

**The geology of the Mozambique belt and the Zimbabwe craton
around Manica, Western Mozambique.**

By

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I Hereby certify that this thesis is my own work except where specifically acknowledged and that this thesis has not been submitted elsewhere for the purposes of being awarded a degree.

António dos Santos Tchuê Mamede

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THE GEOLOGY OF THE MOZAMBIQUE BELT AND THE ZIMBABWE CRATON AROUND MANICA, WESTERN MOZAMBIQUE

Table of contents

	Page no.
Acknowledgements	iii
Table of contents	iv
List of figures	viii
List of tables	xiii
List of appendices	xiv
Abstract	xv
Uittreksel	xvi
1. INTRODUCTION	1
1.1. Introduction	1
1.2. Regional geological setting	1
1.3. Previous geological work	2
2. LITHOSTRATIGRAPHY	5
2.1. Introduction	5
2.2. Field distribution and age relationship of lithostratigraphic units	8
3. MANICA GREENSTONE BELT	10
3.1. Introduction	10
3.2. Field description	10
3.2.1. Macequece Formation	10
3.2.2. M'Beza/Vengo Formation	12
3.3. Petrography	13
3.4. Chemistry	18
3.5. Interpretation of metamorphism and chemistry	20
3.5.1. Metamorphism	21
3.5.2. Chemistry	23
4. ARCHAEOAN TO EARLY PROTEROZOIC GRANITOID GNEISSES OF THE ZIMBABWE CRATON-	26
4.1. Introduction	26
4.2. Field description	26
4.2.1. Vumba Granite Gneiss	26
4.2.2. Messica Granite Gneiss	27
4.3. Petrography	28
4.4. Chemistry	33



4.4.1. Introduction	33
4.4.2. Major element chemistry	34
4.4.3. Trace element chemistry	37
4.4.4. Radiogenic isotope chemistry	41
4.4.5. Discussion and conclusions	43
5. FRONTIER FORMATION	44
5.1. Introduction	44
5.2. Field description	44
5.3. Petrography	45
5.4. Interpretation	47
6. VANDUZI MIGMATITE GNEISS	48
6.1. Introduction	48
6.2. Field Description	48
6.3. Petrography	49
6.4. Interpretation of petrography	50
6.5. Leucosome development history	51
6.6. Melt P-T conditions	52
7. CHIMOIO GRANODIORITIC GNEISS	54
7.1. Introduction	54
7.2. Field description	54
7.3. Petrography	55
7.3.1. Interpretation of Petrography	58
7.4. Chemistry	59
7.4.1. Major element chemistry	59
7.4.2. Trace element chemistry	64
7.4.3. REE chemistry	64
7.4.4. Radiogenic Rb/Sr isotope chemistry	64
7.5. Discussion	65
8. NHANSIPFE GRANITIC ORTHOGNEISS	66
8.1. Introduction	66
8.2. Field description	66
8.3. Petrography	70
8.3.1. Interpretation of petrography	74
8.4. Chemistry	75
8.4.1. Introduction	75
8.4.2. Major element chemistry	75
8.4.3. Trace element chemistry	77
8.4.4. REE chemistry	77

8.4.5. Radiogenic Rb/Sr chemistry	80
8.4.6. Discussion and interpretation of chemistry	80
9. MAFIC INTRUSIONS	84
9.1. Introduction	84
9.2. Field description	84
9.3. Petrography	85
9.3.1 Interpretation of petrography	88
9.4. Chemistry	90
9.4.1. Interpretation of chemistry	93
10. TCHINHADZANDZE GRANODIORITE GNEISS	96
10.1. Introduction	96
10.2. Field description	96
10.3. Petrography	96
10.4. Chemistry	99
10.4.1. Major element chemistry	99
10.4.2. Trace element chemistry	103
10.5. Discussion and conclusions	103
11. STRUCTURAL GEOLOGY	106
11.1. Introduction	106
11.2. Description of structures	106
11.2.1. Domain 1	106
11.2.2. Domain 2	108
11.2.3. Domain 3	108
11.2.4. Domain 4	111
11.3. Conclusions	113
12. METAMORPHIC HISTORY	115
12.1. Introduction	115
12.2. Metamorphism	115
12.2.1. Low grade terrain	115
12.2.2. Medium to high grade terrain	116
12.3. Thermobarometry	116
12.3.1. Introduction	116
12.3.2. Thermometry	120
12.3.3. Barometry	121
12.3.4. Discussion of petrographic and thermobarometric results	122
12.4. Thermochronology	122
12.4.1. Introduction	122
12.4.2. Discussion of results	123



12.5. Metamorphic history	125
13. SUMMARY OF CONCLUSIONS	126
13.1. Lithologies	126
13.2. Deformation	127
13.3. Metamorphism	128
13.4. Isotope chemistry	129
13.5. Summary of the geology of the study area and comparison with Antarctica	131
13.6. Proposed geological model	134
References	136

List of Figures	Page no.
1.1. Location of the study area shown in the context of the regional geological structure of Southern Africa -----	2
2.1. Major lithological units within the study area -----	6
2.2. Sampling locality map -----	5
3.1. Pinkish quartz-sericite schist intercalated with dark brown banded iron formation -----	11
3.2. Folding in the andalusite chloritoid schist -----	12
3.3. Sub - to idiomorphic opaque minerals associated with fine grained chlorite and talc -----	14
3.4. Chlorite and carbonate wrapping around and invading opaque minerals. -----	14
3.5. Medium grained carbonate, antigorite and fine grained idiomorphic opaque minerals filling cracks -	15
3.6. Medium grained idiomorphic chloritoid grain exhibiting hour glass zoning in a matrix of fuchsite --	16
3.7. Al ₂ O ₃ , FeO and CaO versus MgO variation diagram -----	19
3.8. Variation diagram plotting Cr, Ni and V versus MgO -----	19
3.9. ACF diagram of mineralogy and chemistry of ultramafic and pelitic rocks -----	20
3.10. Isobaric reaction curves depicting phase relationships in mafic to ultramafic rocks -----	21
3.11. Low temperature phase relationship in mafic to ultramafic rocks at isobaric pressure of 2k bar ----	22
3.12. Phase relationships in metamorphism of pelitic rocks presented in a P-T diagram -----	23
3.13. Irvine and Baragar (1971) tholeiitic versus calc-alkaline series discriminant diagram of the Macequece Formation -----	24
3.14. Jensen (1976) discriminant diagram for the fields of komatiites, tholeiites and calc-alkaline rocks of the Macequece Formation -----	24
3.15. Le Maitre (1989) discriminant diagram for various types of basalts of the Macequece Formation --	25
4.1. Fine grained amphibolitic enclaves in the Vumba Granite Gneiss -----	27
4.2. Quartz, microcline, plagioclase, biotite, muscovite and titanite in the Vumba Granite Gneiss -----	28
4.3. Feldspar phenocrysts (with biotite wrapped around), microcline and fine grains of quartz in the Messica Granite Gneiss -----	29
4.4. Finer quartz grains exhibiting polygonal texture in the Vumba Granite Gneiss -----	31
4.5. Biotite occurring at quartz grains boundaries in the Messica Granite Gneiss -----	32
4.6. Variation diagram plotting Na ₂ O and K ₂ O versus SiO ₂ of Messica and Vumba granite Gneisses ----	35
4.7. Variation diagram plotting FeO, MgO and CaO of Messica and Vumba granite Gneisses -----	35
4.8. Alumina-saturation Index of Vumba and Messica Granite Gneiss -----	36
4.9. Streckeisen (1976) QAP plot of Vumba and Messica granitoids -----	36
4.10. Irvine and Baragar (1971) calc-alkaline versus tholeiite discriminant diagram plot of Vumba and Messica granitoids -----	39
4.11. Jensen (1976) cationic diagram plot of Vumba and Messica granitoids -----	39
4.12. Plot of Vumba and Messica granitoids data in the Pearce <i>et al.</i> (1984) discriminant diagram ----	40
4.13. Chondrite normalized REE abundance variation diagram of Vumba and Messica granitoids data -	40
4.14. Rb/Sr isotope data diagram of Messica granitoids -----	42

5.1. Very resistant quartzite ridge in the Frontier Formation	44
5.2. Biotite flakes and sillimanite needles wrapping around garnet grain in the Garuzo schist	46
5.3. AFM diagram of the Frontier Formation around Garuzo	46
5.4. P-T conditions relevant to the Frontier Formation	47
6.1. Folding in the leucosome bands of the two stages, stromatic gneiss near Vanduzi	48
6.2. First stage stromatic migmatite and second generation stictolithic migmatite near Matsinho	49
6.3. Plot of the Vanduzi migmatite Gneiss mineralogical assemblage in the ACF diagram	51
6.4. Nomenclature of stromatic migmatite	51
6.5. Granite solidus representing partial melting during the formation of Vanduzi Migmatite Gneiss	52
7.1. Sub-horizontal foliation concordant to fine layering in the Chimoio Granodioritic Gneiss	54
7.2. Boudinage in the deformed migmatitic gneiss in the Chimoio Granodioritic Gneiss	55
7.3. Green hornblende, brownish laths of biotite, plagioclase, apatite and felsic inclusions in hornblende in the Chimoio Granodiorite Gneiss	56
7.4. Myrmeckitic intergrowths in the gneisses of Chimoio Granodiorite Gneiss	57
7.5. Equilibrium mineral assemblage of Chimoio Granodiorite Gneiss shown in an ACF diagram	58
7.6. Normative Anorthite-Albite-Orthoclase ternary diagram of Chimoio Granodiorite Gneiss	60
7.7. Shand's aluminum saturation Index diagram of Chimoio Granodiorite Gneiss	60
7.8. Irvine and Baragar (1971) discriminant diagram for the tholeiites and calc-alkaline fields of the Chimoio Granodiorite Gneiss	61
7.9. Streckeisen (1976) AQP ternary diagram of the Chimoio Granodiorite Gneiss	61
7.10. Ba-Rb-Sr El Bouseily and El Sokkary (1975) discriminant diagram of the Chimoio Granodiorite Gneiss	62
7.11. Pearce <i>et al.</i> (1984) discriminant diagram for the fields of Within-Plate, Syn-Collisional and Volcanic-Arc and Orogenic granitoids of Chimoio Granodiorite Gneiss	62
7.12. Pearce <i>et al.</i> (1984) discriminant diagram for the fields of Within-Plate, Syn-Collisional Volcanic-Arc and Orogenic granitoids of Chimoio Granodiorite Gneiss	63
7.13. Chondrite normalized REE abundance variation diagram of Chimoio Granodiorite Gneiss	63
7.14. Diagram of isotopic data of Chimoio Granodiorite Gneiss	65
8.1. Quartz feldspatic partial melt bands in the Nhansipfe gneisses	66
8.2. Pegmatitic veins forming intercalated bands in the Nhansipfe gneisses	67
8.3. S ₁ and S ₂ foliations in the megacrystic gneiss near Mombeza	67
8.4. Infolding in the deformation induced fine grained gneiss in the megacrystic gneiss in Matsinho	68
8.5. Folded felsic bands offset by subvertical faults in the Nhansipfe gneiss	68
8.6. Feldspar stretching in the megacrystic gneiss near Chibata	69
8.7. Mafic enclaves mesoboudins in the megacrystic gneiss near Chibata	69
8.8. Myrmeckitic intergrowths in the Nhansipfe gneisses	72
8.9. Biotite flakes forming planar foliation in the Nhansipfe gneisses	72
8.10. Hornblende mantled xenoblastic and cracked garnet and idioblastic garnet grains along	

plagioclase cracks from the Nhansipfe Granitic orthogneiss -----	73
8.11. ACF diagram plotting mineral and chemistry of the Nhansipfe Granitic Orthogneiss-----	73
8.12. Harker diagram of MgO, CaO and total iron versus SiO ₂ from Nhansipfe Granitic Orthogneiss ----	76
8.13. Harker variation diagram of TiO ₂ , P ₂ O ₅ and K ₂ O versus SiO ₂ and of isothermal curves drawn on the basis of TiO ₂ of the Nhansipfe Granitic Orthogneiss -----	76
8.14. Saturation surface thermometry diagram utilizing P ₂ O ₅ and Zr contents and solubility calibrations from Harrison and Watson (1984) and Watson and Harrison (1983) of the Nhansipfe Granitic Orthogneiss -----	78
8.15. Ba-Sr-Rb El Bouseily and El Sokkary (1975) discriminant diagram of the Nhansipfe Granitic Orthogneiss -----	78
8.16. Pearce <i>et al.</i> (1984) discriminant diagram for the fields of Within-Plates, Syn-Collisional, Volcanic-Arc and Orogenic Granitoids of the Nhansipfe Granitic Orthogneiss -----	79
8.17. Chondrite normalized REE abundance variation diagram of the Nhansipfe Granitic Orthogneiss -	79
8.18. Diagram plotting isotope data of the Nhansipfe Granitic Orthogneiss -----	81
8.19. Whalen <i>et al.</i> (1987) discriminant diagram for anorogenic and orogenic granites of the Nhansipfe Granitic Orthogneiss -----	81
8.20. Whalen <i>et al.</i> (1987) Zr versus Ga/Al discriminant diagram of the Nhansipfe Granitic Orthogneiss -----	82
8.21. Eby (1992) discriminant diagram for the A1 and A2 granites of the Nhansipfe Granitic Orthogneiss -----	82
9.1. Patches of partial melts in amphibolite intruding a megacrystic granite -----	85
9.2. Mineralogy of mafic rocks with igneous rocks -----	86
9.3. Granoblastic texture in the metamorphic rocks from mafic intrusions -----	86
9.4. Idioblastic fine-grained garnet associated with plagioclase and amphibole from mafic intrusions -----	87
9.5. Xenoblastic grains of garnet with inclusions of plagioclase in mafic intrusions -----	88
9.6. ACF diagrams of the chemistry and the mineralogical assemblages of the mafic intrusions -----	89
9.7. Chemographies representing the metamorphism in the mafic intrusions -----	89
9.8. FeO and TiO ₂ versus MgO variation diagram of mafic intrusions -----	91
9.9. CaO versus MgO variation diagram of mafic intrusions -----	91
9.10. Variation diagram plotting Cr and Ni versus MgO of mafic intrusions -----	92
9.11. V versus MgO variation diagram of Mafic intrusions -----	92
9.12. Plot of the mafic intrusions chemistry in the Jensen (1976) discriminant diagram for the fields of komatiites, tholeiites and calc-alkaline -----	93
9.13. Plot of the mafic intrusions chemistry the Irvine and Baragar (1971) discriminant diagram for the fields of alkaline and sub-alkaline rocks -----	94
9.14. Plot of the mafic intrusions chemistry in Irvine and Baragar (1971) discriminant diagram for the fields of tholeiites and calc-alkaline -----	94

9.15. MORB normalized trace elements abundance variation diagram of the mafic intrusions -----	95
9.16. Chondrite normalized trace elements abundance variation diagram of the Mafic Intrusions -----	95
10.1. Inequigranular medium grained texture in the Tchinhadzandze Granodiorite Gneiss -----	97
10.2. Preferred orientation of biotite and hornblende in the Tchinhadzandze Granodiorite Gneiss -----	97
10.3. Albite-Anorthite-Orthoclase discriminant diagram of the Tchinhadzandze Granodiorite Gneiss ----	100
10.4. Shand's alumina-saturation Index (1947) diagram of the Tchinhadzandze Granodiorite Gneiss ---	100
10.5. Al ₂ O ₃ and Fe ₂ O ₃ versus SiO ₂ variation diagram of the Tchinhadzandze Granodiorite Gneiss -----	101
10.6. MgO, CaO and FeO versus SiO ₂ variation diagram of the Tchinhadzandze Granodiorite Gneiss -----	101
10.7. Na ₂ O and K ₂ O versus SiO ₂ variation diagram of the Tchinhadzandze Granodiorite Gneiss -----	102
10.8. Plot of chemistry of the Tchinhadzandze Granodiorite Gneiss in the Irvine and Baragar (1971) discriminant diagram for the tholeiite and calc-alkaline fields -----	102
10.9. Chondrite normalized trace elements abundance variation diagram of the Tchinhadzandze Granodiorite Gneiss -----	104
10.10. Chondrite normalized REE abundance variation diagram of the Tchinhadzandze Granodiorite Gneiss -----	104
10.11. Ba-Rb-Sr El Bouseily and El Sokkary (1975) discriminant digram of the Tchinhadzandze Granodiorite Gneiss -----	105
10.12. Pearce <i>et al.</i> (1984) tectonic discriminant diagram of the Tchinhadzandze Granodiorite Gneiss -----	105
11.1. Map showing planar fabric directions and the subdivision of the study area in 4 domains and subdomains I and II -----	106
11.2. Stereonets of the Manica Greenstone Belt -----	107
11.3. Stereonets of the Vumba Granite Gneiss -----	107
11.4. Stereonets of the M'Beza / Vengo Formation -----	108
11.5. Stereonets of the Messica Granite Gneiss -----	109
11.6. Stereonets of the Frontier Formation -----	109
11.7. Stereonets of the Vanduzi Migmatite Gneiss -----	110
11.8. Stereonets of planar fabrics in the Nhansipfe Granitic Orthogneiss -----	110
11.9. Stereonets of linear fabrics in the Nhansipfe Granitic Orthogneiss -----	112
11.10. Stereonets of the Chimoio Grnodioritic Gneiss -----	112
11.11. Stereonets of the Tchinhadzandze Granodiorite Gneiss -----	113
12.1. Thermobarometry results of the Mafic Intrusions and inclusions from Garuzo-Chibata area, within the Mozambique Metamorphic Province -----	119
12.2. Thermobarometry results of the Mafic Intrusions and inclusions from Mombeza area, within the Mozambique Metamorphic Province -----	119



12.A. Cumulative Ar versus age diagram of Vumba Granitoids	124
12.B. Cumulative Ar versus age diagram of Vumba Granitoids	124
12.C. Cumulative Ar versus age diagram of Messica Granitoids	124
12.D. Cumulative Ar versus age diagram of Chimoio granitoids	124
12.E. Cumulative Ar versus age diagram of Nhansipfe granitoids	124
12.F. Cumulative Ar versus age diagram of Frontier Formation quartzite	124
13.1. Metamorphic blocks separated by steep zones which defines shear zones	129
13.2. Diagram of initial $^{87}\text{Sr}/^{66}\text{Sr}$ ratios versus age of some lithological units	130
13.3. Temperature-time diagram for the mineralogical Ar/Ar and whole rock Rb/Sr data of some granitoids and metasediments in the study area	131
13.4. Temperature-time diagram for the various mineralogical and whole rock Rb/Sr data of some rocks from H.U. Sverdrupfjella	131

List of Tables	Page no.
2.1. Stratigraphic framework of the study area -----	7
3.1. Mineralogy of talc-chlorite schists and carbonate antigorite hornfels -----	13
3.2. Mineralogy of quartz-sericite and chloritoid-andalusite schists -----	16
3.3. Mineralogy of M'Beza/Vengo Formation -----	17
3.4. Chemical composition of the mafic to ultramafic rocks of the Macequece Formation -----	18
4.1. Mineralogical composition of Vumba Granite Gneiss -----	29
4.2. Mineralogical composition of Messica Granite Gneiss -----	30
4.3. Major element chemistry and CIPW normative compositions and classifications of Vumba and Messica granitoids -----	33
4.4. Trace element compositions of the Messica and Vumba granitoids -----	37
4.5. Radiogenic isotope data of Messica and Southern Vumba granitoids -----	41
4.6. Radiogenic isotope data of Northern Vumba granitoids -----	41
5.1. Mineralogical assemblage of Frontier Formation -----	45
6.1. Mineralogical assemblage of the Vanduzi Migmatite Gneiss -----	50
7.1. Mineral assemblage of the Chimoio Granodioritic Gneiss -----	56
7.2. Major and trace elements composition of the Chimoio Granodioritic Gneiss -----	59
7.3. REE composition of the Chimoio Granodioritic Gneiss -----	64
7.4. Radiogenic isotope composition of Chimoio Granodioritic Gneiss -----	64
8.1. Modal proportions of minerals in the gneisses -----	71
8.2. Major and trace elements of Nhansipfe Granitic Orthogneiss -----	75
8.3. Rare earth elements composition of Nhansipfe Granitic Orthogneiss -----	77
8.4. Rb/Sr radiogenic isotope data of gneisses from Nhansipfe locality -----	80
9.1. Mineralogical assemblage of the mafic intrusions -----	85
9.2. Major and trace elements compositions of the mafic intrusions -----	90
10.1. Mineralogical assemblage of Tchinhadzandze Granodiorite Gneiss -----	96
10.2. Major and trace elements composition of Tchinhadzandze Granodiorite Gneiss -----	99
10.3. REE composition of Tchinhadzandze Granodiorite Gneiss -----	103
12.1. Summary of analytical data used in the thermobarometry of the mafic intrusions and inclusions within the Mozambique Metamorphic Province -----	117
12.2. Thermobarometry data from the mafic intrusions and inclusions within the Mozambique Metamorphic Province -----	120
12.3. Thermochronological data from various lithological units -----	125
13.1. Summary and comparison of the geology of the study area and Antarctica -----	132

List of appendices

1. Table showing samples per lithological unit, locality and coordinates of samples used in geochronology, geothermobarometry and thermochronology
2. Table of microprobe analyses of minerals used in the thermobarometry
3. Description of analytical techniques

THE GEOLOGY OF THE MOZAMBIQUE BELT AND THE ZIMBABWE CRATON AROUND MANICA, WESTERN MOZAMBIQUE.

Abstract

The study area comprises the Archaean Manica Greenstone Belt and the Vumba Granite Gneiss, the Proterozoic Messica Granite Gneiss of the Zimbabwe Craton, the possibly allochthonous metasedimentary sequence of the Frontier Formation, the granitoids of the Mozambique Metamorphic Province, which are subdivided into Vanduzi Migmatite Gneiss, the Chimoio Granodiorite Gneiss, the Nhansipfe Granitic Orthogneiss and the Pan-African Tchinhadzandze Granodiorite Gneiss. The rock sequences in the two provinces are cut by mafic intrusions.

The greenstone belt comprises mafic to ultramafic and pelitic schists and serpentinites of the Macequece Formation and metasediments of the M'Beza/Vengo Formation. The mafic to ultramafic schists and the serpentinites have chemical signatures of komatiites. The Vumba Granite Gneiss comprises the northern and southern Vumba granitoids dated at 3885 ± 255 Ma, and 2527 ± 632 Ma respectively. They vary from metaluminous to peraluminous, have normative QAP compositions of granodiorites and monzogranites and chemical signatures of mantle fractionates and volcanic-arc granitoids. The Early Proterozoic Messica Granite Gneiss is 2348 ± 267 Ma old, is metaluminous and has QAP compositions of monzogranites and chemical signatures suggesting a crustal source and a volcanic-arc environment. The Frontier Formation comprises quartzite and pelitic schists. The Vanduzi Migmatite Gneiss comprises stromatic and stictolithic types. Two mineral assemblages are distinguished as they contain either garnet or hornblende. The Mid-Proterozoic Chimoio Granodioritic Gneiss is 1236 ± 201 Ma old. It is granodioritic and metaluminous with a chemical signature of volcanic-arc granitoids. The Late Proterozoic Nhansipfe Granitic Orthogneiss is dated at 981 ± 83 Ma and varies from metaluminous to peraluminous. The Rb, Nb and Y contents are typical of within-plate granitoids, whereas Ga, Zr, Al, Ce and Y are typical of A-type granitoids. The age of the mafic intrusions falls between ~ 500 and ~ 1100 Ma. The rocks typically contain plagioclase, hornblende and clinopyroxene with or without garnet and orthopyroxene. The chemistry of the rocks is typical of sub-alkaline tholeiites. The Tchinhadzandze Granodiorite Gneiss may be part of a Pan-African event which lasted till ~ 450 – ~ 500 Ma. The normative feldspar compositions and Rb, Ba and Sr contents are typical of granodiorites. It is metaluminous and has Rb, Y and Nb contents typical of volcanic-arc granitoids.

The planar fabrics in the Archaean granite-greenstone belt are characterized by E-W to SW-NE strikes and steep dips to N and S and to NW and SE. The mineral lineations and fold axes plunge 60° and 30° respectively towards the E. Within the Mozambique belt, around the central part and in the extreme east of the study area, the planar fabrics have essentially N-S strikes and steep dips to E and W in contrast with complex deformation observed in the migmatites and megacrystic granitoids.

The study area can be subdivided into three metamorphic blocks, namely, one of low-grade greenschist facies, one of medium-grade amphibolite facies and a third block of high-grade metamorphism.

Uittreksel

Die studiegebied behels die Argeïese Manica Groensteengordel en die Vumba Granietgneis, die Proterosoïese Messica Graniet Gneis van die Zimbabwe-kraton, die moontlik allochtone metasedimentêre opeenvolging van die Frontier Formasie, die granitoïede van die Mosambiek Metamorfe Provinsie wat onderverdeel word in die Vanduzi Migmatiet Gneis, die Chimoio Granodioriet Gneis, die Nhansipfe Granitiese Ortogneis en die Pan-Afrikaanse Tchinhadzandze Granodioriet Gneis. Die gesteente-opeenvolgings in die twee provinsies word gesny deur mafiese indringings.

Die groensteengordel bestaan uit mafiese tot ultramafiese en pelitiese skiste en serpentiniete van die Macequece Formasie en metasedimente van die M'Beza/Vengo Formasie. Die mafiese tot ultramafiese skiste en die serpentiniete het chemiese kenmerke van komatiïete. Die Vumba Graniet Gneis bestaan uit die noordelike en suidelike Vumba granitoïede wat op 3885 ± 225 Ma en 2527 ± 632 Ma onderskeidelik gedateer is. Hulle varieer van metalumineus tot peralumineus, het normatiewe QAP samestellings van granodioriete en monso-graniete en chemiese kenmerke van mantelfraksionate en vulkaniese-boog granitoïede. Die Vroeg-Proterosoïese Messica Graniet Gneis is 2348 ± 267 Ma oud, is metalumineus, het QAP samestellings van monso-graniete en chemiese kenmerke wat op korsoorsprong en vulkaniese-boog granitoïede dui. Die Frontier Formasie bestaan uit kwartsiet en pelitiese skis. Die Vanduzi Migmatiet Gneis behels stromatiese en stiktolitiese tipes. Twee mineraalversamelings word onderskei deurdat hulle óf granaat óf horingblende bevat. Die Middel-Proterosoïese Chimoio Granodioriet Gneis is 1236 ± 201 Ma oud. Dit is metalumineus en is tipies granodiorities met die chemiese kenmerke van vulkaniese-boog granitoïede. Die Laat-Proterosoïese Nhansipfe Granitiese Ortogneis is gedateer op 981 ± 83 Ma en wissel van metalumineus tot peralumineus. Die Rb-, Nb- en Y-inhoud is tipies van intraplaat granitoïede, en die Ga-, Zr-, Al-, Ce- en Y-inhoud is tipies van A-tipe granitoïede. Die ouderdom van die mafiese intrussies lê tussen ~ 500 en ~ 1100 Ma. Die gesteentes bevat tipies plagioklaas, horingblende en klinopirokseen met of sonder granaat en ortopirokseen. Die chemie van die gesteentes is tipies van subalkaliese tholeïiete. Die Tchinhadzandze Granodioriet Gneis is moontlik deel van 'n Pan-Afrikaanse gebeurtenis wat tot ~ 450 - ~ 500 Ma geduur het. Die normatiewe veldspaat-samestellings en die Rb-, Ba- en Sr-inhoud is tipies van granodioriet. Dit is metalumineus en het Rb-, Y- en Nb-inhoude tipies van vulkaniese-boog granitoïede.

Die vlakkige maaksels in die Argeïese graniet-groensteengordel word gekenmerk deur O-W tot SW-NO strekkings en steil hellings na N en S en na NW en SO. Die mineraallineasies en plooi-asse duik 60° en 30° onderskeidelik na die Ooste. In die Mosambiekgorde, naby die middel en in die ooste van die studiegebied, strek die vlakkige maaksels in wese N-S en hel steil na die Ooste en Weste, in teenstelling met die komplekse vervorming wat in die migmatiete en megakristiese granitoïede gesien word.

Die studiegebied kan in drie metamorfe terreine onderverdeel word, naamlik een van lae- en medium- en hoë-gradse metamorfose.