

KARST IN SLOVENIA

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Word *kras* (*karst*) entered to international scientific terminology from Slovenia; and also some other words like *dolina*, *polje* ect. *Kras* is a low carbonate plateau between *Divača*, *Sežana* and *Trieste*, and from there the technical term derives. The term *karst* – *kras* has a pre-indoeuropean origin from word *karra*, which means rock – stone. The ancient word for »stone« gave the origin to the ancient name for the region (*Carusadus*, *Carsus*) and this word changed according to different languages into *Kras* (Slovene), *Karst* (German) and *Carso* (Italian). From this toponym the international term – *karst* – for such type of landscape is derived.

Kras, carbonate plateau, and its topographical and hydrological phenomena was becoming largely known after scientists and travels in last centuries published their descriptions about it. A lot of works were published in German language, so the translation of *Kras* to *Karst* entered into terminology denoting a special type of landscape.

Karst is developed everywhere where carbonate rocks are presented. In Slovenia *karst* covers 43% of the surface; 35% is on limestone and about 8% on dolomite, that is about 8.800 km². *Karst* is developed in carbonate rocks from Devonian to Miocene age. Jurassic and Cretaceous limestones are the most favourable for karstification in our region. In Slovenia, the prevalent limestones display great purity, for they contain a very insignificant amount (1–2%) of insoluble residue (Gams 1974, 2003, Ogorelec & Rothe 1993). According to Herak (1972), the limestones from the Dinaric *Karst* contain different parts of CaCO₃, with regard to the sedimentation conditions in the given period. Thus the Lower Triassic limestones contain from 80% to 95% of CaCO₃, Lower Cretaceous between 95% and 98%, while Upper Cretaceous contain from 98% to 100% of CaCO₃.

Our *karst* was not always green as it at the present. Less than hundred years ago there was bare landscape with grass and some bushes. That was due to different land use, for example pasturing was much more intensive.

One of basic properties of *karst* is underground waters drainage. All meteoric water very soon flow in the *karst*. In the past there was not enough drinking water so people collected water from roofs. At present people use big *karst* springs for water supply, about 50% of drinking water in Slovenia derives from *karst* waters.

Karst Types in Slovenia

Related to geological, hydrological and morphological conditions in Slovenia, *karst* is divided into three larger units (Habič 1969): Alpine *karst*, Dinaric *karst* and intermediary pre-Alpine and pre-Pannonian isolated *karst* which are subsequently, due to morphological and hydrographical properties, subdivided into smaller regions.

1. **Alpine karst**, high mountainous and mountainous *karst* in Julian, Savinjske Alps and Karavanke.
2. **Dinaric karst**, divided in high and low *karst* of Primorska, Notranjska and Dolenjska.
3. **Dinaric-alpine intermediary and isolated karst** in the area of Idrijsko, Cerkljansko and Tolminsko, Polhograjski Mountains, Posavske folds, Gorjanci Mountain in some other places of N Slovenia.

Alpine karst is presented in mountain region of NW and N part of Slovenia. Different parts are named after main mountain belts. Limestones and dolomites are from Devonian to Cretaceous age, but Triassic carbonate rocks prevail. Main tectonic structures are expended in E-W direction. In that



Figure 1: Alpine karst in NW Slovenia. The deepest Slovenian caves are presented in the area (photography Jurij Senegačnik).



Figure 2: Cerknica polje is the biggest karst polje in Slovenia. Intermittent lake is characteristic for the lowest part of the polje (photography Marjan Garbajs).

type of karst simple runoff of underground prevails (Habič 1969). All known surface karst features and caves may be found. For high mountain karst surface pavements, all kinds of karren, »kotličiči« – small depressions with vertical walls, and konte – big dolines, are characteristic. There is also a lot of shafts and caves. In Julian Alps, on Kanin mountain, the deepest caves in Slovenia were found.

Dinaric karst is a karst with numerous dolines, karst poljes, levelled surfaces and plateaus (Kranjc 1997). It is divided in Low and High Dinaric karst. Low Dinaric karst is divided in littoral karst which is represented by Kras plateau and karst of inner Slovenia. Kras plateau has levelled surface with many dolines, collapse dolines and caves, with the most famous of them Škocjanske jame, Kačna jama, Labodnica ect. On its edges there is a lot of blind valleys. High Dinaric karst consist of high plateaus and large basins between them. Because of high altitude it is mostly forested. The longest and the most well known cave of this region is Postojnska jama.

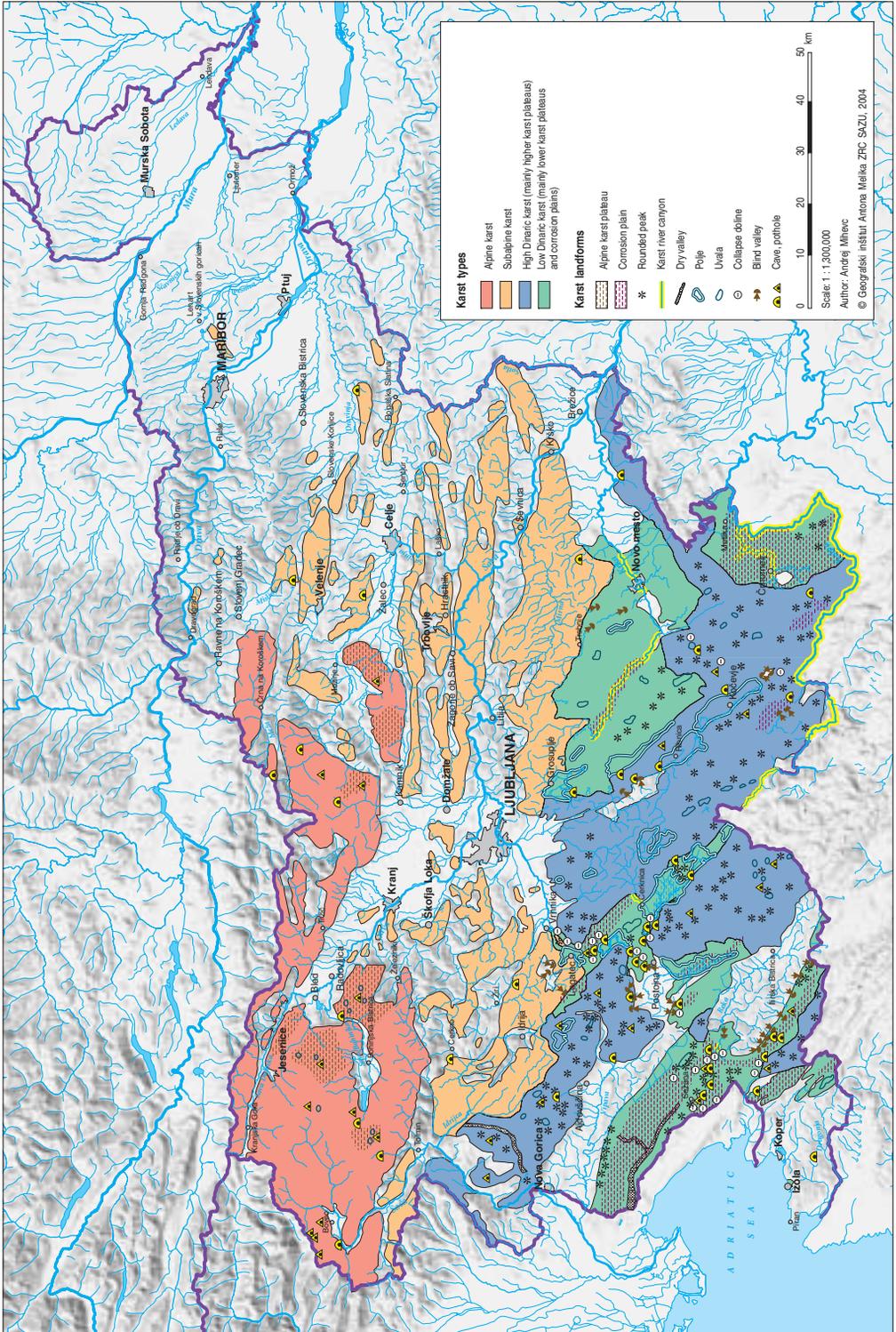
Intermediary karst and isolated karst of middle part of Slovenia is developed in limestones and dolomites from Paleozoic to Neogene in the belt between Alps and Dinarids. The tectonic structures are in Alpine, E-W, and in Dinaric, NW-SE, directions. These karst units mostly belong to simple flow-off hydrographical regions. **Isolated karst** is represented by single shallow islands of limestones and dolomites of various ages in the central part of Slovenia, strongly differing in structure and hydrology (Habič 1969); this is why different hydrogeological types of isolated karst exist in this part of Slovenia. Pre-Pannonian isolated karst in the eastern part of Posavsko hribovje and Slovenske gorice is a special type of superficial and underground karst developed in the Miocene lithothamnian, marl and sandy limestones.

Karst Morfology

On the karst surface all types of **karren** are presented, from thin rillenkarren, to larger runnels and lapies (large karren) where the limestone surface is bare and exposed to precipitations. If karren were



Figure 3: Doline is the most common relief feature in the karst in Slovenia (photography Matej Gabrovec).



◀ *Figure 4: Karst surface.*

developed under soil cover they are rounded. Also some other features were developed under soil cover as notches and holes and for them smooth surfaces are characteristic.

Depressions are the predominant features on karst surface in Slovenia. There are all kinds, from small solution pits as kamenitza and doline, to large as big collapse dolina, uvala and polje.

Doline is maybe the most common morphological feature in our region. Usually they are solution forms. Dolines are presented in all karst types in Slovenia, but they are developed mostly on karst plains, there are few on slopes. Their bottoms are usually filed by soil and they are also protected against the wind bora. Because of these two reasons they are cultivated a lot of times.

Collapse dolines are much bigger then solution dolines and they indicate their connection to cave collapses. One of the biggest are in the area of Škocjanske jame caves and Divača village. There are Sekelak, Globočak, Risnik, Radvanj, ect.

The biggest karst depression is **karst polje**. Karst poljes are characteristic for Dinaric karst in South of Slovenia. Cerknica polje is the biggest of them. Cerknica polje is a karst polje developed in the important regional fault zone, Idrija fault, in »Dinaric« direction (NW-SE). In the same fault zone are developed also Planinsko polje, Loško polje and Babno polje. For the formation of karst polje in this fault zone along tectonic structures were the most important factor karst processes in the level of water table fluctuation in the bottom of the depression. Bottom of Cerknica polje covers 38 km² in elevation of about 550 m and it is formed on Upper Triassic dolomite. On the polje borders are presented Triassic and Jurassic dolomites and Cretaceous limestones. Inflows are on E, S and partly on W sides of polje. The largest tributary to polje is Cerknica draining the dolomite catchment area. Stržen flows on the W side of polje towards the ponors in the middle of the polje, from where water flows directly to Ljubljana springs, and towards NW side of polje, from where the water flows to Rakov Škocjan. From the foot of Javorniki mountain to the contact with dolomite in the polje bottom is 12 ponor caves. They are connected to Karlovica cave system to which also the highest waters from polje flows. In the system there is more the 7 km of passages. The intermittent lake covers about 26 km² when is full.

Another set of karst poljes is spread out SE of Ljubljana, in Dolenjska region.

Caves

At this moment is in Cave Register of Slovenian Speleological Association and Karst Research Institute more than 8.200 caves. They are horizontal and vertical, connected to cave systems, with active water flows to fossil ones completely filed by sediments. The longest is Postojna cave system with 20.5 km and the deepest is Čehi 2 with 1500 m in W Julian Alps on Kanin mountain. Deepest on single pit is Vrtiglavica with 643 m and the second is Brezno pod Velbom with 501 m in one single drop also on Kanin mountain.

One of very well known are also Škocjanske jame (Mihevc 2001), they are included in Unesco's World Heritage List because of their significance.

The Dinaric karst is inhabited by the richest obligate subterranean fauna in the World (Sket 2002) and the richest part of it in the aquatic (stygobiotic) fauna is in Slovenia. Postojnska jama cave is the type locality of first described cave animal, beetle *Leptodirus hochenwarti* and European cave salamander *Proteus anguinus*.

For tourist visit is arranged about 20 caves. Vilenica cave is probably the oldest documented tourist cave of the World. At the beginning of 17th century the landlord left over the income from the visitors to the parish priest of the church at Lokev. One of the most famous and oldest show caves is Postojnska jama cave where important tourist development started in 1818. Between the years 1818

and 1992 it was visited by 26.000.000 people. On of the most beautiful are Škocjanske jame with their large underground canyon.

Gams, I. 1974, Kras. Slovenska matica, p. 359, Ljubljana.

Gams, I. 2003: Kras v Sloveniji v prostoru in času. Založba ZRC, ZRC SAZU, p. 516, Ljubljana

Habič, P. 1969: Hidrografska rajonizacija krasa v Sloveniji. Krš Jugoslavije, 6, p. 79–91, Zagreb.

Herak, M. 1972: Karst of Yugoslavia. Karst. Important Karst Regions of the Northern Hemisphere. Elsevier Publishing Co., p. 25–83, Amsterdam.

Kranjc, A. 1997: Kras, Slovene Classical Karst. Založba ZRC, Ljubljana.

Mihevč, A. 2001: Speleogeneza Divaškega kras. Založba ZRC SAZU, p. 27, 180, Ljubljana.

Ogorelec, B. & Rothe, P. 1993: Mikrofazies, Diagenese und Geochemie des Dachsteinkalks und Hauptdolomits in Sud-West-Slowenien. Geologija, 35 (1992), p. 81–181, Ljubljana.