centro de pesquisa em geofísica e geologia

Comparing metallogenic and phosphogenic events in the intracratonic and passive-margin Proterozoic basins of the SF Craton: The Bambuí/Una and Vazante Groups

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Proterozoic Basins

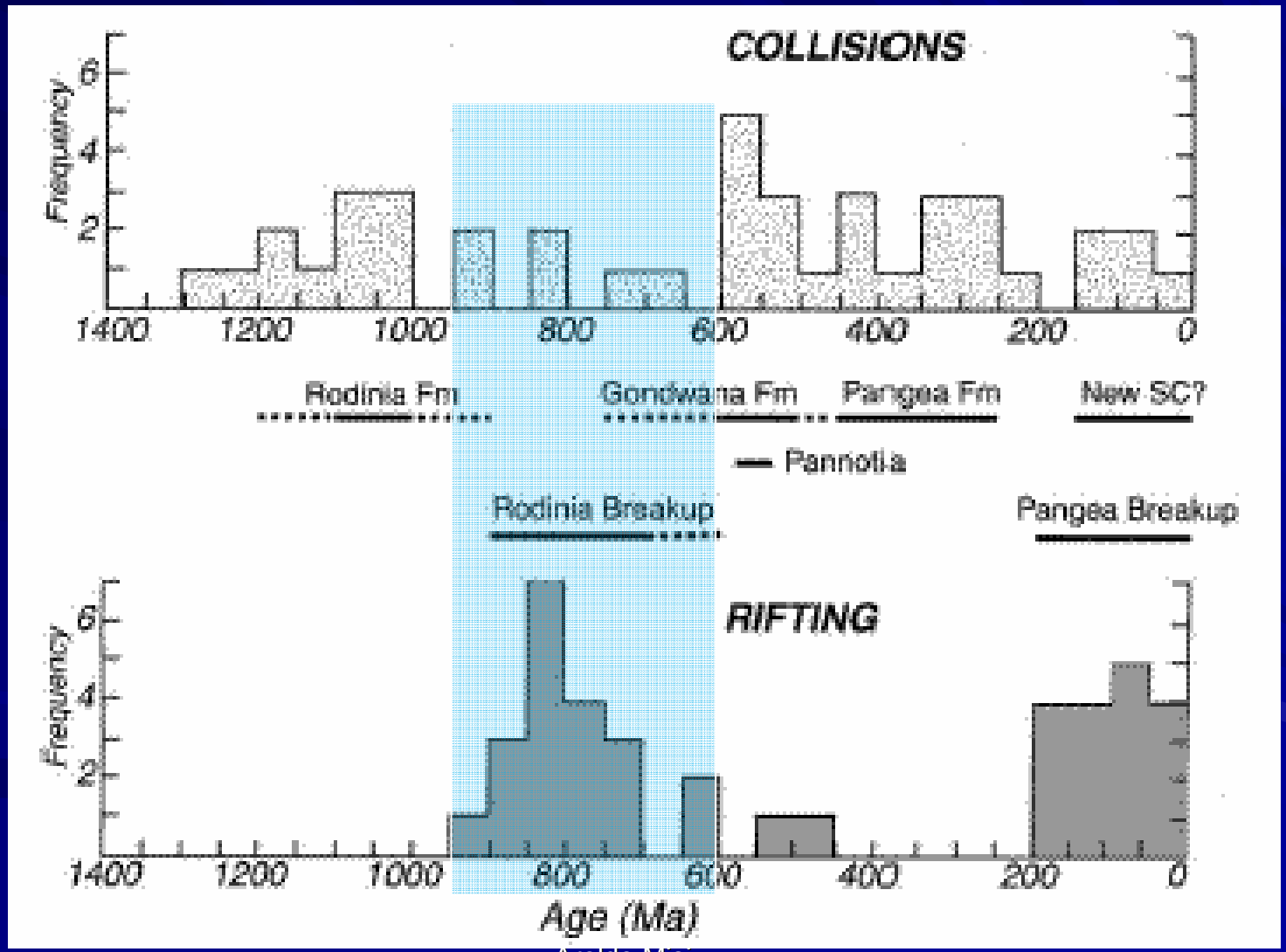
Irecê Sub-Basin (Una Gr.)

Una-Utinga Sub-Basin
Una Group

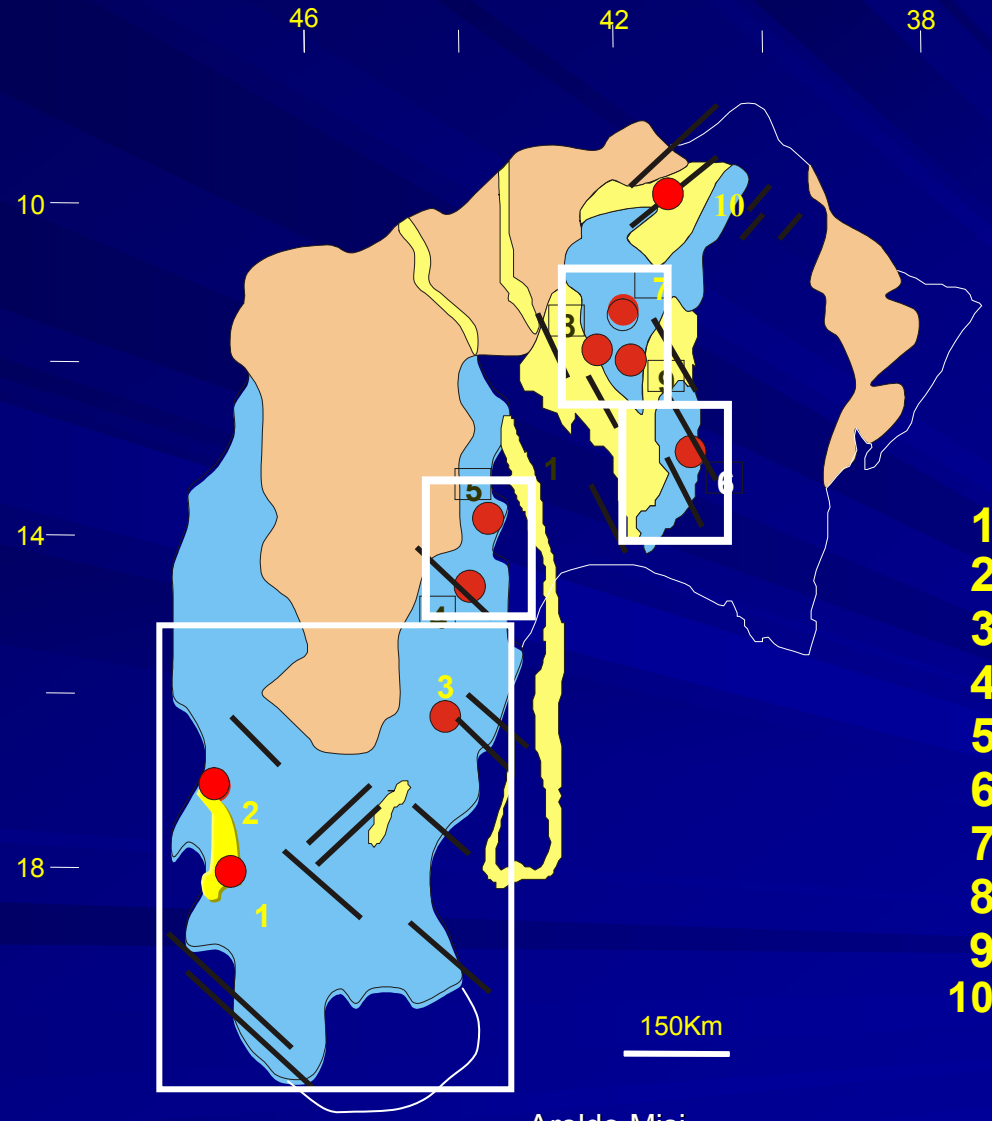
S. Francisco Basin
Bambuí Group

Brasilia Fold Belt
Vazante Group

Distribution of rifting and collisional ages Rodinia→ Gondwana (Condie, 2002)

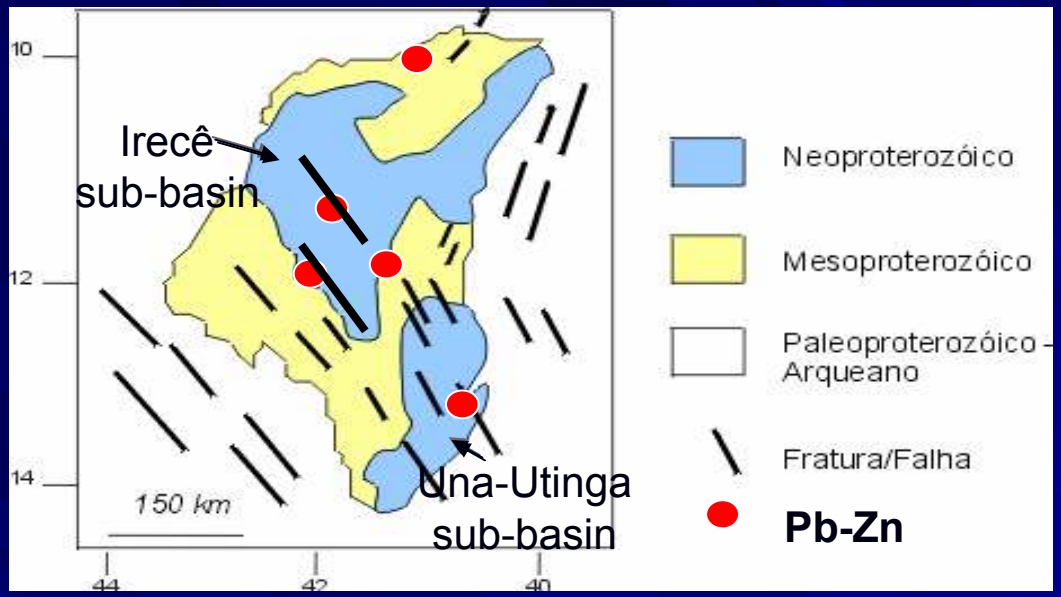


Proterozoic Sediment-Hosted Pb-Zn deposits of the São Francisco Craton

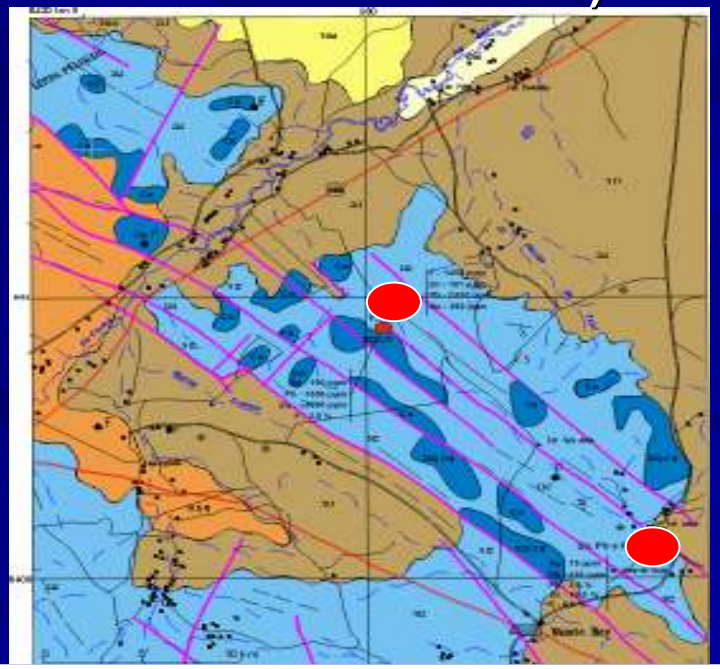


1 - Vazante
2 - M. Agudo
} Vaz. Group
3 - Januária-Itacarambí
4 - Montalvânia
5 - S. Ramalho
6 - N. Redenção
7 - Irecê
8 - M. Gomes
9 - Melancias
10 - Galena (Caboclo) – Chapada Diamantina Group

Chapada Diamantina

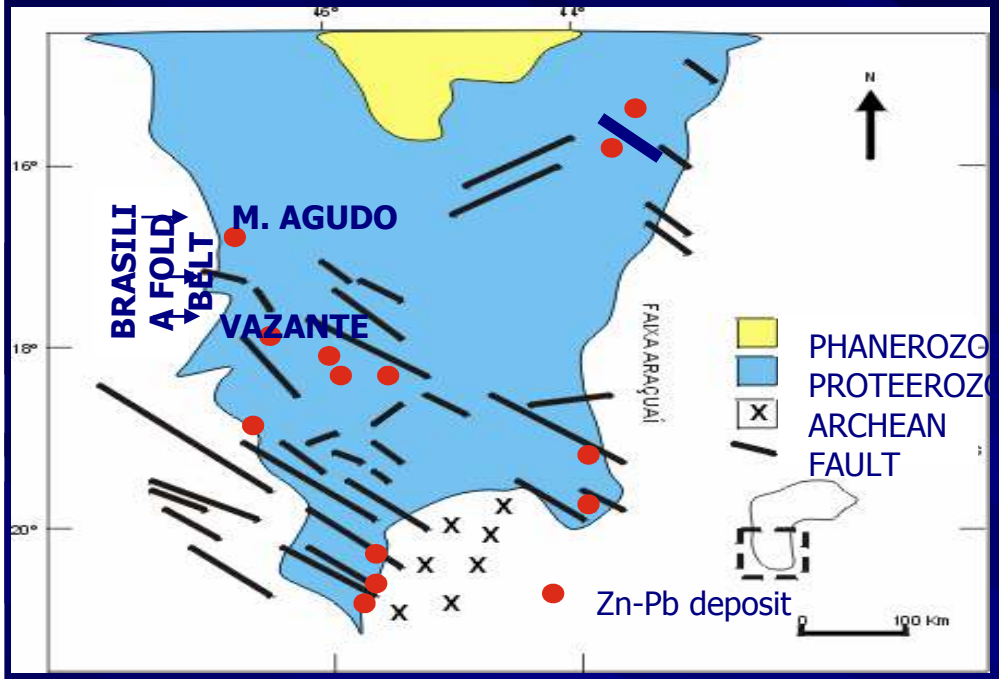


Côcos-Montalvania (São Francisco Basin)

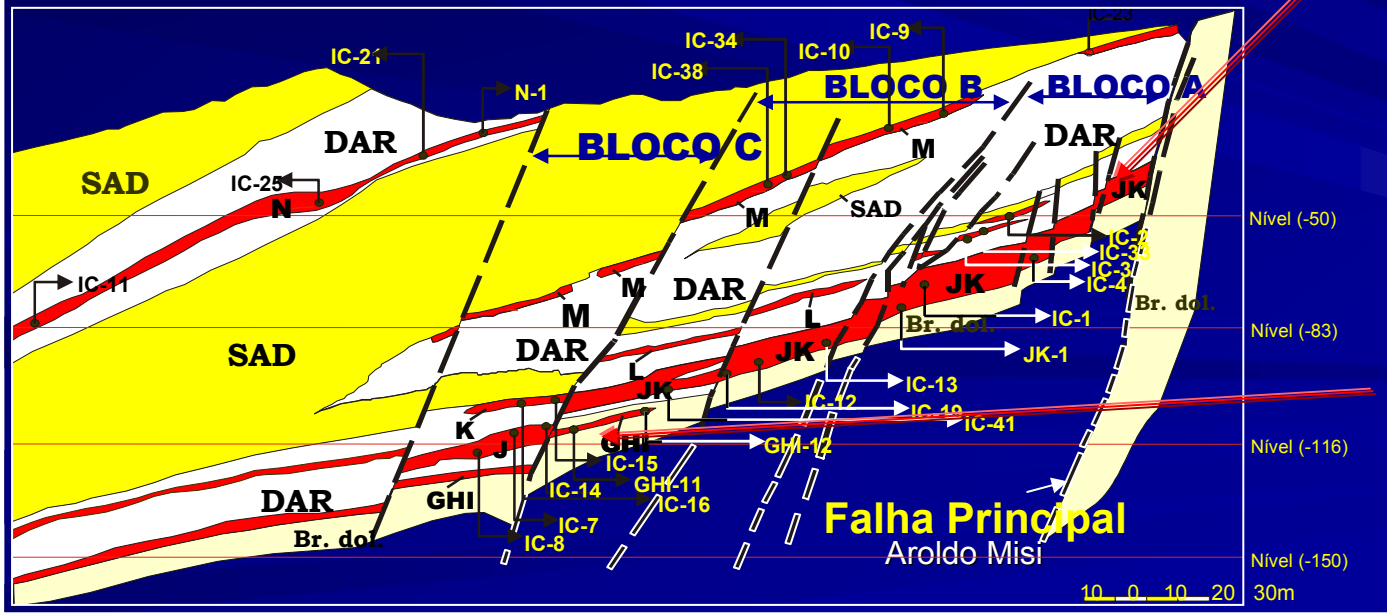


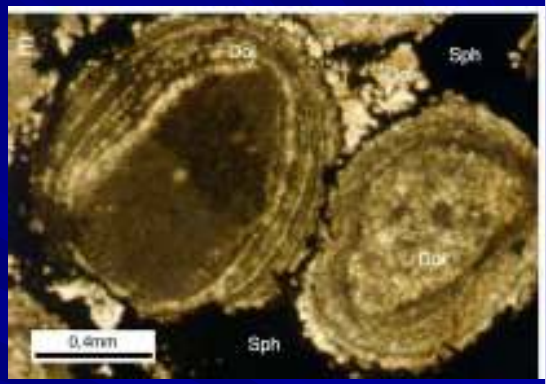
Conceição Filho et al., 2003

South São Francico Craton

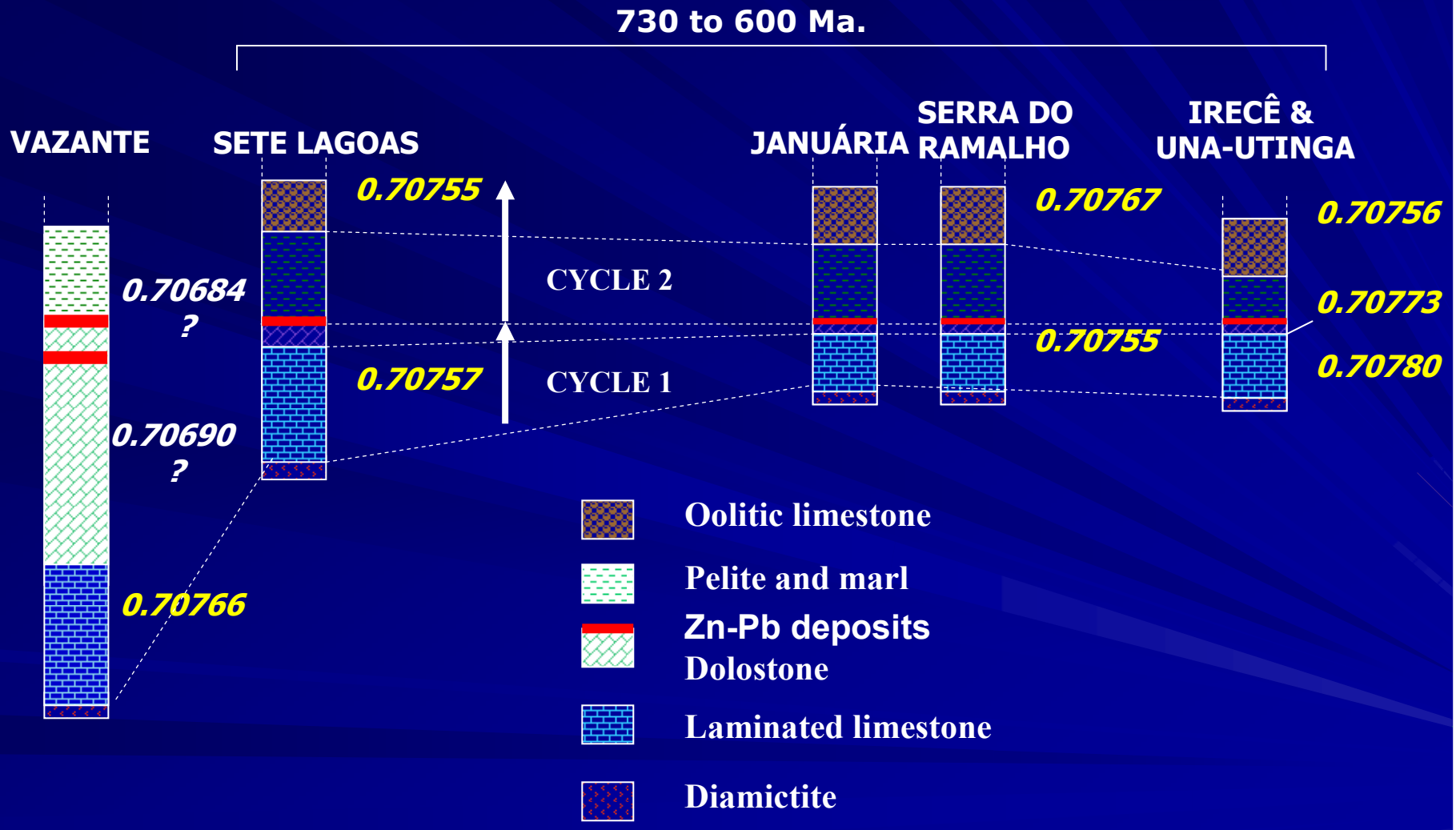


Morro Agudo Mine

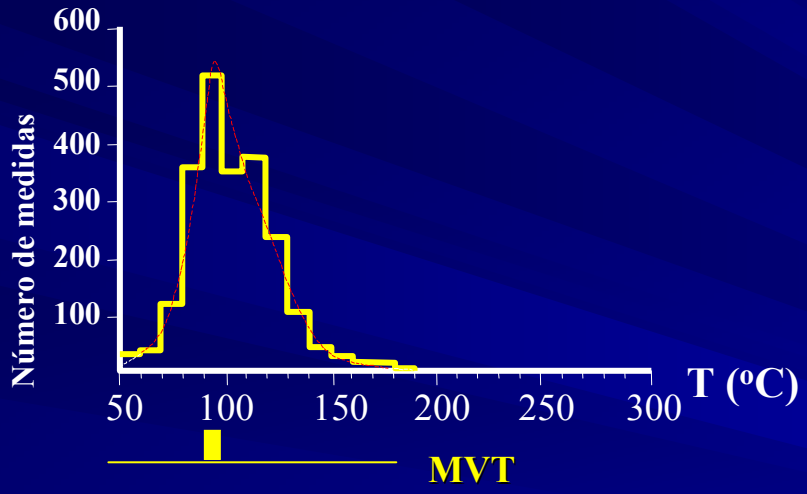


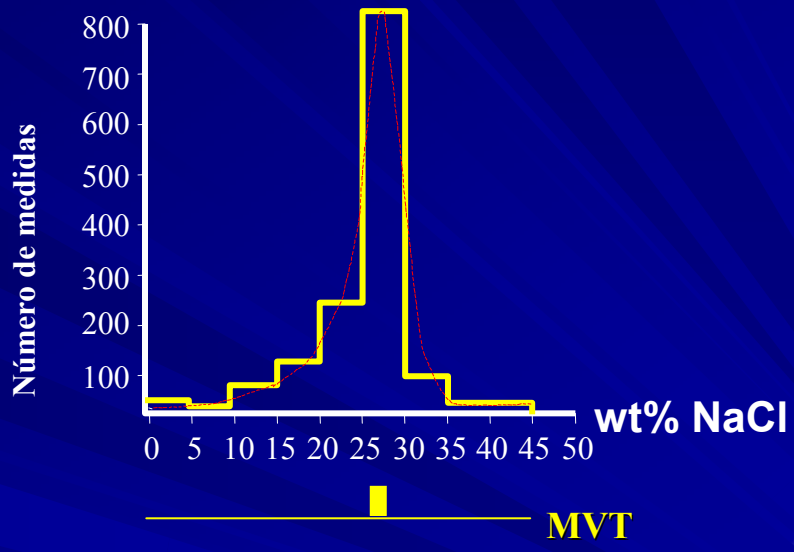


STRATIGRAPHIC CONTROLS AND CORRELATIONS

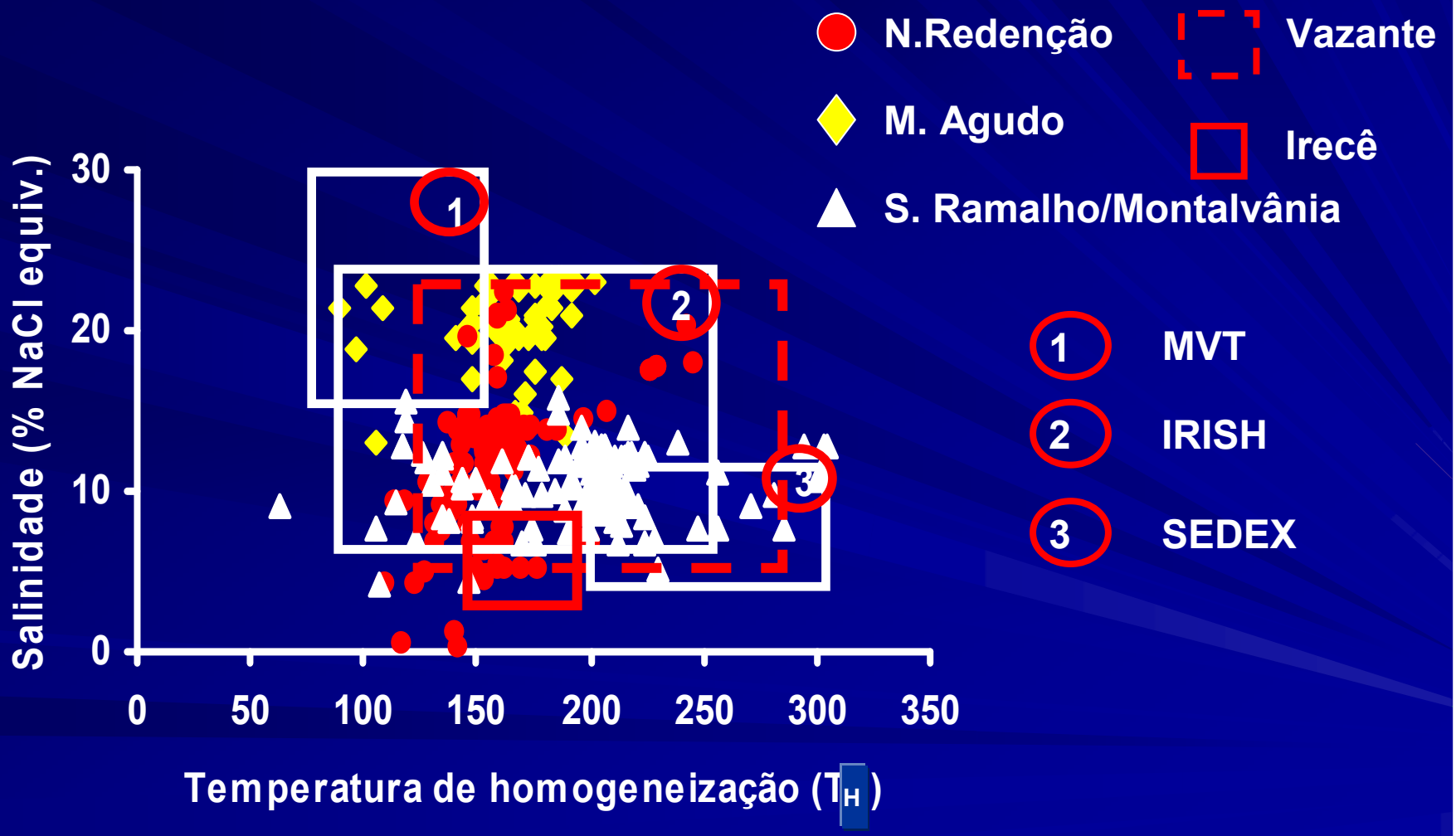


Mississipi Valley-type (MVT) deposits ?





HOMOGENIZATION TEMPERATURES AND SALINITIES FROM PRIMARY FLUID INCLUSIONS



Model of fluid circulation applied to the Zn-Pb mineralizing fluids in the Proterozoic basins of the SFC

S. Francisco Craton

↓

NEOPROTEROZOIC

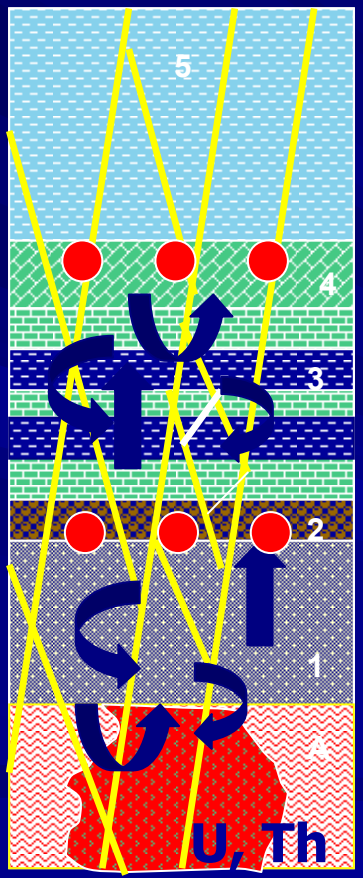
MESOPROTEROZOIC

-Paleoproterozoic and Archean basement w/ high heat flow
-Paleoproterozoic U-Th-K rich granites
-Negative Bouguer anomalies

Sources: Iyer & Hamza, 1992; Iyer et al., 1996; Misi, 1999; Misi et al., 2005

Conceptual model

↓



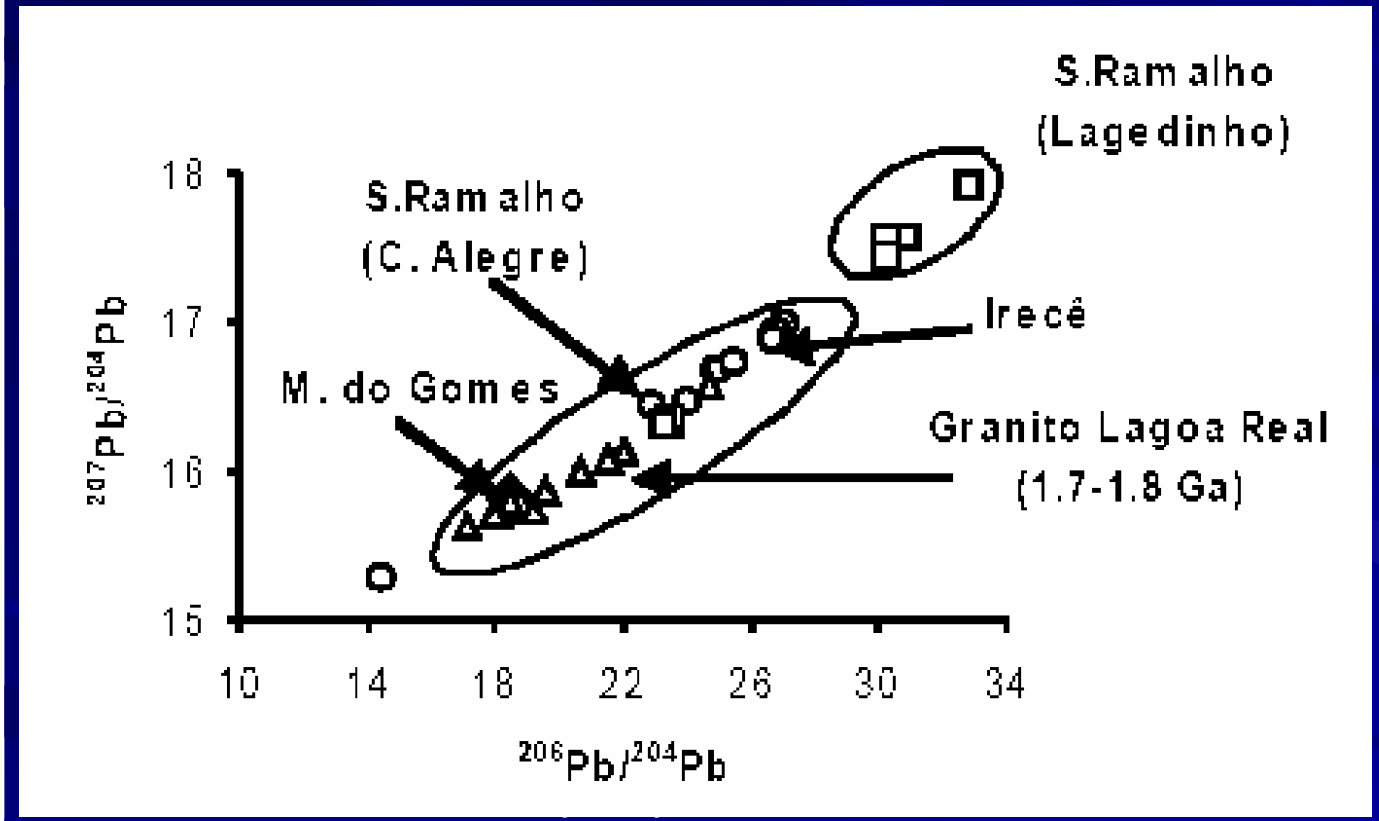
High radiogenic heat liberated by late episode of fracturing

HHP K-rich granites (below) are possible sources for Zn and Pb

High Heat Production (HHP) granites:
- Elevated heat flow (>60mW m^{-2})
- U-Th rich (U>6ppm and/or Th>25ppm)
- Strong negative Bouguer anomalies

Sources: Spirakis & Heyl, 1998; Sangster et al., 1998 Fehn, 1985; O' Connor, 1986

Ratio plots for Irecê/M.do Gomes (Irecê sub-basin) and S.do Ramalho (S.Francisco Basin) sulfides and for Lagoa Real granites

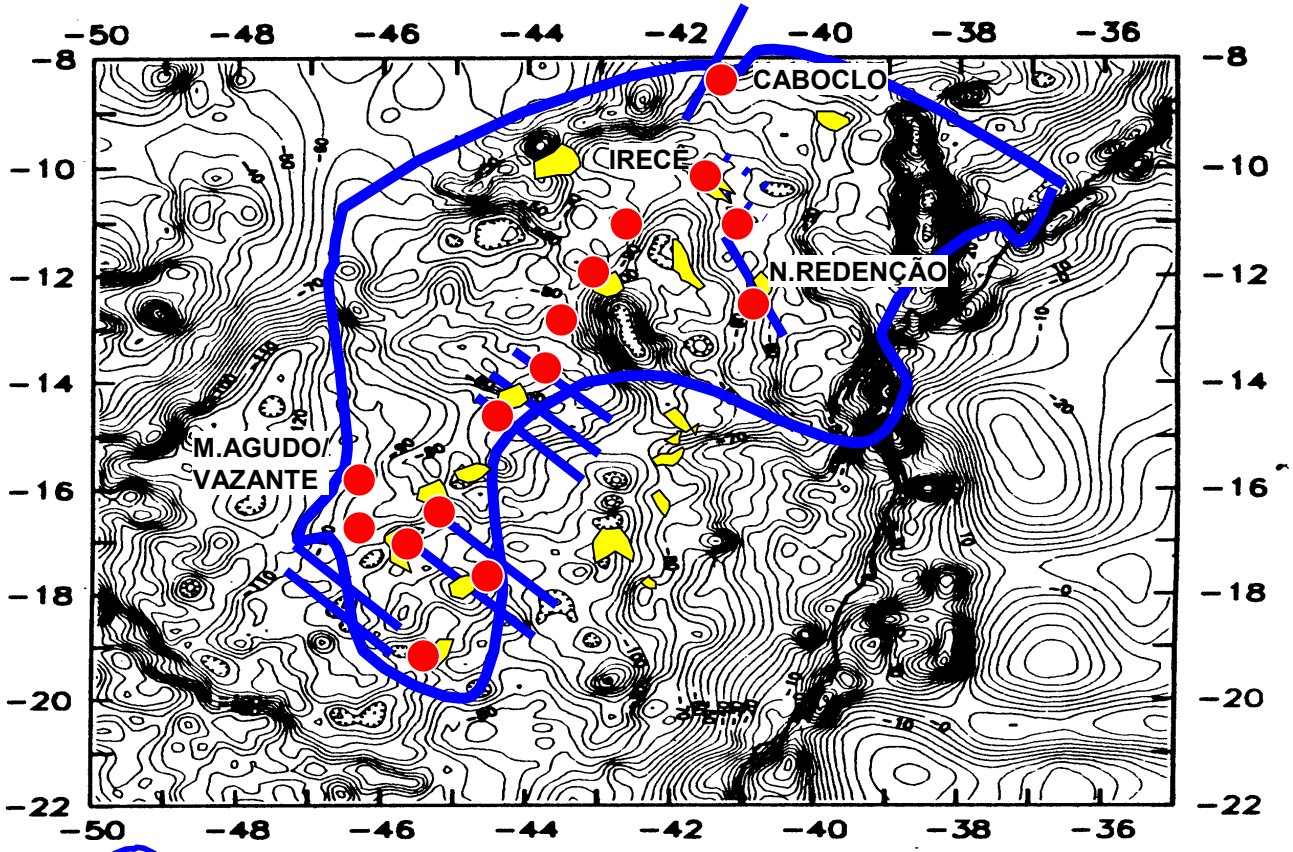


Lagoa Real Granites:
U = 4 – 20 ppm
Th = 17 – 76 ppm
(Maruéjol et al., 1987)

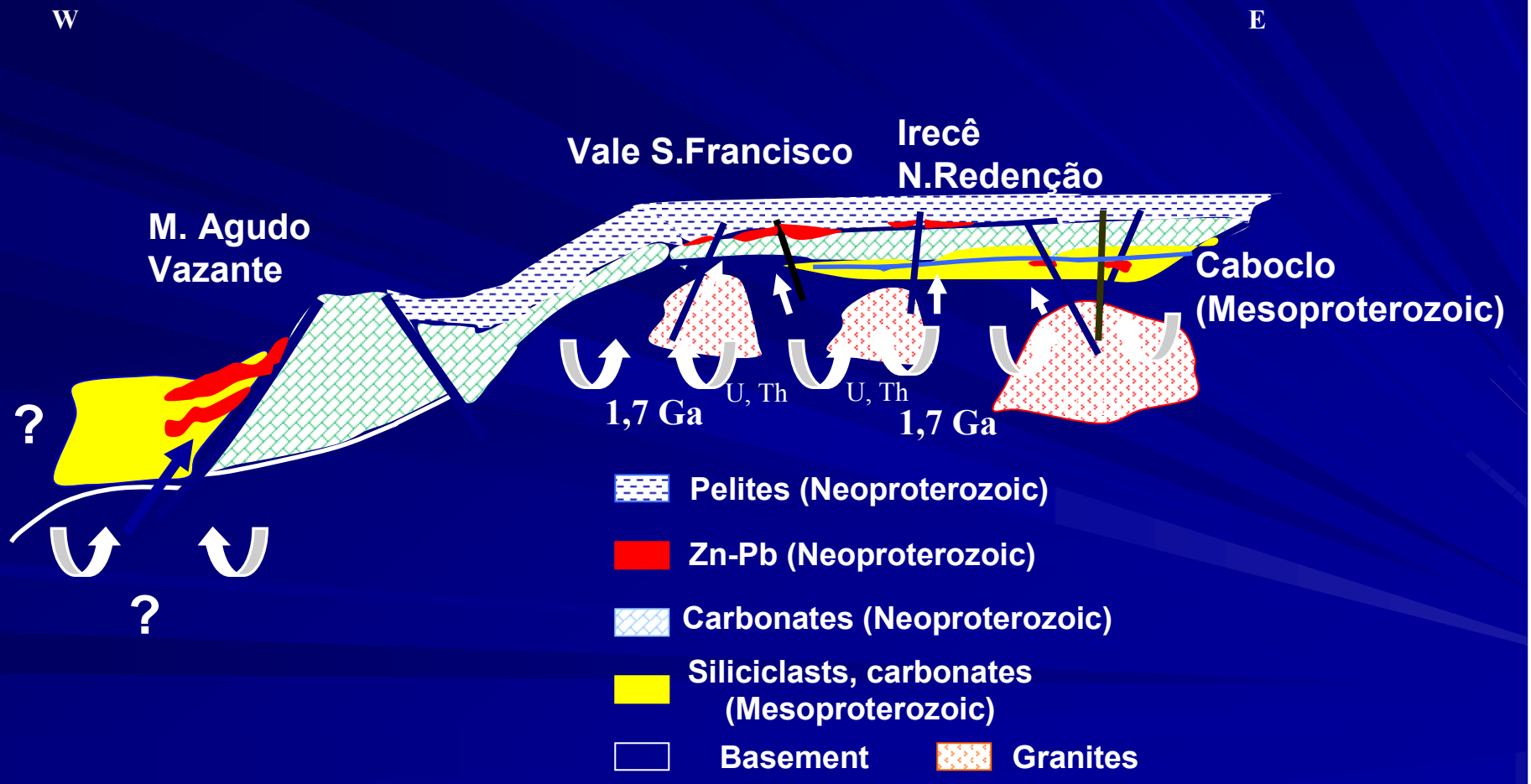
HHP granites?

Misi et al., 2004

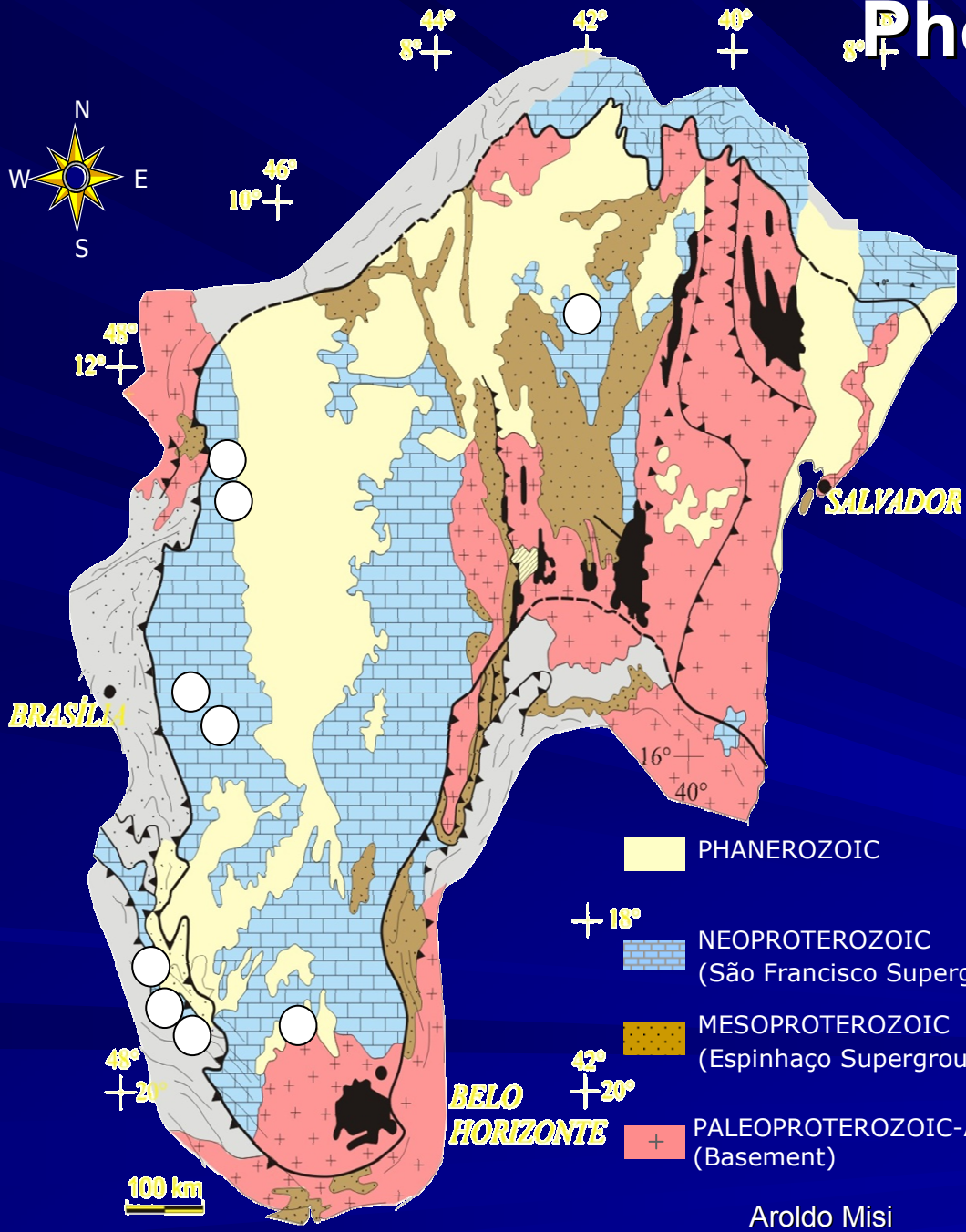
NEGATIVE BOUGUER ANOMALIES AND Pb-Zn MINERALIZATION



A POSSIBLE METALLOGENIC EVOLUTION MODEL FOR THE Zn-Pb DEPOSITS OF THE SÃO FRANCISCO CRATON



Phosphate deposits of the S. Francisco Craton

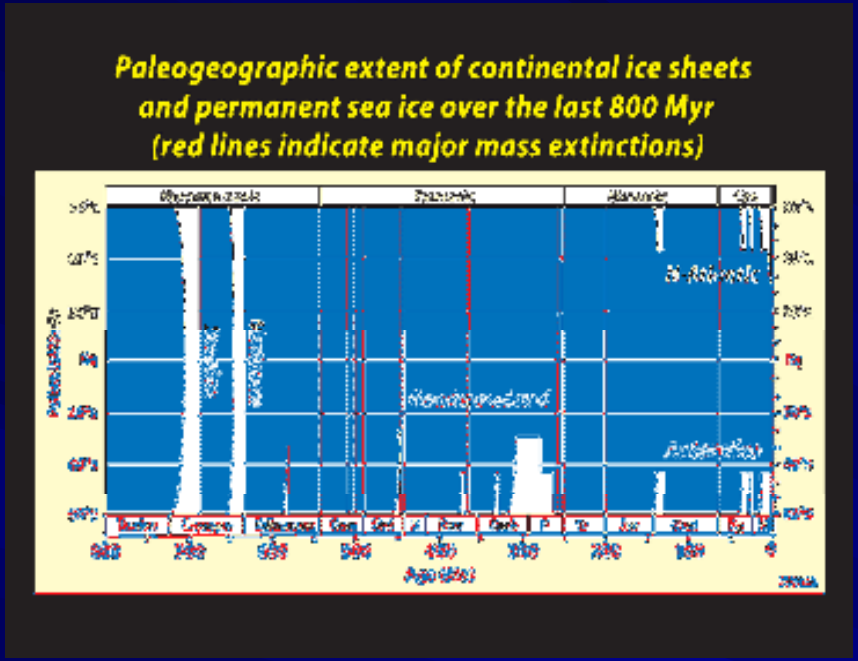


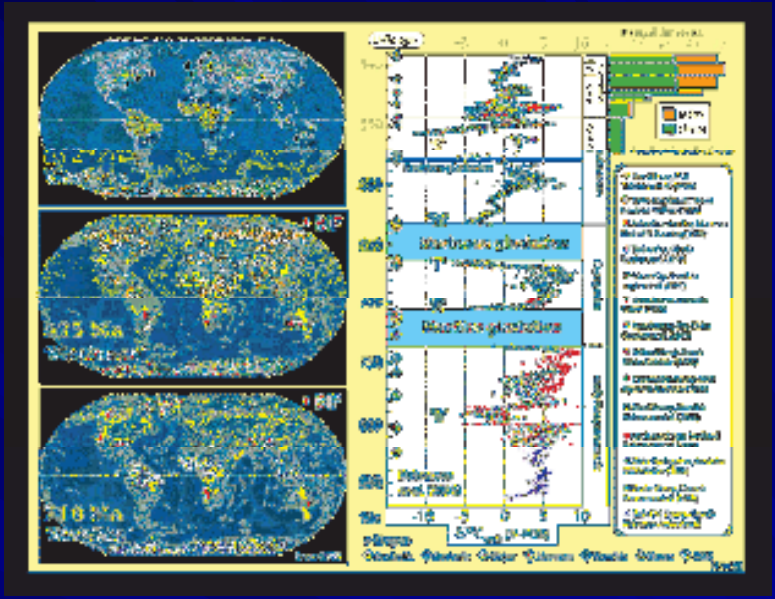
1. Campos Belo
2. Nova Roma
3. Formosa
4. Cabeceiras
5. Vazante
6. Lagamar
7. Rocinha
8. Cedro do Abaeté
9. Irecê

Some factual information about phosphorites and phosphogenesis

- 20% of the phosphate production of the world comes from Precambrian and Cambrian phosphorites.
- The formation of phosphorites is episodic and related to events of global extent.
- During the Proterozoic the most important phosphogenic events occurred in the Neoproterozoic Era: (i) 700-800 Ma and (ii) 620 Ma (Cook & Shergold, 1980).

Snowball Earth

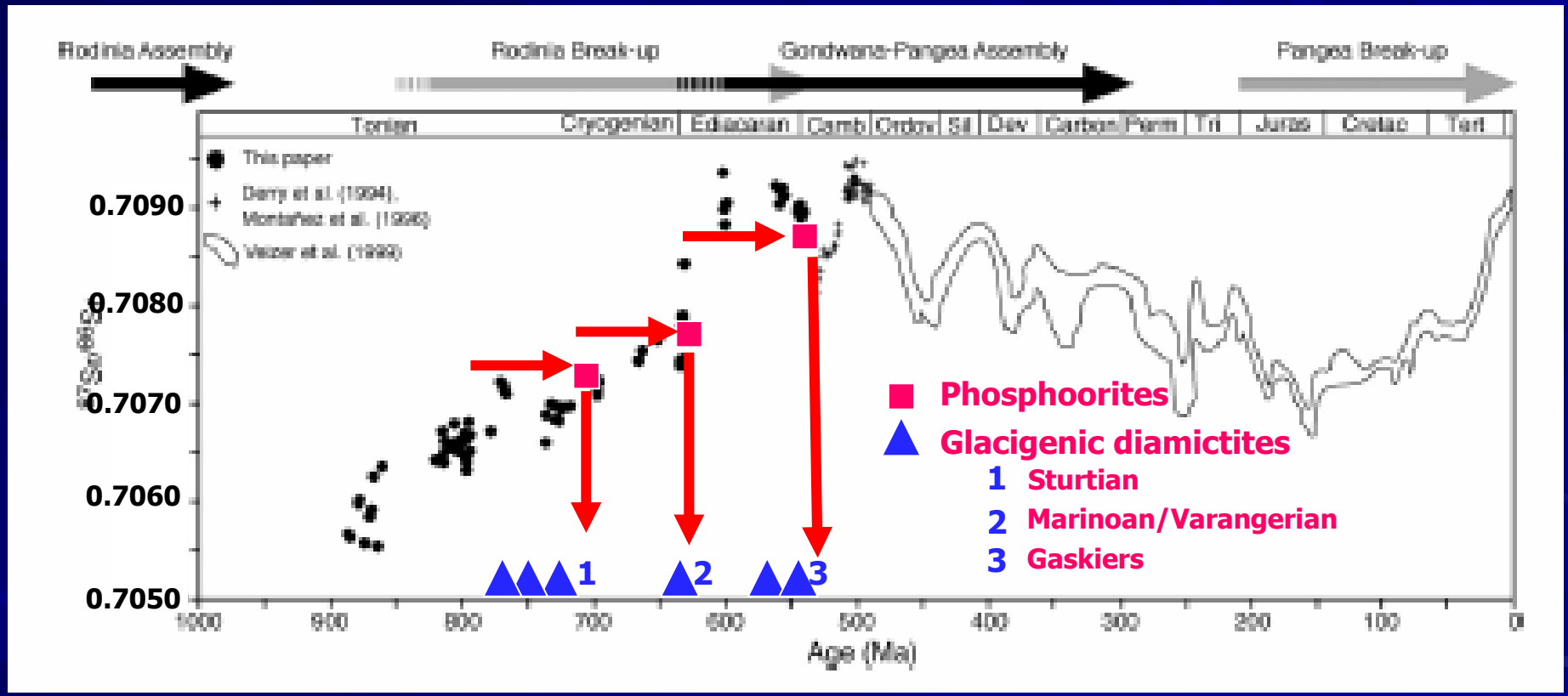




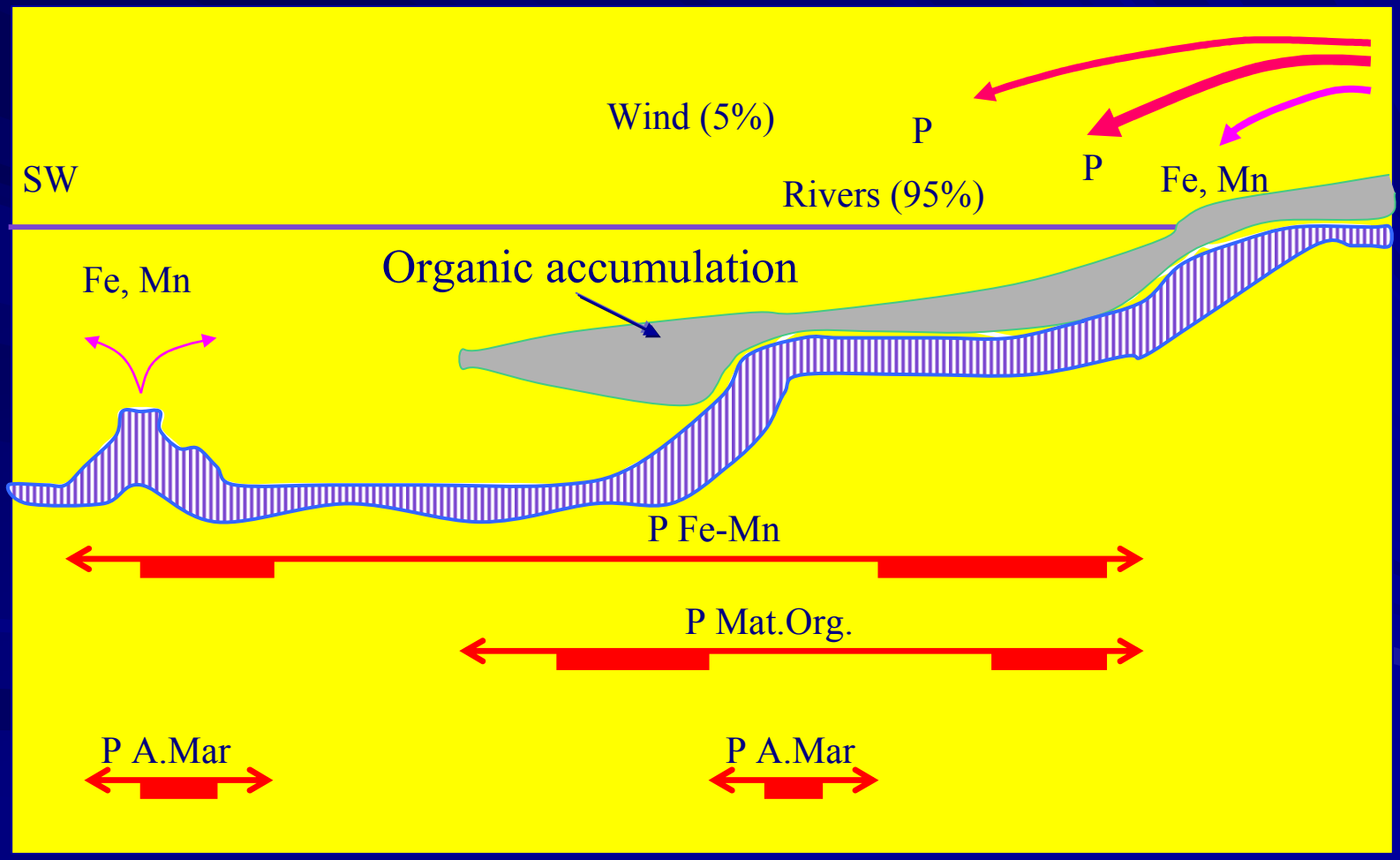
Marinoan Glaciation

Paul Hoffman: www.snowballearth.org

Glacial events and phosphate deposits Neoproterozoic Era

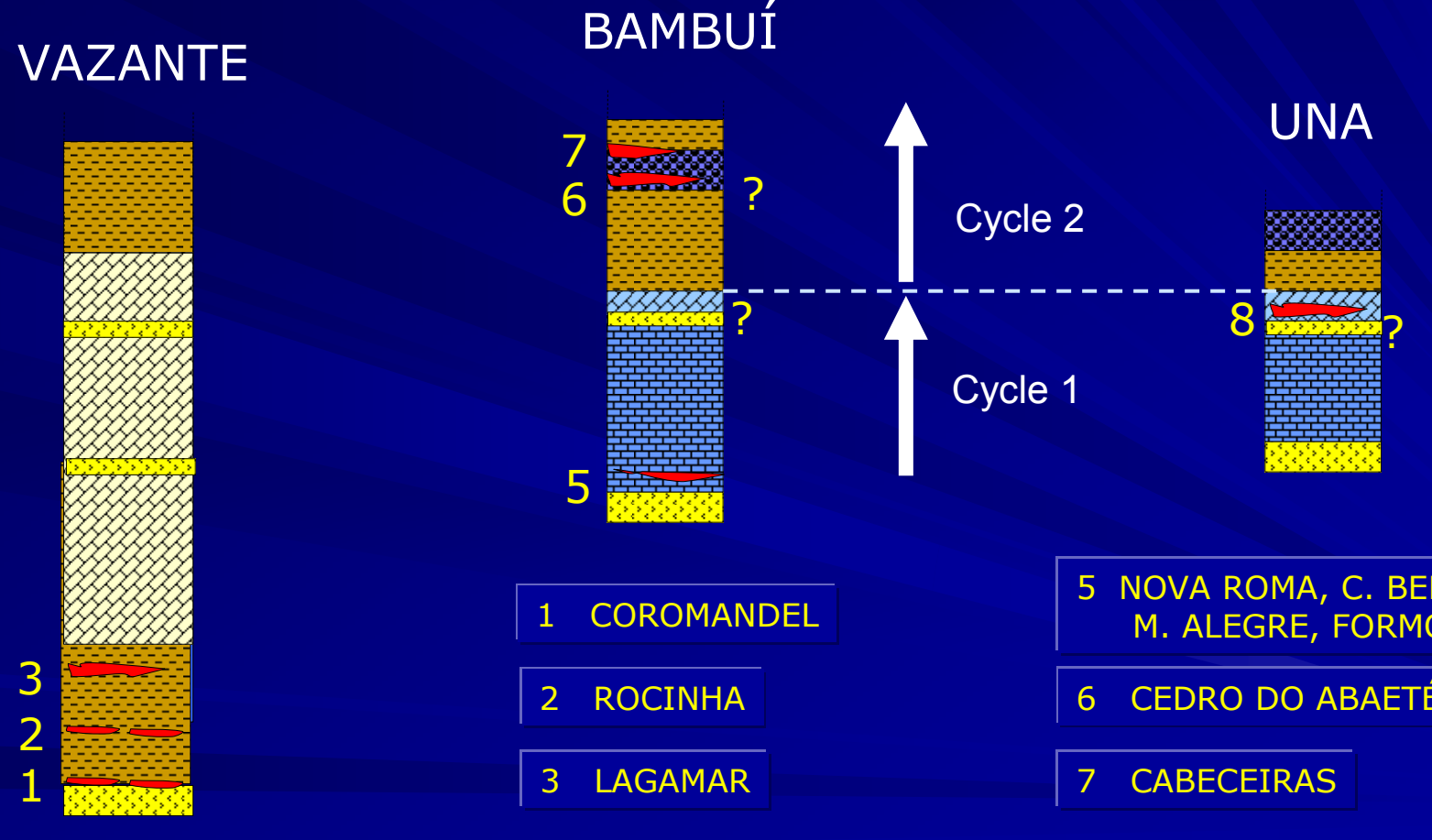


P CYCLE AND P_2O_5 CONCENTRATION



Cook & Shergold, 1986

Stratigraphic controls of the phosphate deposits: related to glacial events ?



1 COROMANDEL

2 ROCINHA

3 LAGAMAR

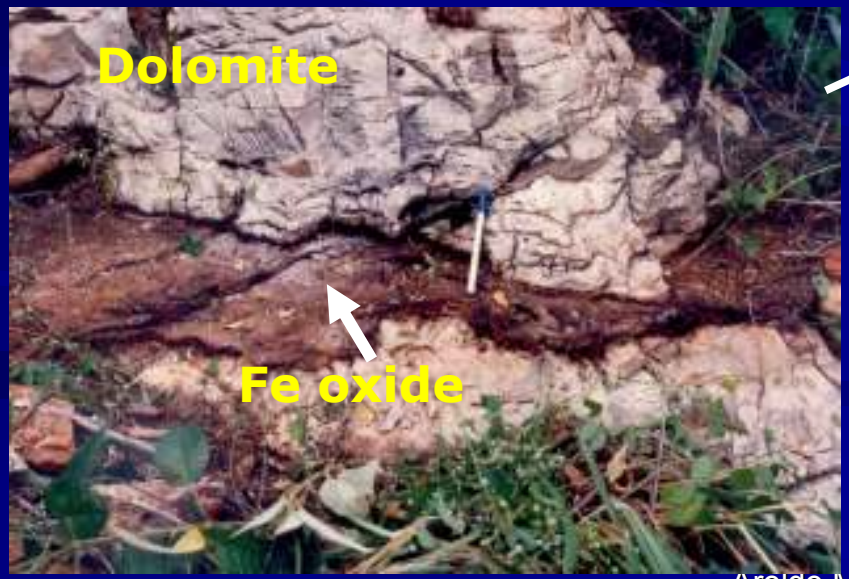
5 NOVA ROMA, C. BELOS, M. ALEGRE, FORMOSA

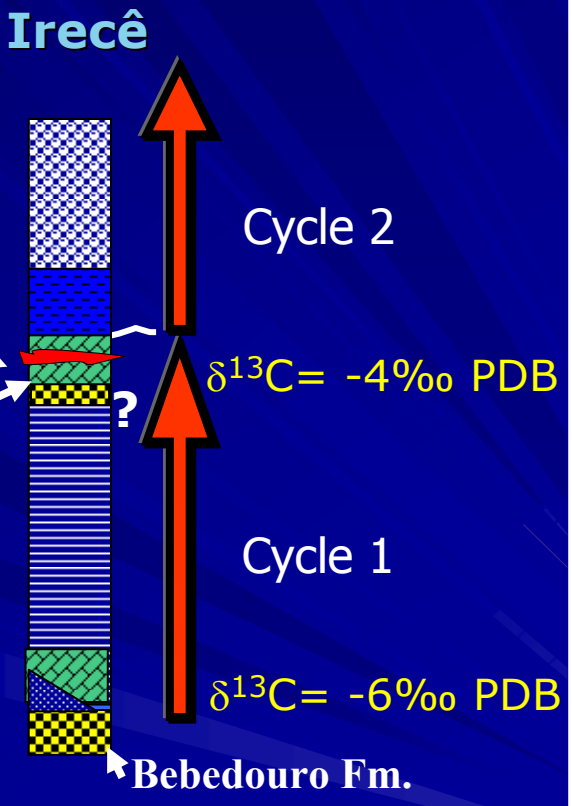
6 CEDRO DO ABAETÉ

7 CABECEIRAS

8 IRECÊ

Irecê Basin





Diamictite

Phosphorite

Irecê (Una Group)

Stromatolitic phosphorite
Initial reserves: 240 Mt 14% P_2O_5

Lagamar (Vazante Group)

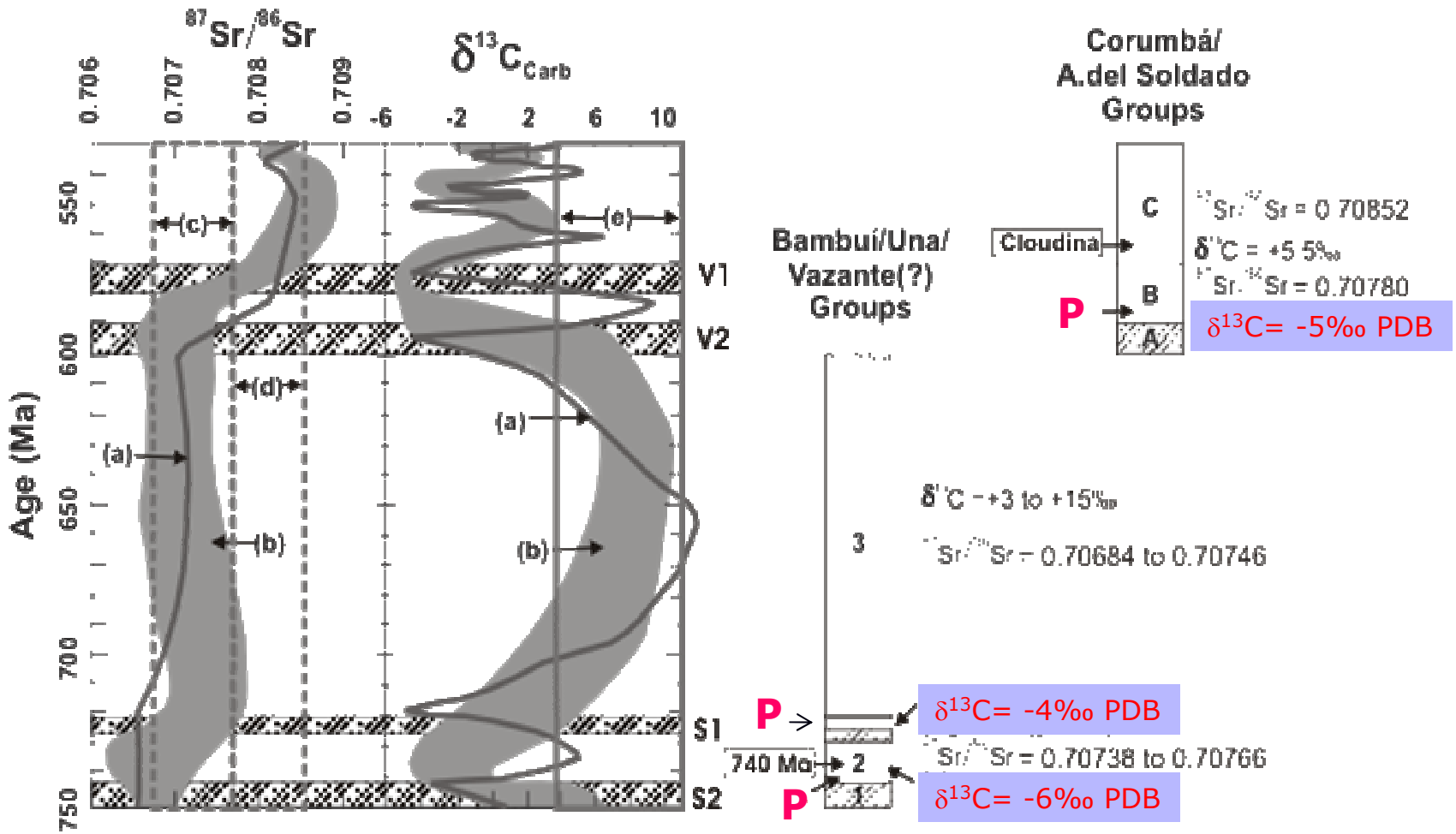
Banded phosphorite Initial reserves: 5 Mt 35% P_2O_5

Rocinha (Vazante Group)

Banded phosphorite Initial reserves: 200 Mt 12% P_2O_5

Least $^{87}Sr/^{86}Sr$ ratios from Rocinha, Lagamar and Irecê

	Sr (ppm)	$^{87}Sr/^{86}Sr$	
	Phoosphorite	Phosphorite	Micrite
ROCINHA	5680	0.70766	0.70760
LAGAMAR	2095	0.70767	-
IRECÊ	623	0.71263	0.70762



Bambui/Una/Vazante(?) Groups

3 - carbonate sequence "2"
2 - carbonate sequence "1"
1 - glaciogenic sequence (Jequitaí/Bebedouro/ Santo Antonio do Bonito(?) Formations)

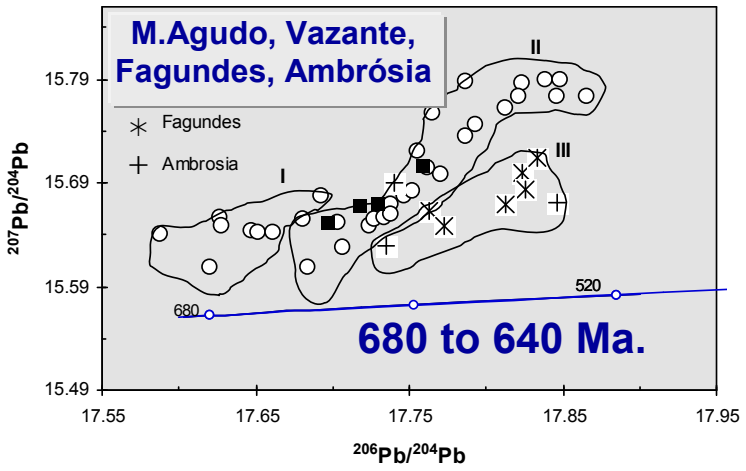
Corumbá/Arroyo del Soldado Groups

C - carbonate sequence "2"
B - carbonate sequence "1"
A - glaciogenic sequence (Puga Formation)

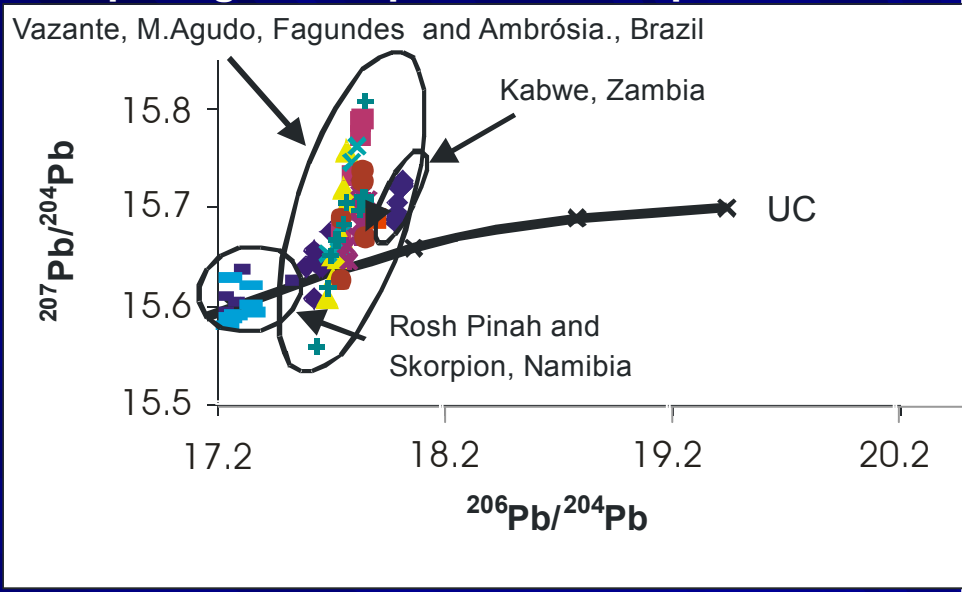
Misi et al., 2007 (modified)

Ages of Zn-Pb and Phosphate deposits, Vazante Group

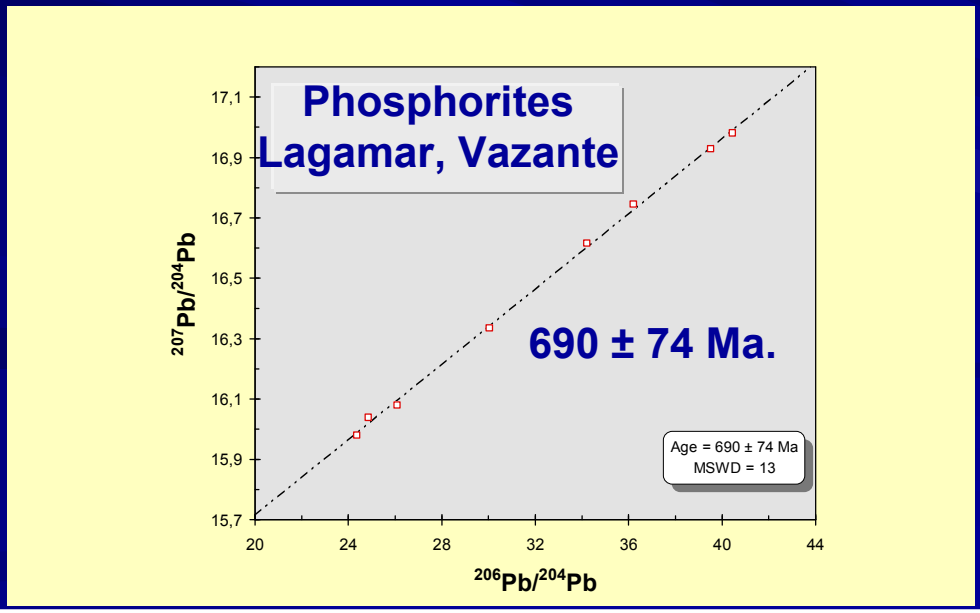
Pb-Pb isotope age: Zn-Pb deposits, Vazante



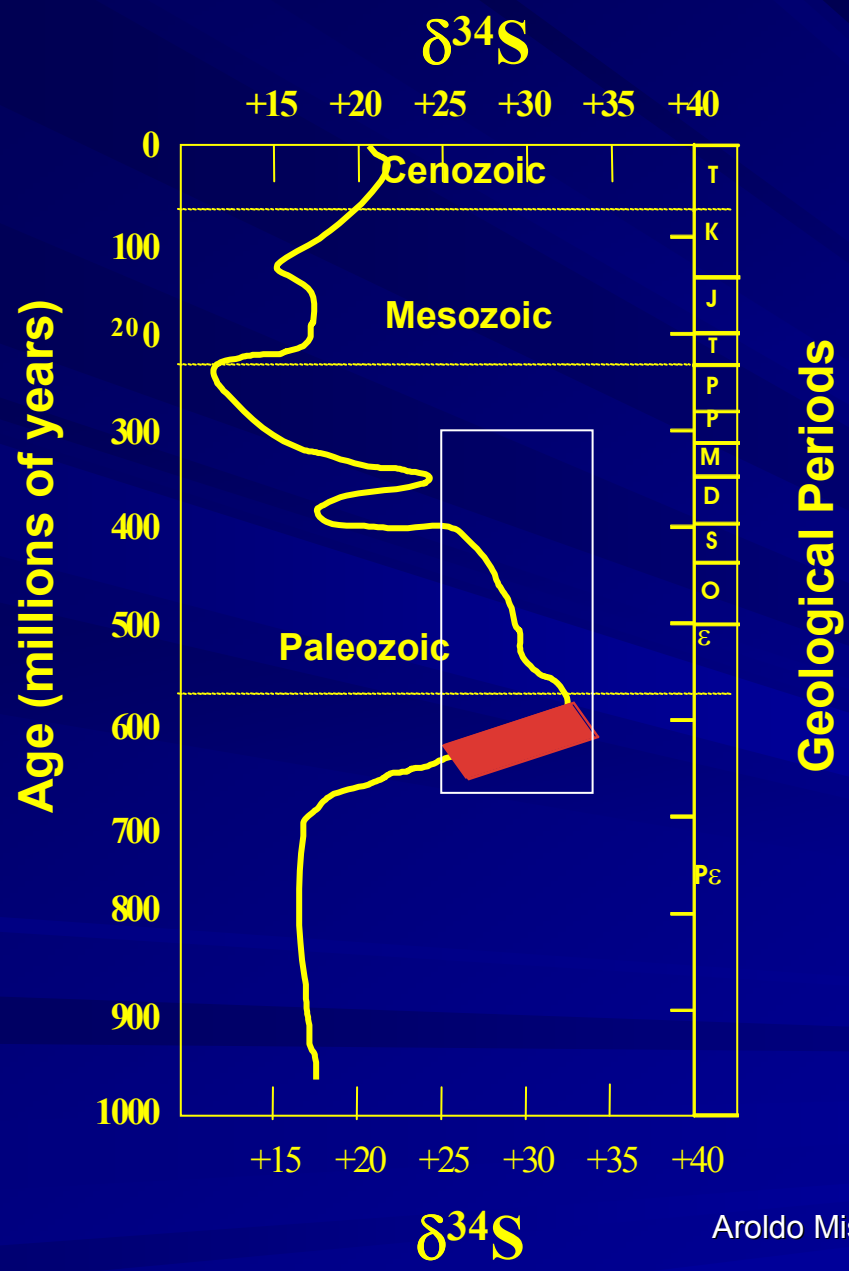
Comparing w/ Neoproterozoic equiv. in Africa



Pb-Pb age (leachates): P deposits, Vazante



Estimated ages from $\delta^{34}S$ of sulfates



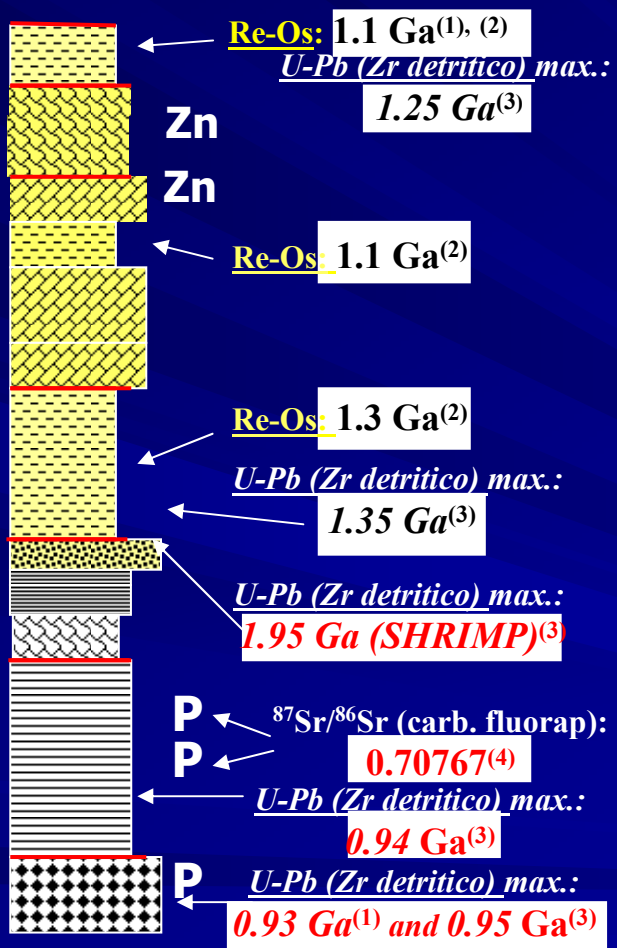
SULFATES
(CDT)

Irecê	+29 (n = 13)
Nova Redenção	+37,5 (n = 4)
Morro Agudo/ Vazante	+24,6 (n = 19)

Misi et al., 2005

The Vazante Group: Ages

Conventional units (Formations)
(Dardenne et al., 2001)



S. da Lapa

M. do Calcário

S. do Poço Verde

S. do Garrote

Lagamar

Rocinha

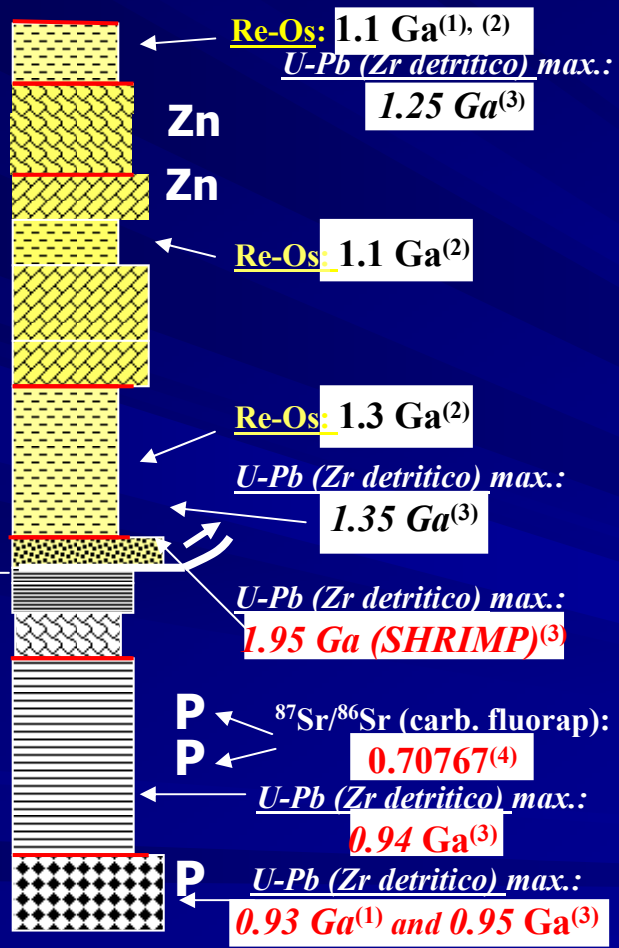
Sto.Antonio do Bonito

(1) Azmy et al., 2008
(2) Kaufman et al.,2007 (unp.)
(3) Rodrigues et al., 2008
(4) Misi et al., 2007

The Vazante Group now: A possible interpretation

Work hypothesis

Conventional units (Formations) (Dardenne et al., 2001)

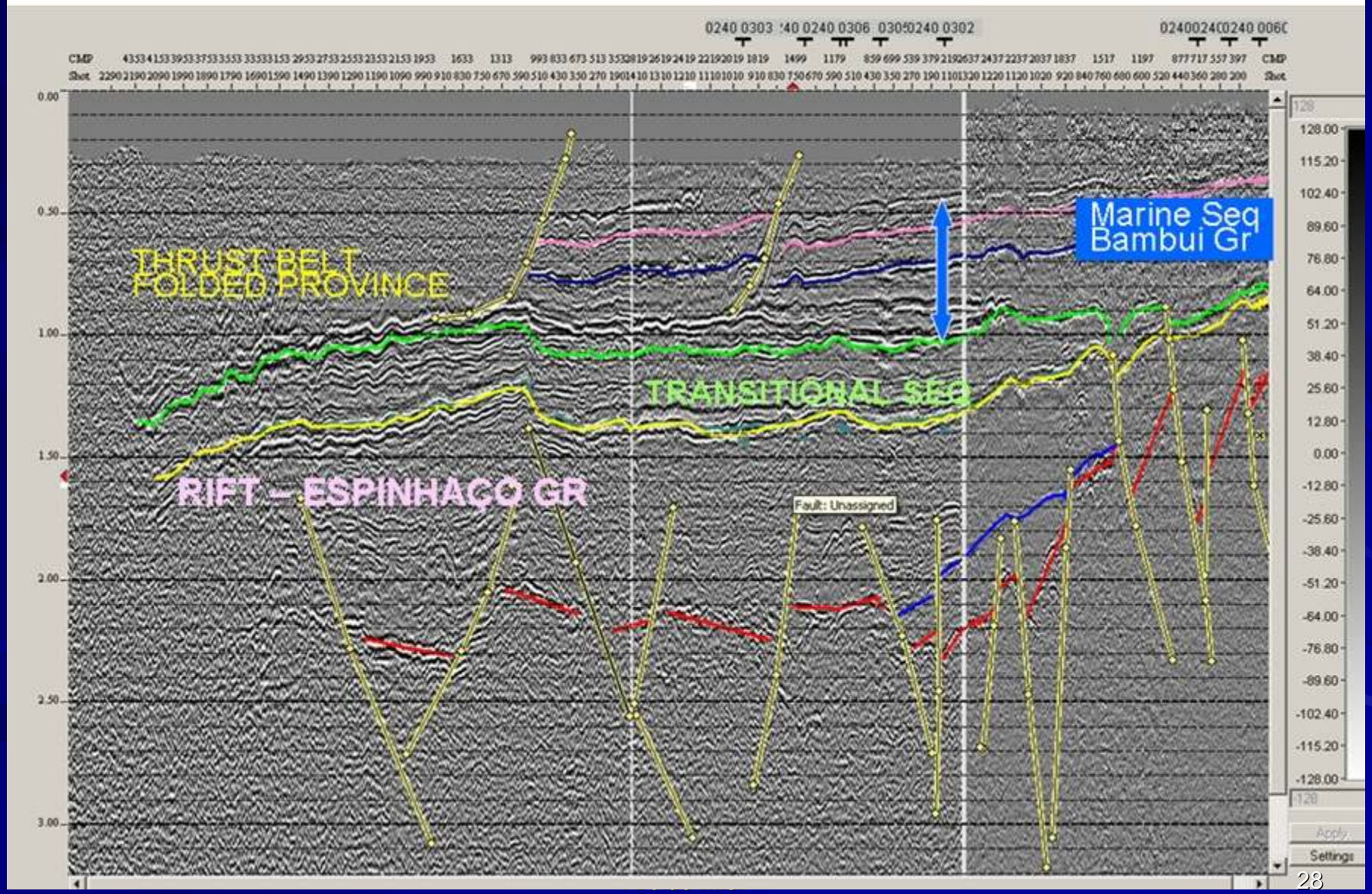


Rocinha

Sto.Antonio do Bonito

(1) Azmy et al., 2008
(2) Kaufman et al.,2007 (unp.)
(3) Rodrigues et al., 2008
(4) Misi et al., 2007

Seismic section across the SW border of the SF Craton (by Petrobras)



CONCLUSÕES

- Os eventos metalogenéticos (Zn-Pb) e fosfogenéticos das bacias Proterozóicas intracratônicas e de margens passivas do Cráton do São Francisco estão relacionados a eventos globais ocorridos durante a Era Neoproterozóica.

- Esses eventos estão bem representados no Grupo Vazante, em duas seções com idades distintas, separadas por uma falha de empurrão, que coloca sequências mais antigas (mesoproterozóicas), mineralizadas em Zn-Pb, sobre outras mais novas (neoproterozóicas), mineralizadas em fosfato.

- Os modelos de exploração mineral devem considerar a possibilidade de existirem outros depósitos econômicos de metais-base principalmente nas bacias de margem passiva, por causa da maior espessura do pacote sedimentar. Os fosforitos podem correr tanto nas bacias intracratônicas como nas de margem passiva, em ambientes sedimentares pós-glaciais..