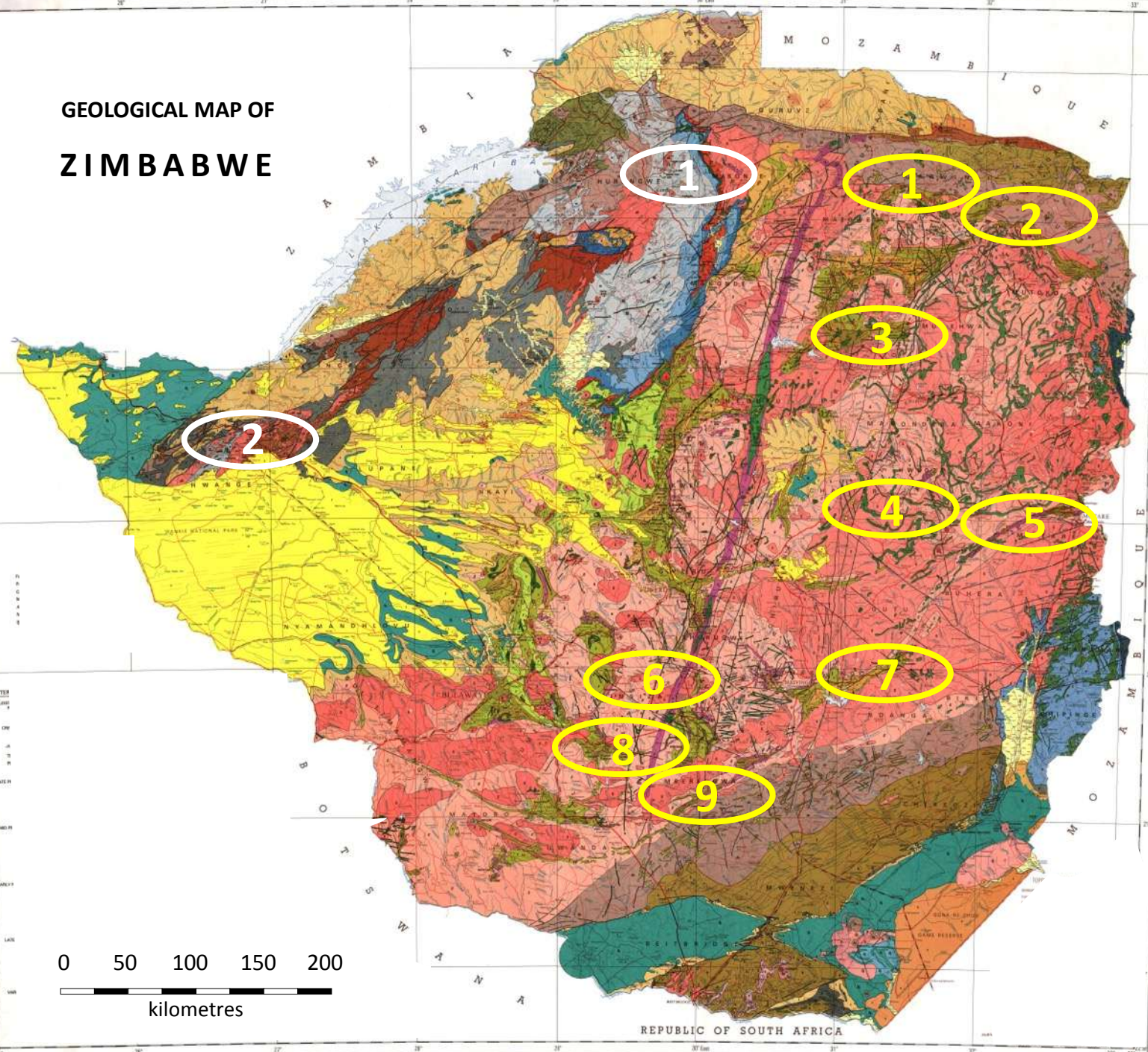


Some observations on Pegmatites

Summer School Symposium November 2019

Tony Martin

GEOLOGICAL MAP OF ZIMBABWE



Pegmatite Occurrences

Proterozoic

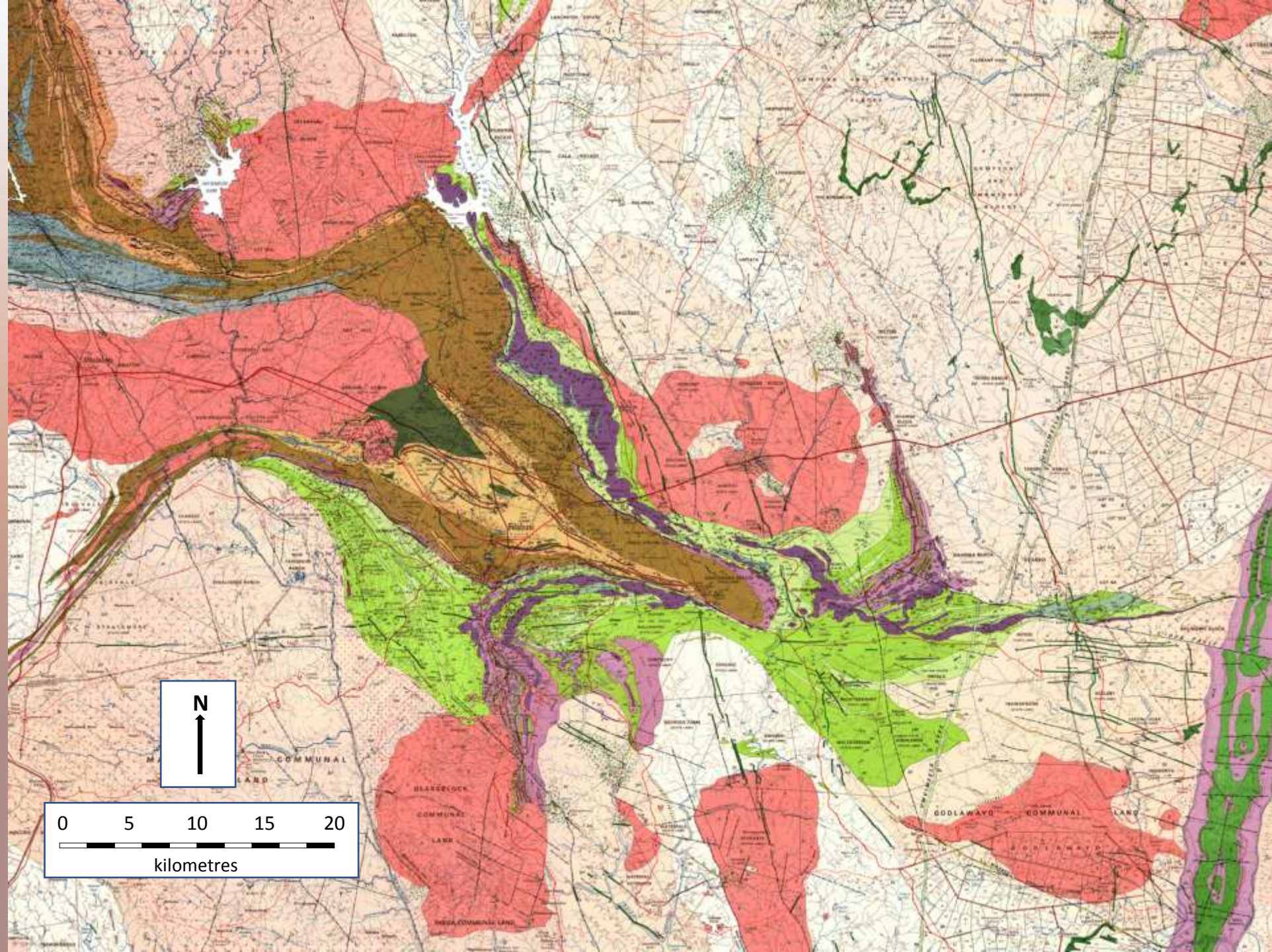
1. Mwami
2. Kamativi Dete

Archaean

1. Mount Darwin
2. Mtoko
3. Harare
4. Felixburg
5. Odzi
6. Fort Rixon
7. Bikita
8. Filabusi
9. Mwanesi



Filabusi Greenstone Belt



Dips of pegmatites
mostly shallow to
horizontal

Bikita
Arcadia
Odzi

Hydrothermal vein deposits steep to vertical



Pegmatite Classification

Simple Pegmatites

Quartz Feldspar Mica



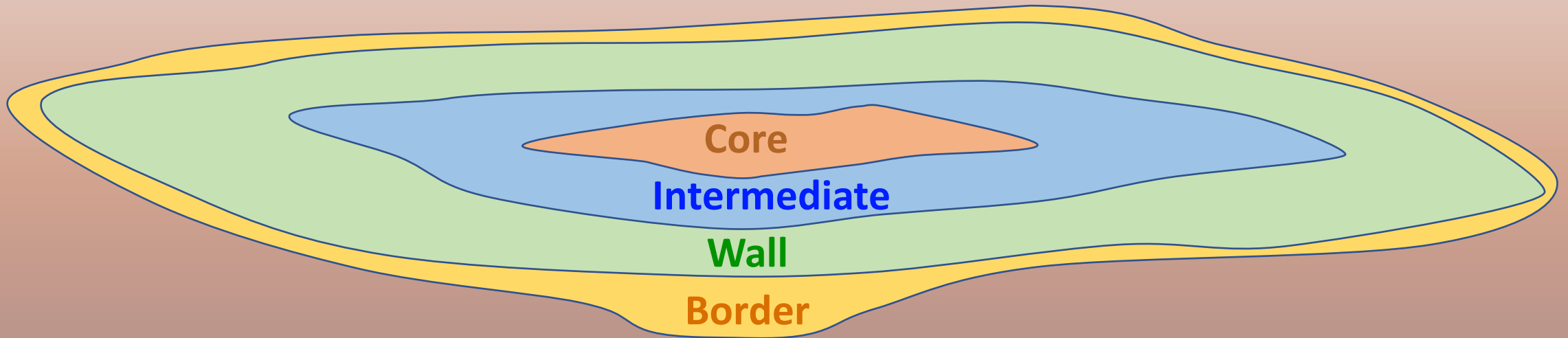
Complex Pegmatites

Quartz Feldspar Mica
Lithium
Tantalum/niobium
Beryllium

Boron
Tin
Tungsten
Bismuth
Titanium
Rare Earths

Tourmaline
Emerald
Topaz
Kunzite
Aquamarine
Morganite
Citrine
Garnet

Pegmatite Zoning

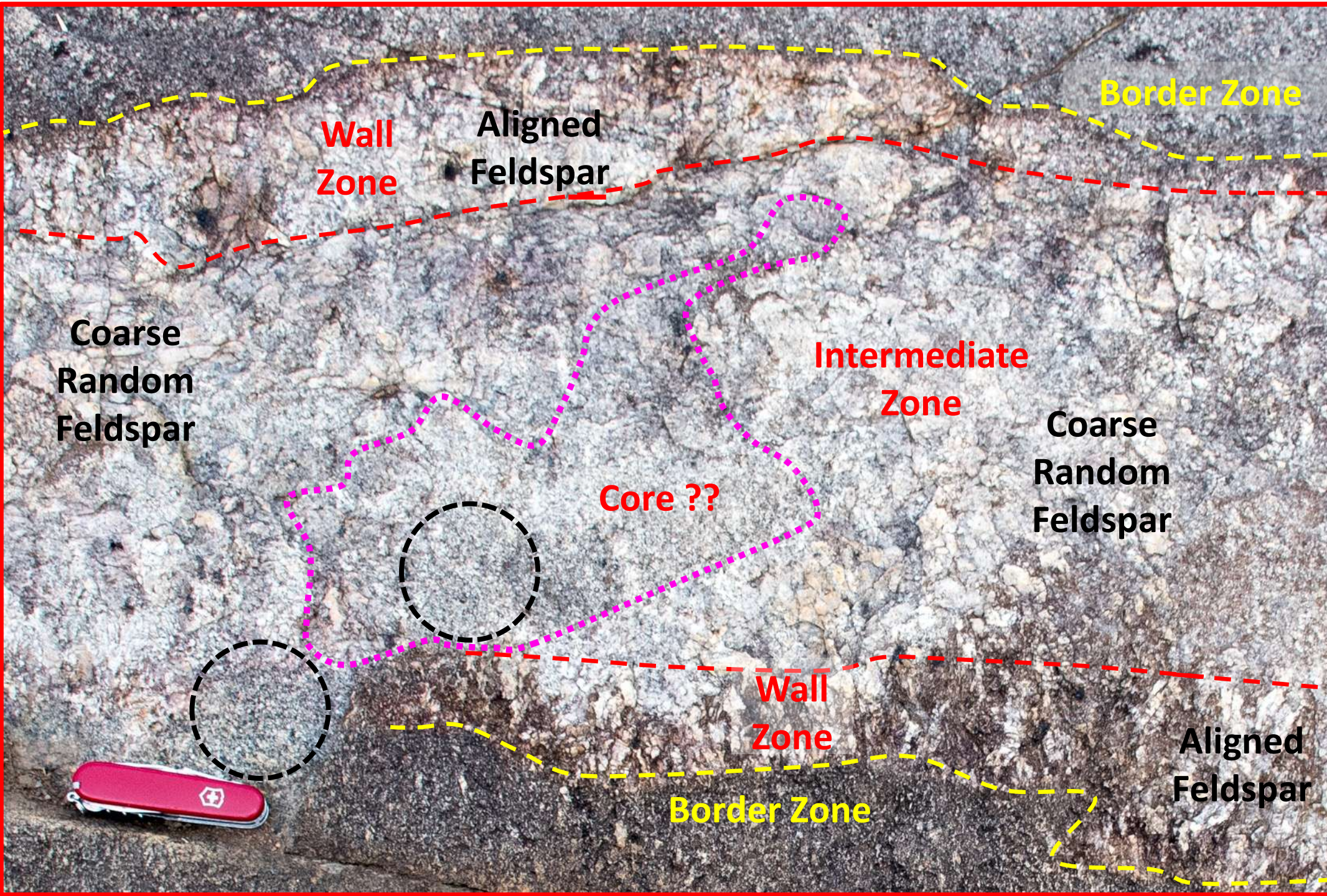




Granite

**Mafic
Xenolith**

**Simple
pegmatite
Arcturus
Road**



Simple
pegmatite

Arcturus

Road

Most simple
pegmatites

small and

close to

source

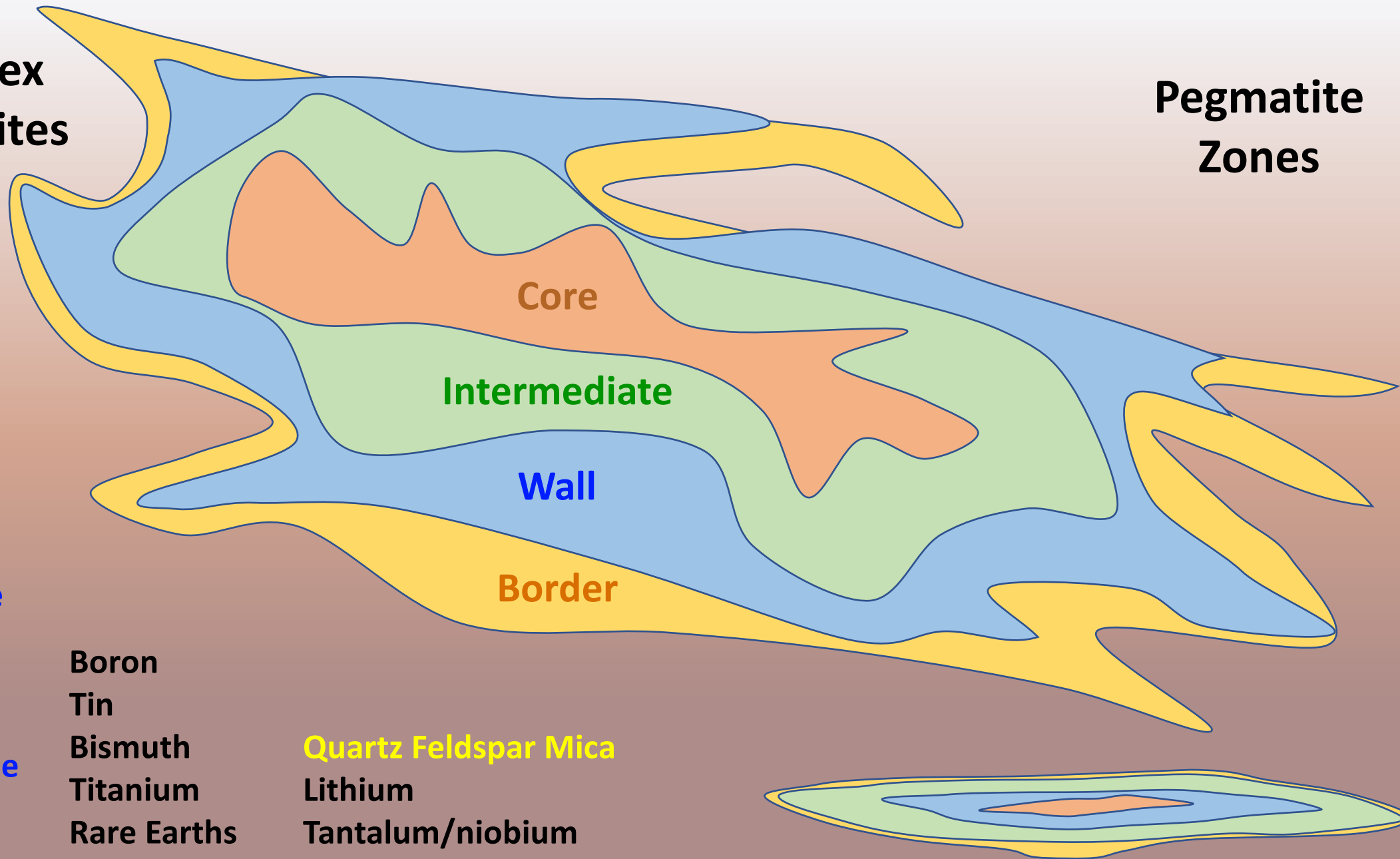
Complex Pegmatites

Pegmatite Zones

Tourmaline
Emerald
Topaz
Kunzite
Aquamarine
Morganite
Citrine
Garnet

Boron
Tin
Bismuth
Titanium
Rare Earths

Quartz Feldspar Mica
Lithium
Tantalum/niobium
Beryllium



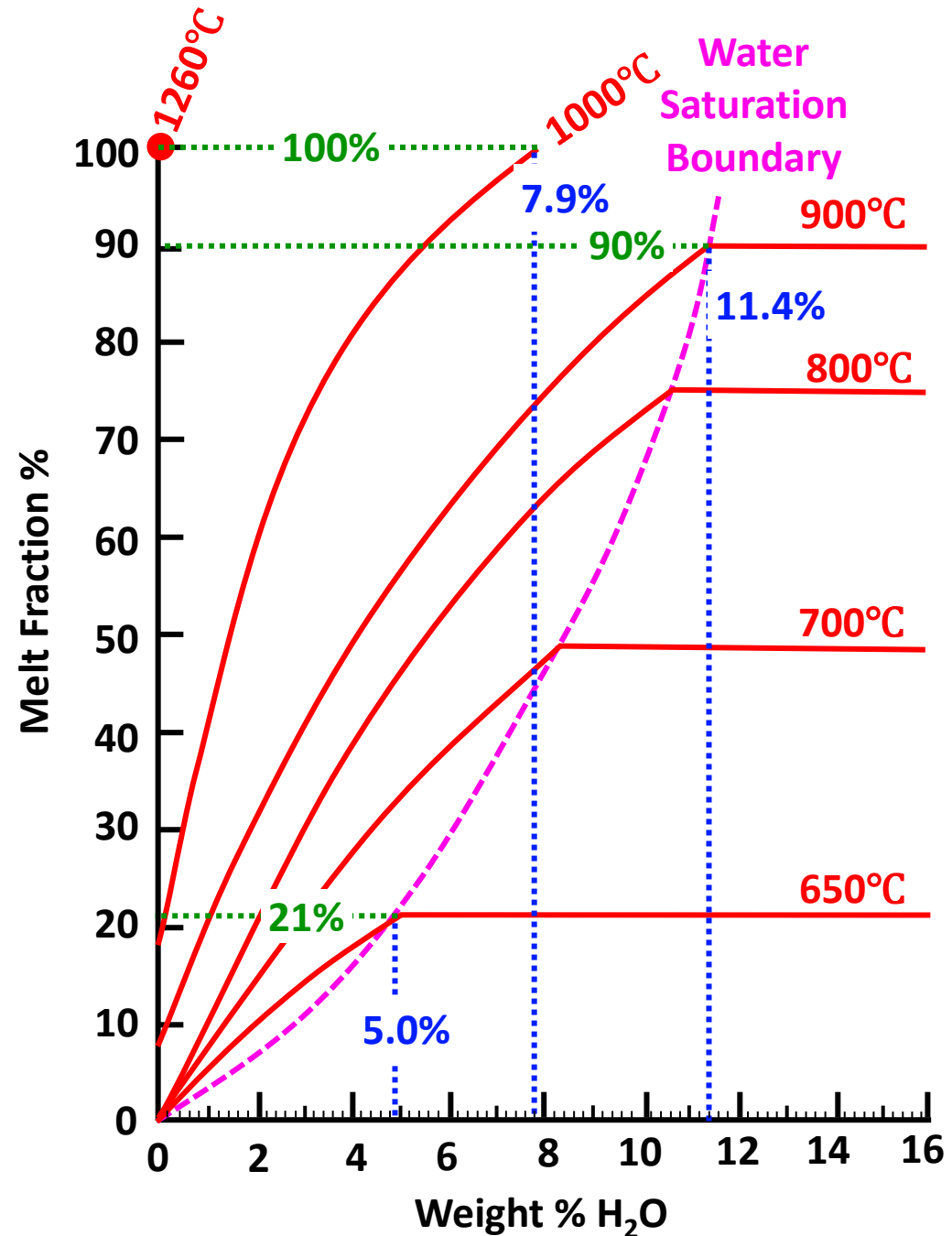
Origin of Pegmatites

Are they igneous rocks?

Melting points

Dry granite 1215 – 1260 °C

Wet granite 650 °C



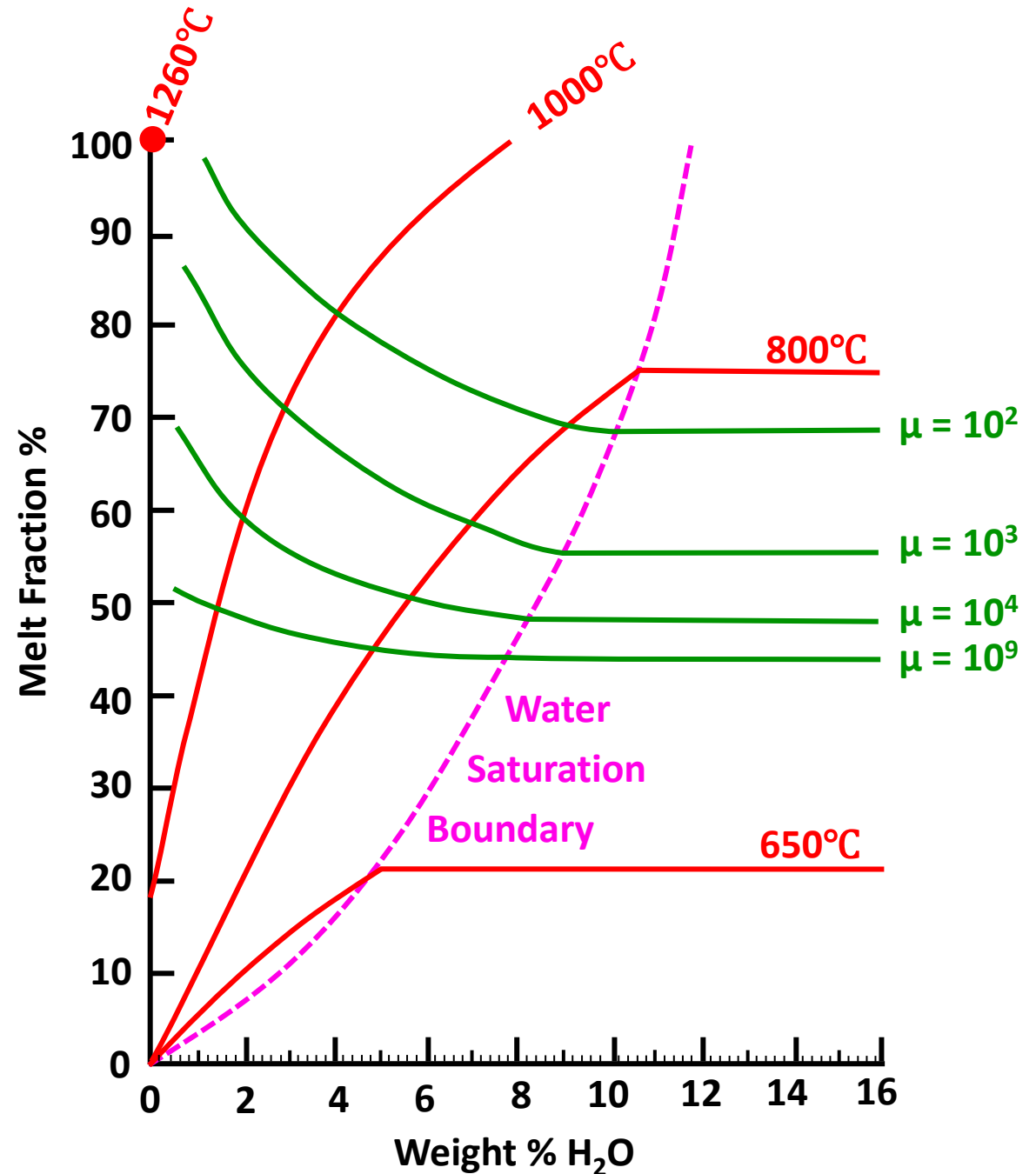
Origin of Pegmatites

Graphs for granitic melts

What about pegmatitic
fluids?

Fluid transitions between
magma and hydrothermal
and this not constant
through process of
formation of pegmatites

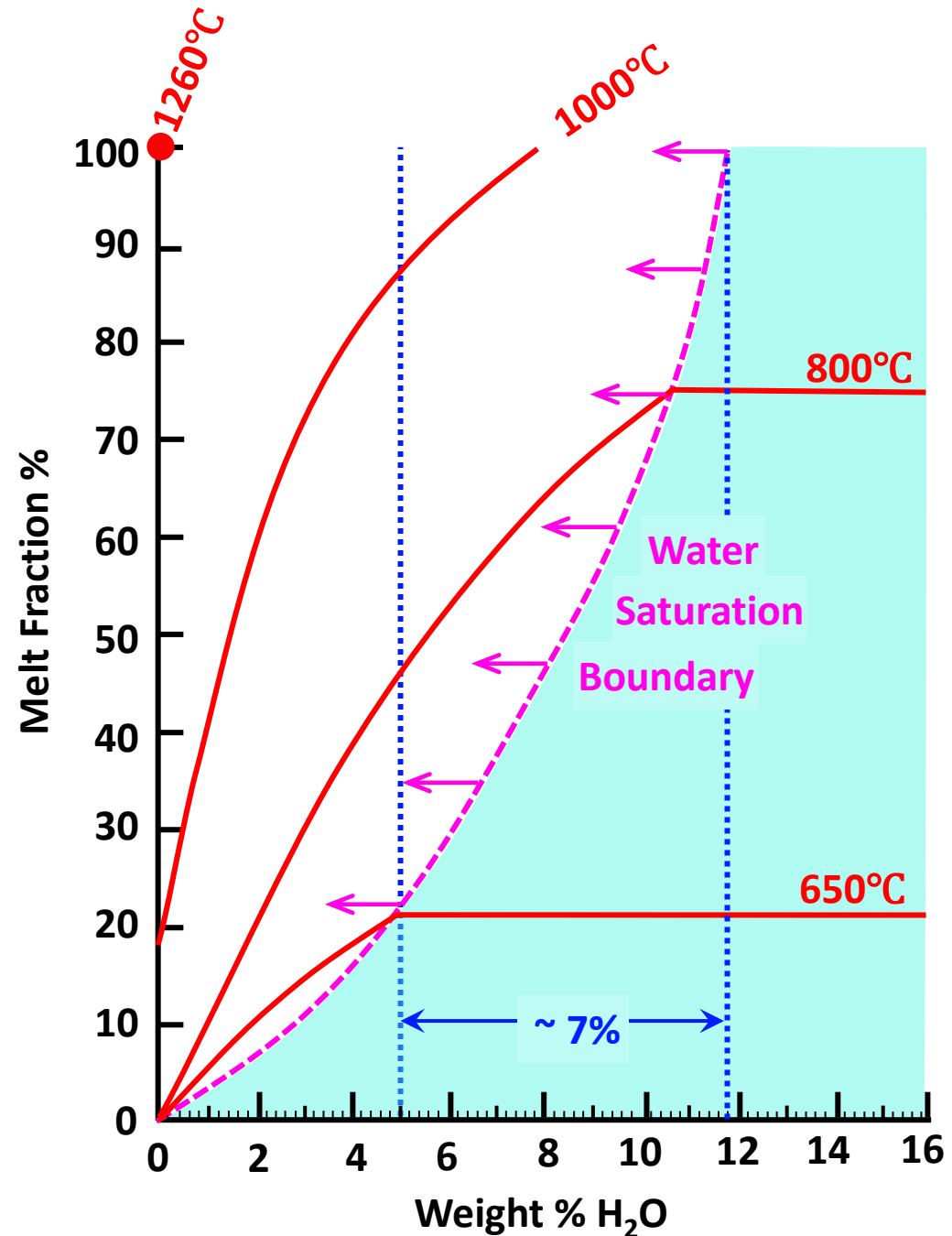
Viscosity and water content
temperature and pressure
dependent



Origin of Pegmatites

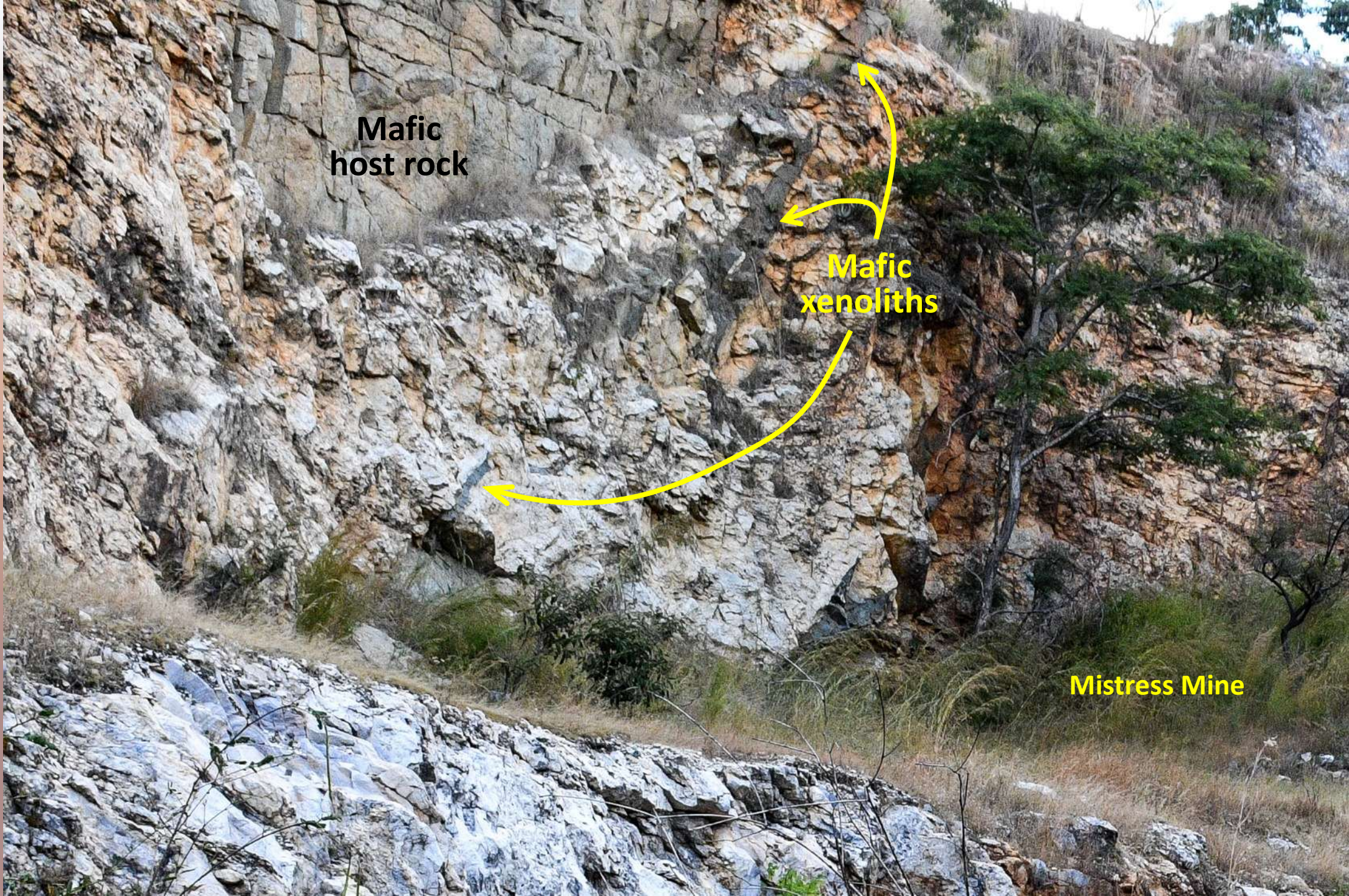
Wet granite 650 °C

Pegmatite temperatures
250 – 700 °C



Origin of Pegmatites

Coarse
amphibolite
xenoliths



Mafic
host rock

Mafic
xenoliths

Mistress Mine

**Origin of
Pegmatites**

**Relatively
high
viscosity**



**Mafic
xenolith**



Anatexis
Shabani Gneiss





**Chilimanzi
Suite
Porphyritic
Granite**

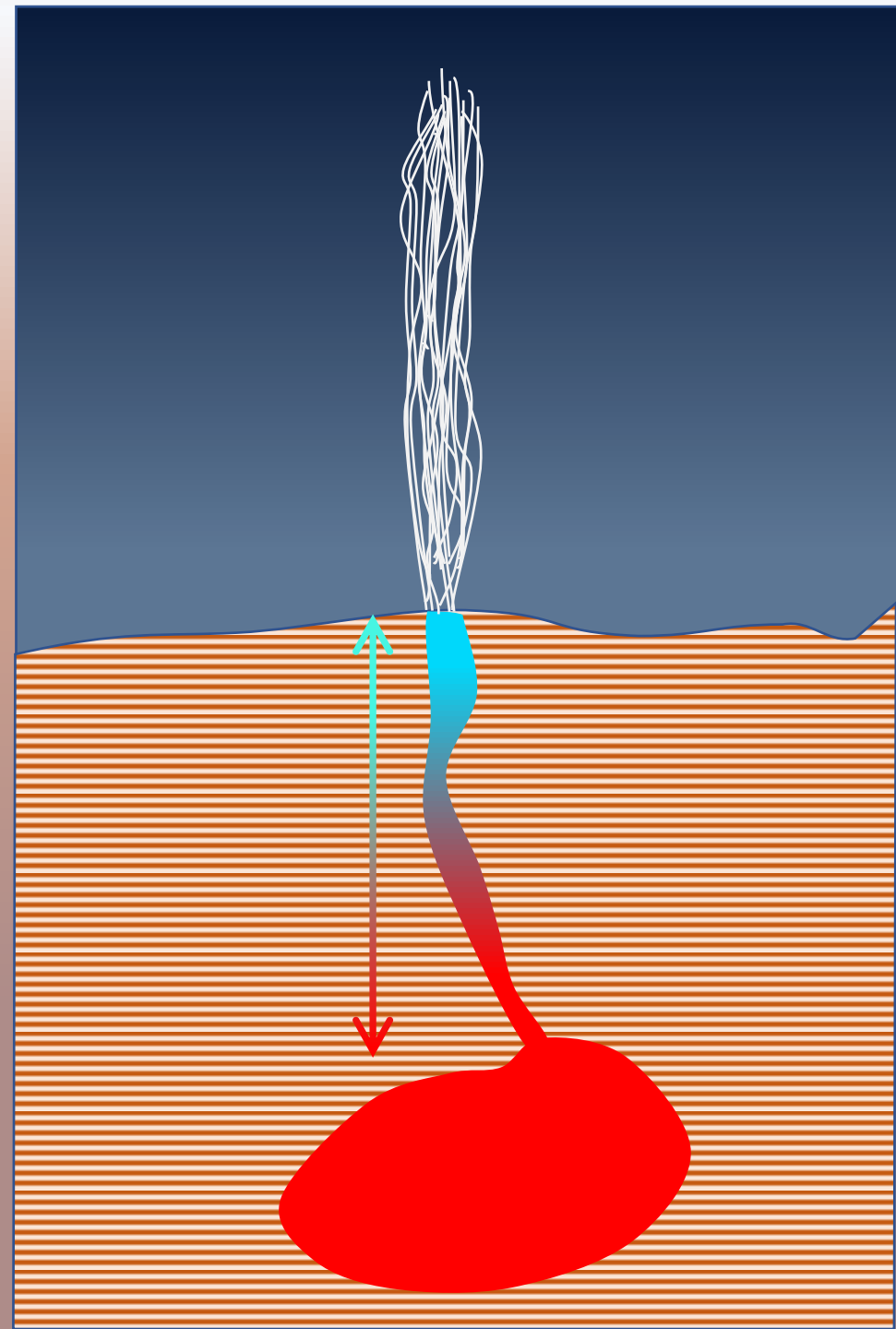
**Wet crustal
re-melts
with
excess
water for
pegmatite
generation**

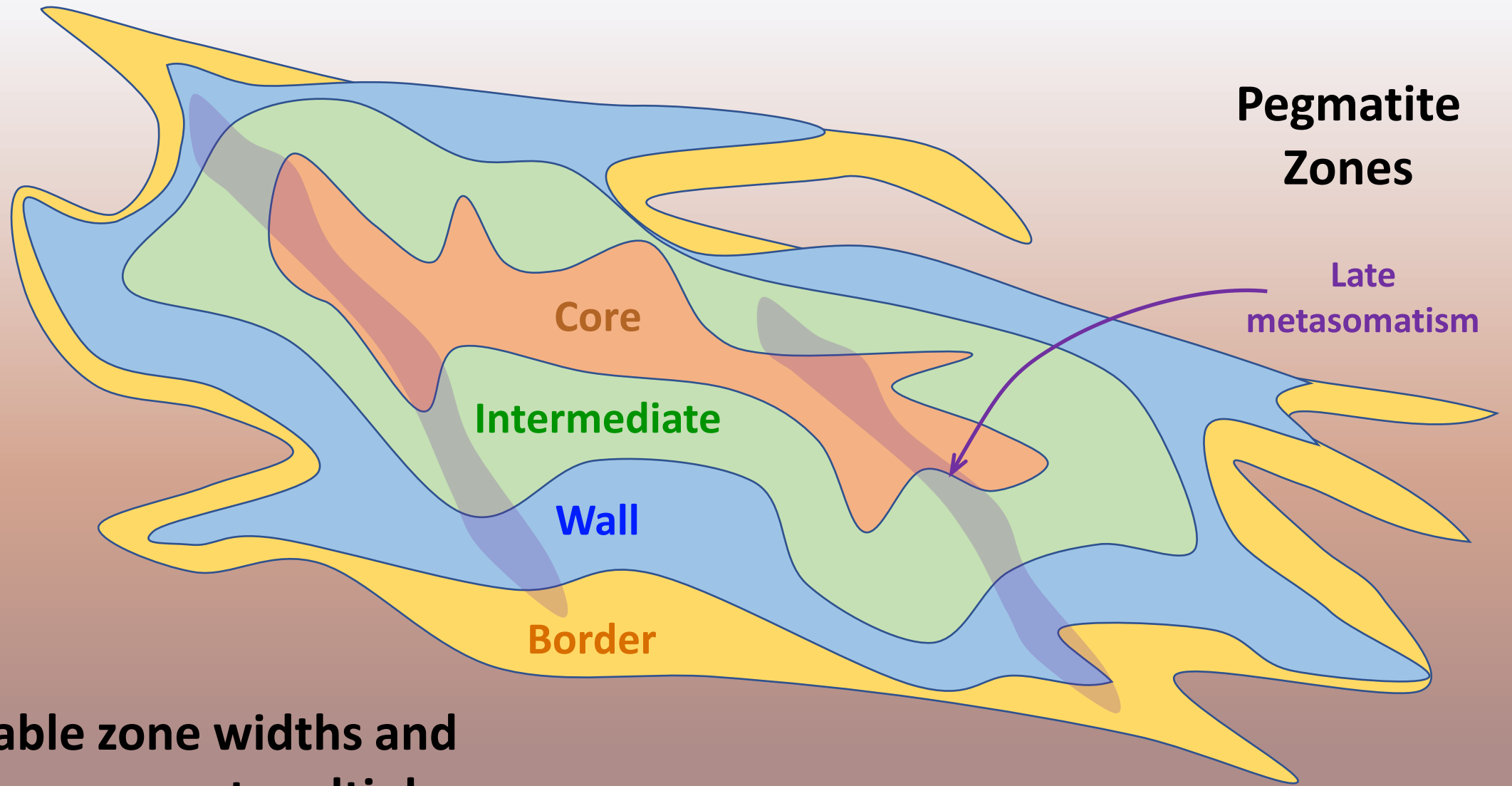
**Opportunity
for element
collection**



**Old Faithfull
Yellowstone
National Park
Wyoming USA**

**Erupted every
44 to 125
minutes since
2000**





Pegmatite Zones

Late
metasomatism

Core

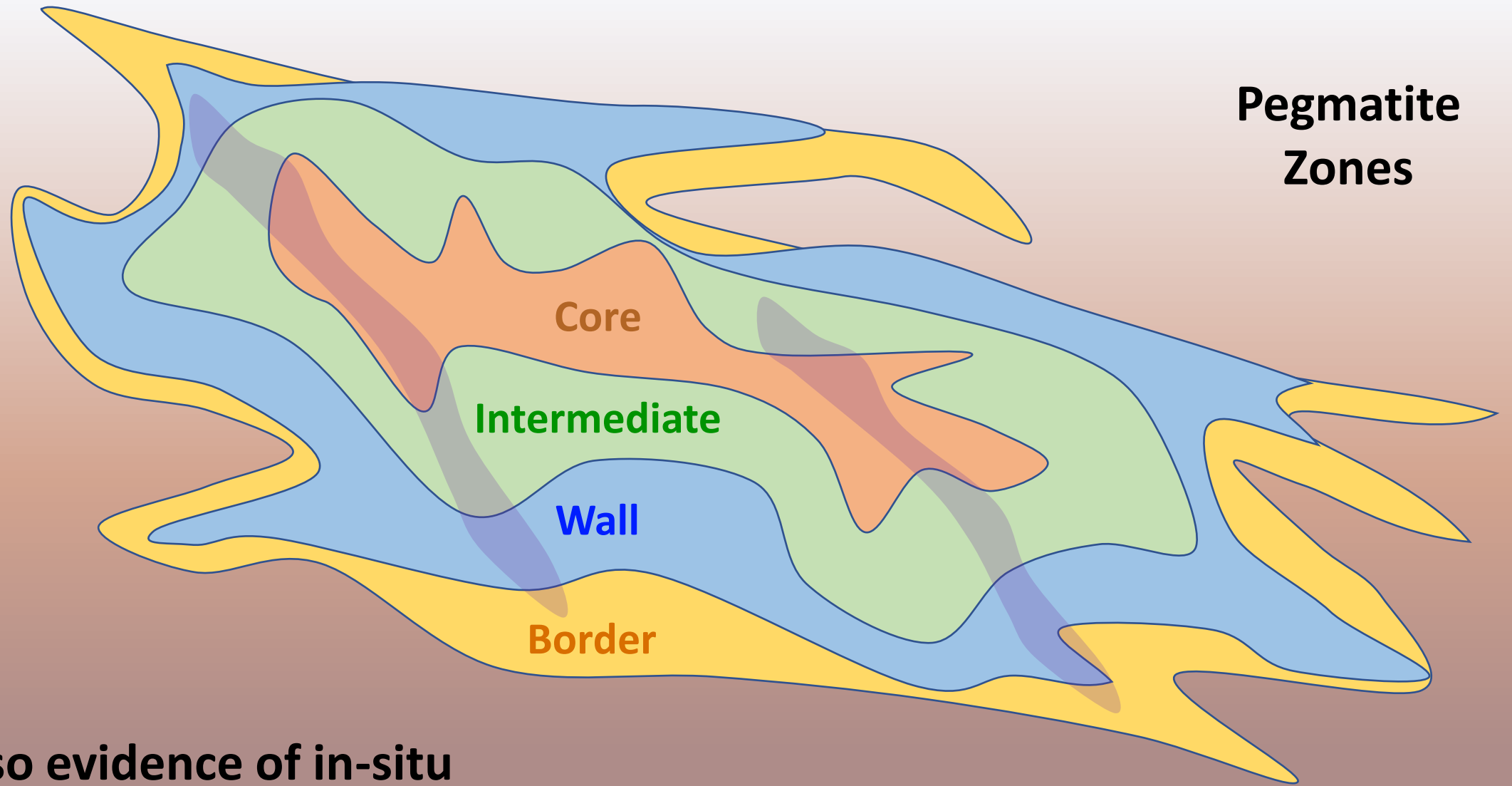
Intermediate

Wall

Border

Variable zone widths and
shapes suggest multiple
injections of pegmatitic fluid

Evidence for multiple injections cross-
cutting zones, brecciation/recementing and
metasomatic replacement



Pegmatite Zones

Also evidence of in-situ
crystal growth on pre-existing
surfaces

Pegmatite Origins



Bikita

Bikita

In-situ crystal growth on pre-existing surfaces

Border/Wall Zone



Bikita

Pegmatite Origins



Bikita

**Forceful fluid injection
brecciation and matrix infill
and
diffusional alteration
Intermediate Zone**



Bikita

Pegmatite Origins



Mistress Mine

**Forceful fluid injection
brecciation and matrix infill**

Intermediate Zone



Bikita



Zinnwaldite
Quartz/feldspar

Arcadia

Pegmatite Origins

Petalite

Forceful fluid injection
brecciation and matrix infill

Intermediate Zone



Lepidolite

Bikita



Pegmatite Origins

**Metasomatic
replacement**

**Lepidolite
after
zinnwaldite**

Bikita

Zimbabwe

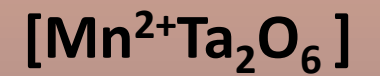


Morua
Mozambique

Pegmatite Origins

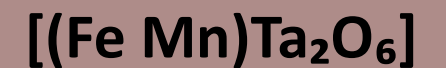
Metasomatic
replacement

Manganotantalite

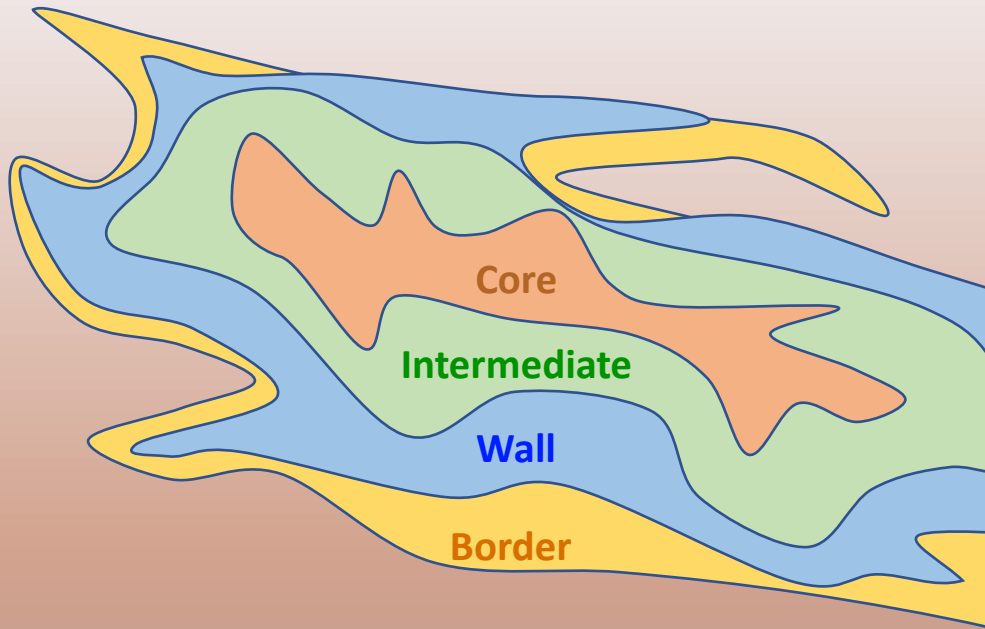


after

tantalite



Pegmatite Origins



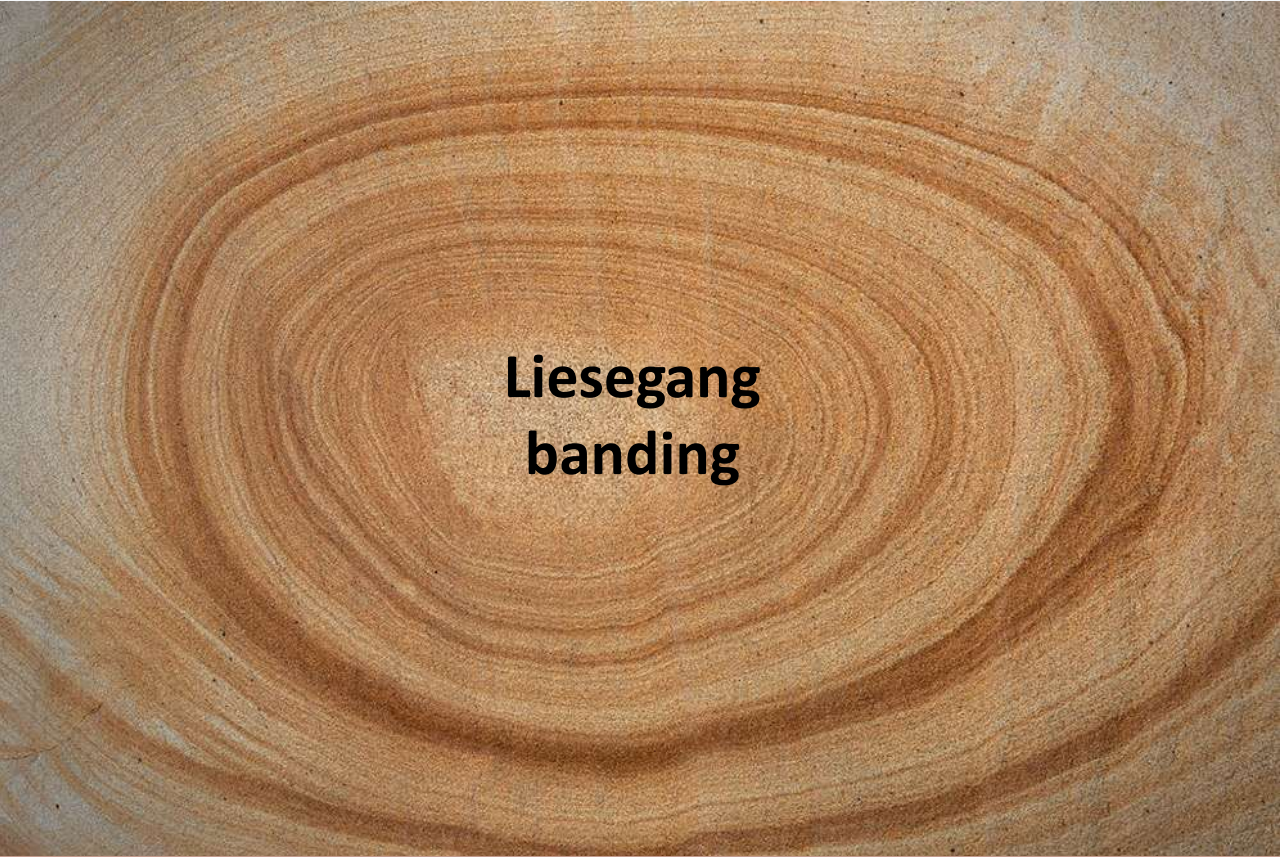
Metasomatism

**Lepidolite
pseudomorph after
feldspar**

Intermediate Zone



Morua Mozambique



**Liesegang
banding**

Pegmatite Origins

**Metasomatic
replacement**



Mistress Mine



**“Liesegang
banding”**

Pegmatite Origins

**Metasomatic
replacement**



Sunungukai



Mistress Mine

Pegmatite Origins

Multiple fluid
injections

Cross cutting
relationships



Arcadia

Pegmatite Origins

Cross cutting
relationships

Spodumene

Metasomatism

Breccia

Mistress Mine





Morua Mozambique

**Mangano-
tantalite
in
tantalite**

**Pegmatite
Origins**

**Change in
fluid
composition**

**Manganotantalite
growing into open
space with later
quartz**



Morua Mozambique



Mwami

Pegmatite Origins

Growth into
open space

Euhedral and
giant crystals

Core Zone



Morua Mozambique

Pegmatite Origins

**Growth into
open space**

**Euhedral,
giant crystals**



Gypsum Niaca Mine Mexico



Pegmatite Origins

**Change in
fluid
composition**





Karibib Namibia

No open space no gem
quality but
giant crystals
diffusional growth in a
mush?



Spodumene

Manono DRC

Summary

Simple pegmatites

Complex Pegmatites

Granite association

Pegmatite Zoning

Crystal growth

Space competition

Open space

Summary

Pegmatitic Fluids

Very wide range initial to final

- Initial
 - Wet granitic/magmatic
 - High temperature ~ 650°C
 - Relatively high viscosity

Border & Wall
Zones

Relatively low H₂O

- Final Fluid
 - Low temperature < 350°C
 - Relatively low viscosity
 - Relatively high H₂O

Intermediate
& Core Zones

Pegmatitic Fluids

Multiple pulses of fluids

- Variable compositions
 - Metasomatism
 - Pseudomorphism
 - Variable Minerals

