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Interactive comment on "Shallow water carbonate platforms (Late Aptian, Southern Apennines) in the context of supraregional to global changes" *by* A. Raspini

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I thank Prof. Föllmi for his comment to my manuscript. You may find the final version of my manuscript (attached as Supplement) revised following most of the suggestions of all the referees.

General remarks The overall stratigraphic frame provided by Di Lucia et al. (this volume; 2009) for the "Orbitolina level" of the Apennine carbonate platform is strikingly in contrast with the points that I report in my manuscript. In fact: 1) I basically ground my stratigraphic, geochemical and paleoecologic discussion on the solid assumption that the "Orbitolina level" of the Apennine carbonate platform is Late Aptian in age

(Gargasian; see Cherchi et al., 1978; Bravi & De Castro, 1995; but also Schroeder et al., 2010, among many others), confirmed by my own experience with Mesorbitolinid stratigraphy in Aptian sediments of the Central-Southern Apennines since the Nineties (Raspini, 1996, 1998, 2001; D'Argenio et al., 1999); 2) my paleoenvironmental and paleoecologic interpretations are rooted in a stratigraphic model which includes sea level oscillations and paleoclimatic controls on the evolving trophic levels as the main governors for the sedimentation of the "Orbitolina level". As consequence, the main features of the Gargasian hydrosphere-biosphere system, as deduced by local carbon isotopic curves coupled to secular fluctuations of Ca/Mg ratio and pCO2 (among others), have been taken into consideration and discussed consistently.

Finally, I think that, in all aspects of life, the great (and legitimate) desire to achieve success and "make history" may lead to unexpected positive results. But, if one is in a hurry, and the desire is too great, results may become counterproductive. In my view, this is what happened to the paper of Di Lucia et al. (this volume).

Specific answers Following the referee's request, I have added the section 3.1 (Remarks on the age of the "Orbitolina level") to the final version of the manuscipt (attached as Supplement), as reported below: "Recently, the "Orbitolina level" of the Southern Apennines has been attributed to the Bedoulian, based on the δ13C record of shallow carbonate sections, supported by a numerical age of 122.9 Ma (122.1-123.5) obtained from the 87Sr/86Sr ratio of a sample collected 1 m above the first marls with Mesorbitolina (Di Lucia et al., this volume). According to these authors, the orbitolinid-rich marly level represents the base of the "Selli level" black shales of epicontinental and oceanic basins. The "Orbitolina level" of the Southern Apennines is rich in Mesorbitolina texana and subordinately Mesorbitolina parva (Cherchi et al., 1978). Although M. parva possibly appeared in the latest Bedoulian (Velić, 2007; Schroeder et al., 2010), the F.O. of M. texana occurred in the Late Aptian (Gargasian), as recently reported by Schroeder et al. (2010): it, therefore, remains one of the tie-points for the calibration of the Late Aptian biostratigraphy of central and southern Tethyan carbonate

platforms (Simmons, et al., 2000; Bachmann and Hirsch, 2006; Velić, 2007; Chihaoui et al., 2010; Embry et al., 2010; Heldt et al., 2010; Vincent et al., 2010). In this paper the "Orbitolina level" is considered a Gargasian litho and biostratigraphic marker in the carbonate platform successions of the Southern Apennines, in which it marks the first occurrence of M. texana and M. parva. This age is further supported by the following observations: 1 - In the lower part of the Tobenna-Faito composite section a progressive decrease of the accommodation space on the platform is recorded; it culminates with the Sequence Boundary Zone (SBZ1) above the "Orbitolina level", as testified by the maximum abundance of characean-rich sediments (see section 5.2 and Fig. 4 below). According to D'Argenio et al. (1999), this $\sim$8 m-thick deposits represents about 800 ka. An overall comparable trend of facies evolution was also observed in coeval sediments cropping out at Serra Sbregavitelli now located more than 100 km from the Faito section and encasing the orbitolinid-rich biostratigraphic marker (D'Argenio et al., 1999). If the "Orbitolina level" marked the onset of the OAE1a in the Apenninic platform, it would imply that: i) about two/third of the Selli-equivalent deposits at the Tobenna-Faito settled during the sea level lowstand, not during the rising of the sea level as reported in the literature (Schlanger & Jenkyns, 1976; Jenkyns, 1980; Haq et al., 1988; Bralower et al., 1994; Erbacher et al., 1996; Erba et al., 1999; Wissler et al., 2004; Emeis & Weissert, 2009; Jenkyns, 2010; Skelton & Gili, 2011, and many others); ii) considering the cyclostratigraphic studies carried out on the Aptian carbonate platform successions encasing the "Orbitolina level" (Raspini, 1998, 2001; D'Argenio et al., 1999) and the related C-isotopic record recently published (D'Argenio et al., 2004), at Tobenna-Faito the negative isotopic spike corresponding to the segment C3 of Menegatti et al. (1998) would be recorded in sediments deposited more than 400 ka from the beginning of the Selli event (bed-scale cycle 45 in Fig. 4), instead of marking its onset (cf. also Mehay et al., 2009; Erba et al., 2010). This would also occur in the Serra Sbregavitelli section (D'Argenio et al., 2004). 2 - According to Ferreri et al. (1997) and D'Argenio et al. (2004), carbon isotope curves extracted from several shallow water carbonate sections cropping out in the southern Apennines evidence

that the positive δ13C spike reflecting the Selli event clearly underlies the "Orbitolina level". This level is placed close to the boundary of G. algerianus/G. ferreolensis zone, confirming a Gargasian age as proposed by Cherchi et al. (1978). 3 – The recent astronomical tuning of the Aptian Stage (Huang et al., 2010) constrains the Selli event between 124.55 and 123.16 Ma, while for Di Lucia et al. (this volume) the "Orbitolina level" (that should represent the base of the Selli event) is dated at 122.9 Ma.".

All of the above considerations claim a Gargasian age for the "Orbitolina level" of the southern Apennines (see also my reply to the comments by Di Lucia to my manuscript at http://www.solid-earth-discuss.net/3/901/2011/sed-3-901-2011-discussion.html). This is also supported by the following observations: 1) Archaeoalveolina reicheli cannot be considered an independent tie-point of Gargasian age as indicated by Di Lucia et al. (this volume). In fact, A. reicheli has been reported from the Gargasian of Algeria and north Tunisia (Bismuth, 1973; Fourcade & Raoult, 1973), from the Late Gargasian and Clansayesian of the eastern Algeria (Masse & Chiki-Aouimeur, 1982) or dated as Late Aptian/Early Albian in the Southern Apennines, Croatia and even in Central Tunisia (De Castro, 1991; Chiocchini et al., 1994; Bravi & De Castro, 1995; Husinec et al., 2000; 2009; Chihaoui et al., 2010). This conflicting age is likely the reason for Tethyan range charts of A. reicheli have not yet been established (see Heldt et al., 2010). 2) As stated in a recently discussed but not yet published Doctoral thesis "The "Orbitolina level" of the southern Apennines cannot be correlated with the "Couches supérieures à orbitolines" of the French Vercors and the "Upper Orbitolina Beds" of the Helvetic Alps (Linder et al., 2006; Föllmi and Gainon, 2008). Instead, a correlation with the "Niveau Fallot" of the Vocontian Basin (Friedrich et al., 2003), recently proposed by Raspini (2011), is compatible with our chemostratigraphic data" (Trecalli, 2011, p. 94-95). These statements overturn the interpretation and conclusions by Di Lucia et al. (this volume) on the orbitolinid-rich level of the Southern Apennines, lending explicit and definitive support to my manuscript. Consequently, the stratigraphic conclusions on the "Orbitolina level", interpreted as the base of the basinal Selli OAE by Di Lucia et al. (this vol., but see also Di Lucia, 2009), have to be

considered unrealistic and therefore rejected.

I really do not know what the referee is referring when he writes "...the 4‰ positive shift was correlated with a minor, 1‰ shift near the base of the Late Aptian.... in corresponding pelagic sections.". The only 4‰ positive shift in the δ13C record reported by D'Argenio et al. (2004) and in my manuscript is above the "Orbitolina level" (Fig. 6). The correlation between this 4‰ positive shift (trend) and a minor (1‰ shift is with the Resolution Guyot (Cretaceous shallow-water carbonates; Jenkyns & Wilson, 1999). In the manuscript the correlation between the $\sim$ 4‰ positive shift of the Apenninic carbonate sections fits well with the corresponding positive shifts of about 4‰ in the (hemi)pelagic record represented by Piobbico-Cismon and Peregrina Canyon deposits (Fig. 6). In general, however, as the referee well knows, an offset of δ13C values such as the one between Apenninic and Pacific shallow water sections (or between deposits of shallow and deeper-water settings) could be related to different diagenetic conditions between compared sections (see also Vincent et al., 2010, their Fig. 9) and/or reflect the productivity- and depth-dependent uptake of 12C and 13C in carbonates (e.g., Bodin et al. 2009; Meyer et al. 2011). Finally, a climatic cooling can cause major oceanographic changes such as a destabilization in the oceanic density structure or ocean overturns that bring deep 13C-depleted water to the surface (Wilde & Berry, 1984; Glumac & Walker, 1998).

Regardless of diagenetic effects the oxygen isotope absolute values locally suffered, I think that the very good reproducibility of δ18O main trends of the studied sections at a regional scale (Fig. 5B) and the comparison with reference curves (Fig. 7) suggest that the main trends can be plausibly regarded as indicative of excursions of the isotopic composition of the sea water and, consequently, that the "Orbitolina level" deposited during a long-term global climate cooling, similarly to the Niveau Fallot in the hemipelagic setting (Takashima et al., 2007). This is in agreement with the sedimentological and cyclostratigraphical results summarized in Fig. 4 in which a progressive longer-term sea-level lowering is clearly recorded in the corresponding deposits (see

also Raspini, 1998).

In my manuscript I also utilised previously published isotopic data (D'Argenio et al., 2004) which have a low resolution; this is one of the reasons why the research presented here has to be considered a fundament for future, more conceptual work that I hope to realize (I am working to do it soon). Therefore, more detailed sampling of both the already studied and new coeval sections are required to reinforce the conclusions of the manuscript. Nevertheless, this does not mean that everything must be directly supported by geochemical evidences. Similarly to the more widely accepted interpretation (Vilas et al., 1995; Pittet et al., 2002; Bachmnn & Hirsch, 2006; Burla et al., 2008; Embry et al., 2010; Schroeder et al., 2010 and many others), the exceptional concentration of conical foraminifera featuring the marly "Orbitolina level" of the southern Apennines can be well explained as mainly influenced by a variation of nutrient levels in the surficial waters (which were advantageous to the development of the orbitolinids) respect to the general paleoenvironmental conditions that favour the settlement of the under- and overlying carbonates.

Finally, I must say to be saddened and astonished by the "subliminal message" coming out from the referee's comment to my manuscript. In my view, a referee should evaluate a paper considering, for example, its organization, if the collected data are coherent with their interpretation, and so on, without suggesting, d'emblée, which manuscript he tends to favour. If different interpretations exist on the same topic, I think it is better make all of them known, giving the readers the chance to fully evaluate them and finally choose the version they prefer.

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http://www.solid-earth-discuss.net/3/C650/2012/sed-3-C650-2012-supplement.pdf

Interactive comment on Solid Earth Discuss., 3, 901, 2011.