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# Discharge of sedex ore-forming brines into Paleozoic oceans caused global marine Sr-isotope spikes, perturbations to global carbon cycles, global ocean anoxic events (OAEs) and mass extinctions

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Emerging research shows that venting of sedimentary-exhalative (sedex) ore brines into the ocean formed the planet's largest seafloor hydrothermal deposits, and caused short-duration (< 1 m.y.), positive Sr-isotope excursions ("spikesâ€ ) in the global marine record. Ore genesis research on these enormous Zn-Pb-Ba sedex deposits, combined with oceanographic modeling, demonstrates that the mass of Sr discharged into the ocean by these sedex systems was sufficient to explain the enigmatic Sr spikes. High-resolution chemostratigraphic studies show that these Sr spikes were produced isochronously around the globe and coincide, precisely, with the age of several world-class Paleozoic sedex deposits. The fact that these hydrothermal events are etched in the global marine record suggests the $^{87}Sr/^{86}Sr$ record provides a unique tool for ore genesis studies and for assessing the mineral potential of sedimentary basins of varying ages. In the course of this research we discovered that the ages of these short-lived Sr spikes overlap global ocean anoxic events (OAEs). These dramatic global marine events are characterized by $\delta^{13}C$ and $\delta^{18}O$ excursions, the deposition of metal-rich black shales and ironstones, global climatic and environmental change, metal-induced malformation (teratology) of marine organisms, all associated with mass extinction events. The relationships among these phenomena remain poorly understood and diverse models have been proposed as the trigger of these events. Most of these models invoke a massive nutrient delivery to the ocean as a stimulus of primary productivity and marine eutrophication that eventually, through a series of linked processes, progresses to OAEs. Mass transfer calculations using the known composition of basinal brines and the flux of Sr from these enormous sedex systems shows that biolimiting nutrients, including reduced N (dominantly ammonia), C, Fe and trace metals, Si, and S present in ore brines surpass that of the total modern riverine system into the ocean. Given these strong temporal correlations, mass balance estimates, and ocean chemistry modelling, further work is warranted to determine the frequency and extent to which periodic venting of brines from sedex systems into the ocean influenced evolution of the Earth's litho-, hydro-, atmo- and bio-sphere.