Reviewer 1

The manuscript compiles several seismic and magnetotelluric profiles in the Upper Archean Craton, revealing the geometry of major ancient faults, reconstructing their activity and reactivation over time, and their role in the craton's evolution.
The new version of the article is more clearly written and well structured, and leads the reader through the study with greater ease. The data presented, particularly the figures, strongly support the authors' interpretations and conclusions.
I have only two small points to make about the manuscript:
1. "TL layer" is mentioned on line 40, but its meaning is not stated until lines 109-110. Mention its meaning on line 40. >>TTG? layer; meanings added
2. On line 447, reference is made to figure 13b, but figure 13b does not exist. Correct to "fig. 13". >>Done

Reviewer 3

This paper presents a summary of the seismic and other geophysical studies of the Superior Craton. It reflects a compilation of Lithoprobe data and new data from the Metal Earth project.

It has received contrasting reviews, and I would say that my review sits between the two.

It is good to see the extent of work that has been done. However, this can only ever be an interpretation as the exact geometry of the geology in cratonic areas at depth is poorly constrained, so one would expect a degree of variation in the interpretations.
The temptation is to overinterpret such results – for example the strong assertation that the vertical faults are leaky transforms – why not simply vertical accretion boundaries of more mafic material with more granitic material?
>>Many of these faults have been (over)interpreted previously, some numerous times, so we tried to emphasize how our new interpretation differed and the broader tectonic implications. That perhaps sounded assertive. We have added qualifying phrases throughout and additional supporting observations for syn-volcanic transform faults.

This result is an interpretation as there is no plate tectonic context, there is no strong geological context as in these Archean cratons can only be

interpreted based on what one thinks might have been happening. The implication here is that there has been tectonic accretion and that the crustal structures represent that tectonic accretion process with imbrication of the relatively low angle thrusts.
>>We feel this reviewer is a tad too pessimistic. Although interpretation of seismic sections in neotectonic settings are greatly aided by earthquakes that define the fault zone and provide sense of offset, sections in all other geological settings can only provide deep interpretations without direct validation (rare drill holes excepted). Interpretation of Archean structures are indeed uniquely hindered by the lack of a widely agreed 'plate tectonic' paradigm for context.

Only where there is exposure of deep crust can some sort of constraints be placed and these can be inferred from the Kapuskasing section. It would have been useful to see some more direct comparisons with mid-crustal reflections from this section. I believe that a lot of the low angle reflectors are mafic sections like the amphibolites in the Kapuskasing structure. The same goes for some of the layered lower crustal sections that one sees outcropping from the Superior province in for example the Ungava region underthrusting the Proterozoic sections (see work from Lucas, St Onge etc..) These are very instructive on what one might interpret in the Superior geophysical section and how layering might develop during the accretion process.
>>The Percival & West 1994 synthesis volume provides arguably the best interpretable seismic sections from the Kapaskasing structure and show a series of linked low-angle thrusts that form crustal wedges. This albeit Proterozoic structure is one of the examples that initially inspired many of our interpretations of thrust-bound wedges in this manuscript. Their interpretation of a middle crust characterized by felsic intrusions into (mafic) amphibolites and localized horizontal shear zones we feel is consistent with our interpretations, although not directly relevant to faults. Our interpretation of thin-skinned folding in the Timmins area (Fig. 8) would be consistent with the described younger Ungava structures.

The section on fluid flow in the crust is poor and comes through as an afterthought. The Metal Earth project was conceived to look at fluids and mineralisation in the cratons and their margins – an entire paper could be written about how the fluid pathways are preserved – especially in the southern Superior where there are significant greenstone belts, superimposed by Huronian rifting and fluids and even younger kimberlites associated with Phanerozoic rifting.
>>All true and several papers by Graham Hill, referenced here, described this fluid flow process via preserved conductor geometries. This section was

included because many readers will wonder how the conductors shown on the Metal Earth Atlas sections in our figures relate to the proposed fault zone geometries. We interpret this fluid flow as not occurring exclusively in fault planes , but also by percolation through wider structural zones of disruption. Although probably thus an afterthought, we feel this is an important clarification.

In general, given that the authors have replied to the critical comments I would think the paper is acceptable for publication with some modifications. It would be worth seeing some less definitive assertions and a more nuanced interpretation that recognises that we do not really have much idea of the exact processes of Archaean tectonic accretion.
>>Nuance added in several places. A wise colleague once told me that interpretations (of a single seismic section) need only be permitted by other currently available observations/knowledge; they do not need to be either definitive or encompassing all possibilities.