



TABLE OF CONTENTS

COVER

APPROVAL PAGE	ii
STATEMENT PAGE	iii
STEPS RESEARCH PROJECT AGREEMENT	iv
PREFACE	vi
TABLE OF CONTENTS.....	vii
LIST OF FIGURES	xi
LIST OF TABLES	xvi
ABSTRACT	xvii

CHAPTER I. INTRODUCTION

1.1. Background	1
1.2. Research Area	3
1.3. Formulation of Problems	3
1.4. Aims and Goals of Research	4
1.5. Significances of Research	4
1.6. Previous Researchers	5

CHAPTER II. LITERATURE REVIEW

2.1. Regional Geology.....	8
2.1.1. Tectonic Setting and Basin Configuration	8
2.1.2. Basin Evolution.....	11
2.1.3. Tectonostratigraphy.....	12
2.1.4. Regional Petroleum Systems.....	14
2.1.5. Timor-Tanimbar Region Stratigraphy and Structural Geology	18
2.1.5.1. Stratigraphy of Timor and Tanimbar	18
2.1.5.2. Structural Geology of Timor and Tanimbar	23
2.2. Theoretical Background	25
2.2.1. Provenance Study.....	25
2.2.2. Basin Study	29



2.2.3. Sedimentary Facies	30
2.2.4. Sedimentology and Depositional Environments	31
2.2.5. Stratigraphy	32
2.2.6. Tectonic and Sedimentation	36
2.2.7. Reservoir Efficiency.....	41

CHAPTER III. HYPOTHESIS AND METHODOLOGY

3.1. Hypothesis.....	44
3.2. Data Availability	44
3.3. Licensed Software Used.....	49
3.4. Research Procedures	50
3.5. Analytical Procedures	52
3.6. Flowchart of Research.....	55
3.7. Timeline of Research	56

CHAPTER IV. DATA ANALYSIS

4.1. Geochronology Data Analysis	57
4.1.1. Crystalline Rocks Dating	57
4.1.1.1. Dating Method Application.....	57
4.1.1.2. Age Distribution Analysis.....	59
4.1.2. Thermo-Chronology Analysis.....	63
4.1.2.1. Data Description.....	63
4.1.2.2. Rocks and Mineralogy	64
4.1.2.3. Burial-Cooling Analysis	66
4.1.2.4. Tectonic Setting	69
4.1.2.4.1. Mineral Deposit Data Analysis	69
4.1.2.4.2. Geodynamic Interpretation.....	72
4.2. Seismic Data Analysis	76
4.2.1. QC Seismic Data.....	76
4.2.2. Subsurface Analysis	77
4.2.2.1. Subsurface Mapping	77
4.2.2.1.1. Horizon Interpretation	77
4.2.2.1.2. Structure Interpretation	84



4.2.2.1.3. Jurassic-Triassic Interval Subsurface Map.....	90
4.2.2.2. Basin Evolution	92
4.3. Detrital Zircon Data Analysis	104
4.3.1. Zircon Dating Method.....	104
4.3.2. Age Distribution Analysis.....	106
4.4. Well Data Analysis	112
4.4.1. Well Data Description.....	112
4.4.2. Well Correlation and Stratigraphy Analysis	123
4.4.3. Depositional Environment	127
4.5. Sedimentary Petrology	129
4.5.1. Heavy Mineral Analysis.....	129
4.5.2. Sedimentary Texture and QFL Analysis.....	132
CHAPTER V. INTERPRETATION	
5.1. Provenance Study.....	136
5.1.1. Sediments Transfer/ Pathways	136
5.1.2. Sediment Quality.....	142
5.2. Paleogeography	142
5.2.1. Early-Middle Triassic Paleogeography	143
5.2.2. Late Triassic Paleogeography	144
5.3. Triassic Reservoir Distribution and Efficiency.....	146
5.3.1. Triassic Reservoir Distribution and Quality	146
5.3.2. Triassic Reservoir Efficiency	148
5.3.2.1. Clast Index	148
5.3.2.2. Infilling Index.....	149
5.3.2.3. Pore Dimension Index.....	150
5.3.2.4. Pore Correction	150
5.3.2.5. Reservoir Efficiency Index	151
5.3.3. Collision Tectonic Effects on Triassic Reservoir Properties	152
5.3.3.1. Porosity	152
5.3.3.2. Permeability	156
5.4. 1D Basin Modelling	157
CHAPTER VI. DISCUSSION	163



CHAPTER VII. CONCLUSION AND RECOMMENDATION

7.1. Conclusion	168
7.2. Recommendation.....	169

REFERENCES

APPENDIX

APPENDIX 1: Interpretation of Seismic Section

APPENDIX 2: Plate Reconstruction (Metcalfe, 2006 and Hall, 2009)



LIST OF FIGURES

Figure 1.1. Basemap of Research Area: Timor to Tanimbar Region.....	3
Figure 2.1. Setting Tectonic of Australian and Timor-Tanimbar Region.....	8
Figure 2.2. Regional Cross Section Australian–Timor Tanimbar Region	9
Figure 2.3. Basin Configuration of Australian Northwest Shelf.....	10
Figure 2.4. Timor-Tanimbar Trough to Calder Graben Seismic Section	10
Figure 2.5. Evolution of the Basin Exposure of the Northwest Australia – Eastern Indonesia from Cambrian to the Late Miocene.....	12
Figure 2.6. Stratigraphy Regional Column of Bonaparte Basin	16
Figure 2.7. Chronostratigraphic Post-Paleozoic Summary of Selected NW Shelf sub-Basins	17
Figure 2.8. Stratigraphy Column of Timor Region.....	20
Figure 2.9. Stratigraphy Column of Tanimbar Region	22
Figure 2.10. Cross-Section N-S Timor Region.....	24
Figure 2.11. Cross-Section NW-SE Tanimbar Region	24
Figure 2.12. Closure Temperatures of various chronometers	28
Figure 2.13. Stages of Integrated Data Interpretation to Make Prediction Reservoir Quality.....	29
Figure 2.14. Scheme of Facies and Depositional Environment Analysis	31
Figure 2.15. Various of Depositional Environment	32
Figure 2.16. Diagram Illustrating Interaction Sediment Supply, Eustacy, Tectonism Controlling Basin Physiography	34
Figure 2.17. Parasequence-Stacking Pattern in Parasequence-Sets	35
Figure 2.18. Basin Classification Scheme Based on Kingston et al (1983).....	37
Figure 2.19. Rift Basin Classified into Stages Pre-Rift, Rift Initiation, Rift Climax, Immediate Post-Rift, Late Post-Rift.....	39



Figure 2.20. Syn-Rift Phase Classification: Early, Mid and Late Syn-Rift	40
Figure 2.21. Cartoon of Inverted Half Graben	41
Figure 2.22. Reservoir Efficiency Index	43
Figure 3.1. Well Data Distribution in Timor Region	45
Figure 3.2. 2D Seismic Data Distribution In Northwest Shelf Australia.....	46
Figure 3.3. Geochronology (Crystalline Rock and Zircon Detrital/Sedimentary Rock), Mineral Deposits	48
Figure 3.4. Flowchart of Research	55
Figure 4.1. Interpreted Geochronology Map.....	62
Figure 4.2. Burial-Cooling Event Analysis.....	67
Figure 4.3. Structural Evolution of Timor (Sawyer et al., 1993)	68
Figure 4.4 Mineral Deposit Distribution.....	71
Figure 4.5. Mineral Deposit Classification: Continental Arcs and Back-Arc Basins (Lydon, 2007)	72
Figure 4.6. Regional Geochronology and Mineralization Zonation Map	74
Figure 4.7. Cross Section A-B of Australia – Banda Arc Region.....	75
Figure 4.8. Mistie Analysis of Line Seismic 11602.....	77
Figure 4.9. Uninterpreted and Interpted Sesimic of Section 11602	78
Figure 4.10. Uninterpreted and Interpted Sesimic of Section 11603	79
Figure 4.11. Uninterpreted and Interpted Sesimic of Section 11608	80
Figure 4.12. Uninterpreted and Interpted Sesimic of Section 11609	81
Figure 4.13. Interpreted Horizon Line Seismic 11602.....	83
Figure 4.14. Interpreted Line Seismic Section of Horizon, NW Shelf Australia <i>(data source: STEPS and Exploration Insight, 2017)</i>	84



Figure 4.15. Interpreted Structure Line Seismic 11609	88
Figure 4.16. Interpreted Line Seismic Section of Structure, NWS Australia	89
Figure 4.17. Time Structure Map of Triassic Sequences	91
Figure 4.18. Depth Structure Map of Triassic Sequences.....	91
Figure 4.19. Flattening of Paleo-Proterozoic Basement Top.....	93
Figure 4.20. Flattening of Paleozoic Top.....	94
Figure 4.21. Flattening of Triassic Top.....	95
Figure 4.22. Flattening of Early Jurassic Top.....	96
Figure 4.23. Flattening of Middle Jurassic Top	97
Figure 4.24. The Flattening of Late Jurassic Top	98
Figure 4.25. The Flattening of Early Cretaceous Top.....	99
Figure 4.26. The Flattening of Late Cretaceous Top	100
Figure 4.27. Flattening of Early Eocene Top.....	101
Figure 4.28. Flattening of Late Miocene Top	102
Figure 4.29. Recent Condition	103
Figure 4.30. The Distribution of Detrital Zircon Along Banda-Arcs	107
Figure 4.31. The Zircon age distribution of Triassic Sand, West Timor	108
Figure 4.32. The Zircon age distribution of Triassic Sand, East Timor.....	109
Figure 4.33. Zircon age distribution of Triassic Sand, Babar	110
Figure 4.34. Zircon age distribution of Triassic Sand, Tanimbar	111
Figure 4.35. Flamingo Well Description	113
Figure 4.36. Noe-Bihati Well Description	114
Figure 4.37. Noe-Fatu Well Description.....	115
Figure 4.38. Noe-Meto Well Description	116



Figure 4.39. Noe-Bisone Well Description.....	117
Figure 4.40. Noil Naito Well Description	120
Figure 4.41. Noil Tunsip Well Description.....	121
Figure 4.42. Niof Formation Well Description	122
Figure 4.43. Turbiditic Facies and Its Mechanisms (Bouma, 1962).....	124
Figure 4.44. Stratigraphy Corelation of Noe- Bihati, Meto, Fatu Well	125
Figure 4.45. Stratigraphy Corelation of Noil -Bisone, Naito, Tunsip, Niof	126
Figure 4.46. The Gross Depositional Environment Distributions.....	128
Figure 4.47. The Photograph and SEM Image Sample of: a.zircon, b.tourmaline c.apatite, d.hypersthene, e.rutile, f.garnet, g.andalusit, h.silimanit	130
Figure 4.48. Overview of Heavy Mineral Percentages from the Various Islands for Triassic Sandstones.....	131
Figure 4.49. Petrography of Triassic Sandstone in West Timor.....	132
Figure 4.50. Petrography of Triassic Sandstone in Tanimbar.....	134
Figure 4.51. QFL and QmFLt Diagram Plots of Triassic Sand along Banda-arc Islands	135
Figure 5.1. Australian Region Plate Reconstruction of 250 Ma	138
Figure 5.2. Australian Region Plate Reconstruction of 230 Ma	139
Figure 5.3. Australian Region Plate Reconstruction of 215 Ma	140
Figure 5.4. Australian Region Plate Reconstruction of 200 Ma	141
Figure 5.5. Interpreted Channeling Geometry of NE-SW Section at Triassic Sequence	143
Figure 5.6. Paleogeography Model of Early-Middle Triassic.....	144
Figure 5.7. Paleogeography Model of Late Triassic	146
Figure 5.8. Clast Index of Quartz, Feldspar, and Lithic	148
Figure 5.9. Filling Index of Clay Cement, Fully Silica Cement and	



Partially Filled by Silica.....	149
Figure 5.10. Pore Dimension Index of Pores >250 μm , Pores 25 μm – 250 μm and Pores <25 μm	150
Figure 5.11. Petrography Section Analysis of Triassic Sandstone.....	151
Figure 5.12. Schematic Diagram of Collision Tectonic Impact to Triassic Reservoir in Timor in Term of Porosity and Permeability	153
Figure 5.13. Summary of Porosity-Depth Curves for Different Lithologies	155
Figure 5.14. Paleo-Thermal Model of Northwest Shelf Australian Basin.....	157
Figure 5.15. Erosion Analysis of Manta-1 Well	157
Figure 5.16. Representation of Manta Field Basin Modelling.....	160
Figure 5.17. Margin Thrust Basin Modelling	161
Figure 5.18. Oil Seep and Gas Seep as Petroleum System Indication Timor Region	162



LIST OF TABLES

Table 2.1. Advantages and Limitations of Dating Method and Application	27
Table 3.1. The Seismic Line Data List.....	44
Table 3.2. Timeline of Research in 2017-2018.....	56
Table 4.1. Australia, Papua New Guinea and Timor Region Interpretations	59
Table 4.2. Rocks and Mineral Distribution in Australia, Papua and Timor.....	65
Table 4.3. Mineral deposit Class and Type	70
Table 4.4. Depth-Time Data Type of Flamingo Well.....	76
Table 5.1. Porosity and Permeability of Australia NWS Triassic Reservoir.....	152
Table 5.2. Converting Time Domain to Depth Domain-Estimating Porosity ...	154
Table 5.3. Porosity-Depth Relationship	155