Geophysical Research Abstracts, Vol. 7, 04662, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04662


## 0.1 Subcontinental Lithospheric Mantle beneath the Ukrainian Shield

**S.V. Bogdanova** (1), S.N. Tsymbal and Yu.S. Tsymbal (2), I.K. Pashkevich and V.I. Starostenko (3)

(1) University of Lund, Sweden, (2) Institute of Geochemistry, Mineralogy and Ore Formation, Ukraine, (3) Institute of Geophysics, Ukraine (Svetlana.Bogdanova@geol.lu.se / Fax: 46 (0)46 222 44 19 / Phone: 46 (0)46 2224597)

The questions to what extent Archaean lithosphere has been preserved and how the subcontinental mantle has changed throughout time are important both theoretically and in economic geology, particularly, diamond prospecting. The wide age range of the mantle-derived rocks and minerals in the Ukrainian Shield (UkS) of the East European Craton (EEC) also allows conclusions in regard to the Precambrian lithosphere evolution in general.

The UkS is part of Sarmatia, the southernmost crustal segment of the EEC. In contrast to the Fennoscandian and Volgo-Uralian segments, it represents a continuous albeit episodic evolution from ca. 3.7 Ga onwards (e.g. Shcherbak et al., 2003, Miner. J.,). In the UkS, Sarmatia features three Palaeo- and Mesoarchaean blocks/terranes, (i.e. Azov, Middle Dniepr and Podolian) that are separated from each other by Palaeoproterozoic (2.2-2.1 Ga) belts in the Volhyn, Ros' and Kirovograd domains. The Archaean lithosphere has been variously reworked in the Palaeoproterozoic at 2.1-2.0, 1.8-1.75, and 1.7-1.4 Ga, and again during rifting in the Neoproterozoic at ca. 550 Ma and once more during the Devonian at 380-360 Ma, when the Dniepr-Donets Palaeorift was formed.

Mantle-originated alkaline ultramafic rocks of the Proterozoic and Devonian ages, xenoliths and xenocrysts, and mantle minerals in alluvial deposits of local derivation all indicate that the subcontinental lithospheric mantle (SCLM) beneath the entire UkS is composed of eclogites, pyroxenites, and dominant peridotites. The SCLM is well

differentiated. Generally, its uppermost parts consist of eclogites and Cr-pyrope pyroxenites, while the middle levels are occupied by Cr-pyrope lherzolihic with high contents of clinopyroxene. The deepest SCLM is essentially garnet dunitic-harzburgitic with low contents of clinopyroxene. The proportions of these major rock groups vary greatly. The eclogitic layer is thickest in the Podolian Archaean block, whereas dunites and harzburgites prevail in the area of Neoproterozoic flood magmatism in the western UkS.

Geochemically, the SCLM in the UKS vary from depleted in the Volhyn, Podolian, Ros' and Middle Dniepr domains to strongly metasomatised and enriched in incompatible elements (Kirovograd and Azov blocks). These features correlate well with the geophysical characteristics of the UkS lithosphere. Two large regions of stable and up to 200 km thick lithosphere with the crust thickness of more than 45km correspond to the Archaean terranes or indicate the presence of the deep-seated Archaean roots beneath the Palaeoproterozoic belts (e.g. in the Volyn domain). Here, the uppermost mantle has high Vp:s (8.4-8.5 km/s) and densities (3250-3400 kg/m$^3$) which are due to eclogites and garnet pyroxenites, and the depleted character of the SCLM. Thinner, highly conductive (activated) lithosphere with low Vp:s (7.8 – 8.1 km/s) and densities (3000-3200 kg/m$^3$) characterises the Palaeoproterozoic, Kirovograd and the western Azov blocks where the crust is thinnest. However, while the SCLM of the Kirovograd block formed in the Palaeoproterozoic, the Azov SCLM obtained its structure and enriched composition during both the Palaeoproterozoic and in the Devonian events.

Various geodynamic processes can be considered as the causes of changing SCLM compositions throughout time. Thus, the depletion of pristine Archaean lithosphere was caused by Archaean and Palaeoproterozoic plate-tectonic subductional and collisional processes, particularly in the NW Shield. The enriched SCLM, in contrast, was formed mostly by mantle-plume events and associated rifting e.g. in the Devonian.

An interesting problem is whether the ages of the crust and the SCLM are the same. Even though the crust and the underlying lithosphere were coupled during the formation of the continental crust of the Shield, the available data suggest that many superimposed events can have changed the original SCLM substantially.

*This is a contribution to the Swedish Institute research net "Precambrian Evolution of Western Baltica".*