

THE LIFE AND SCIENTIFIC WORK OF DÁVID FRÖLICH (1595–1648)

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FRÖLICH DÁVID ÉLETE ÉS TUDOMÁNYOS MUNKÁSSÁGA (1595–1648)

Összefoglalás

Frölich Dávid, európai hírnű késő reneszansz matematikus, csillagász, naptárkészítő és földrajztudós 1595-ben született Késmárkon [Käsmarkt; ma Kežmarok (Szlovákia)], s ugyanott halt meg 1648-ban. Ebben az időben a Magas-Tátra DK-i tövében fekvő Késmárk, mint zipszer város, a történelmi Magyarország egyik legfontosabb oktatási központja volt. Az itt végzett protestáns diákok – így Frölich Dávid is – tanulmányait gyakran folytatták az Odera menti Frankfurtban s az akkor főként német nyelvű Elbinga (Elbląg) Dancka (Danzig, Gdańsk) főiskoláján. Az utóbbi két város és Késmárk között a diák- és tanárcsere sem volt ritka. Tanulmányai befejeztével Frölich – a kor szokása szerint – 12 éven át vándordiákoskodott az akkori Német-Római Császárság több országában és Franciaországban is. 1629-ben vagy 1630-ban tért vissza Magyarországra, bejárta Erdélyt, majd szülővárosában telepedett le. Csillagászati munkáiban Magyarországon elsőként ismertette Copernicus napközpontú világméretű képét (1632). Földrajzi szempontból két legfontosabb műve a „Medulla Geographiae practicae” és a „Cynosura seu Bibliotheca Viatorum” [Bártfa (Bartfeld, Bardejov) 1639, ill. Ulm 1644. Mindkettőt ismerték és tankönyvként is használták Nyugat- és Közép-Európában. Mindkét könyvben leírja 1615-ös „Tátramászása”kor (Késmárki-csúcs 2558 m) szerzett tapasztalatait; leírta hogyan változik a szél ereje és iránya, a felhőzet, a csapadék és a levegő sűrűsége a magassággal. E megfigyeléseit szó szerint vette át a XVII. sz. egyik legnagyobb földrajztudósa, Bernhardt Varenius „Geographia generalis” (Amsterdam 1650) című, korszakalkotó művében.

Summary

David Frölich the European famed late humanist mathematician, astronomer, calendar maker and geographer was born in Késmárk (Käsmarkt, now Kežmarok in Slovakia) in 1595 and died there in 1648. In those ages Késmárk, a Zipszer (German) town at the High Tatra was very important educational center in the historical Hungary. David Frölich studied in this town, after in Elbinga (Elbląg), Dancka (Gdansk) and Frankfurt am Oder. He took peregrination (study tour) in Middle and West Europe. After that, in 1630 he returned to Hungary. He lived and worked mainly in Késmárk. He was the first in Hungary, who described the heliocentric world concept of Copernicus (1632). From the geographical point of view his two most important books are: „Medulla Geographiae practicae” (Bártfa=Bartfeld=Bardejov, 1639), and „Cynosura seu Bibliotheca Viatorum” (Ulm, 1644). Both of them were well known and used in countries of West and Central Europe. Both of those contain his observations, which he made when he climbed the Késmárk Peak (Keszmarker Spitze, Késmárki-csúcs, Kežmarký štít) (2558 m) of High Tatra in 1615. He described how the winds, the clouds, the precipitations and the density of the air changes with the altitude above sea-level. This chapter was taken over by many foreign authors. For example: Ottonis de Guericke’s „Experimenta Nova (ut vocatur) Magdeburgica de Vacuo Spatio” (Amsterdam 1672).

David Frölich, one of the greatest Hungarian physicists, astronomy and geographers was born in 1595, 411 years ago. Between 1623 and 1648, he had published 75(!) works, while another 4 or 6 had been published after his death. He created and wrote 68 (70!) calendars and almanacs, wrote 3 books on calendar making, one book on astronomy, 2 about literature, 2 in geography and two books about history. The manuscript of his third history book is also known. The two geography books are classics. Besides his German mother language (published 40-42 works in German), he could speak and read in Latin (12 works in Latin), Hungarian (23-25 works were published in Hungarian) and probably in Slovakian (with 4 published works). His works were well known in Upper Hungary, Transdanubia, Transylvania, and were used also in Breschlaw (Wroczlaw), Frankfurt am Oder, Nürnberg, Ulm, in France and in the „Low Countries“ (Netherlands).

His life

Although some biographer (*Kölesy* and *Melzer* 1816, *Pukánszky* 1926, *Lipták* 1933, *Csinády* 1958, 1965, *Zemplén* 1964, *Kovács* 1979, 1990) dated his birth to 1600, his real birth year, based on his father, *Johann Frölich's* records, was 1595 (ASZTALOS, 1931). He was born in Késmárk (Käsmarkt, Kežmarok). His father was a school principal in the neighboring town of Leibitz (Lubica) from 1591. In that time, this town had the same notability as Késmárk had. Between 1601 and 1628, his father was a teacher in the Lyceum of Késmárk. His son, David, started his education in the same institute in Késmárk and had a grand tour to Rostock with the financial help of the Lyceum (LIPTÁK, 1933). His famous Tatra (Tatry) hike in 1615 was also in that period (see below).

As the member of a typical Zipser (German inhabitants of Upper Hungary), Lutheran family, he continued his studies in the mainly protestant, German-populated Elbing (belonged to Prussia that time, now Elbląg, Poland) and later went to Dancka (Gdańsk, Danzig) (KOVÁCS, 1979). Between 1620 and 1623 he studied mathematics, astronomy, prosody and medical sciences at the University of Frankfurt am Oder. His first calendar was printed there in 1623.

After this period he started his 12 years long peregrination, as all graduates used to do that time, like his famous contemporaries, *Albert Szenczi Molnár* (1574–1639) and *Márton Szepesi Csombor* (1595–1622) (KOVÁCS, 1979, 1990). Within that period he visited numerous countries of the German-Roman Empire, the low countries and France. His travels were financially helped from Késmárk. He also studied at the famous University of Wittenberg in 1627 (LIPTÁK, 1933). It has to be noted here that, according to *Csinády's* studies (1958, 1965), during his peregrination through West- and Central Europe, he met *Bernhardt Varenius*, one of the most significant geographers of that ages. This relation was also cited by *Bulla* (1954). However, *Varenius* was born in 1622 and died in 1650, personal meeting of them was unlikely.

Frölich returned to Hungary in 1629 or 1630 (PUKÁNSZKY, 1926; LIPTÁK, 1933). From 1629, *Johann Heinrich Alsted(t)* (1588–1638), who taught at Gyulafehérvár, invited him to travel and study Transylvania for almost a year. He visited *Albert Szenczi Molnár*, who was working there that time, and made him writing to his memory book. Due to this friendship, he dedicated his calendar published in 1637 in Lőcse (Letschen, Levoča) to *Albert Szenczi Molnár* (VÁSÁRHELYI, 1975). He moved back to Késmárk in 1637 and lived there till his death (1648). His work at Késmárk is not well documented, only mismatching data is available. According to *Jakab Melczer*, he was the rector of the Késmárk Lyceum from 1631 (KÖLESY and MELCZER, 1816). However, according to the records of the Lyceum, *David Pretorius*, Frölich's friend and supporter was the rector that time, and David took only pupils (LIPTÁK, 1933; KOVÁCS, 1990). It is a fact that the majority of his professional work is from the „Késmárk“ period from 1631 to 1648. *Ferdinand III* honoured and promoted him

to be a mathematician of the emperor and king of Hungary, which meant a regular salary for him. He bought a house and a garden in Késmárk, where he married the daughter of the chemist and pharmacist *Bartholomäus Bertram, Judit*. He had two daughters, who were born in 1638 and 1644. He died in the age of 52, due to the Black Death epidemic in 1648.

The cultural situation of Hungary in the ages of David Frölich

The ages of the attempts to found a Hungarian University to increase the level of education onto the „European standards” has ended with the death of the *King Mátyás* (1490). Before his death several attempts were made to found Universities in Hungary: *Nagy Lajos*, Pécs, 1367–13?? or 14??; *Zsigmond*, Óbuda, 1389–1402 and 1410–1437(?); *Vitéz János*, Pozsony, 1465–1472(?); *Mátyás*, Buda: 147?–14??. The level and development of the Hungarian natural sciences in those ages can be best represented with the classic map of Hungary by *Lázár deák* from Esztergom (1521, printed in 1528) and *Johann Honterus’ „Rudimenta Cosmographica”* (The basic of cosmography, published in Krakow in 1532). That also indicates that Buda lost its cultural center position right after the Turkish occupation. After the establishment and stabilization of the Transylvanian principality (*György Fráter*, 1541–1551) and the division of Hungary into three parts, the safest and most peaceful towns, fortress and farms far from the Turkish occupied area have become the most influential cultural centers. Késmárk, Brassó (Kronstadt, Braşov) and Kolozsvár (Klausenburg, Cluj) were some of them.

Johann Honterus (1498–1549), who graduated from the universities of Vienna, Krakow, Basel and Wittenberg and was the most influential person in the religion reformation of the Transylvanian Saxons, founded a printing house in Brassó. Besides of his above mentioned book published in Brassó, Köln, Basel, Duisburg, Praga, Boroszló (Breschlav, Wroclaw) and Antwerpen, he also published a map of Transylvania and Europe. In his school he taught about the nature – like geography – in the nature (WACZULIK, 1984; BARTA, 1987; KLINGHAMMER, 2000).

Gáspár Heltai (1490?/1510?–1574?/75?), the Wittenberg graduate, became the head of the town printing house in the early 1550s in Kolozsvár. After his death, his wife took over the lead of the printing house. Among the 22 Hungarian books printed in the Heltai printing house, the most important was Heltai’s „*Magyar Krónika*” (1575) (Hungarian Chronicle), which is based on *Antonio Bonfini’s* work. This was the first Hungarian language description of Hungary, just like as the first Hungarian „*Herbarium*” of *Péter Melius Juhász* (1536–1572), which was printed there as well in 1578. The city as an educational center has gained more importance with the foundation of Jesuitical University by *István Báthori* (1579–1603).

Between the death of *István Báthory* (1586) and the crowning of *Gábor Bethlen* in 1613 the peaceful, science promoting life had disappeared from Transylvania. The cultural center function of Brassó and Kolozsvár was shifted to the north and Késmárk and Lőcse (Leutschau, Levoča) took over this function. The Késmárk Evangelic Lyceum, founded in 1533, „inherited” the culture of the Honterus’school. It was very common for the Késmárk Lyceum in that time to have students from Transylvania and also teachers who moved from Transylvania to Késmárk. It is a fact, that Honterus method and approach of teaching natural sciences, his love of the nature survived the best in the upper part of Hungary, namely in the Késmárk Lyceum. Up to the XVII century, geography was a stand alone course in almost all of the German high schools in upper Hungary, even in Eperjes (Preschau, Presov) (CSINÁDY, 1958; 1965).

The students of the Késmárk Lyceum studied the world of forests, creeks, outcrops, stones, plants and animals outdoor in the nature, at the bottom of the High-Tatry. They collected plants and stones and minerals there and celebrated the outdoor „forest-celebration” (Frühlingwaldfest, LIPTÁK 1933) in every spring. In *Dávid Frölich’s* childhood,

it was very common for him to attend a school organized field trip to the Tatra (between 1598–1600, while *Adam Kunisch* was the rector, they guided students and teachers from the Eperjes High school to excursions to the Tatra; GRÓSZ, 1941).

The Késmárk Lyceum was filling the time gap between 1586 and 1629, while there was no other significant middle and high level education in Hungary. The most significant educational institutes have been founded after 1629: Gyulafehérvár (Weissenburg, Alba Julia), 1629; Nagyszombat (Trnava), 1635; Sárospatak, 1638; Debrecen, 1660; Nagyenyed (Strassburg am Mieresch, Aiud), 1662. The Késmárk Lyceum and the other two major evangelic schools of the region, Elbinga and Dancka – which belonged to Prussia that time – were in a close working relationship. Between 1598 and 1630, the Elbingien high school was led by the same person, *Johannes Mylius* (1557–1630), who was the principal of the Késmárk Lyceum between 1595 and 1598. He was followed by four Késmárk students to Elbinga. David Pretorius (1577–1646) was among them, who later followed Dávid Frölich's father in the rectorship of the Lyceum (KOVÁCS, 1979, 1990). It was also common to have Hungarian students in the Dancka protestant academic high school, founded in 1555.

Thus, the two main persons of the Hungarian geography int hat time, the Hungarian Márton Szepsi Csombor (1595–1623) and the Zipser David Frölich had similar scientific impacts on their carrier from the Lyceum to Dancka. Both of them were the students of the Késmárk Lyceum from 1607 to 1609. Because of some records, which set his birth year to 1600, numerous researches stated that they could not meet in Késmárk (KOVÁCS, 1979, 1990). However, it is very likely for them to meet, or even be classmates int he Lyceum. David Frölich studied in Elbinga between 1616 and 1620, and than moved to Dancka. Márton Szepsi Csombor was in Dancka between 1616 and 1618, but in that period he also visited Elbinga – as he wrote in his book „*Europica varietas*”, published in Kassa (Kaschau, Košice), 1620. Both of them were thought by *Adrianus Pauli* (1583–1622) and *Petrus Crügerus* (1580–1639), whose names are mentioned in Szepsi Csombor's „*Europica varietas*”. Crüger wrote some memories into Frölich's „*Stammbuch*”, while Frölich mentioned Crüger's name among the teachers of the Dancka high school in his „*Medulla geographiae...*”, published in 1639. It is also known that Adrianus Pauli was the leader and executive of the geographical discussions among the Hungarian students (KOVÁCS, 1979; 1990).

With respect to the University of Frankfurt am Oder, it was at least as visited university by the Hungarian evangelic, protestant students as the universities of Wittenberg, Heidelberg or Utrecht. Due to its relative closeness to Hungary more poor Hungarian students studied there than on the other universities further to the west: among others Mihály Katona (1764–1822) (HEVESI, 1971), one of the classical geographers in Hungary in the XVIII–XIXth centuries. David Frölich learnt astronomy directly from *David Origanus* between 1620 and 1622 (KOVÁCS, 1990).

David Frölich's professional life

As it was mentioned above, David Frölich was competent in more scientific areas. His least significant works are the ones in literature (two) because those are not more than a simple collections of Latin phrases (*Loci communes poetici*, Lócse (Leutschau), 1646; *Gnomologia metrica*, Boroszló (Breschlau) 1646). One of his two printed historical books deals with the origin of the Transylvanian Saxons and the upper Hungarian (Zipser) Germans („*Der Uralte Deutsche-Ungarische, Zipserische und Siebenbürgische Landszmann*”, Lócse, 1641). Unfortunately, he originated the Germans of Hungary from the East. Their ancestors, the *géta*-s are originated from one of *Noah's* grandchildren. *Géza I.* (ruled between 1074–1077) invited and settled them down in Hungary. He also mentioned the legend of the Transylvanian Saxons, „the Hamelian rat legend”, to explain their origin. He concluded in his book that the German language spoken in Upper Hungary is most similar to the

Meissenien dialect. Although some impact from the Austrian dialect can be identified as well (PUKÁNSZKY, 1926).

The major part of Frölich's professional work – the calendars (68 or 70), and the books about calendar making (3), astronomy (1) – shows strong correlation with each other.

Making calendars became popular in Hungary from the end of the XVIth century. The calendars („schreibkalender“) and almanacs („almanach“) consisted not only of the plain calendar, but gave the dates and places of the main fairs, gave event-forecasts based on the constellation of the stars („Prognosticon Astrologo-Physicum“) and listed the main events of the national history („krónika“). It is characteristic for the historical part that as approaching to the recent years, the number of less significant event appearing in the calendars is increasing, like the fights, earthquakes, severe droughts, hails, lightings, etc. The majority of the event are Hungarian, but there are events mentioned from other countries, regions of the World, like in Frölich's calendar published in 1633, in Lőcse „Ephemeris, vulgo Calendarium Astro-Meteorologicum“ that had citation from all over Europe, South-East Asia, Egypt, Yucatan and Hispaniola.

The „prognosticon“ and „Kronika“ parts of the calendars worth for a deeper study. The astrology based prognostication – the horoscope making – has become more popular in Hungary in the last few decades. However, these modern ones are not as sophisticated ones as the ancestors in the 16–17th centuries. Based on the „krónika“ chapters, complete records of unusual meteorological, hydrological events, earthquakes, etc. can be set up for almost 300 years – for the period before the organized, regular meteorological observation (RÉTHLY, 1962).

The creation of a perpetual calendar, the forecasting of the solar and lunar eclipses and the calculation of the constellations required very sophisticated astronomical and mathematical knowledge. Frölich was the first in Hungary who knew and wrote about Nicolaus Kopernicus' solar centered conception of the Universe (ZEMPLÉN, 1964).

His most significant book in this field was the „Anatome Revolutionis Mundanae Statum Genuinum“ (A sketch about the status of the rotation of the World, Lőcse, 1632). Despite of the execution of *Giordano Bruno* (1600), the forbidding of *Kopernicus'* teachings by the pope (1616) and the outrage of *Galileo Galilei* (1633), he kept continuing teaching about the rotation of the Earth and circulation of the Earth around the Sun. Of course, in his book he also describes the Earth Centered concept of the Universe and the movements within that. The reason, why he stood onto neither side, was that his personal experiences and the available literature and tools at Késmárk were not enough to support or object any of the theories. It is an interesting fact that he listed the main arguments supporting the Earth rotation in some of his calendar as well (for example in 1640).

The two main geographical works of Frölich are classical in both national and European aspects. In 1639, he published his book „Medulla Geographiae practicae“ (The essence of practical geography; Bártfa (Bartfeld, Bardejov). The second figure shows the title page. The translation is below:

„The essence of practical geography is dedicated to the travelers of this wartime age, to give detailed information on the things and events that already happened or will happen: This book is about the more noble and accessible part of Europe, following a homogeneous method: listing their location, number, quality, government, division, the distribution of the towns and villages, the attractions and the habits, situation, political life and morality of the local population: Islands, peninsulas, seas, bays, rivers, lakes, ports, mountains, springs, mineral waters, minerals, farmlands, pastures, forests, wildernesses, animals, the remnants of ancient times and other interesting natural phenomenon, artificial, man-made attractions, and summaries of the main regions of the World: From David Frölich, mathematician of the gepida Carpathians. This book is partly based on my personal experiences, and partly on the readings of the modern geographic literature.“

The significance of this work can be summarized as follows:

1. In the introduction part, he explains why geographical knowledge is important for almost all of the sciences.
2. That was the first domestic text book, which has defined the meaning of the most important geographical scientific nomenclature. Out of the 103 geographic terms that he mentioned in Latin and German, 45 terms were named in Hungarian as well (Fig. 1).



Figure 1. Part of the tri-lingual geographical dictionary published in his book entitled „Medulla Geographiae practicae” (Bártfa, 1639)

3. In this book, the most important contemporary works from Münster, Braun, Bertius and Schröter and his personal experiences were unified, harmonized and summarized based on real geographic categorizations.
4. Based on the data of Tycho Brahe (1546-1601) he divided the Northern hemisphere to hot, temperate and cold regions. He calculated the lengths of the days for all the second or third latitudes and presented it in a tabular format. He also indicated the corresponding European areas for each of his latitudinal sections.
5. One of the main advantages of this work is that he used his personal, field experience that he collected through his peregrination. Such a detailed book about the Hungarian – particularly the upper Hungarian and Transylvanian – climate, water, mountains, settlements, population and their habits, language, mining, farming, animal husbandry, and market has not been published before specially not in a uniform, clearly geographical approach.
6. This book summarizes his famous findings and observations about the atmosphere that he experienced in his Tatra-hike in 1615. (For further information on this topic, please see below!)

The „Medulla Geographiae” have got abroad soon. The delegate of Mazarin cardinal – who was governing France in Louis XIV childhood – of György Rákóczi I, Antonie de Croilly has written the followings onto the pages of one of this book (CSINÁDY, 1965):

„Dear Distinguished Sir! I have read your book in our France and have seen our greatest men using that and reading that even in the Netherlands. I tell You, that You are a very well appreciated and honored man in our country, and Your book is kept in all of our libraries. I have also heard that our professors give lectures on your Geography.”

The other famous geographic book of David Frölich was the „Cynosura seu Bibliotheca Viatorum” (Traveler’s library or leading star, travel guide, Ulm, 1644). This was a specialized book that has contained the basic geographical approaches, while a new field, the ancestor of the „tourism geography” was added to the chapters as well.

„For travelers, and for their library, a guidebook which is absolute the most useful and happiest one. Contains two chapters: The first chapter has for books in it: I. Hundred and plus another ten of the traveler’s problems. II. Many suggestions for the travelers. III. The method of geographic exploration. IV. Two kinds of syllabuses, a simple one and a mathematical one with the description of the markets and currencies. The second chapter contains four books as well: I. Geography for the travelers. II. History for the travelers. III. A perpetual calendar and four kinds of prognostications with the use of that, namely meteorological, physiognomical (soothsaying from the face), palmistry and dream analysis. IV. Prays and anthems for travelers. It was written by D.F., mathematician of the Emperor, in Hungary, by summarizing different books, interesting memories and experiences. Ulm, printed by Endter Wolffgang, 1644.”

As it is highlighted in the introduction, this book contains everything that has been published in his previous book „Medulla Geographiae practicae”. In his second book, he uses a lot of figures in both the traditional geography and the travel guide book parts (Figures 2 and 3). His basic principle: *„... there are several ways of attaining morality, wisdom and knowledge, but the best one is traveling: this way is not only the tool for attaining wisdom, but also a practicing field of derring-do.”*

The two-volume book (1010 and 1019 pages) has all together 2029 pages without the letters of support, and divided into four books. The table of the latitudinal characteristics in the „Medulla” was complemented with a distance table of 113 towns. There are no Hungarian geographic terms in the edition published in Ulm. In this book a very important sentence was added to chapter describing the Tatra hike.



Figure 2. The title page the fourth chapter of „Cinosura seu Bibliotheca Viatorum” (Ulm, 1644)

Figure 3. Decorative drawing from „Cynosura seu bibliotheca Viatorum” (Ulm, 1644)

This famous chapter has got abroad very soon. Bernhardt Varenius (1622–1650), one of the most famous geographers of that age has referred this chapter word by word in his famous book „*Geographia generalis*” (Figure 4) six years after its first publication (BERTALANFFI, 1757). This was the 7th chapter of the Vth volume of *Ottonis de Guericke „Experimenta Nova (ut vocatur) Magdeburgica de Vacuo Spatio”*, published in Amsterdamban in 1672 (PETHŐ, 1899).



Figure 4. The title page Varenius *Geographia Generalis* (Amsterdam, 1650)

David Frölich's book, published in Ulm, has been probably as well known as the „*Medulla*”, as it is adumbrated from the first few sentences of the first Hungarian translation (SZÖNYI, 1774):

„It is admirable to translate the writings of David Frelichius (mathematician of Emperor Ferdinand III) in his book about the mountains of Késmárk, that he called Viatorium and published in Ulm, 1644. It is so well known that Physiologist, professors of natural sciences from all nations uses that in their own language. It would be a shame for us that such an interesting thing that has been found in Hungary, cannot be read in Hungarian.”

The translation of this chapter of the „*Cynosura*” to Hungarian by Emil Ponori Thewrewk has been published in the 15th booklet of the second volume of „*Természettudományi Közlöny*” (PETHŐ, 1899). This is translated to English below:

„Among the Hungarian mountains, the first one is the „Kárpát” (Carpathians). This is the common name of the Sarmata ranges of mountains which separates the Hungarians from the Ruthenians, Polish, Bohemian, Silesians, and from the Cis-Danubian part of Austria. The steepest and highest ranges, which raises above the clouds, are in the Szepesség, close to my loved birthland of Késmárk. This part of the mountain is named after the town, Késmárk Mts. or snowy Mts., because it covered by snow through the year. The Slovaks called it Tatral or Tarczal, due to its bald appearance. (The range that extends to Liptó county is called by the locals Krivoán (oxtail).

These rocks, which overshadow the Italian, Swiss and Tyrolean Alps, are almost impossible to hike due to their inhospitable and steep slopes, and rarely visited by some friend of nature.

As a young man who wanted to explore the height of the mountain with two of my schoolmates, I hiked up to the mountains in June, 1615. As I was approaching to the peak with many troubles

and difficulties, I had to realize that there is another, much higher peak hiding behind this one. As we were approaching to the neighboring peak through many unstable rocks (among which we made one roll down into the valley, it took many hundreds with itself making such a huge noise, that makes a man frightened and think as if the entire mountain would fall onto him) we were faced with new, higher and higher peaks towering above the previous ones. We were crossing those peaks and the deep valleys between them, being faced with continuous life danger till reaching the highest peak of all. While I was looking down to the endless forests from the slopes, we did not see anything else than dark night or something bluish that I would call cloudless air-sky, and I felt like if I fall down from the mountain, than I would have fallen directly into the sky and not onto the ground. The peaks and ranges under us looked slurred and small. As I was approaching the highest peaks I found myself in a dense fog. As I progressing further to the peak and turned back for a moment to look down to the area where it was foggy, I saw dense white clouds drifting through the sky. Underneath and above the clouds there was a nice view reaching beyond the borders of the Szepesség. I saw the clouds being higher and lower, in different distances from the ground. I understood three things there: 1. I have crossed the border of the middle layer of the air, 2. the distances of the clouds from the ground are not the same for all, it can be small or large depending on the quality of the haze, 3. the distance of the clouds from the ground is much smaller than it is believed by the natural scientists. It is not 72 German miles, but only a half mile. As I reached the peak, I felt no wind, even a weak one, while in the lower regions I experienced strong winds. I concluded from this hike that the height of the Tatry-mountains is exactly one German mile, and the peaks reaches that layers of the air, which is not effected by the winds.

At the top, I shot my rifle, which had a sound not stronger than the sound of braking a wooden stick. But after a while the sound filled up the bottom of the mountains, the valleys and forests.

As a descended from the top and crossed the regions of the old snow, I shot my rifle again, which made a very strong sound, even stronger than the biggest gun, and I was afraid of having the entire mountain collapsed. It took for a half of a quarter hour, till it had reached the deepest holes, from where the air came back even stronger. And because these kinds of holes do not appear in the upper part of the mountain, the first echo can be hardly heard. While descending to the lower regions having more of those hole and caves the sounds bounce back from them and make bigger noise. When the neighboring plain areas have rain falling, those higher mountains have snow and hail falling even in summer time. The age of the snow can be estimated based on its color and the firm crust on it."

Although, the first observer and scientific descriptor of the relationship between the vegetation, climate and the elevation was *Leonardo da Vinci* and *Bembo* (the end of 15th century and the beginning of the 16th century), they have never wrote down their personal experiences in such a detailed way as Frölich did. He concluded that the air pressure decreases with the increase of the elevation even before *Torricelli's* (1608–1647) and *Pascal's* (1623–1662) measurement. He experienced that the wind speed varies throughout the layers of the atmosphere and the clouds can go in different height and different forms of precipitation can fall from it. He also identified the relationship between the speed and strength of the sound and the density of the air (ZEMPLÉN, 1964).

The new sentence added to the version written in the „*Medulla*” was about the age of the snow: „The age of the snow can be estimated based on its color and the firm crust on it”. This statement refers to a person with good observing and interpreting skill. That is why he is classified among those natural scientists, who could go beyond theories and add a lot of personal experiences to them to derive conclusions.

We have to reconsider the age of Frölich in 1615, when he climbed up to one of the peaks of the High-Tatra. Several biographers set his birth year to 1600. Many of them doubted that in the age of 15 he was such a good observer. However, we know that in 1615 he was 20. Formerly, many of his biographer believed that he climbed the Lomnic-peak (2632 m).

Grósz (1941) analyzed his hike and concluded that he climbed the neighbouring and a little bit lower Késmárk-peak (2558 m). However, this fact and conclusion does not decrease the greatness of his hike and the importance of his conclusions about the atmospheric processes! Since 1927, his name and memory is preserved in the name of a rose species of the North-Western Carpathians, *Rosa Frölichiana*, Degen et Gyórfy (CSINÁDY, 1958).

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