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Rapid Devonian terrestrialisation by land plants changed the continental weathering regime

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Silicate weathering is the primary long-term process by which atmospheric CO_2 is drawn down. Continental weathering likely changed dramatically during the Devonian period, when plants colonized the continents (terrestrialisation) [1]. This change is believed to have shaped palaeoclimate and created a more habitable niche for terrestrial biotas [2]. However, compared to the richness of data showing the variations in CO_2, temperature and O_2 during this period, palaeo-records specifically targeting continental weathering are very limited. Here, we have analysed lithium isotope ratios (a tracer of silicate weathering) from 70 brachiopods and bulk carbonate samples across the Devonian to reconstruct the δ^7Li curve of Devonian seawater. The curve shows a low δ^7Li in the Early Devonian and a rapid rise in δ^7Li in the Middle Devonian, followed by a high δ^7Li in the Late Devonian. The observed change likely involved an increase in the δ^7Li of the riverine input, which is in part probably due to an increase in clay formation and retention on the continents. The evolution of deep rooting systems and well-establishments of forests in the Devonian will have not only changed the nature of weathering and erosion, but also caused the stabilization of continental sediments. Our data shows that this process occurred rapidly, with significant consequences for the operation of the global carbon cycle and nutrient transport to the oceans.

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