

TABLE OF CONTENTS

Frontispiece	
Synopsis	I
Table of Contents	i
INTRODUCTION	1
Project Area and Boundaries	2
Well Data Base	2
Cross-Section Grid	3
Maps	3
Text	4
Acknowledgements	4
REGIONAL TECTONIC, STRUCTURAL, STRATIGRAPHIC SETTING	6
Mississippian Global Paleogeography, Paleoclimate	6
Secular Changes in Hydrosphere and Atmosphere: Mississippian Implications	7
Proto-North American Paleotectonic-climatic setting	10
Regional Surface Geology	12
Regional Structural Setting	12
Stratigraphic Framework	15
FACIES AND ENVIRONMENTS: 1	18
Introduction	18
Classification of Limestones	18
Components of Mississippian Limestones	18
Lime Mud/Mudstones	19
Skeletal Grains (Bioclasts)	19
Echinoderms: crinoids, blastoids, asteroids, echinoids	19
Bryozoans	20
Brachiopods	22
Molluscs	22
Corals	22
Ostracods	23
Foraminifera	23
Sponges and Spicules	23
Calcispheres	24
Algae: Calcareous Green, Coralline	24
Phosphatic Grains, Vertebrate Fragments, Scales	25
Non-Skeletal or Altered Skeletal Carbonate Grains	25
Micritic peloids, pellets	25
Micritized Grains	25
Coated Grains	25
Oöids	26
Oncoids, Pisoids	27
Intraclasts, composite grains	27

CRINOID GRAIN DENSITY: SEDIMENTOLOGICAL IMPLICATIONS	28
JURASSIC FACIES	29
Nordegg Member of Fernie Formation	29
MISSISSIPPIAN FACIES	30
Turner Valley Facies	30
Shunda Facies	31
FACIES AND ENVIRONMENTS: 2	36
Pekisko Facies	36
Facies P1: Anhydrite, interbedded dolomudstone	36
Facies P2A: Dissolution breccia and karst infill	37
Facies P2B: Brecciated and displaced dolomudstone, grainstone (special case)	37
Facies P2C: Green claystone interbeds	38
Facies P3: Transgressive bioclastic mudstone to wackestone	38
Facies P4: Fenestral lime mudstone, pelpackstone	38
Facies P5: Burrowed lime/dolomudstone	39
Facies P6A: Fenestrate bryozoan dolomudstone	40
Facies P6B: homogeneous lime/dolomudstone	44
Facies P7: Cherty lime/dolomudstone	44
Facies P8: Lime/dolo-micropackstone	45
Facies P9: Algal oncolite floatstone	46
Facies P10: Crinoidal, bioclastic wackestone, packstone	46
Facies P11A: Micritized, coated grain, oolitic-bioclastic grainstone	47
Facies P11B: Crinoid, bryozoan grainstone	47
Facies P12: Silicified/cherty packstone, grainstone	50
Banff-Pekisko Boundary	50
FACIES AND ENVIRONMENTS: 3	51
The Banff-Upper Exshaw Relationship	51
Banff Facies	53
‘Intra-Banff’ shelf facies	55
Facies B1: Lime/dolomudstone, argillaceous, silty	56
Facies B2: Burrowed and mottled lime/dolomudstone	56
Facies B3: Fenestral/cryptalgal pelpackstone, mudstone	57
Facies B4: Laminated mudstones (tidal laminites)	57
Facies B5: Algal-coated oncolite floatstone	57
Facies B6: Crinoidal, bryozoan lime/dolograinstone	58
Facies B7: Thin-bedded grainstone, floatstone, wackestone event beds	60
Facies B8: Cherty mudstones	62
Facies B9: Stylonodular to bedded argillaceous wackestone/mudstone	62
Facies B10: Thin bedded/laminated argillaceous mudstone	62
Exshaw Facies	63
Introduction and Data Base	63
Regional Exshaw subdivisions, facies	63
Upper Exshaw Facies	64
Basal (Basal Banff) Banff Facies BB1: Burrowed crinoid, coral wackestone	65
Basal Banff or uppermost Exshaw Facies BB2: Sandy algal oncolite peloid floatstone	65
Basal Banff or uppermost Exshaw Facies BB2:	

Coarse/intraclastic, oolitic, bioclastic grainstone.....	65
Exshaw Facies E1: carbonaceous, calcareous siltstone	65
Upper Exshaw Facies E2: swaley bedded sandy grainstone	66
Upper Exshaw Facies E3: 'Scalarituba' burrowed calcareous sandy siltstone	66
Upper Exshaw Facies E4: Displaced grainstones	66
FACIES AND ENVIRONMENTS: 4	68
Mississippian Facies (cont.)	68
Biotic Associations and 'Cool Water' Carbonates	68
Depositional Models for Mississippian Ramps and Platforms	70
Pekisko Environments, This Report	75
Banff Environments, This Report	77
Sequence Stratigraphic Interpretation	80
DIAGENESIS AND DOLOMITIZATION	85
Introduction	85
Previous Diagenetic Analyses	86
Paragenetic Stages	87
Syndimentary Processes	87
1. Micritization	87
2. Micritic coatings and ooid envelope	87
3. Fenestral fabrics	88
4. Sabkha anhydrite	88
5. Marine phreatic cement	88
Syndimentary to Earliest Burial	88
6. Dissolution of skeletal and micritic aragonite (mineral stabilization)	88
7. Stabilization of Mg Calcite	88
Earliest Burial	89
8. Syntaxial (epitaxial) calcite cement on crinoids	89
9. Microspar rim cement	89
10. Onset of mechanical compaction	90
11. Silicification of bioclasts	90
12. Formation of nodular chert	90
13. Dolomitization of lime mudstones in saline settings	91
Early to Intermediate Burial	91
14. Onset of matrix dolomitization	91
15. Quartz cement	91
16. Coarse crystalline intergranular calcite spar cement	92
17. Onset of pressure solution, microstylolite formation	92
18. Pervasive fine crystalline matrix dolomite in argillaceous hosts	92
19. Matrix replacive dolomitization	93
20. Leaching of calcitic bioclasts	93
21. Saddle Dolomite	93
22. Anhydrite cement	93
23. Karst: dissolution, sand-clay infill, calcite cement	93
24. Calcitization of dolomite (dedolomitization)	95
Intermediate to Deep Burial	95
25. Progressive macrostylolite formation	95
26. Maturation of hydrocarbons	95
27. Late stage monocrystalline calcite	96
28. Fluorite	96

29. Sulphur	96
30. Dissolution of dolomite, calcite	96
31. Geopetal bitumen/pyrobitumen residues	96
32. Vertical stylolites	97
33. Fractures	97
34. Horizontal shear and slickensides	97
DOLOMITIZATION AND RESERVOIR DEVELOPMENT	100
Introduction	100
Analytical procedures	100
Formation of microcrystalline dolomudstones	101
Formation of dolograinstones	105
Burial-thermal history and dolomitization: timing implications	113
Burial history and regional thermal maturation	114
RESERVOIR QUALITY	116
Introduction	116
Pore types	116
Limestones	116
Primary intergranular	116
Primary shelter pores	117
Primary fenestral pores	117
Enhanced primary/secondary leached (limestone) pores	117
Special case: chert micropores	117
Dolomite/Dolostones	118
Secondary biomoldic pores	118
Secondary vug, microvug pores	118
Secondary intercrystalline pores	118
Fractures	118
Sheared and crushed fabrics (slicken): reservoir anisotropy	119
Dolomite Volume-Porosity Relationship	119
Grain Density Versus Porosity, Permeability	119
Porosity-Permeability Relationship	120
REFERENCES	121
MAPS (see following list)	
CROSS-SECTIONS (see following list)	
APPENDIX 1: Core Descriptions	in binder
APPENDIX 2: Aeromag-Gravity Report	in binder
APPENDIX 3: Micropaleontological Reports	in binder
APPENDIX 4: Data Base	in binder

Map# (folded, in report box)

1. Base map
2. Subcrop edge, structural, reef trend map
3. Aeromagnetic map
4. Structure, top Mississippian
5. Structure, top Mississippian. – 3rd order residual
6. Structure, top Mississippian. – 3rd order residual block diagram
7. Structure, top Pekisko
8. Structure, top Pekisko – 3rd order residual
9. Structure, top Pekisko – 3rd order residual, block diagram
10. Structure, top Banff
11. Structure, top Banff – 3rd order residual
12. Structure, top Big Valley
13. Structure, top Big Valley – 3rd order residual
14. Isopach, Turner Valley
15. Isopach, Shunda
16. Isopach Pekisko
17. Isopach Banff-Big Valley
18. Isopach upper Exshaw–M1–M2 to Big Valley
19. Isopach Banff to top upper Exshaw – M1 –M2
20. Structure, upper Exshaw–M1–M2 surface
21. Isopach, upper Exshaw–M1–M2: Block diagram
22. Facies maps, Pekisko
23. Facies maps, Banff
- 24A. Pekisko porous facies trends
- 24B. Middle Banff grainstone, porous facies trends
- 24C. Upper Banff porous dolomudstone, lower Banff/upper Exshaw grainstone trends
25. Ferrier area maps, ABCD
26. Ferrier area maps ABCD
27. Porosity, upper Pekisko
28. Porosity, middle and lower Pekisko
29. Porosity, upper Banff

30. Porosity, middle Banff
31. Porosity, lower Banff/Upper Exshaw
32. Production Map

Cross-Sections (folded, in report box)

A-A ₁	Regional grid
B-B ₁	Regional grid
C-C ₁	Regional grid
D-D ₁	Regional grid
E-E ₁	Regional grid
F-F ₁ , F ₁ -F ₂	Regional grid
G-G ₁ , G ₁ -G ₂	Regional grid
H-H ₁	Upper Exshaw correlation
I-I ₁	Anhydrite correlation
J-J ₁	Banff-Exshaw correlation sections
K-K ₁	Banff-Exshaw correlation sections
L-L ₁	Banff-Exshaw correlation sections
M-M ₁	Banff-Exshaw correlation sections
N-N ₁	Banff-Exshaw correlation sections
O-O ₁	Banff-Exshaw correlation sections
P-P ₁	Banff-Exshaw correlation sections
Q-Q ₁	Banff-Exshaw correlation sections
R-R ₁	Banff-Exshaw correlation sections