



Title	Anatomy, Systematics and Paleopathology of Pterosaurs: insights based on new specimens from China [an abstract of dissertation and a summary of dissertation review]
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Citation	北海道大学. 博士(理学) 甲第15600号
Issue Date	2023-09-25
Doc URL	http://hdl.handle.net/2115/90745
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Type	theses (doctoral - abstract and summary of review)
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Abstract of Doctoral Dissertation

Degree requested: Doctor of Science Applicant's name: Xuanyu Zhou

Title of Doctoral Dissertation

Anatomy, Systematics and Paleopathology of Pterosaurs: insights
based on new specimens from China
(翼竜類の解剖学・系統分類学・古病理学：中国産新標本に基づく
洞察)

Pterosaurs, from the Greek, *pterosauros*, meaning “winged lizards”, were flying reptiles of the order Pterosauria (Diapsida, Archosauria). They originated in the late Triassic and went extinct at the end of the Cretaceous. Pterosaurs are characterized by unique skeletal features such as the extremely elongated fourth finger (the wing finger), a well-developed forelimb, a weak hindlimb, and pneumatic bones with thin walls.

China comprises some of the most important sites of pterosaurs discoveries in the world. There are about 62 genera 66 species belonging to ten families of pterosaurs discovered till 2022. The earliest Chinese pterosaur record was found in the Middle-Late Jurassic Shaximiao Formation. The latest Chinese pterosaur record was found in the Late Cretaceous Tangshang Formation. Chinese pterosaurs are mainly found in north China besides *Angustinaripterus longicephalus* (Zigong, Sichuan, Southwestern China) and *Zhejiangopterus linhaiensis* (Linhai, Zhejiang, Southeastern China). Especially, the western Liaoning and its surrounding areas are most representative location. Tiaojishan Formation (Oxfordian-Kimmeridgian), Yixian Formation (Barremian-Aptian) and Jiufotang Formation (Aptian) are the most representative stratum of this region. Some recent fundamental pterosaur discoveries researches have come from there, such as pterosaur embryos, soft tissues, the transitional form *Darwinopterus modularis*, the female *Kunpengopterus antipollicatus* preserved with her egg and the holotype of *Kunpengopterus antipollicatus* which exhibits the oldest record of opposed thumb. These discoveries make China one of the most productive regions in the world, that can outmatch Germany (Jurassic Solnhofen deposits) and Brazil (Cretaceous Santana Group). Especially, China is the only country which simultaneously found the primitive type (with a short neck and long tail), advanced type (with a long neck and short tail) and transitional type (bear a combination of characters and are distinguished from both) of pterosaurs in the world. All these discoveries provide further important information on our understanding of pterosaurs. In this study, the comment of Chinese representative clade from all three groups is periodically updated, and the holistic view of my pterosaur research framework is constructed. We use the methods of anatomy, systematic and paleopathology to study a varied sample of all three groups from the western Liaoning and surrounding areas, as follows:

1)Advances in Chinese primitive type pterosaur: Here we reported a new anurognathid pterosaur from the Tiaojishan Formation, named *Sinomacrops bondei*. This new species is represented by an almost complete skeleton, which is, notoriously, one of the best known anurognathid specimens found so far. Importantly, this is the first anurognathid specimen ever to exhibit a skull preserved in a

lateral view. This discovery shed new light onto the anatomy of Anurognathids and their systematic position. We also commented on the group anurognathid.

2) Advances in Chinese transitional type pterosaur: Here we reported a new species of darwinopteran pterosaur revealing an opposed thumb, named *Kunpengopterus antipollicatus*. A revision of Darwinopteran taxonomy, based on comparisons between the new material and the previously known species, is also presented.

3) Advances in Chinese advanced type pterosaur 1: A revision of Chinese Tapejarid taxonomy, based on the comparisons of *Sinopterus* complex with the new genus *Huaxiadraco*, is also presented. Six new tapejarid specimens from the Jiufotang Formation prompt here the opportunity to revise, in detail, the *Sinopterus* complex - a complex of seven nominal species that have been referred to *Sinopterus* and *Huaxiapterus* and that are the focus of taxonomic debate. Through qualitative and quantitative analyzes, we conclude that only two species are valid, *S. dongi* and "*Huaxiapterus*" *corollatus*, for which the new genus *Huaxiadraco* is erected given the fact that "*Huaxiapterus*" is found invalid.

4) Advances in Chinese advanced type pterosaur 2: A new istiodactyliform pterosaur from the Jiufotang Formation. This new species is based on an almost complete skeleton, which can be seen as the best known skeleton ever found of an istiodactyliform. It provides the first ever recorded case of ameloblastoma in a pterosaur. This pathological condition is explored in detail using histological analyses.