



## **Secular variations in Ce/Y and Ho/Yb ratios of igneous rocks in the Chinese North Tianshan arc system: tracing varied crustal thickness and subduction margin**

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Accretionary orogens form at sites of subduction of oceanic lithosphere. Based on the velocities and dips of subducting slabs, accretionary orogens can be grouped into advancing and retreating type, which would cause crustal thickening and thinning, respectively. Tracing the changes in crustal thickness is thus critical to recognize these two modes of orogeny. A consensus has been achieved that crustal thickness can be reflected by REE patterns of arc magmas, namely thin and thick arc crust corresponds to the flat and steep pattern, respectively. Accordingly, temporal variations in ratios of REEs (e.g., La/Yb and Ho/Yb) could record the relative changes in crustal thickness. The Chinese North Tianshan arc system is composed of several arcs (e.g., Dananhu and Harlik arc) and suture zones, and has been ascribed to Paleozoic subduction of the Paleo-Tianshan Ocean, and probably involved episodically advancing and retreating orogen. To refine its subduction-accretion process, we employ the Ce/Y of basalts and Ho/Yb of felsic rocks in the Dananhu-Harlik arc to track the variations in crustal thickness and then to unravel the varied subduction margin (advancing and retreating). It is found that both Ce/Y and Ho/Yb ratios give coherent results. During Ordovician–Devonian and late Carboniferous time, both Ce/Y and Ho/Yb ratios show increasing trends, reflecting two periods of crustal thickening probably related to the advancing subduction. Conversely, Ce/Y and Ho/Yb ratios decrease in the early Carboniferous, indicating relatively shallow melting depths probably caused by a retreating orogen. It can be proposed that the Chinese North Tianshan arc system underwent alternating advancing and retreating accretionary orogen during Paleozoic time.

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