

STRATIGRAPHY AND STRUCTURE OF THE TERTIARY
COLLAPSE IN THE ROSETOWN LOW, SASKATCHEWAN
CANADA

E.A. Christiansen 2009

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STRATIGRAPHY AND STRUCTURE OF THE PLEISTOCENE COLLAPSE IN THE ROSETOWN LOW, SASKATCHEWAN, CANADA

E.A. CHRISTIANSEN

Abstract: The Rosetown Low is a collapse structure formed as a result of dissolution of salt from the Middle Devonian Prairie Formation. The base of exploration herein is the Base of the Colorado Second White Speckled Shale. The age of the Rosetown structure is post-Bearpaw Formation and pre-Pleistocene. The stratigraphic position and composition of the sediments which fill the Rosetown Low indicate that the Rosetown Low is Tertiary in age.

INTRODUCTION AND PREVIOUS WORK

The Prairie Formation of the Devonian Elk Point Group is an extensive salt deposit in southern Saskatchewan (Fig. 1). According to De Mille et al. (1964), the Rosetown Low (Figs. 1, 2) is a salt collapse structure which was formed by solution of salt from the Prairie Formation. During this investigation, testhole Imperial Fortune designated here as No. 7 (Table 1, Fig. 3) was drilled in 1962. This hole penetrated the Judith River Formation, which is an extensive groundwater aquifer in Southern Saskatchewan. Eleven water-wells and eight oil company testholes penetrated the Judith River Formation (Figs. 3 and 4) establishing this formation as an important shallow structural marker bed. This conclusion is supported by the parallelism of the Judith River Formation with the Second White Speckled Shale Marker (Fig. 3).

INFORMATION

Stratigraphic information (Table 1) was obtained from electric logs, side-wall cores (Morrison, 1969), and rotary cutting samples provided by the Saskatchewan Research Council through grants from the Federal and Provincial governments.

STRATIGRAPHY

Stratigraphic bedrock units (Figs. 3, 4) and Table 2, in ascending order, are: (1) Lower and Upper Colorado Group separated by the Second White Speckled Shale; (2) Lea Park and Judith River formations; (3) Snakebite, Cruikshank, and Aquadell members of the Bearpaw Formation, and (4) Tertiary deposits.

Stratigraphic drift units, in ascending order are: (1) Lower drift, mainly till, the upper part of which is oxidized (Fig. 4, borehole 20), (2) Upper drift, mainly till, the upper part of which is also oxidized, and (3) Alluvium, (9) deposited in the Eagle Creek Valley (Figs. 3, 4).

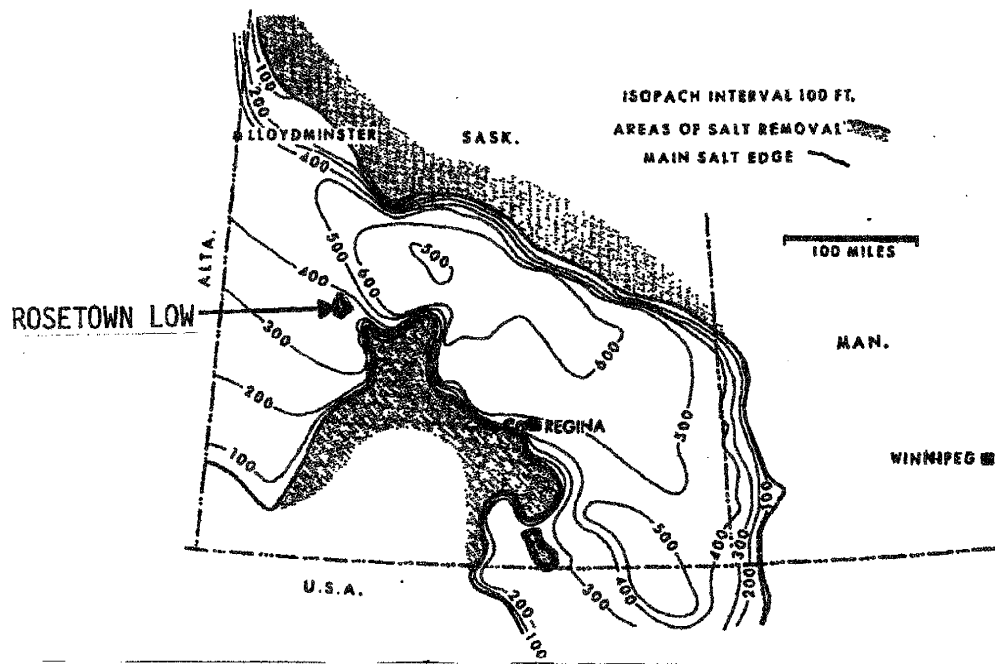


Figure 1. Isopach Prairie Formation showing areas of salt removal. The stippled areas contain the solution breccias which suggest a greater previous extent of the Prairie Formation. From G. De Mille *et al.* 1964. Arrow points to Rosetown Low.

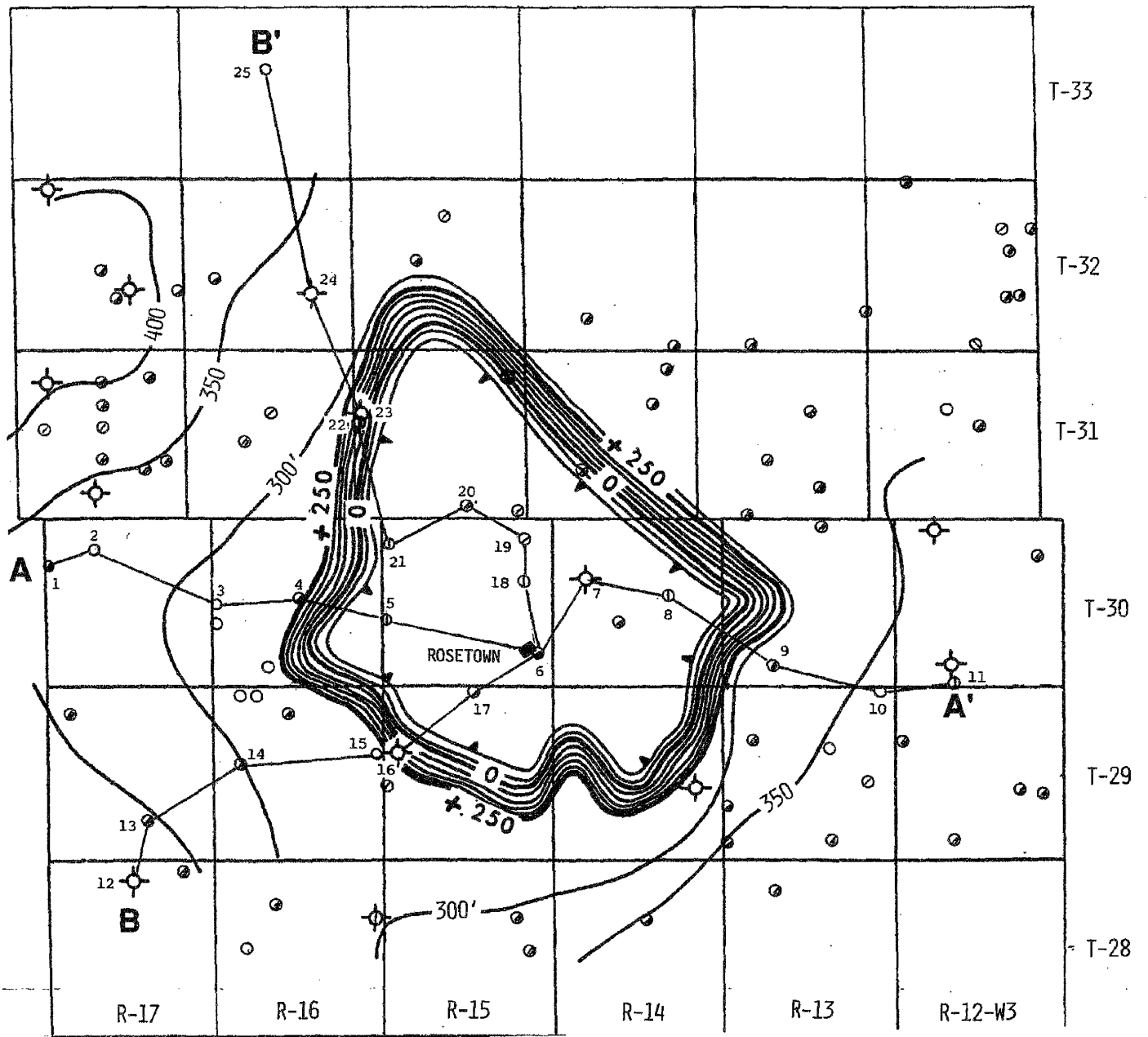


Figure 2. Location map for cross sections A-A¹ and B-B¹ is from G. De Mille *et al.* 1964, p. 312.

No.	NAME	LOCATION	SYMBOL*
1	Bill Sawatsky	05-30-30-17-W3	
2	*CAL STAN Herschel	16-29-30-17-W3	
3	Barnwell Herschel	13-18-30-16-W3	
4	Chad Forsyth	04-22-30-16-W3	
5	SRC Rosetown	05-18-30-15-W3	
6	EPD Rosetown	07-12-30-15-W3	
7	Imperial Fortune	13-20-30-14-W3	
8	SRC Pym	05-23-30-14-W3	
9	Mike Lefeure	16-05-30-13-W3	
10	ZD & HB Rosetown	15-36-29-13-W3	
11	SRC Sovereign	04-04-30-12-W3	
12	H B Rosetown	04-34-28-17-W3	
13	Wayne W. Gambi	08-10-29-17-W3	
14	Sim & Sons Farms	05-20-29-16-W3	
15	Larry Wood	09-24-29-16-W3	
16	SOC Sohio Ridpath	11-19-29-15-W3	
17	SWC Rosetown	14-34-29-15-W3	
18	SRC Rosetown	13-24-30-15-W3	
19	SDH Eagle Creek	05-36-30-15-W3	
20	EPD Hutterian Brethren	09-03-31-15-W3	
21	SRC Anglia	04-31-30-15-W3	
22	SRC Anglia	12-19-31-15-W3	
23	IMP TW Rosetown	12-19-31-15-W3	
24	SRC Herschel	15-11-32-16-W3	
25	TW Herschel No. 2	15-11-32-16-W3	
26	TW Goldburg Crown 1	13-22-33-16-W3	
⊙	Electric logs, cutting samples and cores.		Wells defined by electric logs, cutting samples, and cores.
⊖	Electric logs and cutting samples.		Wells defined by electric and driller's logs.
			Oil company electric logs, only.

Table 1. Index of borehole logs in cross sections A-A¹ and B-B¹, Figs. 3 and 4.

* See explanation of borehole abbreviations below.

CAL STAN	The California Standard Company
EPD	Elk Point Drilling Corp.
HB	Hudson Bay Oil and Gas
IMP	Imperial Oil Ltd.
SDH	Saskatchewan Department of Highways
SRC	Saskatchewan Research Council
SWC	Saskatchewan Water Corporation
TW	Tidewater Oil Company
ZD	Zoller & Donneberg Oil Ltd.

Figure 3. Cross section A-A¹ across the Rosetown Low.

Figure 4. Cross section B-B¹ across the Rosetown Low.

TIME UNITS	Stratigraphy				
	Group	Formation	Member	No.	Deposit
HOLOCENE				9	Alluvium
PLEISTOCENE				8b	Upper drift, mainly till
				8a	Lower drift, mainly till
TERTIARY				7	Sand, chert and quartzite gravel
CRETACEOUS	MONTANA	Bearpaw	Aquadell	6e	Shale
			Cruikshank	6d	Sandstone
			Snakebite	6c	Shale
		Judith River		5	Sandstone and shale
		Lea Park		4	Shale
	COLORADO	Upper		3	Shale, silty
			Second White Speckled Shale	2	Calcareous shale
		Lower		1	Shale

Table 2. Stratigraphic chart of sediments in the Rosetown Low and surrounding areas.

STRUCTURE

The structure of the Rosetown Low (Fig. 2) by De Mille et al. (1964) is used herein as a base map for cross sections A-A¹ and B-B¹ (Figs. 3 and 4). The base of the Second White Speckled Shale beneath the Rosetown Low is from borehole 7 (A-A¹, Fig. 3). The Rosetown Low structure is better defined in cross section A-A¹, and the Tertiary deposits are better defined in cross section B-B¹. Between boreholes 16-17 and borehole 18 (Fig. 4), the Cruikshank and Aquadell members of the Bearpaw Formation are missing, presumably because of Tertiary erosion prior to deposition of the Tertiary deposits.

AGE OF THE ROSETOWN LOW

Examination of cross sections A-A¹ and B-B¹ strongly suggests that the collapse forming the Rosetown Low occurred during the Tertiary Period after deposition of the Bearpaw Formation and before deposition of the glacial drift. The brown colour of the finer silts and clays and the chert and quartzite composition of the gravels are typical of Tertiary sediments in southern Saskatchewan.

SUMMARY AND CONCLUSIONS

1. The collapse and formation of the Rosetown Low occurred between deposition of the Bearpaw Formation and glacial drift.
2. The maximum thickness of the Tertiary deposits is about 82 m and the amount of collapse of the Judith River Formation is about 115 m suggesting that about 33 m of the Tertiary deposits were eroded by glacial action.
3. The Base of the Second White Specks and the Judith River Formation are structural markers.
4. The collapse and formation of the Rosetown Low happened during the Tertiary Period between deposition of the Bearpaw Formation and glacial drift.
5. The removal of the Tertiary deposits at site 20 (Fig. 4) was caused by glacial erosion (Christiansen and Sauer (1988)).

6. The presence of an oxidized zone in the drift at site 20 (Fig. 3) indicates that at least two glaciations occurred at this site.

SIGNIFICANCE OF THIS PAPER

1. Structural control was established by the Second White Speckled Shale and Judith River Formation.
2. The assignment of the Tertiary age of the Rosetown Low collapse structure.
3. Separation of the shale interval between the Second White Speckled Shale and the Judith River Formation into the Upper Colorado Group and Lea Park Formation is based on the higher electrically conductivity of the Upper Colorado Group.

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REFERENCES

- Caldwell, W.G.E. 1968. The Late Cretaceous Bearpaw Formation in the South Saskatchewan River Valley. Saskatchewan Research Council, Report No. 8, 89 p.
- Christiansen, E.A. and Sauer, E.K. 1988. Fire Lake depression: a glacially eroded feature in southwestern Saskatchewan, Canada. *Canadian Journal of Earth Sciences*, 25: 2130-2138.
- De Mille, G., Shouldice, J.R., and Nelson, H.W. 1964. Collapse structures related to evaporites of the Prairie Formation, Saskatchewan. *Geological Society of America Bulletin*, 75:307-316.
- Morrison, B. 1969. A side-wall sampler. *Canadian Geotechnical Journal*, 6: 431-439.

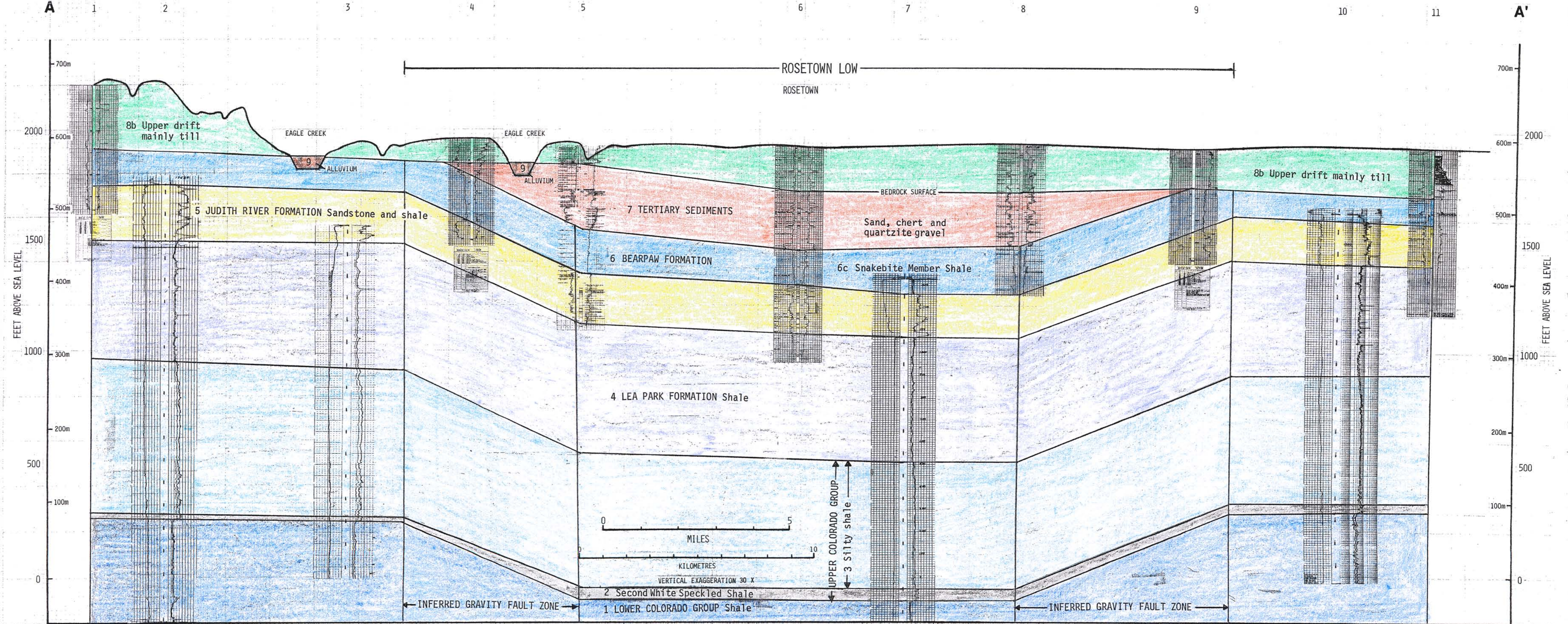


FIGURE 3. CROSS SECTION A-A'

See Figure 2 for location of cross section and Table 2 for the stratigraphic chart.

