The Geologic Wonders of Wood Buffalo National Park, Alberta

Andres K. Altosaar, Suncor Energy Inc., Calgary, Alberta
aaltosaar@suncor.com

Introduction

The beauty of the Canadian North is exemplified by the natural wonders found within the limits of Wood Buffalo National Park (WBNP). Located in the northeast corner of Alberta and extending across the border into the Northwest Territories, the park hosts numerous attractions including the world's largest herd of free-roaming buffalo, a variety of ecosystems, rare and endangered species, as well as diverse landscapes. In terms of geology, WBNP offers spectacular exposures of Middle Devonian Elk Point Group evaporites and carbonates in a peculiar yet world-class setting: a modern karst landscape.

Suncor agreed to send two geoscientists to the area over a period of a week in June of 2012 to investigate the Middle Devonian evaporites and carbonates discontinuously exposed within the park's limits. A great deal of valuable geological data were collected over the course of that brief field excursion which has greatly enhanced Suncor's understanding of Elk Point Group stratigraphy and its post-depositional history, as well as the karstification process.

Discussion

The northeast corner of the Park lies within the Elk Point Group subcrop/outcrop belt: the eastern erosional edge of the Elk Point paleo-basin that extends from southwestern Manitoba to the Northwest Territories. The rocks exposed within the Park and around the nearby town of Fort Smith, NT include, in stratigraphic order, Precambrian granitic gneisses, basal sandstones of the "Granite Wash" type, Chinchaga Formation (a.k.a. Contact Rapids Formation) mixed evaporites and carbonates, Keg River Formation (a.k.a. Winnipegosis Formation) carbonates, as well as the overlying Fort Vermilion evaporites and Slave Point carbonates, of the Beaverhill Lake Group. Prairie Formation evaporites (a.k.a. Muskeg Formation) and dolomudstones of the Watt Mountain Formation do not outcrop in the area. Local occurrences of Cretaceous clastics have been noted within the park, however, were not investigated. Laterally extensive Quaternary glacial and post-glacial sediments blanket the region.

Due to the presence of at- or near-surface evaporites and fractured carbonates, the terrain in the northeast corner of WBNP is pockmarked with hundreds of sinkholes of a variety of dimensions and ages, networks of underground cavernous systems, and lined with several prominent escarpments that extend for several kilometers. These features are all attributed to solution of predominantly subsurface evaporites (and to a lesser extent, carbonates) coupled with collapse of overlying stratigraphic successions, and erosion.

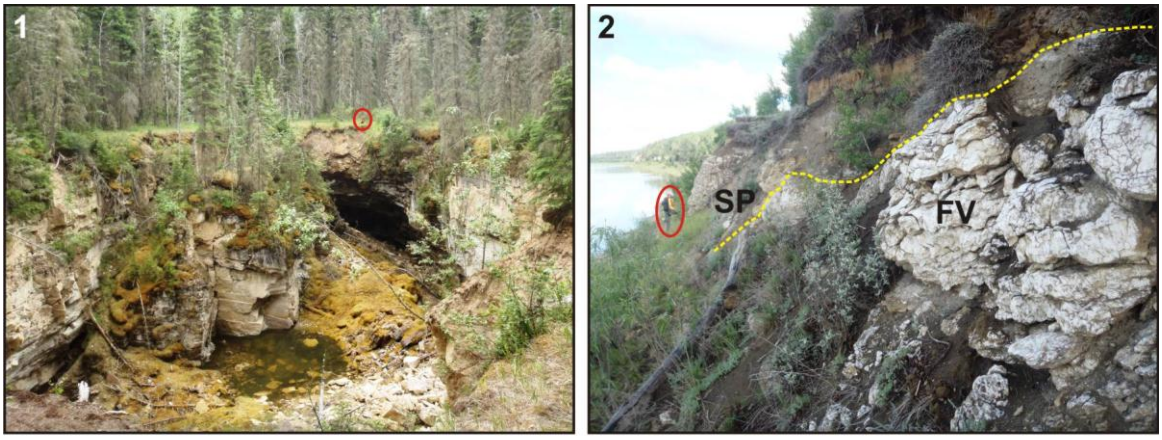

Figure 1: One of many large sinkholes located in WBNP, exposing Lower Keg River carbonates.
Figure 2: Margin of a collapse feature displaying relationships between Fort Vermilion gypsum (FV; right) and brecciated Slave Point carbonates (SP; left). Person for scale in both photos.

Conclusions

Similar karst features are commonly imaged using geophysical methods in the subsurface of the general Fort McMurray area at the sub-Cretaceous unconformity (SCU) level. Based on relatively simple stratigraphic relationships between the Devonian Beaverhill Lake Group substrate and the overlying Cretaceous McMurray and Clearwater formations, a relative sense of timing regarding the genesis of the karst features can be resolved. This sense of timing is key to evaluating and maximizing the true resource potential of the McMurray, and determining the appropriate extraction methodology (ies) of the bitumen. The difficulties associated with accurately imaging and characterizing the commonly karsted SCU lie within the resolution of the seismic survey, and to a lesser extent, corehole spacing. Investigating the karst of the park is a relatively inexpensive way to gain an appreciable sense of scale, and presents itself as a superb analogue. To geologists and geophysicists alike, the opportunity to observe, measure, and characterize a world-class, present-day karst terrain such as that found within Wood Buffalo National Park, is truly one of extreme value.

The presentation will focus on two main elements: 1) a brief overview of the park's stratigraphy, and 2) the observed karst topography, its evolution over geologic time, and its use as an analogue for the buried, rugged topography of the SCU in northeast Alberta.

Acknowledgements

I am grateful to Suncor Energy for granting permission to present the material and to Chris Schneider (formerly of the Energy Resources Conservation Board/Alberta Geological Survey) for providing support and insight.