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A Trigonian Faunule from Mindoro in the Philippine Islands*

By

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With one Plate

Little is known of the pre-Tertiary stratigraphy of the Philippine islands. There is a chert-bearing formation variously called Babuyan, Mirinduque or Negrito (HASHIMOTO, 1939, 41). When SMITH found *Cenosphaera affinis* HINDE and *Dictyomitra tenuis* HINDE in the series on Panay and Balabac islands, he correlated it to the Franciscan group in California and considered it to be Jurassic, the age determination being, however, a matter of discussion (KOBAYASHI and KIMURA, 1944).

No other pre-Tertiary fossil had ever been known for a long time until VILLA discovered perisphincti and some other Molluscan remains at Mansalay in Mindoro island in 1937. Lately the existence of the Cretaceous formation was proven in the Philippines with the find of *Orbitolina* limestone in Cebu (TEVES, 1953).

On the occasion of the Eighth Pacific Science Congress at Quzon City, 1953, I had a happy opportunity to see a fossil collection of Mindoro deposited in the Bureau of Mines at Manila and to make replicas for study for the facility of which I wish to tender my sincere gratitude to Dr. Jean S. TEVES of the Bureau. My thanks are also due to Mr. J. KATTO of the Kochi University for the study of *Solemya murotoensis*, nov.

The Trigonian Faunule of the Amaga River

According to VILLA (1944) there are two ammonites-bearing formations in Mindoro. One is his Mansiol shale and mudstone

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formation exposed on the southeast coast of Mindoro between Colasi Point and Mansiol Point and yields Callovian (?) *Macrocephalites* and *Oppelia*. The other is the Mansalay formation fairly extensive in the south of Mansalay and a few other places in the same island. It is composed of conglomerate, sandstone and shale. In the black shale member there is an ammonites bank whence perisphincti and other Molluscs were collected and the Oxfordian age was suggested for the fauna by VILLA.

None of them, however, has been described except *Trigonia mindoroensis* HAYASAKA (1943) which is a member of the Mansalay fauna. As pointed out already (KOBAYASHI and MORI, 1955), it is a typical *Vaugonia*, but *Vaugonia* as a genus ranges widely through the Jurassic period. Dating of *V. mindoroensis* by its morphic resemblance with any species in a remote place is not very reliable.

Lately RIVERA (1954) gave a brief note on the fossils from Mindoro. According to her there are various ammonites indicating geological ages from upper Lias to Tithonian. Further, it is stated that "Lot No. 6 contains several specimens of *Trigonia* all of which appear to belong to one species. This *Trigonia* resembles *T. literata* YOUNG and BIRD, and according to the recent classification of *Trigonia* by COX, it will fall into the genus *Myophorella*, subgenus *Vaugonia*". Because the species in question is compared with *Trigonia literata*, it belongs probably to the subgenus *Hijitrigonia* of the genus *Vaugonia*, instead of the genus *Myophorella*, in my classification. This means that it may be different from not only *Vaugonia* (*Vaugonia*) *mindoroensis*, but also any of the below listed Trigonian species.

The collection which I have seen at Manila is neither VILLA's, nor RIVERA's but a new one which comprises three sets of fossils. Namely, one consists of Trigonians and other pelecypods contained in "*Floats on the Amaga river, Mindoro island*," another of ammonites and still another of a slate slab containing *Solemya*. Because I had carried out a study on the Trigonians in Japan, I extended my investigation into the Trigonian faunule of the Amaga river. As the result the followings were distinguished in it:

1. *Rutitrigonia yeharai* KOBAYASHI
2. *Rutitrigonia amagensis* KOBAYASHI, new species.
3. *Latitrigonia multicostata* KOBAYASHI, new species.
4. *Nipponitrigonia* (?) sp. indt.
5. *Myophorella* (*Promyophorella*) *orientalis* KOBAYASHI and TAMURA

6. *Myophorella* (*Promyophorella*) new species.
7. *Chlamys* (*Radulopecten*?) *villai* KOBAYASHI, new species.
8. *Chlamys* sp. indt.

As discussed in a recent paper of mine (1957), *Rutitrigonia* is a cosmopolitan genus in the Cretaceous period, but *R. yeharai* is a lower Neocomian species.

Myophorella or even its subgenus, *Promyophorella*, is widely ranged from upper Lias to Lower Cretaceous, but the distribution of *Myophorella* (*Promyophorella*) *orientalis* is restricted in Japan to upper Malm. More precisely, it occurs in the Jurassic of Soma, North Japan, in the Koyamada formation at the top which is considered Tithonian in age. In the southern Kitakami region it is known from the upper Kogoshio formation and the Tashiro formation the age of which is Tithonian or/and Kimmeridgian. In Japan *Promyophorella* or *Myophorella* is well represented by several species in the Middle and Upper Jurassic formations, but none is known from the Cretaceous deposits.

Latitrigonia ranges from Middle to Upper Jurassic and *L. tetoriensis* to which *L. multicostata* is allied, occurs in the Yambarazaka sandstone at the top of the Kuzuryu stage of the Tetori series in Prov. Echizen, Fukui Pref. The sandstone is judged to be upper Malm from the occurrence of *Katroliceras yokoyamai* KOBAYASHI and FUKADA (1947) in the subjacent beds. *Nipponitrigonia* occurs in Japan in the Middle (?) and Upper Jurassic and Lower and Middle Cretaceous, but not in the Upper Cretaceous rocks.

There is no other species or genus of great importance for chronology. It is, however, quite warranted by these facts that the age of the Amaga faunule is somewhere in a range from Tithonian to lower Neocomian. Because the fossils are in fluviatile boulders, it remains to be a question, whether they were derived from two or more fossiliferous horizons in the above mentioned time range, or whether there is only a passage bed from Malm to Neocomian in which the late Jurassic and early Cretaceous elements are coexistent.

In the Sakawa basin, Shikoku, Japan, *Nipponitrigonia* cfr. *kikuchiana*, *N. convexa* and *Rutitrigonia yeharai* are found together with *Pterotrigonia pocilliformis* var. in the Yamanokami sandstone which is considered the marine facies of the Wealden or lower Neocomian

Ryoseki series (KOBAYASHI, 1932). According to KIMURA's detailed survey (1956) this sandstone conformably overlies the Kambaradani shale and the latter in turn lies on the Kambaradani sandstone containing *Aulacosphinctoides* cfr. *steigeri* SHIMIZU which is a Kimmeridgian ammonites (KOBAYASHI, 1935). Therefore the Kambaradani shale is most probably Tithonian and may be correlated with the Trigonian sandstone of the Amaga, if the above fossils were derived from a fossil bed.

Finally, a few words are added here as to *Solemya* sp. It is contained in a small slab of dark gray somewhat slaty shale, as commonly seen in Japan in the so-called Shimanto and Nakamura groups i. e. the unclassified Mesozoic-Palaeogene formations in West Japan. Its lithology reveals that the slab came from a formation different from either the ammonites or the Trigonian beds. The life range of *Solemya* is from Cretaceous to Recent and its subgenus *Acharax*, to which the pelecypod in question probably belongs is a mud-lover in a few hundred fathoms to the abyssal depth. Therefore it is presumed that a float of the *Solemya* shale on the Amaga river was derived from somewhere in a Flysch type of sediments younger than the Trigonian sandstones. Assuming that the Ammonites beds are all Jurassic, it is reasonable to consider that the Trigonian sandstone of the Amaga indicates the marine regression of the Oga phase at the end of the Jurassic period. (KOBAYASHI, 1941).

Description of Fossils

Family Solemyacidae

Genus *Solemya* LAMARCK, 1818

Subgenus *Acharax* DALL, 1908

Solemya (*Acharax*) *johnsoni* DALL is the type species of the subgenus. This as well as *S.* (*A.*) *agassizi* DALL are said to have been dredged from a sea bottom, more than 1,000 fathoms deep, from fine mud or soft ooze. In Japan there are 3 living species of *Solemya* (KURODA and HABE, 1952) and *S.* (*A.*) *tibai* KURODA (1948) was collected from off the Erimo cape, southern Hokkaido at the depth less than 250 fathoms.

In the Tertiary of Japan the subgenus is represented by two

Miocene species, i. e. *S.* (*A.*) *tokunagai* YOKOYAMA (1925) and *S.* (*A.*) *yessoensis* KANEHARA (1937) where the former has a very wide distribution. From their associate shells KANEHARA noted that the great depth like an abyss is not indispensable for *Acharax* or *Solemya* to live, but it requires a fine mud or silty facies of fair depth.

In these Tertiary species periostracum is sometimes shown to be protruded ventrally into processes, but such projections are unpreserved in *Solemya angusticaudata* NAGAO (1932) and other Cretaceous species in Japan.

NAGAO's species from the upper Ikushumbetsu river has radial grooves distributed with irregular intervals, more densely in the posterior than in the median part. His Pombetsu specimen (1938) is too badly deformed to make specific identification. *S.* cfr. *angusticaudata* by NAGAO and OTATSUME (1938) is represented by an imperfect cast from Hetonai which is similar to *Solemya* (*Petrasma*) *labeosa* YOKOYAMA (1928) in size and undeveloped radial markings, although they are easily distinguishable from each other by the difference in outline.

Lately *Solemya angusticaudata* was reported by KATTO and OZAKI (1956) from two localities in Southern Shikoku. Through the courtesy of Mr. J. KATTO of the Kochi University I could examine the specimens. *S.* (*A.*) *murotoensis* nov. is established here for the specimens from the Muroto cape because KATTO turned over to me the privilege of its determination. The other was procured at Utsuno tunnel, south of Kochi city, from the upper division of the Shimanto group. (KOBAYASHI, 1957.) This is too strongly deformed to figure out its original outline, but undoubtedly it is specifically distinct from the Muroto form, because radial grooves are well marked all through the shell. They are distributed almost equidistantly in the Utsuno form, while the intervals are very irregular in breadth in *S. angusticaudata.* The Utsuno form appears closer to *S.* (*A.*) *tokunagai* than *S. angusticaudata* in the strong radial channels, but the bands and channels are more numerous and the channels are always narrower than the bands in the Utsuno form, while the channels are sometimes broader than interspaces in the anterior in *S. tokunagai.*

It is probable that the morphic difference between the Utsuno and Muroto forms corresponds to the time displacement between the Shimanto and Nakamura groups to the latter of which the

Muroto formation belongs.

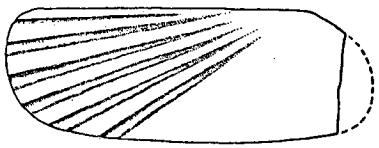
Solemya (*Acharax*?) *murotoensis* KOBAYASHI, new species

MM4397-3-17
MM4398-3-18

Plate III, Figures 17-18; Text-figure 1.

1956 *Solemya angusticaudata* by KATTO and OZAKI, non NAGAO, *Res. Rep. Kochi Univ. Vol. 5, No. 10*, p. 2, figs. 1-2.

Shell long and slightly inflated; umbo very excentric; antero-dorsal margin straight, longer than twice the height; anterior margin subvertical, gently arcuate, forming an obtuse angle with dorsal one and by increasing curvature downward, passing into ventral margin which is almost parallel to dorsal one; posterior margin gently slant from umbo; posterior outline unknown; shell length presumably three times longer than shell height; 7 channels and 8 bands radiating antero-ventrally in umbonal angle of 50 degrees; the former narrower than the latter near dorsal margin, but almost as broad as the latter on the other side; these radial sculptures strengthened from umbo to periphery; median and probably posterior part smooth or radial markings only very feebly impressed near ventral margin.



Text-fig. 1. *Solemya* (*Acharax?*) *murotoensis* KOBAYASHI, new species

This species is represented by three specimens, none of which, however, shows the posterior portion. The type left valve is 14 mm. high and its pre-umbonal margin about 32 mm. long. This can easily be distinguished from *S. angusticaudata* by its taller and parallel-sided outline and the absence of radial markings in the median part.

Locality:—Black shale of Muroto formation at Sakamoto village, Muroto-town, Aki-county, Kochi Prefecture, (Tosa Province). The age of the formation has been undetermined, but must be Cretaceous or Palaeogene, because it yields *Solemya* and it is overlain discordantly by the Miocene Shijujiyama formation.

Solemya sp. indt.

Plate III, figure 16.

The Amaga specimen is so fragmentary that the outline of the shell can hardly be restored. It is somewhat similar to *Daonella*, but can readily be distinguished from that genus by its broad soleniform shell, very excentric umbo and broad radial channels. In my opinion it is more probable to belong to *Solemya* than any other genus and if so, appears likely a member of *Acharax*, although nothing is known of its ligament.

The imperfect right valve is gently inflated and 8 channels and 8 bands are found in the antero-dorsal part. A channel is narrower than a half of a band near the dorsal margin, but the breadth becomes greater on the other side as far as it attains about a half of a band. There a narrow median ridge may be present on the bottom of the channel. The radial markings become, however, very weak in the median part. The specimen is evidently larger than any Cretaceous specimen in Japan.

Family Trigoniidae

Trigonians are rather uncommon in this part of Asia (WANNER, 1931). *Prorotrigonia seranensis* (KRUMBECK) and *Prosogyrotrigonia timorensis* KRUMBECK respectively from the Noric of Seram and the Rhaetic of Timor are two old aberrant forms.

WANDEL (1936) has described *Trigonia tenuicosta* LYCETT from the *Harpoceras* shale and *Trigonia moorei* LYCETT from the *Hammatoceras* beds in Misol. As noted already (KOBAYASHI and MORI, 1954), WANDEL's *moorei* agrees fairly well with the lectotype of LYCETT's *moorei*, both evidently belonging to *Trigonia* s. str., i. e. *Lyriodon*. *Trigonia moorei* LYCETT occurs at Geralton, Western Australia, in the Champion Bay group (Kojarena sandstone and Colalura sandstone) and proved to be Bajocian in age (ARKELL and PLAYFORD, 1954). Prior to WANDEL, SOERGEL (1913) reported *Trigonia* (s. str.) cfr. *similis* AG. to occur in Misol in the *Prodicoelites* and *Belemnopsis persulcata* bearing limestone and marl (Bathonian).

The age of the Molluscan fauna in western Borneo which comprises *Exelissa*, *Protocardia* and other shells has been a subject of

dispute. While VOGEL (1890, 1900) took it for White Jura, NEWTON (1903) considered it to be Lower Oolite. The Bathonian age of the fauna was upheld by GRABAU (1928). "In later years these fossils proved to occur also in the Lower Cretaceous so that the Jurassic age of these areas is no longer proved (Zeylmans VAN EMMICHOVEN, 1938)" (VAN BEMMELEN, 1949, p. 64).

NEWTON emphasized the Lower Oolite age of the fauna, when he described *Trigonia molengraffi*, with the statement that "Since its main characters are only to be found in forms common to the Bajocian or Bathonian strata of the Jurassic system". (NEWTON, 1903, p. 409.) It can, however, hardly be overlooked that the resemblance of *T. molengraffi* is much closer with *Myophorella* (*Haidaia*) *crenulata* than with European Clavellatae (*formosa*, *phillipsi* and *moutieriensis*). Because *orientalis* occurs in the *Lima* sandstone of the Nakanosawa formation in the Soma area, Fukushima Prefecture which is considered middle Malm (Oxfordian-Kimmeridgian), I think that the age of *molengraffi* may not be much deviated from *orientalis*.

Finally, *Trigonia limbata* D'ORBIGNY is known from the Rudistid formation (Cenomanian) of Martapoera (MARTIN, 1889) in Southeast Borneo and *Trigonia* cfr. *limbata* from the upper Seberuang (Senonian) stage in West Borneo (GEINITZ, 1883). *T. limbata* D'ORBIGNY is a Pterotrigonian occurring in Europe in various Cretaceous formations, Cenomanian and later. While the one from Martapoera is illustrated, the other is only listed.

MARTIN's Martapoera form is a Pterotrigonian having diagonal costellae on the concave area. (See Fig. 14, Taf. XVI.) These costellae are simple and less numerous and significant than those of *Acanthotrigonia moriana* (YEHARA). Some 26 costae on the disk are distinctly crenulate. The sculpture, outline and convexity of the shell show that its close affinity with *Acanthotrigonia moriana* from the Albio-Aptian Miyako series in Eastern Tosa, Shikoku.

Genus *Latitrigonia* KOBAYASHI

Latitrigonia multicostata KOBAYASHI, new species.

Plate III, figure 3.

Shell subquadrate and moderately convex; umbo small, located at about a third the shell length from front; area nearly half as

large as the disk; cardinal and median carinae obscure, but posterior area is distinguishable from anterior by its concavity; escutcheon fairly large, concave and clearly separated from area by tuberculate inner carina; costae some 12 in number, somewhat flexuous, narrower than their intervals.

This is more or less similar to *Latitrigonia tetoriensis* KOBAYASHI (1957), but can easily be distinguished by more numerous costae and other features.

Occurrence:—Float on the Amaga river, Mindoro.

Genus *Nipponitrigonia* COX

Nipponitrigonia (?) sp. indt.

MM4402 -3-12

Plate III, figure 12.

Though this is a fragmentary right valve, it appears to be a Trigonian resembling *Nipponitrigonia* (?) *sakamotoensis* (YEHARA). The disk is ornamented by flat-topped concentric costae which become obsolete in the mesio-anterior part; area of moderate size, somewhat concave and defined by a blunt marginal angulation. The umbo is possibly opisthogyl, insofar as can be judged from the curvature of the angulation.

Occurrence:—Same as the preceding.

Genus *Rutitrigonia* VAN HOEPEN

Rutitrigonia yeharai KOBAYASHI

MM4401-3-1

Plate III, figure 1.

1923 *Trigonia neumayri* YEHARA, non CHOFFAT, *Japan. Jour. Geol. Geogr. Vol. 2*, p. 82, pl. 9, figs. 1-3.
1954 *Rutitrigonia yeharai* KOBAYASHI, *Japan. Jour. Geol. Geogr. Vol. 25*, p. 74.
1957 *Rutitrigonia yeharai* KOBAYASHI, *Trans. Proc. Pal. Soc. Japan, N.S. No.* 26, p. 59, pl. 10, fig. 1.

As a detailed description of this species was given in the third paper, any repetition is here avoided. A small Trigonian from Mindoro has a moderately convex and distinctly rostrate shell with a relatively large umbo. Subconcentric costae in the anterior part are fine, somewhat flexuous and widely spaced. Compared with the typical *yeharai* in Japan, its umbo is a little larger and the costae

become obsolete already below the umbo, while they persist a little longer in the Japanese form. Otherwise this agrees with the Japanese form very nicely. Therefore the minor difference may be no more than an endemic variation.

Occurrence:—Float on the Amaga River, Mindoro. This species occurs in the Sakawa basin, Shikoku in the lower Neocomian Trigonian sandstone at Yamanokami of Nagano in association with *Nipponitrigonia convexa* and *Pterotrigonia pocilliformis* var.

Rutitrigonia amagensis KOBAYASHI, new species

Plate III, figure 2.

Shell gently convex and dilating posteally, but not so remarkably rostrate as the preceding species; its umbo smaller than that one; subconcentric costae more than 15 in number, coarser than those of the preceding species, but seemingly weak near the umbo, a little wavy and become evanescent on the posterior side. This has a blunt angulation. The costae become obsolete near the vertical through the umbo. Behind this line and especially on the area fine lines of growth are tolerably well impressed.

Occurrence:—Float on the Amaga River, Mindoro.

Genus *Myophorella* BAYLE

Subgenus *Promyophorella* KOBAYASHI and TAMURA

Myophorella (*Promyophorella*) *orientalis* KOBAYASHI and TAMURA

Plate III, figures 5–8.

1925 *Trigonia formosa* by SHIMIZU, non LYCETT, in YABE and AOKI, *Japan. Jour. Geol. Geogr. Vol. 3*, p. 31, pl. 3, figs. 3a–c.

1955 *Myophorella* (*Promyophorella*) *orientalis* KOBAYASHI and TAMURA, *Japan. Jour. Geol. Geogr. Vol. 26*, p. 98, pl. 5, figs. 6a–b.

Several imperfect specimens from the Amaga reveal different parts of this species, as can be recongnized their comparison with the nearly complete left valve from Soma in fig. 4. They have regularly tuberculate costae which are somewhat roof-shaped and widely spaced; marginal and inner carinae also tuberculate; median groove in place of the carina divides the area into a broader anterior and a narrower posterior band.

In the specimen in fig. 7 the transverse costellae are broadly spaced, but in the other in fig. 5 they are even denser and finer than those of the Japanese form.

Occurrence:—Float on the Amaga River, Mindoro. This species is widely distributed in the upper Malm in North Japan. The type locality of the species is in the Soma area of Fukushima Prefecture where it occurs in the 9th Trigonian zone in the Koyamada formation. In the Southern Kitakami Mountains it is known from the Upper Kogoshio and Tashiro formations.

Myophorella (*Promyophorella*) sp. nov.

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MM4409-3-10

Plate III, figres. 9–10.

The specimen in fig. 9 is similar to the preceding, but essentially distinct in the entirely smooth area and the lack of the marginal carina. Additional distinctions are much finer costae, neat tubercles on them and broad and flat interspaces in which respects the other specimen in fig. 10 appears to agree better with this than the preceding species. This species is evidently new to science, but the specimens are unfortunately too poor to give a name.

Occurrences:—Float on the Amaga River, Mindoro.

Subgenus *Haidaia* CRICKMAY

Myophorella (*Haidaia*) *molengraffi* (NEWTON)

Pl. III, fig. 4

Plate III, figure 4.

1903 *Trigonia molengraffi* NEWTON, *Proc. Malacol. Soc. Vol. 5*, p. 405, pl. 16, figs. 1–6.

Original diagnosis runs as follows:—

Shell small, ovately trigonal, moderately convex, and of nearly equal height and length; anterior border rounded, posterior end truncated; umbones almost mesial, obtuse, slightly recurved; area depressed, covered with closely-set transverse striations divided by a feeble distinct median furrow, marginal carina gently curving and slightly raised, the inner carina shorter, escutcheon narrow and of small dimensions; surface ornamented with concentrically excavated, step-like costae, equally spaced and elevated; intercostal area furnished with numerous perpendicular clavate ridge bearing oblique striations.

In referring this species to the Clavellatae, NEWTON made its comparison with *Trigonia formosa*, *T. phillipsi* and *T. mountieriensis*

from the Lower Oolite in Europe. It looks to me more closely related to *Myophorella* (*Haidaia*) *crenulata* KOBAYASHI and TAMURA than any of these three LYCETT's. The Japanese species occurs in the *Lima* sandstone or the 5th Trigonian zone of Soma in Fukushima Pref., North Japan. As illustrated in fig. 11 for comparison, it disagrees with this only in the more inequilateral and taller outline and more anterior position of the umbo. Striation on the vertical crenules on the costae are occasionally seen in *crenulata*, but they are transversal, instead of oblique in *molengraffi*.

This species is represented by several specimens, but all smaller than *crenulata*. The largest is said 20 mm. by 20 mm. and the smallest example 15 mm. by 15 mm.

Occurrence:—Buduk (Boedoek), West Borneo.

Family Pectinidae

Genus *Chlamys* BOLTON MS., RÖDING

Chlamys sp. indt.

Plate III, figure 15.

A right valve 22 mm. high and 20 mm. long is moderately convex and ornamented with numerous radial ribs which are often bifurcated. The ears are not well preserved, but the anterior one is seen to have a deep byssal sinuation.

Occurrence:—Float on the Amaga river, Mindoro.

Subgenus *Radulopecten* ROLLIER

Chlamys (*Radulopecton*?) *villai* KOBAYASHI, new species

Plate III, figures 13–14.

Shell a little higher than long, subequilateral, slightly inequivalve; right valve nearly flat; left one gently convex; ventral margin almost semicircular; dorsal margins of the main body nearly straight, meet at the umbo, forming an angle of 90 degrees or a little less; anterior ear of right valve one and a half as long as posterior ear, provided with a deep byssal notch; its posterior ear subrectangular; each valve bearing 8 stout round radial ribs which are more or less obsolete near umbo; their intervals mostly broader than ribs; along dorsal margins there is a broad flat area on each

side which is somewhat undulate or may be provided with a slender median rib; concentric lines insignificant.

The right valve which is the holotype is 32 mm. in height and 29 mm. in length; left valve is almost the same size, but imperfectly preserved.

This is evidently not a typical *Chlamys*, but more likely an *Aequipecten* FISCHER, because the shell is slightly inequivalve and its outline fairly broad and well rounded; ribs stout and small in number.

In accepting the opinion of STAESCHE and ARKELL that the so-called Jurassic *Aequipectens* are not ancestral to the Cainozoic *Aequipecten*, COX (1952) adopted *Radulopecten* for the group of *Aequipecten fibrosus* SOWERBY by STAESCHE (1926). It was noted by STAESCHE that the right valve has stout sculptures in the group, while they are found in the opposite valve in the group of *A. varians*. In this species the strength of the ribs is nearly the same between the two valves.

As a characteristic of *Radulopecten*, COX pointed out the presence of imbricating concentric lamellae by which the ribs take squamose aspect, like most ribs of *Chlamys*. Such concentric markings are, however, not seen in the Philippine specimens. *Radulopecten* has flourished in Europe in the Middle and Late Jurassic period. *Chlamys* (*Radulopecten*) *moondanensis* COX is described from the Tithonian of Cutch, but the Philippine form is not diagnostic of the subgenus.

Occurrence:—Same as the preceding.

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Explanation of Plate III

Figure 1. *Rutitrigonia yeharai* KOBAYASHI, ×1.5, Amaga River, Mindoro..... 359 4401

Figure 2. *Rutitrigonia amagensis* KOBAYASHI, new species, ×1.5 Amaga River, Mindoro 360 4403

Figure 3. *Latitrigonia multicostata* KOBAYASHI, new species, ×1.5 Amaga River, Mindaro 358 4400

Figure 4. *Myophorella* (*Haidaia*) *molengraffi* (NEWTON) from Buduk, (Boedoek), Western Borneo. From Text-fig. 1 in NEWTON, 1903. ×1/3 ..... 361 4404-5

Figures 5–7. *Myophorella* (*Promyophorella*) *orientalis* KOBAYASHI and TAMURA. Natural size, Amaga River, Mindoro..... 360 4405-6 4406-7

Figure 8. *Myophorella* (*Promyophorella*) *orientalis* KOBAYASHI and TAMURA. Natural size, Koyamada formation; Umasawa, Soma, Fukushima Pref. 360 4407-8

Figure 9–10. *Myophorella* (*Promyophorella*) sp. nov. Natural size, Amaga River, Mindoro 361 4408-9 4409-10

Figure 11. *Myophorella* (*Haidaia*) *crenulata* KOBAYASHI and TAMURA. Natural size, South Valley of Tomisawa, Soma, Fukushima Prefecture 362

Figure 12. *Nipponitrigonia* (?) sp. aff. *N. sakamotoensis* (YEHARA). Natural size, Amaga River, Mindoro..... 359 4402

Figures 13–14. *Chlamys* (*Radulopecten?*) *villai* KOBAYASHI, new species. Natural size, Amaga River, Mindoro 362 4411-13 4412-14

Figure 15. *Chlamys* sp. ×1.5 Amaga River, Mindoro 362 4410

Figure 16. *Solemya* sp. indet. Natural size. Amaga River, Mindoro..... 357 4399

Figures 17–18. *Solemya* (*Acharax?*) *murotoensis* KOBAYASHI, new species. Natural size. Muroto formation, Muroto-town, Kochi Pref. 356 4397-17 4398-18

All of the illustrated specimens from Mindoro are in the Bureau of Mines at Manila, Philippines. Their replicas made from dental modeling are kept in the geological Institute, University of Tokyo. The specimen in fig. 8 belongs to the collection of the same institute. The replicas of *Solenomya* (*Acharax?*) *murotoensis* are also in the institute and their original specimens stored in the Kochi University.