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Continental weathering, clay formation and marine oxygenation across the Precambrian–Cambrian transition

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The long-term evolution of oxygen cycles on Earth's surface is ultimately determined by the balance between oxygen production and consumption. Although the overall oxygenation levels of atmosphere and ocean in the early Paleozoic may have been lower than those in present time, enhanced marine biological pump is commonly considered as a critical factor that causes global atmospheric and oceanic oxygenation from the late Neoproterozoic to the earliest Paleozoic (i.e., Neoproterozoic Oxygenation Event). However, large uncertainties remain on identification of drivers of secular shifts in marine organic carbon burial and its link to the oxygenation of the ocean and atmosphere. Here we report new lithium isotope (δ^7Li) and K/Al data of marine mudstones spanning the late Neoproterozoic to the middle Cambrian, in order to better constrain the effects of continental silicate weathering and clay mineral factory on organic carbon burial efficiency across the Precambrian–Cambrian transition. Notable decreases in δ^7Li and K/Al of the mudstones after the early Cambrian suggest enhanced continental silicate weathering and clay influx to continental margin sediments, which promotes the organic carbon burial and deeper oceanic oxygenation under relatively low oxygen levels of atmosphere. We further compile elemental data from the SGP database to evaluate the changes in marine redox states and continental silicate weathering through the Paleozoic, and build the potential links between environmental factors on Earth's surface.