Phylogeny, Palaeobiodiversity and Palaeogeography

Geobiodiversity database and its application in stratigraphic research

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The Geobiodiversity Database (GBDB, http://www.geobiodiversity.com) is an integrated system for the management and analysis of stratigraphic and paleontological information. Its goal is to facilitate regional and global collaborations focused on regional and global correlation, quantitative stratigraphy, systematics, paleogeography and paleoecology. The GBDB project was started in 2006 and provided online service since 2007. It became the formal database of the International Commission on Stratigraphy (ICS) in August 2012 at the 34th International Geological Congress in Brisbane, and will consequently produce comprehensive and authoritative web-based stratigraphic information service for global geoscientists, educators and the public. As of March 2013, an abundance of over 6,000 sections, 40,000 collections and 200,000 fossil occurrences from the world has been digitized and compiled into the GBDB system. The chrono-, bio- and litho-stratigraphic data are all supported in the present database structure. GBDB provides the capability of completely digitizing raw data, as well as integrating of different interpretations to the same paleontological and stratigraphic content. Many visualization and analytical tools has been developed or integrated to make the database more useful as a scientific and educational tool, such as geographical visualization (GeoVisual 1.0), stratigraphic visualization (powered by TS Creator), panoromic view of outcrop (GeoPano 1.0), quantitiative stratigraphic correlation (CONOP 9 and SinoCor 4.0), 2D and 3D distribution analysis of strata or any geologic body (GeoVisual 1.0 and GIS software such as ArcGIS).

Keywords: geobiodiversity, database, application in stratigraphy.

Recent progress in assessing paleobiodiversity and its evolution through time

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Paleobiodiversity used to be quantified by taxon counts at a given rank (especially orders, families and orders). The limitations of this approach linked with the subjective rank assignment of taxa has prompted the development of new, more objective and sophisticated methods. Thus, phylogenetic diversity (the sum of branch lengths, which represent evolutionary time) can quantify biodiversity at a given time. This requires knowing with reasonably good precision the appearance dates of taxa. The main problem is that the fossil record gives directly only minimal divergence dates that may be much younger than actual divergence dates. In the last few years, several methods have been used to estimate actual divergence dates. Of these, those using birth and death models or total evidence dating appear especially promising, although they are still in their infancy. Biodiversity evolution is even more difficult to tackle because of taphonomic biases and because species turnover may seem fast in geological time. Birth and death models can be used to quantify diversification and extinction rates using timetrees. Until recently, these models made very little used, if any, of fossil data, but recent developments allow extinct taxa represented by fossils and incorporated directly into timetrees to inform the analyses and reduce estimation error.

Keywords: Paleobiodiversity, phylogenetic diversity, diversification, extinction rate, evolution.

Fusulinid diversification and the contemporaneous sea level change of the Dian-qian-gui Basin during Early and Middle Permian, South China

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The study of the diversification process of shallow sea benthos as well as its coupling relationship with the change of sea levels is an important method to reveal the effect of global environmental changes on biological evolution and to discover the co-evolution laws between life and environment during geological time. This paper analyzes the diversification progress of fusulinid fauna from the Dian-qian-gui Basin during Early to Middle Permian in detail. It also compared such progress with the relative sea level change at that time, to discuss the relationship between the diversification of fusulinid and sea-level changes. Results show that in the Asselian to Sakmarian stages of Early Permian, when relative sea-level in the Dian-qian-gui district slowly rose, the specific number of fusulinids increased rapidly. And in the Wordian Stage, when sea-level changed frequently, the number of fusulinid genera grew fast.

Keywords: Dian-qian-gui Basin, Fusulinid, Permian, Sea level Change.