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Interactive comment on "Fire, vegetation and Holocene climate in the south-eastern Tibetan Plateau: a multi-biomarker reconstruction from Paru Co" *by* Alice Callegaro et al.

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The manuscript "Fire, vegetation and Holocene climate in the south-eastern Tibetan Plateau: a multi-biomarker reconstruction from Paru Co" uses a suite of biomarkers to assess vegetation and fire change during the Holocene from a sedimentary record of a small lake on the Tibetan Plateau. This study presents original data with potentially interesting new results on fire history that has not been widely studied on the Tibetan Plateau.

The manuscript is well written and methodologies are robust. Given that this is a relatively new field of research, mainly the application of fire-related biomarkers to paleo-

climate records, there are additional aspects that the authors should consider.

PAHs: For instance, although they suggest that there are only a few studies of PAHs as tracers of biomass burning and only cite two (Page 3, Line 12), there are others out there that may help with their interpretations, for instance: Page et al. 1999, Marine Pollution Bulletin; Yunker et al. 2002, Organic Geochemistry; Denis et al. 2012, Organic Geochemistry; Yan et al. 2014, Environmental Toxicity and Chemistry; Yunker et al. 2015, Organic Geochemistry; and Denis et al. 2017, Organic Geochemistry. In particular, not all PAHs result from biomass burning, so using the sum of PAHs, for example, may not be as useful as targeting the pyrogenic PAHs (examples in Page et al. - fluoranthene, phenanthrene, benzo(e)pyrene). Denis et al. 2012 suggest that there are differences in high molecular weight PAHs representing the intensity of the fire (also see McGrath et al. 2003, Journal of Analytical and Applied Pyrolysis), whereas, the low molecular weight PAHs more consistently record local fire events. These considerations may or may not be applicable, but could be tested without acquiring more data. This analysis may help to resolve differences in between the MAs and the PAHs. Finally, with respect to the PAHs (Page 13, Line 28), if there is a change in the biogenic/diagenic signal of the PAHs, then it would likely manifest specifically in the PAHs like perylene - it would be worth having a look at how the individual PAH profiles change when this signal becomes prominent. Degradation, if it is of the overall organic material should also manifest in changes in the carbon preference index (CPI) values, but these data are not plotted. If a low CPI is seen during times of highly charred material, this index could help support the argument made on Page 16, Line 3.

n-Alkanes: It is worth applying some caution in the use of the Paq from Ficken et al. 2000, which was derived in from Mt. Kenya in Africa. The organic geochemistry community is finding that a site-specific approach may be needed and while the assertions about long-chain and short-chain n-alkanes generally hold true, in some environments the relationship is slightly more complex. For example, in Garcia-Alix et al. 2018, Scientific Reports, the supplemental information shows how this index and the ACL vary with distance from water source. Because grasses are prominent during more humid conditions in the arid Sierra Nevada region, the C31 shows aquatic rather than terrestrial-type vegetation changes. This may apply to similar high-elevation sites on the Tibetan Plateau and should be discussed. It is not a fault of the authors, just a really recent paper that might change the interpretations made here. This could help explain why the n-alkanes are showing a different pattern of change than the MAs and the grass/wood prevalence of pollen data (Page 16, Line 27).

Overall, this is a very interesting and well thought out study, but further analysis given the above comments could help with discussion.

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