Solid Earth Discuss.,
https://doi.org/10.5194/se-2020-142-RC1, 2020

Interactive comment on "The Piuquencillo Fault System: a long-lived, Andean-transverse fault system and its relationship with magmatic and hydrothermal activity" *by* Jose Piquer et al.

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Received and published: 9 September 2020

The paper by Piquer and coauthors, on the structural characterization of a NW-striking fault system in the southern Central Andes, reports new fault kinematic data and performs stress inversion analysis, which are used to discuss the relationship between pre-existing structures, local stress field, and fluid migration. The results from these analyses are then integrated with geophysical data to provide an integral characterization of the fault system. The paper is well-written, and of wide interest to the broad Solid Earth audience. Below, I provide six recommendations on how to clarify and enhance the manuscript, to make it a stronger contribution: (1) Tectonic setting: To give

the manuscript a broader impact, I suggest adding a tectonic setting section, which can be integrated into the Geological-tectonic setting, with a synthesis of the Cenozoic extensional and compressional phases, and a description of the main structures of the area. Also, I would add a description of the Miocene intrusive complexes, such as the La Obra batholith. (2) Lithospheric-scale structures: Since there is no evidence that these fault systems involve the continental lithosphere, it is more convenient to name them as "continental-scale structural systems" (as they are called in the Discussion section). An alternative approach could be to use the available geophysical data and clearly propose the connection between the crustal structures and deeply-seated anisotropies. These geophysical data/analyses are just mentioned, but not properly presented as a discussion. (3) Kinematic vs dynamic analysis of fault-slip data: This must be more deeply discussed. Why do the authors perform these two kinds of analyses? What are the reduced stress tensors obtained from fault-slip data close to a major long-lived trans-crustal fault system telling us in terms of dynamics? Can they be interpreted as reflecting the stress of the crust during the movement of these structures? Since these structures have been previously generated during at least the Oligocene extension, or probably before (as the authors mention in the Discussion), these tensors are not probably reflecting a stress field because, in this case, one of the basic assumptions during the inversion technique, the one concerning the absence of interference between faults, is not properly fulfilled. I suggest that the authors discriminate between stations close to the main faults, from stations located far away from the main faults. For example, data from the Piuquencillo Alto area could be separated into two (close and apart from the NW fault). (4) Age of dikes and intrusives: You should clarify the relationship between the emplacement of dikes and intrusives, and movement along the study fault system. Are there any time constraints on this relationship? For example, what is the age of the Ag-Pb-Zn-Cu vein system in the San Pedro de Nolasco sector? In this respect, move paragraph 182-186 from the Discussion section to the Results section, and add any other information about the timing of emplacement of these intrusives and the timing of slips of the studied faults. (5) The fluid pathways.:

This idea must be broadened. Discuss here how sigma 1 is obtained. Are WNW and ENE conjugated strike-slip faults, or not? For each measurement station, add the main strike of dextral and sinistral faults, as well as the orientation of local stress tensor axes, and then compare them. As I pointed out above, it would be nice to have had previously discrimination between tensors obtained close to or far apart from the main faults. It is not clear to me why the ENE striking faults are optimally-oriented for the migration of fluids, while the WNW striking faults are not. If both sets are conjugate strike-slip faults, as stated in lines 201-202, why is one set more likely to dilate and the other one more likely to slip? In my opinion, more information about the strike of the local sigma 1 is needed to evaluate this proposal. Add a table containing: location of each station, number of measured faults, results of fault-slip inversion (orientation of principal stress axes and stress ratio), and lapse of time for each calculated reduced stress tensor. (6) Transient stress reversals: This statement is very questionable. It is difficult to explain a change from compression to extension as stress reversals during the coseismic stress release. Positive changes in the Coulomb failure stress (see Harris et al. 1998; Stein, 1999; King and Cocco, 2000; Freed 2005) bring receiver faults in the continental crust closer to failure, but the magnitudes involved in these stress changes are small (<1 MPa). The process is more related to the unclampling of the receiver faults, due to a drop in the normal stress that prevents the slip during the interseismic period. See Spagnotto et al (2015), who explore how changes in the Coulomb conditions associated with the Maule earthquake triggered upper-plate earthquakes. They argue that the reactivation of faults after a mega-earthquake at the subduction interphase derives from unclamping processes associated with co-seismic dilatation deformation inferred from GPS observations. To summarise, I recommend that this important paper for the understanding of the relationship between pre-existing structures, local stress field and fluid migration should be published in Solid Earth, after some important points are addressed to make it an even stronger contribution.

Sincerely, Laura Giambiagi

Minor comments are listed below: Line 59: contractional deformation instead of compressive deformation Line 64: by whom? Line 75: Here I wonder how are these sheeted dikes related to mineralization in the El Teniente porphyry? Line 80: The term “progressive unconformities” is used to describe unconformities between beds of a single stratigraphical unit, not between two units such as Abanico and Farellones Fms. Lines 85-87: This suggests that the crust was thicker in the north than in the south during the extrusion of these units, but it does not necessarily imply that Cenozoic compression has started first in the north. The crust may have been thickened during previous compressional phases or it may not have been extended during the Abanico extension as much as the southern segment. Line 103: Reduced paleo-stress tensors: Briefly describe here which is the methodology to separate heterogeneous data sets into homogeneous ones, since this is a very critical step to obtained robust tensors. Line 115: Is the intrusion of the La Obra batholith related to the NW striking fault system? Stress here the importance of the new dating. Line 144: Can these dikes, intrusives and breccia be more constrained in age? Lines 174-176: In a strike-slip fault system, fault-slip sets taken from stations close to the system may have been formed under extensional and compressional local stress fields, generated a bend of faults, step overs, etc. Line 178: Explain how the ENE trend of sigma1 has been obtained. Lines 191-192: Discuss the possibility that the change from compressive in the highest sectors to compressive/strike-slip stress regime in the lowest sectors could also be related to excess of gravitational potential energy in the highest sectors of the Principal Cordillera. Lines 244-250. Part of this structural information may be move to the tectonic or structural setting. Lines 277-278: The focal mechanism solution for the Las Melosas earthquake is quite particular, with NNW-oriented P axis, not compatible with the WNW-striking sinistral faults of the PFS. Figure 1: add sense of displacement of normal and strike-slip faults Figure 2: Improve the location map (a) to show the main tectonic characteristics of the study area. Add lat- long in the map from Figure 1b. Figure 3: I suggest that the authors replace the red lines with a semi-transparent polygon. Figures 3 and 5: These figures can be integrated into one. Add lat-long, volcanoes, rivers, and localities (for example. Santiago and Rancagua cities, San José de Maipo, etc) Figures 9, 11, 12 and 13: These figures will benefit a lot if, instead of presented the satellite image again, the authors add a geological map and locate the stereoplots in the borders of the map (not inside it).

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