



MEIOCARDIA (BIVALVIA : GLOSSIDAE) FROM THE KANCHANPUR BED, DISTRICT HAILAKANDI, ASSAM

BAHARUL I. MAZUMDER¹ and RAGHAVENDRA P. TIWARI²

¹DEPARTMENT OF GEOLOGY, KARIMGANJ COLLEGE, KARIMGANJ - 788710, ASSAM

email: bimazumder@rediffmail.com

²DEPARTMENT OF GEOLOGY, MIZORAM UNIVERSITY, AIZAWL - 796009, MIZORAM

email: rptiwari84@rediffmail.com

ABSTRACT

This paper provides the systematic palaeontology of the marine veneroid bivalves belonging to the genus *Meiocardia* (family: Glossidae) from the upper part of the Bhuban Formation, Surma Group, Assam. Six species of the genus *Meiocardia* are described and figured, out of which three are new: *Meiocardia elongata*, *M. kanchanpurensis* and *M. sp.* Occurrence of *Meiocardia* only in this bed at Kanchanpur reflects selective preservation that might have resulted from unusual diagenetic conditions rather than restricted stratigraphic and geographic ranges.

Keywords: Bivalves, Glossidae, systematics, Upper Bhuban Formation, Surma Group, Kanchanpur, Assam

INTRODUCTION

Fox and Sale (1927) of Burmah Oil Company, for the first time, collected fossils from the Kanchanpur bed of Hailakandi District, Assam, India. Subsequently, Mukerjee (1928, 1929) studied this collection. Based on marine fauna, Sale (1932) and Sale and Evans (1940) assigned a lower Miocene age for the thin fossiliferous bed at Kanchanpur and stratigraphically placed it in the uppermost part of the Bhuban Formation of the Surma Group. Pascoe (1962), however, assigned Chattian (Upper Oligocene) age to the Kanchanpur fauna.

Six species of the bivalve genus *Meiocardia* (family: Glossidae) are being described in this paper, out of which three namely, *Meiocardia elongata*, *M. kanchanpurensis* and *M. sp.* are new. Lithologically, the fossil-yielding bed is sandy-mudstone with rounded, deep brown clay pebbles. The fossils are rather well preserved and embedded in soft host rock making their extraction easy. However, the shells are fragile and break easily. During cleaning, many specimens have been destroyed. As the internal characters are not observable, identification of fauna is based exclusively upon external morphological characters.

In the present collection, specimens with isolated valves have shell material, whereas the complete specimens are devoid of original shell material. This may be interpreted as an evidence of unusual diagenetic conditions. Few samples show evidence of deformation that might have resulted from compaction of the host rocks.

Keen and Casey (1969), while preparing materials for the family Glossidae, considered *Meiocardia* H. Adams and A. Adams, 1957 as a subgenus of the genus *Glossus* Poli, 1795. However, we have assigned generic status to *Meiocardia* following Noetling (1901), Habe (1951), Ozaki (1958), Kira (1963), Habe and Kosuge (1967), Davies (1971), Noda (1988), and Majima, Ikeda, Wada, and Kato (2003).

FOSSIL LOCALITY

The fossil locality H1 (Figure-1), is about 7 km WSW of Hailakandi Town in Hailakandi District of Barak Valley, Assam, along *Telgatha Nala*. It is in close vicinity of the Kanchanpur Tea Garden and lies near an old working of B. O. C., from where gas seepage has been observed. The area falls under the Survey

of India Topo Sheet no. 83D/10. The fossil-yielding bed is composed of soft sandy mudstone with rounded, deep brown clay pebbles. The associated fossils belong to gastropods, anthozoans, arthropods, foraminifers and fish teeth.

SYSTEMATIC DESCRIPTION

Phylum **Mollusca** Linné, 1758

Class **Bivalvia** Linné, 1758

Subclass **Heterodonta** Neumayr, 1884

Order **Veneroida** H. Adams & A. Adams, 1856

Superfamily **Glossacea** Gray, 1847

Family **Glossidae** Gray, 1847

Genus ***Meiocardia*** H. Adams & A. Adams, 1857

Type species: *Meiocardia moltkiana* "Spengler" (= *Chama moltkiana* Gmelin, 1791); by subsequent designation, Stoliczka, 1870. Recent; E. Indies.

Meiocardia metavulgaris Noetling
(Pl. I, figs. 5a,b)

Meiocardia metavulgaris Noetling, 1901, p. 193, pl. XII, figs. 2, 3, 3a.

Material: One right valve (No. H1/B/2).

Measurement: Length, l, 27.50mm, height, h, 21.00mm, thickness, t, 8.50mm, h/l, 76.36%, t/l, 30.91%.

Remarks: The Kanchanpur specimen resembles the holotype (GSI Type No. 7589-7590) of *Meiocardia metavulgaris* Noetling (1901) reported from the Singu Formation (Chattian) of Myanmar. It is observed that there is a close similarity between the two with respect to elongated nature of the valve; height about three-fourth of length, moderate inflation of about 30%, incurved umbo, beak placed at anterior fourth of length, arcuate anterior, truncated posterior and arched ventral margin. Besides, a strong carina runs from umbo to postero-ventral corner. Hence, the species under consideration is assigned to *Meiocardia metavulgaris* Noetling.

However, the carina in the Kanchanpur specimen is more prominent and slightly arched-up, and concentric ribs on its surface seems to be finer. Detailed comparison is, however, not possible due to its worn-out nature.

Horizon: Upper Bhuban Formation.

Meiocardia protovulgaris Noetling
(Pl. I, figs. 2; 3a,b,c & 4)

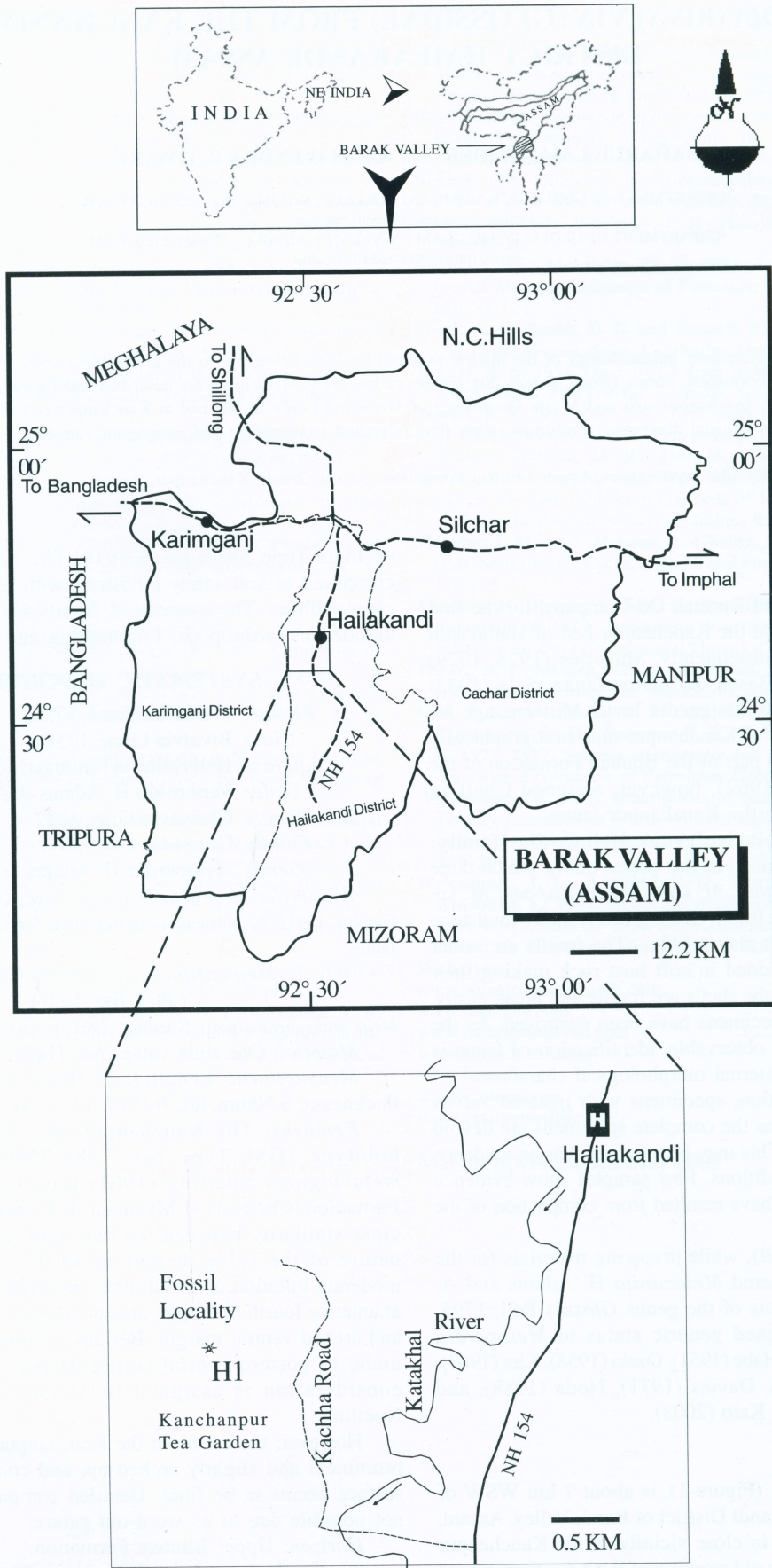


Fig. 1. Map showing the fossil locality.

Meiocardia protovulgaris Noetling, 1901, p. 191, pl. XII, figs. 1a-e.

Material: Three right valves.

Measurements in mm:

Sp. no.	length,l	height,h	thickness,t	h/l%	t/l%	valve
H1/B/3	32.00	27.50	11.50	85.94	35.94	RV
H1/B/4	25.50	21.20	9.00	83.14	35.30	RV
H1/B/9	6.80	6.00	2.20	88.24	32.35	RV

Remarks: Holotype of *Meiocardia protovulgaris* is known from a well-preserved right valve (GSI Type No. 7588), designated by Noetling (1901) from the Kama Formation (Aquitanian) of Myanmar. It measures l, 24.00; h, 21.00mm; t, 8.20mm; h/l%, 87.50; t/l%, 34.17. Sharp and elevated carina divides the valve surface into anterior and posterior areas; posterior area is smaller, slightly excavated and slopes steeply from the posterior keel. Surface covered with numerous fine concentric growth lines.

The combination of subtrapezoidal outline, dimensional ratios, sharp and elevated carina, and fine concentric growth lines distinguishes the species as *Meiocardia protovulgaris* Noetling.

Horizon: Upper Bhuban Formation.

Meiocardia aff. *tetragona* Adams & Reeve

(Pl. I, figs. 1a,b)

References of *Meiocardia tetragona* Adams & Reeve are as follows:

Meiocardia tetragona Adams & Reeve, 1850, p. 76, pl. 22, fig. 1; - Habe, 1951, p. 117, figs. 243-245; - Ozaki, 1958, pl. 10, figs. 5-7; - Kira, 1963, p. 131, pl. 52, fig. 24; - Habe and Kosuge, 1967, p. 142, pl. 53, fig. 16; - Noda, 1988, p. 75, pl. 15, fig. 9; - Majima *et al.*, 2004, p. 301, fig.3.

Material: One exfoliated left valve (No. H1/B/1).

Measurement: Length,l, 25.00mm; height,h, 18.5mm; thickness,t, 8.00mm; h/l, 74%; t/l, 34%.

Description and remarks: Valve medium sized, elongate, inequilateral and nearly tetragonal in outline. Posterior slope acutely set off by a strongly developed posterior keel running from umbo to the postero-ventral corner. Both sides of the keel are depressed, but the posterior depression is of higher intensity. Anterior margin convex and narrowly rounded, posterior margin straight and obliquely truncated, ventral margin broadly arched. Beaks enrolled, high, prosogyrous, placed at anterior-third of the valve length. Hinge line curved with narrow cardinal area. Sculpture not preserved.

Noda (1988) illustrated *Meiocardia tetragona* Adams & Reeve from the Pliocene Shinzato Formation of Japan to which the present form compares well in shape, position of umbo and valve margins. However, the lack of surface ornamentation in the Kanchanpur form allows to describe it as *Meiocardia* aff. *tetragona* Adams & Reeve.

The species also resembles *Meiocardia metavulgaris* reported by Noetling (1901) from the Upper Oligocene Singu Formation of Myanmar, but the Noetling's form has slightly more excavated posterior area.

Horizon: Upper Bhuban Formation.

Meiocardia elongata n. sp.

(Pl. I, figs. 6a,b,c)

Material: One complete specimen (No. H1/B/7); surface sculpture not preserved.

Derivation of name: The trivial name is derived from the extremely elongate outline of the form.

Measurement: Length,l, 26.50mm; height,h, 16.00mm; thickness, t, 14.80mm; h/l, 60.38%; t/l, 55.85%.

Diagnosis: Shell medium in size, transversely elongate and

tetragonal in outline, height about two-fifth of length, low inflation and with terminal umbo.

Description: Shell medium, transversely elongate and tetragonal in outline, strongly inequilateral and inequivalved. Left valve is slightly smaller than the right valve. Maximum inflation of the valve is along the carina and about mid-height of the shell. Beaks terminal, incurved and prosogyrous. Anterior margin small, narrowly rounded, posterior one long and truncated, ventral margin is almost horizontal. Posterior slope acutely set off by a strongly developed posterior keel running from umbo to the postero-ventral corner. The keel makes an angle of about forty-five degrees with the ventral margin. Posterior area depressed and much excavated inside. Surface sculpture cannot be ascertained due to worn-out nature of the shell.

Internal characters unobservable.

Remarks: The species is certainly a new one for its elongate nature, low inflation and terminal umbo. However, due to tetragonal shape of the shell it seems to match with *Meiocardia tetragona* Adams & Reeve, reported by Noda (1988) from Pliocene of Japan, but the latter form is taller than the former and its umbo is not terminal; rather, it is placed at anterior-third of shell length. No other comparable form is known for further comparison. So, the present specimen has been given a new name based on its distinct morphological attributes.

Horizon: Upper Bhuban Formation.

Meiocardia kanchanpurensis n. sp.

(Pl. I, figs. 8a,b,c; 9a,b & 10)

Material: One exfoliated specimen along with its counter part and a right valve.

Derivation of name: Based on the occurrence of the taxon in Kanchanpur Tea Garden (study area) of Hailakandi District, Assam.

Measurements in mm:

Sp. no.	length,l	height,h	thickness,t	h/l%	t/l%	valve
H1/B/5 _{holotype}	22.00	20.00	19.00	90.90	86.36	BV
H1/B/6 _{paratype}	c.24.00	22.00	10.00	91.67	41.67	RV

Diagnosis: Shell medium sized, tall and inflated. Surface with angular commarginal ridges, finer in the posterior area.

Description: Shell medium in size, heart shaped, tall, inflated, subtrigonal in outline, inequilateral and inequivalved. Left valve is slightly smaller and more inflated than the right valve, maximum inflation is below the umbo at three-fourths of height. Beaks enrolled, high, sharp, prosogyrous and placed about anterior-sixth of length. Anterior margin narrowly rounded, sloping steeply downwards and joins the broadly arched ventral margin. The posterior is beaked and the ventral margin slightly sinuate near the posterior keel. The posterior margin is truncated. Posterior area concave, defined by a sharp keel running from umbo to the posteroventral corner, anterior section is convex. Both the specimens under consideration do not show their surface sculpture, but the counterpart of holotype points to the presence of sharp commarginal ridges, which are finer on the posterior slopes.

Internal characters not known.

Remarks: The species resembles *Isocardia (Meiocardia) moltkiana* Spengler, reported by Abrard (1946-1947) from Neogene of Paris, but from the illustration it can be noted that the Paris form is not so high and the commarginals on its surface are of high intensity than in the Indian form.

The species also shows resemblance with *Meiocardia*

protovulgaris reported by Noetling (1901) from the Kama Formation (Aquitanian) of Myanmar. However, Noetling's form is not as tall as the present one, inflation also is on the lower side and concentric growth lines on its surface are finer than in the Indian form.

Meiocardia pacifica Ozaki (1958) from the Pliocene Naari Formation of Chiba Prefecture seems to match with the present species in its tall stature, but the former differs from the latter in having fine concentric growth lines, and possessing a secondary ridge on the posterior depressed part which is lacking in the Indian example.

Horizon: Upper Bhuban Formation.

Meiocardia sp.
(Pl. I, fig. 7)

Material: One left valve (No. H1/B/10).

Measurement: Length, l, c21.00mm; height, h, 22.80mm; thickness, t, 8.00mm; h/l, 108.63%; t/l, 38.10%.

Description and remarks: Shell medium sized, suborbicular in outline, inequilateral and moderately inflated. Maximum inflation of the valve is on the mid-height of the shell. Beak incurved and prosogyrous, placed at anterior third of the umbo. Anterior margin not preserved, posterior one truncated, ventral margin is rounded. Posterior slope acutely set off by a strongly developed posterior keel running from umbo to the postero-ventral corner. Posterior area depressed and much excavated inside. Surface sculpture cannot be ascertained due to worn-out nature of the shell; however, the posterior flank of the valve shows some close concentric threads.

This species has not been assigned a new name for want of sufficient material.

Horizon: Upper Bhuban Formation.

REPOSITORY

All the illustrated specimens are housed in the Geology Department of Karimganj College, Karimganj - 788710, Assam, India.

DISCUSSION

Meiocardia is a member of the cold-seep assemblage (Majima *et al.*, 2003). The earlier records of the genus from the Indian Subcontinent are from the Singu and Kama formations

of Myanmar by Noetling (1901) and Pascoe (1962, 1973). Detailed studies of Miocene molluscan fauna by Tiwari (1992) and Mazumder (2004) from Mizoram and Mukerjee (1939) and Lyngdoh *et al.* (1999) from the Garo Hills of Meghalaya have however, not yielded even a single specimen of *Meiocardia*. The occurrence of *Meiocardia* in the Kanchanpur bed only reflects selective preservation that might have resulted from unusual diagenetic conditions rather than restricted stratigraphic and geographic ranges. This report of *Meiocardia* from the Kanchanpur bed of Barak Valley, Assam may be helpful in ascertaining the palaeogeography of the Miocene sea in this area.

ACKNOWLEDGEMENTS

Financial assistance to BIM from UGC-NER, Guwahati (F.5-45/2000-01, Dated: 13.3.2001) is thankfully acknowledged.

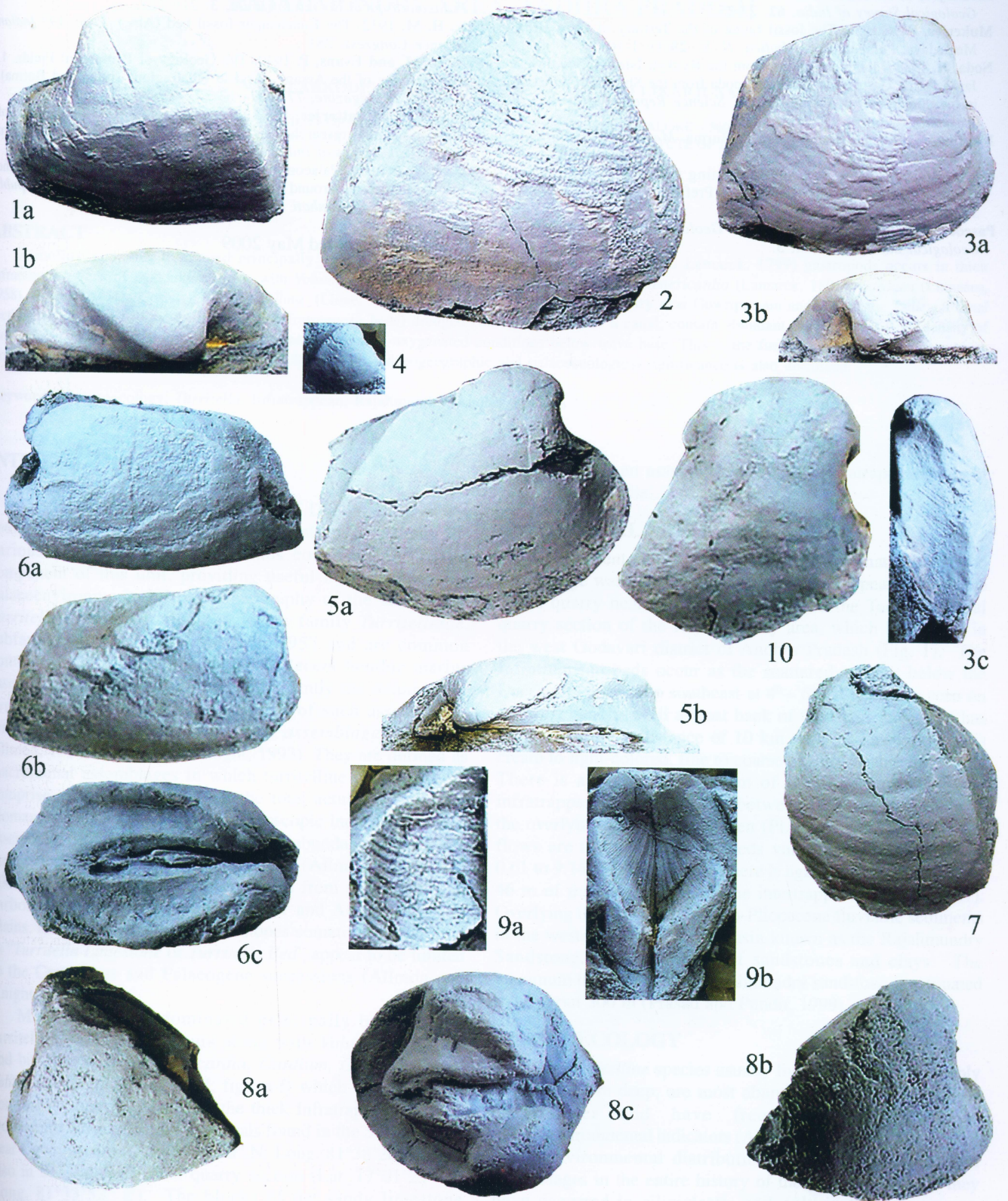
REFERENCES

- Abrard, R. 1946-47. Fossiles Néogènes Et Quaternaires Des Nouvelles - Hébrides. *Annales de Paléontologie*, XXXII.
- Das Gupta, S. 1982. Synthesis and review of the faunal records from the Surma Basin. *Record Geological Survey of India*, 112(IV): 31-38.
- Davies, A. M. 1971. *Tertiary Faunas. I - The composition of the Tertiary Faunas* (Revised by F. E. Eames and R. J. G. Savage). George Allen & Unwin Ltd., London.
- Eames, F. E. 1950. 'The Pegu System of central Burma', *Record Geological Survey of India*, 81(2): 377-388.
- Ganguly, S. 1983. Geology and Hydrocarbon prospects of Tripura - Cachar - Mizoram region. *Journal Petroleum Asia*, 6(IV): 105-109.
- Habe, T. 1951. *Genera of Japanese shells, Pelecypoda*, 1-3.
- Habe, T. and Kosuge, S. 1967. *Shells of the world in colour*, 2.
- Keen, M. and Casey, R. 1969. Superfamily Glossacea, p. N657-N664. In: *Treatise on Invertebrate Paleontology*, (Eds. Moore, R.C. *et al.*), Pt N. 2 (of 3), Mollusca, Bivalvia. Lawrence, Geol. Soc. America & University of Kansas Press.
- Krishnan, M. S. 1968. *Geology of India and Burma*. 2nd ed., Higginbothams (P) Limited.
- Lyngdoh, B. C., Tiwari, R. P. and Kachhara, R. P. 1999. Miocene Molluscan Biostratigraphy of the Garo Hills, Meghalaya, India. *Journal of the Palaeontological Society of India*, 44: 55-67.
- Majima, R., Ikeda, K., Wada, H., and Kato, K. 2003. An outer-shelf cold-seep assemblage in forearc basin fill, Pliocene Takanabe Formation, Kyushu Island, Japan. *Paleontological Research*, 7(4): 297-311.
- Mazumder, B. I. 2004. A study of Miocene invertebrates from the area around Kolasib, Mizoram. *Unpublished Ph. D. Thesis of*

EXPLANATION OF PLATE I

(All figs x 2)

- 1 a) *Meiocardia* aff. *tetragona* Adams & Reeve, sp. no. H1/B/1, exterior of left valve.
b) *Meiocardia* aff. *tetragona* Adams & Reeve, same specimen, dorsal view.
2. *Meiocardia protovulgaris* Noetling, sp. no. H1/B/3, exterior of right valve.
- 3 a) *Meiocardia protovulgaris* Noetling, sp. no. H1/B/4, exterior of right valve.
b) *Meiocardia protovulgaris* Noetling, same specimen, dorsal view.
c) *Meiocardia protovulgaris* Noetling, same specimen, posterior slope showing ornamentation.
4. *Meiocardia protovulgaris* Noetling, sp. no. H1/B/9, exterior of right valve.
- 5 a) *Meiocardia metavulgaris* Noetling, sp. no. H1/B/2, exterior of right valve.
b) *Meiocardia metavulgaris* Noetling, same specimen, dorsal view.
- 6 a) *Meiocardia elongata* n. sp., holotype, sp. no. H1/B/7, exterior of left valve.
b) *Meiocardia elongata* n. sp., holotype, same specimen, exterior of right valve.
c) *Meiocardia elongata* n. sp., holotype, same specimen, dorsal view.
7. *Meiocardia* sp., sp. no. H1/B/10, exterior of left valve.
- 8 a) *Meiocardia kanchanpurensis* n. sp., holotype, sp. no. H1/B/5, exterior of left valve.
b) *Meiocardia kanchanpurensis* n. sp., holotype, same specimen, exterior of right valve.
c) *Meiocardia kanchanpurensis* n. sp., holotype, same specimen, dorsal view.
- 9 a) *Meiocardia kanchanpurensis* n. sp., sp. no. H1/B/8, external mould of right valve of holotype showing ornamentation.
b) *Meiocardia kanchanpurensis* n. sp., same specimen, external mould of posterior slopes of holotype showing ornamentation.
10. *Meiocardia kanchanpurensis* n. sp., paratype, sp. no. H1/B/6, exterior of right valve.



- Nagaland University*, Kohima.
- Mukerjee, P. N.** 1928. General Report for the year 1928. *Record Geological Survey of India*, **61**: 20.
- Mukerjee, P. N.** 1929. General Report for the year 1929. *Record Geological Survey of India*, **62**: 23-25.
- Mukerjee, P. N.** 1939. The fossil fauna of the Tertiary of Garo Hills, Meghalaya. *Palaeontologia Indica, N. S.*, **28**(1): 1-101.
- Noda, H.** 1988. Molluscan fossils from the Ryukyu Islands, Southwest Japan Part 2. Gastropoda and Pelecypoda from the Shinzato Formation in the middle part of Okinawa-jima. *Science Reports, University of Tsukuba*, Section B, **9**: 29-85.
- Noetling, F.** 1901. Miocene fauna of Burma. *Memoir Palaeontologia Indica*, **1**(3): 1-378.
- Ozaki, H.** 1958. Some new and interesting molluscs from Miocene Nobori Formation in the eastern Koti Prefecture. *Bulletin National Scientific Museum*, **3**(1): 1-6.
- Pascoe, E. H.** 1962. *A Manual of the Geology of India and Burma. Geological Survey of India*, **3**.
- Pascoe, E. H.** 1973. *A Manual of the Geology of India and Burma. Geological Survey of India*, (3rd ed.), **3**.
- Sahni, M. R. and Sastry, M. V. A.** 1958. Lower Miocene (Gaj) fauna from Travancore - Cochin, South India. *Journal of the Palaeontological Society of India*, **3**: 219-223.
- Sale, H. M.** 1932. The Kanchanpur fossil bed (Abs.). *Proc. 19th Indian Science Congress*, 381.
- Sale, H. M. and Evans, P.** 1940. The Geology of British Oil Fields. 1. The Geology of the Assam - Arakan Oil Regions (India and Burma). *Geological Magazine*, **77**: 337-363.
- Sinha, N. K., Chatterjee, B. P. and Satsangi, P. P.** 1982. Status of Palaeontological researches in the north-east states of India. *Record Geological Survey of India*, **112**(IV): 66-88.
- Tiwari, R. P.** 1992. Palaeontological and biostratigraphic studies of the Surma Group rocks around Aizawl and Lunglei, Mizoram, India. *Unpubl. Ph. D. Thesis of Gauhati University*, Gowahati

Manuscript Accepted May 2009