

Li isotopic composition of subduction-related leucogranites: Source tracking and tectonic implications

YILIN XIAO,^{1*} LIJUN XU¹, YONGJUN GAO²,
SHUGUANG LI¹, HE SUN¹ AND HAIYOU GU¹

¹School of Earth and Space Sciences, University of Science and Technology of China, Hefei, 230026, China
(ylxiao@ustc.edu.cn)

²Department of Earth and Atmospheric Sciences, University of Houston, Houston, TX 77204, USA

We report lithium (Li) elemental and isotopic data for a suite of leucogranitic and gneissic rocks (presumed protolith of the leucogranites) from the boundary between the North China craton (NCC) and the South China plate (SCP), which represents an important repository for understanding the Mesozoic thinning processes of the NCC. The leucogranites have very low Li concentrations (around 1-8 ppm) but extremely heavy isotopic compositions (from 8.6 to 16.1). Overall, Li concentrations and isotopic compositions of the leucogranites are different from those of associated rocks from adjacent areas, including granites ($\delta^7\text{Li} = 2.7-3.8$) and gneisses ($\delta^7\text{Li} = 0.8-6.5$) from North Dabie, garnet-bearing gneisses ($\delta^7\text{Li} = 2.2-4.2$) from South Dabie, as well as those of their host rock—the Archean gneisses ($\delta^7\text{Li} = -0.6$ to 0.0), but are similar to those of garnet-bearing gneisses ($\delta^7\text{Li} = 1.2-22.5$) from the Sulu area. Based on Li isotope data, with the combination of mineralogical (e.g., garnet) and other geochemical data, we suggest that the leucogranites resulted from the partial melting of the subducted gneisses from the Sulu area. Such an observation is very important for providing constraints on the subduction direction of the SCP during the Triassic UHP metamorphic event.

Trace element redistribution in oceanic crust during subduction-zone metamorphism – Evidence from Western Tianshan, China

YUANYUAN XIAO^{1*}, YAOLING NIU^{1,2}, HUAIKUN LI³,
HUICHU WANG³, JON DAVIDSON¹ AND XIAOMING LIU⁴

¹Durham University, UK (yuanyuan.xiao@durham.ac.uk;
yaoling.niu@durham.ac.uk; j.p.davidson@durham.ac.uk);

²Lanzhou University, China;

³Tianjin Institute of Geology, China (tjlhuaikun@cgs.gov.cn;
tjwhuichu@163.com);

⁴Northwest University, China (xmliu@nwu.edu.cn)

Constraining the geochemical consequences of subduction-zone metamorphism (SZM) is important for understanding subduction-zone magmatism, crustal growth and the origin of mantle compositional heterogeneity. For this purpose, we have conducted a detailed trace element study on ultra-high pressure metamorphic (UHP) rocks of both basaltic and sedimentary protoliths from Western Tianshan, China using *in situ* LA-ICP-MS.

We found that during SZM, phengite, and to a lesser extent, paragonite, are major hosts of all the Ba, Rb and Cs. Paragonite also hosts some Sr and Pb. Epidote group minerals host 95% of LREEs, Th, U, Pb and Sr, 60% of MREEs and 30% of HREEs. Garnet preferentially hosts HREEs relative to progressively lighter REEs. Rutile and titanite host essentially all the Ti, Nb and Ta. Titanite also hosts some Sr, Pb and REEs. Retrograde albite can host some Sr and Ba. Glaucofanite and (sodic-)calcic amphiboles, omphacite and chlorite contain very low contents of these incompatible elements (except Li). In addition, analyses of coexisting paragonite and clinozoisite, preserved as lawsonite pseudomorphs in garnet, show $K_d^{\text{clinozoisite/paragonite}}$ for Pb and Sr to be ~ 20 and 4-10 respectively.

Because lawsonite, epidote, garnet, titanite and rutile are stable over a large P-T range during SZM and can exchange REEs, Th, U and HFSEs among each other, these elements are largely redistributed in the newly-formed minerals without significant loss from the system, explaining their relatively immobile nature. Sr and Pb may have been mobilized as shown by their decrease towards rims of prograde clinozoisite, which is also consistent with the insignificant correlations of bulk-rock Sr and Pb with immobile HFSEs. Ba, Cs and Rb are mobile in rocks of basaltic protolith and could have been re-enriched by late infiltrated fluids (e.g., some retrograde mica crystals have very high Ba, Cs and Rb), whereas these same elements may be immobile in rocks of sedimentary protolith, reflecting stronger protolith controls on elemental behavior.