

# Petrogenesis and mode of emplacement of the Doros Complex, Namibia

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# Doros Gabbroic Complex

Relatively small (~ 8 km × 4 km), funnel-shaped, layered gabbroic intrusion

Consists of several stacked gabbroic units with varying textures and compositions

Intrudes the contact between the Doros granite-syenite pluton and the Zerrissene Group metasedimentary rocks in the Southern Kaoko Zone of the Damara Orogen

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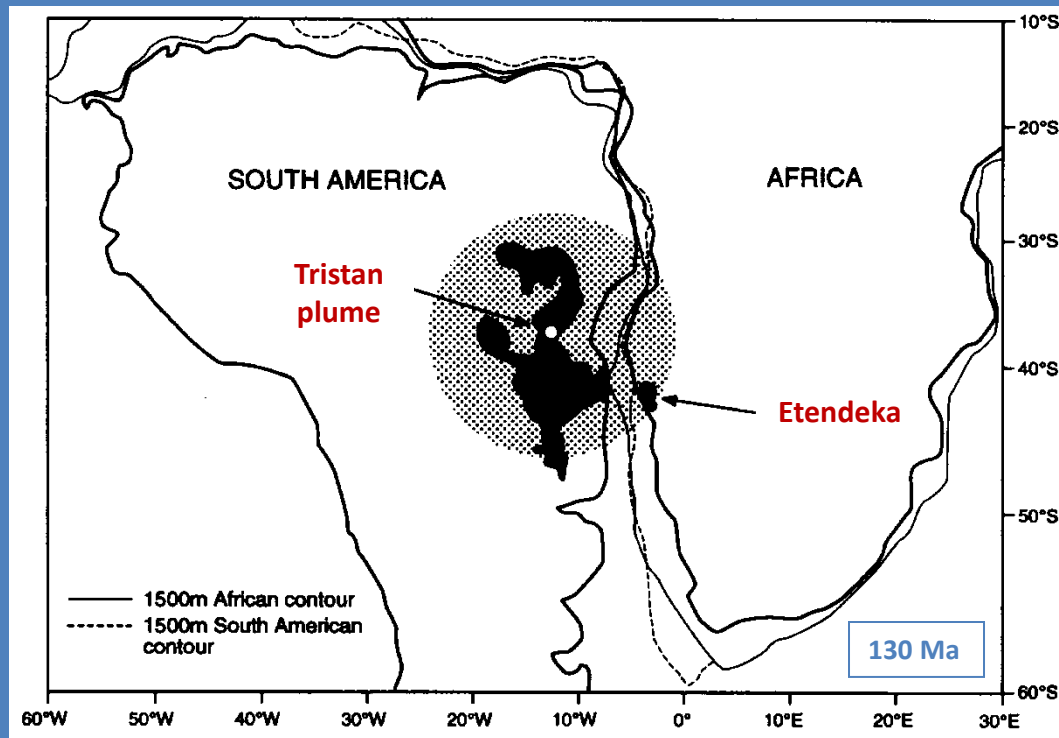
Eye alt 10.36 km

2994 m

33 K 425622.32 m E 7704315.28 m S

# Doros Gabbroic Complex

- Member of the **Damaraland Suite** of igneous complexes in Namibia
- Along with the ~132 Ma Etendeka continental flood basalts, these represent the Namibian component of magmatism in the greater **Paraná-Etendeka Large Igneous Province**, which is attributed to the activity of the **Tristan mantle plume** and the associated rifting of West Gondwana during the Early Cretaceous



# Previous research

Hodgson & Botha (1974):

Identified 7 major lithological units

Preliminary interpretation using major

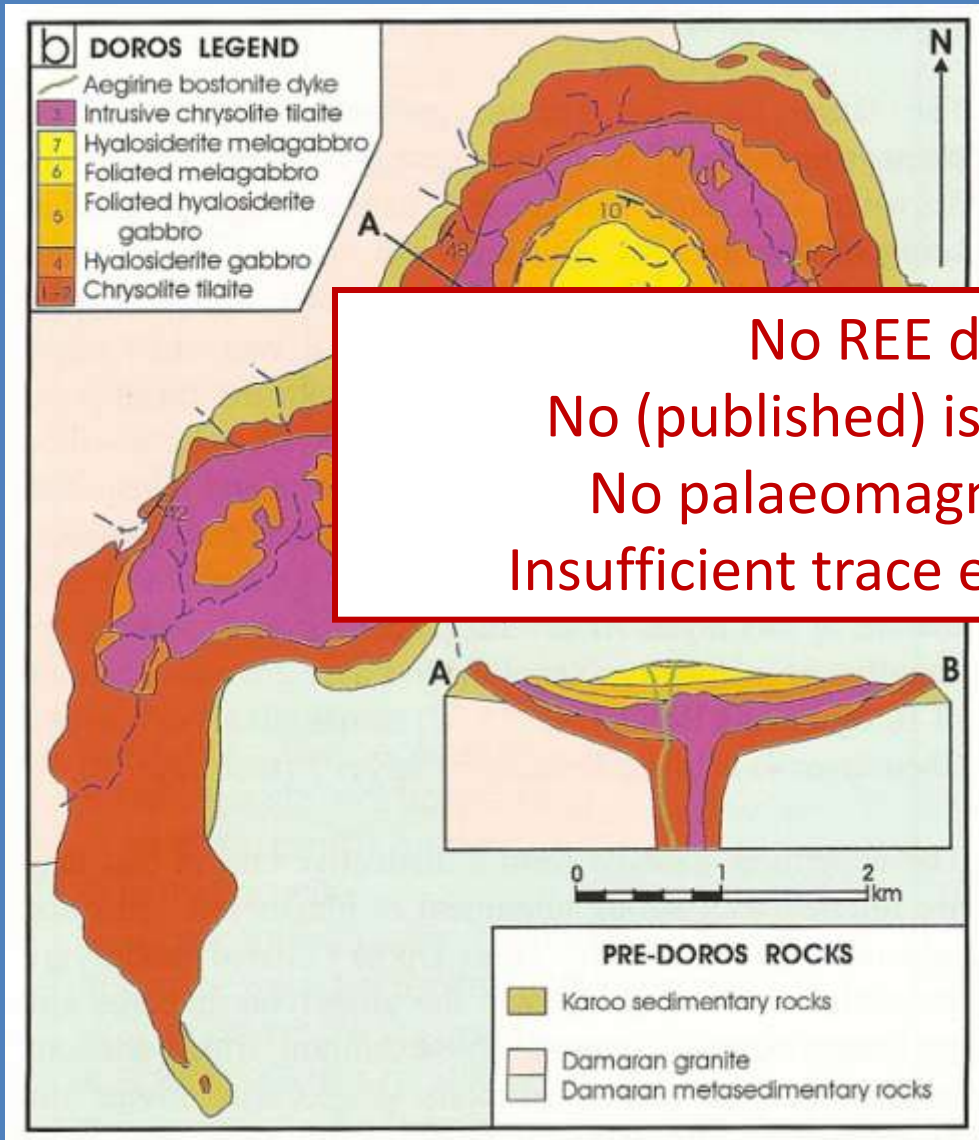
3):

No REE data  
No (published) isotope data  
No palaeomagnetic data  
Insufficient trace element data

Extended interpretation using selective trace element geochemistry

Marsh *et al.* (2001):

Suggested links to Tafelkop lavas of Etendeka using preliminary unpublished Sr, Nd and trace element data



# Aims of the research

Investigation of:

- **Magma processes** (number, nature and timing of magma pulses, mixing, contamination, differentiation)
- **Magma sources** (plume input, contamination, relation to Etendeka)
- **Magma emplacement dynamics** (emplacement geometry, nature of sag)

Using:

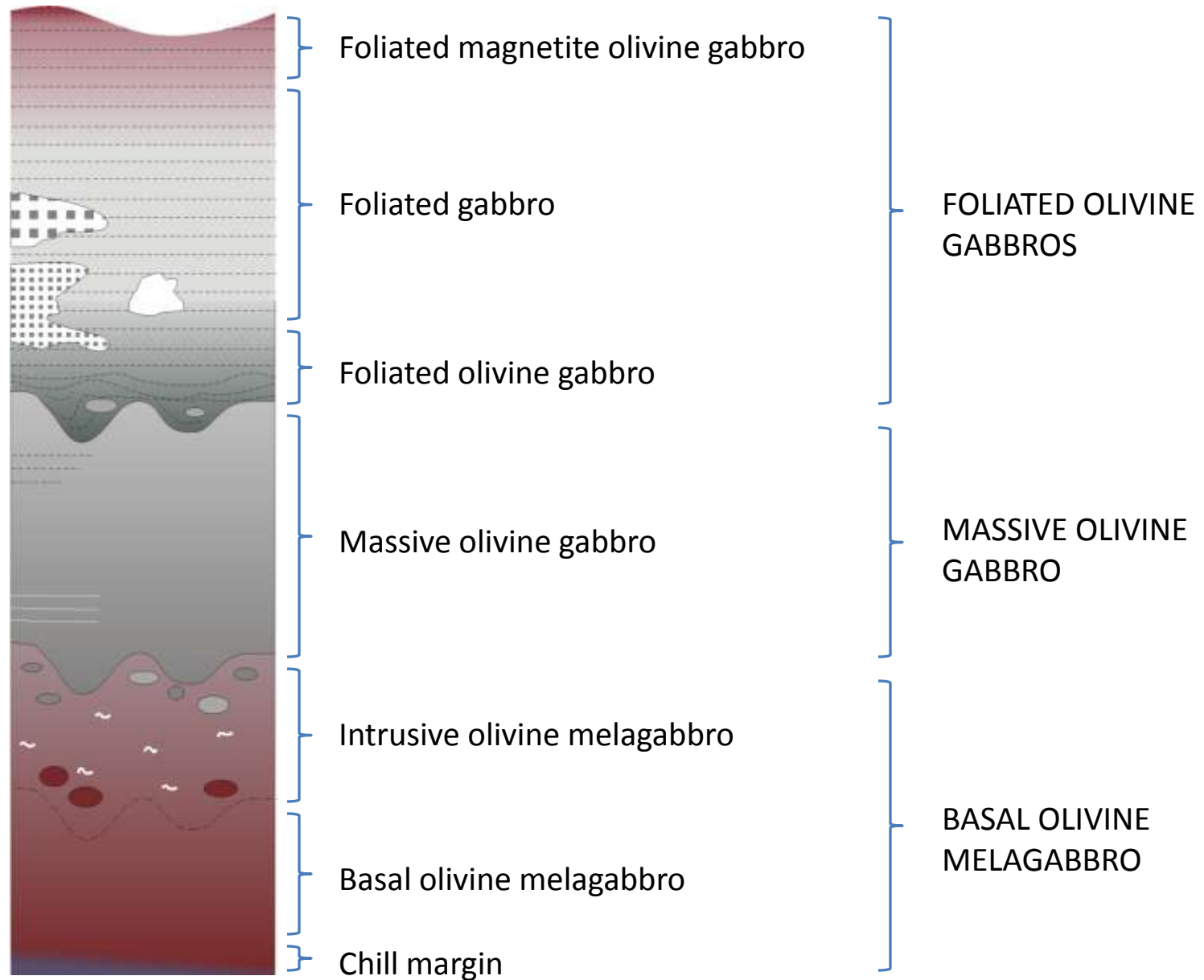
- **Petrographic analysis** (mineralogy, abundances, textures)
- **Geochemical analysis** (whole-rock and mineral; majors, traces, REEs)
- **Isotopic analysis** (Sr, Nd, Pb, Hf)
- **Palaeomagnetic analysis**

For a greater understanding of:

- The processes operational in the formation of **layered mafic complexes**
- The role of **mantle plumes** in continental rifting and associated magmatism
- The **regional tectonic events** of the Early Cretaceous.



# Representative section



# Chill margin

- Glassy/fine-grained matrix + phenocrysts of ol, plag, cpx, hopper mgt
- Calcite-filled vugs



Damaran  
sediments

Gabbroic  
chill

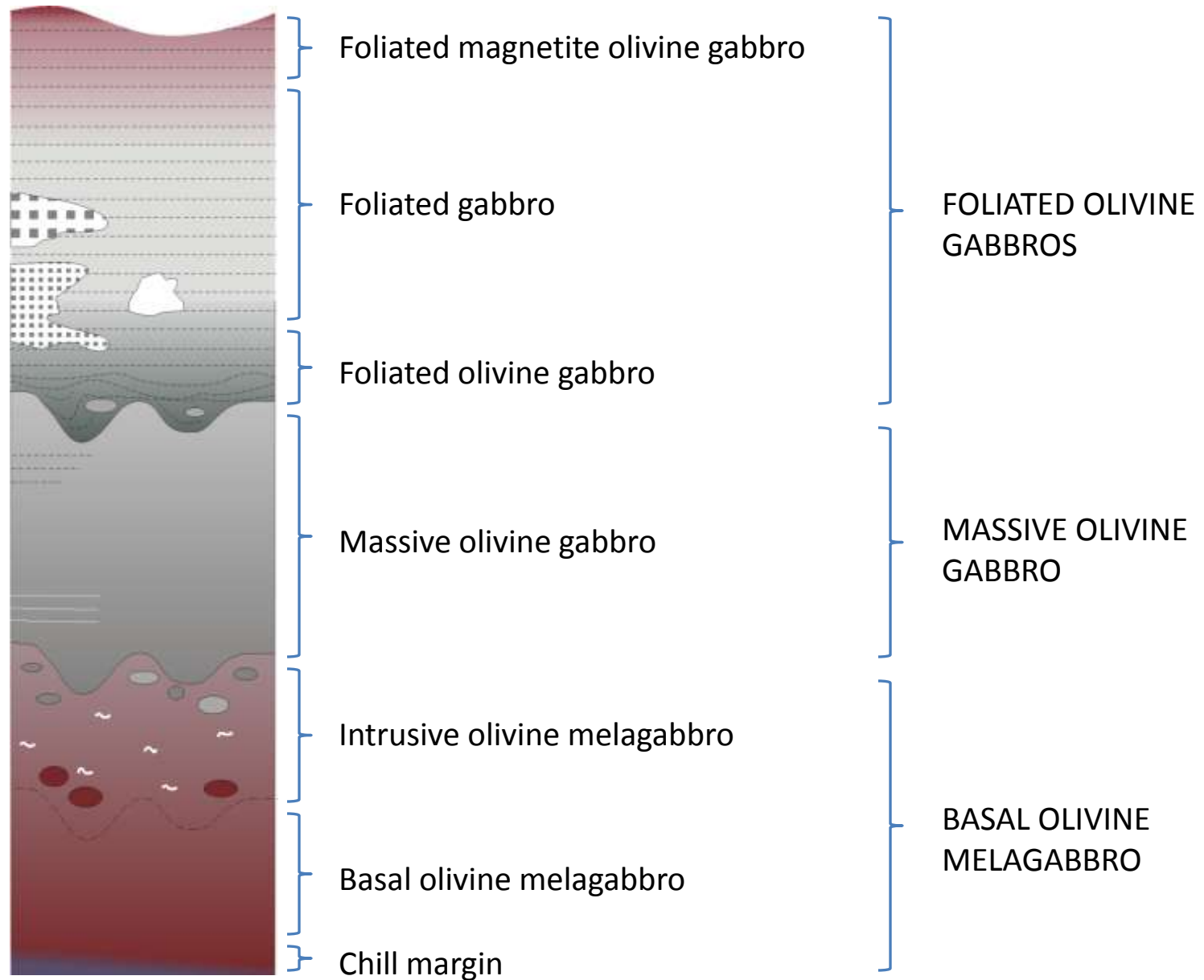


# Basal olivine melagabbro



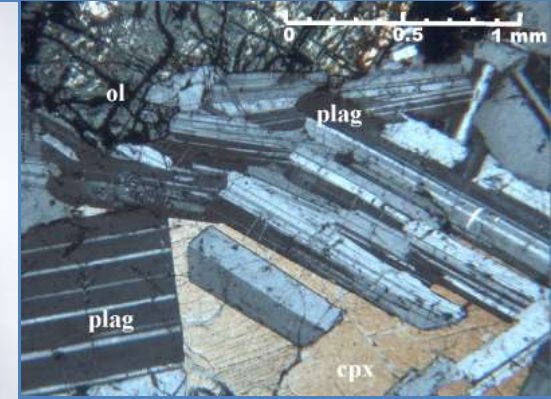
- Localised cpx porphyry
- Xenoliths of ol-rich and leucocratic gabbro, feldspathic schlieren

# Representative section



# Massive olivine gabbro

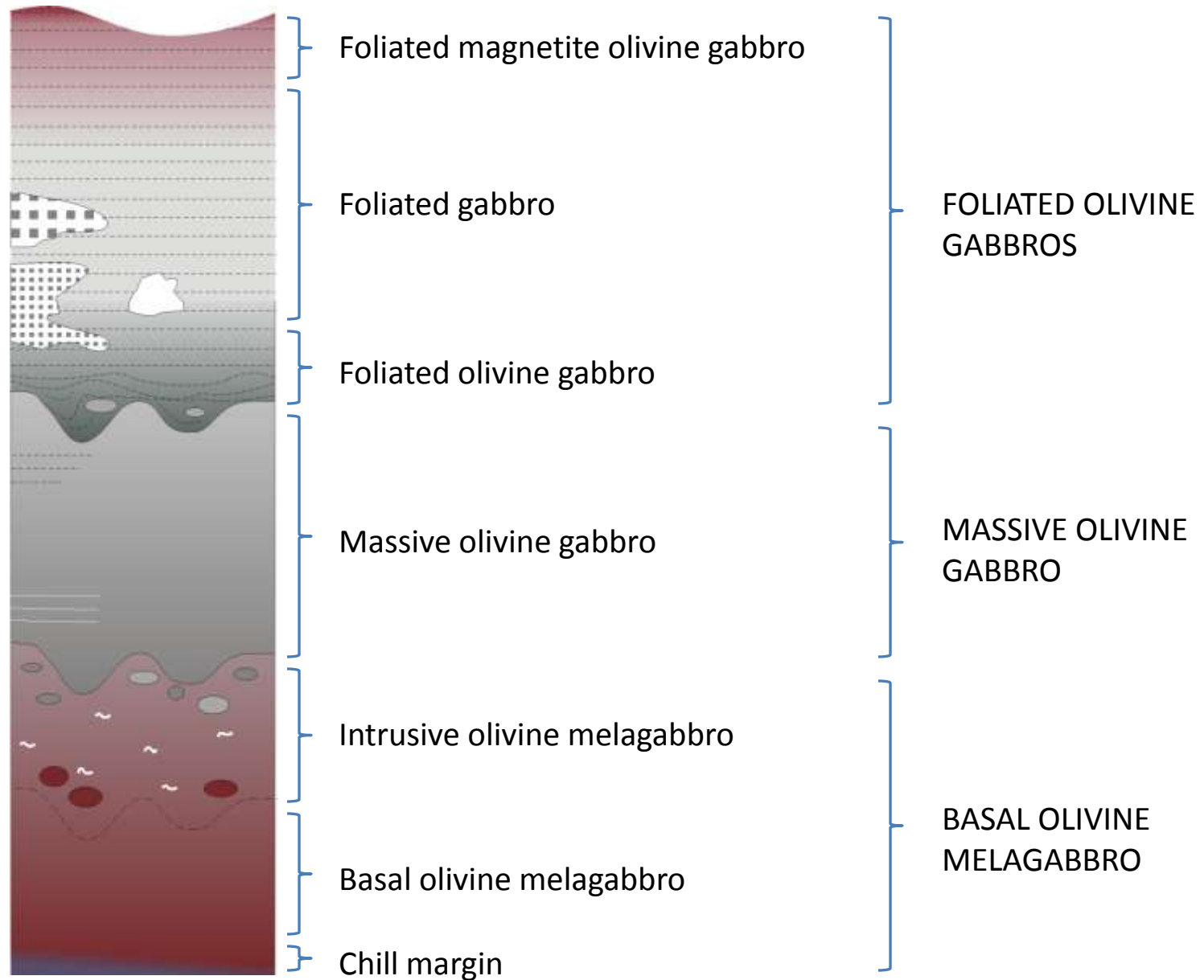
- 50-65% plag, <20% ol
- Massive to weakly foliated



Weathers to characteristic dark, ribbed & dimpled boulder piles

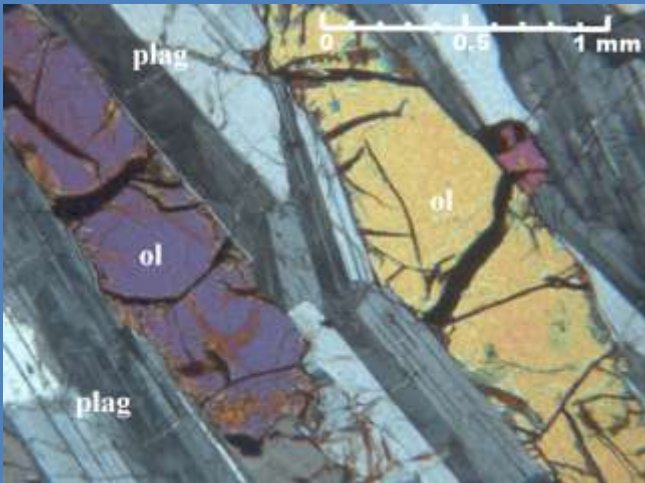


# Representative section



# Foliated olivine gabbro

- ~50% plag, 10-20% ol
- Coarse-grained, moderately foliated
- Xenoliths of lower gabbro in contact zone



# Foliated gabbro

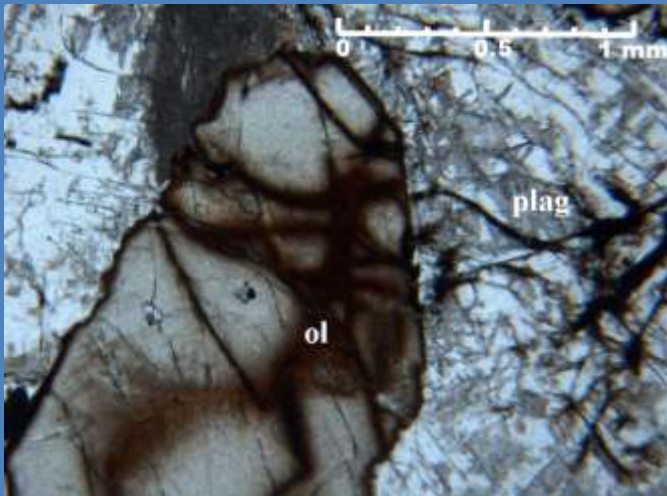
- ~50% plag, 50% mafic minerals
- Regular foliation of plag and elongate cpx



Generally ol-poor, although large coin-shaped ol in upper parts

# Foliated magnetite olivine gabbro

- Aligned elongate cpx, ol and plag
- ~15% mgt
- Otherwise very variable composition – pure troctolite alongside pure gabbro



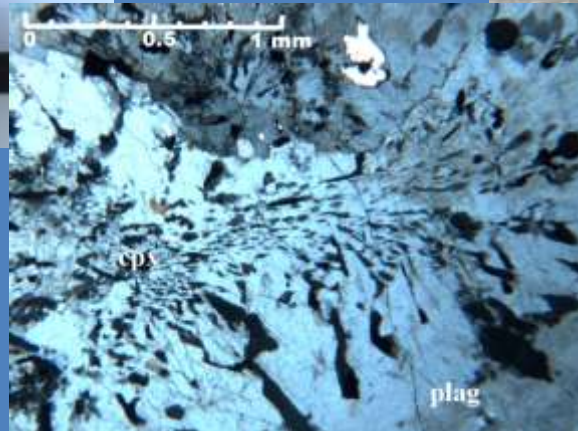
# Dolerite

- Thin dyke cross-cutting central units
- Thick chill margin
- Fine-grained matrix + phenocrysts of cpx, ol, plag, mgt



# “Bostonite”

- Strongly zoned dykes
- 75% feldspar, 10% cpx (increases towards rim)
- Radial cpx lamellae



# Heterogeneities



Coarse-grained enclaves and  
pegmatite dykes



# Heterogeneities

Poikilitic leucogabbro and  
feldspathic enclaves  
and veinlets



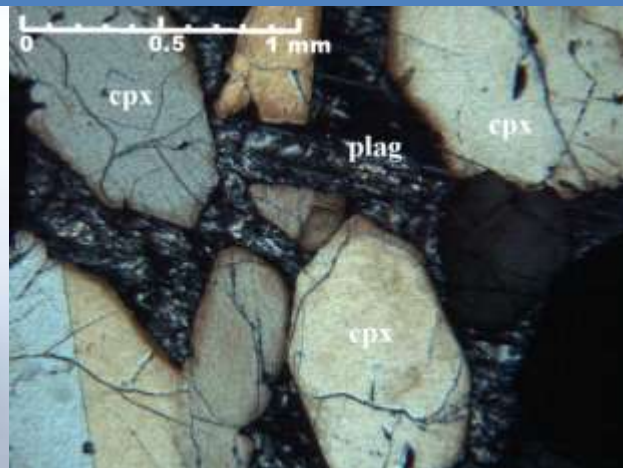
# Heterogeneities



Grain-size layering



Modal grading



Pyroxenitic patches

# Important questions raised

- Reasons for **foliation** in upper unit?
- Origin of **xenoliths**? Are they actually xenoliths?
- Origins of plagioclase **schlieren** and **laminae**?
- Origins of localised coarse-grained, feldspathic and pyroxenitic **enclaves**?
- Origin of **modal grading** and regular **interlayering** of gabbros ?
- Relative **timing** of emplacement? Style of emplacement?
- Reasons for **compositional trends** in emplacement?
- Cross-sectional **geometry** of intrusion? Are there unexposed lower units?
- Relation to **dolerite and bostonite** dykes?



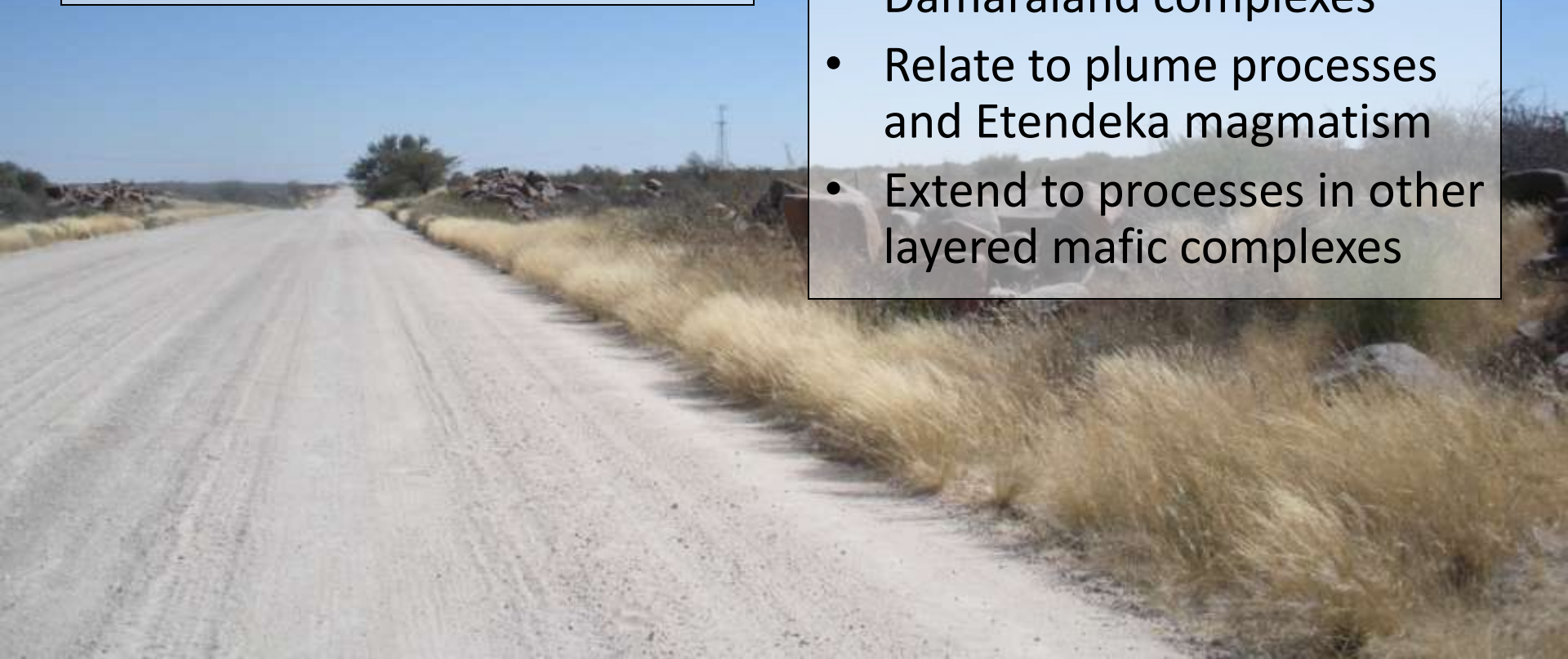
# Findings so far...

- Doros is a lot more **complex** than previous workers would have it!
- Complex interaction of crystal mushes and liquids emplaced from different levels of a lower magma chamber, which itself may be replenished from the mantle, with the entrainment of earlier semi-solid material
- Negligible contamination/assimilation

# What next?

- Whole-rock major element, trace element and isotope geochemistry
- Mineral geochemistry
- Palaeomagnetic analyses

- Make better sense of magma sources, processes and emplacement dynamics within Doros
- Relate to processes in other Damaraland complexes
- Relate to plume processes and Etendeka magmatism
- Extend to processes in other layered mafic complexes



# Questions?



