Review of "Updating Thermal Head of Recoverable Autonomous Sonde (RECAS) for Better Drilling Performance in Qilin Subglacial Lake Exploration", by Li et al., egusphere-2026-4471.

This paper presents results of quantitative though very limited laboratory tests on a melt head intended for the RECAS probe, which incorporates water jetting to penetrate ice with embedded layers of sediment and small (cm-scale) rocks. (The paper also preliminary calculations of flow rates to suspend sediment particles and required jetting-pump pressure.) While jetting for passage of an electrically powered probe through debris-laden ice has long been reported (the authors' references I would add Rado et al., 1987), quantitative data (e..g., on flow rates required for debris with specific characteristics) seem to be, at best, very rare. This paper therefore contributes to work not only with the RECAS melt head but also more generally, despite its limited results. I therefore recommend publication, but also recommend revision to address the following points, so as to make the paper contribute more generally. With revisions to address these points, I think the paper would make a worthwhile contribution to the literature. (I will not reiterate the points made by anonymous reviewer 1, with which I agree and which the authors have already addressed).

(1) The authors base their expectations of the volumetric concentrations and characteristics of debris in ice above their target lake on observations of ash layers in cores well above the bases of ice sheets, and on (the few) inclusions observed in accreted ice above or bordering Lake Vostok. However, at ~3600 m depth, the ice sheet upstream of their intended target lake is certainly wet at its base. Ice flow over a wet bed entrains much denser concentrations of sediment and rock than those in the authors' tests, as shown for example in data from Byrd Station (Gow et al., 1979) and in the WISSARD and SALSA project experiences. The authors, as well others interested melt probe entry into subglacial lakes, should therefore work toward tests with much denser debris concentrations. The first essential step to evaluate the current results and plan for further tests is to report in Section 4.3 not only the dust-laden ice layer thickness, but also the material (silica?), **volumetric concentration or mass fraction of dust in the layer** (especially), and dust particle size distribution (not just minimum particle size) .

(2) In the case of rock inclusions (Section 4.4), it must be expected that ice above the intended lake will have debris layers with many rocks in close proximity (many more than 5). To begin to evaluate the significance of the results with so few rocks, the first question is whether melt head penetration at the specified jetting rate, and the mechanism the authors suggest (melting of a cavity large enough for the rocks to move up the sidewall of the probe as it descends), are in fact **repeatable**, or whether other results are sometimes obtained – the authors presently seem to have presented results so far only from a single trial. If the current results are repeatable, it would then be essential to begin to explore the relationship between successful penetration and (1) jetting rate; (2) mass fraction of rock embedded in an ice layer; and (3) rock size. I would urge the authors to add data along these lines to the paper.

(3) Ice temperature is likely also important to understanding how general the results presented here may be. I looked for but did not find any data in the paper on ice temperatures during the penetration experiments.

Finally, one minor editorial note: the various drilling and melt probe efforts summarized in Section 1 have been reviewed comprehensively, along with many others, by Talalay (2020). I suggest referring to that work.

References

Gow, A.J., S. Epstein, and W. Sheehy (1979), "On the Origin of Stratified Debris in Ice Cores from the Bottom of the Antarctic Ice Sheet", *Journal of Glaciology* **23**(89), 185-192, doi:10.3189/S002214000029828.

Rado, C., C. Girard, and J. Perrin (1987), "Electrochaude: A self-flusing hot-water drilling apparatus for glaciers with debris", *Journal of Glaciology* **33**(114), 236-238.

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