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GEOLOGICAL SCIENCES IN THE UNIVERSITY OF VILNIUS AND IN THE LYCEUM OF KRZEMIENIEC IN THE YEARS 1781–1832

The natural history, comprising botany, zoology and mineralogy[1], was introduced to the Main School of the Grand Duchy of Lithuania not earlier than during a reorganization of the university in Vilnius done by the Commission of National Education in 1781[2]. At the time when the faculty was established, Vilnius did not have its own staff of the scientists who, after all, were not too numerous in the whole country where the natural science was cultivated to a very limited degree only, and the level of knowledge in this particular field was very low. In this status quo it was decided to choose for the Head of the Faculty a foreign scientist of well-established reputation; and so, the task of delivering lectures was entrusted to a French doctor and scientist Jean Emmanuel Gilibert[3], who was holding that post in the years 1781–1783. His successors to the Faculty of Natural History in Vilnius were, in turn: in the years 1784–1787 – a well-known scientist and traveller Johann Georg Forster[4], in the years 1792–1802 – a doctor from Vienna Ferdinand Spitznagel[5], and finally, in the academic year 1802/03 – a graduate from the Main School of the Grand Duchy of Lithuania Stanisław Bonifacy Jundziłł[6]. The attention of those scientists was mainly focussed on biological sciences.

In Vilnius the individual branches of natural history were not developing in a uniform way; botany developed most quickly and was the first one to become independent, while mineralogy was definitely lagging behind. The reason was not only the degree to which all those sciences were advanced in Europe but, to certain extent, also personal interests of the successive lecturers. The curricula were, in prevailing part, of a utilitarian character. What was emphasized in them was the necessity of studying the natural resources for their practical exploration.

Within the scope of natural history, the lectures on geology were delivered in the years 1781–1783, 1784–1787, 1791/93, 1799/1800 and

1801/02. The education was based on the classification of minerals and rocks and, probably, the students were instructed how to assimilate the skill for their recognition. Basing on the preserved syllabus, it is difficult to ascertain what principles of mineralogical classification were adopted by Gilibert and Forster as a basis of their studies. Spitznagel was using the systematic scheme of Ignatius Born[7]. Gilibert restricted himself to teaching the rudiments of mineralogy (in a modern meaning of this word). The problems related with geology were discussed in a most comprehensive way by Forster who enriched his lectures with geographical mineralogy and, what was even more important, with elements of geology understood in a broad meaning of this word (the theory of an origin of our Earth, the description of an internal structure of the Earth, the origin of minerals and rocks) and with the knowledge of fossil fauna. This deserves special attention in view of the fact that the first attempts aiming at the creation of some foundations of modern geology were made as late as in the latter part of the 18th century, initiated by the works of Johann Gottlob Lehmann, Georg Christian Füchsel and others, and constructively developed since 1775 by Abraham Gottlob Werner. Due to Forster's lectures, in the late eighties of the 18th century, the first – still very modest, elements of our knowledge of the structure of lithosphere, supported by the field investigations, started to be disseminated in the circles of Vilnius. Spitznagel limited the scope of his lectures to the rudiments of mineralogy; he also paid some attention to the problems of mining and metallurgy (mining of ores and methods of obtaining metals out of them) and, though incidentally, to the fossil fauna[8].

In the newly started process of the formation of geology as a separate branch of knowledge, some of its elements were at that time included into the scope of teaching of the chemistry and physics. As it follows from the programme of education prepared by Józef Sartoris, in his lectures on chemistry, delivered in the years 1785–1793, he paid quite a lot of attention to the problems of mineralogy[9], teaching his students the classification of minerals, their properties (with regard to the chemical characteristics), and the applicability in industry and medicine. He was also teaching the rudiments of metallurgy, disclosing the methods used in the preparation of ores for smelting, and describing the process of refining and extraction of metals, including the basic and most indispensable equipment used to this end. In this way, the lectures on chemistry delivered by Sartoris ensured a continuity in teaching of the essentials of mineralogy at the time when the post at the faculty of natural history in Vilnius was vacant.

Since the very beginning of the existence of natural science in the Main School of the Grand Duchy of Lithuania, the need for making a naturalistic collection was understood very well. The collection of natural history was formed as early as in 1781, using the specimens which, presented by King Stanislaus Augustus to the Main School of Vilnius after the dissolution of

Medical School, were brought by Gilibert from Grodno. The collection included about 10 000 pieces of minerals. In the subsequent years the collection was enriched with Forster's specimens picked up during his voyage around the world, with the collection of Saxon minerals purchased by Primate Michał Poniatowski (a gift of the Wielkopolskis family), and with the collections presented by Michał Ogiński (stones and conches), by Jan Wichert (a collection of jaspers, agates and rock crystals), and by Joachim Chreptowicz (the collections of volcanic products from Vesuvius). Yet, all those collections, though precious, were usually of a purely incidental character, and as such represented little scientific and didactic value. Gilibert and Forster appreciated the importance of naturalistic collections, and they took care to enlarge and preserve them. Spitznagel, on the other hand, was not interested in the collection of natural history; he did nothing to protect it, and during the ten years when he was professor the collection was partially destroyed[10].

In the period which preceded the establishment of a faculty of the natural history in Vilnius, the knowledge of the geological structure and raw materials in eastern territories of the Polish Republic was very poor and based mainly on the publications of Gabriel Rzączyński (1721–1742), Jean Baptiste Dubois (1778) and Jean Étienné Guettard (1764)[11]. The need for starting physiographic researches was acknowledged in Vilnius almost at the very beginning of an existence of the faculty of natural history, and the requirement of making the didactics utilitarian favoured the commencement of such researches. The nature in Lithuania was waiting for its discovery, and all the investigations, even those carried out in order to satisfy the most urgent needs in the scope of raw materials, promoted the development of a workshop for the scientific activities. Yet, the scientists in Vilnius were, first of all, biologists, and no wonder that they were mainly interested in the fauna and flora of Lithuania. This, as well as the difficulties which were faced by the newly established faculty (frequent changes in personnel, lack of the back up facilities, etc.), contributed to the fact that in the Main School of Lithuania the geological investigations were carried out on a very small scale only, and were usually reduced to checking the places of occurrence of some raw materials, like rock-salt, peat and bog iron ores. From that period originate only three printed geological works and three hand-written reports of the journeys[12]. Among them, of the greatest cognitive value is Gilibert's treatise published in 1783, in which he described the drifts in the territories of East Lithuania and in the district of Novgorod, nowadays reckoned among the formations of the Quaterternary Period, along with their genesis and age, reported on the raw materials present there, and touched certain problems related with the dynamic geology (e.g. river erosion, the erosive action of rain waters, the formation of sand dunes). It was the most mature treatise on geology that had ever been created in the society of the scientists from the Main School of Vilnius.

The scientific works on geology written by the professors of natural history were very modest. Yet, their individuality laid the first foundations of the development of natural science in Vilnius; they were not only able to arouse interest and create a good climate for further progress in this field, but also knew how to implant the conviction that the main duty of a scientist is to study the Earth and its natural resources. Due to that attitude, it became possible to educate the staff of the first Polish naturalists from among whom recruited the later lecturers of natural history and mineralogy in Vilnius: S. B. Jundziłł, Roman Symonowicz and Ignacy Horodecki[13].

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A very important step forward in the development of natural science was taken along with the transformation in 1803 of the Main School of Lithuania into an Emperor's University of Vilnius and the related reorganization which, preserving Polish as a language of instruction, initiated a modern development of the university, achieved through stabilization of its legal and financial rights and a far-reaching autonomy.

In this four-faculty University, natural science was included into the Faculty of Physics and Mathematics where, among the ten divisions provided in the syllabus, natural history and botany formed separate disciplines. It was also assumed that there would be additional subjects, i.e. new disciplines not included into the main curriculum but still recognized by the university authorities as necessary for the completion of a general education of the students. The university authorities took almost immediately this opportunity to extend the programme of education, the opportunity which, at the same time, opened new ways for the development of natural science. Consequently, as early as in 1803 the decision was taken to start at the Faculty of Physics and Mathematics additional classes in zoology and mineralogy[14]. In this way, there was a practical division of natural history into the three separate branches of botany, zoology and mineralogy, which signified the beginning of an independent existence of these branches of science in the University. The structure of the Faculty still included, formally, the department of natural history, but the post was always vacant. Two times only, during the rectorate of Hieronim Strojnowski, an unsuccessful attempt was made to fill this post[15]. Later on, the attempts were not repeated because with increasing specialization of the natural science, it rather became necessary to raise the status of additional classes in mineralogy and zoology to the rank of faculties.

The division of the Faculty of Natural History into three separate branches caused a formal increase in the number of the classes assigned for teaching of natural science. According to the university statutes, teaching of

the main subjects, i.e. of those which formed separate faculties, should take 5–6 classes in a week, and of additional subjects – 2 or 3 classes, depending on the individual requirements of a given discipline. From the very beginning, for the lectures on mineralogy more hours were assigned than it might follow from the status of this science, recognized as an additional subject; in some years mineralogy was even taught in the number of hours corresponding to main subjects[16]. The reason was, probably, on one hand, a rapid development of this branch of science in Vilnius, and – on the other – the attempts of the successive lecturers of mineralogy to increase the number of classes, because they were not able to teach the whole material during the classes assigned for additional subjects.

The first lecturer of mineralogy in the University became adjunct Roman Symonowicz, graduate from the Main School of Lithuania, doctor of philosophy and medicine, appointed to that post in 1803. Symonowicz started his lectures at the beginning of 1804. After one year's break which took place in the academic year 1804/05, due to his complementary studies under Werner's supervision at the Mining Academy of Freiberg, Symonowicz resumed his lectures in autumn 1805 and delivered them regularly until February 1813. The next lecturers were: Makary Bogatko[17] (February – June 1813), Feliks Drzewiński[18] (1814–1817), Ignacy Horodecki (1817–1824), Feliks Drzewiński (April – June 1824), Józef Jundziłł[19] (1824–1825) and Ignacy Jakowicki[20] (1825–1832). All the lecturers of mineralogy in the University of Vilnius were graduates from this University. Moreover, in the years 1827–1831, the Head of the Faculty of Zoology and Comparative Anatomy was Karol Edward Eichwald[21], who took a keen interest in the problem of geology and palaentology.

It is not an easy task to make now an exact reconstruction of the contents and scope of the lectures on mineralogy which were delivered in the University of Vilnius. An attempt of this kind can be made basing on the analysis of rather scarce source materials, i.e. the syllabi which have been preserved until now, 76 sets of questions for the examinations entered to obtain academic degrees, a few dissertations[22], the academic handbooks used at that time, and the back-up facilities available in the university (mineralogical collection, library acquisitions, etc.).

The lecturers in the University of Vilnius, the followers of Werner's geology, well-informed on the European problems of geology, were teaching their students the neptunistic approach of their master, focussing their attention, first of all, on teaching of oryctognosy (mineralogy – in the modern meaning of this word) and geognosy (geology). Quite often they completed and enlarged the scope of their lectures with the practical knowledge of geology acquired during the excursions with students to the surroundings of Vilnius.

Symonowicz delivered his lectures using his own notes of Werner's lectures, a hand-written sextern which, in the first version, was prepared as

early as in 1804, and his treatise "On the present state of mineralogy", which was the first Polish presentation of Werner's neptunistic theory[23]. The scientific views of Symonowicz were not changing in any more important way, and till the end of his life he remained a faithful and rather uncritical advocate of Werner's doctrine. In his lectures he mainly laid emphasis on teaching of oryctognosy and on the theoretical fundamentals of neptunism. He spoke about the formation of the Earth in a process of the solution in water and the subsequent precipitation of chemical and mechanical deposits from the waters of a first ocean, about the distribution of metals in the lithosphere and about their genesis. He was also teaching the rudiments of stratigraphy, following Werner's approach to that problem. Even then when he was discussing the points of view different from those confessed by Werner, e.g. the crystallographic classification of minerals elaborated by René-Just Haüy[24], he did it from the position of defending his master's opinions.

At the beginning of the 19th century teaching was done during the lectures which served not only for the demonstration of collections but also for practical experiments, e.g. in chemistry. Therefore, it has to be emphasized that Symonowicz was fully aware of how important it was for the students to be in direct contact with the mineralogical specimens not only during the demonstrations made in the course of the classes but also later in the study-room, open for the students for a couple of hours in a week. He also attempted, though to no effect, to divide the students into less numerous groups and to give them, in this way, an opportunity to study closer the demonstrated specimens[25].

The successors of Symonowicz sticked, in a general outline, to the same curriculum. Drzewiński was teaching from the handbooks written by André Brochant, Alexander Brongniart and others[26]. He paid more attention to teaching of oryctognosy, but, compared with Symonowicz, was less adamant on making his students familiar with the theoretical fundamentals of neptunism.

Horodecki based his lectures on Werner's works and on the handbooks written by Christian Hoffmann, Haüy and Drzewiński[27]. This teacher of physics and natural history, working for so many years at the Gymnasium of Vilnius and adjunct at the Faculty of Chemistry of the University of Vilnius, possessed an outstanding knowledge of geology, great pedagogical experience, and well-mastered elements of physics and chemistry. His lectures comprised a systematic course in mineralogy, understood in the contemporary meaning of this word. Yet, it was no longer the uncritical Werner's neptunism, confessed by Symonowicz and – to a great extent – also by Drzewiński. In teaching the rudiments of Werner's classification of minerals, Horodecki paid due attention to all the advantages and drawbacks of that system. As a very experienced chemist he could not disregard and underestimate the contemporary knowledge of chemistry, or debase the part

that the chemical analysis played in the studies and division of minerals and rocks. It seems that he was able to make his students familiar, in a much more extensive way, with the classification of minerals based on the chemical principles.

Horodecki was vividly interested in the problems which at that time took up the attention of all the geologists in Europe and gave rise to numerous scientific disputes, viz. the genesis of veins and of the metals present in them as well as the genesis of some magmatic rocks, regarded by Werner as sedimentary formations, e.g. basalts. Since, at least, the academic year 1818/19 in his lectures he was speaking in favour of the theory of a vulcanic origin of basalts. His opinions on the genesis of veins also proved his critical approach to the theoretical generalizations in geology. He did accept Werner's theory of the genesis of veins, considering it to be most convenient and close to reality at the contemporary stage of knowledge, but – at the same time – he also suspected the whole problem to be of a much more complex nature than it might result from the teaching of the master from Freiberg, and he thought that it was unreasonable to accept quite unciritically only this one mechanism of their formation. Because the neptunistic theory could not explain in an adequate way the formation of numerous veins, then – according to Horodecki – it seemed advisable to assume that the process of their formation must have been affected by other factors which had exerted, at least, an indirect effect. In geognosy Horodecki remained faithful to Werner's opinions; he was also teaching Werner's stratigraphic schema, developed by the French geologists, and various theories on the formation of our Earth.

A one-year series of the lectures on mineralogy prepared by J. Jundziłł was very traditional, probably the least comprehensive of all the lectures delivered during the entire period of an existence of this subject in the University. The lecturer limited himself to oryctognosy, a short presentation of various theories of the formation of our Earth, starting with Buffon, and to Werner's principles of stratigraphy.

In his didactic activities Jakowicki was using his own handbook and the works of Jean D'Aubuisson, Johann Breithaupt, François Sulpice Beudant, Carl Leonhard, and Alexander Humboldt[28]. As regards oryctognosy, the scope of his lectures resembled the lectures delivered by Horodecki. In geognosy he emphasized the research methods applied in the description of the terrestrial globe, and of the processes which had been occurring there. Jakowicki was particularly interested in the processes which took place on the surface of the Earth, in the forces which made them take place, and in the effects of their occurrence, expressed by the successive changes of this surface noted in the course of an existence of our Globe. At that time, those problems aroused a lot of interest in the whole Europe. The reason were numerous geological travels, the investigations undertaken on a scale un-

heard of until then, and the formation of new theoretical generalizations in the geological history of the Earth, especially Cuvier's theory of cataclysms and the works of Leopold von Buch and Humboldt. Jakowicki was also teaching his students the structure of the terrestrial globe and the stratigraphic schema of D'Aubuisson, which was a further development of Werner's ideas of stratigraphy. He emphasized the significance of fossil organisms in the process of reconstruction of the history of our Earth and in, occasionally, the determination of a relative age of the examined formations.

The syllabus of Jakowicki's lectures was wider and more systematic than those of his predecessors, and the proportions between teaching of oryctognosy and geognosy were chosen in a much better way. Most probably, Jakowicki sticked to this programme without any more serious changes till the end of an existence of the University. He was only introducing additional information and modernized the programme to some extent, e.g. since the academic year 1826/27 he had been paying more attention to other systems of oryctognosy (Fischer, Beudant and Breithaupt); he introduced Breithaupt's scale of the minerals hardness (12 degrees), he lectured on the history of crystallography and extended the scope of the knowledge of geology and probably also that of palaeontology. At the last stage of his lectures, anyway, he disclosed to the students in a slightly more extensive way George Cuvier's opinions on geology and his theory of cataclysms. He was less interested in the theoretical generalizations and spent less time on them. He was teaching the students various methods of researches, showed them how to pick up the geological observations and how to put them in a systematic order. In teaching of oryctognosy he still used Werner's classification, but the reason was not exactly his conviction of its perfection but rather a belief that, using the simplest methods for distinction between the minerals, it was most convenient in teaching the rudiments of oryctognosy.

Analysing the curriculum of teaching geology in the University of Vilnius, one cannot omit the lectures on zoology and comparative anatomy, and not only due to the significance that mastering of the fundamentals of the contemporary knowledge of zoology and palaeontology had for the adepts in geology, but also and mainly owing to Eichwald's personality and his contribution to a development of this branch of science in Vilnius. In his programme of education he paid a lot of attention to the fossil fauna, he disclosed to his students the principles of Cuvier's comparative anatomy, and he gave a critical review of the numerous systems of zoological classification, among others, of those elaborated by Johann Blumenbach, Jean Baptiste Lamarck and Cuvier[29]. It is to be supposed that the fragments of Eichwald's lectures on fossil fauna were presented by him against a wider background, i.e. speaking about the importance of this fauna in a reconstruction of the history of our Earth and in the evolution of organic life. Eichwald was not only an excellent lecturer but also and mainly the scientist of a

well-established in Europe reputation and a most eminent palaeontologist of that epoch.

In recapitulation of the twenty nine years of the pedagogical activities of the lecturers who taught mineralogy it has to be emphasized that nowhere else but in the University of Vilnius had they laid the foundations of the Polish geology. That division was started by the creator of Werner's mineralogical school in Vilnius – Symonowicz, continued by Drzewiński and Horodecki, and finished by Jakowicki. The lectures on mineralogy were delivered "after Werner's pattern", but a considerable evolution in the respective viewpoints can be traced: from very "orthodox" Werner's science in Symonowicz's lecturers to preservation of only those of the opinions which had survived and entered the contemporary science, with attention focussed every time more carefully on the European achievements, disclosed in the lectures of the successors of the author of a treatise "On the present state of mineralogy". More emphasis was laid on oryctognosy. The scope of teaching geognosy was gradually extending, until in his lectures Jakowicki discussed those problems in a most comprehensive way.

At that time, in the universities in Europe, oryctognosy, geognosy and mining were usually taught separately during the classes which sometimes took from 2 to 3 years. In Vilnius the whole of the contemporary mineralogy was taught in the course of one year. No wonder that in this way the scope of the imparted knowledge suffered quite considerable reductions, and some of the problems were just mentioned. Therefore, in geology the lecturers paid relatively less attention to the theoretical trend, fixing their minds on the practical knowledge which was applicable in life, and on making their students familiar with the research methods used by the contemporary geology. In spite of all those restrictions they were still able to keep the lectures on a high European level, though they did not avoid certain, fortunately not very great, delays in respect to a development of this discipline in the world.

The number of the students attending the lectures on mineralogy was quite considerable, and it did not differ in any particular way from the attendance observed during the lectures on other mathematical and natural sciences. It varied between 60 students in the academic year 1814/15 (with the total of 146 students attending the Faculty of Physical and Mathematical Sciences) and 210 students in the academic year 1827/28 (with the total of 509 students attending the Faculty at that time). Altogether, during the twenty one years which the collected numerical data cover, the classes in mineralogy were attended by 2619 students which makes slightly more than 1/4 of the total number of pupils studying at that time in the University[30]. Quite high was also the percentage of the students who took mineralogy as a subject of their examinations passed in order to obtain the scientific degrees (minimum 537 students)[31]. These numbers are a good evidence that mineralogy quickly established its position in the university, became a popular

and useful science, and in its development was attracting the students with its problems.

Quite soon they also thought in Vilnius about the publication of Polish handbooks on geology. Consequently, as early as in 1806, Symonowicz's book "On the present state of mineralogy"[32] was published. It was the first comprehensive Polish exposition of Werner's ideas. In 1816 Drzewiński published the first in Poland university handbook on mineralogy "The rudiments of mineralogy after Werner's principles compilated"[33], in which he also took into consideration the investigations of other well-known European mineralogists. The book was in common use till the late thirties of the 19th century. In the third decade of the 19th century a few more handbooks based on Werner's ideas were issued. Those were, among others, the books written by Jakowicki[34] and Norbert Alfons Kumelski[35], a graduate from the University. The handbooks represented the same level and had the information arranged in the same sequence as the work written by Drzewiński, but they were provided with numerous addenda and supplements which proves that their authors were carefully tracing the progress made in the geological science in Europe, and that they knew how to use the contemporary reference books on mineralogy and geology. One should also mention the first Polish handbook on palaeontology, edited by Kumelski in 1826[36].

In the period of 1806–1829, seventeen university and school handbooks were published in the Polish language on the above mentioned subjects, out of this number – eleven in Vilnius. The handbooks published in Vilnius represented a scientific level higher than the remaining works, and their authors – Symonowicz, Drzewiński, Jakowicki and Kumelski – played an important part in the history of the Polish geology.

All the teachers of mineralogy in Vilnius had one feature in common, viz. they fully appreciated the significant part played in the didactic process by a rich and possibly complete geological collection, and consequently they tried to enlarge and protect in a best way the existing specimens. In 1803 the mineralogical collection, though already quite abundant, was still inadequate to the needs of the didactics. The specimens were not put in a systematic order, and there was no catalogue. Due to the generosity of people (the donations made by, among others, Michał Walicki, Jędrzej Śniadecki, Stefan Zienowicz) and the purchases done by the University, the collection was systematically increasing. The most important acquisition of the University, purchased in 1813, was the collection left by Roman Symonowicz and composed of 14 867 specimens. This illustrious set of great didactic value raised the rank of the University collection of mineralogy to a level equal with the most significant collections of this type in Europe[37].

Out of the collection of more than 30 000 specimens, 28 school collections of a total number of 14 000 specimens were formed. In the study-room of the University remained 20 800 specimens which were used for the for-

mation of two collections: mineralogical (more than 18 000 specimens), and geognostic (more than 1200 specimens). Both collections had their own catalogues. The mineralogical collection had a catalogue prepared by J. Jundziłł in 1826, the geognostic one – a catalogue prepared by Jakowicki in 1831[38]. The works on the arrangement and listing of collections were accompanied by discussions on the range of collections, methods of their acquisition, and the system of classification. In the mineralogical collection they adopted Werner's schema of minerals classification, while in the geognostic collection, the rocks and fossils were arranged geographically, according to the places (provinces) of their occurrence, using D'Aubuisson's stratigraphic schema.

It is difficult to determine now to what extent the university library was provided with professional literature on geology. Obviously, the sufficient and relatively complete stock of publications was not available. And yet, the good knowledge of the European literature, specially French, German and Russian, which the naturalists from Vilnius had certainly acquired, proves that the supply of books to the library was, at least in respect to the basic treatises and handbooks, quite good. It seems that the publications were pouring in after a short delay only. The geologists from Vilnius were not rich people, their salaries were but very modest, and their personal contacts with foreign scientists were rather limited. Therefore, the main means of access to the foreign geological literature remained the items purchased by the University.

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In discussion of the part which the centre of natural science in Vilnius played in the development of the Polish geology, one cannot omit the Gymnasium of Volhynia (since 1818 – a Lyceum), established at Krzemieniec in 1805 on the initiative of Tadeusz Czacki, and with participation of Hugon Kołłątaj. Czacki and Kołłątaj were experts in the problems of geology, the people who were vividly interested in the development of natural science and physiographic investigations. They managed to gather at Krzemieniec and excellent, though small, team of the lecturers teaching the subjects related with natural science[39]. Until the middle of 1807, mineralogy was taught during the classes of natural history by Franciszek Scheidt[40] from the Jagellonian University. After his death, in 1810 the lectures on natural history were taken over by a graduate from the Jagellonian University – Wilibald Besser[41]. He refused to teach mineralogy, claiming not to be prepared well enough for this task. In his lectures on botany and zoology he was paying quite a lot of attention to the problems of palaeontology. In spite of Czacki's efforts to ensure a continuity in teaching of mineralogy at Krzemieniec, the

subject was given up, and a break of eight years followed. In 1815 the lectures on mineralogy were taken by a teacher of chemistry in the Gymnasium – Stefan Zienowicz[42]. This graduate from the University of Vilnius, a keen collector of geological items, was – with his thorough knowledge of the subject received from Symonowicz – well-prepared for the lectures on mineralogy, which he was teaching without any interruption until the dissolution of the Lyceum.

Scheidt's mineralogy[43] was based on the solid basis of chemistry. In its scope and approach to the subject, his syllabus was similar to the mineralogy-related part of Sartoris' lectures on chemistry delivered in the Main School of the Grand Duchy of Lithuania. It seems that Scheidt paid little attention to the problems of geology, limiting himself only to a few observations on the "types of mountains". Scheidt's programme differed to a considerable extent from the lectures on mineralogy delivered in the same period by Symonowicz in the University of Vilnius, where the theoretical fundamentals and the contemporary knowledge of geology were given much more attention. In comparison with the mineralogy taught in the University, Scheidt's programme was outdated.

Zienowicz was teaching Werner's mineralogy using Drzewiński's handbook and the works of Brochant, Brongniart, Jöns Jacobs Berzelius, and Haüy[44]. He made his students familiar with the terminology and characteristics (external, chemical and physical) of minerals as well as with the essentials of Werner's and Haüy's systematics. He taught them, first of all, oryctognosy, while in geognosy he limited himself to a description of all the rocks mentioned in Drzewiński's handbook; he also spoke about the principles of Werner's stratigraphy[45]. The lectures delivered by Zienowicz were a faithful, though shortened, copy of the curriculum of teaching mineralogy held at the University of Vilnius. The limitation was caused by a much smaller number of the classes in a week and by the level of knowledge of the pupils who for the first time were in contact with this branch of science. Zienowicz was a geologist full of zeal, and a teacher very devoted to his pupils. He was preparing very carefully the teaching aids for his lessons.

For the didactic purposes was also used the mineralogical study-room with separate collections of oryctognostic and geognostic specimens, open for the pupils in some definite hours. The mineralogical collection at Krzemieniec was very rich. It was based on the collection of King Stanislaus Augustus, comprising 7703 specimens and purchased for the Gymnasium in 1805. The collection was next enriched further with purchased acquisitions and donations (among others, a set of labradorites of Kołłątaj, the collection of Primate Michał Poniatowski presented by Prince Józef Poniatowski, and the gifts of Walicki) as well as with the specimens picked up by the scientists from Krzemieniec during their field investigations.

In 1824 the catalogued collection of the Lyceum of Krzemieniec included 12 194 specimens; moreover, there were also the collections of fossils, minerals, rocks and crystals (the gift of Walicki) as well as a "reference" collection of minerals to serve the didactic purposes. So, altogether the number of items included in the mineralogical collection went far beyond 12 000 specimens[46].

The mineralogical collection in the Lyceum of Krzemieniec was not the only collection of this type in that city. The rich private collections, originating mainly from the territories of Volhynia and Podolia, were owned by the teachers, mainly by Wojciech Zborzewski[47] (about 20 000 specimens, this including over 1000 pieces of fossils), Zienowicz and Antoni Andrzejowski[48].

Thanks to the fact that natural science was taken into consideration in the programme of education, the staff of the teachers was excellent, and the back-up facilities were good (collections, library), the Lyceum of Krzemieniec was not only efficient in giving the solid fundamentals of natural science to the youth learning there, but quite soon it also became the second after the University of Vilnius centre of physiographic investigations.

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Full understanding of the need for field investigations in geology, though appreciated and vivid, was nevertheless being materialized in the circles of Vilnius rather slowly and not without difficulties. The reasons were numerous, but the most important ones were inherent in, firstly, the weakness of the "faculty" of mineralogy itself, which throughout the entire period of an existence of the University had as a staff of lecturers one person only and, secondly and mainly, in the lack of material means for excursions and organization of more extensive field investigations.

At first, the field investigations were carried out occasionally and on a small scale only[49]. The persons responsible for them were: in 1803 S. B. Jundziłł in the District of Oszmiany, Symonowicz in Volhynia (1805–1807) and in the estate of Chancellor Rumiancev in the Province of Mohylev (1810–1811), in the years 1817–1822 – Horodecki in the District of Vilnius, in 1817 – Bogatko in the Districts of Kaunas and Trokai, and since 1820 – Jakowicki in some regions of the Provinces of Vilnius, Grodno and Minsk. In 1821 the first physiographic travel around Lithuania was made by J. Jundziłł, and in 1828 – by Eichwald.

By the end of the twenties of the 19th century the geologists from Vilnius had acquired quite a good knowledge of the geological structure of Lithuania and of some regions in the present Byelorusia. The field investigations in those territories mainly covered the Quaternary formations and

not too numerous outcrops of older deposits, nowadays included into the Tertiary Period and the Mesozoic Era. Because the Pre-Quaternary sediments were outcropped to a very small degree only, those territories were not an object quite proper for geological investigations, while the determination of a stratigraphic sequence was, with the data so incomplete, not an easy task at all.

In a much better situation were the scientists from Krzemieniec. First of all, the progress in geological investigations was much easier there due to the geological structure itself of Volhynia and the nearby Podolia, where on the surface there were numerous well-formed series of the Pre-Quaternary sediments. The quicker and better organization of the field investigations was also due to Czacki's personal interest in the problems of geology, and to greater possibilities of getting the funds for scientific expeditions, financed in great measure by the citizens from Volhynia and Podolia.

The systematic investigations had been carried out at Krzemieniec since 1810. They were started by Besser who every year made botanic excursions and trips, alone or with Andrzejowski. Besser was interested in a relation between the plants and a substratum, and therefore in his observations he was taking into account the geological structure in the investigated territories of Volhynia, Podolia and the Province of Cherson.

The most important and most productive geologist at Krzemieniec was Andrzejowski who, in the years 1814–1824, made 8 physiographic travels in Volhynia, Podolia and Pobereże. The results of his observations he published in 1823 in his "Outline of botany"[50]. The geological investigations were also carried out by Zienowicz and Zborzewski. The hand-written treatise of Zienowicz entitled "A geognostic description of the mountains of Krzemieniec", sent to the Warsaw Society of the Friends of Sciences, was lost.

Zborzewski, held in high repute by his contemporaries as an excellent expert in the fossil fauna in Volhynia and Podolia, published a few papers in the Russian journals. The lot of his handwritten treatise on geology in Volhynia and Podolia has remained unknown.

A good occasion for the exploration of much more interesting terrains with varied geological structure and a good degree of outcrop of the Pre-Quaternary sediments was offered to the geologists from Vilnius not earlier than during an expedition to the South provinces of the Russian Empire sent by the University of Vilnius in 1829. The expedition was organized on the initiative of Eichwald. Apart from the initiator himself who was, at the same time, also chief of the expedition, other scientists took part in it as well, viz. Jakowicki, Andrzejowski and a student of the Training College – Józef Małecki – by that time already a graduate in philosophy. The target of the expedition was to carry out various investigations in geology (Jakowicki), botany (Andrzejowski), zoology (Eichwald) and topography, geodesy and geography (Małecki). The investigations were meant to cover a vast area between the rivers Boh and Dniester up to the Black Sea. For the scientists

from Vilnius the choice of the terrains for exploration was very opportune, because they were covered by the well-outcropped and diversified series of deposits dated from the Pre-Cambrian to Quaternary Periods (in the present nomenclature). Moreover, there were some beautifully shaped formations from the Cretaceous and Tertiary Periods which had already aroused the interest of the European scientists.

The expedition proved to be particularly useful for learning the geological structure of Volhynia, Podolia and the Province of Cherson, mostly because the geological observations were made by all those who participated in it. Apart from a rich collection of the specimens of natural science (over 1000 specimens were gathered), the output of the expedition were three important scientific works written by: Eichwald – "Naturhistorische Skizze", Jakowicki – "Geognostic observations", and Andrzejowski – "An outline of botany", as well as two papers written by Eichwald and published in the Russian and German journals[51]. The most comprehensive and important dissertation seems to be the work "Geognostic observations" written by Jakowicki which is, to some extent, a recapitulation of the knowledge of geological structure in eastern territories of the former Polish Republic. The author included into that work not only his own many years' observations but also the results of investigations carried out in Lithuania in 1825 by Johann Ullmann[52], the descriptions of profiles made by Andrzejowski, Małecki and Maciej Przybylski, the information on the fossil fauna in the described regions compiled by Zborzewski, Zienowicz and Andrzejowski as well as the designations of fauna made by Eichwald.

The output of this, more than thirty years lasting, work of the geologists from Vilnius and Krzemieniec turned out to be quite important. They collected an enormous material based on observations, made the comprehensive and correct descriptions of numerous outcrops and geological profiles, left a rich collection of minerals, rocks and fossils, and gave the designations and descriptions of numerous species of the fossil fauna, especially of the phylum Mollusca from the Tertiary and Cretaceous Periods. They were carrying out their investigations in the same territories, so it is quite obvious that the scope of their works was similar, the descriptions of the rocks – convergent, and the conclusions – generally consistent. In the explored territory two separate geological zones (systems) were distinguished: a region lying between the rivers Niemen and West Dźwina (Lithuania), and a region between the rivers Dnieper and Dniester (Volhynia, Podolia, Pobereże). Applying one of the generally accepted stratigraphic schemata, viz. that of D'Aubuisson, they distinguished in the explored territory five geological ages, which they called mountains: primary, transitive, secondary (stratified), tertiary and alluvial; within the individual ages they distinguished numerous formations. They described the sediments included into those formations and determined the range of their geographic expansion. This picture of the ge-

ological structure of the examined territory was completed with a collective stratigraphic profile prepared by Jakowicki[53].

Into the deposits of primary mountains they included the magmatic and metamorphic rocks in Volhynia and Podolia which, according to the opinions prevailing at that time in some circles of the geologists in Europe, were considered to be the oldest sedimentary rocks. They distinguished three generations of granites.

Among the transitive mountains they reckoned the loamy-greywacke and calciferous-marl sediments with an abundant fauna of the Corals, Brachiopoda, phylum Mollusca and Trilobita, present in Podolia on the river Dniester, and its left-bank tributaries: Seret, Zbrucz, Smotrycza, Studennica and Uszyca.

According to the geologists from Vilnius and Krzemieniec, the deposits of the secondary mountains were widely spread in Volhynia and Podolia, between the rivers Ikwa, upper Horyn, upper Boh, Dniester, and its tributaries: the rivers Zbrucz, Ladawa and Murafa; they also occurred in Lithuania on the rivers, Minia, Windawa, Musza, Ławenna, Niemenek, Święta, Dubissa, Wilia and Niemen. The geologists from Vilnius distinguished in Volhynia and Podolia three formations of the secondary mountains: the gypsum formations on the river Zbrucz, the rocky chalk with flints and a fauna of, mainly, the phylum Mollusca in Podolia, and the formation of white chalk with flints and an extremely rich fauna of the phylum Molusca, Brachiopoda and sea urchins, widely spread on the rivers Ikwa and Horyń in Volhynia. In Lithuania they distinguished four formations: the formation of Alpine limestone (red sandstones and mottled limestones with beautiful fauna of ammonites) on the rivers Windawa, Minia and Musza, the formation of shell limestone with griffithites in the regions of Pozwole and Kiejdany, the formation of new sandstone on the river Musza and of the chalk with the fauna of Terebratula, belemnites and sea urchins in the region of Grodno.

The Tertiary mountains, widely spread in Volhynia, Podolia and Pobereże, had been shaped in the form of alternately lying, marine and freshwater series of sands, sandstones and carbonate sediments, often containing an extremely rich fauna of the phylum Mollusca. Adopting the schema of a division of the Tertiary Paris basin[54], Jakowicki distinguished five formations here. He had, however, some doubts as to whether the distinguished formations did form the successive series from various ages. He supposed that they were rather partial links in one and the same huge formation of the marine limestone, formed in various ways in the individual parts of this enormous Tertiary basin under the influence of different conditions of sedimentation. Eichwald, on the other hand, divided the examined sediments into two formations: an older formation (the Tertiary deposits in Volhynia and Podolia) and a younger formation (spongy limestones oc-

curring along the northern coast of the Black Sea, from the river Dniester to the river Dnieper).

The sediments of the alluvial mountains – sands, clays and erratic boulders – were noted by the geologists from Vilnius and Krzemieniec to occur all over the examined area. Jakowicki distinguished two formations there: local and general. According to him, the local formation was formed from parts of the Tertiary rocks crushed down by the strong erosive sea currents with the successive sedimentation of this material on the elements of this formation or in its nearest vicinity. The deposits of the general formation were said to be made during the last great sea flood, while the erratic boulders present there, very similar to the Scandinavian rocks, were a proof that the last flood came to those terrains from the North-West direction, i.e. from the Baltic Sea.

The geologists from Vilnius and Krzemieniec covered by their field investigations a vast, and at that time almost unknown, area lying between the river Niemen, the Baltic Sea, the lower Dźwina, the lower Dnieper, the Black Sea and the river Dniester. They carried out the regional investigations following a model that was commonly adopted at that time by all the scientific centres in Europe. They were neptunists, and their neptunism was an effect of not only the knowledge acquired at the university, but it seemed to be additionally strengthened by the geological structure of the terrains they were exploring. They applied the general stratigraphic criteria accepted at that time in geology, which means that they were examining the sequence of strata in a profile, and the direct interrelations between them. When the sequence of the strata could not be determined, they adopted as a criterion for the determination of a stratigraphic position the resemblance in a lithological formation of the sediments examined in various spots, and the presence or absence of fossils, typical of a given formation. They distinguished three stratigraphic units: strata, formations (petrographic or petrographic-faunistical complexes) and mountains (terrains). Though they were aware of the significance that the presence of fauna had in the determination of a relative age of the deposits, they were not able to use, to a full extent, the biostratigraphic method in levelling out of the examined profiles.

Their publications provided the first in the Polish literature picture of a geological structure of the eastern territories of the former Polish Republic, and in this way formed a proper back-ground for further explorations – regional, stratigraphic and palaeontological. The conditions of their work were not easy. The development of research was hampered and disturbed by the complicated political and economic situation; certain confinements in their scientific activities were imposed by the lack of direct and broad contacts with the European geology. They formed a team of the young scientists who were just making their first steps in the independent researches carried out on a wider scale. The compiled material might have been a good basis for the future studies and research of a much more general nature. The disso-

lution of the University of Vilnius and of the Lyceum of Krzemieniec interrupted suddenly the continuous stream of researches, cut off an access to the back-up facilities and made any further progress in the investigations impossible.

The material means of the research centres and of the teams of the scientists were dissipated. Eichwald and Jakowicki found an occupation at the service faculties of zoology, comparative anatomy and mineralogy of the Medical and Surgical Academy in Vilnius, while the team of scientists from Krzemieniec moved to the University of St Vladimir in Kiev.

[1] At that time, the term "mineralogy" denoted the whole contemporary knowledge of the inanimate nature, nowadays included into the scope of geological sciences (geology, mineralogy, petrography, stratigraphy, palaeontology, etc.).

[2] The place and scope of natural history in the structure and system of education in the Main School of Vilnius was discussed by, among others, J. Bieliński, *The University of Vilnius 1579–1831*, Warsaw–Cracow 1899–1900, vol. 1–2; J. Kołodziejczyk, *Natural science in the activities of the Commission of National Education*, Warsaw 1936; Z. Fedorowicz, *The organization of naturalistic studies in the University of Vilnius in the years 1781–1832*; "Stud. Mat. Dziejów N. Pol." 1957, series B, no. 1, p. 3–71; Idem, *The Faculty of Natural History in the former University of Vilnius*, *ibidem*, p. 70–126; J. Garbowska, *Geological sciences at the higher schools of Vilnius and Krzemieniec in the years 1781–1840*. "Prace Muzeum Ziemi" 1993, z. 42, p. 5–112.

[3] The scientific activities of Gilibert (1741–1814) were discussed in detail by, among others, W. Sławiński, Dr Jean Emmanuel Gilibert. *Professor and founder of the Botanical Garden in Vilnius. A biographic contribution to the history of the University of Vilnius*. Vilnius 1925; Z. Fedorowicz, *The Faculty of Natural History*, p. 79–87.

[4] The scientific biography of Forster (1754–1794) was given by, among others, Z. Fedorowicz, *The Faculty of Natural History*, p. 93–96; *Idem*, *Georg Forster's speech under the heading of "Limites naturalis" made in Vilnius in 1785*, "Memorabilia Zoologica" 1963, no. 10, p. 5j10.

[5] An information note on the didactic activities of Spitznagel (1757–1826) was published by Z. Fedorowicz, *The Faculty of Natural History*, p. 99–101.

[6] A most comprehensive scientific biography of Jundziłł (1761–1841): W. Sławiński, *The Reverend Stanisław Bonifacy Jundziłł, professor of natural history in the University of Vilnius*, "Annales UMCS" Lublin 1947, series E, suppl. I.

[7] The curricula of the lectures delivered by Gilibert, Forster and Spitznagel were published by Z. Fedorowicz, *The Faculty of Natural History*, pp. 81–82, 93–96, 101–111.

[8] The scope and contents of teaching geology during the lectures delivered by the professors of natural history in Vilnius were discussed in detail by J. Garbowska, *Geological sciences at the higher schools of Vilnius and Krzemieniec*.

[9] The text of Sartoris' *curriculum* was published by J. Bieliński, *op.cit.*, vol.. 2, p. 95–96.

[10] Detailed information on the collection of natural history in the Main School of the Grand Duchy of Lithuania in: J. Bieliński, *op.cit.*, vol. 1, p. 152–153; Z. Fedorowicz, *The Faculty of Natural History*, pp. 84, 97, 114; S. B. Jundziłł, *The Collection of Natural History and the Botanical Garden*, "Bibl. Warsz." 1850, vol. 1, p. 39–42.

[11] G. Rzączyński, *Historica naturalis curiosa Regni Polonicae, Magni Ducatus Lithuaniae* (...), Sandomierz 1721; Idem, *Auctuarium historiae naturalis curiosae Regni Poloniae*, Gedani 1742; [J. B. Dubois], *Essai sur l'histoire littéraire de Pologne par M. D. Reflexion générales sur les progrès des sciences et arts. Histoire naturelle et géographie*, Berlin 1778; J. E. Guettard, *Mémoire sur la nature du terrain de la Pologne et des minéraux gu'il renferme (...)*, "Histoire de l'Académie Royale des Sciences Année 1762", Paris 1764, pp. 234–256, 293–336, VI illustrations, a mineralogical map of Poland.

[12] J. E. Gilibert, *Minéralogie*, "Mémoire" 1783; J. Sartoris, J. Mickiewicz, *A report of the mineralogical trip along the bank of the river Niemen and of an examination of the saline mineral waters at Stokliszki in 1787*, (In:) M. Baliński, *The Former Academy of Vilnius*, Petersburg 1862, p. 529–530; S. B. Jundziłł, *On the saline springs and the salt of Stokliszki*, Vilnius 1792; Idem, *A report on the peat in the Provinces of Vilnius and Mińsk*, Vilnius 26 June 1799, BUWil. manuscript, F. 2 DC 35, p. 2; Idem, *A report (...) of the journey made to Birża and other places to discover salt; to the Academy of Vilnius* 31 May 1802, ibidem, DC 13, p. 3; Idem, *A mineralogical and geographical dissertation on the places where the metals can be found and on their annual output*, presented on the first day of the commencement of public lessons in the Main School of Lithuania, Vilnius 1798.

The scientific achievements of the professors of natural history in the field of geology were discussed in detail by J. Garbowska, *Geological investigations carried out by the Scientific Centre of Vilnius in the years 1781–1832*, (In:) *A contribution of the Scientific Centre of Vilnius to the naturalistic explorations of the country. 1781–1842*. A collective work under the supervision of J. Babicz and W. Grębecka, "Mon. Dziej. N. i T." 1988, vol. 141, p. 79–80.

[13] Information on the scientific activities of Symonowicz (1768–1813) was given by I. Skuodienė (*Roman Simonowicz – pierwyj priepowodatiel minerałogii w Wilnjuskom Uniwiersitietie*, (In:) *Russko-polskije swiazi w obłasti nauki o ziemlie*, Moscow 1975, p. 22–26), and on the scientific activities of Symonowicz and Horodecki (1776–1824), doctor of philosophy and since 1823 professor of mineralogy in the University – by J. Garbowska (*Geological sciences at the higher schools of Vilnius and Krzemieniec*).

[14] BUWil.., manuscript, F. 2 KC 232, p. 118 (A report for the year 1803 submitted by Rector H. Strojnowski).

[15] In 1804 Strojnowski wanted to reduce the scope of subjects taught at the Faculty of Natural History to mineralogy, mining and metallurgy, and to entrust the Faculty to A. G. Werner – professor at the Mining Academy in Freiberg (CVIA Lit., manuscript, F. 721, op. 1, jed. skr. 401, no. 27, p. 10–11, Werner's letter to Strojnowski of 8th June 1805). In 1806, following the same principles, he wanted to entrust the Faculty to Symonowicz who was favoured and recommended by Werner, Józef Mickiewicz and Carl Christian Langsdort. The problem of Symonowicz's nomination started quarrels and disputes at the University. As a consequence, the school superintendent Adam Czartoryski did not approve of the decision of the Department of Physical and Mathematical Sciences to make the candidate profesor of natural history (CVIA Lit., manuscript, F. 721, op. 1, jed. skr. 401, no. 27, p. 1–14). It is difficult to understand that decision because Symonowicz was not only a very talented man and a full of zeal mineralogist, but he was also extensively educated and well-prepared for taking of the Faculty.

[16] BUWil., manuscript, F. 2 DC 176 b, p. 455 and a printed text, The time-table of classes in the Emperor's University of Vilnius in the years 1816/17, 1825/26, 1826/27, 1827/28, 1828/29, 1929/30, 1930/31.

[17] M. Bogatko (1755–?), master of philosophy, was at that time assistant in the study-room of natural history. After 1813 he was performing the duties of a school teacher in the District of Vilnius.

[18] F. Drzewiński (1788 – about 1850), doctor of philosophy, obtained in 1813 his doctor's degree after submission of a dissertation on mineralogy. Since 1819 – adjunct, and then professor of physics in the University.

[19] J. Jundziłł (1794–1888), master of philosophy, since 1823 – adjunct and lecturer of botany.

[20] J. Jakowicki (1794–1847), candidate of philosophy, passed the examinations required for taking his master's degree in 1819 and submitted his dissertation on mineralogy. His master's degree was, at first, confirmed by the Minister of Education on the 14th of April 1820 (BUWil., manuscript, F. 2 KC 323, p. 25), but

(philosophy, botany, zoology) and the attempts made by the University authorities, Jakowicki's degree was not re-confirmed (BUWil., manuscript, F. 2 KC 123, p. 15–18). After dissolution of the University he was teaching mineralogy at the Medical and Surgical Academy in Vilnius.

[21] The scientific activities of Eichwald (1795–1876) were discussed by Z. Fedorowicz, *The Faculty of Zoology and Comparative Anatomy*, p. 189–196.

[22] The *curricula* of lectures delivered by: Symonowicz in: J. Bieliński, *op.cit.*, vol. 2, p. 146; Drzewiński: *Praelectiones in Universitate doctrinarum Caesarea Vilnensis a kalendis septembris Anno MDCCCXIV ad pridie kal. Juliy anni MDCCCXV habendae indicuntur a rectore et senatu Academico*, Vilnae, Typis J. Zawadzki, p. 5 and *Praelectiones in (...) MDCCCXVI (...) MDCCCVII (...)*, p. 12–13; Horodecki: *Praelectiones in (...) MDCCCXVII (...) MDCCCXVIII (...)*, p. 12–13; *Praelectiones in (...) MDCCCXIX (...) MDCCCXX (...)*, p. 10–11 and an *Announcement of the classes due to take place in the Emperor's University of Vilnius in a period from the day of the 1st of September in the year MDCCCXXI till the day of the 30th of June in the year MDCCCXXII*, Vilnius, J. Zawadzki, p. 4; Jakowicki: CVIA Lit., manuscript, F. 721, op. 1, jed. skr. 741, p. 186–187.

Moreover, the contents of J. Jundziłł's lectures on mineralogy (BUWil., manuscript, F. 2 KC 326, p. 26–27) and Jakowicki's lectures (*ibidem*, KC 325, pp. 29, 43, 72, 77, 85; KC 264, p. 339–341).

Questions for examinations in the University registers: BUWil., manuscript, F. 2 KC pp. 123, 125, 323, 329 and BAN Lit., manuscript, F. 13–51).

Texts of the dissertations on mineralogy for obtaining of scientific degrees: BUWil., manuscript, F. 2: KC 366, p. 385–400; KC 367, pp. 37–52, 430–436; KC 368, p. 267–273; KC 369, pp. 146–153, 172–192, 346–375, 467–475; KC 370, p. 347–353; KC 371, pp. 12–13, 23–26, 340–345.

[23] The manuscript of the sextern was not found. R. Symonowicz, *On the present state of mineralogy*. Vilnius 1806.

[24] R. J. Haüy, *Traité de Minéralogie*, Paris 1801.

[25] BUWil., manuscript, F. 2 KC 3, p. 262.

[26] A. J. M. Brochant, *Traité élémentaire de Minéralogie suivant les principes du Professeur Werner, avec 18 Tableaux et une planche*, Paris 1800, vol. 1–2; A. Brongniart, *Traité élémentaire de Minéralogie avec des applications aux art*, Paris 1807, vol. –2. In the last year Drzewiński used for the lectures his own handbook: *The rudiments of mineralogy after Werner's principles compilated for the students*. Vilnius 1816.

[27] Ch. A. S. Hoffman, *Handbuch der Mineralogie*, Frieberg 1812, vol. 1–4; R. J. Haüy, *op.cit.*, F. Drzewiński, *op.cit.*.

[28] I. Jakowicki, *A short lecture on oryctognosy and geognosy compiled after the last system of Werner*, Vilnius 1825; Idem, *A lecture on aryctognosy and the rudiments of geognosy*. Second edition revised and enlarged. Vilnius 1827; J. F. D'Aubuisson de Voisins, *Traité de Minéralogie ou Exposé des connaissance actuelles sur la constitution physique et minérale du globe terrestre*, Paris–Strasburg 1819, vol. 1–2; J. F. Breithaupt, *Vollständige Charakteristik des Mineral-System*, Dresden 1817; F. S. Beudant, *Traité élémentaire de Minéralogie*, Paris 1814; C. I. Leonhard, J. H. Kopp, C. L. Gaertner, *Eileitung und Vorbreitung zur Minéralogie*, Frankfurt am Main 1817; A. Humboldt, Essai géognostique sur le gisement des Roches dans les deux hémisphères, Paris 1823.

[29] The scope and contents of Eichwald's lectures who was teaching from his own handbook (*Zoologia specialis, quam expositis animalibus tum vivis tum fossilibus potissimus in Rossiae in universum et Poloniae in specie*, P. 1–3, Vilnae 1828–1830–1821) were discussed by Z. Fedorowicz, *The Faculty of Zoology and Comparative Anatomy*, p. 189–196.

[30] BUWil., manuscripts F. 2: KC 3, p. 255–258; KC 12, pp. 5, 7; KC 232, pp. 113, 313; KC 235, p. 149; KC 237, p. 57; KC 239, p. 56; KC 240, p. 61; KC 241, p. 197, KC 247, p. 93; KC 251, p. 73; KC 255, p. 267; KC 256, p. 115–130; KC 257, p. 161; KC 258, p. 119; KC 260, p. 27; KC 262, p. 89; KC 263, p. 81; KC 264, pp. 73, 247; KC 329, p. 29–30; KC 337, p. 5.

[31] Ibidem, KC 247, p. 33–34; KC 327, pp. 3, 20, 26, 32, 37; KC 123, p. 9–467.

[32] R. Symonowicz, *op.cit.*

[33] F. Drzewiński, *op.cit.*

[34] I. Jakowicki, *A short lecture on oryctognosy and geognosy*; Idem, *A lecture on oryctognosy and the rudiments of geognosy*; Idem, *Mineralogy applied to arts, handicraft, factories and agriculture for forms III of district schools*, Vilnius 1829.

[35] N. A. Kumelski, *A short lecture on mineralogy after Werner's principles*. Part I, Vilnius 1825; Idem, *A short lecture on mineralogy after Werner's principles*. Part II, Vilnius 1826; Idem, *The principles of geognosy after Werner's teachings*. Part I, With three drawings, Vilnius 1827; Idem, *The principles of geognosy after Werner's teachings*. Part I, With three drawings, Vilnius 1827; Idem, *The principles of geognosy after Werner's teachings*. Part II, Vilnius 1827. KUmelski (1802–1853), exceptionally talented and productive popularizer of the natural science; he performed the duties of an assistant of the university librarian.

[36] N. A. Kumelski, *A systematic outline of the science of fossils, that is, petrofactology*, Vilnius 1826.

[37] The history of the university collection of mineralogy was described by, among others, Bieliński, *op.cit.*, vol. 1, p. 152–156; S. B. Jundziłł, *The collection of natural history*, p. 39–42; J. Garbowska, *Geological sciences at the higher schools of Vilnius and Krzemieniec*.

[38] BUWil., manuscript, F 2 KC 337, p. 28–29, 31–35. In 1828 they published: *A register of minerals in the Emperor's University of Vilnius prepared for the student who visits the collection of mineralogy compiled after Werner's system.* Its author was probably Jakowicki, the contemporary patron of geological collection.

[39] The geological sciences in the Lyceum of Volhynia are discussed by, among others, M. Danilewiczowa, *The scientific life in the former Lyceum of Krzemieniec*, "Nauka Polska" 1937, vol. 22, p. 71–99 and J. Garbowska, *Geological sciences in the higher schools of Vilnius and Krzemieniec*.

[40] F. de Paula Scheidt (1759–1807), doctor of philosophy, professor of natural history and chemistry in the Main Polish School in Cracow (the years 1787–1805).

[41] W. Besser (1784–1842), graduate from the Jagellonian University, honorary member of the University of Vilnius, professor of botany and zoology at Krzemieniec (1809–1832) and professor of botany in the University of St Vladimir in Kiev (1833–1838).

[42] S. Zienowicz (1779–1856), candidate of philosophy, graduate from the University of Vilnius, since 1814 – teacher in the Lyceum.

[43] Scheidt's *curriculum* (In:) *The pattern and order of the subjects which during public lessons will be given in the Gymnasium of Volhynia in a period from the 1st of October 1805 till the last days of July 1806, Krzemieniec 1805.*

[44] F. Drzewiński, *op.cit.* A. Brochant, *op.cit.*, A. Brongniart, *op.cit.*, J. J. Berzelius, *Nouveau Système de Minéralogie* traduit du Suédois, Paris 1819; R. J. Haüy, *op.cit.*

[45] Zienowicz's syllabus on mineralogy (in:) *Praelectiones in Lycaeo Volhyniensis sub auspiciis Universitatis Litterarum Caesareae Vilnensis. A Kalendis Septembribus anni MDCCCXXI ad Kalendis Quintiles anni MDCCCXXII*, printed by Glücksberg Typographus Lycaei, p. 4.

[46] The data on the collection of Krzemieniec in, among others, the reports of inspectors Kazimierz Moniuszko and Zienowicz (BUWil., manuscript, F 2 KC 543, p. 51; KC 39, p. 1013).

[47] Information on the collection of Zborzewski (about 1795–1860), alumnus of the Lyceum, then drawing-master in the district school at Międzybórz and in the Lyceum of Krzemieniec, is given by, among others, J. Bieliński, *The University of Vilnius*, vol. 2, p. 149–150.

[48] Andrzejowski (1785–1868), botanist and geologist, alumnus from Krzemieniec, since 1818 assistant of the profesor of botany in the Lyceum, in the years 1832–1839 adjunct at the Faculty of Botany in the University of St Vladimir in Kiev.

[49] The results of field investigations in the scope of geology carried out in Vilnius and Krzemieniec were disclosed by J. Garbowska, *The geological studies carried out by the scientific centre in Vilnius*, p. 81–114.

[50] A. Andrzejowski, *A botanical outline of the countries visited during the journeys made in the years 1814, 1816, 1818, 1822, between the rivers Boh and Dniester, from Zbrucz up to the Black Sea*, Vilnius 1823.

[51] E. K. Eichwald, *Naturhistorische Skizze von Lithauen, Volhynien und Podolien in geognostisch-mineralogische, botanischer und zoologischer Hinsicht*, Vilnius 1830, Part I: *Geognostische-mineralogischer Bemerkungen*, p. 2–104; I. Jakowicki, *Geognostic observations in a country spreading from the shores of the Baltic Sea, between the rivers Połąga and Riga, in the direction of Vilnius, Żytomierz, Kamieniec Podolski, up to the shores of the Black Sea, between Cherson and Odessa*, "Dz. Wil. Um. Szt." 1830, vol. 5, pp. 65–92, 150–183, 185–220, 227–384 (the same was published in the form of a book under the title changed into: *Geognostic observations in Western and Southern Provinces of the Russian Estate*, Vilnius 1831); A. Andrzejowski, *A botanical outline of the countries visited in the years 1823 and 1824 during the journeys made between the rivers Boh and Dniester up to the estuaries of those rivers into the sea*. Part II, Vilnius 1830 (the same in: "Dz. Wil. Um. Szt." 1830, vol. 5, pp. 121–?150, 220–275); E. K. Eichwald, *Geognostische Bemerkungen während einer Reise durch Lithauen, Volhynien und Podolien*, "Arch. Mineral. Geogn. etc." 1830, B. II, p. 113–126; Idem, *Kurtze geognostische Bemerkungen über Lithauen, Volhynien und Podolien*, "Bull. Soc. Nat. Moscou" 1830, vol. 2, p. 29–52.

[52] J. Ullmann, *Geognostic examination of the Provinces of Vilnius and Grodno*, etc., "Dz. Wil. Um. Szt." 1827, vol. 2, p. 246–265 (a translation of Ullmann's paper in "Gornyj Żurnał" 1827, vol. 3, p. 27–36; vol. 4, p. 25–42.

[53] I. Jakowicki, *Geognostic observations*, p. 8–15, 214–241.

[54] G. Cuvier, A. Brongniart, *Essai sur la géographie minéralogique des environs de Paris, avec une carte géognostique et des coupes de terrain*, "Annales du Museum d'Histoire Naturele" 1808, vol. 10, p. 293–326.