
# Results of PERLA (Paraná-Etendeka Regional Lithospheric Analysis) on gravity and petrographic modeling of the upper mantle

PERLA
Paraná-Etendeka Regional Lithospheric Analysis

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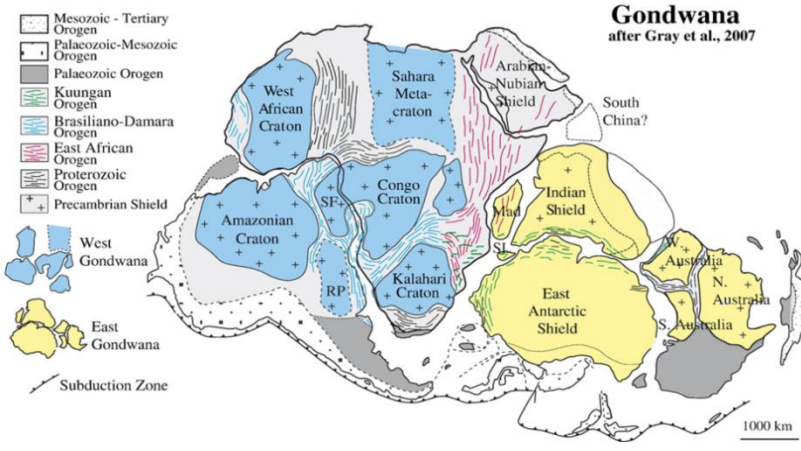
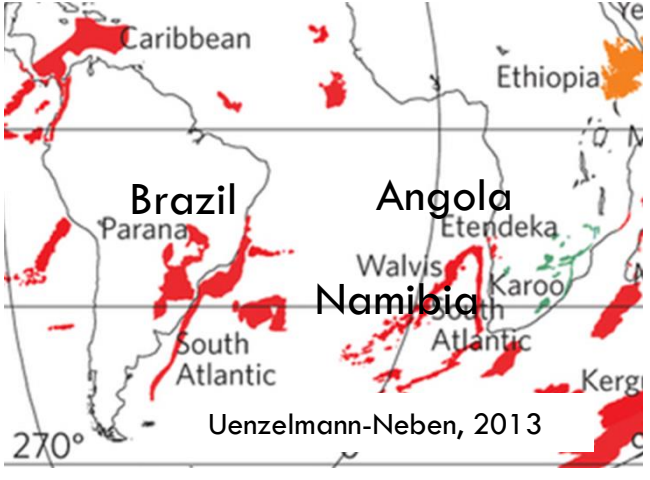
# Motivation

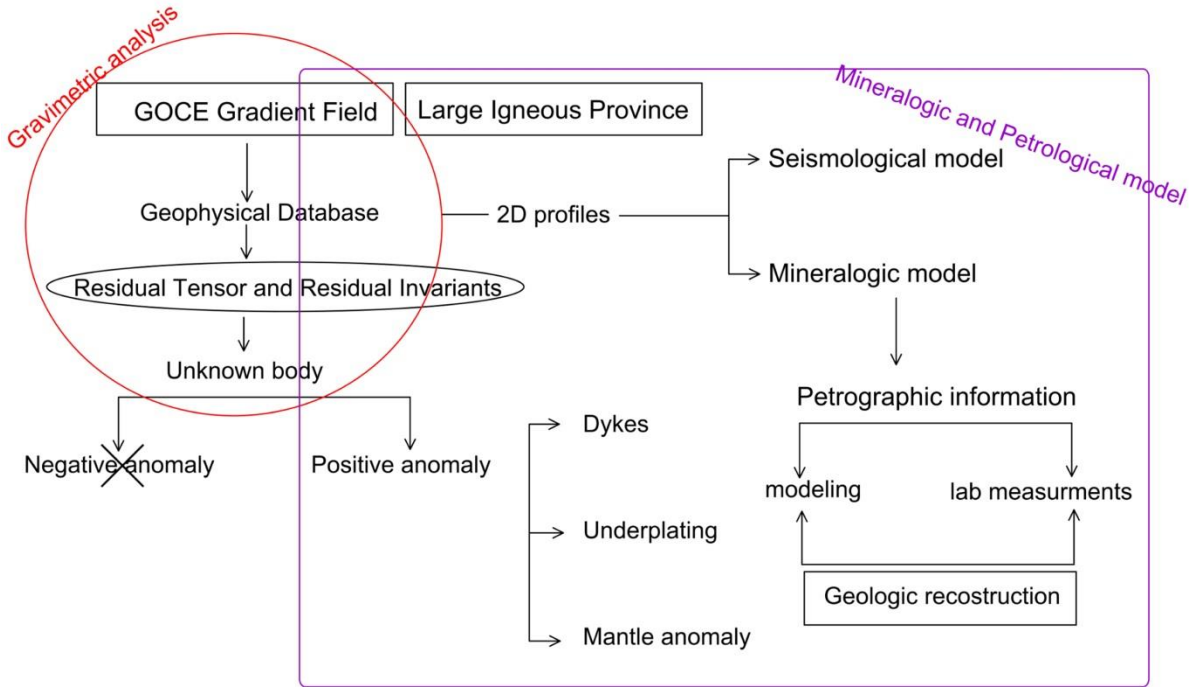
- Studying lithosphere after the breakup of W-Gondwana
- Looking for heterogeneous lithosphere explaining asymmetric volcanic effusion of Paraná and Etendeka (South America and Africa).
- Tholeiitic basalt + alkaline + alkaline-carbonatitic complex in P-E ignous province with a large span of age (250-50 Ma) (Comin-Chiaramonti et al., 2007)




Age LIPs: 50-150Ma; >150Ma



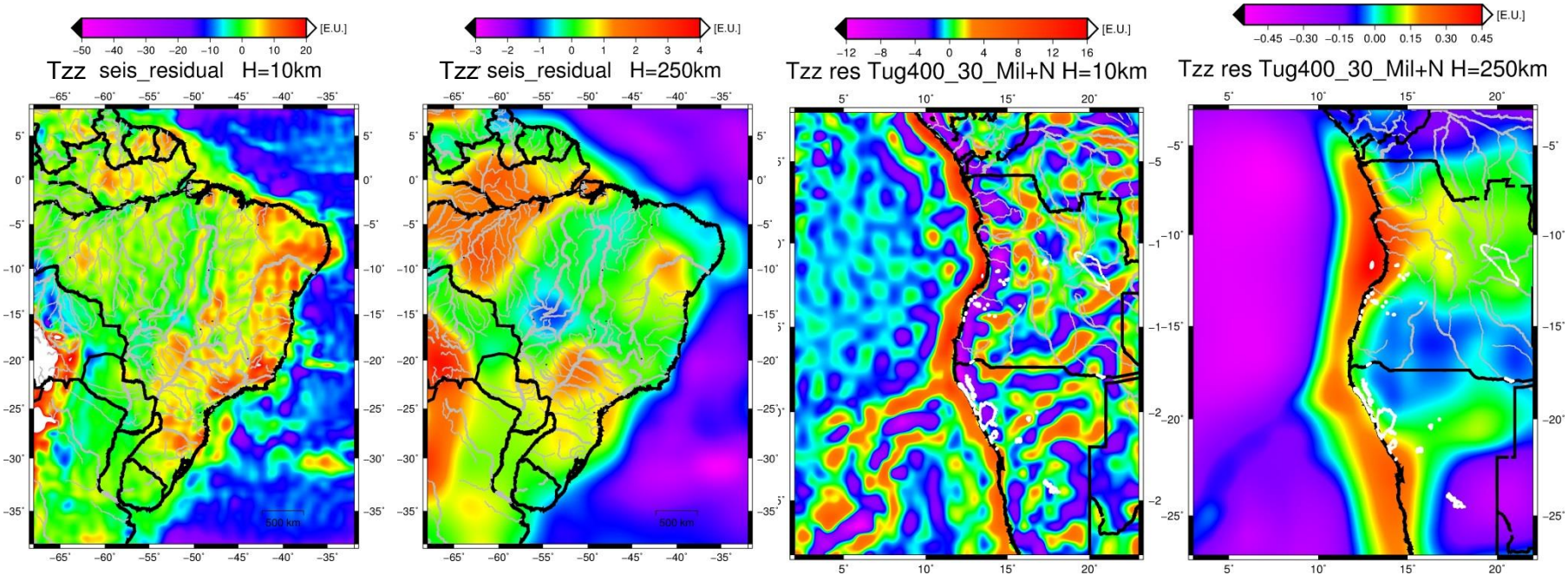
# Methodology



# Tzz RESIDUAL signal (CRUSTAL LAYERS)

**SAM**

**AFRICA**

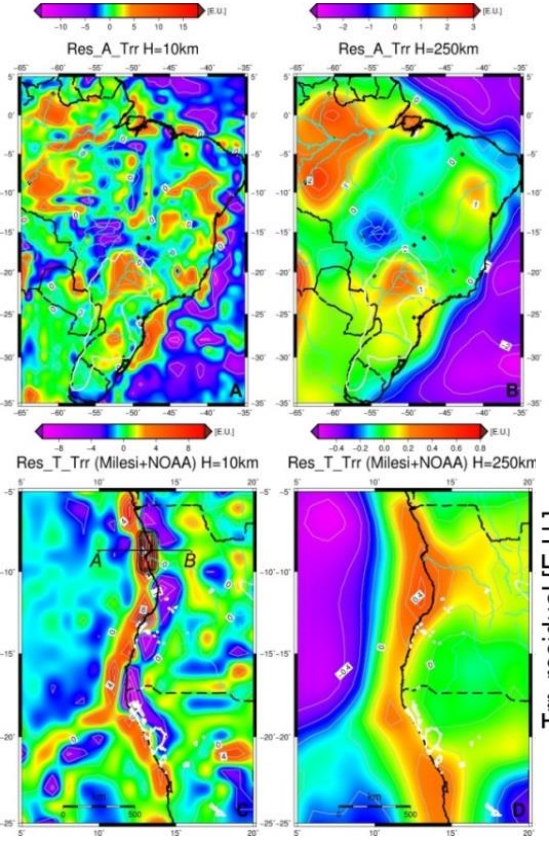


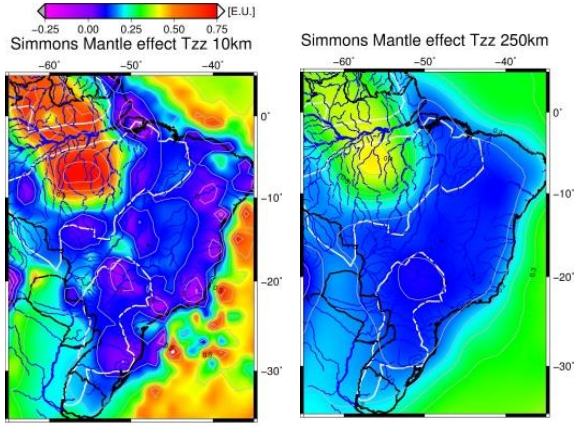
# Study of the Upper mantle

Information about the mantle are given by:

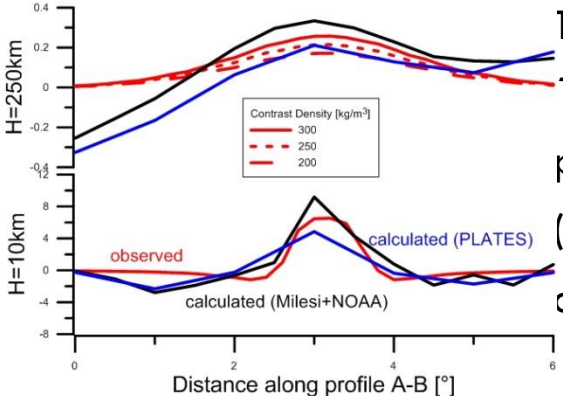
- 1) Geophysical studies
- 2) Mantle xenolites
- 3) Ophiolites: uplifted oceanic crust + upper mantle

# Residual modeling




Mantle effect:
1 E.U. Trr at 10 km,
0.4 E.U. at 250 km,
Contrast density 80 kg/m$^3$




The source is a prism:
1°x2.5°x 6km (width, length, thickness)
placed above the Moho
(bottom at 29 km depth), with a density contrast of 250 kg/m$^3$

# FROM CRUST TO MANTLE →Mantle modeling

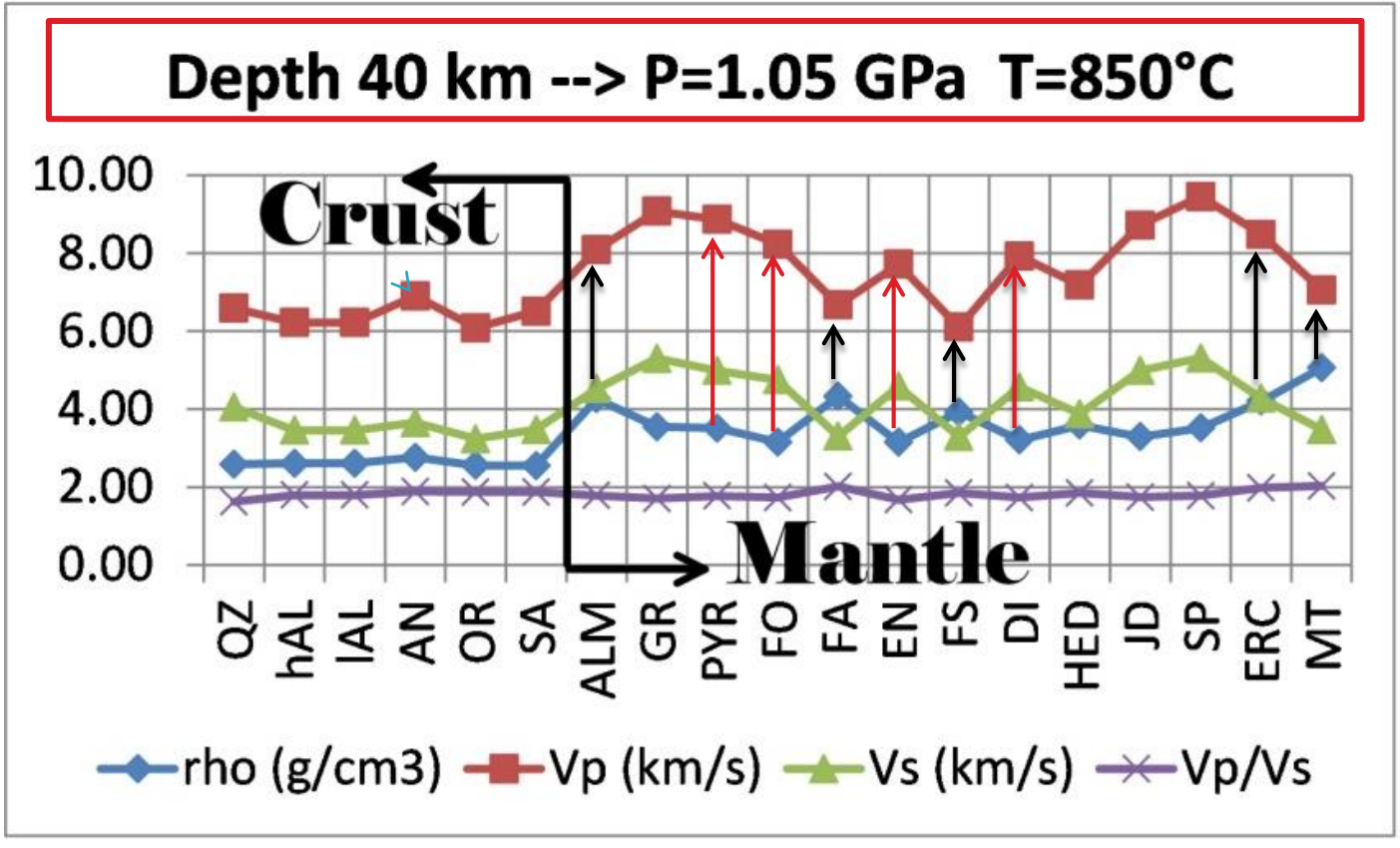
Density variation driven by:

- Petrological composition
- T-P condition with depth

Model tested:

- Monomineralogic rocks
- Mantle Petrological models
- Linear Temperature Gradient (LGT) on peridotites, age dependent

LITOSPHERE

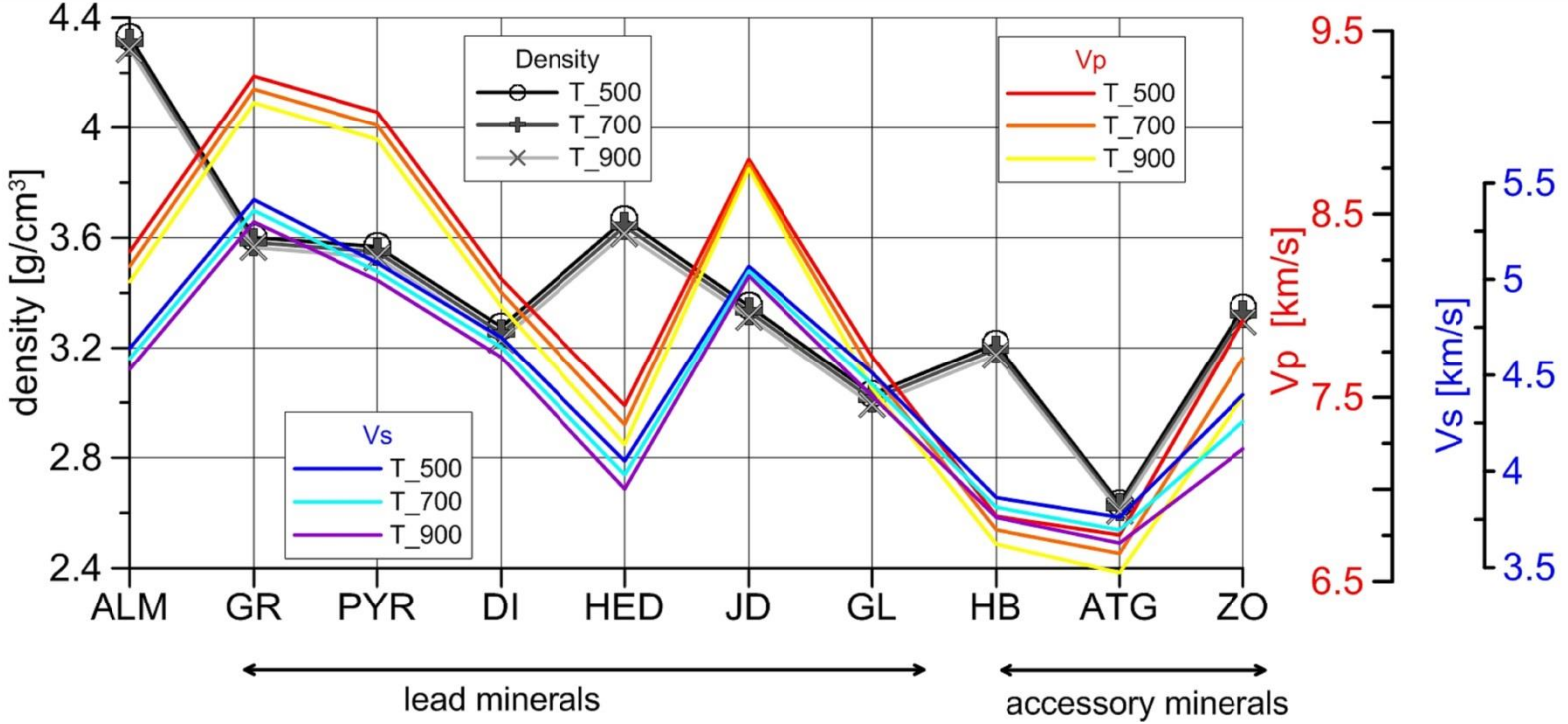



Fe

Mg

The behavior of Fe: the increase of density and the decrease in Vp and Vs velocity is evident

# ECLOGITE MINERAL COMPONENTS P=2GPa



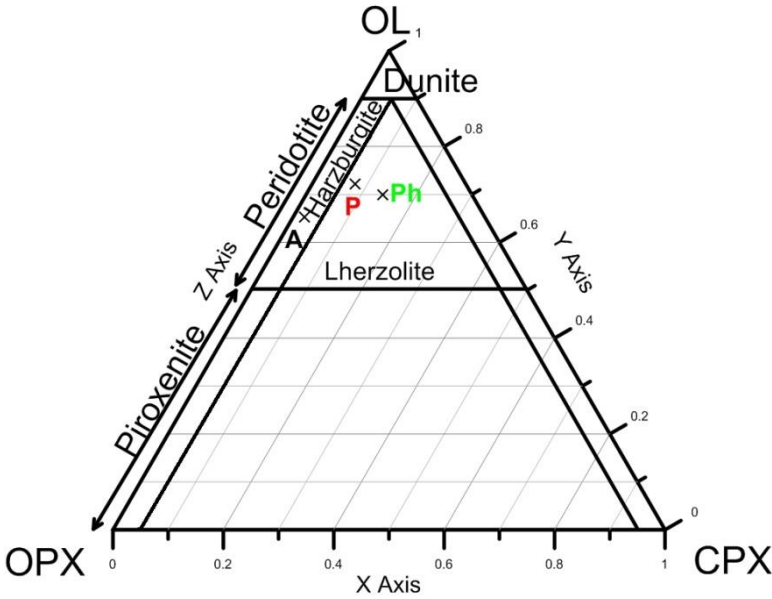

- Main minerals occurring in eclogite
- High density is possible: underplating could explain the positive anomaly across the southern African margin

# Mantle Petrological classification

| | OL | OPX | CPX | GRN |
|---|---|---|---|---|
| **ARCHEAN** | 62<br>Fo93 | 31<br>En92 | 2 | 5 |
| **PROTEROZOIC** | 65<br>Fo92 | 18<br>En91 | 7 | 7 |
| **PHANEROZOIC** | 65<br>Fo90 | 15<br>En90 | 13 | 5 |

< # Mg

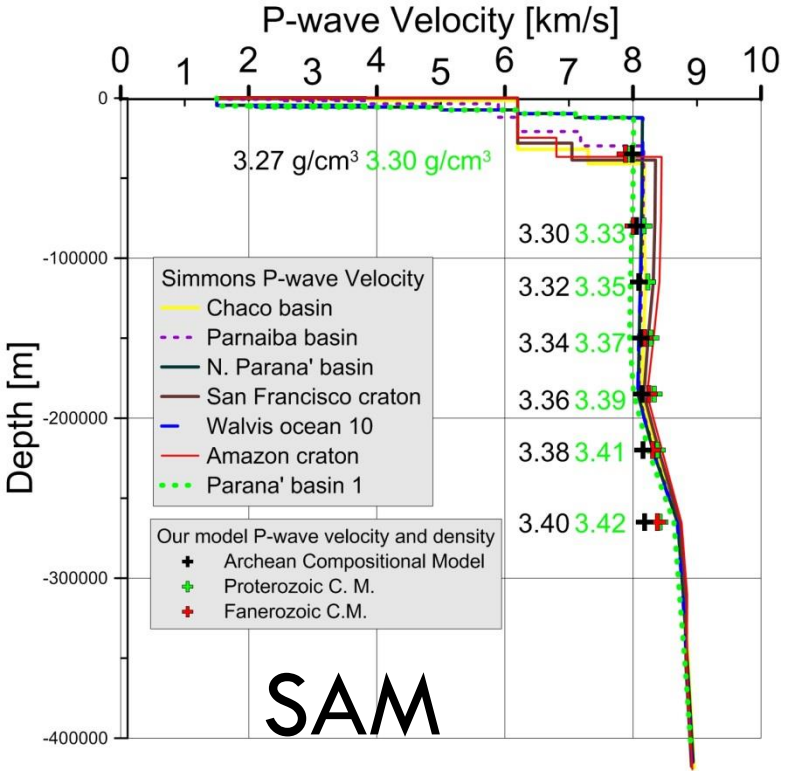
> # Fe

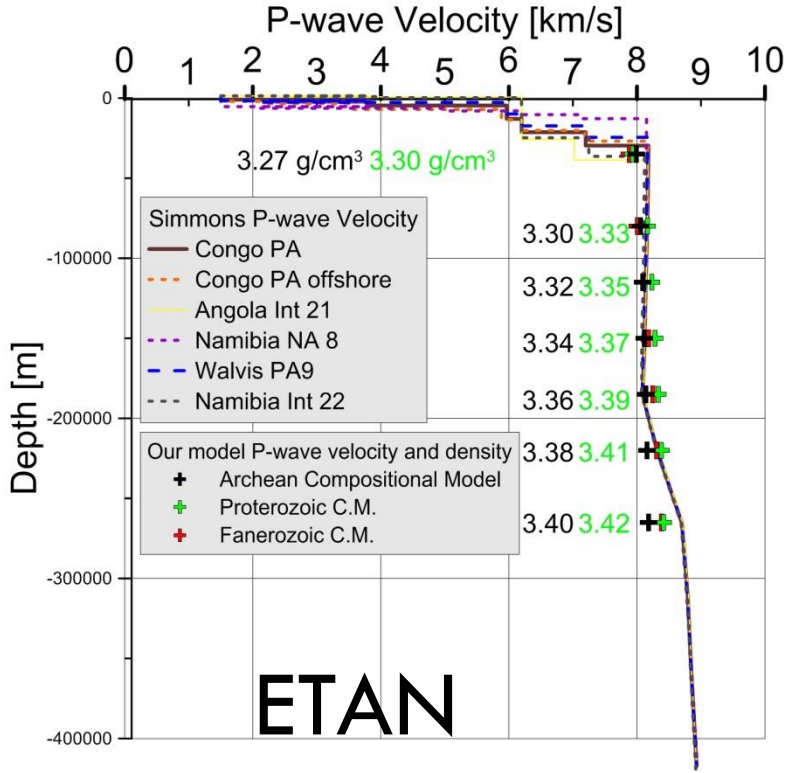



Age influence in composition (Artemieva 2011)
Proportion of lead minerals

Olivine/Ortopiroxene/Clinopiroxine/Garnet

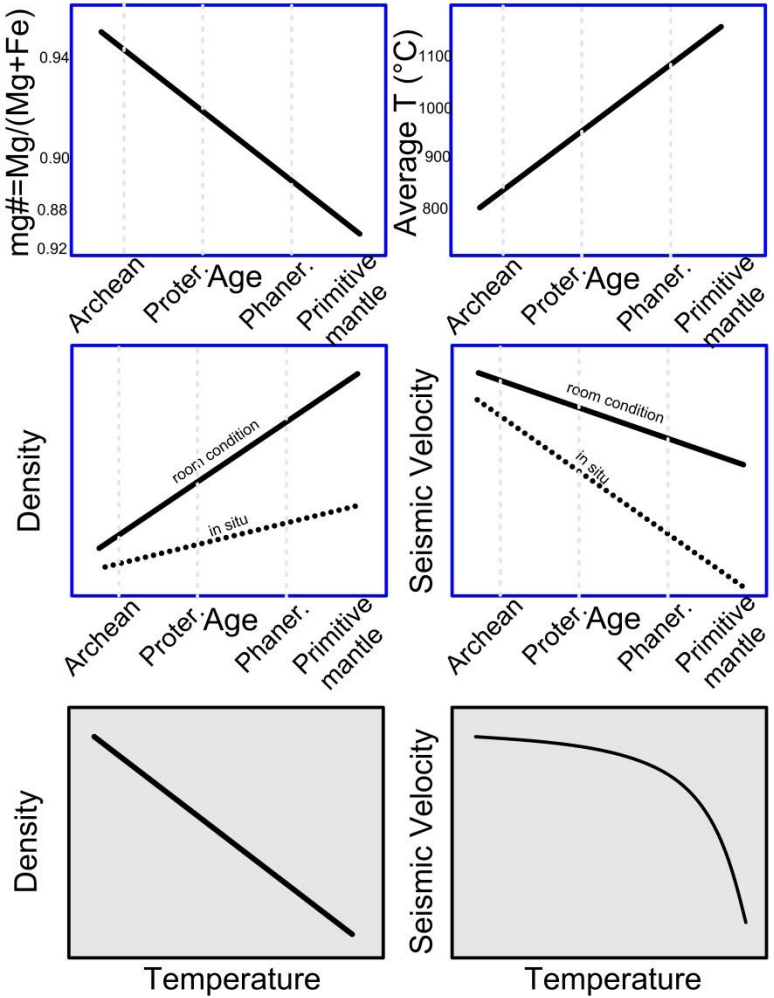
# LTG: P-wave Velocity profiles (SAM-ETAN)



# Discussion

- Mineralogical composition have to be used to calculate seismic velocity and density
- Temperature and pressure affect Vp, ρ values significantly

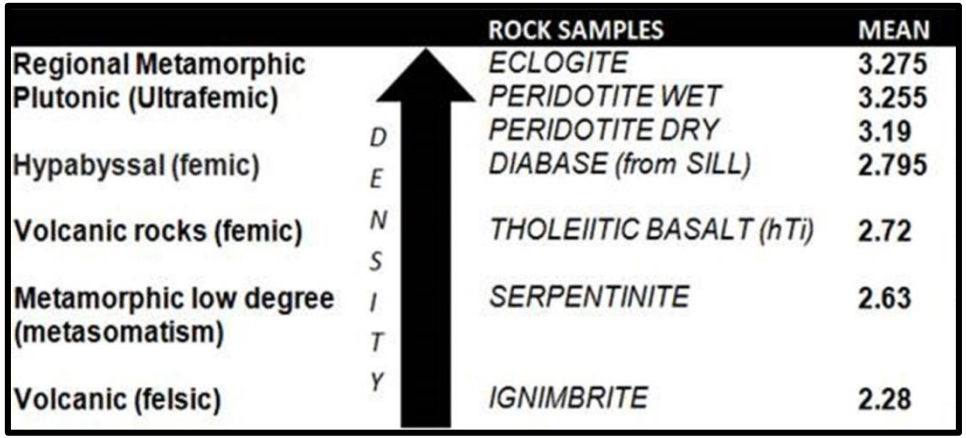


# Conclusion

- P-E can be well studied with GOCE products: Angola and Namibia coastline has equal gravity behavior
- Hard to localize the anomaly in the crust or in the mantle: tomography could be more useful
- The behavior of rock minerals is essential to join gravimetry and tomographic methodologies
- Now: Vp in P-E has similar values, while under SAM craton and ETAN craton values are different  metasomatism explaining lithosphere of P-E

# Outlook

- Improve and Refine the petrophysical behavior in the upper mantle to better constrain the lithosphere in P-E
- Make inversion program on complete Tensor



# Thank you for your attention