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Ultra-high supermountains linked to the evolution of species

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The First Great Oxidation Event, at ca. 2.45 Ga, changed the oxidation state of Earth's atmosphere and oceans from anoxic to oxic, and had a profound effect on surface weathering, but surprisingly, it had no detectable influence on the evolution of species or on their maximum size (biovolume). Earth's biovolume increased in two giant steps [1], both of approximately seven orders of magnitude, the first at ca. 1.85 Ga, when eukaryotes arguably made their first appearance, and the second between 750 and 500 Ma, when animals first appeared. Here we use the distribution of low-Lu zircons from the world's major rivers [2], which correlate with peaks in high-pressure metamorphism, to document the temporal distribution of ultra-high, Himalayan-style mountains. We show that 1.95-1.85 Ga and 650-500 Ma were periods of extensive ultra-high supermountains formation, whereas the intervening period was not. We suggest that the ultra-high supermountains were produced by continent-continent collisions, associated with the assembly of the Nuna and Gondwana supercontinents. We argue that a profound increase in the flux of essential nutrients into the oceans, which resulted from the rapid erosion of these ultra-high supermountains, was responsible for the explosions of biological activity that occurred at these times.

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