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Fluid activities during oceanic subduction recorded by garnet oxygen isotopes

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In-situ garnet oxygen isotope profile analysis and whole-rock pseudosection phase modelling were conducted for both eclogite and metapelite from North Qilian, China.

For the country metapelite, two stages of core–rim zonation can be recognized for garnet. These garnets show homogenous $\delta^{18}\text{O}$ compositions of $10.2 \pm 0.5 \text{ ‰}$ ($n = 7$) for cores and $10.9 \pm 0.4 \text{ ‰}$ ($n = 9$) for rims.

Garnets from eclogite show three stages of zonation from core to rim for major elements. Compositionally, the growth zonation is represented by X_{Py} increase from 0.11 to 0.16 in the core portion, then down to 0.13 in the mantle portion, and finally up to 0.22 in the rim. The garnet core portion has $\delta^{18}\text{O}$ composition of $8.4 \pm 0.5 \text{ ‰}$ ($n = 7$). The mantle portion shows increased $\delta^{18}\text{O}$ composition of $9.3 \pm 0.4 \text{ ‰}$ ($n = 13$). The inner rim portion shows decreased $\delta^{18}\text{O}$ of $7.8 \pm 0.4 \text{ ‰}$ ($n = 10$). The thinner outer rim portion shows an increase again and wider spread in $\delta^{18}\text{O}$ of $8.3 \pm 0.6 \text{ ‰}$ ($n = 12$). Combined with the pseudosection calculation, garnet major elements and oxygen isotopes data record a ‘yo-yo’-like subduction and related fluid release process.

