

Alluvial diamond deposits of the North West Province (NWP) 'diamond-triangle', RSA

Pierre De Jager

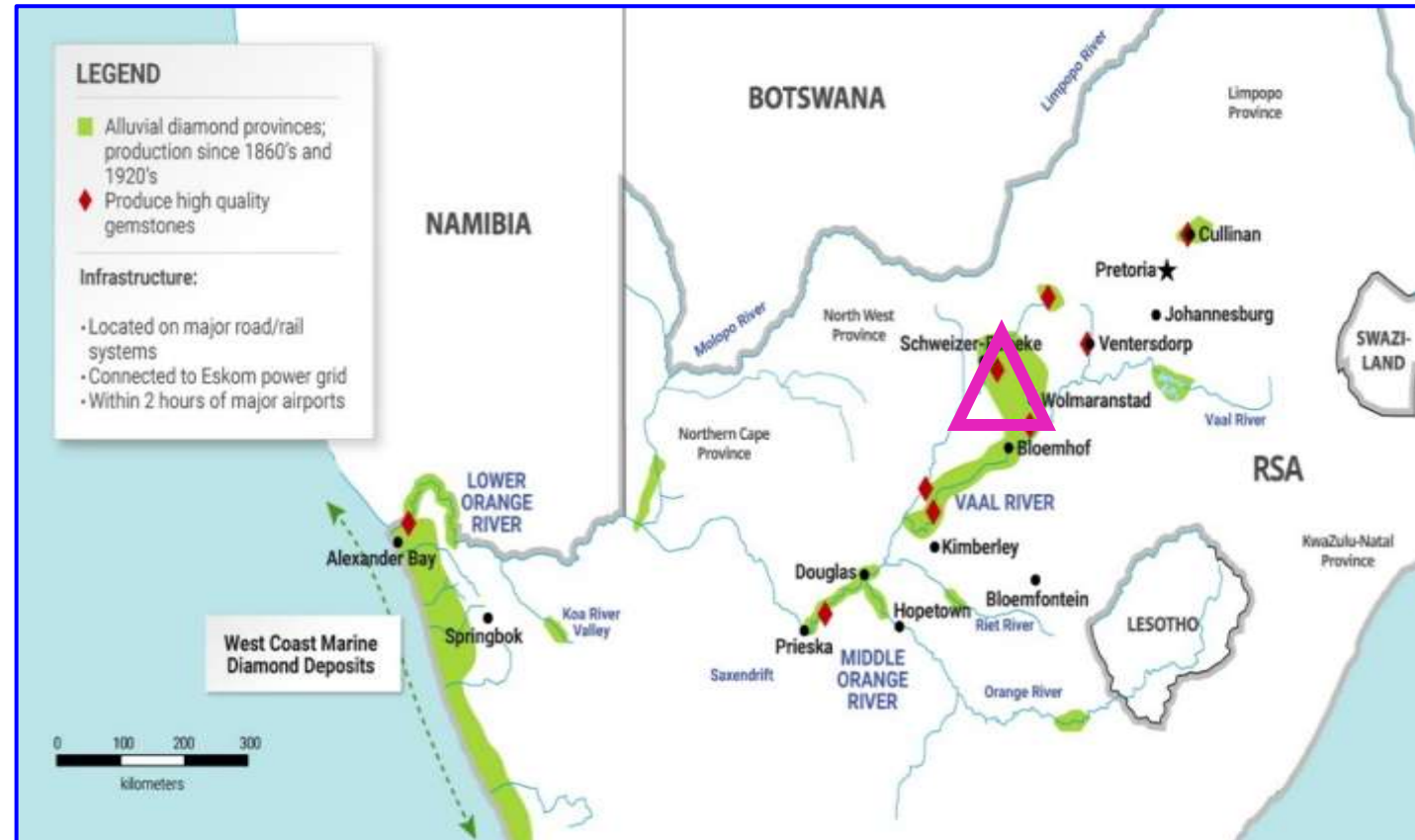
27 June 2022

OGG-SADPO-GSSA Diamond Short Course

June 2022

Presentation structure

1. History of the deposits
2. Geological summary
3. Geological setting
4. Description of the deposits
5. Production Data
6. Mining challenges
7. Summary and Conclusions



History of the NWP 'diamond-triangle'

Wolmaransstad, Bloemhof, Schweizer-Reneke

- ❖ Diamonds discovered in 1912
 - ❖ 'Delwers' and Small diamond miners have produced more than 5 million carats since 1912
 - ❖ Well sorted 'rounded' population, average size about 1 carat per stone
 - ❖ Exceptional quality – well known for coloured diamonds e. g. orange blue and pink
 - ❖ Average price \$800 to \$1200 per carat.
-
- Du Toit (1910) recognized the area west of the Harts River ('Dry Harts') as a glacial valley, and highland between the Harts & Vaal rivers as the pre-Dwyka topography – Cargonian Highland
 - Von Gottberg (1970) noticed widespread deposition and occurrence of Dwyka sediments in the area

378 carat parcel from southern NW Province

(ave. size ~ 1 carat/stone)



85% gemstone - \$800 to
\$1200 per carat

Production from the NWP 'diamond-triangle'



2.78 ct Lime Green

Panfontein Diamonds -2003 (courtesy of the late Mr Dick Barker)

0.76 ct Orange

Special diamonds from the southern NWP 'diamond-triangle'

Oersonskraal Specials

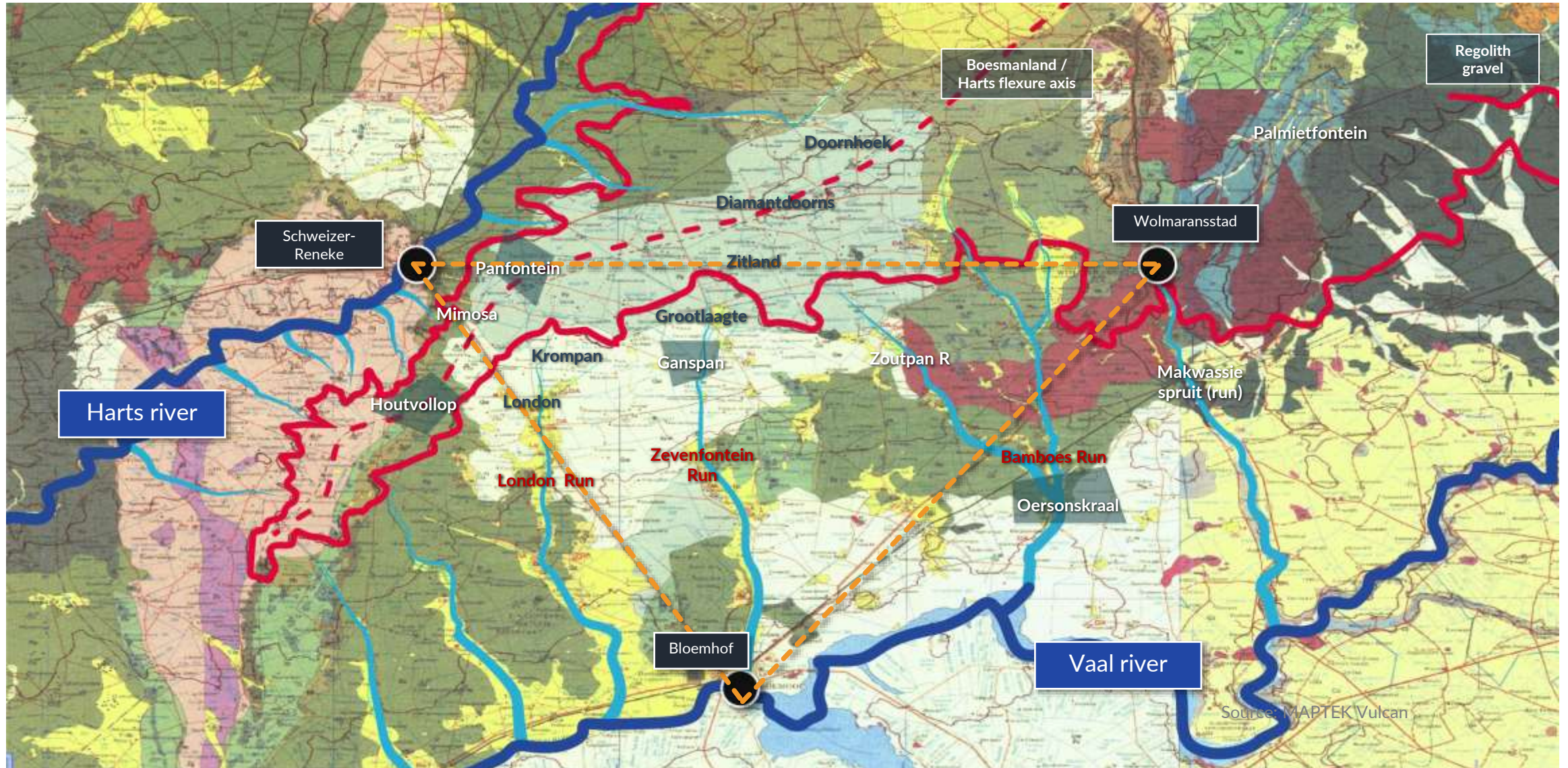
26.74 ct D IF Type II a
\$44,000 per carat
\$1,176,560

7.53 ct vivid orange
\$176,713 per carat
\$1,333,649

3.08 carat blue stone

The North-West province (NWP) 'diamond-triangle'

Southern North West Province geology setting




Summary of Geology and Alluvial deposits

Geology

- Underlain by Archaean rocks and Proterozoic Ventersdorp Supergroup volcanics and sediments
- Overlain by a thin layer of Carboniferous Dwyka tillite (diamictites) on the glacial outwash plain.
- Extensive Middle-Ecca Group Marine Sediments overly the diamictites close to the Cargonian Highland
- Pre-Dwyka topography is represented by the Cargonian Highlands in the NNW, with glacial outwash plains to the south of these Highlands
- Plains consist of glacial outwash, streams, lodgement till, reworked moraines and 'kettle' structures
- Permian Ecca sediments occur on the edge and on the Cargonian Highland.

Alluvial diamond deposits sequence:

- 
- Younger reworked 'deflation' deposits

 - Regolith gravels on the Cargonian platform
 - Primary middle-Ecca beach gravels
 - Primary Dwyka glacial streams
 - Extensive Dwyka outwash glacial plains with lodgement till, reworked moraines and kettles

 - Archaean rocks and Ventersdorp basement (lavas & shale)

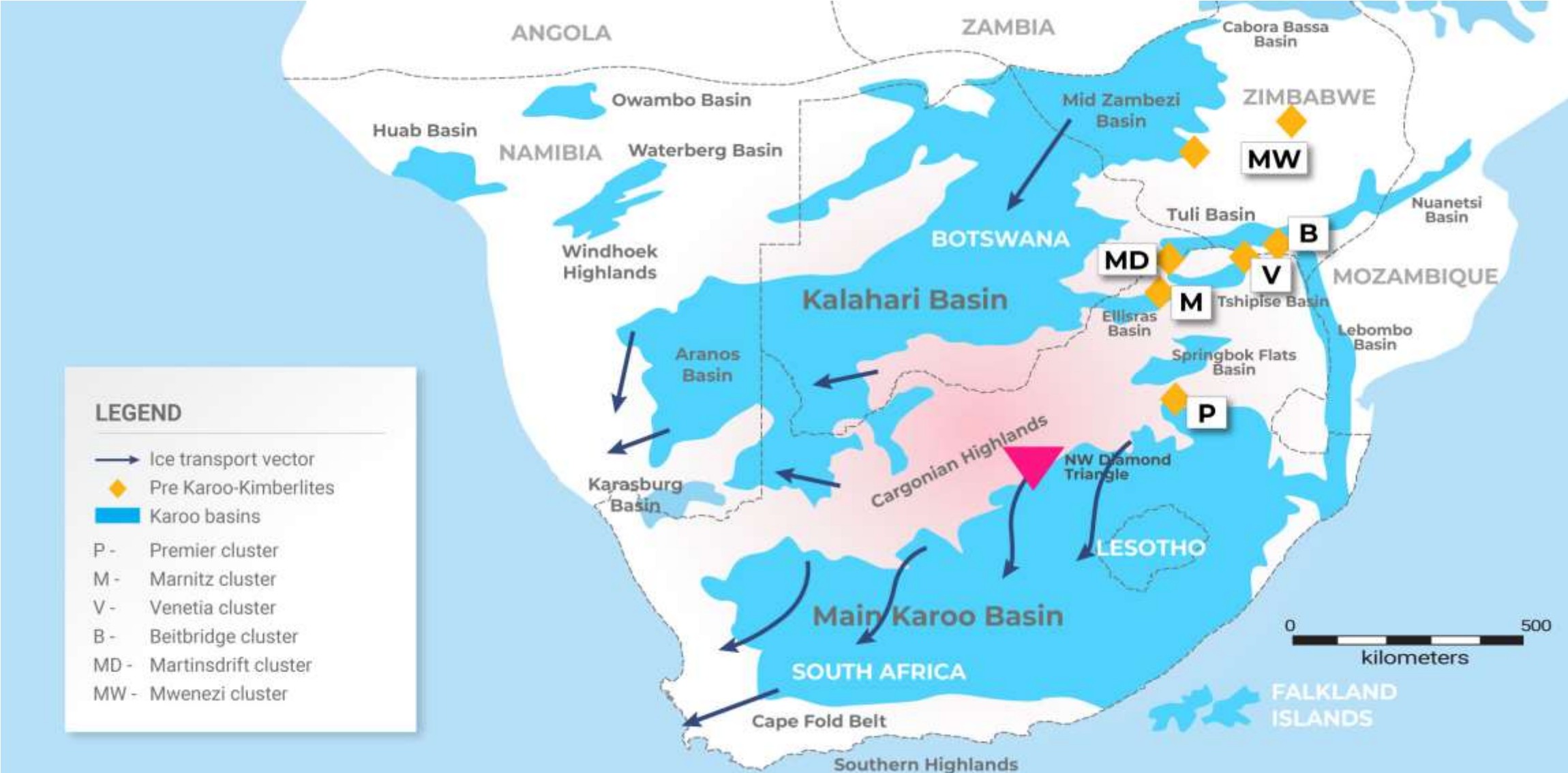
Cargonian Highland and Dwyka glacial outwash plain

Local setting



Cargonian Highlands & Pre-Karoo kimberlites

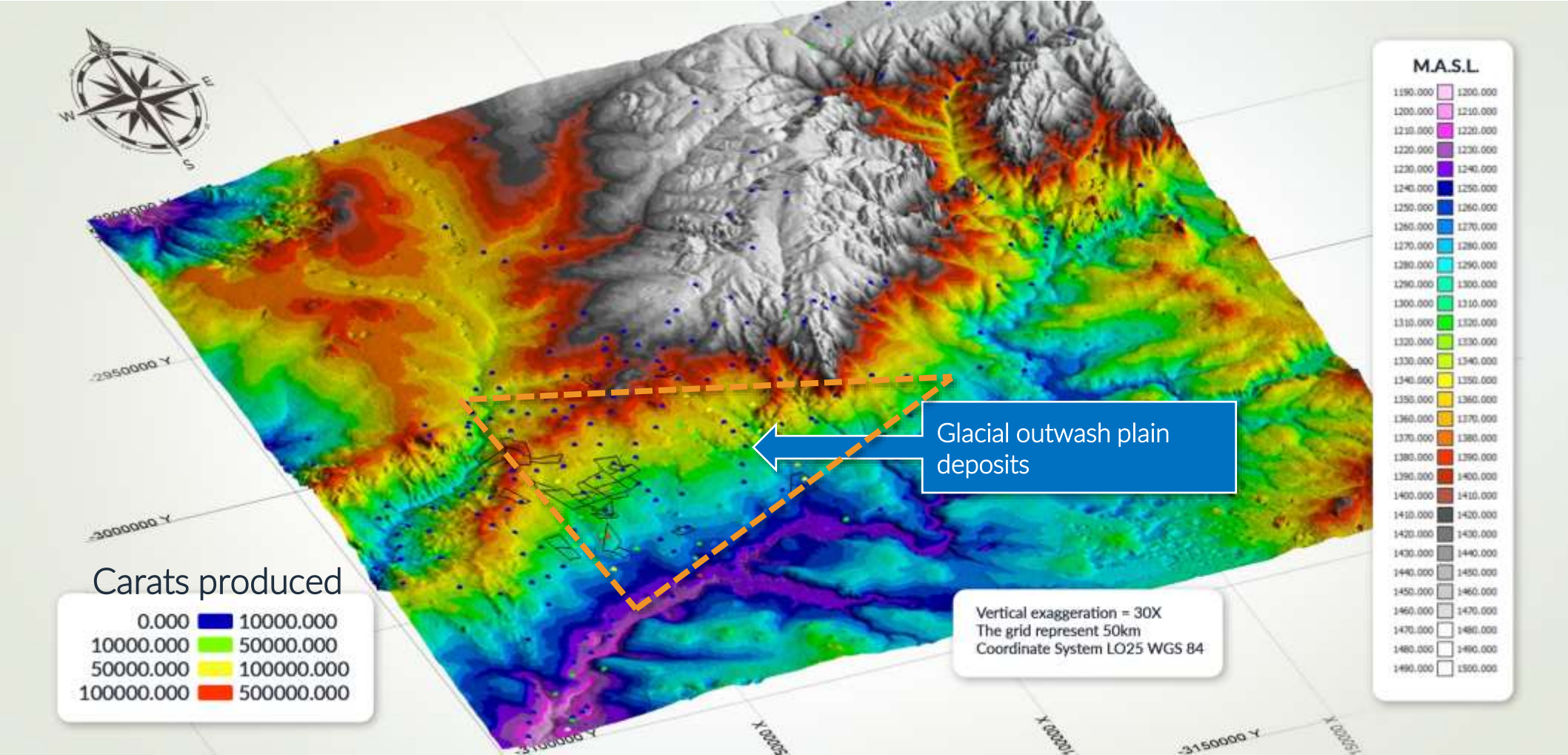
Regional Setting



Pre- and Post-Karoo kimberlite ages

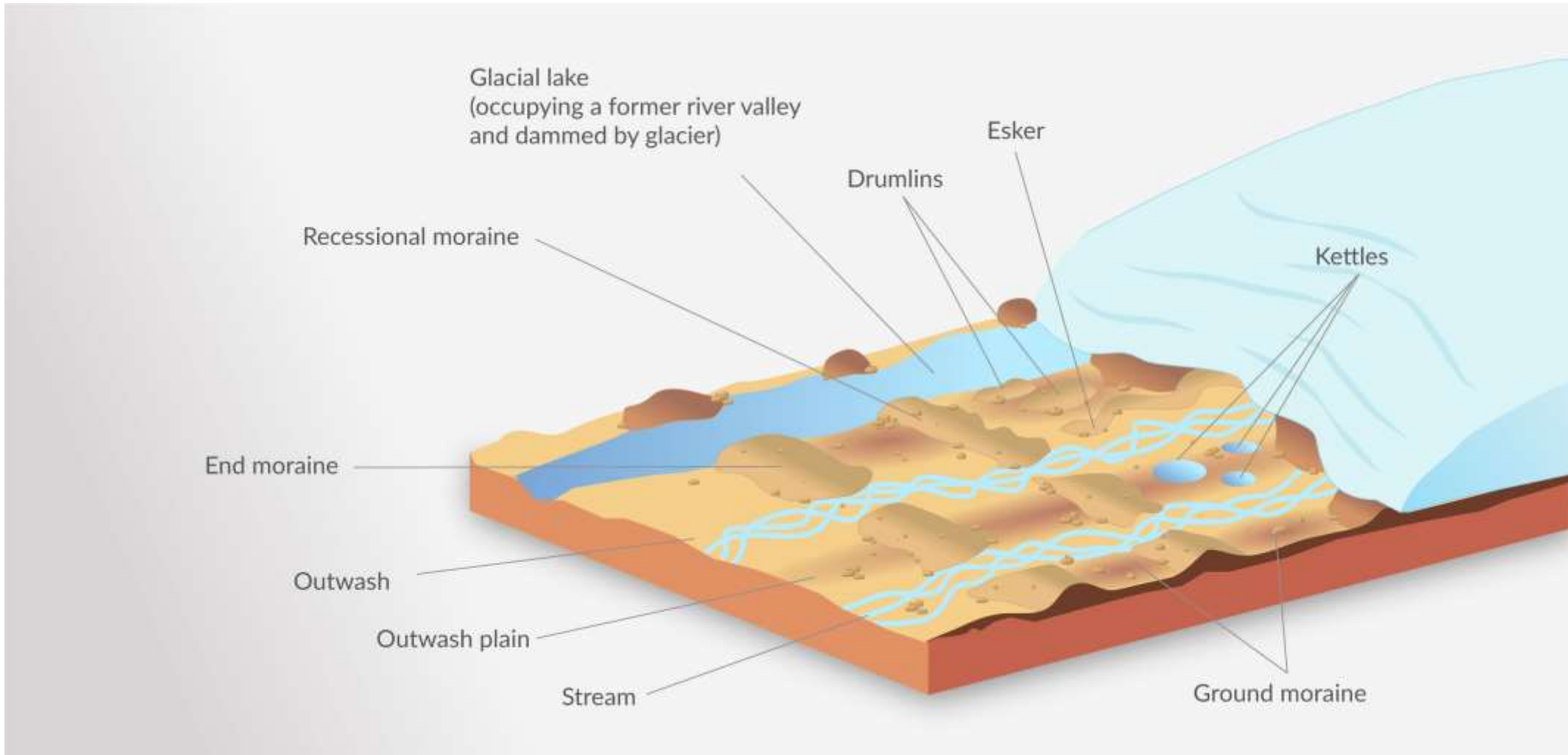
	KIMBERLITES	AUTHOR(S)	AGE (MA)
Post Ecca Kimberlites	Orapa	Haggerty et al., 1983	93
	Initiation of Orange River Fluvial system	Ward and Bluck, 1997	100
	Barkley west, Koffiefontein, De Beers	Phillips et al., 1998	118-117
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	Swartruggens, Klipspringer	Westerlund et al., 2004	144
	Dullstroom	Jelsma, 2004	165
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Digital Elevation Model (DEM) of the 'diamond-triangle'



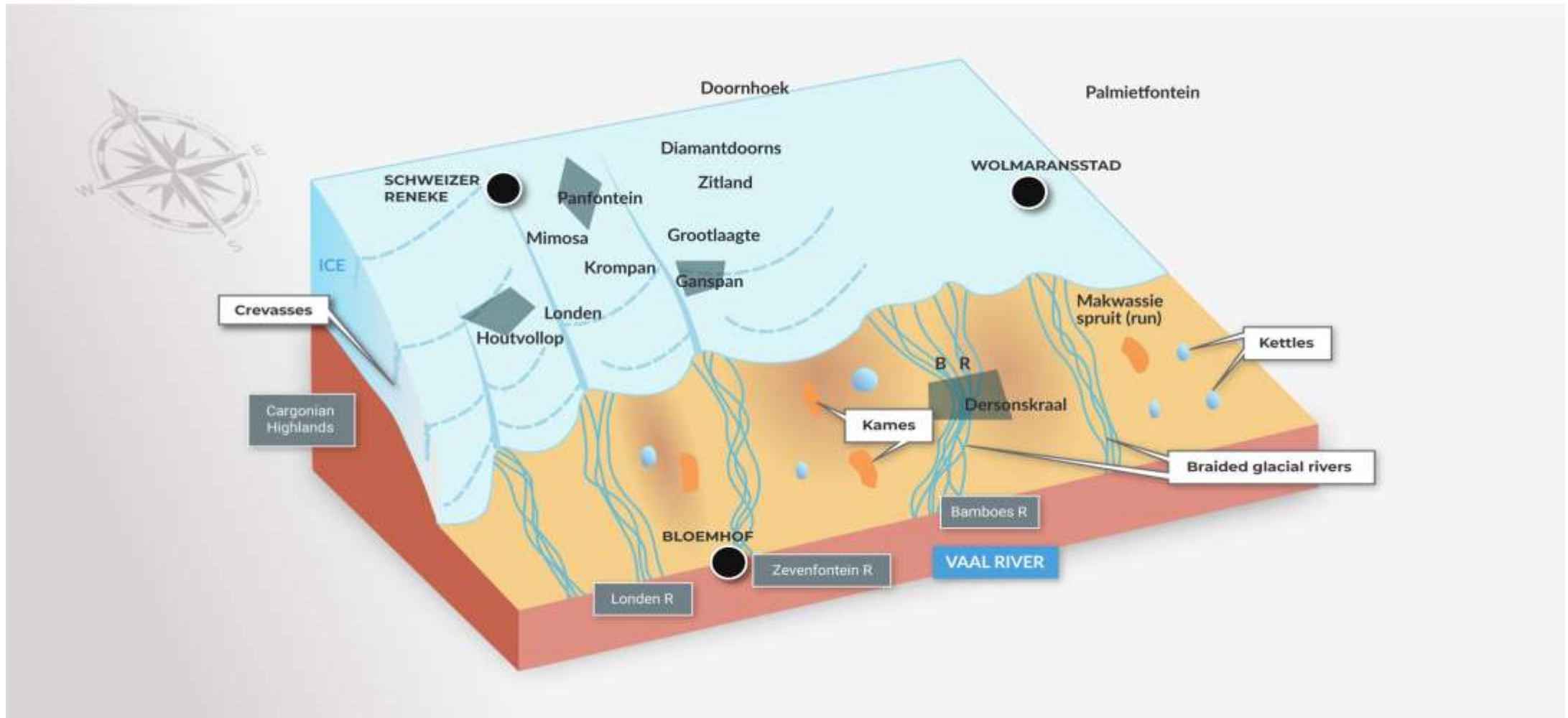
Receding Terrestrial Dwyka glacier deposition model

Carboniferous glacial distribution model



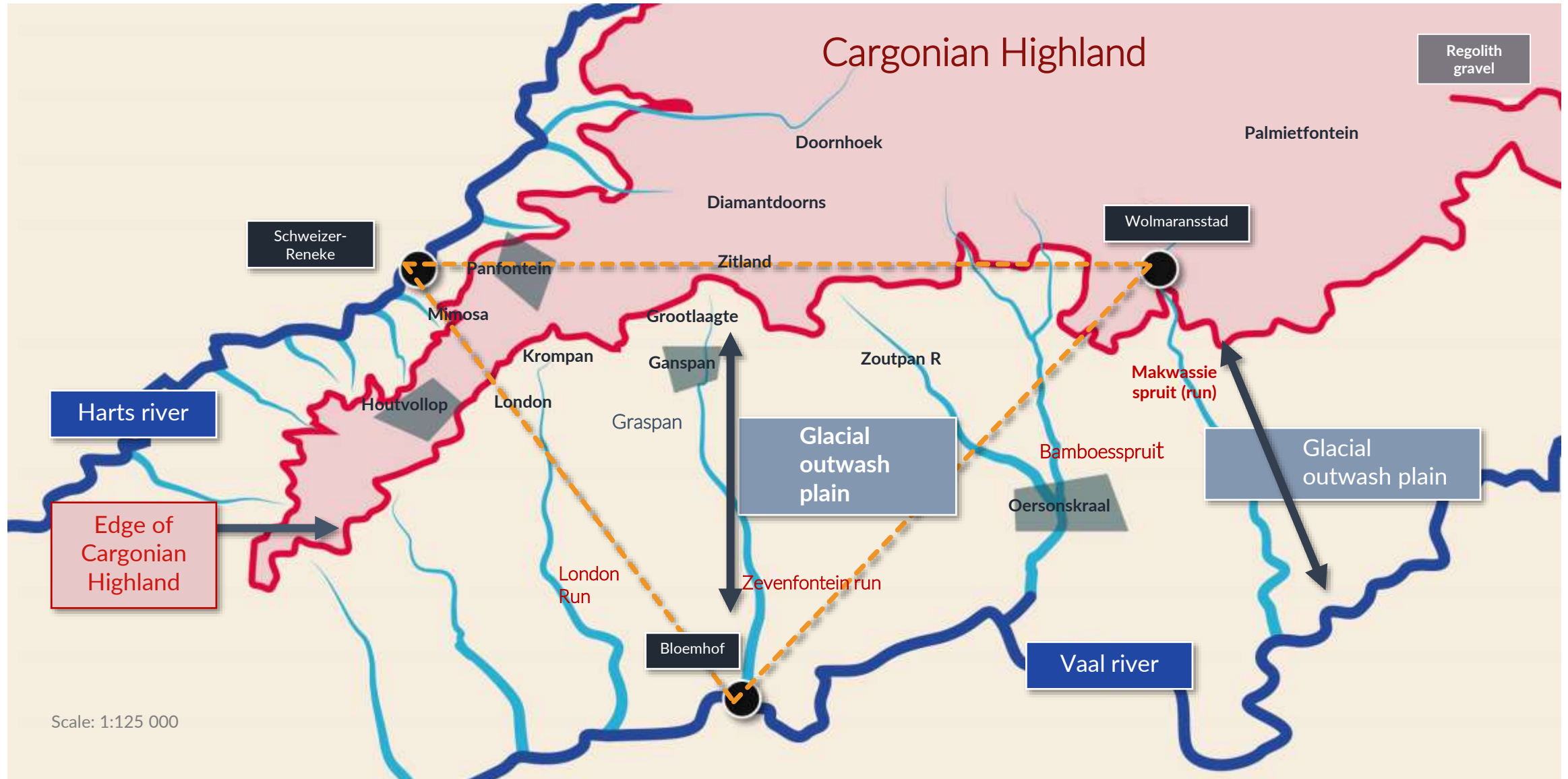
Terrestrial glacial deposition in the 'diamond-triangle'

Present day setting



Cargonian highland and Dwyka glacial outwash plain

Local Setting



Glacial river gravel deposit - Bamboesspruit Run (Farm Oersonskraal)



Reworked Dwyka
glacial river gravel

Dwyka glacial
river gravel

Glacial river gravel - Bamboesspruit Run (Farm Oersonskraal)



Dwyka glacial river gravel deposit - London Run (Farm London - near Cargonian Highlands)



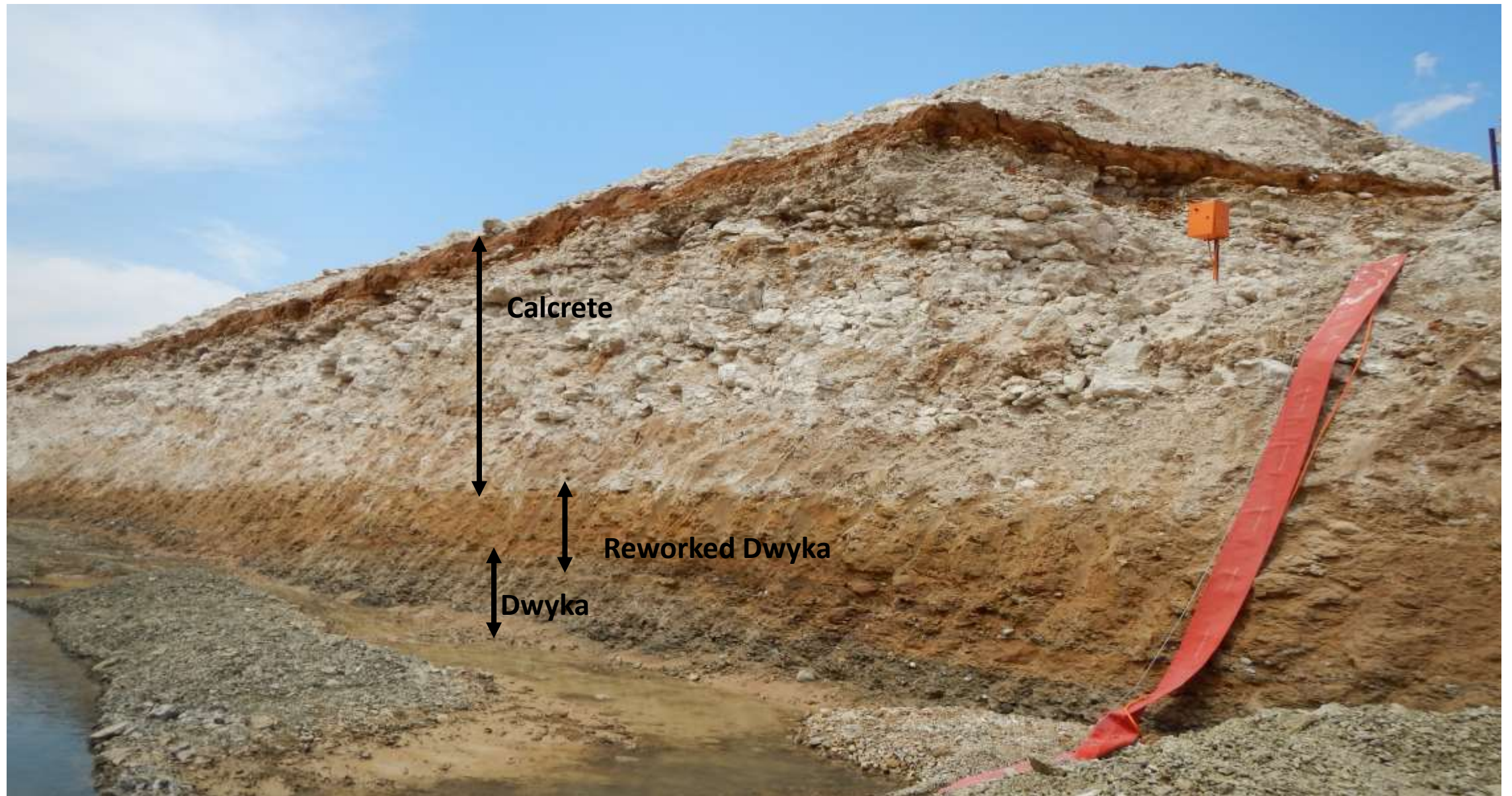
Large Ventersdorp
boulder

Glacial river gravel or
reworked glacial river
gravel

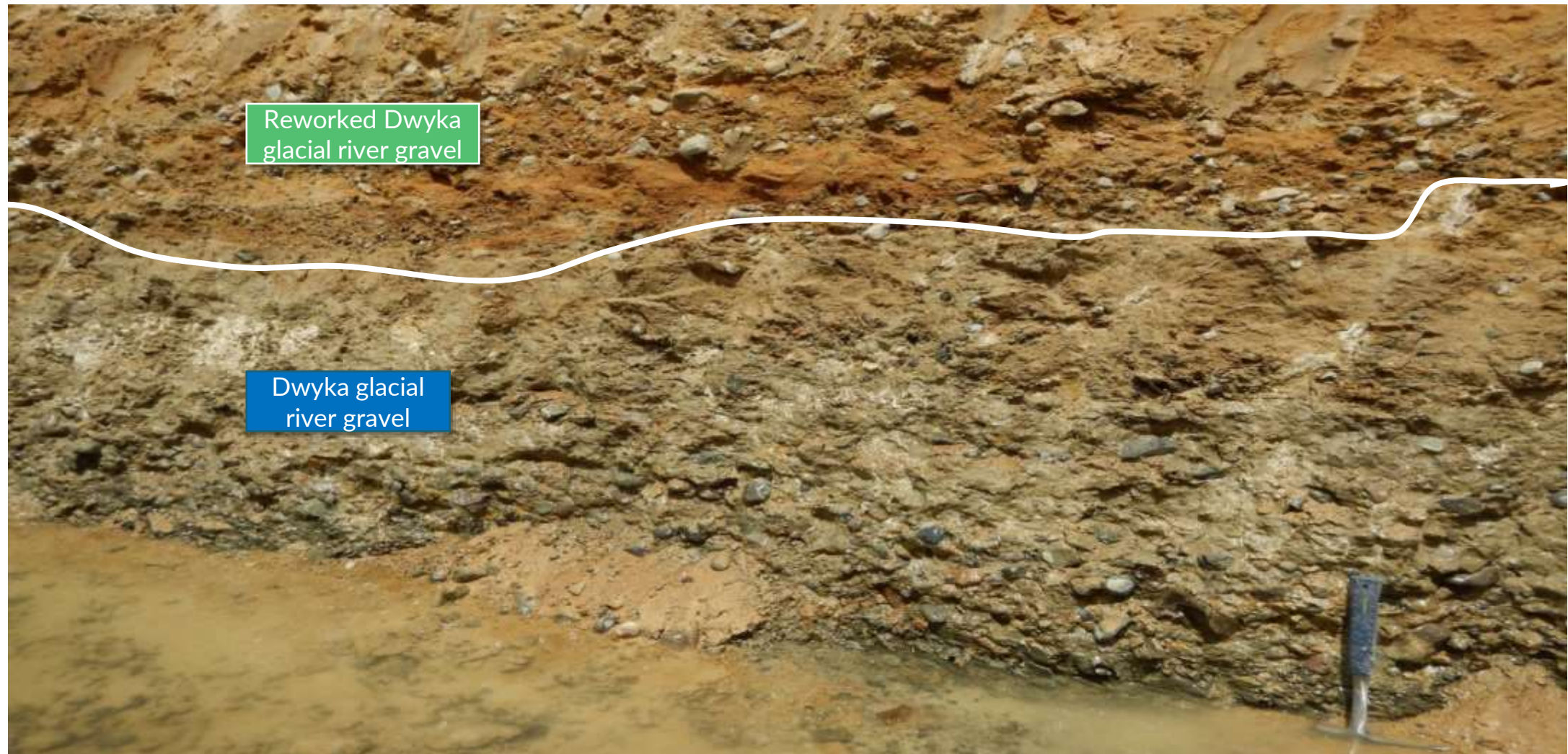
Dwyka bedrock exposed in the London Run (Farm London)



Glacial river - Zevenfontein Run (Farm Ganspan)



Glacial River - Zevenfontein Run (Farm Ganspan)



Glacial river gravels - Zevenfontein Run (Farm Ganspan)



Clast shapes range from angular to well-rounded

Poorly sorted

Glacial River - Zevenfontein Run (Farm Ganspan)



Poorly sorted gravel with clast shapes ranging from angular to well rounded

Mining lodgment till on glacial outwash plain (between Zevenfontein & London glacial rivers - Farm Graspan)



Large angular clasts
representing thin
Dwyka layer

Occasional subrounded cobbles with rare pebbles

Mining of lodgment till & reworked moraines on glacial outwash plain (Farm Graspan)



Note large angular clasts in sand matrix

Diamond Grades similar to glacial river grades

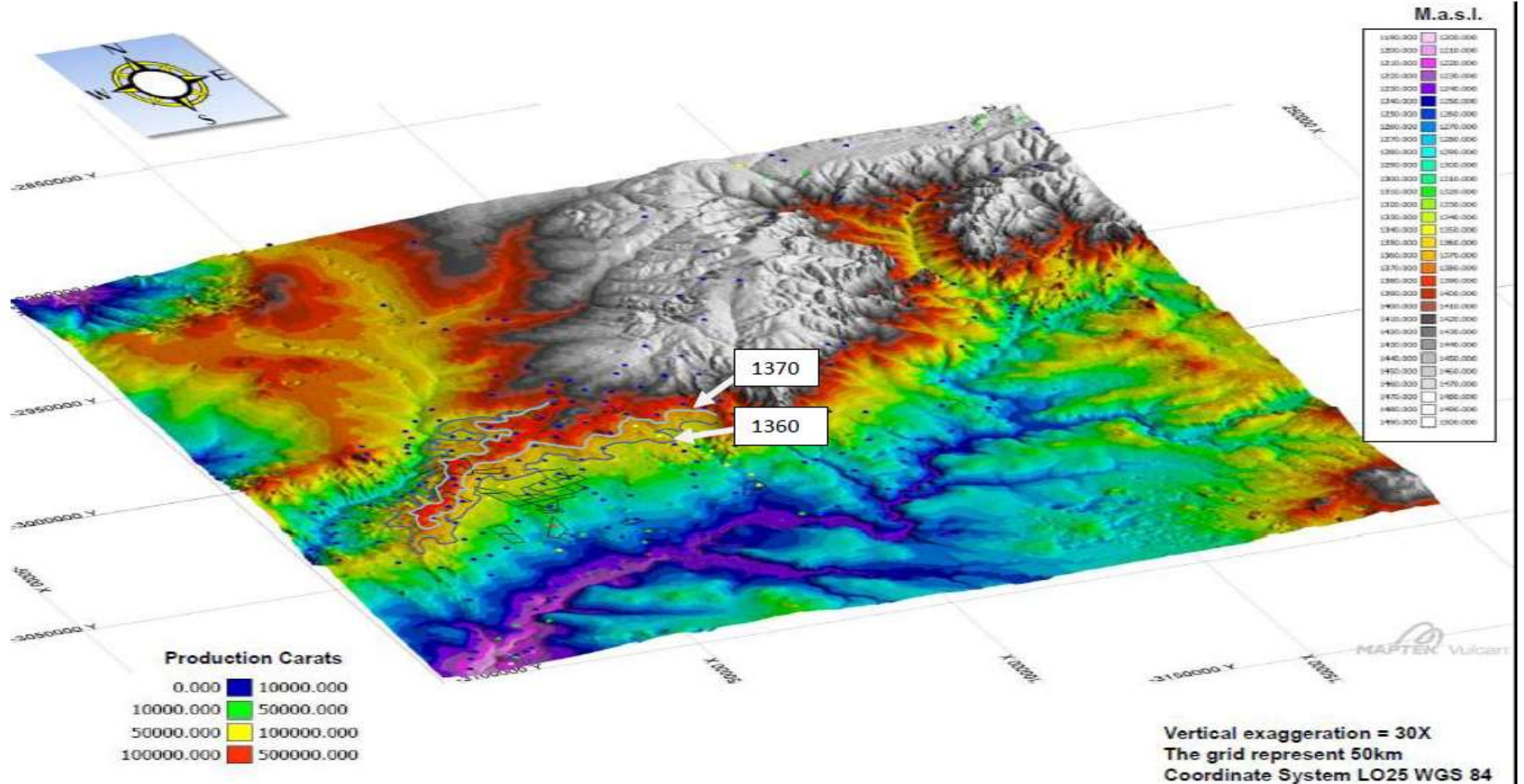
Dwyka glacial *Kettle* structure (Diamonddoorns)



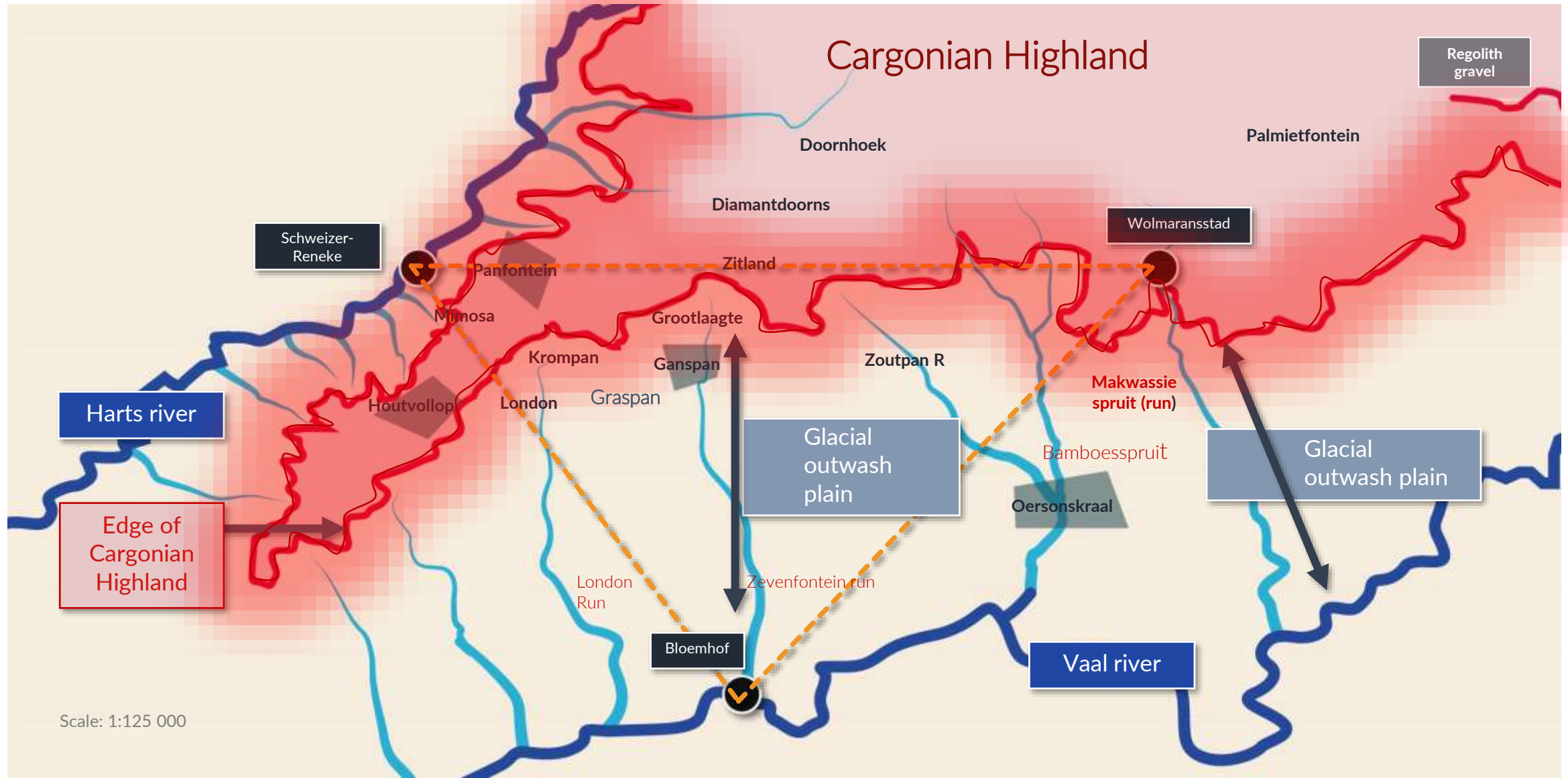
Kettle Hole structure

Kettle holes or 'dead ice sinks' are characteristic melt-out features in formerly glaciated areas; typically associated with glaciofluvial landforms such as hummocky moraines, kames, kame terraces and outwash plains

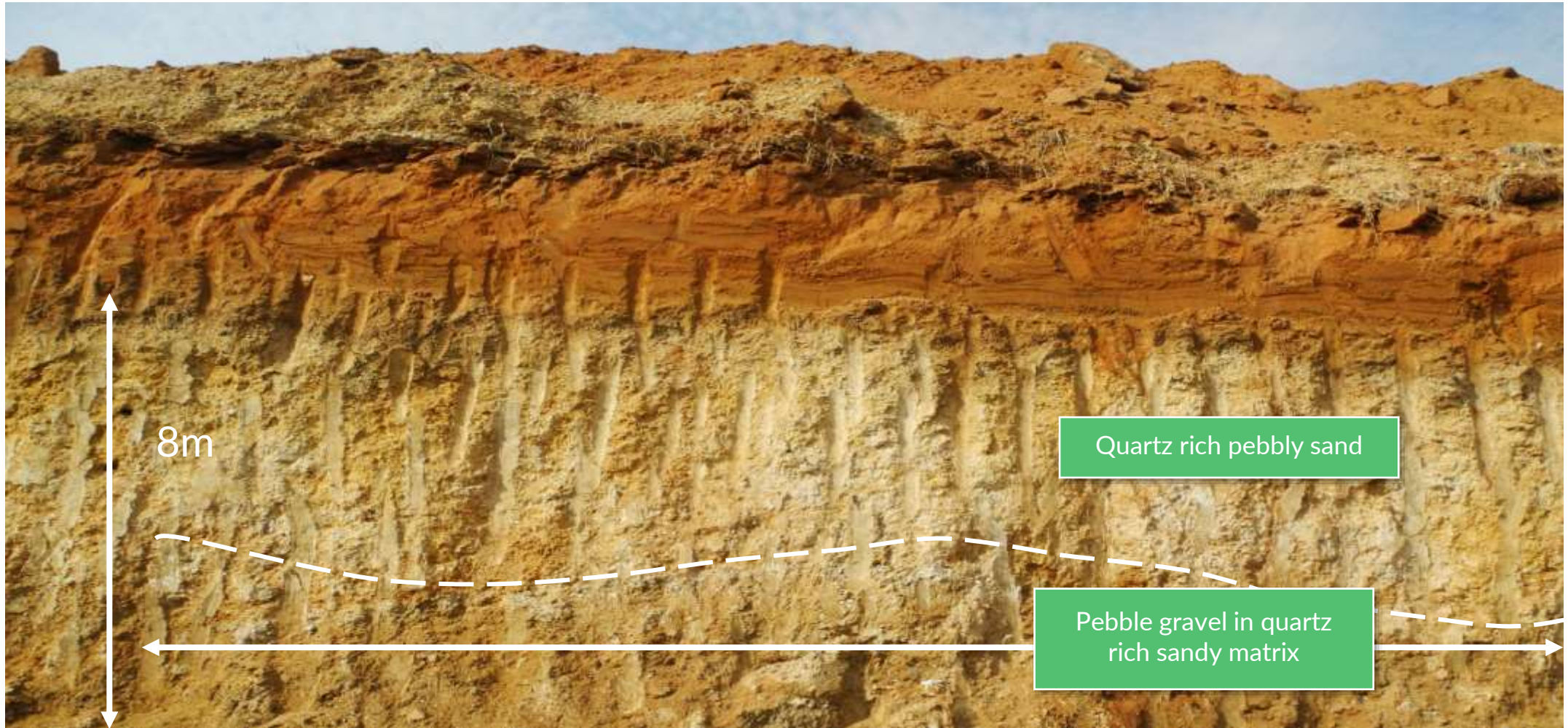
DEM : Middle-Ecca marine deposit from 1360 masl against Cargonian Highland



Cargonian highland with glacial outwash plain & Ecca marine deposits



Primary middle-Ecca marine deposit on Cargonian Highland (Farm Doornhoek)



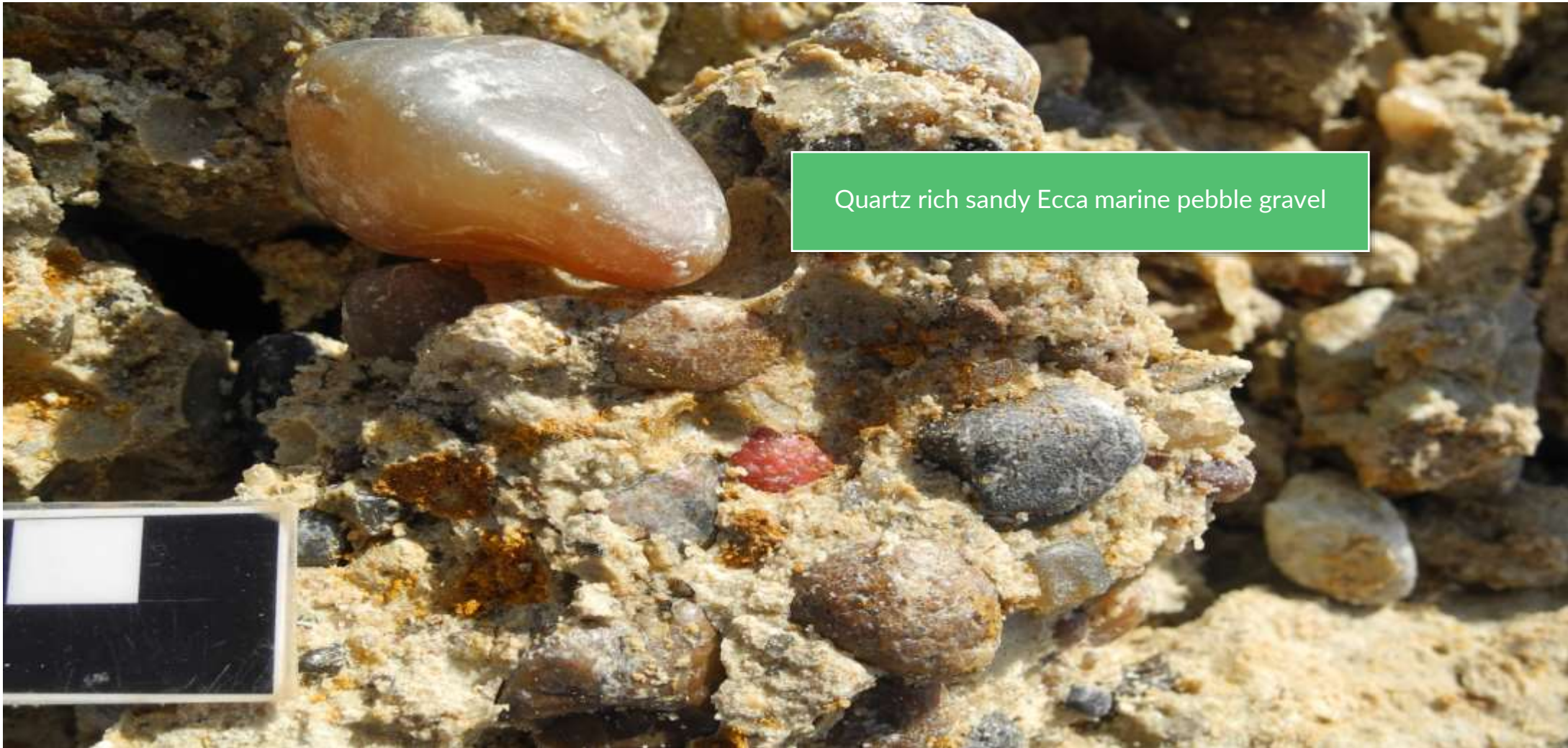
Primary middle-Ecca beach deposit (Farm Doornhoek)



Primary middle-Ecca beach deposit (Farm Doornhoek)



Primary middle-Ecca beach deposit (Farm Doornhoek)



Regolith gravels on Ventersdorp lava bedrock (Farm Panfontein)



Regolith gravel on lava bedrock (Farm Mimosa)



Regolith gravels on Ventersdorp quartzite footwall (Farm Zandfontein)



Ecca marine stoneline

Regolith gravels on Ventersdorp quartzite footwall (Farm Zandfontein)



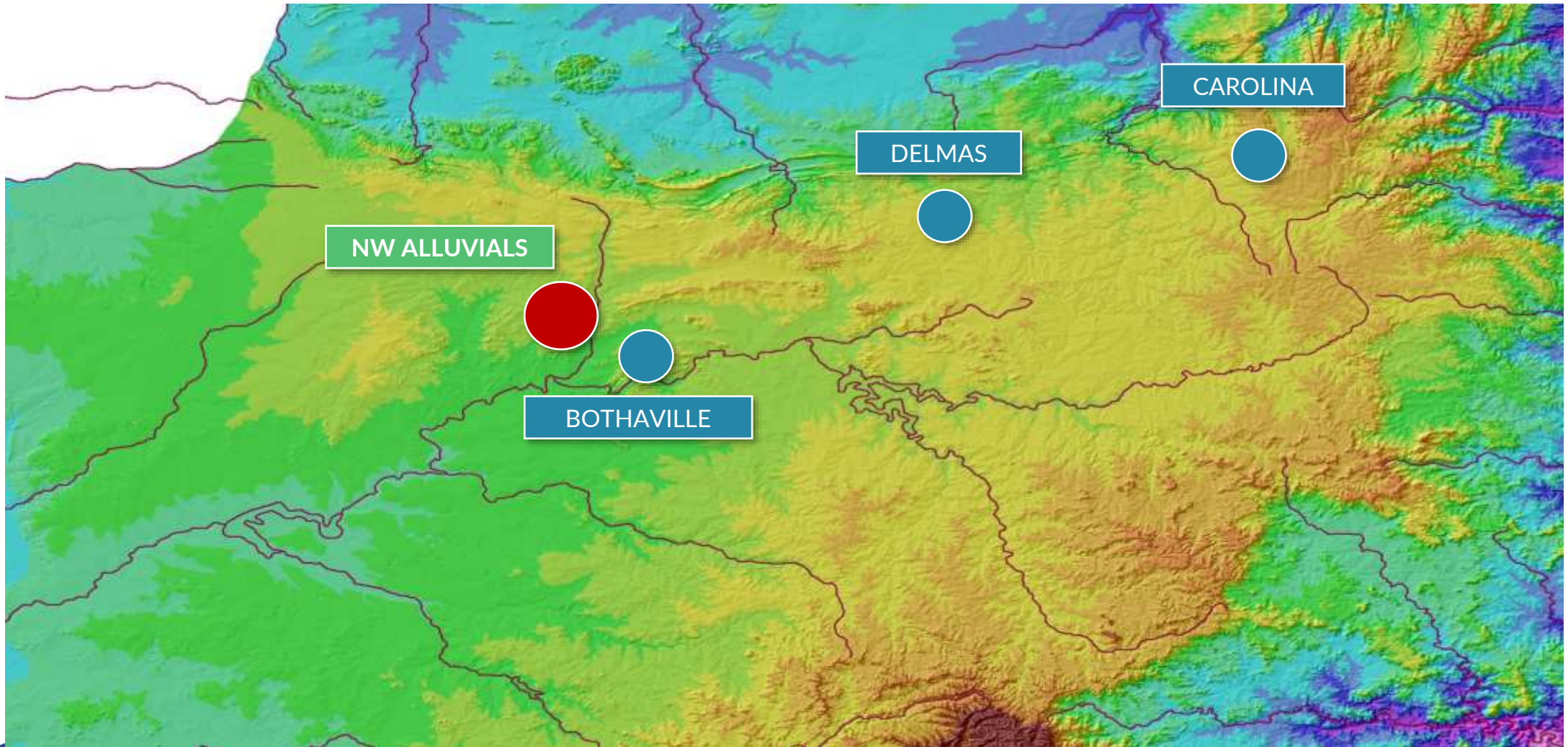
Middle Ecca marine stoneline

Watertable mealie fields- Regolith gravel acts as aquifer (Farm Zitland)



Extensive 'Regolith gravels' which form aquifers and ideal maize growing deposits
(Chemically weathered from Ecca marine gravel)

Karoo heavy mineral deposits & southern NWP diamond deposits



Primary middle-Ecca beach deposit (Farm Doornhoek)



Matrix supported pebble gravel

Diamonds in the area occur as follows

1. Carboniferous glacial outwash plains in:
 - a. Reworked Glacial Rivers
 - b. Reworked Glacial Debris

2. Permian middle-Ecca beach deposits on Cargonian Highlands in:
 - a. Primary middle-Ecca beach gravel
 - b. Regolith Gravel (chemically weathered middle-Ecca beach gravel)

Production 2012 to 2015

Diamond production data from the 'diamond triangle'

MINE	GRAVEL TYPE	SED ENVIRONMENT	TONS	QTY	CT	CARAT/STONE	GRADE CPHT	US\$
London	London Run Alluvial	Reworked glacial stream	2 287 382	14 176	14 874	1.05	0.65	9 078 433
Oersonskraal	Bamboes Run Alluvial	Reworked glacial stream	2 212 114	39 691	18 512	0.47	0.84	641 399
Kameelkuil	London Run Alluvial	Reworked glacial stream	352 897	2 979	3 189	1.07	0.9	1 237 591
Ganspan	Zevenfontein Run Alluvial	Reworked glacial stream	123 049	1 024	1 224	1.2	0.99	-
Diamantfontein	glacial debris	Reworked glacial debris	233 524	1 449	1 684	1.16	0.72	436 256
Koppie alleen	glacial debris	Reworked glacial debris	1 084 051	4 503	5 363	1.19	0.49	300 640
Graspan	glacial debris	Reworked glacial debris	230 036	1 615	2 128	1.32	0.92	108 447
Doornhoek	Regolith	Ecca marine shoreline	2 404 520	21 446	16 203	0.76	0.67	5 668 563

Dwyka gravel over-size (with diamond lock-up)



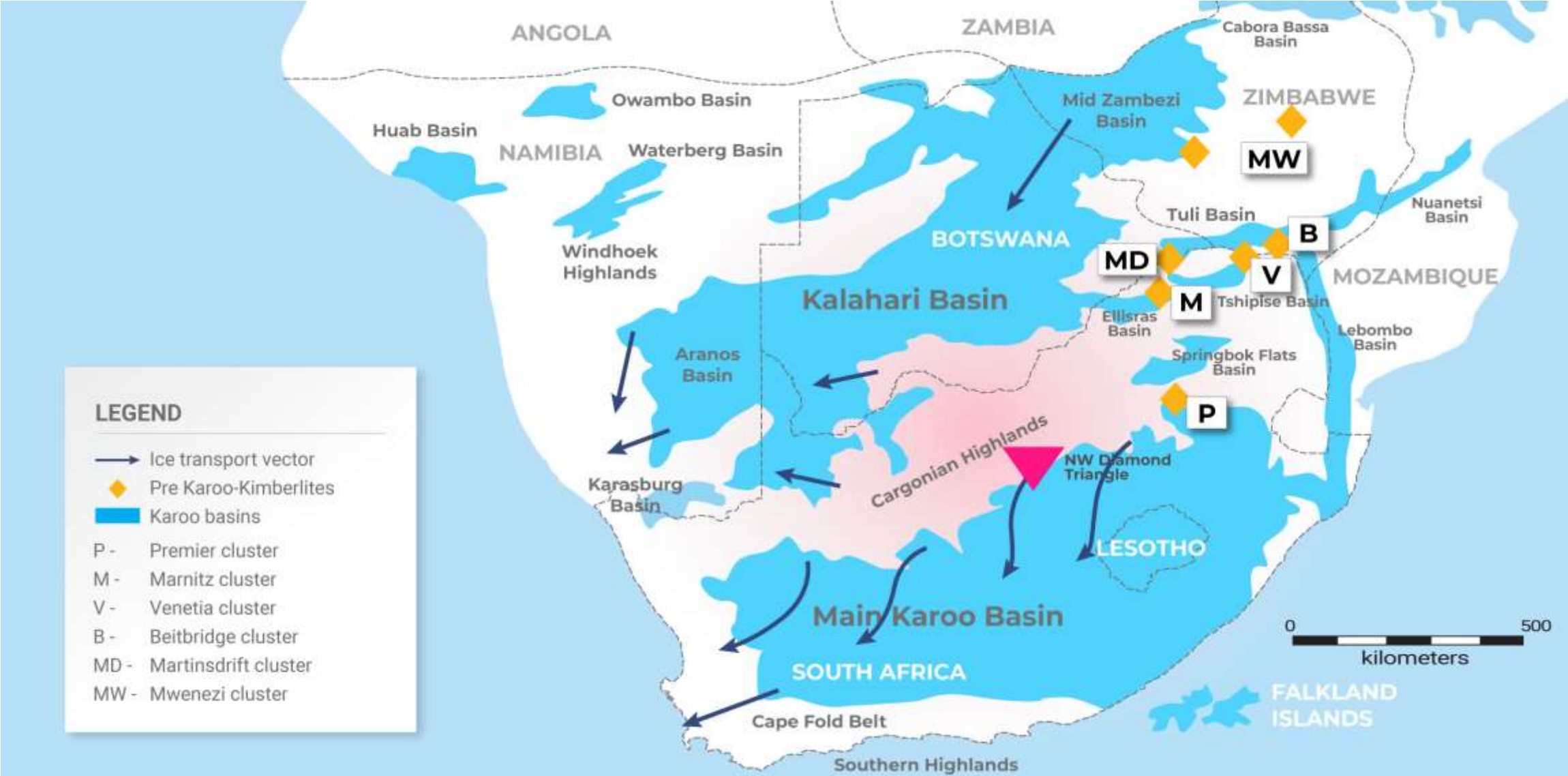
Dwyka gravel over-size (with diamond lock-up)

Note hardness of fine sandy matrix as well as packing, sorting and shape of clasts



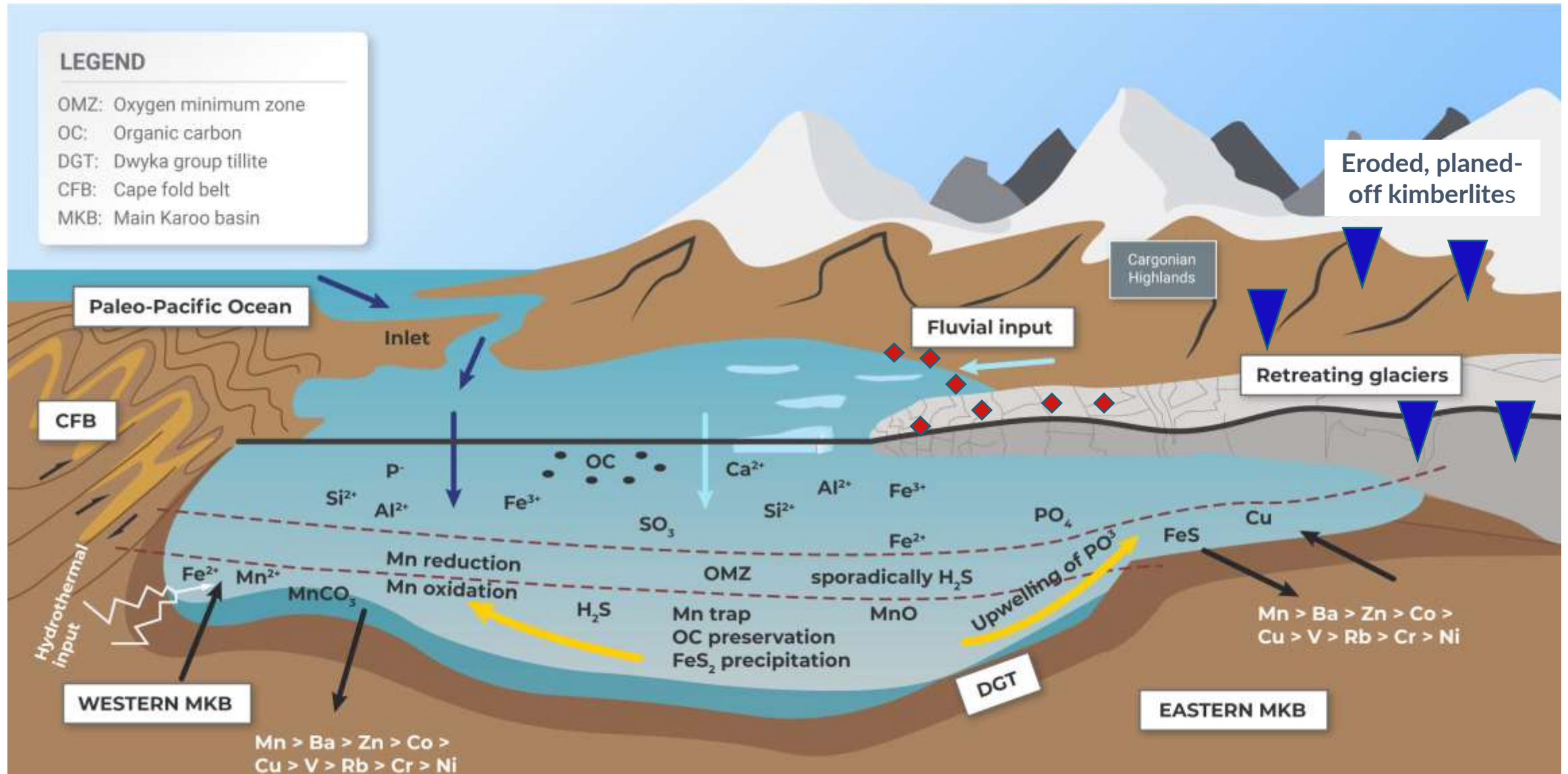
Cargonian Highlands & Pre-Karoo kimberlites

Regional Setting



Reconstruction of the Ecca (Karoo Basin)

Regional Setting

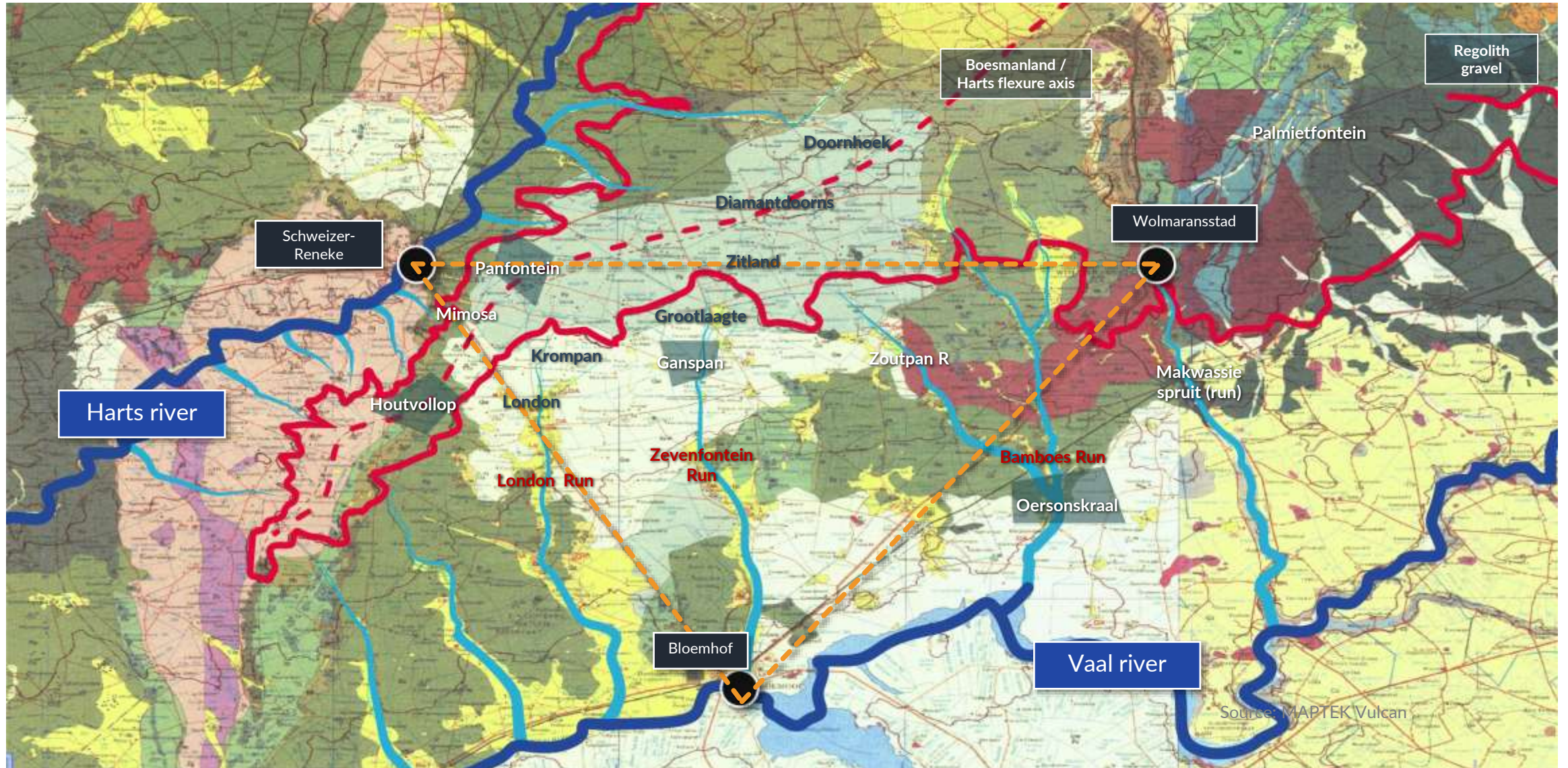


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Conclusions

Origin of diamonds in the North West Province Triangle

1. Alluvial mining in the area started in the early 19th century. Renewed interest in the mining of alluvial diamonds was generated by the El Niño related drought of 1974 when many farmers turned to diamond mining
2. Subsequent to 1974 much larger volumes of gravel could be moved and greater depths of gravel were reached owing to modern earth moving and sorting equipment
3. Processes including glacial activity, structures and deposits associated with the Carboniferous Dwyka glaciers, karst formation, erosion and eskers played a significant role in the liberation and transport (from NE to SW) of diamonds from pre-Dwyka kimberlites
4. Reworking of glacial outwash and other material during the Permian Ecca marine-basin setting led to concentration and localization of the alluvial diamond deposits mined since across the area
5. Modern geological work has highlighted the primarily pre-Karoo origin of the extensive NW Province Triangle diamond deposits, and younger reworked 'deflation' deposits, between the well-known N-S trending 'Runs' of the NW Triangle (e.g. London Run, Bamboes Spruit).

Thank You

Questions + Answers

Acknowledgements:

1. The farming and alluvial mining fraternity of the North West Province who allowed me access to their properties and shared their diamond production and parcels over many years
2. Geologist John Ward for positive conversations and support in establishing the Middle-Ecca shoreline as well as the excellent photographs.
3. John Bristow for providing his insights and experience of deposits in the *NWP Diamond Triangle*, and help with the presentation
4. Mike de Witt for sharing views and experiences
5. Rosika Delport for excellent assistance with the PPT construction & graphics.

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YouTube Presentation Link

Pierre De Jager – Alluvial diamond deposits of the North-West Diamond Triangle
(YouTube, June, 2022 On-Line Diamond Short Course)

https://www.youtube.com/watch?v=VjQpHz-NqIY&list=PL-MPMaHidsW0bTZ_Kp543Da4RT3gY8CGi&index=12&t=703s&pp=iAQB