



Sino-German Symposium

The Yunnan Biodiversity Hotspot – its history and future threats, Kunming, August 4 – 10, 2015

Organizers: Zhou Zhe-Kun, Volker Mosbrugger

Outline and Report (by Zhe-Kun Zhou, Volker Mosbrugger, Tao Su, and Torsten Utescher)

1. Motivation

Yunnan Province, located in southwest China, includes the southeastern margin of the Qinghai-Tibet Plateau, characterized by variegated landscapes and a large altitudinal range. The present-day climate of Yunnan is distinctly monsoonal, but unlike other South and East Asian regions, either influenced by the Indian or the Southeast Asian Monsoon, this region is under the influence of both monsoon systems. As regards the biosphere, Yunnan Province constitutes a hotspot of biodiversity, and therefore represents a crucial key area to study interactions of geological processes, climate and biology.

The biodiversity hotspot Yunnan has more than 15,000 extant plant species. Nearly half of the Chinese plants grow in this region, occurring in a variety of vegetation formations. The represented biomes span a considerable ecological range, from tropical ecosystems in the south of the province to alpine meadows existing in the north, near the Tibetan border. The high biodiversity is, on the one hand, connected to the present-day topography and the climatic situation of Yunnan. On the other hand, it is the result of the evolution of landscape triggered by substantial uplift processes and changes of climate and monsoon intensity. All these factors have exerted a strong natural selection on plant communities and shaped the modern vegetation. Yunnan is a region where diversification of biota happened in most recent times, and hence constitutes the ideal model area to study the link between the diversification of biota and changes of non-biotic factors.



Neogene continental strata containing plant fossils and vertebrate fauna are exposed in Yunnan in numerous isolated basins. During the last decade, comprehensive research by Chinese colleagues focused on taxonomy of the plant record and palaeoclimate reconstructions, including the study of the Neogene Asian monsoon systems. For all this recent progress made, the palaeobotanical and palaeontological record of Southwest China is far from being completely studied. In particular, the status of taxonomy, dating of sites and time control in the Neogene sequences needs improvement. Yet, the Neogene continental strata of Yunnan and their flora and fauna allow for a case study on how palaeoclimate and palaeoenvironmental changes impacted biodiversity. Thus, the history of the present-day biodiversity hotspot can be exemplified. To achieve this, interdisciplinary research is needed in order to unravel interactions of regional uplift and climate change with the biosphere, in the context of global cooling and changes in atmospheric CO₂.

Recent contacts and considerations made at the Sino-German Symposium held in Xishuangbanna, in 2013, now open up the perspective for joint research on the origination of a modern biodiversity hotspot, under consideration of the geologic and palaeontologic history and possible future threats. This second Sino-German Meeting is to set up a joint Sino-German project initiative with the working title "The Yunnan Biodiversity Hotspot – Its Origin and Climatic Threats".

2. Report on the results

39 oral presentations covered various fields of science such as palaeoclimatology, palaeontology, palaeomagnetism, geochemistry, palaeoanthropology, biogeography, botany, entomology, molecular biology, evolutionary ecology, biome modelling, and palynology. Many participants showed their recent research progress, for example, reconstructing paleoclimate and paleoaltitude using fossil plants, new methods in paleomagnetism, reconstructing paleoenvironment and paleoclimate by isotope geochemistry, the combination of molecular biology and evolutionary biology, high resolution paleoclimate reconstruction, palynology and palaeofire reconstruction.

Three main topics were addressed on the symposium: 1) Historic evolution of the Yunnan biodiversity hotspot. The knowledge of the evolution of biodiversity in Yunnan is crucial when studying the impact of diverse drivers on the biosphere. To unravel past diversity evolution, we need an integrated study based on both fauna and flora. On the symposium, an integrated summary of all



available records and data was presented, and open questions, suitable sections, and fossil sites for future research were discussed. 2) Main drivers in the evolution of biodiversity. Past global climate change and its imprint on regional climates, affecting temperature gradients in general and changes in the hydrological regimes on the one hand, and palaeogeographic, in particular orogenetic changes, on the other, can be considered as the main drivers in the evolution of biodiversity. The participants discussed how to compile palaeontological literature resources in order to make them available for the quantitative reconstruction using various techniques, how to generate extensive new records by selecting and studying suitable key sections in the frame of the intended large project, how to quantify uplift in the study area using the plant fossil record, the colonization history of organisms with narrow ecologic niches, molecular methods and geochemistry, as well as the further development of the stratigraphical framework, employing radiometric dating, magnetostratigraphy and mammal zonation. 3) Future threats for Yunnan ecosystems and their diversity. Knowing about the history of the biodiversity hotspot and the mechanisms involved, it will be possible to evaluate anticipated changes and threats for ecosystems and their diversity. This topic includes the study of the evolution of endemic plants and potential changes of their requirements in the past using the fossil approach and molecular records. The assessment of possible threats under anticipated climate changes will primarily be based on a variety of modeling approaches (climate, biome, species distribution modeling, etc.).

The meeting provided an excellent impetus for further Sino-German exchanges. The participants explicitly agreed on continuing and even intensifying the existing cooperation after three days of oral presentations and discussion, because Yunnan represents a key region where the impact of past changes on biodiversity can be exemplified in order to understand ongoing and anticipated changes in biodiversity. Conclusively it was decided to set up a joint, major research project focusing on the biodiversity of Yunnan, as one of the actual, global biodiversity hotspots. Fruitful and intense discussions have been seen on the meeting, which increased the knowledge about the history and future threats of the Yunnan biodiversity hotspot.

After the meeting, the participants investigated the biodiversity, vegetation and fossil sites in Northwest of Yunnan on a two-day field trip. Moreover, the financial cover of the international flights through the Sino-German Center supported the participation of seven German scientists, willing to act as PIs in the intended large project, in an extended excursion to NW Yunnan and



Sichuan where deeper insights into the study area could be gained and a detailed working plan could be set up.

The Sino-German Symposium hosted by the NECLIME members Zhe-Kun Zhou and Volker Mosbrugger, and joined by more than 60 international scientists, was funded by the Sino-German Center which is gratefully acknowledged.

A following up meeting will be organized in Dresden, Germany, in 2016, from April 2 – 6, organized by Lutz Kunzmann and colleagues. If you have interest in the intended project initiative and would like to be involved please contact Torsten Utescher or Lutz Kunzmann.