

CHAPTER 5

CONCLUSION

The Thung Yai-Khlong Thom area is located in peninsular Thailand covering approximately 1,160 square kilometres. The topography of the area is generally high mountainous and undulating landforms, the maximum elevation is approximately 754 metres above the mean sea level at Khao Sam Chom. The southwestern part of the area is largely covered by mangrove, whereas the western part is mostly undulating landform. The main river system flowing to the north and northeast whereas the western part of the area mainly shows the irregular drainage pattern with some preferred orientation in the northeast-southwest direction.

The present investigation embraces the systematic geological mapping and defining the lithostratigraphy of the non-marine Mesozoic rocks distributed in the Thung Yai-Khlong Thom area, southern Thailand. Additional attempt has been made to analyse the sedimentary sequences in terms of sedimentary facies and to reconstruct the depositional environment of the area. Finally, the findings under the present study are presented as the geological map, graphic representation of 17 measured sections, stratigraphic designation, proposed nomenclature, and reconstruction of depositional environment.

The oldest rocks of Thung Yai-Khlong Thom area is believed to be the Permian limestone and marine Triassic rocks. These basinal basement rocks unconformably underlie the sedimentary sequences of non-marine Mesozoic rocks of the proposed, Trang group.

The sedimentary sequences of the Trang group unconformably overlie the basinal basements. The Trang group consists of 4 formations, namely, Khlong Min formation, Lam Thap formation, Sam Chom formation, and Phun Phin formation, in ascending order. The total thickness varies from 65 to 1,145 metres.

The Khlong Min formation, the lowermost formation of the Trang group, can be further subdivided into 4 lithofacies, namely, the mudstone intercalated with fossiliferous limestone of lithofacies I, the siltstone of lithofacies II, the calcareous sandstone of lithofacies III, and the fossiliferous limestone of lithofacies IV. The total thickness of Khlong Min formation varies from 58 to 116 metres.

The lowest unit of the Khlong Min formation within the Thung Yai-Khlong Thom area is the mudstone intercalated with fossiliferous limestone of lithofacies I. The formation unconformably overlies the Sai Bon formation of Triassic rocks indicated by the basal conglomerate at Khao Khom in the western part of Thung Song. This lithofacies is commonly characterised by grayish brown to gray mudstone with thin-bedded fossiliferous limestone and bituminous jets. The limestone is microscopically designated as biomicrite and biosparite. This lithofacies composes of abundant fossils such as estheria, ostracods, sporopollens, and vertebrates etc., graded bedding and hummocky, load casts, and liminated structures. The overall geometry of this lithofacies is confined only in the central to southwest part as tabular. The graded bedding shows the gradual change in grain size from medium-grained sand to clay with maximum thickness 3-5 metres. This lithofacies underlies the siltstone lithofacies with gradational contact.

The siltstone of lithofacies II of totally 51-67 metres thick is mainly characterised by the association of thick-to very thick-bedded reddish-brown to maroon siltstone. The lowest part of this lithofacies is represented by thick-bedded reddish-brown to maroon siltstone interbedded with thin-bedded limestone with abundant fossils, particularly vertebrates of hybodont shark, *Lepidotes*-like

actinopterygians, and lungfishes etc. Petrographically, biomicrite is confined as thin-bedded limestone with abundant ostracods, and gradually passing upward to mudstone and siltstone in the upper part. The overall geometry is widely distributed only in the central part of the study area as tabular.

About 15-60 metres thick of the sandstone of lithofacies III is generally characterised by yellowish-brown medium-grained sandstone, well sorted, with calcareous cement. The overall geometry is distributed only central part of the study area as tabular. This lithofacies overlies siltstone of lithofacies II with transitional contact. The sedimentary structures are predominantly flaser bedding and small-scale cross strata. The upper part of this lithofacies is represented by thin-bedded fine-grained sandstone, commonly laminated.

Overlying the sandstone of lithofacies III is the upper bed fossiliferous limestone lithofacies (IV). It is characterised by the associations of light gray to gray fossiliferous limestone interbedded with yellowish brown medium-grained sandstone, well-sorted with common flaser bedding, of totally 7-10 metres thick. The overall geometry of this lithofacies is prism and distributed only in the central part of the study area. The interbedded sandstone is well laminated with calcareous cement. The fossiliferous limestone contains abundant bivalves of *Modiolus* sp. and wood fragments. The lithofacies IV underlies the Lam Thap formation with sharp contact.

The Lam Thap formation, with the thickness ranges from 30 to 197 metres, is generally characterised by alternating beds of siltstone, shale interbedded with thin-to medium-bedded sandstone, and very thick-bedded arkosic sandstone with common planar cross-bedding and graded bedding. The lateral facies changes are very common. The Lam Thap formation consists of two lithofacies; the thick-bedded arkosic sandstone of lithofacies V and siltstone interbedded mudstone of lithofacies VI.

The arkosic sandstone of lithofacies V is characterised by thick-to very thick-bedded, yellowish brown to brown with graded bedding, planar cross-bedding and load casts. The fining upward sequences show the gradual change in grain size from sand to clay with maximum thickness of each cycle of less than 5-8 metres. The overall geometry of this lithofacies is tabular over the study area. The lithofacies V underlies the siltstone interbedded mudstone of lithofacies II with sharp contact.

The siltstone interbedded mudstone of lithofacies VI is represented by fining upward sequences of sandstone and mudstone alternating with sandstone mudstone thinly interbedding. At least 6 cycles of fining upward units of thinly interbedded sandstone to mudstone have been recognized. The overall geometry of this lithofacies is tabular covering over the study area. The maximum thickness of each cycle is approximately 2-20 metres.

Overlying the Lam Thap formation is the conglomerate and conglomeratic sandstone of lithofacies VIII of the Sam Chom formation. It is characterised by series of conglomerate, conglomeratic sandstone and thin-to medium-bedded sandstone with predominantly graded bedding. The conglomerate is matrix-supported and clasts are made up mainly of quartz, chert, sandstone and fragments of volcanic rocks. The upperpart of the Sam Chom formation is mostly very loose medium-coarse sandstone, well sorted with angular to subangular. The lower part of this formation is marked locally by medium-bedded, medium-grained sandstone. The overall geometry is lense-type with maximum thickness of the lithofacies VII is about 8-100 metres.

The lowermost Phun Phin formation conformably overlies the Sam Chom formation and unconformably underlies the Tertiary rocks. It is characteriaed by red to reddish brown fine-grained sandstone and conglomerate/breccia. This formation consists of 2 lithofacies; the fine-grained sandstone of lithofacies VIII and conglomerate/breccia of lithofacies IX.

The lower part of the Phun Phin formation is the red to reddish brown fine-grained sandstone of lithofacies VIII, thin-to very thick-bedded with planar and trough cross-bedding. The upper part of this lithofacies of about 20 metres thick consists of reddish-brown thin-to medium-bedded sandstone interlayer with conglomerate. The boundary between fine-grained sandstone of lithofacies VIII and the overlying lithofacies IX is a sharp contact.

Overlying the fine-grained sandstone of lithofacies VIII is the conglomerate/breccia of lithofacies IX of about 28 metres thick. It is characterised by conglomerate/breccia with both clast-supported and matrix-supported. Clasts are made up of quartz, chert, quartzite, sandstone and rock fragments.

The lower part of the Khlong Min formation, the mudstone intercalated with fossiliferous limestone of lithofacies I with abundant vertebrate and invertebrate fossils, and primary structures, i.e. hummocky and flaser bedding. According to Fursich and Werner (1986), and Fursich (1993), the salinity-controlled benthic macroinvertebrate associations indicating salinity ranges from brachyhaline to mesohaline of this lithofacies. The fossils assemblages of the mudstone intercalated with fossiliferous limestone lithofacies in the lower part reflect lagoonal environment and gradually change over to lacustrine environment of the siltstone of lithofacies II in the middle part. The calcareous sandstone of lithofacies III and the fossiliferous limestone of lithofacies IV are commonly represented by flaser bedding, wood fragments, and bivalves of *Modiolus* sp. indicating the marine influxes to the continent.

The rocks of the Lam Thap formation were believed to be deposited in meandering stream, floodplain, and alluvial fan environments. The paleocurrent of this formation is mainly from east to west directions (285 direction). The lateral facies change is very common from the thick-bedded arkosic sandstone of lithofacies I

mainly in the east to the siltstone and mudstone of lithofacies II in the west and southwest.

The conglomerate and conglomeratic sandstone lithofacies of the Sam Chom formation commonly exhibits sharp contacts, graded bedding, and fining upward sequence in some areas, reflecting the braided stream and alluvial fan origins. Both discontinuity of rock exposures and varies of clasts indicating locally separated alluvial fan deposits.

The fine-grained sandstone of lithofacies I is characterised by red-reddish brown with commonly trough and planar cross-bedding of the Phun Phin formation indicating braided stream with east direction of the paleocurrent in the lower part, and northeast direction in the upper part. The sharp contact, matrix-supported, and varies of clasts of upper part conglomerate of lithofacies II of Phun Phin formation indicate debris flow origin.

From stratigraphical and paleontological evidences, the age of the Trang group should be assigned as lower Middle Jurassic-Upper Cretaceous.

Within the study area, various geological structures are measured and described including, faults and fractures. The major trend of bedding has a common NNW-SSE orientation. However, within the Lam Thap formation, poles of bedding are quite variable as compared with other formations. From the stereographic projection plots, two trends defined in the study area. Most of the dip angles are between 30-45 degree for all rocks.

The photogeological interpretation indicates that there are three sets of faults in the study area, notably, the NE-SW, NW-SE, and E-W trendings. Among these, the NE-SW faults are most common. It is noted that the NW-SE and E-W faults have been offset by the NE-SW faults.

From the field investigations, NE-SW faults are mostly left-lateral strike-slip faults, whereas the NW-SE faults are right-lateral strike-slip faults. The rosette diagram plots of fault planes in the study area show that the NE-SW, and NW-SE sets are the major fault system, whereas the E-W system is the minor fault system.

The fractures in the study area are diversify and very difficult to delineate faults. They can be assigned to NE-SW set which is the major fracture system of all formations except the fracture of the Phun Phin formation which is mainly of E-W set.



สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย