First evidence for exhumation of UHP garnet peridotite in the North American Cordillera

D. CANIL[1], J. MACKENZIE, M. MIHALYNUK[2], C. CHARNELL, S. JOHNSTON AND J. ENGLISH

[1]School of Earth and Ocean Sciences, University of Victoria, Victoria, BC., Canada (dcanil@uvic.ca)
[2]British Coulmbia Ministry of Energy and Mines, Victoria, B.C., Canada

The Cordillera of western North America is a youthful collisional orogen. Garnet peridotite and other ultrahigh pressure (UHP, > 2.8 GPa) rocks recognized in other orogens are suspiciously absent in this mountain belt. Only sparse occurrences of crust and mantle rocks derived from moderate depths (< 60 km) are recognized, favouring 'thin-skinned' accretion of crustal flakes over a fixed deeper substrate of the continent. In contrast, exhumation of mantle lithosphere requires 'thick-skinned' involvement of deeper parts of the crust and mantle. These contrasting mechanisms bear on the growth of the Cordillera, often used as a 'classic' actualistic example of continental growth by accretion. Here we show the first evidence for exhumation of UHP garnet peridotite and eclogite in the northern Cordillera and its deposition as detritus in an early Jurassic forearc basin (Laberge Group, NW B.C.). We use textural observations, major and trace element compositions of garnets and pyroxenes, and thermobarometry to show that mantle lithosphere likely of Proterozoic age and equilibrated at pressures greater than 2.8 GPa and temperatures of 850 to 1100 C, was exhumed and quickly deposited as fresh detritus during collision over a restricted time interval about 190 m.y. ago. Our results suggest collision in the northern Cordillera must have been thick-skinned, involving a Proterozoic continental mass with a lithosphere greater than 100 km (and possibly up to 150 km) thick. Our discovery also attests to the efficacy of denudation in nascent continental arcs.