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# Brachiopod-associated faunas in the Middle and Upper Devonian of the Baoshan Block: implications for biostratigraphy and palaeoenvironment

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## Abstract

The Baoshan Block constituted an important part of the Sibumasu Terrane which has a great palaeontological and palaeobiogeographical significance for the study of development of the Palaeotethys Ocean during the Palaeozoic. The block is defined by the Nujiang and Kejie-Nandinghe faults (the latter is a branching fault of the Jinshajiang Fault) in the western Yunnan Province of China. Devonian rocks in the Baoshan Block were named after the Heyuanzhai village of Shidian County, where thick fossiliferous successions of carbonate deposits were firstly investigated (Sun & Szetu, 1947). However, due to a lack of specific designation of the rocks and type section, the Heyuanzhai Formation was a matter of confusion regarding both stratigraphy and correlation. Herein the authors re-investigated the Devonian Heyuanzhai Formation in its type area in Shidian, with new discoveries on the sequences and their faunas in the Douyashan section.

The Heyuanzhai Formation in the Douyashan is mainly composed of greyish marls and limestone interbedded with yellowish calcareous shales and mudstones. A great number of fossils were collected from the successions, with detailed documentation of brachiopods, crinoids, and ostracods by the authors. In the lower and middle parts of the formation, the brachiopod *Gypidula*-*Schizophoria*-*Spinatrypa* assemblage is recognized and generally correlated to the Eifelian–Givetian. Whereas, in the upper part, the brachiopod *Pugnax*-*Hypothyridina*-*Tenticospirifer* assemblage is recognized for the first time, indicating an early-middle Frasnian age in terms of occurrences of new species of rhynchonellid and cyrtospiriferid brachiopods. The age determination was further supported by occurrence of the Middle and Late Devonian crinoids (*Megaradialocrinus*, *Halocrinites*, and *Melocrinites*) and ostracods (*Palaeocopida*, *Platycopida*, *Metacopina* and *Podocopida*).

The Heyuanzhai faunas from the Douyashan section are composed of abundant benthos (i.e., brachiopod, corals), along with long stems and well-preserved crinoid crowns as well as mixture of nearshore–offshore ostracod assemblages, demonstrating a relatively high-energy background. This is supported by sedimentary analyses, by which repeatedly well-bedded bioclastic packstone–floatstone generally demonstrating an overall high-energy background. Meanwhile, accumulation of shelly faunas in the upper Heyuanzhai Formation consists of unsorted brachiopods, crinoids, and coral debris, suggesting relatively turbulent condition of ramp. The presence of long stems and well-preserved crowns of crinoids in the muddy limestone of the Heyuanzhai Formation normally indicate nearly in-place degradation or relatively rapid burial subsequent to transport (as the discs and plates of crinoid are easily

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disarticulated after death). Alternatively, ostracods from the crinoid-bearing beds of the Heyuanzhai Formation demonstrating possible transportation and physical turbulence connected to storm wave or tempestite concentrations, in light of accumulation of both nearshore (type II) and offshore (type III) inhabitants. Overall, the facies association and fossil assemblages indicate that the faunas were possibly living in a ramp with high-energy setting between the fair-weather wave-base and the storm wave-base, and deposited in an environment that was typically derived from immediately adjacent habitats after short distance transportation.

**Keywords:** brachiopod, Devonian, Baoshan Block, Sibumasu, palaeoecology