The character and evolution of boron isotopic composition of marine carbonate rock and sea water from the Jixian section, North China during 1630 Ma~800 Ma

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The boron isotopic composition of marine carbonate rock ($\delta^{11}B_{CC}$) is believed to be an archive of the boron isotopic composition and pH of seawater. In this study, we explore the well preserved strata of marine carbonate-dominated Jixian section in northern China, which dated to 1630 Ma~800 Ma spanning from the Mesoproterozoic to early Neoproterozoic, with relatively continuous deposition and well preserved sedimentary features. We have analyzed the boron isotopes of Jixian section with separated phases (surface adsorbed phase and carbonate phase) and made assessment of their fidelity to reconstruct the $\delta^{11}B_{SW}$ in combined with $\delta^{13}C$, $\delta^{18}O$ and trace element (Al, Mn, B, etc.) analyses. The boron isotopic composition of carbonate phase in Jixian range from 0.0‰～12.9‰ during 1630 Ma~800 Ma, including 9 siliceous band-interbedded dolomite samples from Gaoyuzhuang Formation to Wumishan Formation with $\delta^{11}B_{CC}$ ranging from 3.3‰ ~ 12.9‰ (averaged at 9.2‰) and other samples ranging from 0.0‰ ~ 7.1‰ (averaged at 3.7‰). The siliceous-band-interbedded dolomite samples with higher risk of being affected by diagenetic process is not suitable for the reconstruction of $\delta^{11}B_{SW}$ in the geological past. We have also constrained the paleo-pH of the seawater using the $\delta^{11}B_{CC}$-pH_{SW} relationship by assuming that the chert bands are deposited in environment with near neutral to slightly acidic pH value. So the paleo-pH of seawater ranges from 7.3~8.3, with corresponding $\delta^{11}B_{SW}$ ranges from 25‰~26‰ proposed. By plotting $\delta^{11}B_{SW}$ of Mesoproterozoic ocean calculated from this study together with that of other periods of the Earth's history retrieved from various carbonate records proposed by previous studies, we have obtained the $\delta^{11}B_{SW}$ evolution curve, which shows that the $\delta^{11}B_{SW}$ increase steadily from Mesoproterozoic to modern ocean.

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