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Interactive comment on "Controls on the distribution of the soil organic matter in mountain permafrost regions on the north Qinghai-Tibet Plateau" *by* C. Mu et al.

Anonymous Referee #1

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Review of Mu et al. Manuscript General comments This manuscript is about the controls of SOM distribution in a mountain permafrost region of the QZP. The authors over simplified the factors controlling the carbon stores/density and distribution of SOC in deep strata in a permafrost environment. The discussion and conclusion (as in lines 21-23 and lines 160-169). The conclusions may well apply to the active layer or 0-2 m as described in many other papers. The near surface SOM is biogenic, resulting from the biomass accumulation form the vegetation community. However, the SOC accumulated in the deep strata may, and often the result of the geomorphic processes such as erosion and sedimentation. Therefore the SOC stores in deep layers may not be controlled by vegetation as what is currently on the surface. Since the parent materials

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of these soils or cores studied are of Quaternary age, the past climate, vegetation, and especially the mode of deposition are important to the SOC stores; as we consider the syngenetic nature of the soil development. The major problem for me to review this manuscript is the lack of original data. There is no tabulated data for each analyzed soil horizon or layer. Thus there is no way to tell if the values of pH, soil texture, conductivity, C-density, C/N ratio presented are from one particular section/horizon or the average of the whole sampling depth. The authors are responsible should provide the original data as supplement that should include all the analyses as indicated in the Method section, and present the analytical data of each sampled layers of sections. The soils are likely syngenetic if the particle size distribution is more relatively uniform, or fluvial/erosion or sedimentation modification if there are contrasting soil textures. The %SOC correlates well with %clay because of physical protection, a function of surface area. But the fine soil particles are not limited to clay. There are several papers dealing with SOC contents in both the clay and silt fractions. Will there be any difference if the %silt is considered in the correlation? Soil drainage is mentioned in Table 1 but not discussed. The SOC content is controlled by vegetation community which is affected by drainage or soil water content due to soil texture and landform position. I recommend the manuscript be accepted upon major revision. Specific comments L. 18. “silt loam over ASM” change “over” to “in”. L. 19-20. “higher fine-fractions” change to “higher finer textured fractions”; “coarse soils” change to “coarser-textured soils”. L. 21. “more decomposable” or “more decomposed”? L. 29. Insert “more” after “become”. Insert “due to climate warming” after “decomposition”. L. 34. Delete “permafrost”. L. 38. Citation “(Bockheim and Hinkel, 2007)” is not the proper reference. In their paper, the deepest soil horizon was sampled at 161 cm. This can hardly be called “deep carbon”. For the vulnerability of deep carbon, refer to the papers by Schuur et al. and Zimov et al. L. 46-48. “consequently resulting in easily decomposable substances”. It is because the original substrate was easily decomposable thus resulting in less negative delta 12C values. So consequently resulting in highly decomposed substances as indicated by lower C/N values. L. 60. “soil texture also relates to veg-

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etation types". Soil texture is one of the several factors affecting vegetation types. L. 64. Insert "carbon" between "the" and "contents". L. 70. Change "area" to "region". Last word "westerlies"? L. 71. Insert "mean" before "annual". L. 74. Change "main" to "major". L. 76. Capitalize "Quaternary"/ L. 80. Change "gradually" to "gradual". L. 86. Last word "largely" change to "strongly". Are the pH values and electric conductivity measured for only the surface soil (topsoils) or average values for the whole profile (down to the bottom of sampling? For definition for saline and alkaline soils, see http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052523.pdf Reaction of EB1 is neutral and EB2 is slightly alkaline. L. 99. Delete "values" and change "conductivities" to singular. L. 100-103. Where is the data for soil texture and rock fragment content? L. 103. Insert "contents" after "(TN)". L. 120. The variation of vegetation type is limited to 2 Kobresia species. L. 122. The SOC density ranged from 0.4 to 22.4 kg m-3. Is the density of different soil horizon or this is the average of the whole soil profile? If so, then what is the carbon stores (kg m-2) of the active layer or 0-2 m and the whole profile? L. 128. Add "respectively" at the end of sentence. L. 141. Insert "class" after "texture". L. 151. "moisture" is not the proper word; water! The equation is poorly constructed. Use symbols; in line 150, add (D) after depth, add (W) after water content, add (Db) after bulk density, and "Cy" or other choice after clay content. L. 155. See general comments.

Tables Need footnote for the Drainage class in Table 1. Whay are there 2 columns of conductivity? Tables 1 and 2 should be combined and titled "Physiographic environment of the study sites in the Heihe River basin, Qinghai_Tibetan Plateau". Soil properties should be in another table. Besides pH, conductivity, the methods section also include SOC and water contents, C/N ratio, bulk density, particle size distribution, rock fragment content.

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