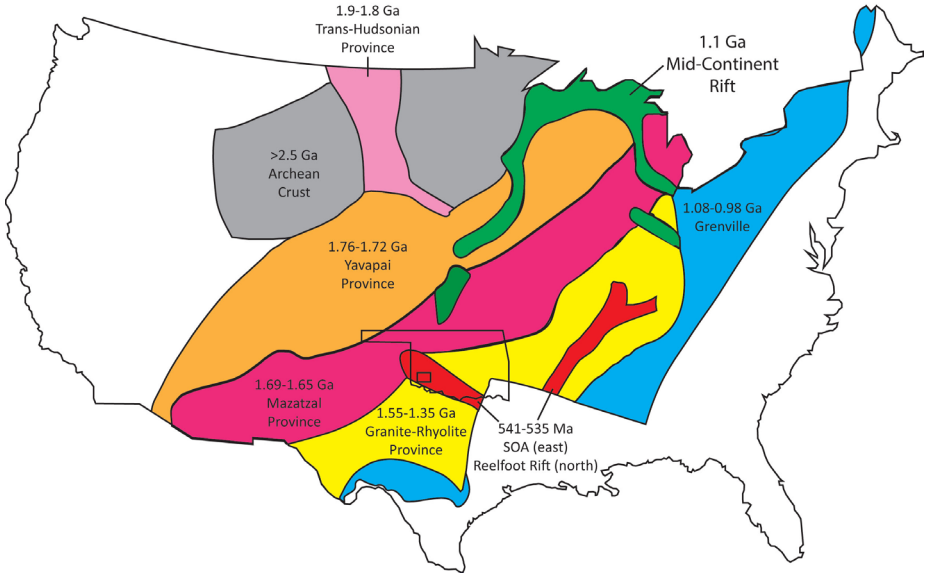
The Cold Springs Breccia

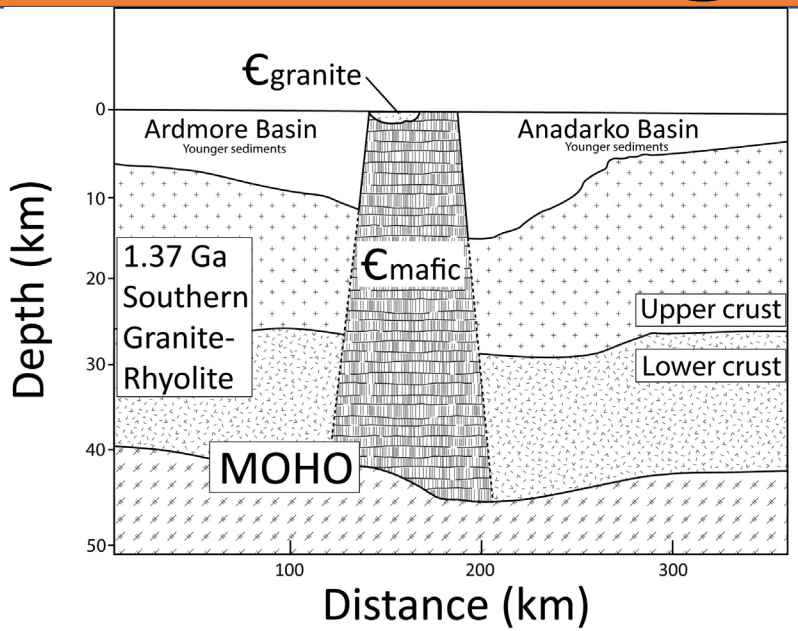
Magma mingling, mixing, and morphology

Southern Oklahoma Aulacogen

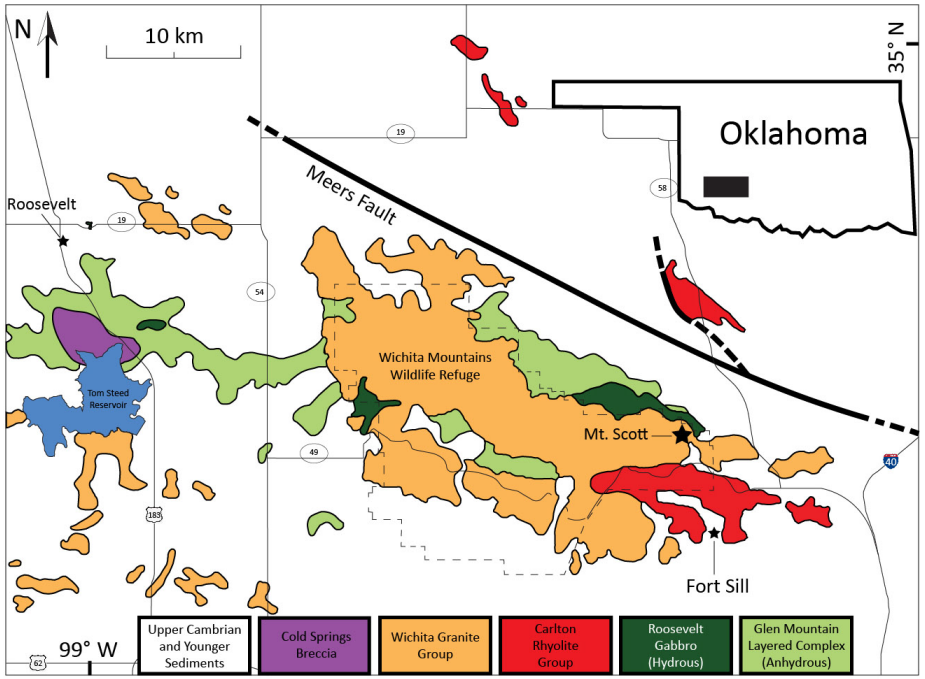
Basement Provinces SOA is Early Cambrian

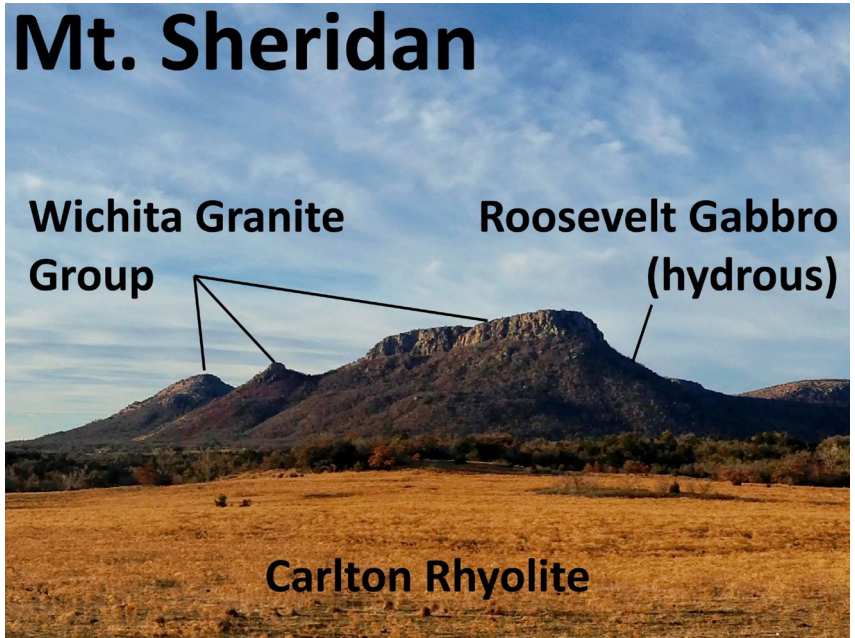


Cross-section of SOA



Wichita Mtns are the exposed basement rocks of the SOA

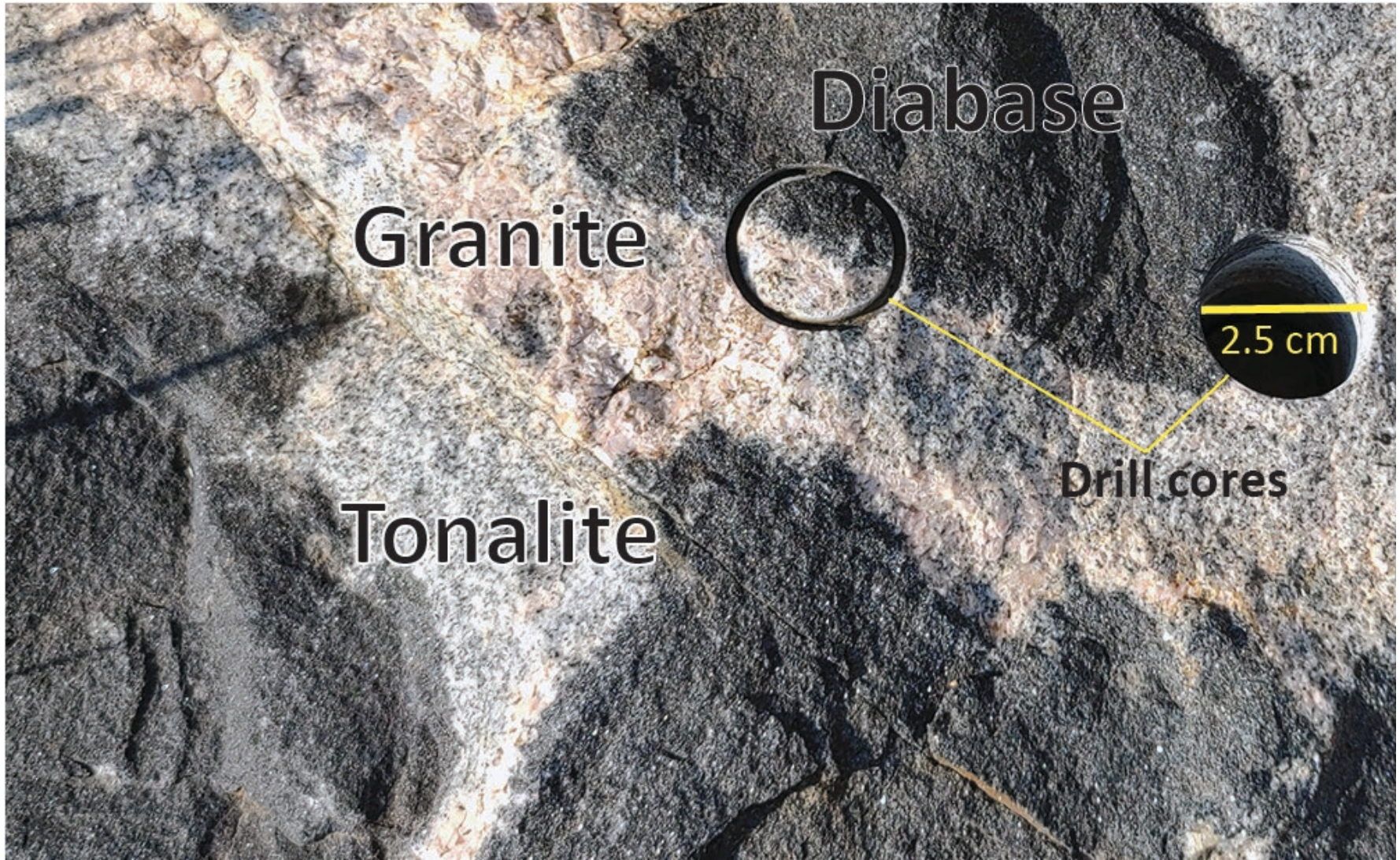




Bimodal lithology – felsic and mafic

Cold Springs Breccia is trimodal

Diabase enclaves entrained in granite and intermediate rocks



Magma Mingling

- Key concepts
  - Mixing-Mingling is not a dichotomy but a continuum
    - Endmembers: solid rock and liquid magma
    - Rheologic endmembers: brittle fracture and pure liquid flow
  - Miscibility and turbulence

Solid-liquid

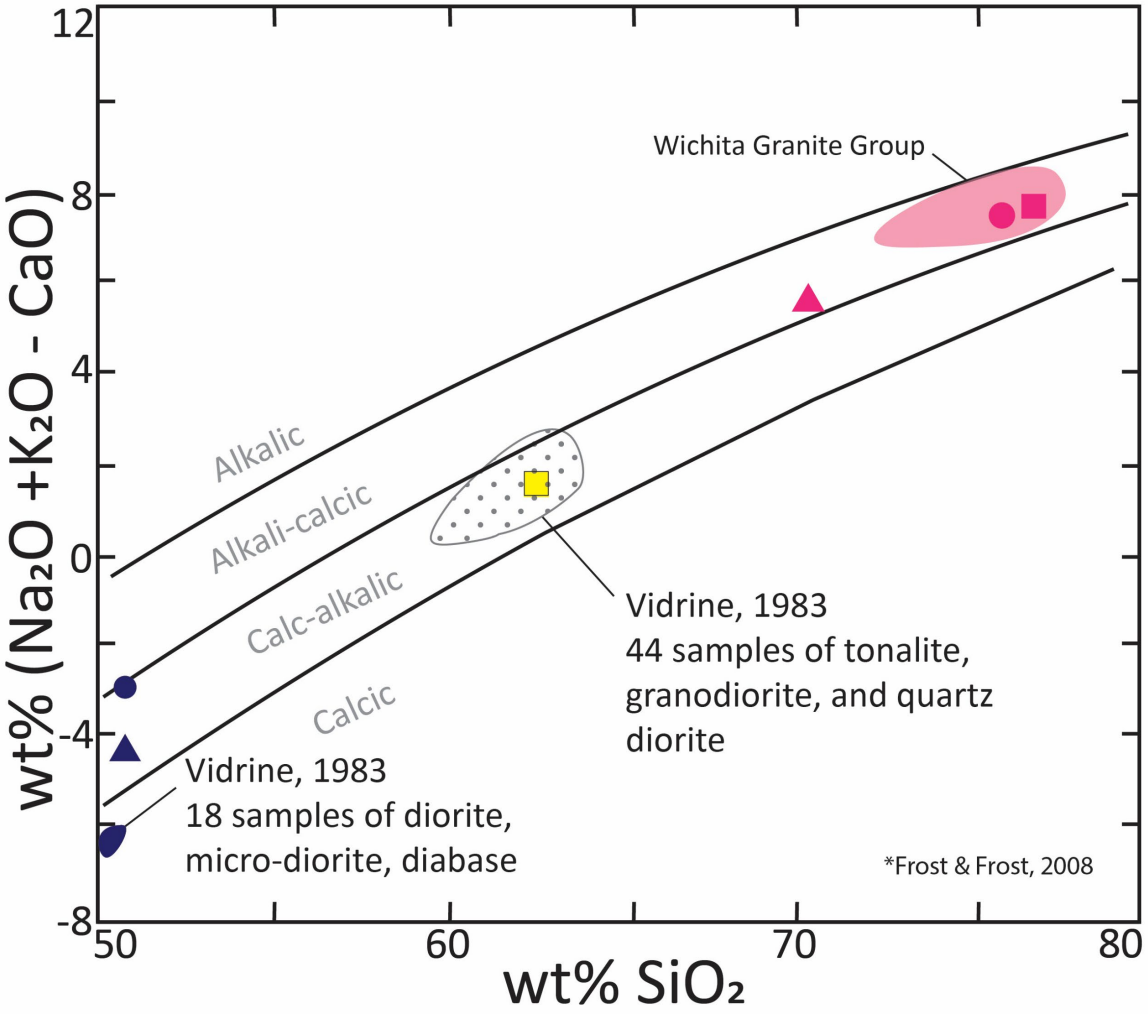
Liquid-liquid

Zone	Idealized Structure	Outcrop	Diagram	Locatio
Zone 1: No mixing/no mingling Granite Cap				
Zone 2: Mingling/no mixing Granite and diorite mingling zone				
Zone 3: Some mixing Intermediate, diabase, and granite seams				
Zone 4: Well mixed/mingling Intermediate with diabase				
Zone 5: Mixed (Homogeneous) Intermediate only				
Zone 6: Mingling Diabase with interstitial intermediate				

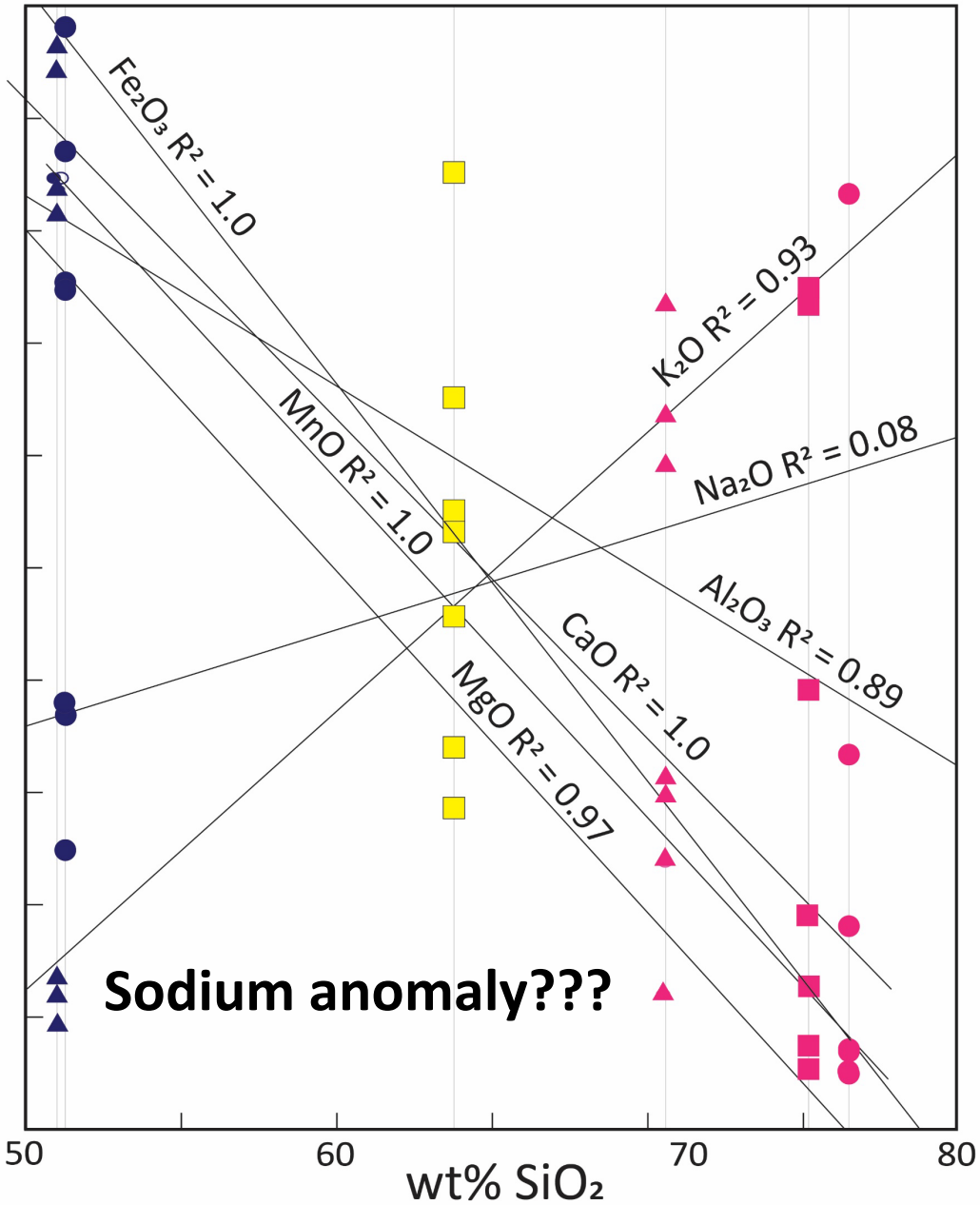
Granite Intermediate Diabase

Magma Mixing

MALI (Modified Alkali-Lime Index)



Magma Mixing Diagram for Major Oxides

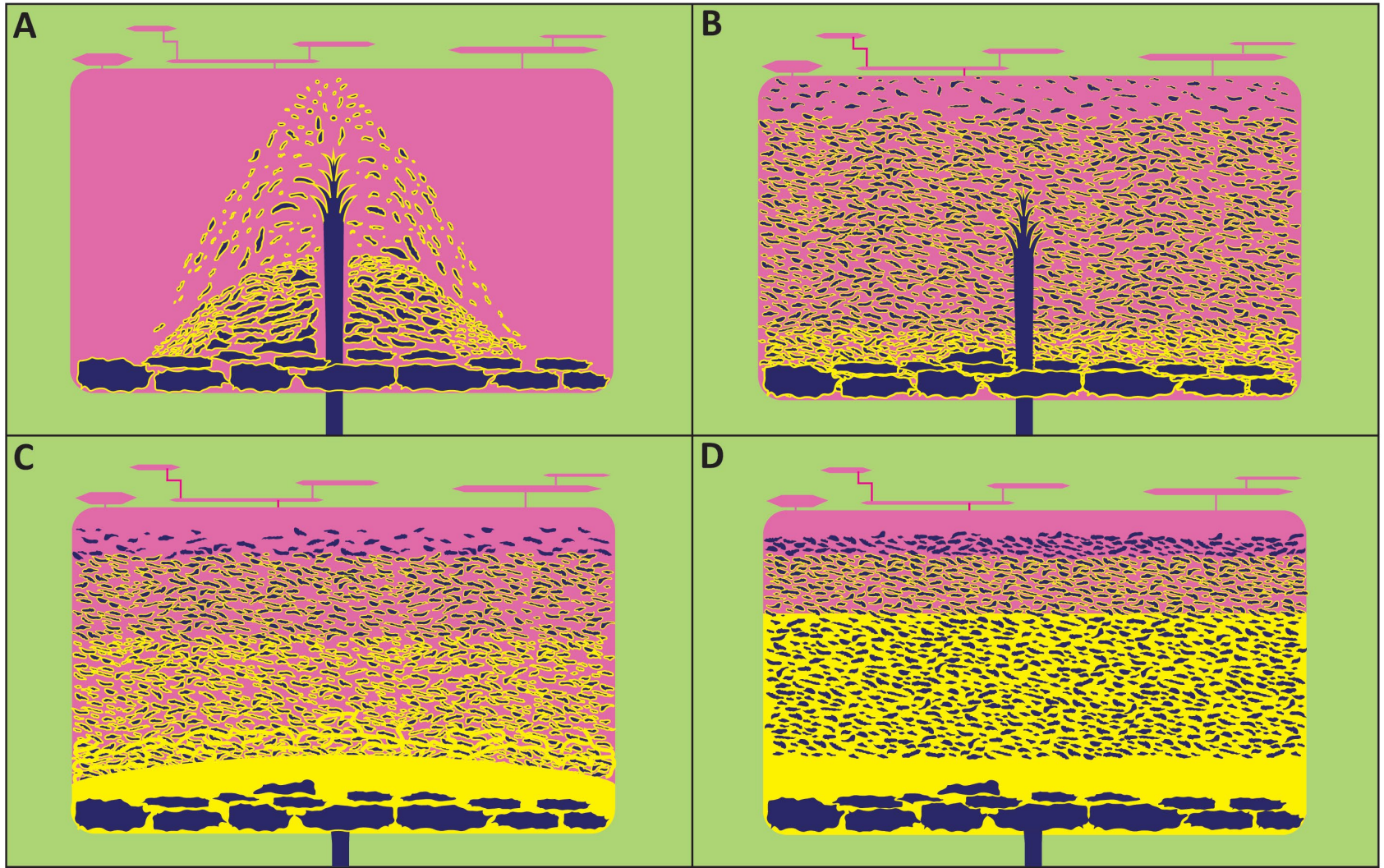


Morphology and Formation hypothesis

Granite

Intermediate

Diabase



Diabase begins intruding granite magma chamber - turbulence drives mingling and mixing

Further mixing occurs; diabase and intermediate settle through granite and accumulate at bottom of magma chamber

Differing magma densities cause separation displacing granite and concentrating intermediate; continued mixing

Final crystallization - rocks record processes