Paleoproterozoic gold deposits at Alta Floresta Mineral Province, Mato Grosso, Brazil: two overprinted mineralizing events?

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INTRODUÇÃO

Large gold provinces commonly show complicated mineralization histories, and the Paleoproterozoic Alta Floresta, one of Brazil's most exciting Au-Cu mineral provinces, is a good example. The current models defined four deposit types, all connected to a single (1.88–1.75 Ga) magmatic-hydrothermal event (Assis 2015; Trevisan 2015; Assis et al. 2017). However, the long Province history, diverse geodynamic environment, and older ages of Type-1 mineralization weaken the single metallogenic event and open the hypothesis of overprinted mineral events. Therefore, we propose type-1 as an older, granitoid-hosted orogenic mineralization, with subsequent overprinting by the magmatic-hydrothermal event related to types 2 and 3.

Geological context

The AFMP has an inlier nucleus, called Peixoto de Azevedo domain, of the older Tapajós–Parima Province (c. 2.05–1.97 Ga, volcanic arc-related rocks) surrounded and cut by younger rocks of the Rio Negro–Juruena Province (c. 1.82–1.52 Ma, an arc-related rocks) (Santos et al. 2000, 2015; Duarte et al. 2012, 2019) (Fig. 1).

The Alta Floresta Mineral Province deposits are roughly classified into four types (Paes de Barros 1997; Santos et al. 2001; Assis 2015, Assis et al. 2017): Type-1, Au+Cu shear zone-hosted veins, entirely hosted in the older granitic, granitic–gneiss and metamorphic rocks of the Peixoto de Azevedo domain; Type-2, Au–Cu porphyry deposits, also called Au+ Cu+ Mo disseminated deposits; Type-3, Au+Ag epithermal deposits, also called Au+ Ag+base metal fault veins; and Type-4, Intrusion-related gold deposits (IRGD), not this work focus. Complete references in the original paper (QR code).

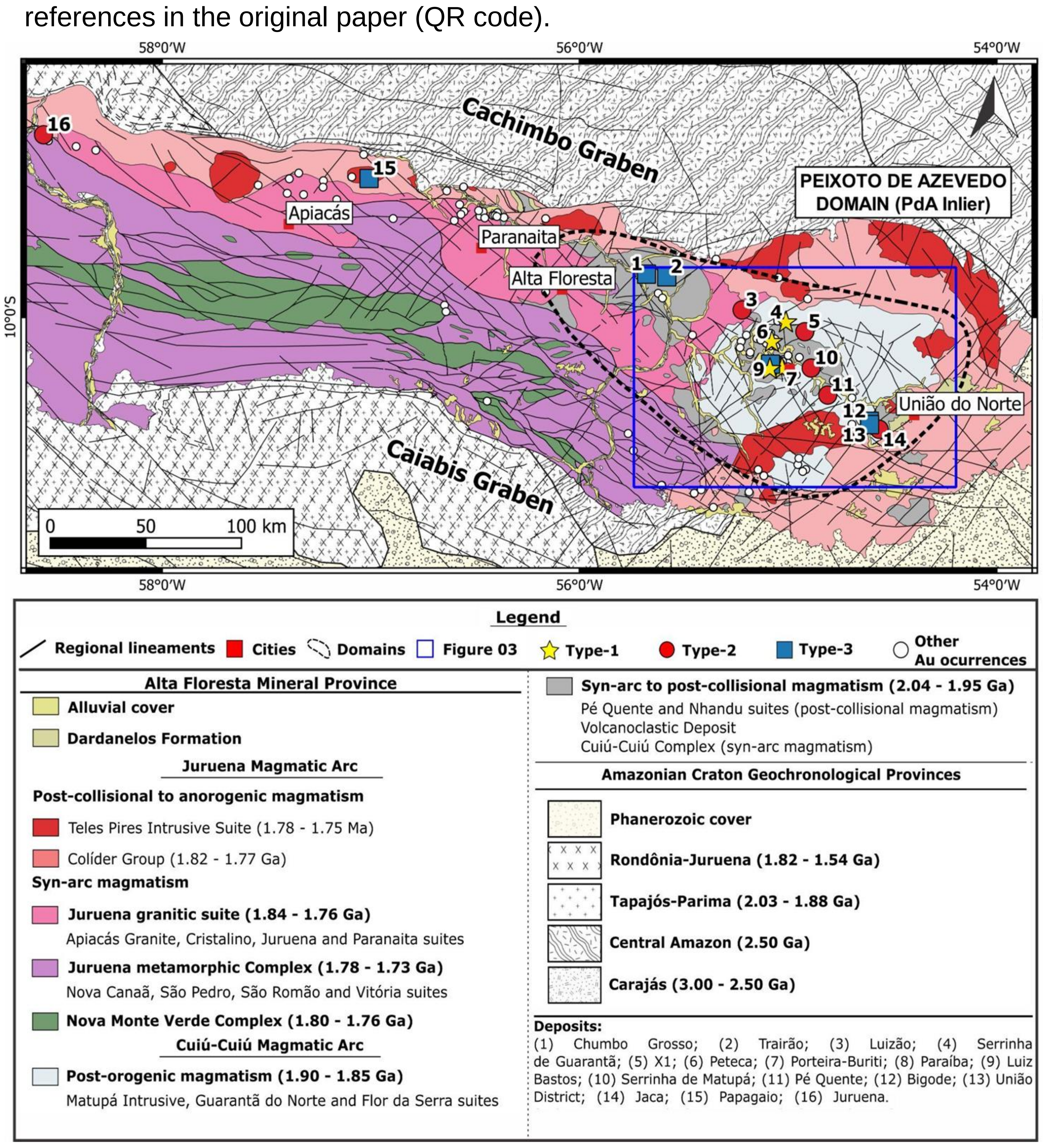

Figure 1: Simplified geological map of the Rondônia–Juruena and Tapajós–Parima provinces, highlighting the Peixoto de Azevedo Domain (black dashed-line contour). The main deposits are presented (modified from Lacerda Filho et al. 2004).

Results

The shear-hydrothermal gold event developed orogenic gold deposits on WNW-trending shear zones in the Peixoto de Azevedo domain granitic-gneiss rocks (Fig. 1).These rocks developed mylonites and phyllonites (Fig. 2a). Phengite-biotite-chlorite-carbonate phyllonites host fault-fill quartz veins (Fig. 2b).The ore is pyrite, chalcopyrite, magnetite, pyrrhotite, gold, and Bi-Ag tellurides. Mg-rich chlorite-phengite is the main footprint for this mineralization type. The chlorite-white mica P-T conditions are 3.3-6.1 kbar and 300º-420ºC Fig. 3).

A younger magmatic-hydrothermal event developed Au-Cu deposits along the Juruena magmatic arc, related to the deposits Types 2 and 3 (Fig. 1). These rocks produced Fe-rich chlorite-white mica alteration zones. The Jaca Type-2 ore is disseminated and stockwork in diorite porphyry (Fig. 3c). A Type-D pyrite veinlets with sericite-quartz halos (are recognized (Fig 3d). Type-3, epithermal deposits, occur in breccia and several veinlets generation (Fig. 2e, f). The ore assemblage are pyrite, chalcopyrite, gold, molybdenite, Ti minerals, allanite. Where the younger mineralization overprints the older, phyllic alteration destroyed the phengite orogenic gold phyllonite S_{n+1} foliation. The chlorite-white mica P-T conditions are 0.6-4.6 kbar, 120º-380ºC.

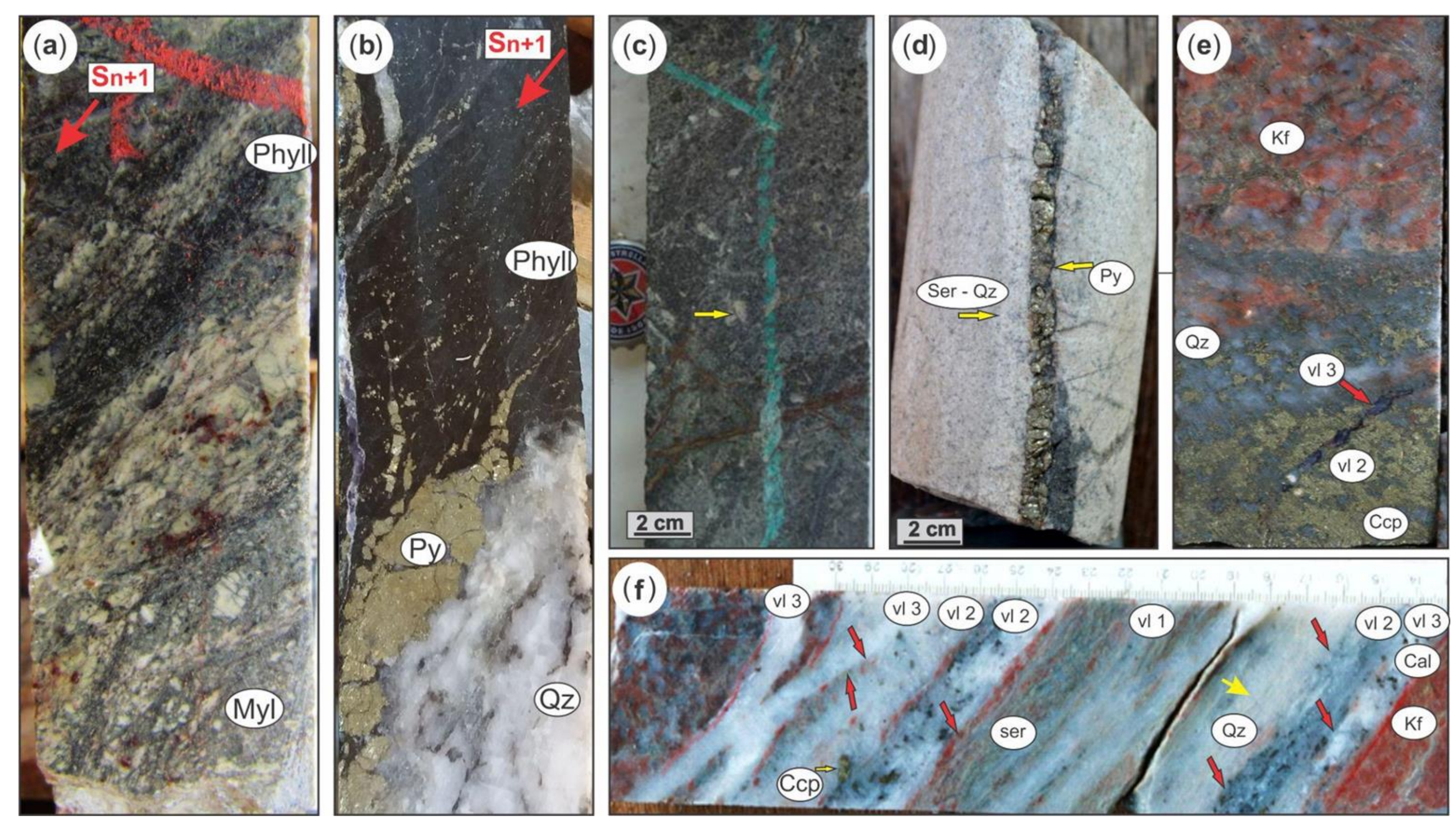

Figure 2: **(a)** Type-1 deposit, mylonitic-phyllonitic fabric in metagranodiorite, with S_{n+1} foliation. **(b)** Type-1 deposit, phlogopite–carbonate phyllonite hosts the gold quartz vein (Paraíba deposit). **(c)** Type-2 deposit, sericitized plagioclase porphyritic intrusion. **(d)** Type-2 deposit, typical Type-D pyrite veinlet with sericite–quartz halo host in arkose (Jaca deposit). **(e)** Type-3 deposit, quartz–sulfide veinlet 2 cut by millimetric quartz–fluorite veinlet 3 in a K-feldspar–hematite altered granite. Absence of an alteration halo in the veinlet 2 wall. **(f)** Multiple interlayered generation of veinlets in a K-feldspar–hematite alteration: quartz–sericite veinlet 1, in the centre. The vl 1 is cut by the sulfide–quartz vl 2, further cut by silica–calcite vl 3. Red arrows indicate the cross-cut relationships.

Discussions and Conclusions

The ages of two pyrite populations (1979 and 1841 Ma, Paes de Barros 2007 and Assis et al. 2017) in the older fault-fill veins and molybdenite in late fractures (1805-1782 Ma, Acevedo 2014; Assis 2015; Rocha et al. 2020) or disseminated in the ca. 1.79 Ga syenogranite porphyry suggest more than two episodes of mineralization. These two events differ in their alteration zones, structural, mineralogical, and textural ore styles (Fig. 1, 2). These also shows different P-T conditions, where the orogenic deposits develop in higher T and especially variable P than the porphyry-epithermal deposits. The fluid pressure gradient is assigned to fault-valve behavior in the shear zones. The multi-scale approach enlightens the relationships between the various mineralization events, allowing a new explorational potential within the province.

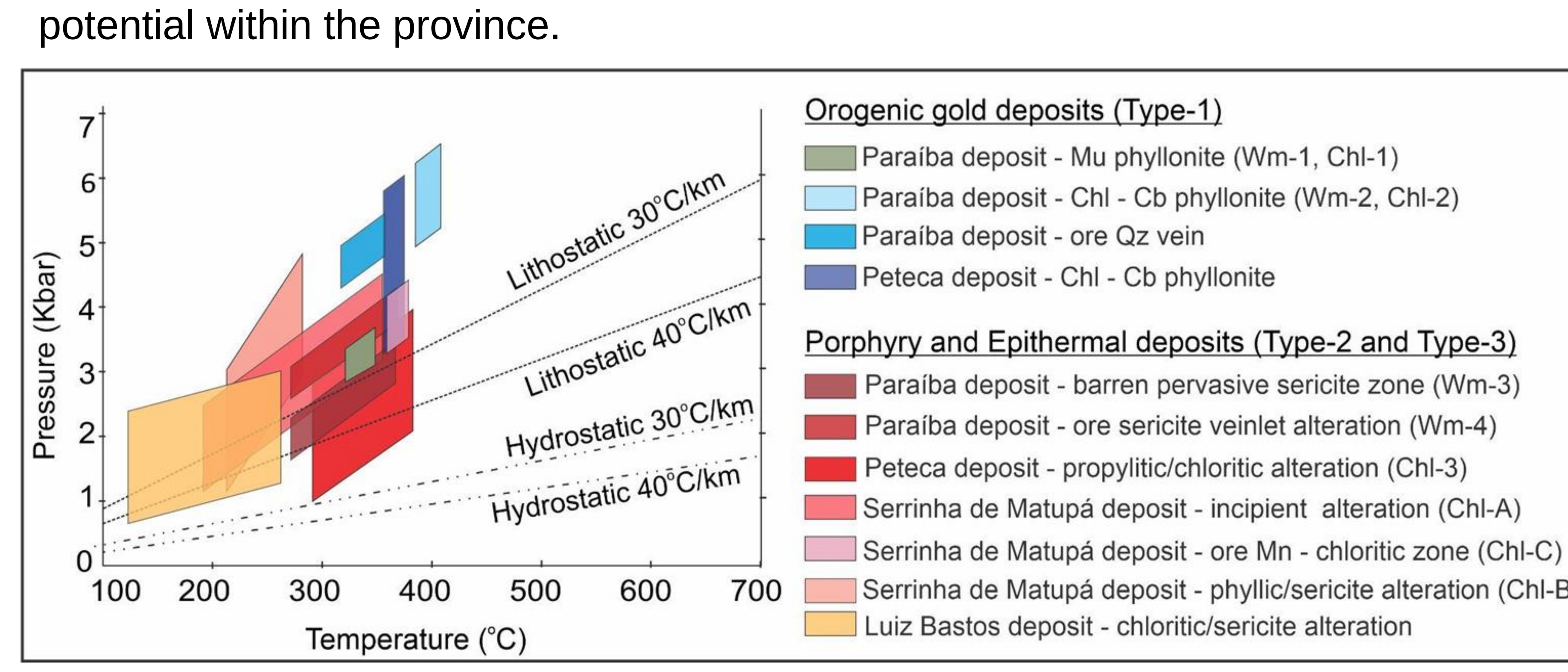

Figure 3: P–T reconstruction based on chlorite geothermometer vs. white mica geobarometer of the same alteration zone for each deposit.

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