GEOLOGICAL SURVEY OF CANADA
COMMISSION GEOLOGIQUE DU CANADA

**Open File 3574**

# DETAILED OUTCROP MEASURED SECTIONS OF THE ST. MARY RIVER/HORSESHOE CANYON FORMATIONS, LITTLE BOW RIVER AND TRAVERS RESERVOIR, NEAR CARMANGAY, SOUTHERN ALBERTA

By

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MARCH 1998

## INTRODUCTION

The enclosed measured outcrop sections represent a partially complete succession through the Maastrichtian-age St. Mary River Formation in the geographic location where generalized geologic maps suggest a gradation between this unit and the approximately correlative Horseshoe Canyon Formation to the north. The exposures are fair to good, are scattered along 20 km of Travers Reservoir and the Little Bow River (Table 1; Fig. 1) in a line oblique to the strike of the bedding and reveal portions of most of the ~425m of stratigraphic thickness. The outcrops are located in Twp. 14-15, Rge 21-23W4. Together, the exposed sections cover about 200m of the succession, with large gaps only in the lower 1/3 and the upper 1/6 (Fig. 2). A subsurface Gamma Ray-Sonic log from a nearby well to the west is also included for comparison to the outcrops.

Comparison of the surface and subsurface sections (Fig. 3) suggests that the intertonguing of the St. Mary River in the south with the Horseshoe Canyon of the north occurs in a definable and stratigraphically organized fashion at this latitude. Horseshoe Canyon-type facies (pale grey thick channel sandstones interbedded with burrowed marine-brackish mudstone, thick coals and lesser pedogenic siltstone) are prevalent in the lower ~175m and the upper ~50m. However, strata of the intervening 200m are dominated by St. Mary River-type facies (greenish grey pedogenic siltstone with abundant caliche/paleosol horizons and roots, interbedded with thin grey to buff sandstones and minor thin carbonaceous shales and coals).

This stratigraphic arrangement may be interpreted as representing a N-S climatic trend (more humid to the north, more arid to the south) which shifted first northward, then southward through the time of Maastrichtian deposition. Conversely, it may be the result of the large-scale intertonguing of two different clastic wedges in this area which had different depositional styles, sediment sources and patterns of sediment dispersal. A combination of both is possible. Further work is required to resolve the regional-scale stratigraphic architecture of the Maastrichtian deposits of southern Alberta. This may be important because a limited number of gas pools are known in the Horseshoe Canyon to the north, but vast areas of Alberta shallowly underlain by these units are essentially unexplored.

## LIST OF FIGURES

1. Location map for measured outcrop sections.
2 (a-e). Measured outcrop sections in stratigraphic context.
3. Comparison of well 6-24-14-27W4 with measured outcrop sections.

| SECTION | SURVEY GRID | NTS GRID (1:250000/1:50000) | LAT/LONG | FACIES TYPE |
|---|---|---|---|---|
| Woolf Coulee | 31-14-21W4 | Gleichen/Travers (82 I/2) 666633--672637 | 50° 13' / 112° 52' | Horseshoe Canyon |
| Little Bow Provincial Pk | 2/3-15-22W4 | Gleichen/Travers (82 I/2) 615655--624655 | 50° 14' / 112° 56' | Horseshoe Canyon |
| Log Bridge | 24-14-23W4 | Gleichen/Carmangay (82I/3) 554610 | 50° 11' / 113° 02' | St. Mary River |
| Abandoned Farm | 10-14-23W4 | Gleichen/Carmangay (82I/3) 522585 | 50° 10' / 113° 04' | St. Mary River |
| Range 4 Rd Bridge | 4-14-23W4 | Gleichen/Carmangay (82I/3) 506570 | 50° 09' / 113° 06' | St. Mary River |
| Carmangay RR Bridge | 5-14-23W4 | Gleichen/Carmangay (82I/3) 488559 | 50° 08' / 113° 07' | St. Mary River |

Table 1. Location of Measured Outcrop Sections.

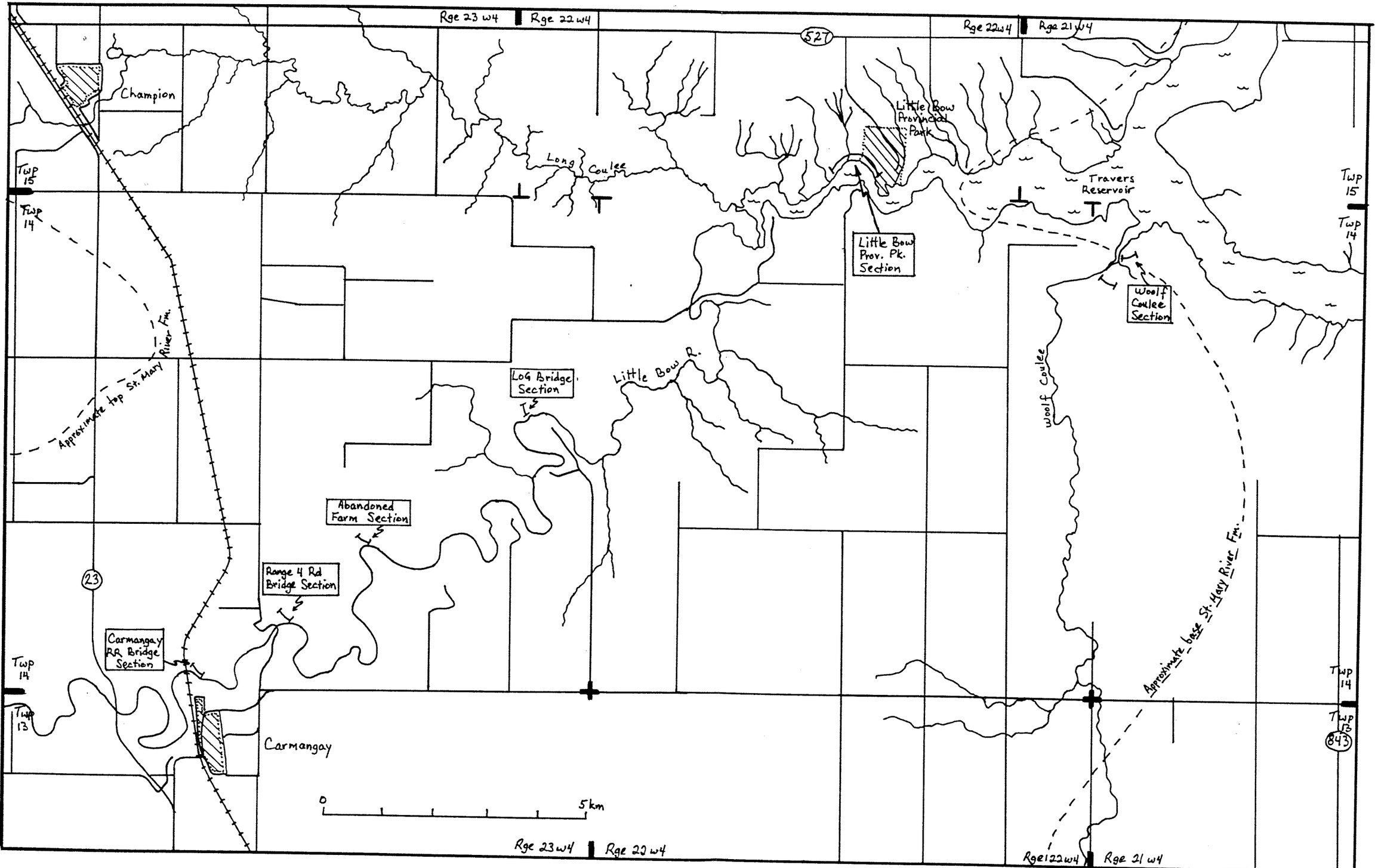



FIGURE 1

FIGURE 1

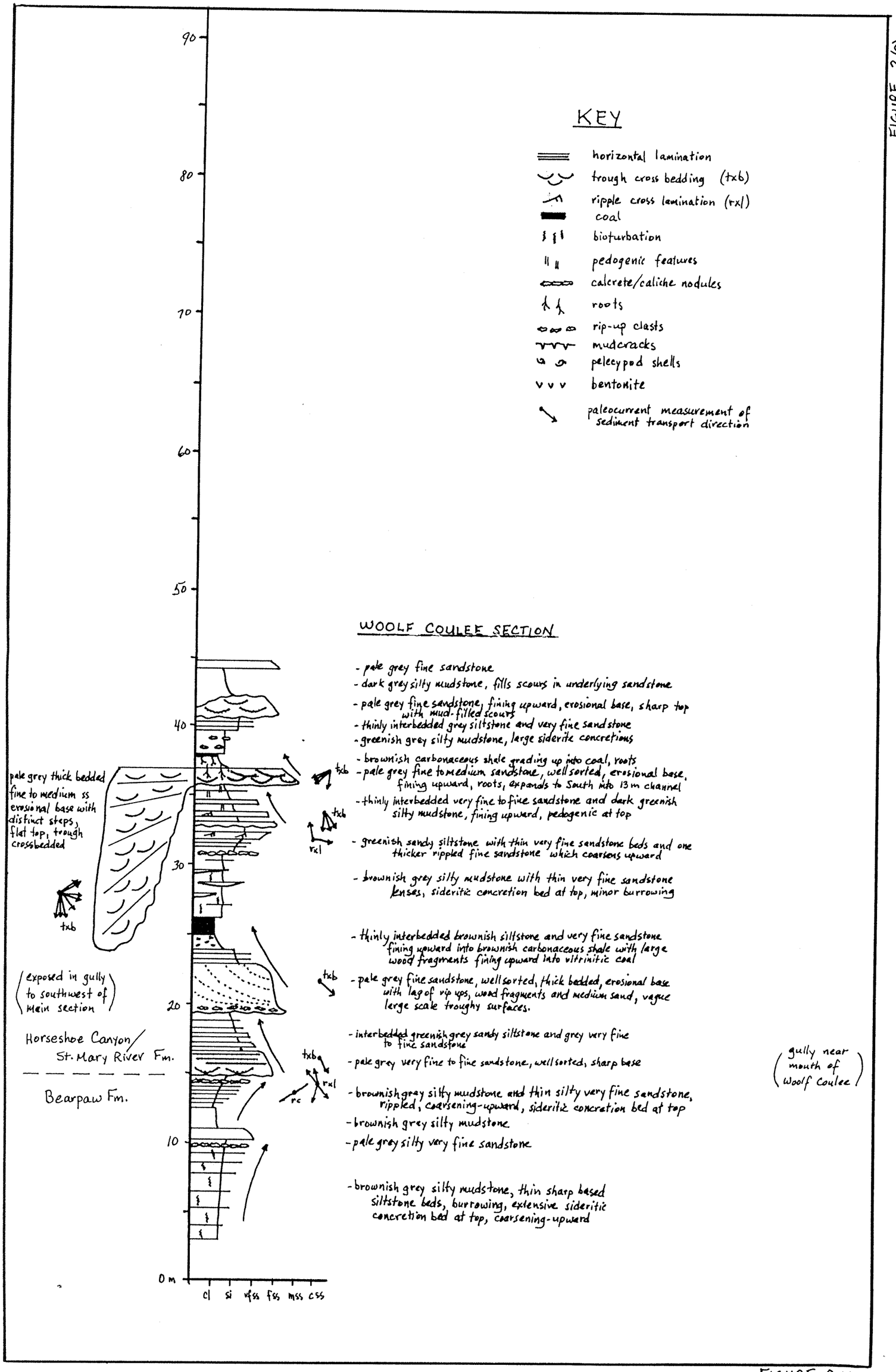
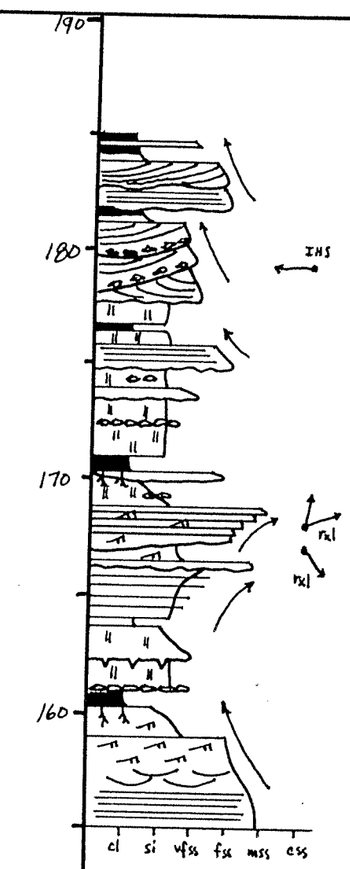


FIGURE 2 (a)
KEY
horizontal lamination
trough cross bedding (txb)
ripple cross lamination (rxl)
coal
bioturbation
pedogenic features
calcrete/caliche nodules
roots
rip-up clasts
mudcracks
pelecypod shells
bentonite
paleocurrent measurement of sediment transport direction
WOOLF COULEE SECTION
- pale grey fine sandstone
- dark grey silty mudstone, fills scours in underlying sandstone
- pale grey fine sandstone, fining upward, erosional base, sharp top with mud-filled scours
- thinly interbedded grey siltstone and very fine sandstone
- greenish grey silty mudstone, large siderite concretions
- brownish carbonaceous shale grading up into coal, roots
- pale grey fine to medium sandstone, well sorted, erosional base, fining upward, roots, expands to South into 13 m channel
- thinly interbedded very fine to fine sandstone and dark greenish silty mudstone, fining upward, pedogenic at top
- greenish sandy siltstone with thin very fine sandstone beds and one thicker rippled fine sandstone which coarsens upward
- brownish grey silty mudstone with thin very fine sandstone lenses, siderite concretion bed at top, minor burrowing
- thinly interbedded brownish siltstone and very fine sandstone fining upward into brownish carbonaceous shale with large wood fragments fining upward into vitrinitic coal
- pale grey fine sandstone, well sorted, thick bedded, erosional base with lag of rip ups, wood fragments and medium sand, vague large scale troughy surfaces.
- interbedded greenish grey sandy siltstone and grey very fine to fine sandstone
- pale grey very fine to fine sandstone, well sorted, sharp base
- brownish grey silty mudstone and thin silty very fine sandstone, rippled, coarsening-upward, siderite concretion bed at top
- brownish grey silty mudstone
- pale grey silty very fine sandstone
- brownish grey silty mudstone, thin sharp based siltstone beds, burrowing, extensive siderite concretion bed at top, coarsening-upward
pale grey thick bedded fine to medium ss erosional base with distinct steps, flat top, trough crossbedded
(exposed in gully to southwest of main section)
Horseshoe Canyon/ St. Mary River Fm.
Bearpaw Fm.
(gully near mouth of Woolf Coulee)
90
80
70
60
50
40
30
20
10
0 m
cl si vfss fss mss css
txb
rxl
rc

FIGURE 2 (a)




## LITTLE BOW PROVINCIAL PARK SECTION

- black coal and carbonaceous shale with thin very fine sandstone
- light grey fine sandstone, thick bedded, IHS bedding
- dark grey carbonaceous shale grading up into bituminous coal
- light grey very fine sandstone, thick bedded, silty IHS beds with sideritic concretion horizons
- greenish grey siltstone, pedogenic, with thin laminated coal
- light grey fine sandstone, erosional base, thin bedded
- greenish grey siltstone, pedogenic, horizons of caliche nodules, thin very fine sandstone
- black bituminous coal
- grey fine sandstone, erosional base, large roots, pinches out to west
- greenish grey siltstone, pedogenic, caliche nodules
- light grey fine to medium sandstone, erosional base, coarsening upward, thin bedded, thickens to west
- light grey sandy siltstone, caliche nodules
- thinly interbedded greenish grey sandy siltstone and very fine sandstone, coarsening upward, capped by fine to medium sandstone with erosional base and coal fragments
- grey sandy siltstone, pedogenic, mudcracks, caliche nodules, capped by thin carbonaceous shale
- black laminated coal, bituminous
- grey very fine sandstone to siltstone, large vertical roots
- light grey fine to medium sandstone, well sorted, thick bedded, base not exposed, horizontal lamin, txb, rxl, fining upward

(second gully west of Park Boundary)

(first gully west of Park Boundary)

(near boat launch)

FIGURE 2(b)

FIGURE 2(b)

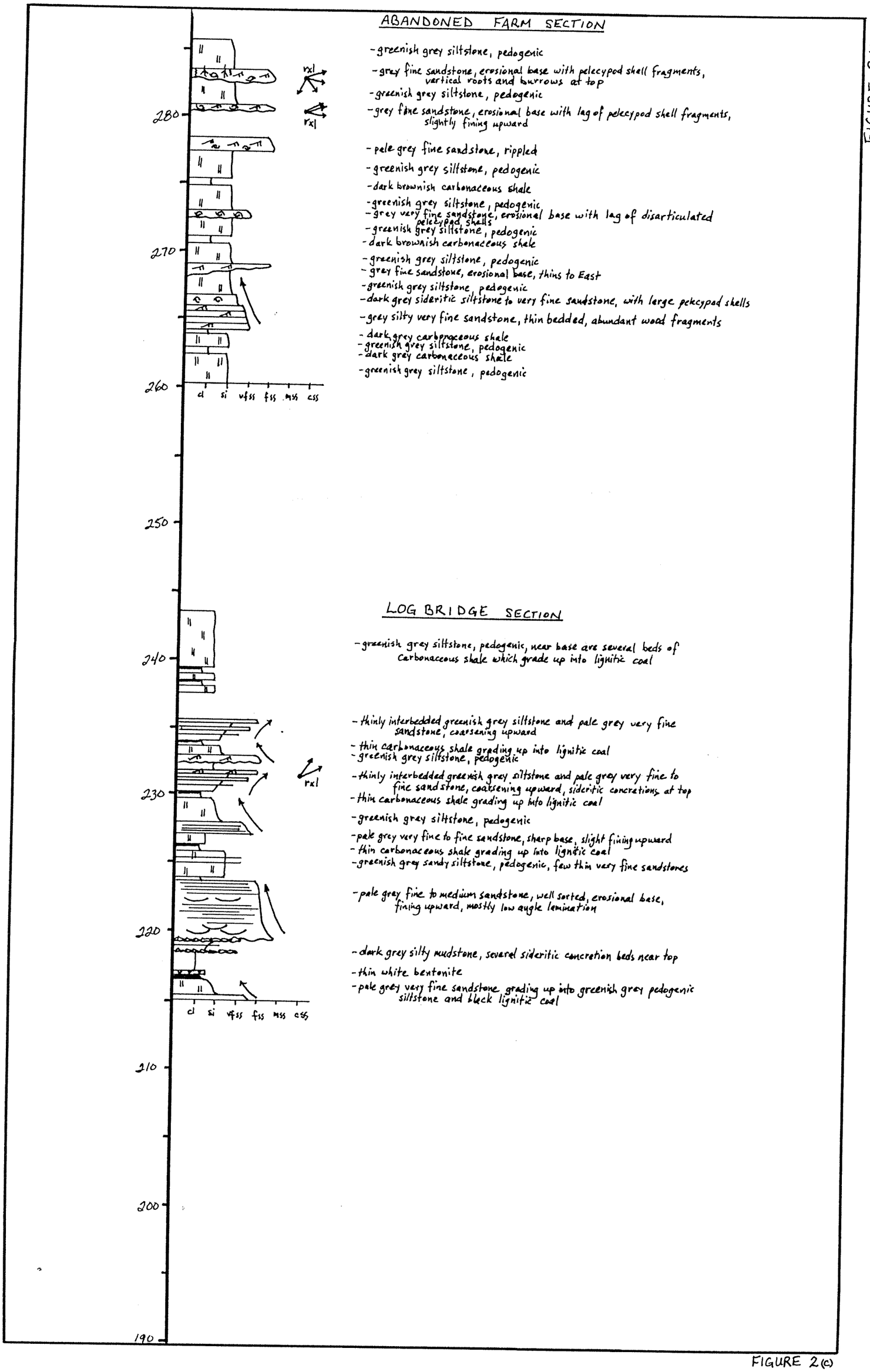

ABANDONED FARM SECTION
-greenish grey siltstone, pedogenic
-grey fine sandstone, erosional base with pelecypod shell fragments, vertical roots and burrows at top
-greenish grey siltstone, pedogenic
-grey fine sandstone, erosional base with lag of pelecypod shell fragments, slightly fining upward
-pale grey fine sandstone, rippled
-greenish grey siltstone, pedogenic
-dark brownish carbonaceous shale
-greenish grey siltstone, pedogenic
-grey very fine sandstone, erosional base with lag of disarticulated pelecypod shells
-greenish grey siltstone, pedogenic
-dark brownish carbonaceous shale
-greenish grey siltstone, pedogenic
-grey fine sandstone, erosional base, thins to East
-greenish grey siltstone, pedogenic
-dark grey sideritic siltstone to very fine sandstone, with large pelecypod shells
-grey silty very fine sandstone, thin bedded, abundant wood fragments
-dark grey carbonaceous shale
-greenish grey siltstone, pedogenic
-dark grey carbonaceous shale
-greenish grey siltstone, pedogenic
rxl
rxl
280
270
260
cl si vfss fss mss css
250
LOG BRIDGE SECTION
-greenish grey siltstone, pedogenic, near base are several beds of carbonaceous shale which grade up into lignitic coal
240
-thinly interbedded greenish grey siltstone and pale grey very fine sandstone, coarsening upward
-thin carbonaceous shale grading up into lignitic coal
-greenish grey siltstone, pedogenic
-thinly interbedded greenish grey siltstone and pale grey very fine to fine sandstone, coarsening upward, sideritic concretions at top
-thin carbonaceous shale grading up into lignitic coal
-greenish grey siltstone, pedogenic
-pale grey very fine to fine sandstone, sharp base, slight fining upward
-thin carbonaceous shale grading up into lignitic coal
-greenish grey sandy siltstone, pedogenic, few thin very fine sandstones
-pale grey fine to medium sandstone, well sorted, erosional base, fining upward, mostly low angle lamination
-dark grey silty mudstone, several sideritic concretion beds near top
-thin white bentonite
-pale grey very fine sandstone grading up into greenish grey pedogenic siltstone and black lignitic coal
rxl
230
220
cl si vfss fss mss css
210
200
190
FIGURE 2(c)

FIGURE 2(c)

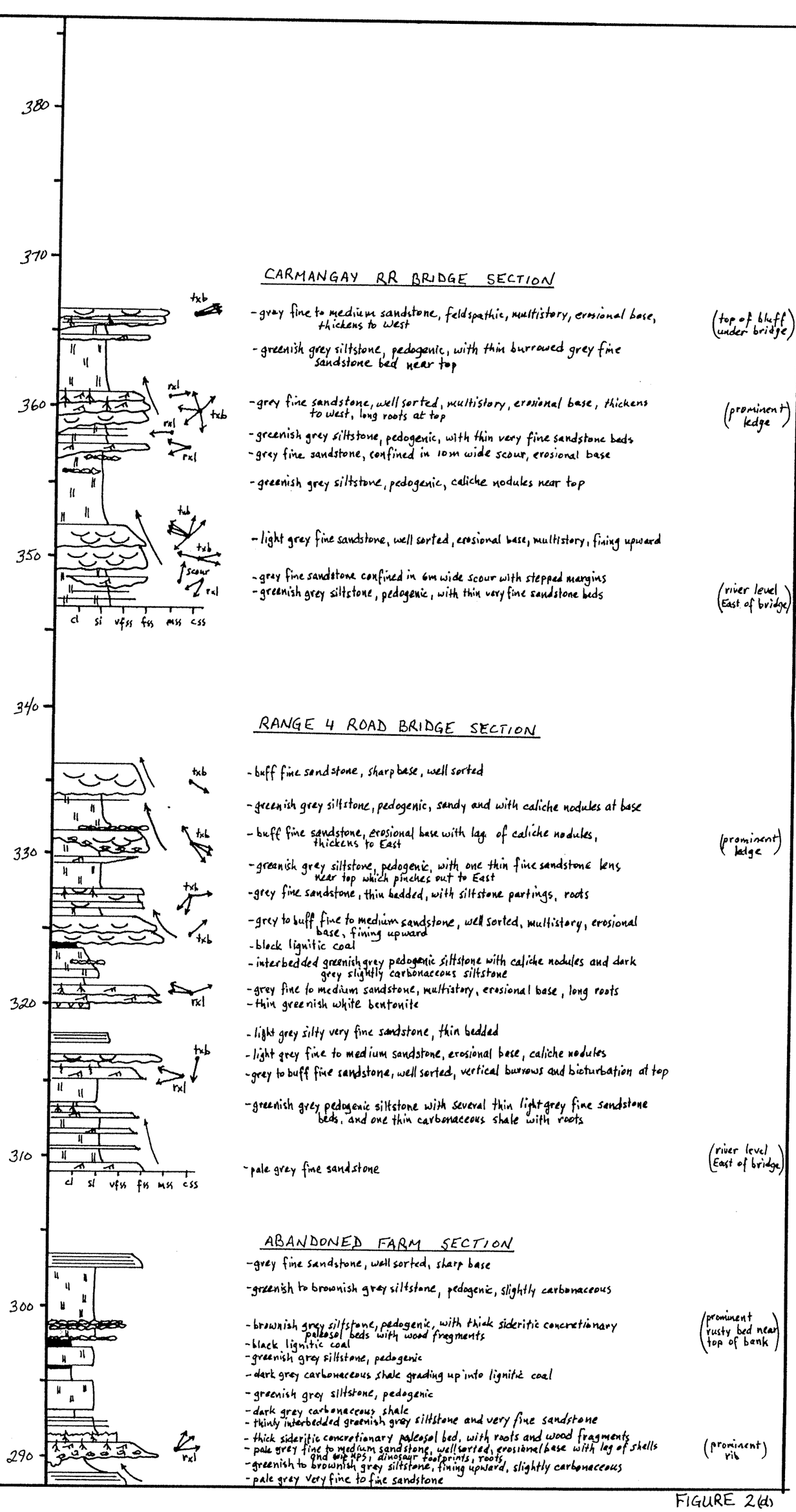


FIGURE 2(d)
380
370
360
350
340
330
320
310
300
290
txb
rxl
scour
cl si vfss fss mss css
CARMANGAY RR BRIDGE SECTION
- grey fine to medium sandstone, feldspathic, multistory, erosional base, thickens to west
(top of bluff under bridge)
- greenish grey siltstone, pedogenic, with thin burrowed grey fine sandstone bed near top
- grey fine sandstone, well sorted, multistory, erosional base, thickens to west, long roots at top
(prominent ledge)
- greenish grey siltstone, pedogenic, with thin very fine sandstone beds
- grey fine sandstone, confined in 10m wide scour, erosional base
- greenish grey siltstone, pedogenic, caliche nodules near top
- light grey fine sandstone, well sorted, erosional base, multistory, fining upward
- grey fine sandstone confined in 6m wide scour with stepped margins
- greenish grey siltstone, pedogenic, with thin very fine sandstone beds
(river level East of bridge)
RANGE 4 ROAD BRIDGE SECTION
- buff fine sandstone, sharp base, well sorted
- greenish grey siltstone, pedogenic, sandy and with caliche nodules at base
- buff fine sandstone, erosional base with lag of caliche nodules, thickens to East
(prominent ledge)
- greenish grey siltstone, pedogenic, with one thin fine sandstone lens near top which pinches out to East
- grey fine sandstone, thin bedded, with siltstone partings, roots
- grey to buff fine to medium sandstone, well sorted, multistory, erosional base, fining upward
- black lignitic coal
- interbedded greenish grey pedogenic siltstone with caliche nodules and dark grey slightly carbonaceous siltstone
- grey fine to medium sandstone, multistory, erosional base, long roots
- thin greenish white bentonite
- light grey silty very fine sandstone, thin bedded
- light grey fine to medium sandstone, erosional base, caliche nodules
- grey to buff fine sandstone, well sorted, vertical burrows and bioturbation at top
- greenish grey pedogenic siltstone with several thin light grey fine sandstone beds, and one thin carbonaceous shale with roots
- pale grey fine sandstone
(river level East of bridge)
ABANDONED FARM SECTION
- grey fine sandstone, well sorted, sharp base
- greenish to brownish grey siltstone, pedogenic, slightly carbonaceous
- brownish grey siltstone, pedogenic, with thick sideritic concretionary paleosol beds with wood fragments
(prominent rusty bed near top of bank)
- black lignitic coal
- greenish grey siltstone, pedogenic
- dark grey carbonaceous shale grading up into lignitic coal
- greenish grey siltstone, pedogenic
- dark grey carbonaceous shale
- thinly interbedded greenish grey siltstone and very fine sandstone
- thick sideritic concretionary paleosol bed, with roots and wood fragments
- pale grey fine to medium sandstone, well sorted, erosional base with lag of shells and ostracods, dinosaur footprints, roots
(prominent rib)
- greenish to brownish grey siltstone, fining upward, slightly carbonaceous
- pale grey very fine to fine sandstone

FIGURE 2(d)

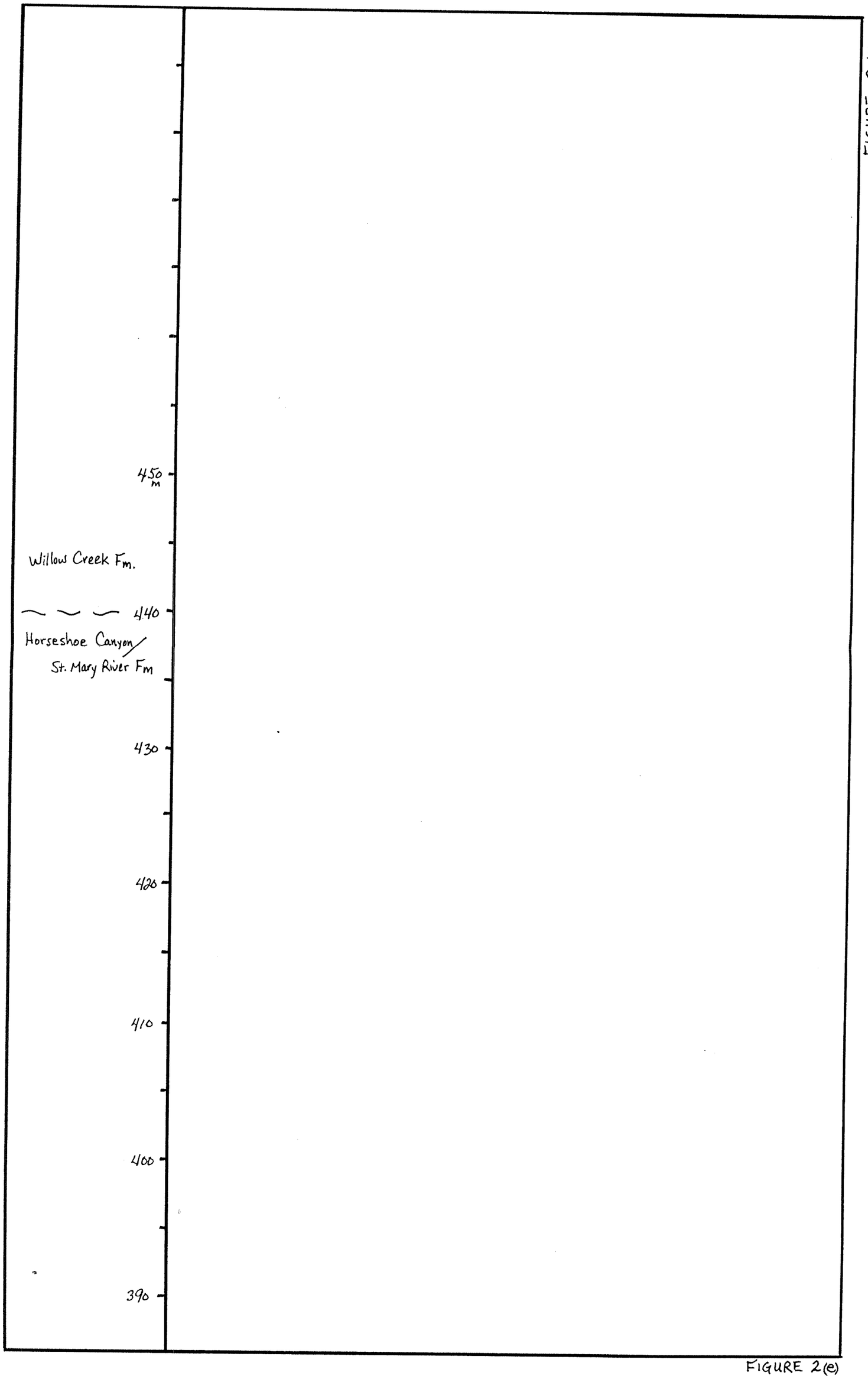



FIGURE 2 (e)

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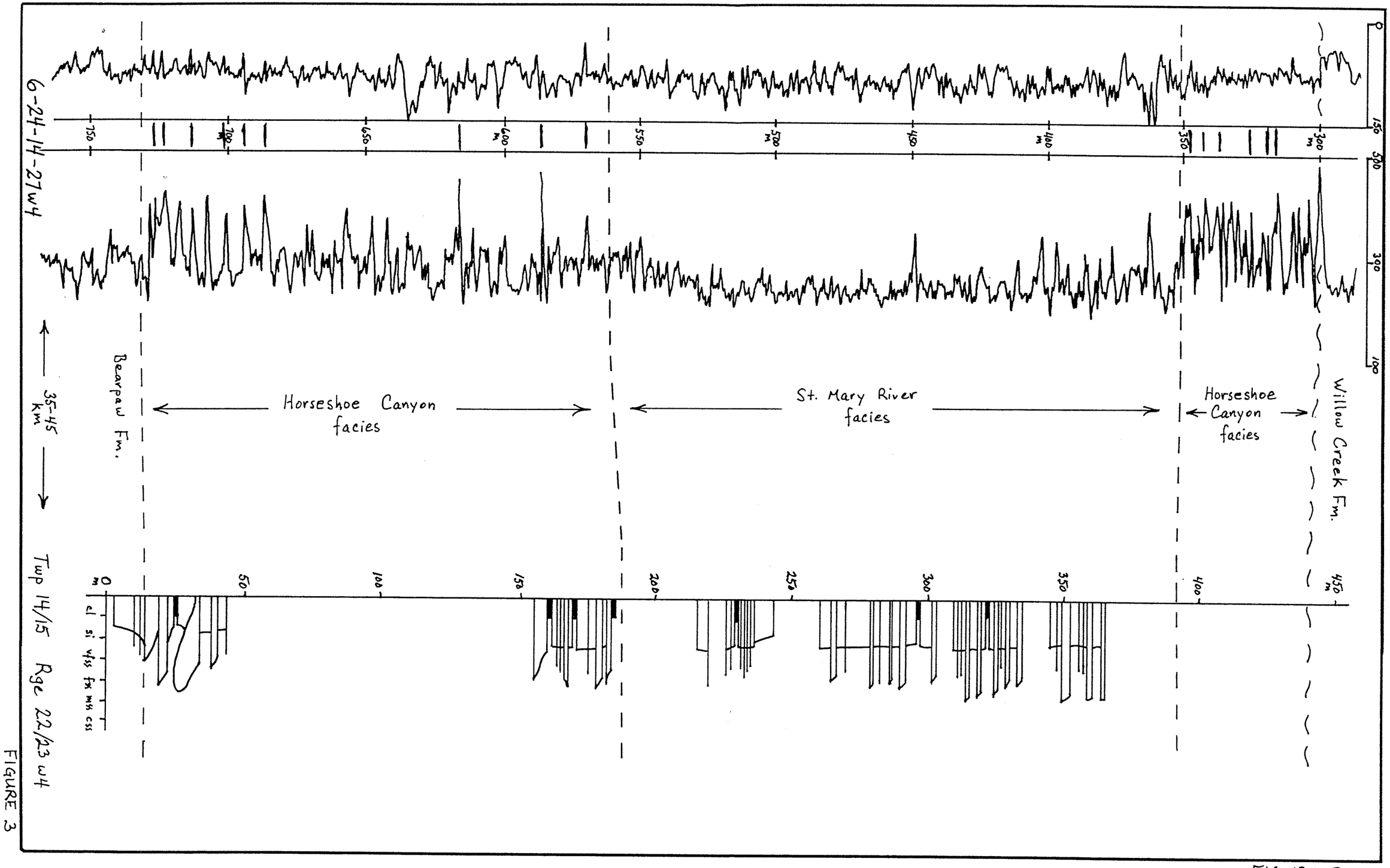


FIGURE 3

FIGURE 3