# The Middle Pleistocene Subseries: a potential second stage based on the Mid-Brunhes event

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**Abstract**

The Global boundary Stratotype Section and Point (GSSP) at Chiba, Japan defines the base of the Middle Pleistocene Subseries and Chibanian Stage with an astronomical age of 774.1 ka. This boundary represents the approximate midpoint of the Early–Middle Pleistocene transition, a 1.4–0.4 ka interval marked by a progressive increase in the amplitude and asymmetry of climate oscillations and a shift towards quasi-100 ky periodicity. Both units currently extend upwards to the base of the Upper Pleistocene Subseries dated provisionally at ~129 ka. The Middle Pleistocene with a 645 kyr duration is the second longest subseries of the Quaternary. Introducing a second stage, beginning at the approximate mid-point of this subseries, would provide a useful division. The 'Mid-Brunhes Event' (MBE) more recently termed the 'mid-Brunhes Transition' is an abrupt step-change to increased amplitude of the quasi-100 kyr cycles and to warmer interglacials from MIS 11 onwards, as revealed by Antarctic ice core records, the LR04 benthic foraminiferal isotope stack, and a recent long alkenone paleotemperature record from the central Mediterranean Sea. Other long-term changes at this time include an abrupt weakening of the East Asian Summer Monsoon, suggesting an increase in average Northern Hemisphere ice volume. The base of this new stage would reasonably be placed at around the MIS 12–MIS 11 transition (Termination V, ~420 ka), an interval of rapid change clearly recognised in the marine record. This level appears to approximate the bases of the Holsteinian, Hoxnian, Likhvinian, and Zavadivian regional stages across northwestern and central Europe, the Russian Plain, and the Ukrainian Loess Plain; and can be traced across the Chinese Loess Plateau. Climatostratigraphic signals associated with Termination V (~420 ka) would serve as the primary guide to this proposed new stage for the Middle Pleistocene. The 'Bermuda' geomagnetic excursion occurring within a prominent relative paleointensity minimum at ~412 ka in MIS 11 offers additional stratigraphic characterization. Such a second stage would terminate the Chibanian, eliminating its redundancy as the sole stage of the Middle Pleistocene.

**Keywords:** Quaternary, Pleistocene, new stage, Mid, Brunhes event

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