SERVIÇO GEOLÓGICO DO BRASIL

Orosirian bimodal volcanism of the Uatumã SLIP in the Tapajós Mineral Province, Amazon Craton, Brazil

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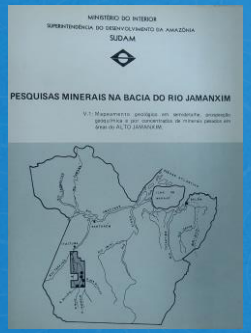
Junny K. M. Oliveira

GeoMinE 2025
· XIII SIMPÓSIO SUL-BRASILEIRO DE GEOLOGIA
· IX SIMPÓSIO DE VULCANISMO E AMBIENTES ASSOCIADOS
· I CONFERÊNCIA DE GEOLOGIA E MINERAÇÃO DO MERCOSUL
· II WORKSHOP ARMAZENAMENTO DE CO_2 POR MINERALIZAÇÃO EM BASALTOS
· I EXPOGEOMINE
2 A 6 DE JUNHO DE 2025, EM FOZ DO IGUAÇU-PR

Junho de 2025

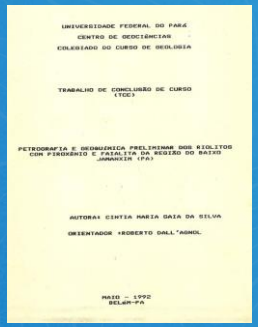
50 Years of Knowlogment

SUDAM



(SUDAM, 1976)

CG-UFPA



(Silva, 1992)

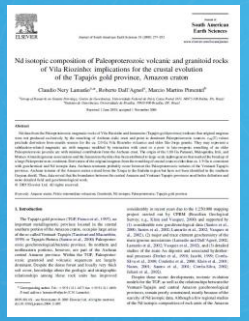
RTDM

(Jacobi, 1999)

USP

(Juliani et al., 2005)

PPGG-UFPA

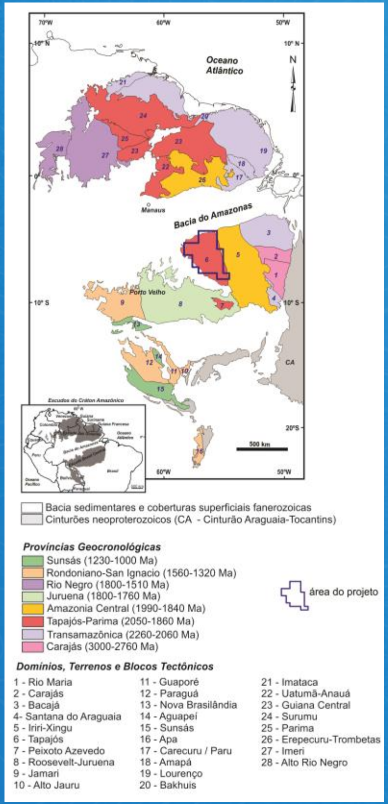


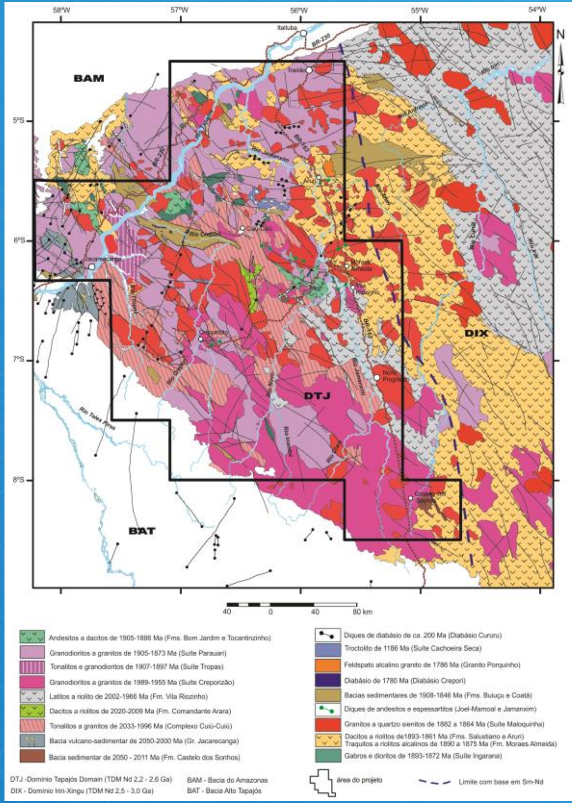
(Lamarão et al., 2005)

SGB-CPRM

(Vasquez et al., 2024)

Tectonic Framework





Tapajós Domain

- ✓ **Volcanic events**
  - **2020-2009 Ma – CA-HKCA**
  - **2002-1970 Ma – CA-HKCA-SHO**
  - **1908-1870 Ma – CA-HKCA / ALK**

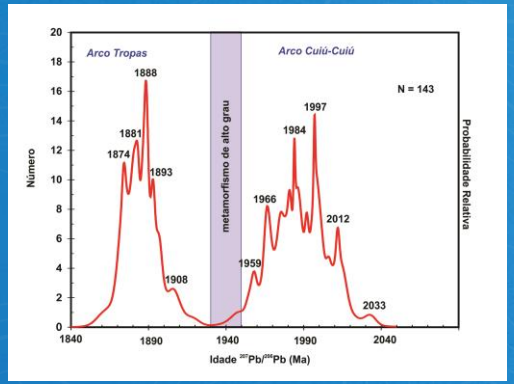
Tapajós Mineral Province

- ✓ **Epithermal (HS-IS-LS)**
- ✓ **Porphyry-like**
- ✓ **1885-1860 Ma mineralization**

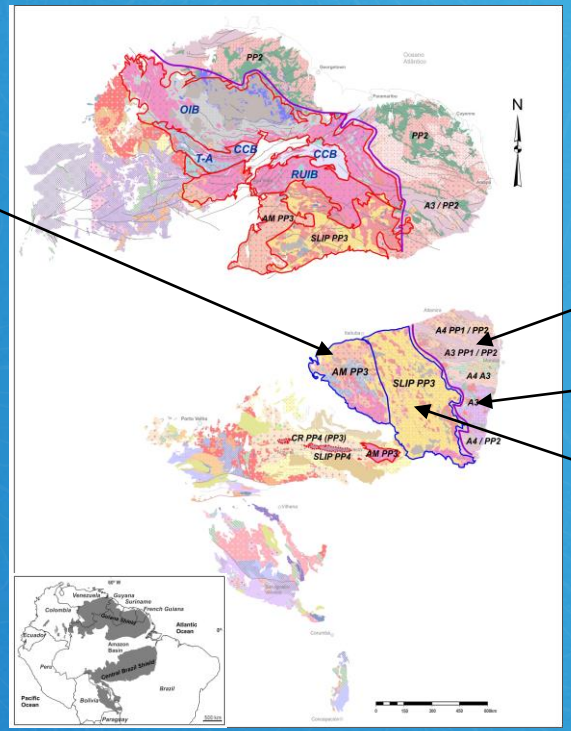
Tectonic Setting

Orosirian Magmatic Arcs

- Cuiú-Cuiú 2040-1970 Ma
- Tropas 1910-1870 Ma



(*Vasquez et al*., 2024)



Rhyacian collisional orogen

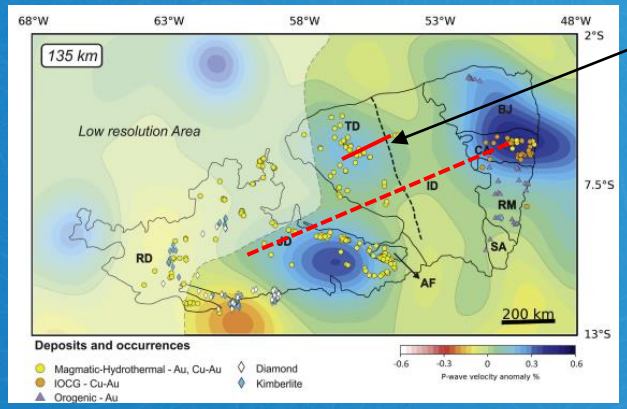
Archean Craton

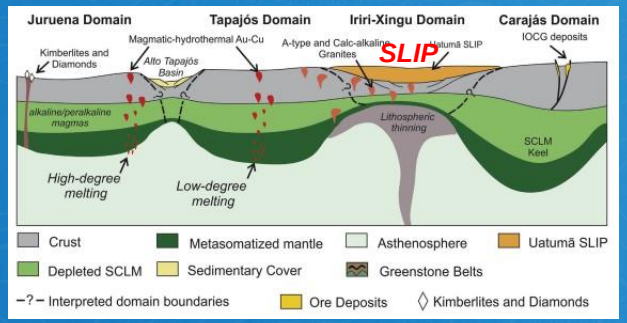
Orosirian SLIP

- Orocaima 1990-1970 Ma
- Uatumã 1890-1870 Ma

Deep Geophysics Models

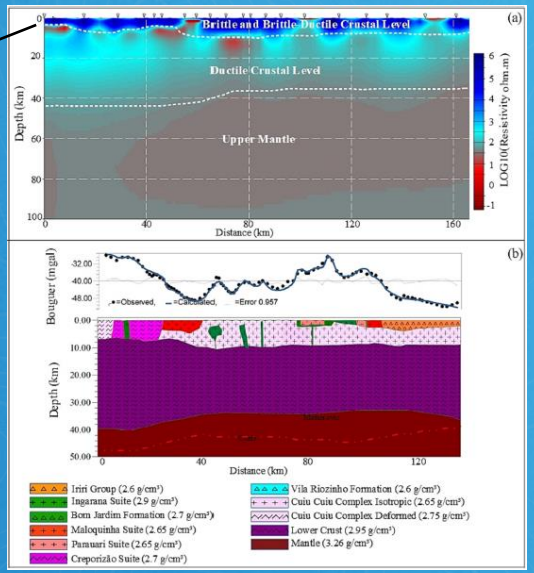
Multiple-frequency Seismic Tomography





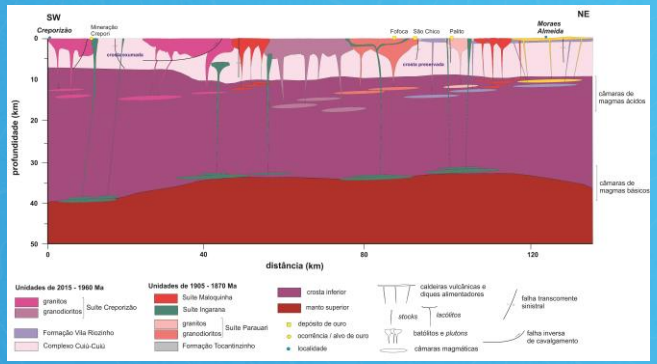
(Costa *et al*. 2020, JSAES)

Magnetotellurics and Gravity



(Correa *et al*. 2023, Tectonophysics)

40 km → 35 km



(Vasquez *et al*. 2024, ARIM-Tapajós)

Geological Mapping

ARIM-Tapajós Project – 1:500,000

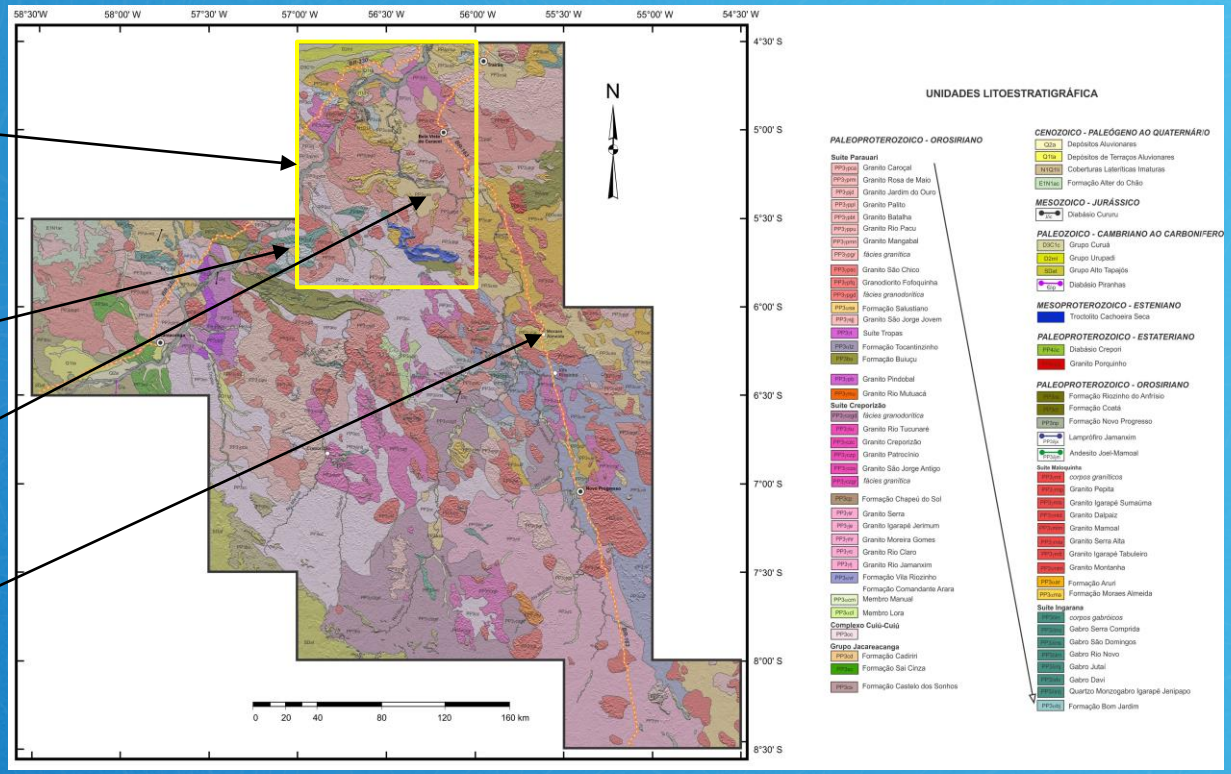
Médio Tapajós Project
6 maps of 1:100,000

Volcanism of 1890-1870 Ma

Bom Jardim Fm.
(type area)

Salustiano Fm.
(type area)

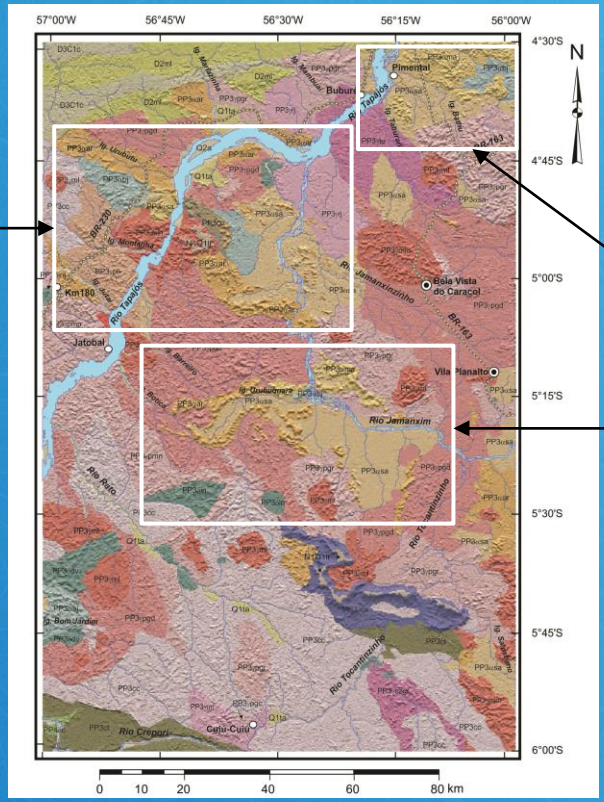
Moraes Almeida Fm.
(type area)



(*Vasquez et al.*, 2024)

Bimodal Volcanic Calderas

Chapéu do Sol caldera

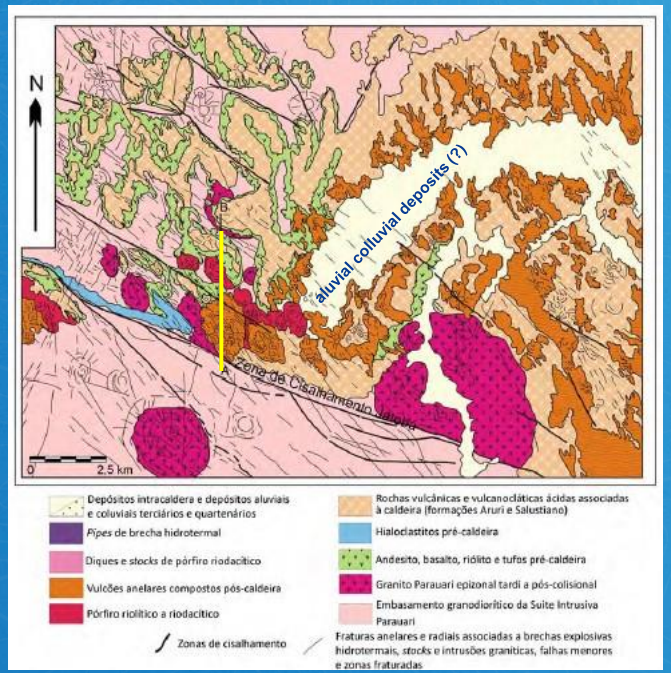


Pimental caldera

Urubuquara caldera

Structure of the Volcanic Caldera

Urubuquara caldera



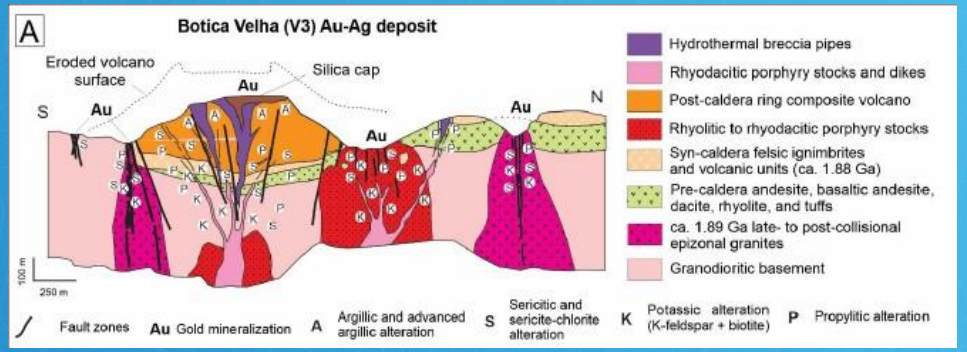
Juliani *et al*., (2014, MPT)

➢ Juliani *et al*., (2005, Chemical Geology)

- Post-caldera volcanism (ring dikes, vents, breccias, vugs)
- Intracaldera deposits (alluvial and lacustrine settings)

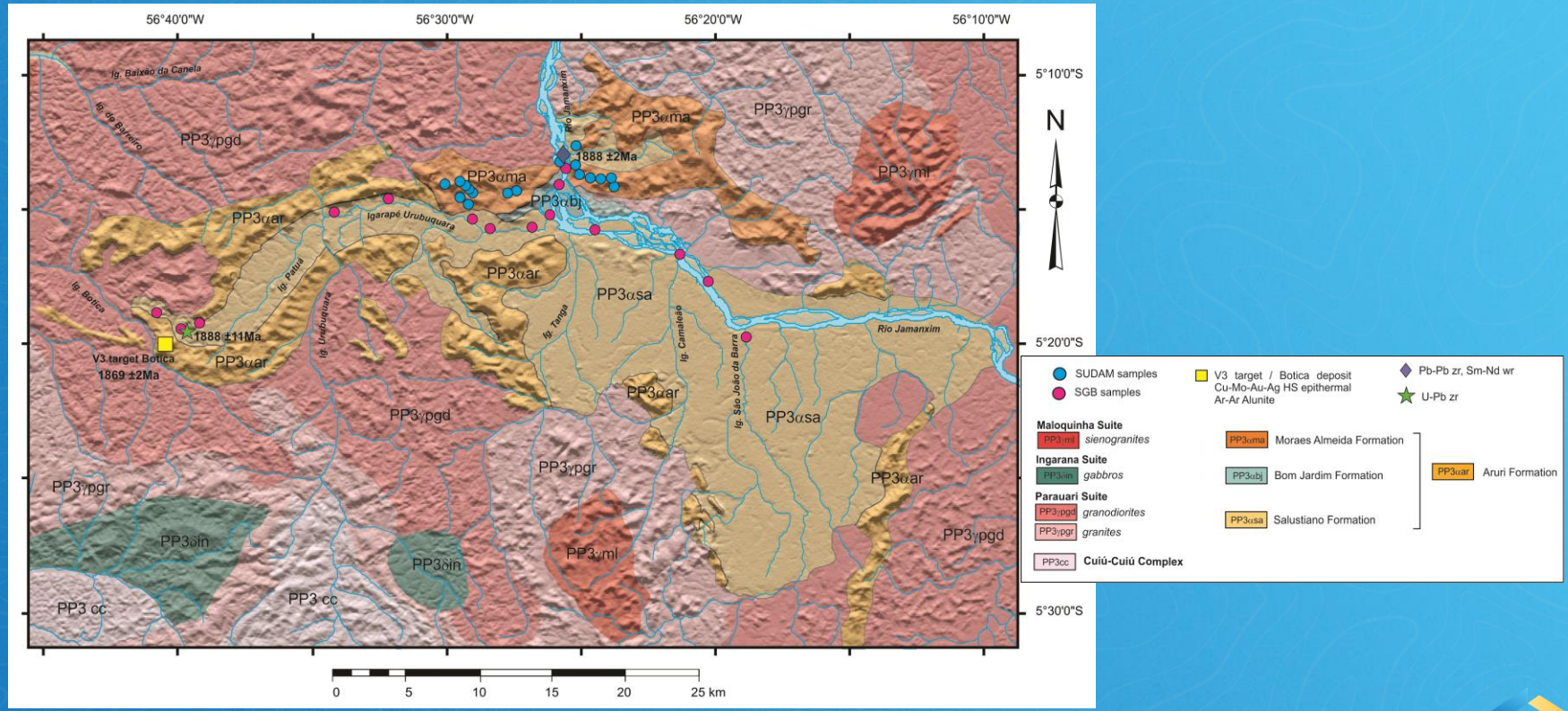
Epithermal HS deposit

- Caldera-related volcanism – Salustiano Fm. and Auri Fm. (?)
- Precaldera volcanism (precollpse) – Bom Jardim Fm.



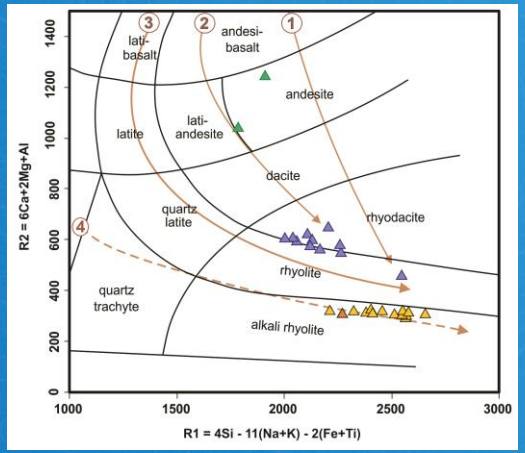
Juliani *et al*., (2021, Minerals)

Urubuquara Volcanic Caldera



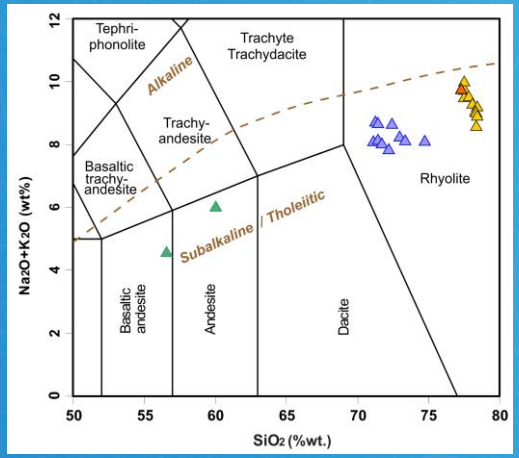
Geochemical Classification

R1-R2



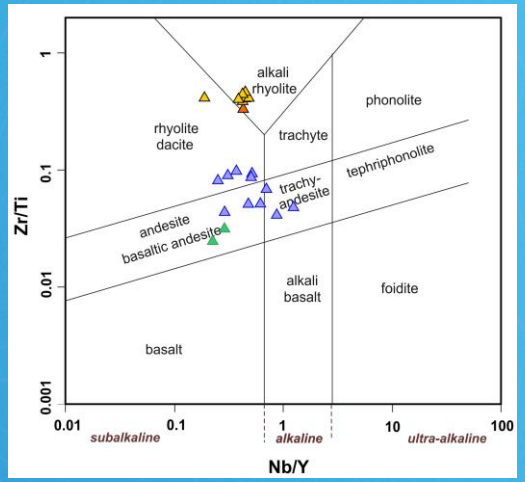
(De La Roche *et al*., 1980)

TAS



(Le Maitre *et al*., 1989)

Zr/Ti x Nb/Y



(Pearce, 1996)

Magamatic Series

1 - calc-alkaline
2 - toleiitic
3 - subalkaline potassic (shoshonitic, high-K calc-alkaline)
4 - alkaline (silica-oversatured and silica-satured)

(after Pagel and Leterrier 1980)

Urubuquara Volcanic Caldera

- high-K calc-alkaline andesites and basalts (Bom Jardim Formation)
- high-K calc-alkaline dacite and rhyolites (Salustino Formation)
- alkaline (A-type) rhyolites (Moraes Almeida Formation)

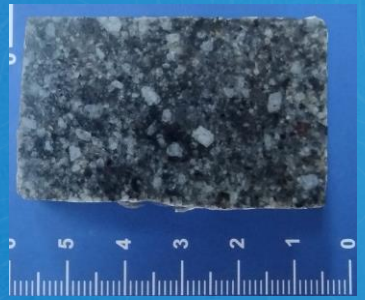
Vasquez *et al*. (2024) **ICP**

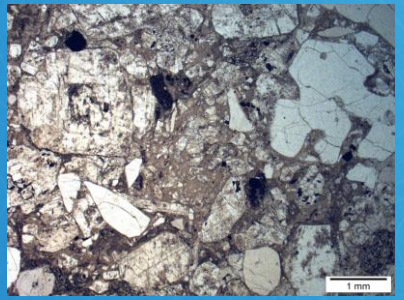
- rhyolites with fayalite, clinopyroxenes, amphiboles, alkali amphiboles (Silva, 1992) **XRF**

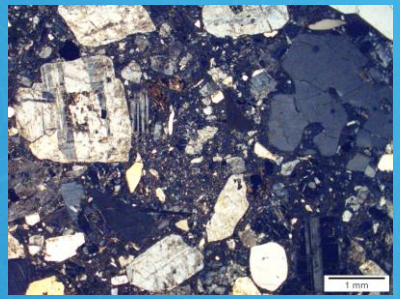
Salustiano Formation

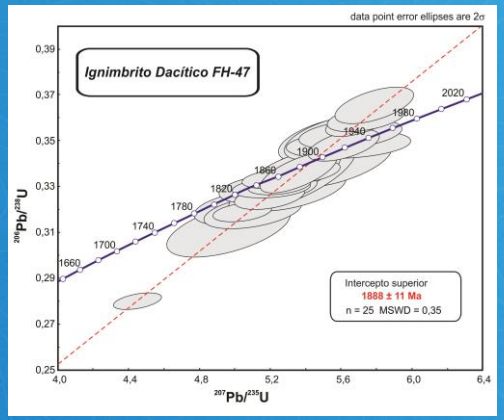
FH-47

Dacitic ignimbrite (no welded)



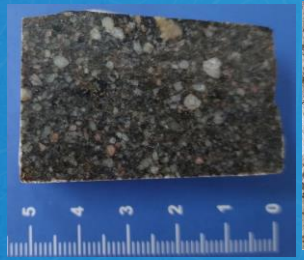
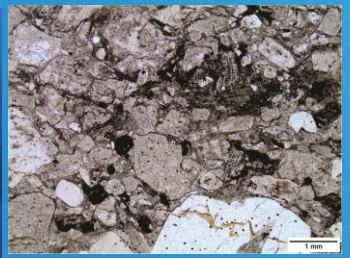
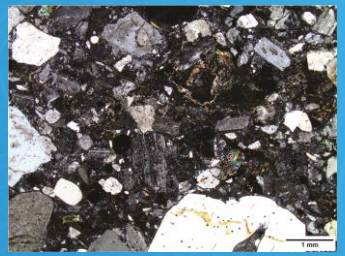






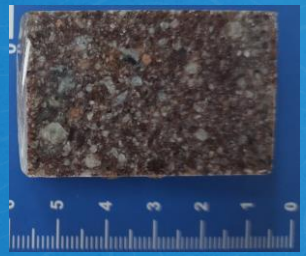
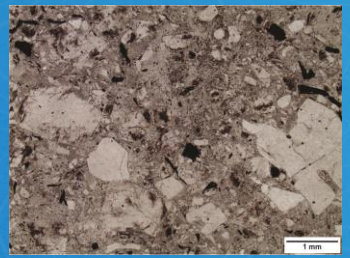
U-Pb zr - 1888 ±11 Ma
(Médio Tapajós project)

Salustiano Formation

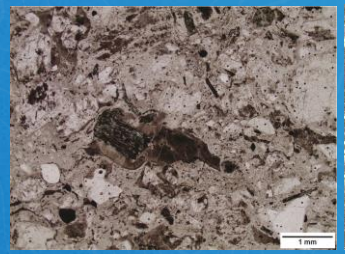
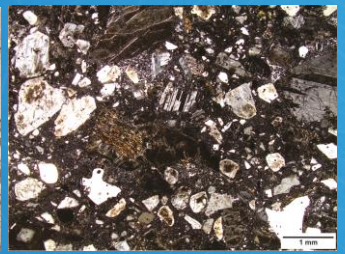
JK-125

Rhyolitic ignimbrite (few welded)


JK-128

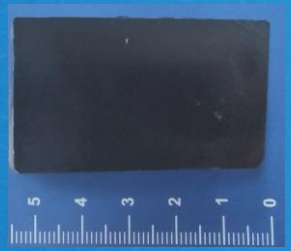
Dacitic ignimbrite (no welded)

JK-130

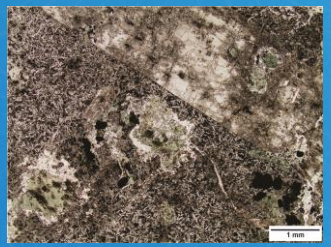
Rhyolitic ignimbrite (no welded)

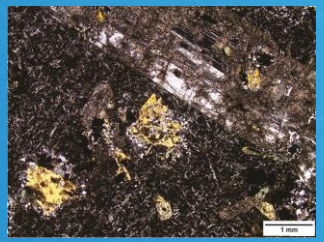
Bom Jardim Formation



JK-132

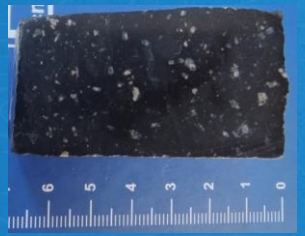
Andesite lava flow (aphyric)

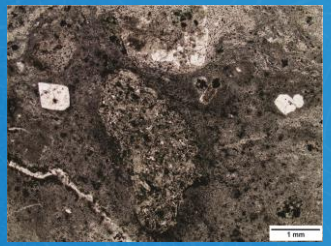


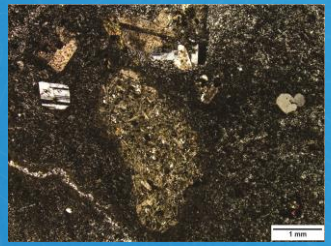


JK-135

Andesite lava flow (porphytiric)





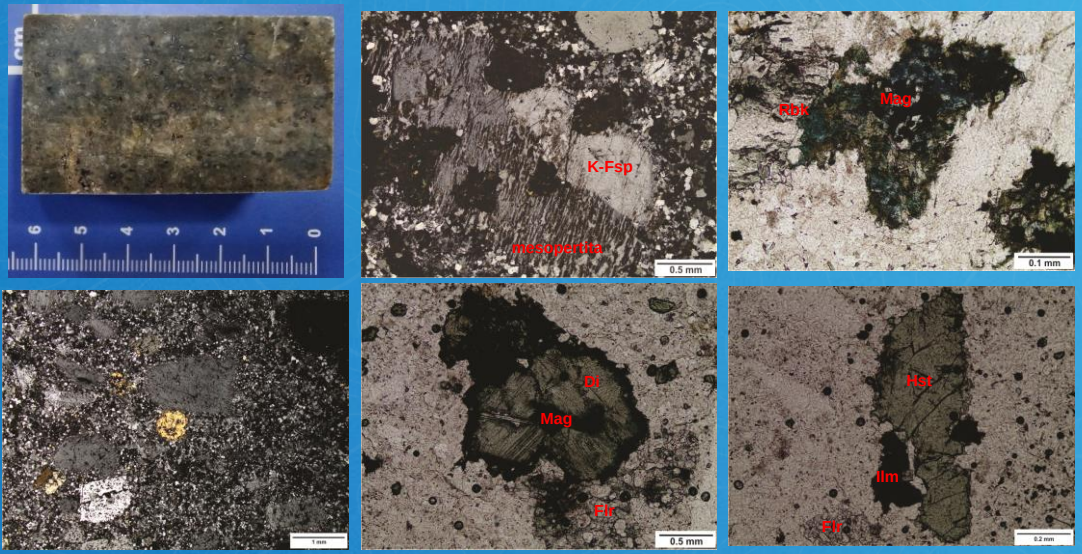


JK-140

Andesitic tuff (crystals and lithoclasts)

Moraes Almeida Formation

JK-134B



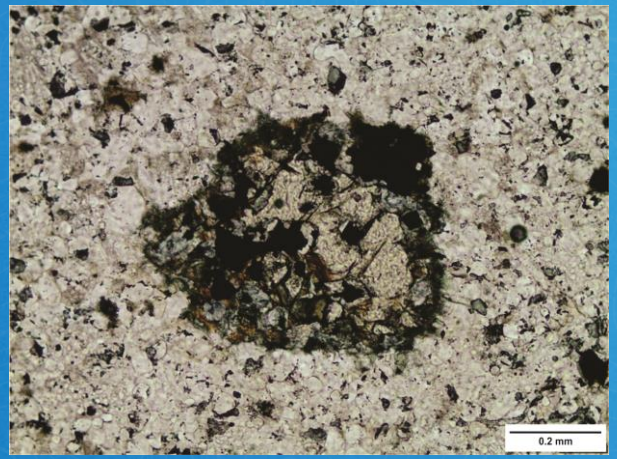
Alkali Rhyolite (lava flow)

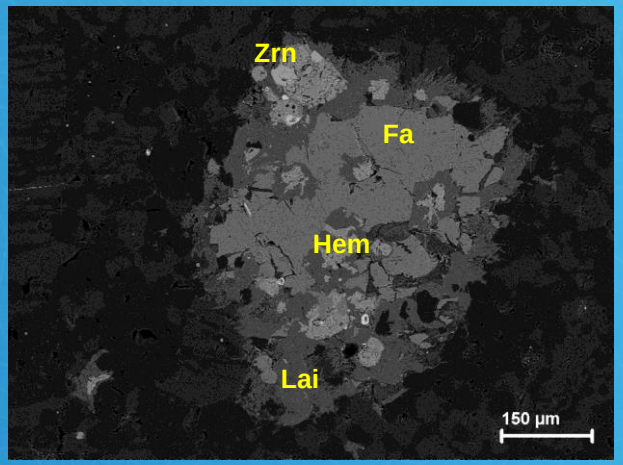
Modal Composition (Silva 1992)

Fayalite 0.3 – 1.1 % (Fa)
Clinopyroxene 0.1 – 2.1 % (Di-Hd)
Green Amphibole 0.2 – 5.4 % (Hst)
Blue Amphibole 0.1 -1.0 % (Arf,Rbk)
Biotite 0.2 – 1.5 % (Bt)
Fluorite 0.1 – 0.8 % (Flr)
Opaque minerals 0.2 – 1.7 % (Mag, Ilm)

- ✓ **Pb-Pb zr - 1888 ±2 Ma *(Dall'Agnol et al. 1999)***
- ✓ **T_{DM} Nd 2.37 and 2.34 Ga / $\varepsilon_{Nd\ (1888Ma)}$ - 2.83 and - 2,47 *(Lamarão et al. 2005)***

Mineral Chemistry



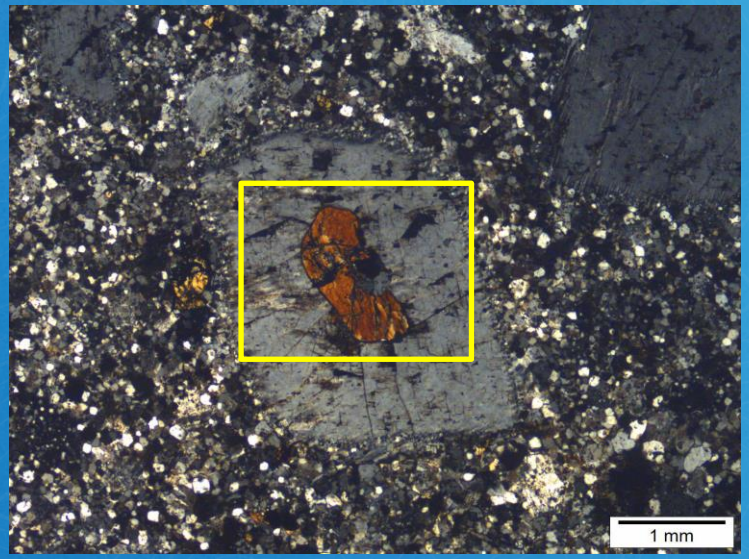


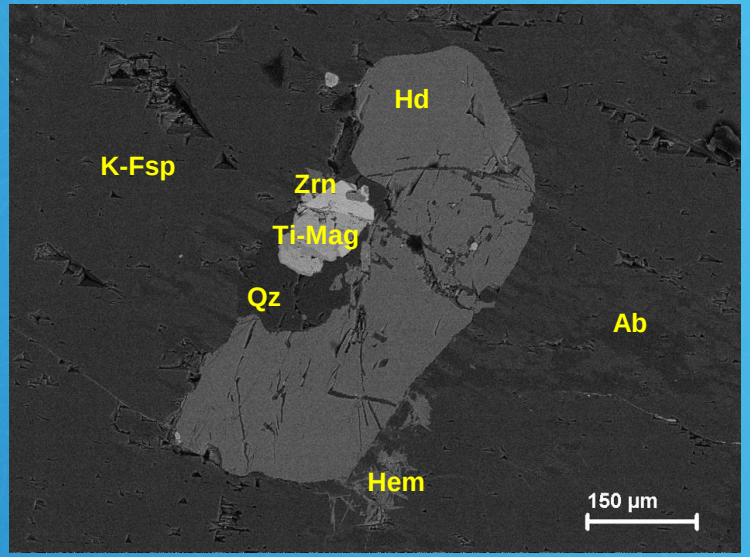
Fayalite (Fa) → ***Laihuite (Lai)***

Fe 52%
Si 15%
O 32%

Fe 34%
Si 21%
O 41 %

Mineral Chemistry

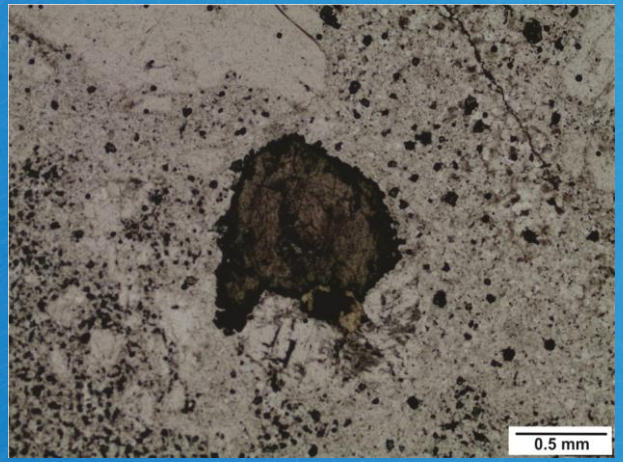


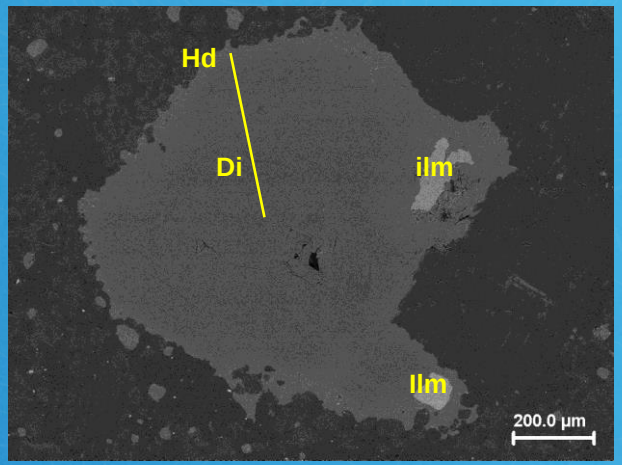


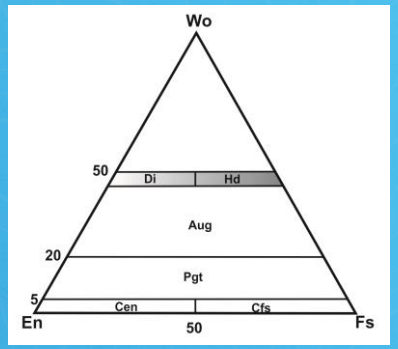
Hedenbergite (Hd)

Fe 23%
Si 23%
Ca 13%
O 41%

Mineral Chemistry





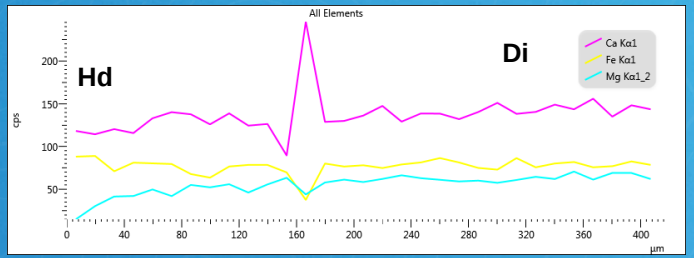


Hedenbergite (Hd)

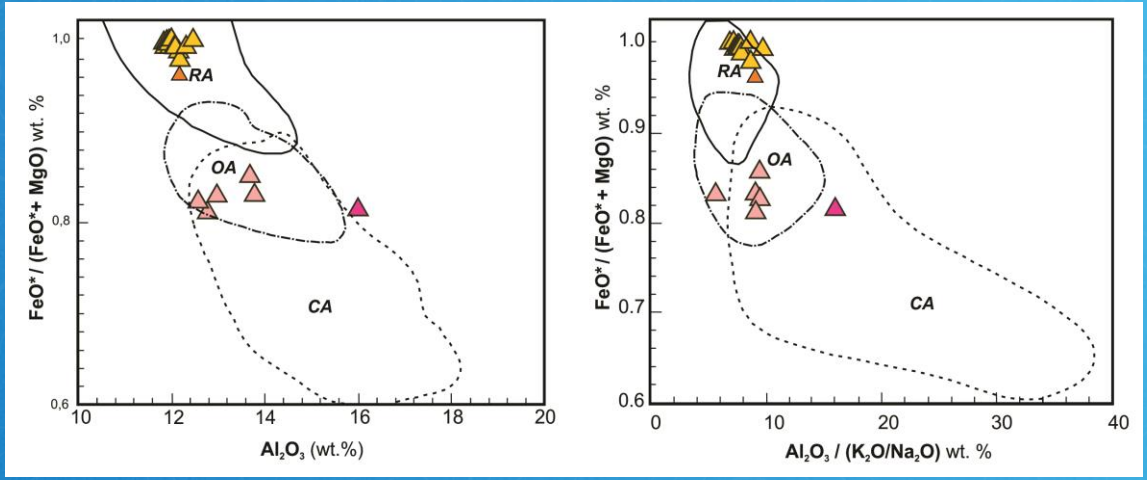
Fe 24%
Si 22%
Ca 7%
O 43%

Diopside (Di)

Fe 14%
Mg 6%
Si 23%
Ca 12%
O 24%



Oxidiesed x Reduced A-Type



(Dall'Agnol and Oliveira, 2007)

Moraes Almeida Formation (type area)

- trachytes Fe-Hbl, Aug
- rhyolites Bt

Lamarão *et al*. (2002)

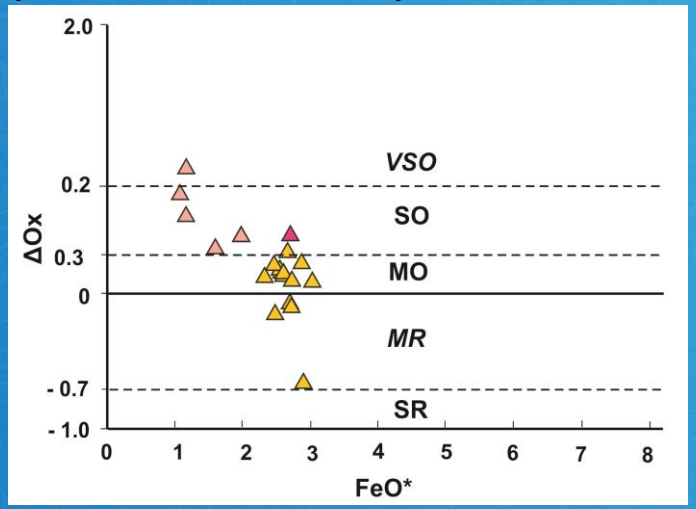
Urubuquara Volocanic Caldera

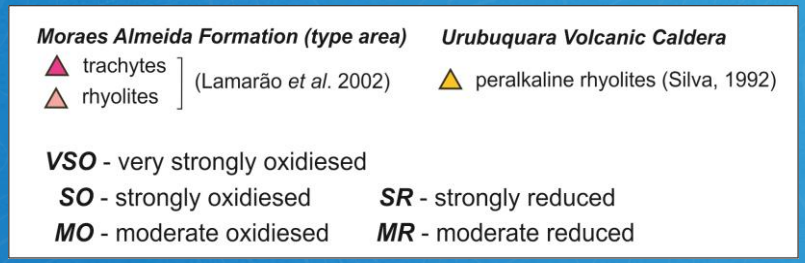
- peralkaline rhyolites (Silva, 1992)
- peralkaline rhyolites (Vasquez *et al*. 2024)

RA - Reduced A-type ***OA*** - Oxidiesied A-type ***CA*** - calk-alkaline

Oxidation State - ΔOx index

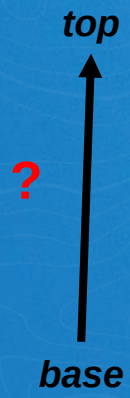
(Blevin, 2005, Geosc. Austr.)





- ✓ Fe_2O_3 (XRF) and FeO / Fe^{+2} (wet chemistry)
- ✓ *FeO** = Fe_2O_3 x 0.9 (Total FeO)
- ✓ $\Delta Ox = Log_{10} (Fe_2O_3/FeO)+0.3+0.03xFeO^*$
- ✓ MAF type area ⟶ SO (VSO)
- ✓ UVC rhyolites ⟶ MO to MR (SR and SO)
- ✓ *ΔOx ~ 0* ⟶ QFM buffer

Conclude Remarks



- ✓ *Ubuquara is a bimodal volcanic caldera of 1888 Ma*
- ✓ *Volcanoclastic and volcanogenic sedimentar rocks (resedimeted and reoworked)*
- ✓ *Rhyolites dommes (hypersolvus, peralkaline, H_2O-poor, FeO-rich, SiO_2-rich, ALK felsic magma)*
- ✓ *Dacites and rhyolites ignimbrites (subsolvus, H_2O-rich, CAK felsic magma)*
- ✓ *Andesites flows and tuffs (H_2O-rich, CA-CAK mafic magma)*

Coeval Volcanic Formations

Chapéu do Sol Caldera

Aruri Fm.

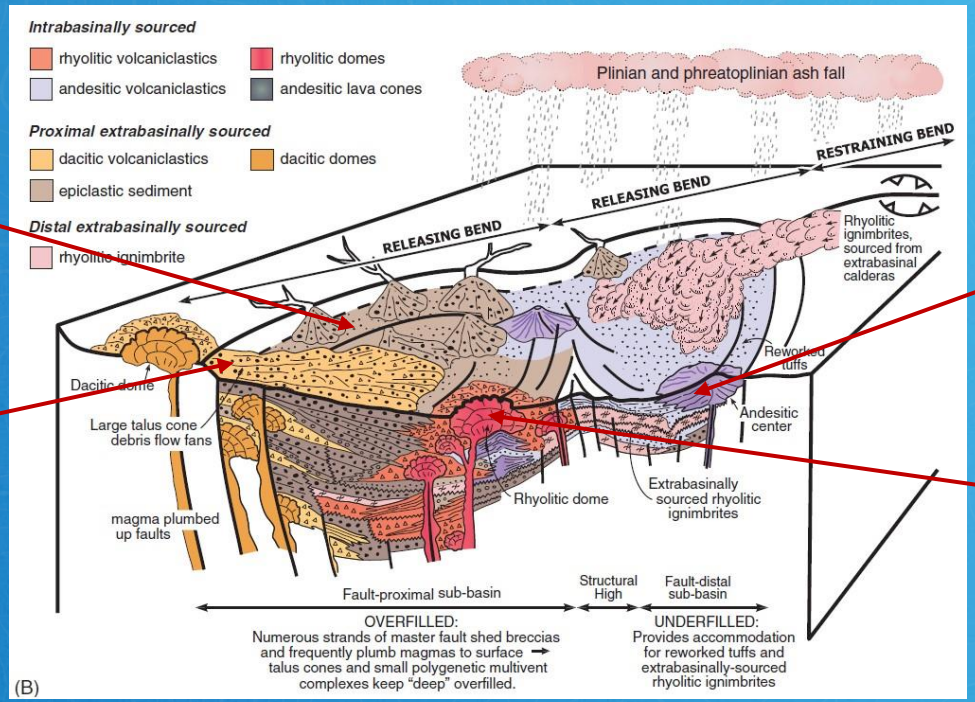
U-Pb zr 1888±7 Ma

Aguja Bocanegra (2013)

Urubuquara Caldera

Salustiano Fm.

U-Pb zr 1888±11 Ma



Chapéu do Sol Caldera

Bom Jardim Fm.

Pb-Pb zr 1889±2, 1886 ±2Ma

Galarza et al. (2015)

Urubuquara Caldera

Moraes Almeida Fm.

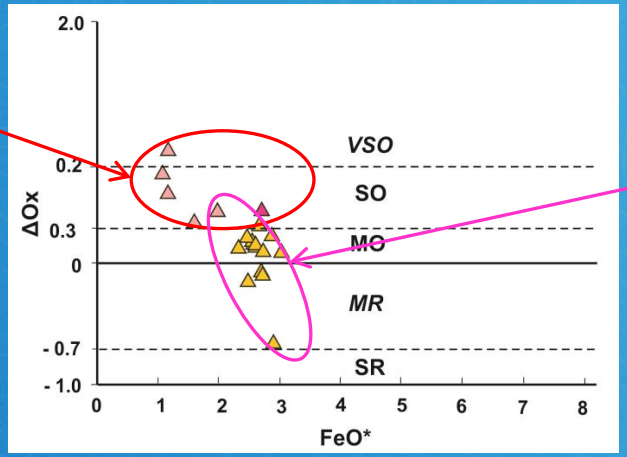
Pb-Pb zr 1888±2 Ma

(Bubsy, 2012, Continental Arc Basins: Case Studies)

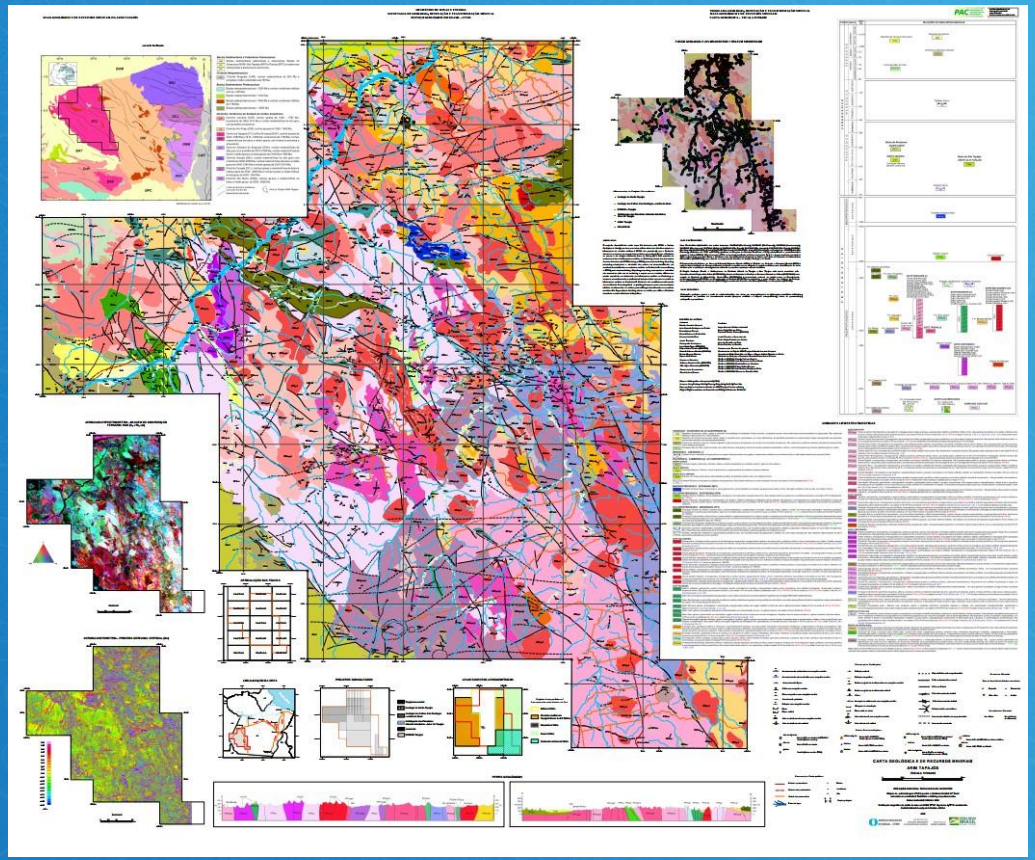
Conclude Remarks

- ✓ ***Two oxidation state for A-type magmas of ca. 1880 Ma from the Tapajós Mineral Province:***

Oxidesied A-type



***Reduced A-type around* QFM buffer**



Disponível no RIGeo

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GeoMinE 2025

· XIII SIMPÓSIO SUL-BRASILEIRO DE GEOLOGIA
· IX SIMPÓSIO DE VULCANISMO E AMBIENTES ASSOCIADOS
· I CONFERÊNCIA DE GEOLOGIA E MINERAÇÃO DO MERCOSUL
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· I EXPOGEOMINE

2 A 6 DE JUNHO DE 2025, EM FOZ DO IGUAÇU-PR

SGB SERVIÇO GEOLÓGICO DO BRASIL

OBRIGADO