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Interactive comment on "An 83 000 year old ice core from Roosevelt Island, Ross Sea, Antarctica" *by* James E. Lee et al.

Anonymous Referee #2

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Review of the manuscript "An 83,000 year old ice core from Roosevelt Island, Ross Sea, Antarctica" by Lee et al.

General comments: This manuscript presents a suite of new gas records from an ice core drilled at Roosevelt Island, an ice rise in the Ross Sea. The primary objective is to establish its chronology by annual layer counting for relatively shallow depths and matching of gas records with existing WAIS Divide and Greenland ice core chronologies. The continuous part of the ice core extends to 65 kyr BP, suggesting that the Roosevelt Island has existed since at least this age. CH4 records show centennial-scale variability throughout the Holocene, with implications on natural vs. anthropogenic CH4 emission in pre-industrial periods. These discussions have some important implications for past climate and ice sheet variations. The dating method developed here is

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a nice contribution to the ice core community.

However, the lack of water isotope records and interpreted temperature records in this manuscript makes it difficult to review the estimated annual layer thickness using a firn densification model and its effects on dating and paleoclimatic implications. I find this study is potentially an important contribution to paleoclimatic communities but do not recommend publication in its current form. The authors would need to decide if they remove some parts of the manuscript regarding annual layer thickness estimates from firn modeling (but it will make the manuscript much less attractive), or they add water isotope data and temperature estimate (I would recommend the latter for publication in CP). The discussion of anthropogenic and natural CH4 variability needs some quantitative analyses (for example comparing frequency and variability after detrending for different time periods). To my eyes, the CH4 records appear to have different centennial-scale variations in earlier and later parts of the Holocene.

Specific comments: P5, L5. Regardless of the careful trimming of the ice in the same shape, the cut-bubble effect should change (generally decreasing) with depth due to the change in bubble sizes. The cut-bubble effect thus needs to be corrected.

P16, L28. I do not understand why the temperature stability of the sample leads to the improvement in S/N of the gas chromatograph.

P17, L30. Please explain why the solubility correction factors are so different for sample and bubble-free ice?

Fig. 2c and i. The scales of the axes should be the same for the left and right panels.

Fig. 5d. Why is the vertical line drawn at about 9000 yr BP and not near 9200 yr BP (highest occurrences)?

Supplementary file "RICE17_Interpolated_Ages_20180530.txt" appears to contain two units for the ice age (probably C.E. and yrBP are switched at 343.5 m).

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