Figure and Table captions in the ESM

ESM 1 Occurrence and microstructure of representative rocks in the Shenglikou peridotite massif, North Qaidam (NE Tibet). Figure (a) displays the blocks of garnet-free serpentinites in the outer part of this massif. Figure (b) shows the interlayers of Pyro-rich and Ol-rich peridotites (07SLK06L and 07SLK06H). Figures (c-e) show the scanned thick sections of garnet-bearing peridotites from the Ol-rich group, and are 07SLK12, 07SLK08 and 07SLK29, respectively. Lherzolite and pyroxenite in the Pyro-rich group are shown in (f-h): Figure (f) exhibits a transition between the Pyro-rich layer (PRL) and the Ol-rich layer (ORL); Figure (g) is a garnet lherzolite (07SLK15), while (h) shows the clinopyroxenite layer (07SLK05).

ESM 2_Table 1 Estimated mineral modes of ultramafic rocks in the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 3 Petrographic illustration of representative large grains of garnet (a-c), clinopyroxene (d-f), orthopyroxene (g-i) and spinel (j-l) in the Shenglikou peridotite massif, North Qaidam (NE Tibet). (a) is under plane-polarized light, (b-d, g and j) are BSE images, and others are of X-ray maps of different elements. (a-c) show Ru exsolutions and inclusions within Gt porphyroblasts. (d-f) display exsolved lamellae of Amp, Sp and Serp along the Cpx cleavage planes. (g-i) show exsolutions of Sp and Cpx within Opx porphyroblasts. (j-l) exhibit two high-Cr Sp grains sitting into the garnet kelyphites, and the Sp has high-Al rims similar to those in the kelyphites. Mineral abbreviations are the same as in Fig. 2; Ru, rutile.

ESM 4_Table 1 Major-element compositions (wt%) of garnet from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 4_Table 2 Major-element compositions (wt%) of spinel from the Shenglikou peridotite massif, North Qaidam (NE Tibet)
ESM 4_Table 3 Major-element compositions (wt%) of olivine from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 4_Table 4 Major-element compositions (wt%) of clinopyroxene from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 4_Table 5 Major-element compositions (wt%) of orthopyroxene from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 4_Table 6 Major-element compositions (wt%) of amphibole from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 4_Table 7 Major-element compositions (wt%) of ilmenite from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 4_Table 8 Major-element compositions (wt%) of rutile from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 5_Table 1 Trace-element compositions (ppm) of garnet from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 5_Table 2 Trace-element compositions (ppm) of clinopyroxene from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 5_Table 3 Trace-element compositions (ppm) of amphibole from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 5_Table 4 Trace-element compositions (ppm) of orthopyroxene from the Shenglikou peridotite massif, North Qaidam (NE Tibet)
ESM 5_Table 5 Trace-element compositions (ppm) of olivine from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 5_Table 6 Trace-element compositions (ppm) of checking standards (NIST612 and BCR-2) measured in this study and those GeoReM recommended values

ESM 7_Table 1 Oxygen-isotope data (‰) of zircon from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 7_Table 2 Oxygen-isotope data (‰) of garnet from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 8 Supplementary analytical methods

ESM 9 Variations of SiO₂ (a), Al₂O₃ (b), Mg# (c), Rb (d), Ba (e), Ce (f), Yb (g), Th (h) and Eu anomaly (i) with LOI contents in the whole-rock samples from the Shenglikou peridotite massif, North Qaidam (NE Tibet). The literature data are from Song et al. (2007), Yang and Powell (2008) and Shi et al. (2010).

ESM 10 Trace element distribution among the rock-forming minerals (Gt, Cpx, Opx, Ol and Amp) in the representative Pyro-rich interlayer (a; 07SLK06L) and Ol-rich block (b; 07SLK08) from the Shenglikou peridotite massif, North Qaidam (NE Tibet). The contributing proportions of each element were calculated by the comparison between reconstructed compositions and measured whole-rock results. The modal abundances of Gt, Cpx, Opx, Ol and Amp were obtained by point-counting method and converted to mass proportions. The unbalanced elements are probably hosted in the non-counted minerals, fluid inclusions or grain boundaries.

ESM 11 Multi-element patterns of orthopyroxene (a) and olivine (b) in the
Shenglikou peridotite massif, North Qaidam (NE Tibet, China). All the patterns are normalized to the values of primitive mantle (McDonough and Sun 1995). The error bars shown are ±1σ.

ESM 12_Table 1 Pressure (P) and temperature (T) estimates of mineral pairs from the Shenglikou peridotite massif, North Qaidam (NE Tibet)

ESM 13 Diagrams of $^{87}\text{Sr} /^{86}\text{Sr} (t=430 \text{ Ma})$ vs $^{176}\text{Hf} /^{177}\text{Hf} (t=430 \text{ Ma})$ (a, b) and εNd (t=430 Ma) vs εHf (t=430 Ma) (c) for garnet (Gt), clinopyroxene (Cpx), amphibole (Amp) and whole rock (WR) from the Shenglikou peridotite massif. Diagram (b) is the enlarged region in (a) and does not show garnet isotopic compositions. The thick, red curve in (b) represents the probability density plot of in situ $^{87}\text{Sr} /^{86}\text{Sr}$ initial ratios. In (c), the black arrows point to the εNd (t=430 Ma) and εHf (t=430 Ma) values of garnet that are plotted out of range, as (εNd, εHf) below the garnet ID (for instance: Gt-07SLK06H). The fields of MORB and OIB and the evolution trend in the global terrigenous sedimentary system (thick black line) in (c) are from Vervoort et al. (1999). The CHUR and DM values are calculated back to 430 Ma.

ESM 14 Modeling of age (Ma) vs $^{143}\text{Nd} /^{144}\text{Nd}$ initial ratios for garnet (red line), clinopyroxene (green line), amphibole (grey line) and whole rock (black line) in the Shenglikou peridotite massif. The modeling method is similar to that shown in Fig. 11. The similarity of evolution paths between clinopyroxene, amphibole and bulk rock, indicates that the Sm-Nd system is dominated by the clinopyroxene and amphibole, consistent with the results of mass-balance calculations (Online Resource 10). The vertical dashed lines on the right side in (a-c) show the isochron ages of 607 Ma (07SLK06L), 548 Ma (07SLK06H) and 615 Ma (07SLK12), respectively; also shown are the variations in Nd-isotope ratios at 430 Ma (left-side dashed line).
References in ESM


