

日本最初の地質時代名称チバニアンと最後の地磁気逆転

Chibanian, the first Japanese GSSP associated with the last geomagnetic reversal

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On January 17, 2020, a GSSP proposal for "Chiba Section", which was a candidate for Japan's first Global Boundary Stratotype Section and Point (GSSP), and had been under review for a long time, was ratified by the International Union of Geological Sciences (IUGS). As a result, the Middle Pleistocene, which is between 774,000-129,000 years ago, was named as the Chibanian period.

In this talk, I will explain what a geologic age and a GSSP, which are generally difficult to be understood is.

Geologic ages are mainly divided by changes in fossil flora and climatic cycles. A geologic age used to be defined by a type section of a sedimentary formation which represents the most typical fossil flora indicating the geologic age. However, this scheme was not able to determine when the geologic age started. To solve this problem, a scheme to have a type section for the boundary of two geologic ages was proposed in 1976 to define an initiation of geologic age. A type section in this scheme is called as "GSSP: Global boundary Stratotype Section and Point". For the whole Earth's history, 116 boundaries of geologic ages have been defined. However, GSSPs have been able to be set up only for the last ca. 635 Ma, after the Ediacaran period, whose geologic formations yield fossils of organisms. Currently, 74 GSSPs have been ratified by IUGS.

Because a GSSP is the best section representing the initiation boundary of geologic age, a GSSP has a role to be a reference section to define the boundary horizon in some other section elsewhere in the world. Even if a geologic section in somewhere only contains a limited kind of fossils, the GSSP needs to provide data for the same type of fossils with that section to facilitate for stratigraphic correlations. Consequently, a GSSP has to be a marine formation yielding many kinds of fossils and providing various methods for stratigraphy as much as possible. Moreover, a site for the GSSP has to be guaranteed feasibility for future studies and sampling.

The initiation of Pleistocene, ca. 2.6 Ma, is defined as the period for the start of the Northern Hemisphere Glaciation (NHG). During that period, the Earth's climate cycle has changed from 20 kyr to 41 kyr, and the amplitude has gradually become larger. After that period, between 1.2 and 0.5 Ma, the climate cycle has changed again from 41 kyr to 100 kyr, and the amplitude became much more significant. This second change, called sometimes as EMPT (Early-Mid Pleistocene Transition), has been utilized as the basis to divide Early and Middle Pleistocene. However, the difference is so gradual, which is not suitable to define an exact boundary.

For this reason, the Matuyama-Brunhes boundary (MBB), which is the last geomagnetic reversal in the Earth's history, has been used as "a marker horizon" to define the Early-Middle Pleistocene boundary.

Consequently, a GSSP for the Early-Middle Pleistocene boundary has to provide a high-quality geomagnetic record to be able to indicate the MBB horizon in the geologic section where the GSSP is set up. Since the actual point for the GSSP, represented as a "Golden Spike", should be on a distinctive layer in the section, the Byk-E tephra bed laying just below the MBB was proposed as the GSSP horizon in the Chiba section.

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