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Interactive comment on "Organic carbon production, mineralization and preservation on the Peruvian margin" *by* A. W. Dale et al.

Anonymous Referee #1

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Referee Comments: October 1, 2014 Journal: BG Title: Organic carbon production, mineralization and preservation on the Peruvian margin Author(s): A. W. Dale et al. MS No.: bg-2014-418 MS Type: Research Article Special Issue: Low oxygen environments in marine, fresh and estuarine waters

General Comments: This manuscript presents a synthesis of a comprehensive set of in situ benthic flux measurements, pore water and sediment geochemistry data, and modeling to evaluate organic carbon mineralization and burial along two cross margin transects within the Peruvian coastal upwelling system. The authors have employed best available methods and taken care to quantify uncertainties so that they can evaluate carbon rain rates and burial efficiencies (CBE) as a function of water depth. A focus is the factors that may explain unexpectedly low CBEs on the Peru shelf and high CBEs

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on the slope below the Oxygen Minimum Zone (OMZ). The strengths of the paper are: (1) the clear presentation and richness of the pooled data, and (2) the authors efforts to compare rates of carbon and sediment accumulation to global averages and other continental margin sites. A weakness is the discussion does not come to any definitive or new conclusions about mechanisms of carbon preservation. Instead, the authors prefer to rehash the debates on the significance of bottom water O2 concentration and sorption for organic matter mineralization, and they only give brief consideration to lateral transport effects. An important observation in the data is that accumulation rates on the Peru slope below the OMZ are anomalously high and completely consistent with lateral transport (especially over the 11oS transect). Previous studies cited by the authors have emphasized lateral sediment distribution processes and large hiatuses in outer shelf and slope cores that can be explained by bottom current reworking or slumping. Many episodes of resuspension are also consistent with what appears as more efficient water column mineralization of organic matter. When organic matter is relatively labile, rates of aerobic and anaerobic remineralization have been shown to be nearly equal in several studies as the authors note on page 13095. Thus, the residence time of particles in the water column should control the "Martin curve exponent" more than any other factor. One would also expect rain rates based on integrated benthic data versus short-term sediment trap sinking fluxes to diverge as in Figure 7.

Specific Comments: In general the paper is well written, the figures and tables are clear, and the organization is easy to follow. Some specific changes that may improve the clarity are: 1. The term "inner shelf" is used in reference to stations at 74-101 m depth and >10 km from shore. Most physical oceanographers would refer to this zone as the "middle shelf" because the physical dynamics is much different than nearer to shore. I recommend that the authors change this description globally throughout their paper. 2. Within the abstract the sentence "Elsewhere, CBEs were mostly above the range expected for sediments underlying normal oxic bottom waters, ..." is confusing. The authors should omit the phrase "for sediments underlying normal oxic bottom waters" here because it sounds like this is the Peru case. I would also recommend not

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referring to “a Martin curve exponent” in the abstract. This is too specific for a general reader who may not know the origin of this term. 3. It is not clear what makes the papers referred to on page 13071 “companion papers” since they do not discuss the Peru margin system. Also Loscher et al. unpub. data would not qualify as a “paper”. 4. P. 13072 line 20. Please make it clear in this sentence over what water depth range the spionid polychaetes are found. It is confusing because the previous sentence describes below the OMZ. 5. P. 13074. At first mention of “MUC technologies” the authors need to indicate what MUC is short for. 6. P. 13081. The reference to a “trapped body of water close to the coast” leaves the reader wondering what the authors are talking about. More explanation is needed if this is to be included.

Technical Corrections: 1. P. 13075 lines 6-7. Are the optodes referred to here the ones in the chambers? Simplify to: “....vigorously bubbling filtered bottom water at each station....”. (It is obvious that it is seawater). 2. P. 13075 line 11. It can be confusing to refer to the “core of the OMZ” in a study that uses sediment “cores”. The authors might say “mid-waters” instead. 3. P. 13076. Change line 2 to read “used as a constraint in models of benthic N turnover”. Rewrite the sentence from lines 7-8 because it was not the samples that were “flushed”. Lines 15-17 are unclear. Weight difference after what? Were the precision and detection limit dry weight percent C or CaCO3? 4. P. 13077 lines 8-11. Separate into two sentences. 5. P. 13081. “Discrete” is not a verb, so I do not think “discretized” is a word. 6. P. 13115. Table 1. Replace “gears” with “sampling equipment” or “instrumentation”. 7. Figure 1. Correct the right longitude label to read “77oW”. 8. Figure 3 caption. Change “sediments core” to “sediment cores”. 9. Figure 8. Correct the spelling of “cumulative” along the top axis.

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