

Grzybowski and his school: the beginnings of applied micro-palaeontology in Poland at the turn of the 19th and 20th centuries

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The achievements of 19th century Polish Geologists laid to rest the idea that the quality of research was directly linked to the amount of financial resources they had at their disposition. Despite the absence of an independent nation and the weakness of potential industrial sponsors in the Polish lands, Polish Geologists became renowned for their scientific achievements. Of the three parts of Poland that were partitioned at the end of the 18th century, the Geological Sciences flourished best in the southern region known as Galicia, which was part of Austro-Hungary. From the second half of the 19th century Galicia was a semi-autonomous district, and this created a beneficial atmosphere for the establishment of Polish centres of scientific research. One of the major technological developments of this era was the discovery by two Pharmacists - Ignacy Łukasiewicz and Jan Zeh - of a method that not only brought them world-wide acclaim, but lead to the establishment of a new industry based on petroleum. The two scientists worked out a method of distilling crude oil and in March of 1853 succeeded in constructing the first kerosine lamp. As early as the 31st of July, 1853 their new lamp was used to illuminate the Public Hospital in the city of Lvov.

That moment in history marks the beginnings of the rapid search for petroleum in the Carpathians - especially in the eastern sector of the mountain chain where deposits rich in oil were discovered. Among the Polish scientists who were involved in the early exploration work, Emil Dunikowski, Rudolf Zuber, Wawrzyniec Teisseyre, and Józef Grzybowski, were acclaimed as world-class experts who were invited to share their expertise in

Petroleum Geology in various parts of Europe, Asia, and South America.

Among these early workers, Józef Grzybowski was not only knowledgeable in the field of petroleum exploration, but he worked out a method of stratigraphic correlation by examining assemblages of microorganisms contained within the monotonous series of flysch sediments that are otherwise barren of any macroscopic organic remains. This method, which was especially suited to interpreting sediment cuttings obtained from boreholes, is of extreme importance to this day.

The accuracy of interpretations based on microfossil assemblages depends for the most part on how well their varied environments are understood. Józef Grzybowski was not the first Palaeontologist who studied microscopic remains from sedimentary rocks. Among the early Polish researchers, Wojciech Zbożewski, a secondary school teacher from Krzemieniec deserves honourable mention. Already in the years between 1832 and 1843, Zbożewski described fossil foraminifera from the Wołyń region. The benefit that Józef Grzybowski's work brought to the profession was the discovery of practical applications of foraminifera for stratigraphical studies, the description of many new species, and finally, inspiring his younger colleagues to take up and continue his research. Today the type of applied micropalaeontological research that originated in the Kraków School has matured into a diverse field. By gaining some general insight into the beginnings of applied Micro-palaeontological research, it may be possible to place these studies in their proper perspective.

Józef Grzybowski's path to the Chair of Palaeontology at the Jagiellonian University

Józef Grzybowski's biography reads like a central European success story. He was born Józef Bolesław Grzybowski in Kraków on the 17th of March 1869, to a family of modest means. His father Franciszek owned a small antiquarian book store, and between 1862 and 1869 operated a publishing house that specialised in printing school textbooks. In 1870, the firm unfortunately went into receivership, and Franciszek was forced to sell his business. He later worked as a purchasing agent. Young Józef Bolesław spent his childhood years under difficult conditions. In 1873, he commenced his studies at the St. Anne Gymnasium in Kraków. In 1883, he was probably required to repeat a year, and he transferred to the more modest St. James's School. He passed his qualifying examinations in 1887, and began his freshman year in the Faculty of Law and Administration of the Jagiellonian University. He obtained a degree in Law in 1891.

Grzybowski's choice of a first degree was probably dictated by his dire personal situation, but it is obvious that already as an undergraduate, Grzybowski displayed interests outside his chosen curriculum. In 1886, the Jagiellonian University received its first chair in Geology, which was awarded to Władysław Szajnocha. Prof. Szajnocha came to Kraków from the University of Vienna, where he earned his doctorate in Palaeontology under the supervision of Melchior Neumayer. In Kraków, he took on the task of organising the University's Department of Geology. The young Grzybowski was the first geological assistant that Prof. Szajnocha hired. He began working in the Geology Department on August 1st, 1890 - even before he had been awarded his degree in Law.

In 1891, Grzybowski commenced his normal course of Geological studies at the University. His tutors were Feliks Kreutz, Professor of Mineralogy, Antoni Wierzejski in

Zoology, Julian Schramm in Chemistry, and his main advisor was Prof. Szajnocha in Geology. In 1893 his position was changed to that of permanent assistant under the supervision of Prof. Szajnocha, which signalled the start of a life-long career of scientific collaboration and mutual friendship.

In 1894, Grzybowski completed his formal training in Geological Sciences. In the same year, he published his first micropalaeontological monograph, *The Microfauna of the Carpathian Sandstones from the environs of Dukla*, illustrated with five plates of drawings in Grzybowski's own hand. Without delay, Grzybowski proceeded to undertake his next study, which became his doctoral dissertation. His "*Microfauna of the Carpathians I. Foraminifera of the Red Clays from Wadowice*." was completed within a year and submitted to the University examiners in 1895. The main advisor was Prof. Szajnocha, with Prof. Kreutz serving as the second examiner. Prof. Szajnocha stressed that he was impressed by the complete description of 112 species illustrated with pencil drawings completed by the author. Among the species Grzybowski illustrated, 55 were new to science. Szajnocha praised the dissertation as being a major contribution to the knowledge of the Carpathian deposits, and both examiners concurred in their decision that Grzybowski's dissertation fulfilled the requirements for a degree. Grzybowski passed his examinations in the fields of Geology, Chemistry, and Philosophy, and in 1896 received the title Doctor of Philosophy.

In the course of the next few years, Grzybowski carried out a series of further micropalaeontological studies, and took part in compiling the geological maps for the Geological Atlas of Galicia. In 1897, he traveled with Prof. Szajnocha to the 7th International Geological Congress in Russia. He attended geological excursions in south-eastern Russia - the Crimea and the Caucasus. The contacts he established during the Geological Congress enabled him to embark on a one-man geological expedition to examine the Tertiary sediments of northern Peru.

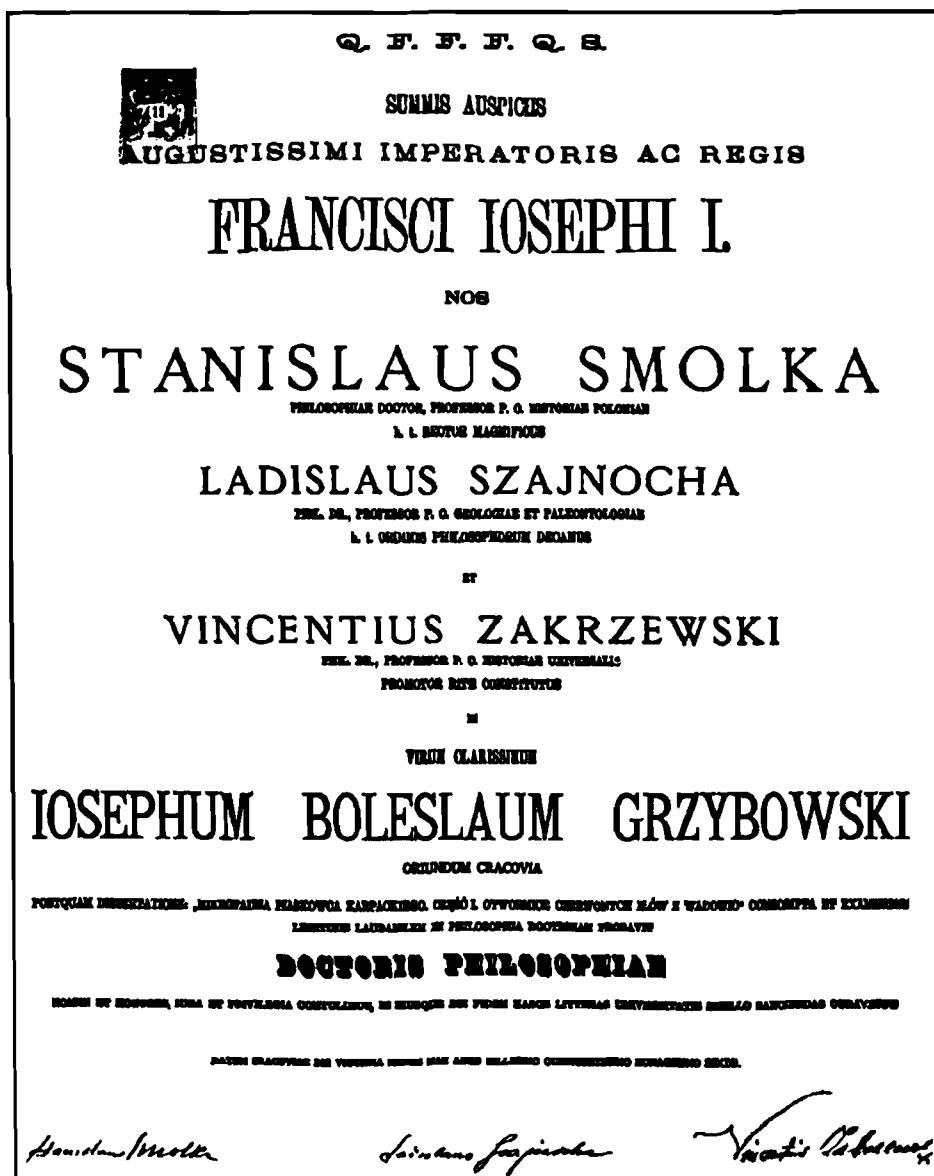


Figure 1. Grzybowski's Ph.D. Diploma, scanned from a photograph, courtesy of the Geology Museum of the Jagiellonian University.

Earlier in 1898, Grzybowski was successful in obtaining a scientific travel grant from the Academy of Knowledge in Kraków that enabled him to travel to Munich for a six months. The Professor of Palaeontology at

Munich University was Karl Zittel himself. The Lecturer in Palaeobotany was A. Rothpletz, and J.F. Pompeckj was conducting studies on the Paleozoic. Grzybowski was able to build on the experience he gained during his



Wien, am 11. April 1908.

Ministerium
für Kultus und Unterricht.

Z. 13.793.

Seine k. und k. Apostolische Majestät haben mit
Allerhöchster Entschließung vom 25. März 1908 den Privatdozenten,
Dr. Josef Grzybowski, zum unbesoldeten außerordentlichen
Professor der Geologie und Paläontologie an der Universität in
Krakau allernächst zu ernennen gerüht.

Von dieser Allerhöchsten Schlussfassung setze ich
das Dekanat in Erledigung des Berichtes vom 10. Dezember 1906,
Z. 865, mit dem Frsuchen in Kenntnis, dem Genannten das zuliegende
Dekret ausfolgen zu wollen.

In diesem Dekrete ertheile ich den Professor Dr.
Grzybowski den Lehrauftrag, vom Studienjahr 1909/10 ab
in jedem Semester nach Massgabe des Unterrichtsbedürfnisses, min-
destens aber durch drei Stunden wöchentlich Vorlesungen über Pa-
läontologie abzuhalten und bewillige ihm für diese Lehrtätigkeit
ein Jahreshonorar von eintausendzweihundert (1200) Kronen, welches
ihm vom 1. Oktober 1909 ab seitens des Herrn Statthalters für
Galizien in antizipativen Monatsraten vorschriftsmässig angewie-
sen werden wird.

Für den Minister für Kultus und Unterricht:

Figure 2. The letter from the Austrian Ministry of Culture and Education confirming Grzybowski's appointment to the post of Professor of Geology & Palaeontology at the University in Kraków.

studies in Kraków. It was during his stay in Munich that Grzybowski wrote up the results of his Peruvian sojourn. His paper published in 1899 on "Die Tertiärlagerungen des nördlichen Peru" formed the written part of his Habilitation, or Doctor of Science degree.

On the 25th of January 1900, a committee of 24 professors met in Kraków to consider Grzybowski's application for his Habilitation. Six days later, Grzybowski successfully defended his Habilitation in front of an audience of 26 professors. His talk was entitled "Biology and its relationship to Palaeontology". The Austro-Hungarian Ministry of Education confirmed his title of Dr. habl. on the 10th of July 1900. Eight years later, on the 25th of March 1908, Grzybowski was awarded the title of (unpaid) Associate Professor of Geology and Palaeontology. It wasn't until Poland regained independence, that the Head of State Józef Piłsudski conferred upon Grzybowski the title of Full Professor (with full salary) on the 24th of May, 1919.

"Foraminiferenspielerei"

From among the varied topics of Grzybowski's scientific research, he is perhaps best remembered from his studies of the Foraminifera. His monographs were the first detailed studies of the Carpathian foraminiferal faunas. Although it is true that the Austrian Geologist Victor Uhlig described a foraminiferal fauna from Wola Łużańska in 1886, his study was limited to descriptions of foraminifera and four plates of illustrations. He did not pursue this line of research, but concentrated his efforts on studies of the geology and tectonics of the Tatra Mountains and the Pieniny Klippen Belt.

Grzybowski, on the other hand, began his career with his study of the foraminiferal fauna of Dukla, and spent the next seven years mainly studying the foraminiferal fauna of the Carpathians. He embarked on this task with deliberate purpose: to accomplish a series of studies documenting the foraminiferal fauna of the Carpathians. His publication record between 1894 and 1921 con-

sists of 60 titles, of which over a dozen concentrated on microfauna. This includes the four monographs compiled in this book: the microfauna from Dukla (1894), from the red clays of Wadowice (1896), from the oil fields of Krosno (1898) and from the Inoceramian beds of Gorlice (1901). He designated the Wadowice paper as nr. I, and Gorlice as nr. III.

In addition to the monographs, in 1897 Grzybowski published a paper entitled "Microscopical investigations of borehole muds of oil fields. I. The Potok - Krosno Belt. II. General Remarks". In this paper he explained his methods of using microfauna for correlating strata. He began by listing 106 species of foraminifera from individual exploration wells and outcrops, and pointed out which taxa characterise the "known producing horizons", or as Grzybowski explained...

"For a given geological stage, would it not be possible to use foraminifera to distinguish individual layers i.e. in an individual well or in the field, and in so doing provide more precise information for the petroleum industry?"

The material that Grzybowski had at his disposal was enormous - over 1000 sediment samples from 40 wells. With zeal and thoroughness, he examined the foraminiferal content of over 4000 samples. He illustrated his paper with a geologic map, an areal map showing well locations, and geological cross sections, upon which he had drawn the occurrence of individual foraminiferal assemblages. Grzybowski concluded his paper by stating...

"We see then, that we can answer the question of whether micropalaeontological studies can provide detailed information for the petroleum industry, whether in a given well or in the field, - and it must be answered in the affirmative. [...] Micropalaeontological studies can provide us with information about the superposition of the beds, and can be used to control the age dating that the drillers records give us, and with further studies will probably be able to furnish more precise information than drilling logs alone."



Figure 3. A view of the petroleum field in Potok, where Grzybowski first demonstrated the utility of micropalaeontological analyses of borehole muds for correlating subsurface strata (from an undated, early 20th century postcard).

Although he pointed out the utility of foraminifera for correlating subsurface strata, he was forced to admit in the conclusion of his paper that the current state of these investigations do not yet allow precise chronostratigraphic determinations, and his inability to distinguish unequivocal Cretaceous and Tertiary taxa in his fossil assemblages.

In several of his papers, Grzybowski acknowledged the assistance given to him by the Counsellor for Mining Affairs, Henryk Walter (he named two of his new species after him). Grzybowski also voiced his opinion to Rudolf Zuber's comments to one of Henryk Walter's articles that appeared in a Viennese periodical. Henryk Walter was the first of the Petroleum Geologists who as early as 1894 recognised the potential value of Grzybowski's investigations on the Carpathian microfauna. In his article "*Foraminiferen-Studien, oder das Mikroskop im Dienste des Naphta-Bohrtechniken*"

which appeared in the 9th and 10th issues of the Viennese journal "Organ des Verein der Bohrtechniken", Walter voiced his enthusiasm on the potential utility of micropalaeontological investigations. In later years, he took Grzybowski under his wing and introduced him to the problems of the petroleum industry and to the ranks of oil company geologists.

In 1895, Rudolf Zuber expressed unfortunate condescension toward both Walter's geological interpretations and Grzybowski's micropalaeontological research in an article published in the Viennese journal "Chemiker und Techniker Zeitung". The latter Zuber termed "Foraminiferenspielerei", which literally translated means "fooling around with forams". Zuber maintained that playing with forams was pointless - because you would never find an index fossil for oil - only the for-

the beds in which the oil occurs. Grzybowski replied to this criticism by writing:

"Petroleum Foraminifera" do not and cannot exist, for the same reasons why there are no index fossils for Iron, Copper, Coal, or Rock Salt. Anyone who has had even a little experience with the subjects of Geology or Palaeontology knows this. [...] The principles and objectives of the current investigations in the Carpathians and for the associated petroleum industry is to establish a more solid frame of reference than petrographic or lithologic studies alone are able to provide."

Despite this seemingly convincing explanation to the original criticism, in an article entitled "*Some comments on the matter of Dr. J. Grzybowski's investigations on the Carpathian microfauna*" that appeared in the last issue of the journal Kosmos for 1890, Zuber triumphantly proclaimed that Grzybowski himself admits to not finding "Petroleum Foraminifera" that are unique to given oil-bearing horizons. Zuber continued to criticise Grzybowski's studies even in later years, especially when the latter began to conduct geological investigations of such an important petroleum-producing region as Boryslaw. The motivation behind Zuber's remarks appears simply to be tarnished ambitions, and a vain attempt to protect his status as a petroleum geologist. Regretfully, such attacks are not uncommon in the annals of the geological sciences.

It is worth mentioning that Zuber's misinterpretations of Grzybowski's work have survived in some modified form to this very day. The well-known Polish science writer M. Iłowiecki wrote in his 1985 "Annals of Polish Science" that "The precursor of the field of Micropalaeontology was Józef Grzybowski (1869-1922) who was the first to discover that oil-bearing deposits are accompanied by a characteristic microfauna."

Grzybowski the Petroleum Geologist

The fears of Rudolf Zuber, whether real or imagined, came to fruition in an unusually short span of time. Grzybowski matured into a talented geologist, an expert in the natural

resources industry, and not only in petroleum geology. He had admirable expertise in the drilling industry as a whole, as well as in the coal industry.

Grzybowski's work on the "Geological Atlas of Galicia", especially the sheets on the petroleum-producing areas of the Middle Carpathians and Drohobycz, his continuing scientific collaboration with Henryk Walter, as well as his studies of the Carpathian microfauna, furnished him with broadly based experience for forming a synthetic view of the geological structure of certain regions. He published several articles together with Henryk Walter on the structure of individual oil deposits and he authored numerous consulting reports that are preserved as typescripts. The problems of structural geology, and the collection of various materials captured his interest to a greater degree. After the year 1901, his micropalaeontological monographs were replaced by publications in other topics.

The majority of Grzybowski's later publications were in the field of applied geology. Among others, he wrote scripts on the Geology of Drohobycz (1903, 1904); the explanations to the 20th volume of the Geological Atlas of Galicia (1906), which was co-authored by W. Szajnocha and P. Miączyński; Contributions to the Geology of Boryslaw (1907, 1908, 1909, 1911); an article on the recovery of gas from oil wells in Italy (1911), and on the problems associated with ground water in the Tustanowice mines (1911).

Grzybowski devoted much of his interest to the geology of the Boryslaw region, which was the most important hydrocarbon-producing region in all of Galicia. Grzybowski was of the opinion that the petroleum industry in Boryslaw ought to have its own geological research station, which would compile the existing geological data and undertake its own investigations. He took the lead in campaigning for such a station by writing articles in the popular journals, voicing his opinion at geological conferences, and lobbying the petroleum industry. His efforts eventually bore fruit, and in the autumn of 1912, the Geological Station in Boryslaw opened its

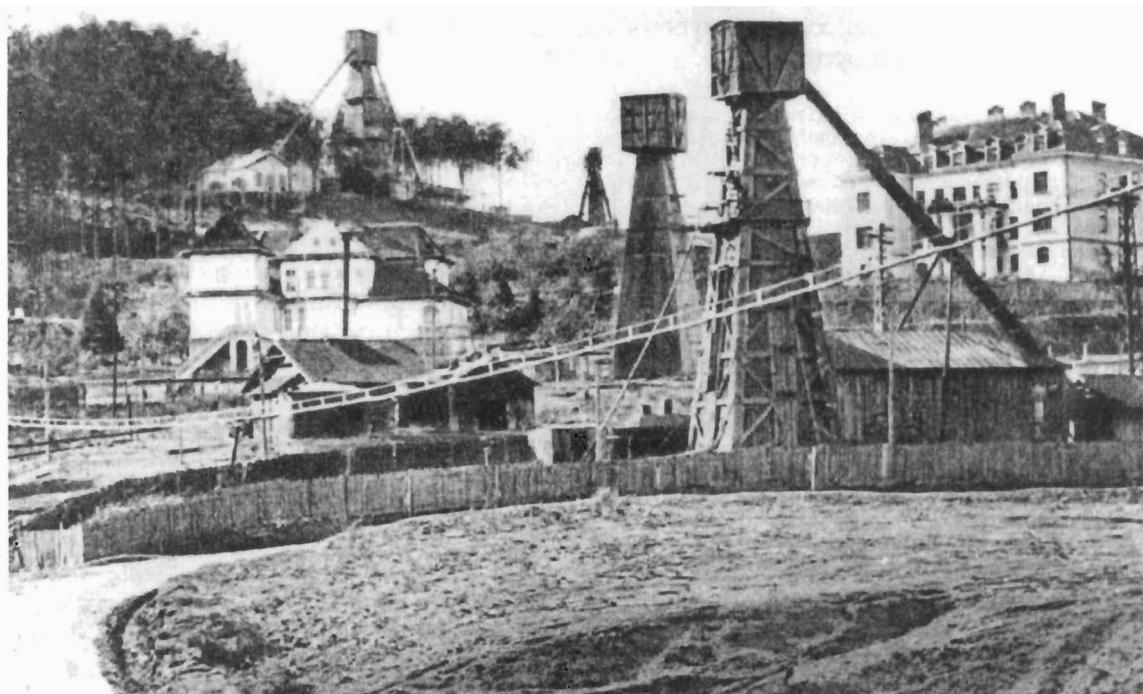


Figure 4. A view of the Geological Station in Boryslaw (building in upper right corner). Undated photograph courtesy of "Współczesna Sztuka" Publishers, Przemysl.

doors. The Station in fact, continues to exist to this day. It expanded its operations in the years between 1919 and 1939 under the direction of Dr. Konstanty Tolwiński. In 1939 it was amalgamated into the network of geological research stations of the Academy of Science of USSR (now the Russian Academy of Science).

The scientific advisor of the newly opened research station was of course Grzybowski. Its day to day operations in the first year of its existence was entrusted to Dr. Bolesław Kropaczek.

Dr. Kropaczek was a graduate of the University of Vienna. Already as a high school student in Rzeszów, he was introduced to the geological sciences by his teacher, Wilhelm Friedberg, who took him out on collecting excursions. At that time, he discovered a locality containing a rich gastropod fauna in the village of Babica. His monograph of that fauna entitled "*Montienfauna aus dem Flysch der Nordkarpaten von Babica bei Rzeszów, I Teil, Gastropoda*" became his

doctoral dissertation, which he defended on the 8th of July, 1910.

Following his statutory military service, he began working as a volunteer at the newly-formed Palaeontological Laboratory of the Jagiellonian University. Professor Grzybowski, the director of the laboratory, took a liking to the young Kropaczek. In April, 1912, he became a member of the Physiographical Commission of the Academy of Knowledge, and two months later was employed as the first director of the new Geological Station in Boryslaw.

Kropaczek was given the task to which Prof. Grzybowski attached great importance - the complete documentation of the geological structure of the Boryslaw region. This documentation was in an advanced state when world war was declared in 1914 and the newly conscripted Dr. Kropaczek fell in battle on November 8th of that year.

After the war in 1919, Prof. Grzybowski was able to resume and complete Kropaczek's

work, and published a paper entitled "*Borysław, Geological Studies according to material collected by the Director of the Station (Deceased) Bolesław Kropaczek*". This publication consisted of a geological atlas, text explanations, and five geological cross sections. It remains the most complete documentation of the area to this day.

In that same year, Prof. Grzybowski published "*A Review of Oil-bearing Regions of Poland*" with a map drawn at a scale of 1:400,000, as well as a second map entitled "*An Overview Map of Petroleum Occurrences in the Carpathians*". The latter was accompanied by the printed text of a lecture that Grzybowski delivered on "*The Petroleum Industry in Poland*" (1919). A great deal of information on the petroleum industry was of course contained in the three volumes of the "*Geological Atlas of Galicia*" that Grzybowski had compiled earlier: map volume 14 (1903) covered the region of Pilzno, Ciężkowice, Brzostek, Tyczyn, and Dynów; volume 20 (1906) centred on Drohobycz, and volume 25 (1911) - Ustrzyki Dolne, Turka, and Bolechów.

Grzybowski's interests in the Carboniferous Coal Measures of Upper Silesia was also linked to his studies of Carpathian geology. In 1909, he published a paper co-authored by Kazimierz Wójcik entitled "*A Geological Overview of the Silesian-Kraków Coal Basin, with regard to neighbouring areas*". In that article, Grzybowski discussed two problems: The relationship of the Carpathians to the Silesian Coal Measures; and the possibility of the eastern extension of the Coal Measures. Grzybowski correctly predicted that the productive coal measures do in fact extend further east than their known limits at that time. Several typescript consulting reports for the local coal industry authored by Grzybowski have also been preserved.

The only evidence of Grzybowski's interest in metallic ore deposits is an undated brochure "*Les Gîtes métallifères de la Bukowina orientale*". It is a summary of two of Grzybowski's reports (from January 24th, 1904,

and October 18th, 1905), as well as his account of a trench that was dug upon his recommendation. The results of that trench were positive.

By this time, Grzybowski began to travel widely in the role of a consultant petroleum geologist. In addition to his scientific expedition to Peru mentioned earlier, he traveled to the Caucasus in the company of Henryk Walter. He was especially fascinated by the deposits of petroleum wax on the Chelekan Peninsula. From 1916-1917, Grzybowski took part in a scientific excursion to Mesopotamia on an invitation from the Turkish authorities. However, his most remembered contribution to Geology outside of Galicia is his final paper, published in the *Bullettino Societá Geologica Italiana* in 1921. In his paper "*Contributo agli studi sulla struttura geologica dell'Italia Meridionale*", he demonstrated that the area west of the River Liri in Abruzza is built of a series of nappe structures.

This article, as well as other earlier works on the oil-producing regions of Italy, contributed to Grzybowski's highly esteemed reputation in Italy. This spoke highly of the scientific qualifications of the Polish specialists, and no doubt lead to the later invitation extended to the Polish petroleum geologist Stanisław Zuber to visit Italy in 1927. The latter was the son of Grzybowski's antagonist Rudolf Zuber. The younger Zuber earned his reputation working in Czernogora, Italy, and especially Albania. He spent many years in the latter country where he earned the title "Father of Albanian Petroleum Geology". He perished in a communist prison in Tirana in 1947.

Grzybowski the Educator and Citizen

The Palaeontological laboratory of the Jagiellonian University was formally established in 1912. Since 1900, Prof. Grzybowski had been lecturing palaeontology in the Geology Department. He devoted the winter term to his taught course on invertebrate palaeontology, and in summer he taught vertebrate palaeontology. Prof. Szajnocha



Figure 5. A postcard that Grzybowski sent to his wife Wanda during one of his excursions in Italy. From the collections of the Laboratory of the History of Polish Geology.

once wrote "Grzybowski prepared his lectures carefully and delivered them well - but the world of fossilised organisms - with the possible exception of his beloved foraminifera and the origins of life, a topic he wrote about in the Warsaw popular science magazine "Wszemświat" in 1903 - excited him less than the topic of general Geology, particularly Stratigraphy and to a lesser extent, Tectonics".

In fact, Grzybowski wrote relatively few papers on fossil groups other than the Foraminifera. In his 1899 habilitation paper on the Tertiary of northern Peru mentioned earlier, he described 58 species of bivalves

and gastropods, of which 41 were new. The value of this work is reflected in the fact that nearly 40 years later in 1937, it was translated into Spanish and republished in Lima. In one of his early papers "Mikroskopische Studien über die grünen Conglomerate der ostgalizischen Karpathen" (1896), in addition to a list of foraminifera, Grzybowski described four species of *Lithothamnia*. Grzybowski also wrote a paper entitled "Fukoidy i hieroglyfy" (1895), based on a paper written by Theodor Fuchs "Studien über Fucoiden und Hierogliphen".

Grzybowski's publications in the field of general Geology are impressive. The first

textbook Grzybowski wrote was "*A Brief Introduction to Geology*" (published in Polish) which was published in Boryslaw by the Association of Drilling Technicians in 1908. It was primarily intended as a textbook for Drillers and Mud Loggers. In that same year, Grzybowski contributed several chapters to the Polish Translation of Melchior Neumayer's textbook "*The Story of the Earth*". His next general science paper was one that he co-authored with Stanisław Weigner, on "*Fossil resources of the Polish Lands*" (published in Polish in 1912), which appeared in the Polish Encyclopedia edited by the Academy of Knowledge. In that same year, Grzybowski published his "*Geological Map of the Polish Lands*", (in Polish) which was accompanied by explanatory text and three cross sections. This was only the second modern geological map of its kind, after the one compiled by J. Siemiradzki and E. Dunikowski which was printed in 1891. Fewer than one hundred years after the publication of the first geological map of Poland by the "Father of Polish Geology" Stanisław Staszic in 1815, Grzybowski was able to put together a synthetic map that was of comparable quality to "*International Geological Map of Europe*" published at about the same time. As the Polish Geologist H. Świdziński wrote in 1962 "For many years, Grzybowski's explanatory text was the only general reference on the Geology of Poland and adjacent lands."

In his activities as a University Professor, Grzybowski not only attached great importance to research, but also endeavoured to build up his independent laboratory, and his wide-ranging interests as a teacher and advisor to students. Grzybowski devoted much energy to this.

The Austrian Ministry of Education was not renowned for its generosity towards the scientific requirements of Galicia. When Grzybowski became the director of Palaeontological Laboratory of the Jagiellonian University in 1912, not only did he carry out his obligations without salary, but until the end of the World War was unable to secure any paid positions for research assistants. The first

paid Demonstrator in his laboratory at the University was Franciszek Bieda, who started in 1920. In spite of this hardship, during the 10 years when Grzybowski served as its first Director, the Palaeontological Laboratory got off to a good start. That laboratory exists, though under a different name, to this day. The quarters the Palaeontological Laboratory occupied in the Collegium Iuridicum were so cramped that to the end of his life, Prof. Grzybowski had to conduct his lectures at the Geology Department several blocks away. There was only space for eight chairs at the Palaeontological Laboratory, and students had to complete their laboratory exercises standing up. To equip his newly-formed laboratory Grzybowski sent grant applications to the Academy of Knowledge in Kraków. In 1913 he received a grant of 200 crowns to partially pay for the cost of photographic equipment. In the following year his application was unfortunately rejected due to insufficient funds. Above all, Grzybowski tried to build up the Palaeontological library. He managed to obtain complete runs of foreign palaeontological journals, numerous monographs, and a large number of reprints on palaeontological and stratigraphical topics. However, the lack of microscope equipment and a Demonstrator to assist him with teaching was an added burden. In the beginning Grzybowski performed all the technical work, such as sample preparation and picking, himself.

Despite these difficulties in getting started, Grzybowski was able to attract a number of talented young people who carried out their first scientific studies in the fields Palaeontology and Stratigraphy. Jan Jarosz described the trilobites and brachiopods from the Lower Carboniferous. Bronisła w Rydzewski carried out studies on the flora of the Upper Carboniferous of Dąbrowa Górnica, and Stanisław Weigner investigated the Carboniferous fauna of Czolonóg. Several students, such as Weigner, Kropaczek, and K. Wójcik, published papers together with Grzybowski, or carried out research under his supervision. Three Ph.D. students

took up the study of foraminifera, thereby continuing Grzybowski's early work. The Franciszek Bieda, who would eventually take over the Chair in Palaeontology at the laboratory, became a specialist on larger Foraminifera. Maria Dylązanka (whose dissertation appears in this book) studied the foraminifera from the Inoceramian beds in Szymbark, and Władysław Żelechowski studied the Paleogene microfauna from a borehole at Lgota near Wadowice.

Prof. Grzybowski was quite active in academic circles outside the university. He was a member of the Physiographical Commission of the Academy of Knowledge, a member of the N. Copernicus Society of Naturalists, and was a founding member of the Geological Society of Poland. Grzybowski also had numerous contacts with geological societies abroad.

Grzybowski's scientific investigations, the responsibilities with his new laboratory, and supervising students, did not exhaust his energies. He also felt an obligation to civic duties outside the sphere of the University. For several years he was a faculty member at the A. Mickiewicz Open University in Kraków. Before the World War, he was convinced that Poland would some day regain her independence. He honestly believed that education is the only path to true freedom, and he devoted much effort to popular science education.

After the outbreak of war in August 1914, Grzybowski was active in the National First Committee. He carried out his duties as the deputy commander of a Reserve Division. In 1917, when the Polish Legions were interned, he became a member of the Committee for the Care of Interned and Freed Polish Legionnaires.

Throughout the decade before the outbreak of war, Kraków was the cultural centre for independent-minded artists and writers. Grzybowski was well-known among the circles of political writers and activists of the day. He befriended Stanisław Przybyszewski, a key figure in the "Young Poland Movement" which was a loose association of artists, writers, and satyrists. Because of his

industrial contacts, Grzybowski was able to contribute financially to their cause, in addition to his activities as an educator and citizen.

Grzybowski's legacy

Professor Grzybowski's death was sudden and unexpected. He was struck down on the 22nd of February, 1922 by diphtheria that had been diagnosed too late. He was only 53 years of age, the 32 of which he dedicated to his science. His palaeontological laboratory was left in the hands of his assistant and student Franciszek Bieda, who had just finished his doctoral dissertation on the Nummulites of the Carpathian Flysch.

In the Palaeontological Laboratory, Grzybowski left an enormous collection of microfossils. His collection occupied a large wooden cabinet filled with thousands of glass vials filled with his micropalaeontological residues. These collections remained untouched for many years, surviving both the war and changes brought on by the postwar communist authorities, who in mid-1950 decided to move the Department of Geology to the Academy of Mining and Metallurgy. In 1956, they were moved back again to the University's reorganised Department of Geology and Mineralogy. In 1967, a program of cataloguing the geological collections was begun. On the invitation of Dr. Stanisław Geroch, Mrs. Zofia Martini, who had carried out the curation work at the Polish Academy of Sciences, began the task of making an inventory of Grzybowski Collection. Mrs. Martini discovered that in addition to the collections that formed the basis for Grzybowski's monographs, there is still much more material that Grzybowski never published. The collection houses sample residues from the Carpathians as well as from various places he visited, especially from Italy. Some time later seven unfinished plates of Grzybowski's drawings were found, an example of which is illustrated in Plate 1. These drawings depict Miocene shallow-water foraminifera from the village of Żegocina in the Carpathians. Vials

of foraminifera from the same locality are preserved in the microfossil collections. From this we can conclude that Grzybowski was working on another monograph when he fell ill.

After Grzybowski's death, the university authorities appointed Doc. Dr. Jan Nowak, a graduate of the Lvov Polytechnic, to the Chair of Palaeontology. He carried out this function for seven years until 1929, when he took over as chairman of the Geology Department after the death of its founder, Prof. Szajnocha. Jan Nowak was not a micropalaeontologist, and after moving to the Jagiellonian University no longer carried out research.

The person who replaced Jan Nowak in the Chair of Palaeontology was Wilhelm Friedberg (1873-1941), who directed the activities of the Palaeontological Laboratory until his retirement in 1933. Friedberg was also a graduate of the Lvov Polytechnic. After teaching in a secondary school in Rzeszów, he took up a post at the University of Poznań after Poland regained her independence. Friedberg is best remembered for his numerous studies of Miocene molluscs, but he also worked on foraminifera early in his career. In the same volume of "Kosmos" that contains Grzybowski's paper "*Microscopical investigations of borehole muds*", Friedberg published his first scientific paper "*A contribution to the knowledge of Cretaceous foraminifera from the Lvov marls*". In this paper he described 28 species of foraminifera of which eight were new. Four years later, he published his monograph "*The Foraminifera of the Inoceramus beds in the vicinity of Rzeszów and Debica*", which is translated in this volume. In this paper, Friedberg attempted to relate the composition of foraminiferal assemblages to the chemical composition of the sediment, a point that apparently elaborates upon some of Grzybowski's observations in "*Microscopical investigations of borehole muds*".

Throughout the whole time when the Palaeontological Laboratory was directed by Nowak and Friedberg, Franciszek Bieda continued his work on the larger foraminifera.

He advanced through the ranks of Assistant, Senior Assistant, and after defending his Doctor of Science degree in 1931 was given the title Docent. Upon Friedberg's retirement, Bieda assumed the position of Director of the Laboratory, and in 1935 was awarded the title of Professor. He remained in that function until his retirement in 1967. From 1951 when the Laboratory was relocated by the communist authorities, he remained at the Academy of Mining and Metallurgy where he continued his research on Cenozoic larger foraminifera. Between 1948 and his death in 1982, Bieda wrote numerous articles on the subject of the History of Geology, which include many of his personal observations. His recollections about Professor Grzybowski appeared in several of his articles.

The later career of Grzybowski's second Micropalaentology student, Maria Dylązanka (1886-1966), turned out rather differently. Maria's father was a driller in the petroleum industry. She graduated from a teacher's school, and was first employed in an elementary school. After successfully sitting her qualifying examinations at the St. Anne Gymnasium in Kraków, she studied natural sciences at the Jagiellonian University (1910-1922). During the war years of 1916-1919, she was the Geology Department's librarian. In 1919, she was given the post of Demonstrator, and later she became a Junior Assistant in Mineralogy and the University. She was awarded her Ph.D. in 1922 for her dissertation entitled "*The Inoceramus Beds from the quarry in Szymbark, near Gorlice*", which appears in this volume. After defending her thesis, Dylązanka worked briefly at the Department of Geology and Palaeontology of the Academy of Mines in Kraków. She intended to continue her work on the Carpathian microfauna, but being unable to secure an academic post she accepted a teaching position at one of the secondary schools in Kraków in 1923, where she remained until her retirement. Despite her unfortunate situation, Dylązanka was the only one of Grzybowski's students who continued his work on the agglutinated faunas of the Carpathians.



Figure 6. Franciszek Bieda, Maria Dylążanka and an unidentified associate in front of the Palaeontological Laboratory. Photograph was taken around 1920.

He was keenly interested in Dylążanka's work. She followed up on Grzybowski's ideas about the facies dependency of benthic foraminiferal faunas, and wanted to carry this work further.

After Dylążanka left the University, two decades passed before anyone continued the investigations of Grzybowski's agglutinated foraminiferal faunas. In the interbellum period before 1939 most of the micropalaeontological research carried out in Poland concentrated on larger foraminifera, with Maria Cizancourt and Olga Pazdrowa publishing several papers on the topic of *Nummulites*. Also two communications by T. Chlebowski J. Czernikowski (1936 - 1938) dealt with the microfauna of the eastern part of the Carpathian Foredeep in the Stryj region. The study of smaller foraminifera received only marginal interest. Janina Syniewska was a notable exception, and in 1937 published a study "On the foraminiferal fauna of the Palaeogene flysch of Koniuszka near Dobromil" (in Polish) in which she listed 146 taxa. During the Second World War, Heinrich Hiltermann, who was carrying out geological investigations in the Carpathians near Jasło published his paper "Zur Stratigraphie und Mikrofossilführung der Mittelkarpaten" in the journal "Oel und Kohle" (1943), a biostratigraphic study of Carpathian foramin-

ifers in which he confirmed the utility of Grzybowski's initial studies. After the war, interest in Grzybowski's research in the Carpathians grew rapidly as a number of Professor Bieda's students took up the study of Micropalaeontology. Today the research that Grzybowski inspired as the founder of Micropalaeontology in Poland is continued at universities and centres of applied research throughout the country and abroad.

In his paper "Zur Geschichte der angewandten Mikropaläontologie" Hiltermann definitively stated that the earliest practical applications of Micropalaeontology in the field of Petroleum Geology were carried out by Grzybowski. It is most unfortunate that the critical comments voiced by some of Grzybowski's contemporaries had obviously discouraged him from publishing micropalaeontological papers after 1901. However, the recently discovered unfinished plates and specimens from the Miocene of Żegocina are evidence that he did not give up his interest in foraminifera entirely.

Only the perspective of time allows us to fully appreciate the fact that among Grzybowski's unsurpassed contributions to Earth Science, it was his micropalaeontological work that had such a lasting impact among his contemporaries and followers. Much in the same way that the Father of British Geology William Smith demonstrated to the world how sedimentary rocks can be correlated, Józef Grzybowski showed us how to study the great flysch sequences that are so poor in other guide fossils. Thanks to his pioneering studies the microscopic world of the foraminifera became a key to unlock countless mysteries in both practical and theoretical aspects of Earth Science.

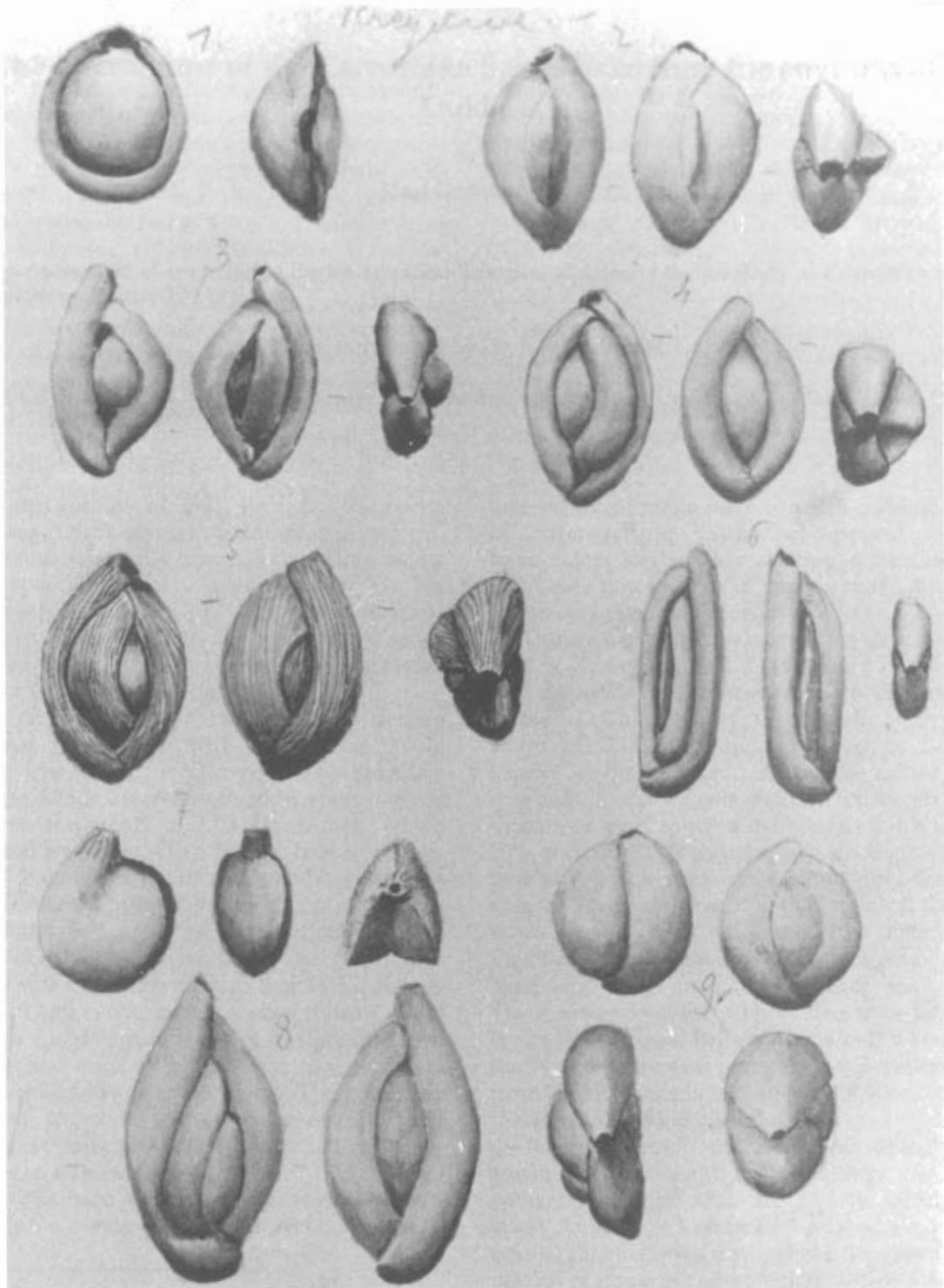


Plate 1. An example of one of Grzybowski's unfinished plates of the Miocene foraminifera from Zegocina, from the archives of the Polish Academy of Science.