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A pulse of cadmium burial in the post-Sturtian ocean

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The sequence of environmental changes that followed the Sturtian Snowball deglaciation was highly complex. Various processes including volcanism, extreme weathering, anoxia and nutrient recycling have been proposed to account for a period that encompassed major changes to the global biosphere. We present new cadmium isotope records obtained from samples spanning the Snowball deglaciation and aftermath from three locations: the Arena Formation (Greenland), the Datangpo Formation (Nanhua Basin, China) and the Tapley Hill Formation (Adelaide Superbasin, Australia). These records consistently show pulses in non-detrital cadmium accumulation, accompanied by elevated δ^{114}Cd compositions up to ~0.3 ‰, that occur in the immediate aftermath of Sturtian deglaciation. We interpret this post-Snowball 'pulse' in cadmium to record a high rate of cadmium weathering, coupled with enhanced burial by a combination of organic productivity and sulfide, the latter controlled by higher marine sulfate concentrations in the immediate post-Sturtian ocean. Both non-detrital cadmium concentrations and isotope compositions diminish to crustal values shortly afterwards, over the prolonged inter-Snowball interval. Lower cadmium concentrations and isotopic compositions likely reflect an oceanic reservoir that was depleted under conditions of more limited continental weathering as global temperatures decreased, coupled with intense removal to sediments in the early stages of the inter-Snowball. The data indicate a cadmium inventory in the Cryogenian ocean that was lower than modern, and therefore highly sensitive to changes in its oceanic fluxes.