The evolution of boron isotopic composition of seawater during Mesoproterozoic to early Neoproterozoic: evidence from the Jixian section, North China

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Boron isotope composition in carbonate archives ($\delta^{11}B_{carb}$) is considered to be a record of the boron isotopic composition of seawater ($\delta^{11}B_{sw}$). Nevertheless, it has not been applied to the carbonate rocks prior to the Neoproterozoic, such as limestone, dolostone and stromatolite in the Mesoproterozoic. It has been suggested that the $\delta^{11}B_{sw}$ changed dramatically throughout the Earth's history. However, the $\delta^{11}B_{sw}$ value of the modern ocean are still applied to the study of pre-Neoproterozoic rocks, because almost no constraint has been made for the $\delta^{11}B_{sw}$ value. In this study, we developed a method for extracting the carbonate-associated B from dolostone and other carbonate materials, with B from the detrital components not being leached. We applied this method to the well preserved marine carbonate dominated strata from Jixian section in north China which dated to 1630 Ma–800 Ma, spanning from the Mesoproterozoic to early Neoproterozoic. After screening data from samples with higher risk of being affected by clay contamination and diagenetic processes, the boron isotopic composition of pristine carbonate associated component in Jixian section ranges from 0.0 ‰–11.0 ‰, with an average of 4.81 ‰, which is obviously lower than that of modern marine carbonates. The estimated $\delta^{11}B_{sw}$ values varied from 21±3 ‰ to 29±3 ‰ during 1630-1400 Ma and was 25±3 ‰ at early Neoproterozoic, with pH value of 7.5-8.3. Combining the $\delta^{11}B_{sw}$ values of the Mesoproterozoic and early Neoproterozoic ocean from this study with previous $\delta^{11}B_{sw}$ reconstructions retrieved from various carbonate archives in the Precambrian and the Phanerozoic, we obtained the secular $\delta^{11}B_{sw}$ evolution since the Mesoproterozoic, which shows a general increasing trend from the Mesoproterozoic to the present.