

Some Observations on the Dwars River Chromitite Seams and a nearby Breccia Pipe, Bushveld Igneous Complex



Dwars River Chromitite



Breccia Pipe

LAYERED IGNEOUS COMPLEXES

Name	Age	Location	Area (km ²)
Bushveld	Precambrian	South Africa	66,000
Dufek	Jurassic	Antarctica	50,000
Duluth	Precambrian	Minnesota, USA	4,700
Stillwater	Precambrian	Montana, USA	4,400
Muskox	Precambrian	Canada	3,500
Great Dyke	Precambrian	Zimbabwe	3,300
Kiglapait	Precambrian	Labrador	560
Skaergård	Eocene	East Greenland	100

THE GEOLOGICAL SOCIETY OF SOUTH AFRICA, SPECIAL PUBLICATION 1, 1970
SYMPOSIUM ON THE BUSHVELD IGNEOUS COMPLEX AND OTHER LAYERED INTRUSIONS

**ORIGIN OF AN ULTRAMAFIC PEGMATOID IN THE EASTERN PART OF
THE BUSHVELD COMPLEX**

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**Fluid overpressure in layered intrusions: formation of a breccia pipe
in the Eastern Bushveld Complex, Republic of South Africa**

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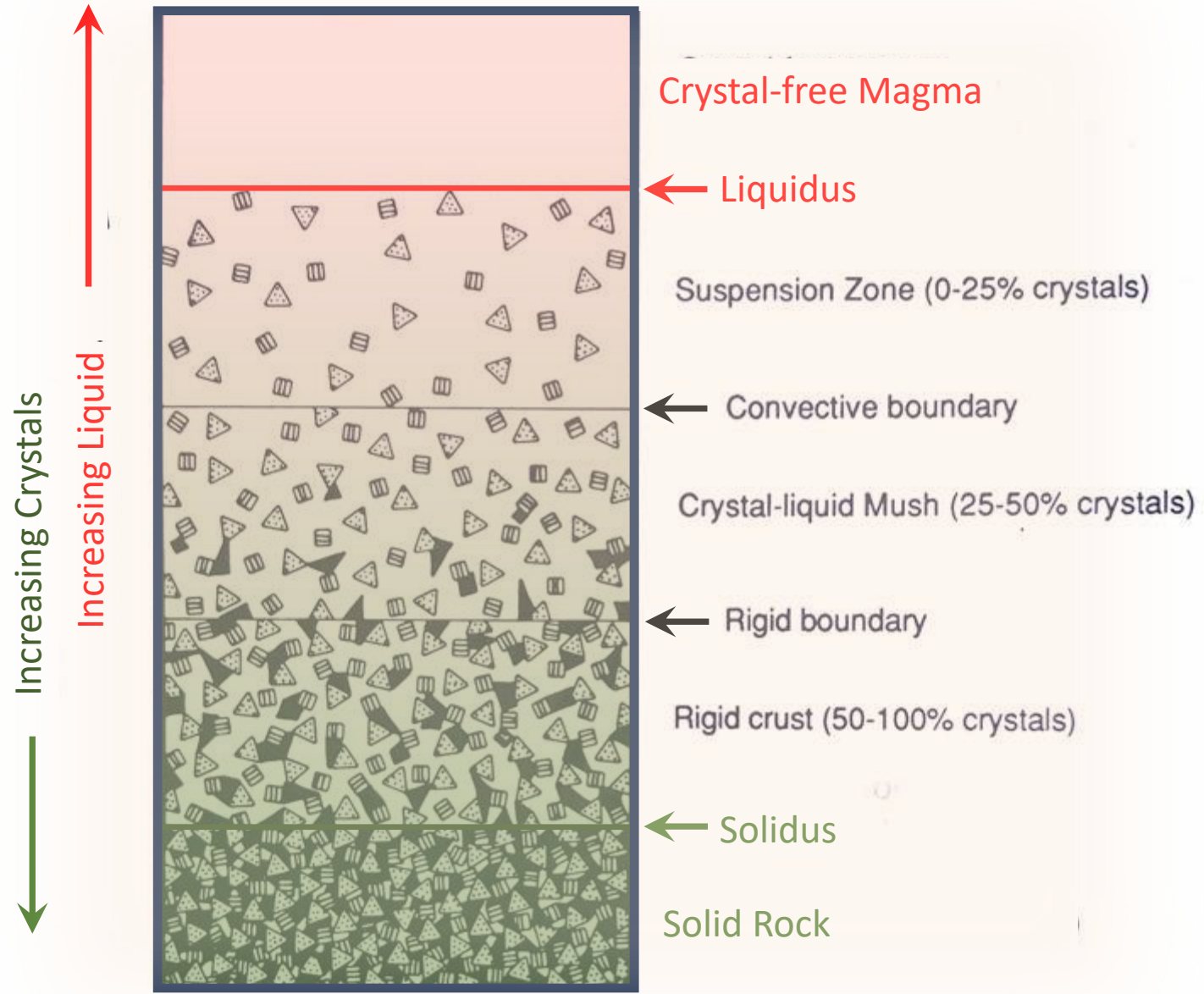
Journal of the Geological Society, London, Vol. 161, 2004, pp. 903–909. Printed in Great Britain.

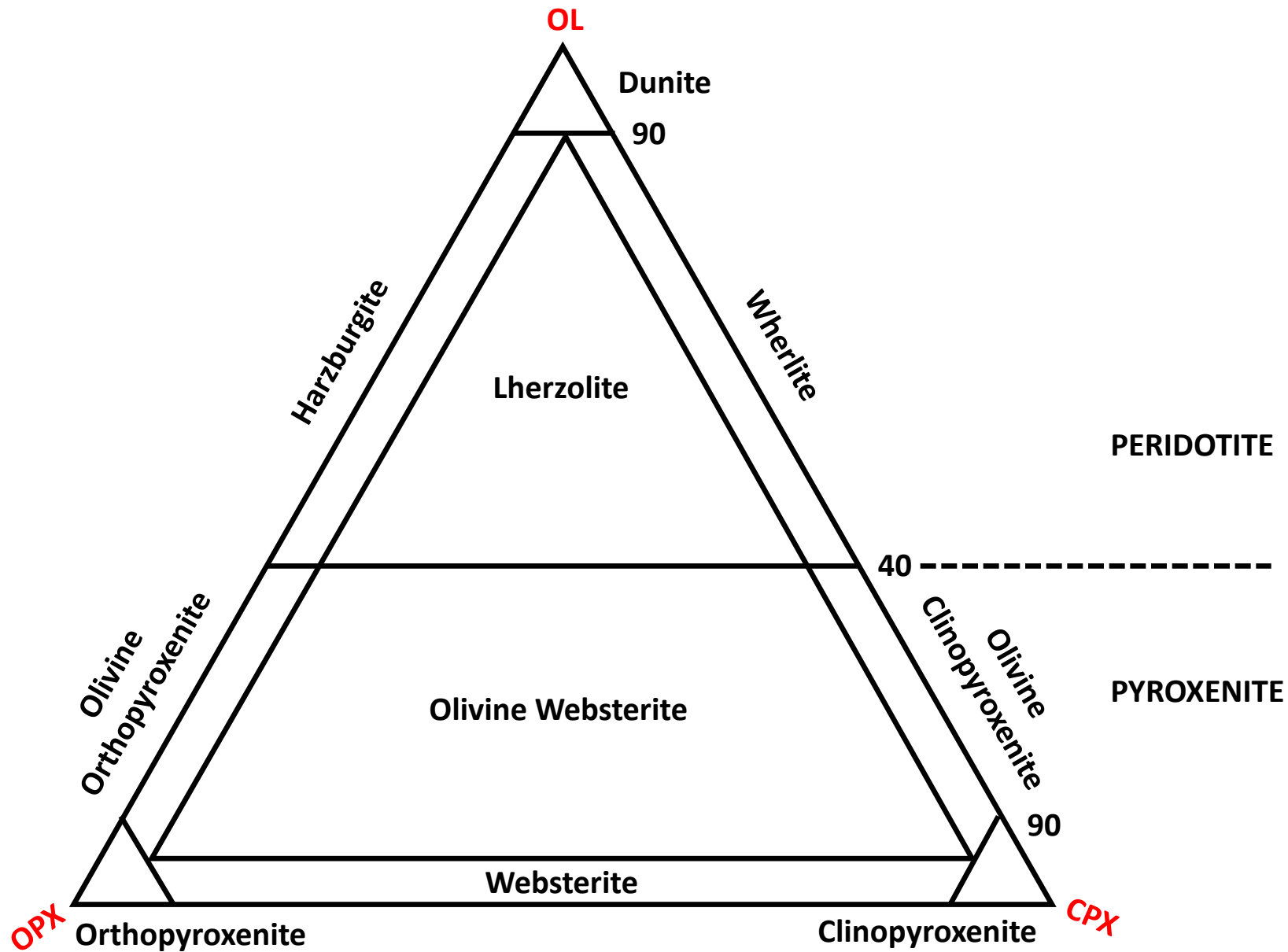
**Formation of bifurcating chromitite layers of the UG1 in the Bushveld Igneous
Complex, an analogy with sand volcanoes**

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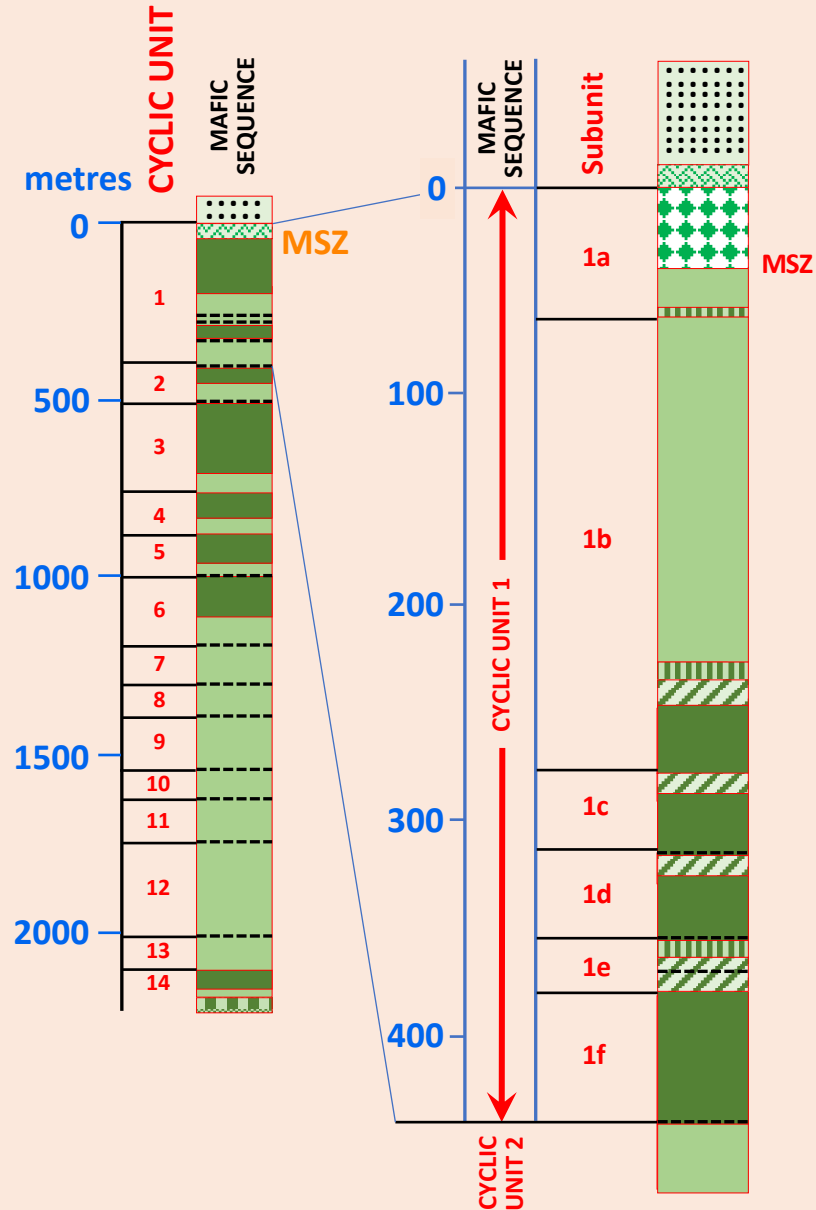
(e-mail: nexp@geosciences.wits.ac.za)





Great Dyke Stratigraphy

-  Gabbronorite
-  Websterite
-  Orthopyroxenite
-  Olivine Orthopyroxenite
-  Harzburgite
-  Dunite
-  Chromitite
-  Basal Norite



-  Gabbronorite
-  Olivine Gabbro
-  Websterite
-  Orthopyroxenite
-  Olivine Orthopyroxenite
-  Harzburgite
-  Dunite
-  Chromitite





MECHANISMS FOR THE FORMATION OF IGNEOUS LAYERS

1 MAGMA EMPLACEMENT

2 CONVECTION

3 MECHANICAL PROCESSES

4 VARIATIONS IN INTENSIVE PARAMETERS

5 LATE-STAGE CRYSTALLIZATION AND COOLING

MECHANISMS FOR THE FORMATION OF IGNEOUS LAYERS

3 MECHANICAL PROCESSES

Layer Formation



Gravity settling

Magma currents and convection

Later processes



*** Magmatic deformation ***

*** Compaction due to superincumbent load ***

Seismic shocks

Tectonic deformation



The Bushveld Complex, South Africa

The biggest:
300-400 km x 9 km

The Red Granite
intruded 50-100 Ma
afterwards

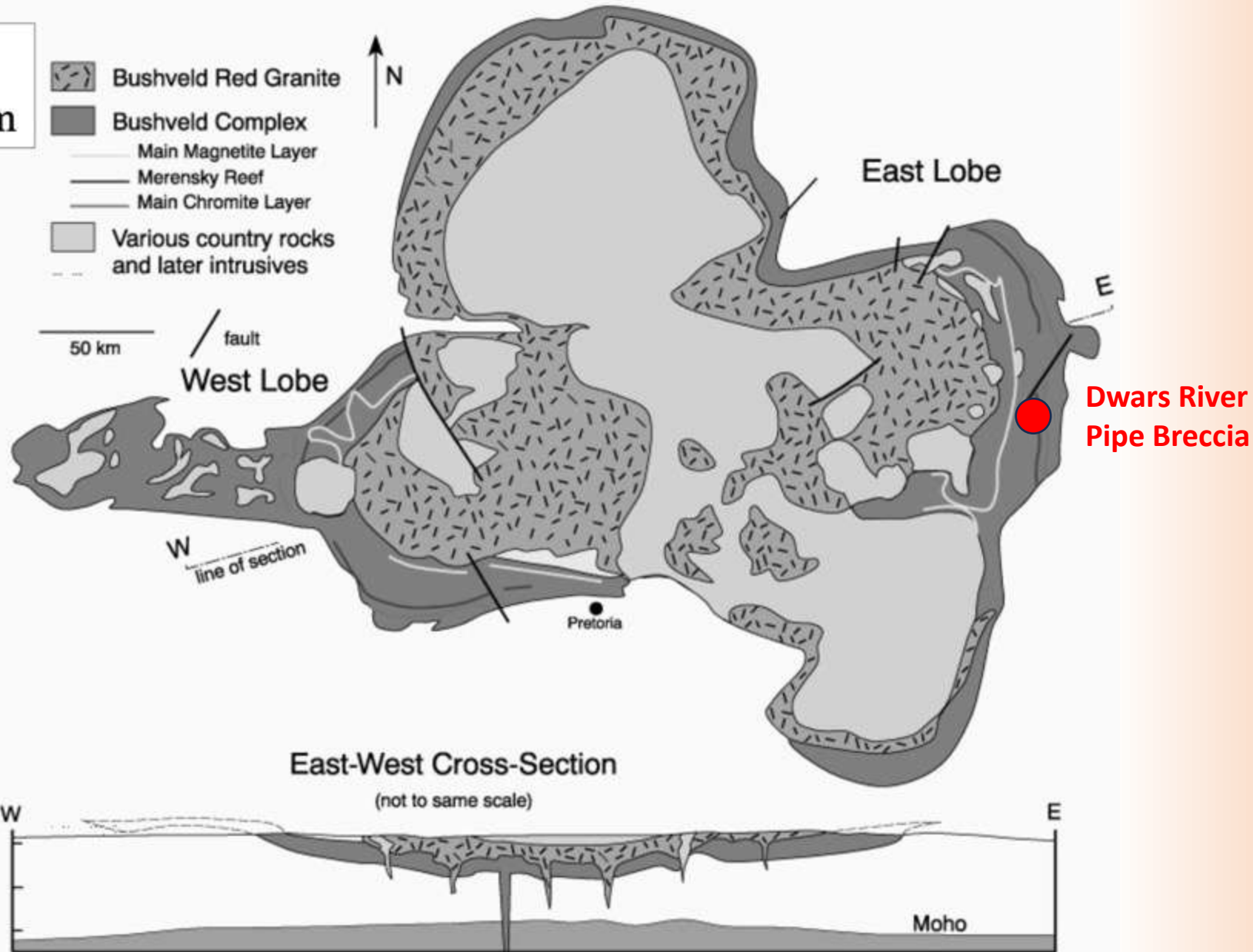


Figure 12-5.
Simplified geologic
Map and cross
section of the
Bushveld complex.
After Willemse
(1964), Wager and
Brown (1968), and
Irvine *et al.* (1983).

BUSHVELD IGNEOUS COMPLEX STRATIGRAPHY

Upper Zone : Gabbro

Main Zone : Gabbronorites with pyroxenite and anorthosite

Critical Zone : Chromitite interlayered with dunite, harzburgite, pyroxenite, norite and anorthosite

Lower Zone: Pyroxenite, harzburgite, dunite

Marginal Zone: Norite and gabbronorite locally contaminated by Transvaal Supergroup sediments

BUSHVELD IGNEOUS COMPLEX STRATIGRAPHY

Breccia Pipe



Dwars River



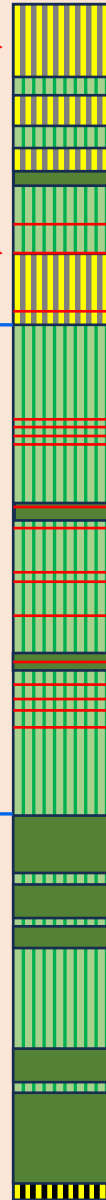
Upper Critical Zone



Lower Critical Zone



Lower Zone



Bastard Unit
Merensky Unit

** PGM/BM

Footwall Unit
Pseudoreefs

UG2
UG1 Upper Group

** PGM/BM

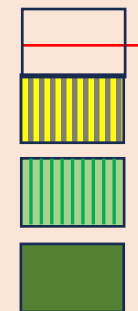
UG1 Footwall

Middle Group
Chromitites

LG8

Lower Group
Chromitites

LG1



Chromitite Layer

Norite – Anorthosite Dominant

Pyroxene Dominant

Olivine Bearing

West

East

Dwars River





Anorthosite

Chromitite



Anorthosite

Chromitite



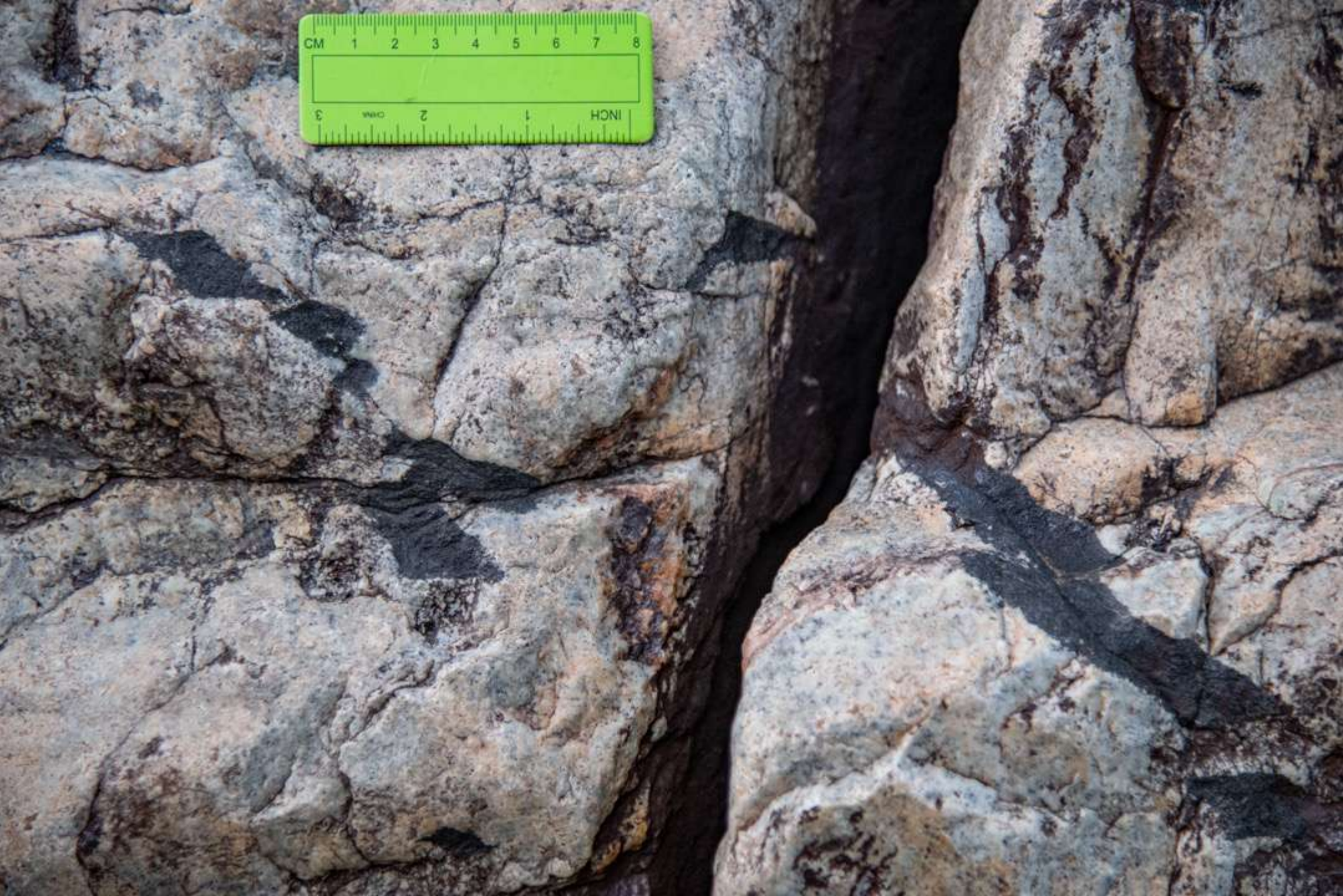
Chromitite

Anorthosite



















BUSHVELD IGNEOUS COMPLEX STRATIGRAPHY



Chromitite

Oikocrysts?



Pyroxenite

Anorthosite



Pyroxenite

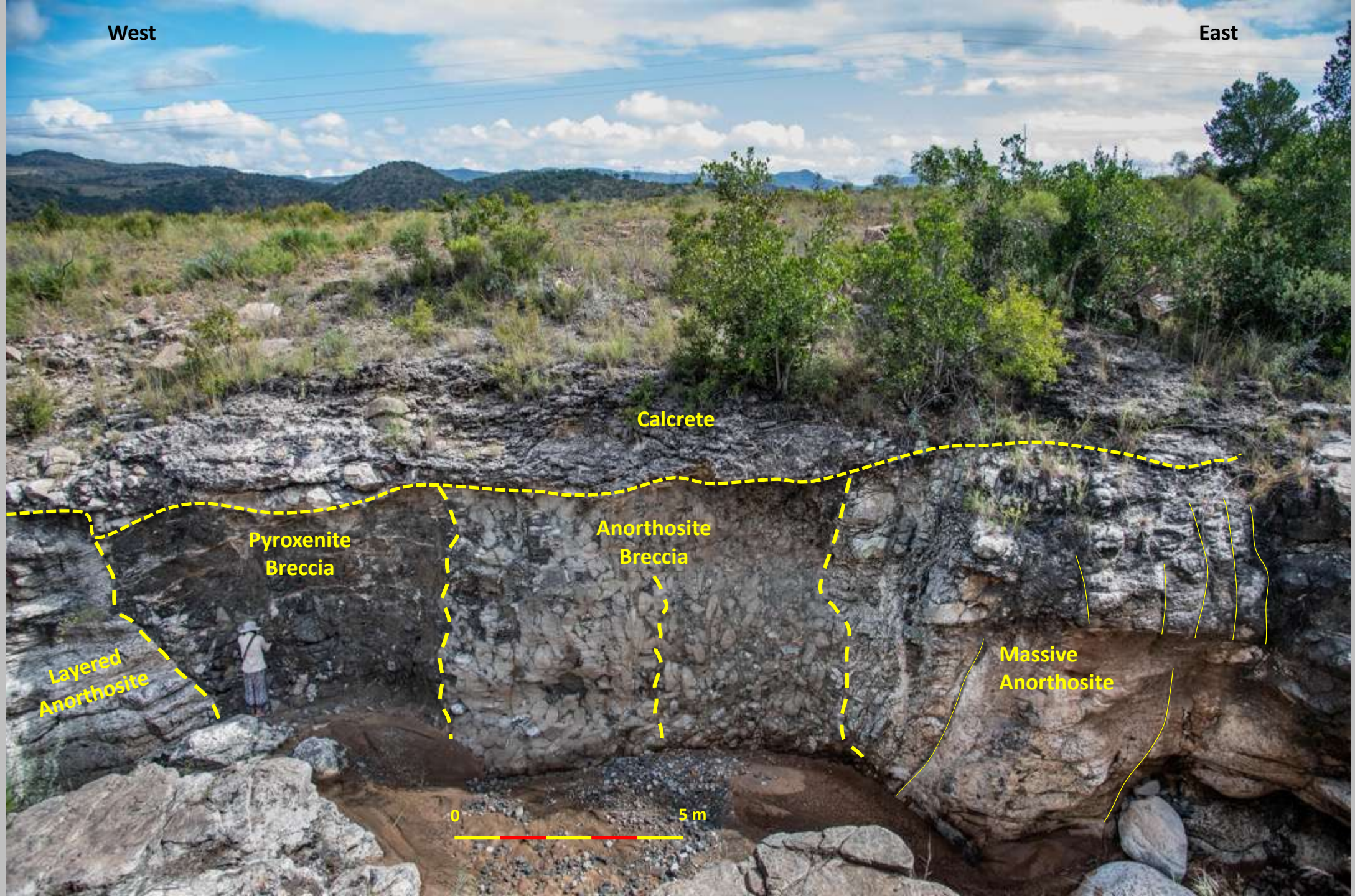
Pyroxenite

Pegmatitic

Layered Anorthosite

West

East



Calcrete

Pyroxenite
Breccia

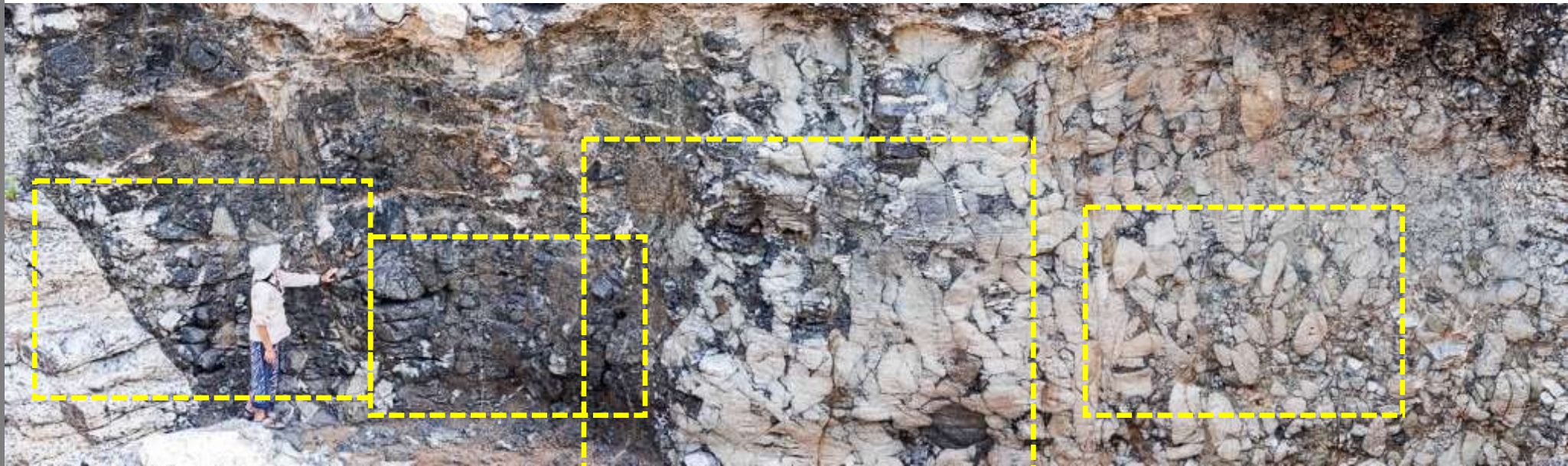
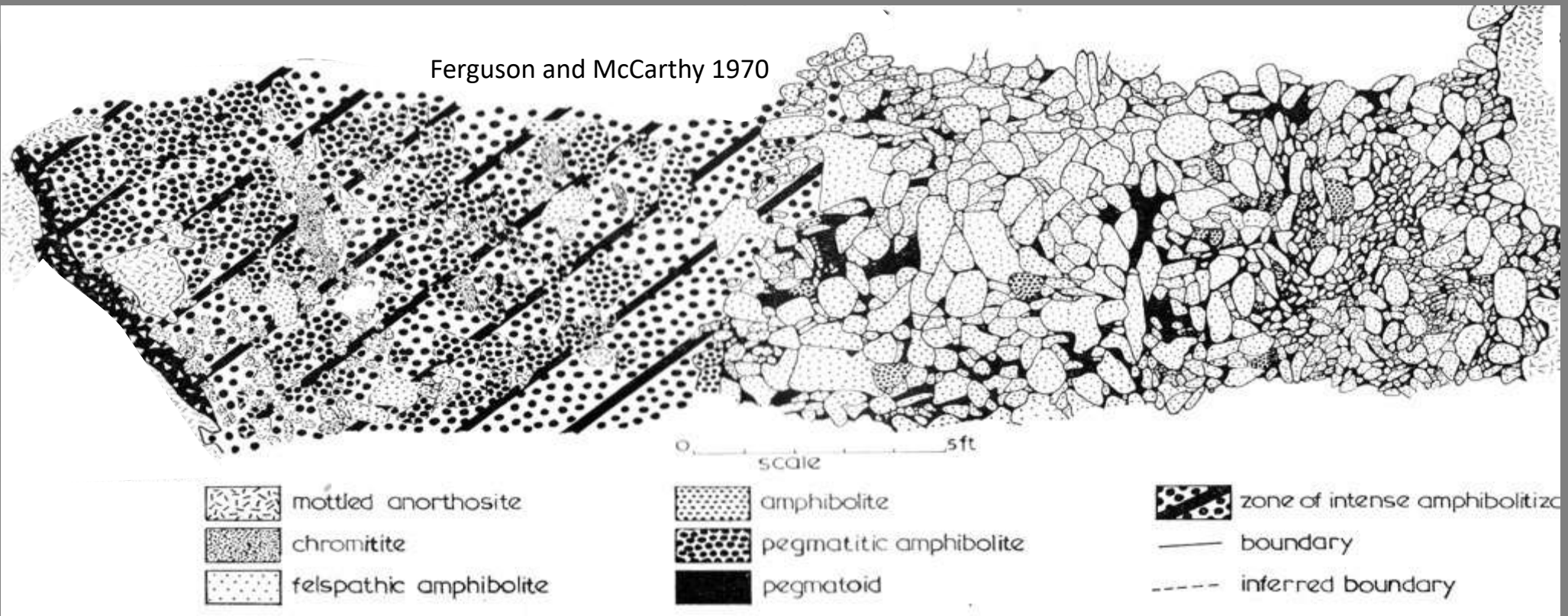
Anorthosite
Breccia

Layered
Anorthosite

Massive
Anorthosite

0 5 m

Ferguson and McCarthy 1970



PYROXENITE BRECCIA

Anorthosite

Pyroxenite

**Mottled
Anorthosite**

①

②

①

②

②

??

??

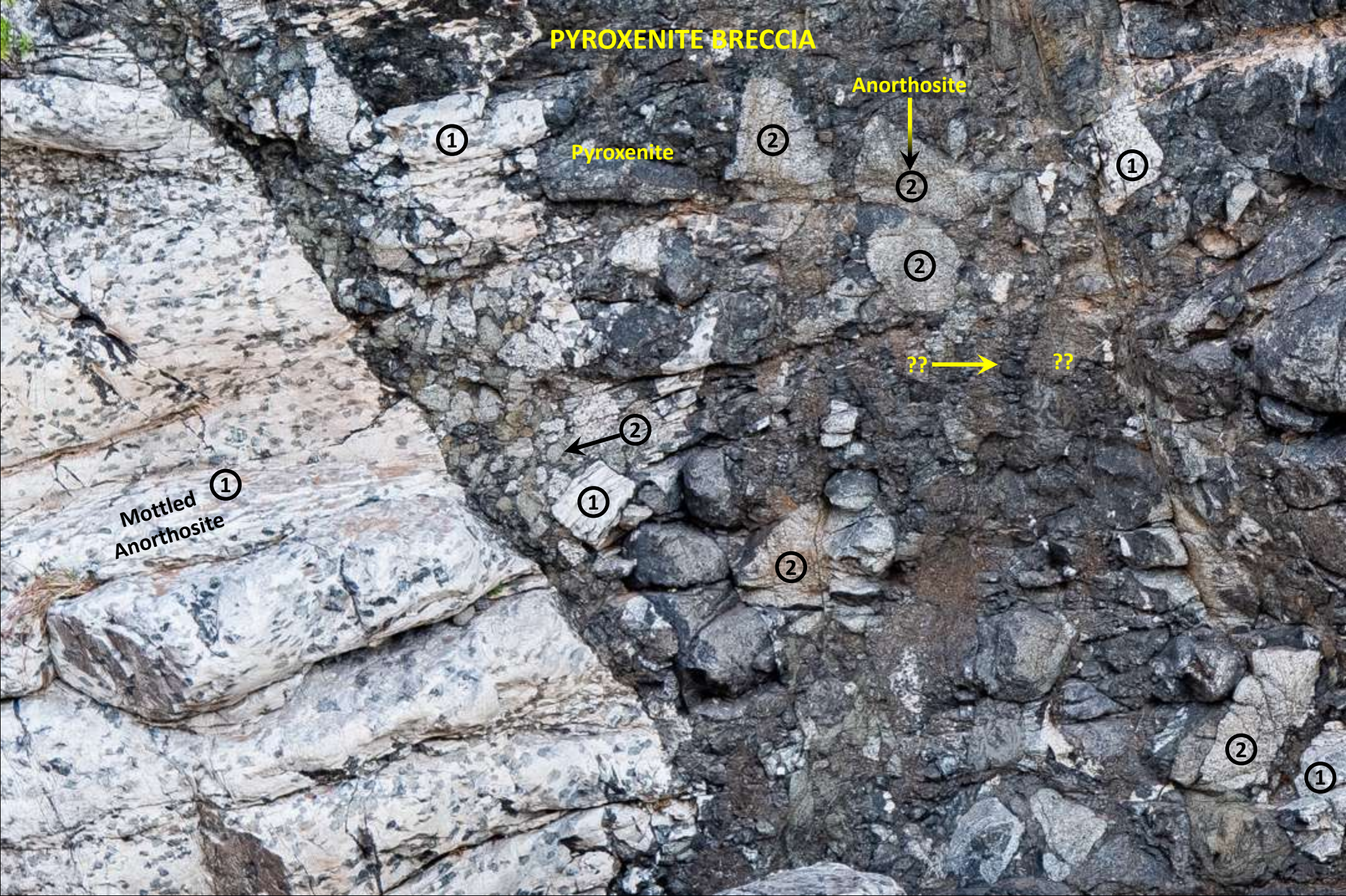
②

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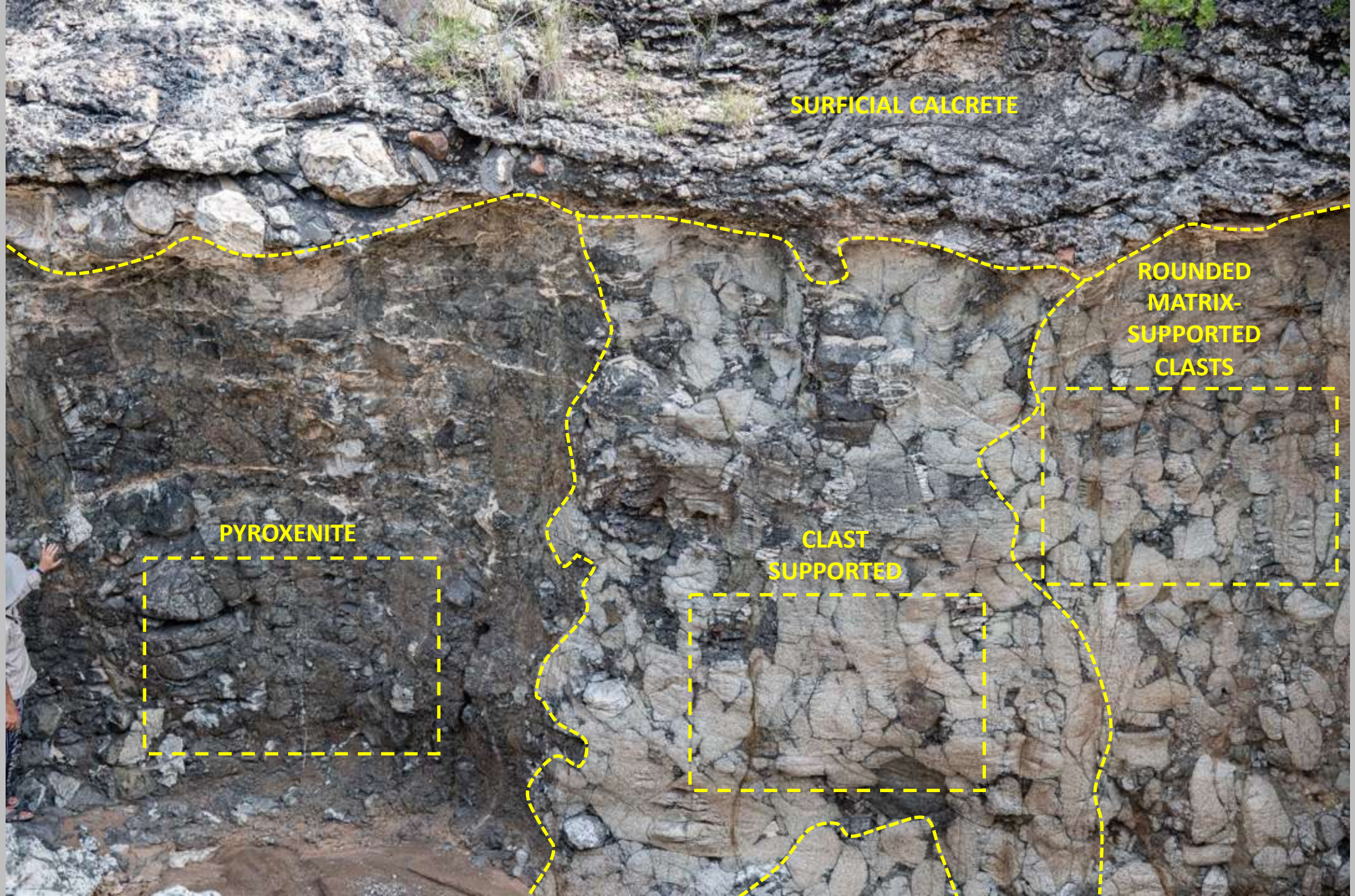


SURFICIAL CALCRETE

**ROUNDED
MATRIX-
SUPPORTED
CLASTS**

PYROXENITE

**CLAST
SUPPORTED**





Pyroxenite

Anorthosite

Pyroxenite

Anorthosite





Pyroxenite

Pyroxenite

Anorthosite

Pyroxenite



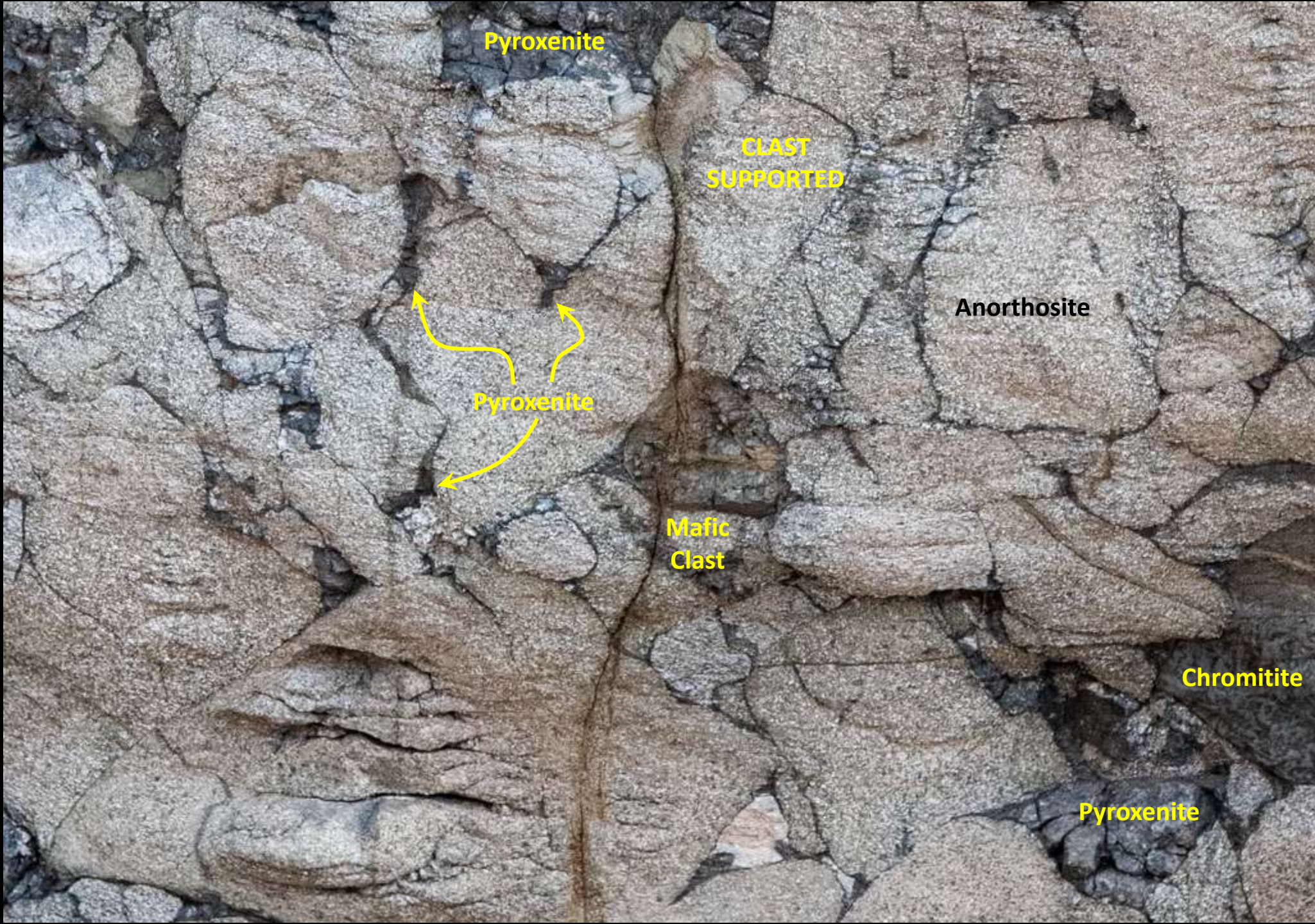
Anorthosite

Pyroxenite

Pyroxenite
veins

Pyroxenite

Chromitite



Pyroxenite

CLAST
SUPPORTED

Anorthosite

Pyroxenite

Mafic
Clast

Chromitite

Pyroxenite

Anorthosite

Pyroxenite



**Mottled
Anorthosite**

Gabbro?

Pyroxenite



Anorthosite

Fine-grained matrix?

Fine-grained matrix?



**ROUNDED
MATRIX-
SUPPORTED
CLASTS**



What Happened?



What Happened?

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The end