



Ministry of Energy and Mines

Abstract

British Columbia (BC), located on the Western margin of North America, has a complex tectonic history. It is described in terms of the margin of the North American continent, adjacent pericratonic and lisplaced terranes, and accreted superterranes. Basement rocks that underlie the diamond occurrences in Alberta extend to BC. Most of the alkali rocks, such as carbonatites, kimberlites, lamproites, alkaline complexes and syenite gneisses approximately follow the

margin of the North American craton (Pell, 1994).

Diamonds were reported from Jack (Lens Mountain), Mark (Valenciennes River), Kechika (Xeno) area, and the Cranbrook cluster

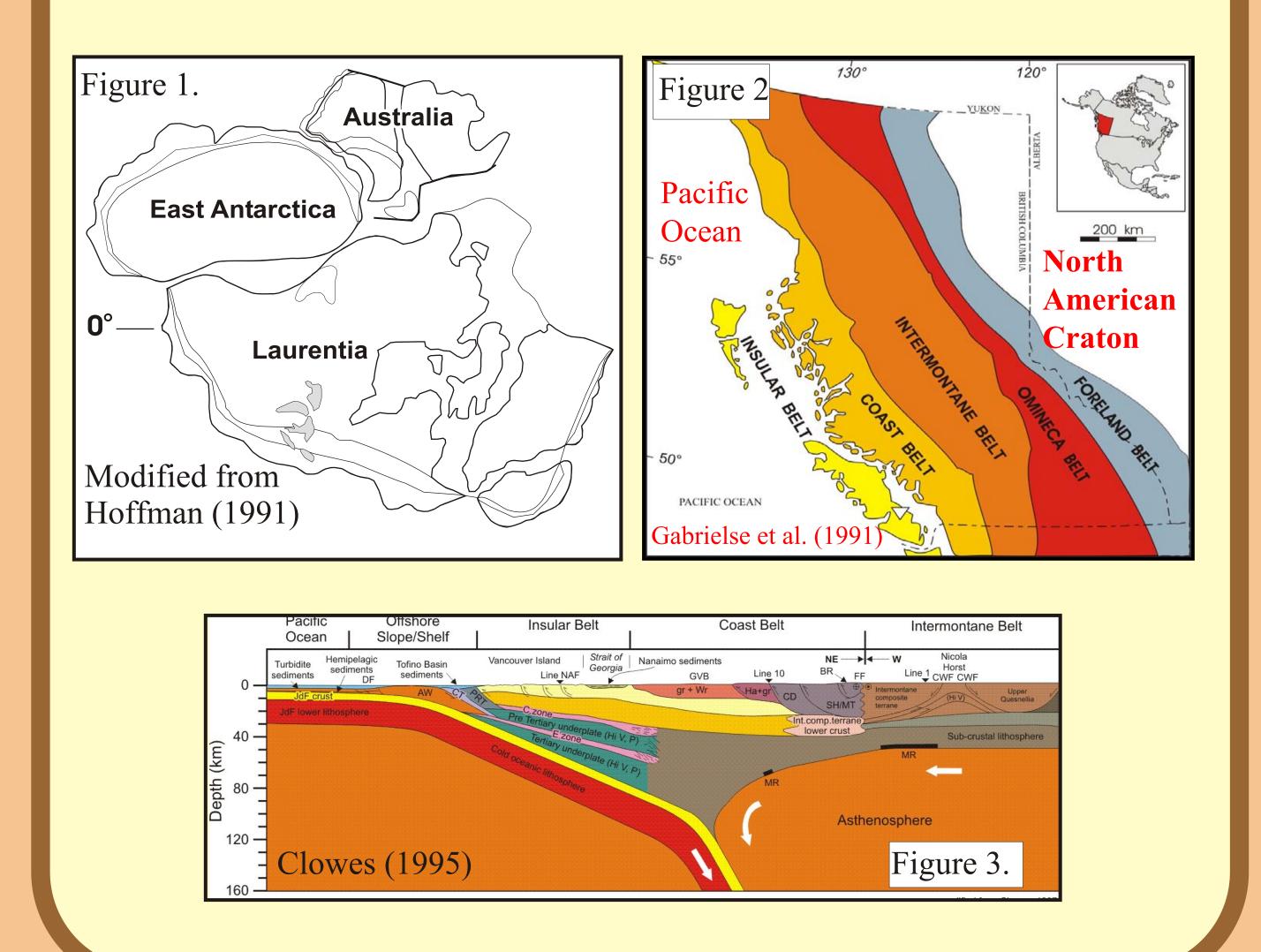
(Bonus and Ram 5 and 6 pipes).

The tectonic setting and regional geology of the diamond occurrences in BC does not match the traditional diamond producing areas such as Northwest Territories and South Africa.

Blue schist- and eclogite-facies rocks, interpreted as subduction zone related, and alkali basalts containing mantle xenoliths are also present, however, the mineralogy of these facies and mantle xenoliths in alkali basalts, suggest conditions outside of the diamond stability field. The diamond potential of the province and the significance of the reported diamond occurrences in BC should be covered in terms of traditional "Diamondiferous Mantle Root Model" (DMR) el) and possibly by modified version of "Subduction Zone **Diamond Model''** (ES model) as described by Baron et al. (1994) and Barrows et al. (1996). Recent discoveries of diamond occurrences in non-traditional lithologies in Ontario and elsewhere (Lefebvre et al. 2003; Janse, 1994; Xu et al., 1992; Bai, 1993, Katayama et al., 2001, and many others) indicate that exploration geologists should keep an open mind and be ready to test unconventional hypotheses.

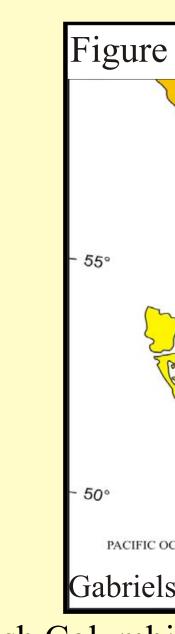
Tectonic Setting

British Columbia (BC) is located on the western margin of North America. 750 Ma ago it was part of the Rodinia supercontinent (Figure 1), and its current tectonic setting is shown on Figures 2 and 3.



The Alkaline Province and **Diamond Occurrences** The main concentration of alkali rocks, such as carbonatites, kimberlites, lamproites, and alkaline complexes and syenite gneisses follow approximately the margin of the North American continent, which we refer to as the Alkaline Province 200 km **BC** Alkalir PACIFIC OCEAN A tabrielse. et al.(1991) Figure 4: British Columbia's Alkaline Province and the locations of major Ultrabasic diatreme cluster indicated by stars. - identifies reported diamond/microdiamond localities. The term Cranbrook cluster covers all alkaline volcanic rocks east of Cranbrook. Crossing Creek diatreme is the only confirmed kimberlite in BC, therefore it is distinguished from the rest of them. Cr - diopside 2.0 cm Figure 6: The Jack Figure 5: The 500m Longdyke near the Lamproite (Golden) HP pipe (Golden area). Figure 7. The Cross Kimberlite.

(Figure 4).







Diamond Exploration Concepts for British Columbia, Canada

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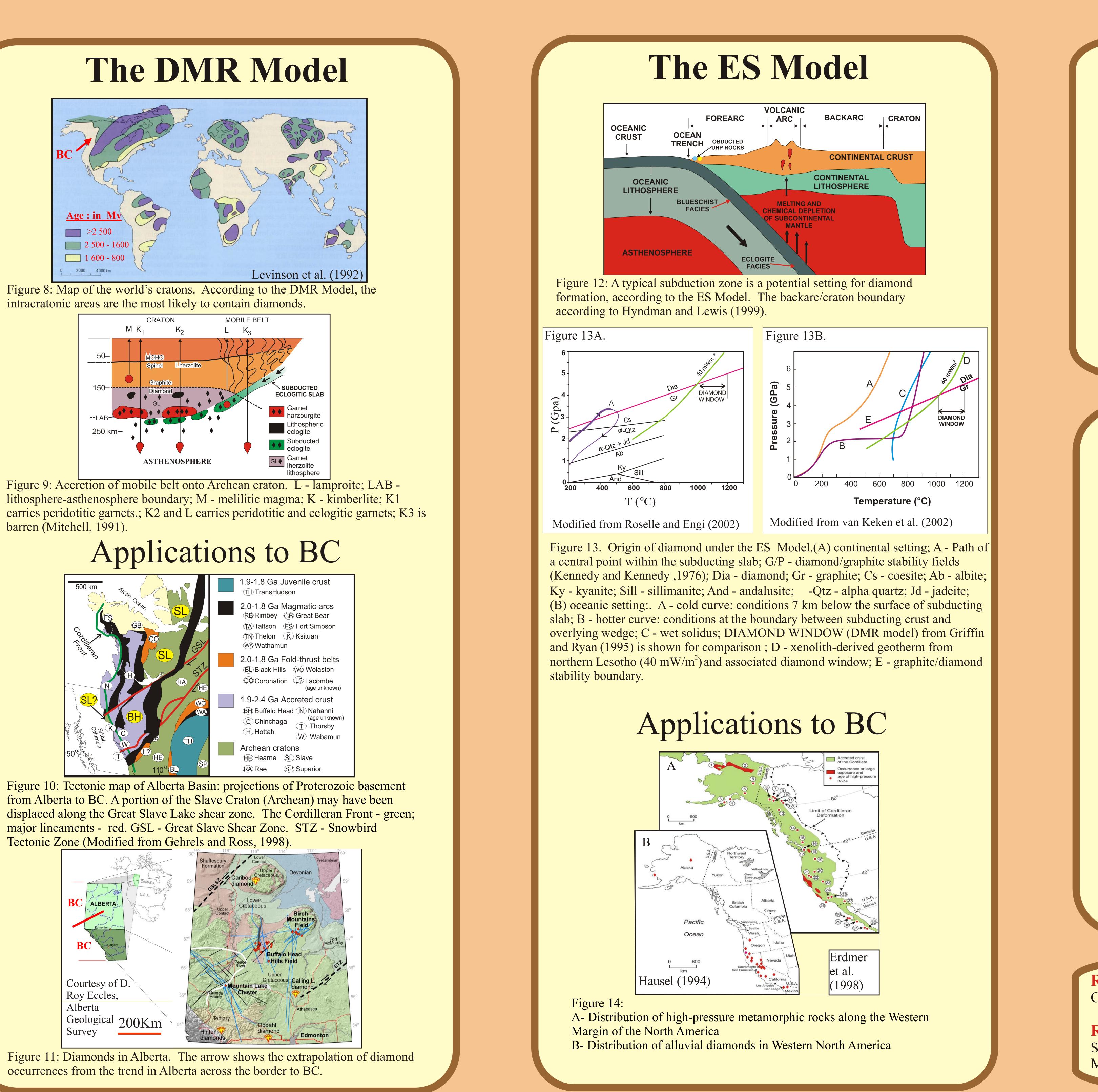
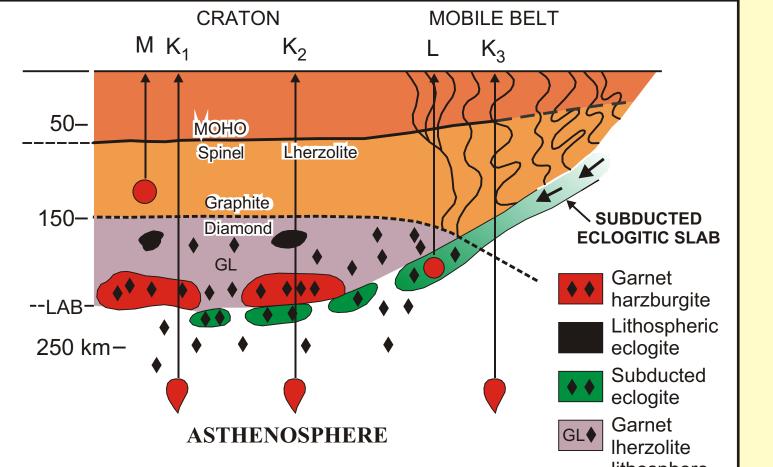
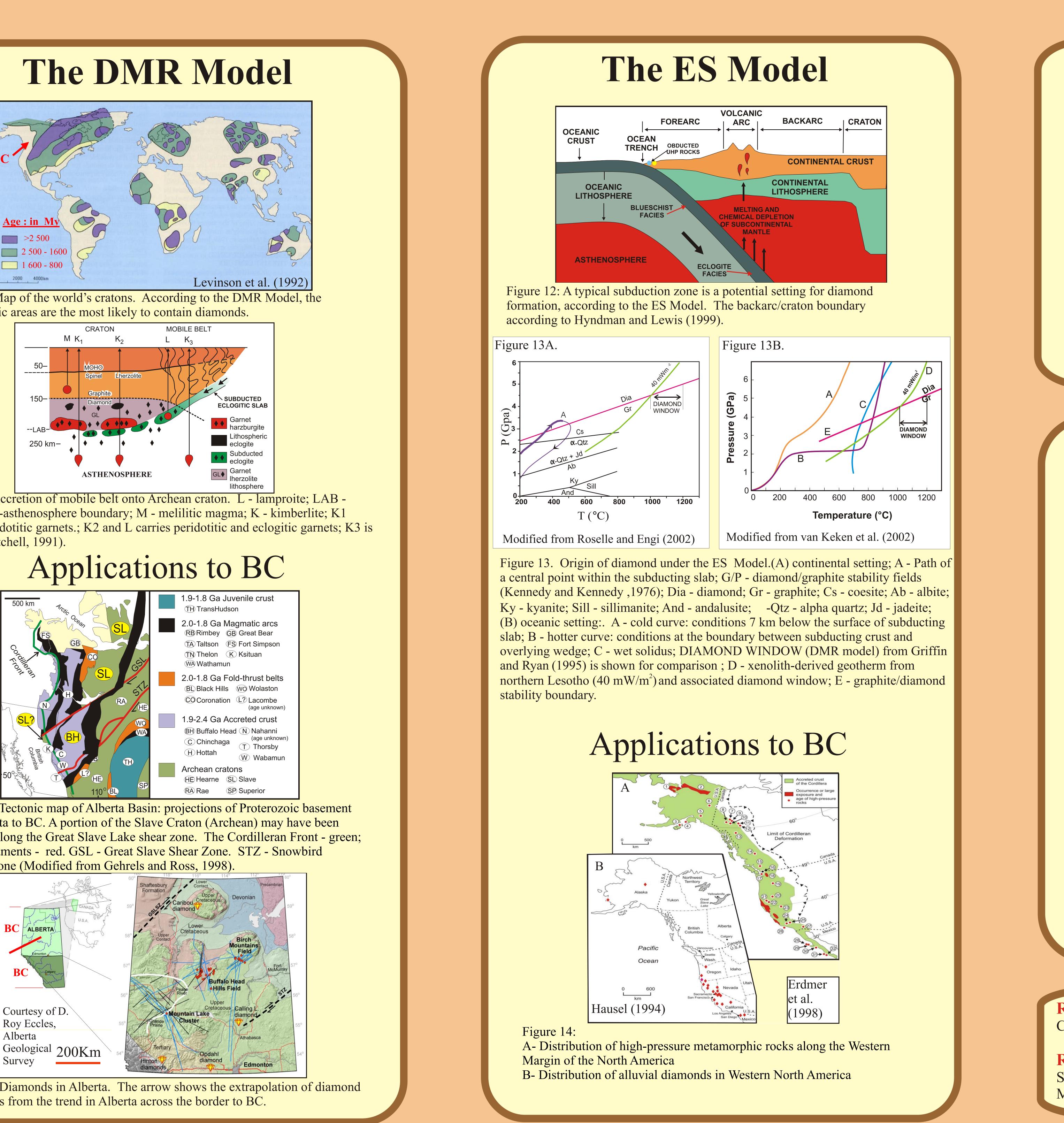


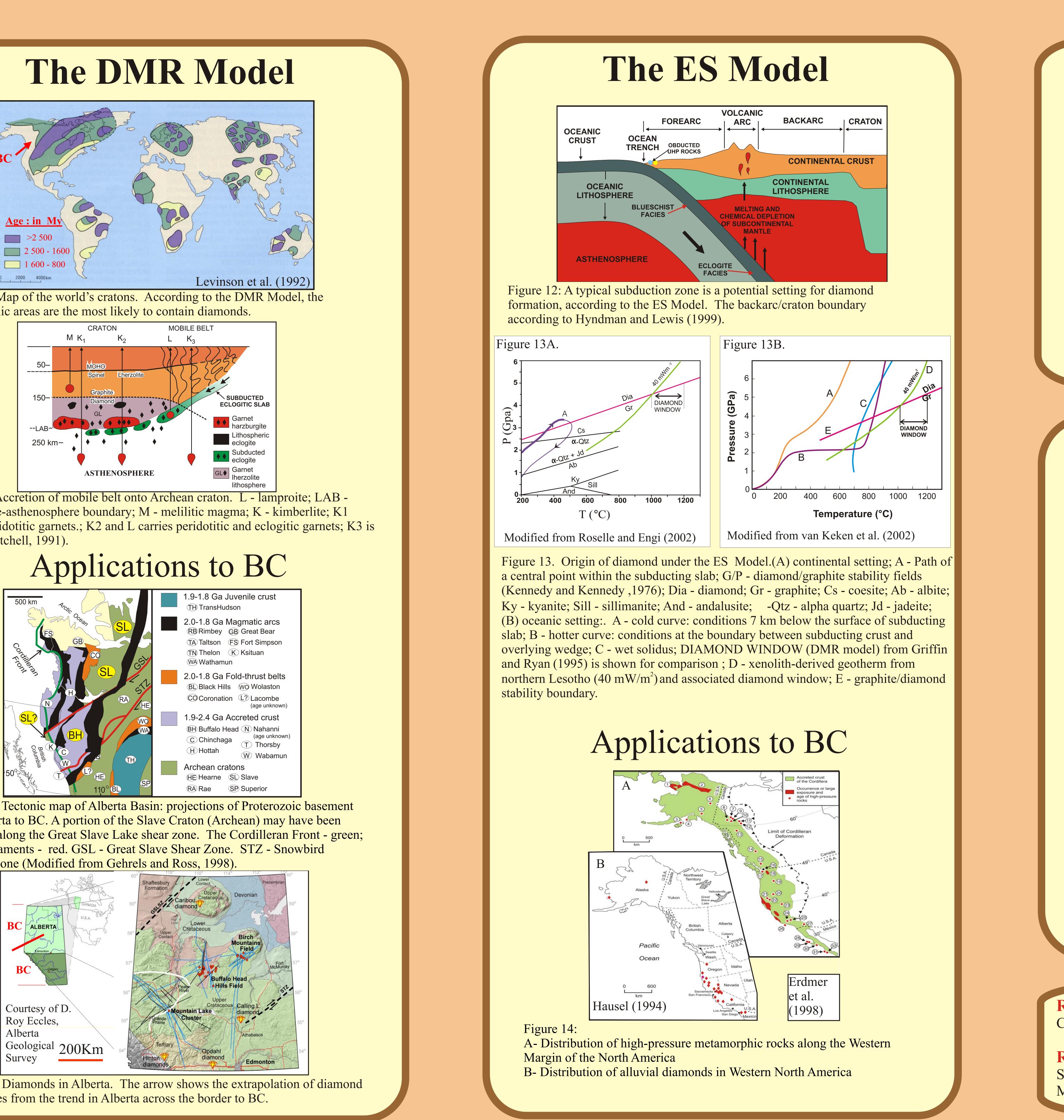
Figure 8: Map of the world's cratons. According to the DMR Model, the intracratonic areas are the most likely to contain diamonds.



barren (Mitchell, 1991).



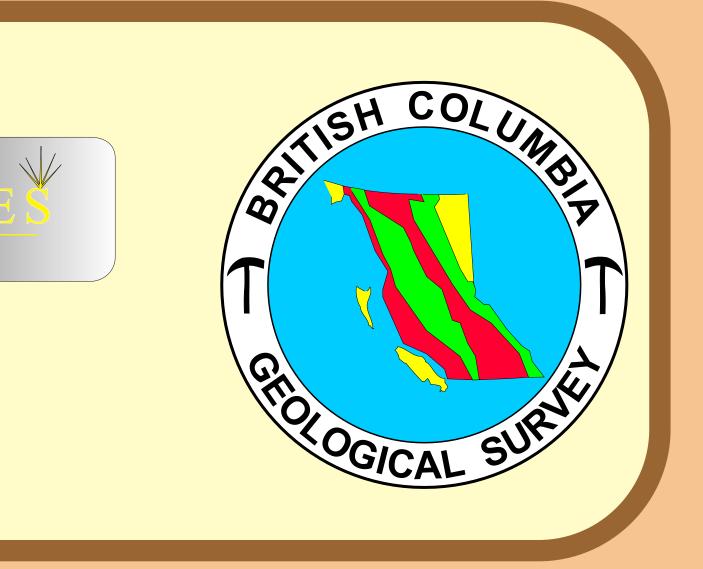
major lineaments - red. GSL - Great Slave Shear Zone. STZ - Snowbird Tectonic Zone (Modified from Gehrels and Ross, 1998).



occurrences from the trend in Alberta across the border to BC.



Geofile 2004-3



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Diamonds in British Columbia?

Known diamond occurrences. Virgin ground for diamond exploration. **DMR model** applies in eastern BC. **ES model** is proposed for west of the Rocky Mountain Trench. **Diamond placer** potential is untested.

Ongoing and Projected Work

DMR Model

- . Better characterize mantle conditions in eastern BC through the study of xenoliths and indicator minerals. Use a variety of methods including single grain Cr-diopside geothermobarometry.
- . Determine if geological/geophysical data from the oil/gas industry can be applied in diamond exploration to be used to delimit the nature, age and boundaries of the crystalline basement terranes in NE BC.
- . Age date the basement in NE BC (if possible). A joint program with NRCan and UVic was designed (SHRIMP II).
- 4. Customize indicator mineral procedure for the eastern BC settings.
- 5. Consider mineralogy and chemistry of bentonites in NE BC to evaluate their use in diamond exploration. Also, look at the most likely stratigraphic intervals to host signs of alkaline volcanism.

ES Model

- 6. Combine information on tectonic history of BC, alkaline volcanism west of the Rocky Mountain Trench, high-pressure metamorphic rocks, and distribution of ultramafic rocks (just completed) (Voormeij and Simandl, 2004; Geofile 2004-1) to select most promising areas for grassroots exploration.
- 7. Customize indicator mineral procedure for the western BC settings.

Indicator Minerals

8. Confirm diamond potential of selected areas (targets) of the province by heavy mineral (indicator) sampling. Reference samples from NE and NW BC, Pinchi Lake and Tulamene area are already available.

Synthesis

. Describe BC's diamond potential in terms of primary and placer deposit models and provide examples.

References:

Complete list is available upon request from the senior author.

Reference for this publication:

Simandl, G. J. and Robinson, N. (2004): Diamond Exploration Concepts for British Columbia, Canada. Ministry of Energy and Mines, Geofile 2004-3.