TEKTONIKA

Review Report

Perret et al. - Crustal to microscale strain partitioning during transpression and control on ore formation: insights from the Paleoproterozoic Séguéla shear zone, southern West African Craton. TEKTONIKA, 2025.

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1st Round of Revisions

Decision letter

Due to a technical error, the official decision letter is not recoverable. In it’s stead here we provide the unofficial e-mail to the corresponding author, notifying them of the manuscript decision.

Hi Julien,

Many thanks for your patience regarding your submission to Tektonika. We have now made a decision and recommend some revisions. I've sent a message via our website with all the details but on pressing submit was told it didn't send, though I can see it in the 'sent messages' page. Can you let me know whether you got it, and if not I will resend all the necessary info.

Kind regards,

Craig Magee

Comments by Reviewer A (Gerold Zeilinger) and author response

See review form.

Comments by Reviewer B (Sebastian Zapata) and author response

The manuscript titled “Crustal to microscale strain partitioning during transpression and control on ore formation: insights from the Paleoproterozoic Séguéla shear zone, southern West African Craton”, submitted to Tektonika by Perret et al., presents a thorough, well-documented, and well written micro- and mesoscopic structural data obtained in surface outcrops and drill cores along the mineralized Séguéla shear zone. The work has important implications for understanding both the tectonic evolution of the region and the relationship between transpressional deformation and structurally controlled mineralization. I consider this contribution suitable for publication in Tektonika following minor revisions. Below, I detail my main and specific comments:

1. The introduction can be improved. It begins with an extended theoretical review of transpression, followed by abrupt transitions into geological and methodological details. It will be better to first identify key knowledge gaps and frame the research objectives clearly.

The two first paragraphs of the introduction have been rewritten to address these comments (see response to point 5).

2. The manuscript lacks discussion on the origin of the mineralizing fluids and their tectonic controls. Since tectonic processes often control both deformation and fluid migration, a more detailed discussion in either the Geological Setting or Discussion sections would strengthen the manuscript.

This is a fair point, but it lies somewhat beyond the scope of the paper and is not supported by the data presented. The source of mineralising fluid for orogenic gold deposits is highly debated and discussing the origin of mineralising fluids would require the integration of multiple datasets, such as stable isotope analyses, fluid inclusion studies, and geochemical characterisation of ore and alteration-related mineral phases, which are not available in this structural geology-focused study. In addition, robust geochronological constraints on deformation (and therefore fluid circulation), as well as on magmatic events that could potentially release fluids contributing to intrusion-related or magmatic-derived gold deposits, are lacking in the study area.

As the only intrusions observed in the study area are likely pre-tectonic (Kwenko granite), we can reasonably infer that mineralising fluids are hydrothermal, which is also stated in the resource estimates reports documenting the district. This is now mentioned in the geological setting section. However, further discussion of their nature would be highly speculative, and even should the body of missing data were to be available (radiogenic and stable isotope signatures), these tend to give ambiguous signature that rarely (if ever) allow for a source identification (*e.g.,* Goldfarb and Groves, 2015). We hope this makes sense.

Finally, the tectonic control on ore-forming processes, such as fault reactivation driven by fluid overpressure and associated fault-valve behaviour is already addressed in Section 5.3.2.

3. The methodology is detailed and generally well-explained. However, a schematic figure showing the different vein types would improve clarity.

This is a valuable suggestion. However, numerous schematic representations illustrating the differences in textures and orientations of shear, shear-extensional, and extensional veins formed within the same system are already available in the literature. Rather than creating an additional figure that would add little to these existing examples, we have instead referred to several publications with figures that illustrate the different vein types for reference: *"Note that the differences in textures, orientations and formation mechanisms for shear, shear-extensional and extensional veins are widely illustrated in literature (e.g., Bons et al., 2012; Dubé & Gosselin, 2007; Hodgson, 1989; Jébrak & Marcoux, 2008; M. G. Miller, 2014; Robert et al., 1995; Sibson, 2020)".*

4. The temporal context of deformation events is only briefly addressed in Section 5.1.2. A more comprehensive discussion of timing, including correlation with regional tectonic events, is recommended.

A similar comment has been made by Reviewer A and we did our best to address it. In the absence of robust geochronological constraints, which we attempted to obtain but were unable to (absence of sufficiently large monazite, xenotime, titanite, or other hydrothermal accessory minerals coeval with deformation and mineralisation), it is difficult to be more conclusive without resorting to speculation. We have now emphasised this limitation more clearly and slightly expanded the discussion to elaborate on the protracted NW-oriented convergence during the peak to late Eburnean Tectonic Event.

Line-by-line comments

5. Line 46-56: The introduction is heavy on definitions and theoretical background. Consider a more engaging opening that emphasizes the relevance and significance of transpressional structures.

The opening of the introduction has been rewritten to start with the relevance of transpressional shear zones and their economic significance rather than a long definition sequence. The definitions and models of transpression are still mentioned in after context-setting, but they are less expanded than in the submitted version, so they support rather than dominate the opening.

6. Line 69: Expand on the link between transpression and ore formation, this is central to the manuscript and deserves early emphasis.

This link is now made in the first paragraph of the introduction for more emphasis.

7. Line 71: Clearly state the key structural and geodynamic concepts being tested or explored in the study.

We assume this refers to line 83 of the submitted manuscript. This point is now made more clearer in the revised version of the introduction: *"Understanding strain partitioning and influence of structural inheritance during transpression is therefore essential for deciphering regional tectonic evolution (Choulet et al., 2012; Diraison et al., 1998; Fossen & Tikoff, 1998; Solar & Brown, 2001; Wu et al., 2023) and linking it with ore-forming processes. In this study, we investigate these concepts through an integrated analysis of the Paleoproterozoic, north-striking Séguéla shear zone, that remains overlooked despite its strategic location for investigating the tectonic record of the Paleoproterozoic southern West African craton (sWAC) assembly, and its significant gold endowment."*

8. Line 76: Clarify what is meant by "strategic"?

We assume this refers to "strategic" line 88 of the submitted manuscript. The meaning of strategic has been explicated: *"In this study, we investigate these concepts through an integrated analysis of the Paleoproterozoic, north-striking Séguéla shear zone, that remains overlooked despite its strategic location for investigating the tectonic record of the Paleoproterozoic southern West African craton (sWAC) assembly, and its significant gold endowment.".*

9. Line 143: Any estimates or constraints on the timing of metamorphism would be informative

It indeed would, but there are no *P-T-t* constraints on metamorphism in this area. This is now clearly stated: *"The sequence underwent greenschist facies metamorphism (Criddle et al., 2021; Weedon et al., 2023), but there are no constraints on timing and pressure-temperature conditions reached to date."*

10. Line 147: Indicate the locations of mentioned regions on a map to improve geographic clarity.

An inset has been added in Fig. 1a for reference, as also requested by Reviewer A.

11. Line 160: Comment briefly on the tectonic context and timing of the deformation events, and consider addressing possible fluid origins here as well.

We assume this refers to line 188 of the submitted manuscript.

Please see points 2 and 4 for further comments on the tectonic context and on how the Séguéla record relates to the craton-scale tectonic evolution.

Regarding fluid origins (see reply to point 2), we now specify that the mineralisation is hydrothermal, as stated in the referenced reports. However, given the limited available evidence, it would be too speculative to make further interpretations about the fluid source.

12. Line 305: Consider mentioning bed thicknesses to add context to the sedimentary structures.

We assume this refers to line 350 of the submitted manuscript.

The related statement is deleted, but we now mention the bed thickness when describing the context of the Antenna deposit (section 2.3.2), where these beds have been properly documented: *"The Antenna deposit occurs along a north-striking sheared contact between a rhyolitic unit (up to ~150 m thick), interlayered with felsic volcaniclastics (up to 10 m thick) and a basaltic unit to the east".*

Acceptance letter

Julien Perret, Nicolas Thébaud, Denis Fougerouse, Crystal Brochard, Patrick C. Hayman, Mark W. Jessell:

We have reached a decision regarding your submission to ТЕКТОNIKA, "Crustal to microscale strain partitioning during transpression and control on ore formation: insights from the Paleoproterozoic Séguéla shear zone, southern West African Craton".

Our decision is to: Accept Submission