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Discussion

Discussion on the article "Remarks on the Permian-Triassic transition in Central and Eastern Lombardy (Southern Alps, Italy)" by G. Cassinis, M. Durand and A. Ronchi

Discusión sobre el artículo "Apuntes sobre el tránsito Pérmico-Triásico en Lombardía central y oriental (Alpes Meridionales, Italia)" de G. Cassinis, M. Durand y A. Ronchi

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In their paper "Remarks on the Permian-Triassic transition in Central and Eastern Lombardy (Southern Alps, Italy)", Cassinis *et al.* (2007) propose regional correlations in the Southalpine area (Northern Italy) around the P/Tr boundary. Their reconstructions are based on the integration of paleontological, stratigraphic, and sedimentological data from published works and original analyses on the studied succession, spanning from the Early Permian (Cisuralian) to the Olenekian. The authors attempt to integrate their observations in a coherent scenario, but their conclusions are largelly biased by the incorrect preconception that climatically-controlled sedimentary features should be necessarily synchronous, even if in contrast with biostratigraphic evidence.

Specifically, the occurrence of ventifacts (wind-worn pebbles, interpreted as markers of arid climate) is not only assigned an undemonstrated chronostratigraphic significance, but even claimed to merit predominance on the occurrence of the cosmopolitan marker *Claraia* (Valsassina, Orobic Alps, Posenato *et al.,* 1996). The *Claraia* horizon of the Servino Formation, representing the Lower Triassic in the western Southern Alps (Sciunnach, 2005), is thus arbitrarily shifted upwards in the stratigraphic chart, to comply with preconceived ideas based on equivocal sedimentological evidence.

The Valsassina *Claraia* horizon is located in the middle Servino Formation about 7 m above the basal Prato Solaro Member (Posenato *et al.,* 1996; Sciunnach *et al.,* 1996, 1999), which contains the ventifacts of Cassinis *et al*. (2007). The fossiliferous horizon only yields the bivalve *Claraia*, an opportunistic crisis progenitor taxon (*sensu* Kauffman and Harries, 1996), which is characterised here, as everywhere, by a wide range of morphological variability. The following morpho-species have been recognized: *Claraia intermedia* (Bittner), *C. radialis* (Leonardi), *C. tesidea* (Leonardi), *C.* cf. *bittneri* (Ichikawa), *C.* cf. *clarai* (Emmrich) and *C.* cf. *aurita* (Hauer). But for the latter, all these taxa have been classified, applying a species-population concept, into *C. intermedia* (Posenato *et al.*, 1996), a species belonging to the *Claraia stachei* group (Ichikawa, 1958), which is characterised by well developed radial ornamentation. Specimens of this group have been reported in the *Claraia clarai* subzone of Dolomites (Broglio Loriga *et al.,* 1983, p. 559), while *Claraia intermedia* and *C. aurita* dominate the *Claraia* beds located between the *C. clarai* and *C. aurita* subzones of the Dolomites (Leonardi, 1960). Therefore the *Claraia intermedia* horizon of Valsassina was correlated to the transitional beds between the *C. clarai* and *C. aurita* subzone (*sensu* Broglio Loriga *et al*., 1983; 1990) of the Dolomites (Posenato *et al.,* 1996), which range in age from late Griesbachian to Dienerian (Broglio Loriga *et al*., 1983, 1990).

Cassinis *et al.* (2007), adducing the high morphological variability of *Claraia*, disregard its chronostratigraphical value and cite some old papers where *C. claraia* and *C. aurita* were also quoted in Smithian units of the Southern Alps (e.g. Yin, 1985). Such younger position, however, has never been demonstrated, and all recent papers report a *Claraia* range in the western Tethys (Dolomites and Hungary) restricted to the Induan Mazzin and middle Siusi members of the Werfen Formation (Broglio Loriga *et al*., 1983, 1986, 1990; Neri, 2007) and lower-middle Aracs Marl and Alcsutdoboz formations of the Transdanubia (Hungary) (Kozur, 1987; Broglio Loriga *et al.,* 1990). In the Dolomites, this dating is constrained by conodont biostratigraphy (e.g. Perri, 1991), magnetostratigraphy (Scholger *et al*., 2000), and chemostratigraphy (Horacek *et al*., 2007a). The Induan age of the *Claraia* beds has been recently also re-proposed in Iran (Horacek *et al.*, 2007b) and South China (Tong and Yin, 2002; Zhao *et al.*, 2007), where the genus appears in the late Changhsingian (He *et al*., 2007). Smithian occurrences of *Claraia* in the Tethys concern the *Claraia decidens* (Bittner) group, for which the new genus *Crittendenia* has been proposed (Newell and Boyd, 1995), or species with only dense, concentric lines (e.g. *Claraia hubeiensis* Chen: Tong *et al.*, 2006, pl. 2, figs. 11-14).

Ventifact-bearing conglomerates of the French Buntsandstein have "pratically no element for direct dating" and the "correlation between NE France and northern Germany…are well still debated", although the Volpriehausen Formation of the Germanic basin is "the best candidate" (Durand, 2006, p. 290) to record the arid phase which "may correlate to the late Dienerian to early Smithian interval" (Durand, 2006, p. 291). However, a younger dating for the Volpriehausen Formation is known in literature, e.g. a middle-late Smithian age has been proposed by Kozur and Bachmann (2005). In the Germanic basin, another, older arid episode is recorded in the uppermost Nordhausen Fm (now Calvörde Fm) which was correlated to the Andraz Horizon (Werfen Formation) of the Dolomites (Kozur, 1989), a prevailing evaporitic unit located between the *Claraia wangi-griesbachi* and *C. clarai* subzones (Broglio Loriga *et al*., 1990). The Prato Solaro Member may thus be correlated with the Andraz Horizon, consistently with the correlation between the *Claraia* beds of the Valsassina and the transitional *Claria claraia* - *C. aurita* beds (Siusi Member) of the Dolomites proposed by us (Posenato *et al*., 1996). This part of the Siusi Member records the MFS of the second Scythian sequence (Sc 2) of the Dolomites (Gianolla *et al*., 1998; Neri, 2007).

In summary, we consider the hypothesis that ventifacts should necessarily occur in a single interval during the Early Triassic, as proposed by Cassinis *et al*. (2007), as unjustifiable and biased by an unscientific approach. Incidentally, we note that because of incomplete fossil record of central Europe continental successions, and consequently uncertain chronostratigraphic framework, biostratigraphy, magnetostratigraphy, and sequence stratigraphy of continental Buntsandstein (e.g. Kozur, 1993; Kozur and Bachmann, 2005; Szurlies, 2007) were calibrated by marine Lower Triassic successions (e.g. *Claraia* beds of Western Tethys).

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