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**ALPINE AND ICE CAVES IN SLOVENIA  
IN OLDER LITERATURE (17<sup>TH</sup> TO 19<sup>TH</sup> CENTURY)**

ALPSKE IN LEDENE JAME IZ SLOVENIJE V STAREJŠI  
LITERATURI (17. DO 19. STOLETJE)

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**Abstract**

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**Andrej Kranjc: Ice and Alpine Caves in Slovenia in older literature (17<sup>th</sup> to 19<sup>th</sup> century)**

The first printed literature mentioning caves in a nowadays Slovenia dates to the 16<sup>th</sup> century already (description of Cerkniško lake, research of underground water connections) but description of alpine and ice caves does not appear before the 17<sup>th</sup> century. The most important and the best known is Valvasor's work "Die Ehre des Herzogthums Crain" (1689). In the Alps he describes 3 caves, but none of them is a real cave. Exception is a spring of Savica which proved 250 years later to be really a spring cave. He described also some ice caves and ice formations in them. B. Hacquet visited some of the same caves a century later and in his work "Oryctographia carniolica ..." (1778 – 1789) explained the formation of ice more realistically. In the middle of the 19<sup>th</sup> century appears a real speleological literature, as Schmidl's work "Die Grotten und Höhlen von Adelsberg ..." (1854) is regarded as the first "modern speleological work". At the end of the 19<sup>th</sup> century the Gratzky's list of caves in Carniola (great part of the today's Slovenia) includes 7 caves from the Alps and 30 ice caves. The last are practically all out of the high mountains, where the ice caves are a normal feature. The 19<sup>th</sup> century literature including alpine and ice caves is very diversified, there are "classical" speleological works on ice caves as Fugger's "Eishöhlen und Windröhren" or Schwalbe's "Über Eishöhlen", and local literature or reports talking about extracting of ice for example.

**Key words:** history of speleology, alpine cave, ice cave, Slovenia.

**Izvešček**

UDK: 551.444.6(497.4)"16/18"

**Andrej Kranjc: Alpske in ledene jame iz Slovenije v starejši literaturi (17. do 19. stoletje)**

Z današnjega slovenskega ozemlja je najstarejša literatura iz 16. stol. (opis Cerkniškega jezera, raziskave podzemeljskih vodnih zvez), toda alpske in ledene jame se v njej ne pojavijo pred 17. stol. Najpomembnejše in najbolj znano je Valvasorjevo delo "Die Ehre des Herzogthums Crain" (1689). Opisuje 3 jame iz Alp, a nobena ni prava jama. Izjema je izvir Savica, za katerega se je 250 let kasneje izkazalo, da je v resnici izvorna jama. Opisuje tudi nekaj ledenih jam in led v njih. Nekatere izmed teh je stoletje kasneje obiskal B. Hacquet, ki v delu "Oryctographia carniolica ..." (1778 – 1789) jamski led razlaga pravilneje. Če upoštevamo Schmidlovo delo "Die Grotten und Höhlen von Adelsberg ..." (1854), ki velja za prvo sodobno speleološko delo, lahko od srede 19. stol. dalje govorimo o pravi speleološki literaturi. V Gratzkyjevem seznamu kranjskih jam s konca 19. stol. je omenjenih 7 alpskih jam in 30 ledenih jam. Zadnje so večinoma izven alpskega prostora, saj so tam ledene jame običajen pojav. Literatura, ki omenja alpske in ledene jame, je zelo različna, vmes so temeljna speleološka dela o ledenih jamah, kot sta Fuggerjevo »Eishöhlen und Windröhren« in Schwalbejevo "Über Eishöhlen", pa tudi lokalna literatura, ki npr. poroča o pridobivanju ledu iz jam.

**Ključne besede:** zgodovina speleologije, alpska jama, ledena jama, Slovenija.

Man visited and used caves since the Palaeolithic times in our Alps proved by archaeological findings. In the Middle and early New Ages man dug iron ore in potholes on the Alpine plateaus (Pokljuka, Jelovica, surrounding of Bohinj). During Illyrian Provinces deserters were hiding in caves, brigands used them and occasionally even common people lived in them. The second half of the 19<sup>th</sup> century was the heyday of building mountaineering huts in the Alps, and builders often used cave porches or “abri-sous-roche” for provisional dwelling (Kranjc 1979; 1984). The shafts located in Kanin Mts. belong to deepest in the World, yet in 1897 (Gratzy) only one cave (an emergency shelter) is mentioned there; the real speleological exploration started more than half a century later (Štirn 1954; 1955).

The first printed literature that mentions caves in a nowadays Slovenia dates to the 16<sup>th</sup> century already. This is Leonberger’s poem about Cerknjško jezero periodical lake (Leonberger 1537) and the description of the same lake by Wernher (1551). The research of underground water connections between Škocjanske jame swallow-cave and springs of the Timava is mentioned as early as in 1599 (Imperato 1599). But ice and alpine caves do not appear in the literature until the 17<sup>th</sup> century.

The earliest, the most important of the time and the best known is Valvasor’s work “Die Ehre des Herzogthums Crain” (Valvasor 1689). This is a sort of topography of the period, published in four volumes with more than 2000 pages. It mentions four caves or holes in the “Snow Mountains” as he called the highest ridges of the Alps. Descriptions of other caves that he visited or explored in other parts of Carniola, are quite accurate and good, while the descriptions of these three alpine caves are rather a mere tales. First one is the “stormy hole” near the footpath towards Jezersko (village in Karavanke Mts., at 900 m). It is a deep hole in the rock wall. If a stone is thrown into it, it begins to rain and a storm appears, Valvasor writes. But he tries to explain it in a more reasonable way: there must be a deep water pool at the bottom; when disturbed by a stone, the water vapour comes out from the hole (Valvasor 1689, 164-165).

The second one is the hole through the mountain above the village of Kranjska gora (Julian Alps). Through the hole there is, according to Valvasor (1689, 117, 168) even the road leading to Bovec, town in the Soča valley, on the other side of the mountains. A lot of controversy was already written about this hole. In fact there are two large holes – windows (the upper one has about 80 m high opening) in the Prisojnik Mt. (2547 m), which can be seen from the surrounding of Kranjska gora – but to reach them is mountaineering or even an alpinist achievement.

The third one is really a hole, made by man, allowing travellers to pass the mountain ridge and to avoid the rocky crest (Valvasor 1689, 170-71) at Ljubelj (Karavanke).

Valvasor mentions also the Savica spring, a 60 m high waterfall (the spring of the Bohinjska Sava at Bohinj, Julian Alps); for him it is not a cave but just an exceptional spring. He writes: “...among the highest Snow-Mountains, Bochinska Sava is jetting from the high rock-wall...” and “...”it flows from the hole in completely smooth rock-wall...” (Valvasor 1689, 159, 605). Little more than hundred years later Hacquet knows that this spring discharges underground water from the seven Triglav lakes, located on the background plateau in the height between 1600 and 2000 m (Hacquet 1778, 14-15). For both scholars this spring was so important that they published its illustration in their works. In the modern times cavers discovered that the water flows from a cave, about 100 m long; by diving the siphon, they later penetrated even deeper into the massif (Mlinar 1994).

Out of the Alps Valvasor describes two caves containing ice all the year round or at least long into the summer. The most important is Ledenica cave (Ice cave) under the Tabor hill (Lačna gora by Valvasor) not far from the town of Grosuplje in the southwestern Slovenia. Today the cave makes part

of the show cave Županova jama, owing to 34 m long tunnel dug through the sediment fill between both caves in the year 1928. Beside the description of cave and ice formations, Valvasor was trying to find out if the ice is different from the ice formed on the surface during the winter. He took the ice out of the cave and exposed it to the sun. He writes about it in two different parts of his work.

In the Book II (p. 242-243) Valvasor writes: *“Also here one can see formations of the ice only, of different dimensions and different heights; some are a fathom or two high and thick like a man, while the others are just two or three spans high or higher, and as thick as an arm, and some also thinner. The ice is forming from the drops of falling water; and indeed in summer as there is no ice therein in winter...”*

The same cave is mentioned in the Book IV (p. 517): *“There are different icicles. Some are few fathoms long, the others few spans only, and there are shorter even. Some are thick as robust man, the other thin as a finger or even thinner. And all these are from the ice formed by water drops, which are falling from above and turning into ice. This ice breaks all too easily and quickly as I have seen myself with surprise. A piece can be thick as an arm, but all the same you can break it more easily than an icicle hanging from the drip, which is thick as a little finger only. However, this ice lasts much longer in the sun and the heat than the other ice; this I know from my own experience. It is so clear like no others. Some might think it would eventually turn into stone: this, however, does not happen: for it remains only in summer and disappears in winter, as I can say for certain, as I have been in myself in the winter as well as in the summer time. In the summer the floor is quite covered with ice: it makes walking so dangerous and bad that one cannot take a step without climbing irons; but in the winter time one goes safely and well. There are lot of reasons to wonder, because water drops are freezing (or turning into the ice) each summer, which does not happen in any other cave, although there are drippings in all of them.”* (Translation taken from Balch 1900, 238-240).

Besides the above-mentioned Ledenica Valvasor describes some others also. The first is so-called “Rossecker Eisgrube” (Ice Cave of Rožek) (1689, Buch II, 243; Buch IV, 516): *“And there underneath there are many holes where the ice remaining through the whole summer. Of this ice cave Duke Frederick Graf and Duke von Gallenberg daily made use in summer to cool their wine. Six years ago I descended there in the month of August and found enough ice in all the holes.”* (From Balch 1900, 240). This is a small cave in the bottom of a deep doline and it was used as an ice cellar to keep wine. Later authors (Petrucci 1849) report that a wall closes the cave. The second one is “cave with ice above Tomišelj”. There is no description of it, Valvasor just mentions: *“...man can find ice in it through the whole summer. When at Ljubljana all the ice pits have been empty already, they served his Emperor’s Majesty with the ice from this cave.”* (Valvasor 1689, 517). This is a well known cave “Ledenica pri Planinci”, ice cave near the village of Planinca (above Tomišelj, as Valvasor says), 70 m deep and 125 m long, seriously explored in 1927 but unfortunately there is no permanent ice in it (Karst Research Institute Archives).

Balthazar Hacquet (1739/40-1815) lived in Carniola (Kranjska) between 1766 and 1787, when he left it to become professor of natural history at Lviv (Lvov) in the Ukraine. He travelled a lot. To choose which caves to visit, he used Valvasor’s work as a sort of a guidebook. Hacquet publishes the most important observations about the karst in Carniola in four volumes (623 pages) *Oryctographia Carniolica oder Physikalische Erdbeschreibung...* (*Oryctographia carniolica* or physical description of the duchy of Carniola, Istria and partly the neighbouring countries) (1778-1789) (Hacquet 1778; 1781; 1784; 1789). Under “physical description” is meant geology, mineralogy, geomorphology,

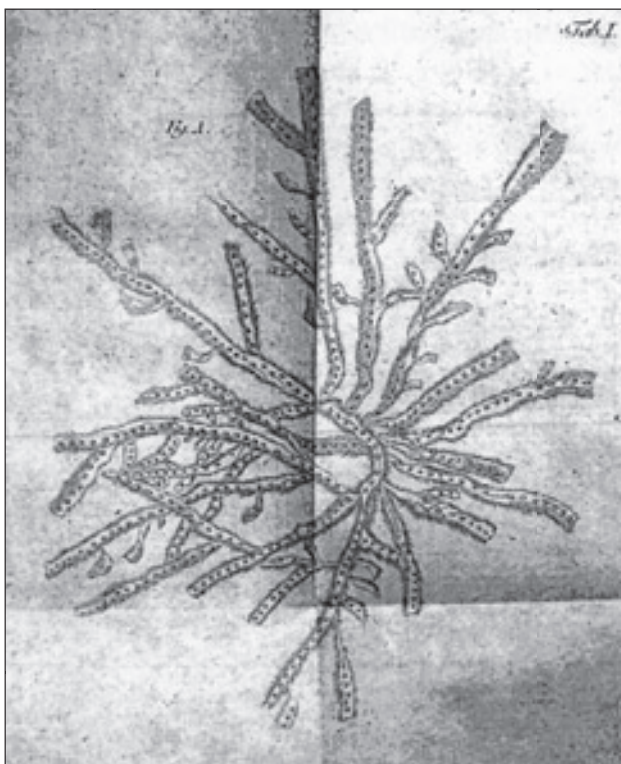
topography, hydrology (in particular springs and thermal springs) and some industry, mining and metallurgy. In his work Hacquet often polemizes with Valvasor's statements. He also visited Ledenica under Lačna gora, which made Valvasor so enthusiastic. Hacquet thinks that the ice in the cave at Lačna gora forms in winter (Balch 1900, 271). He states that this is a common ice, this means frozen water dripping from the ceiling. But he says that the ice in this cave is "just made of five- or six angles crystals... Why just this type of crystallization I could not find out. There must undoubtedly be some salt particles in the water." (Wester 1956). Hacquet was interested in ice crystals in general, as shows his article on frostwork on a windowpane (Hacquet 1790; Južnič 2003) (Fig.1).

In the works of later authors Valvasor's descriptions and statements are often repeated (Rosenmüller & Tilesius 1805).

By the end of the 18th century only few alpine and ice caves mentioned later were known in literature in the territory of Carniola (Kranjska) and the main scientific question of all the authors was:

- when the ice forms (in summer or in winter),
- what are the properties of the ice.

During the 19th century many more alpine and ice caves became known and attention was focused on number of ice caves, their distribution and general characteristics of ice. The alpine caves did not attract special attention. By 1897, when O. Gratzy (1897) published his list of caves in Carniola, the list included 10 alpine and 30 ice caves. Among the last ones two were described



*Fig. 1: Hacquet's drawing of the frostwork on a windowpane (Hacquet 1790).*

as different caves but in fact it is the same cave. From the remaining number of ice caves 10 are not real ice caves – the ice melts completely during summer or autumn. Thus at the end of the 19th century there were 18 real ice caves and 10 alpine caves (Valvasor's holes are not included) known in Carniola. As in that time people in generally did not search the caves in the higher parts of the Alps, also the majority of ice caves was known from high Dinaric karst plateaus from western to south-eastern Carniola: Trnovski gozd, Krimsko višavje, Kočevska Velika gora and Kočevski Rog. There are only few exceptions; three ice caves on the plateau of the Fore-Alps of Kamnik (Velika planina north of Ljubljana), one on the plateau of Mežakla (Julian Alps) (Petruzzi et al. 1851, 62), and one above the town of Radovljica. All the others are dry caves; one of them (Jama pod Babjim zobom) was even displayed as a show cave. In 1861 a pathway with two bridges existed in the cave and two guides were at disposal in the nearby village (Zoff 1850; J. W. 1883). In 1837 already H. Freyer, curator of Ljubljana Museum, when haunting the source of fossil bones coming from the Kamniške planine (Kamnik Alps), found the cave Zijalka or Mokriška jama at 1550 m a.s.l. There are layers rich of cave bear bones and he organised the excavations in 1839 (Kranjc 2002).

During the mentioned period each of five authors (Petruzzi, 1850; Boué 1867; Schwalbe 1887; Moser 1889; Fugger 1894) published a comprehensive list of ice caves including detailed descriptions. Moser's work contains also the first sketch of one of the ice caves on Trnovski gozd plateau that is of Ledenica v Dolu. Boué relied mainly on the literature, while the others used their own researches. The oldest one (Petruzzi 1850) described 10 ice caves, while later ones (Schwalbe 1887; Fugger 1894) included 18 ice caves each. I have to point out these two authors because their works are not just the lists or mere descriptions of the ice caves but it can be said that these are classical works on ice caves. And they used the data of ice caves from Carniola too. Fugger's (1891; 1894) main work is "Eishöhlen und Windröhren" (Ice caves and wind tubes) (Habe 1971). Schwalbe used the data and observations from ice caves of Carniola also in his other works, "Über Eishöhlen" (About ice caves) (Schwalbe 1882) and "Über die locale Verbreitung der Eishöhlen" (About local distribution of ice caves) (Schwalbe 1884) as well in publications of 1881 and 1886 respectively. It is interesting that Schwalbe (1882a) mentions also Kungur ice cave, the example taken from the Russian author. The last publication of the treated period, which contains a sort of list of ice caves from Carniola, is Balch's book (1900). There are 28 ice caves mentioned although some of them are not ice caves at all. Nevertheless, his data related to untrue ice caves can be also very interesting, for example his statement, that ice stalactites can form during the winter far inside the Škocjanske jame caves (Balch 1900, p. 237).

Other published works are reports of various explorations, such as E. Graf (1882) and Knapp (1883) related to discoveries in Fridrihštajn's ice cave. Not from the view of speleological science but from the historical point of view the article of Radics (1885) is very interesting, describing the construction of path and stairs down into the Fridrihštajn's ice cave for tourist purposes. Otherwise we would never know that Fridrihštajn's ice cave was ever a show cave. In the middle of the 20th century there were practically no traces of this work left, just some remains of wooden steps sunk deep in the ice already. In that time, for example, Dobšinská ľadová jaskyňa (Slovakia) was a show cave for more than 10 years already (Bella s.a.) (Fig. 2).

The first modern speleological research in some of these ice caves is already known from the first half of the 19th century. S. Graf (1837) studied and described the vegetation distribution in the entrance collapse doline of an ice cave in 1837 already. However the "vegetation inversion" which

follows a temperature inversion was mentioned in the literature much earlier (Hacquet 1778) but in connection with deep dolines on high karst plateaus only, and not with ice caves. Taking into consideration that the first example of the cave fauna, the cave beetle *Leptodirus hochenwarti* was discovered in 1831 in Postojnska jama cave (Šket 1998), the first research of fauna in ice caves started relatively early too. Such was the research of Miller (1855) in the Ledenica under Lačna gora, the cave mentioned by Valvasor already. Fauna of the ice caves, also from the lower part of the Alps, was collected and studied by S. Robič (1824-1897). He was a priest and an amateur naturalist. He collected fauna and other natural history items also in the caves. His data related to fauna of ice caves on Velika planina (Fore-Alps of Kamnik) were published by Fugger 1894 for example. As a curiosity I would like to mention that among the others Robič has sent a collection of 400 flowerless plants to Sankt Petersburg too (Bole & Aljančič 1996).

The research of ice formations was not overlooked. The most important are the works of two authors, Schwalbe and Reich. The first one (Schwalbe 1887) compared the summer temperatures on the surface, near the entrance to an ice cave with the duration of summer ice in a cave. While Reich (1834) suggested even more modern methods although his work is much earlier: he drew attention to the relations between ice and rock temperature in an ice cave.

It is relatively well known that local population extracted the ice from ice caves for the water supply during summer drought and also for commercial use. In literature the examples of ice caves from Trnovski gozd plateau are commonly cited; from there the ice was transported to Trieste harbour and by ships to Egypt and even Bombay (Reich 1834), and also used for local water supply during the summer (Habič 1992). The data for 1867 show the extraction of 16.000 quintals of ice from the caves (Gams 2003, 102). In the “Velika ledenica v Paradani” ice cave the extraction of



*Figure 2: Ice cave Dobšinská ľadová jaskyňa (Slovakia) was open for tourists in 1871 already (postcard from 1912) (Krištof Kranjc collection).*

ice continued into the 50-ties of the last century (Michler 1950). From the published works from the 19<sup>th</sup> century there is evidence that such was a practice also in other regions. Petruzzi (1849/50) reports that the ice was used for commercial purposes from two ice caves on Kočevski Rog plateau too: those were Ledena jama (Ice cave) v Rogu and Ledena jama pri Kunču. The last one was also a sort of storehouse for ice during the summer months. The villagers of Planinca (plateau of Krim) used the ice from the nearby ice cave (mentioned already by Valvasor) to cool the water in their rainwater cisterns during the summer (Aichholzer 1878, 152).

The 19th century was the turning point in the research of ice caves when the scholars abandoned mere descriptions and more or less “theoretical” discussions about ice in these caves and started a real research, we can call it a scientific approach. B. Schwalbe for example, who writes about ice caves in Carniola too, regularly measured air temperatures once a month at four points in Dobšina ice cave (Balch 1900, 253). He concluded “all my observations point to the fact that the rock is the cooling factor in summer, and that the cold goes out from it” (Schwalbe 1886). Balch (1900, 299) states that “Schwalbe’s work *Über Eishöhlen und Eislöcher* (from 1886) is one of the four or five most important contributions to glacière literature, and his opinion is entitled to great respect on account of his many observations”. The researches of ice caves in Carniola contributed to these studies.

Reading the first published descriptions of ice caves, in particular Valvasor, the number of ice caves, containing ice all over the year is surprising as this is not the case now. It is often said that Valvasor was superstitious; that his reports are tales and that he exaggerates a lot. In some cases it is true. But when he talks about the phenomena and things he himself saw, he is usually accurate

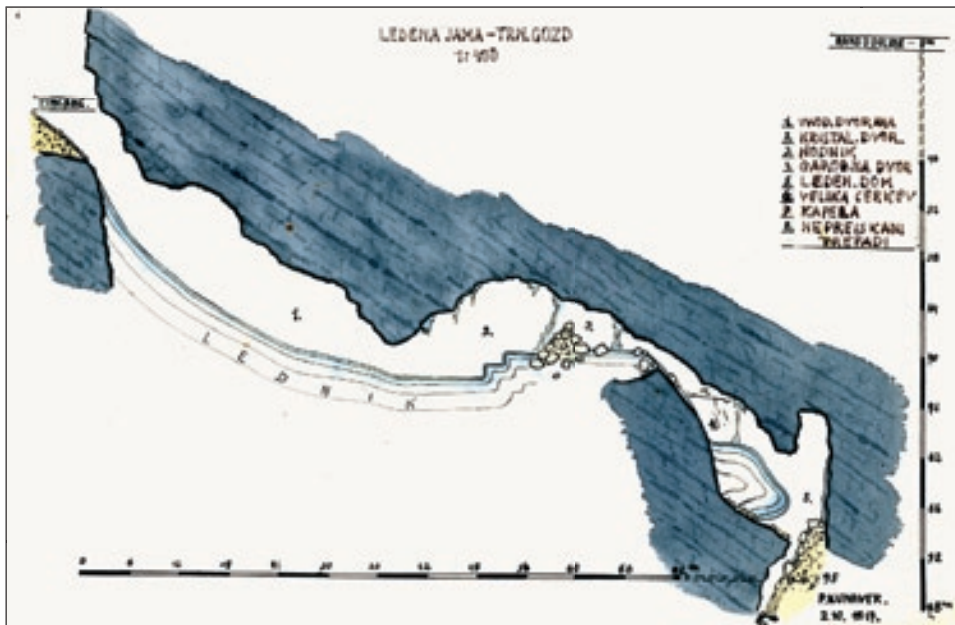


Figure 3: Some ice caves were explored for the military purposes during the 1st World War. Cross-section of Velika ledenica v Paradani (plateau Trnovski gozd) by Pavel Kunaver, 1917 (Archives of Karst Research Institute).



and objective. Does these old reports show the climate change? The 17<sup>th</sup> century was still the time of “little ice age”. Is it possible that the caves, which are very cold today, but are not real ice caves, had been such few centuries ago? Valvasor writes about the ice in the “Ledena jama pri Planinci” ice cave to last the whole year round – and modern observations (Karst Research Institute Archives) show the summer temperatures of 2°C there. Can this difference show the climate warming during the last three centuries?

In the second half of the 20<sup>th</sup> century, the interest in ice caves in Slovenia diminishes again or better, turns to other direction. There are practically no more scientific researches of the ice cave phenomena and related publications are very rare (Habe 1971; Gams 2003).

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