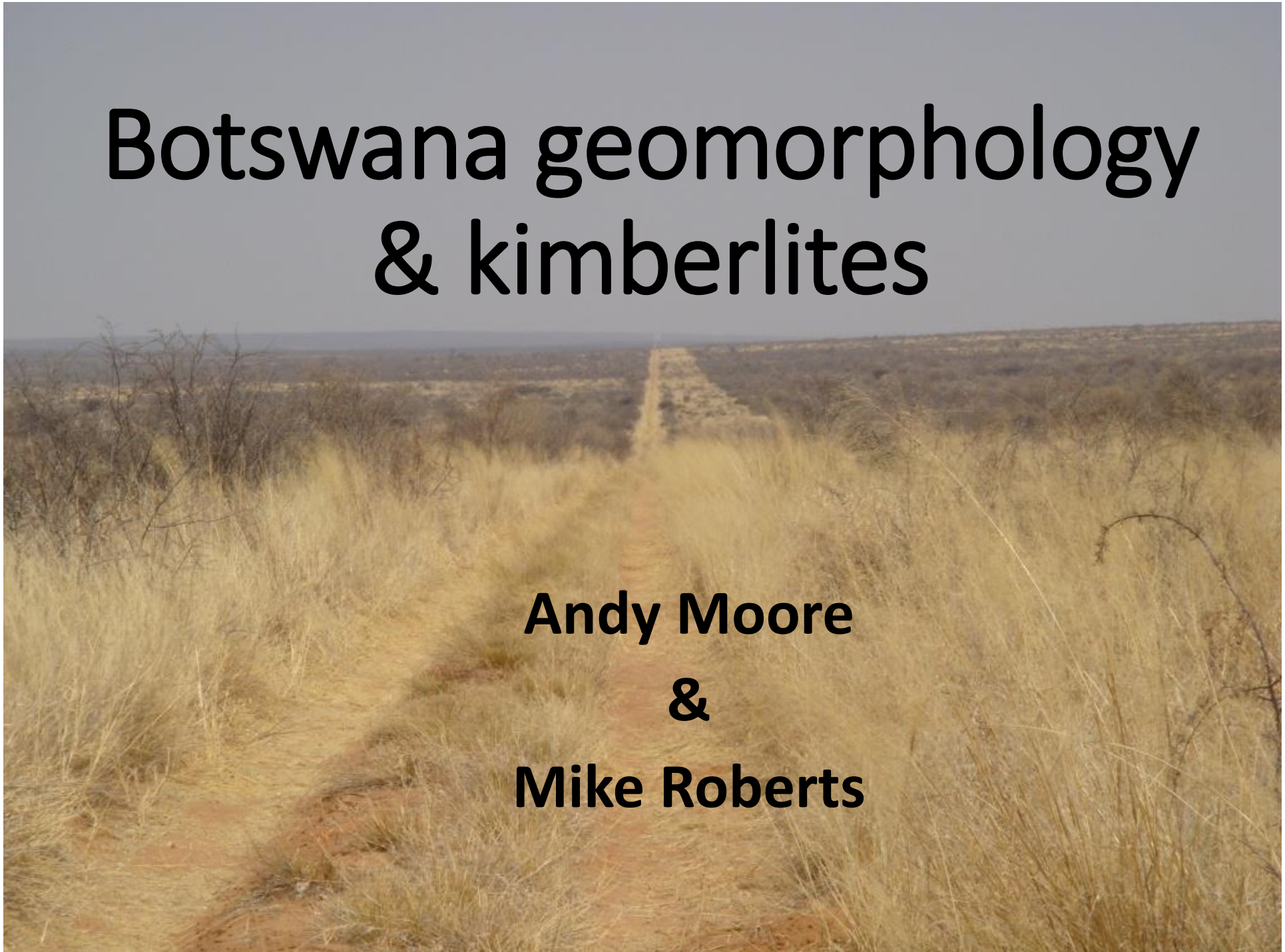
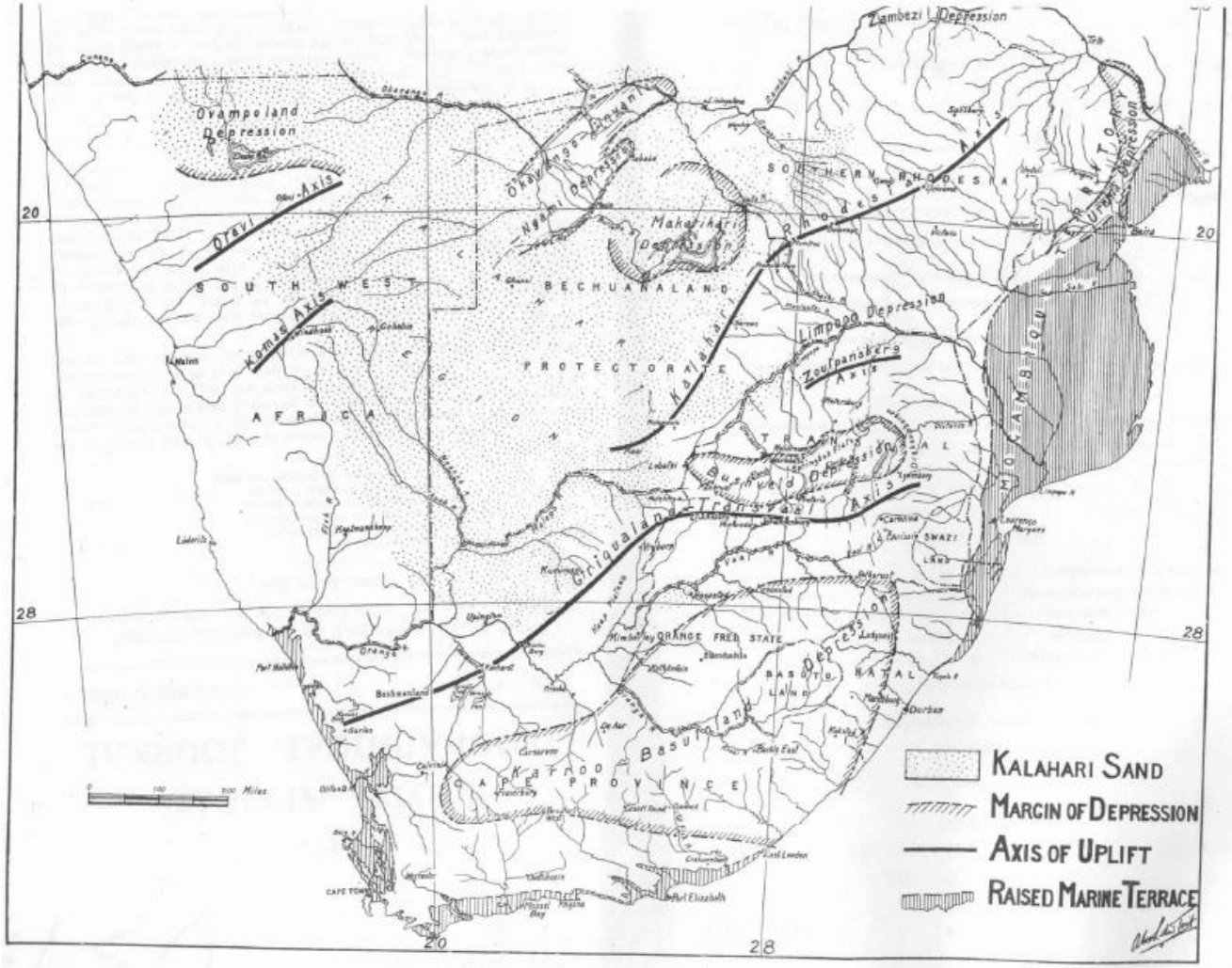
Botswana geomorphology & kimberlites



Andy Moore

&

Mike Roberts



Du Toit (1933), SA Geogr Jour

SOUTH AFRICAN JOURNAL OF SCIENCE, *Vol. XXIV, pp. 30-36, December, 1927.*

SOME PROBLEMS IN RHODESIAN PHYSICAL GEOLOGY.

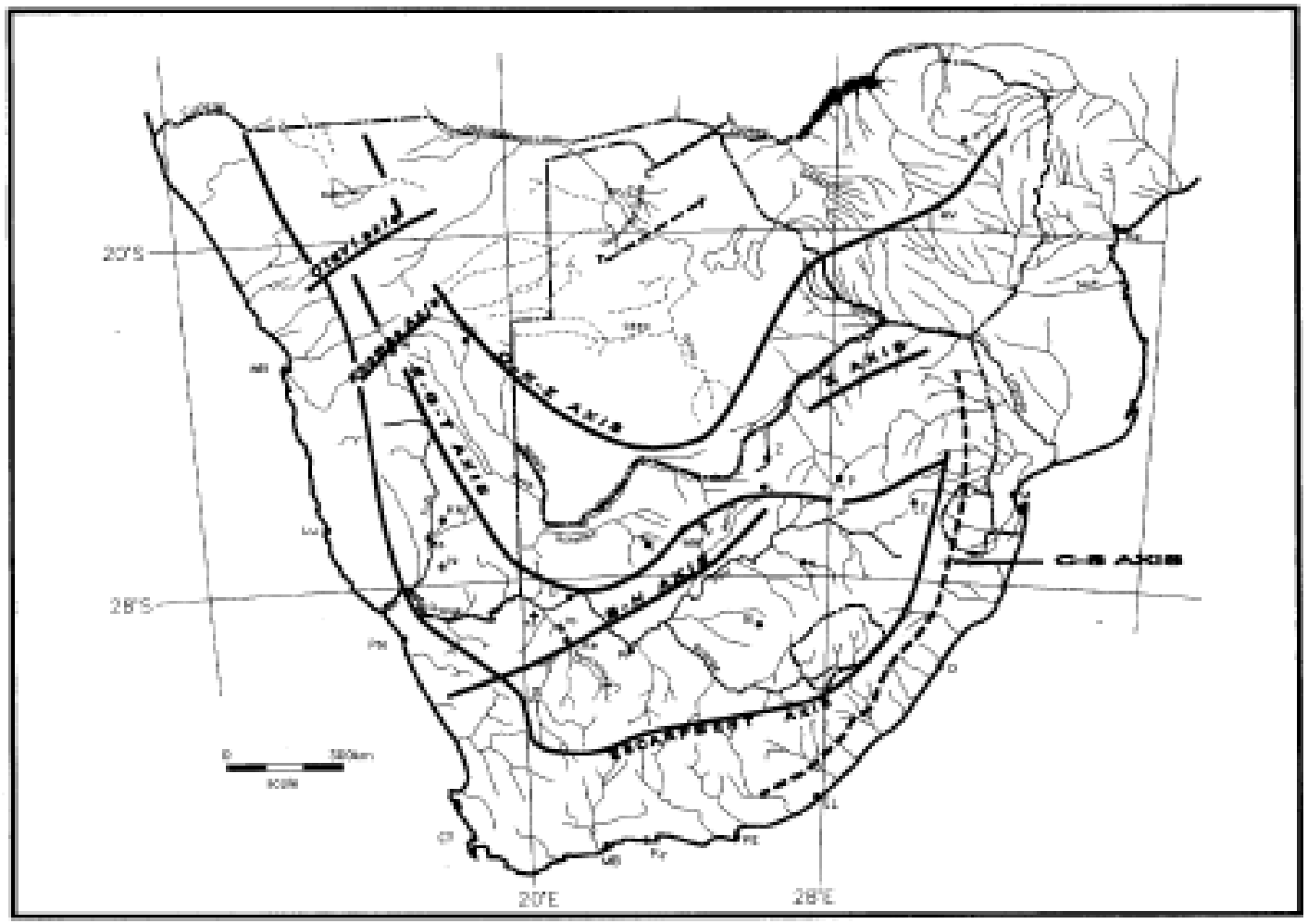
BY

H. B. MAUFE, M.A., F.G.S.,

Director, Geological Survey of Southern Rhodesia.

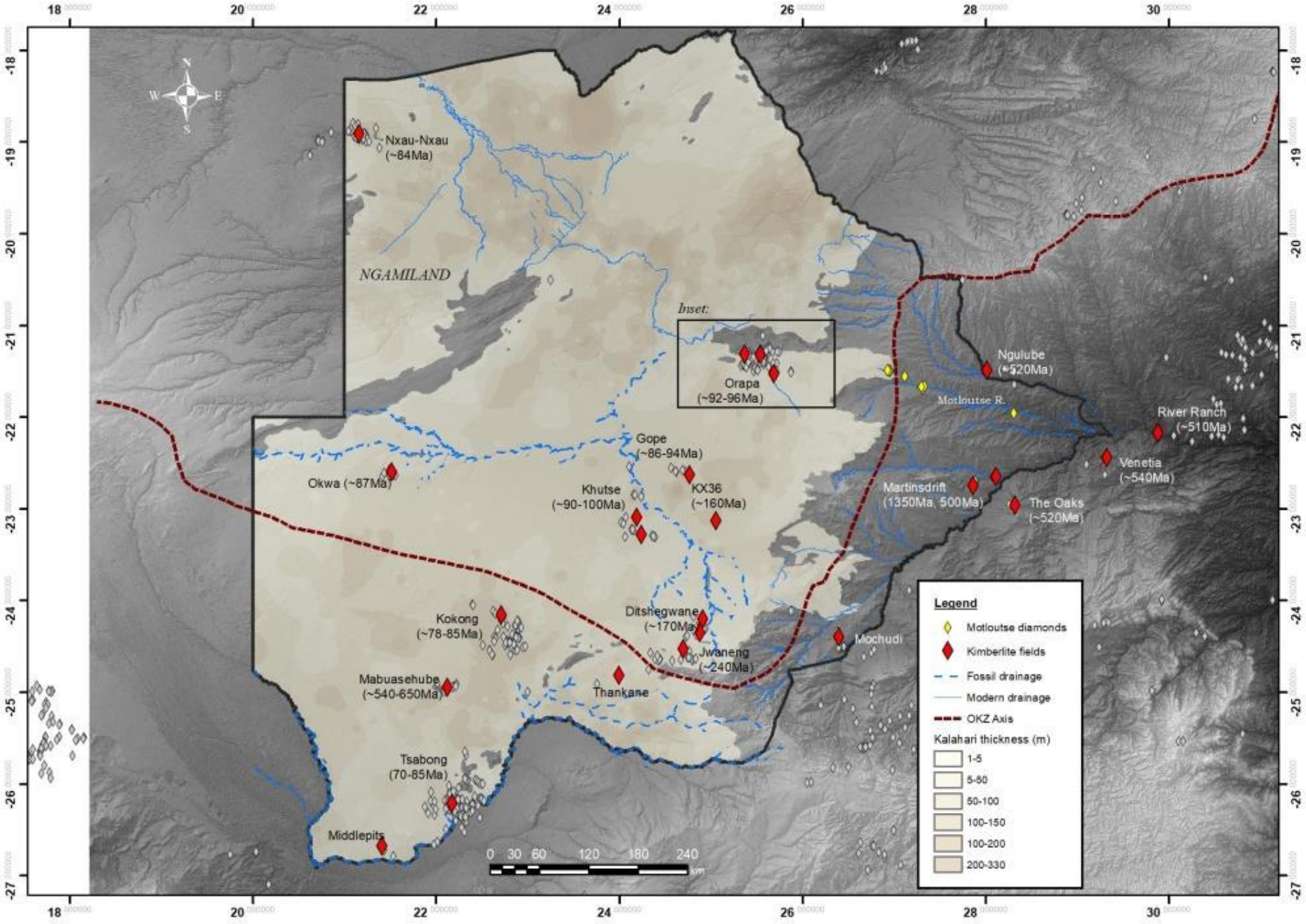
With 1 Map.

Presidential Address to Section B, delivered 29 June, 1927.



Moore (1999) S. Afr. Jour. Geol

Orapa (AK-1) Open pit, 1.5km long axis


NGAMILAND
Nxau-Nxau (~84Ma)
Inset:
Orapa (~92-96Ma)
Gope (~86-94Ma)
KX36 (~160Ma)
Khutse (~90-100Ma)
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Mabuasehube (~540-650Ma)
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Middlepits
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Jwaneng (~240Ma)
Thankane
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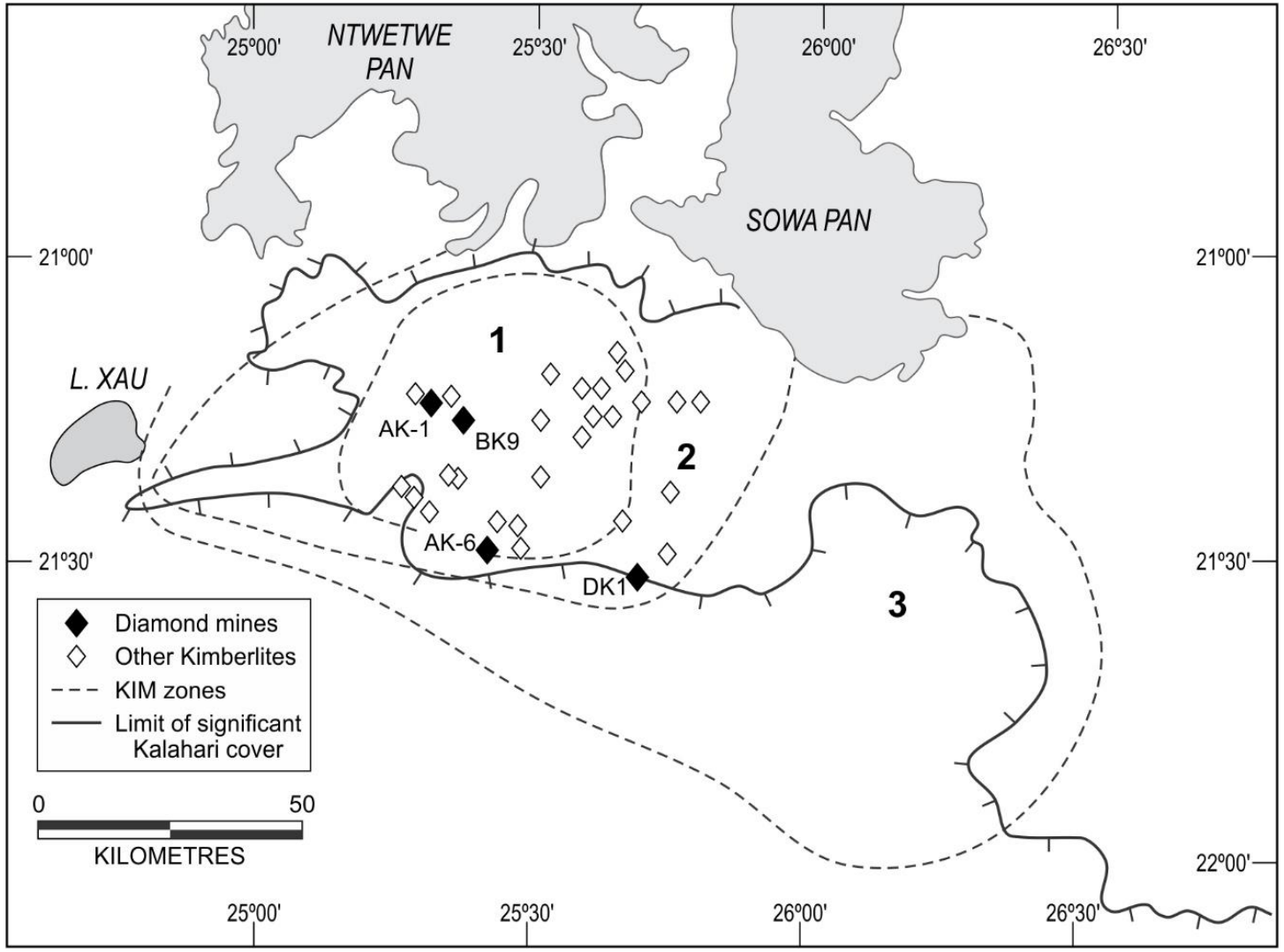
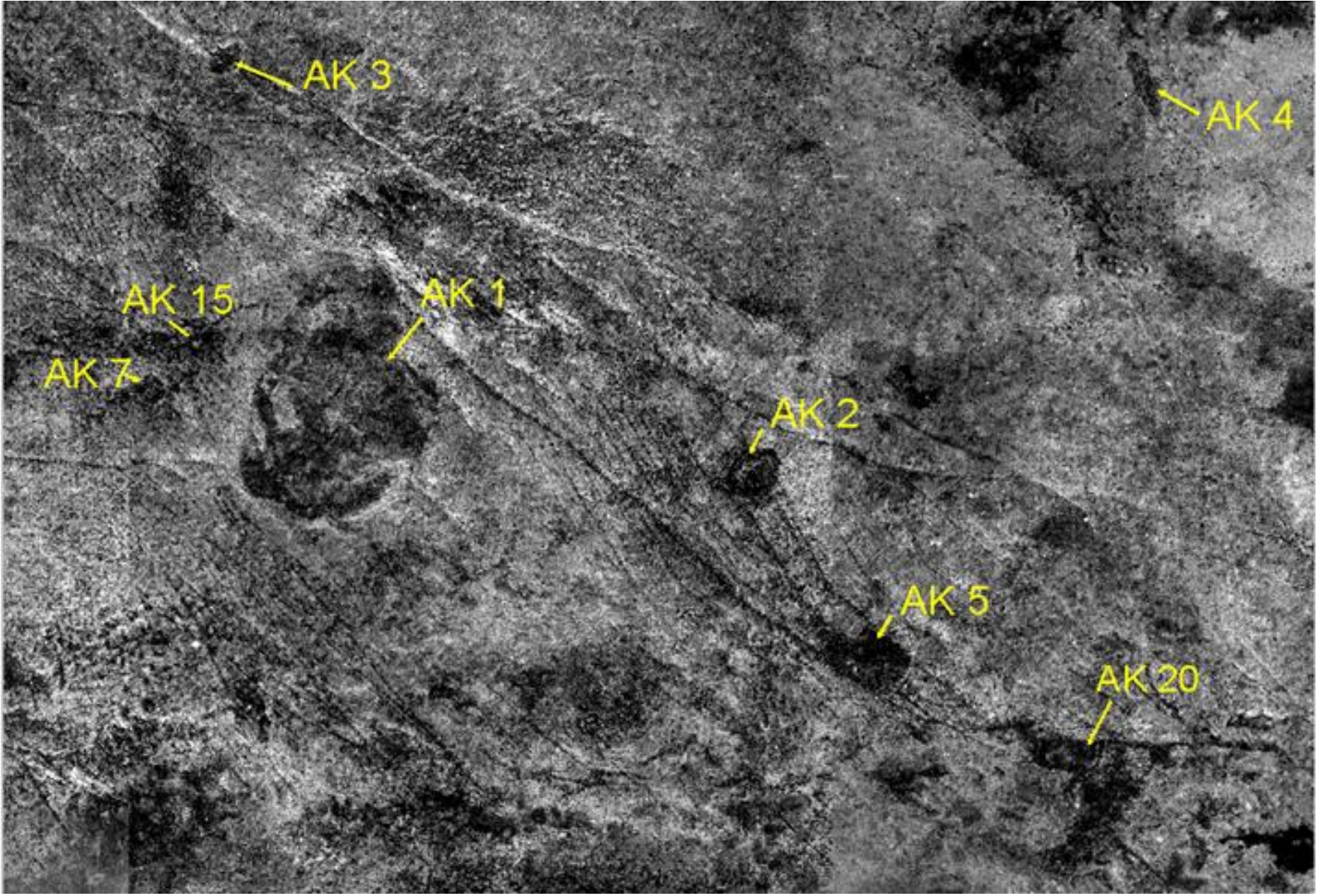
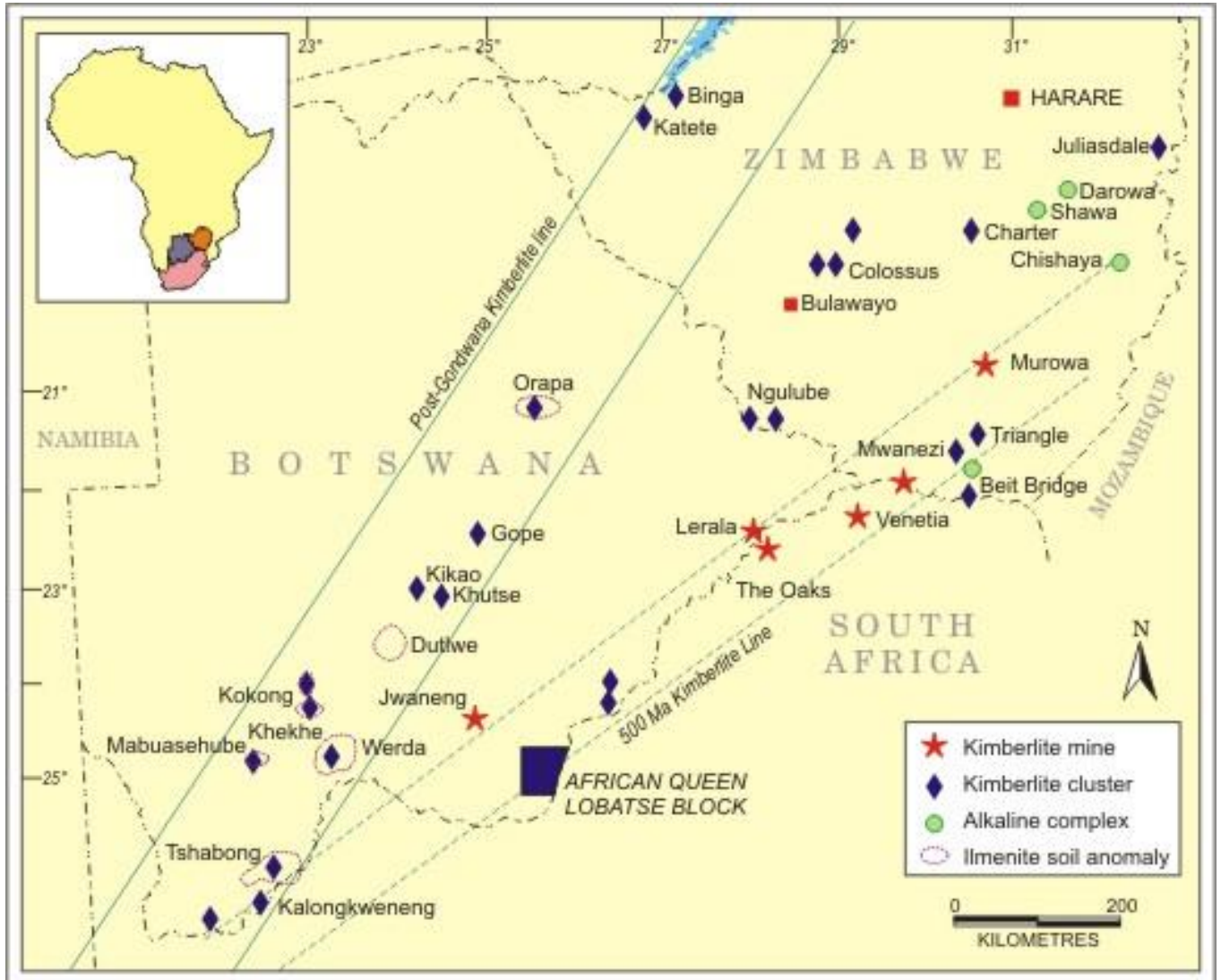
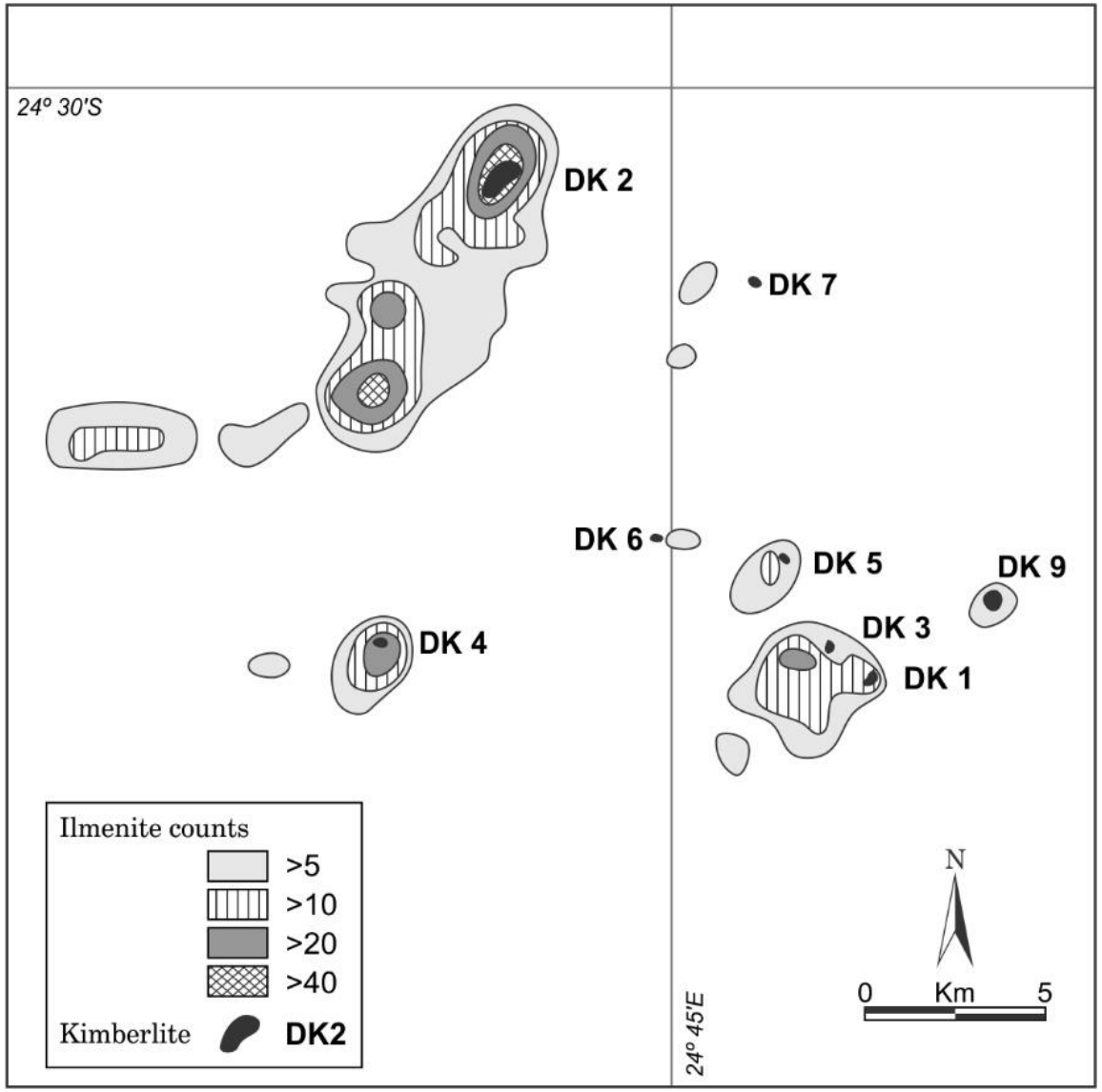
Ngulube (~520Ma)
Motloutse R.
River Ranch (~510Ma)
Venetia (~540Ma)
Martinsdrift (1350Ma, 500Ma)
The Oaks (~520Ma)
Legend
Motloutse diamonds
Kimberlite fields
Fossil drainage
Modern drainage
OKZ Axis
Kalahari thickness (m)
1-5
5-50
50-100
100-150
100-200
200-330
0 30 60 120 180 240 km
N
S
W
E


NTWETWE PAN
SOWA PAN
L. XAU
25º00'
25º30'
26º00'
26º30'
21º00'
21º30'
22º00'
1
2
3
AK-1
BK9
AK-6
DK1
Diamond mines
Other Kimberlites
KIM zones
Limit of significant Kalahari cover
0
50
KILOMETRES

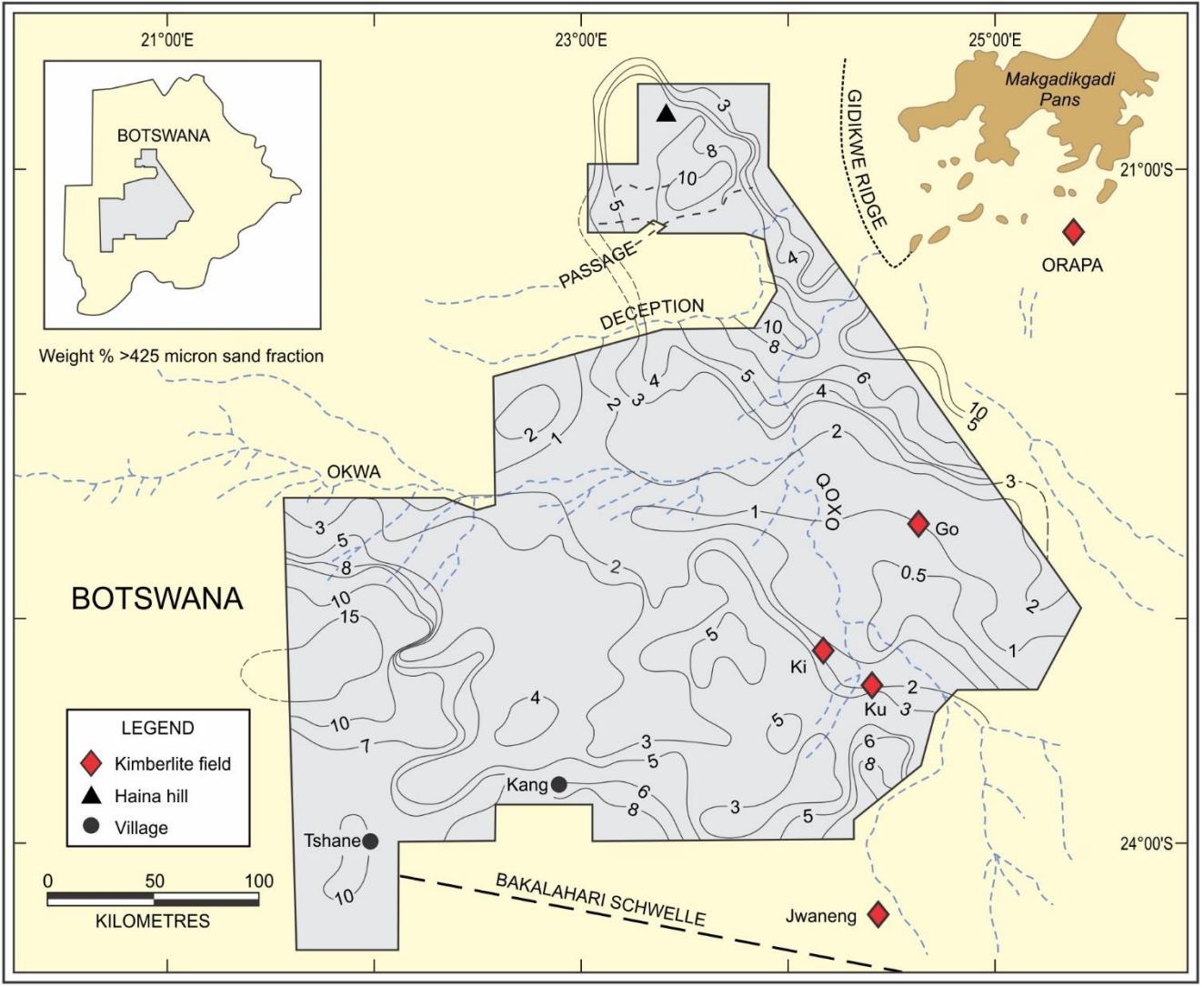

AK 3
AK 4
AK 15
AK 1
AK 7
AK 2
AK 5
AK 20



TRENDS OF PROMINENT KIMBERLITE LINES AND KNOWN KIMBERLITES



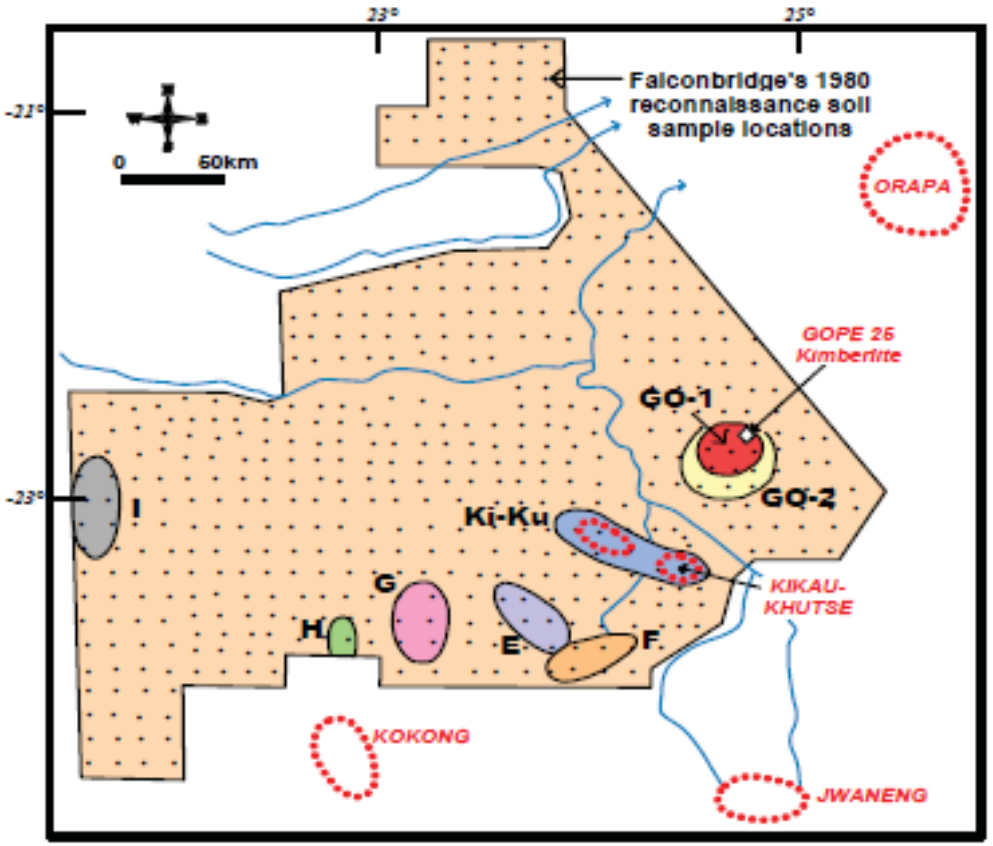
Jwaneng kimberlites



Falconbridge helicopter recce, 1980; 13km x 13 km sample grid

Figure 2. Botswana Diamond Exploration Meeting, 1978 (Tsabong). Front: Dave Fielding, Mike Waldman, Richard Fynn, Debbie Caskey*, Andy Moore, John Blaine, Ash Clarke (hat), John Gurney# (hat)Back: John Harris, Hugo Dummett*, John Lee, Roger Billington, Chris Jennings (hat), Nick de Bever (All Falconbridge staff, except: *Superior Oil, #Consultant).*

Drillsite PPE, 1978



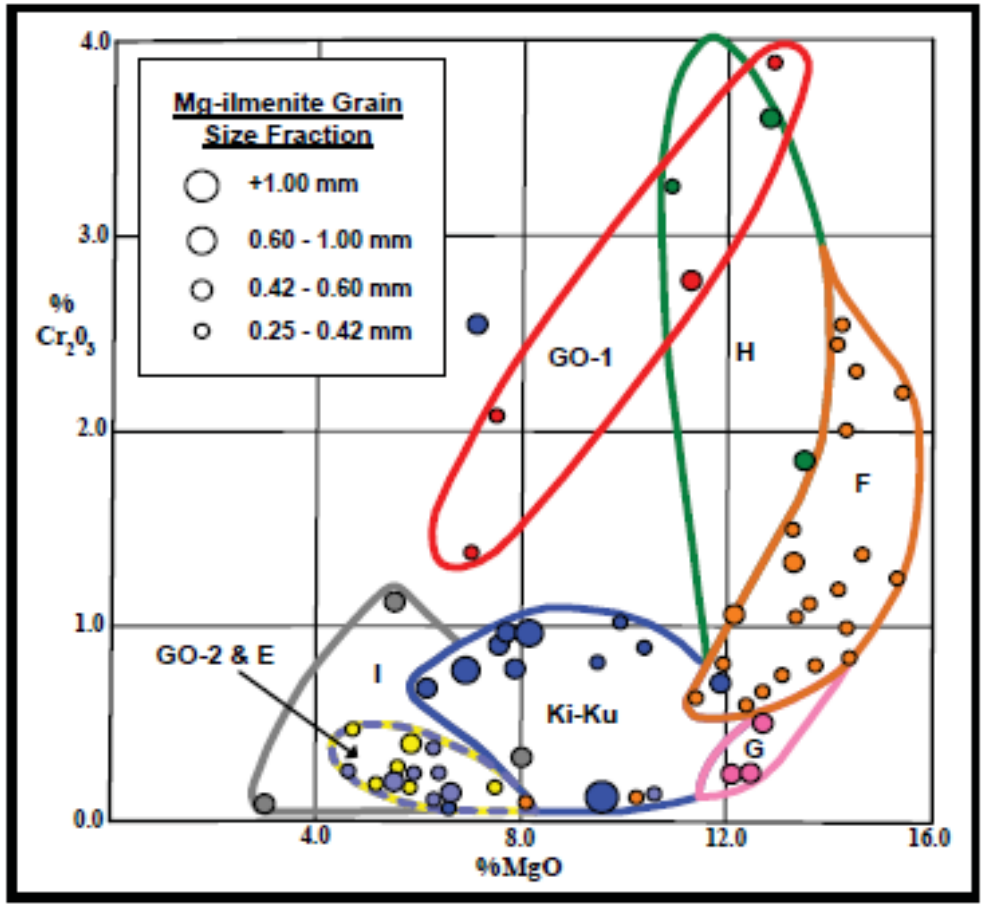
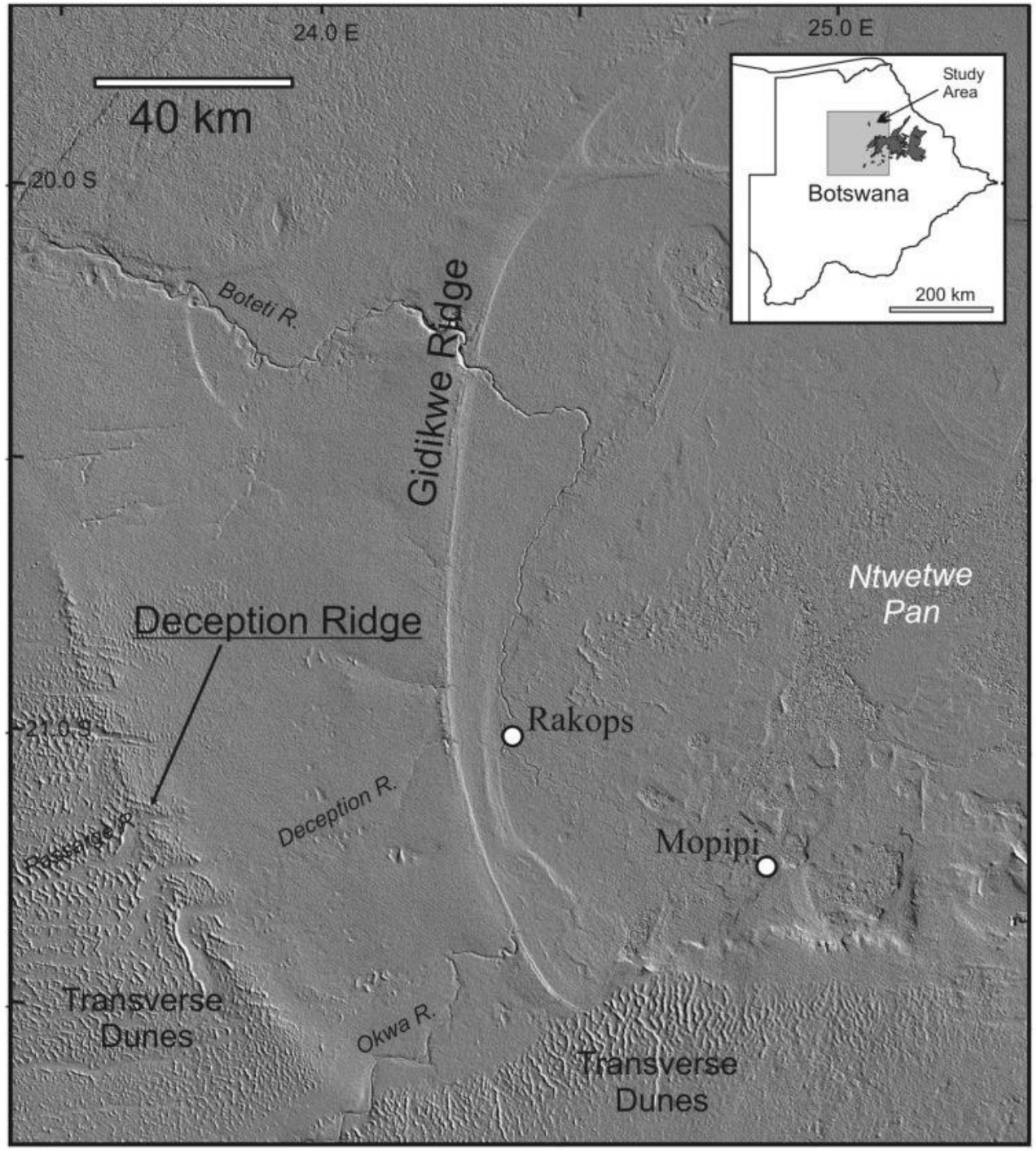
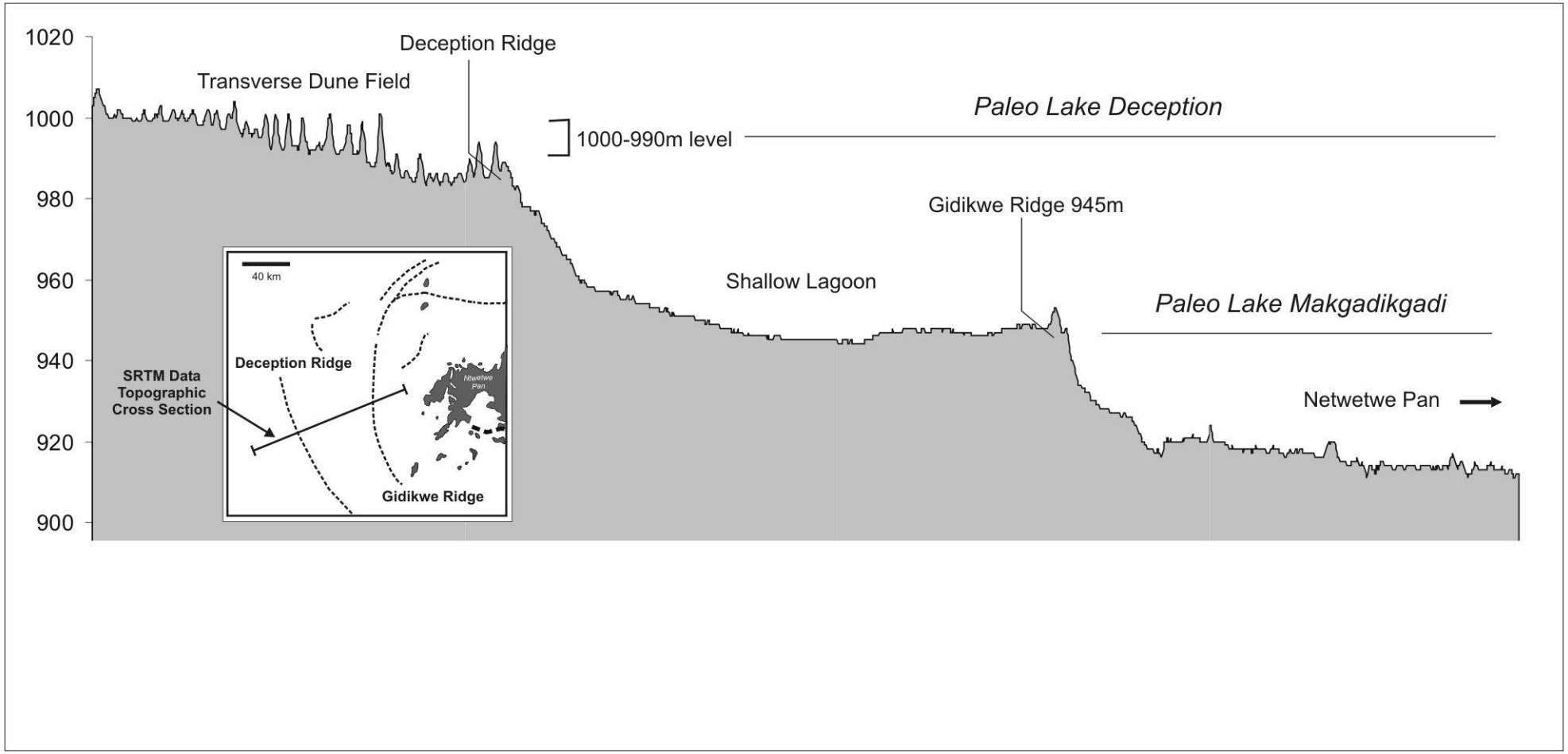
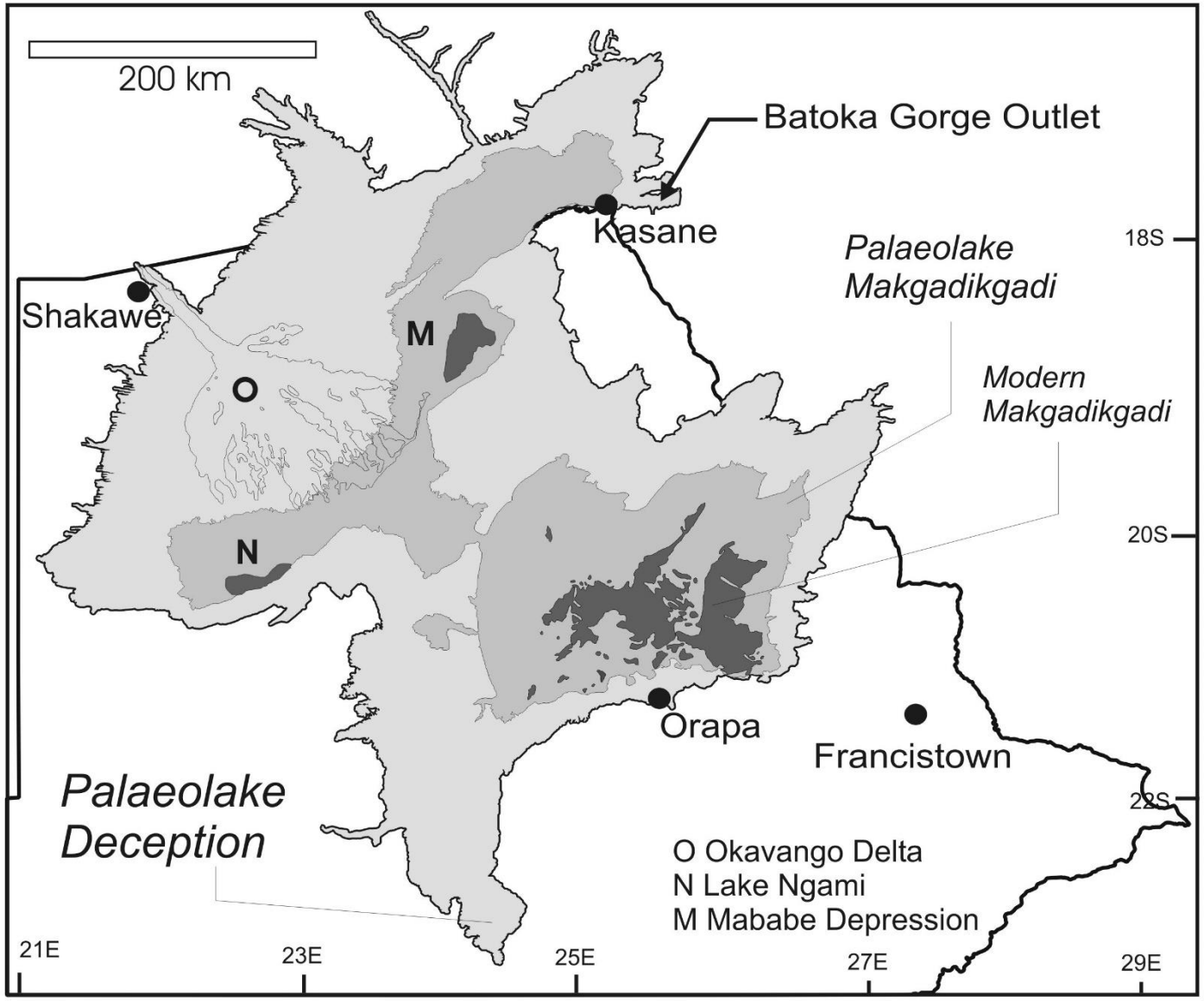


Figure 3. Mg-ilmenite anomalies GO-1, GO-2, Ki-Ku, E, F.

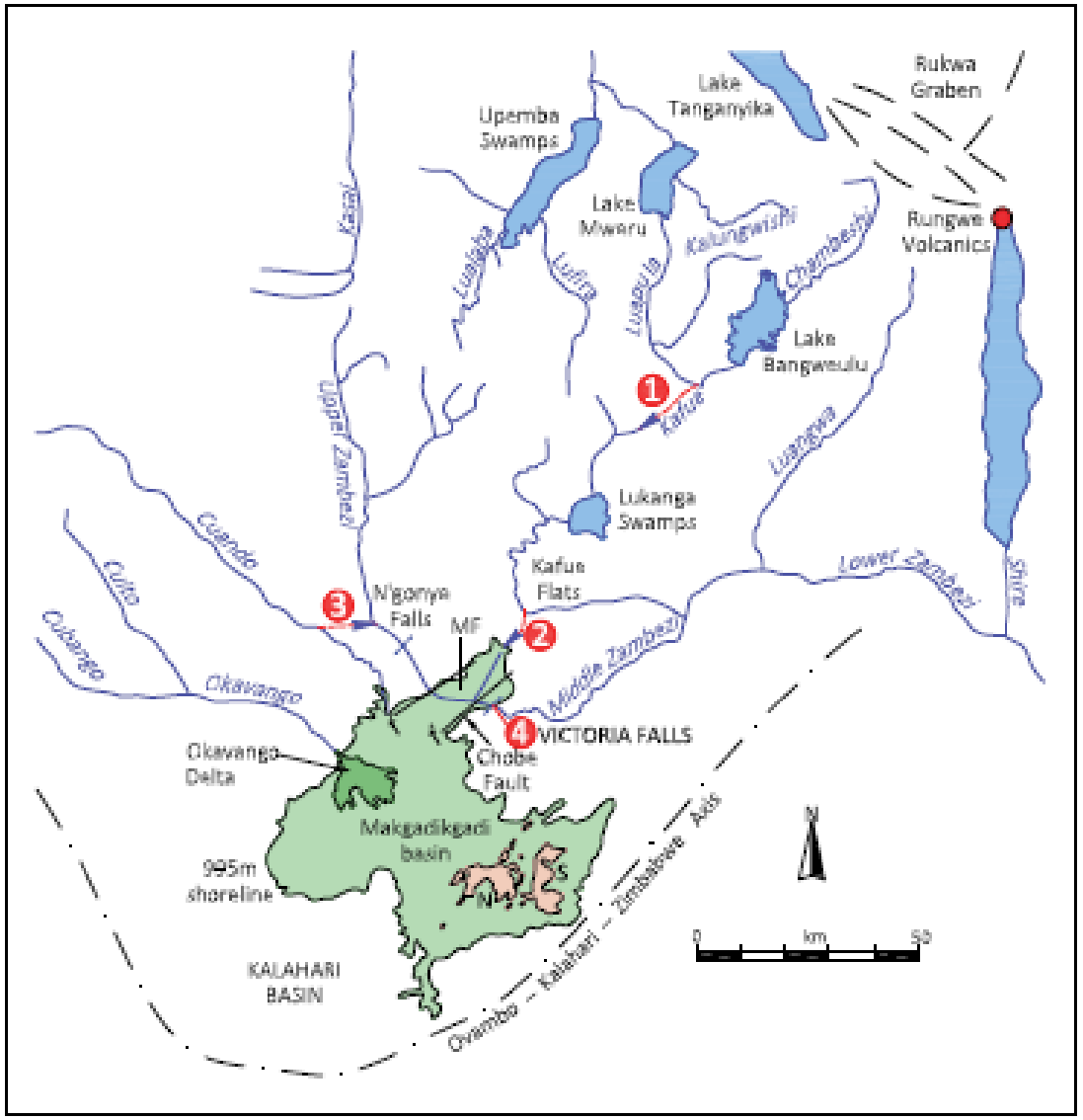

24.0 E
25.0 E
40 km
20.0 S
21.0 S
Study Area
Botswana
200 km
Boteti R.
Gidikwe Ridge
Ntwetwe Pan
Deception Ridge
Rakops
Deception R.
Passarge R.
Mopipi
Transverse Dunes
Okwa R.
Transverse Dunes

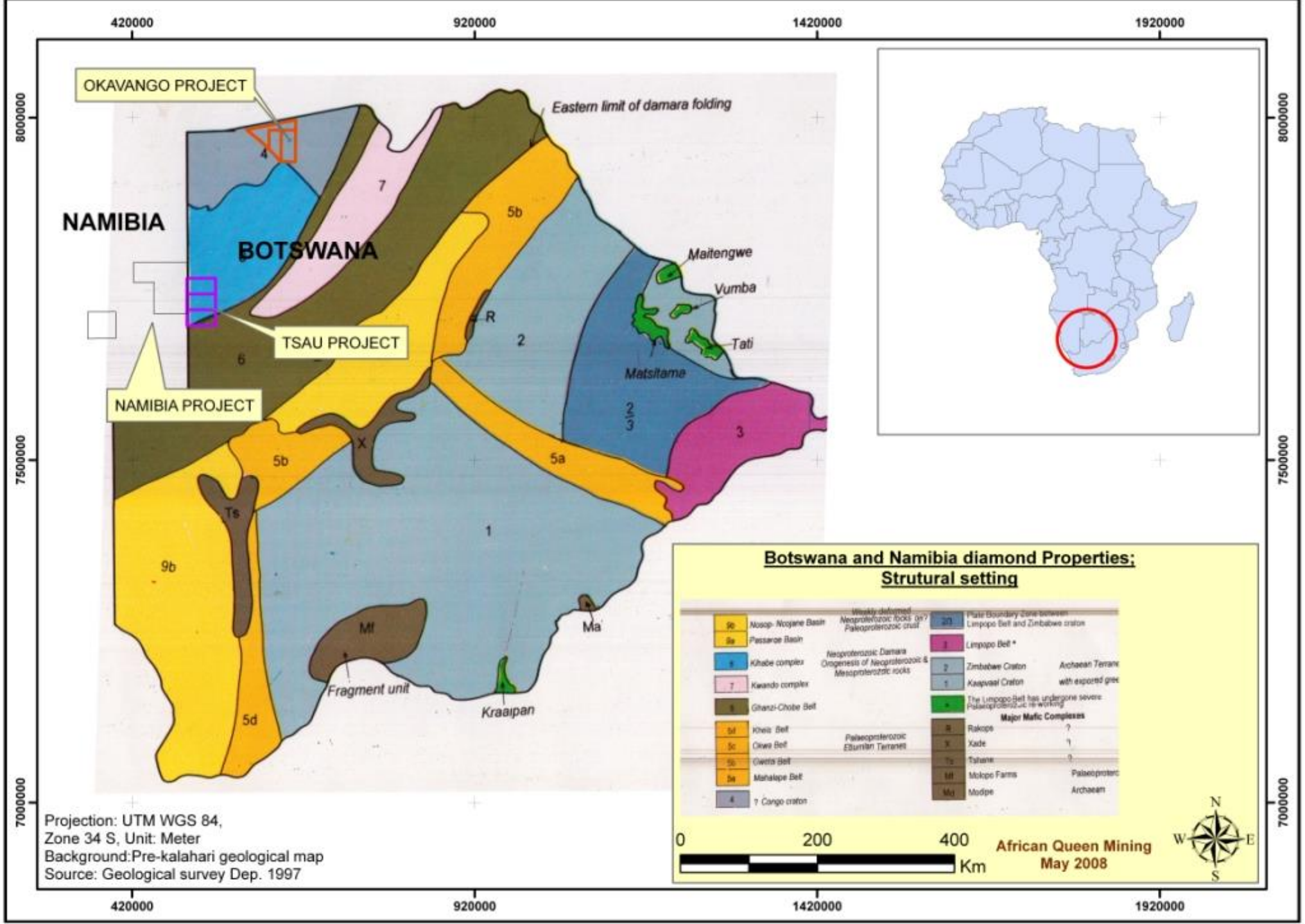

1020
1000
980
960
940
920
900
Deception Ridge
Transverse Dune Field
1000-990m level
Paleo Lake Deception
Gidikwe Ridge 945m
Shallow Lagoon
Paleo Lake Makgadikgadi
Netwetwe Pan
40 km
Deception Ridge
Gidikwe Ridge
Ntwetwe Pan
SRTM Data
Topographic
Cross Section

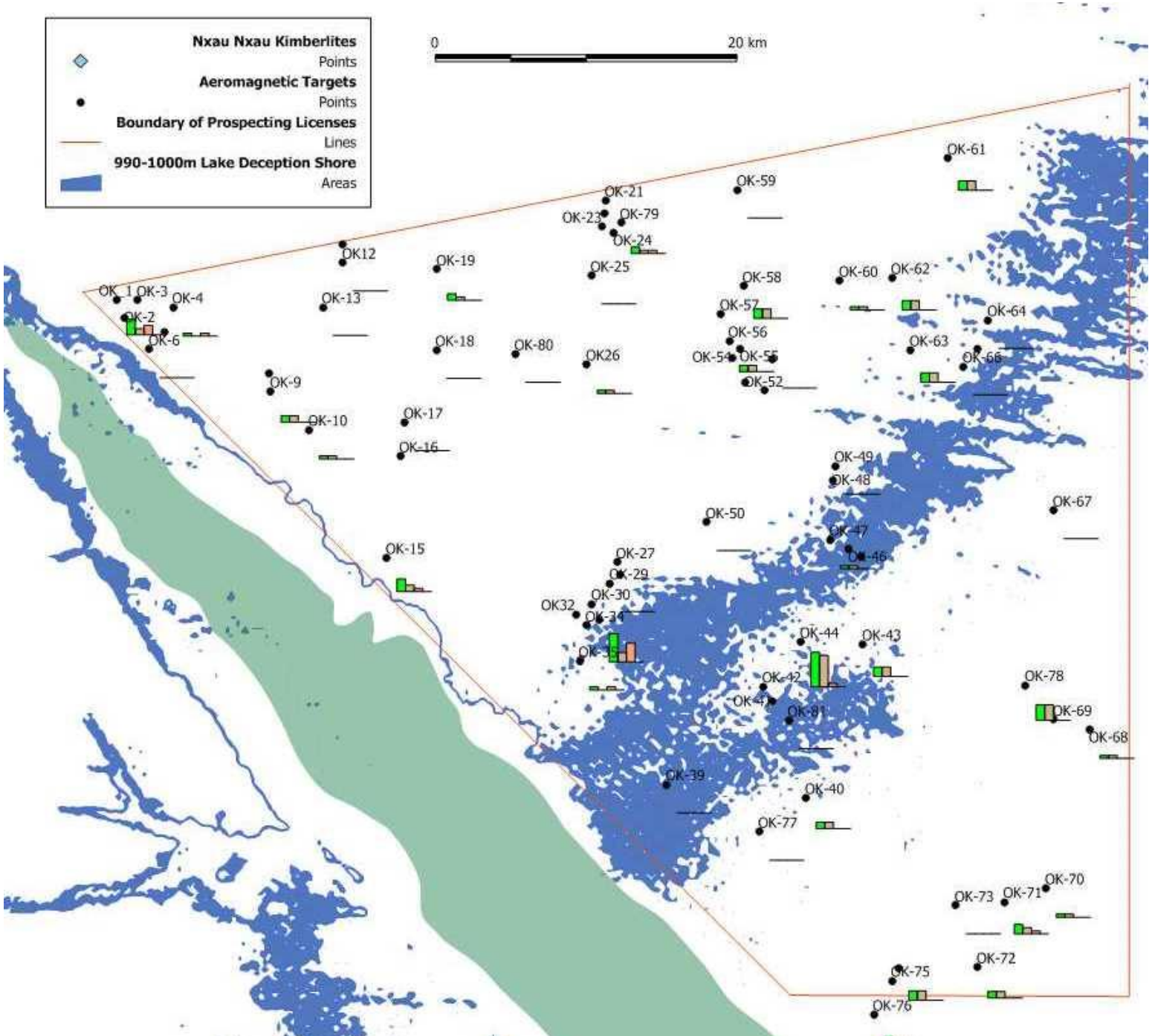

200 km
Batoka Gorge Outlet
Kasane
Palaeolake
Makgadikgadi
18S
Shakawe
M
O
Modern
Makgadikgadi
N
20S
Orapa
Francistown
Palaeolake
Deception
22S
O Okavango Delta
N Lake Ngami
M Mababe Depression
21E
23E
25E
27E
29E

B

A


Rukwa Graben
Lake Tanganyika
Upemba Swamps
Lake Mweru
Kalungwishi
Chambeshi
Rungwe Volcanics
Lualaba
Luapula
Lake Bangweulu
Kasai
Upper Zambezi
Kafue
Luangwa
Lukanga Swamps
Cuando
Cuito
Cubango
Kafue Flats
N'ganya Falls
MF
Lower Zambezi
Shire
Middle Zambezi
Okavango
VICTORIA FALLS
Okavango Delta
Chobe Fault
Makgadikgadi basin
995m shoreline
KALAHARI BASIN
Ovambo – Kalahari – Zimbabwe Axis
0
km
50


420000
920000
1420000
1920000
8000000
7500000
7000000
OKAVANGO PROJECT
TSAU PROJECT
NAMIBIA PROJECT
NAMIBIA
BOTSWANA
Eastern limit of damara folding
Maitengwe
Vumba
Tati
Matsitama
Fragment unit
Kraaipan
Botswana and Namibia diamond Properties;
Strutural setting
Projection: UTM WGS 84,
Zone 34 S, Unit: Meter
Background:Pre-kalahari geological map
Source: Geological survey Dep. 1997
0
200
400
Km
African Queen Mining
May 2008
N
S
W
E


Nxau Nxau Kimberlites
Points
Aeromagnetic Targets
Points
Boundary of Prospecting Licenses
Lines
990-1000m Lake Deception Shore
Areas
0
20 km
OK-61
OK-59
OK-21
OK-23
OK-79
OK-24
OK12
OK-19
OK-25
OK-58
OK-60
OK-62
OK-1
OK-3
OK-4
OK-13
OK-57
OK-64
OK-2
OK-6
OK-56
OK-18
OK-80
OK26
OK-54
OK-55
OK-63
OK-66
OK-9
OK-52
OK-10
OK-17
OK-16
OK-49
OK-48
OK-67
OK-50
OK-47
OK-15
OK-46
OK-27
OK-29
OK-30
OK32
OK-44
OK-43
OK-42
OK-78
OK-41
OK-81
OK-69
OK-68
OK-39
OK-40
OK-77
OK-70
OK-73
OK-71
OK-72
OK-75
OK-76

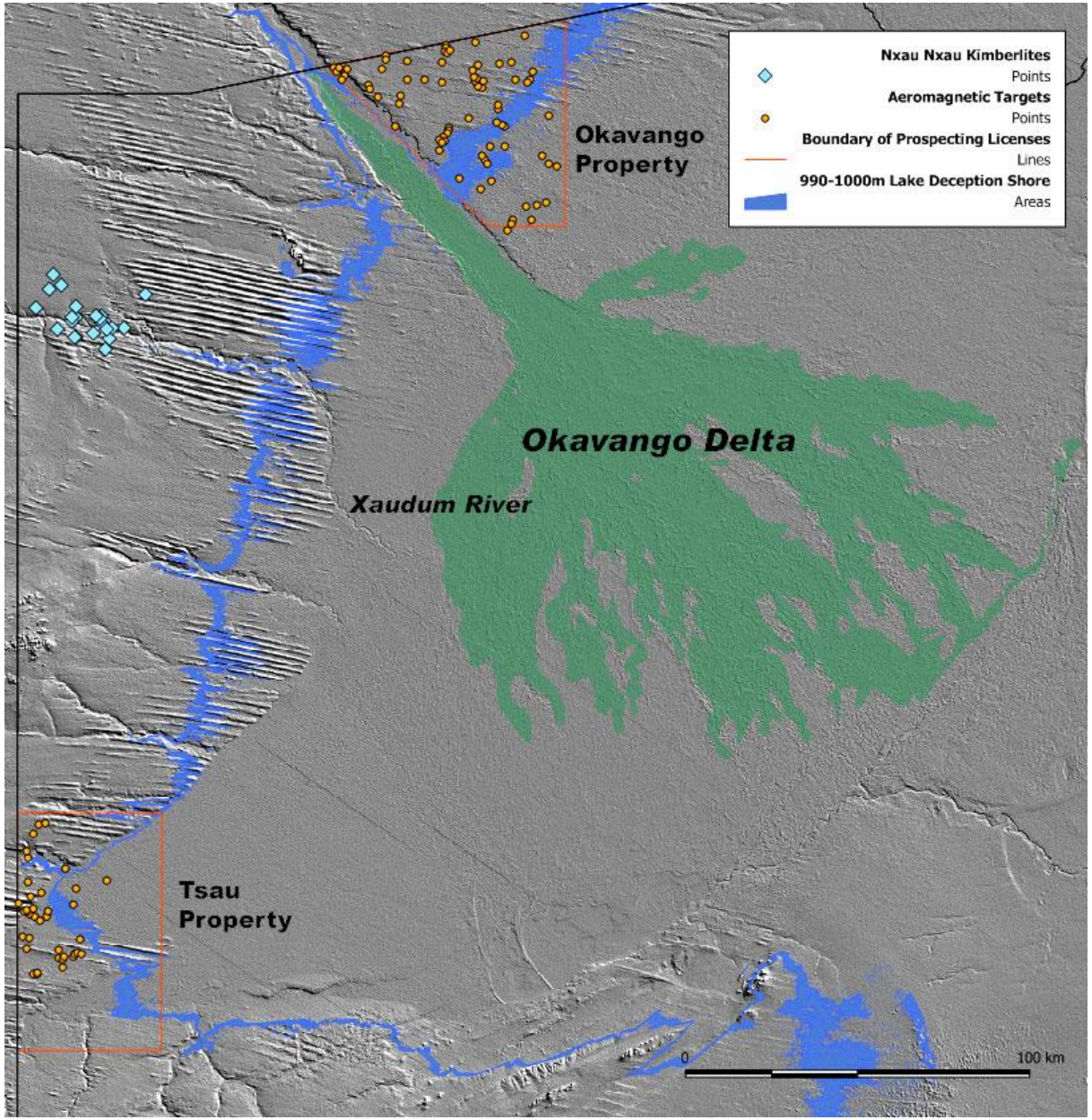
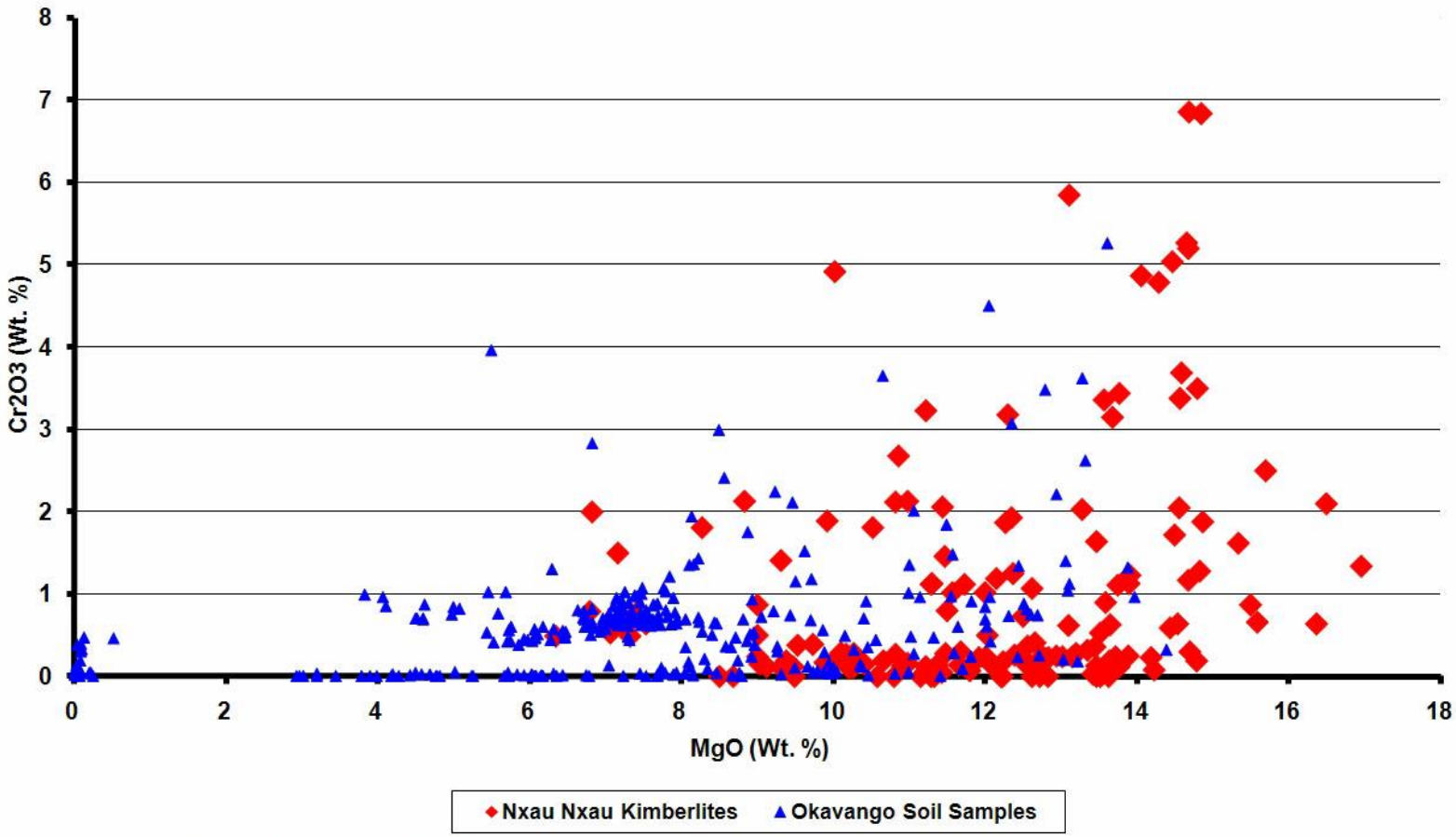
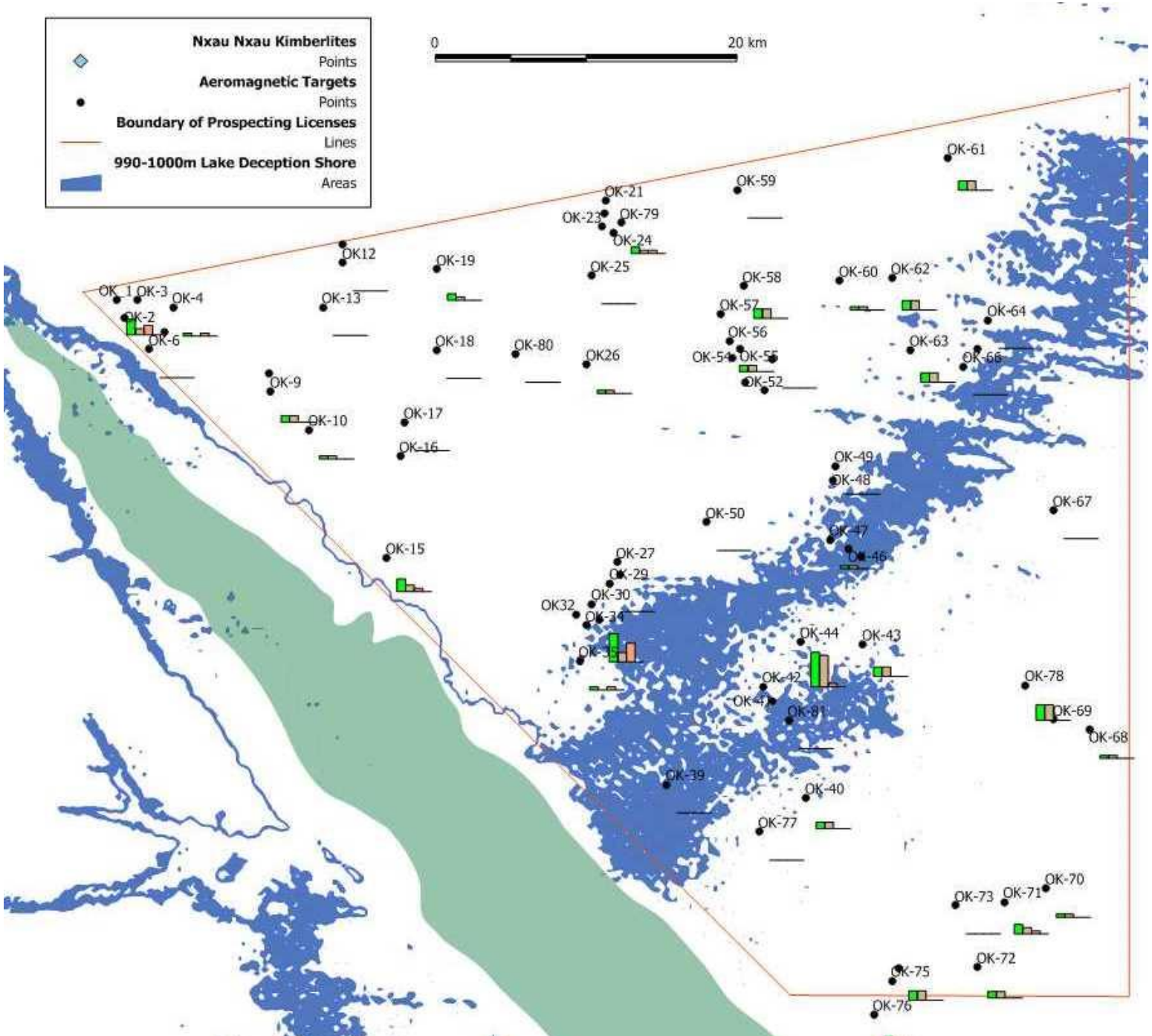

Nxau Nxau Kimberlites
Points
Aeromagnetic Targets
Points
Boundary of Prospecting Licenses
Lines
990-1000m Lake Deception Shore
Areas
Okavango Property
Okavango Delta
Xaudum River
Tsau Property
0
100 km

Fig. 7 Ilmenites from Nxau Nxau Kimberlites and Okavango Project soils




Nxau Nxau Kimberlites
Points
Aeromagnetic Targets
Points
Boundary of Prospecting Licenses
Lines
990-1000m Lake Deception Shore
Areas
0
20 km
OK-61
OK-59
OK-21
OK-23
OK-79
OK-24
OK12
OK-19
OK-25
OK-58
OK-60
OK-62
OK-1
OK-3
OK-4
OK-13
OK-57
OK-64
OK-2
OK-6
OK-56
OK-18
OK-80
OK26
OK-54
OK-55
OK-63
OK-66
OK-9
OK-52
OK-10
OK-17
OK-16
OK-49
OK-48
OK-67
OK-50
OK-47
OK-15
OK-46
OK-27
OK-29
OK-30
OK32
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OK-43
OK-42
OK-78
OK-41
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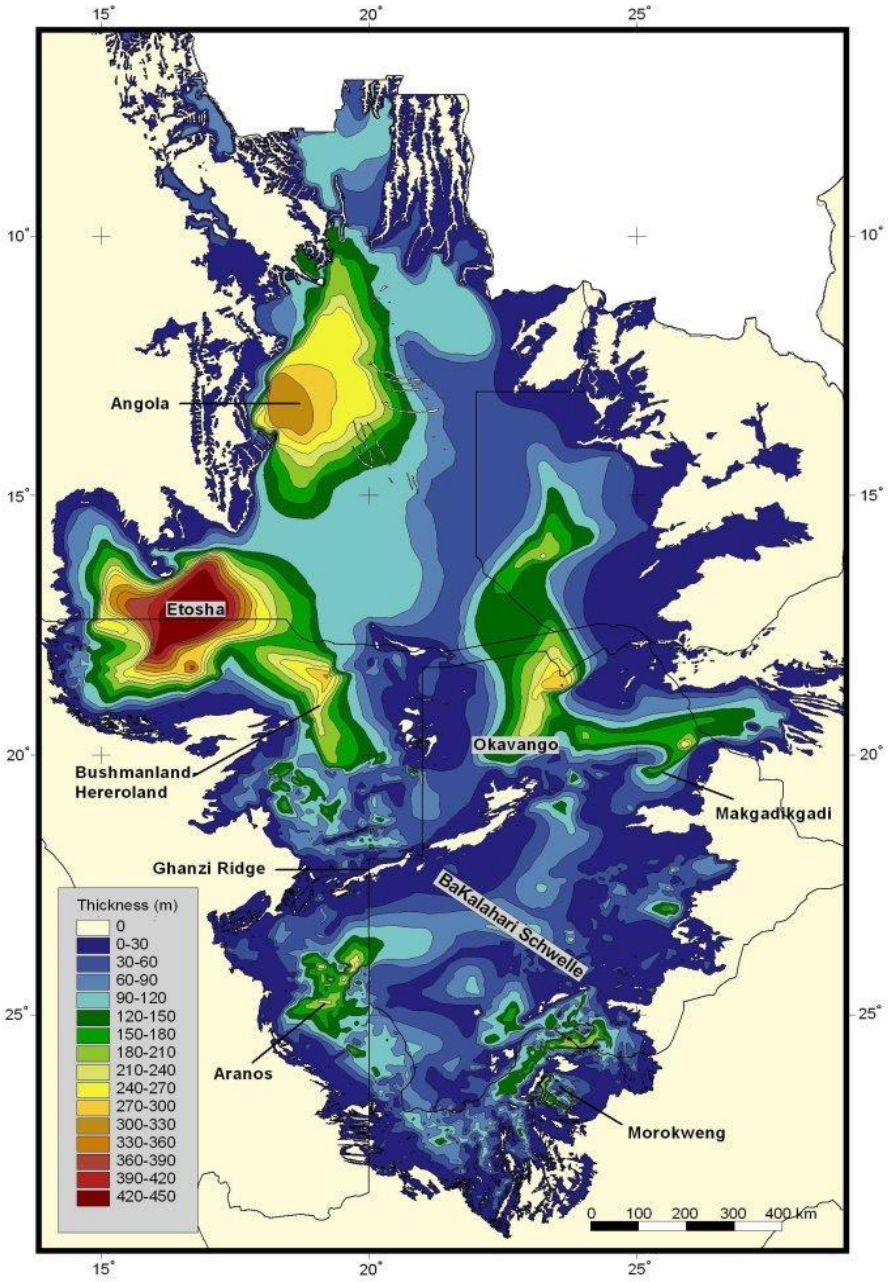
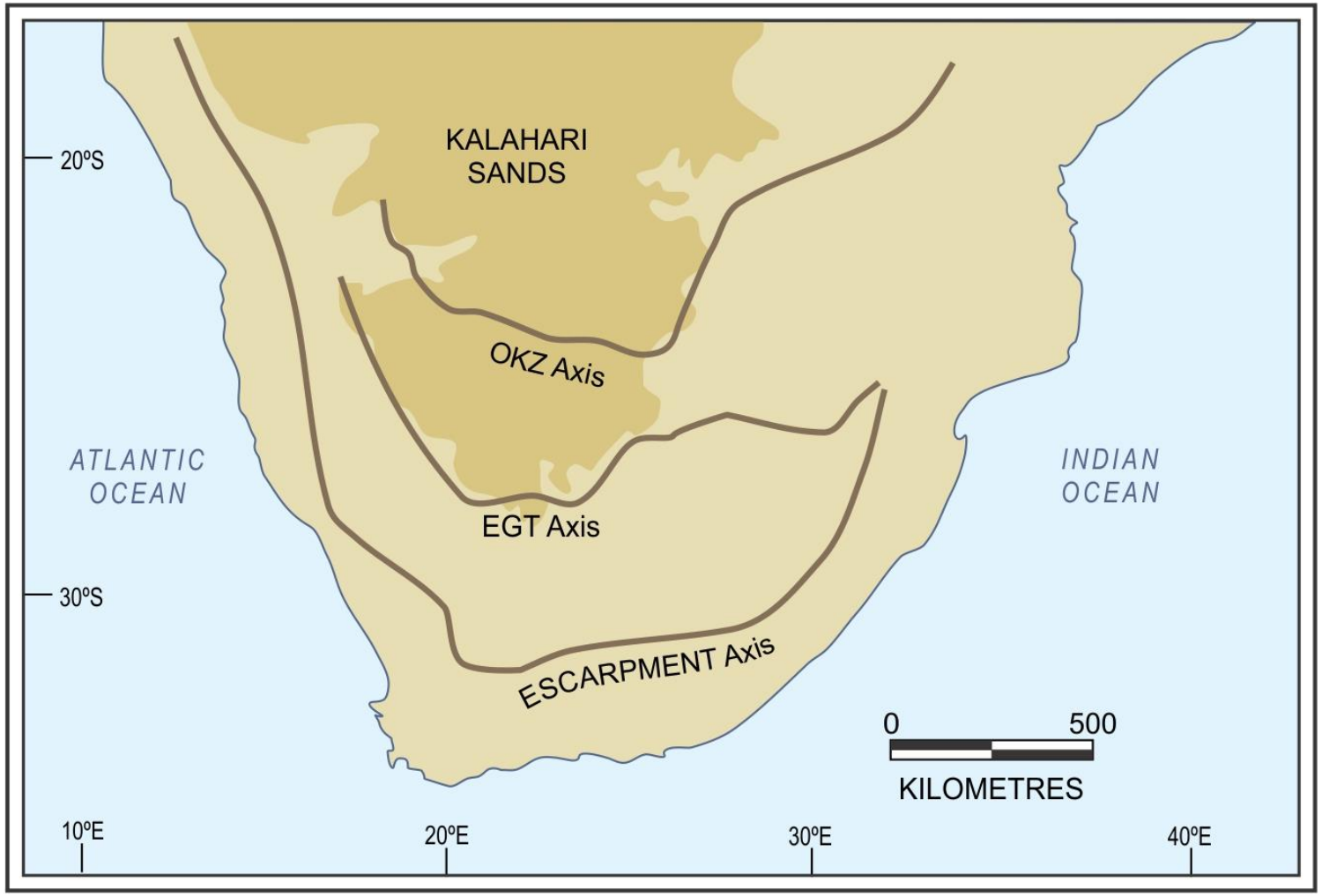
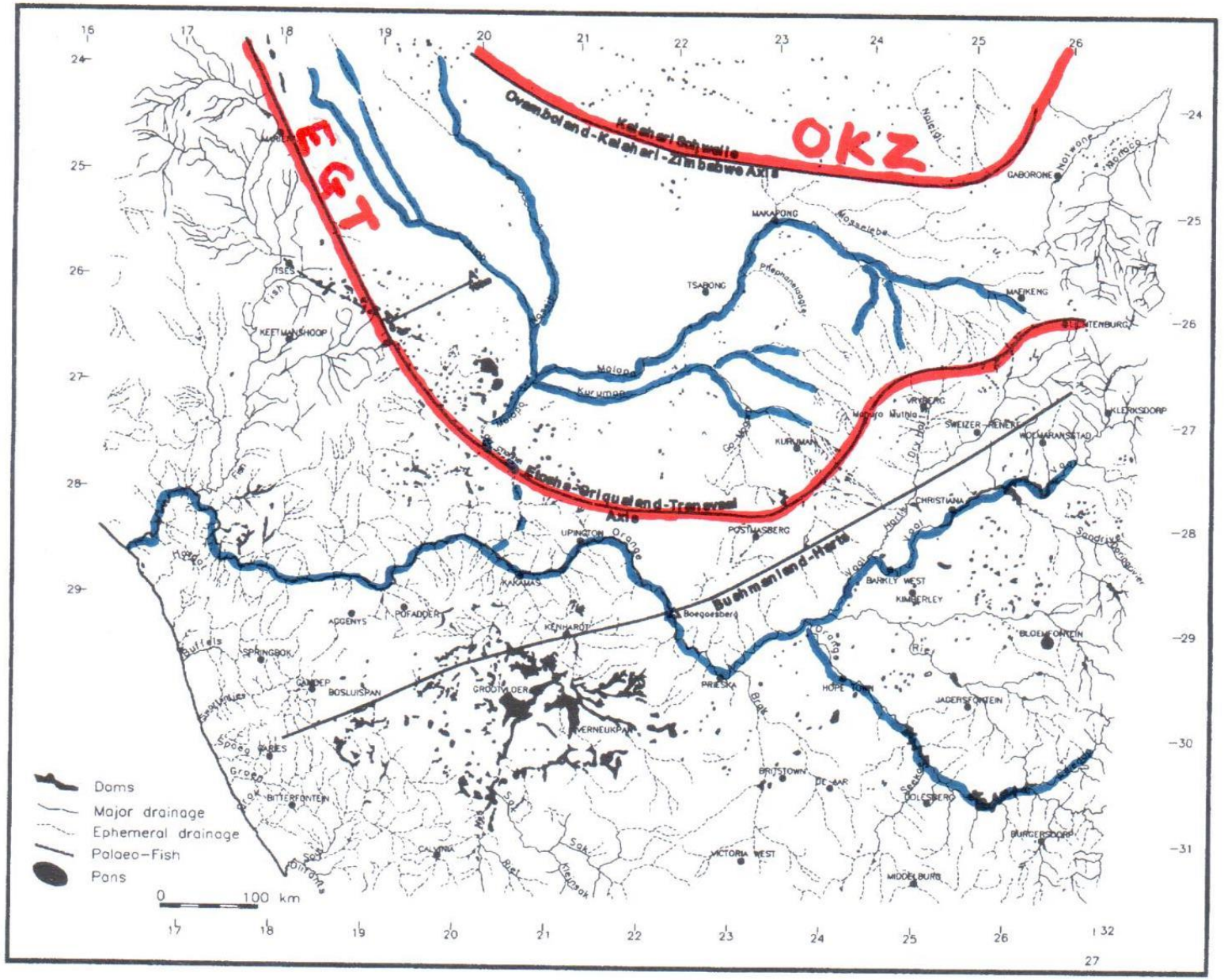
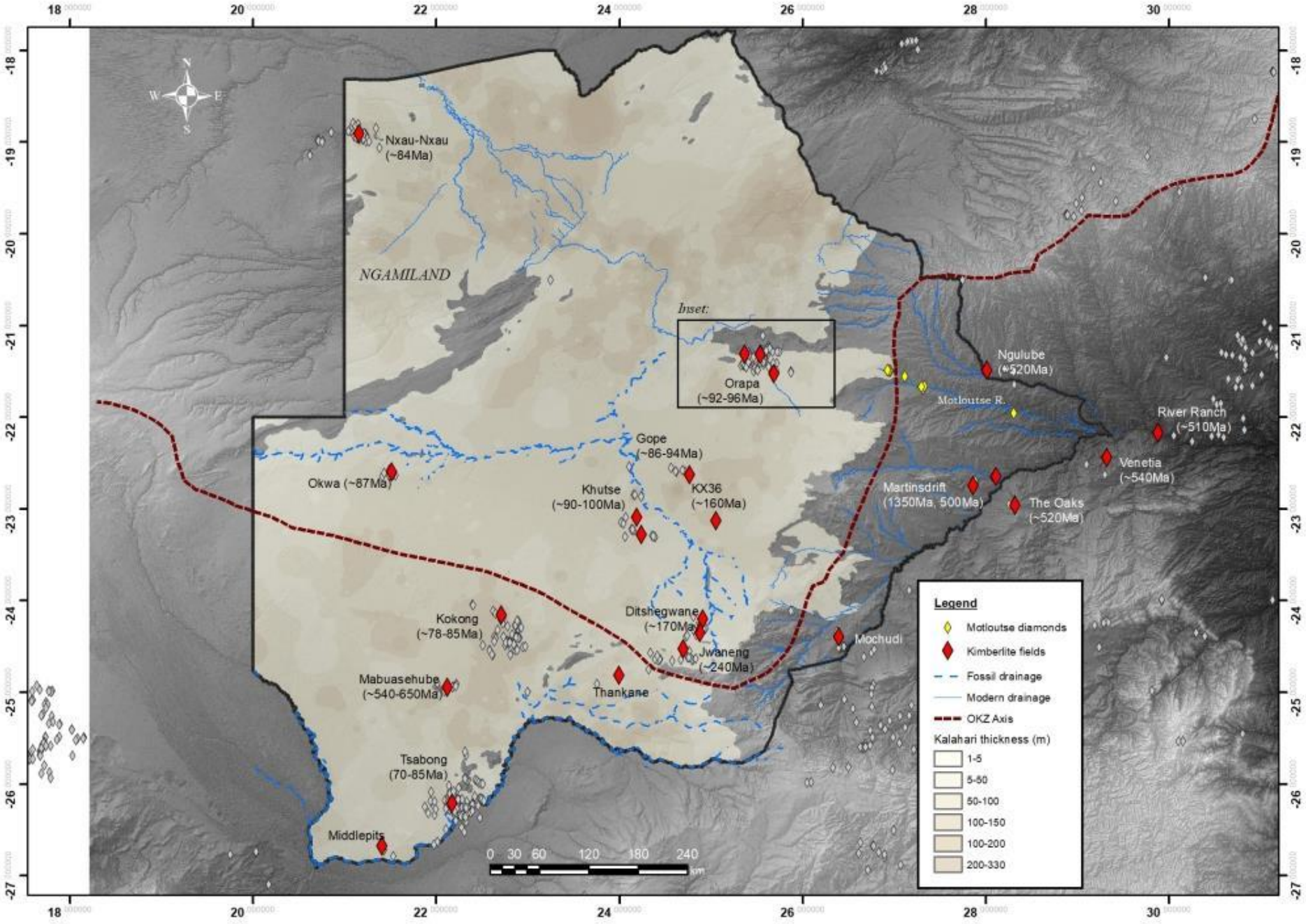
OK-77
OK-70
OK-73
OK-71
OK-72
OK-75
OK-76



Kalahari Isopachs,
Ian Haddon,
PhD thesis (2006)


KALAHARI
SANDS
OKZ Axis
EGT Axis
ESCARPMENT Axis
ATLANTIC
OCEAN
INDIAN
OCEAN
20ºS
30ºS
10ºE
20ºE
30ºE
40ºE
0
500
KILOMETRES


EGT
OKZ
Kalahari Schwelle
Ovamboland-Kalahari-Zimbabwe Axis
Etosha-Griqualand-Transvaal Axis
Bushmanland-Harts
GABORONE
MAKAPONG
TSABONG
MAFIKENG
VRYBURG
KLERKSDORP
CHRISTIANA
POSTMASBERG
UPINGTON
KAKAMAS
KENHARDT
Boegoesberg
BARKLY WEST
KIMBERLEY
BLOEMFONTEIN
HOPE TOWN
JADERSFONTEIN
PRIESKA
GROOTMODER
VERNEUKPAN
BRITSTOWN
DE AAR
COLESBERG
BURGERSDORP
VICTORIA WEST
MIDDELBURG
CALVINIA
BITTERFONTEIN
SPRINGBOK
POFADDER
ADGENYS
BOSLUISPAN
KEETMANSHOOP
KURUMAN
Orange
Vaal
Molopo
Kuruman
Nossob
Mosselebe
Pilanesberg
Nuweldt
Nossob
Nossob
Hartbeespoort
Sandveldt
Doornberg
Hartbeespoort
Bulfels
Kunkuiveld
Groot
Sak
Klaarsak
Bel
Sak
Sak
Sak
Doornfontein
Groot
Sak
Hartbeespoort
Hartbeespoort
Hartbeespoort


NGAMILAND
Nxau-Nxau (~84Ma)
Inset:
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Middlepits
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Motloutse R.
River Ranch (~510Ma)
Venetia (~540Ma)
Martinsdrift (1350Ma, 500Ma)
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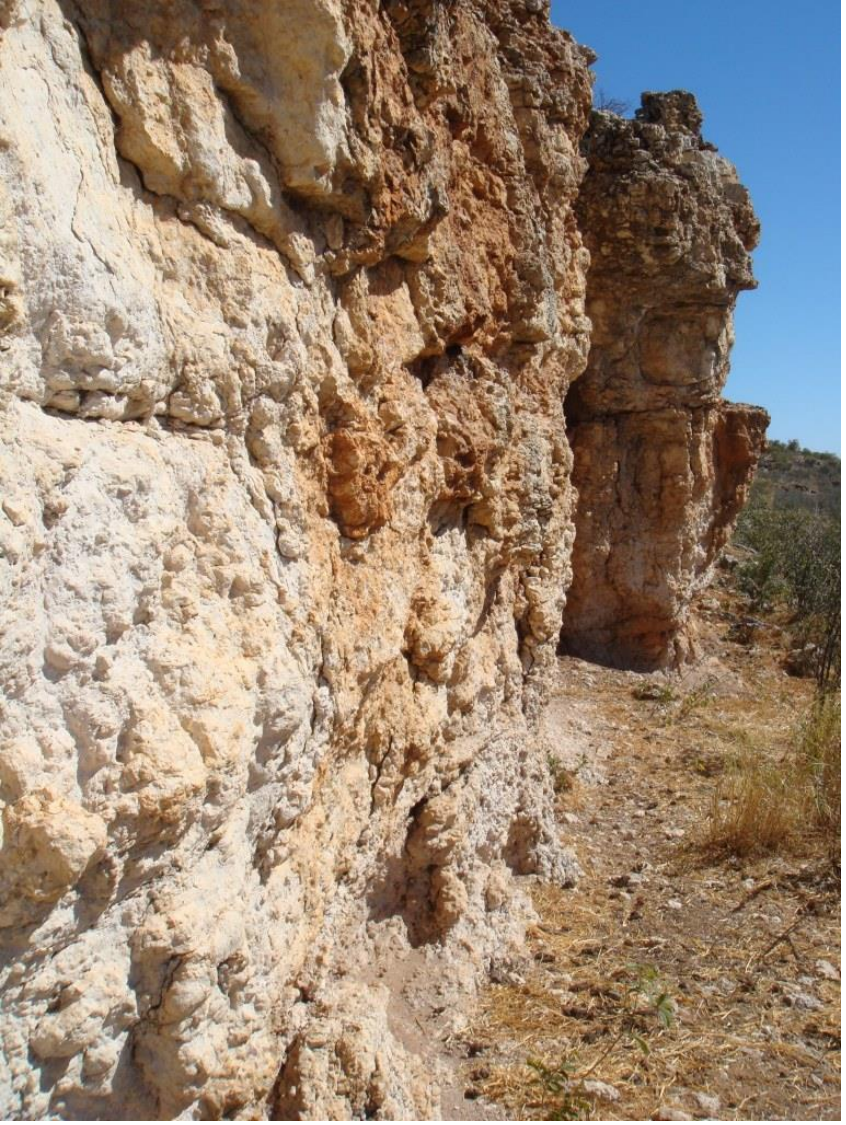
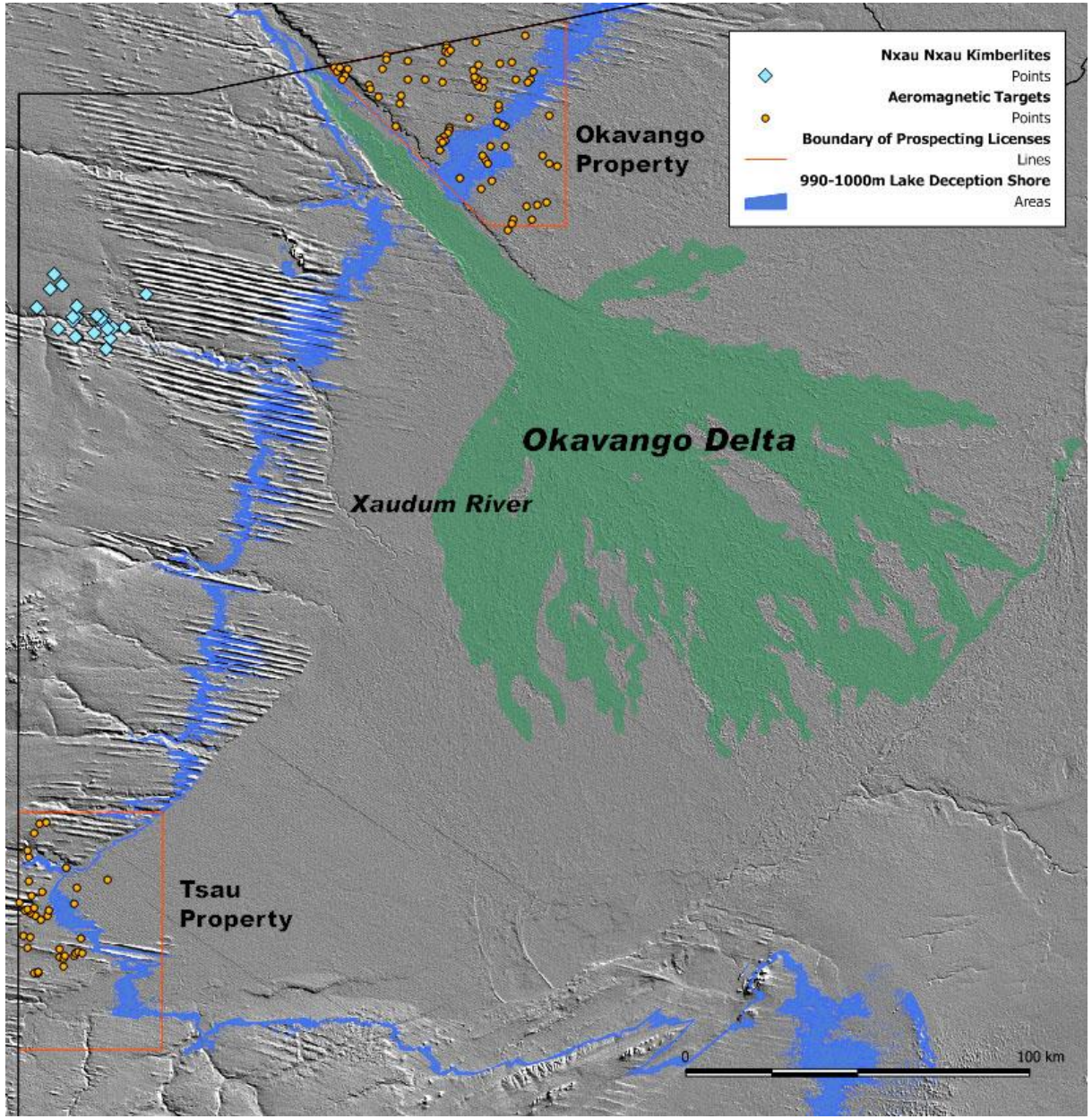
Modern drainage
OKZ Axis
Kalahari thickness (m)
1-5
5-50
50-100
100-150
100-200
200-330
0 30 60 120 180 240 km
N
S
W
E

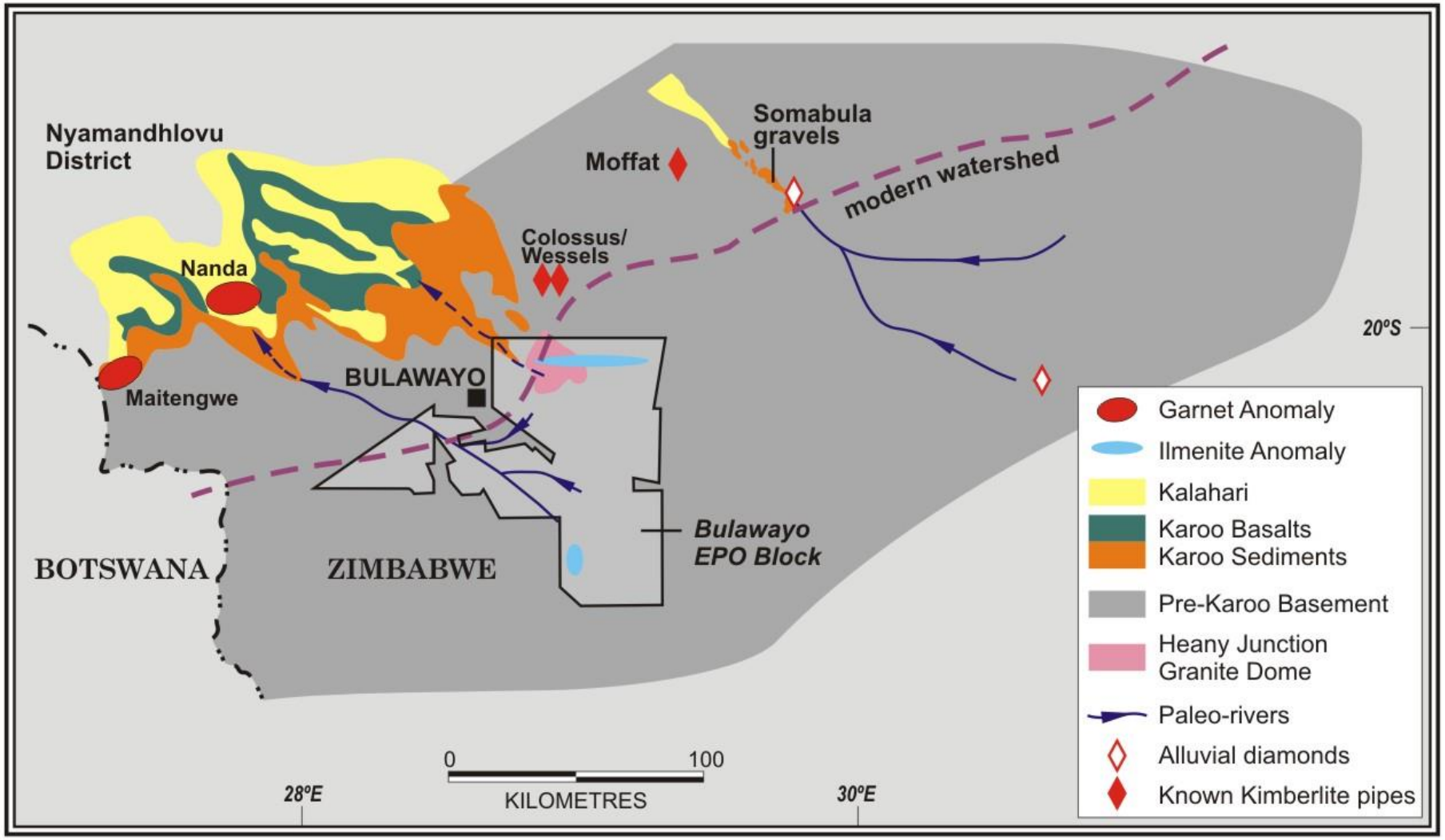
Calcrete-cemented conglomerate capping 78 Ma kimberlite

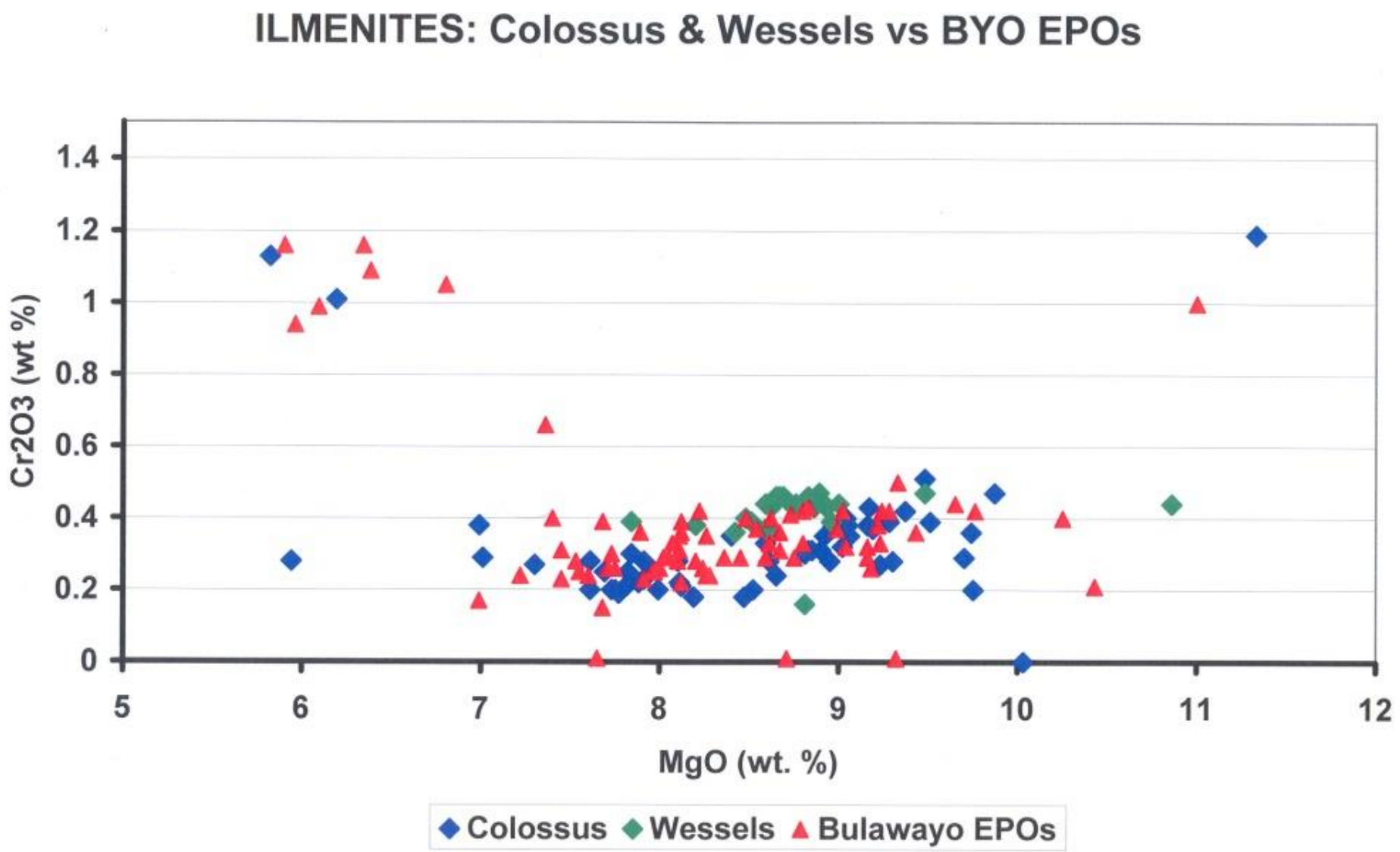
Calcrete-cemented conglomerate in 78 Ma kimberlite crater sediments

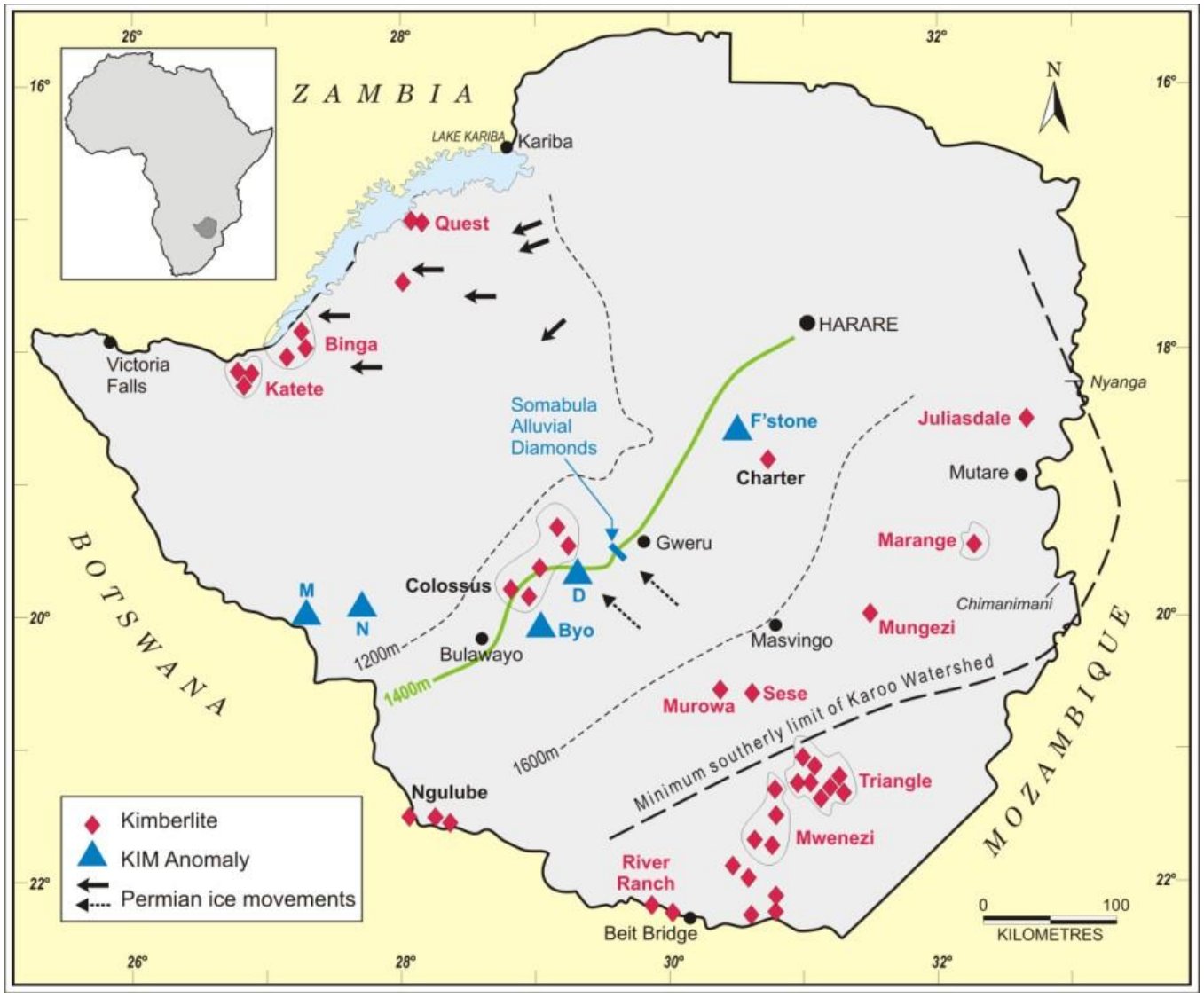
African surface silcrete partly replaced by calcrete – Eiseb valley, NE Namibia

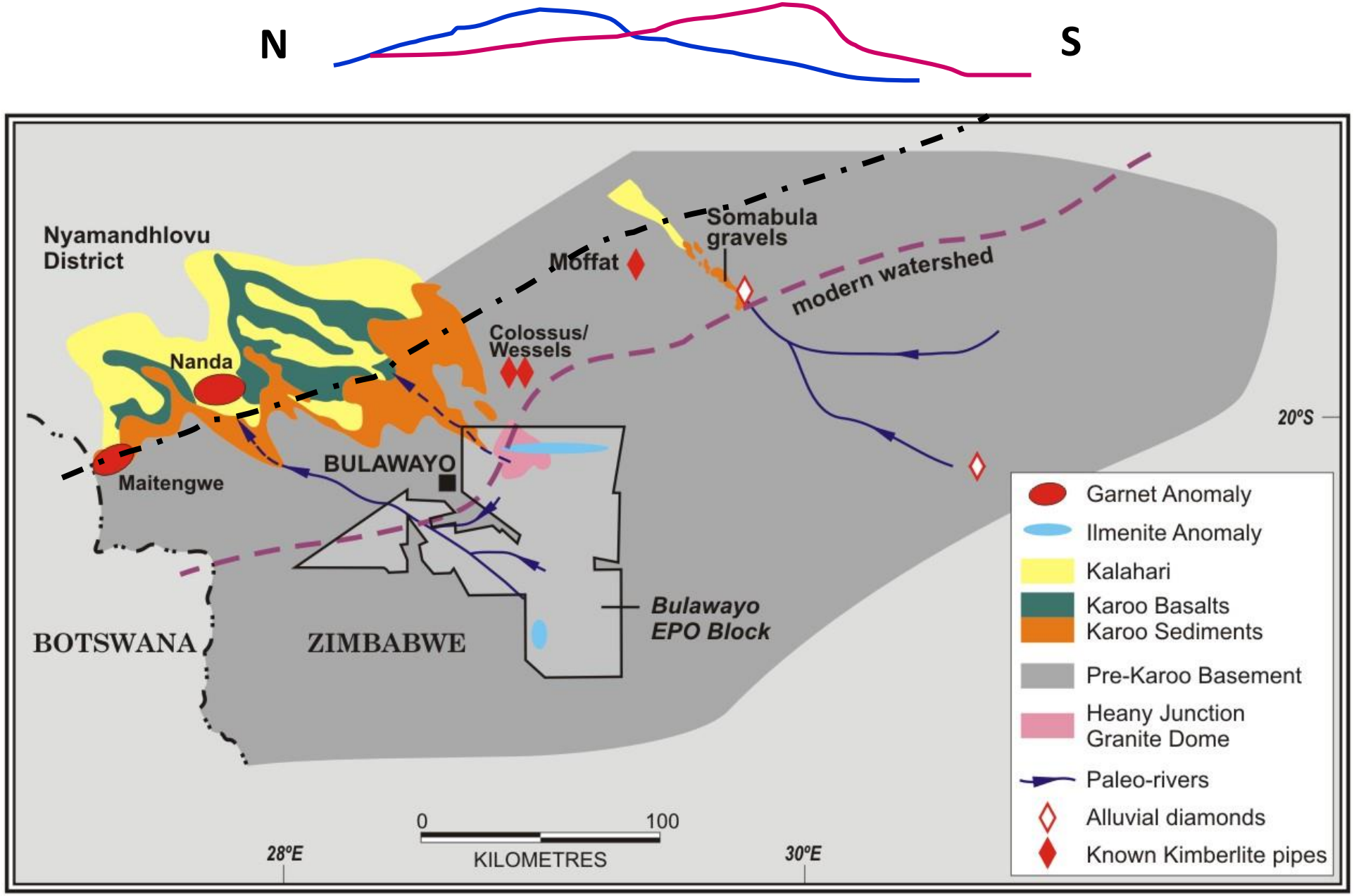



Nxau Nxau Kimberlites
Points
Aeromagnetic Targets
Points
Boundary of Prospecting Licenses
Lines
990-1000m Lake Deception Shore
Areas
Okavango Property
Okavango Delta
Xaudum River
Tsau Property
0
100 km

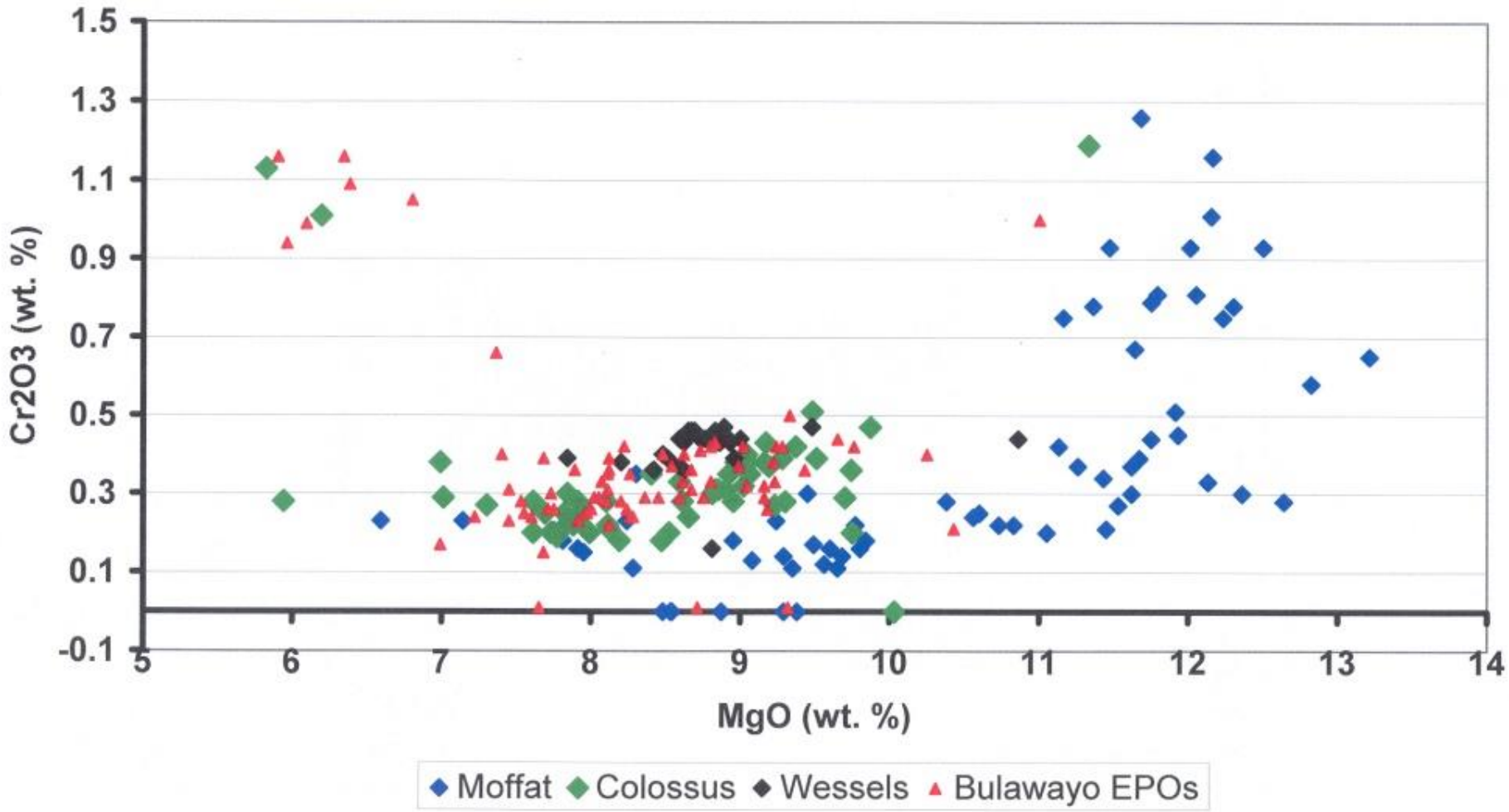

Nyamandhlovu District
Nanda
Maitengwe
Moffat
Somabula gravels
modern watershed
Colossus/ Wessels
BULAWAYO
Bulawayo EPO Block
BOTSWANA
ZIMBABWE
20°S
28°E
30°E
0
100
KILOMETRES
Garnet Anomaly
Ilmenite Anomaly
Kalahari
Karoo Basalts
Karoo Sediments
Pre-Karoo Basement
Heany Junction Granite Dome
Paleo-rivers
Alluvial diamonds
Known Kimberlite pipes


ILMENITES: Colossus & Wessels vs BYO EPOs
Cr2O3 (wt %)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
5
6
7
8
9
10
11
12
MgO (wt. %)
Colossus
Wessels
Bulawayo EPOs


ZAMBIA
BOTSWANA
MOZAMBIQUE
LAKE KARIBA
Kariba
Quest
Binga
Katete
Victoria Falls
HARARE
Nyanga
Juliasdale
F'stone
Charter
Mutare
Somabula Alluvial Diamonds
Gweru
Marange
Colossus
M
N
D
Byo
Bulawayo
Masvingo
Chimanimani
Mungezi
1200m
1400m
1600m
Murowa
Sese
Minimum southerly limit of Karoo Watershed
Triangle
Mwenezi
Ngulube
River Ranch
Beit Bridge
Kimberlite
KIM Anomaly
Permian ice movements
0
100
KILOMETRES
N
26°
28°
30°
32°
16°
18°
20°
22°


N
S
Nyamandhlovu District
Nanda
Maitengwe
Moffat
Somabula gravels
modern watershed
Colossus/ Wessels
BULAWAYO
Bulawayo EPO Block
BOTSWANA
ZIMBABWE
20°S
28°E
30°E
0
100
KILOMETRES
Garnet Anomaly
Ilmenite Anomaly
Kalahari
Karoo Basalts
Karoo Sediments
Pre-Karoo Basement
Heany Junction Granite Dome
Paleo-rivers
Alluvial diamonds
Known Kimberlite pipes

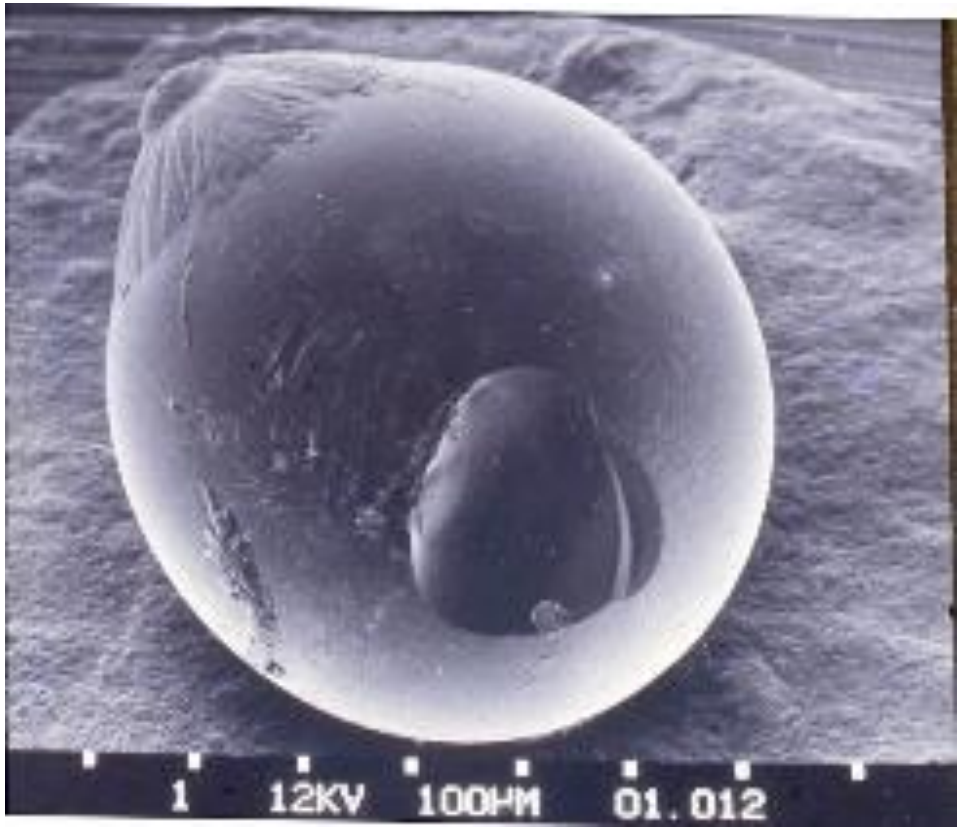
ILMENITES: Colossus kimberlites vs Bulawayo EPOs



Wot is this??

Clue 1: It comes from the Kalahari

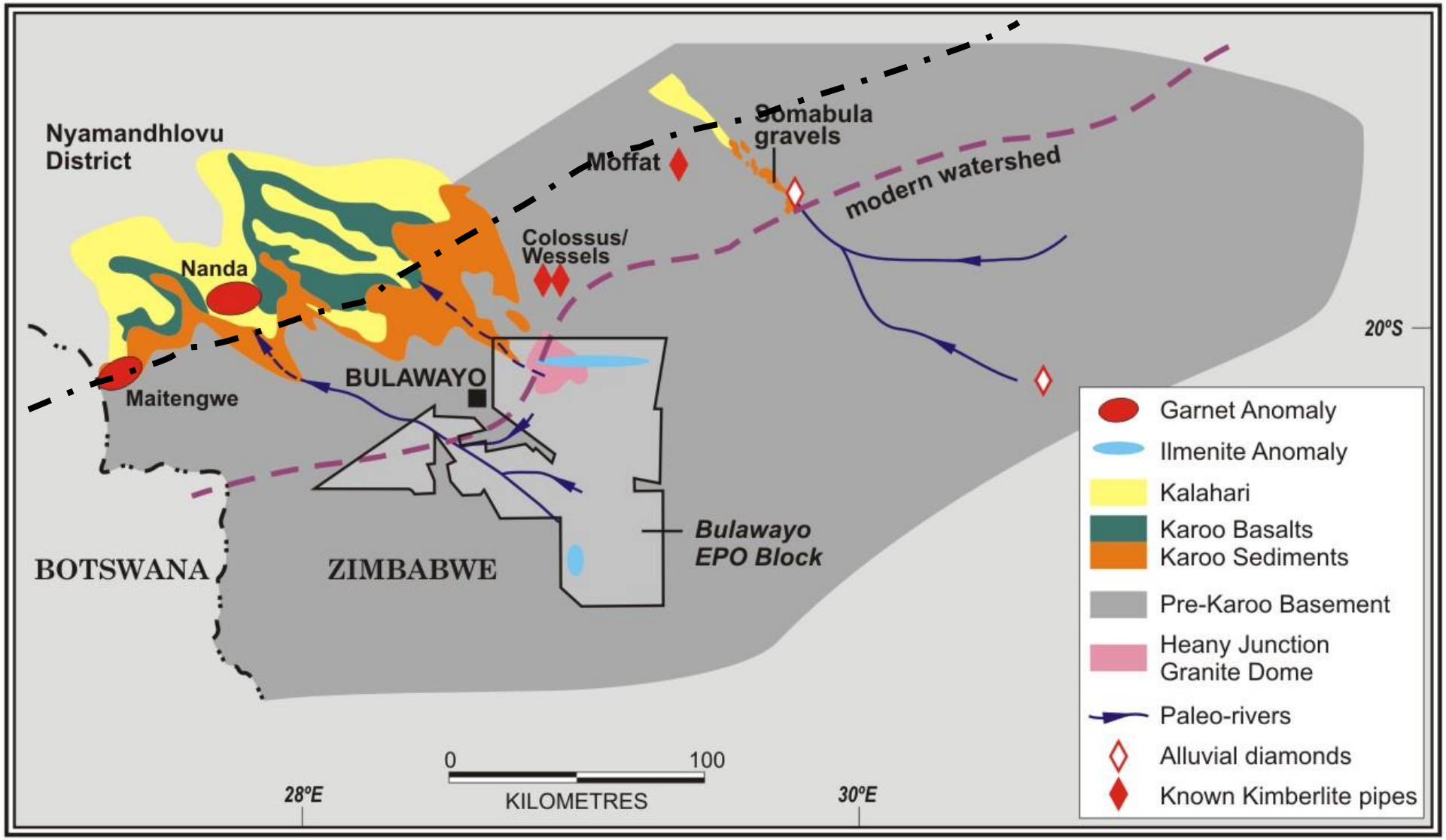
Clue 2: Sharad Master found it very exciting



Kalahari tektite ??

Tectite from Pretoria Salt Pan impact structure

N
S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