Astronomically paced changes in continental weathering rates recorded in the Mesozoic bedded chert

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Weathering of continental rocks, especially silicate rocks, is a primary factor controlling earth surface processes through changes in atmospheric CO2 level, nutrient cycle, and oceanic chemical composition. How to quantitatively reconstruct chemical weathering history has therefore is an important issue in global change research. However, controlling factors of chemical weathering on geologic time scales are largely uncertain due to the uncertainty of proxy records, especially before Mesozoic. Here, we reconstruct a secular evolution of global chemical weathering rate from Mesozoic radiolarian bedded chert deposited in the low latitude region of Panthalassa. Average low-mid-latitude biogenic silica (BSi) burial flux during the early Mesozoic is 90% of that of the modern global ocean. We hypothesize that BSi in chert was a major sink for oceanic dissolved silica (DSi), with fluctuations proportional to DSi input from chemical weathering on timescales longer than the residence time of DSi (<100 kyr). Chemical weathering rates estimated by the revised GEOCARBSULFvolc model support these hypotheses, excluding the volcanism-driven oceanic anoxic events of the Early-Middle Triassic and Toarcian. These exceptions would result in underestimate for silicate weathering by GEOCARBSULFvolc due to the assumption of relatively stable degassing rate on multimillion year-scale. Up to 50% amplitudes of orbital-scale BSi burial flux are larger than that of orbital cycles themselves. Similar orbital-cycles are also recorded in lake-level records of Newark Supergroup, which reflect Mega-monsoon intensity in the supercontinent Pangea and potentially influence on the spatial chages in chemical weathering rate. Therefore, significant changes in BSi burial flux can be paced with the Mega-monsoon dynamics, which nonlinearly amplified the orbitally paced global chemical weathering during the early Mesozoic greenhouse world.

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