CRITICAL INTERVALS IN EARTH HISTORY: PALAEOBIOLOGICAL INNOVATIONS

Abstract Volume of the 2nd Joint Conference of the Palaeontological Society of China and the Paläontologische Gesellschaft

Editors / Qun Yang · Joachim Reitner · Yongdong Wang · Mike Reich

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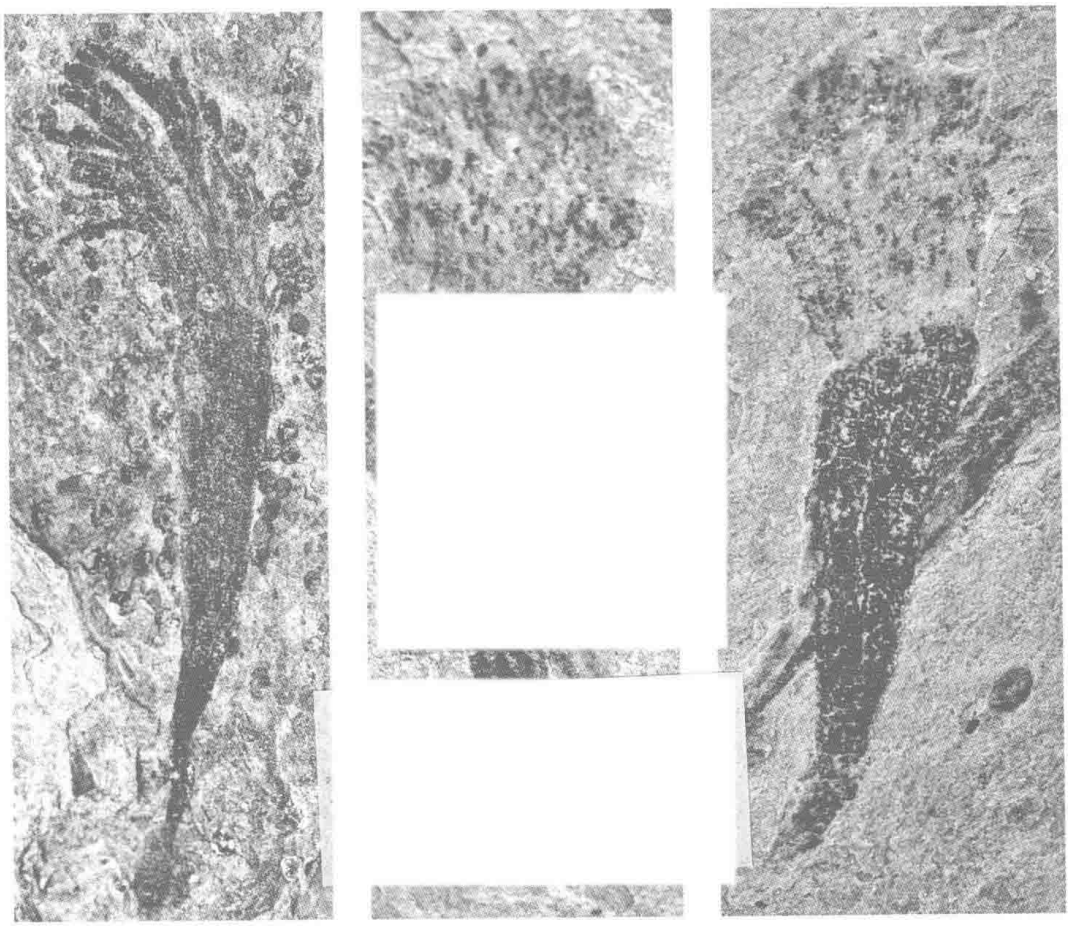

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内 容 简 介

本书是关于地球历史的关键时期与古生物革新领域的高水平国际论文专集，反映近几年来德国及德语系其他国家和我国古生物学工作者所取得的最新成果，是世界范围内该领域的最新著作。内容涵盖领域主要包括：早期生命演化、寒武纪特异化石库及埋藏学、晚古生代生物多样性与环境、二叠纪－三叠纪之交生态系演变、热河与燕辽生物群研究进展、三叠纪－侏罗纪转换时期生物多样性变化及环境、侏罗纪－白垩纪之交陆地生态系统、新生代生物多样性与环境变化、综合地层学、古生物化石数据库、定量地层学与定量古地理学、旋回地层与高分辨率地层、微体古生物学及应用 、古生态古地理与古气候、古脊椎动物与古人类的起源与演化、分子生物学、地球生物学、青藏高原地层古生物研究进展、古生物博物馆与科普教育、古生物化石及其保护、古生物学研究中的新技术与新方法等。

本书可供相关领域学者参考引用。

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序

中国古生物学会成立于1929年，是中国最早成立的自然科学学术团体之一。作为中国古生物学会的姊妹学会，德国古生物学会（Paläontologische Gesellschaft）成立于1922年，是在德语国家中享有盛誉的学术团体，对中国古生物学会的早期创立产生了重要影响。中国古生物学会的两位创始成员孙云铸（1895—1979）和杨钟健（1897—1979）早年就在德国进行学习与进修，他们在参加德国地质学会1927年学术年会的野外考察过程中，萌生了成立中国古生物学会的想法。

自成立之日以来，中国古生物学会在走过的88年的发展历程中稳步发展。在过去的五十多年中，中国古生物学会在会员数量增加的同时，与世界各国的国际交流与合作不断扩大。尤其令人瞩目的是，在最近的十余年间，中国和德国古生物学家的交流合作增长非常迅速，合作领域包括古生物学的各个方面和分支学科，比如前寒武纪和寒武纪之交，寒武纪大爆发，古生代和中生代的海洋和陆地系统及生物群，新生代气候和环境变化，分子古生物学，微体古生物学，以及化石库埋藏学等。2013年9月，第一届中德古生物学国际会议在德国哥廷根大学成功召开。这是中国古生物学会和德国古生物学会首次联合召开学术会议，对于加强两个学会和中德两国之间的学术交流与合作起到了重要推动作用。

经过近两年时间的商讨筹备，第二届中德古生物学国际会议将于今年10月在中国湖北宜昌召开。宜昌地区是中国地质现象丰富、地层发育齐全、古生物化石众多、极具科研价值的著名地区，包括新元古代地层、古生代地层和中新生代地层及生物群，并且包含奥陶系大坪阶和赫南特阶两个全球界线层型（金钉子）剖面，被誉为“天然地质博物馆”。

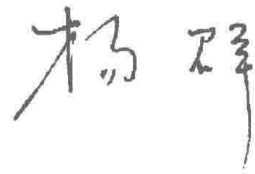
本次会议以“地球历史的关键时期与古生物革新”为主题开展系列研讨活动聚焦地质历史关键转折期生物的形态和生态方面的革新演化以及与环境之间的相互作用等并组织野外地质考察活动。本次会议有约350位代表（来自中国和德国等7个国家）参会，展示近年来在古生物学及相关领域取得的进展和成果，研讨开展进一步国际交流合作的前景。本论文摘要集包含了260余项古生物学及相关领域的成果（口头报告和展板报告），来自近500位作者或合作者。

作为本次会议的组织者，我们衷心希望第二届中德古生物学国际会议能够为参会的各国专家学者和青年学生，搭建起开展卓有成效的学术交流和增进相互了解的另一个重要平台。通过本次会议，我们期待各国学者能够进行深入研

讨、积极参加野外考察和学术交流，在跨学科交流中碰撞出明亮的火花，结出国际合作的硕果。

我们感谢所有为本摘要集提交论文和成果的参会者，感谢中国科学技术大学出版社的编辑对本专集的出版提供的大力支持和付出的辛勤劳动，也感谢中国古生物学会和德国古生物学会秘书处工作人员和会议志愿者在本次会议的筹备过程中所付出的热情和奉献。

杨群，中国古生物学会理事长



Joachim Reitner，德国古生物学会主席

王永栋，中国古生物学会秘书长

Mike Reich，德国古生物学会秘书和德国《古生物学杂志》主编

2017 年 10 月，中国宜昌

PREFACE

The Palaeontological Society of China (PSC), founded in 1929, is one of the earliest science associations established in China. The Paläontologische Gesellschaft (PalGes) in Germany, the "sister society" of the PSC, has a longer history and a high reputation in German-speaking countries, influential to early members of the PSC even before 1929; two of the founding members of the PSC, Yunzhu Sun (Y. C. Sun) (1895—1979) and Zhongjian Yang (C. C. Yang) (1897—1979), were both Chinese palaeontologists trained in Germany. The idea of founding a palaeontological society in China was born when they participated in a field excursion during the annual meeting of the German Geological Society in 1927.

After its founding, the PSC has grown steadily. In the last 50 years, members of the society have multiplied and international communication and cooperation have expanded worldwide. It is particularly noteworthy that recent activities among Chinese and German palaeontologists have dramatically increased in various directions, such Precambrian-Cambrian trasition and the Cambrian explosion, Palaeozoic and Mesozoic marine and terrestrial fossils, molecular paleobiology, micropaleontology, taphonomy and so on. In September 2013, the 1st Joint Conference of the PSC and the PalGes was successfully held in Göttingen, Germany. This was the first time that the PSC and the PalGes organized a joint academic conference, further promoting the bilateral relationship between the two societies and their member experts.

This year, the 2nd Joint Conference will be held in Yichang, Hubei Province of Central China, after nearly two years of joint discussion and preparation. The city of Yichang was chosen as the meeting site because participarnts will have opportunity to visit fantastic geological sections, national geoparks known as the "Natural Field Geological Museum" in the vicinity of the city, including the exceptional Neoproterozoic sections, Paleozoic stratigraphy and a number of GSSP sites. This conference will focus on the primary topic of "Critical intervals in earth history: palaeobiological innovations", which presumably will involve key time periods in the geological history regarding morphological and ecological innovations of organisms and their interaction each other and with the physical environment.

We have received registrations from over 350 participants from 7 countries, from China, Germany and a number of other nations, who will gather to show case research advances and results, discuss their research, and give perspectives for future studies,

potentially involving further international collaboration.

This volume contains the abstracts of more than 260 presentations (oral and poster) that have been contributed by over 500 authors or co-authors.

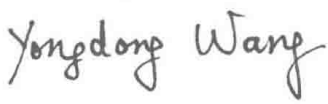
We, the conference organizers, sincerely hope that the 2nd Joint Palaeontological Conference will serve as another vital platform for participating experts and students for fruitful academic exchange and mutual understanding of ongoing research activities across different research organizations in the countries involved. We anticipate that more interdisciplinary and international co-works will emerge from such intensive discussions, organized field excursions and friendly exchanges of views and ideas.

We thank all registered participants for their contribution to this volume, publishing experts from the Press of the University of Science and Technology of China for their support, and staff and volunteers from PSC and PalGes for their enthusiasm and hard work in the long preparation.

Qun Yang, President of PSC

Joachim Reitner, President of PalGes

Yongdong Wang, Secretary General of PSC



Mike Reich, Archivist of PalGes & Editor-in-Chief of *PalZ*

October 2017, *Yichang*, *China*

VORWORT

Die "Palaeontological Society of China" (PSC) wurde im Jahre 1929 gegründet und ist damit eine der ältesten Wissenschaftsgesellschaften in China. Die "Paläontologische Gesellschaft" (PalGes) in Deutschland-als "Schwestergesellschaft" der PSC-mit ihrer längeren Geschichte und dem hohen Ansehen in den deutschsprachigen Ländern, kann auf enge Verbindungen zur PSC, bereits vor 1929, zurückblicken. So wurden beispielsweise die beiden Gründungsmitglieder der PSC, Yunzhu Sun (Y. C. Sun) (1895—1979) und Zhongjian Yang (C. C. Yang) (1897—1979), als Paläontologen in Deutschland ausgebildet. Die Idee zur Gründung einer paläontologischen Gesellschaft in China kam beiden während ihrer Teilnahme an der Jahrestagung der "Deutschen geologischen Gesellschaft" im Jahr 1927.

Seit 1929 ist die PSC stetig gewachsen. In den letzten 50 Jahren hat sich ihre Mitgliederzahl vervielfacht und die gesamte PSC steht in beiderseitigem Austausch mit paläontologischen Fachkollegen weltweit. Herauszustellen ist, dass v. a. während der letzten Jahre chinesische und deutsche Paläontologen ihre Forschungskooperationen und den akademischen Austausch-im Zusammenhang mit verschiedensten paläontologischen und stratigraphischen Themenbereichen außerordentlich intensiviert haben. Im September 2013 fand in Göttingen (Deutschland) erfolgreich die 1st Joint Conference of the PSC and the PalGes statt. Es war das erste Mal, dass die PSC und die PalGes eine gemeinsame akademische Tagung abgehalten haben. Seit dieser Zeit sind die Paläontologen Chinas und Deutschlands noch näher zusammengerückt.

Der erfolgreichen ersten gemeinsamen Konferenz (2013) in Deutschland folgend, findet in diesem Jahr die 2nd Joint Conference of the PSC and the PalGes in Yichang (Provinz Hubei), in Zentralchina statt. Yichang ist aufgrund seiner verschiedensten geologischen Naturerbe-Stätten und nationalen Geopark-Anlagen in China auch als "Natural Field Geological Museum" berühmt. In der näheren Umgebung von Yichang sind bemerkenswerte Aufschlüsse im Neoproterozoikum und generell Paläozoikum sowie eine Reihe von GSSP Lokalitäten. Wir freuen uns, dass mehr als 350 Teilnehmer aus 7 Ländern (vor allem aus China und Deutschland) in dieser Stadt zusammentreffen und Einblicke in die geologische Vergangenheit unserer Erde geben und paläontologische Fragen diskutiert werden. Die Konferenz steht unter dem generellen Thema "Critical Intervals in Earth History: Palaeobiological Innovations" und konzentriert sich damit auf Schlüssel-Zeitabschnitte (insbesondere kritische Übergangsintervalle) der Erdgeschichte und möchte damit die Diskussion zu den Innovationen der Organismen und Organis-

mengemeinschaften in der Erdgeschichte anregen.

Der Tagungsband enthält die Kurzfassungen von mehr als 260 Präsentationen (Vorträge und Poster), die von mehr als 500 Autoren und Ko-Autoren auf der gemeinsamen Konferenz vorgestellt werden.

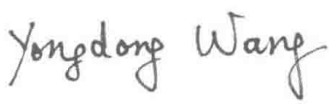
Wir wünschen allen Teilnehmern der "2nd Sino-German Joint Conference of the PSC and the PalGes" eine erfolgreiche Tagung und eine stimulierende Atmosphäre, die zum Erörtern und Diskutieren paläobiologischer Innovationen der Erdgeschichte einlädt. Die Tagung ist eine exzellente Plattform zum Wissenschaftsaustausch, zur Förderung der Netzwerkbildung zwischen Kollegen, und wissenschaftliche Projekte voranzutreiben. Wichtig ist uns die interdisziplinäre Zusammenarbeit zwischen den unterschiedlichen paläo-biologischen Fachkulturen, die stets stimuliered für unsere Forschungsarbeit war und ist. Die Tagung bietet mit ihrem Programm und ihren Exkusionen einen exzellenten Überblick und Einblick über laufende Forschungsarbeiten und Einsichten in die geologischen und paläontologischen Besonderheiten Chinas.

Die Unterzeichner danken den beteiligten Mitarbeitern beider Gesellschaften für ihren Enthusiasmus und die harte Arbeit in der Organisation und Durchführung der Tagung! Die Veröffentlichung des Tagungsbandes wird im Verlag "Press of University of Science and Technology of China" ermöglicht und garantiert einen einfachen und ungehinderten Zugang zu den Inhalten der in Yichang vorgestellten Beiträge.

Qun Yang, Präsident der PSC

Joachim Reitner, Präsident der PalGes

Yongdong Wang, Generalsekretär der PSC



Mike Reich, Archivar der PalGes & Editor-in-Chief der PalZ

im Oktober, 2017, *Yichang*, *China*

CONTENTS

ABSTRACTS

The Latest Oligocene Kailas Flora from Southern Tibet and its implications for the plateau uplift

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ABSTRACT

As a main structure unit of the Tibet Plateau, Lhasa terrane plays a key role in understanding the palaeoelevation evolution of the Southern Tibet Plateau after India-Asia collision. The Kailas Basin developed during Late Oligocene—Early Miocene time along the Indus-Yarlung suture zone in Southwestern Tibet. Recently, we find a new fossil flora with fine age-dating, occurred at 23.3 Ma, from the Kailas Formation in the Kailas Basin. We distinguished 14 leaf morphotypes amongst 90 plant megafossils that were collected from Kailas Formation in Kailas Basin, Southern Tibet. The plant fossil assemblage comprises a needle of pine (Pinaceae), leaf fragments of *Typha* L., and 12 morphotypes of nonmonocot angiosperms including *Populus* cf. *glandulifera* Heer, *Populus* cf. *balsamoides* Göppert, *Quercus* Section *Heterobalanus* sp., *Alnus* sp., *Betula* sp., *Carpinus* sp., *Leguminosae* sp. and five types of dicotyledon leaves, the affinities of which are not clearly unknown. Poplar and legume are most abundant in the fossil assemblage. Nearly half of the fossil leaves (41/90) belong to *Populus*, and 18 fossil leaves are referred to *Leguminosae*. Betulaceae appears the most diverse in fossil assemblage, including three genera. Extant *Populus*, *Quercus* Section *Heterobalanus*, *Alnus*, *Betula* and *Carpinus* are all deciduous trees or shrubs, suggesting that a low diverse, poplar and legume dominated, deciduous broadleaf vegetation with a few pines in the Kailas Basin, Southern Tibet, indicating a temperate and humid environment during the Late Oligocene. By compiling the environmental niches of the living families genera that are related to these fossils, we infer that the fossil plant assemblage is mostly like occurred at the elevation of 1500—2900 m during the Late Oligocene in the Kailas Basin.

KEYWORDS: Fossil flora, palaeoelevation, Southern Lhasa terrane, Late Oligocene

to Early Miocene, Kailas Basin.

ACKNOWLEDGMENT

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Biostratigraphic study of Late Carboniferous-Early Permian spores and pollen from Western Yunnan, China

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ABSTRACT

This study collected 123 rock samples from the Dingjiazhai Formation of the Baoshan Block and the Kongshuhe Formation of the Tengchong Block, and separated sporopollens from them. The identified spores and pollens were classified into 51 genera and 80 species. Based on a summary of research into the Gondwana Realm and an analysis of spores and pollens assemblages from the Dingjiazhai and Kongshuhe formations, both formations appear to be characterized by Gondwana spores and pollens, such as *Microbaculispora tentula*, *Horriditriletes tereteangulatus*, *Vestigisporites gondwanensis*, *Marsupipollenites striatus* and *Gnetaceaepollenites sinuosus.*

Gondwana microflora have features that distinguish them clearly from the micro-geoflora of other plates. The majority of this region has been studied. Most areas

of the Gondwana Realm have been studied by Palynomorph, including Australia, Antarctica, India, South America, South Africa, Yemen and Oman. The spores and pollens from those areas have certain similarities, but they are not the same. The most widespread characteristics are the successive emergence and development of monosaccate pollens, cheilocardoid spores (e. g. *Microbaculispora*), *Cycadopites*, striate and nonstriate bisaccate pollens. The Baoshan, Tengchong and Lhasa blocks are recognized as Gondwana derived blocks.

This paper considers the emergence sequences for gymnospermous pollens and fern spores, the variety of species and their biodiversity, and correlates these with related factors. It concluds that the upper strata of the Upper Kongshuhe Formation are Late Asselian to Early Sakmarian in age, and that the lower strata are Late Gzhelian to Early Asselianin in age. Whereas, the upper strata of the Dingjiazhai Formation can be dated back to Late Sakmarian to Early Artinskian, and the lower strata can be dated to Late Asselian to Early Sakmarian.

The lower strata of the Upper Kongshuhe Formation in the Datang Section of the Tengchong Block is characterized by low biodiversity and a small number of spores and pollens, with bisaccate pollens almost absent. The cheilocardoid spore *Microbaculispora tentula* is dominant. The most frequent pollens are monosaccate *Plicatipollenites* spp. and *Vestigisporites gondwanensis*. There is no *Cycadopites cymbatus* in this formation. This formation can therefore be dated back to Late Asselian to Early Sakmarian.

Microbaculispora tentula increases in the upper strata of the Upper Kongshuhe Formation (Datang Section). *Calamospora microrugosa* accounts for a significantly high proportion of the total spores and pollens. There are some bisaccate pollens, such as *Alisporites* spp and *Protohaploxypinus rugatus*. *Converrucosisporites confluens* shows a significant percentage content. It is concluded that the upper strata is thus Late Asselian to Early Sakmarian in age.

The spores and pollens assemblage of the Shangcaiyuan Section is very similar to that of the Upper Kongshuhe Formation of the Datang Section. The age is therefore most likely to be Late Asselian to Early Sakmarian.

Lycopsids are the main spores and pollens found in the lower part of the Dingjiazhai Formation at the Woniusi Section of the Baoshan Block. *Punctatisporites gretensis* is common and *Cycadopites cymbatus* appears. The age is thus inferred as Late Asselian to Early Sakmarian.

The percentage of pollens is higher than spores in the upper part of the Dingjiazhai Formation of the Wafang Section. Striate and non-striate bisaccate pollens

dominate this section, e. g. *Weylandites magmus*, *Vittatina*, *Tiwariasporites simplex*, *Striatopodocarpites fusus*, *Striatopodocarpites cancellatus*, *Striatoabieites multistriatus*, *Scheuringipollenites ovatus*, *Scheuringipollenites maximusetc.* The age of these strata is most probably Late Sakmarian to Early Artinskian.

Vertical variation of spore and pollen from the Baoshan and Tengchong blocks and the corresponding vegetation indicates the two blocks experienced climate amelioration with temperature rise from glacial to interglacial stage. The Baoshan Block maintained a different palynomorph composition from Tengchong Block which suggests that Baoshan Block was located in a higher latitude in late Asselian to Early Sakmarian.

KEYWORDS: Permian, Western Yunnan, biostratigraphy.

ACKNOWLEDGMENT

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The epidermal anatomy of typical Cathaysian plant fossils from the Lower Permian of Shanxi, China

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ABSTRACT

Cathaysia is one of the four major Late Palaeozoic floral provinces and includes the palaeotropical plant assemblages from present-day China and East Asia. The concept of Cathaysia as a distinct floral province was coined by T. G. Halle (1927) for Permian floras from Shanxi Province, China. Until today wheather the taxonomy is primarily based on the macromorphological criteria and the relationships of the taxa remains unclear. The detailed studies of the Cathaysia flora are necessary for a better understanding of its relationships with other floral provinces. Cuticular analysis not only allows a much more precise definition of individual taxa, but also provides an important information on the palaeoeceology and climate. The Palougou Section in Shanxi is an ideal place to study the Cathaysia flora as it is one of the very few continuous terrestrial sections, if not the only, covering the entire Permian known from Euramerica and Cathaysia, comprising all representative strata of the North China microcontinent. Recent field work revealed eight new plant-bearing horizons of the late Early Permian Shihhotse Formation with well preserved macrofloras of typical Cathaysia elements as *Tingia*, *Yuania*, *Conchophyllum*, *Cathaysiopteris*, *Protoblechnum*, *Emplectopteris*, *Lobatannularia*, and endemic species of *Taeniopteris*. Moreover, several species of these genera were recovered with cuticular preservation. For the first time, different species assigned to the genus *Taeniopteris* by T. G. Halle (1927) can be differentiated based on clear differences in their epidermal anatomy. This enables a delimitation of these taxa and allows to assign them closer to natural plant groups as recently outlined by Van Konijnenburg-van Cittert et al. (2017). We also present the first cuticles of *Protoblechnum wongii*, a so far poorly understood plant, giving new insights into its relationship with possibly related genera as *Glenopteris* and *Compsopteris* (e. g., Wan, Wang, 2015). Furthermore, a new species of *Emplectopteris* marks the first record of cuticular preservation of this genus. As the cuticles of the identified taxa are generally thin and do not show any xeromorphic adaptions, it can be concluded that they did not have to sustain stress by seasonality or drought. This is in ac-