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1 **Reply to:**

2

3 **Comment** by Eric Font, Gerta Keller, Diethard Sanders and Thierry Adatte

4

5 **on “Post-impact event bed (tsunamite) at the Cretaceous-**

6 **Palaeogene boundary deposited on a distal carbonate platform interior”**

7

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9

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14

15 We disagree with many of the concerns raised by Font et al., (submitted) and take this opportunity to
16 clarify matters. We wish to emphasise that in our paper (Korbar et al., 2017), as well as in the first report
17 on the “potential“ Cretaceous-Palaeogene (K-Pg) tsunami in Adriatic region (Korbar et al., 2015), we
18 reported on *rare shallow marine* distal K-Pg records that differ from *dominantly deep marine* records
19 commonly reported in other papers. We did not include more references on the latter, since that was
20 not a goal of our paper and we encourage the authors of the Comment themselves to make additional
21 research of the Likva section, especially the issues that are criticised.

22 The authors of the Comment note that none of the well defined K-Pg successions paleogeographically
23 located along the eastern Atlantic (today Bay of Biscay) region “(*Bidart, Zumaia, Hendaye and Sopelana*
24 *sections)*, which are located more proximal and towards the hypothetical tsunami wave propagation
25 front“, include a tsunamigenic record on the K-Pg boundary. However, all the listed successions were
26 deposited within deeper bathial (1000-1500 m) water depths and were located at least 50 to 100 km
27 from the shallow platforms (cf. Alegret, 2007; Rodríguez-Tovar et al., 2011). When later later orogenic
28 shortening is accounted for the original distance would have been even greater. Furthermore, there is a
29 lack of any seismogenic evidence (liquefaction, slumping, etc.) in the sedimentological records from very
30 distal K-Pg deep-marine successions. We discussed that issue in Korbar et al. (2015), especially with
31 respect to Gubbio as the closest reported deep-marine K-Pg record to the Adriatic platform and the
32 shallow-marine K-Pg successions of Hvar and Likva. Thus, neither the giant hydrodynamical perturbations
33 expected in a K-Pg tsunami nor attenuated seismic energy would be expected to affect the deep-water
34 sediments in very distal regions.

35 Considering the explanations above, such a criticism is not accepted. It would be much more useful to
36 see published reports on possible shallow-platform or coastal K-Pg records from the eastern Atlantic
37 paleo-margin. Such an analysis requires systematic fieldwork and focussed geological mapping of the

38 region, similar to that we have performed in Adriatic region before making conclusions about an issue of
39 almost global significance.

40
41 **1. Tsunami benchmarks – highlights on unknown tsunami effects in modern isolated carbonate**
42 **platform interiors**

43
44 The major issue underestimated by Font et al. (submitted) is that there is no modern analogue for an
45 isolated carbonate platform tsunamite (e.g. Shiki et al., 2008; Korbar et al., 2015 and references therein).
46 Major modern tsunamis are documented either from coral-reef dominating atolls and small intraoceanic
47 islands or coastal regions encompassing broad open shelves (Shiki et al., 2008). Conversely, the intra-
48 oceanic Adriatic carbonate platform (ACP) was a shallow and flat, few hundreds kilometers wide mud-
49 dominating rimmed carbonate bank without coral reefs, while the Likva locality was situated in the
50 central part of it in a sheltered lagoon. Thus, one cannot expect all the features typical for modern
51 tsunamis in such an environment.

52 Concerning criticism on the composition of the tsunamite, Font et al. (submitted) compiled the expected
53 redeposited components from various modern settings. For example, there is no sedimentological
54 evidence for the statement that *“bed 4 may have accumulated after intermittent bank-top exposure*
55 *where intraclasts formed by desiccation and/or bioturbation”, since such features are common deeper*
56 *downsection (not reported in Korbar et al. (2017)). There are also not “just a few angular bioclasts” in a*
57 *lag, since we reported also on rounded mud intraclasts that originated from bed 3. Besides, there are*
58 *clear sediment loading structures observed in bed 4 (Fig. 2c of Korbar et al., 2017). It should be*
59 *highlighted that our study documents a relatively high-energy event in very low-energy setting of a very*
60 *distal and broad carbonate platform interior (tidal flat) lacking sands, characterized by monospecific*
61 *skeletal material (requieniid-rudist bivalves). Thus, there is a thin but relatively coarse-grained bioclastic*
62 *lag of 10-12 cm thick sediment deposited after the attenuated tsunami surge. Apart from obviously*
63 *abundant soft-tissue worms, other biological debris was also probably minor and was mostly*
64 *decomposed by diagenetic processes during subsequent regional Cretaceous-Palaeogene platform*
65 *emersion phase and orogenic burial (Korbar, 2009).*

66 Modern tsunami records on atoll-fringing narrow carbonate platforms (eg., Nichol and Kench, 2008), and
67 various continental marginal marine environments (eg., Font et al., 2013) certainly differ significantly
68 from the record on ACP. This is because a carbonate platform interior tsunami record must be completely
69 different than preserved in open shelves (Smit et al., 2011). That is why many features described in
70 modern tsunamites (Morton et al., 2007; Goto et al., 2012) cannot be used for ancient mud-dominated
71 intra-oceanic flat and broad carbonate platform interiors, until the characteristic tsunamigenic record is
72 documented from similar modern settings (e.g., Bahamas).

73 There are also differences concerning various peri-Adriatic Late Cretaceous shallow-water carbonate
74 environments. For example, relatively small (narrow and thin) carbonate ramps/banks developed within
75 mixed carbonate-siliciclastic Gosau-type settings (Polšak, 1981; Sanders and Pons, 1999; Moro et al.,
76 2016) are rich in siliciclastic material and various macrofossils, including corals. The tsunami effects on
77 these small fringing carbonate bodies attached to the exhumed oceanic and/or continental basement
78 cannot be compared to the broad and flat ACP interior characterized by deposition of almost pure
79 carbonate mud. Similarly, the Adriatic platform differs also from Maiella (Apenninic) platform that was
80 characterised by ramp-like geometry and relatively open high-energy environments and flourishing
81 rudist communities in the marginal areas (Eberli et al., 1993; Sandres, 1996).

82 Another criticised issue are calcispheres shown on Fig. 2D and 3A of Korbar et al (2017). . It would have
83 been helpful if Font et al. (submitted) provided a reference (with figures of that type of calcisphere) to
84 support their statement that the calcispheres at Livka are “a common feature...” in Late Cretaceous
85 carbonate platform deposits.

86 **2. Bioturbation**

87
88 Sub-horizontal to sub-vertical burrowings are not interpreted by Korbar et al. (2017) to be formed only
89 during escape of light-body animals (probably polychaete worms), but were predominantly formed
90 hours-to-days after the deposition of the event bed, as excellently illustrated by modern laboratory
91 research (Herringshaw et al., 2010), giving the idea for reconsiderations on many
92 conventional/traditional ichnological interpretations. Font et al. (this issue) stated that „*bioturbation*
93 *illustrated is characteristic of a hardground or firmground burrow network slightly modified by*
94 *compaction, rather than softground bioturbation*“. Our interpretations are based on analyses of tens of
95 slabs and thin-sections from the bed, confirmed also by a reviewer who is an authority on ichnology. We
96 offer collected material for further ichnological research. Considering criticism on habitat of modern
97 polychaetes (annelide worms) we can only repeat the discussion on the topic in Korbar et al. (2017),
98 including references therein.

99

100 **3. Shocked-quartz**

101

102 We neither “*claim additional support for tsunami interpretation from PDFs*” nor analyze “*a single*
103 *shocked quartz grain*” and the grains are used for correlation with the K-Pg impact rather than for the
104 tsunami. We analysed tens of quartz grains and provided quality SEM images for two with multiple
105 features that were both straight and regularly and closely spaced.

106 We accept that it would be useful to make crystallographical measurements on the quartz grains to
107 confirm that the features are genuine PDFs, and we offer the material to any interested and experienced
108 scientist. However, suggestions on a possible terrigenous origin and redeposition of shocked quartz are
109 highly unlikely, since the grains occur in a lagoon within an isolated carbonate platform that was situated
110 far from possible terrigenous sources .

111 **4. Planktonic foraminifera**

112 The specimens are rare, very small and not very well preserved, however they present valuable evidence
113 on the Early Paleocene evolution of the planktonic foraminifera. We explain our determination for
114 specimens where we disagree, and accept suggestion of Font et al. (this issue) for the species
115 *Chiloguembelina midwayensis*.

116 Thus, the Fig. 5 SEM images (in Korbar et al., 2017) of the basal Paleocene (P0-P α zones) planktonic
117 foraminifera isolated from the K–Pg boundary “clay” of the Likva section are as follows:

118 (A-B) *Guembelitra cretacea* CUSHMAN

119 (C) *Parvularugoglobigerina* cf. *longiapertura* BLOW

120 (D) *Eoglobigerina eobulloides* (MOROZOVA)

121 (E) *Woodringina claytonensis* LOEBLICH and TAPPAN

122 (F) *Parvularugoglobigerina* cf. *extensa* (BLOW) – We agree that this specimen is difficult to determine
123 because the previous chambers are visible only in part.

124 (G, H, I) *Praemurica taurica* (MOROZOVA) – wall textures indicate that these specimens belong rather to
125 *Praemurica taurica*, than to microperforate *Parvularugoglobigerina eugubina*. Spiral side also implies
126 genus *Praemurica*.

127 (J-K) *Globoconusa daubjergensis* (BRÖNNIMANN)- due to very small test size and very thin wall we
128 consider that these specimens belongs to *Globoconusa*. Our specimens could belong to *Globoconusa*
129 *victory* KOUTSOUKOS (2014).

130 (L) *Chiloguembelina* cf. *morsei* (KLINE)- The upper layer of the test is dissolved and determination is
131 difficult. We accept the suggestion that it could be *C. midwayensis*.

132

133 5. Correlation with the Hvar section

134

135 Considering criticism of Font et al. (submitted) on correlation with Hvar section, we can only repeat our
136 arguments from Section 1. Namely that there is knowledge on tsunami effects on mud-dominated
137 carbonate platform tidal-flat interiors that are modern analogues for the Livka and Hvar sections.

138

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