

The Cryosphere Discuss., referee comment RC2  
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## Comment on tc-2021-88

Anonymous Referee #2

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Referee comment on "Comment on "Ice content and interannual water storage changes of an active rock glacier in the dry Andes of Argentina" by Halla et al. (2021)" by W. Brian Whalley, The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-88-RC2>, 2021

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### Comments

The author presents information to support the view that Dos Lenguas (DL) rock glacier is glaciogenic (glacier origin), as opposed to cryogenic (permafrost origin). For example, the author highlights that there is no rock glacier formation within the extensive local talus. In addition, he concludes that the formation and flow of DL is best explained by a glacier ice-core model (glaciogenic) on L18. This is plausible, however more details to support the conclusion on L18 need to be incorporated into the text since this is not obvious from the papers cited (Whalley and Azizi, 1994, 2003). While these geomorphological observations alone are not enough to determine the origins, the seismic wave velocities for areas identified as ice-rich permafrost are in the range expected for a glaciogenic rock glacier (e.g. > 3000 m/s; Milana and Güell, 2008) which strengthens this hypothesis. This contrasts with Las Tolas rock glacier mentioned by the author which has the same geomorphological characteristics as DL, but much lower velocities (1662 m/s) plus other geophysical observations that suggest it is cryogenic (Milana and Güell, 2008). I suggest including these geophysical data for Las Tolas (e.g. velocities) in the commentary on L28-33.

While debris-free and debris-covered glaciers exist in proximity to DL and Las Tolas, neither rock glacier is connected to a debris-free or debris-covered glacier. This should be explicitly stated. The thermokarst ponds described in Halla et al. (2020) on DL occur within furrows (depressions) and are constrained by the ridge-furrow topography. These ponds are distinct from the thermokarst ponds on debris-covered glaciers (Las Tolas and Tapado) mentioned in the comment which are not associated with furrows, are larger, and have a chaotic distribution on the glacier surface. These observations leave room for a cryogenic interpretation of DL and this hypothesis is strengthened by the geophysical results in Halla et al. (2020) which show discontinuous ice-rich areas below the surface often separated by zones of reduced ice and elevated water content associated with furrows. The comments on L21-26 imply that the thermokarst lakes on DL are comparable to the examples given. The differences between the thermokarst lakes on DL and the examples given should be identified in the text.

It is possible to interpret DL as being glaciogenic or cryogenic. The argument presented by the author is sufficiently convincing to justify the consideration of this alternative interpretation by the authors of Halla et al. (2020) and I suggest the comment be accepted for publication.

### **Technical corrections**

L15 add "a" before 'talus rock glacier'