

Content

	Page
Declaration	i
Acknowledgements	iii
Abstract	iv
Uittreksel	vi

Chapter 1: Introduction

1.1 Problem Statement	1
1.2 Objectives of Study	5
1.2.1 Constraining the Age of Paleoproterozoic Sedimentary Basins	6
1.2.2 Defining Detrital Zircon Populations within Late Archean to Late Paleoproterozoic Sedimentary Sequences	7
1.2.3 Tectono sedimentary model	9
1.3 Methods	9
1.4 References	10



Chapter 2: General Geological Setting and Overview of Available Age Data

2.1 Introduction	18
2.2 Kaapvaal Craton	18
2.3 Cover Sequences	19
2.4 Surrounding Mobile Belts and Cratons	25
2.5 References	27

Chapter 3: Radiometric Ages of the Hekpoort and Ongeluk Formations of the Transvaal Supergroup Revisited

3.1 Introduction	35
3.2 Regional Geological Setting	39

3.3 Sampling	40
3.4 Zircon Analyses	42
3.4.1 SHRIMP Analyses of Sample EBA-1 from the Hekpoort Lava	43
3.4.2 TIMS Analyses of Zircons from Sample RHK-1 of the Hekpoort Lava	48
3.4.3 SHRIMP Analyses of Zircons from the Ongeluk Formation	48
3.5 Discussion	52
3.5.1 Evaluation of Radiometric Ages	52
3.5.2 Geological Implications	53
3.6 Conclusion	54
3.7 Reference List	55

**Chapter 4: Precise SHRIMP U-Pb Ages for Quartz Porphyritic
Lavas Near the Base Part of the Waterberg Group**

4.1. Introduction	61
4.2 Geological Setting	61
4.2.1 Regional Overview	62
4.2.2 Nylstroom Area	63
4.2.3 Rust de Winter Outlier	67
4.3 Geochronology	67
4.3.1 Swaershoek Quartz Porphyry	67
4.3.2 Rust de Winter Quartz Porphyry	69
4.4 Discussion	69
4.5 Conclusion	75
4.6 References	75



**Chapter 5: A Precise Zircon SHRIMP Age for the Post-Tectonic
Entabeni Granite of the Limpopo Metamorphic Belt : Implications for
the Age of the Soutpansberg Group**

5.1 Introduction	79
-------------------------	-----------

5.2 Geological and Geochronological Constraints	81
5.3 Zircon Geochronology	83
5.4 Discussion	83
5.5 Conclusion	89
5.6 References	89

Chapter 6: Provenance of Detrital Zircons from the Wolkberg Group and Transvaal Supergroup

6.1 Introduction	94
6.2 Stratigraphic Setting	97
6.2.1 Wolkberg Group and Correlatives	97
6.2.2 Transvaal Supergroup	100
6.2.2.1 Chuniespoort and Ghaap Groups	100
6.2.2.2 Pretoria and Postmasburg Groups	103
6.3 Detrital Zircon Studies	110
6.3.1 Sampling	110
6.3.1.1 Schelem Formation	110
6.3.1.2 Deutschland Formation	110
6.3.1.3 Timeball Hill Formation	113
6.3.1.4 Hekpoort Formation	114
6.3.1.5 Daspoort Formation	115
6.3.1.6 Magaliesberg Formation	117
6.3.2 Analyses and Results	118
6.3.2.1 Schelem Formation	119
6.3.2.2 Deutschland Formation	123
6.3.2.3 Timeball Hill Formation	129
6.3.2.4 Hekpoort Formation	133
6.3.2.5 Daspoort Formation	138
6.3.2.6 Magaliesberg Formation	142
6.4 Discussion	151
6.4.1 Stratigraphic Variation in Detrital Zircon Ages	151



6.4.1.1 Variation in Youngest Detrital Zircons	151
6.4.1.2 Variation in Zircon Populations	153
6.4.2 Provenance and Tectonic Model	156
6.4.2.1 Wolkberg Group Provenance- Implications for the Origin of the Limpopo Belt	157
6.4.2.2 Chuniespoort/Campbellrand to Timeball Hill Times	160
6.4.2.3 Hekpoort to Magalies Times	163
6.4.2.4 Summary of Tectonic Model	164
6.5 Conclusion	166
6.6 Further Work	167
6.7 References	167

Chapter 7: Detrital Zircon Provenance of the Waterberg Group

7.1 Introduction	177
7.2 Geologic Setting	180
7.3 Stratigraphic Setting of Samples	181
7.3.1 Swaershoek Formation	181
7.3.2 Sandriviersberg Formation	183
7.4 Detrital Zircon Analyses	184
7.4.1 Swaershoek Formation	185
7.4.2 Sandriviersberg Formation	189
7.5 Discussion	194
7.5.1 Provenance of the Waterberg Group	194
7.5.2 Tectonic Model	198
7.6 References	204

Chapter 8: Ages of detrital zircon populations from the Proterozoic Soutpansberg Group and correlative Palapye Group and Roodeberg Formation, Southern Africa and Botswana

8.1 Introduction	210
-------------------------	------------

8.2 Stratigraphic Setting and Sampling	214
8.2.1 Soutpansberg Group	214
8.2.1.1 General Stratigraphy	214
8.2.1.2 Wylliespoort Formation	217
8.2.1.3 Ngwanedsi Formation	220
8.2.2 Palapye Group	220
8.2.2.1 General Stratigraphy and Sampling	220
8.2.2.2 Selika Formation	222
8.2.2.3 Tswapong Formation	226
8.2.3 Roodeberg Formation	230
8.3 Stratigraphic Correlation Working Model	231
8.4 Zircon Analyses	236
8.4.1 Soutpansberg Group	236
8.4.1.1 Wylliespoort Formation	237
8.4.1.2 Ngwanedsi Formation	241
8.4.2 Palapye Group	243
8.4.2.1 Selika Rhyolite	243
8.4.2.2 Manganese Member of the Selika Formation	243
8.4.2.3 Tswapong Formation	243
8.4.3 Roodeberg Formation	256
8.6 Discussion	258
8.6.1 Stratigraphic Variation in Detrital Zircon Populations	258
8.6.2 Revised Stratigraphic Correlations	262
8.6.3 Possible Source Areas	267
8.6.4 Tectonic model	269
8.7 Reference List	272



Chapter 9: A Tectonic Model for the Kaapvaal Craton from 2.7-1.8Ga

9.1 Introduction	278
9.2 Ages of Igneous Events	281
9.3 Stratigraphic Variation in Detrital Zircon Populations	283

9.3.1 Variation in youngest zircons	285
9.3.2 Variation in Provenance Age Populations	286
9.3.3 Gaps in Detrital Zircon Age Populations	289
9.4 Tectonic model and source areas for detrital zircons	290
9.4.1 Provenance of the Wolkberg Group and Implications for Development of Limpopo Metamorphic Complex	290
9.4.2 Provenance and Tectonic Setting of the Pretoria Group	295
9.4.3 Provenance of the Waterberg Group and Implications of the Limpopo Metamorphic Complex	297
9.4.4 Provenance and Origin of the Soutpansberg, Palapye and Roodeberg red bed successions	299
9.5 Conclusion	300
9.6 References	303

Appendix I
Analytical Techniques

1.1 Fieldwork	311
1.2 Sample Collection	312
1.3 Sample Preparation	312
1.4 SHRIMP Analyses	313
1.5 References	314

Appendix II

Description of Detrital Zircon Populations	315
---	------------

Appendix III

Aeromagnetic image of Central and Southern Africa	326
--	------------