Boron isotopes in brachiopods during the end-Permian mass extinction: constraints on pH evolution and seawater chemistry

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The global biogeochemical cycling of carbon is fundamental for life on Earth with the ocean playing a key role as the largest and dynamically evolving CO$_2$ reservoir. The boron isotope composition (commonly expressed in $\delta^{11}$B) of marine calcium carbonate is considered to be one of the most reliable paleo-pH proxies, potentially enabling us to reconstruct past ocean pH changes and understand carbon cycle perturbations along Earth’s geological record (e.g. Foster et al., 2008; Clarkson et al., 2015). Brachiopods present an advantageous and largely underutilised archive for Phanerozoic carbon cycle reconstructions considering their high abundance in the geological record and its origin dating back to the early Cambrian. Moreover, their shell made of low-magnesium calcite makes these marine calcifiers more resistant to post-depositional diagenetic alteration of primary chemical signals. We have investigated the $\delta^{11}$B using MC-ICP-MS (Neptune Plus) and B/Ca and other elemental ratios (Mg/Ca, Sr/Ca, Al/Ca, Li/Ca, Ba/Ca, Na/Ca and Fe/Ca) using ICP-MS-Quadrupole (Agilent 7500cx) from the same specimens in pristine brachiopod shells from two sections from northern Italy during the Late Permian. These sections cover the $\delta^{13}$C excursion in excess of $\sim$4‰ (Brand et al., 2012) and are associated with major climate and environmental perturbations that lead to the mass extinction event at the Permian-Triassic boundary. Particular emphasis will be placed on the implications of our new paleo-pH estimates on the seawater chemistry during the Late Permian.

