

Study On The Occurrence Status And Protection Classification Of Paleontological Fossil Specimens In Shandong Province

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Abstract:

Shandong Province is a province with a large collection of paleontological fossils, and a lot of work has been done to protect paleontological fossil specimens. There are more than 34,000 paleontological fossil specimens in the collection of Shandong Provincial Museum, and there are 14 key fossil collection institutions. The types of specimens are comprehensive, including almost all categories of paleontological fossils. The sources of specimens are divided into self-collection, purchase, collection, donation and other methods. Shandong Provincial Museum has 22,233 key protected paleontological fossils, 12,723 general protected paleontological fossils, among the key protected paleontological fossils, there are 4,843 first-level key protected paleontological fossils, 15,525 second-level key protected paleontological fossils, and 1,865 third-level key protected paleontological fossils pieces.

Keywords: paleontology fossil specimen fossil protection fossil classification

Date of Submission: 01-09-2023

Date of Acceptance: 11-09-2023

I. General situation of specimen collection

Paleontological fossils discovered in Shandong Province total more than 2,000 species of more than 800 genera in 25 categories, including trilobite and cephalopod fossils from the Paleozoic Era, dinosaur fossils from the Mesozoic Era, and animal and plant fossils from the Shanwang Basin in the Cenozoic Era. It is the most typical fossil species in Shandong Province^[1]. Laiyang in Yantai, Zhucheng in Weifang, and Shanwang in Linqu were named as national key protected paleontological fossil production areas, and 21 fossil genera and species such as spiny-nosed Qingdaosaurus, giant Shandong dragon, and giant Zhucheng tyrannosaurus were listed in the first national batch List of key protected paleontological fossils. As a province rich in fossils, Shandong Province has always attached great importance to the protection and research of fossils. At present, the province has established 17 geological parks and nature reserves with paleontological fossil origins as the main protection objects, 14 key collection institutions of paleontological fossils, and more than 34,000 paleontological fossil specimens in their collections.

The main collection institutions of paleontological fossils in Shandong Province are: Tianyu Natural Museum of Shandong Province, Zhucheng Dinosaur National Geological Park, Shandong Linqu Shanwang Paleontological Fossil Museum, Shandong Museum, Yantai Natural History Museum, Zhanghe International Tree Fossil Forest, Laiyang Cretaceous Geological Museum, Shandong Shanwang National Geological Park Museum, Zhucheng Dinosaur Museum, Shandong Geological Museum, etc., Shandong Geological and Mineral Science and Technology Museum, Shandong University of Science and Technology Earth Science Museum, Shandong Prospecting Museum, Xintai City Museum, etc. Among the paleontological fossil specimens collected in the Shandong Provincial Museum, more than 25,000 specimens were excavated from the strata and stored in the collection institutions; more than 9,000 fossil specimens were exposed in the strata and kept in place, and were properly collected, displayed and preserved (In situ footprint fossils are not included). The fossils belong to Shandong Shanwang Biota, Shandong Jiaolai Basin Dinosaur Fossil Cluster, Early Cretaceous Jehol Biota in Western Liaoning, Gansu Hezheng Fauna, Guizhou Xingyi-Guanling Biota, Yunnan Chengjiang biota, trilobite concentrated production place, dinosaur egg fossil concentrated production place, wood fossil concentrated production place and other important domestic biological clusters.

II. Sources and circulation of specimens

The collection of paleontological fossil specimens has its particularity. Before the release of the "Administrative Measures for the Protection and Management of Paleoanthropoid Fossils and Paleontological Fossils" in 2006, the excavation and circulation of paleontological fossils were generally neglected. sale

phenomenon. The promulgation of the "Regulations on the Protection of Paleontological Fossils" in 2010 set conditions for the excavation, collection, entry and exit of paleontology, and stipulated that, except for the transfer, exchange, and gift of key protected fossils between collection units, any other unit Individuals and individuals are not allowed to buy or sell key protected paleontological fossils, and the buying and selling of generally protected paleontological fossils should be carried out in places designated by local people's governments at or above the county level. Therefore, after 2010, the number of fossil specimens that can enter the trade circulation is extremely limited, and the fossil specimens of key protected paleontology cannot be obtained through purchase, but are mainly self-collected and donated according to prescribed procedures. The sources of specimens collected in Shandong Provincial Museum mainly include the following methods: self-collection, purchase, collection, donation, etc.

Self-collection

Zhucheng City, Laiyang City, and Linqu County in Shandong Province are concentrated production areas of paleontological fossils. Local paleontological fossils produced for scientific research, popularization of science, teaching or rescue are generally collected as specimens in local paleontological fossil museums or exhibition halls. Such as Zhucheng Dinosaur National Geological Park, Shandong Linqu Shanwang Paleontological Fossil Museum, Shandong Shanwang National Geological Park Museum, Zhucheng Dinosaur Museum, etc.

Purchase

the promulgation of the "Regulations on the Protection of Paleontological Fossils" in 2010, specimens could be obtained through purchase, and some fossil collection institutions obtained the ownership of some fossils through market channels. For example, the Tianyu Natural Museum of Shandong Province, as a project of the gold industry of the state-owned Pingyi Guilaizhuang Gold Mine, purchased a large number of paleontological fossils across the country before opening in September 2004. An integrated large-scale natural science museum with a collection of more than 16,000 paleontological fossils.

Solicitation

from the whole society by issuing specimen collection announcements for exhibitions, popular science, scientific research, etc. The specific collection methods can be divided into paid or free, designated types or unspecified types.

Donation

Accepting free donations from government agencies, institutions of higher learning, scientific research institutes, other collection units or individuals is also one of the sources of paleontological fossil collection specimens, which has made important contributions to the protection of paleontological fossils and the promotion of science popularization. For example, the tree fossils in Laiyang Zhanghe International Tree Fossil Forest were donated by Zhang He, curator of Shenzhen Museum of Paleontology, hence the name "Zhanghe International Tree Fossil Forest".

III. Paleontological Fossil Genera and Species Classification

The types of paleontological fossil specimens collected in Shandong Province are comprehensive, including almost all types of paleontological fossils. It mainly includes fungi and algae fossils, fern fossils, gymnosperm fossils, and angiosperm fossils in plant fossils; hemicordia graptoliths; insects, arthropods, molluscs, brachiopods, and coelenterates in invertebrate fossils, echinoderms; reptiles, mammals, birds, fish, amphibians among vertebrate fossils; and trace fossils.

Plant fossils

The plant fossils collected in Shandong Provincial Museum include fungus and algae fossils, fern fossils, gymnosperm fossils, and angiosperm fossils. The fossils of bacteria and algae are mainly stromatolites; the fossils of ferns are mainly representative plant fossils of Mesozoic Era such as scale wood, reed wood, coniferous fern; gymnosperms include ginkgo, cypress, fir and pinaceae. Mainly, including silicified wood formed from the trunk of cypress trees; there are many types of angiosperms, including Lauraceae, Magnoliaceae, Berberidaceae, Ranunculaceae, Betulaceae, Oculiaceae, Liliaceae, Hundred Branches, etc., and the most The ancient angiosperm Liaoning Gugu.

Chordate fossils

The chordate fossils in the collection of Shandong Province include fish fossils, amphibian fossils, reptile fossils, bird fossils, and mammal fossils (Table 3). Among them, the fish include Mesozoic sturgeon and wolf-finned fish in western Liaoning, carp and crucian carp in Shandong, Mesozoic lepidodon in Guizhou and some

fish fossils found in other countries. Amphibians include Mesozoic salamanders and frog fossils in western Liaoning and Cenozoic salamanders and frog fossils in Shanwang. Reptiles include theropod dinosaurs, pterosaurs, turtles, and aquatic reptiles in the Mesozoic Jehol biota in western Liaoning, Mesozoic dinosaurs and dinosaur egg fossils in Zhucheng and Laiyang, Shandong, and turtle snakes in Shanwang biota Crocodile fossils, Mesozoic marine reptiles in Guanling and Xingyi areas of Guizhou, and dinosaur egg fossils unearthed in other provinces such as Henan and Shaanxi. Birds include Mesozoic skeletal birds, anti-birds, and modern birds in the Rehe biota in western Liaoning, Shandong birds, Chinese river ducks, and beautiful Yang's birds in the Shanwang biota in Shandong. Mammals are mainly Cenozoic mammals rhinoceros, deer, chiroptera, rodents in Shanwang, Mesozoic basal mammals in western Liaoning, and Cenozoic mammal fossils in Gansu and Zhengzhou.

Invertebrate fossils

Invertebrate fossils include arthropods, mollusks, coelenterates, echinoderms, and brachiopods, and arthropods include insects, arachnids, crustaceans, ostracods, ostracods, and trilobite fossils (Table 4). Insect fossils are mainly Mesozoic insect fossils in Inner Mongolia Daohugou and Shanwang insect fossils, including bees, cicadas, ants, stinkbugs, mosquitoes and flies. The arachnids are mainly Cenozoic arachnids in Shanwang area.

Trace fossils

The trace fossils in Shandong Province include ornithopod dinosaur footprints, theropod dinosaur footprints, sauropod dinosaur footprints, bird footprints, and insect tracks. Trace fossils are mainly distributed in Zhucheng City, Linshu County, Tancheng County, and Junan County.

IV. Protection of Paleontological Fossils

Relevant Policy Basis

promote the standardized management of paleontological fossil protection in accordance with laws and regulations. The Shandong Provincial Government issued a series of notices on the implementation of the "Regulations on the Protection of Paleontological Fossils", the classification of fossil collection units, the identification of concentrated origins of paleontological fossils, and the registration of key protected paleontological fossils. The Plan for the Protection of Paleontological Fossils implements the supervision system for the protection of palaeontological fossils, effectively curbs the indiscriminate mining, trafficking and smuggling of paleontological fossils, and maintains entry-exit and market order.

Preservation and Restoration of Fossils

Fossil protection at the micro level involves the preservation and restoration of paleontological fossils. The purpose is to maintain the original appearance of the fossils as much as possible after they are taken out of the surrounding rocks, and maintain the sustainability of their scientific, popular and aesthetic values. In terms of preservation conditions, the collection unit of paleontological fossils should meet the following conditions: have a fixed site, a special exhibition room, a storage place of a corresponding area, and have a corresponding number of paleontological or related professional technicians with relevant research results, there are technologies, techniques and equipment to prevent the natural damage of paleontological fossils, there are complete fire prevention, anti-theft and other facilities, equipment and perfect security management systems, and there are funds required to maintain normal operation. In terms of restoration conditions, different repair tools and restoration methods should be adopted according to the specific conditions of fossil types, surrounding rocks, and preservation conditions. There are three main types of common restoration methods^[2,3]: (1) purely manual repair, which is to clean the surrounding rock with the naked eye or with tools such as picking needles under a microscope; (2) clean the surrounding rock with electric tools or pneumatic pens; (3) brushing varnish, acid treatment or acrylic resin consolidation treatment.

V. Classification of Protection Levels for Paleontological Fossils

Grading standards that can be used for reference

According to "National Standards for Grading Paleontological Fossils (Trial)" and "List of National Key Protected Paleontological Fossils (First Batch)" (hereinafter referred to as "grading standards" and "protection list"), according to the importance of biological evolution and biological classification, the The paleontological fossil specimens collected in Shandong Provincial Museum are divided into key protected paleontological fossils and general protected paleontological fossils, including 22233 key protected paleontological fossils and 12723 general protected paleontological fossils. Key protected paleontological fossils are further divided into first, second and third grades according to their importance. In terms of subdividing fossil grades, the "Classification Standards" and "Protected List" have provided guidance on the classification of key protected paleontological fossils at the national level, but because the grades in the "Protected List" only indicate the importance of a certain

species in the evolutionary history , does not take into account the quantity, individual integrity and preservation status, and therefore cannot be used as the only criterion for determining the protection level of individual fossils [4]. At the provincial level , only Liaoning Province took the lead in formulating fossil classification and grading standards in 2007. As a standard for identifying the scientific value of fossils, it has certain references, but it is highly targeted and only applicable to the Jehol fossils discovered in Liaoning Province . biota and Yanliao biota fossils [5].

The above work failed to solve the problem of grading the large number of hadrosaurs found in Zhucheng area of our province. There are more than 11,000 hadrosaur skeleton fossils discovered in Zhucheng area. Due to their large number and scattered exposure [6], if all of them are classified as the first-level key protected paleontological fossils, the management cost will be too high and the necessity will not be great. The author believes that the division of the protection level of individual fossils should be analyzed in detail, combined with the importance of the species in the evolution history, and comprehensively considering its scientific value, quantity, individual integrity and preservation status, and finally determine its protection with a quantitative method . level.

Classification of fossil protection levels

Based on the above principles, this study proposes the following grading standards: For the large number of hadrosaur skeleton fossils in Zhucheng area, the skull, gums, teeth, sacral vertebrae, girdle and other key parts or fossils with important identification features are listed as one. The skeleton fossils of other parts are listed as the second-level key protection; and the fossils represented by Zhucheng Chinese ceratopsian, giant Zhucheng Tyrannosaurus, and Zhucheng Chinese Ankylosaurus are rare and have great scientific value, regardless of whether the fossils are complete or not. , are listed as first-level key protected paleontological fossils. This view has been recognized by experts in the province. Based on this, 4,843 first-level key protected paleontological fossils, 15,525 second-level key protected paleontological fossils, and 1,865 third-level key protected paleontological fossils were determined in Shandong Provincial Museum.

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