THE INTEGRATION OF GEOPHYSICS AND GEOCHEMISTRY REVEALS THE NATURE OF THE LITHOSPHERIC MANTLE BENEATH THE SLAVE CRATON (CANADA)

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The Slave Province in Canada is a small Archean fragment, bounded on the east by the Thelon magmatic arc (2.0-1.9 Ga) on the western edge of the Archean Rae Province and on the west by the Great Bear magmatic arc of the Wopmay Orogen (1.88-1.84 Ga). The northern and north-eastern part is overlapped by Upper Proterozoic and Phanerozoic supracrustal rocks. On the south, the Slave craton is separated by the Great Slave Lake Shear Zone from the Lower Proterozoic Chinchaga and Buffalo Head terranes.

We use robust geochemical methods based on mantle-derived xenoliths, heavy mineral concentrates from over 25 kimberlites, and representative diamond populations and their inclusions to construct sections that delineate the composition, structure and thermal state of the lithospheric mantle across the Slave Craton. This analysis reveals a distinct two-layered lithosphere beneath the craton: a shallow ultradepleted, olivine-rich layer and a deeper less depleted layer, interpreted as an Archean plume head.

We have mapped variations in the gravity/topography relationships across the Slave Province in terms of the effective elastic thickness (*Te*). The northern part of the craton is characterised by a relatively weak lithosphere (*Te* < 25 km), probably related to the intrusion of the Mackenzie Plume (ca 1270 Ma). The strongest lithosphere is found in the eastern part of the craton (*Te* > 56 km). A N-S zone of low *Te* along in the middle of the craton may map the deep extension of the suture between the ancient continental block making up the western part of the craton, and the younger accreted terranes that make up the eastern part. The zone of low *Te* gradient coincides with an area of strongly conductive upper mantle, and with the Nd/Pb isotope lines which define a major crustal boundary at depth, and is a major locus of kimberlite intrusion.