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Ernst Weinschenk (1865–1921) a pioneer of microscopy and petrography in Munich (Southern Germany)

An explorer of sulfidic ores and graphite deposits in the Moldanubicum

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Abstract Ernst Weinschenk was an excellent teacher at the High School of Technology from 1897 till his death 1921, and at the university in Munich from 1900. His studies of the mineralogy of meteorites and the contact-metamorphic mineralization in the eastern and western Alps and southern Tyrol made him widely known early-on. He successfully determined many new minerals with the aid of the polarizing microscope and the use of mineral and thin rock sections. He attributed the genesis of the sulfidic ore deposit Silberberg at Bodenmais (northern Bavarian Forest) and the graphite deposits near Passau (Lower Bavaria) to the exhalative output of sulphur and carbon during the granite orogenesis (Weinschenk 1914).

Keywords Polarizing microscope · Petrography · Meteorites · Graphite · Sulfidic ores · Contact metamorphism

Introduction

Though the polarizing microscope was already in general use in the year 1850 (Pfaffl 1985), the technical experience was missing for use in petrography. Only Henry Sorby (1828–1908, Sheffield, UK) used thin sections for the exploration of petrified wood , Rosenbusch (1873) and Zirkel (1894) created the scientific prerequisition for rock microscopy. C. W. Gümbel (1823–1898), who had been active in Munich since 1851, dominated the life of geo-sciences at both high schools in Munich until his death and many years after that with outdated trials of neptunistic explanations. In 1891, during this phase of scientific stagnation, Ernst Weinschenk, who was young and a believer in progress, came out with his thesis of the genesis of the contact minerals in the Alps. His many publications concerned the genesis of graphite in genetic correlation of the high metamorphic gneisses (metatexite, bearing garnet, cordierite and sillimanite), with sulfidic ore deposits in the moldanubicum in eastern Bavaria. In his manuals of petrography, published in 1905, he tried to establish a new nomenclature of rocks, and from 1906 he called upon the increasing use of the polarizing microscope in teaching and research with an instruction on its use (Weinschenk 1906). A conflict with the founder of petrography since 1863, Ferdinand Zirkel in Bonn, followed as a matter of cause.

Ernst Weinschenks biography

Ernst Weinschenk was born on 6 April 1865 as the sixth child of the chief Counsellor of justice, and his wife Luise von Sicherer in Wurttembergian Esslingen near Stuttgart. He finished school with final examinations at the Karls-Gymnasium (High School) aged 17 and studied nature sciences, especially mineralogy and geology, at the High school of technology in Stuttgart and the universities of Tübingen, Leipzig and Munich. He attained his doctorate summa cum laude in Munich in 1888 with a thesis on the alteration of Quartz to "Speckstein" (a kind of talcum stone). He continued his studies at the universities of Greifswald, Paris und London (Klemm 1925).

Ernst Weinschenk was happily married to his wife Elsa, whose maiden name was Lechner, and gave birth to their three sons and two daughters. On geological excursions he always was an accommodating, cheerful and brilliant

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colleague. The sum-total of his publications shows 94 books (with several editions) and single articles. He died at 26 March 1921 following a gallstone operation. His descendants still live in Munich today.

Early studies of meteorites

Under instruction of Aristides Brezina from the Natural Historic Museum of Vienna, which housed a large collection of meteorites, Ernst Weinschenk, together with Emil Cohen (1842–1905), studied the components of minerals from meteorites at the university of Greifswald in North-eastern Germany from 1888. On the basis of these studies he could proof the phases graphite, cohenite, taenite and schreibersite in the meteor of Magura in the Komitat Arva in Hungary (Weinschenk 1889). He compared the formation of meteoritic iron to the melting process of raw iron in iron works. He found the cause of the segregation of the connection of FeC to sometimes be the extreme slow cooling between the temperatures of 600 and 700°C, hence his conclusion that cohenite Fe_3C was created under similar conditions—at a temperature when the surrounding iron was still in a weak plastic condition.

"The intimate relationship to (the mineral) taenite, the same inclusions of (the mineral) schreibersite, and the transparent grains, which show the cohenite to the same degree at the iron itself, allow that at all the crystallisations of the meteoritic components went on around the same time, during the long cool down of temperature, around the melting point" (Weinschenk 1899). Ernst Weinschenk summarized his studies of meteorites in a first classification of meteorites in 1894 and 1899, which published in the "Sitzungsberichte" of the Bavarian Academy of Sciences in Munich. Weinschenk seemed to arrive at his investigations of meteorites because of the mineral graphite. His teacher was Emil Cohen in Greifswald, who wrote 26 books and articles about meteorites.

Investigations of contact-deposits

His geological/mineralogical explorations in the Alps were very important. He tried to find proof for his thesis, that central gneisses are younger than Schistmantle, which originated earlier and whose high crystalline consistency is doe to contact metamorphism, not to dynamic metamorphism. He also pointed out the difference between the contact zones of many non-alpine plutonic masses and the contact metamorphism of the alpine schist mantle, which happened during high pressure. He also put forward the idioms "Piezokristallisation" (high-pressure crystallization) and "Piezokontaktmetamorphose". His points of view, based on many years of observation in the mountains and the thorough research of thus collected extensive materials, were heavily criticised in the beginning, or were simply ignored. Weinschenk suffered many difficult hours due to the misjudgement of his important scientific results, which were so important for the (oro) genetic relationships of high-alpine areas. Many institutions show this kind of negative attitude to this day. It is slowly becoming more evident that the genesis of folded mountains stood in close relation to the intrusion of igneous rocks. Weinschenks suggestions on this topic were very important. He always pointed out that recognition of the genetic relations of a rock should be based on geological investigation and strongly discouraged from basing it solely on the interpretations of its chemical compounds. He always pointed out that geological age is not the only measure for its external form, especially the "kristalliner Schiefer" (gneiss), should not lead to the conclusion of a higher geological age (Weinschenk 1907). On the other hand, he emphasized that the state of preservation of a rock is heavily influenced by its geological age like diabases, melaphyres and "Trapp" (trapp basalt). They were probably originally very similar in mineralogical composition and structure. One can probably say rightly that Weinschenk was responsible to a great part for the—wrong—decline of "Handstückspetrographie" (Klemm 1925; Tröger 1948).

Weinschenk (1900a, b, c) tried to explain the alpine metamorphism as syntectonic, and to deduce its special characters from this theory. "Piezokristallisation" refers to the presumption, that the Tauern mountains were crystallized syntectonically and that therefore certain accumulations in the mineral association are the cause of statically re-crystallized areas.

During that time Weinschenk (Munich) and the Austrians Cornelius Dölter (Vienna) and A. Cathrein (Innsbruck) with some other geologists and mineralogists, studied the rocks and contact formations of Predazzo, St. Cassian, Seiser Alm, and the valley of Fassa, all situated in the Dolomites, with all their alterations, which had experienced the mesozoic limestones and dolomitic stones in contact with volcanic rocks. (Fischer 1976)

But the Alps are also home to other kinds of contact deposits, which are connected to the intrusion of peridotites in rocks of the Central Alps. Their relations were not made clear until E. Weinschenks research in Munich concerning the mineral deposits of the area of the Großvenediger and other parts of the Alps at the end of the nineteenth century. He stated that the intrusions caused changes in the perforated rocks, that necessarily shows analogies to the rocks previously mentioned where these were lime-rich. The rock material with olivine was altered to serpentine after its consolidation and with this (plutonic) process entailed the

Plus ultra! Der Verfasser.

Grundzüge

der

Gesteinskunde.

Von

Dr **Ernst Weinschenk,**

a.-o. Professor der Petrographie an der Universität München.

II. Teil:

Spezielle Gesteinskunde.

Freiburg im Breisgau.

Herdersche Verlagshandlung.

1905.

Zweigniederlassungen in Wien, Straßburg, München und St Louis, Mo.

Front page of the book "Grundzüge der Gesteinskunde". Freiburg/Breisgau, 1905

Ernst Weinschenk (born) Esslingen 1865; (died) München 1921

formation of mixtures of Mg-rich crystallized minerals in the serpentine itself as well as in its contact zones (Weinschenk 1891).

There is an opinion that, depending on the rock, the paragenesis of minerals of the alpine clefts with adular, smoky quartz, hematite, titanite (sphene), pericline and fluorite differs, so that a gradually eluviation of the adjoining rock ("Lateralsekretion") had to be suggested. To underpin this opinion Weinschenk collected in many deposits of the Eastern Alps, which show the characteristic mineral paragenesis of the central Alps.

For this thesis of paragenesis Weinschenk mainly collected specimens in the Bavarian Forest and the Alps. He was able to travel to the Alps from munich by train as early as 1889.

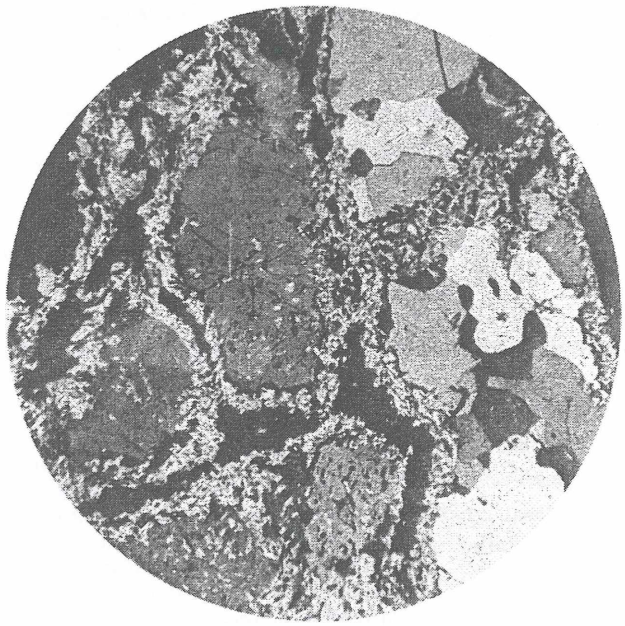
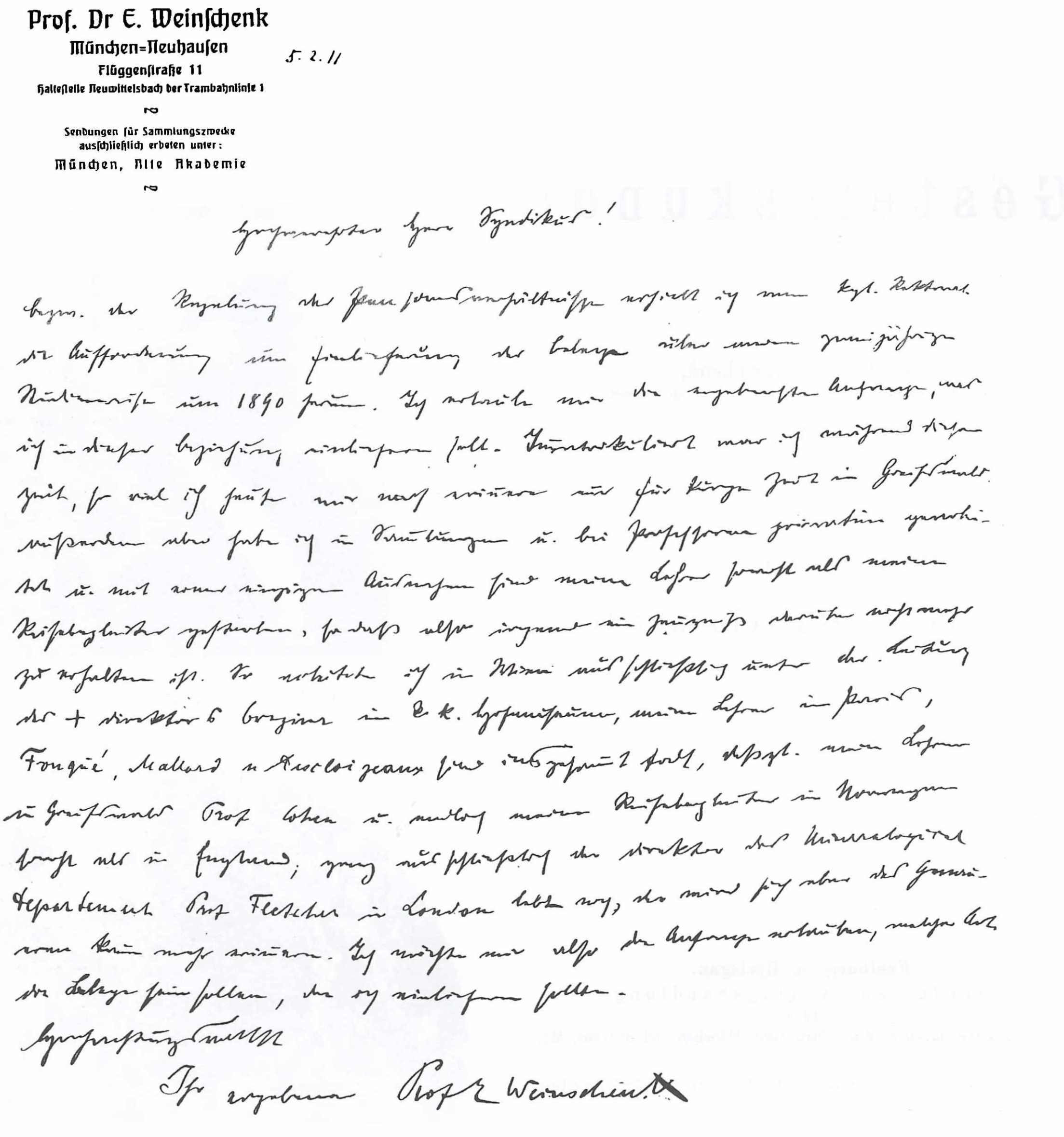


Fig. 1 Parties of rocks next the ore of Silberberg (Bodenmais) are traversed with loadings of zinc spinel (Kreittonit). Enlarging scale: 1:35, crossed nicols. From: Weinschenk 1901

Weinschenks studies of graphite

He assumed that carbonyls of heavy metal which transmigrated the rock ascendentally and supplied the pneumatological mineral of graphite during decomposition.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5. 2. 11

Hochverehrter Herr Syndikus!

Bezwecks der Regelung der Pensionsverhältnisse erhielt ich vom kgl. Rektorat die Aufforderung um Einlieferung der Belege über meine zweijährige Studienreise um 1890 herum. Ich erlaube mir die ergebenste Anfrage, was ich in dieser Beziehung einliefern soll. Immatrikuliert war ich während dieser Zeit in Greifswald, außerdem aber habe ich in Sammlungen und bei Professoren privatim gearbeitet und mit einer einzigen Ausnahme sind meine Lehrer sowohl als meine Reisebegleiter gestorben, so daß also irgend ein Zeugniß darüber nicht mehr zu erhalten ist. So arbeitete ich in Wien ausschließlich unter dér Leitung des verstorbenen Direktors Brezina im K. K. Hofmuseum, meine Lehrer in Paris, Fougue, Mallord und Descloizeaux sind insgesamt tot, desgleichen mein Lehrer in Greifswald Professor Cohen und endlich meine Reisebegleiter in Norwegen sowohl als in Englang; ganz ausschließlich der Direktor des Mineralogical Department Professor Fletscher in London lebt noch, der wird sich aber des Genaueren kaum mehr erinnem, Ich möchte mir also die Anfrage erlauben, welcher Art die Belege sein sollen, die ich einliefern sollte.

Hochachtungsvollst
Ihr ergebener

Prof. E. Weinschenk

Transcription of the letter dated 5 Feb 1911 to the rectorship at the University of Munich

A. Die Eruptivgesteine .

- I. Orthoklasgesteine . .
  - Granit . . . . . .
  - Granulit . . . . . .
  - Liparit und Quarzporphyr .
  - Syenit . . . . . .
  - Trachyt und Orthoklasporphyr
- II. Plagioklasgesteine . .
  - Quarzdiorit und Diorit . . . .
  - Gabbro . . . .
  - Porphyrit und Andesit . . . .
  - Trapp, Diabas und Melaphyr . . . .
  - Anhang: Metamorphismus der basischen Eruptivgesteine und ihrer Tuffe . . . .
- III. Natrongesteine . . . .
  - Nephelinsyenit und Theralith . . . .
  - Phonolith, Nephelinporphyr und Tephrit . .
  - Natrongranit und Natronsyenit . . .
  - Natronliparit, Natrontrachyt und Keratophyr .
- IV. Spaltungsgesteine . .
  - Aplit und Pegmatit . .
  - Minette und Kersantit .
  - Kamptonit und Basalt .
- V. Feldspatfreie Gesteine
  - Peridotit und Pyroxenit .
- Anhang: Vulkanische Tuffe .

B. Die Sedimentgesteine

- I. Mechanische Sedimente .
  - Tongesteine . . . . . .
  - Kontaktmetamorphose der Tonschiefer
  - Sandstein . . . .
  - Konglomerate und Brekzien . .
  - Anhang: Mylonit . . . .
- II. Chemische Sedimente .
  - Anhydrit, Gips und Steinsalz .
- III. Organogene Sedimente . . . . . .
  - Kohlen . . . .
  - Anhang: Torf . . . .
  - Petroleum, Ozokerit und Asphalt . . .
  - Karbonatgesteine . . . .
    - Kalkstein . . . .
    - Dolomit . . . .
    - Anhang: Sonstige Karbonatgesteine . .
    - Kontaktmetamorphismus der Karbonatgesteine
  - Organogene Kieselgesteine . . . .
  - Phosphorit . . . .

C. Die kristallinischen Schiefer .

- Gneis . . . .
- Glimmerschiefer und Serizitschiefer . . . . .
- Amphibolit und Eklogit . . . .
- Chloritschiefer und Grünschiefer . . . . . .
- Kristallinische Karbonatgesteine . . . . . .
- Phyllit . . . .
- Kristallinischer Quarzit . . . .
- Akzessorische Bestandmassen: Gabbro, Serpentin, Talkgesteine, Graphitgesteine, Erzgesteine, Smirgel . . . . .

Fig. 2 Classification of the rocks after E. Weinschenk. (from: "Grundzüge der Gesteinskunde", 1905)

Weinschenk was of the opinion, that the graphite penetrated the granites and gneisses exhalatively. He agreed with Walthers (1889) opinion of an anorganic graphite genesis by effect of certain carbon compounds with the statement, that especially the graphite of Ceylon (Weinschenk 1900c) whose structure and gaseous appearance allow the conclusion that it originated from the reduction of vapours containing carbon from the earths' interior ("black smokers").

E. Weinschenk was the main advocate of the anorganic thesis. His study of the moldanubic graphites that organic substances, be it primary components or the conveyance of asphalt or petroleum (kerosene), can be excluded for its origin. He was of the opinion that the genesis of graphite is due to the decomposition of gaseous exhalations at not very high temperature from the granite massive nearby. These exhalations consisted of carbon oxides as well as carbonic compounds and iron, sulphur manganese, cyanic compounds of titanium, carbonic acid and water. They penetrated where weak zones were created by orogenesis at the boundary of rocks of different solidity.

The genesis of a certain group of graphite deposits made raise the question, if the graphites of the border mountains of the bohemican mass had developed from the bituminous "Lagerkalke" (laying limestones) by way of "pneumatic eluviation" ("pneumatischer Lateralsekretion"). One assumes that true bituminous limestone is the original material, heated by contact metamorphosis. During that process bodies similar to bitumen and asphalt, moved away from the source of the heat and disintegrated into an array of gases, which were precipitated under the segregation of graphite (Weinschenk 1897a, b, c).

Weinschenk and the Silberberg mountain at Bodenmais

He began his mineral excursions of the Bavarian forest, which you could already reach by train ("Ostbahn") from Deggendorf by 1877, in 1895. In 1897 he examined the mineral anthophyllite of the Silberberg mountain near Bodenmais. He first wrote about the sulfidic ore deposit in the journal "Berg- und Hüttenmännische Wochenzeitschrift" in 1898 a short version of it was published in the guide." Der Bayerische Wald zwischen Bodenmais und dem Passauer Graphitgebiet" (Pfaffl 1991); in 1900 in the journal: "Zeitschrift für praktische Geologie": "Der Silberberg bei Bodenmais im Bayerischen Wald"; in 1901: "Die Kieslagerstätten im Silberberg bei Bodenmais" and in 1903: "Vergleich von Bodenmais mit der des Schneeberges in Tirol". (The mountain of Silberberg near Bodenmais in the Bavarian

Forest/the sulfidic ore deposit in the Silberberg mountain near Bodenmais/comparison of Bodenmais with the deposit of Schneeberg (Tyrol)).

Ernst Weinschenk wrote the following in 1901 in the journal "Abhandlungen der Bayerischen Akademie der Wissenschaften": "The Silberberg near Bodenmais with ore deposits mined for centuries, offers a lot to the mineralogist as well as the geologist. The wealth (84!) of minerals, which coexist with the ore deposits, the petrographical constitution of the gneisses with garnet and cordierite, in which the ores are stored, but also the storing conditions in themselves. Especially as the type of ore deposits, as found at the Silberberg, belong to the most controversial ones today." The so called "Fahlbänder" (zones in metamorphic rock impregnated with sulfidic ores) used to be viewed as creations of the same age as the surrounding layered rocks, sedimentations of the primordial ocean, which had supposedly caused the creation of the genesis of adjoining rocks. "The geological and especially the petrographical relations, however, that could throw light on the relationship of ore bodies to adjoining rocks, have thus far not been considered." For these investigations Weinschenk used thin sections for the first time (Fig. 1). "In the same way or perhaps more extreme as against the genesis of the "Fahlbänder" of the Silberberg from the circulating solutions in the rock or from sulphur sources, ascending from depth, all appearances spoke against their genesis by alternating decomposition of gases and vapours, so of a pneumatolytical way none of the appearances mentioned above, indicates such processes". There remains only one possibility explanation of the "Fahlbänder" of the Bavarian Forest, and that is the burning, liquid ore magma was pressed into the rock which tore at the points of least resistance and spread out in the form of concordant deposits." The ore bodies are therefore younger than the surrounding rocks." Weinschenk's observation, that the rock, right of the mountain site, is granite, was wrong, it is rather a form of migmatite ("Rabensteiner Gneise"), but with a typical granulitic structure.

Ernst Weinschenk and his manuals (textbooks)

His special petrography was criticised for using biased views as a basis for this systematic of rocks. His earlier work "Allgemeinen Gesteinskunde" (common petrology) aroused the same criticism: it was said that it was unsuited as an introduction to this extraordinarily difficult field, especially as the so-called "polemic side" of the discussion of the vastly differing scholarly opinions were obvious (Weinschenk 1916).

E. Weinschenk did not give quote any literature in his manuals, which offended his colleagues. He did not use tables of the macroscopic identification characteristics of rocks. In the acknowledgements he only mentioned one person: his chief professor Friedrich August Rothpletz in Munich.

Weinschenk realised, that the older systematic of rocks was defective. A reassessment of the petrological terms had to follow the recognition of the characteristics of a natural system, which is based in chemical and physical laws, (the Streckeisen-diagram is deduced from that) which lead to uncertainty in the whole rock nomenclature (Fig. 2). This aroused several weighty objections: a conservative view, lead by the creator of the really petrography: Ferdinand Zirkel in Bonn. In those days petrography was viewed more out-of-date than palaeontology.

In his instruction for using the polarizing microscope E. Weinschenk mentioned that it was mainly used for examination of rocks—petrography—and that the enormous progress of petrography method(s), in the last third of the nineteenth century was solely due to microscopic examinations (Weinschenk 1912).

Examples of his literature of that time (German original, not translated)

Das Polarisationsmikroskop, 4. Auflage 1919; russisch von P. P. Sustschinsky, Moskau 1904.

Die gesteinsbildenden Mineralien, 3. Auflage 1915, englisch 1912.

Franz von Kobell's Lehrbuch der Mineralogie (gemeinsam mit K. Oebbeke), 7. Auflage 1913.

Anleitung zum Gebrauch des Polarisationsmikroskops, 3. Auflage.

Grundzüge der Gesteinskunde. Spezielle Gesteinskunde mit besonderer Berücksichtigung der geologischen Verhältnisse, 2. Auflage, 1907, englisch 1916.

Die gesteinsbildenden Mineralien, 2. Auflage 1907.

Petrographisches Vademekum: ein Hilfsbuch für Geologen, 2. Auflage 1907, russisch 1934.

Anleitung zum Gebrauch des Polarisationsmikroskops 1901, englisch 1912.

Die gesteinsbildenden Mineralien, 3. Auflage 1901.

There were not only friends amongst Ernst Weinschenks colleagues in Munich (Broili, v. Groth, Oebbeke, Weber), but also envious colleagues, who would not devote an obituary to him after his early death in 1921.This was made up for by G. Klemm (University of Darmstadt) as speaker for his friends 1925. The proverb is proving true: "Who is running ahead of his contemporaries, will rarely being appreciated of them."

Ernst Weinschenks merits

He has worked successfully in each former field in mineralogy. institutes, similar to the one in Munich, where the main care was towards petrography, also appeared in the universities of Bonn, Heidelberg, Freiburg and Greifswald at the end of the nineteenth century. Special petrographical institutes, separated from the mineralogical ones, existed only temporary at the universities at Strassburg (Alsace) under H. Rosenbusch and at Munich under E. Weinschenk.

The International Academic Committee of the University of Edinburgh nominated E. Weinschenk the Honorary British Academic Consul in 1912. He became a honorary member of the National Academy of Sciences at Cordoba (Argentina) in 1914.

Ernst Weinschenk occupied a special (extraordinary) professor chair for petrography and applied geology in Munich. No other university in Germany apart from Leipzig offered a similar position. In Munich petrography was assigned to the institute of mineralogy. Therefore Weinschenk only remained a professor a.o. throughout his life, despite of his unusual scientific merits and reputation. Maximilian Weber (1866–1944) was nominated as Weinschenks successor after his death in 1921 despite the fact that he was not and never became a scientist of Weinschenks importance (personal file, archives of Munich university).

The assignment of petrography (leader: extraordinary professor) to mineralogy remained in Munich until the retirement of Georg Fischer (1899–1984), who was a student of E. Weinschenk, in 1978. It was omitted after 78 years, when the institute of petrography was dissolved and a new, joint institute for mineralogy and petrography was created (Troll 1985). In 1923 Heinrich Laubmann has named a phosphate of yttrium and erbium as a new mineral weinschenkite from the ore mines of Auerbach in the Upper Pfalz. This mineral forms especially on material of the Maffai mine at Nitzlbuch near Auerbach white radial suns on brown limonitic ore. Formula: $(Y,Er)PO_4 \bullet 2H_2O$. The aggregates, otherwise crystalline, become more and more rough, when the content of erbium rises.

In 1897 Weinschenk named the new mineral batavite (after Castra Batava, the roman castle in Passau), which is a iron-free representative of the series of vermiculite. He wrote the first excursion guide to the Bavarian Forest in 1899 to mark the the congress of the German Geological Society in Munich.

Redwitzite is a specific magmatic rock, mineralogically based between granite and syenite, and therefore also called syenitegranite, but also known as "Wölsauer" or "Seussener syenite". It consists of less quartz but more biotite and "Hornblende" (amphibole) than common granite.

After a dispute, if this rock should not be better called "Wunsiedelite", it was named Redwitzite by Ernst Weinschenk in 1916. Weinschenk offered this name to the amateur geologist Oskar Gebhardt, who was from the Fichtelgebirge, in exchange for a few olivine basalt exponates, which Mr. Gebhardt had in his private collection. Larger deposits can be found in the area of Marktredwitz-Arzberg-Grafenreuth in the Fichtelgebirge in Northern Bavaria.

Acknowledgments I owe thanks to the Russian National library, the national library at Munich and the library of the German Museum at Munich for bibliographical references; to Dr. H Wurster in Passau for the transcription of the letter. I would like to thank the archives of the LMU Munich for letting me inspect the personal file of Weinschenk and for the copies of the promotion document, and two handwritten letters, which I will pass on the geological archive of the "Geologische Vereinigung" (Geological Association).Thanks to Thomas Hirche (Stuttgart) for his critical reviews of the manuscript and the translation. Also thanks to Mr. Turner (Zwiesel) and Ms. Waltraud Ertl for the review of the translation.

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