

Interactive comment on “Holocene environmental changes in the highlands of the southern Peruvian Andes (14° S) and their impact on pre-Columbian cultures” by K. Schittek et al.

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1. Does the paper address relevant scientific questions within the scope of CP? Yes.
2. Does the paper present novel concepts, ideas, tools, or data? Yes.
3. Are substantial conclusions reached? Yes and no (see discussion below under "general comments")
4. Are the scientific methods and assumptions valid and clearly outlined? Yes, the paper is well written and organized, and the data collection methods and analysis techniques are well explained.
5. Are the results sufficient to support the interpretations and conclusions? Yes and no (see discussion below under "general comments")
6. Is the description of experiments and calculations sufficiently complete and precise

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to allow their reproduction by fellow scientists (traceability of results)? Yes I think so, and I would certainly support future analysis of peat records in different parts of the Andes.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes, they do a good job of referencing other relevant research and linking it to their own contributions.
8. Does the title clearly reflect the contents of the paper? Sort of (see discussion below under "general comments").
9. Does the abstract provide a concise and complete summary? Yes, well done abstract.
10. Is the overall presentation well-structured and clear? Yes, well written, well organized, and clearly structured paper.
11. Is the language fluent and precise? Yes.
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? N/A
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Final section on archaeological interpretation should be expanded or cut, as described below in "general comments." Figures are illegible because font is too small, this is a major problem that needs to be addressed.
14. Are the number and quality of references appropriate? Yes, although the authors may consider adding additional references on the relationships between environmental and cultural change.
15. Is the amount and quality of supplementary material appropriate? N/A

General Comments:

This paper presents new data on climate change and variability in the central-southern Peruvian Andes. Specifically, it presents a new high resolution climate proxy record derived from peat deposits in the Nasca river headlands. This is a very well written and organized paper that provides seemingly valuable data from a less-utilized source (peat) and an understudied (from a paleo-ecological standpoint) region (Nasca). I am not an expert on the proxy records/analysis methods used here, and thus I cannot evaluate this component of the project in depth. However, I find the research procedure to be well-explained, well-linked to relevant literature, relatively easy to follow for a non-expert, and seemingly well done/comprehensive. Peat analysis seems like a

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potential goldmine for Andean paleoenvironmental studies, and I think the authors are successful in justifying their research in terms of a new data source/tool.

The paper presents significant findings related the chronology of a series of episodic dry spells alternating with more humid periods and convincingly links them to ITCZ and resulting SASM shifts. By themselves, these findings and interpretations make a great contribution to understandings of climate change and variability in the pre-Hispanic Andes and will provide a valuable complement to previously published paleoenvironmental proxy records.

However, I find the linkages made to archaeological studies and cultural history to be very weak. I think that the authors have presented an overly simplistic explanation of the relationship between climate and culture change. For instance, the reference to Binford et al 1997 on page 1710 is one of the few statements of how the authors view this relationship – the authors go on to mention vaguely that the “success of pre-Columbian civilizations was closely coupled to areas of geo-ecological favorability. . . .” The issue of the relationship between climate/environmental change and cultural change is not addressed again until the very end of the paper, on page 1727, where the authors present a few very brief paragraphs discussing their paleoenvironmental reconstruction in the context of pre-Columbian population history. In general these paragraphs are overly brief, not clearly written, and present only weak linkages/connections between the study’s results and Nasca and Paracas cultural history. For example, they indicate that “periods of cultural bloom. . . coincide with stable humid periods” (p. 1728) but the authors are unclear about how closely they are linking coincidence and causation. The authors may want to consider more nuanced analyses of environmental and cultural change, like those presented by the various authors in Sandweiss & Quilter (eds) 2008. And of course, there is always the question of chronologic resolution in both the culture and climate records which makes analysis of the relationship(s) between these two so difficult.

That said, I do not think that the authors have envisioned this paper as a discussion

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of the relationship between climate/environmental change and cultural change. While this is indicated in the title, the fact that this kind of discussion occupies such a small fraction of the paper seems to demonstrate that it is not the key objective of the paper. Therefore, I suggest that the authors reframe the paper slightly (and definitely rewrite the title). Perhaps they should propose their very interesting and significant wet/dry spell and ITCZ/SASM findings as the key contribution of this paper. Then instead of stating such direct relationships to population, settlement and culture, they might propose a series of more interesting questions for future research. For example: How did the Nasca and Paracas cultures use and management water? What kinds of irrigation were practiced and how were these practices adapted to periods of greater or lesser water availability? Were water storage or drought adaptation activities used? To me, these kinds of questions are much more fruitful than just reporting a direct link between wet/dry conditions and cultural fluorescence/collapse, especially if these broad claims are not fully supported in the text by data and/or discussion.

Overall, I think that either the authors have to do a much better job of linking wetter/drier conditions to human activities and settlement, or I recommend they just leave this component out of this particular paper, and instead simply present the very good climate reconstruction as the main contribution. Apart from the weak archaeological discussion, this is a good paper and could be published after minor revisions addressing the above-mentioned issues.

Specific Comments:

p. 1712, line 5 – What feeds the mentioned springs? Seepage/filtration? Is this related to rainfall and ITCZ shifts? p. 1724, line 18 – Unclear reference to “now” arid conditions p. 1728, line 13 – What is “enforced moisture availability”?

Technical Corrections:

Figure text way too small

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References:

Sandweiss, D.H. and J. Quilter (Eds.). 2008. *El Niño, Catastrophism, and Culture Change in Ancient America*. Dumbarton Oaks Research Library and Collection (Harvard University Press).

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