

## First evidence of glaciation of the Medvednica Mt., Croatia

Tihomir Marjanac<sup>1</sup>, Ljerka Marjanac<sup>2</sup>, Luka Blažić<sup>1</sup>, Josipa Adžić<sup>1</sup> & Ivana Adžić<sup>3</sup>

<sup>1</sup> Department of Geology, Faculty of Science, University of Zagreb, Horvatovac 102a, 10000 Zagreb, Croatia

<sup>2</sup> Institute of Quaternary Paleontology and Geology, CASA, A. Kovačića 5, 10000 Zagreb, Croatia

<sup>3</sup> Javna ustanova Nacionalni park Paklenica, Dr. Franje Tuđmana 14a, 23244 Starigrad-Paklenica, Croatia

Gjuro Pilar wrote in 1877 about glaciation of the Medvednica Mt. and claimed that several striated pebbles were found by one of his students, as evidence of glacial origin of the Medvednica "terrace". He wrote (p. 148) that in total 12 striated pebbles were found in a trough west of Tuškanac, and described the best sample as 5 cm thick triangular-shaped rock, with clear quite large striations on one of the clast side faces, oriented obliquely to the clast longer axis. Gjuro Pilar also claimed on p. 149 that "*Erratics [he here referred to allochthonous debris] occur along the whole length of the [Medvednica] mountain, from vicinity of Sused all the way to Novaki. The center of most intense glacial effects is between Vrapče and Bliznec brooks, and marginal moraine is most shifted to the south near Zagreb. I estimate that the thickness of glacial deposits locally attains 30 m (100 ft) at most*" (translated from Croatian). Gjuro Pilar died in 1893, and his striated pebbles were apparently lost. Dragutin Gorjanović-Kramberger rejected Pilar's evidence in 1902 in heated polemics with Hinko Hranilović (Gorjanović 1907) who adopted Pilar's ideas about glaciation of the Dinaric range.

The 2012 reconnaissance of the Medvednica "terrace" in the foothills of the southwest Medvednica Mt. revealed diamictons with striated pebbles and cobbles, many of bullet-shape, which inspired detailed study of the diamicton fabric, grain-size and composition (Fig. 1).

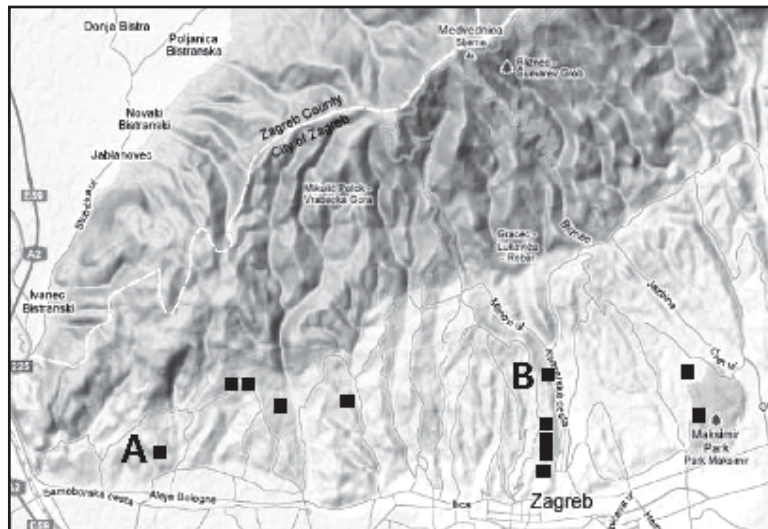


Figure 1. Study locations at the foothills of southwest Medvednica Mt.. Locations A (Lisičina, 224 m a.s.l.) and B (Cmrok, 217 m a.s.l.) are studied in detail.

Diamictons at studied locations on the Zagreb 'terrace' are rich in bullet-shaped clasts (A, Fig. 2), shattered clasts with fissures filled with matrix (B, Fig. 2), and striated clasts (C, Fig. 2), which all indicate glacial origin of the sediments that are interpreted as lodgement till. Glacial striations are apparent on surfaces of many pebbles and cobbles, preferentially on limestone clasts but also on magmatic rock clasts.

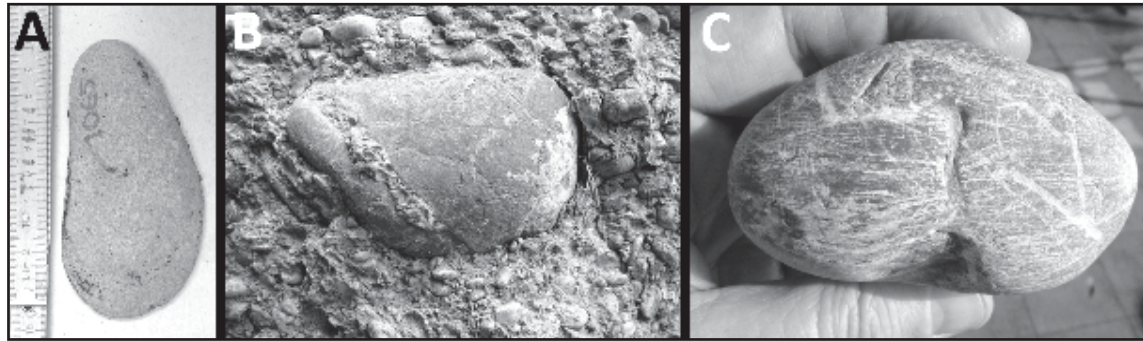


Figure 2. Clast properties. A) bullet-shaped clast, B) shattered clast, C) striated clast.

The till fabric is massive at most locations, but also stratified in the upper part of the Lisičina section (A at Fig. 1). Granulometric and petrographic study of the debris showed no major difference between the underlying massive and overlying stratified facies, thus the stratified fabric is attributed to reworking of the underlying massive diamicton. The stratification dip indicates the north-northeast transport direction, which correlates with glaciotectonic deformations trend in the base of massive diamicton at the same section.

Preliminary study of debris composition shows variety of lithofacies that are not common, even unknown on the Medvednica Mt., so these may be referred to as exotic debris, equal to Pilar's "erratics" of 1877. Tills studied at locations shown in Figure 1 show apparent compositional variations of the debris; limestones being present at all locations, but at the central part of the "terrace" clasts of metamorphic rocks with provenance on the Medvednica Mt. (greenschists and fillites) predominate. Further detailed study of lithofacies represented in debris composition will hopefully reveal their provenance, and ice-raft directions.

Presence of glacial debris and sediment composition confirm Pilar's hypothesis on glaciation of the Medvednica Mt., although the glaciers probably extended from far regions in the north, not from the local cirques as proposed by Pilar.

#### References:

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