Japan Geoscience Union Meeting 2011
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BPT026-01 Room:201B Time:May 24 14:15-14:30

Review of Cenozoic terrestrial turtles (Class Reptilia: Order Testudines) from Japan

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Cenozoic sediments of Japanese Islands are yielding diversified terrestrial turtles from the Early Eocene to Late Pleistocene. Middle Miocene of Southwestern Japan, Pliocene Tsubusagawa Formation of Oita Prefecture, Pleistocene of Ryukyu Islands, and Pleistocene fissure deposits of Honshu Island are especially important localities. They are all cryptodires, including Geoemydidae, Testudinidae, Trionychidae, and Platysternidae.

Ocadia nipponica is a large geoemydid (33 cm long shell), based on a nearly complete skeleton from the Middle Pleistocene Kiyokawa Formation of Chiba Prefecture. Same taxon has been found from the Pleistocene deposits of Nagasaki, Hyogo, Osaka, Shiga, Shizuoka, and Kanagawa Prefectures. Smaller geoemydids are represented by Mauremys yabei and Cuora miyatai from the Pleistocene fissure deposits of Tochigi Prefecture. Additional materials of M. yabei have been collected from the Pleistocene of Chiba, Kanagawa, Shizuoka, Nagasaki Prefectures, and the Miyako Group of Okinawa Prefecture. C. miyatai are also known from the Pleistocene of Yamaguchi and Oita Prefectures. More primitive unnamed taxon of the genus Cuora is known from the Late Pleistocene of Okinawa Island. O. nipponica is closely related with living O. sinensis of Taiwan, Southern China, and Vietnam. M. yabei is most similar to extant M. japonica, possibly ancestral form of the latter. C. miyatai is most similar to living C. flavomarginata among this genus. Geoemyda japonica, an endemic living species, is known since the Early Pleistocene of Ryukyu Islands, whereas extinct taxon of this genus, G. amamiensis, is reported from the Tokunoshima Island. These materials demonstrate diverse endemic geoemydid turtles were once established in the Pleistocene of Japanese Islands, whereas today only two species, M. japonica and G. japonica, are survived.

Large geoemydids like O. nipponica are known from the Early Miocene of Iwate, Okayama, Shimane, Nagasaki, and Kagoshima Prefectures. They are distinguished from the Pleistocene materials in the possession of weak secondary palate and thick shell. Geoemydids identified as Geoemyda and Malayemys are collected from the Early Miocene of Gifu Prefecture and Late Oligocene of Nagasaki Prefecture respectively. These Tertiary geoemydids from Japan are oldest known record of each genus.

Manouria oyamai is an extinct testudinid once widely distributed in the Ryukyu Islands, possibly terminated by human activities. Geoclemmys matuuraensis and Geoemyda takasago are considered as small testudinids from the Paleogene deposits of Kyushu Island.

Fragmentary remains of trionychid turtles are often found from the Cenozoic sediments from Hokkaido to Okinawa Prefectures. Of tehese, large trionychid specimens from the Middle Eocene to Early Miocene deposits are identified as the genus Rafetus based on small eighth costal plates. Early Miocene trionychids are usually found from the shallow marine or blackish deposits. Living Pelodiscus sinensis is found from the Pliocene of Oita Prefecture, whereas its Pleistocene material has never been discivered.

Isolate cranial materials of Platysternidae are found from the Pliocene of Oita Prefecture and Pleistocene of Okinawa Island. These are only known fossil record of this family with certainty.

Terrestrial turtles from the Cenozoic sediments of Japan would be extremely important materials for understanding paleobiogeography, paleoclimate, and human activities in this area.

Keywords: Cenozoic, turtles, organic diversification, paleogeography, paleoclimate

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Carnivorous mammal faunas in the Paleogene of East Asia: chronological changes and geographical differences

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East Asia is known to have provided rich fossil evidences for Paleogene mammals. However, a large portion of the fossil remains has come from the northern East Asia, such as Mongolia and Inner Mongolia of China. During the past decade or so, intensive paleontological expeditions on Eocene localities in Southeast Asian countries such as Myanmar and Thailand have improved terrestrial mammalian fossil records from low latitude East Asia. In addition, reexamination on carnivorous mammals from the late Eocene of Mongolia revealed presence of species that are new taxa or that are previously unknown taxa to the area. In this study, using updated information on the carnivorous mammal fossil records in the Paleogene of East Asia, we attempted to evaluate chronological changes and geographical (latitudinal) differences among carnivorous mammal faunas.

Carnivorous mammals of our comparison consist of three orders: Carnivora (or Carnivoramorph), Creodonta, and Mesonychia. In East Asia, mesonychians were more dominant than other carnivorous mammals at first, and carnivorans became dominant during the later part of the Paleogene. Carnivorans appeared since the Paleocene, represented by the Viverravidae, then by the Miacidae. Southern East Asian faunas differ from the northern traditional Asian faunas in some points. First, mesonychians were dominant until the late Eocene in the northern area, while they became decreased during the middle Eocene in the southern area. Second, hyaenodontid creodonts in the northern faunas are *Hyaenodon* and its relatives and survived until the end of the Oligocene, while hyaenodontids in the southern faunas are proviverrines of Indian affinities and a hyaenaelurine and became extinct during the late Eocene. Third, carnivorans were rare or absent before the late Eocene in the northern area, while they became common elements of the fauna since the middle Eocene in the southern area.

Although there is a general trend of faunal turnover from mesonychians to carnivorans in the Paleogene of East Asia, the timings of first and last appearances of the carnivorous mammal groups differ among areas, suggesting that the turnover started earlier in the lower latitude faunas. Hyaenodontid creodonts in particular suggest that the faunas contain elements of geographically different origins: hyaenodontids from the southern faunas have relatives in India and Africa, while those from the northern faunas are genera known from North America and Europe. In East Asia, latitudinal differences in composition of terrestrial carnivorous mammalian faunas are present at least since the middle Eocene well before the formation of present-day biogeographical regions.

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Evolutionary change of porcupines in the late Neogene of central Myanmar

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The Neogene Irrawaddy Group is mainly composed of fluviatile deposits and widely distributed along the Irrawaddy River and its tributary in central Myanmar. Since the early 20th century it has been known for yielding many vertebrate fossils. Here, we report new discoveries of Old World porcupine (Hystricidae, Rodentia) specimens from the lower part of the Irrawaddy sediments (upper Miocene to lower Pliocene) of Chaingzauk area and the upper Irrawaddy (upper Pliocene to lower Pleistocene) of Gwebin area in central Myanmar.

The hystricid specimens are assigned to a new species ({under}Hystrix{/under} sp. nov.) from Chaingzauk and two species ({under}H{/under}. cf. {under}zhengi{/under}, {under}H{/under}. cf. {under}brachyura{/under}) from Gwebin. The Chaingzauk species is characterized by huge-size, semi-hypsodont, and robust mandibular corpus. These diagnostic features indicate the species to be phyletically closer to the Mio-Pliocene European and African species than to any fossil/living {under}Hystrix{/under} species from South Asia and China.

On the other hand, {under}H{/under}. cf. {under}zhengi{/under} from Gwebin differs from the Chaingzauk species in having much smaller and slightly higher tooth crown but resembles the species from the upper Pliocene to lower Pleistocene of China. Although the Irrawaddy fauna has been correlated with the Siwalik fauna from Indo-Pakistan rather than that from East Asia until the Pliocene on the basis of faunal comparisons, the occurrence of {under}H{/under}. cf. {under}zhengi{/under} suggests faunal interchange between Myanmar and East Asia during late Pliocene and early Pleistocene.

The other species from Gwebin is comparatively small and hypsodont, referring to extant Asian {under}Hystrix{/under}, {under}H{/under}. {under}brachyura{/under}. {under}H{/under}. {under}subcristata{/under}, which is widely discovered from the lower Pleistocene of South China and probable junior synonym of {under}H{/under}. {under}brachyura{/under}, is as large as {under}H{/under}. cf. {under}brachyura{/under} from Gwebin, also suggesting the faunal interchange with South China. In Southeast Asia, Gwebin is the oldest fossil locality of this extant species, suggesting that the extant lineage of {under}Hystrix{/under} occurred in inland Southeast Asia during the Plio-Pleistocene and dispersed into southern areas.

Based on the analyses of the Chaingzauk fauna and the stable isotope data of mammal teeth Zin-Maung-Maung-Thein {under}et al{/under}. (in press) demonstrated that there was the faunal succession in the Mio-Pliocene of central Myanmar caused by an environmental transition from rather wet to dryer conditions. According to our preliminary analysis, the ratio of the woodland dwellers in the Gwebin fauna is lower than in the Chaingzauk fauna, suggesting that the paleoenvironment of the Plio-Pleistocene Gwebin fauna is likely to be more open and dryer condition than the late Miocene/early Pliocene Chaingzauk fauna. The present discoveries of {under}Hystrix{/under} fossils also support this view: that is, the higher-crowned species, which is adapted to the drier condition, has replaced the lower-crowned ones, which is adapted to the wet condition.

Keywords: Myanmar, Hystrix, Neogene, Irrawaddy sediments

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Evolution of the anthracotheres (Mammalia, Artiodactyla) in the Neogene of Myanmar

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We report new gnatho-dental specimens of the anthracotheres (Mammalia, Artiodactyla) discovered from four Neogene localities of central Myanmar. Based on these new specimens, we recognized four species of the anthracotheres in the Neogene of central Myanmar: Microbunodon silistrensis and aff. Sivameryx sp. from the middle Miocene; and Microbunodon milaensis and Merycopotamus dissimilis from the latest Miocene to Plio-Pleistocene. This discovery extends the distribution of Microbunodon and Sivameryx-like bothriodontine from the Indian Subcontinent to Southeast Asia, indicating their broader distribution in the Neogene. Furthermore, the discovery demonstrated that Microbunodon survived until the Plio-Pleistocene. It also indicates that both a highly selenodont hippo-like form (Merycopotamus) and a bunodont and relatively primitive form (Microbunodon) were the last surviving anthracotheres. These two anthracotheres co-existed until the late Pliocene/early Pleistocene in Myanmar. In the Neogene of Myanmar, the anthracotheriid fauna was changed around the late Miocene. This change was probably caused by the invasion of anthracotheres from the Indian Subcontinent likely related to the major faunal turnover events in the subcontinent. Then, the later fauna persisted until the late Pliocene/early Pleistocene, when the last anthracotheres became extinct.

Keywords: Myanmar, Neogene, Anthracotheriidae, Mammalia, fossil

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Ecological distinction of hipparionine taxa distributed synpatric in single locality - detected differential patterns of

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More than two morphologically distinct hipparionine horses (Equidae) were recognized in single mammalian faunas from single locality of late Miocene in Eurasia. They differ from each other on their size and proportion of body, and morphology of skull. The dental morphology observed on wearing surface of cheek teeth that had been previously utilized for their taxonomy has very little and limited taxonomic value. The mesowear analysis on dental battery of cheek teeth shows differentiation in those hipparionines on ecology and feed habitats in single locality. When more than two morpho-types are found from a single locality collection, we need to recognize the correspondence relationships among cranial and postcranial grouping based on above-mentioned morphology. The differences in postcranial bones of those sympatric forms are shown in both size and proportions, or/and only proportions. There are cases that nearly five sympatric hipparionine taxa are found from single locality (from a bed). That wide variation of cranial, dental, and postcranial morphologies among the sympatric horses suggests they separately utilized their environments in narrow and limited geographical space, in widely diverse vegetation and landscape. The methods of such utilization are highly variable in different localities in Eurasia. More derived Pliocene-typed hipparionine taxa than late Miocene forms are recognized in late Miocene Pikermian fauna in the central Asia. These data provides new data for study on origin of derived Pliocene mammalian faunal assemblages in Eurasia, and possibility of fine biostratigraphic correlations of their localities in Eurasia.

Keywords: Miocene, Paleoecology, Hipparion, Morphology, Paleoenvironment

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Evolutionary history of large cercopithecine monkeys in Eurasia: internal cranial morphology and dispersal route

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Procynocephalus and Paradolichopithecus are the largest representatives of fossil cercopithecines known from the middle Pliocene to the early Pleistocene of Eurasia. The specimens from China and India are usually assigned to the former and those from Europe and central Asia are to the latter, although some scholars argue that the latter was a junior synonym of the former. The geological and geographical distributions suggest that Paradolichopithecus/Procynocephalus probably arose in the early Pliocene of western Eurasia and then dispersed eastward. Despite of few differences in external features, there are distinctions in the internal nasal regions among Paradolichopithecus crania from the three localities. Para. arvernensis from the late Pliocene of Seneze, France shows no maxillary sinus, whereas Para. sushkini from the late Pliocene of Kuruksay, Tajikistan, had this feature. The partial maxilla of Para. gansuensis recently reported from the early Pleistocene of Longdan, north western China shows no evidence for the formation of a maxillary sinus, as is seen in the Seneze cranium. Among extant cercopithecines, the maxillary sinus exists only in macaques. Therefore, such a discrepancy might reflect an intergeneric distinction between the Seneze/Longdan and Kuruksay specimens. Despite of no evidence for Procynocephalus, this genus is regarded as most closely related to macaques. Thus, Para. gansuensis might have dispersed eastward retaining a primitive condition though central Asia, while Paradolichopithecus sushkini and Procynocephalus would have acquired this feature independently in central Eurasia and dispersed to East through South and Southeast Asia.

Keywords: Cercopithecinae, Eurasia, dispersal route, maxillary sinus, Primates

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Evolutionary history and dispersal route of catarrhine primates in the late Neogene of Eastern Asia

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Extanct Asian non-human primates are now widely distriuted in the temperate to tropical/subtropical forest and open lands in South to Southeast/East Asia. In this study I discuss the evolutionary history nad the dispersal route of the Asian catarrhine primates, including Hominoidea (apes including gibbons and orangutan) and Cercopithecoidea (Old World monkeys including Colobinae and Cercopithecinae), based on the fossil records in Eastern Asia.

It is generally recognized that the the Asian hominoids and Old World monkeys have origined in Africa in the Early/Middle Miocene, and then invaded into Eurasia in the Middle Miocene or later. They have finally dispersed to Far East Asia, such as Japan and islands of Southeast Asian by the Early Pleistocene.

Among the two groups, hominoids have diversified first, invading into Eurasia as early as the early Middle Miocene, and then dispersed eastward until Southeast Asia via Southern Asia. The oldest fossil record of the Asian large hominoids is Sivapithecus from the Lower Siwaliks of India/Pakistan, which probably produced Gigantopithecus, Pongo (orangutan) and other relatives. Although the fossil specimens of these large hominoids have been discovered from the Middle Miocene through the Middle Pleistocene sediments of the wide area in southern Asian through southern China, all taxa except orangutans of Southeast Asian islands have disappeared by the late Pleistocene. The fact that no homoinoid fossils have been discovered from the northern China indicates they have dispersed to East Asia through southern Asia. The evolutionary history of small apes, gibbos, is not well known because of the scanty fossil records of this group.

On the other hand, Old World monkeys have invaded into Eurasia from Africa as early as the Late Miocene, which is much later than did hominoids. Although both groups (colobines and cercopithecines) have finally arrived at the Far East Asia, the fossil records indicate that evolutionary history of the two groups is not simultaneous: the present fossil records suggest that colobine monkeys have invaded into Eurasia first during the late Miocene, and then cercopithecines followed them around the latest Miocene, and that the eastward despersal of colobines in the Eurasian continent was much earlier than that of cercepithecines. The oldest fossil records of colobines is from the late Miocene of Upper Siwaliks in Southern Asia, and recently, colobine fossils was discovered from the latest Miocene/early Pliocene of Myanmar, Southeast Asia. In addition, the colobine fossils have been reported from the middle Pliocene of Transbaikalia, southern Sibelia, suggesting the possibility of the northern dispersal route. The preliminary analysis of the relatively complete colobine skull discovered from the Upper Pliocene of Kanagawa Prefecture indicates that it is not similar to Asian but to African forms, suggesting the complicated evolutionary history of the group.

Meanwhile, cercopithecine monkeys invaded into Eurasia as early as the latest Miocene: the oldest fossil record is the isolated macaque(?) teeth from the early Pliocene of Yushe, Shanxi Province, northern China, suggesting the distribution of macaque monkeys in the relatively high latitude ares at this time. On the other hand, many fossils remains of macaques as well as colobines have been discovered from the Lower Pleistocene cave deposits of southern China, suggesting that the Southeast Asia was the center of the diversification of Old World monkeys. Moreover, many fossil specimens of large non-macaque cercopihtecine monkeys have been reported from the Pliocene sediments of Europe and Asia. Although the phyletic positions of these large cercopithecines are still in debates, their geographic distribution is obviously viased in the high-latitude area, suggesting the northern dispersal route rather than the southern one.

Keywords: primates, East Asia, hominoids, Old World monkeys, dispersal route

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Evolution of the Late Cenozoic Mammal and Integrated Stratigraphy of South East Eurasia

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Integrated stratigraphy of the Late Cenozoic sites from the South East Eurasia is required by the origin and evolution of human (hominids) and great ape (hominoids). We have no radiometric age in the Late Cenozoic honinids and hominoids sites from the South East Eurasia, because of lacking of volcanics and tuff.

We will show some examples of integrated stratigraphical study in the South West China and North Thailand. We used some immigration events of mammals from the North America to Eurasia, correlation of particular mammalian taxa, precision magnetostratigraphy, finding of magnetic excursion, based on the detailed lithostratigraphy.

Studies of integrated stratigraphy reveal that Yuanmou is not the oldest site of Homo erectus, Homo erectus immigrated about one million years ago into the East Eurassia and the age of the oldest great ape from the South East Eurasia was 12 million years old.

Keywords: South East Eurasia, Late Cenozoic, Mammal, Evolution, Stratigraphy, Chronology