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**PÁL KITAIBEL'S EARTH SCIENTIFIC WORK WITH
SPECIAL REGARD TO HIS DESCRIPTION OF THE USE
OF LAND ECONOMY IN THE CARPATHIAN BASIN**

THESES OF (PH.D.) DOCTORAL DISSERTATION

by
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I. A SHORT SUMMARY OF THE SET RESEARCH TASK

In my doctoral dissertation I introduce the research on the botanical and geological relationships and land economy in the Carpathian Basin on the basis of Pál Kitaibel's (1757-1817) works and his contemporaries' writings. Pál Kitaibel is one of the most versatile and significant Hungarian natural scientists. He was the first describer of the Hungarian flora who gained European fame. He is regarded as a pioneer researcher in several areas of science such as chemistry, mineralogy, geophysics and balneology. The relevance of Kitaibel's works is shown by the fact that the young historical ecology including several areas of science relies on the floristic data of Kitaibel's diaries. One of the aims of my paper is to verify that Kitaibel's diaries and *Icones plantarum* are outstanding sources from a natural geographical point of view.

Pál Kitaibel's natural geographical work has been almost forgotten. However, in the first part of his main work *Descripciones et Icones plantarum rariorum Hungariae* (*Description and pictures of the more unique plants in Hungary*) in 1802 Kitaibel provided an almost complete description about the Carpathian Basin's geography together with the summary of his collecting field work and the geological and botanical results of his contemporaries. In my dissertation it has been proved with the analytical presentation of *Descripciones et Icones plantarum rariorum Hungariae*'s Introduction that this work has science historical significance in the literature of the European plant geography and Hungarian geology as well as in natural geography.

In order to evaluate Kitaibel's natural geographical activity it is inevitable to introduce the historical antecedents. With the introduction of some significant works of the predecessors and contemporaries researching the natural endowments of the Carpathian Basin I have attempted to enrich and shade the picture of Kitaibel's versatile work. His natural scientific significance and his synthetising view receives more emphasis with the brief description of his age.

In the first part of my paper an outline is provided about the emergence of the Hungarian earth sciences from the beginning of the 16th century to the age of the Enlightenment through the works which are the antecedents of Kitaibel's regarding their themes and view. Instead of a strict chronological order I follow the emergence of the natural geographical thinking – with an eye to the Hungarian cultural historical endowments – in connection with the Christian

churches' educational traditions. Those works of the lecturers and professors of Protestant (Sárospatak, Debrecen, Kolozsvár) and Lutheran (Késmárk, Pozsony) colleges and the University of Nagyszombat have been evaluated which had a significant role in the development of the natural sciences.

One of the important features of the Hungarian paradigm history in the age of the Enlightenment is the creation of the Hungarian natural scientific language. The aim of my dissertation is to introduce the role of the Calvinist schools in the birth of the first Hungarian botanical and earth-scientific works. The leading role of the Lutheran intelligentsia graduating at German universities has been examined in the birth of the sociogeographical treaty, maps and journals created in the scientific workshops of general knowledge about motherland.

While introducing the 18th century research on the natural endowments of the Carpathian Basin I have also mentioned the Hungarian practitioners of the 'sciencia amabilis' as well as the effect

of foreign (L. Born, J. E. Fichtel) and Hungarian travellers on Kitaibel's work. It has also been shown how the Neptunist/vulcanist debate affected the research on the Carpathian Basin especially Kitaibel's geographical view. While revealing these connections I have provided new data for the science history of geology.

Those results of the main researches in the field of botanics, geology, natural geography, meteorology and pedology have been placed in focus which were connected to the revelation of the natural endowments of the Carpathian Basin and to the land economy. Kitaibel's and his contemporaries' work in this field have been summed up in a comprehensive figure.

As for the contemporary works on pedology and land economy the salines, areas covered in sand and the hydro regulation work have been focused on. The writings of the contemporaries have been compared with Kitaibel's diaries with the aim of throwing light on the originality of Kitaibel's research method, his novel interpretation of the relationship between land and man, which is still relevant in land historical research.

With the parallel evaluating analysis of the *Introduction of Icones plantarum*, Kitaibel's diaries (in detail the diaries of Baranya) and the Lipszky-maps I have brought up a new source, new methodological possibilities and aspects in connection with the present land historical researches.

II. THE METHODS OF THE ARCHIVAL AND LITERATURE RESEARCH

My doctoral dissertation belongs to science historical genre and is based on archival data and the comparative analysis of the works of the Enlightenment.

Kitaibel's botanical and earth scientific work have been examined together in connection with the science branches of his age concerned with the living and non-living nature. It was necessary not only because of Kitaibel's versatile scientific life but also because of the practical view on science in the Enlightenment and the different divisions of the areas of science. This several-angled approach has revealed new connections about Kitaibel's science-organizing attempts.

I have done archival research in the library of the Benedict Secondary Grammar School of Gergely Czuczor, where I have found school-historical documents about Kitaibel's so far unknown phase of life providing information about his natural scientific education.

Lajos Mitterpacher's letter to Kitaibel can be found in the Science Historical Collection of the Hungarian Museum of Natural Sciences, which proves their personal relationship and co-operation. On the basis of this, new data have been provided about Kitaibel's life path regarding his preparation for his research journeys and also about his relationship with the founder of Hungarian geography.

From the material found in the Science Historical Collection of the Hungarian Museum of Natural Sciences I relied on the catalogues (1818) of Konstantin János Schuster, one of the organizers of Kitaibel's heritage. These contain -among others- the list of Kitaibel's correspondents and the list of his notes and library. They provided archival data about Kitaibel's botanical, meteorological and pedological research as well as about his relationship with his contemporaries and also about his science-organising work.

While writing my dissertation I worked from such a point of view which is not or hardly used in the Hungarian educational and natural geographical historical research, which is due to the revealed sources and the analysis covering several areas of science. Besides the changing fundamental ideas (the Ptolemaic and Kopernic world view) in the curriculum of the Royal Academy of Győr and the textbooks of the professors in Nagyszombat in the 18th century, I have also mentioned the Aristotelian and Newtonian material world view living next to each

other, as well as the view-forming effect of the flogiston explaining burning and the oxidational theory.

In the overview of the history of earth sciences and botanics the main sources were Kitaibel's contemporaries' German (L. Mitterpacher, J. Korabinszky. and G. Windisch.) and Hungarian (M. Varga and M. Katona) works and also literary works on the history of natural sciences of that age Fodor (2006), Szabadváry, Szőkefalvy (1972), Papp (2002), M. Zemplén (1964) and Vekerdi (1994), Gombocz (1936), Jávorka (1957) és Juhász-Nagy (1996).

My research and data processing were made difficult by the changing quality of literature about the history of earth sciences. It was the most difficult to compensate for the problems caused by the lack of literature about Hungarian geological research.

I have introduced the mineralogical (F. Benkő), pedological (F. Pethe), botanical (S. Diószeg, M. Fazekas) and geographical literature (A. Vályi) of the Hungarian natural scientific books of the Enlightenment.

Kitaibel's land examining method and his new idea about land-man relationship are introduced on the basis of comparing his diary of Baranya with country descriptions (the first soldier survey in Baranya between 1782 and 1785 by Korabinszky) and travelogues (Piller and Mitterpacher, D. Teleki).

From a science historical point of view the most significant part of my doctoral dissertation is the analysing and evaluating presentation of the natural historical description of the Carpathian Basin in the Introduction of *Icones plantarum*. In order to do this, the translation of the work was necessary, which is my colleague's, György Schäffer's (AVKF) work. It was Gábor Papp Dr who contributed to the linguistic and professional improvement of the translation. As an appendix of my paper I present the list of geographical names mentioned in the Introduction of *Icones plantarum* and the table of contents in my edition as well as the translation itself.

III. SUMMARY OF THE SCIENTIFIC RESULTS, COMPOSING THE THESES

1st thesis

Pál Kitaibel was a student of the Royal Academy of Győr in the academic year 1777-1778, where he was given natural scientific education at the level of his age. The Academy working on the basis of Jesuit traditions and in the spirit of the Ratio Educationis (1777) provided versatile astronomical, topographical, meteorological and knowledge of physics, which contributed to the foundation of his earth scientific field work.

Unfolding the thesis

On the basis of school historical documents it has been proved that Pál Kitaibel started his higher education at the Royal Academy of Győr as a science philosophical student in 1777 in the former school of the Jesuits. The educational order of the academy reflected the Jesuit educational tradition (training providing classical ancient and modern natural scientific education, natural historical laboratory and library) and one of his teachers was the famous physicist of his age, József Domin. In the year of the introduction of Ratio Educationis (1777) the reformed curriculum provided a wider scope for those subjects that gave natural scientific education and knowledge that came in hand in life (agricultural). At the Academy of Győr 'the old and the new' educational orders existed parallelly, both of which helped Kitaibel to found his versatile natural scientific knowledge and his education based on experimenting and field research.

2nd thesis

Kitaibel can be considered the first researcher of the lands of the Carpathian Basin who based his research on regular observation (partly chemical analysis). The new feature of his land approach was the examination of land constituents (rock, land, flora) in their interrelationship. Recognising the cause and effect relationship between living and non-living environmental effects (FOREST erdotakaro – erodin) in the indicational interpretation of soil erosion he provided the first ecological interpretation of the phenomenon.

Unfolding the thesis

In my doctoral dissertation the science historical works about land research and land economy in the 18th century, Kitaibel's contemporaries' university textbooks about soils (L. Mitterpacher), specialist books (F. Pethe), Kitaibel's diaries, correspondancies and the Introduction of Icones plantarum have been used. On the basis of the analysis and evaluation of these works it can be stated that Kitaibel collected data regularly about soils and the way of cultivating them almost in the whole Carpathian Basin at the scientific level of his age. He also described soil profiles and did chemical soil analysis. One of the original features of his observaitons is the examination of living and non-living environmental constituents together. He described the relationship between the micro terrain and its water coveredness, the base rock-soil-vegatiation which influences the spacial pattern of the salines. On the basis of this, he differentiated between the main types of vegetation in the Hungarian salines. In the description of the soils he empasised the traditions of the different farming. He provided an exact descprition about the causes and effects of erosion in the sandy areas of the Great Plain as well as in the Carpathians. He recognised the role of the vegetation in making salines and sand-covered areas fertile as well as in the protection of forest soils. His recommendations concerning the improvement of salines and binding moving sand were based on the observation of the ecological needs of certain plant species. Kitaibel's way of seeing created a synthesis, which can be revealed in the observations and descriptions of the connection between the quality of surface-covering rock, terrain, soil, vegetation and hydrographical relations.

3rd thesis

Kitaibel's diaries, the Introduction to Icones plantarum are documents of the 18th and 19th century about land economy with unique natural scientific base contain environmental protection views. In the Introduction of Icones Plantarum (sections H,K and L) he provided the summary of the effect of unfavourable and improper farming on the environmental state of Hungary as a part of the description of the natural endowments.

Unfolding the thesis

On the basis of the analysis of science and land historical works about the 18th century, Kitaibel's diaries (in the most detailed way the diaries of Baranya) and the Introduction of

Icones plantarum it can be stated that Kitaibel had thorough knowledge about the land-forming effect of mining, water and sylveculture. He drew the attention to the effects of environment-destroying economy. His experiences gained in this field are summed up in the Introduction of Icones plantarum

It is probable that Kitaibel was the first to warn about the unfavourable biological effects of air pollution on living beings caused by mining and metallurgy as well as about mine exploitation changing the face of the land.

Kitaibel was the first to recognise the unevenness of the density of the water networks in the Carpathian Basin, the diversity of the basin's surface waters and in connection with this, he explained floods with the help of the steepness of the Carpathian mountains, rock-quality and with the ongoing deforestation.

From the second half of the 18th century change at unprecedented scale began in the land economy of the Carpathian Basin. Kitaibel's travelogues are the first and last recording with a natural scientific view about the vegetation of several small lands with rich wetland habitat as well as about the people's farming traditions in these areas. In the Introduction of Icones plantarum he emphasised the favourable sanitary consequences of hydro regulation work in the country.

4th thesis

Pál Kitaibel as one of the first natural scientist researchers of the Carpathian Basin's weather and climate conditions provided the most comprehensive summary in the Introduction of Icones plantarum about Hungary's weather conditions.

Unfolding the thesis

Comparing J. Schuster's (1818) and A. Réthly's (1970) data and making use of the Introduction of Icones plantarum and Kitaibel's diaries I was the first to present the scientific historical significance of Kitaibel's work in the research of the Carpathian Basin's weather in my doctoral dissertation. He collected the survey data of the observatory in Nagyszombat and the University of Buda as well as of the Hungarian amateur naturalists'. Relying on the contemporaries' data and his own regular weather and phenological (change of plants' life rhythm according to the weather and geographical environment) observations he provided the summary of his country's weather conditions in the Introduction of Icones plantarum. In this

work he is likely to be the first to have recognised and explained the rhythm in the typical changes of wind direction in the Carpathian Basin, as well as the joint effect of wind directions and terrain on the distribution of precipitation.

Fifth thesis

***The Introduction of Icones plantarum* was a pioneering work both in Hungary and in Europe from a plant geographical point of view.**

Unfolding the thesis

Kitaibel provided a comprehensive natural geographical description about almost the whole Carpathian Basin in order to provide an explanation for the existence of unique plant species of the Carpathian Basin with the help of the conditions created by the diverse natural environment. He connected the diversity of plant species with the favourable climatic conditions (temperature and precipitation), soil characteristics and the structured terrain. *Icones plantarum* introduced the previously less well-known flora of the Carpathian Basin to the European scientific world in a way that it served as the natural geographical, field research-based foundation for his plant geographic statements. The elaborated drawings as well as the scope of his work contributed to the European success of *Icones plantarum*.

Sixth thesis

Kitaibel summarised and organised the most advanced research results of the 18th century about the geological conditions and formation of the Carpathian Basin. He was the first to create a land division that made use of geological and plant geographical aspects. He can be considered one of the pioneer researchers of geological and geomorphological research.

Unfolding the thesis

In the description of the Carpathians Kitaibel collected and took stock of his contemporaries (Mitterpacher, Piller, Born, Fichtel, Townson, Esmark) and his own field mineralogical and petrographical research. He set these in one frame with the geological theories (Werner, Bergman, Hutton) of his age. In the description of the Carpathians he made use of the aspects of geo-morphology, petrographic built-up, plant geography as well as the historic aspect of formation. His characterization of the north-western mountains is outstanding in that of the

Carpathians. He was the first to reveal the rock species and ranges in such details and with such precision. He was one of the first original pragmatic describers of the shape of the Carpathian Basin, the forms of the high mountain ranges, of the caves and karsts above and under the surface as well as of the witness mountains in the Highlands of Balaton.

Kitaibel was the first to provide a comprehensive summary of the results of the Hungarian geological field research, of the ores and their whereabouts in Royal Hungary, of salt precipitation on the surface, palaeontological fossils and their whereabouts. He can be considered with good reason as one of the founders of advanced geological research on the basis of his field research, collections and the comprehensive description in the Introduction of *Icones plantarum*.

Seventh thesis

Kitaibel used his international respect to introduce the natural endowments and treasures of Royal Hungary to foreigners. He took part in the creation of the Hungarian natural scientific language. As a science organizer he participated in the development of the plan about the improvement of public collections. As a part of this he drew up a plan concerning the exploration of the natural endowments of the whole Carpathian Basin supporting the practical applications of his own scientific findings. He served public welfare as a responsible Hungarian natural scientist.

Unfolding the thesis

In the Introduction of *Icones plantarum* (1802) and in the publication of the Mineralogical Society of Jena, Kitaibel attempted to present the natural treasures of his country. That is the reason why he laid emphasis on the unique features and richness of Royal Hungary's supply of ores, mineral waters, soil and vegetation.

Kitaibel was a professional supporter of the first, up-to-date botanical work in Hungarian, the Hungarian Herbal and chemistry textbook, *Chémia or secrets of nature*.

In his official submissions he drew up the plan of a country-level, centralised collecting and observing network, which he considered viable with harmonised research on the different areas of science (topography, botanics, pedology, meteorology).

Practical view on science was typical of Kitaibel as a scientist of the Enlightenment. His aim was to create such plant cultivation and silviculture that paid more attention to the natural endowments, to improve the sanitary conditions and to fix the bad effects of improper land economy.

My paper revealed new science historical data about Pál Kitaibel's higher-level education, about his relationship with his contemporaries and his science-organizing work.

The results of my dissertation – Kitaibel's natural geographical and land ecological work – can provide a historical guidance for the Hungarian botanical, historical ecological and land-research programmes. Kitaibel recognised the importance of forward-looking economy of natural resources. His thoughts are still relevant if the theoretical basis of natural geographical and ecological research are sought which are long-termed, land-scaled, practical and at the same time adjusting to the scales of natural processes. His writings together with the maps of his age can be a basis of preparations for studies of environmental consequences.

IV. LIST OF PUBLICATIONS AND PRESENTATIONS IN THE THEME OF THE RESEARCH

- (P1) **Both,M.**-Csorba F. L.(1993):Tudománytörténet I. (Science History I.)
Budapest: Gondolat/PSZM pp. 267.
- (P2) **Both,M.**-Csorba F. L. (ed.) (1993): Tudománytörténeti szöveggyűjtemény.
(Science Historical Chrestomathy.) Budapest: Gondolat/PSZM pp.121.
- (P3) Teleki P. (1994): A földrajzi gondolat története. (The History of Geographical
Thought.) (notes) Budapest:Kossuth Kiadó, p. 157-187.
- (P4) **Both,M.** (1995): A világ városai a történelem sodrában (Cities of the world in
the course of history.) (review) Földrajzi Közlemények, **119**.(43.) 1, p. 98-99.
- (P5) **Both,M.**,Csorba F. L. (2003): Források.(Sources.) Budapest: Nemzeti
Tankönyvkiadó pp. 485.
- (P6) **Both,M.** (2003): Németh László szellemi öröksége a természettudományok
tanításában. (László Németh's spiritual inheritance in the teaching of natural
sciences.) Természet Világa **134**, 9, pp. 409-413.
- (P7) Bánkuti,Zs.,**Both,M.**,Csorba F. L.(2006): A kísérletező ember. (The
experimenting man.) Budapest: Kairosz Kiadó pp. 532.
- (P8) **Both,M.** (2008): A kísérletező ember. A természettudományok komplex
tanításában rejlő módszertani lehetőségek a tanárjelöltek képzésében. (The
experimenting man. Methodical possibilites for trainee teachers in the
complex teaching of natural sciences.)
XI. Apáczai Days Conference
Győr, October 18-20 2007. pp. 362-366. Publisher: Nyugat-Magyarország
Egyetem

- (P9) **Both,M.-Csorba F.L.** (2008): Up-to-dateness of the Greek world view.
 Proceedings of the Conference History of Mathematics and Teaching of
 Mathematics, 2008 Tirgu Mures. (Approved article for publication)
- (P10) **Both,M.** (2008): A természetbúvár reneszánsza. Kitaibel és kortársai (The
 renaissance of the naturalist) XII. Apáczai Days Conference Győr, October
 20-22. (Approved article for publication.)
- (P11) **Both,M.** (2009): A geográfus Kitaibel. (The geographer Kitaibel) Földrajzi
 Múzeumi Tanulmányok (Approved study for publication.)
- (E1) **Both,M.:** A kísérletező ember. A természettudományok komplex tanításában
 rejlő módszertani lehetőségek a tanárjelöltek képzésében (The experimenting
 man. Methodical possibilities for trainee teachers in the complex teaching of
 natural sciences.)
 Presentation at XI. Apáczai Days Conference, Győr, October 18-20 2007
 Organized by NYME AK
- (E2) **Both,M.:** A tudománytörténeti alapozású földrajztanítás tapasztalatai
 (Experiences in science-historical based teaching of geography.)
 Presentation at the international HIPST (History and Philosophy in Science
 Teaching) programme's first international meeting, Budapest, May 30-31
 2008
 Organized by BME, ELTE.
- (E3) **Both,M.-Csorba F.L.:** Up-to-dateness of the Greek worldview
 Előadás a History of Mathematics Teaching of Mathematics Konferencián,
 Marosvásárhely/Tirgu Mures, June 4-8 2008
 Organized by „Petru Maior” University Marosvásárhely, Sapientia University
 and University of Miskolc.
- (E4) **Both,M.- Csorba F.L.-Zemplén,G.:** The possibilities for History of Sciences
 in Education and Training in Hungary,
 Presentation at the conference of Styles of Thinking in Science and

Technology Vienna, September 11-12 2008.

Organized by HIPST international programme

- (E5) **Both, M.:** A természetbúvár reneszánsza. Kitaibel és kortársai. (The renaissance of the naturalist. Kitaibel and his contemporaries.)
Presentation at the XII. Apáczai Days Conference, Győr, October 20-22 2008
Organized by NYME AK
- (E6) **Both, M.:** Göttinga hatása a magyar földtudományok és botanika fejlődésére (Göttinga's effect on the development of the Hungarian earth sciences and botanics.)
Presentation at the conference of Göttingen's dimensions, Szarvas, April 24 2009
Organized by the University of Szent István Pedagogy Faculty

I did my doctoral education in the academic year 2007/08, I received my university leaving certificate on 26th June, 2008. Meanwhile I taught environmental studies as a full-time lecturer at the Catholic College of Vilmos Apor in Vác. I am a participant of the 'Rátóti Workshop' of the Ecological and Botanical Research Institute of the Hungarian Academy of Sciences which deals with land historical research and also of the international HIPST (History and Philosophy in Science Teaching).

On 20-21 November 2008 an international conference was held under the title *Foundation of and making students' love natural scientific thinking* organized by the Catholic College of Vilmos Apor in Vác in the framework of events of the Month of Hungarian Science. I was the event manager of this conference. Connected to this, an exhibition was made in co-operation with the Museum of Pedagogy under the title 'Aids in the teaching of natural sciences from the reform of Eötvös until today'.