Paleontological Research in China: Retrospect and Prospect

Reconstruction of the world-famous Jehol Biota, which includes Mesozoic birds, feathered dinosaurs, primitive mammals and flowering plants.

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For the last decade, paleontological research in China has been in the spotlight. Many new discoveries fascinated colleagues worldwide. Not only did a host of research papers appear in the prestigious journals both at home and abroad, but they also caused frequent media frenzies. Paleontology, used to be a Cinderella, is now in the glass shoes. Since 1986 and particularly in the last decade, 56 paleontological papers, either solely contributed or co-authored by Chinese scholars, have been published in “Nature” (39) and “Science” (17). Although some of the published papers resulted from the collaborations with foreign scientists, all fossil discoveries were made in China. The drastic increase in recent discoveries is largely due to the preferential support from the government agencies, such as the Ministry of Science and Technology, the Ministry of Education, the National Natural Science Foundation of China and CAS. These agencies have realized China’s unique and rich fossil resources and the Chinese paleontologists’ potential to excel. They have also seized the opportunity to create a favorable environment for the young generation to grow. Consequently, we have successfully overcome the shortage of well-trained young paleontologists due to the destructive “Cultural Revolution”.

I. Chinese Paleontology in Retrospect

In the first half of the 20th century, paleontology played an important role in affirming and interpreting Charles Darwin’s theory of evolution, thanks to the critical evidence derived from fossils and researches in organismal biology that supports evolution and phylogenetic reconstruction. Consequently, many biologists and geologists at the time became interested in paleontology; in fact, many of the Chinese pioneer geologists started out as paleontologists. As a historical science, paleontology deals with the life of past, subjected to neither direct observations of its living conditions nor repeated experiments on its evolutionary processes. Instead, traditionally paleontologists drew their conclusions from observing the fossils out of the researchers’ own empirical experience and intuition. By the mid-20th century, some scientists engaged in reconstructing the history of life tried to adopt a more rigorous, logical, and deductive approach characteristic of the other branches of modern science, thus making their conclusions testable. Plate tectonics’ triumph over the immobile continents has introduced the concept of co-evolution between the earth and its habitants, and, in combination with cladistics, has methodologically ushered in vicariance biogeography. Similarly, the revival of Mendel’s genetic law, coupled with the discovery of DNA’s double helix and its critical role in genetics, has revolutionized the whole discipline of biology, and provided molecular biological information to the specialists of the history of life. Some of the Chinese paleontologists have also launched a concerted...
effort with their neontologist colleagues to apply molecular biological methods to paleontological research.

Darwin envisioned gradualism in evolution. However, the alternative view has been posed that evolution proceeds with a long period of stability punctuated by a rapid change, as illustrated by the fossil records from the Ediacara Fauna in Australia, the Burgess shale fauna in Canada, and in particular, the Chengjiang and Weng’an faunas in China’s Yunnan and Guizhou provinces respectively. The “Punctuated Equilibrium” hypothesis is also corroborated by several mass extinction events occurred globally at the ends of the Ordovician, the Permian, and the Mesozoic Era. At each turning point in the geological history, the biota’s explosion, extinction, recovery, and radiation constitute four closely linked and successive stages in the macroevolutionary process.

In recent years, the exquisite fossils of Mesozoic birds, feathered dinosaurs, other vertebrates, invertebrates, and flowering plants have been discovered from the Jehol Biota in western Liaoning Province of northeastern China. These discoveries provide an unprecedented line of evidence on probing into many important questions in the history of life, such as the origins of birds and their flight, of avian feathers, of mammals, and of angiosperms.

In its practical aspect, the research results of the discipline always contain the data on geological background needed for mineral prospecting. Since 1978 when China first launched its current reform drive, we have had more opportunities to interact with the outside world, and have established a precise and globally correlated geo-chronological framework, i.e. “golden spike”, including the boundary stratotype between Permian and Triassic periods, the stratotype of the mid-Ordovician Darriwilian, and the stratotypes for the Permian Leping series and Changxing stage. Therefore, we have made constructive contributions to a high-precision and high-resolution global stratigraphic framework.

II. Prospects for the Future

Paleontology still is an indispensable tool in deciphering some long-standing mysteries in the history of life. In-depth studies of the recently discovered fossils in China will shed important lights on evolution of life, such as the early development of life, the origins of metazoans, vertebrates, birds, mammals, and angiosperm as well as the life’s transition from water to land. These studies may result in more plausible hypotheses or even new theories.

Interdisciplinary approaches are one of the most
Fossil specimen of a feathered dinosaur, *Caudipteryx zoui*. Although it was not a bird, its body was covered with dense and gorgeously decorated feather, a special endowment of the Jehol Biota.

important directions in paleontology today. The correlated evolution between life and earth indicates that organisms always try to adapt themselves to their environments, thus their evolutionary stasis or rapid changes correlating well with a stable or volatile environment. Therefore, it is inevitable that in studying global events, paleontologists and geologists must work together to demonstrate how geological events have shaped the course of organismal evolution. Similarly, through studies of life of the past, we are able to reveal some hitherto unknown geological events. In addition, the emergence of molecular biology and progresses in developmental biology have widened horizons in evolutionary studies and made digitalization possible in biological researches (including some paleontological studies). In particular, the progress in molecular phylogenetics has revived a renewed interest in morphological phylogenetics. As anthropologist Peter Andrews put it, morphology and molecular structure are the two sides of the same coin: the former with more morphological information and the latter, more genetic information. At present, the evolutionary studies have partnered up the oldest and newest sub-disciplines of biology.

With the adoption of new technologies and methods, new methodology and new concepts must also be introduced into China. As a result of the advancements in observational means such as sectioning, electromicroscopy, CT scan, the anatomic and histological studies of microfossils will also play an important role in research on evolution.

In terms of its role in the national economy and public education, paleontology in China is bound to make more substantial contributions to this country as well as the world. With China’s uniquely rich fossils, well-trained young generation of paleontologists, and generous governmental funding, what is badly needed is a favorable environment in which the youngsters can devote themselves to research with single-mindedness, passion, and determination, and thus avoid like plagues the sloppiness in scholarship such as impetuosity, exaggeration, and shallowness. Only in so doing is it possible for us to excel in the world paleontological community in the near future.