



## Glacial geomorphology of the northeastern part of the Jakupica Mountain, Macedonia, Central Balkan Peninsula

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In the frame of our GeCosMa project on the Quaternary landscape and climate evolution in the central parts of the Balkan Peninsula, after Jablanica Mt [1], we continued with glacial geomorphological mapping on the Jakupica Mt (~41.7 N, ~21.4 E).

Jakupica Mt (Solunska Glava, 2540 m) is a large mountain massif in the Republic of Macedonia, with a high central plateau from which several mountain ridges extend radially. Most of the mountain is built of metamorphic carbonate rocks that cover a crystalline basement (gneiss, micaschist, granitoids). The central plateau is segmented in a number of large, closed to semi-open depressions, sculptured by both karst and glacial processes. Evidence of past glaciations on the Jakupica Mt was first reported at the beginning of the 20th century [2], followed later by some more detailed descriptions on the glacial geomorphology. However, these few studies lack a detailed geomorphological mapping, as well as a reliable chronological framework.

Following a deskwork delineating landforms using various data sources, fieldwork and a detailed glacial-geomorphological mapping were performed on the northeastern parts of the Jakupica Mt. This side was chosen because, developed at the contact of different lithologies, it allows us to determine the possible contribution of plateau ice to the radially extending valleys, and also provides a possibility for future application of  $^{10}\text{Be}$  exposure age dating on the quartz-rich basement rocks.

Topographically, three main ice accumulation areas can be delineated on the central plateau. The mapped area comprises the NE part of the plateau and six valleys extending to the NE and SE. Kadina and Begova valleys have their upper parts developed in carbonates and their lower parts in the basement rocks. Salakova Valley stands separate from the plateau and is completely developed in the basement rocks. The other three valleys (Šaškovića, Aliagica and Juručica) have developed in the basement lithology and are topographically separated from the plateau only by a relatively flat NNW-SSE oriented ridge. The presence of carbonate boulders in their lowest moraines confirms that during the most extensive glacial stages the valley glaciers were fed by ice overflowing above this ridge from the plateau.

Cirques have NNW to E directions and are relatively poorly developed. Cirque floor elevations range from ~2180 m asl at Salakova Valley, to between ~2115 and ~2210 m asl on the carbonate plateau. The lowest mapped moraines are descending down to 1550-1500 m asl in Kadina and Begova valleys, and to 1700-1650 m asl in the other studied valleys. Due to the large plateau ice and the complicated system of confluences, glacier reconstructions using semi-automated GIS tools are problematic. A preliminary estimation of the equilibrium-line altitude (ELA) based on the maximum elevation of the lowermost lateral moraines gave ELA values of  $1800 \pm 50$  m for the most extended phase.

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[1] Temovski, et al., 2018. *Geosciences* 8, 270, 0-21; doi:10.3390/geosciences8070270

[2] Oestreich, 1902. *Beiträge zur geomorphologie Makedoniens*, 1-93, Abh. K.K. geogr. Ges. Wien.