SEG 100 Conference: Celebrating a Century of Discovery

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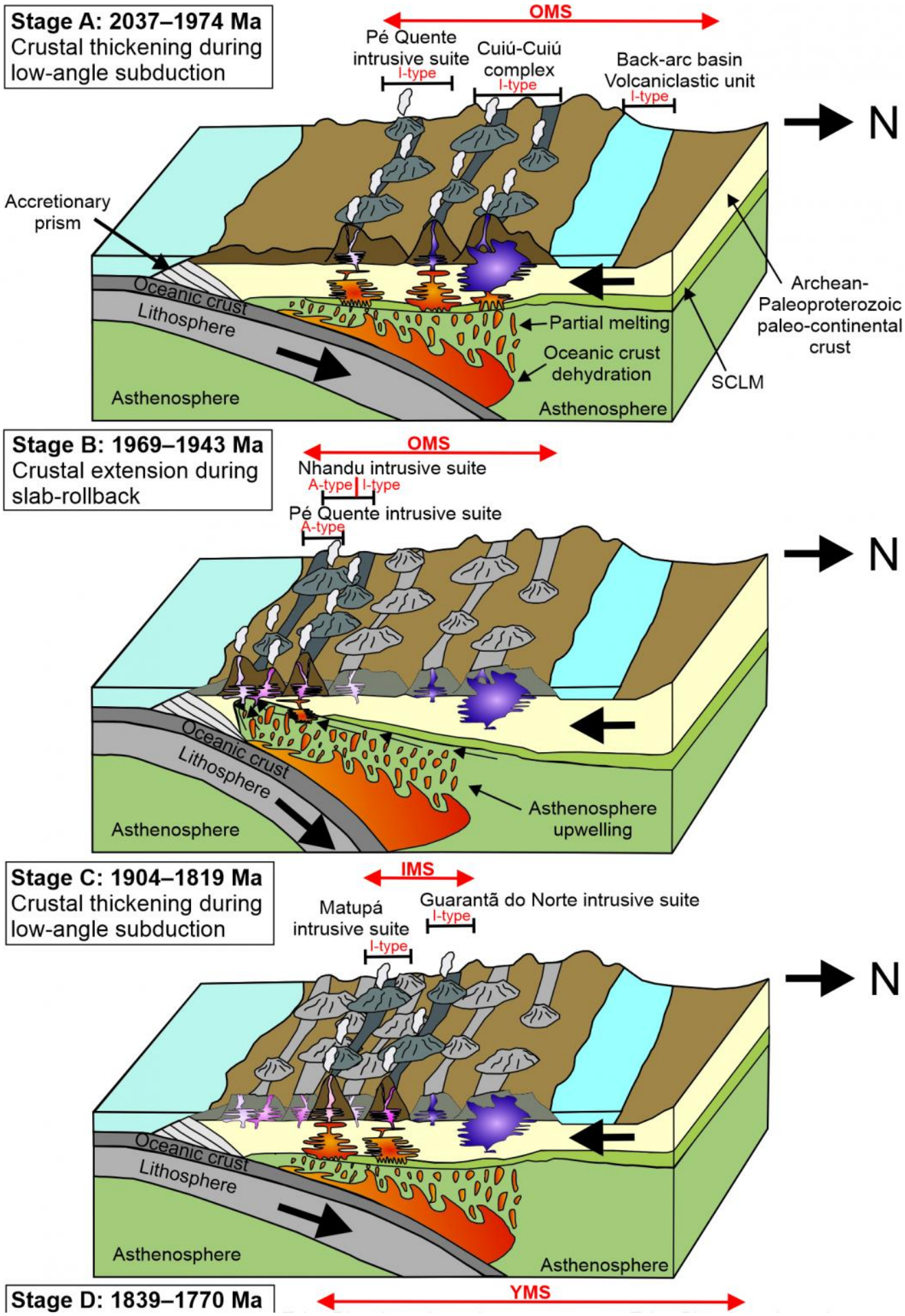
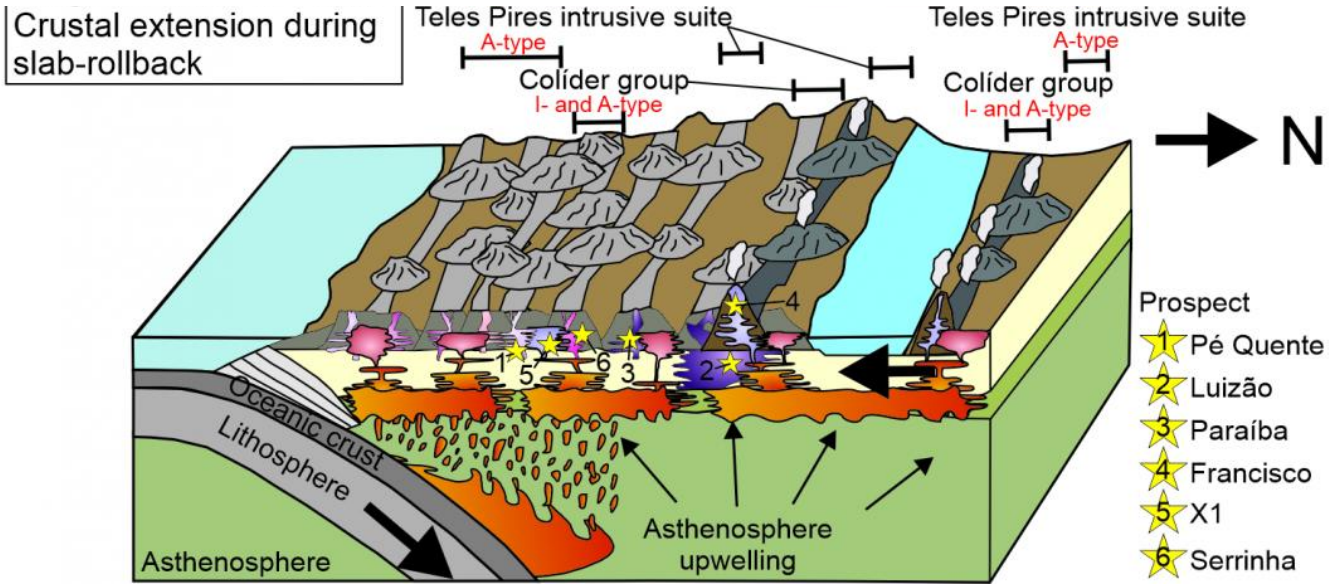
Crustal Evolution, Tectonics, and Magma Fertility of the Paleoproterozoic Alta Floresta Mineral Province, Amazonian Craton

Veronica Trevisan[1], Roberto Xavier[1], Steffen Hagemann[2, 3], Robert Loucks[2], João Motta[1], Andreas Petersson[3, 4], Anthony Kemp[2, 3], Gonzalo Henríquez[2], Luis Parra-Avila[3], Jian-Feng Gao[5], Rafael Assis[6]
1. Institute of Geosciences, University of Campinas, Campinas, SP, Brazil, 2. Centre for Exploration Targeting, The University of Western Australia, Crawley, WA, Australia, 3. School of Earth Sciences, The University of Western Australia, Crawley, WA, Australia, 4. Swedish Museum of Natural History, Stockholm, Sweden, 5. State Key Laboratory of Ore Deposit Geochemistry, Chinese Academy of Sciences, Guiyang, China, 6. Institute of Geosciences, University of São Paulo, São Paulo, SP, Brazil

The Alta Floresta Mineral Province (AFMP) constitutes a belt approximately 500 km long by 100 km wide in the southern portion of the Amazonian Craton. The province comprises numerous compositionally heterogeneous acidic intrusions, acidic to intermediate volcanic rocks, and subordinate volcaniclastic rocks and granitic gneisses. These rocks are hosts to several disseminated and vein-type intrusion-hosted Au-Cu-Mo, Cu-Mo-Au, and Au-Zn-Pb-Cu primary deposits and prospects. These mineral occurrences have been interpreted as Paleoproterozoic porphyry and epithermal-style mineral systems. Despite abundant information in the literature about the hydrothermal alteration, ore mineralogy, fluid regime, mechanisms of metals precipitation, and timing relationships between mineralization and magmatism, relatively little is known about the source and evolution of the magmatism using an integrated approach across the eastern portion of the province and at a regional scale. This situation impedes understanding of the magmatic history, establishing links to regional-scale tectonic events, and identifying potentially Cu- and Au-fertile geologic units. The main objective of this study is to constrain the crustal evolution and magma fertility potential of the eastern portion of the AFMP by reconstruction of the chronochemical evolution of the magmatism, reinterpretation of the stratigraphy and new characterization of magmatic framework and geodynamic evolution, examination of whole-rock and zircon chemical compositions to characterize Cu- and Au-ore-related magmas, and identification of geologic units potentially prospective for Cu and Au mineralization. The obtained results revealed that i) magmatism in the eastern portion of the AFMP occurred from 2037 to 1757 Ma; ii) the region evolved within an accretionary orogenic system with tectonic switching that alternates between low- and normal-angle subduction; iii) precious- and base-metal porphyry- and epithermal-style mineral systems formed from 1.83-1.75 Ga during crustal extension or relaxation; iv) the eastern portion of the province correlates with the eastward Tapajós Mineral Province and records magmatism of the Western Amazonia Igneous Belt; v) the evolution of this region and other Proterozoic terranes worldwide suggests that parts of the Columbia supercontinent operated in similar fashion to Phanerozoic Andean-type accretionary orogens; vi) the whole-rock geochemistry represents an exploration tool to assess Cu- and Au prospectivity with some limitations because of the strong hydrothermal alteration that affects the rocks across the province; vii) zircon chemical analyses can be used as an efficient exploration tool to identify geologic units potentially fertile for Cu and Au; viii) the integration of whole-rock and zircon geochemistry with geochronology information is particularly useful to track the tectonic stress regime (e.g., compressive versus noncompressive) over time in the province; ix) the zircon geochemistry suggests that the Colíder group and, to a lesser extent, the Matupá and Teles Pires suites are the geologic units prospective for Cu and Au in the eastern portion of the province due to their high water content and high oxidation state; x) the identification of potentially prospective hydrous and oxidized magmas for Cu and Au mineralization across the eastern AFMP is encouraging and can help guide exploration for Cu and Au (e.g., porphyry- and epithermal-style deposits) in the southern Amazonian Craton.


Stage A: 2037–1974 Ma
Crustal thickening during low-angle subduction
OMS
Pé Quente intrusive suite
I-type
Cuiú-Cuiú complex
I-type
Back-arc basin Volcaniclastic unit
I-type
N
Accretionary prism
Oceanic crust
Lithosphere
Asthenosphere
Partial melting
Oceanic crust dehydration
Asthenosphere
SCLM
Archean-Paleoproterozoic paleo-continental crust
Stage B: 1969–1943 Ma
Crustal extension during slab-rollback
OMS
Nhandu intrusive suite
A-type
I-type
Pé Quente intrusive suite
A-type
N
Oceanic crust
Lithosphere
Asthenosphere
Asthenosphere upwelling
Stage C: 1904–1819 Ma
Crustal thickening during low-angle subduction
IMS
Matupá intrusive suite
I-type
Guarantã do Norte intrusive suite
I-type
N
Oceanic crust
Lithosphere
Asthenosphere
Asthenosphere
Stage D: 1839–1770 Ma
YMS


Crustal extension during slab-rollback
Teles Pires intrusive suite
A-type
Colíder group
I- and A-type
Teles Pires intrusive suite
A-type
Colíder group
I- and A-type
N
Prospect
1 Pé Quente
2 Luizão
3 Paraíba
4 Francisco
5 X1
6 Serrinha
Oceanic crust
Lithosphere
Asthenosphere
Asthenosphere upwelling