



Karst and Caves in Post orogenic carbonate breccias in Croatia

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In Croatian karst area there are several places where post orogenic carbonate breccias are present. Coarse carbonate clastics of Lika, Velebit, Mala Kapela and Hrvatsko Primorje were first considered and described as a facies of the Paleogene Promina beds. However, because of their indistinct relation or sporadically mutual connections as well as the great difference in composition, were the reasons for the introduction of the term «Jelar beds». Their genesis is later connected with significant tectonic disturbances (inverse faulting and overthrusting), followed by younger predominantly vertical faults. Promina beds found in Ravni Kotari and Mt. Promina area, as well as Jelar bed areas, are at all times in transgressive contact with older beds (carbonate clastics estimated to date from Palaeogene -Neogene). Karstification in these beds is very intensive. Additionally, spring of river Gacka (length of third sinking river in the World), is situated in Jelar beds area, and river Zrmanja is partly breaking through Promina beds. Jelar carbonate breccias is present in Northern and Southern Velebit mountain. Maybe their genesis is connected with glaciation too, but the most important is that these rocks are very soluble.

In an area of approx. 25 km² on North Velebit Mt. more than 400 caves were discovered and explored. The systems Lukina jama - Trojama (-1392 m), Slovacka jama (-1301 m) and Velebita – Dva javora (-1026 m) are the deepest caves in Croatia. Furthermore, significant depth was reached at Meduza (-679 m), Patkov gust (-553 m), Ledena jama (-536 m) and Jama Olimp (-531 m). These caves are really vertical and inner vertical step in Valeria (518 m) is the deepest in the World, and outer vertical step in Patkov Gust (553 m) is the second vertical entrance in the World.

All these caves are located in post or carbonate Jelar breccias.

In an area of approx 30 km² on South Velebit Mt. There are more than 300 caves discovered and explored. Well known Cerovačke caves (more than 4,5 km length 2779 + 1295+445m), Kita Gacesina (length 10603 m, depth -465 m), Munizaba (length 5993 m, depth -437 m).

In this area many big underground chambers were found (in Sveti Rok tunnel Cavern 168 x 60 x 50 m, in Burinka 160 x 90m, in Velebit tunnel 150 x 120 x 100 m, Veliko grotlo 100x 100 m, Munižaba 160 x 55m, etc)

The development of large caves was analysed in respect to the geology, hydrogeological relations, karstification processes and paleoclimatic conditions. Neotectonic movements with summary amplitudes of about 1600 m, the Bakovac fault and its interruption of the Velebit complex barrier extension, as well as the concentrated recharge during interglacial stages of Pleistocene are recognised as the main factors contributing the speleogenesis.

The largest underground chambers in Croatian karst are situated precisely in Jelar beds in Southern Velebit region. These are chambers larger than 100 meters in diameter. Even deepest speleological features of this area partly or entirely break through Jelar beds, which indicates later intensive karstification (depths more than 450 meters). Karst in Jelar and Promina beds is very developed. Better meltability of breccias have enabled genesis of many karst phenomena. More recent speleological and hydrogeological research carried out as part of building the highway Zagreb-Split have shown great karstification intensity and large number of speleological phenomena (caves and pits), which were not known during research on the surface, but were discovered for example by breaking a tunnels (Grič, Plasina, Sveti Rok, etc.) or building a bridge across Gacka, etc. Number of speleological features per km² in Jelar beds comes right after areas with Liassic Jurassic limestones, and in some places Senonian Cretaceous limestones.