



## CHAPTER V

### PALAEOECOLOGICAL STUDIES OF BIVALVE ASSEMBLAGES

Bivalve fossils had been reported from the Sao Khua Formation of the Phu Wiang area by Meesook and Wongprayoon (1999), and Jearanaiwong (2000) Wongprayoon and Meesook (2002). However, these former works had done only identification and description of fossils.

In this study, the detailed study on the palaeoecology of fossil assemblages is based on Hanley and Flores (1987) and Sato (1991). Seven assemblages of five bivalve fossils localities were described in many features, such as articulation, orientation, diversity, species composition, size sorting, and population structures.

These seven assemblages are PW-M-1/1, PW-M-1/2, PW-M-1/3, PW-M-2, PW-M-3, PW-M-4, and PW-M-5. The block sampling method was tried to collect the block sample of PW-M-1/3 for paleoecological analysis. Other assemblages were analyzed in outcrops both on bedding surface and in cross-section, and collected the specimens from rolling stones.

#### 5.1 Palaeontological studies

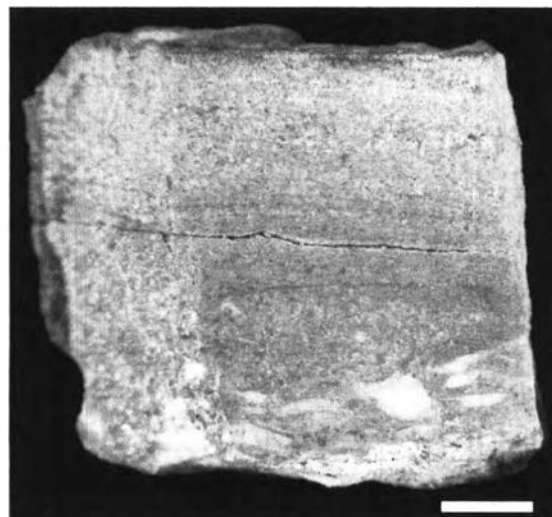
##### 5.1.1 Phu Wiang molluscan locality 1-Bed 1 (PW-M-1/1)

**Occurrence:** This shell bed is exposed near the trail from Dinosaur Site 3 to the view point at Phu Pratu Tee Ma. It is a thin layer of shell fragments in the lower part of 15-25 cm. thick of medium-grained sandstone bed (Figure 5.1). This bed intercalated in the thick cross-bedded sandstone (Figure 3.3, 3.5). The shells and fragments were preserved as recrystallized shells, the rather complete shells exposed on bedding surface can be preliminarily identified as Unionids bivalves (Figure 5.2)

**Articulation:** Almost of rather complete shells are disarticulated valves.

**Orientation:** fossils and their fragments show no-preferred orientation.

**Variation:** The rather complete shells are rare, which the available shells are only of Unionids bivalves.



**Figure 5.1** Vertical section slab of Phu Wiang molluscan locality 1 Bed 1 (PW-M-1/1) show thin layer of shell fragment. (Scale bar = 10 mm.)



**Figure 5.2** Unionids bivalves on bedding surface of PW-M-1/1, show no preferred orientation.

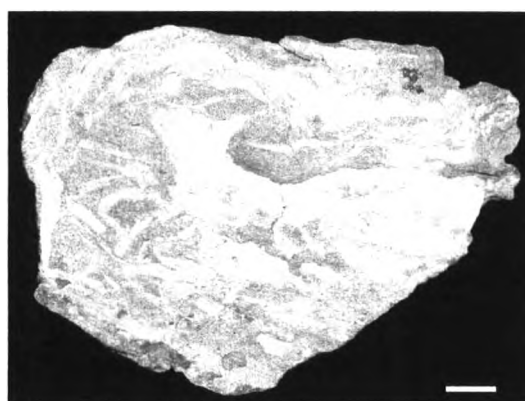
### 5.1.2 Phu Wiang molluscan locality 1-Bed 2 (PW-M-1/2)

**Occurrence:** This shell bed is about 90 cm thick, it is exposed near the trail from Dinosaur Site 3 to view point at Phu Pratu Tee Ma in the central part of the alternation of mudstone, very fine-grained sandstone, and caliche (Figure 3.3, 3.6). The shell fossils were preserved as recrystallized shell, but they are very fragile to break off and the internal moulds were left behind.

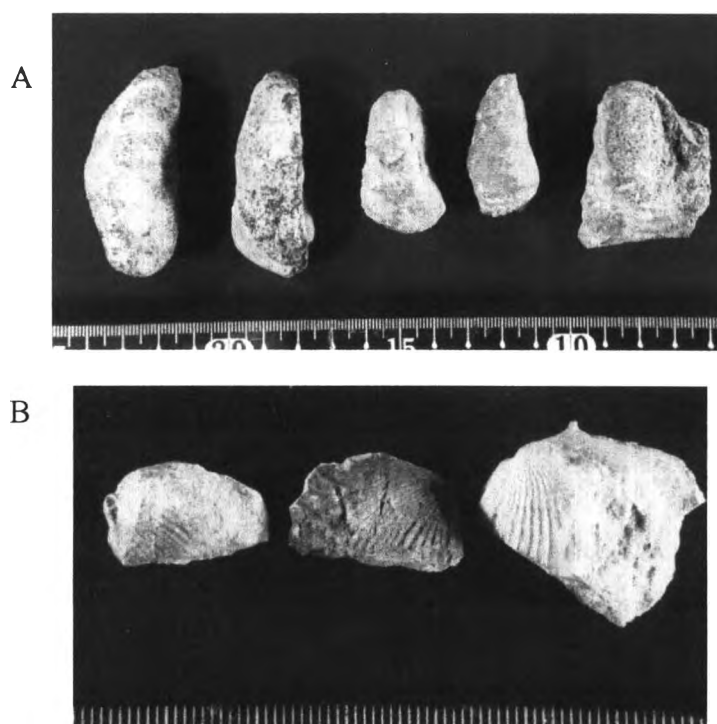
**Articulation:** Most of the shell and internal moulds are mix of articulated valves and disarticulated valves.

**Orientation:** Shell fossils show no preferred orientation. (Figure 5.3)

**Variation:** After the process of fossils preparation, the internal moulds of articulated valves are remained. These internal moulds show only the shell outline and internal morphology of shells, which can be roughly classified into at least 2 morphospecies. (Figure 5.4)



**Figure 5.3** Vertical section slab of Phu Wiang molluscan locality 1 Bed 2 (PW-M-1/2) show densely packed of bivalve. (Scale bar = 10 mm.)



**Figure 5.4** The internal mould of bivalve fossil of PW-M-1/2; A. *Mytilinae gen. et sp. indet.*; B. *incertae cedis.* (7)

### 5.1.3 Phu Wiang molluscan locality 1-Bed 3 (PW-M-1/3)

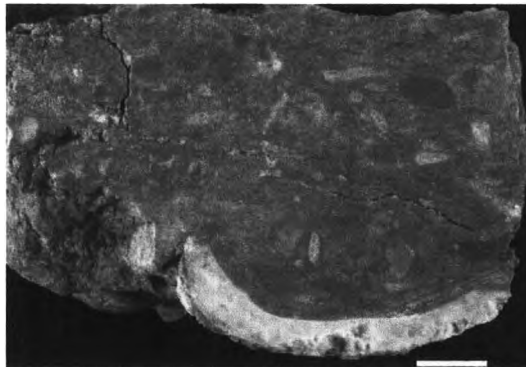
**Occurrences:** This shell bed is about 10-20 cm thick; it is exposed near the trail from Dinosaur Site 3 to the view point above the 400 cm thick of alternation of mudstone, very fine-grained sandstone, and the chalice layer near this shell bed (Figure 3.3, 3.7). The shell fossils were preserved as recrystallized shell in mud-nodule conglomerate bed, which contain the bioturbation in upper part. (Figure 3.8, 3.9, 5.6)

**Articulation:** The vertical section of this shell bed exposed about 56.3 m long, it was examined by tracing on the translucent plastic in front of the outcrop; this shell bed contains about 99% of disarticulated valves. (Table 5.1)

**Orientation:** This shell bed was examined in both bedding surface and in cross-section. On the bedding surface, six convex-up trigonal shells were measured the direction of umbo, and show as the rose diagram in Figure 5.7. The vertical section shows no preferred orientation. (Figure 5.8 and Table 5.1)

**Variation:** The diversity of this shell bed was examined by block sampling method, which one block of 25x25x20 cm. was cut, broken, and counted the numbers of individuals in each morphospecies. The total species is nine; the most abundant species was recognized as the characteristic species is Unionids *gen. et sp. indet.* (Figure 5.9 and 5.10)

**Size sorting and population structure:** The most abundant species were examined the size frequency distribution by measured shell height, which the result show high mortality in young shells and gradually decreased in older stage. (Figure 5.10)



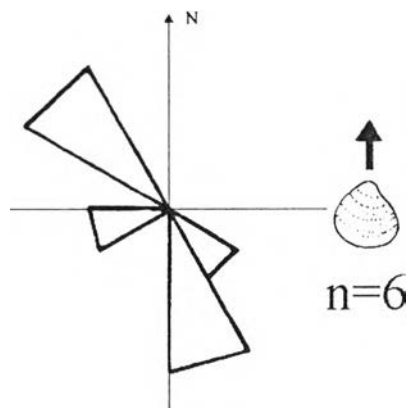
**Figure 5.5** Vertical section slab of Phu Wiang molluscan locality 1 Bed 3 (PW-M-1/3) show scattered of bivalve. (Scale bar = 10 mm.)



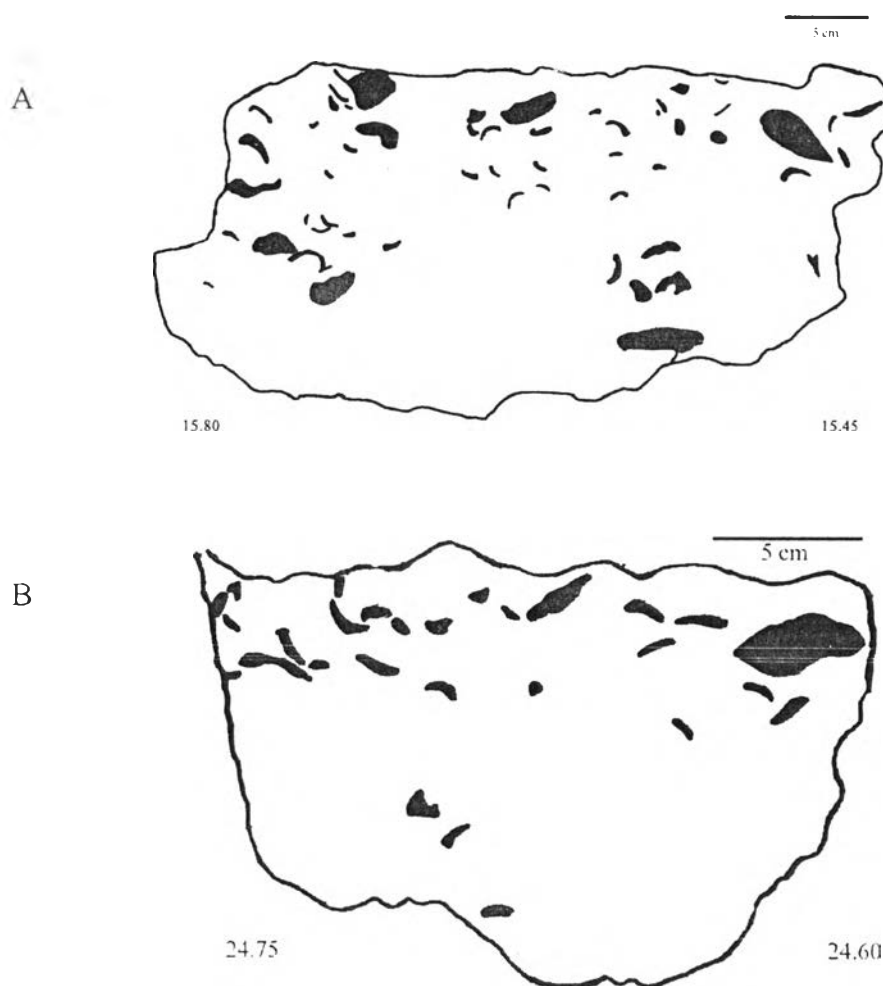
**Figure 5.6** Vertical burrow in laminated muddy fine-grained sandstone overlay on shell bed PW-M-1/3

**Table 5.1** The occurrence of shell orientation in vertical section of PW-M-1/3

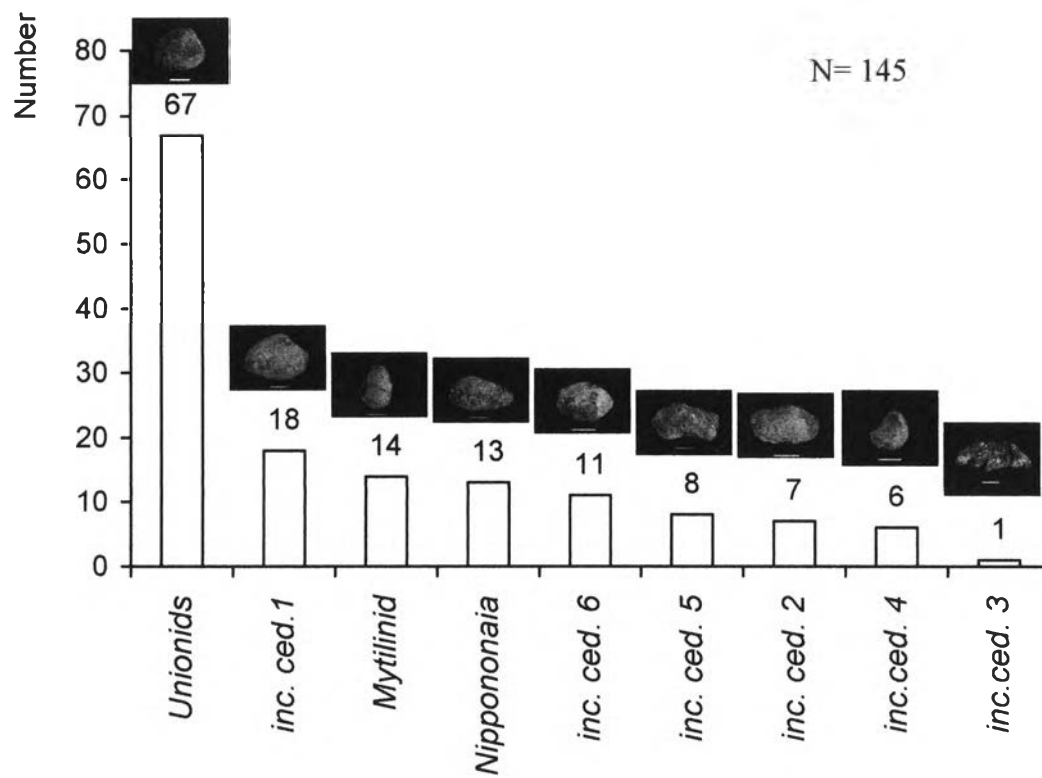
Block number	Location in outcrop (meters x to meters y)	Occurrences					total
		Disarticulated shells				Articulated shells	
		Convex-up	Concave-up	oblique	parpendicular		
1	8.00-8.20	-	-	2	-	-	2
2	8.75-8.95	9	2	1	-	1	13
3	9.30-9.55	9	9	5	-	-	23
4	9.65-9.80	2	2	4	-	-	8
5	10.05-10.25	-	-	-	-	-	0
6	11.25-11.45	1	2	7	3	-	13
7	11.48-11.65	1	1	3	-	-	5
8	12.35-12.50	4	3	11	6	1	25
9	12.65-12.90	3	5	7	-	-	15
10	13.00-13.20	2	2	4	4	-	12
11	13.25-13.37	1	-	2	-	-	3
12	13.65-13.90	1	3	18	-	-	22
13	14.35-14.65	5	5	13	2	-	25
14	14.85-15.05	1	1	9	-	-	11
15	15.45-15.80	6	5	39	4	2	56
16	16.20-16.55	3	5	7	5	-	20
17	16.75-17.00	1	1	21	1	-	24
18	17.60-17.80	3	2	13	3	-	21
19	18.30-18.52	7	3	9	-	-	19
20	18.53-18.65	-	1	1	1	-	3
21	18.70-18.90	4	-	11	-	-	15
22	24.00-24.25	4	5	13	-	-	22
23	24.60-24.75	5	2	20	1	-	28
24	56.20-56.30	-	3	5	-	-	8
Total		72 (18.32%)	62 (15.78%)	225 (57.25%)	30 (7.63%)	4 (1.02%)	393 (100%)
Total		389 (98.98%)					



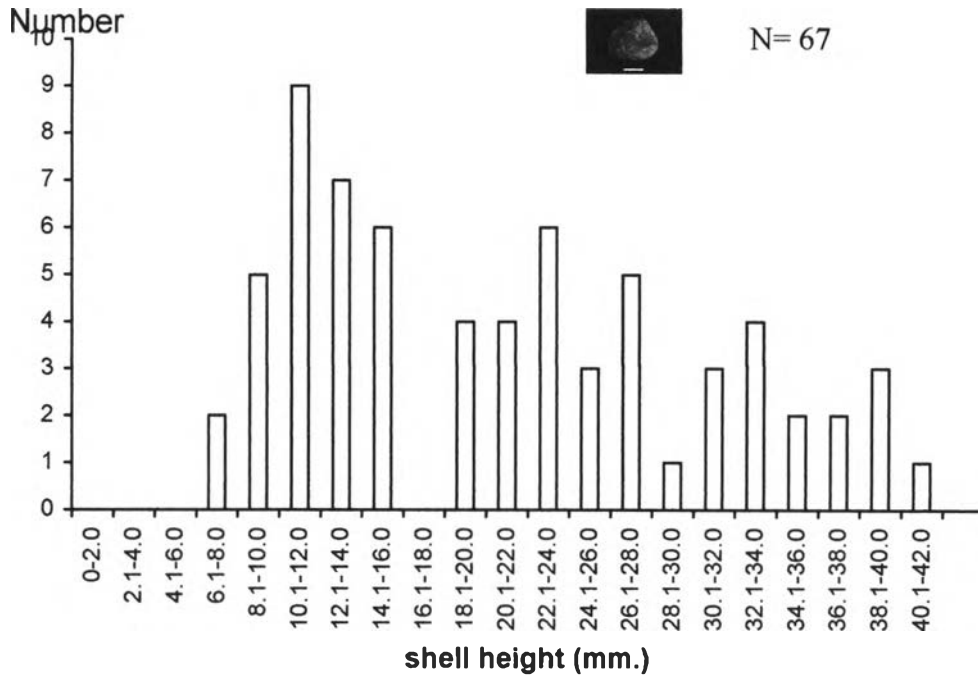
**Figure 5.7** Rose diagram of bivalve shell orientation on bedding surface of shell bed PW-M-1/3



**Figure 5.8** The occurrences of shell orientation in vertical section of PW-M-1/3 A. Block number 15 (between meters 15.45 and 15.80) B. Block number 23 (between meters 24.60 and 24.75)



**Figure 5.9** Bivalve species composition of PW-M-1/3 (Scale bar = 10 mm)



**Figure 5.10** Size frequency distribution of Unionids *gen. et sp. indet.*



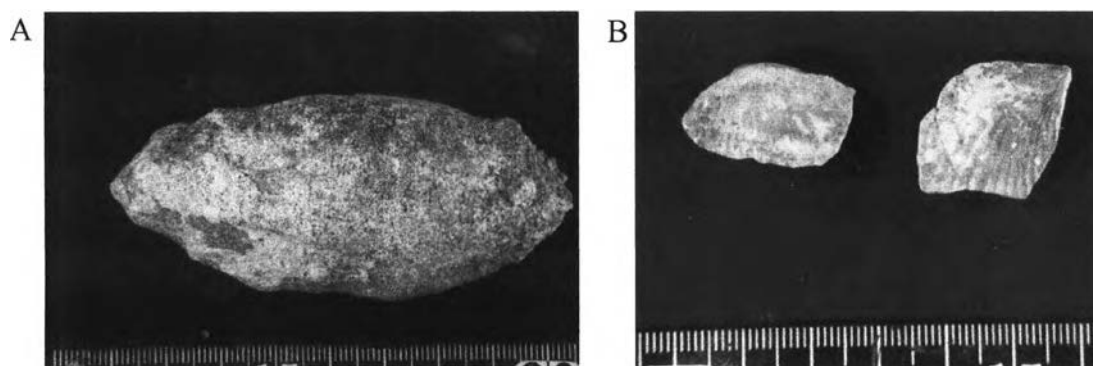
#### 5.1.4 Phu Wiang molluscan locality 2 (PW-M-2)

**Occurrences:** This shell bed is the thickest of shell bed in present study; it is exposed near the top of Phu Pratu Tee Ma about 200 cm. thick, and overlain lime-nodule conglomerate bed, medium-grained sandstone, and dinosaur site 2 bed in the alternation of laminated muddy fine-grained sandstone and fine-grained sandstone (Figure 3.10, 3.12). The shell fossils were preserved as recrystallized shells, which this recrystallized calcite is very fragile to break off and the internal moulds were leaved behind, this characteristic, is similar to PW-M-1/2

**Articulation:** Most of the shells and internal mould are articulated valves.

**Orientation:** Shell fossils show no preferred orientation.

**Variation:** The internal mould of bivalve fossils found in this shell bed can be roughly classified into 2 morphospecies (Figure 5.11)



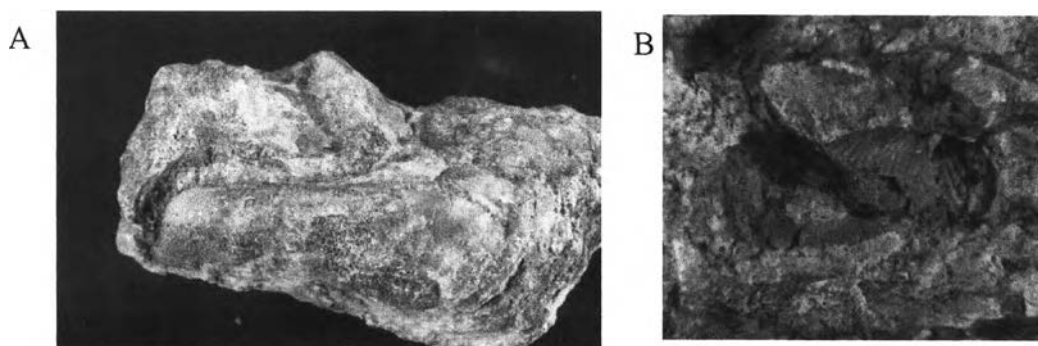
**Figure 5.11** The internal mould of bivalve fossil of PW-M-2; A. *Mytilinae gen. et sp. indet.*; B. *incertae cedis.* (7)

### 5.1.5 Phu Wiang molluscan locality 3 (PW-M-3)

**Occurrence:** This shell bed is exposed at the foot of Phu Pratu Tee Ma, near the left side of the road cut to Dinosaur Site 2. This bed is about 50 cm. thick, overlain laminated muddy medium-grained sandstone and alternation of mudstone and sandstone respectively (Figure 3.13). The lithology and preservation of this shell bed is similar to PW-M1/2 and PW-M-2.

**Orientation:** Shell fossils show no preferred orientation.

**Variation:** The internal mould of bivalve fossils found in this shell bed can be roughly identified into 2 morphospecies (Figure 5.12)



**Figure 5.12** The internal moulds of bivalve fossil of PW-M-3.; *Mytilinae gen. et sp. indet.*; B. *incertae cedis.* (7)

### 5.1.6 Phu Wiang molluscan locality 4 (PW-M-4)

**Occurrence:** This shell bed is the weathering out mudstone bed in the alternation of mudstone and very fine-grained sandstone. This shell bed overlays thin layer of caliche and dinosaur site 9 beds in very red sandstone (Figure 3.16, 3.18) which contain abundant of burrows. This internal mould of articulated valves with remains of parts of shell (Figure 5.13) was found as the debris fell from the weathering out of the upper bed.

**Articulation:** In the present study, no evidence of bivalve fossils in the outcrop, therefore their orientation can not be examined.

**Variation:** Only one species of bivalve fossils were found in this locality, the fossils as the internal mould of elongate and slender which was identified as *Unio* sp. by the former researchers.



**Figure 5.13** The internal mould of articulated valve of *Unio* sp. cf. *U. samplanoides*, shell remain on the central part of left valve of internal mould.



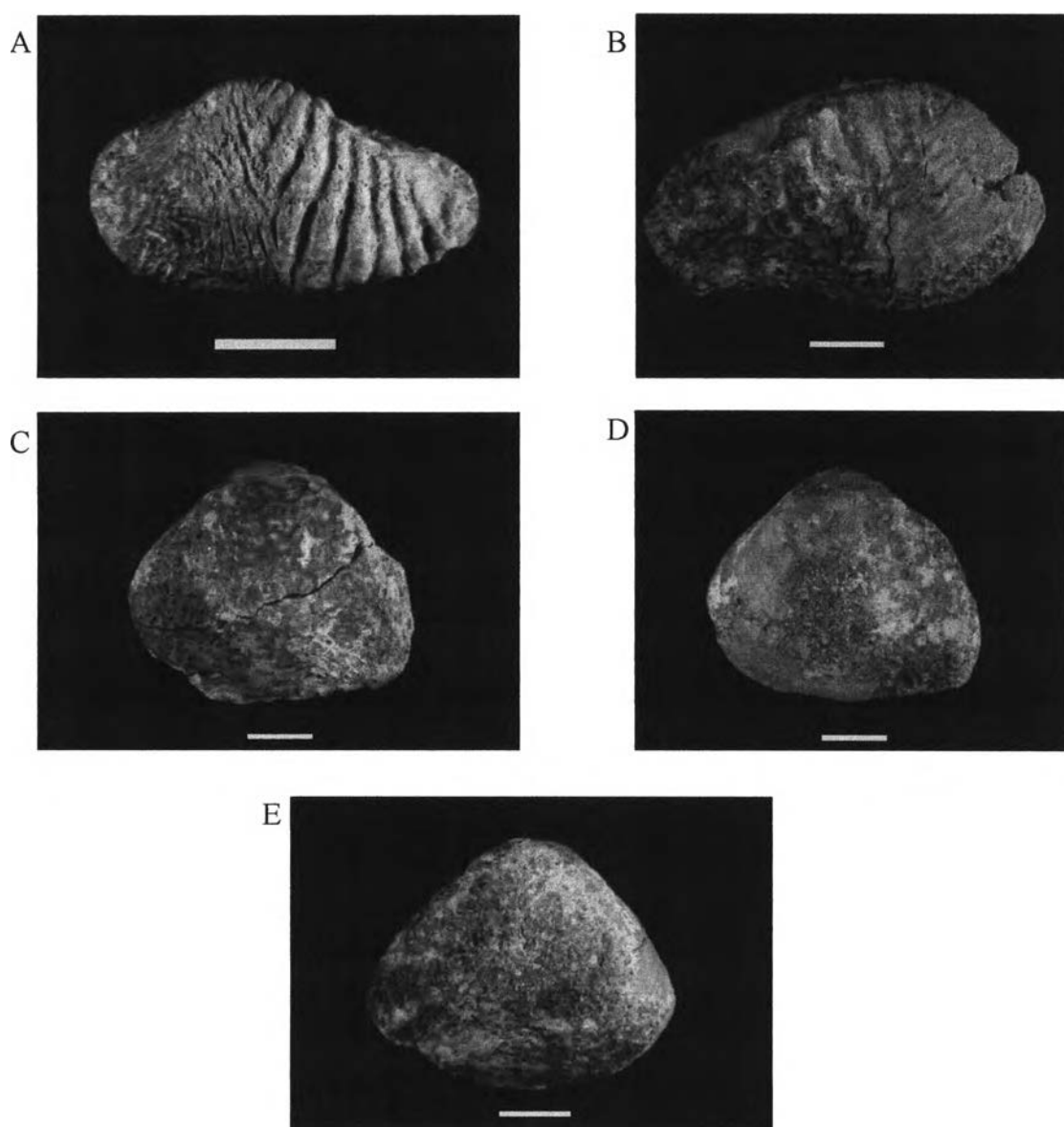
**Figure 5.14** The vertical section slab show the vertical and horizontal burrows in red sandstone bed of Dinosaur Site 9.

### 5.1.7 Phu Wiang molluscan locality 5 (PW-M-5)

**Occurrence:** This shell bed is exposed at the southern foot of Phu Noi hillock near to the dinosaur site 7 in the northern of same hillock. This shell bed is about 10 cm. thick of weathering mud-nodule conglomeratic sandstone. (Figure 3.19, 3.20, 3.21, and 3.22) the shell fossils were preserved as recrystalized shell.

**Articulation:** This shell bed is in situ weathering, which can not be examined shell orientation.

**Variation:** This shell bed was examined by collection the bivalve fossils, which leave out from the weathering conglomeratic sandstone bed. The total species is five, and the most abundant species was recognized as the characteristic species is Unionidae *gen. et sp. indet.* (4).



**Figure 5.15** Shell of bivalve fossils of PW-M-5.; A. *Nippononaia mekongensis* Kobayashi, 1963; B. Unionidae *gen. et sp. indet.* (1); C. Unionidae *gen. et sp. indet.* (2); D. Unionidae *gen. et sp. indet.* (3); E. Unionidae *gen. et sp. indet.* (4).