GLASS SPHERULES IN MIDDLE PLEISTOCENE GLACIOGENIC SEDIMENTS OF W. CROATIA, THEIR COMPOSITION AND POSSIBLE ORIGIN

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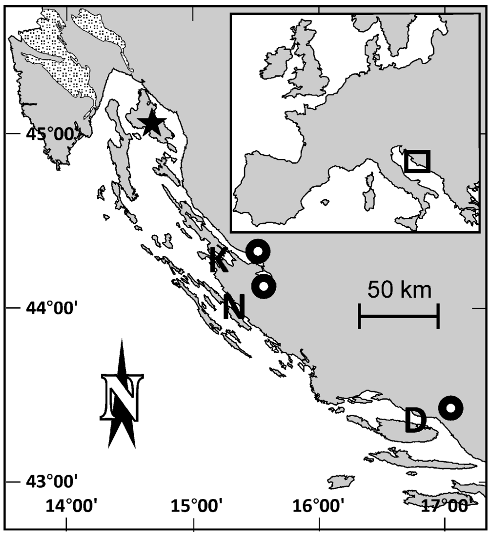

Fig. 1) Locations with glass spherules (E. Adriatic Sea coast, Croatia): K (Velebit Channel), N (Novigrad Sea), D (Biokovo Mt.). Star = Proposed Krk impact structure.

Sub-millimeter size glass spherules are found in Pleistocene glaciogenic sediments at three localities in coastal Dinaric Mts. (Fig. 1) which are built primarily of Mesozoic carbonates and Paleogene carbonate flysch clastics in restricted occurrences along the coast (eg. near localities N and D).

Spherules were extracted from clayey matrix of basal (lodgement) tills attributed to Middle Pleistocene glaciation of Dinaric Mts. [1] where they occur in discrete macroscopically indistinct laminae. Repeated sampling did not reveal any spherules at different horizons, so we rule out possibility of contamination.

Spherules are transparent, usually almost perfect spheres, but sometimes also fused and spherical. Though most spherules occur free, some also occur imbedded in yellow amorphous matrix. Their chemical composition (Table) is compared with published compositions of Eocene flysch [2] and Pleistocene loess [3] from Adriatic localities, and shows closer affinity to Pleistocene loess, which could have been their parent lithology. The studied Pleistocene glass spherules are herein interpreted as distal impact ejecta formed by an asteroid impact into sedimentary target. At the distance of 100 km NW from loc. K is located proposed Krk impact structure [4] of presumed post-Eocene age, whereas possibly time-equivalent Zhamanshin crater is located in Kazakhstan at the distance of 3480 km. Compositional affinity of glass spherules with Pleistocene loess suggests that the impact occurred into loess-like target, very likely in early Pleistocene.

Table Composition of glass spherules and their matrix analyzed by micro-PIXE, and Krk "flysch" and Susak loess analyzed by ICP-AES. All values in wt %. ND = Not determined, NA = Not analyzed. * we could not determine the oxidation stage of iron, so we calculated the role of FeO and Fe_2O_3.

	Loc. K spherules	Loc. N spherules	Loc. D spherules	Loc. D matrix	Eocene “flysch”[2]	Pleistocene loess [3]
SiO_2	77.14	73.32	75.86 - 76.83	26.21	38.06	47.72 - 62.25
Al_2O_3	8.46	15.38	12.16 - 12.57	21.52	4.25	9.65 - 12.07
K_2O	7.39	4.97	5.92 - 6.25	ND	0.80	1.53 - 2.20
CaO	2.55	2.35	2.73 - 2.82	1.18	28.76	7.35 - 11.77
TiO_2	1.15	0.21	0.01 - 0.3	ND	0.39	0.54 - 0.77
MnO	2.66	2.94	1.46 - 1.73	4.55	0.1	0.07 - 0.09
*FeO	0.06	0.14	0.07 - 0.1	1.58	1.94	-
*Fe_2O_3	0.06	0.04	0.01 - 0.03	ND	-	3.19 - 4.44
Na_2O	0.21	0.41	0.13 - 0.19	0.31	0.87	1.64 - 2.86
MgO	ND	ND	ND	1.63	1.53	3.49 - 5.94
P_2O_5	ND	ND	ND	5.71	ND	0.14 - 0.22

References:

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