Preliminary stratigraphic correlation of subsurface and outcrop sections of the Favel Formation, southwestern Manitoba by M.P.B. Nicolas¹, J.D. Bamburak¹ and S. Hosseininejad²



Summary

The Upper Cretaceous Favel Formation (Figure 1) in Manitoba is a biogenic, gas-bearing, chalk-speckled, calcareous, sandy to silty mudstone, with abundant thin carbonate beds. This formation is exposed at various locations along the Manitoba escarpment (Figure 2), with the best sections located along the banks of incised river valleys. These outcrop sections were examined in the field, however, it was difficult to position these sections within the overall stratigraphic structure of the formation and its two members. It was decided that a complete core of the Favel Formation recovered from well 3-27-1-25W1 could be used as a reference section. Using a detailed core description, a preliminary correlation of outcrops was attempted to determine their stratigraphic positioning (Figure 3). The selected outcrop sections are located in ditches and along the banks of rivers, and include, from south to north: 1) east of the Pembina Hills;

- 2) Ochre River,
- 3) Vermilion River,
- 4) Wilson River,
- 5) Sclater River.
- 6) East Favel River, 7) Swan River, and
- 8) Little Woody River.

Stratigraphic positioning of the outcrops is important to better characterize the lateral variability of the Favel Formation in outcrop, as well as to help with long-range subsurface correlations where there is minimal core information available. It was found that the best way to correlate outcrop sections of the Favel Formation was to position the sections lithostratigraphically, based on lithology, relative to the reference subsurface section or other outcrop sections, while ignoring the thickness variability that can occur between outcrop and subsurface sections. The thickness variability of different intervals within the formation and the presence or absence of bentonite beds is due to changes in depositional conditions and synformational erosive events. (c.f. Nicolas et al., 2013)

Economic considerations

The Favel Formation is likely the best prospect as a shale gas resource for Manitoba. It is a thick section of gas-bearing silty and sandy mudstone equivalent to formations with proven gas production records in Saskatchewan and Alberta. In Manitoba, the rarity of core through this section makes it difficult to characterize the formation properly and best determine its true potential, despite the abundance of wireline geophysical information available. Correlation of subsurface information with outcrop information is the best tool available in Manitoba to better characterize the Favel Formation to determine its economic potential. (c.f. Nicolas et al., 2013)

Acknowledgments

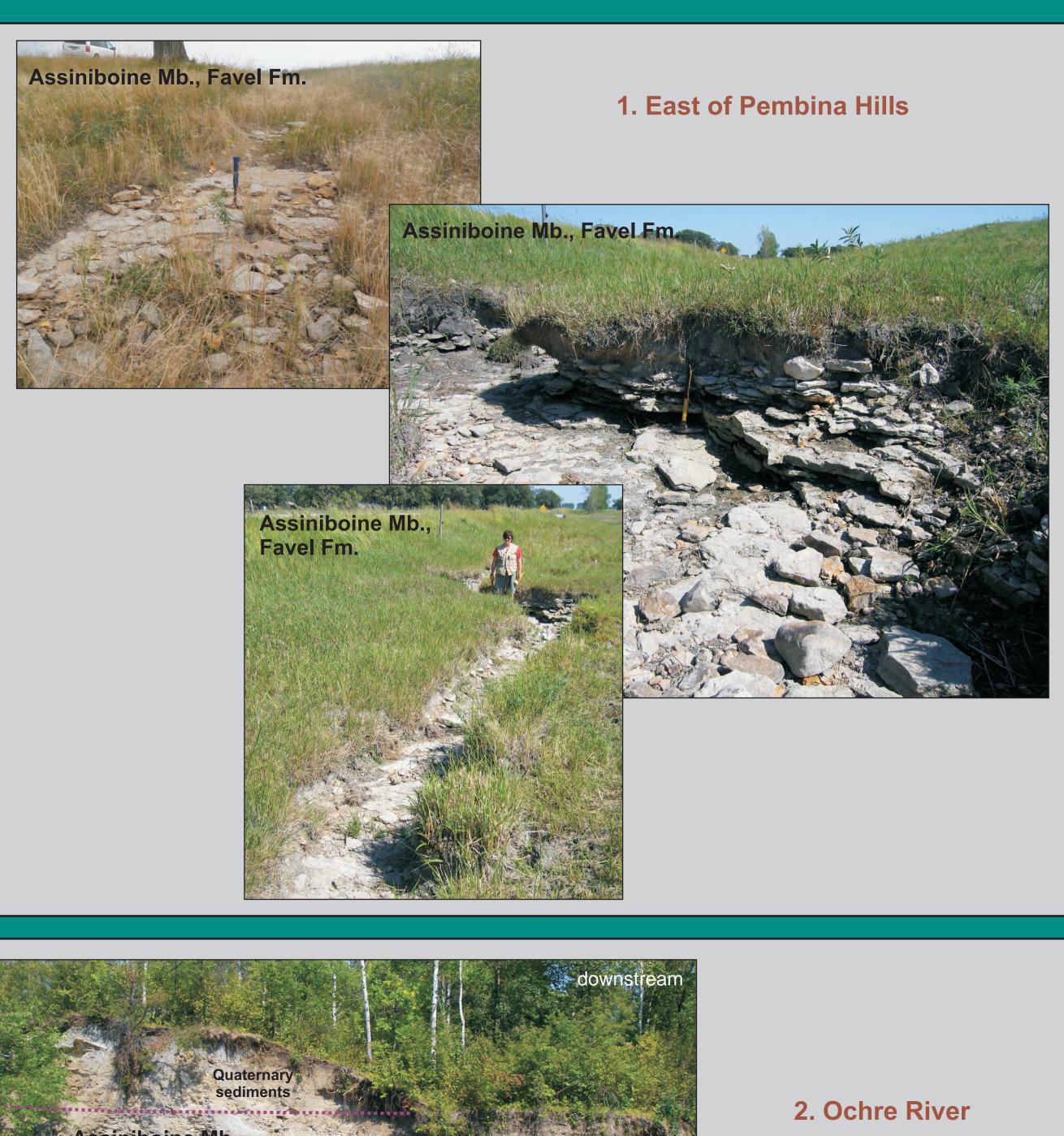
The authors would like to thank P. Pedersen from the Department of Geoscience, University of Calgary, for reviewing an earlier version of this paper, and gratefully acknowledge Centra Gas Manitoba Inc., a subsidiary of Manitoba Hydro, for their generous support of the Shallow Unconventional Shale Gas Project.

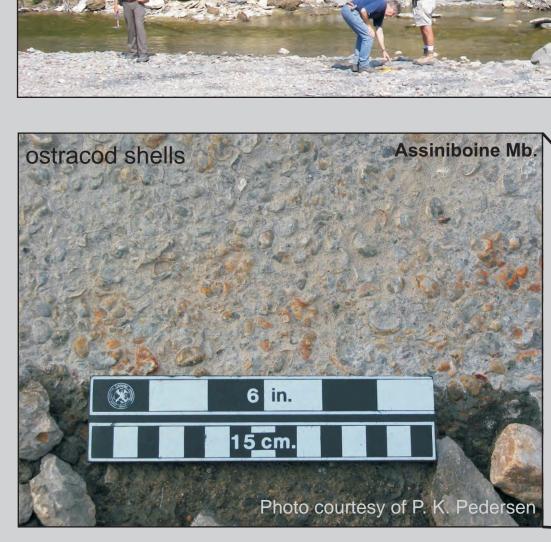
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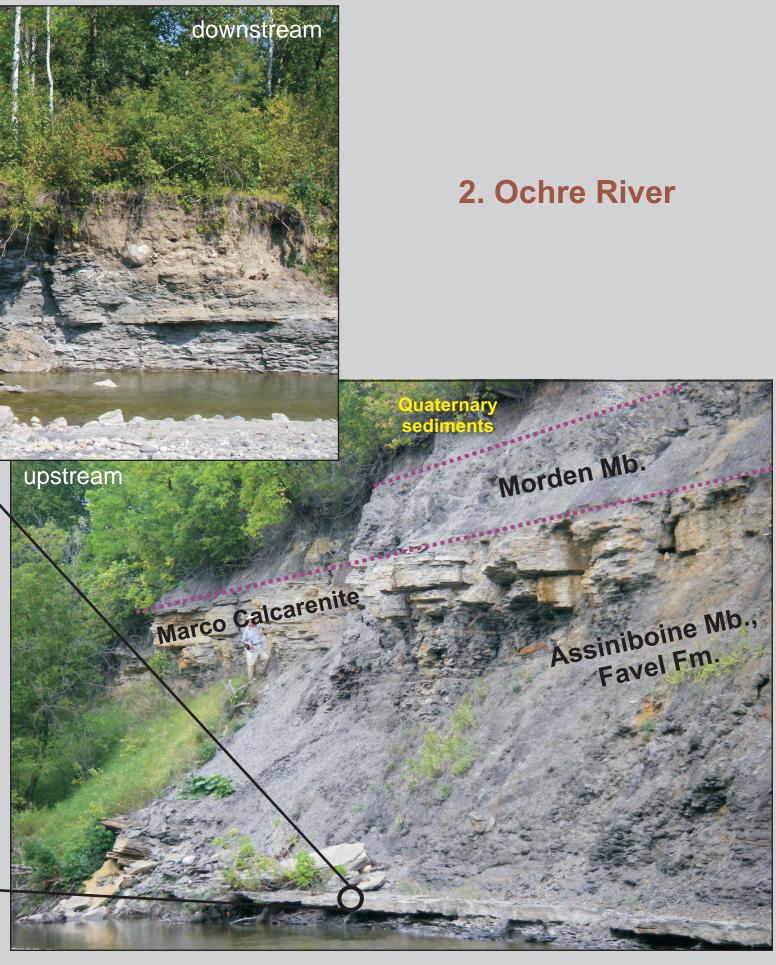
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- United States Geological Survey 2002: Shuttle radar topography mission, digital elevation model Manitoba; United States Geological Survey, URL <ftp://edcsgs9.cr.usgs.gov/pub/data/srtm/>, portions of files N48W88W.hgt.zip through N60W102.hgt.zip, 1.5 Mb (variable), 90 m cell, zipped hgt format [Retrieved March 2003; dead link October 3, 2013].

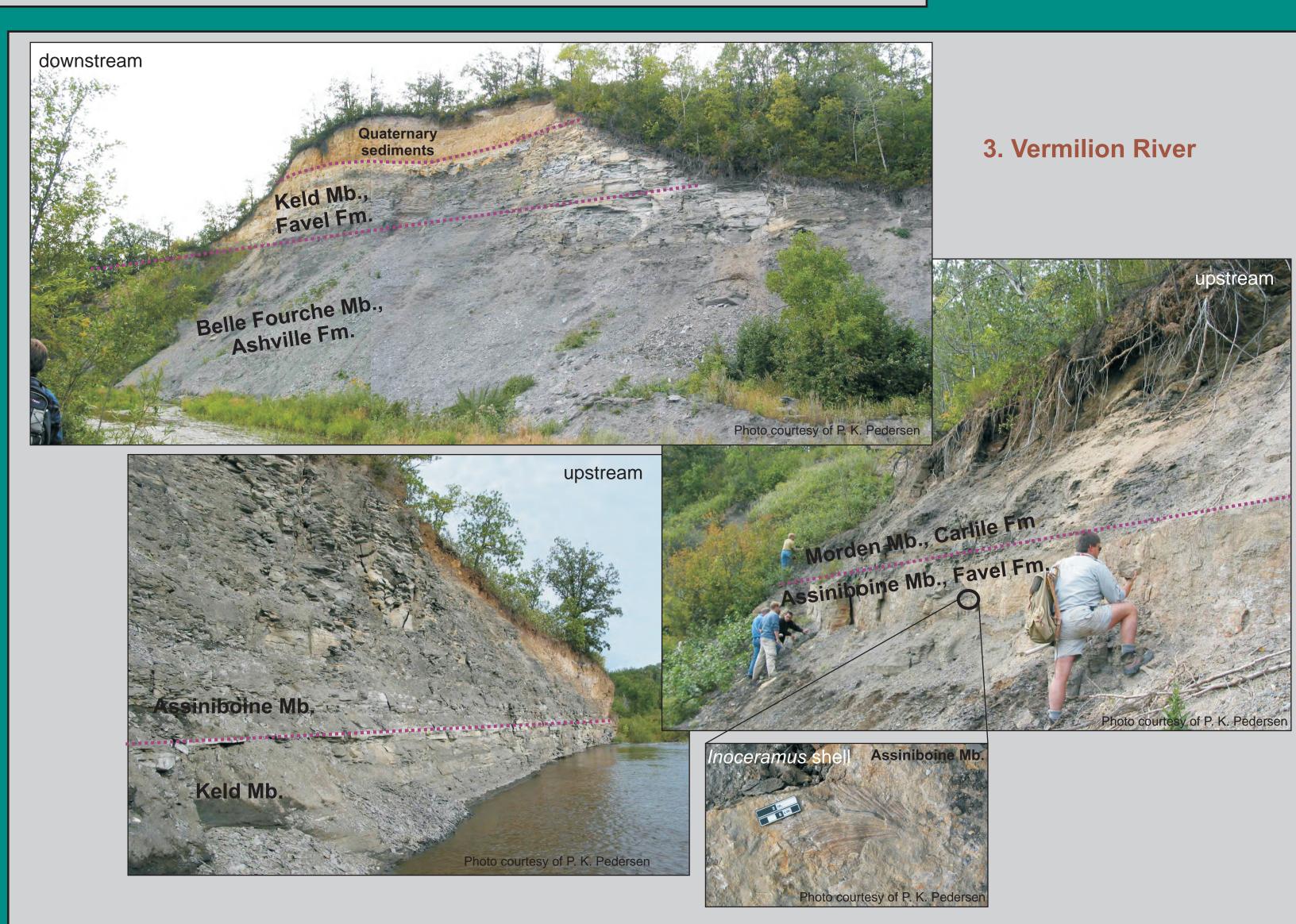
Formation	Member	Marker bed
Carlile	Morden	
Favel	Assiniboine	Marco Calcarenite
	Keld	Laurier Limestone unnamed calcarenite
Ashville	Belle Fourche	X-bentonite

Figure 1. Stratigraphic column of the part of the Cretaced section in southwestern Manitoba, showing the positioning of prominent and important marker beds that aid in correlation.









¹Manitoba Geological Survey, Winnipeg, MB ²Department of Geoscience, University of Calgary, Calgary, AB

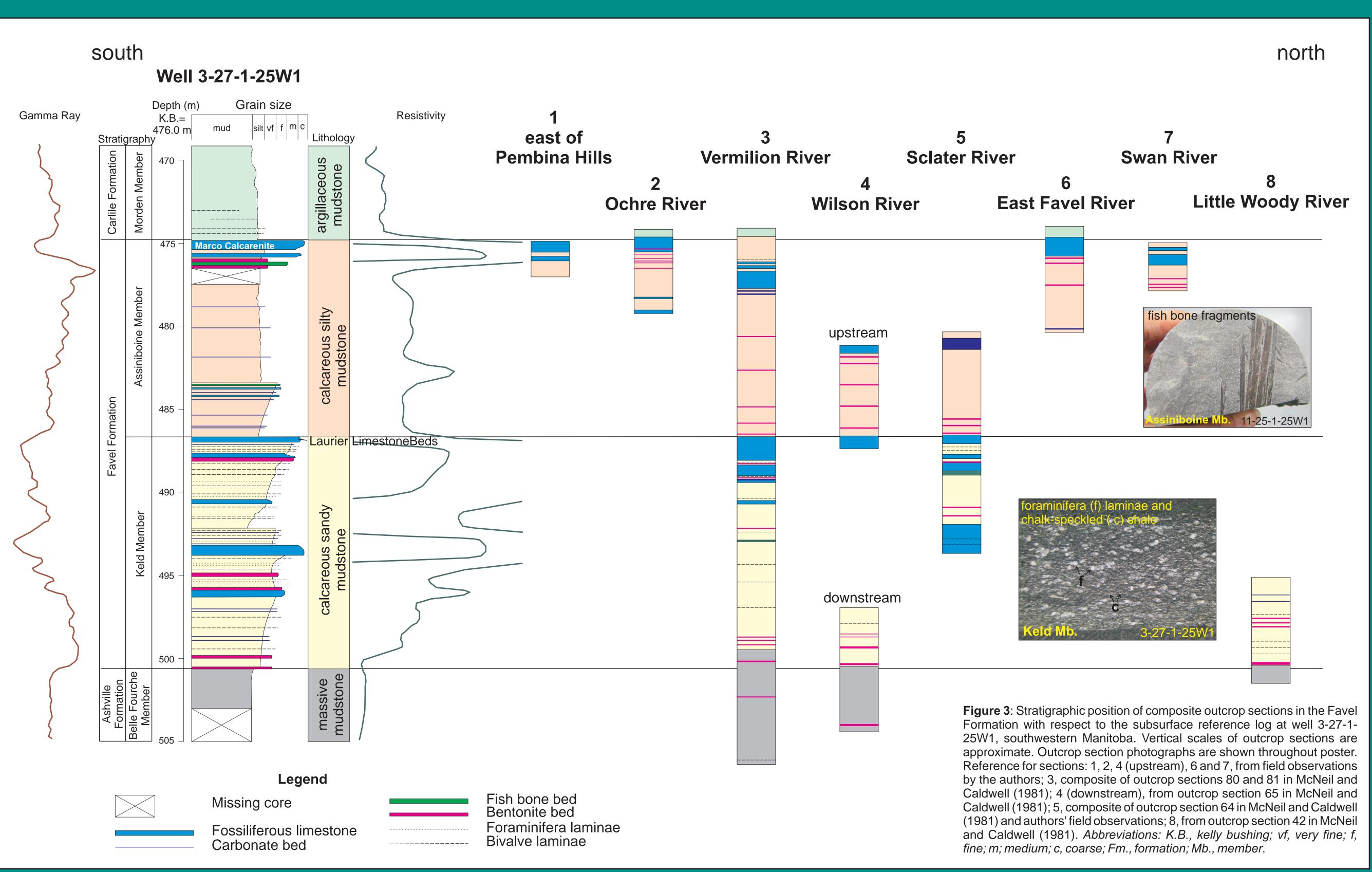
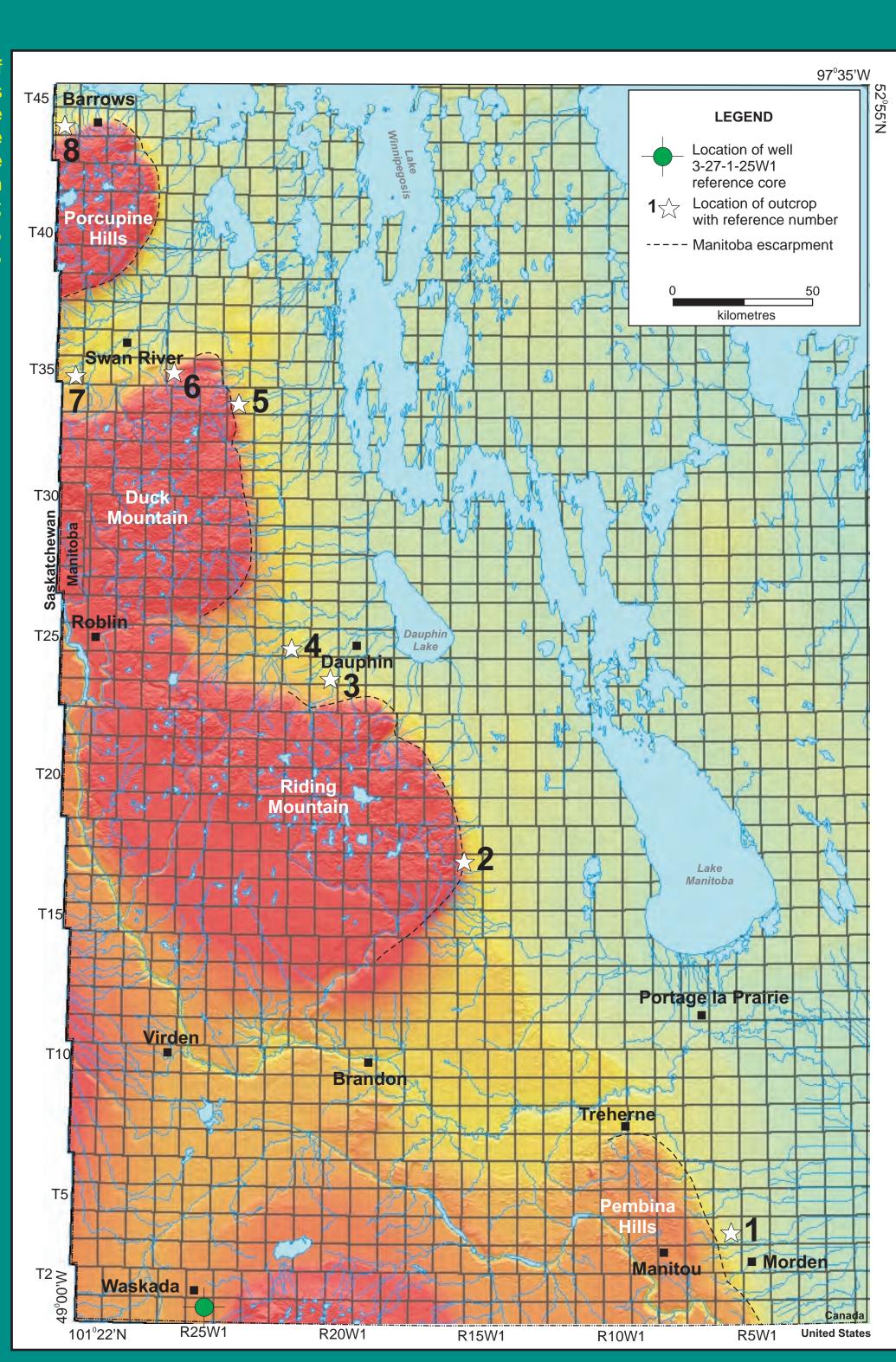


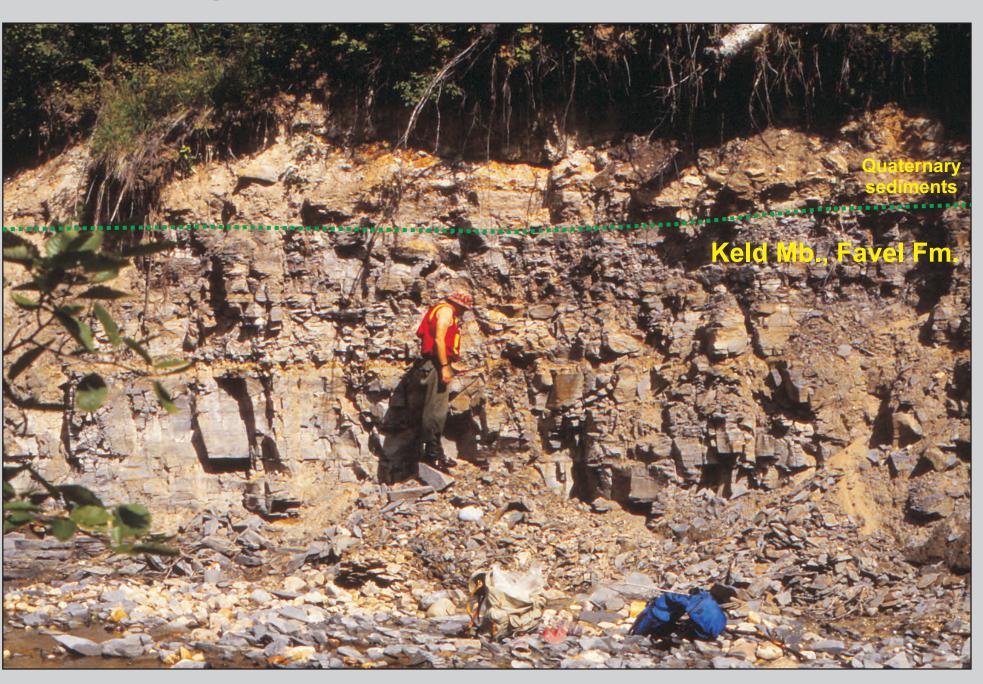
Figure 2: Digital elevation model map southwestern Manitoba (United Sta Geological Survey, 2002) showing location of the reference subsurface c (well 3-27-1-25W1) and represent outcrop sections of the Favel Formati (1, east of Pembina Hills; 2, Ochre Riv 3, Vermilion River; 4, Wilson River; Sclater River; 6, East Favel River; Swan River; 8, Little Woody River).



7. Swan River

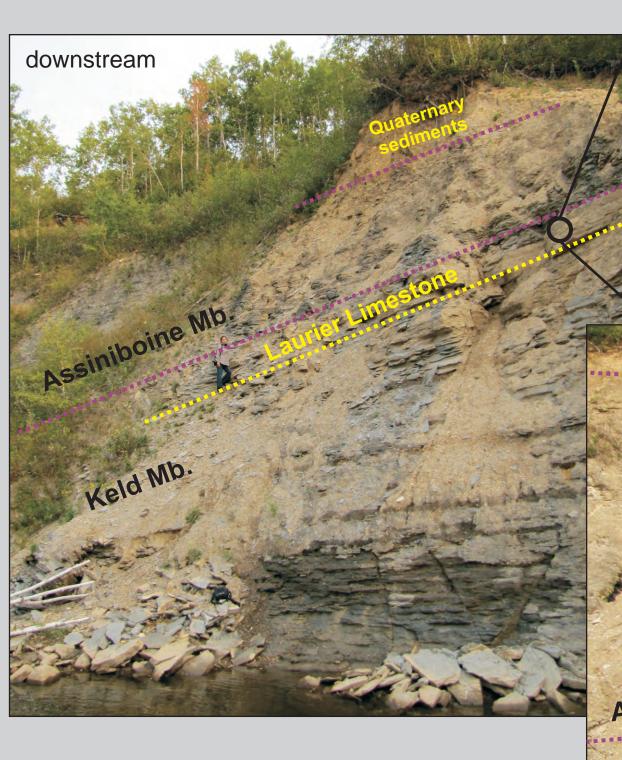


8. Little Woody River

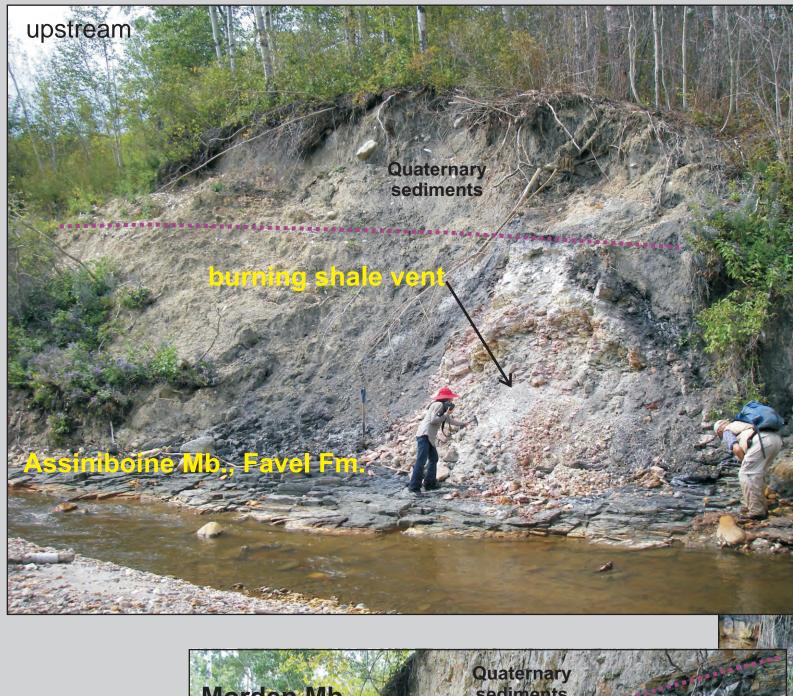














6. East Favel River



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