Mantle Composition and Processes Beneath The Taiwan Strait, SE Asia

Kuo-Lung Wang[1, 2], Suzanne Y. O'Reilly [1], William L. Griffin[1, 3], Norman J. Pearson[1], and Ming Zhang[1]

[1]*GEMOC Key Centre, Department of Earth & Planetary Sciences, Macquarie University, Sydney, Australia*
[2]*Institute of Earth Sciences, Academia Sinica, Taipei, Taiwan, R.O.C.*
[3]*CSIRO Exploration and Mining, North Ryde, Australia*

Since the Cenozoic, the entire East Asian continental margin has undergone extension accompanied by widespread intraplate volcanism. Cenozoic basaltic volcanism in Eastern China captured abundant mantle xenoliths that can shed light on the composition and evolution of the subcontinental lithospheric mantle. Xenoliths in Miocene (~16-8 Ma) intraplate alkali basalts in Penghu Islands in the Taiwan Strait have been studied to characterize the lithospheric mantle beneath the region, which has been subjected to severe extension. The xenoliths are dominantly spinel peridotites with minor spinel pyroxenites. Most peridotites have fine to coarse-grained porphyroclastic or equigranular microstructures, and some are foliated. They commonly show textural disequilibrium with clinopyroxene exsolution lamellae in orthopyroxenes, spinel exsolution in clinopyroxenes, and strained clinopyroxene grains coexisting with strain-free clinopyroxene neoblasts. Some orthopyroxenes have cores with high Ca contents, indicating partial equilibration of the rims to lower temperatures. Thus, petrographic and geothermal evidence suggest these peridotites may have originated from upwelling of deeper mantle materials. The equilibration temperatures of these peridotites range from 880°C to 1015°C.

The peridotites from the Penghu Islands show a large range in modal clinopyroxene contents; some have more clinopyroxene (>20%) than most estimated primitive mantle compositions. However, the major-element data suggest that some of the lithospheric mantle beneath this region is quite refractory. The Fo contents of olivine in spinel peridotites range from 89.0 to 91.7, but most fall between 90.0 and 91.0; Mg# of olivine is correlated with Cr# (0.11-0.55) in spinel. It suggests that some of the lithospheric mantle beneath this region is quite refractory, and may possibly be ancient. Trace-element patterns of clinopyroxenes in these peridotites can be divided into three types: depleted, enriched and intermediate. The depleted patterns ($(La/Yb)_N$=0.1; $(La)_N$=0.5) are typical of unmetasomatised, refractory, lithospheric mantle. The enriched and intermediate ones provide fingerprints of different metasomatic episodes. Rare depleted peridotites contain amphibole and/or apatite evidencing some modal metasomatism. At least two episodes of metasomatism can be recognized. High La/Yb and low Ti/Eu ratios in clinopyroxenes indicate carbonatitic metasomatism, whereas the other metasomatic signature is geochemically characteristic of silicate melt interaction. *In situ* Re-Os analysis of sulfides in the mantle peridotites reveals old ages for the original lithospheric mantle formation and suggests that some Proterozoic mantle domains have survived, but may have been subjected to metasomatic re-enrichment during the Miocene extension and thinning in this region.