F Crust-mantle transition

F1

THE NATURE OF THE LOWER CRUST/UPPER MANTLE TRANSITION IN EASTERN AUSTRALIA – EVIDENCE FROM ECLOGITE AND GRANULITE XENOLITHS IN BASALTIC ROCKS

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Lower crustal xenoliths occurring in basaltic rocks range from garnet-bearing granulites and eclogites, through pyroxenites, amphibole-rich metagabbros to felsic metamorphic rocks. Contact relationships between different rock types suggest a complex petrogenesis including multiple intrusive, metasomatic and metamorphic events. Unaltered spinel therzolite, typical of "normal" eastern Australian upper mantle, is interleaved with or veined by eclogitic and granulitic rocks. Geobarometry using a variety of methods yields equilibration pressures for different xenoliths ranging from 12-18 kb. Geothermometry gives ranges of different xenoliths from 850° to 950°c. These physical parameters suggest the eastern Australian crust may be up to 60 km thick and has sustained a high geothermal gradient.

The nature of the mineral assemblages and the contact relationships suggest that the Moho is not a discrete feature, but is represented by a transition zone over approximately 20 km. This is in agreement with geophysical parameters (mainly seismic velocities) determined for this region.

The geochemistry of the lower crustal xenoliths suggests they originated as underplating of the crust by continental-type basaltic magmas. It is postulated that such addition of basaltic magma to the lower crust may represent an important alternative or additional mechanism to the conventional andesite model for crustal accretion.

F2

PERIDOTITE NODULES FROM THE NOGPETSEU AND LIPELANENG KIMBERLITES, LESOTHO: A CRUSTAL OR MANTLE ORIGIN.

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Observed variations in both whole rock and mineral chemistries have lead to the recognition of four groups of peridotite nodule samples in these kimberlites, which overall contain an unusually high proportion of spinel bearing garnet free peridotites. Equilibration temperatures estimated from various mineral equilibria, together with general geochemical considerations, strongly suggest that Group 1 (dunitic spinel wehrlite/lherzolite) and Group 2 (more 'fertile' spinel lherzolite) nodules are of lower crustal origin. However, Group 3 ('depleted' spinel lherzolite/harzburgite) and Group 4 ('depleted' garnet harzburgite) nodules are considered to have had progressively deeper upper mantle origins. The implication is therefore of a Cr-spinel

(Y_{Cr}^{Sp} = 0.25-0.48) peridotite zone at the top of the mantle section sampled by these kimberlites. Such rocks mostly show subsolidus deformation and recrystallisation effects leading to the development of mosaic and symplektite textures. Element partition considerations indicate that such textures have developed during cooling from an earlier temperature maximum.

F3

MANTLE AND LOWER CRUSTAL XENOLITHS FROM KIMBERLITES OF THE CENTRAL CAPE PROVINCE, R.S.A.

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In the central Cape Province Cretaceous-age kimberlites are intruded on a regional scale through postulated Namaqua mobile belt basement (1000 m.y.), that forms the southern fringes to the Kaapvaal craton. These kimberlites are non-diamondiferous. Mantle-derived peridotite and pyroxenite xenoliths are found together with lower crustal eclogites and garnet granulites in these kimberlites. The peridotites are inferred to have equilibrated at lower P,T's than similar xenoliths in kimberlites of the Kaapvaal craton. The lower crustal suite is believed to have equilibrated during high grade metamorphism accompanying Namaqua tectogenesis. Geochemical data are presented for the different xenolith suites.