FOSSIL TURTLE RESEARCH

VOLUME 1

Proceedings of the Symposium on Turtle Origins, Evolution and Systematics

August 18-20, 2003,
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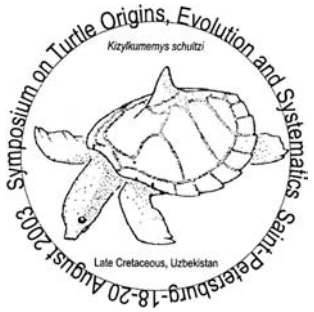

Edited by
Igor G. Danilov and James F. Parham

St. Petersburg, 2006

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**Cover photo: PIN 52-1a, holotype of *Yaxartemys longicauda* Riabinin, 1948,
Upper Jurassic of Kazakhstan, Karatau Ridge, vicinity of Mikhailovka village
Photograph: Igor Danilov**

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REPORT ON THE 3RD SYMPOSIUM ON TURTLE ORIGINS, EVOLUTION AND SYSTEMATICS, ST. PETERSBURG, RUSSIA, 2003 [1]

An International Symposium on Turtle Origins, Evolution and Systematics was held at the Zoological Institute of the Russian Academy of Sciences (St. Petersburg) August 18th-20th, 2003. This symposium continued a tradition founded 20 years ago by the First International Symposium on Fossil Turtles (Paris, France, 1983). Since then, there have been two additional sessions within the context of larger meetings: One within the 75th Annual Meeting of the American Society of Ichthyologists and Herpetologists (Edmonton, Canada, 1995) and one within the 56th Annual Meeting of the Society of Vertebrate Paleontology (New York, USA, 1996). Unfortunately, for political and later for financial reasons, most Soviet and Russian specialists were not able to participate in any of these meetings.

Russia has a long tradition of turtle studies. L. G. Bojanus (1776 – 1827) published his famous «Anatome Testudinis Europaea» (1819, 1821), while he was rector of the University in Vilna (now Vilnius, Lithuania), which belonged to Russian Empire at that time. This work remains the most detailed description of turtle anatomy and was republished in 20th century twice (1902, 1970). Academician A. A. Strauch (1832 – 1893), director of the Zoological Museum in St. Petersburg (now the Zoological Institute), is well known for his papers on chelonology (Strauch, 1862, 1890). In fact, the term «chelonology,» introduced by Polish turtle expert M. Młynarski (1969), was based on Strauch's (1862) «Chelonologische Studien» (Borkin, pers. com.). W. A. Lindholm (1874 – 1935) should also be mentioned among turtle experts of the beginning of the 20th century, although he is better known as a malacologist.

Large collections of fossil turtles from the territory of the Russian Empire, and later Soviet Union, are housed in St. Petersburg (Leningrad) at the Zoological Institute (ZIN) and at the Chernyshev's Central Museum of Geological Exploration (CCMGE). These collections were studied by A. N. Riabinin (1874 – 1942), L. I. Khosatzky (1913 – 1992) and L. A. Nessov (1948 – 1995). In the second half of the 20th century, turtle specialists appeared in other parts of the Soviet Union: Moscow (Russia), Kiev (Ukraine), Tbilisi (Georgia) and Almaty (Kazakhstan). Soviet chelonologists formulated important ideas about turtle phylogeny and systematics. Unfortunately, their ideas were not published in English and so were often ignored by foreign colleagues. Furthermore, the possibility of direct contact between soviet and foreign scientists, and access to published materials, was limited. The international symposium on turtles in St. Petersburg aimed not only to solve scientific problems, but also to establish close contacts between Russian and foreign turtle specialists.

The Symposium was organized by an international team, led by I. G. Danilov (ZIN). The scope of the symposium was expanded in comparison to previous ones to include problems connected with studying both fossil and recent turtles. The number of registered participants was 19, including scientists from Russia (7), Japan (4), France

[1] This report was presented in the 1st issue of the *Fossil Turtle Newsletter* (2004), *Herpetological Review,* **34**(2), 150, and a shortened version was published in *Paleontologicheskii Zhurnal*, **4**, 110-112 (English translation in *Paleontological Journal,* **38**(4), 465-467).

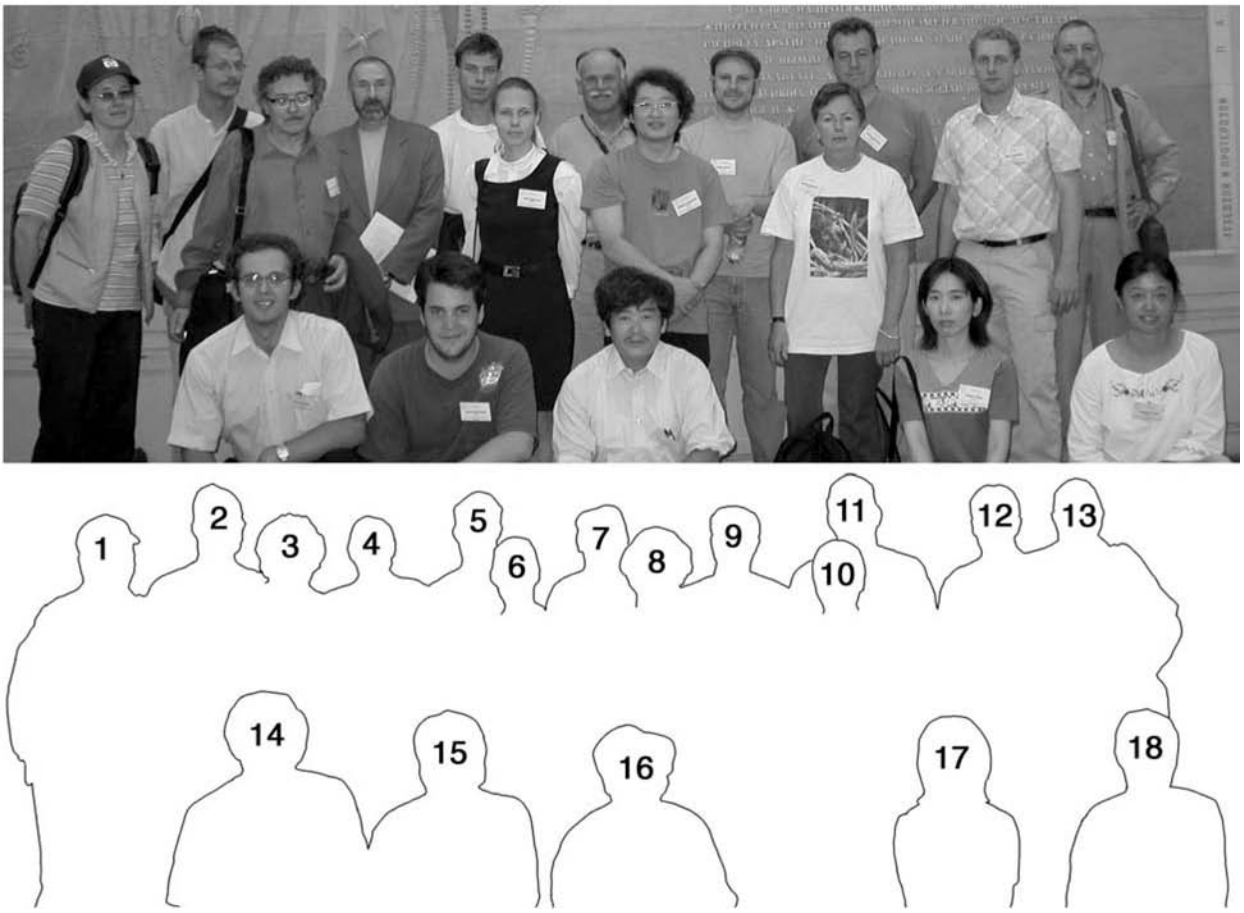

Fig. 1. A group photo of some of the participants of the International Symposium on Turtle Origins, Evolution and Systematics that was held at the Zoological Institute of the Russian Academy of Sciences: 1 – S. Krasnova; 2 – J. Claude; 3 – V. Sukhanov; 4 – G. Cherepanov; 5 – A. Rezvyi; 6 – V. Egorova; 7 – D. Brinkman; 8 – S. Kuratani; 9 – W. Joyce; 10 – S. Chapman; 11 – V. Gillespie; 12 – O. Piskurek; 13 – E. Buffetaut; 14 – I. Danilov; 15 – J. Parham; 16 – R. Hirayama; 17 – Y. Ohya; 18 – H. Tong.

(3), USA (2), the United Kingdom (1), Canada (1) and Georgia (1). This symposium was the largest by number of presentations (21). The age composition of participants was shared equally between young and middle generations. There were only two participants older than 60, V. B. Sukhanov (Moscow, Russia) and V. M. Chkhikvadze (Tbilisi, Georgia). It is worth mentioning that besides registered participants, sessions were attended by up to 50 additional people (colleagues from ZIN, students of the St. Petersburg University and visitors). The official language of the Symposium was English.

The welcoming speech was made by Head of the Department of Ornithology and Herpetology of ZIN, N. B. Ananjeva. She wished fruitful work to the participants and noted that this Symposium took the baton from the XIIth Ordinary General Meeting of the Societas Europaea Herpetologica, which had been just held in ZIN and SPSU (August, 12th-16th, 2003).

The scientific program of the Symposium consisted of four oral sessions, one poster session and work with fossil turtles collections of ZIN and CCMGE. After the Symposium, eight participants

traveled to Moscow to continue work with collections in the Paleontological Institute (PIN).

The first session «Evolutionary Morphology of Turtles» included six presentations. G. O. Cherepanov (St. Petersburg) presented regularities of the morphogenesis and main tendencies in the evolution of the horny shell in turtles. Morphogenetic data allow him to suppose that turtle ancestors had a polymeric pattern of scales in longitudinal series on each trunk segment. The evolution of the horny shell mainly progressed towards a reduction in the number of elements resulting from a reduction in their anlagen.

S. Kuratani, S. Kuraku, H. Nagashima, K. Yamamoto (Kobe, Japan) also discussed the development and origin of the turtle shell. These authors studied the influence of the carapacial ridge (CR) on the development of the carapace. CR is unknown in amniote embryos besides turtles. It is composed of aggregated undifferentiated mesenchyme and overlying ectodermal thickening on both sides of the embryo. Fifteen genes expressed in the CR were identified. They concluded that evolution of the carapace involved de novo regulation of regulatory genes that are widely present in amniote genomes.

J. Claude (Montpellier, France) investigated the morphological transformation of the shell in testudinoid turtles in connection with environment (aquatic vs. terrestrial) using geometric morphometrics and phylogenetic comparative methods. His results suggest that environment and plastral kinesis lead to similar morphological changes among the distinct clades of Testudinoidea, though the phylogenetic inertia in Testudinoidea is strong enough to recognize each clade owing to their architectural characteristics. In his next talk J. Claude reported about the correlation of feeding mode and skull shape in testudinoids. He suggests that the relative development of the tongue and hyoid apparatus represent a fundamental model to understand morphological variation within this group of turtles. Also, he submits that phylogenetic constraints are less important for understanding the cranial variation relative to variation in shell morphology.

The report of H. A. Jamnizky, A. P. Russell (Calgary, Canada), and D. B. Brinkman (Drumheller, Canada) presented preliminary results of the application of computedtomography and radiography for study of cranial circulation in turtles. These methods elucidate the evolutionary pathways taken by turtle cranial circulation with major implications for coding these characters for phylogenetic analyses.

V. M. Chkhikvadze reported on the homology of some plastral scales in turtles. According to him, the Dermatemydidae (*Dermatemys*, *Agomphus*, *Baptemys*) lost humeral scales, instead of pectorals as is currently thought.

The second session, named «Basal Turtles,» was devoted to the most primitive and ancient Triassic and Jurassic turtles. This session consisted of three talks. W. Joyce (New Haven, USA) presented new data on the morphology of *Kayentachelys aprix* from the Lower Jurassic of Arizona, which is usually considered a basal cryptodire. *Kayentachelys* was found to have structures (dorsal processes of epiplastra), which were interpreted by the author as cleithra. In *Kayentachelys*, unlike other primitive turtles, these processes are demonstrably represented by separate ossifications. Cleithra are present in most anapsid reptiles, but absent in all diapsids, making it more plausible that turtles are descendants of anapsid reptiles. Analysis of other characters of *Kayentachelys* allowed the author to conclude that this taxon is situated below the divergence of cryptodires and pleurodires.

V. B. Sukhanov reported on a new, undescribed, turtle from the Middle Jurassic of Moscow Region. According to its morphology, this turtle is as primitive as *Kayentachelys*. Unlike other basal turtles, which are terrestrial by habitus, the new taxon has clear aquatic adaptations.

The last report in this section, by V. M. Chkhikvadze, was devoted to scale nomenclature

Fig. 2. Upper left: W. Joyce becomes acquainted with a specimen of *Anatolemys* (foreground) and the holotype of *Lindholmemys* (in box) as I. Danilov (center) discusses some Russian literature with R. Hirayama (left) and D. Brinkman (right) at the Chernyshev's Central Museum of Geological Exploration in St. Petersburg. Photo by Parham. **Upper right:** D. Brinkman prepares to study a pile of 'macrobaenids' including the type specimen of *Macrobaena* (foreground) and numerous *Hangaiemys* (surrounding) at the Paleontological Institute in Moscow. Photo by Parham. **Lower left:** J. Claude measures an undescribed stem-testudinoid from Mongolia at Sukhanov's laboratory in Moscow. Photo by Parham. **Lower right:** V. B. Sukhanov ponders the hoard of visiting paleochelonogists at his home office in Moscow. Photo by Joyce.

in the oldest known turtle *Proganochelys quenstedti* (Upper Triassic, Germany). This author noted considerable similarity in the carapace scalation between Proganochelyidae and Baenidae.

The third session, devoted to Cretaceous turtles, included five reports. R. Hirayama (Ichihara, Japan) reported on Early Cretaceous turtle faunas of Japan. There are several successive assemblages in the Neocomian – Aptian interval. These assemblages include oldest trionychoids and testuinoids, which suggest origins of these groups when Asia was isolated from other continents.

H. Tong, E. Buffetaut (Paris, France), V. Suteethorn (Bangkok, Thailand) and P. Srisuk (Phetchaburi, Thailand) reported about turtles from the Lower Cretaceous Sao Khua Formation of Thailand. Two taxa, belonging to Adocidae and Carettochelyidae, are present in this formation. This turtle fauna shows strong affinities with the mid-Cretaceous fauna of Central Asia (Uzbekistan).

The presentation of P. P. Skutschas (St. Petersburg, Russia) was devoted to Early Cretaceous (Barremian-Aptian) turtles from Krasnyi Yar locality in Transbaikalia (Russia). The assemblage includes 'macrobaenid' turtles Kirgizemys/ Hangaiemys and a chelonioid. The presence of a sea turtle and a hybodont shark at the Krasnyi Yar locality, along with the typical freshwater and terrestrial vertebrates, suggests a lake-like basin and its connection to the ocean during the Aptian sea transgression.

I. G. Danilov and A. O. Averianov (St. Petersburg, Russia) presented new data on the morphology of *Kizylkumemys*, the oldest carettochelyid (Mid-Cretaceous, Asia). *Kizylkumemys* appears to be more primitive than *Carettochelys* and shows some similarities to trionychid turtles. These new data support the monophyly of the clade Trionychia (Carettochelyidae + Trionychidae). However, the carotid morphology of *Kizylkumemys* is more similar to baenid condition (internal carotid canal is floored anteriorly, no foramina basisphenoidales present), which argues in favor of a phylogenetic position of Trionychia outside of Eucryptodira.

The report of D. B. Brinkman and J. Tarduno (New York, USA) was devoted to the Late Cretaceous (Turonian – Coniacian) assemblage of turtles from the Canadian Arctic (Kanguk Shale, Axel Heiberg Island). This assemblage includes trionychids, 'macrobaenids' and eucryptodires. The presence of a diverse assemblage of turtles at high paleolatitudes in the Turonian-Coniacian is consistent with independent interpretations that this was a time of extreme climatic warmth.

The last oral session included three reports. This session was devoted to the 'macrobaenids', a group of Cretaceous – Paleogene turtles of uncertain affinities. Some 'macrobaenids' may be basal members of living cryptodire lineages and others may be sister to crown group cryptodires. J. F. Parham (Berkeley, USA) reported on *Osteopygis emarginatus* (Cretaceous – Tertiary boundary, North America), which was formerly considered as the most primitive sea turtle. He suggests that *Osteopygis* represents a chimera: the shell material (including the holotype) belongs to macrobaenids, whereas the referred skulls belong to typical sea turtles. The decapitation of *Osteopygis* reconciles morphological trends within stem-cheloniids and advanced eucryptodires.

V. N. Egorova (Moscow, Russia) presented her results of the study of morphology of Asian 'macrobaenids'. According to her studies of skull morphology, the genera *Macrobaena* (Upper Paleocene, Mongolia) and *Ordosemys* (Lower Cretaceous, China) are considered related.

I. G. Danilov, A. O. Averianov, P. P. Skutschas, A. S. Rezvyi (St. Petersburg) reported new data on the morphology of the 'macrobaenid' genus *Kirgizemys* known from the Early Cretaceous of Kirghizia, Buryatiya (Russia) and China. New material from the Early Cretaceous of Buryatia allowed study of the previously unknown skull of *Kirgizemys*. In skull and shell morphology, *Kirgizemys* is indistinguishable from *Hangaiemys*

from the Early Cretaceous of Mongolia. The authors consider *Hangaiemys* a junior subjective synonym of *Kirgizemys*.

The poster session included presentations devoted to modern developmental and molecular studies of turtle development and phylogeny. Y. K. Ohya and S. Kuratani (Kobe, Japan) presented their results of the study of Hox-gene expression in turtle embryos. The poster of O. Piskurek, D. Kordis and N. Okada (Yokohama, Japan) reported on the discovery of short interspersed repetitive elements (SINEs) in the turtle genome. SINEs have been reported for many animals from insects to mammals. These colleagues showed that SINEs represent a powerful new tool for systematic biology and that the application of this tool to reptiles may help to solve the problem of turtle origins.

An important part of the program was work with scientific collections of ZIN and CCMGE. In the ZIN, work was conducted at the Department of Herpetology. Fossil specimens, including holotypes, and publications were made available. During those final days, you could find all the participants of the symposium sitting around a big table examining specimens and discussing with colleagues.

The symposium was extremely successful and passed in a friendly climate. In the end, the participants of the symposium came understand each other better. We all got drunk and had a good time. The symposium promoted contacts and cooperation between colleagues.

The organizers would like to express deep gratitude to Drs. N. B. Ananjeva, E. N. Kurochkin (PIN), V. B. Sukhanov, as well as administration and staff of the CCMGE for help in organization of the symposium. The authors thank L. Y. Borkin (ZIN) and Walter Joyce for useful comments on this report.

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Ren Hirayama
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