KRK IMPACT STRUCTURE EJECTA BRECCIA AND MELT ROCKS ON THE ISLANDS OF KRK AND RAB, CROATIAN ADRIATIC: A CLUE ON THE IMPACT TARGET LITHOLOGY. T. Marjanac[1], A. M. Tomša[1], Lj. Marjanac[2], M. Čalogović[1] & S. Fazinić[3], [1]University of Zagreb, Faculty of Science, Department of Geology, Horvatovac 102a, 10000 Zagreb, Croatia, e-mail: marjanac@geol.pmf.hr, [2]Institute of Quaternary paleontology and geology, CASA, Ante Kovačića 5, 10000 Zagreb, Croatia, [3]Ruđer Bošković Institute, Bijenička c. 54, 10000 Zagreb, Croatia.

The study of the proposed Krk impact structure [1] ejecta was conducted on the surrounding northern Adriatic islands of Cres, Krk and Rab, as well as along the mainland coast. Two types of ejecta are found; A) limestone breccia and B) melt rocks (Fig. 1).

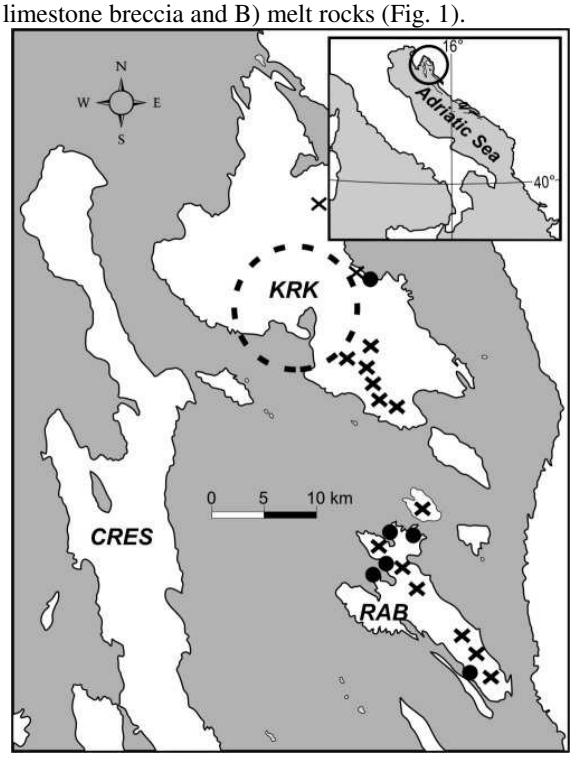

Fig. 1) Study locations in Northern Adriatic Sea. **x** = limestone ejecta breccia (Krk Breccia), ● = melt rocks. Dotted contour of the proposed Krk impact structure.

A) Limestone breccia is polymictic, with clasts of Cretaceous up to Late Eocene age, of chaotic texture with very wide range of clast sizes (from few metres across to sand size), commonly with shattered limestone clasts (Fig. 2A), and attributed to informal unit of Krk-breccia [1], though on the Rab island it is usually referred to as Rab-breccia. The Krk-breccia seldom attains thickness over a few metres (except in the Krk structure centre where it reaches 1500 m) [1]. It is laying disconformably over Cretaceous limestones, but comprises much younger debis with no apparent source. The youngest debris lithology are Eocene sandstones and marls (!) of the Krk Island provenance (Fig. 2B). The farthest occurrence of the breccia is 43 km from the Krk impact structure rim.

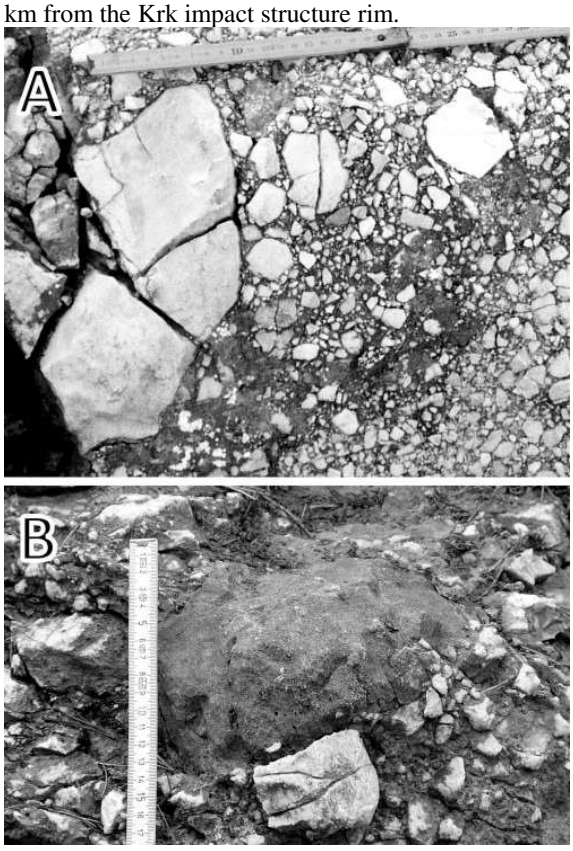

Fig. 2) Krk breccia. A: Shattered clast of Cretaceous limestone surrounded by angular limestone clasts in micritic matrix. Krk Island. B: Large clast of Eocene sandstone. Northern Rab Island.

B) Impact melt rocks are found on eastern coasts of the Krk Island and at several localities on the Rab Island (Fig. 1), but only in secondary position. Two types of melt rocks can be differentiated; i) suevite-like incomplete melts and ii) massive crystalline glass, more-or-less vesicular, sometimes with flow structures. These melt rocks are found 19 km from the Krk impact structure rim (Fig. 1).

i) Partial (incomplete) melts are mottled in colour with two major phases, dark bluish-coloured and light-coloured (beige) glass (Fig. 3), commonly with unmelted sandstone and chert clasts whose rims show thermal alteration. These sandstone remnants are

weathered, and most likely represent Rab Island Eocene sandstones which were subjected to contact thermal metamorphosis when covered with impact melt ejected from the Krk crater.

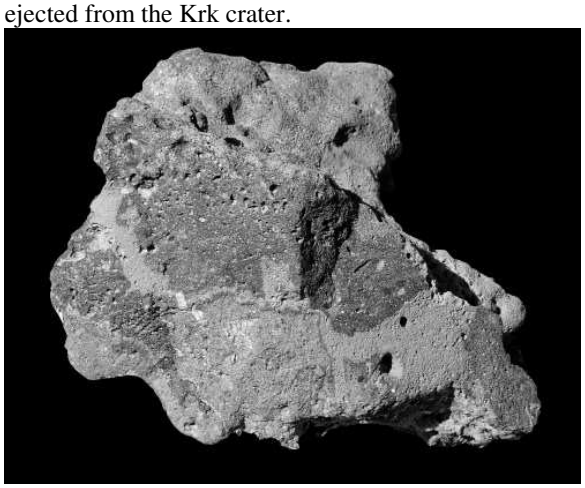

Fig. 3) Incomplete melt rock. The sample is 20 cm long. Northern Rab Island.

ii) Massive vesicular glass is found only on the Rab Island in form of small boulders, 10-30 kg in weight (Fig. 4). These were found to lay above Eocene siliceous sandstones, and some glass blocks are also embedded in an old Roman villa wall. The glass is predominantly dark bluish in colour, crystalline with quench (spinifex) structure made of fibrous pyroxenes, morphologically massive and only locally vesicular. The chemical composition of glass shows predominance of SiO_2 (67.4 wt % in average) and rather high content of CaO (13.5 wt % in average, though with wide scatter between 0.9 and 20.9 wt %) which is probably caused by secondary calcite precipitated in some vesicles.

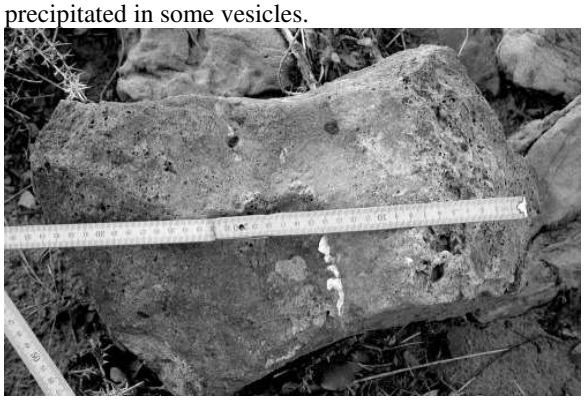

Fig. 4) Massive glass block. Northern Rab Island.

Discussion:

The polymict limestone breccia is interpreted as ejecta from the Krk impact structure, because it comprises abundant debris of mixed ages, particularly Eocene sandstones and marls which do not occur in the base-rocks.

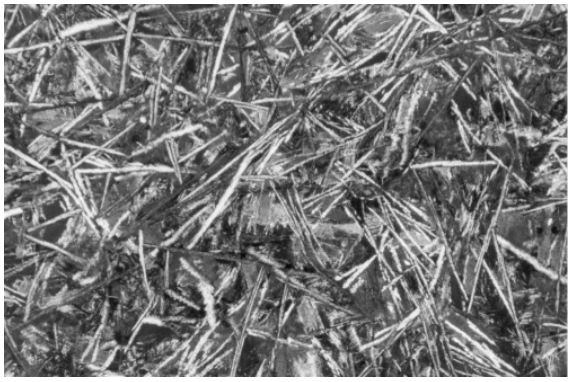

Fig. 5) Microphotograph of melt rock, crossed polars.

The chemical composition of glasses and melt rocks (see Čalogović et al. this volume) shows significantly higher SiO_2 content than published values for the Krk Island flysch [2], but good correlation with the composition of Adriatic loess on the Susak Island (41 km SW from the Rab Island) [3]. The glass and melt rocks seem products of an impact into loess target, which may indicate the Pleistocene age of the event, but prior to major glaciation of the area, since the Krk-breccia is overlain by glaciganic sediments on the Rab Island. To confirm this new age attribution, more research is planned in the near future.

The Krk-breccia is primarily composed of Mesozoic carbonates with subordinate debris of Eocene clastics which indicates deep erosion of the target rocks.

Conclusion: The proposed Krk impact structure produced melt rocks and glasses which provided geochemical evidence of the target rocks; loess of the Pleistocene age. Bracketing the age between the age of the target rocks and the overyling glacigenic sediments may provide better age constrains of the event age, which will be tested in the future research.

References: [1] Marjanac T. et al. (2003) Krk-breccia, Possible Impact-Crater Fill, Island of Krk in Eastern Adriatic Sea (Croatia). Impact Studies, 115-134, Springer, Berlin. [2] De Min A. et al. (2014) Geochemistry of Late Mesozoic - Early Cenozoic turbidites from the NE part of the Adria microplate. Periodico di Mineralogia 83/2, 141-158. [3] Mikulčić Pavlaković S. (2006) Mineraloške karakteristike pijesaka i piroklastita otoka Suska. MSc. Thesis, University of Zagreb.