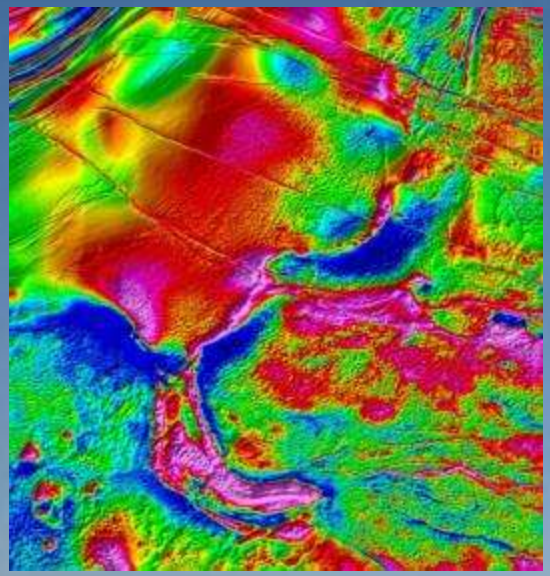
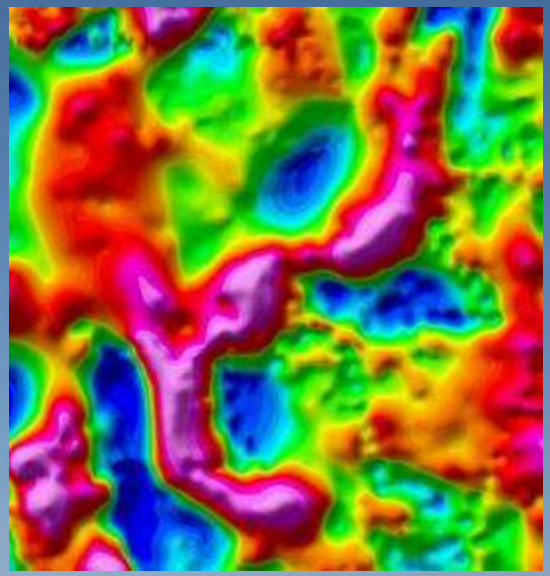


Geological Society of Zimbabwe

Summer Symposium 2017



THE XADE COMPLEX

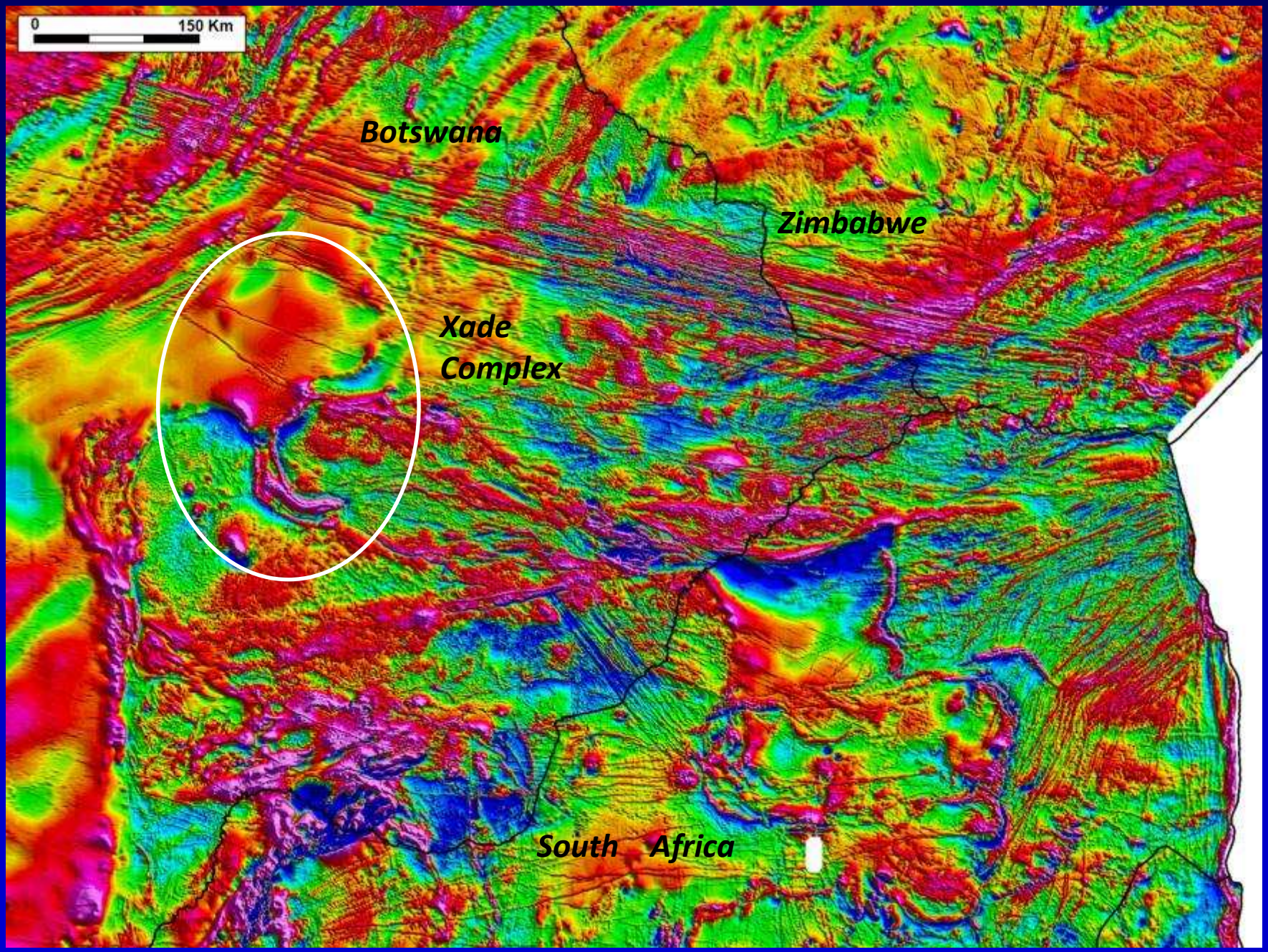
AND ITS PLACE IN THE IGNEOUS UMKONDO EVENT:

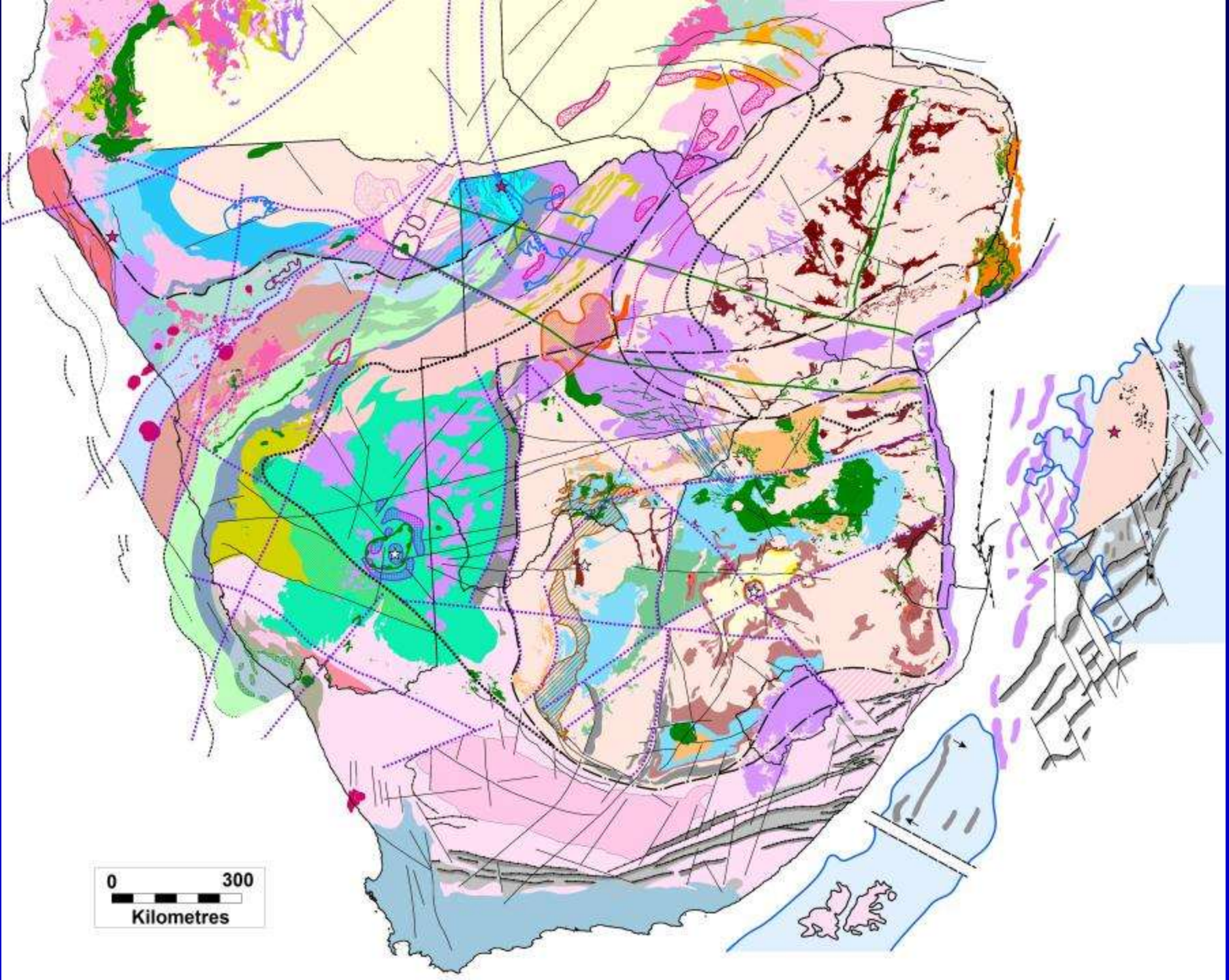
a challenge through 200-1000+ m of cover

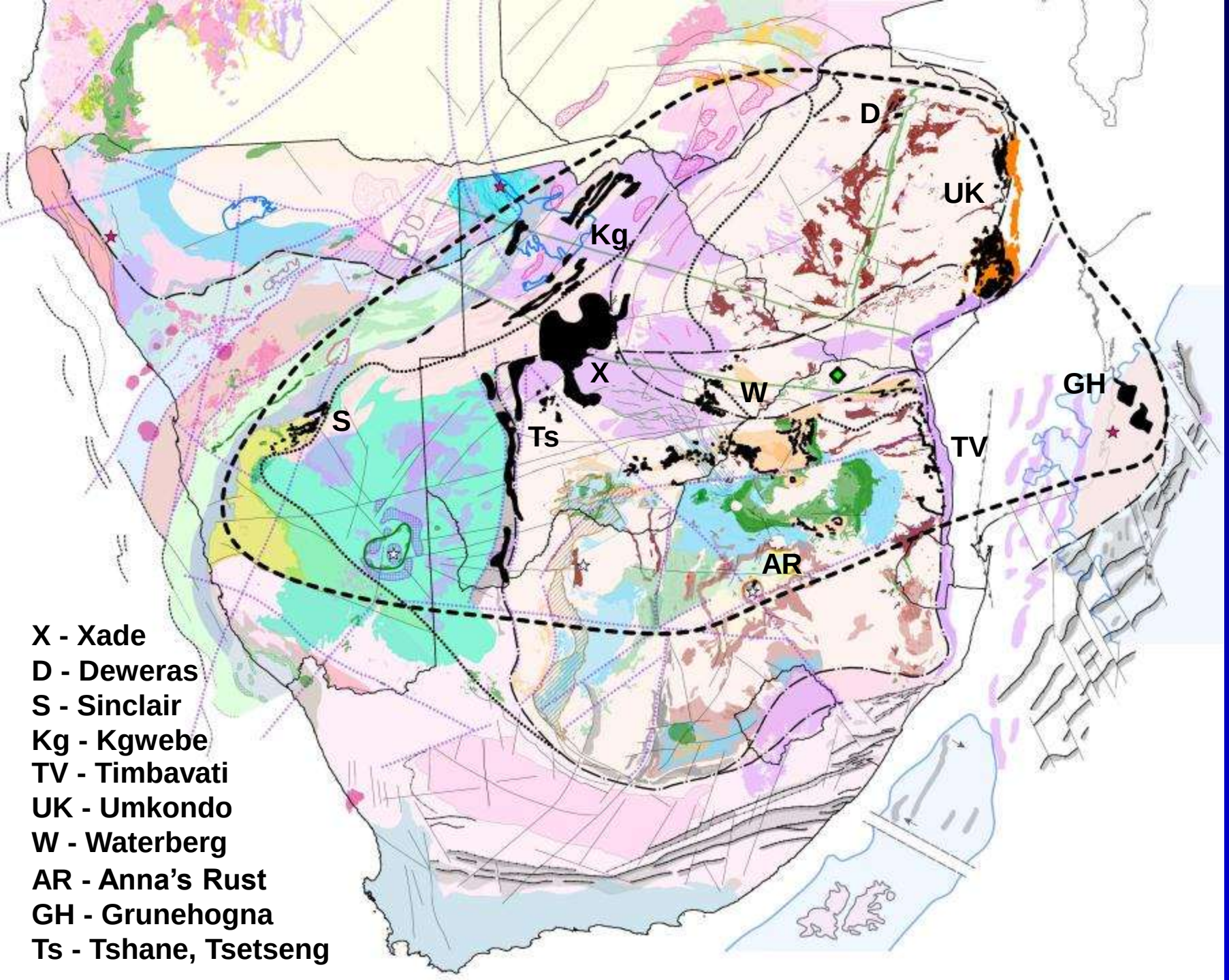
Peter Hildebrand, Branko Corner, John Blaine

Manica Minerals Ltd

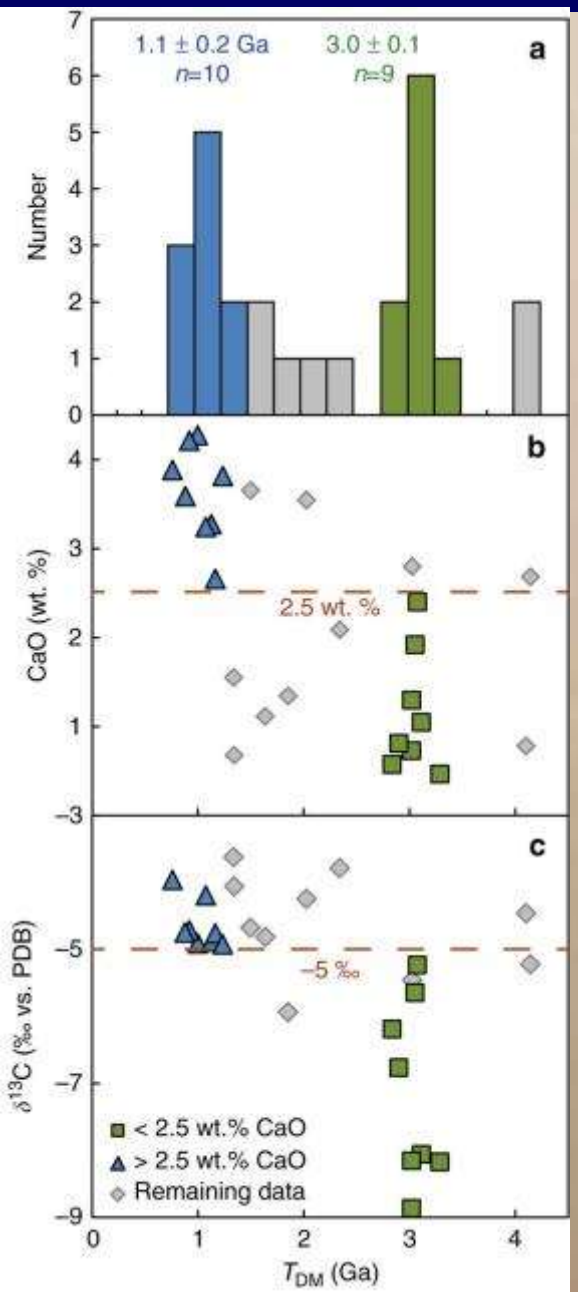
XADE COMPLEX – REGIONAL TOTAL MAGNETIC INTENSITY IMAGE (1 km line data)




0
300
Kilometres


D
UK
Kg
X
W
GH
S
Ts
TV
AR
X - Xade
D - Deweras
S - Sinclair
Kg - Kgwebe
TV - Timbavati
UK - Umkondo
W - Waterberg
AR - Anna's Rust
GH - Grunehogna
Ts - Tshane, Tsetseng

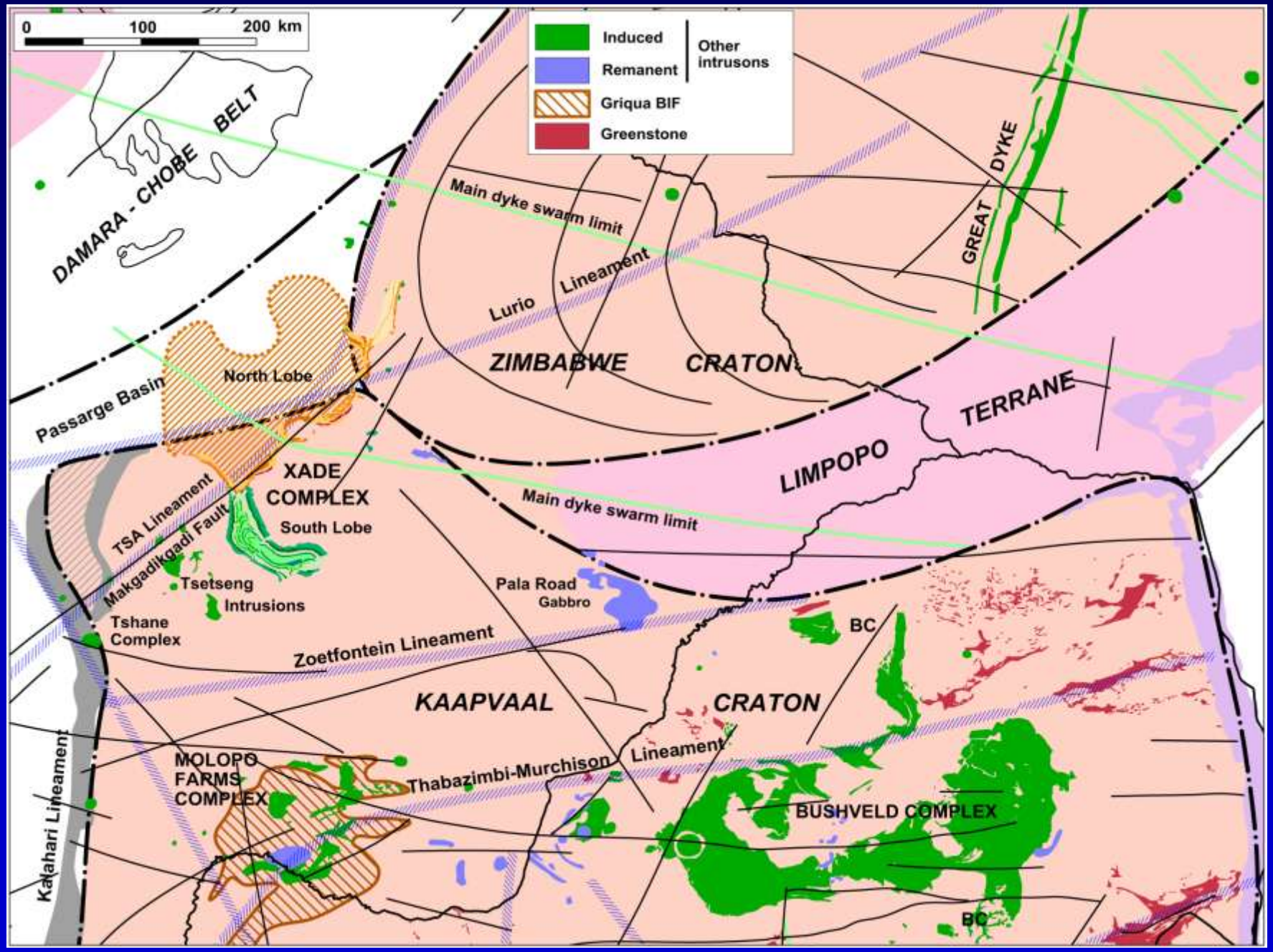
THE UMKONDO IN VENETIAN DIAMONDS – Korneef et al 2017



XADE COMPLEX: DISCOVERY AND BACKGROUND

- Discovered during the first airborne magnetic survey of Botswana in 1976
- First drilled during the Kalahari drilling project in 1977-8, two holes:
  - CKP6 Gabbro
  - CKP6A Dolerite grading into basalt
  - Dated by Hanson at 1.1 Ga
- Anglo American (Ambot) exploration, one hole:
  - XH1 Amygdaloidal lava, dolerite on Waterberg sediments
- Manica Minerals 2005 – 2013, 4 holes:
  - XD09-01 basalt with subordinate gabbro
  - XD09-02 diorite and gabbro
  - XD09-03 gabbro passing through to basement
  - XD12-02 amygdaloidal lavas
  - Dating work confirming Hanson age
  - Extensive petrography and geochemistry

XADE COMPLEX : CRATON MARGIN SETTING AND SIZE



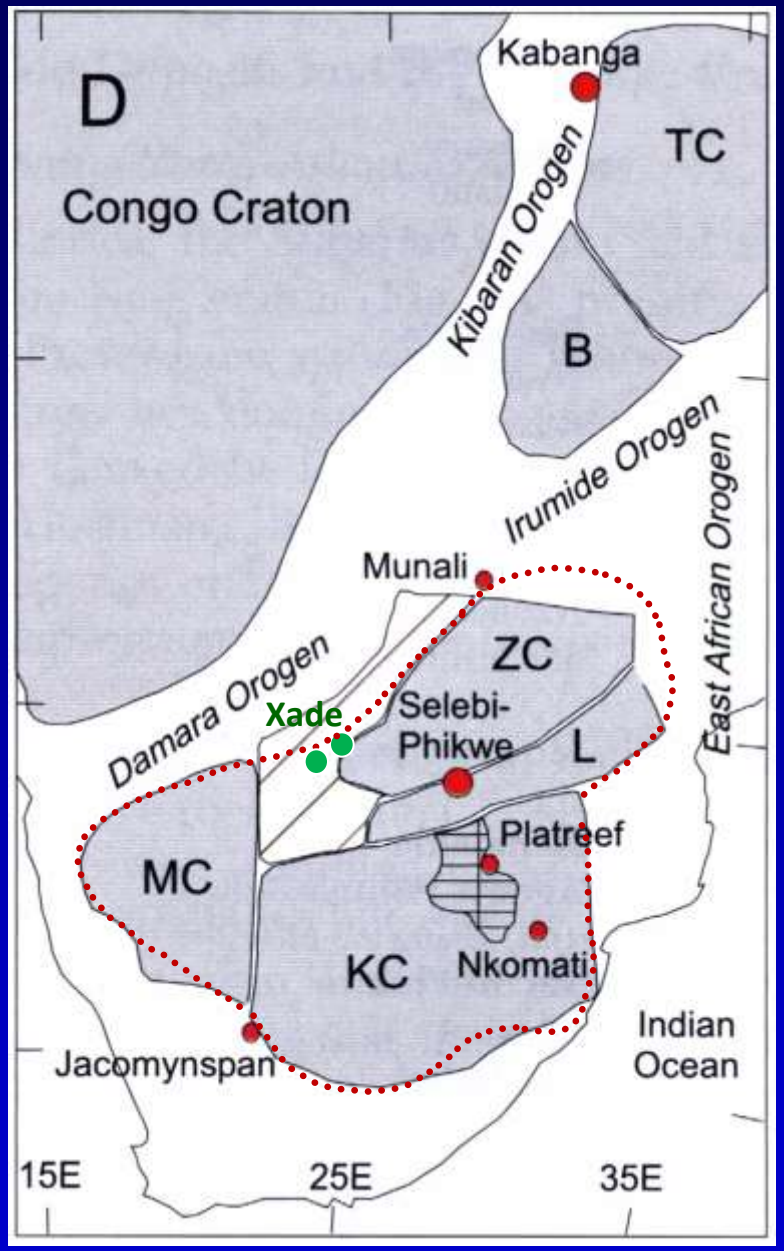
Well known relationship of Ni sulphide deposits to craton margins, e.g.

(Begg, Hronsky, *et al.* Econ. Geol., Sep 2010)

Craton	Deposit
Superior	Thompson, Raglan, Sudbury, Eagle, Duluth
Nain	Voisey's Bay
Yigarn	West Musgrave
Siberian	Norilsk

Other 1.1 Ga Ni deposits

West Central Australia	Giles Complex, Babel Nebo



Ni-Pt deposits (after Begg, Hronsky *et al, 2010)*

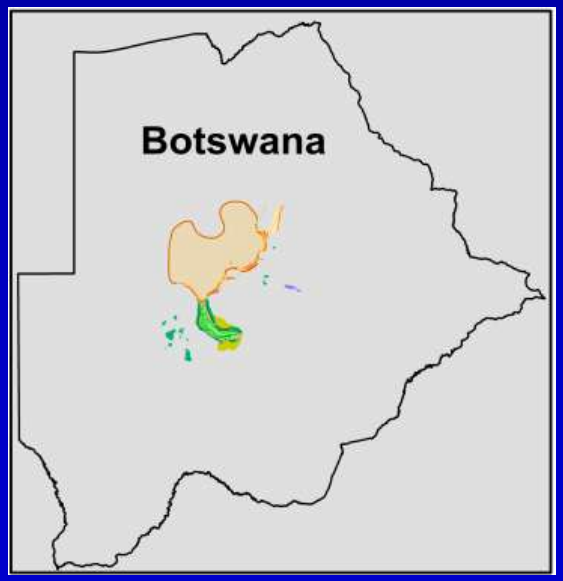
Kalahari Craton (Corner, 2003)

XADE COMPLEX
TOTAL MAGNETIC INTENSITY
(RTP)

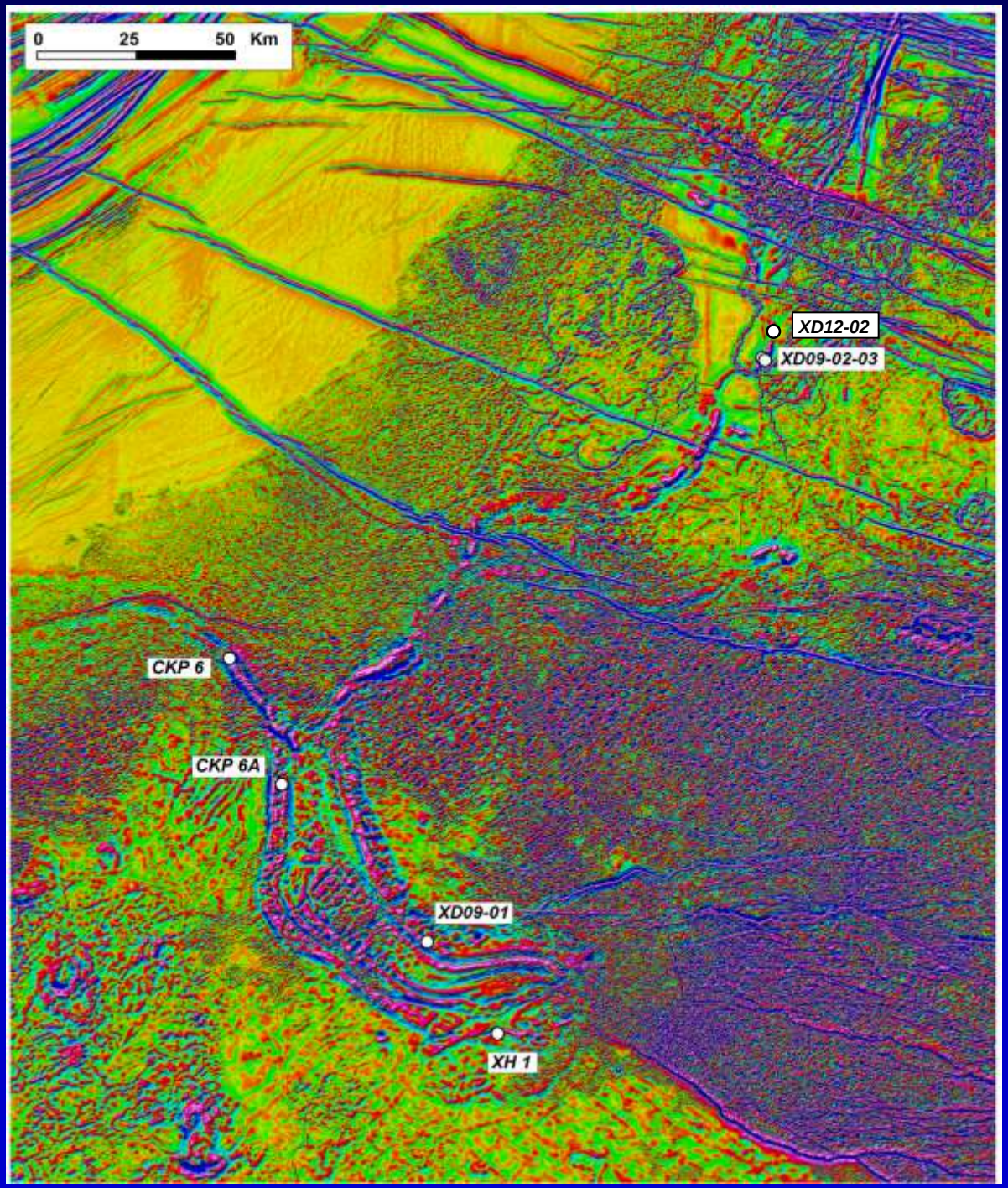
200 m DGS line data

Note

- Boreholes drilled
- 2 lobes interpreted
- Extension under Passarge Basin



Manica Minerals

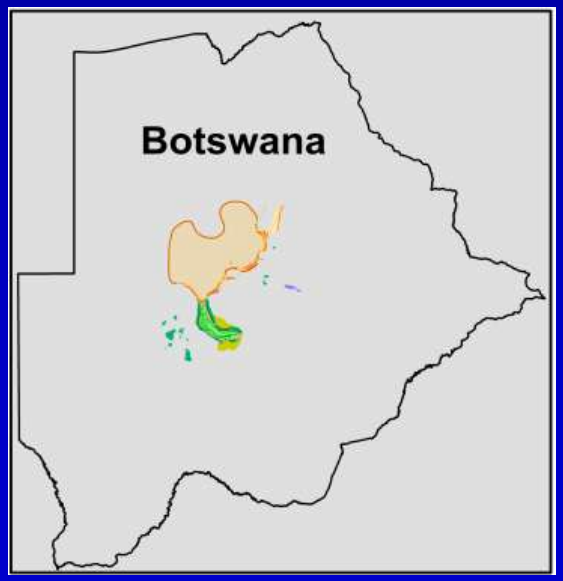


XADE COMPLEX
FIRST VERTICAL DERIVATIVE (RTP)

200 m DGS line data

Note enhancement of

- South lobe zoning
- Structure
- North lobe subcrop
- North lobe overlies South lobe?



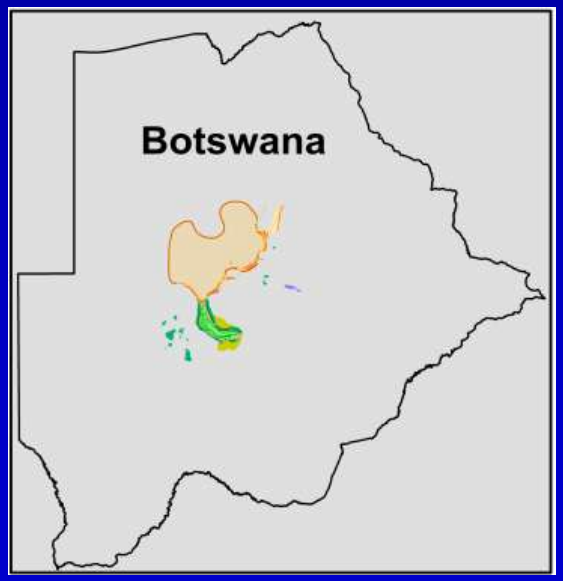
XADE COMPLEX BOUGUER GRAVITY RESIDUAL IMAGE

DGS ground data

Gravity station locations shown as black dots

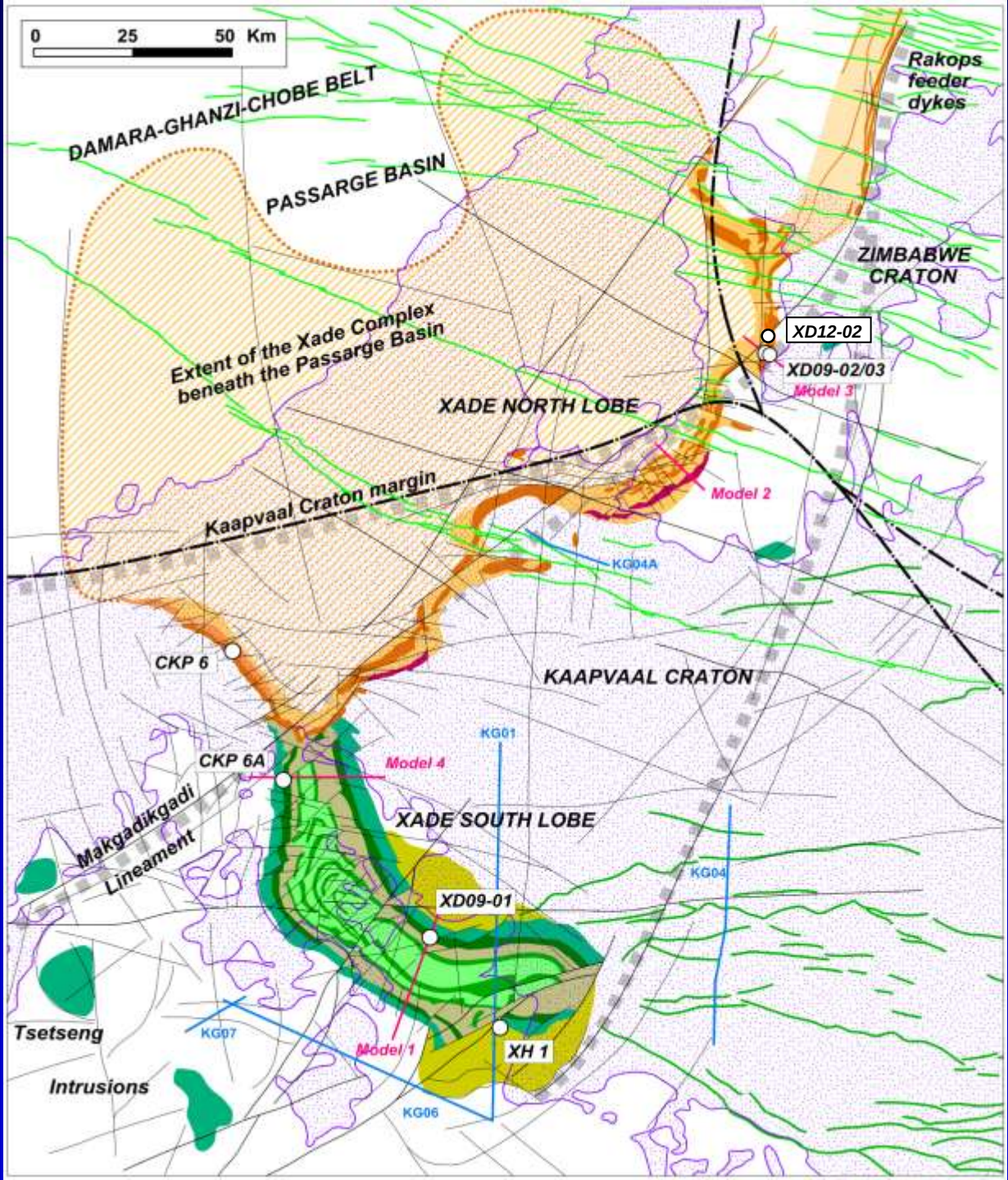
Note

- Clear gravity signature
- Extension under Passarge Basin



Manica Minerals

XADE COMPLEX GEOPHYSICAL INTERPRETATION



LEGEND

- Boreholes
- Modelled profile
- Ambot seismic line
- Dyke (undifferentiated)
- Pre-Karoo dyke (?)
- Fault
- Regional structure, Lineament
- Craton margin
- Karoo basalt

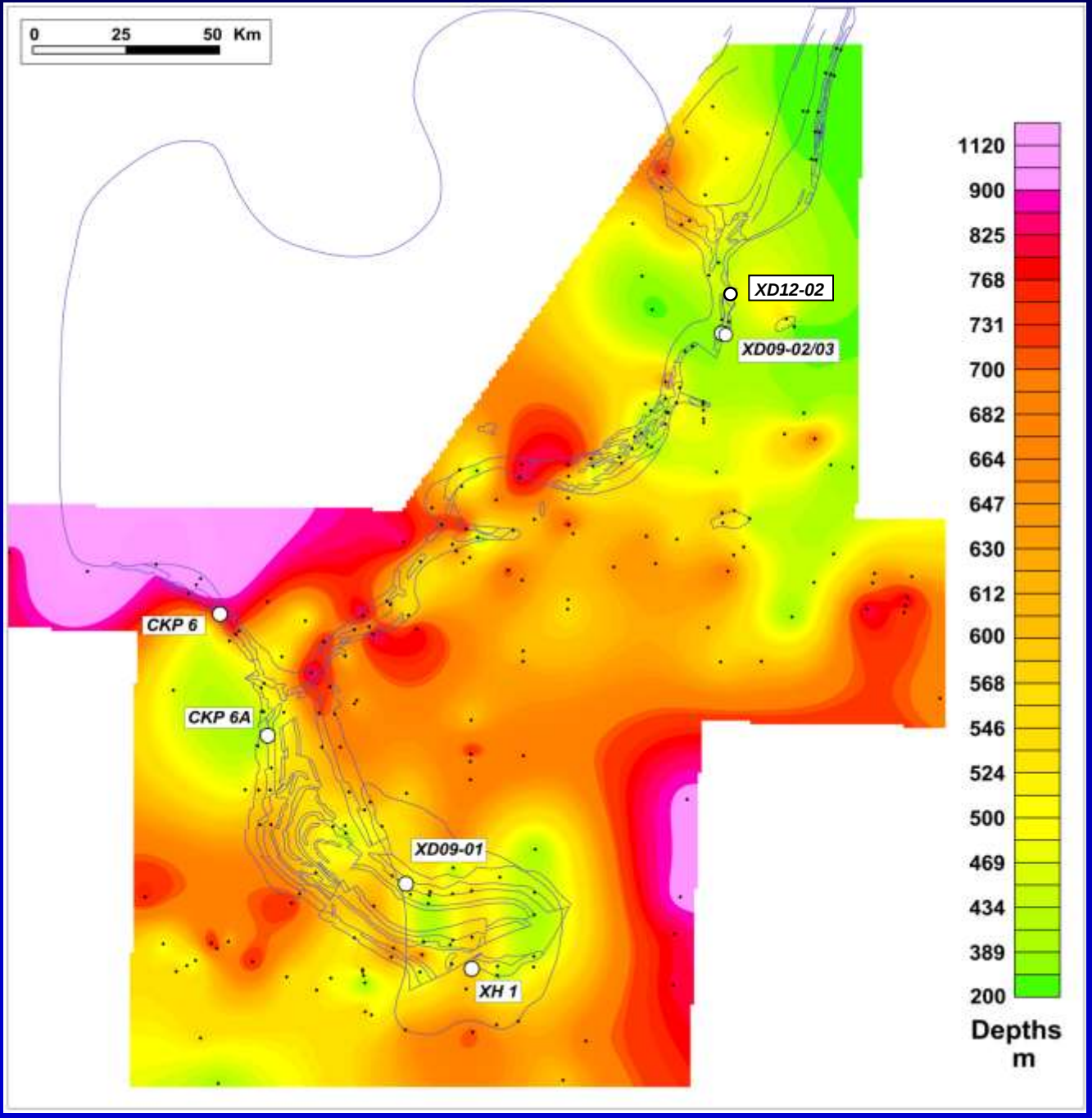
North Lobe (NL):

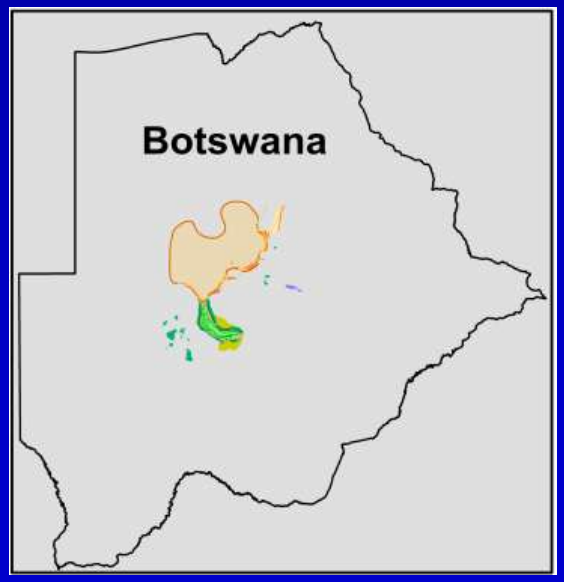
- Extent of North Lobe at depth
- Remanent magnetic zone
- Induced magnetic zone
- Approximate suboutcrop extent
- Zone of feeder dykes

South Lobe (SL):

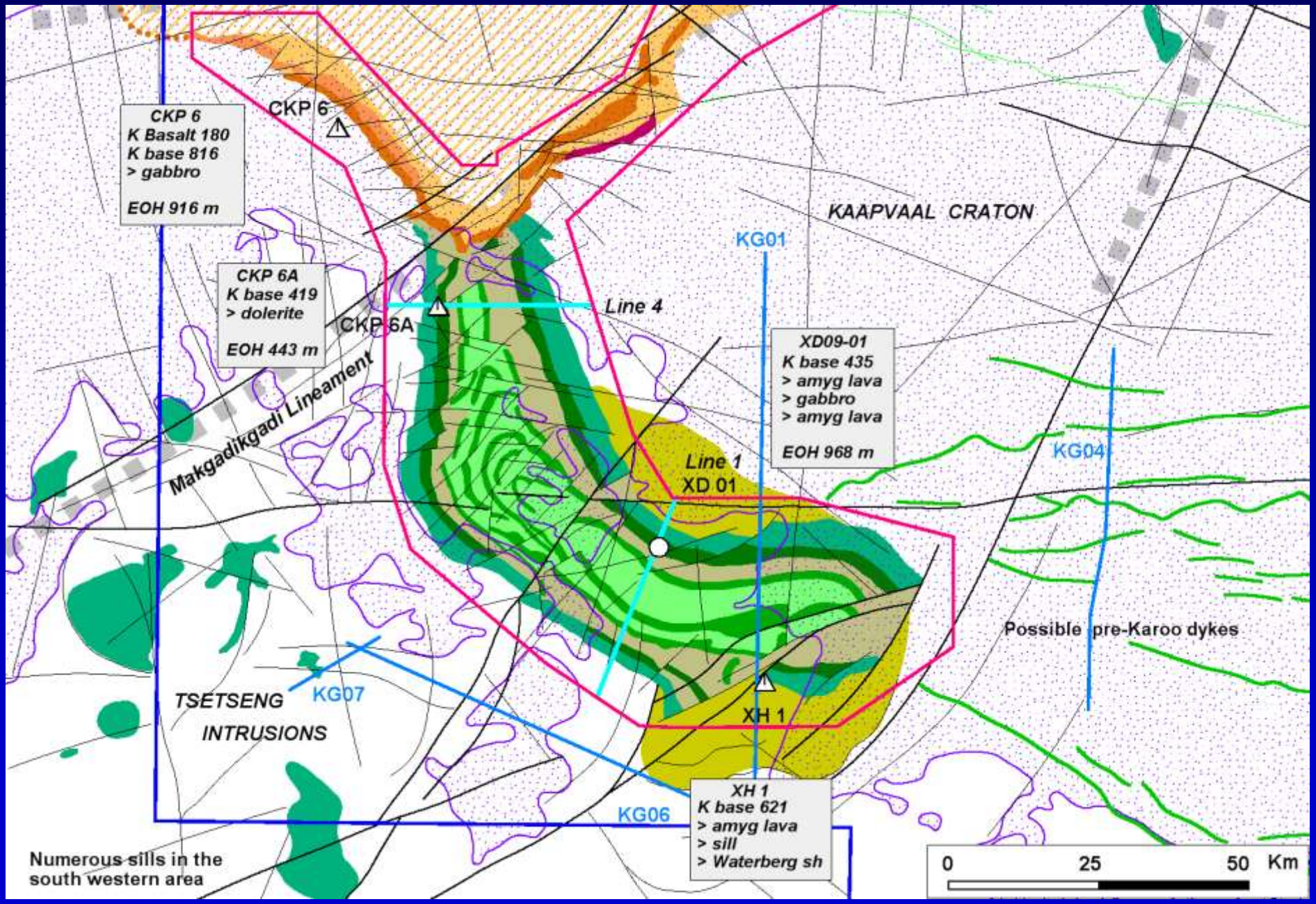
- Upper low-magnetic zones
- Magnetic zone (~0.05 SI)
- Middle low-magnetic zone
- Magnetic zone (~0.135 SI)
- Magnetic zone (~0.14 SI)
- Volcanics (magnetically quiet)

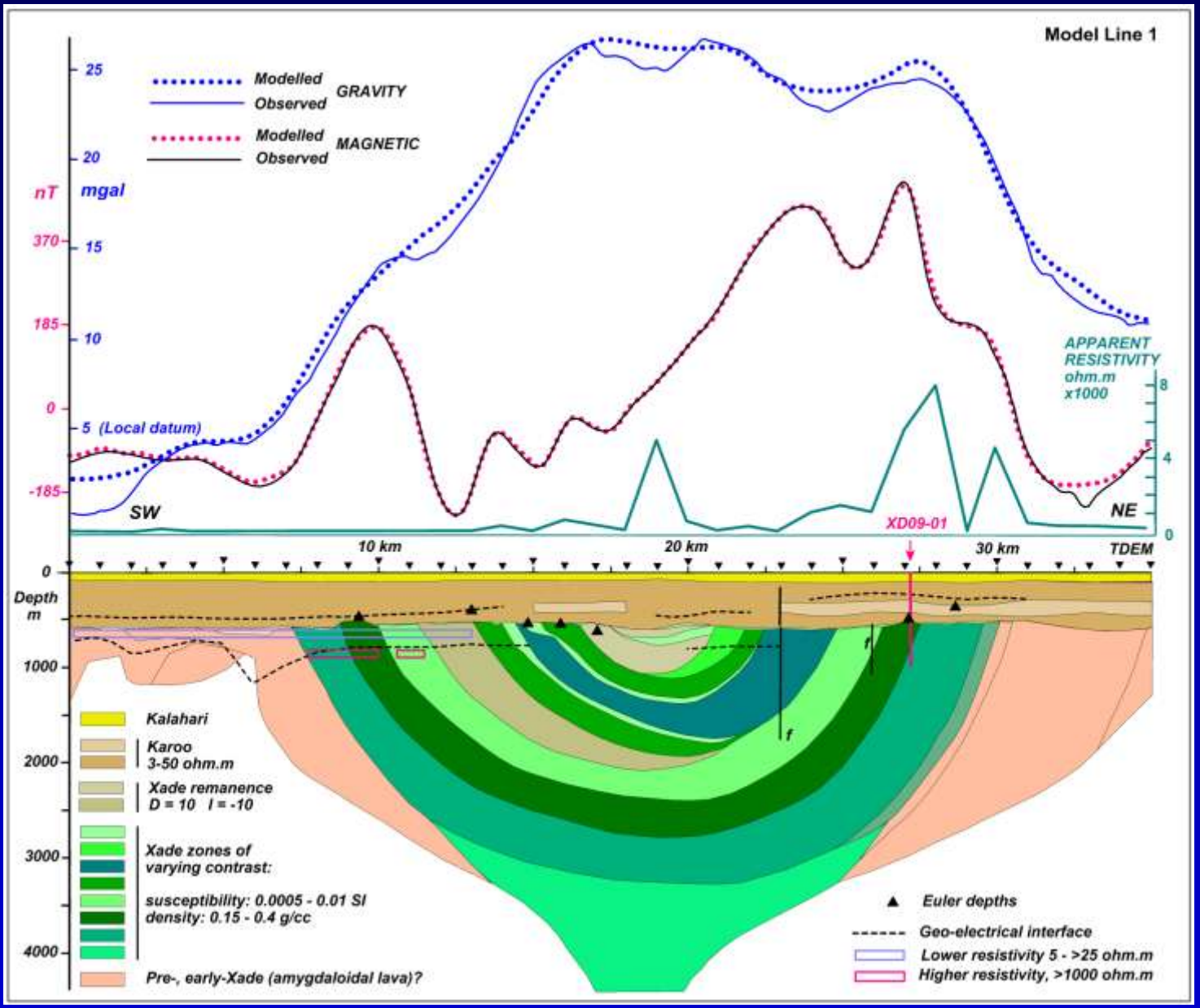
XADE COMPLEX DEPTHS DERIVED FROM EULER DECONVOLUTION





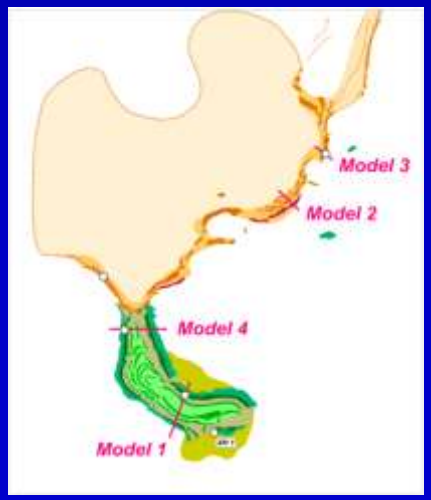
XADE COMPLEX SOUTH LOBE – INTERPRETATION DETAIL





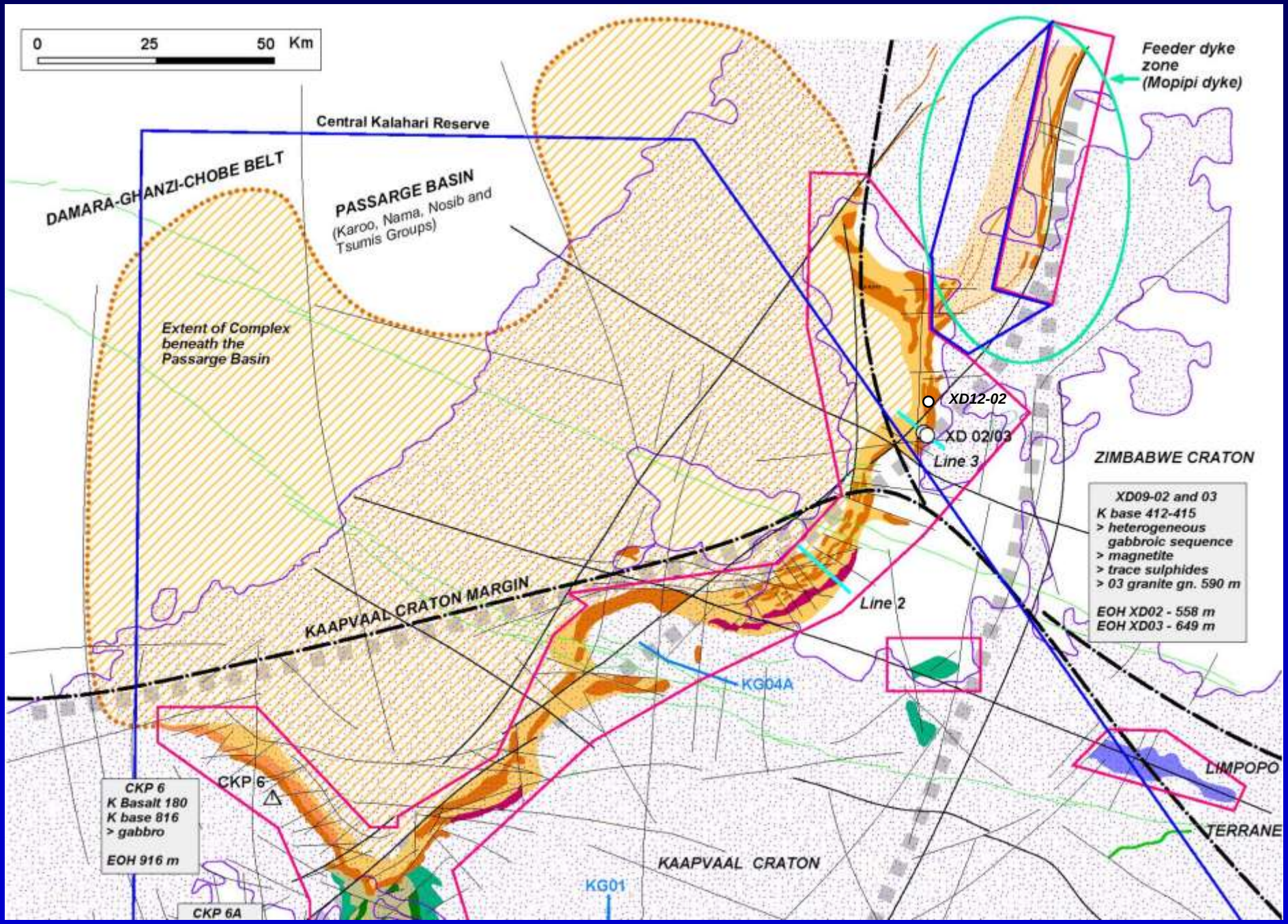
SOUTH LOBE : LINE 1 FORWARD MODEL,

magnetics and gravity



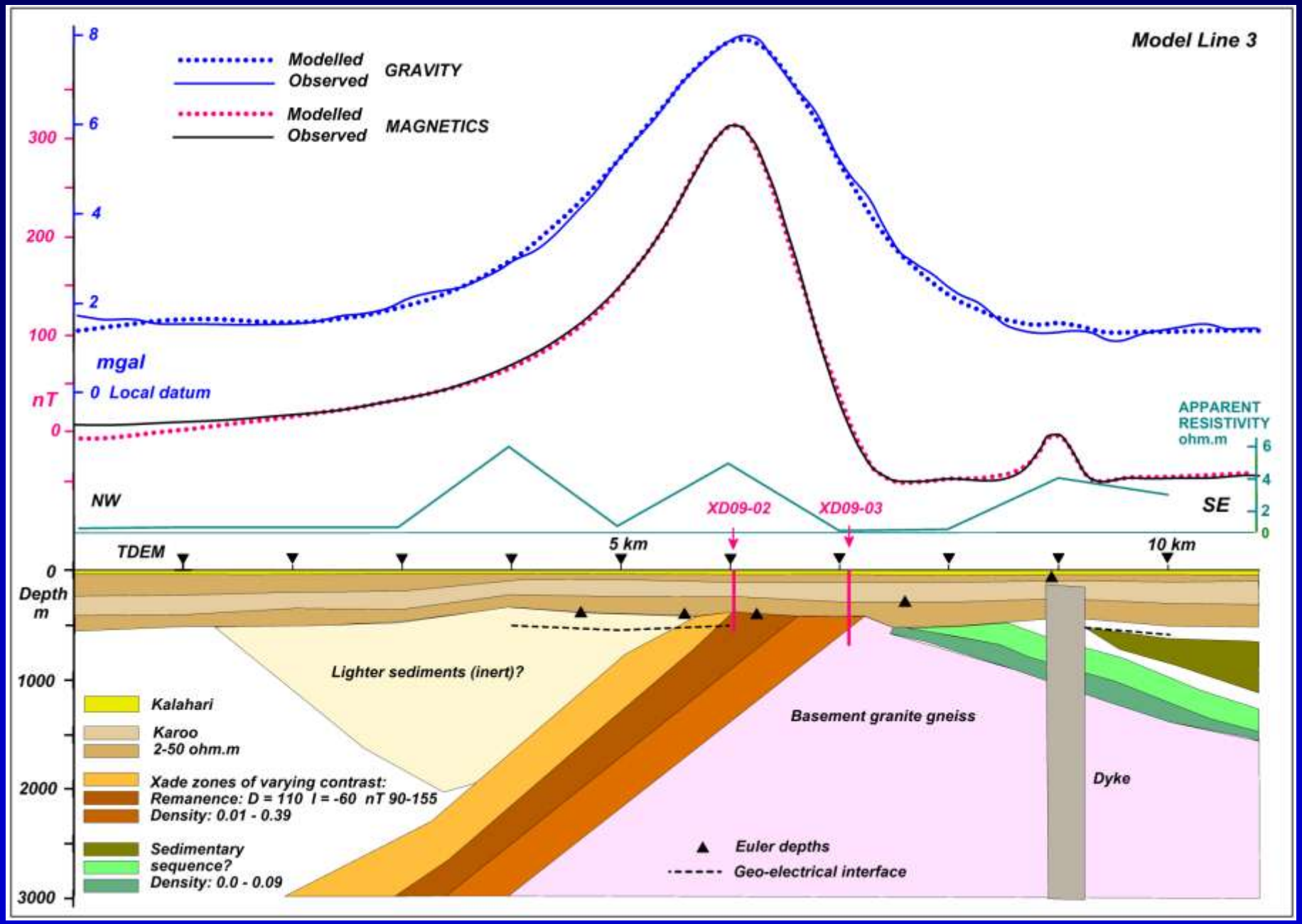
Vertical exaggeration 3:1. Modelled limb dips = 25-30°

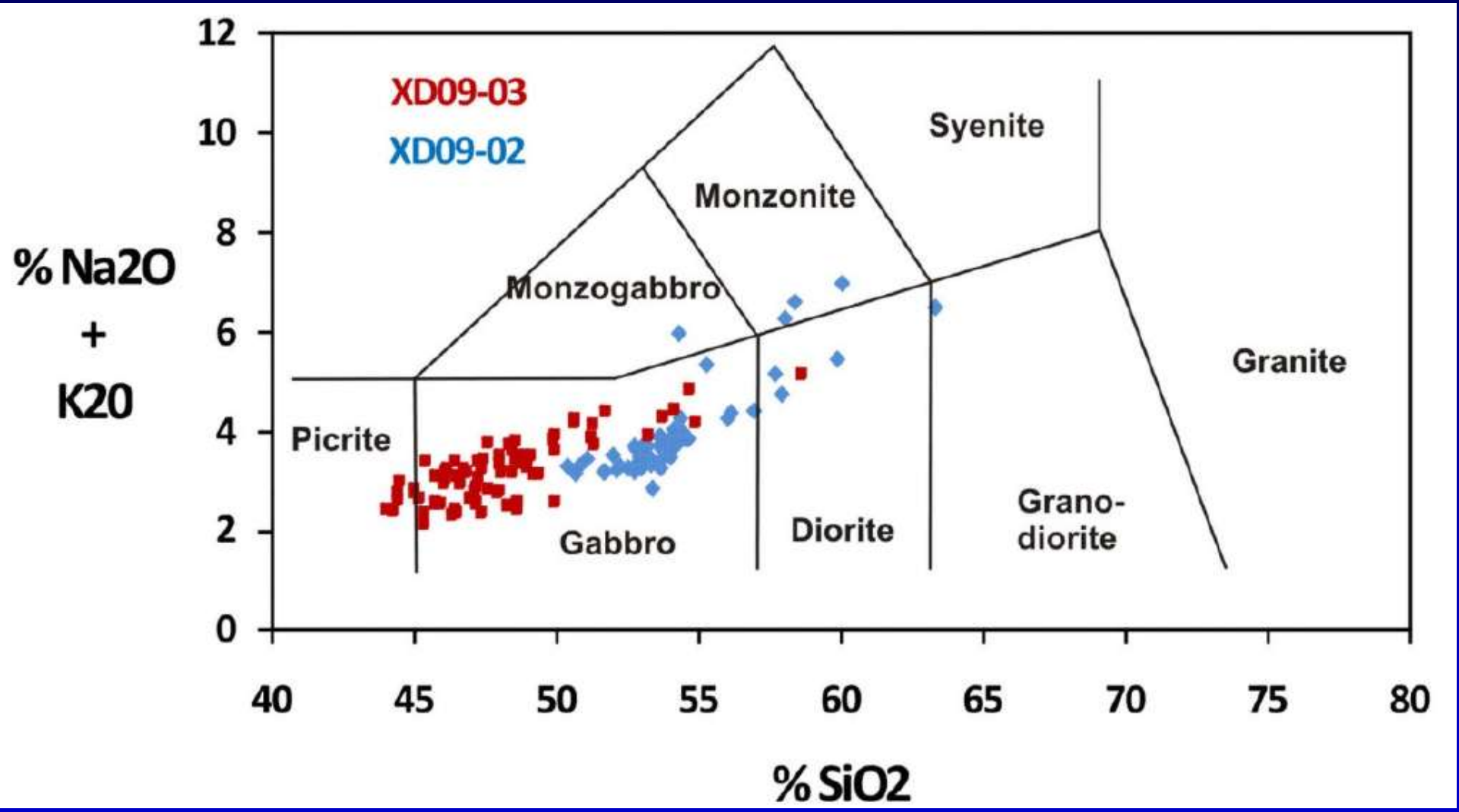
XADE COMPLEX NORTH LOBE – INTERPRETATION DETAIL

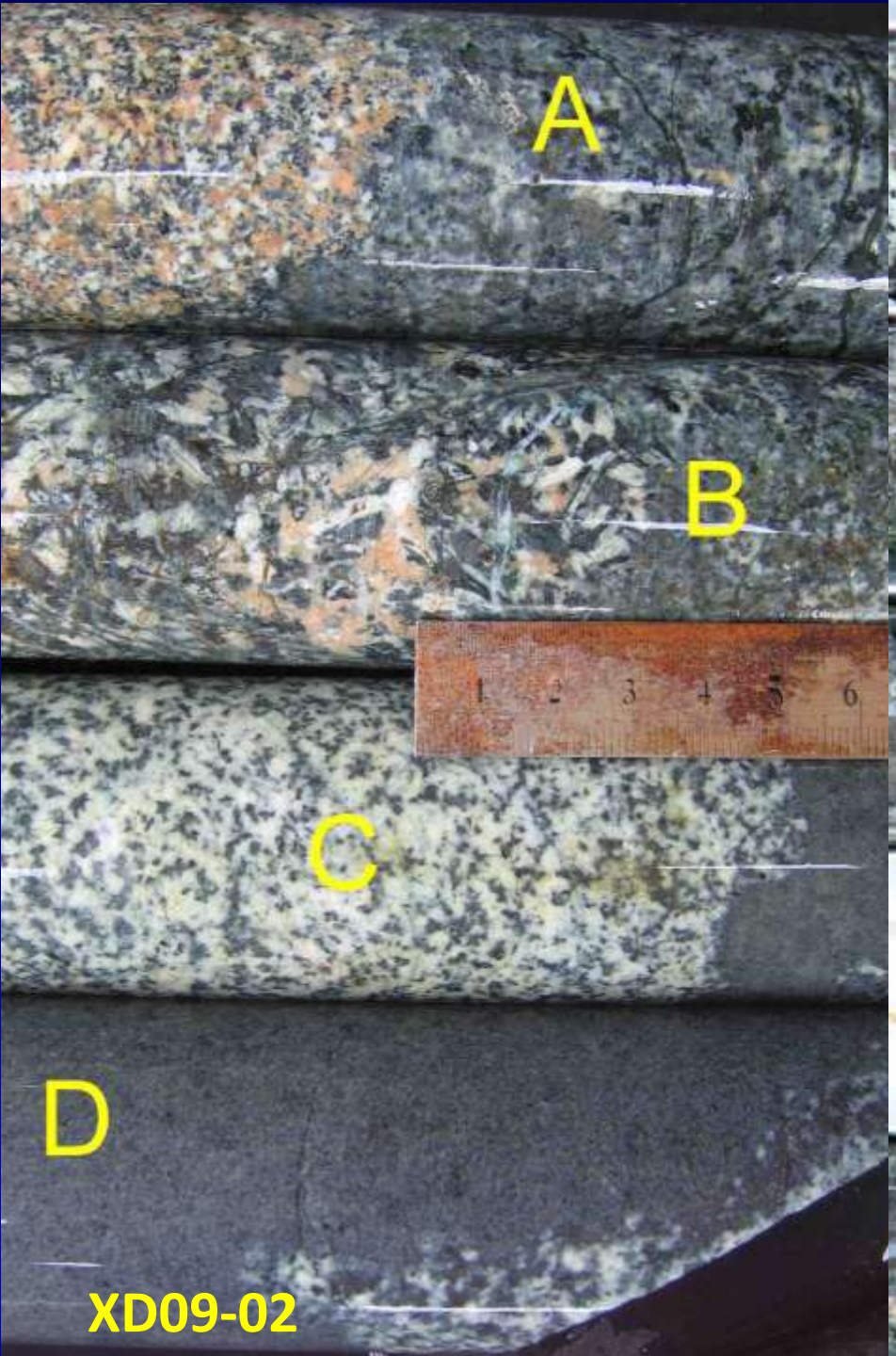


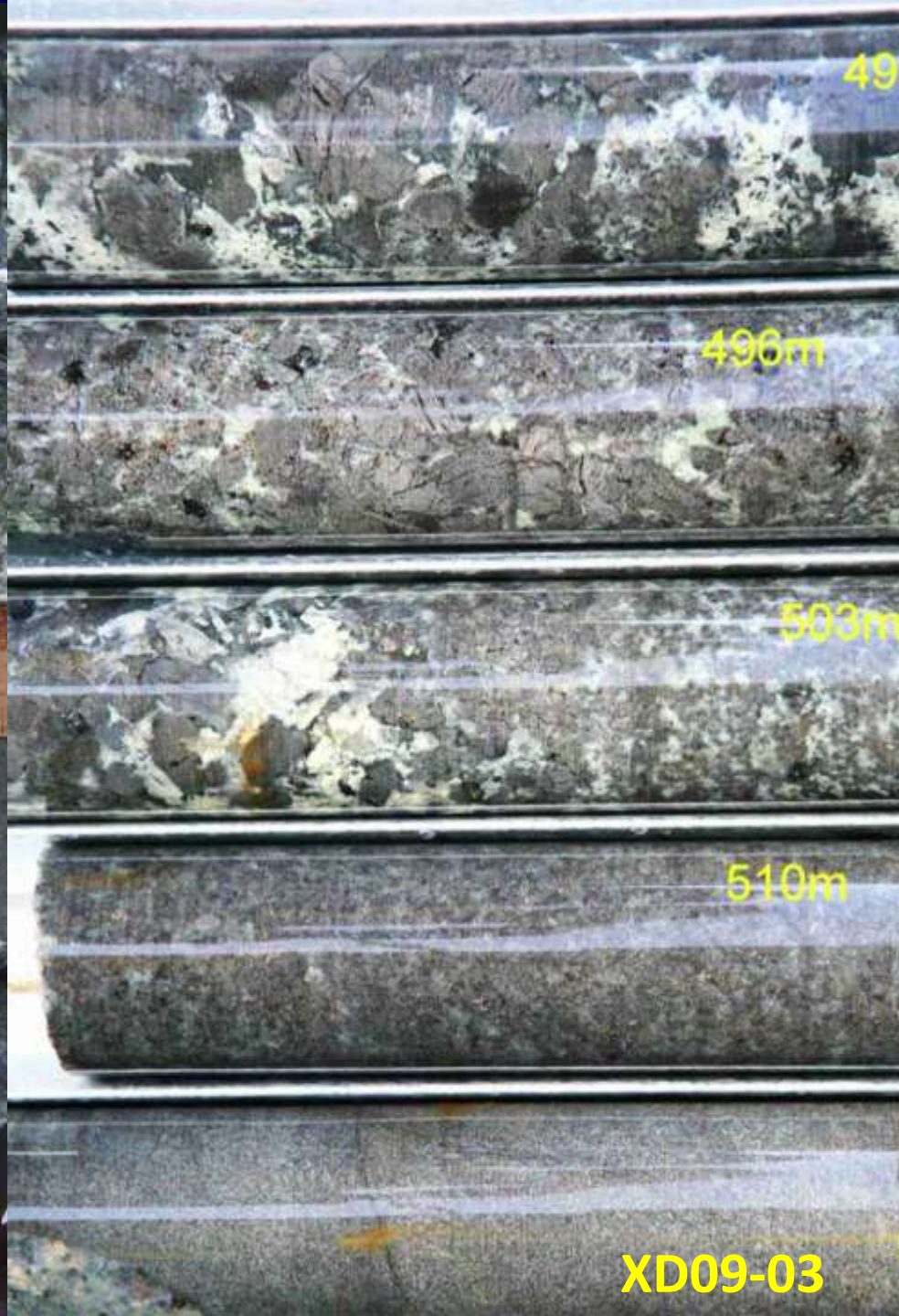
NORTH LOBE : LINE 3 FORWARD MODEL (magnetics and gravity)

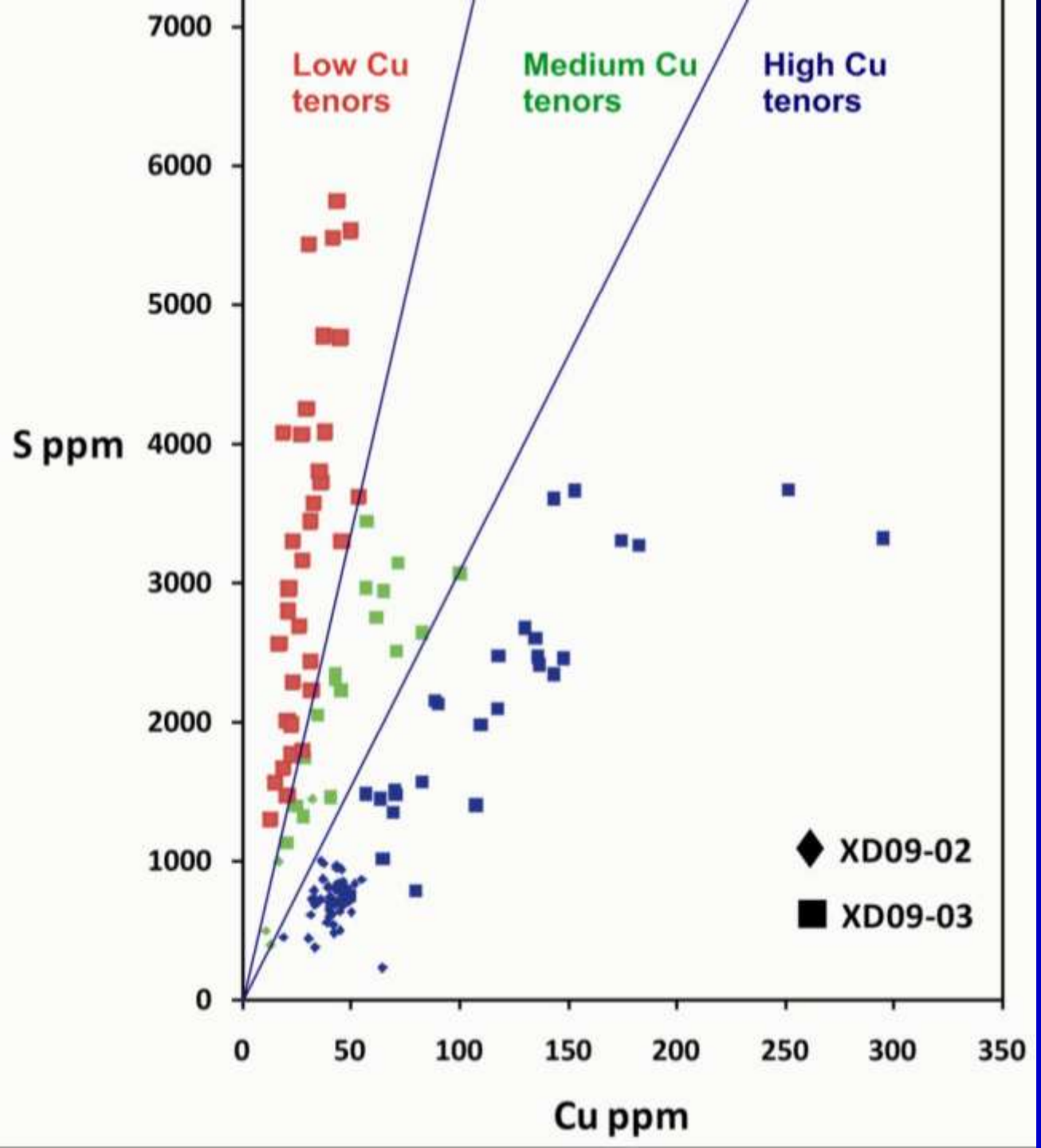
No vertical exaggeration. Modelled and drilled dips = 45° NW




XD09-03
XD09-02
Syenite
Monzonite
Monzogabbro
Granite
Picrite
Gabbro
Diorite
Grano-
diorite
% Na2O
+
K20
% SiO2
0
2
4
6
8
10
12
40
45
50
55
60
65
70
75
80


A
B
C
D
XD09-02


49
496m
503m
510m
XD09-03

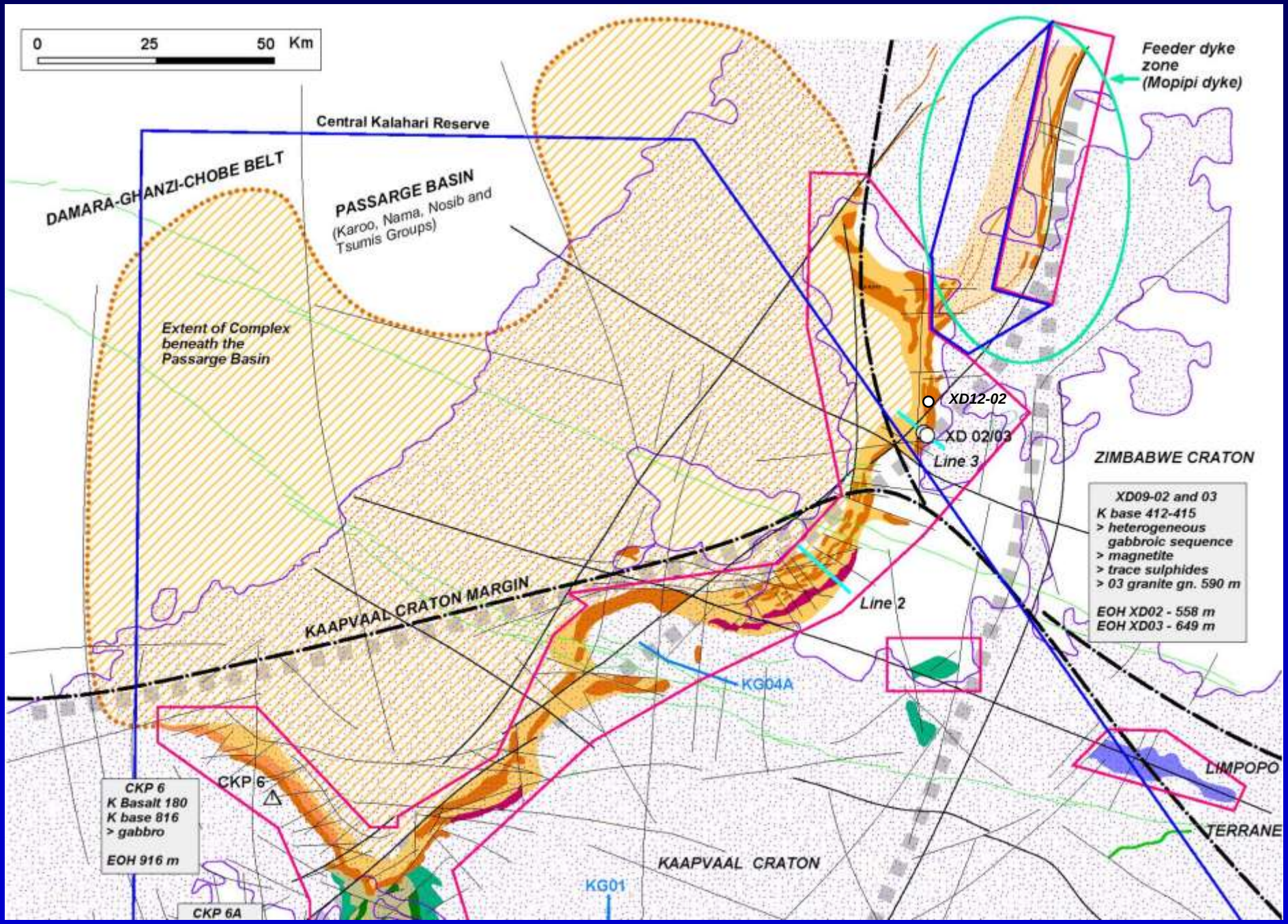


CHALCOPHILE GEOCHEMISTRY

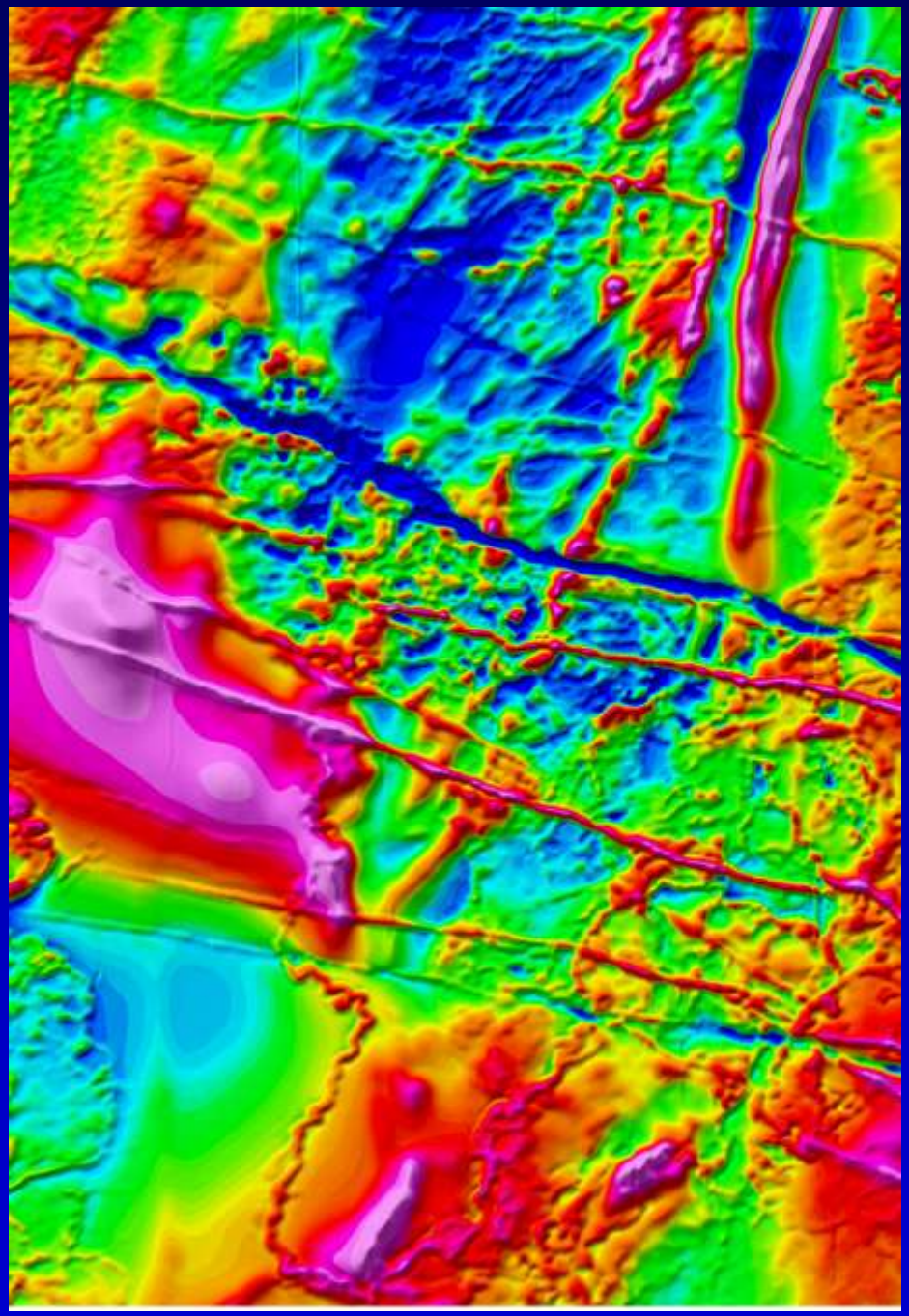
Encouragement for Ni-Cu-GE potential

- Relatively high S contents in XD09-03
- Marked changes in chalcophile geochemistry between holes and within XD09-03
- Much stronger crustal contamination in XD09-02

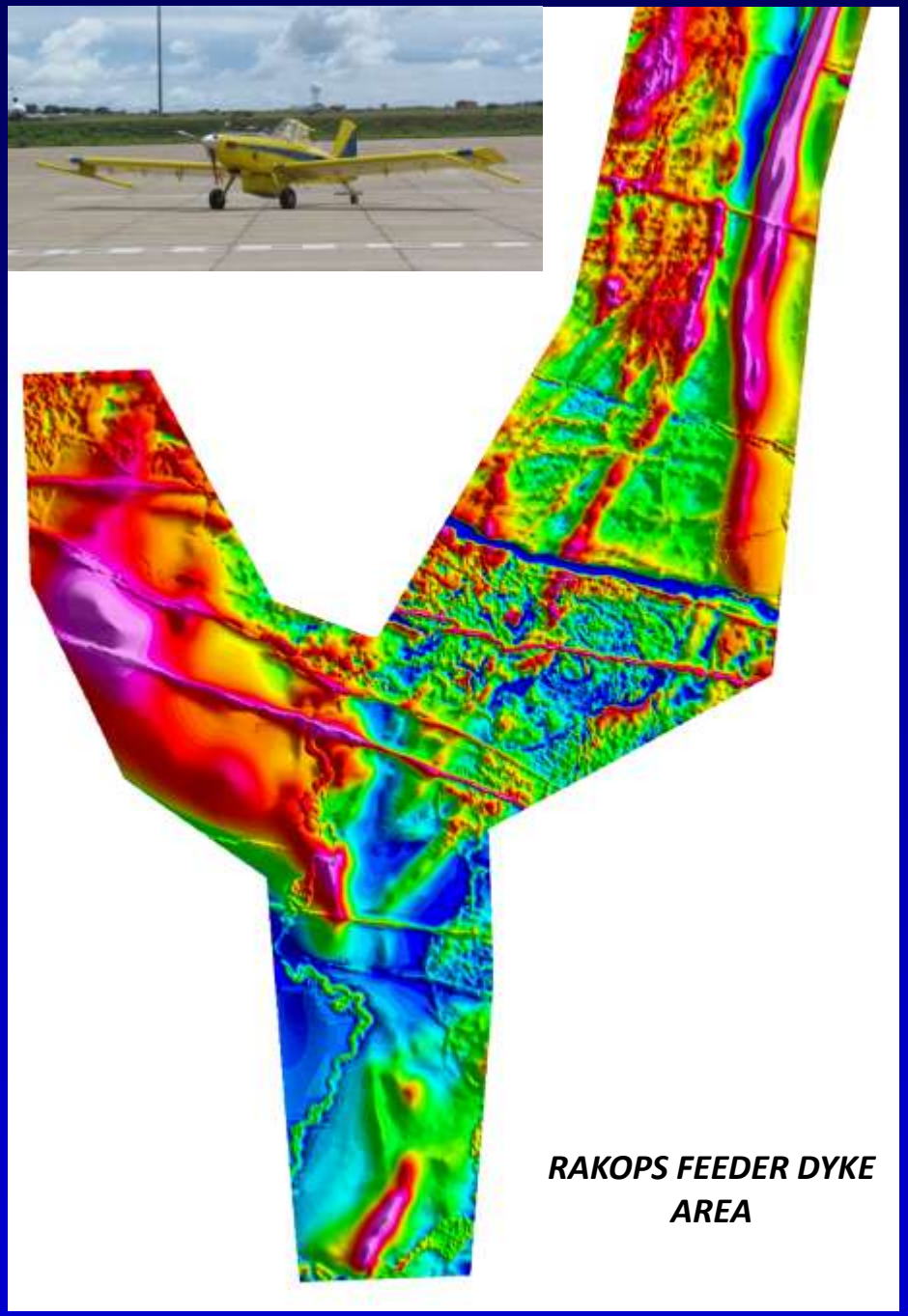
XADE COMPLEX NORTH LOBE – RAKOPS FEEDER DYKE SYSTEM



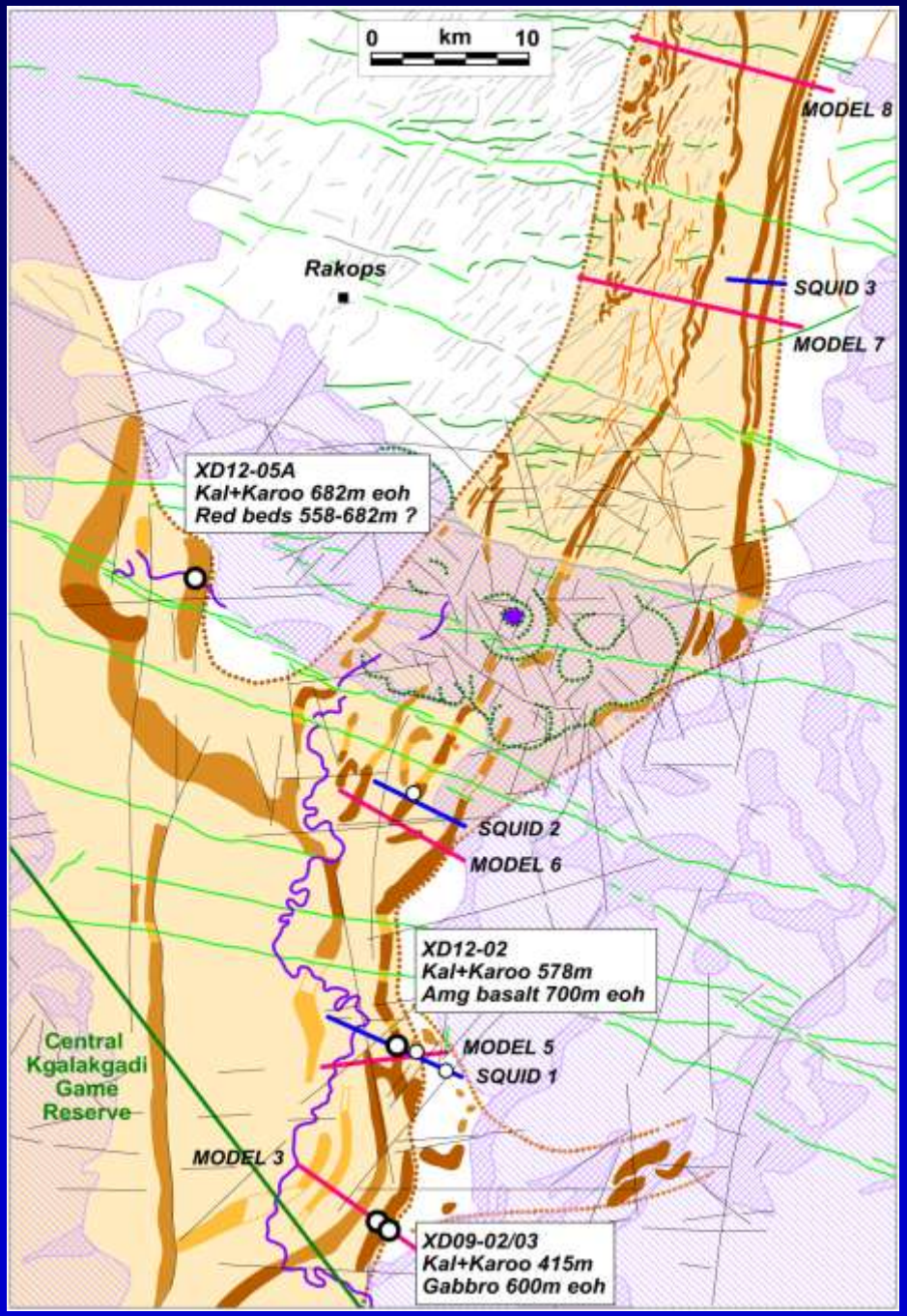
Regional TMI (RTP): 200m lines NS, TC 80m

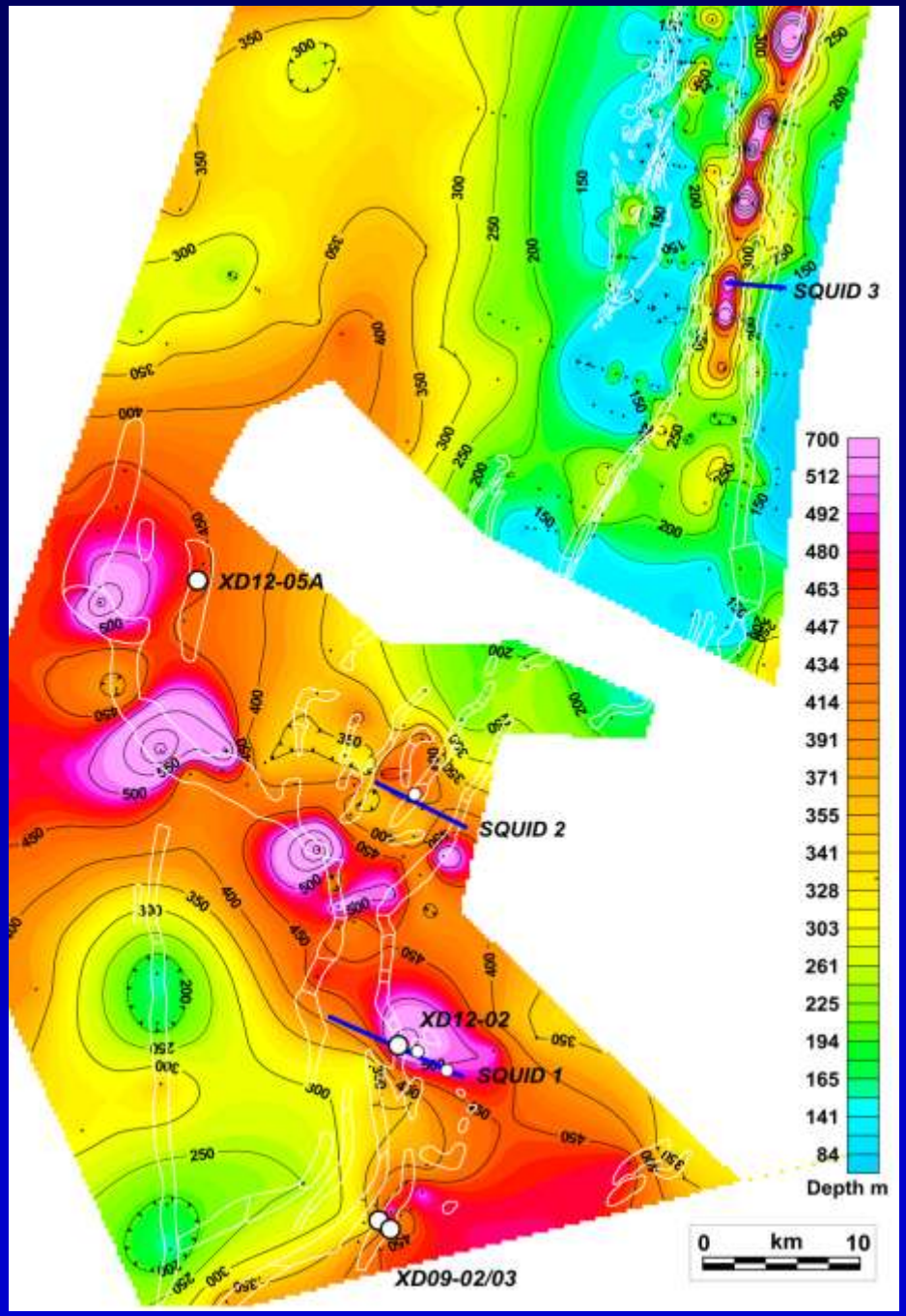


Gradiometer RTP: 150m (~80m) lines EW, TC 20m



RAKOPS FEEDER DYKE SYSTEM : GEOLOGICAL INTERPRETATION AND DEPTHS



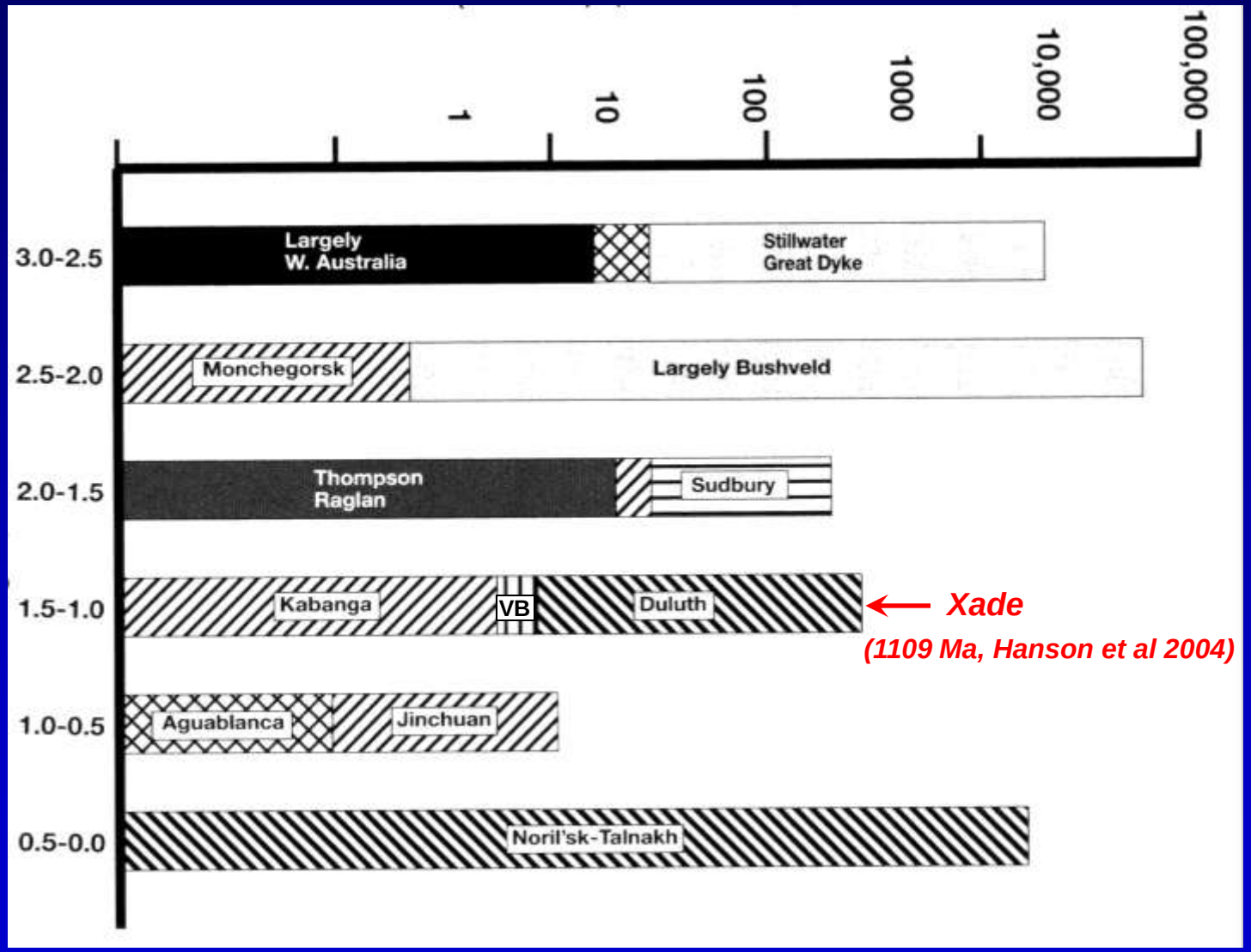


Secular variation of total Pt+Pd contained in different deposit classes

(Naldrett, Econ. Geol., May 2010)

Total Pt+Pd tonnes

Age Ga



CONCLUSIONS

- Interesting variability to the more typical dolerite and basalt Umkondo rocks.\
- There are very few layered igneous complexes of this size (up to 260 x 180 km).
- Very limited past exploration. Current drilling limited to 5 boreholes.
- Two Lobes identified – a South Lobe, comprising the known Xade magnetic anomaly, and a hitherto unrecognized North Lobe.
- The Xade North Lobe straddles the Zimbabwe-Kaapvaal craton boundaries – an ideal setting for Ni potential. A feeder dyke zone has been identified.
- Large scale Ni-Cu-PGE resource potential in the North Lobe
- Future exploration strategy will include deep-penetrating EM surveys, including ground SQUID-based surveys to detect both massive and disseminated sulphides (MIP)