

Karst - a trap for extraterrestrial debris

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INTRODUCTION

Karst is a sink for all sorts of sediments. The debris produced by weathering of the exposed rocks is being transported by slope processes, running water, wind, snow, and ice action, and deposited in karst depressions, dolines, poljes and underground cavities.

In the subsurface, the external debris is being deposited in shallow parts of caves and ponors where it forms sediment layers commonly interbedded with soils and/or cave sediments sensu stricto (speleothems and collapse debris).

This debris compositionally corresponds to the rocks exposed in a particular drainage basin, but karst is also a trap for wind-blown deposits from far sources (e.g. loess) and **cosmogenic debris which rains down on the Earth (e.g. space dust, micrometeorites, microtektites and spherules of various composition and origins).**

We have studied sediments from various Dinaric karst areas. The sediments were decomposed by H₂O₂, wet-sieved and studied under microscope in search for microfossils and mineral grains which might indicate their age, and shed more light onto karst evolution. Some of these yielded **high-temperature quartz grains, glass shards, microtektites, and glass spherules** which occur in discrete horizons. These were found at the Kusača cove in the southern velebit Channel, Novigrad Sea coastal section and Dubci locality.

Chemical composition of spherules was analysed on Tescan Vega SEM coupled with EDAX microprobe and at Rudjer Bošković Institute Accelerator facility using PIXE Spectroscopy in high vacuum at the ion micro-beam end-station.

Chemical composition of analysed spherules

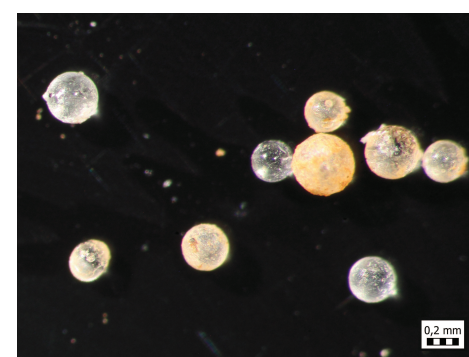
	Kusača	Novigradsko More	Dubci	
SiO ₂	77,14	73.32	75.86	76.83
Al ₂ O ₃	2,66	2.94	1.73	1.46
CaO	8,46	15.38	12.57	12.16
MgO	2,55	2.35	2.82	2.73
FeO	0,21	0.41	0.19	0.13
TiO ₂	0,06	0.14	0.1	0.1
MnO	0,06	0.04	0.01	0.02
Na ₂ O	7,39	4.97	5.92	6.25
K ₂ O	1,15	0.21	0.3	0.1
SO ₃	0,31	0.23	0.37	0.11
Cl	--	--	--	0.05
	99,99	99.99	99.51	99.76

CONCLUSION

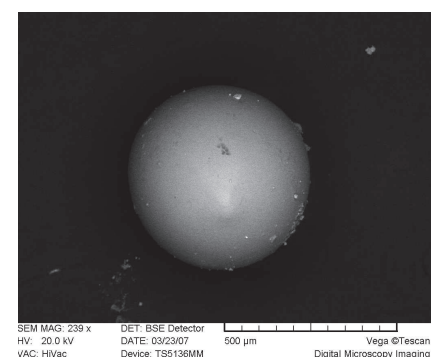
The analyses showed that spherules from the sampled localities have almost identical chemical composition, which warrants their attribution to a single Early Pleistocene ET-event, but unknown in this stage of research.

The spherules are interesting research target which might represent excellent marker horizon for world-wide correlation of Early Pleistocene sediments.

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Spherules from Kusača cove in visible light. Ochre tint is coloration from Fe-rich matrix.



SEM image of a spherule from Dubci.

INTERPRETATION

Glass spherules may have been produced by ablation of a bolide during its flight through the atmosphere, large bolide impacts at the surface of the Earth, and industrial pollution. The pollution is eliminated in the studied case because spherules occur at very distinct levels within sediments of various ages and at distant sites (Middle Permian on the central Velebit Mt., Eocene in the Split environs, Pleistocene at Dubci, Novigrad Sea and Kusača cove at the foothills of the Southern Velebit Mt.

The studied spherules were most likely formed by condensation in explosion plume(s) caused by terrestrial bolide impact(s). Their occurrence at different stratigraphic levels documents multiple impact events, and their compositional differences stem from differences in lithologies of the target rocks. So far, these spherule horizons cannot be associated to any of the known terrestrial impact craters.

This extraterrestrial debris provides good correlation horizon(s) as suggested by Raukas (2000) and should be looked after in the coeval sediments elsewhere in karst areas.

REFERENCES

Raukas, A. (2000): Investigation of impact sphaerules - a new promising method for the correlation of Quaternary deposits. Quaternary International 68-71, 241-252.