EOCENE GLASS SPHERULE-BEARING TURBIDITES IN EASTERN ADRIATIC FLYSCH - EVIDENCE OF MULTIPLE IMPACTS INTO SEDIMENTARY TARGETS?

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There has been a lot of controversy regarding the single- or multiple Late Eocene impacts which shaped the key evolutionary events and faunal turnovers. Nearly 2000 m thick succession of Eocene clastics in Central Dalmatia (Croatia), seemed a promising area to study possible evidence of Eocene impacts.

We have studied Eocene flysch in the hinterland of the city of Split (Fig. 1) and found glass spherules occurring at arenite/marl boundary in several turbidites and marl interbeds.

Fig. 1) Studied area is located in central part of eastern Adriatic Sea coast.

The flysch of Central Dalmatia (Croatian Eastern Adriatic) was deposited in semi-confined basins and comprises several very thick mass flow deposits, referred to as megabeds, interbedded with much thinner beds of identical composition, and several coarsegrained (conglomeratic) wedges (Figs. 2 and 3).

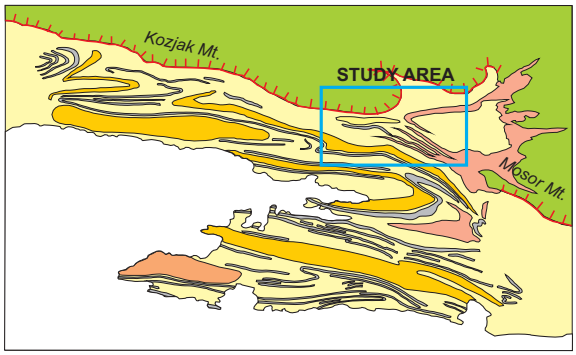


Fig. 2) Simplified gological map of the Central Dalmatian flysch region.

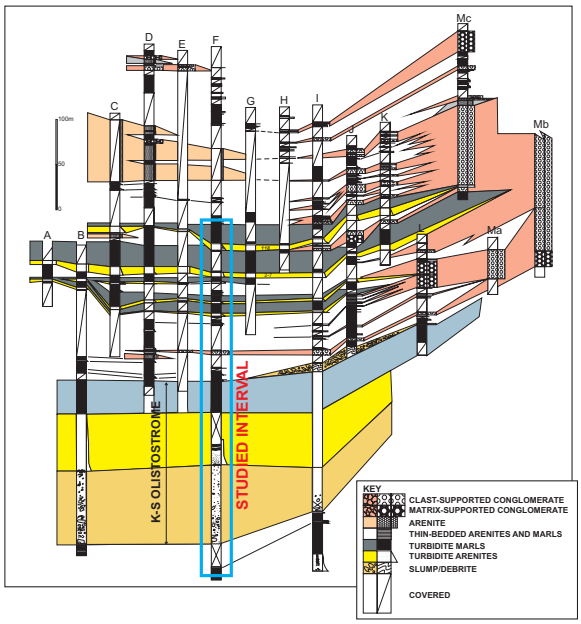
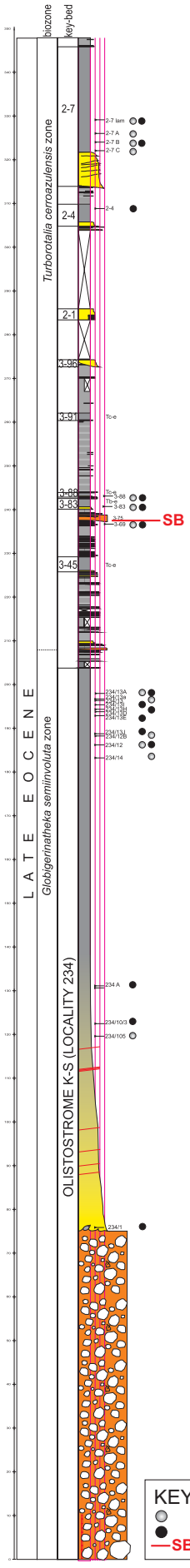


Fig. 3) Cross section of the eastern basin margin. Note interfingering of turbidites and alluvial conglomerates.



There are 16 impact structures of Eocene age in Earth Impact Database (2005). The paleogeographic map below illustrates approximate locations of Late Eocene impacts.

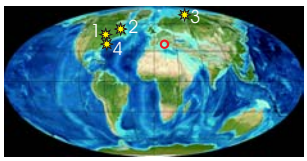


Fig. 4) Late Eocene paleogeography with locations of confirmed Eocene impacts.
1 = Wanapitei Ø 7,5 km, 2= Mistastin Ø 28 km, 3= Popigai Ø 100 km, 4= Chesapeake Bay Ø= 90 km
(Earth Impact Database, 1st November 2005, Map source: Ron Blakey, Northern Arizona University 2005)

Detailed sampling and analyses of marls which represent upper parts of megaturbidites and "ordinary" turbidites revealed presence of impactoclastic debris at least at 4 stratigraphic horizons which are 35 to 65 meters apart.

The best studied, and with most spherules recovered is a composite turbidite 2-7 (Marjanac 1987), which is the youngest in the sequence and belongs to Turborotalia cerroazulensis-hantkenina spp zone. The 2-7 bed comprises impact-generated debris in its finely laminated marl part, which is represented by perfectly clear (or just slightly dimmed) glass spherules 91 to 530 μ across; teardrop transparent microtectites 1225 μ long, and fragments of vesicular glass 450 to 1000 μ across. Some spherules and microtectites comprise fluid inclusions with diameter up to 41 μ.

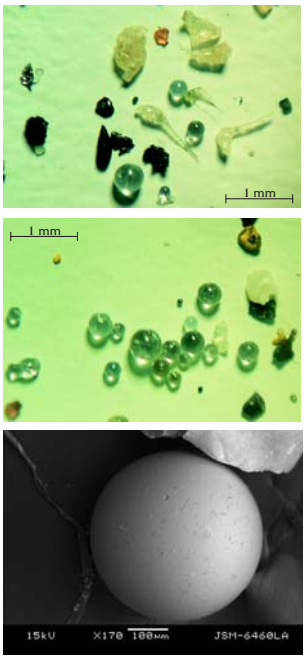


Fig. 5) Microphotographs of spherules from the bed 2-7, and SEM image (below). The analysis was done on JEOL JSM-6460LA electron microscope.

	2-7C : 6
SiO_2	28,90
Al_2O	--
Al_2O_3	--
Fe_2O_3	--
CaO	17,22
MgO	7,84
FeO	0,80
ZnO	0,50
TiO_2	0,42
MnO	0,36
CuO	0,19
Na_2O	0,28
K_2O	0,25
P_2O_5	0,23
SO_3	1,17
SO_2	--
CO_2	41,01
NiO_2	--
NiO	--
Cr_2O_3	--
L.O.I.	--
	99,17

Fig. 6) Chemical composition of transparent glass spherule 2-7C:6

Occurrence of glassy and metallic sphaerules at several horizons suggests there are several impact events recorded in this succession of deep-marine deposits. Exactly how many, remains to be solved by detailed analysis of spherule composition.

Chemical composition of analysed spherules differs from that of Chesapeake Bay and Popigai impacts, and indicates possible sedimentary (carbonate) target. So how many impacts have we got?

We will try to address a question of possible resedimentation, and variations in spherule composition in progress of our research, which is, regrettably, slow.