

Supplementary Information

Analytical procedures

Electron microprobe analyses were performed at the Centro Nacional de Microscopía Electrónica (CNME), Madrid with a JEOL Superprobe JXA-8900M with four wavelength-dispersive spectrometers on polished thin sections and metallized with graphite. The accelerating voltage is of 15 kV and an electron beam current of 20 nA, with a beam diameter of 5 μm . Elements were counted for 10 s on the peak and 5 s on each background position. Standards used were sillimanite (SiO_2), albite (Al_2O_3), almandine (FeO), kaersutite (MgO and CaO), microcline (K_2O), ilmenite (TiO_2), fluorapatite (F), scapolite (Cl), Ni alloy (Ni), chromite, (Cr_2O_3), gahnite (ZnO), and strontianite (Sr). They are from the Smithsonian (Washington DC, USA) and Harvard University (Cambridge, Massachusetts, USA). Some other were done at the Electron Probe Microanalytical Facility at Memorial University of Newfoundland using a 1991 Cameca SX-50 with an acceleration voltage of 15 kV, a beam of 20 nA and a spot of 5 μm . Standards include apatite (F), almandine (FeO), rhodonite (MnO), tugtupite (Cl), orthoclase (K_2O), diopside (CaO), albite (Na_2O), corundum (Al_2O_3), quartz (SiO_2), diopside (MgO), chromium oxide (Cr_2O_3) and rutile (TiO_2).

Radiogenic isotope data (Rb-Sr and Sm-Nd) of the hybrid plagioclase-magnetite-diopside rock were obtained at the Unidad de Geocronología (CAI de Ciencias de la Tierra y Arqueometría) of the Universidad Complutense Madrid using the same methodology and standards that in (Tornos et al. 2021). SEM analyses were done at the CAI de Ciencias Geológicas y Arqueometría using a SEM-EDX JEOL JSM 820 equipment. Other SEM analyses and photos were completed at the Department of Earth Sciences of the University of Tasmania.

The micro-Raman spectra of analyzed sample were obtained in a NT-MDT NTegra Spectra Raman spectrometer, coupled to a BDXFM Olympus, at the Spectroscopy and correlation laboratory, Faculty of Chemistry, Complutense University of Madrid. Spectra were acquired at 100x magnification with a 532 nm laser source emitting 22 mW of power at the sample surface. The average spectral resolution in the Raman shift ranging from 150 to 2650 cm^{-1} was 4 cm^{-1} , with 600 lines/mm grating and 0.8 μm spot size. Five acquisitions lasting 10 s each to improve signal-to-noise ratio were collected.

XRF analyses were performed at the Instituto de Geociencias (CSIC-UCM, Madrid) using a NITON equipment on bulk rock samples and the routine for Fe alloys. Detection limits are 175 $\mu\text{g/g}$ for Fe (as Fe^{2+}) and 30 $\mu\text{g/g}$ for Ti. Results are only representative of the analyzed window (64 mm^2).