

รายงานไดโนเสาร์ในช่วงระหว่างยุคไทรแอสสิก-ยุคจูแรสสิกของประเทศไทย

Triassic-Jurassic boundary Dinosaur from Thailand: a Review

ชลิดา เหล่าจุมพล¹, สุรวเวช สุธีธร^{1,2}

Chalida Laojumpon¹, Suravech Suteethorn^{1,2}

บทคัดย่อ

ประเทศไทยเป็นหนึ่งในประเทศในโลกที่มีการสะสมตัวของตะกอนน้ำจืดในช่วงยุคไทรแอสสิก - จูแรสสิก และมีการค้นพบซากดึกดำบรรพ์สัตว์มีกระดูกสันหลังจำนวนมาก ในที่นี้เรารายงานไดโนเสาร์ในช่วงปลายยุคไทรแอสสิก - ยุคจูแรสสิกของประเทศไทย ผลการศึกษาแสดงให้เห็นว่าตัวอย่างไดโนเสาร์ทั้งหมดสะสมตัวอยู่ในหมวดหินน้ำพอง (ยุคไทรแอสสิก-จูแรสสิก) โดยไดโนเสาร์กลุ่ม sauropodomorphs มีการค้นพบทั้งที่เป็นไดโนเสาร์กลุ่ม prosauropod และ basal sauropods ไดโนเสาร์ทั้งสองกลุ่มมีลักษณะคล้ายกับไดโนเสาร์ในช่วงยุคจูแรสสิกมากกว่ายุคไทรแอสสิก โดยเฉพาะอย่างยิ่งไดโนเสาร์ในประเทศจีน ยิ่งไปกว่านั้น ผลการศึกษายังทำให้พบว่าไดโนเสาร์กลุ่ม sauropodomorphs ในช่วงยุคไทรแอสสิก - จูแรสสิก ของไทยค่อนข้างหลากหลาย ในขณะที่ไดโนเสาร์กลุ่ม theropod มีการค้นพบเฉพาะรอยตีนเท่านั้น แม้จะมีการค้นพบแค่เพียงรอยตีน แต่ซากดึกดำบรรพ์ที่พบทั้งหมดค่อนข้างสมบูรณ์ และเป็นซากดึกดำบรรพ์ของไดโนเสาร์กินเนื้อขนาดใหญ่ ผลการศึกษของเราจึงสามารถนำมาใช้ทำความเข้าใจว่าวิวัฒนาการของไดโนเสาร์ว่า สัตว์กลุ่มนี้น่าจะเกิดขึ้นในช่วงกลาง - ปลายยุคไทรแอสสิก และมีการกระจายในแถบเอเชียตะวันออกเฉียงใต้ช่วงปลายยุคไทรแอสสิก เราหวังเป็นอย่างยิ่งว่าการศึกษานี้จะช่วยให้เข้าใจต้นกำเนิดของไดโนเสาร์และการกระจายตัวทางชีววิทยาของไดโนเสาร์ในเอเชียตะวันออกเฉียงใต้มากยิ่งขึ้น

คำสำคัญ: ช่วงระหว่างยุคไทรแอสสิก-ยุคจูแรสสิก ไดโนเสาร์ รายงาน

Abstract

Thailand is among the regions in the world where continental sedimentary rocks spanning the Triassic-Jurassic age are found and yielded many vertebrate remains. Here we have reviewed dinosaur from late Triassic to early Jurassic of Thailand. Our results show that all of dinosaur specimen deposited in the Nam Phong formation (Late Triassic-Early Jurassic). In sauropodomorphs, both of prosauropod and basal sauropods were found. Both of them are rather similar to early Jurassic more than late Triassic sauropodomorphs especially, the Chinese sauropodomorphs. Moreover, the results also found that sauropodomorphs in Late Triassic to Early Jurassic of Thailand is rather diverse whereas only footprints were found in theropod dinosaur. Although, only footprints were preserved but all of them rather complete and indicated that they belong to large theropods. Our results implied that dinosaurs had evolved sometime during the Middle-Late Triassic period and diverse through Southeast Asia at the end of Triassic. We hope our study will help to understand the origin of dinosaur and their biogeography in Southeast Asia.

Keywords: Triassic-Jurassic boundary, Dinosaur, Thailand, Review

¹ Department of Biology, Faculty of Science, Mahasarakham University, Khantarakwichai, Mahasarakham 44150, Thailand.

² Palaeontological Research and Education Centre, Mahasarakham University, Khamrieng, Mahasarakham 44150, Thailand.

Corresponding author: Ch.laojumpon@gmail.com



Introduction

The Triassic-Jurassic boundary is the first steps of the early dinosaur evolutionary. In the Late Triassic, dinosaur were radiation and more abundant^{1,2}. However, reports of dinosaur compare with other vertebrate fossils in that time are still rare². In Thailand, the first dinosaur bone was found in 1976 by Mr. Sutham Yaemniyom, geologist from the Department of Mineral Resources, in order of uranium survey in Phu Wiang of Khon Khean Province³. Since then, a lot of dinosaur specimens from Late Triassic to early cretaceous were found in several localities in Thailand.^{4,5,6,7,8,9} This paper summarizes current knowledge on the dinosaur in the Triassic-Jurassic boundary from Thailand, both from previous paper and

recent discovery. All of dinosaurs described and illustrated in the present paper were found in Namphong Formation and housed in the collections of Sirindhorn museum (SM) and Palaeontological research and education centre, Mahasarakham University (PRC).

Continental Triassic-Jurassic boundary sediment of Thailand

The continental sedimentary rocks in the Mesozoic of Thailand range in age from the Late Triassic to the Early Cretaceous^{10,11}. Sedimentary rock from Triassic period consists of the Huai Hin- Lat and the Nam Phong Formations.

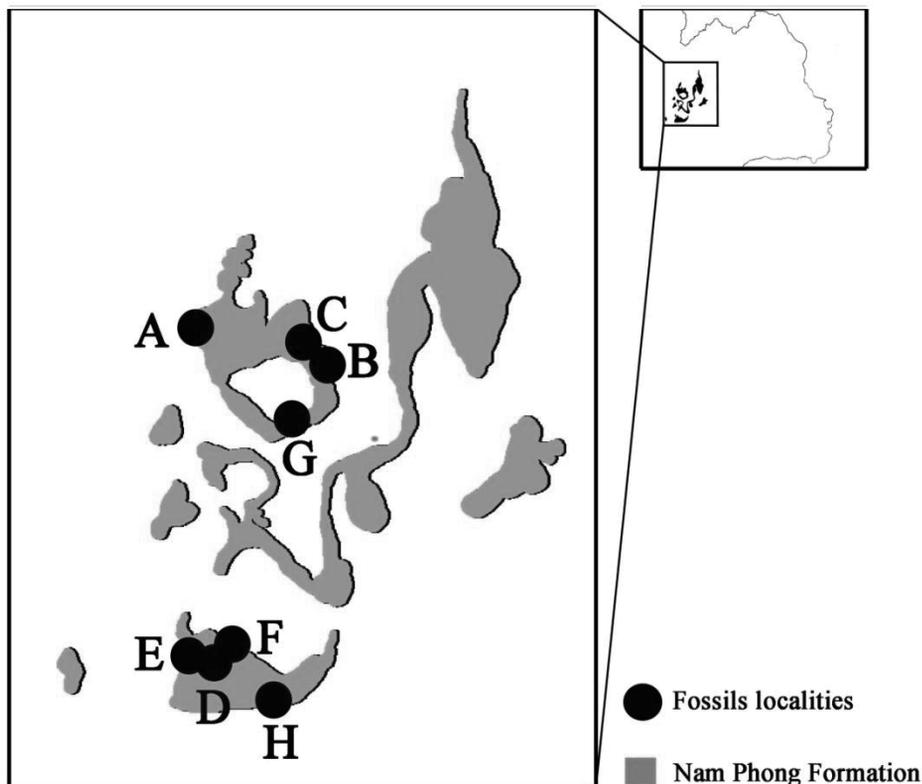


Figure 1 is dinosaur localities in the Triassic-Jurassic boundary of Thailand A a few meters to the east of the eastern entrance of Nam Nao National Park, along the Chum Phae-Lom Sak highway; B is Phu Hin Tan locality; C is Phu Khuang locality; D is Phu Nok Khian locality; E is Khok Hin Poeng locality; F is Ban Non Sao Ae locality; G is Tha Song Khon locality and H is Non Thum locality

The lowermost unit is the Huai Hin Lat Formation. This formation is composed of fluvial and lacustrine sands, silts and mudstones deposits associated with volcanic rock;¹⁰ this unit is Upper Triassic (Carnian to Norian: see Chonglakmani and Sattayarak, 1978)¹² on the basis of its palynological contents^{10,11,12} and vertebrate assemblages⁶. The Huai Hin Lat Formation is unconformably overlaid by the Nam Phong Formation. The Nam Phong Formation consists of continental rocks formed in fluvial environments (braided and meandering channels interbedded with lacustrine or floodplain sequences).¹³ Palynology suggests that the formation is not older than Pliensbachian (Late Early Jurassic). This result is in accordance with seismic analysis which clearly divides this formation into two sections: The Lower Nam Phong Formation is Upper Triassic and the Upper Nam Phong Formation, not older than Pliensbachian and no younger than Late Jurassic¹⁰. Moreover, Recey (2009) suggested that environment of the Lower unit is alluvial fans and floodplains which underline uncommity with the Lacustrine dominated alluvial floodplain in Upper unit. Triassic dinosaurs from Thailand were found in several localities of the northeastern part. All of them were deposited in the Nam Phong Formation (FIGURE 1).

1. Prosauropod

The earliest prosauropod from Thailand was reported in 1995, found in a road cutting, a few meters to the east of the eastern entrance of Nam Nao National along the Chum Phae-Lom Sak highway, Phetchabun Province (FIGURE 1). This specimen (SM11-1-020) is was the distal part of the fused Ischia (FIGURE 2), discovered by Dr. Varavuddh Suteethorn and described by Buffetaut et al in 1995. Relatively narrow shape of the distal symphysis indicated that this Ischia belong to a prosauropod.¹⁴ Although the specimen is rather well preserve but systematic position still uncertain. Because of the degree of distal fusion of the ischia is similar to most of Plateosaurus from Narian in Germany but the specimen from Thailand quite robust and more advance¹⁵. According to our present studies, indicated that, its triangular outline indicated to a prosauropoda or a basal sauropod. The proportion between anteroposterior length and anteroposterior/ lateromedial length in the distal end of SM11-1-020 is about 1-1.5 as in Lessemsaurus and Vulcanodon, less than Prosauropoda (1.7-2.27) and more than Eusauropoda (less than 0.5). The ischial symphysis of SM11-1-020 is rather flat as in basal and eusauropoda. Moreover, the distal end of the symphysis is rather slender and less expanded laterally as in most of prosauropod in contrast with more expanded and more or less V-shape in cross-section with concave posterodorsal surface in basal sauropod¹⁵. Thus, the specimen is more advanced than the previous hypothesis.

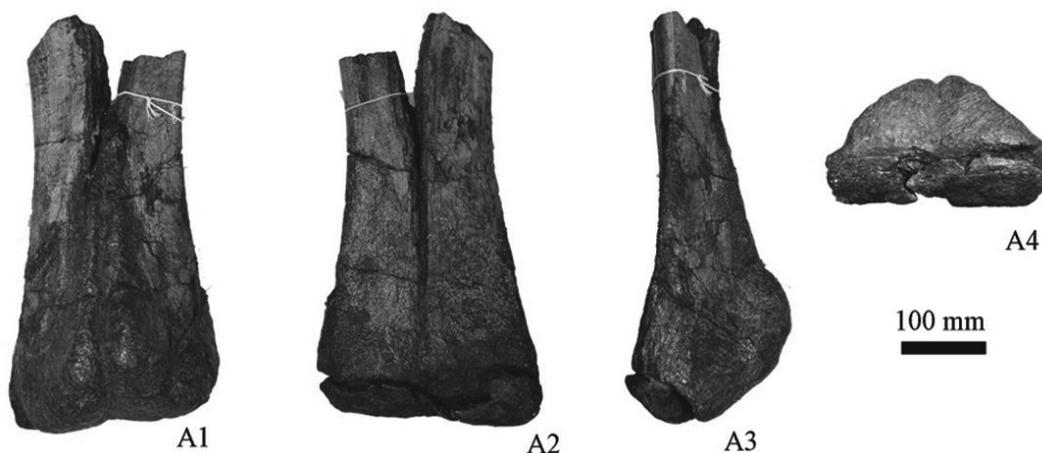


Figure 2 is SM11-1-020 in the posterior (A1), anterior (A2), lateral (A3) and distal view (A4).



The second prosauropod specimen (LI-04) were found by forestry guards in Phu Khuang locality, near Phu Kradung, Loei province in 2006. These specimens consist of twenty one vertebrae, ribs, a well preserved left scapula and coracoid, parts of the left ilium and pubis, incomplete left and right femora, the proximal and distal ends of a right tibia, with the articulating astragalus, and the proximal end of a fibula belonging to a single individual (FIGURE 3). All specimens were found on the surface or redeposited in loose sediment on the hillside¹⁶. The preliminary report describes by Buffetaut et al. in 2008 suggested that, these specimens are previously

assigned to a close relationship with Plateosaurus from the late Triassic of Germany¹⁶. In contrast with recently result shows that several characters of Thai prosauropod are similar to those of the Early Jurassic Lufengosaurus huenei from Lufeng Formation of southern China. However, some typical character of scapuocoracoid and distal end of femur show that LI-04 should be a different species to Lufengosaurus huenei. Therefore, we suggest that LI-04 as a new species (detail in other publication). Moreover, the age of the Nam Phong Formation is controversial ranging from the Late Triassic to the Early Jurassic.

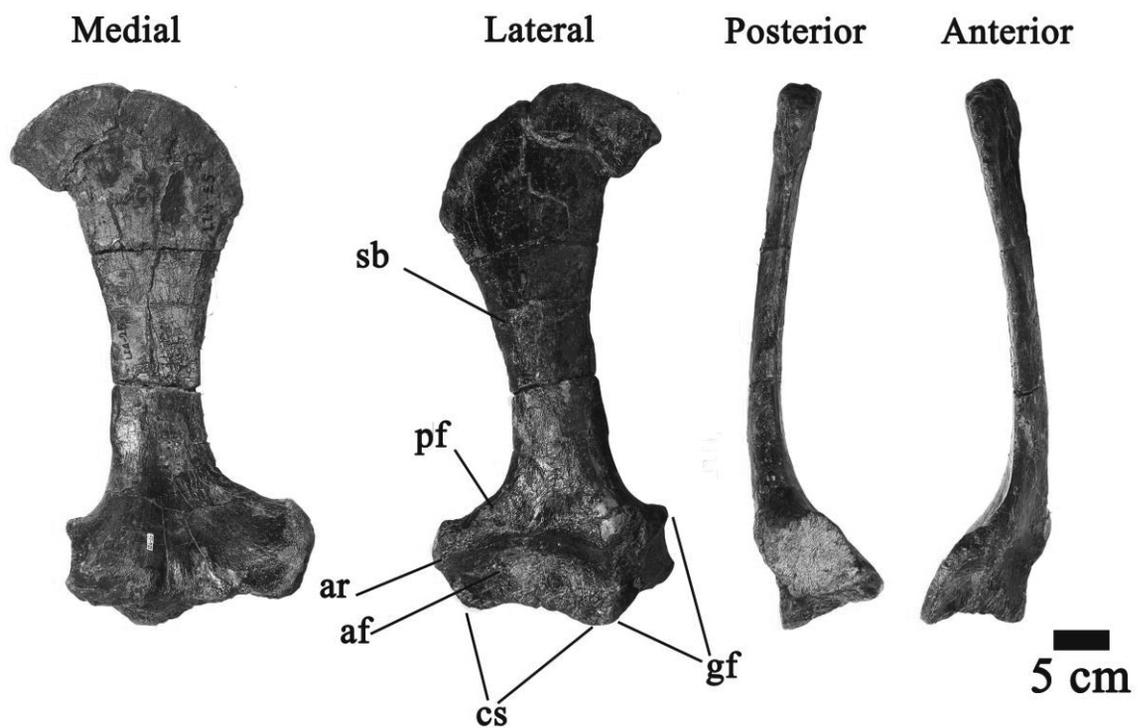


Figure 3 is scapula of prosauropod specimens in Phu Khuang locality (LI-04). Abbreviations: af; anterior fossa, ar; acromian ridge, cs; coracoid suture, gf; glenoid fossa, pf; posterior fossa and sb; scapula blade

If the fauna from this formation linked to those of the Lufeng Formation, it is likely to be that prosauropod in Asia probably evolution from southeast to northern Asia or the Nam Phong Formation is younger than the previously hypothesis.

2. Basal sauropod

The earliest sauropod in the Triassic from Thailand was reported by Buffetaut et al., 20007. These

specimens deposited in Phu Nok Khian hill near Ban Non Thaworn village, in Chaiyaphum Province (FIGURE 1). Left femur, right scapula, dorsal vertebra and sternal plate and unfused neurocentral sutures from the locality indicate that the dinosaur may not have been immature. This dinosaur can be clearly separated from among the prosauropod and basal sauropod base on its vertebrae and femur (FIGURE 4A). Therefore, all specimens were described as new dinosaur called Isanosaurus attavipachi.

We visited Phu Nok Khian hill again in 2011-2012. Unfortunately, the locality was destroyed and changed to an agricultural area. Only the proximal part of femur and fragmented bone were found. The new femur show that a robust straight and craniocaudally flattened shaft as in most of sauropod dinosaur. The fourth trochanter is located at the very proximal position as in *I. attavipachi* and some primitive dinosaur¹⁷. Moreover, the prominent S-shape ridge of fourth trochanter also similar to *I. attavipachi*. Consequently, the new femur is belongs to *I. attavipachi*.

In 2002, the more sauropod specimens were found at Khok Hin Poeng. The fossil sites far from Phu Nok Khian Locality about 1 km from the first, close to the village called Ban Non Thawon. Buffetaut et al., 2002¹⁸ reported that, most of specimens are not complete; some of them rather fragment. The most complete specimen

from this locality is right humerus (CH5-1) (FIGURE 4B). CH5-1 shows typically-sauropod like character. It is 1040 mm proximodistally length. Size of the humerus is larger than the humerus of *Melanorosaurus* (500 mm), ones of the large prosauropod in the late Triassic but rather same size with several sauropod dinosaurs in early-late Jurassic such as *Apatosaurus*, *Camarasaurus* *Diplodocus* and *Omeisaurus*²⁰.

The third sauropod locality is in Ban Non Sao Ae (FIGURE 1). Several sauropod bones in this locality are rather complete and very well preserved. The complete sauropod remains in this locality include vertebrate centrum, ulna, astragalus, tibia, pubis and metatarsal. Although all of them did not yet study in detail but general characters indicate that it belongs to the large size of basal sauropod dinosaur.

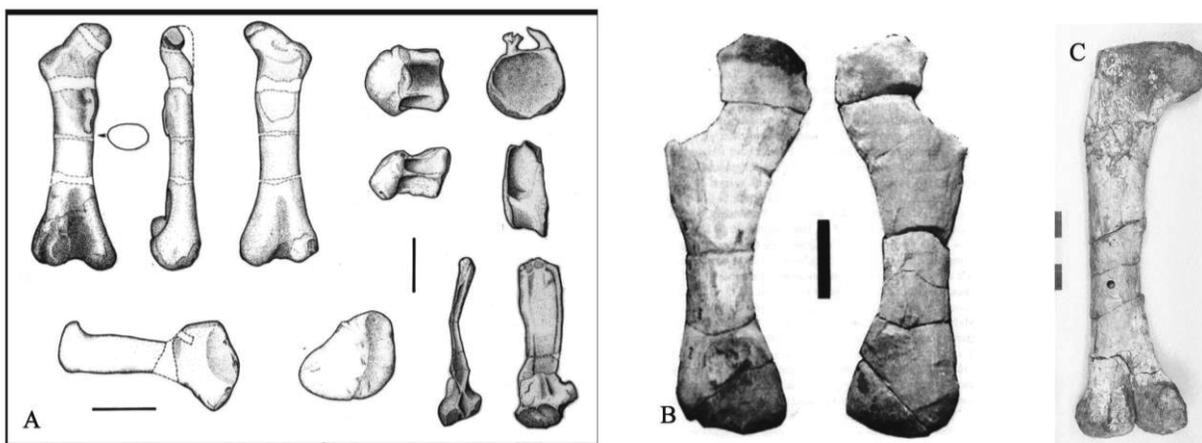


Figure 4 is sauropod specimen in the Triassic-Jurassic boundary A is *I. attavipachi*; B is humerus Khok Hin Poeng locality and C is Femur in Phu Hin Tan locality

The recent sauropod specimens in the Triassic-Jurassic boundary are the complete femur and rather complete vertebrae in the Phu Hin Tan locality, Leoi province (FIGURE 1). The complete femur (FIGURE 4C) in this locality is rather slim and smaller than *I. attavipachi*. Moreover, fourth trochanter of the specimen is located in the middle part of femur shaft as in Middle – Late Jurassic sauropod dinosaur. This character is rather different from

the proximal position of fourth trochanter as in *I. attavipachi*. Therefore, it is probably more advanced and belongs to different species of *I. attavipachi*.

3. Theropod

Theropod dinosaurs were found in Thailand since 1978 by Thai-French expedition. These specimens consist of an isolated tooth and skull fragments of large



carnivorous dinosaur deposited in The Khok Krut Formation, late early Cretaceous and studied by Philippe Taquet (Buffetaut, 1982). After that, Thai-French expedition found a lot of isolated tooth, bone and theropod footprint distributed around Khorat group from late Triassic – early Cretaceous²⁰. In case of Triassic-Jurassic boundary, only theropod trackways are recorded, whereas theropod bones have not yet been found. The first dinosaur track way in the Nam Phong Formation was found in 2007 on the bank of the Nam Phong River at Tha Song Khon, Loei Province from northeastern part of Thailand. The dinosaur track way preliminary described by Le Loeuff et. al. in 2007²¹. This trackway consists of six tetradactyl biped footprints preserved in argillites with mudcracks and ripple marks (FIGURE 5). Le Loeuff (2007; 2009)^{21,22} suggested that, this track way belong to a large theropod dinosaur (hip height 240 cm, its length can be estimate at around 6 m). A welldeveloped hallux impression, which is directed medially 90°–108° from the middle toe axe indicated that this track way close to the Gigandipus from the Early Jurassic of Connecticut, USA²¹. However, Thai specimen shows more developed digit I than Gigandipus. Although, the second theropod track way in this locality also found in 2011. the estimated of foot length is about 19 cm (hip height is about 108 cm) but most of footprints cover by sediment thus shape of them is rather difficult to identify.

The second theropod footprint locality is Non Thum locality, Chiyaphum province. The locality is located in the Chi river bank (FIGURE 1). Numerous of dinosaurs and more than 200 footprints of undetermined tetrapod footprints were found in the locality. In case of theropod footprints, more than 3 theropod track way were found in this study. All of them is rather complete and very well preserved (FIGURE 6). Although, size of theropod footprint in Non Thum locality is comparable to Tha Song Khon locality but shape of them are rather different, especially a well-develop hallux impression which did not found in the theropod footprint of Non Thum locality.

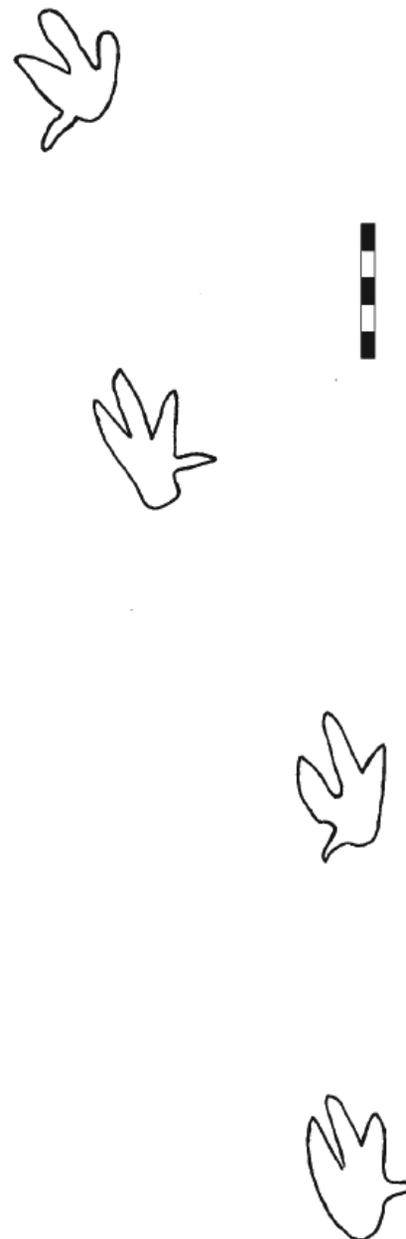


Figure 5 is Theropod footprints in Tha Song Khon (Nam Phong Formation, Rhaetian). Scale bar: 50 cm.

Discussion and Conclusion

This review remarks the dinosaur richness in the Late Triassic-Early Jurassic boundary of Thailand. In sauropodomorphs, both of prosauropod and basal sauropods were found. All of prosauropod specimens are similar to early Jurassic specimen from China more than late Triassic. In case of basal sauropod, they are very diverse. Not only *I. attavipatchi* were reported but probably 2 or 3 other basal sauropod taxa are found. More detail studies in both of them are still needed.



Preliminary surveys indicated that sauropodomorphs in the Late Triassic-Early Jurassic boundary of Thailand is rather advanced and larger in size. All of sauropodomorph specimens will be help us to understand the early stages in the evolution of the group.

Although theropod bone did not found yet but several theropod footprints are still present. All of them belong to giant theropod and similar to early Jurassic specimen.²² Theropod footprints in Tha Song Khon locality are close to the Gigandipus from the early Jurassic of Connecticut, USA. However, this character did not found in theropod footprints in Non Thum locality. Therefore, both of them probably belong to differences species²².



Figure 6 is theropod footprint in Non Thum locality

Discovery of vertebrate fossils in the Triassic of Thailand started when Thai-French palaeontological team began excavation in several sites of Thailand. They found a lot of vertebrate fossils ranging in age from the Late Triassic to the Early Cretaceous in the continental rocks of the Khorat plateau. However, reports of Triassic fossil vertebrates of Thailand are still rather rare. Most of vertebrate fossils were found in the Huai Hin Lat Formation (Late Triassic). These include: a shark denticle²³, a tooth of *Ferganoceratodus szechanensis*^{24,25,26}, the turtle *Proganochelys ruchae*²⁷, the amphibians *Cyclotosaurus* cf. *posthumus* and a plagiosauroid²⁸, and phytosaurs²⁹.

All of them were found at an outcrop near Chulaborn dam in Chaiyaphum Province. Archosaur trackways were discovered at Tad Huai Nam Yai, near Nam Nao in Phetchabun Province^{20,21,22}. The latest report consists of coprolites from Huai Nam Aun, Chaiyaphum province³⁰.

However, in the Nam Phong formation (Late Triassic-Early Jurassic), a younger sedimentary rock was dominated by a dinosaur group including; a basal sauropod, *Isanosaurus attavipachi*, numerous footprint of giant theropod and sauropod dinosaur, whereas all of giant amphibian and phytosaur are missing. Result from this study showed that, dominated vertebrate animal in the Late Triassic to the Early Jurassic of Thailand was changed from the giant amphibian and continental reptile to a several group of dinosaur especially sauropod; the long neck plant eating dinosaur. The preliminary taxonomical study found that most of sauropod dinosaurs in Nam Phong formation rather similar with Chinese dinosaur from the early Jurassic. Consequently, this study not only indicate to effect of dinosaur distribution with other continental animals at that time, but also the evident to support that dinosaur in Thailand and South East Asia probably distributed from China.

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References

1. Brusatte S., Nesbitt S., Irmis R., Butler R., Benton M. Norell M. The origin and early radiation of dinosaurs. *Earth-Science Reviews* 2010; 101: 68–100
2. Langer, M. C., Ezcurra, M. D., Bittencourt, J. S., & Novas, F. E. The origin and early evolution of dinosaurs. *Biological Reviews*, 2010; 85(1): 55-110.
3. Ingavat, R. and Janvier, P. *Cyclotosaurus* cf. *posthumus* Fraas (Capitosauridae, Stereospondyli



- from the Huai Hin Lat Formation (Upper Triassic), Northeastern Thailand, with a note on *Capitosaurid* biogeography): *Geobios*, 1981; 14: 711-725.
4. Buffetaut, E., and Suteethorn, V. The Dinosaur of Thailand in GEOSEA VII, Bangkok; 1991.
 5. Buffetaut, E. and Ingavat, R. Phytosaur remains (Reptilia, Thecodontia) from the Upper Triassic of North-Eastern Thailand: *Geobios* 1982; 15: 7-17.
 6. Buffetaut, E. and Suteethorn, V. The biogeographical significance of the Mesozoic vertebrates from Thailand; in Hall, R. and Holloway, J.D., eds., *Biogeography and Geological Evolution of SE Asia*: Leiden, Backhuys; 1998. p.83–90.
 7. Buffetaut, E., Suteethorn, V., Cuny, C., Tong, H., Le Loeuff, J., Khansubha, S., and Jongaut-chariyakul, S. The earliest known sauropod dinosaur. *Nature* 2000; 701: 42-44.
 8. Buffetaut, E., Suteethorn, V., Tong, H. Dinosaur assemblages from Thailand: a comparison with Chinese faunas. *Papers from the 2005 Heyuan International Dinosaur Symposium*. J. C. Lü, Kobayashi, Y., Huang, D. & Lee, Y.-N. Beijing, Geological Publishing House: 2003. p. 183-194.
 9. Buffetaut, E., Suteethorn, V., Saenyamoon, T., Liard, R., Tong, H., Le Loeuff, J. and Cuny, G. Prosauropod skeleton (Dinosauria: Saurischia) from the Nam Phong Formation of the Northeastern Thailand. 6th meeting of the European association of vertebrate palaeontologists, SLOVAK REPUBLIC; 2008.
 10. Racey, A. the Khorat Group of NE Thailand Mesozoic red bed sequences from SE Asia and the significance of Thailand; in Buffetaut, E., Cuny, G., Le Loeuff, J. and Racey, A. and Goodall, J. G. S., 2009, *Palynology and stratigraphy of the Mesozoic Khorat Group red bed sequences from Thailand*; in Buffetaut, E., Cuny, G., Le Loeuff, J. and Suteethorn, V., eds., *Late Palaeozoic and Mesozoic ecosystems of SE Asia*: Geological Society of London, Special Publication; 2009 (315) p. 67-81.
 11. Racey, A., Love, M.A., Canham, A.C., Goodhall, J.G.S., Polachan, S. and Jones, P.D. Stratigraphy and reservoir potential of the Mesozoic Khorat Group north eastern Thailand: Part 1, Stratigraphy and Sedimentary Evolution. *Journal of Petroleum Geology* 1996; 19: 5-40.
 12. Chonglakmni, C. and Sattayarak, N., Stratigraphy of Huai Hin Lat Formation (Upper Triassic) in NE Thailand; in Nutlaya. P., ed., *Proceedings of the Third Regional Conference on Geology and Mineralogy Resources of Southeast Asia*: Department of Mineral Resources, Thailand; 1978. p. 739-762.
 13. Racey, A. and Goodall, J. G. S., Palynology and stratigraphy of the Mesozoic Khorat Group red bed sequences from Thailand; in Buffetaut, E., Cuny, G., Le Loeuff, J. and Suteethorn, V., eds., *Late Palaeozoic and Mesozoic ecosystems of SE Asia*: Geological Society of London, Special Publication; 2009. p. 67-81.
 14. Buffetaut, E., Martin, V., Sattayarak, N. and Suteethorn, V. (1995) The oldest known dinosaur from southeast Asia: a Prosauropod from the Nam Phong Formation (Late Triassic) of northeastern Thailand. *Geol. Mag* 132 (6): 739-742.
 15. Upchurch, P., Barrett, P.M. & Galton, P.M. A phylogenetic analysis of basal sauropodomorph relationships: implications for the origin of sauropod dinosaurs. *Evolution and palaeobiology of early sauropodomorph dinosaurs*. P. M. B. a. D. J. Batten. , *Special Papers in Palaeontology* 2007; 57–90.
 16. Buffetaut, E., Suteethorn, V., Saenyamoon, T., Liard, R., Tong, H., Le Loeuff, J. and Cuny, G. Prosauropod skeleton (Dinosauria: Saurischia) from the Nam Phong Formation of the Northeastern Thailand. 6th meeting of the European association of vertebrate palaeontologists. 30th June- 5th July 2008.
 17. Buffetaut, E., Suteethorn, V., Cuny, C., Tong, H., Le Loeuff, J., Khansubha, S., and Jongaut-chariyakul, S. The earliest known sauropod dinosaur. *Nature* 2000; 701: 42-44.
 18. Buffetaut, E., Suteethorn, V., Le Loeuff, J., Cuny, Tong, H., and Khansubha, S. The first giant dinosaurs: a large sauropod from the Late Triassic of Thailand. *C.R. Pale.* 2002; 1: 103-109.
 19. Sues, H. D. in *The Dinosauria* (eds Weishampel, D.



- B., Dodson, P. & Osmolska, H.) Univ. California Press, Berkeley; 1990. P. 143–147
20. Le Loeuff, J., Saenyamoon, T., Souillat, C., Sutethorn, V. and Buffetaut E., Triassic trackways from Thailand. GEOTHAI'07 International Conference on Geology of Thailand: Towards Sustainable Development and Sufficiency Economy; 2007 p.362-363
 21. Le Loeuff, Souillat, C., and Sutethorn, V. Tracks in the Triassic: New Vertebrate footprints from Thailand. 6th meeting of the European association of vertebrate palaeontologists. 30th June- 5th July 2008.
 22. Le Loeuff, J., Saenyamoon, T., Souillat, C., Sutethorn, V. and Buffetaut E. Mesozoic vertebrate footprints of Thailand and Laos; in Buffetaut, E., Cuny, G., Le Loeuff, J. and Suteethorn, V., eds., Late Palaeozoic and Mesozoic ecosystems in SE Asia: Geological Society of London, Special Publications, 2009; 315: 245-254.
 23. Cuny, G., Suteethorn, V., Khamha S., Lauprasert, K., Srisuk, P. and Buffetaut, E. The Mesozoic fossil record of sharks in Thailand; in Tantiwanit, W., ed, Proceedings of the International Conference on geology of Thailand: towards sustainable development and sufficiency economy, Department of Mineral Resources, Bangkok, Thailand; 2007 p.349-354.
 24. Martin, M. and Ingavat, R. First record of an Upper Triassic Ceratodontid (Dipnoi, Ceratodontiformes) in Thailand and its paleogeographical significance: Mémoires de la Société géologique de France, N.S.n 1982; 147: 101-105.
 25. Martin, M., Buffetaut, E., Tong, H. and Suteethorn, V. New Jurassic dipnoans from Thailand: Geological Society of Denmark, online Series1, http://www.2dgf.dk/Publikationer/DGF_On_Line/Volume_1/newjur.htm; 1997.
 26. Cavin, L., Suteethorn, V., Buffetaut, E. and Tong, H. A new Thai Mesozoic lungfish (Sarcopterygii, Dipnoi) with an insight into post-Palaeozoic dipnoan evolution: Zoological Journal of the Linnean Society 2007; 149: 141-177.
 27. Broin, F. de, Proganochelys ruchae n. sp., Chélonien du Trias supérieur de Thaïlande: Studia Palaeocheloniologica, 1984; 1: 87-97.
 28. Ingavat, R. and Janvier, P. Cyclotosaurus cf. posthumus Fraas (Capitosauridae, Stereospondyli from the Huai Hin Lat Formation (Upper Triassic), Northeastern Thailand, with a note on Capitosaurid biogeography): Geobios 1981; 14: 711-725.
 29. Buffetaut, E. and Ingavat, R. Phytosaur remains (Reptilia, Thecodontia) from the Upper Triassic of North-Eastern Thailand: Geobios 1982; 15: 7-17.
 30. Laojumpon, C., Matkhammee, T., Wathanapitaksakul, A., Suteethorn, V., Suteethorn, V., Lauprasert, K., Srisuk, P., and Le Loeuff, J., Preliminary report on coprolites from the late Triassic of Thailand; in Hunt et al., eds., Vertebrate Coprolites: New Mexico Museum of Natural History and Science, Bulletin; 2012.