ON- AND OFF- THE NORTH CHINA CRATON: WHERE IS THE ARCHAEAN KEEL?

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ABSTRACT

Geophysical data indicates that the lithosphere beneath the North China Craton (NCC) is ca 80 km thick and relatively "hot" (Teng et al., 1983). Although this is contrary to what one might deduce from the presence of Archaean crustal rocks (ca 2.5-3.0 Ga) and Ordovician diamondiferous kimberlites (Ma and Wu, 1981), it is consistent with the information from peridotite xenoliths entrained during the Cenozoic. Peridotites from eastern China, collected over distances of several thousand kilometres, are predominantly shallow mantle rocks that formed immediately below the Moho. Petrological, geochemical and textural data point to the presence of thin, hot lithosphere with a marked similarity to lithosphere found beneath tectonically active continents (i.e., off-craton: Basin and Range USA) or the deep lithosphere found beneath modern ocean basins. Of particular note is :

(a) the predominance of spinel facies peridotites (< 85 km) (Robinson and Wood, 1998) like those found in Cenozoic volcanic fields around the world,

(b) a lherzolitic mode similar to that of "deep" oceanic lithosphere represented by basalt-borne xenoliths from Hawaii, Tahiti and elsewhere (i.e., spinel and garnet lherzolites) but very different to "shallow" oceanic lithosphere as represented by abyssal peridotites (i.e., plagioclase lherzolites, harzburgites & dunites) (Dick et al., 1984),

(c) an orthopyroxene/olivine ratio akin to oceanic & off-craton peridotites (Boyd, 1989) and very different from that found beneath the cratons of Canada (e.g., Griffin et al., 1999), Greenland (e.g., Kelemen et al., 1998), Siberia (e.g., Pearson et al., 1995) and South Africa (e.g., Cox et al., 1973),

(d) a predominance of "depleted" Sr and Nd isotopic ratios.

It appears that most of the on- and off-craton peridotites from eastern China have evolved in response to processes similar to that which led to lithospheric growth in modern ocean basins and areas of post-Archaean crustal growth. These processes are thought to relate to the extraction of basaltic magmas (ca. 1300°C). However on- and off-craton isotopic provinciality does exist within eastern China but only a small number of samples have the enriched isotopic characteristics of on-craton peridotites from areas like the Kaapvaal craton of South Africa.

On the basis of geochemical data we conclude that the pre-existent Archaean lithosphere keel has been effectively delaminated and that thermo-tectonic processes led to Phanerozoic accretion of asthenosphere now apparent as "oceanic" lithospheric mantle beneath eastern China (Menzies et al., 1993). The on- and off-craton differences require a more complex petrogenetic model or a fundamental change to our assumptions about the evolution of sub-cratonic mantle based on the Kaapvaal model.

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