



The Age of the Edmonton Group in the City of Edmonton

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Summary

The Horseshoe Canyon Formation of the Edmonton Group is the main stratigraphic bedrock unit exposed along the river in the City of Edmonton. This unit straddles the Campanian-Maastrichtian boundary, although the exact location of this boundary has not yet been determined. A bentonite near Coal Seam #6 gave a high-precision radiometric (U-Pb, zircon) age of 73.19 ± 0.10 Ma, which is clearly Campanian.

Method

The Edmonton Group is in the Edmonton area mainly represented by the upper Cretaceous Horseshoe Canyon Formation (Godfrey et al., 1993). The bedrock and coal geology of the area was described by Beach (1934) and Chen *et al.* (2005). Davies *et al.* (2014) reported a U-Pb age for a bentonitic sandstone of the nearby Danek bone beds of 71.9 Ma. Uncertainty about the age of the Campanian-Maastrichtian boundary still leaves the location of this boundary in the Edmonton area unknown. The Geologic Time Scale 2012 places this boundary at 72.1 Ma, which would make the Danek Bonebed Maastrichtian in age, while the Geologic Time Scale 2004 places this boundary at 70.6 Ma. Eberth and Bell (2014) provide various arguments to place the Danek bone beds in the Campanian, in disagreement with the 2012 Geologic Time Scale. High-precision radiometric (U-Pb, zircon) age dating of Horseshoe Canyon Formation bentonites in the Edmonton region was performed to refine the correlations with this formation in the better studied Drumheller region.

Observations

The Horseshoe Canyon Formation in the Edmonton area comprises a succession of largely continental clastics, which is about 300 m thick, as measured by elevations of the #1 Seam near Ft. Saskatchewan and the #12 Thompson Seam west of the City. The sediments exposed along the river are dominated by generally fine-grained sandstones, with a variety of sedimentary structures such as planar laminations and cross bedding alternating with finer grained sediments, such as siltstones, mudstones and coal (Drumheller Coal Zone).

A detailed geological map included in the thesis of Beach (1934) was restored. This unpublished map represents the most detailed information on the bedrock geology of the Edmonton area. A good exposure of the 0.65 m thick #6 Coal seam with underlying bentonites is provided by the river valley near Skunk Hollow, about 1 km down-stream from the University of Alberta Campus (Figure 1 and 2).



Figure 1. Geological map of the Skunk Hollow area with sampled outcrop and coal seams #6 and #7 indicated (from Beach, 1934). Green are strata below #6 Seam, red are strata between #6 and #7 seams, blue are strata between #7 and #8 seams, and pink are strata above #8 Seam.



Figure 2. Coal Seam #6 exposed in Outcrop LA-05-31 together with underlying 0.3 m thick bentonite.

This outcrop is stratigraphically 60 m below the Danek Bonebed. Isotope dilution TIMS U-Pb analyses of the two youngest, chemically abraded single, prismatic zircon needles yield identical results yielding a weighted average $^{206}\text{Pb}/^{238}\text{U}$ age of 73.19 ± 0.10 Ma (Figures 3 and 4).

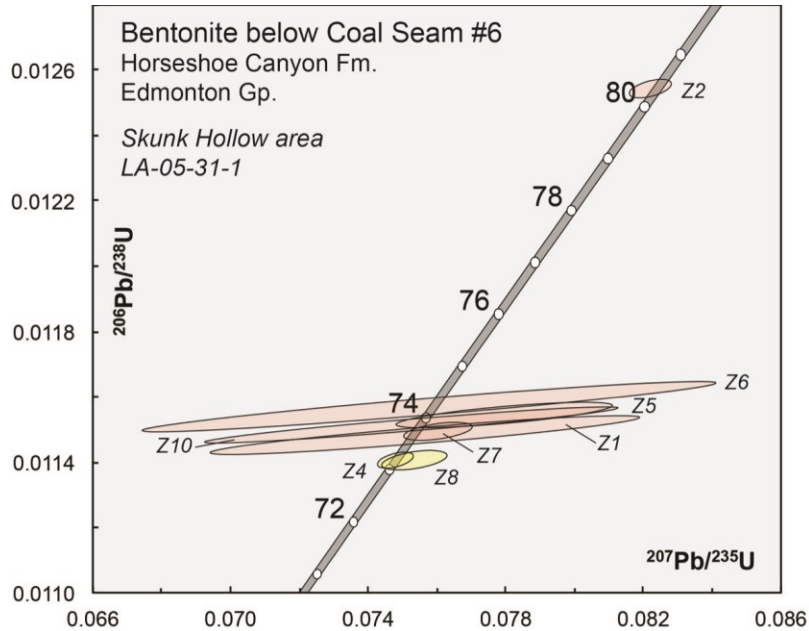


Figure 3. Concordia plot of Late Cretaceous CA-ID-TIMS U-Pb results from single grain zircon analyses of bentonite immediately below Coal Seam #6.

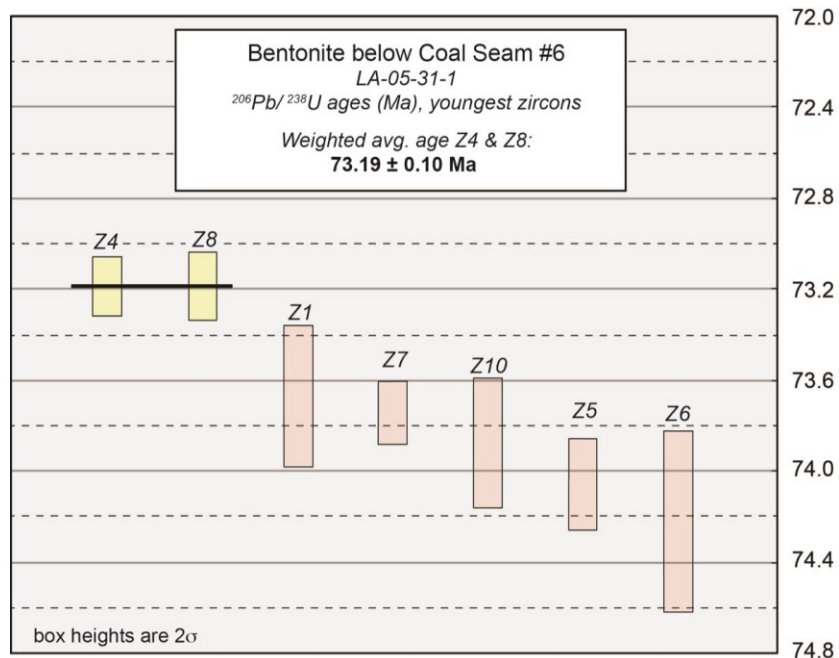


Figure 4. Plot of $^{206}\text{Pb}/^{238}\text{U}$ ages for youngest zircon grains from the bentonite sample (fractions Z4 & Z8). All errors are shown at the 2σ level.

Conclusions

The North Saskatchewan River in Edmonton provides good exposure of the Horseshoe Canyon Formation and Drumheller Coal Zone. A bentonite adjacent to the # 6 Coal seam has yielded a high-precision radiometric (U-Pb, zircon) age of 73.19 ± 0.10 Ma for the two youngest measured zircon needles, which is clearly Campanian.

Acknowledgements

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References

Beach, H.H. (1934): The geology of the coal seams of Edmonton and district and a history of its mining development; M.Sc. thesis, University of Alberta, 148 pages.

Chen, D., Langenberg, W., and Beaton, A. (2005): Horseshoe Canyon - Bearpaw Transition and Correlation of Associated Coal Zones across the Alberta Plains. EUB/AGS GeoNote 2005-08, 22 pages.

Davies, J.H.F.L., Wotzlaw, J., Wolfe, A. and Heaman, L.M. (2014): Assessing the age of the Late Cretaceous Danek Bonebed with U-Pb geochronology. Canadian Journal of Earth Sciences, v. 51, pp. 982-986.

Eberth, D.A. and Bell, P.R. (2014): Stratigraphy of the Danek Bonebed (Horseshoe Canyon Formation) and correlation with Upper Cretaceous strata in the Drumheller and Grande Prairie regions. Canadian Journal of Earth Sciences, v. 51, pp. 975-981.

Godfrey, J.D., Langenberg, C.W., Erdmer, P., Hitchcock, B. and Brooker, E.W. (1993): Edmonton beneath our feet. Edmonton Geological Society, 150 pages.