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Haiyan TONG, Wilailuck NAKSRI, Eric BUFFETAUT, Suravech SUTEETHORN, Varavudh SUTEETHORN, Uthumporn DEESRI & Julien CLAUDE

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Haiyan TONG
Palaeontological Research and Education Centre, Mahasarakham University, Khamrieng Sub-district, Kantharawichai District, Maha Sarakham Province 44150 (Thailand)
and Key Laboratory of Vertebrate Evolution and Human Origins, Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Science, Beijing 100044 (China)
htong09@yahoo.fr (corresponding author)

Wilailuck NAKSRI
Northeastern Research Institute of Petrified Wood and Mineral Resources, Nakhon Ratchasima Rajabhat University, Mueang Nakhon Ratchasima 30000 (Thailand)

Eric BUFFETAUT
Palaeontological Research and Education Centre, Mahasarakham University, Khamrieng Sub-district, Kantharawichai District, Maha Sarakham Province 44150 (Thailand)
and CNRS, UMR 8538, Laboratoire de géologie de l'École normale supérieure, PSL Research University, 23 rue Lhomond, 75231 Paris cedex 05 (France)

Suravech SUTEETHORN
Varavudh SUTEETHORN
Uthumporn DEESRI
Palaeontological Research and Education Centre, Mahasarakham University, Khamrieng Sub-district, Kantharawichai District, Maha Sarakham Province 44150 (Thailand)
and Department of Biology, Faculty of Science, Mahasarakham University, Kantarawichai, Maha Sarakham 44150 (Thailand)

Julien CLAUDE
Institut des Sciences de l'Évolution de Montpellier, CNRS/UM/IRD/EPHE, 2 place Eugène Bataillon, cc64, 34095 Montpellier cedex 5 (France)

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KEY WORDS
Testudines,
Trionychoidae,
Early Cretaceous,
Kut Island,
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ABSTRACT
An isolated first costal turtle plate from the Early Cretaceous of Kut Island, Gulf of Thailand, is reported and assigned to Trionychoidae gen. et sp. indet. The morphology of the plate and comparison with turtle assemblages of the Khorat Group support the correlation of the vertebrates-bearing beds of Kut Island with the Sao Khua Formation, as already suggested by the studies on sharks and dinosaurs.

MOTS CLÉS
Testudines,
Trionychoidae,
Crétacé inférieur,
île de Kut,
Thaïlande.

RÉSUMÉ
Restes de tortue du Crétacé inférieur de l'île de Kut, Golfe de Thaïlande.
Une plaque de tortue isolée (costale 1), provenant du Crétacé inférieur de l'île de Kut, dans le Golfe de Thaïlande, est décrite et attribuée à Trionychoidae gen. et sp. indet. La morphologie de la plaque et la comparaison avec les assemblages de tortues du Groupe Khorat soutiennent la corrélation des couches à vertebrés de l'île de Kut avec la formation Sao Khua, comme cela a déjà été suggéré par les études sur les requins et dinosaures.

INTRODUCTION

Kut Island (Ko Kut in Thai, Trat Province) is a jungle-covered island situated in the eastern part of the Gulf of Thailand, close to the Cambodian border (Fig. 1). Mesozoic vertebrates from Kut Island were discovered in the 1970s and first reported by Buffetaut & Ingavat in 1983 (Buffetaut & Ingavat 1983). Since the 1980s, successive visits by the Department of Mineral Resources, and Palaeontological Research and Education Centre (Mahasarakham University, Thailand), in collaboration with palaeontologists from France and Denmark, have allowed numerous vertebrate fossils to be collected. According to the recent studies (Cuny *et al.* 2010; Buffetaut *et al.* 2019), the vertebrate fauna from Kut Island consists of hybodont sharks (*Hybodus* sp., *Isanodus paladeji* Cuny, Suteethorn, Kamha, Buffetaut & Philippe, 2006, and *Heteroptychodus kokutensis* Cuny, Laojumpon, Cheychiw & Lauprasert, 2010), actinopterygians (Semionotiformes indet., *Lepidodes* sp.), turtles, crocodilians (goniopholidid and cf. *Theriosuchus* sp.), and theropod (including spinosaurids) and sauropod dinosaurs. This assemblage is indicative of a freshwater environment and is considered as Early Cretaceous in age, coeval to the Sao Khua Formation of the Khorat Group.

Vertebrate fossils have been collected from the grey sandstone outcrops on the shore of the island, just above the sea level in two localities on the Kut island, apparently coeval with one another, Ao Phak on the northwestern coast, and Ao Kalang on the southeastern coast. Most fossils come from the Ao Kalang locality, south of Ao Kalang Village (Ban Ao Kalang in Thai). For more geological information, see Cuny *et al.* (2010). Turtle remains from Kut Island are in general very fragmentary. In this paper we report on a nearly complete costal 1 plate from Ao Kalang site. The specimen is housed in the Palaeontological Research and Education Centre (PRC), Mahasarakham University, Thailand. Its stratigraphic significance is discussed.

SYSTEMATIC PALAEONTOLOGY

Order TESTUDINES Linnaeus, 1758
Sub-order CRYPTODIRA Cope, 1868
Superfamily TRIONYCHOIDAE
(*sensu* Gaffney & Meylan 1988)

Trionychoidae gen. et sp. indet.
(Fig. 2)

DESCRIPTION

The specimen (PRC149) is an almost complete first right costal plate, lacking only the lateral tip and part of the medial margin, which is damaged (Fig. 2). The plate is roughly triangular and slightly convex dorsally. As preserved, it measures 110 mm in length, 160 mm in width and 8 mm in thickness. The outer surface is covered with clear ornament of pitted pattern, formed by a network of irregular ridges. In the anterior marginal area, the ridges tend to arrange in a parallel manner, perpendicular to the border of the plate. Although wider than long, the plate is relatively long with the length/width radio about 65%. The sutural margin with the nuchal is partly preserved and those with the peripheral 1 and 2 are intact. The nuchal/costal 1 suture is oblique. The costal 1/peripheral 1 suture and that of costal 1/peripheral 2 have the similar length. The contact with the peripheral 3 is not preserved, and it is not clear whether the costal 1/peripheral 4 contact is present because the relevant part of the plate is broken. Part of the medial margin of the plate is damaged, but the preserved sutural margin indicates that the neural 1 is apparently rectangular. The posterior border of the plate is slightly convex posteriorly.

The scute sulci, although thin, are clearly imprinted on the dorsal surface. The lateral sulcus of the vertebral 1 is divergent anteriorly, reaching about the mid-length of the peripheral 1; this indicates a trapezoidal shape for the vertebral 1 with the posterior margin shorter than the anterior one. The intervertebral sulcus between the vertebrals 1 and 2 is convex forward. The vertebral 2 is clearly narrower than the vertebral 1.

On the inner surface, the strong second thoracic rib is straight, with a stubby and rounded rib head and sharp anterior edge which extends through the whole width of the plate. The first thoracic rib is damaged, it is short.

COMPARISON AND DISCUSSION

Three major groups of turtles are known from the Late Jurassic to the Early Cretaceous in Asia: Xinjiangchelyidae, Macrobaenidae/Sinemydidae, and Trionychoidae (Sukhanov 2000; Danilov *et al.* 2017; Tong 2017). Trionychoidae are notable for presenting a sculptured shell surface, a feature allowing isolated plates to be identified (Danilov *et al.* 2011, 2013b; Tong *et al.* 2014; Vitek & Joyce 2015; Georgalis & Joyce 2017). The ornamentation in PRC149 which consists of a network of raised irregular ridges forming a pitted pattern is typical of Trionychoidae (*sensu* Gaffney & Meylan 1988); such a sculpture is absent in Xinjiangchelyidae and Macrobaenidae/Sinemydidae. Within Trionychoidae, the sculpture in PRC149 is reminiscent of some basal members of the group such as *Isanemys srisuki* Tong, Buffetaut & Suteethorn, 2006 from the Lower Cretaceous Sao Khua Formation of NE Thailand and *Ferganemys* spp. from the mid-Cretaceous of Kyrgyzstan and Uzbekistan (Tong *et al.* 2006; Syromyatnikova 2011).

Among Trionychoidae, the presence of the scute sulci on the carapace surface and the contact with the peripherals exclude PRC149 from the Trionychidae and Carettochelyidae, and place it in a more basal position. The triangular shape of the costal 1 is similar to that of Adocidae such as *Ferganemys* spp., *Isanemys srisuki*, *Protoshachemys rubra* Tong, Buffetaut, Suteethorn, Suteethorn, Cuny, Cavin, Deesri, Martin, Wongko, Naksri & Claude, 2019, *Adocus* spp. (Tong *et al.* 2006, 2009b, 2019a, b; Syromyatnikova & Danilov 2009; Syromyatnikova 2011; Danilov *et al.* 2013b; Syromyatnikova *et al.* 2013), whereas in more primitive turtles such as the xinjiangchelyids *Chengyuchelys* spp., *Xinjiangchelys* spp., and *Annemys* spp., the costal 1 is shorter, with nearly parallel anterior and posterior borders (Ye 1986; Peng & Brinkman 1993; Tong *et al.* 2012, 2015a; Rabi *et al.* 2014). It is noteworthy that some basal trionychoids, such as *Siamochelys peninsularis* Tong, Buffetaut & Suteethorn, 2002 from the Jurassic of southern Thailand, *Basilochelys macrobios* Tong, Claude, Naksri, Suteethorn, Buffetaut, Khansubha, Wongko & Yuangdetkla, 2009 from the Phu Kradung Formation (Khorat Plateau) and *Sinaspideretes wimani* Young & Chow, 1953 from the Xiashaximiao Formation of the Sichuan Basin, China, have a short costal 1 similar to that of xinjiangchelyids (Tong *et al.* 2002, 2009a, 2014). This difference from more primitive turtles is also indicated by the costal 1 length/width radio in PRC149 (65%) which is greater than that of xinjiangchelyids and macrobaenids (around 40% to 50%) and falls within the range of primitive Adocidae (*Isanemys srisuki* (61%) and *Ferganemys verzilini* Nessov & Khosatzky, 1977 (64%) (Tong *et al.* 2009b; Syromyatnikova 2011), whereas *Siamochelys peninsularis* (44%) and *Basilochelys macrobios* (38%) have a costal 1 length/width radio similar to that of xinjiangchelyids

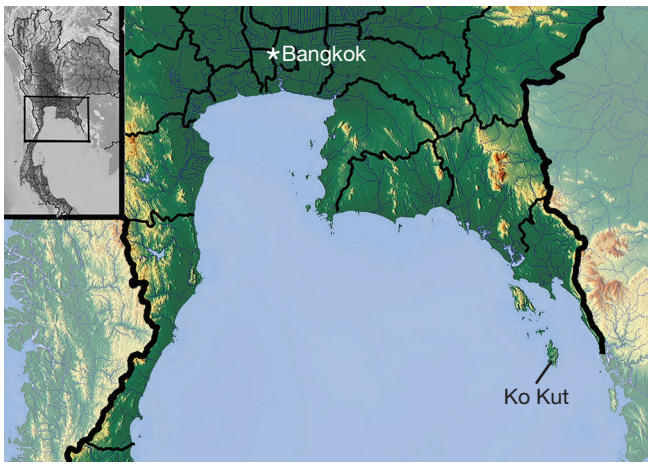

Fig. 1. — Location map showing the position of Kut Island in the Gulf of Thailand (after Buffetaut *et al.* 2019).

(Tong *et al.* 2002, 2009a). The relatively high costal 1 length/width value in *S. wimani* (54%) is likely related to the narrow anterior part of the shell, the morphology of this plate with the parallel anterior and posterior margins is closer to the condition in xiniangchelyids than to trionychoids (Tong *et al.* 2014). Among Trionychoidae, nanhsiungchelyids also have a relatively long costal 1 and many of them reach a large size, but the ornamentation of the shell surface is more prominent than that of PRC149 (Hirayama *et al.* 2001; Danilov *et al.* 2013a; Brinkman *et al.* 2015).

The non-marine Mesozoic deposits of Thailand are rich in basal trionychoid fossils. Several taxa have been reported from the Khorat Group (Late Jurassic – Early Cretaceous). These include the large *Basilochelys macrobios* from the upper part of the Phu Kradung Formation, the small *Isanemys srisuki* and *Protoshachemys rubra* from the Sao Khua Formation, and the medium-sized *Shachemys* sp. from the Khok Kruat Formation (Tong *et al.* 2005, 2006, 2009a, 2019a). Large trionychoid turtle remains have also been collected from the Sao Khua Formation and stratigraphically coeval beds in eastern Thailand, but they are too fragmentary to warrant precise systematic assignment. As mentioned above, on the basis of the shape and the length/width radio of the costal 1, PRC149 is more derived than *Basilochelys*. In addition, the vertebral 1 in PRC149 is trapezoidal in shape and wider than the vertebral 2, whereas in *B. macrobios*, the vertebral 1 is roughly as wide as the vertebral 2, with the lateral borders slightly convergent forward (Tong *et al.* 2009a, b). With a carapace length estimated as about 75 cm, PRC149 may be close to a large trionychoid turtle yet to be named from the Sao Khua Formation.

AGE OF THE KUT ISLAND DEPOSITS

When Buffetaut & Ingavat (1983) first reported vertebrate remains from Kut Island, they tentatively assigned the assemblage an Early Jurassic age, which was in accordance with the attribution of the fossil-bearing strata to the Phu Kradung Formation (at the time referred to the Lower Jurassic (Tansathien

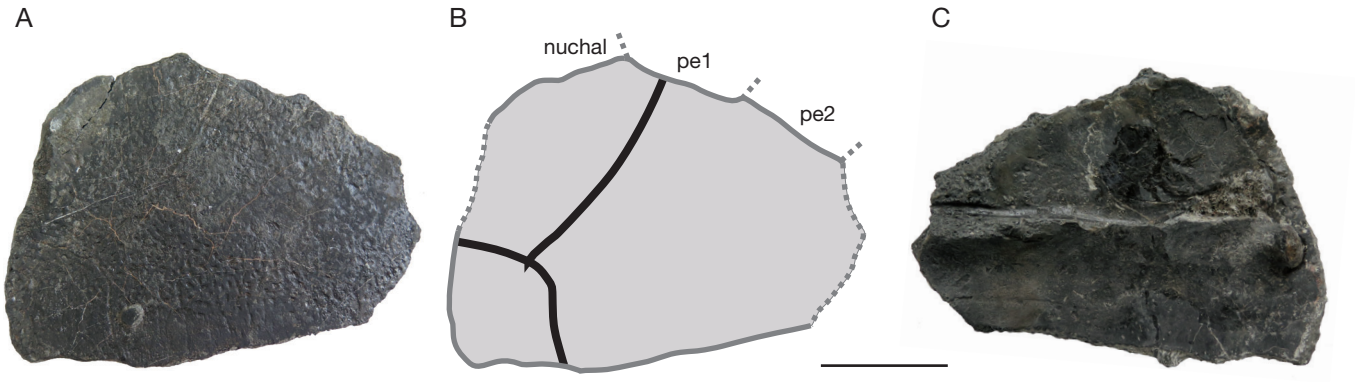

Fig. 2. — Trionychoidae gen. et sp. indet. (Testudines: Cryptodira) from the Early Cretaceous of Kut Island, Gulf of Thailand. Right costal 1 (PRC149) in dorsal (**A**, **B**) and ventral (**C**) views. The solid grey line indicates the sutural margin, the dotted grey line indicates the damaged margin and suture position of peripherals (**pe**) and nuchal plates; the black thick line represents the scute sulci. Scale bar: 5 cm.

et al. 1979)). Based on the vertebrate fauna, notably shark assemblage, Cuny *et al.* (2010) correlated the vertebrate-bearing beds of Kut Island with the Sao Khua Formation of the Khorat Group. This conclusion is supported by the more recent study of spinosaurid dinosaur teeth (Buffetaut *et al.* 2019). The presence of a large trionychoid turtle provides further evidence about the stratigraphical correlation of Kut Island deposits. In the Khorat Group, the Phu Kradung Formation contains two distinct turtle assemblages. The assemblage from the lower part of the formation (Late Jurassic) consists of xinjiangchelyids (*Phunoichelys thirakhupti* Tong, Naksri, Buffetaut, Suteethorn, Suteethorn, Deesri, Sila, Chanthasit & Claude, 2015 and *Kalasinemys prasarttongosothi* Tong, Naksri, Buffetaut, Suteethorn, Suteethorn, Chanthasit & Claude, 2015). The upper part of the formation, which has yielded the abundant large basal trionychoid *Basilochelys macrobios* and an yet undescribed macrobaenid, is likely Early Cretaceous in age (Tong *et al.* 2009a, b, 2018). Turtle assemblages from the Sao Khua (Barremian) and Khok Kruat (Aptian-Albian) formations are so far exclusively composed of Trionychoidae. Adocidae and Carettochelyidae are recorded from both formations (the adocids *Isanemys srisuki* and *Protoshachemys rubra*, the carettochelyid *Kyzilkumemys* sp., and a large undetermined trionychoid from the Sao Khua Formation; and the adocid *Shachemys* sp. and the carettochelyid *Kyzilkumemys khoratensis* Tong, Suteethorn, Claude, Buffetaut & Jintasakul, 2005 from the Khok Kruat Formation (Tong *et al.* 2005, 2006, 2009b). Large trionychoid turtle remains have also been recorded from the Pra Prong locality (Sa Kaeo Province, eastern Thailand) which is coeval with the Sao Khua Formation; but they are (so far) not recorded from the Khok Kruat Formation. As mentioned above, the costal 1 from Kut Island is excluded from Trionychidae and Carettochelyidae; and its morphology is more derived than that of *Basilochelys macrobios* from the Phu Kradung Formation. Our study of the turtle remains would therefore support the conclusions based on sharks and dinosaurs (Cuny *et al.* 2010; Buffetaut *et al.* 2019), viz. that the vertebrate-bearing beds of Kut Island are Early Cretaceous rather than Jurassic in age and can be correlated with the Sao Khua Formation of the Khorat Group.

CONCLUSION

The first costal plate (PRC149) from Kut Island is assigned to Trionychoidae gen. et sp. indet. It represents a large primitive trionychoid turtle that is more derived than *Basilochelys macrobios* from the Phu Kradung Formation. By the comparison with turtle faunas from the Mesozoic of South East Asia, our study supports the correlation of the vertebrate-bearing beds of Kut Island with the Sao Khua formation of the Khorat Group, as do the studies on sharks and dinosaurs.

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REFERENCES

Brinkman D. B., Tong H., Li H., Sun Y., Zhang J.-S., Godefroit P. & Zhang Z.-M. 2015. — New exceptionally well-preserved specimens of *"Zangerlia" neimongolensis* from Bayan Mandahu, Inner Mongolia, and their taxonomic significance. *Comptes Rendus Palevol* 14 (6): 577-587. https://doi.org/10.1016/j.crpv.2014.12.005

Buffetaut E. & Ingavat R. 1983. — Vertebrates from the continental Jurassic of Thailand. *CCOP Technical Bulletin* 16: 68-75.

Buffetaut E., Suteethorn S., Suteethorn V., Tong H. & Wongko K. 2019. — Spinosaurid teeth from the Lower Cretaceous of Ko Kut, eastern Thailand. *Annales de Paléontologie* 105: 239-243. https://doi.org/10.1016/j.annpal.2019.03.006

Cuny G., Laojumpon C. & Lauprasert K. 2010. — Fossil vertebrate remains from Kut Island (Gulf of Thailand, Early Cretaceous). *Cretaceous Research* 31 (4): 415-423. https://doi.org/10.1016/j.cretres.2010.05.007

DANILOV I. G., SUKHANOV V. B. & SYROMYATNIKOVA E. V. 2011. — New Asiatic materials on turtles of the family Adocidae with a review of the adocid record in Asia. *Proceedings of the Zoological Institute RAS* 315 (2): 101-132.

DANILOV I. G., SUKHANOV V. B. & SYROMYATNIKOVA E. V. 2013a. — A redescription of *Zangerlia dzamynchondi* (Testudines: Nanhsiungchelyidae) from the Late Cretaceous of Mongolia with a reassessment of the phylogenetic position and relationships of *Zangerlia*, *Morphology and Evolution of Turtles*. Springer, Dordrecht: 407-417.

DANILOV I. G., SYROMYATNIKOVA E. V., SKUTSCHAS P. P., KODRUL T. M. & JIN J. 2013b. — The first 'true' *Adocus* (Testudines, Adocidae) from the Paleogene of Asia. *Journal of Vertebrate Paleontology* 33 (5): 1071-1080. https://doi.org/10.1080/02724634.2013.768254

DANILOV I. G., SYROMYATNIKOVA E. V. & SUKHANOV V. B. 2017. — Subclass Testudinata, *in* LOPATIN A. V. & ZELENKOV N. V. (eds), *Fossil vertebrates of Russia and adjacent countries. Fossil Reptiles and Birds. Part 4*. GEOS, Moscow: 27-395.

GAFFNEY E. S. & MEYLAN P. A. 1988. — A phylogeny of turtles, *in* BENTON M. J. (ed.), *The Phylogeny and Classification of the Tetrapods, Vol. 1, Amphibians, Reptiles, Birds*. Oxford, Clarendon Press: 157-219.

GEORGALIS G. L. & JOYCE W. G. 2017. — A review of the fossil record of Old World turtles of the clade Pan-Trionychidae. *Bulletin of the Peabody Museum of Natural History* 58 (1): 115-208. https://doi.org/10.3374/014.058.0106

HIRAYAMA R., SAKURAI K., CHITOKU T., KAWAKAMI G. & KITO N. 2001. — *Anomalochelys angulata*, an unusual land turtle of family Nanhsiungchelyidae (superfamily Trionychoidea; order Testudines) from the Upper Cretaceous of Hokkaido, North Japan. *Russian Journal of Herpetology* 8 (2): 127-138.

PENG J.-H. & BRINKMAN D. B. 1993. — New material of *Xinjiangchelys* (Reptilia: Testudines) from the Late Jurassic Qigu Formation (Shishugou Group) of the Pingfengshan locality, Junggar Basin, Xinjiang. *Canadian Journal of Earth Sciences* 30 (10): 2013-2026. https://doi.org/10.1139/e93-177

RABI M., SUKHANOV V. B., EGOROVA V. N., DANILOV I. & JOYCE W. G. 2014. — Osteology, relationships, and ecology of *Annemys* (Testudines, Eucryptodira) from the Late Jurassic of Shar Teg, Mongolia, and phylogenetic definitions for Xinjiangchelyidae, Sinemydidae, and Macrobaenidae. *Journal of Vertebrate Paleontology* 34 (2): 327-352. https://doi.org/10.1080/02724634.2013.807274

SUKHANOV V. B. 2000. — Mesozoic turtles of middle and central Asia, *in* BENTON M. J., SHISHKIN M. A., UNWIN D. M. & KUROCHKIN E. N. (eds), *The age of dinosaurs in Russia and Mongolia* Cambridge University Press, Cambridge: 309-367.

SYROMYATNIKOVA E. V. 2011. — Turtles of the genus *Ferganemys* Nessov et Khosatzky, 1977 (Adocidae): shell morphology and phylogenetic position. *Proceedings of the Zoological Institute of the Russian Academy of Sciences* 315 (1): 38-52.

SYROMYATNIKOVA E. V. & DANILOV I. G. 2009. — New material and a revision of turtles of the genus *Adocus* (Adocidae) from the Late Cretaceous of Middle Asia and Kazakhstan. *Proceedings of the Zoological Institute RAS* 313 (1): 74-94.

SYROMYATNIKOVA E. V., DANILOV I. G. & SUKHANOV V. B. 2013. — The skeletal morphology and phylogenetic position of *Adocus amtgai*, an adocid turtle from the Late Cretaceous of Mongolia. *Cretaceous Research* 45: 155-173. https://doi.org/10.1016/j.cretres.2013.07.006

TANSATHIEN W., POLPRASIT C. & PAJIIPRAPAPORN V. 1979. — *Krong Khemarak Phoumin 1: 250,000 Geological Map of Thailand*. Geological Survey Division, Department of Mineral Resources, Bangkok.

TONG H. 2017. — Testudines, *in* LI J. & TONG H., *Parareptilians, Captorhines and Testudines*, *Palaeovertebrata Sinica*, Vol. II, *Amphibians, Reptiles and Avians*, Fasc. 2. Science Press, Beijing: 92-365.

TONG H., BUFFETAUT E. & SUTEETHORN V. 2002. — Middle Jurassic turtles from southern Thailand. *Geological Magazine* 139 (6): 687-697. https://doi.org/10.1017/S0016756802006805

TONG H., SUTEETHORN V., CLAUDE J., BUFFETAUT E. & JINTASAKUL P. 2005. — The turtle fauna from the Khok Kruat Formation (Early Cretaceous) of Thailand. *Proceedings of the International Conference on Geology, Geotechnology and Mineral Resources of Indochina (GEOINDO 2005)*, Khon Kaen: 610-614.

TONG H., BUFFETAUT E. & SUTEETHORN V. 2006. — *Isanemys*, a new adocid turtle from the Sao Khua Formation (Early Cretaceous) of the Khorat Plateau, northeastern Thailand. *Fossil Turtle Research* 1: 128-137.

TONG H., CLAUDE J., NAKSRI W., SUTEETHORN V., BUFFETAUT E., KHANSUBHA S., WONGKO K. & YUANGDETKLA P. 2009a. — *Basilochelys macrobios* n. gen. and n. sp., a large cryptodiran turtle from the Phu Kradung Formation (latest Jurassic-earliest Cretaceous) of the Khorat Plateau, NE Thailand. *Geological Society, London, Special Publications* 315 (1): 153-173. https://doi.org/10.1144/SP315.12

TONG H., CLAUDE J., SUTEETHORN V., NAKSRI W. & BUFFETAUT E. 2009b. — Turtle assemblages of the Khorat Group (Late Jurassic-Early Cretaceous) of NE Thailand and their palaeobiogeographical significance. *Geological Society, London, Special Publications* 315 (1): 141-152. https://doi.org/10.1144/SP315.11

TONG H., DANILOV I., YE Y., OUYANG H., PENG G. & LI K. 2012. — A revision of xinjiangchelyid turtles from the Late Jurassic of Sichuan Basin, China. *Annales de Paléontologie* 98: 73-114. https://doi.org/10.1016/j.annpal.2012.01.001

TONG H., LI L. & OUYANG H. 2014. — A revision of *Sinaspideretes wimani* Young & Chow, 1953 (Testudines: Cryptodira: Trionychoidae) from the Jurassic of the Sichuan Basin, China. *Geological Magazine* 151 (4): 600-610. https://doi.org/10.1017/S0016756813000575

TONG H., DONG Z. & WANG T. 2015a. — A revision of *Xinjiangchelys oshanensis* (Ye, 1973), and new material from the Middle Jurassic of Lufeng, Yunnan Province, China. *Bulletin de la Société géologique de France* 186 (1): 43-49. https://doi.org/10.2113/gssgfbull.186.1.43

TONG H., NAKSRI W., BUFFETAUT E., SUTEETHORN V., SUTEETHORN S., DEESRI U., SILA S., CHANTHASIT P. & CLAUDE J. 2015b. — A new primitive eucryptodiran turtle from the Upper Jurassic Phu Kradung Formation of the Khorat Plateau, NE Thailand. *Geological Magazine* 152 (1): 166-175. https://doi.org/10.1017/S0016756814000223

TONG H., CLAUDE J., NAKSRI W., SUTEETHORN V., SUTEETHORN S., CHANTHASIT P. & BUFFETAUT E. 2018. — *The age of the Phu Kradung Formation (Khorat Group, NE Thailand): Indications from the turtle faunas*. JK2018, Geneva: 69-70.

TONG H., BUFFETAUT E., SUTEETHORN V., SUTEETHORN S., CUNY G., CAVIN L., DEESRI U., MARTIN J. E., WONGKO K., NAKSRI W. & CLAUDE J. 2019a. — Phu Din Daeng, a new Early Cretaceous vertebrate locality on the Khorat Plateau, NE Thailand. *Annales de Paléontologie* 103 (3): 223-237. https://doi.org/10.1016/j.annpal.2019.04.004

TONG H., NAKSRI W., BUFFETAUT E., SUTEETHORN S., SUTEETHORN V., CHANTASIT P. & CLAUDE J. 2019b. — *Kalasinemys*, a new xinjiangchelyid turtle from the Late Jurassic of NE Thailand. *Geological Magazine* 147 (10): 1645-1656. https://doi.org/10.1017/S0016756818000791

VITEK N. S. & JOYCE W. G. 2015. — A review of the fossil record of New World turtles of the clade Pan-Trionychidae. *Bulletin of the Peabody Museum of Natural History* 56 (2): 185-244. https://doi.org/10.3374/014.056.0204

YE X.-K. 1986. — A Jurassic turtle from Junggar, Xinjiang. *Vertebrata PalAsiatica* 24 (3): 171-181.

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