Referee comment	Answer of authors to referee comment	Proposed modification of the manuscript
The title is too general. It should be more focused on the accretion and stability issue. I think the paper should focus on the second objective. I do not think that the information required for the third objective is available in the paper. I would not bother much about aggregate formation and stability but rather on organic matter incorporation and stabilization in each particle size fraction.	We propose a modified, less general title on the right.	Carbon dynamics of soil organic matter in bulk soil and particle size fraction during secondary succession in a Mediterranean environment
Page 1109 line 25. Need to mention that changes in plant productivity can occur during secondary succession.	Addressed	"Plant productivity generally increases in the last stages of secondary succession in mesic Mediterranean conditions , and also during old field succession on Pantelleria Island (La Mantia et al., 2007; La Mantia et al, 2009)". Otherwise during the early stages of succession the increase of carbon stock mainly do to antropic disturbance reduction. Insert in references: La Mantia T., Oddo G., Rühl J., Furnari G., Scalenghe R., (2007) - Variazione degli stock di carbonio in seguito ai processi di abbandono dei coltivi: il caso studio dell'isola di Pantelleria (Tp). Foresta@ vol. 4, no. 1 (Mar 2007): 102-109 (http://www.sisef.it/forest@/pdf/La_Mantia_433.pdf) La Mantia T., Rühl J., Pasta S., Campisi D., Terrazzino G., (2008) – Structural analysis of woody species in Mediterranean old fields. Plant Biosystems, Vol. 142, n. 3: 462-471.

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Page 11111 line 12. Second objective. What do we learn by describing the differences in SOC turnover along succession. Please try to specify.	Knowledge on SOC turnover along succession are useful to understand the mechanisms of carbon stabilization and to analyze the effect of field abandoned on carbon stock. This fact is of great interest in international agreements on climate change and has an impact on significant research. For example in the "SIXTH FRAMEWORK PROGRAMME PRIORITY 8: Policy-Oriented Research" is written "Soil evolution after the abandonment of cultivated land is connected to the development of the natural vegetation through secondary succession processes (Martinez-Fernandez et al. 1995, Kosmas et al. 2000, Van Rompaey et al. 2001). … The uncertainties increase in succession processes where the soil carbon dynamics are strongly influenced by the vegetation type developing after abandonment. .. Another deficiency is that the forest area change is usually a net balance without specifying deforestation, afforestation and natural succession as separate processes.".	The present study analyses the change in soil carbon stock along a secondary succession after agricultural abandonment describing differences in SOC turnover rates along succession for all soil fractions.
Page 11113 line 6. herb or grass. Please use always the same term.	The terms "herb" and "grass" refer to two different plant communities, which occur in old fields of different abandonment age (please cfr. Material and Methods, p. 11112, l. 14-27). In fact, our sampled chronosequence represents a succession sere, where old field vegetation in the first ca. 5 years after abandonment is dominated by annual and perennial herbs (= HERBS). With time, perennial grasses such as *Hyparrhenia hirta* spread into the old fields, and after 10-15 years these grasses dominate old field vegetation (= GRASS). For a more detailed description of Pantelleria old field vegetation, please see Rühl J., Pasta S., Schnittler M. (2006) A chronosequence study of vegetation dynamics on vine and caper terraces of Pantelleria Island (Sicily). Archiv für Naturschutz und Landschaftsforschung Greifswald, 45	

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	(1): 71-90.	
Line 23. Clarify the sizes of the pores.	The pore sizes are listed in line 24	
Page 11114 line 4. Why soils were sieved through 1 mm instead of 2 mm?	According to official methods 2 mm sieves allow to determine too much labile SOC. It is suggested to reduce sieve at 1 mm and often to 0.5 mm (cfr. references on the right).	Insert in references: RAVEH, A. and AYNIMELECH, Y. 1973. Potentiometer determination of soil organic matter. Soil Sci. Am. Proc. 36: 967. WALKLEY, A. 1935. An examination of methods for determining organic carbon and nitrogen in soil. J. Agric. Sci. 24: 598:609. WALKLEY, A. 1947. A critical examination of a rapid method for determining organic carbon in soils – effect of variations in digestion conditions and of inorganic soil constituents Soil Sci. 63: 251-263. WALKLEY, A. and BLACK, I.A. 1934. An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil Sci. 37: 29-38
Page 11114 lines 21 and 22. The term new crop is not clear to me. The soils analysed are all after abandonment, so no crops are expected.	Instead of the term “crop” we will use the term “vegetation type”	Change “crop” with “vegetation type”
Page 11115 line 5. Which are the new species. More information on species composition, plant productivity and litterfall should be given throughout the manuscript.	Concerning species composition of the sampled old fields, please see page 11112, l. 14-29, page 11113, l. 1-7 and table 1. Concerning plant productivity and litterfall, the information provided on the right will be added to the manuscript.	Insert in the manuscript as first paragraph in “data analysis”: “For data analyses, we considered as distinct vegetation types: 1) annual herb communitites (still cultivated fields); 2) annual and perennial C3 herb communities (recently abandoned fields); 3) perennial C4 *Hyparrhenia hirta* grasslands, 4) C3 shrublands; 5) C3 woods. So, the term “new species” refers always to the “new” vegetation type colonizing the old field with time with respect to the “old” vegetation type which previously dominated. For example, when the present vegetation type is “perennial C4 *Hyparrhenia hirta* grassland”, we

		defined “annual and perennial C3 herb communities” as the previous vegetation type and C4 perennial grasses as the new colonizing species. “ and “The biomass (aboveground and belowground, dry matter) of *Hyparrhenia hirta* is 4.92 t/ha, for cultivated vineyards it is 2.0 t/ha, and for high maquis have been reported values ranging from 72.35 to 121.47 t/ha (Pasta et al., submitted). Litter mass of *Hyparrhenia hirta* is 1,563 Kg/ha (Lodge et al., 2005), while litterfall of still cultivated vineyards is 2.390 Kg/ha/year (Di Lorenzo et al., 1992).), and that of high maquis is 5.980 Kg/ha/year (Arianoutsou, 1989). <u>Insert in references:</u> Di Lorenzo R., Sottile I., Occorso G., Barbagallo M.G., Iannolino G., Meli R., 1992. Influenza delle forme di allevamento sull’andamento della superficie fogliare della vite in Sicilia. Atti IV Simposio Internazionale sulla Fisiologia della Vite. S. Michele all’Adige-Torino, 11-15 maggio. (pp. 75-80). Pasta S., La Mantia T., Marras S., Sirca C., Spano D. and Valentini R., (submitted) - Mediterranean pre-forest plant communities: linking the available data on phytosociology, structure, biomass, and annual variation in carbon fluxes Arianoutsou M., 1989. Timing of litter production in a maquis ecosystem of North-Eastern Greece. Acta oecologica Oecologia Plantarum, vol.10, 4: 371-378. Lodge G. M. , McCormick L. H. and Harden s., 2005. Grazing studies of a Hyparrhenia hirta (Coolatai grass) pasture in northern New South Wales. Australian

		Journal of Experimetal Agriculture, 45: 1603-1611
Line 7. What are the species shrub and wood that occur in the succession. A brief description of vegetation dynamics and growth should be given.	Please see Table 1 of the manuscript	
Line 11. Please explain more.	k formula will be reported Original formula were omissed in the editing for BGD	$K=-(\ln C_t/C_o)/t$ (Dalal et al. 2005) Insert in references: Dalal et al. 2005
Page 11116. Line 17. Why use polynomial curves? Polynomial fitting are highly adaptable to most datasets.	We agree regarding the adaptability of polynomial curves. But the ecological trend of data in relation to succession (an increase and a decrease) need a descriptive adaptation curve	
Page 11118 lines 21-26. Too general.	Unfortunalety it is not clear to us to which statement this referee comment is referring, since lines 21-26 of page 11118 include the last line of results, the title of "dicussion", and the first three lines of discussion.	
Page 11119 line 10. Statement not clear.	Only roots biomass and litter (organic matter input) can improve soil aggregation and macroaggregation	In the last stages of a succession, the increase in litter and roots can favor the formation of macro-aggregates and therefore an increase in the total C_{stock} (Tisdall and Oades, 1982).
Lines 13-20. Why do you think the drivers are the size of the aggregates. Please be more specific. Explain the details if you think there is a relevant process behind it.	Macroaggregate influence on C stock is well documented, as well as that the macroaggregates are able to accumulate the labile SOC, and that, on the contrary, the < 25 micron fraction is responsible of the more stable SOC. In the short period only macroaggreagates can contribute to SOC increase, whereas microaggregates can physically protect SOC in	

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	the long period. Aggragtion reduces accessibility of microbial biomass to substrate and thus contributes to the protection of SOC. In 1982 Tisdall and Oades formulated the concept that stable microaggragates are bound together to larger units by labile organic substance. This concept called “soil aggregate hierarchy” was supported by subsequent research which showed that macroaggregate had a higher carbon content, higher content of SOM labile , and faster SOC turnover compared to microaggragates (six et al .2002, John et al., 2005, Paul et al., 2008)	
Line 28. What do you really mean when you say replacement of C. C stabilizes and remains or decomposes. Page 11120 lines 5-8.	The two phrases will be linked	In the chronosequence of the current study, new carbon became dominant in about 40 yr
Page 11120 lines 5-8. Did you measure primary productivity? Plant productivity may well be the main driver.	See answer for Page 11115 line 5.	
Lines 11-16. Too speculative.	The phrase will be eliminated	Cancel sentence
Fig 6. There is no legend showing the correspondence between figures and soil fractions.	Original legend were missed in the editing for BGD	