Appendix 1. Analytical methods of garnets in the Cuihongshan deposit, Lesser Xing'an Range, NE China.

1 Electron microprobe analyses (EMPA) and mapping

Following detailed petrographic study, twenty-nine representative samples were selected for major elements (SiO_2, TiO_2, Al_2O_3, TFeO, MnO, MgO, CaO, Na_2O) and some of the trace element (F, Cr_2O_3, V_2O_3, SnO_2) were analysed by EMPA using a JEOL JXA-8230 housed at the Institute of Mineral Resources, Chinese Academy of Geological Sciences, Beijing. The operating conditions of selected minerals were as follows: accelerating voltage at 15 kV, beam current at 20 nA, counting time of 30 s, together with a beam diameter of 1-5 μm. Natural minerals and synthetic oxides were used as standards and all of the data were corrected using standard ZAF correction procedures. The analytical uncertainty is less than 1%.

2 Laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) analyses

Twelve polished thin sections carrying representative garnets from the Cuihongshan deposit were selected for major (Si, Ti, Al, Fe, Mn, Mg, Ca, Na, P and K) and trace element (Li, Be, B, Sc, V, Cr, Co, Ni, Cu, Zn, Ga, Ge, Rb, Sr, Y, Zr, Nb, Mo, Ag, Cd, In, Sn, Sb, Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Au, Tl, Bi, Pb, Th and U) analyses. Garnet zoning patterns together with inclusions were investigated by transmitted light microscopy prior to LA-ICP-MS analyses. Forty-eight trace elements were analyzed by LA-ICP-MS using an Agilent x7700 ICP-MS coupled with a Phoyon Machine Excite 193 nm excimer laser ablation

system located in Nanjing Focums Technology Co. Ltd. The laser was operated at 8 Hz with energy of 5.5 mJ with a 10 μm diameter at a scan speed of 3 μm/s. Helium is takend as the carrier gas. Calibration was performed using SRM 612, SRM 610, BIR-1G, BCR-2G, BHVO-2G, GSE-1G, CGSG-1 and CGSG-2 external standards, and ^{40}Ca as an internal standard while Glitter 4.0 software was used to determine element concentrations. Detection limit for LA-ICP-MS is below 0.1 ppm for most elements, and in run precision is <10%.

The accuracy and precision of calculated grossular and andradite data calculated from LA-ICP-MS methods have been verified by a comparative study with data obtained on the same crystal using EMPA method (see Figure A-1). Major and trace element accuracy and precision and instrumental bias between EMPA and LA-ICP-MS analytical methods in the garnet grains are reported along with the entire dataset showing positive relationship within the error levels (see Figure A-1)."

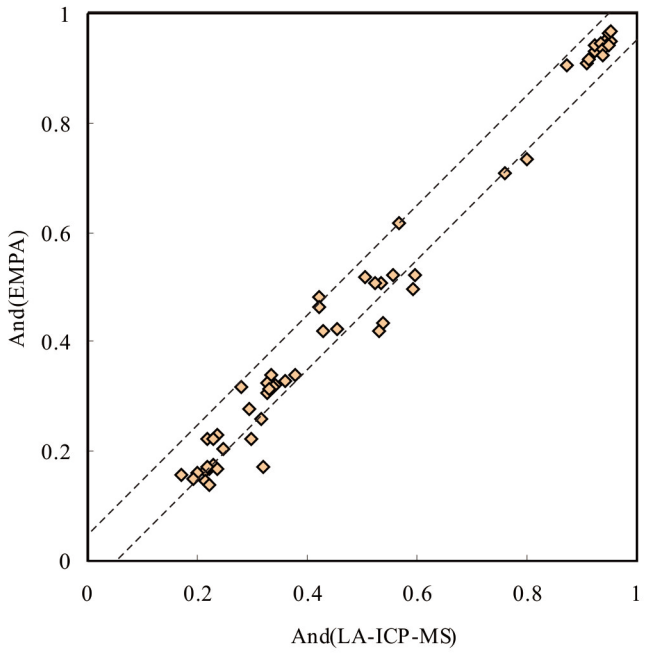

Figure A-1 EPMA versus LA-ICP-MS values of garnet crystals from this study