First record of the genus *Pleuromya* Agassiz (Bivalvia: Anmalodesmata) from the Anaipadi Formation of Trichinopoly Group, Cauvery Basin, South India

Deep Narayan Tiwari1, Kumar Jaitly1, Bindhyachal Pandey1, Jai Prakash Gautam1,* And Ashish Kumar Singh1

Abstract: This research article contains the first report of the genus *Pleuromya* Agassiz (family Pleuromyidae) from the Late Cretaceous Anaipadi Formation of Trichinopoly Group, Cauvery Basin. The present work has been represented here by the record of its three species *Pleuromya ligeriensis* (d'Orbigny, 1845), *Pleuromya servesensis* (Choffat, 1902) and *Pleuromya robustus* n. sp. from Anaipadi Formation. *Pleuromya ligeriensis* (d’Orbigny, 1845) and *Pleuromya servesensis* (Choffat, 1902) are yet not known from any of the Late Cretaceous horizons of the Indian sub-continent. However, these have been reported from the other parts of the world (Europe, Africa, Middle East and North America). Their first record from the Cauvery Basin, south India is of utmost importance in global correlation of the strata. The third one, a new species, *Pleuromya robustus* n. sp. is also recorded here in this study.

Index Terms: Bivalvia, Cauvery Basin, Late Cretaceous, Pleuromyidae, Trichinopoly Group.

I. INTRODUCTION

The Anaipadi Formation is a stratigraphically important fossiliferous litho-unit of the Ariyalur Sub-basin of the Cauvery Basin, South India (Figure 2). It represents the youngest unit of the Trichinopoly Group under the three-fold lithostratigraphic scheme of the basin (Table 1). Lithostratigraphically, the Anaipadi Formation is characterized by concretionary siltstone, mudstone and fine micaceous sandstone. This formation has conformable contacts respectively with underlying Kulkkalnattam Formation of the Trichinopoly Group and Sillakadi Formation of the Ariyalur Group. This study is based on the detailed taxonomy of bivalves collected from the exposed upper part of the 264m thick sediments of Anaipadi Formation. The collected specimens have been prepared, catalogued and reposited in the Stratigraphy and Invertebrate Palaeontology Laboratory, Department of Geology, Banaras Hindu University, Varanasi 221 005 India. Out of the 100 bivalve specimens collected under the present investigation, 40 bivalve specimens have been systematically found to belong to the genus *Pleuromya* Agassiz of the Family Pleuromyidae. This genus has been represented by its three species for the first time from the Ariyalur Sub-basin of the Cauvery Basin in particular and the Indian subcontinent in general. The systematic description of all these three species have been attempted. The systematic organization follows here the works of Bieler et al. (2010) and Carter et al. (2011). The morphological terms are used according to the glossary of Cox (1969) given in the Treatise on Invertebrate Palaeontology. All dimensions (L: shell length; H: shell height; I: inflation of shell) are measured in millimeters with help of Vernier Calipers (Figure 1). The other abbreviations used under the text are Sl. No: (Serial Number of...
the measured specimens), RV (Right valve), LV (Left valve) and BV (Both valves).

![Figure 1. Measurement of Pleuromya bivalve shell.](image)

Table 1. Lithostratigraphic framework of the Cretaceous of Cauvery Basin, south India (after Pandey et al., 2021a, b)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>FORMATION</th>
<th>MEMBER</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ariyalur</td>
<td>Kallamedu</td>
<td>Maastrichtian</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kallankurichchi</td>
<td>Santonian - Campanian</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sillakkudi</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Anaijadi</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Kalakkalnattam</td>
<td></td>
<td></td>
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<tr>
<td>Trichinopoly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uttatur</td>
<td>Karai</td>
<td>Kunnam</td>
<td>Albian-Cenomanian</td>
</tr>
<tr>
<td></td>
<td>Dalmiapuram</td>
<td>Odiyam</td>
<td>Barremian-Aptian</td>
</tr>
<tr>
<td></td>
<td>Terani</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unconformity

Crystalline Basement (Precambrian)

II. SYSTEMATIC PALEONTOLOGY

Class: Bivalvia Linnaeus, 1758
Subclass: Anomalodesmata Dall, 1889
Order: Pholadomyoida Newell, 1965
Superfamily: Pholadomyacea Gray, 1847
Family: Pleuromyidae Dall, 1900
Genus: Pleuromya Agassiz, 1842
Type species: Mya gibbosa J. de C Sowerby, 1823

Pleuromya ligeriensis (d'Orbigny, 1845)
(Pl. 1, Figs 1-5)

1862 *Pholadomya Molli* (d'Orbigny) - Coquand, ? p. 189, pl. 6, figs 6-7.
1887 *Homomya profunda* (sp. nov.) - White, p. 105, pl. 7, fig. 5.
1912 *Liopistha (Psilomya)* cf. *L. ligeriensis* (d'Orbigny) - Pervinquière, p. 292, pl. 20, fig. 22.
1937 *Homomya profunda* (d'Orbigny) - Maury, p. 77, pl. 10, fig. 13.
1958 *Liopistha ligeriensis* (d'Orbigny) - Barber, p. 29, pl. 9, fig. 7.
1997 *Pleuromya ligeriensis* (d'Orbigny) - Smettan, p. 132, pl. 7, figs 12-13.

![Figure 2. Geological map of the Ariyalur Sub-basin (modified after Sathish et al., 2017; Jaitly et al., 2021; Pandey et al., 2021b).](image)
1999 *Liopistha (Psilomya) ligeriensis* (d’Orbigny) - Seeling, p. 136, pl. 6, fig. 5.
1999 *Liopistha (Psilomya)*? cf. *alta* (d’Orbigny) - Seeling, p. 137.
2011 *Liopistha (Psilomya) ligeriensis* (d’Orbigny) - Andrade and Santos, p. 233, figs 2, 3-4
2014 *Pleuromya ligeriensis* (d’Orbigny) - Ayoub-Hanna et al., p. 128, pl. 13, fig. 1.
2015 *Pleuromya ligeriensis* (d’Orbigny) - Ayoub-Hanna et al., p. 50, figs 10 I, J.

**Material**

Five articulated specimens (BHUSM/26, BHUSM/27, BHUSM/28, BHUKN/40 and BHUANP/57).

**Horizon**

Anaipadi Formation of Trichinopoly Group, Cauvery Basin, south India.

**Locality**

West of Sardhamangalam village.

**Dimension**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Specimen no.</th>
<th>H (mm)</th>
<th>L (mm)</th>
<th>I (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BHUSM/26</td>
<td>43</td>
<td>62</td>
<td>34 (BV)</td>
</tr>
<tr>
<td>2</td>
<td>BHUSM/27</td>
<td>47</td>
<td>72</td>
<td>38 (BV)</td>
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<td>3</td>
<td>BHUSM/28</td>
<td>41</td>
<td>63</td>
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<td>4</td>
<td>BHUKN/40</td>
<td>40</td>
<td>64</td>
<td>28 (BV)</td>
</tr>
<tr>
<td>5</td>
<td>BHUANP/57</td>
<td>47</td>
<td>72</td>
<td>34 (BV)</td>
</tr>
</tbody>
</table>

**Description**

The specimens are moderate in size, transversely ovate, strongly inequilateral and well inflated. The posterior- half of the shell is much larger than anterior- half. Umbones broad, prosogyrous, bent inwardly and twisted anteriorly. Lunule is large, oval in shape and moderately deep. Escutcheon well elongated, moderately shallow and lanceolate in shape. Maximum inflation lies almost on mid-shell region from where shell is tapering posteriorly to broad rostrated end. Anterior margin short, narrowly rounded joining the gently convex ventral margin in nearly acute angle. Posterior margin broadly rounded, meeting ventral margin in obtuse curve. Postero-dorsal margin large, straight to feebly concave and antero-dorsal smaller, slightly convex. Ligament is external almost opisthodetic. Umbo is bounded on both anterior and posterior sides by obtusely rounded thick ridges. The anterior umbonal ridge is a bit more prominent, surrounding a deep anterior depression and extends up to mid-anterior region. The posterior umbonal ridge fades out before reaching mid-posterior region. All the specimens have large posterior gapes, which are longitudinal to the posterior margin. The surface is ornamented with both fine and moderately coarse commarginal ribs which are irregularly distributed and separated by interspaces of variable width.

**Remarks**

Only the two complete specimens (BHU KN/40, BHUSM/28) are almost identical to *Pleuromya ligeriensis* (d’Orbigny) especially recorded by Ayoub-Hanna et al. (2014, 2015) from the Cenomanian-Turonian of Sinai and Sergipe Basin. The three incomplete specimens (nos BHUSM/26, BHUSM/27 and BHUANP/57), which are broken along anterior, dorsal and posterior margins have been tentatively kept within *P. ligeriensis*. Specimen no BHUANP/57 is bit more tapering towards anterior and superficially resembling to *Pleuromya servesensis* Choffat (1902) reported by Ayoub-Hanna et al. (2015, p. 50, figs 10 I, J) from the same *P. ligeriensis* yielding horizon.

*Pleuromya servesensis* Choffat (1902) appears to be most closely allied species but differs from *P. ligeriensis* in having absence of lunule and more gibbose umbalonal region. Andrade and Santose (2011, p. 233, figs 2.3-4) described *Liopistha (Psilomya) ligeriensis* from Turonian of Sergipe Basin appears to belong to the genus *Pleuromya*. However, it is poorly preserved and but for its large size, smaller umbo and much inflated shell, no other character is properly visible.

This is the first record of *Pleuromya ligeriensis* (d’Orbigny) from India.

**Pleuromya robustus** n. sp.

(Pl. I, Figs 6-11)

**Etymology**

Due to robust nature of shells.

**Diagnosis**

*Pleuromya* with robust, moderately large, subquadrate shells having submesial umbo and coarse commarginal ribs.

**Material**

Three specimens (specimen no. BHU7/15- Holotype; BHU25/15 and BHU20/15- Paratypes).

**Horizon**

Anaipadi Formation of Trichinopoly Group, Cauvery Basin, south India.

**Locality**

West of Sardhamangalam village.

**Dimension**

<table>
<thead>
<tr>
<th>Sl. No</th>
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<th>H (mm)</th>
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<tr>
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<td>40 (BV)</td>
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<tr>
<td>2</td>
<td>BHUSM/20/15</td>
<td>54</td>
<td>69</td>
<td>40 (BV)</td>
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<tr>
<td>3</td>
<td>BHUSM/25/15</td>
<td>51</td>
<td>64</td>
<td>42 (BV)</td>
</tr>
</tbody>
</table>

**Description**

The present specimens are large in size, robust, subquadrate, inequilateral, equivalved and highly inflated. Umbones broad, slightly incurved and twisting anteriorly, located at one-fourth of the shell- length from the anterior end. The area of maximum inflation lies along the dorsal region of umbo making it quite gibbose. Antero- dorsal and postero - dorsal margins are of equal length but former is slightly concave while later is feebly convex. Both anterior and posterior margins are broadly

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rounded, but anterior is vertically truncated. Both margins are meeting almost straight to slightly arched ventral margin in obtuse curves. An obtusely rounded faint oblique ridge runs just anterior to umbo towards venter, but fades in the midway. The area anterior to this ridge is gradually sloping and becomes almost flat at the anterior end. Though posterior margins of all the specimens are partially damaged but it appears to have large posterior gape of almost of same height of posterior margin. The surface is primarily ornamented with coarse commarginal ribs, which are irregular in both thickness and distribution. The interspaces are wider than the thickness of commarginals, which also contain secondary commarginals ribs, which at places bunching together to give coarser appearance.

Remarks
The present three specimens especially due to typical positions of the umbones are different to all the species of *Pleuronyx* described so far in the available literatures. In all of the closely resembling species of *Pleuronyx* [e.g. *P. elongate* Roemer (1841, p. 75, pl. 10, fi g. 5); *P. servesensis* Choffat (1902, p. 132, pl. 9, figs 1-3); *P. ligierensis* d’Orbigny (1845, p. 355, pl. 363, figs 8-9], the umbones are more anteriorly placed in contrast to submesial in the present specimens. The ornamental pattern is also different in the present specimens. These specimens show some resemblance to *Homonyx solida* Cragin, 1893 describe by Scott and Cloggett (2018) from the Albian of Texas. But this Texas species is taller and having well elevated umbones. *Homonyx solida* has been tentatively assigned to *Homonyx* by Scott and Cloggett (2018). Perhaps it does not belong to the genus *Homonyx*, which has quite a different shape and may belong to the genus *Pleuronyx*. The present specimens also superficially resemble to the earlier described *Pleuronyx ligieriensis* (d’Orbgeny, 1845) somewhat in nature of anterior, posterior and ventral margins and inflation but present specimens are not so oblong and umbones are not so anteriorly placed, besides different surface ornamentation. *Pleuronyx servesensis* Choffat 1902 described by Ayoub-Hannaa et al. (2015, P. 52, figs 11 A-E) from Cenomanian-Turonian of Brazil is nearest approaching species especially in nature and position of umbones, which is as broad and situated at about one-third of total shell length like in present specimens. But *P. servesensis* is still more oblique in shape and the interspaces in between coarse commarginals lack secondary commarginal ribs.

**Pleuronyx servesensis** Choffat, 1902
(Pl. I, Figs 12-13)

*Pleuronyx servesensis* Choffat, 1902, p. 132, pl. 9, figs 1-3.

*Pleuronyx servesensis* Choffat, Ayoub-Hannaa et al., 2015, p. 52, figs 11 A-E.

**Material**
Two specimens (BHUNP/80/17, BHUNP/4/17)

**Horizon**
Anaipadi Formation of Trichinopoly Group, Cauvery Basin, south India.

**Locality**
West of Sardhamangalam village.

**Dimension**

<table>
<thead>
<tr>
<th>Sl. No</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BHUANP/80/17</td>
<td>42</td>
<td>56</td>
<td>23 (BV)</td>
</tr>
<tr>
<td>2</td>
<td>BHUANP/4/17</td>
<td>32</td>
<td>43</td>
<td>20(BV)</td>
</tr>
</tbody>
</table>

**Description**

These shells are medium in size, subquadrate in shape, inequilateral and laterally compressed. Umbones wide and quite gibbose, beaks moved laterally over each other. Umbones submesial, prosogyrous and slightly incurved dorsally. Antero-dorsal margin is slightly convex and postero-dorsal margin equally broadly rounded, both meeting slightly arched ventral margin in obtuse angles. Both the specimens are moderately inflated (may be due to pathologically compressed nature). An obtusely rounded ridge runs from anterior of umbo and fades before reach antero-ventral corner, separating a relatively more flat anterior area. The shells are gaping posteriorly. The surface is ornamented with unevenly spaced coarse commarginal ribs of irregular thickness. Broadly interspaces are widening towards ventral margin and contain finer commarginal ribs.

**Remarks**

These two specimens, though pathologically compressed but adequately resemble to *Pleuronyx servesensis* Choffat recorded by Ayoub-Hannaa et al. (2015) from Upper Cenomanian-Lower Turonian of Sergipe (Brazil). Earlier as discussed by Ayoub-Hannaa et al. (2015), this species has been assigned to *Liopistha* Meek by Barber (1958) due to resembling outline. However, *Liopistha* has characteristic radial ornamentation which is absent in *Pleuronyx*. *P. congoensis* described by Darteville and Freneix (1957, p. 208, pl. 32 figs 9, 10; pl. 33, figs 1, 2) from the Maastrichtian of Congo resembles *P. servesensis* in overall shape and proportionate size, but it has much finer concentric ornamentation than *P. servesensis*. *P. molli* Coquand (1862, p. 189, pl. 6. figs 6, 7) from Turonian of Algeria is also superficially identical to the present specimens but differs in having terminal umbones and finer ornamentation.

This is the first record of the species from India.
Three species of the family Pleuromyidae belonging to the genus Pleuromya are described here from the Late Cretaceous Anaiapdi Formation of Trichinopoly Group, Cauvery Basin, South India. Two species Pleuromya ligeriensis (d’Orbigny, 1845) and Pleuromya servesensis (Choffat, 1902) are recorded for the first time from the Cauvery Basin. The present study also records a newly erected species Pleuromya robustus n. sp. established on the basis of unique morphological characters. These pleuromyid species of Cauvery Basins have close affinity to different species of Tethyan regions in Europe, Africa, Middle East and North America.

CONCLUSION

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REFERENCES


