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# *Interactive comment on* "The nature of organic carbon in density-fractionated sediments in the Sacramento-San Joaquin River Delta (California)" *by* S. G. Wakeham and E. A. Canuel

**Anonymous Referee #2**

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This manuscript addresses the distribution and composition of organic matter in sediments fractionated by density, for a series of depositional sites in a temperate delta environment that is heavily influenced by upstream human use. The methods are all appropriate to the task at hand. Results from an extensive series of analyses provide more opportunity to discern origin of organic matter in the various density fractions than is usually available. The writing is clear, and findings are presented and documented meticulously. These findings are largely consistent with previous studies on density separates of soils and sediments. The various samples yielded somewhat different stories as befits complex mixtures in a complex environment, and there is no large theme or discovery reported here. Nevertheless, the data and intrepretations

add significantly to those reported from other river-ocean interface studies.

Because the deltaic sediments studied here likely derive largely from soils, more consideration of mineral-organic matter associations in soils would be useful. The soil literature often considers these associations via concepts such as “aggregate hierarchy”, which has implications for organic matter sources in various density fractions.

Outcomes in density separations can be strongly influenced by the separation procedure. In this study, “gentle shaking” defines the energy level at which the low-density, organic fractions may or may not separate from the high-density, mineral fractions. The states of aggregation surviving this gentle shaking determine the partitioning, and hence OM-mineral ratio. While there is no “correct” means of disaggregation, various energy levels lead to different insights into the ways organic matter distributes among minerals. The authors here used gentle shaking to preserve “macroaggregates”; this term has specific meaning in the soil literature but it’s not clear how specifically the authors meant it. Indeed, the soil literature has explored implications of these different energies of disaggregation much more than the marine sediment literatures. The authors might consider papers such as Kaiser and Berhe (2014, J. Plant Nutr. Soil Sci., 177:479) and Cerli et al. (2012, Geoderma 170:403), and use them to provide more discussion of states of aggregation that are consistent with the gentle shaking approach.

The term “pre-aged” is becoming more common, but is vague. Presumably it refers to the presence of organic carbon that (1) spent time in (2) some other place. The stable isotope ratio provides a better indicator of place of origin than the radiocarbon. Why not simply use the term “older”? Furthermore, as the authors point out, 14C-depleted soil water can lead to older 14C dates in the organic matter.

In section 2.1, perhaps this delta drains 40% of California, but does not “comprise” it.

Sedimentary and soil organic matter typically has higher density than 1 g/cc. See Adams (1973, Soil Sci., 24:10), Rühlmann et al. (2006, Geoderma 130:272) and Mayer



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et al. (2004, Geochim Cosmochim Acta, 68:3863).

Metatungstate solutions, used for the density separations, can dissolve organic matter to some extent. Explicit statements of recovery efficiencies for carbon (and maybe nitrogen) should thus be provided.

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