ABSTRACT

The Cretaceous System that forms much of the Manitoba Escarpment was deposited during two major cycles of marine sedimentation, near the eastern margin of the Western Canada Sedimentary Basin (Figure 1). The current nomenclature of southwestern Manitoba's stratigraphic succession (Figure 2), in ascending order, follows.

The Swan River Formation comprises 75 m of mainly fine grained sand or sandstone, with minor silt and light to dark grey kaolinitic clay (Figure 3). Its type locality is located northeast of Swan River, Manitoba. The formation unconformably oversteps rocks of Jurassic, Devonian, Silurian and Ordovician age.

The Ashville Formation type locality is situated along the Wilson River near Ashville, Manitoba. Its lower contact is a disconformity. The Ashville formation consists of grey-black, noncalcareous shale, with subordinate amounts of silt, sand and calcarenite; and has a maximum thickness of 115 m. The Fish Scale zone, at the base of the Upper Ashville (or Belle Fourche) Member (Figure 4), marks the division between the Early and Late Cretaceous time in Manitoba. Where possible, the Lower Ashville Member is subdivided, in ascending order, into the Skull Creek, Newcastle and Westgate members).

The Favel Formation comprises olive-black, chalk-speckled calcareous shale, argillaceous limestone and calcarenite, with a maximum 40 m thickness. The formation conformably to nonconformably overlies the Ashville Formation. Its type locality is situated on the East and West Favel river valleys, near Minitonas, Manitoba. The Favel Formation usually includes both its lower Keld (Figure 5) and upper Assiniboine (Figure 6) members, but the upper member has been noted to be absent at some localities.

The Carlile Formation, which disconformably overlies the Favel Formation, was only recently recognized in southwestern Manitoba. The Carlile consists of the Morden Member (Figure 7), a 55 m (max.) thick facies-controlled basal noncalcareous carbonaceous shale; overlain by the Boyne Member (Figure 8), a 75 m (max.) thick calcareous, speckled and chalky shale. The Carlile composite reference section is in northern Montana.

The Pierre Shale unconformably overlies the Carlile. The 340 m thick noncalcareous formation is subdivided, in ascending order, into the Gammon Ferruginous (Figure 9), Pembina (Figure 10), Millwood (Figure 11), Odanah (Figure 12), and Coulter (Figure 13) members. The Gammon is hard black shale with claystone concretions; and weathers dark reddish brown. The Pembina is grayish black carbonaceous shale with numerous thin white to pink nonswelling calcium bentonite beds. The Millwood is popcorn-weathering, semi-swelling bentonitic shale with ironstone concretions. The Odanah is hard black to dark greenish grey siliceous shale, which weathers into thin steel grey conchoidal fragments, with purplish manganese-stained fracture surfaces. The Coulter is a light grey to buff, bentonitic clayey silt. The Pierre Shale type section is near Pierre, South Dakota.

The Boissevain Formation is the uppermost Cretaceous formation in Manitoba. The formation was named after Boissevain, Manitoba, situated just north of its type area. The 33 m thick Boissevain consists mainly of unconsolidated cross-bedded buff quartz-rich medium-grained "salt and pepper" sand; and usually has large calcareous sandstone concretions present in outcrop (Figure 14).

The evolution of Cretaceous nomenclature of southwest Manitoba is documented in the 2009 Report of Activities under GS-19 Revisions to the Cretaceous stratigraphic nomenclature of southwest Manitoba (parts of NTS 62F, G, H, J, K, N, O, 63C, F) by J.D. Bamburak and M.P.B. Nicolas (Bamburak and Nicolas, 2009).



Figure 3: Swan River Formation, Outcrop Section 57 of McNeil and Caldwell (1981, p. 349, 350), part of composite type section (component-lectostratotype), west bank of the Swan River, 5-10-37-26W1 (1993-06-08).



Figure 4: Ashville Formation, Belle Fourche Member, near Outcrop Section 66 of McNeil and Caldwell (1981, p. 357, 358), part of composite type section (component-lectostratotype), north bank of the Wilson River, 14-14-25-21W1 (2009-08-22).

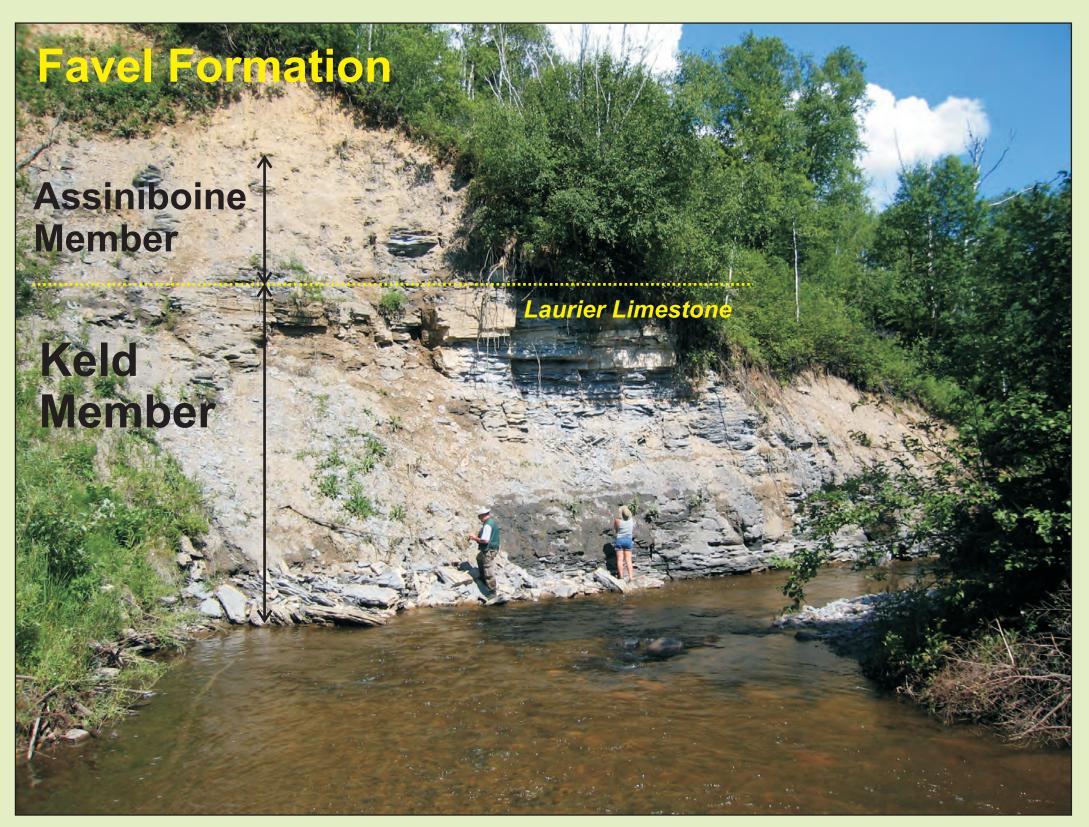


Figure 5: Favel Formation, Keld Member, including the Laurier Limestone, east bank of Sclater Creek, 14-15-34-23W1 (2007-07-03).



Figure 6: Favel Formation, Assiniboine Member, including the Marco Calcarenite, south bank of Swan River, 13-1-35-29W1 (2009-08-21).



01-05W1 (2008-08-26).

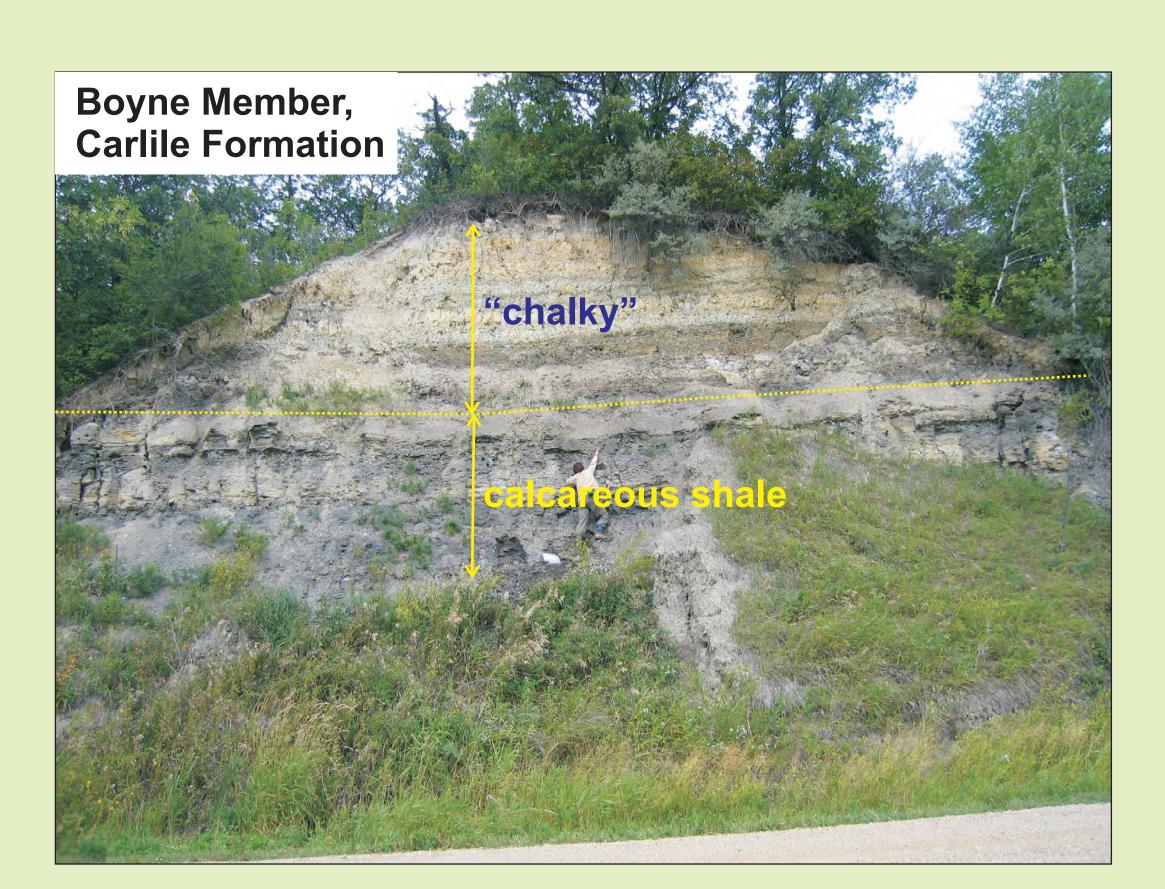


Figure 8: Carlile Formation, Boyne Member, north valley wall of Roseisle Creek (a tributary to the Boyne River), 1-14-6W1 (2008-08-27).

Figure 7: Carlile Formation, Morden Member, west side of roadside ditch, 16-10-

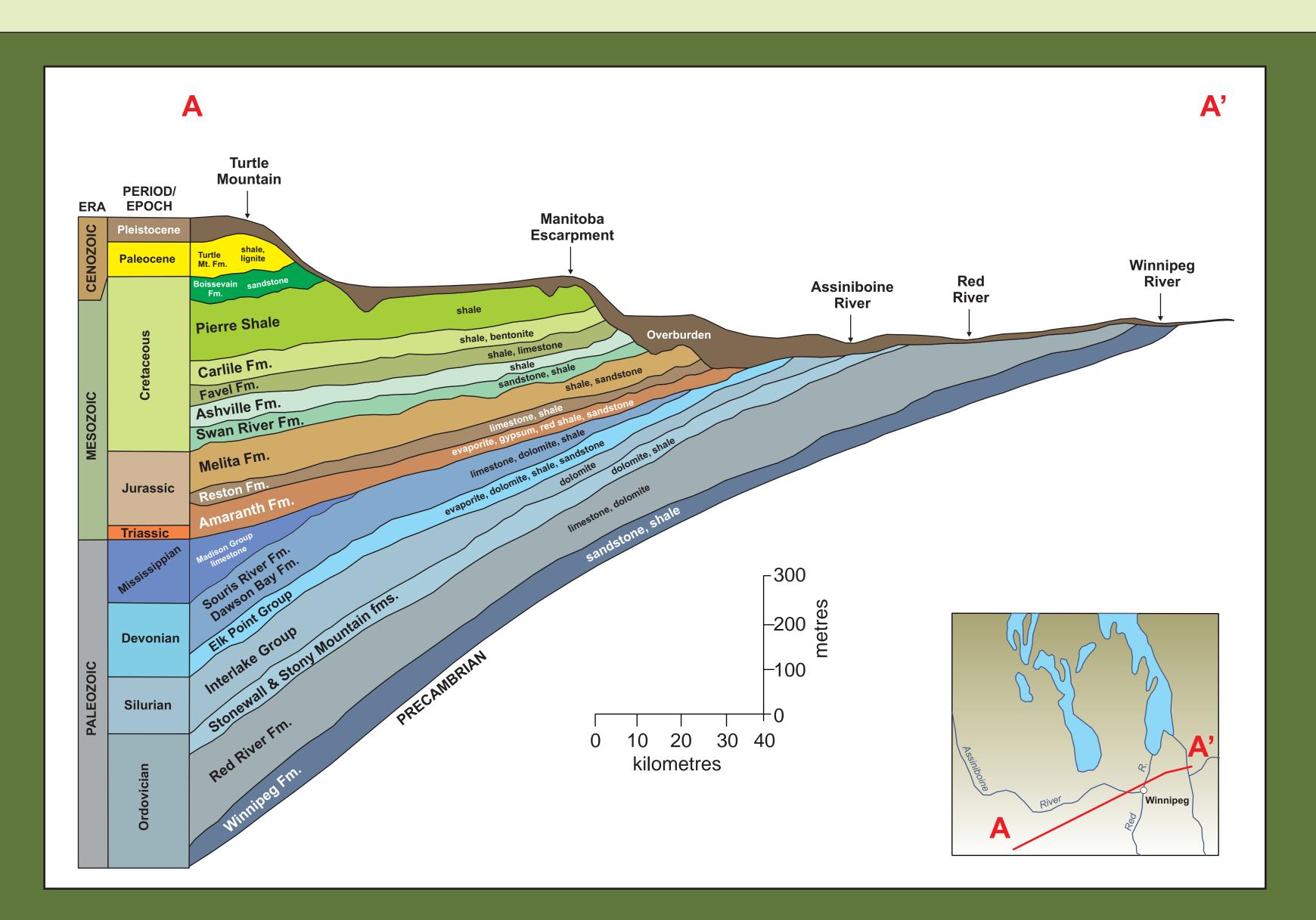


Figure 1: Cross-section of Paleozoic to Cenozoic formations in southern

ERA	PERIOD	EASTERN SASKATCHEWAN		MANITOBA SUBSURFACE			MANITOBA OUTCROP		
		glacial drift		glacial drift			glacial drift		
ZOIC	Quaternary								
CENO	Tertiary	Wood Mountain Formation Ravenscrag Formation		urtle Mountain Formation		Peace Garden Member	Mountain	Formation	Peace Garden Member
			raveneerag r ennadern	Turtle For		Goodlands Member	Turtle	For	Goodlands Member
MESOZOIC	CRETACEOUS	MONTANA GROUP	Frenchman Formation Whitemud Formation Eastend Formation Bearpaw Formation Belly River Formation	Pierre Shale		Boissevain Formation Coulter Member Odanah Member Belly River "marker" "lower" Odanah Member	e Shale		Boissevain Formation Coulter Member Odanah Member
		MO	Lea Park Formation		_	Millwood Member Pembina Member	ierr		Millwood Member Pembina Member
			Milk River Formation			Gammon Ferruginous Member		Ga	mmon Ferruginous Member
			Niobrara Formation						ୁ ଅଧି Chalky Unit
			Boyne Member	Carlile Formation		Boyne Member	e	Ition	
		UP upper	Carlife Do Carlife Do Norden Member			Morden Member	Carlile	For	Morden Member
		RADO GROI	Second White Specks	Favel Formation		Assiniboine Member Keld Member	Favel	Favel Formation	Assiniboine MemberMarco CalcareniteKeld MemberLaurier Limestone
		COLO		e Formation		Belle Fourche Member Fish Scale Zone Base of Fish Scale marker Westgate Member	For	er upper	Base of Fish Scale marker
		<u> </u>	Newcastle Formation Viking Sandstone Joli Fou Formation Pense Formation (P4)	Ashville		Newcastle Member Skull Creek Member Pense "P4" marker	Ashvil	Ashville lower	Skull Creek Member
		MANNVILLE GROUP	P2+P3 (lithological tops of sand) Cantuar Formation			Swan River Formation	S		Swan River Formation
		Success Fm	S ₂ Member			Success Formation (S ₂)	Succe		ess Formation (S ₂)equivalent
	JURASSIC	S	S ₁ Member Masefield Shale			Waskada Formation			
			Rierdon Formation	Melita		Upper Melita Member		-	
		Shaun- avon Fm	Upper Member Lower Member	Me Form		Lower Melita Member			
		Gravel- bourg Fm Lormation	Upper Member Lower Member	Reston Formation		Lower Gravelbourg "marker"	Amaranth Formation		Reston Formation
			Upper Member			Upper (Evaporite) Member			Upper Evaporite
	TRIASSIC		Lower Member	Amaranth Formation		Lower (Red Beds) Member			Lower Red Beds
PALEOZOIC	PERMIAN		•		·		St.	Mar	tin Igneous & Metamorphic Complex

Figure 2: Mesozoic and Cenozoic stratigraphy of eastern Saskatchewan and of the subsurface and outcrop belt of southwest Manitoba (Nicolas, 2009, Figure 2).



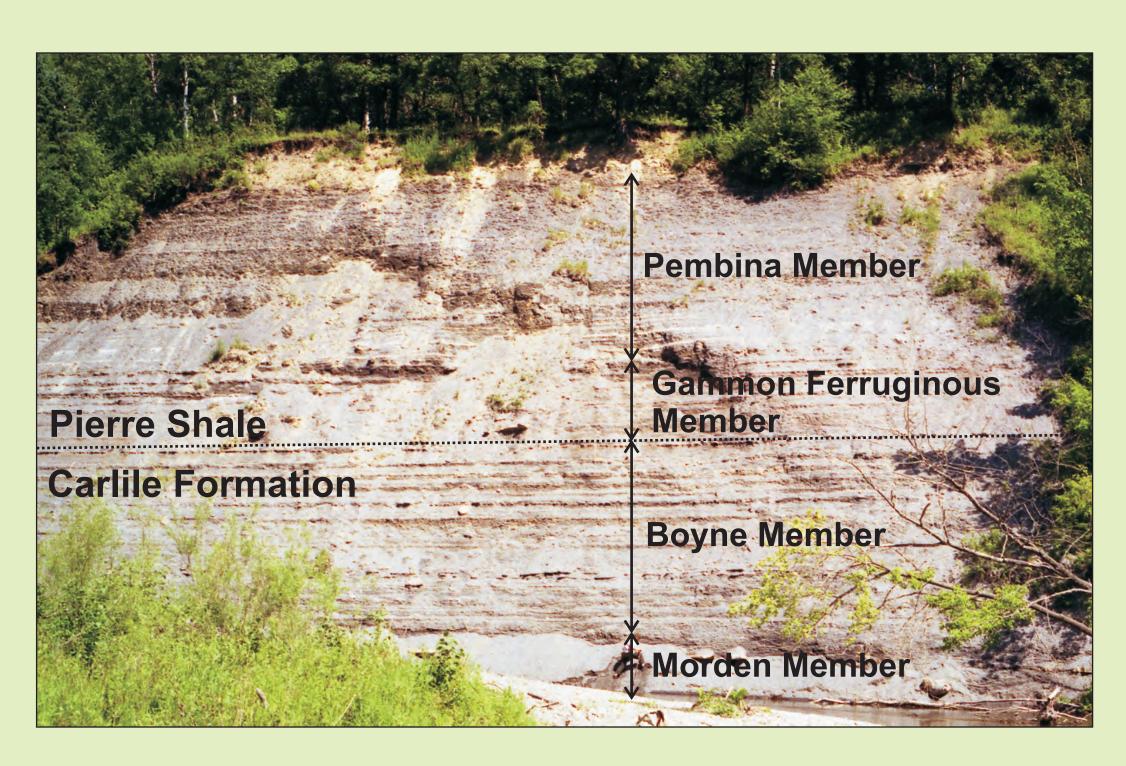


Figure 9: Pierre Shale, Gammon Ferruginous Member, east bank of Vermilion River, 7-23-23-20W1 (1999-07-06).

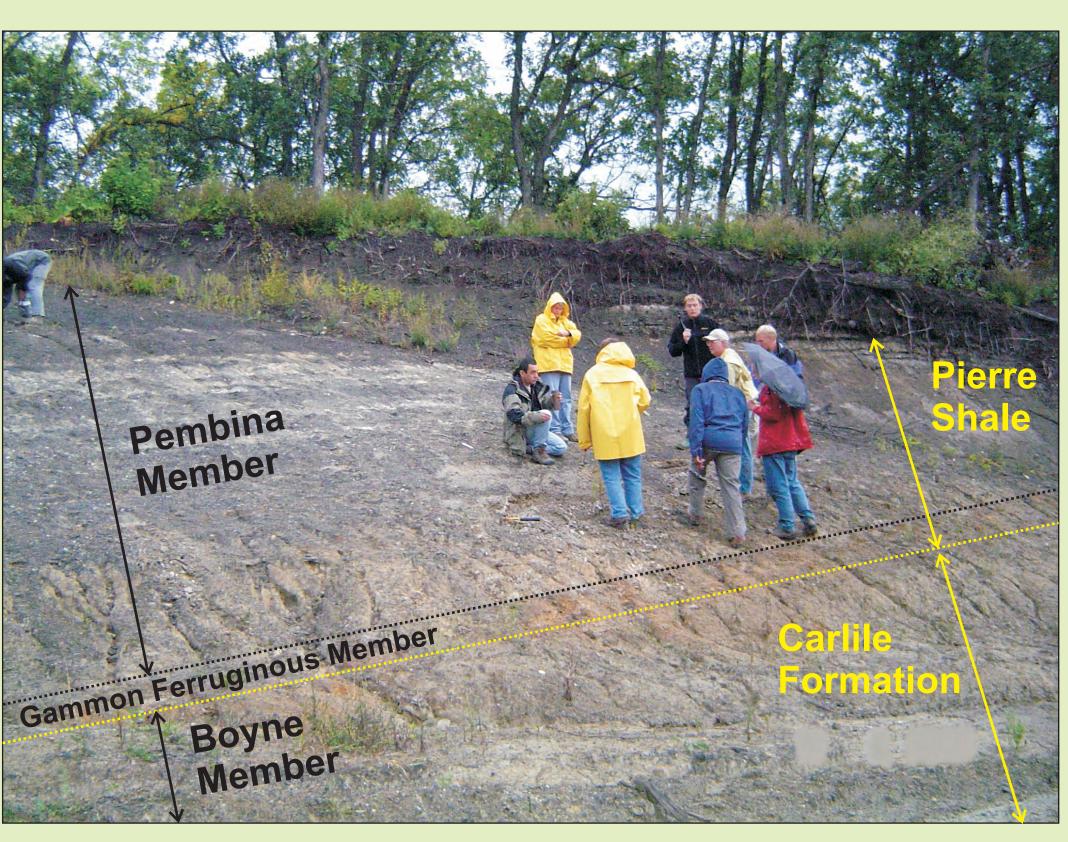


Figure 10: Pierre Shale, Pembina Member, north side of road allowance, 4-7-1-5W1 (2004-09-10).



Figure 11: Pierre Shale, Millwood Member, southeast flank of Mount Nebo, 4-18-4-6W1 (2007-09-29).

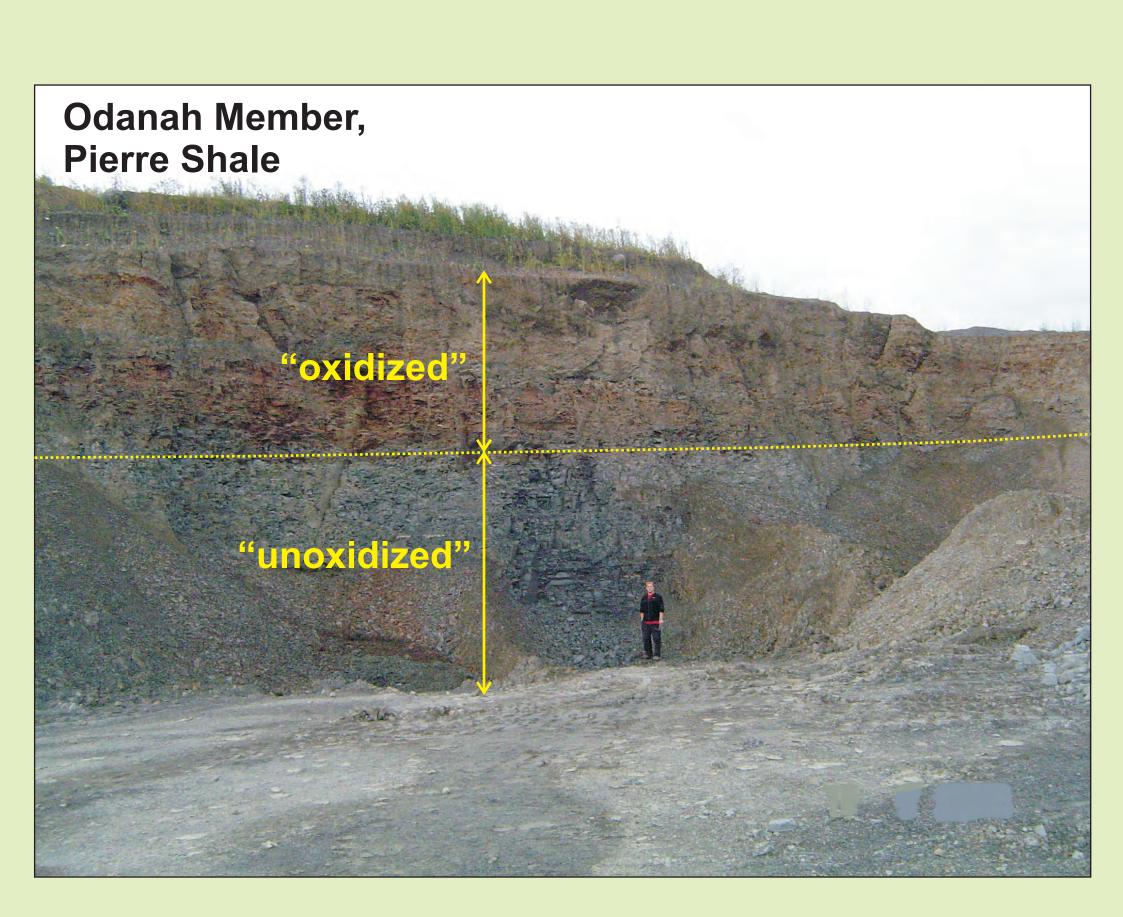


Figure 12: Pierre Shale, Odanah Member, south wall of Brown aggregate shale quarry, 15-1-1-6W1 (2004-09-10).

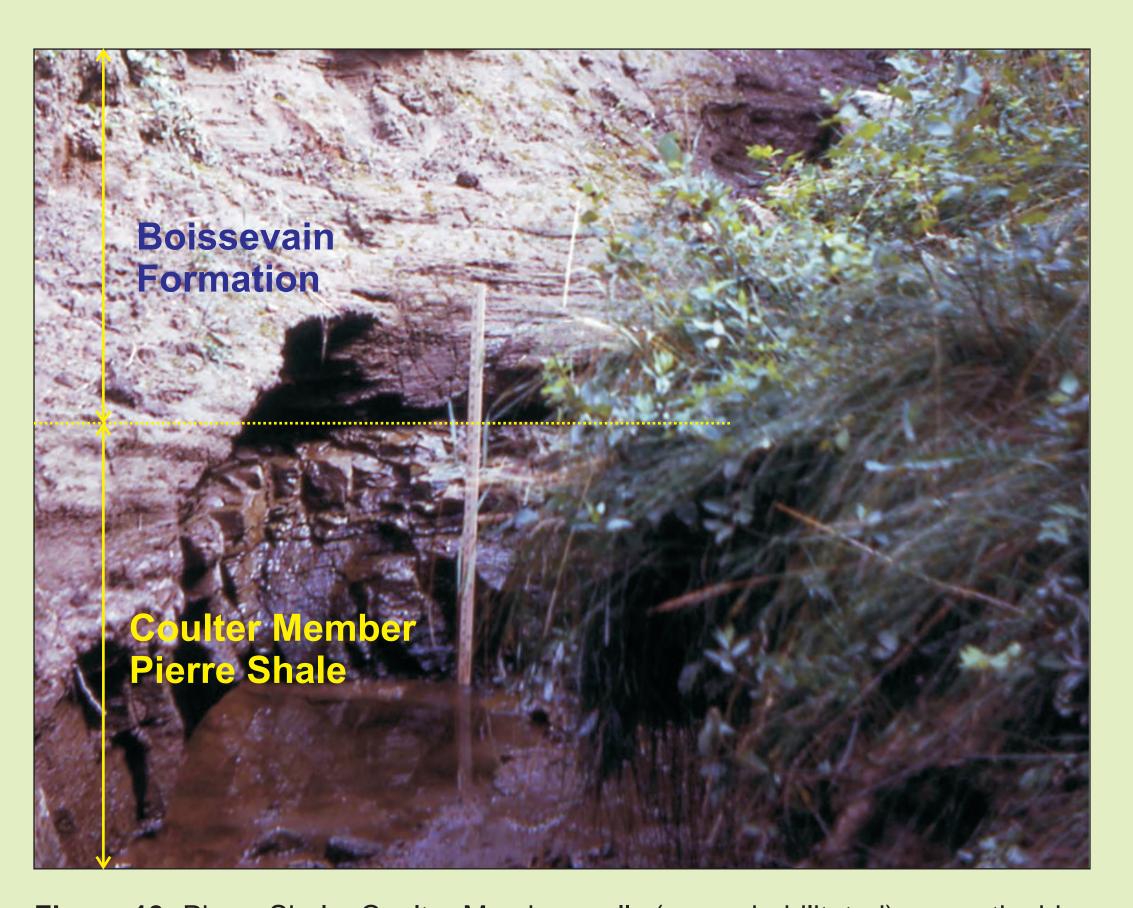


Figure 13: Pierre Shale, Coulter Member, gully (now rehabilitated) on south side of PTH 3, 14-35-2-19W1 (1971-08-05).



Figure 14: Boissevain Formation, along old Great Northern railway cut and adjacent to Boissevain reservoir, 9-7-3-19W1 (1971-05-15).

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Revised Cretaceous stratigraphic nomenclature of southwest Manitoba by J.D. Bamburak and M.P.B. Nicolas Poster presented at the Manitoba Mines and Minerals Convention, November 19-21, 2009 Winnipeg, Manitoba