Thermal Modelling of Apatite Fission Track Analyses from the Liard Basin, Northeast British Columbia

Lisel D. Currie
Geological Survey of Canada, Calgary, Alberta
Margot E. McMechan
Geological Survey of Canada, Calgary, Alberta
Filippo Ferri
British Columbia Ministry of Natural Gas Development, Victoria, British Columbia
Paul B. O'Sullivan
Apatite to Zircon, Inc., Viola, Idaho

Summary

New apatite fission track data for the Liard Basin of northeast British Columbia record significant variations in sample cooling histories. Constraints provided by these data will lead to a better understanding of the thermal and structural evolution of this basin, and the timing of hydrocarbon maturation in this area.

Introduction

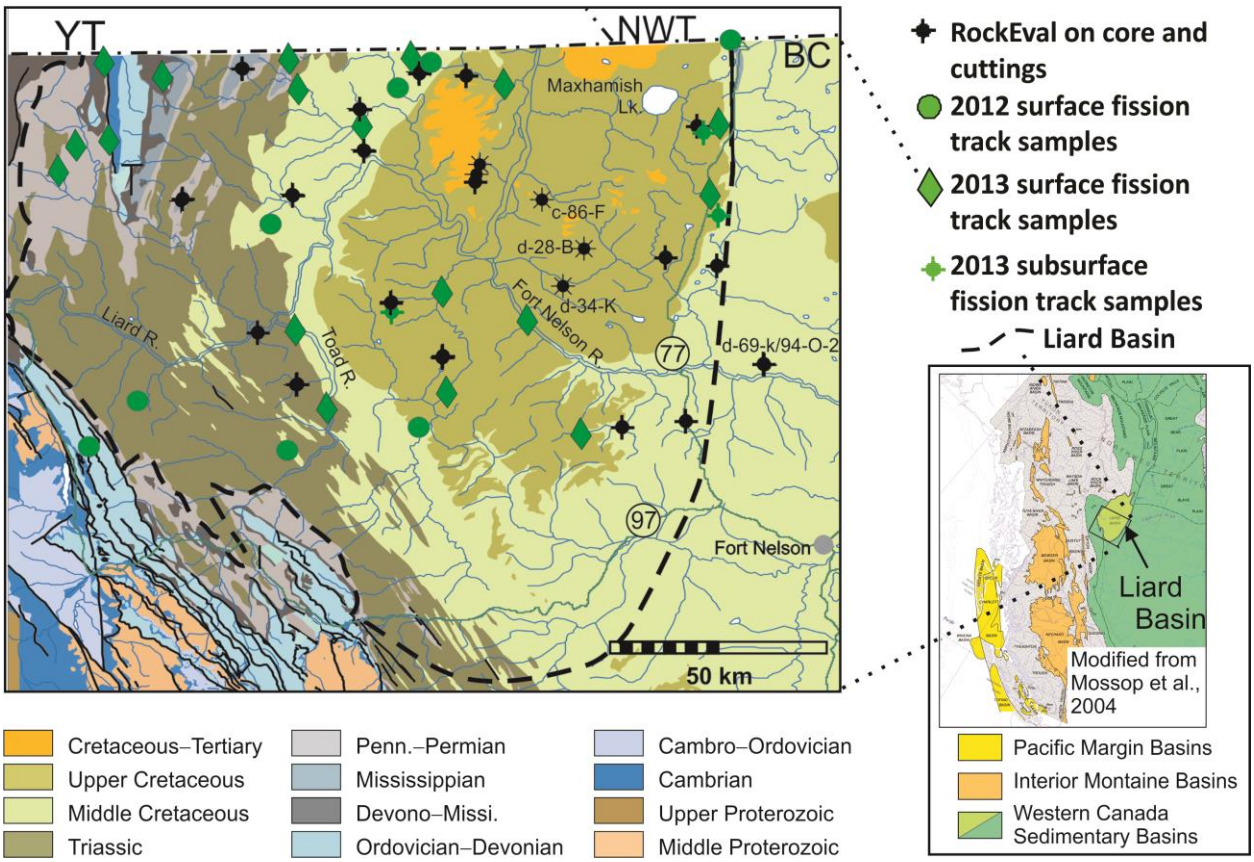
The Liard Basin, a sub-basin of the Western Canada Sedimentary Basin (Figure 1), with up to 5000 m of Upper Devonian to Cretaceous sedimentary fill is undergoing active exploration for Devono-Mississippian shale hosted gas. Significant shale gas resources were discovered by Apache Corporation with the discovery well (D-34-K/94-O-5) characterized by high gas deliverability and low frack rates (Macedo, R., 2012). Understanding the thermal history of the Liard Basin will lead to a better understanding of the thermal and structural evolution of this basin, and the timing of hydrocarbon maturation.

Theory and/or Method

Apatite fission track and thermal maturity results (vitrinite reflectance) from outcrop and core samples in the Liard Basin (Figure 1) are being used to constrain the thermal history of this area. Vitrinite reflectance data were collected to provide maximum paleotemperature constraints. This information is important for interpreting whether or not apatite fission tracks were fully annealed.

Measured apatite fission track parameters and thermal maturity results, together with a temperature-dependent fission track annealing model and a Monte Carlo search technique have been used to determine thermal histories for these samples.

Figure 1



Conclusions

Preliminary results indicate that many of the samples cooled through the temperature range for partial thermal annealing of apatite fission tracks (120-60°C) at times typical of the Rocky Mountain Foothills to the south (e.g. McDonough et al.1999), whereas others record cooling through the same temperatures much later. The cause of this discrepancy is the focus of this study.

References

Macedo, R. (2012): Apache validates new shale play in B.C.'s Liard Basin; Daily Oil Bulletin, June 14, 2012.

McDonough, M. R., Stockmal, G. S., and Issler, D. R. (1992): An Apatite Fission Track Transect across the Rockies at Jasper, Alberta: Preliminary Results of a Thrust Uplift Study. Association of American Petroleum Geologists Annual Meeting, Calgary, Alberta, Canada, June 22-25, 1992.

Mossop, G.D. Wallace-Dudley, K.E., Smith, G.G., and Harrison, J.C. (2004). Sedimentary basins of Canada. Geologiclal Survey of Canada Open File 4673.