The species has been fully described by Prime and it will, therefore, be enough to note its distinguishing characters. The species is of a small size with a triangular oval, subtriangular, not greatly inflated shell, rounded anteriorly and posteriorly and with concentric, regular, somewhat raised ribs; the interspaces between the ribs are somewhat broader than the ribs themselves. On some shells the ribbing is somewhat irregular.

[1] I have some doubt about the dates of publication of p. 342 of *Proc. Zool. Soc. London,* 1854, and Deshayes's Catalogue of Conchifera in the British Museum, but presumably the Catalogue was published after the number of the Proceedings in which Deshayes's paper on the new Cumingian species of *Corbicula* appeared.

Measurements (in millimetres.)

Type shells of *C. cumingii.*

Length	22	20·5	26·4	24·5	24
Maximum height	19	18	23·2	22·2	21·5
Thickness	13·3	13·2	16·3	15	15

Distribution.—The species is fairly common in the island of Luzon, Philippines.

Corbicula elongata Clessin.

(Pl. VIII, figs. 18-20.)

1878. *Corbicula elongata*, Clessin, *Martini u. Chemn. Conch.-Cab.*, p. 186, pl. xxxii, figs. 19, 20.

Semper apparently distributed shells of this species under the manuscript name *C. complanata*, while Moellendorff later distributed shells under the manuscript name *C. quadrasi.* The species, however, was not described under either of these names and Clessin later described it under the very appropriate name of *C. elongata.* In Fulton's Catalogue [1] the species is, however, still listed as *C. quadrasi.* Clessin's description is faulty in several respects and I, therefore, redescribe the species below :—

Species of a small size, thin-shelled, elongate-ovate in outline, very compressed, of a dirty yellow to brownish colour. Upper margin not greatly arched, convex ; anterior side short, nearly straight, posterior side more elongate, somewhat arched ; rounded anteriorly and posteriorly ; posterior region drawn out into a beak, vental margin about straight in anterior two thirds, then curving upwards in the region of the beak. Umbones small, not prominent, slightly curved forwards. Surface finely striated with distinct but not very deep striae running concentrically and regularly. Hinge feebly developed, hinge teeth normal, anterior cardinals shorter than posterior, both nearly straight ; nymphs very narrow, linear, almost smooth ; ligament prominent, thick ; muscle scars not at all impressed. Nacre dirty light blue with lilac bands.

Measurements (in millimetres.)

	1	2	3	4	5
Length	25·8	15·4	14	17·8	[14
Maximum height	12	11·8	10	[13·6	[11]
Thickness	6·5	6·3	5·4	[8	[5·8

Specimens 1-3 are a series marked *C. complanata* Semper and 4-5 are labelled *C. quadrasi* Moellendorff. The latter two specimens have somewhat thicker shells and the sculpture is rather coarser, but I have no doubt that they all belong to the same species.

Distribution.—*C. elongata* was described from a specimen in the Sandberger collection from Mindanao, Philippines, and the two series before me are also from the same place.

[1] Fulton, H. C.—*A Catalogue of Pelecypoda and Brachiopoda*, p. 16 (London, 1927).