



Bridging the Centuries
1909–2009

Historical Gallery



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H i s t o r i c a l G a l l e r y

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AGROGEOLOGY IN THE GEOLOGICAL INSTITUTE OF HUNGARY

In the 1800's focused agrogeological research was started in Hungary, associated with the geological investigations of areas covered by young, loose sediments. Geological and geographical methods were used from the direction of parent material to soil.

In 1886 József Szabó urged in the Geological Association to complete a national soil survey in the framework of a geological mapping of the country. The "Agronom-geologic" (Agrogeology) Department of the Geological Institute of Hungary was established in 1891 with the leadership of Béla Inkey, who was a well known geologist and landowner. His co-worker became Péter Treitz, a teacher of the Agricultural University at Magyaróvár.

1891–1909

In the first year Inkey completed the first agrogeological map about the surroundings of Pusztaszentlőrinc in Pest County. On the map the superficial formations, the rock development of those and soils were also represented. In the following four years other agrogeological maps were created mainly on the Great Hungarian Plain, and later the work was extended to the other parts of the country. In 1897 Inkey resigned as head of department because of professional dissents, but agrogeological research was going on, more and more to the direction of soil survey separated from geology.



1909–1933

The turning point of the Hungarian agrogeological research was the I. International Agrogeological Conference held in 1909 in Budapest in which Inkey was the secretary. In this conference participating experts declared unequivocally: considering the mapping of a country priority must be given to overview map that should be published at small (ca. 1:200.000) scale. It should serve as the basis for following detailed mapping. This concept got fundamentally changed the work of the Agrogeological Department, since the compilation of the national pedological overview map was started. The original name of the Department was used still a long time, but the lowland mapping and pedological research were already separated in the Institute and they developed apart from each other.

1933–1949

In the 1930's a new 1:25 000-scale mapping program started under the leadership of Lajos Kreybig with detailed sample taking and thorough laboratory analysis of the collected samples. Data, at least from one exploration, could be used from every square kilometre of the country. These maps were neither clearly geological maps nor soil maps. They interpret pedological and landuse relations (i.e. cultivated land, temporary wet area, wetland, forest, lake, reed, river, settlement) together.

1949–1985

A new turning point was the recognition of József Sümeghy, who notes that pedology and geology have a number of common, still unresolved problems and geological survey is necessary in agricultural practice. He also called attention to the importance of groundwater in connection to soil and subsoil.

Following the work of Sümeghy, András Rónai became the new head of Lowland department. In 1964 he launched the mapping program of the Great Hungarian Plain foreseen for 20 years. One of its tasks was already the compilation of agrogeological map variants. He was mainly interested in the calcium-carbonate content and the permeability of the superficial formations.

In the 1970's and in the beginning of the 1980's the Regional Geological Services, with the leadership of Tibor Zentay, focused on the exploration and analysis of raw materials suitable for soil-melioration.

1985–

According to the new agrogeological research program of the Geological Institute of Hungary (started in 1986), agrogeology studies those geological characteristics and geological processes of near surface formations that have primordial importance for agricultural production, that influence the condition of the agricultural cultures, that provide information on the soil and parent rock constituents, on the location and quality of groundwater, the salt contents which are determined by groundwater movements, changes on the surface due to human and natural causes below the soil level. Therefore, agrogeology examines not only the surface but the complexity of near surface formations, the relations of the soil-parent rock-groundwater system, furthermore the changes of this system due to human intervention, as well as predicts the positive or damaging consequences leading from them.

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József SZABÓ (1822-1894)

Mining engineer, geologist, mineralogist, professor, member of the Academy of Science, word famous expert in rock-research

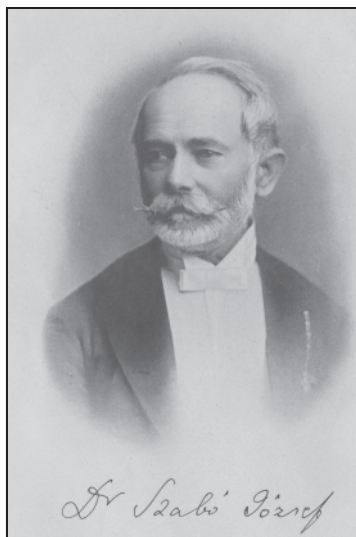
The first agrogeological map of scientific value was compiled by József Szabó. His work focused on the study of the geological setting and soil types of Békés and Csongrád counties and laid the foundation of agrogeological, pedological and lowland geological mapping in Hungary.

This study was not restricted namely to field observations, it included detailed field and laboratory analyses and sampling as well. The laboratory tests performed by János Ferenc, the associate of J. Szabó provide valuable results still today. One of the important aspects of their investigation is that beside studying different soils and sediments they extended their survey on examining subsurface aquifers as well. In existing wells they investigated the depth and chemical composition of groundwater and its action on soil development.

Contracted by the Hungarian Economic Association and published in 1861 this work is mentioned generally as a sole map. This map is though merely the annex of a book exceeding 100 pages (methodological work, pedological textbook, geological description and the characterisation of an area upon its field- and laboratory investigation together with its applied geological and agrogeological evaluation). The publishing was due to the recognition that “natural scientific reporting on soil and land types in general is one of the basic needs of an appropriately educated farmer acting by reason” (SZABÓ J. 1861).

The basis of the work is provided by the geological survey focused not merely on the soil but considering the subsoil and the geological profile as well completed by hydrogeological observations and examinations.

This first successful work was followed by two mapping studies. Chapter IX. of the Tokaj-Hegyalja Album contracted by the Tokaj-Hegyalja Viticulture Association and prepared in 1867 includes a map annex with detailed characterisation of the soils occurring in the region.



The third important work of J. Szabó related to agrogeological mapping is the description of the joined Heves and Külső Szolnok counties. Part II. presents the geological setting of the county. Like in previous works, beside the geological features he presents different soils as well and provides an annex demonstrating the superficial and near-surface young sediments and the soil types as well.

KUTI L. 2003: Szabó József, az agrogeológiai atyja. — „A legnagyobb magyar geológus” Szabó József emlékkönyv, pp. 83-90.

SZABÓ J. 1861: Geológiai viszonyok és talajnemek ismertetése. I. Békés és Csanád megye. — Magyar Gazdasági Egyesület.

Béla INKEY (1847-1921)

Béla Inkey was the first head of the Agrogeological Department (established in 1891) of the Geological Institute of Hungary. He launched the agrogeological mapping of Hungary making use of Prussian and Saxon experience, after he returned from his study tour from abroad and summarised his experiences in a report. He emphasised the importance of the geological basis to the knowledge of soil properties. He determined the methodology and guidelines of agrogeological mapping.



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Based on his observations during his study tour and his own farming experience he thought that agrogeological mapping of the country must have been started by the survey of large estates. The map of the entire country should have thus been established upon the new experience gained in this process.

After his fruitful study tour it is still 1891 when he performs the mapping of the first agrogeological sheet together with his recently appointed associate, Péter Treitz in the surroundings of Pusztaszentlőrinc in Pest county. The related report with map annex was already published next year entitled “Pedological mapping of the surroundings of Puszta-Szt. Lőrinc (Pest county)”.

The first map had been followed by several sheets processed in the Great- and Little Hungarian Plains before in 1895 Inkey recognised that the method they had used was wrong. After five years of work it became evident that the detailed survey of some large estates and the summary of the results are insufficient for completing the agrogeological map of the whole country. He realised that the first priority was the compilation of an overview map featuring all soil types occurring in the country and revealing all problems. Detailed survey can only be launched as soon as this procedure was finished.

Summarising his experience he submitted a memorandum to the Minister of Agriculture in which he emphasises the significance of overview maps and asks for permission to change the concept. However his request would not be appreciated and based on the proposal of the Directorate of the Geological Institute the minister rejected it. He insisted on following the original, Prussian concept further on. This decision exasperated Inkey so much that he resigned as head of department and retired to his estate in Vas county.

More than 10 years later came the confirmation of Inkey's views in a conference held in the Geological Institute. It was convened by its new director, Lajos Lóczy Senior. Inkey also attended as advisor and declared the need for compiling a national pedological overview map. The I. International Agrogeological Conference held in 1909 in Budapest in which Inkey was the secretary came to the same conclusion. In this conference the question of mapping scale was brought up and participating experts declared unequivocally: considering the mapping of a country priority must be given to overview map that should be published at small (ca. 1:200.000) scale. It should serve as the basis for following detailed mapping. Recognition of soil zonality and its general acceptance were major factors facilitating the approval of this view.

INKEY B. 1892: Jelentés a németországi agronom-geológiai felvételek szervezetéről.

– Magyar Kir. Földtani Intézet Évi Jelentése az 1891. évről

INKEY B. 1893: Tájékozódás az Alföld képződményeiben és talajviszonyaiban.

– A Magyar. Kr. Földtani Intézet Évi Jelentése az 1892. évről.

INKEY B. 1894: Pusztá-Szt. Lőrinc (Pest m.) vidékének talajterképezése. – A Magyar Kir. Földtani Intézet Évkönyve 10.

INKEY B. 1914: A magyarországi talajvizsgálat története. – M. Kir. Földtani Intézet, Budapest.

INKEY B. szerk. 1910: Az Első Nemzetközi Agrogeológiai Értekezlet munkálatai.

– M. Kir. Földtani Intézet, Budapest.

Peter TREITZ (1866–1935)

Peter Treitz is the founder of modern Hungarian soil geography and hereby of scientific soil science.

Peter Treitz was born in Kiszállás in 1866. He studied at Szeged, Prague and Vienna. He was qualified in 1890 at Magyaróvár. First he worked at the Experimental Station at Magyaróvár and after that he was colleague of Sándor Cserhádi. In 1891 he became employee of the Agrogeological Department (established in 1891) of the Geological Institute of Hungary.



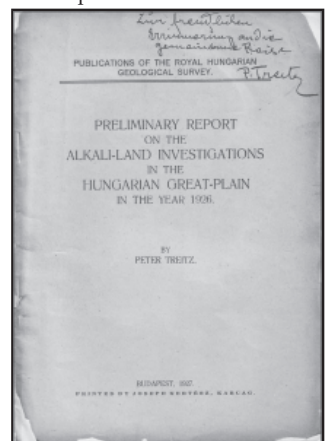
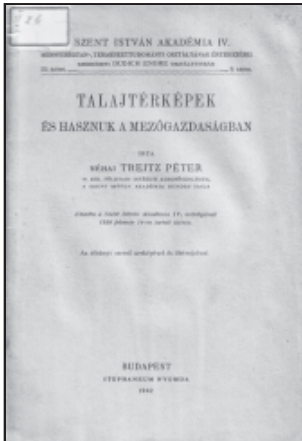
The founder of soil sciences – as independent discipline within natural sciences – **in Hungary**. Paralel with Dokuchaev, Hilgard, Ramann he discovered the soil geographical implication of zonality. With the application of this new theory, he draw country soil maps of Hungary.



He was the initiator and main actor of the first assembly of the world's soil scientists in Budapest. He represented Hungary in the conferences in Prague and in Stocholm and was a cofounder of the International Society of Soil Science founded on the conference of Rome. On the First International congress of Soil Science in 1927, he was elected for a honorary membership of the Society.

He was active on many fields of the soil science discipline. More than 100 original scientific presen-tation, popular papers, great number of soil maps contain his research results. Nearly half of his publications deal with

soil geography and soil mapping. His results in **soil salinity research** and in the **development of reclamation methods of saline and alkaline soils** are also well known and widely cited. Good examples of the applied pedological research are his work on the **filoxera – soil relationship**, or on the **microbiological simulation of soil fertility**.





For the acknowledgement of his scientific achievement he was elected for a member of the Szent István Academy.



A. M. KIR. FÜLDTANI INTÉZET NEPSZERŰ KIADVÁNYAI

MAGYARÁZÓ

A TOBBTERMELES SZŰZGALATÁBAN ÁLLÓ TALAJVIZSGÁLATOKHOZ.

ÍRTA:
TREITZ PÉTER

KIADVA
A. M. KIR. FÜLDÖVISELTÉNYI MINISZTERIUM FENNTARTÁSÁRA ALA
TÁRTOZÓ M. KIR. FÜLDTANI INTÉZET.
BUDAPEST, 1929.



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Elek 'SIGMOND (1873–1939)

“Sigmund is one of the founders of modern soil science. In Hungarian and international scientific life his invaluable merits are rightly remembered and appreciated...” „He is the Hungarian classic of soil science...”

Elek 'Sigmund (Alexius A. J. de 'Sigmund) was born in Kolozsvár (Transylvania) in 1873. He studied chemistry at the Technical University of Budapest, graduating with the degree of chemical engineer in 1895. He is qualified in 1998 by the University of Sciences in Kolozsvár as honorary lecturer in agricultural chemistry.

In 1899 'Sigmund became assistant chemist at the Experimental Plant Cultivation Station at Magyaróvár where his interest in soil problems was stimulated by his chief, S. Cserháti. He engaged in studying Hungarian salt affected soils and the methods of their utilization. In 1904 his book „Agricultural Chemistry” was published.

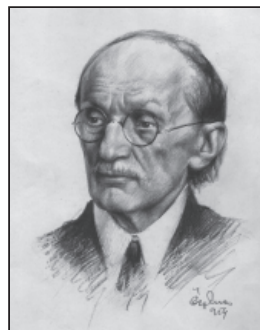
To gain experiences in agricultural and food industry he was sent abroad for a two years study tour (1906–1907). He visited agricultural institutes in Western Europe and in United States, and he studied in Egypt irrigation systems. As a first professor of the newly established Department of Agricultural and Food Chemistry within the Technical University (Budapest) he educated over three decades generation of chemical engineers for the agricultural chemical industry and forms around him the famous school of soil science.

100 years ago, the 1st International Congress on Agrogeology began its sessions in Budapest. This Conference was the start of a new epoch in the evolution of soil science. Soil scientist of Western Europe and USA have met here for the first time the results attained by the Russian school of soil



science. Among the invited and contributing 90 scientists, representing a dozen countries we find the name of Prof. 'Sigmund, who, conjointly with Prof. Stoklasa presented a paper entitled „Über die Bedeutung der chemischen Bodenanalysen im Gebiete der agrogeologischen Forschungen und der Bodenkartierung”.

Elek 'Sigmund suggested international cooperation for the investigation of soils. The International Commission on Chemical Soil Analysis was established in Stockholm



in 1910, and ‘Sigmond was elected president of this commission during the Fourth International Conference on Agrogeology in Rome. In the meantime he received a new office: president of the 5th, Alkali Soils Subcommittee, another important department of the International Soil Investigation Commission. As an acknowledgment of his successful international work he was elected, in Oxford in 1935, Honorary Member of International Soil Science Society, and Honorary President for life of Commission II. (Chemical) Commission of ISSS.

His most important scientific and practical work was in the research of alkali soils. His monography „Hungarian Alkali Soils and Their reclamation” was published by the Hungarian Academy of Sciences in 1923. A few years later it was translated into English and published by University of California (Berkeley) in 1927. He used the results of his scientific research in his practical work when, as the President of the State Central Soil Amelioration Committee, he organized and directed the first national soil amelioration action (1928-1933). In the course of this work about 16 000 acres of alkali land become arable soil. During this time he also performed the duties of the Director of the National Chemical Institute, and established laboratories in Budapest as well as in the country for investigation of soils.



In 1934 ‘Sigmond published his book „General Soil Science” in Hungarian in which he summarized the results of his investigations and his systematic classification of soils. This classification system of soils was set up according to their origin and other soil-forming factors (genetical and dynamical principles). This work was published in English under the title „The Principles of Soil Sciences”, London, 1938.)

‘Sigmond’s scientific activity was not confined to one particular field in soil science. His constructive research work was concerned with so many different topics (e.g. soil fertility, soil mineralogy, soil classification and mapping, soil physico-chemistry, soil physics etc.) that it is simply impossible to summarize.

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Imre TIMKÓ (1875–1940)

Imre Timkó was born on the 21st of October 1875 in the city of Ungvár. Before enrolling to university in Budapest, he attended primary and secondary school in his home town. Between 1896 and 1897 he was working as an intern at the Hungarian National Museum. Between 1897 and 1897 he was an assistant at the Budapest University. He has been appointed as royal geologist of the Hungarian Royal Institute of Geology, and was sent to Mosonmagyaróvár to study agrochemistry and soil science. He made a longer journey in Russian in 1908. In 1921 he became senior mining consultant, in 1933 economic senior consultant. He filled the director position of the Institute of Geology for a short period, before retiring. His works were published in Hungarian, German and French. Imre Timkó died on the 2nd of February in 1940.



Early works

In 1902 he was engaged in the agrogeological mapping of Nemesócsa, Aranyos, Marcelház and Martos. In the summer of the same year, the Ministry of Agriculture assigned him to undertake pioneer mapping works of the Ecsed marshland and its surrounding territory. In three years time, Timkó mapped an area of 97 km². Based on Timkó's work and the increased interest of marshlands, the Institute of Geology decided to survey the countries marshes and their peat amount.

In 1903 he was working in the Csallóköz, in 1904 in the Szigetköz and partly in the marshlands of the Hanság. In the same year he moved the focus of his work to Pest County, where he was conducting mapping work around Budapest and in the ranges of the Dunazug territory between 1904 and 1908. The first agrogeological map was published at that time (Horusitzky, Inkey and Timkó), however the methodology was not unified in every detail, so a committee of Timkó, Güll and László was set up to aim to finalize the methodology and editorial issues of the mapping works. Based on their recommendations, Timkó compiled his map of Érsekújvár and Komárom, which was accepted as the sampled that has to be followed in the future. In 1905, he undertook geological survey in the Pilis-Szentendre-Visegrád range, later on in the surroundings of Budapest, Gödöllő, Isaszeg and the Galga-Tápió watershed.

Study tours, Hungarian soil researchers and the international soil science society

During his visit in 1907 and 1908 he got familiar with the theses of the Dokutchaev school. With the supervision of Glinka, he did a longer study tour along the coastal area of the Black Sea and Poland. After returning, he was totally convinced that the Dokutchaev theory would be of great benefit to the deeper knowledge of Hungary's special soil cover. The row of the big international conferences has been started with

the first agrogeological conference held in Budapest in 1909. The conference was convoked by Lajos Lóczy – the director of the Institute of Geology – by the occasion of the 40th anniversary. This has been recommended by Peter Treitz and Imre Timkó. One of the conference's decree was that soil mapping in favourable to be accomplished allaround Europe, based on the their climate zonality. Based on this statement, soil mapping in the country began in 1911, with the contribution of Treitz and Ballenegger. In 1912 he mapped the Easter territories of the Transdanubian region, Veszprém, Tolna and Fejér County, and Pest-Pilis-Solt-Kiskun Counties. In the Northern part of the Hungary he undertook work in the Low Tatras, the Eastern part of the Big Fatra range, the Hungarian Ore Mountains, the Nógrád-Gömör hills, the Turóc-Garam watershed and the Liptó-Szepes upland. The draft version of his map appears in the Kogutowitz World Atlas in 1913. Mapping of Transsilvania began in 1914 and ended in 1918. Hungary's climate zonal soil map – edited by Treitz and Timkó – was published later on the same year.

Agrogeological mapping between 1919 and 1944

In the beginning of 1919, the Department of Agrogeology was relocated and reorganised as the National Institute of Soil Science of the Agricultural and Botanical Station. Timkó worked for the institute until it was closed two years after its opening. In 1926 the Ministry of Agriculture assigned him with the task of mapping and examining alkaline territories. The Great Hungarian Plain was subdivided into 8 regions, each mapping working group with the leadership of an agrogeologist, agrochemist or botanist was responsible for one of the territories. Within the frames of this programme, Timkó was mapping the Kiskunság and the Jászság.

The heritage of Imre Timkó

With the agrogeological mapping, he did pioneering and highly important work for the development of the country's climate zonal soil map. He contributed to the knowledge of the evolution and dynamics of alkaline and marshland soils. He assessed the possibility of amelioration and agricultural usage of alkaline soils. He reconstructed the development of the Nagy-Sárrét, and assessed the effects of marshland drainage on future soil development. He has been engaged in studying the role of loess deposits and red clays in soil evolution. He contributed to the researches aiming to establish the irrigation stations of the Great Hungarian Plain.



Besides his interest in natural sciences, Imre Timkó was an excellent photographer. Some of his pictures can still be found in the collection of the Hungarian Museum of Ethnography.

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Lajos KREYBIG (1879–1956)



Agrochemist, leader of the first national soil survey. His activity was focused on serving the practical purposes. He summarized the factors and principles of agro techniques and performed significant work on the subject of soil fertilization.

Family and education

Lajos KREYBIG was born in Nagyszében on December 23rd, 1879, and died in Budapest on June 21st, 1956. The family marked him out for military career. He finished his studies in 1901, but because of an accident his career had been modified. He had got his chemist diploma with award in 1912, at the University of Tech-

nology and a few years later he finished his doctoral thesis : “Catalytic oil whitening and oxidation”.

First experiences

In the First World War he served as an aerial reconnaissance, and utilized these experiences later in the soil survey. During the war he contributed in the establishment and management of the “Chinoin” gas grenade factory. After the Trianon peace-treaty he and his family settled down in Cserhát-surány (Nógrád county). He started studies in the potentials of chemistry in agricultural application. He made experiments on his own costs, in the topics of agrochemistry, biology and crop production, established a soil biological and bacteriological laboratory. This was the first soil biological laboratory for research in Hungary and in 1925 the Ministry of Agriculture certified it. He worked on soil nutrient-supply, focusing on the efficiency and effect of manure and fertilizers on crop production. He published his results and presented on many conferences.

He was assigned to lead the Soil Biological Laboratory of the Hungarian Geological Institute in 1930.

Regards of the Academy

In recognition of his work he became associate member of the Hungarian Academy of Sciences in 1952, and member in 1954.

Soil survey

In 1933 he initiated a national soil mapping project. It was carried out between 1933 and 1944 (1951) in several stages. In the fifties, when the action was successfully completed, Hungary was the first in the world to have such detailed (1:25 000)

soil information for the whole country. The aim of the soil survey was unique, being a „national, large-scale survey based on field and laboratory soil analyses and at the same time serving practical purposes” (Kreybig, 1937). As a result of the soil survey he delineated extended agricultural landscape units.

He performed significant work on the subject of soil fertilization. He published “Practical Fertilization” in 1951, and four years later his summarized researches were printed out under the title “Fertilization” (1955).

Selected publication

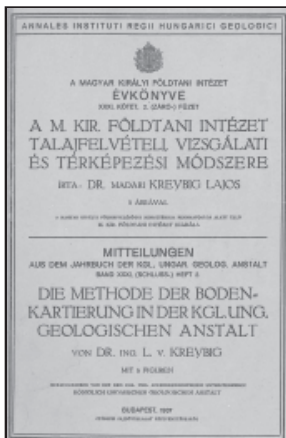
A talaj élete, javítása és trágyázása biológiai szempontból – Soil life, amelioration and fertilization in terms of biology (in Hungarian, Bp., 1928);

Die Bedingungen der Wirtschaftlichkeit der Hartdeldüngemittel (Berlin, 1930);

A Földtani Intézet talajfelvételi vizsgálati és térképezési módszere - Soil Analysis and Survey in the practice of the Geological Institute (in Hungarian, Bp., 1937);

Talajvizsgálatok szerepe a növénytermesztésben - Role of the soil analysis in crop production (in Hungarian, Debrecen, 1940);

Magyar tájak talajismereti és termelési technikai leírása I. rész. A Tiszántúl - Description of the Hungarian lanscape units, soil and agricultural production -Tisza Region (in Hungarian, Bp., 1944);



The place of birth: Nagyszeben (Hermannstadt or Sibiu) then and now (source: www.szeben.ro)

Mezőgazdasági természeti adottságaink -Natural endowments of Hungarian agriclutre (in Hungarian, Bp., 1946);

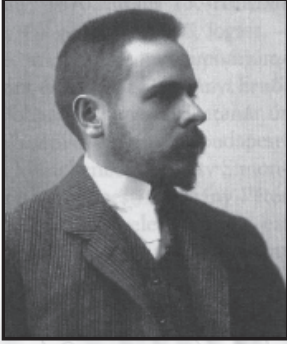
Gyakorlati trágyázástan – Practical fertilization (in Hungarian, Bp., 1951);

Az agrotechnika tényezői és irányelvei -Factors and principles of agrotechniques (in Hungarian, Bp., 1953);

Trágyázástan – Fertilization (in Hungarian, Bp., 1955).

Prepared by: Zsófia BAKACSI, László PÁSZTOR, Annamária LABORCZI, K. VÁLYI | Research Institute for Soil Science and Agricultural Chemistry of the HAS | H-1022 Herman Ottó u. 15. Budapest, Hungary | www.taki.iif.hu; www.mta-taki.hu

Róbert *BALLENEGGER* (1882–1969)



A young scientist at the birth of a new science

Hungary was at the end of an extraordinary development that lasted more than half a century. And he was a teacher of chemistry and physics graduated from the University of Budapest in 1904. And he was a native speaker of three languages but learnt three more during his education and a fourth one in the early years of his career. And he got an advanced degree in chemistry and worked as a chemist between 1905 and 1910. Then he got a job in the Royal Geological Institute of Hungary, Agroteology Department at age of 28 and a scientific career began.

1. CHEMIST FOR THE AGROGEOLOGY

Lead publications: – On the classification of soils. Budapest. 1913. 16 p. (in Hungarian)
– Über die chemische Zusammensetzung ungarischer Bodentypen. *Jung. Geol. R. Anst.* 1916. 596-614. 1917.

2. SYNTHESIS OF THE FIRST TEN YEARS

– The fertile land. *Ethika.* Budapest. 1921. 191 p. (in Hungarian)
– The nutritive salts of soil. *Herba.* 225-260; 372-378. 1921. (in Hungarian)
Field studies of Ballenegger between 1910 and 1916

3. IN ATTRACTION OF THE NEW SCIENCE

The researchers in the Royal Geological Institute of Hungary, Agroteology Department conducted their field work according to the resolution of the First International Congress of Agroteology, Budapest, Hungary, 1909 (climatic-zonal mapping of soils).

He was co-editor and co-author of the journal *Internationale Mitteilungen für Bodenkunde* (1911-1924).

In the International Society of Soil Science, he was member of the special commission I. (physical investigations), special commission II. (chemical investigations) where he also was vice-chair between 1927 and 1935 and special commission V. (soil mapping). See Figure 1.

He was the representative of Hungary in the executive panel of the International Society of Soil Science between 1930 and 1941. He was an active promoter of the foundation of an Institute of Soil Science in 1915-19 in Budapest. The failed initiative was used later to discredit him on a political basis. In his absence, he was assigned to be vice-chair of the 5th International Congress of Soil Science, Amsterdam, the Netherlands in 1950 as a sign of honour.

He led the Hungarian delegation to the 6th International Congress of Soil Science Paris, France in 1956 and that posed a new beginning for the soil scientists in the communist Hungary.

Figure 1

The panel of the special commission II (chemical investigations) of the International Soil Science Society. Standing: R. Ballenegger (Budapest), G. Wiener (Zurich) and B. Aarnio (Helsinki) sitting: D.J. Hissink (Groningen), 'Simond (Budapest) O. Lemmermann (Berlin) and J. Hendrick (Aberdeen) 1929



4. READER, PROFESSOR AND DEDICATED RESEARCHER OF SOIL SCIENCE

He got teaching position after 1919 in the ancestor institute of the University of Horticulture (now part of the Corvinus University) and he was head of the Department of Soil Science and Chemistry between 1939 and 1940 until his retirement. He was reactivated between 1945 and 1949. He was member of the editorial board of the Hungarian journal Agrochemistry and Soil Science (Agrokémia és Talajtan see in references) until his death (Figure 2)

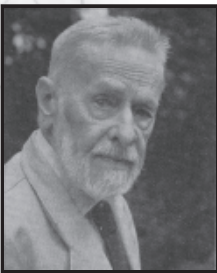


Figure 2
Ballenegger at
age of 85

Lead publications:

Les méthodes de la cartographie de sols alcalins (salins). C. R. Sous-Comm. Sols Alcalins de l'Association Internat. Sci Sol. Budapest. Vol. A. 9-12. 1929. /// Bodenkundliche Betrachtungen über den Obstbau Ungarns. Die Gartenbauwirtschaft., Berlin. (22) 18. 1938. /// Soil investigation methods (Ed.) Magy. Áll. Földtani Int. Budapest. 1944. 302 p. (in Hungarian with Mados L.) /// History of soil research in Hungary until 1944. Akadémiai Kiadó, Budapest. 1963. 318 p. (in Hungarian with Finály I.)

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// Máté 1967. Agrokémia és Talajtan. 16. 293-294. /// (Editorial) 1969. Agrokémia és Talajtan. 18. 341-348. /// Várallyay 1983. Agrokémia és Talajtan. 32. 609-610. /// Fekete 1983. Agrokémia és Talajtan. 32. 611-613. /// Szabolcs 1983. Agrokémia és Talajtan. 32. 614-622. /// Stefanovits 1983. Agrokémia és Talajtan. 32. 623-627. /// Hargitai 1983. Agrokémia és Talajtan. 32. 628-633. /// Rónai 1983. Agrokémia és Talajtan. 32. 634-636. (all in Hungarian)

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Dániel FEHÉR (1890-1955)

Professor Fehér („Weis“) is one of the classics of the Hungarian soilscience, an internationally recognised soilbiologist, botanist, plantphysiologist and microbiologist. Doctor (D.Sc.) of biological sciences (1952), corresponding member of Hungarian Academy of Sciences and the Finnish Scientific Body of Natural and Forest Sciences (1954). Founder of the „*Sopron School of Soil-biology*” at the University of Sopron, Hungary. His main book of the „*Soilbiology*” is an outstanding work, written about the (forest) soils and the affecting environmental factors of the soils, as living entities. **Professor Fehér** had a charismatic personality and his name is still living among students in several legends, called „fehériada”.



Curriculum vitae

Professor Dániel Fehér „the outstanding representative of Hungarian soilbiology” was born at 27th of October 1890 in Tekepuszta (Mórichida), in West Hungary. After the secondary school in Budapest, he was educated as M.Sc. *forest-engineer* in 1912 at the College of Mining and Forest Research in Selmechánya. Between 1913–1914 he was studying in the Berlin University, Germany.

In 1918, he become an *assistant professor* at the Department of Plant sciences in Selmechánya. Later the College was moving to Sopron, when he become finally a *lecturer of forest sciences* from 1926. He gained the Doctor of Philosophy (Ph.D.) level in Vienna from the chemical and plant sciences. He was founding and heading the botanical garden in Sopron and he was also the director of the Library between 1924-1930.

At the years of 1920–30 he was participating in several study trips in Norway, Finland, Switzerland, Germany and Italy. At 1930 he was the leader of a Lapland study trip for examining the forest ecosystems at that climate conditions. At 1936 he was leading a study trip also to East-Africa (Sudan) nominated by the French Academy of Sciences. Results and achievements of those study trips were internationally accepted and highly appreciated among the scientists in the World.

Dániel Fehér become a *dean at the Sopron University* between 1949–50. In 1951 He was creating and leading the Soil-biological Research Team of the Hungarian Academy of Sciences the „*Sopron School of Soil-biology*” in Sopron, Hungary. D.Sc. in biological sciences (1952), *corresponding member of Hung. Acad. Sci.* (H.A.S.) in 1954, and also the Natural and Forest Science Society of Finnland. Member of the Management Committee of Hungarian Microbiological Society (from 1951). Professor Dániel Fehér has died at 22th of February in 1955.

Scientific achievements:

Dániel Fehér was studying several disciplines, such as the forest plant sciences, the plant physiology and plant ecology...etc. before he find the most prominent field of his expertise the study on the ecophysiology of micro organisms in various soils and their interrelations with the plant nutrition. He was currently examining the chemical- and microbiological

composition of the soils (nitrogen-, humous-, phosphor- and potassium content), and its interrelations with the soil-pH, electric conductivity and the soil-life, soil carbon-dioxide (CO₂) release. He was studying the seasonal and spatial variability of the soils, initiated mainly by the climatic factors, and was searching the biological reasons and consequences of those ecological parameters. His main interest was to study the interrelations between forest soil characteristics and the tree-physiology on the background of Hungarian and international forests. He was also studying the effect of radiation on the soil-plant-microbe systems. He was the leader of the foundation of *Soil-biological Laboratorium in Balatonfüred* and the *Research Centrum of the Soil-life-sciences in Kisújszállás* (Hungary).

Dániel Febér had more than 200 published articles in Hungarian and in international journals, periodicals.

Main publications:

Dániel Febér has an outstanding scientific activity. Between 1928-1935 he was writing a 3-volumed *Forest Plant Sciences*, as the morphology, physiology and detailed plant-sciences (Sopron, 1929–1935). He was the author of 2 other important books (co-authored by István Vági): *Basics of organic chemistry*, and the *Basics of Soilsciences* (Sopron, 1930,1931). In 1933 he was publishing a book in German language: *Microbiology of forest soils* (Berlin, 1933).

As the result of his arid research he had a book in 1939 in French language, titled: *The microbiological research of arid soils. Across the Sahar* was published in Sopron (1943) and the *Soilbiological methods* (1944), furthermore *The examination methods of soil bacteria and fungi* (1953) book in Budapest.

His main book of the *Soilbiology* (Budapest, 1954) is being still nowadays an outstanding volume in the World.

It has more than 1200 pages and consisting of up to date results on the soilbiocenology and the impact of ecological factors of the soil-life.

How it happened?

Dániel Febér personality was such a charismatic one, that nobody could be non-influenced by him. It happened, that a Swedish guest has arrived to Sopron, whom he wanted to show the Asztalfő-forest. He thought to join the teaching and scientific activity and therefore invited the 12 students to accompany them for the next „forest living plant practical lessons” on Sunday together with his guest. The students were not welcoming the idea, so they asked from the secretariat, whether: „Is it potentially possible not to participating on the Sunday practical lesson?”. The answer was: „It is possible but They should not advise it!” Still the students was not accompanying the professors. After that *Dániel Febér* was holding all of the remaining lessons of the semester at outside sites of the forest, which needed to reach more than half a day on foot. The students were not complaining for that situations, but were participating in all. On the last lessons the professor was evaluating the situation. „Dear students, you were unwilling to accept my request, therefore I punished you. However you were all survived it, so we can now drink some beers of my own costs”.

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János DI GLÉRIA (1899-1976)

Chemical engineer, Professor of agricultural chemistry, Doctor of Agricultural Sciences; organized the first isotope laboratory for agricultural research and adapted new methods in soil chemistry in Hungary.



- Born in 1899 in Szombathely
- 1924 Graduated as chemical engineer at Technical University, Budapest
- 1924-26 Assistant at the University
- 1926 Doctor's degree at the Technical University; admitted at the Hungarian Engineers' and Architects' Association
- 1927 Got a job in the National Chemical Institute in Budapest
- 1930–31 Studied physical chemistry and colloid chemistry in Zurich Technical University on a scholarship
- Member of the International Society of Soil Science
- 1942 Organized the Agricultural Experimental Station at Budakeszi
- 1944 General director of Experimentation
- 1946 Professor of the University of Agricultural Sciences in Debrecen
- 1950 Researcher in the Institute of Agricultural Chemistry, Budapest
- 1955 Received the title "Doctor of Agricultural Sciences"
- 1955–59 Director of the Research Institute for Soil Science and Agricultural Chemistry (RISSAC)
- 1959– Scientific advisor in the RISSAC
- 1967–1970 Organized the isotope laboratory for the Soil Science Institute in Havana, Cuba

In the last two decades of the nineteenth century food market and generally the agricultural trade rapidly developed in Hungary. As a consequence the demand arose to guarantee the quality of the products and to obtain higher crop yield. This led to the establishment of agricultural chemical experimental stations all over in the country. In the capital and in countryside altogether 23 agricultural experimental stations worked with a staff of 176 persons by 1908. These developed further and new ones were established in the first two decades of the twentieth century with a centralized leadership of the Central Committee of Agricultural Experimentation and a central station, the National Chemical Institute in Budapest.

After the First World War and the brake-down of the Austro-Hungarian Empire Hungary faced new challenges. The reduction in territory and the demand of numerous refugees split the economic balance. The stabilization of the economy brought with it the restructuring of agriculture and industry. Moreover, the government supplied significant financial support to develop natural sciences and applied sciences too. All of these factors influenced the training of chemical engineers with an agricultural attitude.

As a consequence, there moved five chemical departments from the old building of the Technical University in the new building of chemical technology in the back-side of the new campus, and additionally four new chemical departments were instituted there. One of them was the Department of Agro-Chemical Technology.

János di Gleria's interest in chemistry developed at an early age; he studied chemistry at the Technical University in Budapest, and graduated as chemical engineer in 1924. With him more than 500 students studied in the Faculty of Chemical Engineering of the University that time.

Under the guidance of Elek 'Sigmond Professor of the Agro-Chemical Technology of the University he learnt the basic facts about agricultural chemistry and soil chemical analysis. He was highly influenced by his talented and enthusiastic professor. For him 'Sigmond was a mentor who was not only an outstanding scientist but also an inspiring person with great humanity: Elek 'Sigmond was one of the leading soil chemists of the 20th century, but also interested in other problems of chemistry with a great commitment to the Hungarian agricultural development. Di Gleria was very fortunate to be 'Sigmond's student at that time of prosperity, and greatly enjoyed and benefited from 'Sigmond's friendly and unauthoritarian style of research supervision. He remained in the university for two more years and worked there as an assistant lecturer.

In 1926 professor 'Sigmond accepted the directorship of the National Chemical Institute in Budapest, and di Gleria got a position there in 1927 after he gained his doctor's degree at the Technical University. He became later the head of the departments of Soil Science, Agricultural Chemistry and Plant Protection.

That time 'Sigmond introduced him both in the national and international public life of science to promote his scientific carrier. Di Gleria attended to the Hungarian Association of Civil Engineers and Architects, and, became the member of the International Society of Soil Science, where 'Sigmond led the Committee of Soil Chemistry and the Alkali Section. By these organizations possibilities were supplied for high level activity to many young soil scientist.

In the second quarter of the twentieth century a new scientific discipline the colloid chemistry appeared almost without any scientific background in Hungary. Beside his interest in basic and applied agrochemical research, di Gleria became more and more interested in the problems of colloids, especially in the context of the soil processes.

In 1927 the government established The National Council for Scholarship to provide financial support for the education and scientific development. Several thousands of young scientists gained the possibility to study the new theories and methods in their field of interest in western countries.

Di Gleria's work on soil chemistry induced him to study more closely the chemistry of colloids; as a researcher and 'Sigmund's close colleague he got a scholarship, and went to learn to one of the world famous soil colloid chemists: Professor G. Wigner to Zurich Technical University in 1930-31. It was here that he deepened his knowledge on the chemistry of soil colloid systems and drew his attention to the modern research methodology in soil physical-chemistry that was of great importance on his field of interest and further scientific carrier.

After coming back to Hungary he continued his work in the National Chemical Institute in Buda with extended research and developing activity. In the institute, as an experimental and product-controlling center for the country, thousands of samples of soils, crops and additional materials were analyzed yearly and besides the official duties new methods and several instruments and devices have been invented, as well as several scientific and educational studies were published.

He was very active and became an established member of the scientific community of the agricultural research, occupied a worthy position in the circle of scientists who worked on preparations for decision makers

Unfortunately, six years of the most active period of his life was largely overlapped with the 2nd world war, when conditions for research steadily and deeply deteriorated. However, in 1942 di Gleria was assigned to organize the Agricultural Experimental Station at Budakeszi where two years later he accepted the directorship. In 1944 he was assigned to General director of Agricultural Experimentation.

In 1946 he was appointed professor of the University of Agricultural Sciences and Head of the Department of Agricultural Chemistry in Debrecen, where he was teaching physical-chemistry and colloid chemistry. He held this position until the dissolution of the department in 1949. This period the Hungarian educational system was realigned according to the Soviet example. University research was de-emphasized and research institutes were established under the auspices of the Academy of Sciences. He was invited to join and accepted a research post in the newly established Agrochemical Research Institute in 1950 in Budapest. In 1952 he was awarded the title of "Doctor of Agricultural Sciences" (Scientific Qualification Committee). In 1954 he accepted the position of the head of the Institute. During his directorship the Hungarian Academy of Sciences became superintendent authority above the Institute in 1954. Di Gleria was scientifically very active and published a large number of experimental work in various fields of agricultural chemistry and soil physics. Furthermore he had a particular interest in and adapted a number of new research methods of studying especially soil reaction, ion absorption-desorption dynamics,

and the application of radioactive isotopes in agricultural research. As the director of the RISSAC he made every effort to focus the research on up-to-date fields of interest; he made important contributions to the condition of research as well inviting excellent collaborators to the staff, improving research facilities and creating vivid scientific public life. He also invented and organized the first isotope laboratory in the Hungarian agricultural research.

János di Gleria was technologically minded and he was always to the forefront in considering ways of applying the results of scientific research to agriculture. His contributions to soil physics and colloid chemistry, the theory of nutrient availability in plant nutrition, fertilization and research methodology – involved the use of radioactive isotopes - are recorded in a series of monographs, and in his many papers. Together with the colleagues A. Klimes-Szmik and M. Dvoracsek he wrote a book *Soil Physics and Colloid Chemistry* that was first published in 1957 and was also published in German (1962). His handbook *Agricultural Chemistry* was published in 1960; the books *Guidebook on Soil Cognition and Fertilization for Farmers* (first edition in 1958) and *Soil Analytical methods* (1962) were very popular in Hungary. The last book he edited was *Isotope Application in the Agricultural and Soil Research* in which he summarized also the results of the Hungarian research. Di Gleria worked in the editorial board of Hungarian academic journals such as *Agrokémia és Talajtan* and *Acta Agronomica Hungarica*.

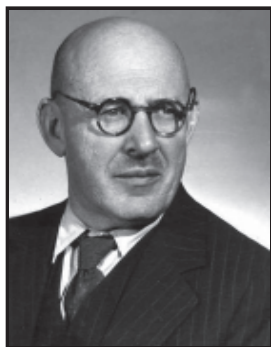
János di Gleria was a member of the permanent Central Committee for Soil Amelioration Section of Agricultural Sciences from 1931; foundation member of the Committee on Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences, and the first president of the Society for Soil Science in the Association of Hungarian Agricultural Science. He was the member of the International Society of Soil Science and the German Society of Soil Science. He was awarded the Outstanding Worker of Agriculture Prize and the Tessedik Commemorative Medal. He was the recipient of the Golden Medal of The Honor of Labour and the Commemorative Medal of the Foundation of Hungarian Society for Soil Science.



Publications of the Hungarian Association of Civil Engineers and Architects 1938.

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Sándor ARANY (1899–1984)



Chemical engineer, the Doctor of Agricultural Sciences, expert of the salt-affected soils, Kossuth prize and Governmental awarded professor. „Doctor Honoris Causa” on the Debrecen University of Agriculture Many of methods and quality indexes were worked out by him, for example such as the method for examine the plasticity of soils: upper limit of plasticity according to Arany, K_A .

Prof. Dr. Sándor Arany was born on 4th March 1899 in Mezőtúr (Hungary). He graduated from the University of Technical Sciences (Budapest) as chemical engineer in 1923 and began his work at the Agricultural Chemical Research Laboratory of Debrecen as food industry engineer. The Research Division of the Ministry of Agriculture entrusted him with the study of the Hortobágy soils. For the successful completion of the work, he joined the Department of 'Sigmond at the University of Technical Sciences (Budapest), where he obtained his doctor's degree in 1926. He continued his studies on the features of sodic soils in the USA at the Agricultural Research Station of the Berkeley University, as a guest researcher of W. P. Kelley.

He spent a year at the University of Bonn with H. Kappen in 1927, where he familiarized himself with the development of soil acidity and the methods of acidic soil amelioration. He published his results with E. 'Sigmond, S. Herke and W. P. Kelly. Returning to Debrecen, in 1932 he was appointed Head of the Chemistry Department of the Debrecen Academy of Economics. As a result of his hard work, the soil science and agricultural chemistry education of the institution was raised to a higher level. He taught soil science also at the István Tisza University in Debrecen as a honorary lecturer and from 1941 as a titular associate professor.

Following Hungary's Liberation in 1945 he organized the Soil Laboratory of the Soil Amelioration Company of the Trans-Tisza Region. When the National Institute for Agricultural Quality Testing was established, he became Head of the Soil Science Department in Debrecen. At this time he received the Doctor of Agricultural Sciences degree (DSc).

The above-mentioned steps in his scientific career all determined his further work and the basic areas of professional interest. His achievements in the study of salinisation/sodification processes, the reclamation and agricultural utilization of salt-affected soils made him well-known and brought world-wide recognition for Hungarian soil science. of the collected soil samples. In the sampling procedure emphasis was laid on the prin-



ciples that were applied by E. Sigmund during the map construction of sodic samples by the Duna-Tisza channel and by S. Arany in the Hortobágy region.

On the basis of the detailed soil sampling in Hortobágy he proved in 1926 that harmful salts can be eluviated by irrigation and drainage; and poorer quality parts of soil can be upgraded by applying an appropriate quantity of lime. In his monography on salt-affected soils of the Hortobágy he establishes that „the quality and agricultural use of salt-affected soils are determined by the quality and quantity of harmful salts, the depth of their occurrence beneath the soil surface, and by their movement downward or out of the soil as a consequence transportation due to the eluvating effect of precipitation.”

He concluded from his research results that those sodic parts of the Hortobágy where the upper layers show a lock of lime owing to eluvation could be upgraded by materials containing carbonic lime (ground carbonate lime, beet potash, and liming land).

Professor Arany investigated the chemical processes of soil reclamation made by beet potash minutely. In his studies on the lime and Mg content of salt-affected soils he rendered it probable that in some cases alkaliation is accompanied by the increase in Mg. According to his opinion the Ca/Mg ratio moves toward Ca in upgraded sodic soils and strongly acidic soils need not be improved neither by limestone rich in Mg nor by magnesia.

Many of his findings were in advance of his time and have not lost their topicality. Several methods and the quality index – which are still used at present in the examination and characterization of salt-affected soils – are connected to his name, such as the method for examining the plasticity of soils (upper limit of plasticity according to Arany, K_p), Na% and Mg ratio for describing the soluble salts of soils, sedimentation procedure for detering the ameliorant requirement, sodicity rate.

With the introduction of irrigation his focus was directed on studying processes in irrigated soils and their practical consequences. He took part in the soil scientific research prior to the establishment of the Tiszalök irrigation system, and elaborated a method for the chemical improvement of irrigation water with high sodium content. In addition to his research and teaching activities, he played a decisive role in international scientific circles. From 1926 he acted as secretary of the Subcommittee on Salt-affected Soils of the International Soil Science Society He was one of the organizers of the meeting of the Subcommittee on Salt-Affected Soils held in Budapest in 1929 and he also delivered a lecture. He participated in the 6th Congress of the International Soil Science Society in Paris in 1956. In the 1950's he was member of the Scientific Council of the Ministry of Agriculture, and president of the Soil Reclamation Thematic Group. For his achievements Prof. Arany was awarded the „Kossuth Prize” in 1958 and a Governmental Award in 1962, and he received the Treitz Medal.

He was conferred the title „Doctor Honoris Causa” by the Debrecen University of Agriculture.



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György VÁRALLYAY senior (1900–1954)



György Várallyay always aimed at simplicity and rationality. He developed several simple soil physical methods and calculation procedures for the characterization of the water management and moisture regime of soil, which were widely used by soil tillage and irrigation practice. The land use/fertilization advisory system based on soil analysis and small plot field experiments was his most important achievement, which made him a classic of Hungarian agrochemistry.

György Várallyay senior, was born on 1st January 1900 in Kisgeresd (West-Hungary) as the sixth child of a typical „progressive farmer” family. He was double talented: He inherited the love of land and agriculture from home, and he was sensitive for new achievements as a graduated chemical engineer. These two elements determined his scientific activities throughout his entire – unfortunately, short – life. He was a well-known and widely recognized representative of Hungarian agrochemistry. His modern and rational thinking and his significant achievements were both practically applicable and widely used in agricultural practice and contributed considerably to the development of agrochemistry.

He graduated from the Budapest Technical University in 1923 as chemical engineer. In 1928 he joined the Soil Science Department of the National Institute of Chemistry in Budapest. There at that time the 'Sigmond-school's young, enthusiastic and creative team (János di Gléria, Károly Páter, László Telegdy-Kováts, Sándor Schönfeld) formed a real „scientific school”, contributing to the development of soil chemistry. This period gave them modern concepts and helpful experiences for their further scientific activities.

György Várallyay was appointed Head of the Chemical Research Laboratory in Sopron (1930–1933), and later in Debrecen (1933–1936), where he had the opportunity to deal with the different agrochemical aspects of plant production under varying conditions. Soil came into the focus of his interest. He studied the soil properties determining soil fertility and land productivity, which served as a scientific basis for the land use and soil management advisory service. The interpretation, determination and evaluation of the „soluble” („available”) nutrient content of soil, became one of his main scientific topics and remained the priority topic of his research activities. During the Debrecen years – taking into consideration the special regional natural conditions – he carried out research and various experiments in the field of soil tillage, soil reclamation and irrigation.

In 1936 he returned to his native land, to North-Eastern Hungary, and was a scientific staff-member of the National Plant Production Research Institute (1936–1945), later the Filial Department of the Agrochemical Institute (1949–1950). Later he became head of the Department of Agrochemistry of the Agricultural Research Institute (1951–1954) up to his early death in 1954. Here, in addition to his contemporary scientific and laboratory research, he paid particular attention to the extension service, to the practical application of scientific

achievements. In the Institute there was a sharp, but promoting scientific discussion between the concepts of two scientific schools:

1. György Várallyay senior believed and propagated that the advisory service for rational plant nutrition (the pre-concept of site-specific precision plant production technology) must be based on experiments (pot and field experiments) and soil analyses. 2. Lajos Dworák was a fanatic pioneer of „modelling”, and tried to formulate and quantitatively describe the mathematical equation of soil fertility, and use it in the extension service.

His most significant scientific result was the development of an exact scientific basis for an up-to-date advisory system for harmonic, rational and efficient plant nutrition. Although he suggested to use the measured soluble („plant available”) nutrient content of soil for the determination of the optimal fertilizer doses, he always emphasized that the limit values for the characterization of soil’s nutrient supply (determined in different nutrient uptake simulating extractants) are never absolute and other characteristics; the nutrient requirement, nutrient uptake dynamics of the given plant; and numerous other factors must be taken into consideration when creating relative categories for the characterization of „nutrient supply status” of soils and in the determination of the optimum dose of fertilizers. György Várallyay senior developed a site- and plant-specific fertilization system, which was the conceptual basis of his up-to-date advisory systems for land use and soil management.

He helped the extension and realization of the given advices with other scientific results. Some examples: determination of the preconditions of efficient rock phosphate application; study of the efficiency of granular fertilizers; propagation of the importance of organic fertilizers and the extension of proper farmyard manure management and application technologies.

In the West-Hungarian region one of the most important limiting factors of soil fertility is strong acidity and high soil acidification.

Lime application reduces soil acidity and may prevent or moderate the acidification process. György Várallyay played a decisive role in the introduction of a state subsidized lime application action.

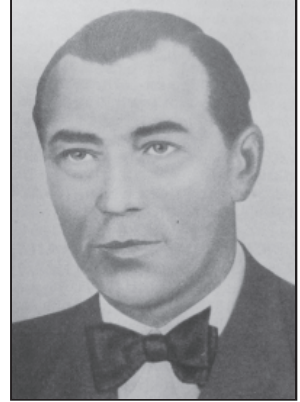
He compiled the 1:100 000 scale soil map of Győr–Sopron–Moson county. This (unfortunately not published) map could have served as a good basis for the regional planning of site-specific plant production. He took part in the compilation of the 1:25 000 Kreybig soil maps. He compiled the „Moson” map sheet with a detailed explanatory booklet. His activities in the compilation of large scale (1:5000, 1:10000) farm soil maps was also significant. The areal units of these maps are the agricultural fields. On the field maps the main soil characteristics determining soil fertility (soil structure, moisture supply, humus content and readily available N, P and K content) in the given area were indicated by column diagrams using his relative nutrient supply category system. For each field a schematic soil profile was given, showing the texture of the different soil layers, and the average depth of the groundwater table. Recommendations for land use and agrotechnics were also given on the maps. These maps successfully served the advisory service and provided valuable information to the large-scale genetic soil mapping system developed and introduced in the early sixties.

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László (KOTZMANN) MADOS

(1901-1945)

László Mados, born as László Kotzmann in the year 1901 in Beregszász was one of the scientists to establish the Hungarian Soil Science Society (HSSS). Besides being an active member of the social-scientific life, he played an essential role in the higher education of soil chemistry and soil science on a whole. His scientific and research interest focused on issues related to soil chemistry and soil classification.



The life of László (Kotzmann) Mados

László Mados was born on the 26th of February 1901 in the city of Beregszász. His home town was annexed to Ukraine after the Trianon Treaty in 1920.

After attending the Cadet School and the Military Academy, he came to Budapest. Mados studied on the former Technical University of Budapest, where he graduated as a chemical engineer on the Faculty of Chemical Engineering in 1926. He received technical doctorate title in 1929, and worked as an assistant professor at the Department of Agritechiques lead by Elek Sigmond. After the death of Profesor Sigmond in 1939, Mados was appointed for the professorship of soil science at the university. Besides being well-appreciated at the department by Professor Sigmond, he has been a permanent consultant engineer of the National Authority of Irrigation. He was well-known of his excellent talent in drawing and painting images for the numerous books, booklets and publications produced mutually with Professor Sigmond.

In 1934, he married Valéria Balázs, with whom he had an idillic life, which formed a strong and essential base for him to dvelve deep in the scientific issues of soil chemistry and calssification.

As an interruption of his university career, Mados spent two years in Egypt, and was based in Cairo at the Museum of Agriculture. His duty was to establish and organize the Department of Industrial Land Use and Soil Fertilization of the museum. During his visit in Egypt, he gained the opportunity to deeply examine the soils and the agriculture of the region. By the end of his staying, he established a permanent exhibition on the topics researched and examined by the department set off by him previously.

After returning, he received the private lecturer position in the field of „soil examination practices and their practical utilization”. After 1939, he took over the soil scientific education at the Chemical Engineering Faculty of the Technical University of Budapest.

As a reward for his work in the field of soil science, he was invited to work as a member of the Permanent Central Committee of Soil Remediation at the Ministry of Agriculture. Besides, he participated in the national mapping programme lead by the Hungarian National Institute of Geology, and became a permanent member of the Pedological Institute of the National Chamber of Agriculture.

In 1942, he has been appointed the professor of the Technical University of Budapest and the head of the independent Department of Soil Science.

He became a leader of the up-growing younger generation of soil scientist and with their help and support he played a key role in establishing the Hungarian Soil Science Society (HSSS) in 1943. He filled the presidential position until his tragical death.

Professor László Mados died on the 2nd of January in 1945 during the bombardment of Budapest in World War II.

The most important publications and scientific activity of László (Kotzmann) Mados

Firstly his scientific interest turned to the properties of the „agricultural land”, which manifested in a report titled „Examination types of different methods for humus identification” (1928). This topic had a follow-up research, as he dedicated his doctorate thesis to the description and analysis of soil humus material in 1929. Not only demonstrating his theoretical talent in this field, but his practical as well, he published a paper on farmyard management and production (1930). His co-operation with János Di Gléria resulted in the development of a method (1932) used to identify and measure the adsorption capacity and properties of various Hungarian soils.

As he was engaged in irrigation issues, he linked soil science and water, irrigation management with a topic pretty much important in agricultural practices on the Great Hungarian Plain. These researches were organised to find out more on the effect of increasing sodium-ion concentration in the groundwater. He conducted studies to determine the highest „non-harmful” concentration of sodium in the soil-water system (1932-1935). He never stopped to develop his method of quantifying the ion content in soils, and this insistent effort led to a practically highly important fact: Mados and his colleagues were able to establish a quantitative method (1942) – by implementing atomic absorption mass spectrophotometry – to identify the amount of carbonates for the remediation of acid soil.

In 1934, he has been asked by Professor Sigmund to contribute to his famous volume entitled „General Soil Science” with a subchapter on humus materials.

Besides his interest in organic soil chemistry, he has been working on soil classification and soil protection issues. One of his main work was done on the description of Chernozem soils evolved on loess parent material within the range of the great Hungarian Plain, and of the so called Rendzina soils (Leptosols in WRB) of the mountain areas. He gave a precise description of Rendzinas evolved either on limestone or dolomite parent rocks.

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Zoltán FEKETE (1911–1988)



Dr. Zoltán Fekete professor of soil science was teacher of thousands of horticultural engineers was the author of the first textbook of soil science after the Second World War. He propagated widely the results of soil science in university and popular presentations and papers.

Life:

Born in Zsarnóca 1911, died in Budapest in 1988.

- Both his father and grandfather members of the Hungarian Academy of Sciences
- Graduation as teacher of natural knowledge and chemistry, Pázmány Péter University of Sciences in 1935
- Doctor's degree of geology, mineralogy and chemistry in 1935
- Study of Lutheran Theology at Sopron College in 1946-1947

Research and teaching activity in the fields of soil science:

Soils of Orosháza, 1937

- Department of Mineralogy and Geology at Pázmány Péter University of Sciences Budapest, 1937
- Laboratory of Soils at Keszthely Agricultural College in 1941
- Organization of Department of Soil Science in 1942
- Participation in mapping of Hungarian soils – region of Kőszeg and Szombathely in 1942



- Honorary lecturer of the Hungarian Agricultural University Budapest in 1947
- Head of Laboratory of Soil Amelioration National Company at Keszthely from 1948
- Head of the Soil Science Department of the Horticultural Faculty Budapest from 1949
- Professor of Soil Science, 1950

- 300 papers including 21 books and textbooks. Very important educational activity
- Most important research fields: **soil protection, fertilization and manuring, improvement of sandy soils for horticultural production, decreasing erosion soil losses, soil evaluation**, etc.
- Important paper: “Complex soil protection on Hungary”
- Prepared the soil protection system of fruit- and grape-yards

Story:

Professor Zoltán Fekete could speak a lot of languages: Hungarian, Slovak, German, English, French, Flemish, Bulgarian, Russian and he could read in Latin, Greek and Hebrew. A foreign student told him at the exam: “Dear

Professor, my Hungarian is very bad and I am not able to express myself.” – “No problem” – told Professor Fekete:” you can use any language.”

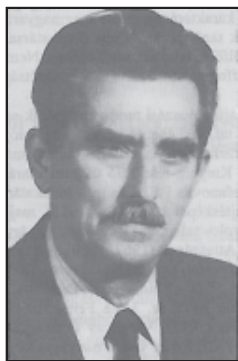


Social activity:

- Member of National Soil Protection Committee
- President of the Hungarian Society of Meteorology
- Vice President and Honorary President of the Hungarian Soil Science Society, and of the Society of Agricultural Sciences
- Tessedik Award, 1960
- Treitz Peter Award, 1979
- The highest secular position of the Lutheran Church from 1973

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László SZŰCS (1916-1996)



László Szűcs was taking part in formation of the Hungarian soil classification system, then its comparison to other international classification systems, and finding the conversion possibilities. Study of the chernozem soils was his main research topic. In that he prepared the candidate of sciences thesis and defended it in 1962. His name had become internationally known afterwards. He reported his results at home and international conferences. As member of some home scientific societies, committees and the International Soil Science Society he was carrying on public activities. Honoring of the scientific achievements he was awarded with the Silver Medal of the Work Order (1967), and Memorial Medal of Péter Treitz (1975).

László Szűcs was born in 5th March 1916 in Jászberény. There he finished his grammar and secondary schools. As chemist graduated from the Nature-Chemistry Branch at the Faculty of the Natural Sciences of the Royal Hungarian Pázmány Péter University in Budapest. In the first workplace he actively participated in field soil surveys, laboratory analytical and map making works of the country wide agricultural area mapping program in the 1: 25 000 scale initiated and coordinated by Lajos Kreybig.

He was one of the founders of the Research Institute for Soil Science and Agricultural Chemistry in 1949 surviving the Second World War and being war prisoner in the Soviet Union. He worked in the Institute till pension and as pensioner later. Dr Szűcs left a rich and significant life-work within 80 scientific papers, several book chapters, different purpose and scales soil maps, carefully edited project reports, artistically prepared soil monoliths, as well as in soil experts educated by him. He had an extreme stereographic ability for analyzing the landscape, soil and ecosystem view. He was able to remember for everything in decades what he had seen, met and experienced. His suggestive personality will remain in mind forever for that peoples who at list once made a soil survey, a field excursion, or a map editing work at the drawing table with him.

Dr. László Szűcs directed attention of his colleagues with his calm personality instead of loud behavior. With this character he had become teacher of colleagues, and visiting home as well as foreign soil scientists. His standards of values were the precision, accuracy and concreteness.

He was one of the emblematic members of the “great generation” of Kreybig’s soil mapping work. In 1941 he surveyed the sheets of Kürt, in 1942 of Tápiószele, Abony and Jászládány. Many other sheets of the Kreybig maps were edited and drawn by him as well. He prepared also the explanatory booklets of those sheets. He had deterministic role in making, editing and drawing the 1: 75 000 landscape

cultivation map designed by Kreybig. With Pál Stefanovits and other colleagues he prepared the genetic soil map of Hungary in the scale of 1: 200 000 (1955), and 1: 500 000 (1960). Beside this he was the soil scientific author of different atlases such like the Climate Atlas (1960), the National Atlas (1967), and the Regional Atlas of Hungary (1974). In the last he wrote the soil scientific part of several planning-economic zones as Central-, North-Hungary, North-Lowland, South-Lowland, North-Transdanubia, South-Transdanubia districts. Together with Ferenc Máté, and with György Várallyay he constructed the bonitation map of Hungary (1975), and the new 1: 100 000 scale soil map of Hungary (1978).

He participated in working out the methodology of farm mapping on the bases of genetic soil classification. Without his experiences in soil science, survey and mapping such maps as “Soil factors determining the agro-ecological potential of Hungary” (1980), “Soil water management categories of Hungarian soils and the map of soil water properties (1:100 000)”, and “Main substance regime types of Hungarian soils” (1981) would hardly be created. The printed Agro-topographic map was the synthesis of these maps and Dr. Szűcs considered that as the main work in his life.

He wrote excellent, informative and descriptive texts about soils in several monographs Lowland of Tisza (Tiszai Alföld), Tisza valley (Tiszavölgy), Open Alluvium of the Borsod Region (Borsodi nyílt ártér), Nagykunság, Loess terrace of Szolnok (Szolnoki löszhát), Loess terrace of the South-Trans-Tisza region (Dél-Tiszántúli löszhát), Territory along the river Maros (Marosmente), Lowland of the river Danube (Dunai Alföld), Mezőföld, Basin of the river Marcal (Marcal-medence).

In 1986 Dr. Szűcs got an invitation to prepare soil description of 230 geographical regions for the monograph of “Cadastre of Small-regions in Hungary”, but he did not accept that. Instead of acceptance he said: “My young colleague will do that because he can”. Such focusing to relevant facts was a very personal characteristic of Dr. Szűcs or Uncle Laci (Laci bácsi) for the young fellow. He promised his supervision during the work. The success of the monograph verified the right judgment of “Laci bácsi”. Address of Dr. Szűcs was “Laci bácsi” among young fellows in the Institute and he was not only honored but also loved at the same time. When a question was raised about soils by somebody the reply started with as follows: “You know small pal” then survey notebooks, handwritten reports, notebook of analytical results, published papers, books and maps come out from the office’s cabinet after each other. More and more details opened up during the answer of “Laci bácsi”. His colleagues are keeping memory of these personal-style teaching performances of László Szűcs.

Moreover, staff members and visitors of the Institute for Soil Science and Agricultural Chemistry every day meet with the beautiful and expressive series of soil monoliths representing the main soil types of Hungary. The series of monoliths praises extraordinary soil survey knowledge and artistic preparatory ability of Dr. Szűcs. Consequently everyone can establish that Dr. László Szűcs is still an active teacher of soil science.

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János SARKADI (1920-2006)



Chemical engineer, the doctor of agricultural sciences, emeritus head of department of the Research Institute for Soil Science and Agricultural Chemistry of the HAS, honorary professor of the University of Pannonia Georgikon Faculty of Agriculture in Keszthely, laureate scientific researcher by Eötvös József Girdle

János Sarkadi got hold of the soil science basic knowledge on the lectures of László Mados, but he engaged in the Kreybig's soil mapping works when he was senior in the University. After graduated in 1942 as chemical engineer started his scientific career in the Soil Science Department of the Hungarian Royal Geological Institute. He had significant function in the foundation of the Agrochemical Institute of Agricultural Ministry as the predecessor of the Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences, where until 1989 he worked as Head of Agricultural Chemistry Department and led the soil fertility, fertilizing, agro chemistry and nutrition researches.

In the beginning he worked in analytical and methodology researches and he retained this interesting on the whole career. He deal with soil- and plant analysis mainly, accordingly the in the first few years he developed the modern analytical methods of P-definition under direction of Endrédi. Later he suggested methods of organic matter and easily soluble P- and K-content definition of soil for initiation, what are in use until nowadays in some Hungarian agrochemical laboratories. By right of spot and filed fertilizer experiments he and his colleges worked out a suggestion for the limit value of soil PK supplying.

Further on he was interested in fertilizing and nutrition of the cultivated plants. Under the direction of Lajos Kreybig he examined the different manure treatments and criticized them at the first time, later he published several article about the topic of humus and organic matter of soils, or rather organic manure. As he known better and better the problems of agriculture, the international trends and the century demands his interesting oriented to the fertilizing problems and its solves in this way shortly he led the research and developments of these problems and the fertilizing experiments what was ran in the Institute.

In home circumstances his work was pioneer in the topic of getting into shape the methods of modern field and pot fertilizer experiments, namely the arrangement of parcels, valuation by biometrics, and sampling methods of soil and plant. By the experiments and researches he and his colleges contributed to the dynamically growing of fertilizer consumption in the late fifties and in sixties.



In the beginning fifties there was an public opinion that under Hungarian soil and weather conditions could not make up for manure with fertilizes only, and only the fertilizers can not be efficient. But the precision manure and fertilizer long-term experiments what was led by Sarkadi showed else, so he confronted by the standpoint of great majority. In the beginning eighties the over fertilizing was the general, so he was up against the trends again, because he attracted the attention about the increased risk of symptom and the harmful effects, confirmed by the long-term fertilizing experiments data.

János Sarkadi set a whole researcher generation going on the scientific field. In the „Sarkadi School” there were not false authoritarian relations, only informal and free discussions, what was the best for advances of mind, motivation of other thinking. He was never rigorous with his employees, and what is more he was forgiving about the ordinary caducity. That was a honourable mention when he sad „Not so bad!” for a well did work.

His researcher quality was characterized by the demanding and the persistent scepticism. As a results of these his researches and experiments were considered authentic and responsible. His precision was typified by that he necessitated his dispute partners to confirm all of their revelations almost in all times. István Láng has remembered to him: „In the beginning of my researcher career my colleges said that János Sarkadi is a very critical individuality and in methodological questions he is extremely demanding. He was a little bit a „bogey-man” ahead of young researchers, who always ask hard questions, tell of our research conceptions, correct our manuscripts, etc. Comparatively within a short time we realized that is not an end in himself heckling, that is an naturally accompanying things of the high quality scientific researches, the precondition of the competitiveness. It was became clear when in the middle of sixties there were several opportunity to accompany on international conferences. It was cleared up that his high level demanding, in point of fact the international gage of soil scientific.”

It is need to refer about his scientific organizer activity. He was member of the Committee on Soil Science and Agricultural Chemistry of the HAS, the editor committee of the Agrochemistry and Soil Science periodical, contributed in the work of FAO Trace Element Network Analytical Workgroup and in the work of management of the Hungarian Soil Science Society of Association of Hungarian Agrosiences. He was participant in all of solutions of nationwide momentous scientific and practical tasks (K-9 Soil-fertility, setting of National Long-term Fertilizing Experiments, ÖKOPOT, Biomass Program, etc.). Under his 50 years career he wrote more than 150 scientific and popularise article and he gave a lot of lectures in international conferences which were successful at all times.



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István SZABOLCS (1924–1997)



Prof. Szabolcs was well-known all over the World among pedologists, agrochemists, agroecologists and related scientists of his broad and continuously updated knowledge, brilliant memory and logical thinking, creativity, and unbelievable enthusiasm for his subject and for research. During his career he brought an almost missionary zeal to his work in soil science and especially in the field of salt affected soils.

István Szabolcs was born in Túrkeve, Hungary, in 1924. He graduated from the Debrecen University of Sciences with a PhD in Chemistry in 1948. He obtained the CSc (Candidate of Science) degree in Moscow, USSR and DSc (Doctor of Science) degree in Budapest in 1968 based upon his monographies „Salt-affected soils in the Hortobágy region (Hungary)” and „The influence of water regularities and irrigation on the soil processes in the Transtisza region”, respectively.

Following two years' service as deputy director at the Research Institute of Irrigation (Szarvas) (1953–1954) he was appointed deputy director (1954–1959) and director (1959–1981) of the Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences, Budapest. After his 21-year directorship he remained scientific adviser of the Institute until his death. He was appointed professor of soil science at the Budapest Eötvös University in 1968.

His main field of interest was the development, regime, classification, mapping, utilization and amelioration of salt-affected soils. He defined, described, characterized and quantified the primary and secondary salt accumulation processes; the mechanisms of phase interactions under saline and/or alkali conditions, the formation of „solonetzes” and „solods”; the human-induced changes in salinization/alkalization/sodification processes. He introduced such important terms as: secondary salinization; critical depth of groundwater table; potential salt affected soils. With his team he elaborated a comprehensive soil survey–analysis–mapping–monitoring system for the prediction and prevention of salinization/alkalization processes which was efficiently used not only in the Hungarian Lowland and the Carpathian Basin, but in many other countries with similar natural conditions as well. He developed a new classification system for salt-affected soils and prepared their maps for Hungary (1:500 000) and for Europe (1:5 M). He coordinated the project „World Map of Salt-Affected Soils”.

In the early sixties he was the main promoter of large-scale genetic soil mapping in Hungary and edited the Hungarian handbook for this programme. He took an active part in the Desertification Assessment UNEP Programme; collaborated with IAEA (International Atomic Energy Agency) for five years in isotope tracer applications in soil science

and agrochemistry; and in recent years in the various „post-Rio” international projects of soil resilience and sustainable land use.

Prof. Szabolcs published 17 books and more than 630 papers in scientific journals in Hungary and abroad. His monographies on salt-affected soils („European Solonetz Soils and their Reclamation”, Akadémiai Kiadó, Budapest, 1971; „Salt Affected Soils in Europe”, Martinus Nijhoff, The Hague - RISSAC, Budapest, 1974; „Modelling of Soil Salinization and Alkalinization”, *Agrokémia és Talajtan*, Tom. 28. Suppl., 1979; „Review of Research on Salt-Affected Soils”, UNESCO, Paris, 1979; „Salt-Affected Soils” CRC Press, Inc., Boca Raton, USA, 1989) are well-known all over the World.

In 1964 he organized the International Symposium on Sodic Soils in Hungary. This meeting, with the participation of top-experts on salinity/alkalinity from all continents, was a real breakthrough on the „iron curtain” and – after a long time – gave opportunity for direct dialogues and discussions between the various scientific schools on salt-affected soils.

The success of the Symposium was one of the reasons of the re-establishment of the Alkali Subcommittee of ISSS during the 8th Congress of ISSS (Bucharest, 1964). Prof. Szabolcs was appointed Chairman of the reactivated Subcommittee on Salt Affected Soils of the ISSS and he fulfilled this task until 1982. During (and after) this time he initiated and organized numerous symposiums and scientific meetings (Budapest, Yerevan, Cairo, Novi Sad, Osijek etc.) and the Subcommittee was one of the most active groups of ISSS. In 1974 (10th ISSS Congress, Moscow) he was elected Deputy Secretary General of ISSS. He was re-elected for this position at the 11th (Edmonton, Canada, 1978), 12th (New Delhi, India, 1982) and 13th (Hamburg, Germany, 1986) ISSS Congresses. At the 11th Congress (Kyoto, Japan, 1990) he was elected Honorary Member of ISSS. Dr. Szabolcs participated in all ISSS Congresses from 1956 and became a decisive personality of ISSS. He played important roles in other international organizations (UNESCO, UNEP, CICRA, CIEC etc.) as well. He was the Director of the International Post-graduate Course on Salinity and Alkalinity (Budapest, 1973); promoter of the Indo-Hungarian Seminars on the Management of Salt Affected Soils (Karnal, India, 1977; Budapest, Hungary, 1981); FAO consultant at the Chambal Project (Rajasthan, India, 1969), IIASA consultant in Laxenburg (1982); UNEP consultant in the 1985 Planning Commission Meeting; and invited lecturer in many countries (Ghana and Nigeria, 1969; Tunisia, Kenya, Tanzania, Ethiopia and Sudan, 1974; Iraq, 1979; Tunisia, 1980, 1982).

Prof. Szabolcs was President of the Hungarian Soil Science Society between 1970 and 1990, and after his two decades' efficient service he was elected Honorary President. He was honorary member of the Indian, Soviet, Russian, Bulgarian and Rumanian soil science societies.

From 1960 he was editor-in-chief of the journal „*Agrokémia és Talajtan*” and he was member of the editorial boards *Acta Agronomica Hungarica*; *Agrochimica*, *Geoderma*, *International Journal of Tropical Agriculture*, *Soil Survey and Land Evaluation*. For his achievements Prof. Szabolcs received two Governmental Awards, the „Tessedik Gold Medal”, the „Treitz Medal”. In 1996 he was awarded the „Dokuchaev Gold Medal”, the highest award of the Russian Soil Science Society.

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László HARGITAI (1930-1996)



Organic matter and humus research, optical examinations of humus matters. Nitrogen forms, and their roles in the effect of organic and humus matters. Peat research, differential peat utilization, peats in horticultural cultivation. Role of organic and humus matters in environmental protection, environmental capacity in soils. Polyfunctionality and biological activity of humus matters in cultivation of plants, in medicine, in environmental protection.



Education, studies:

Bonyhád – primary school

Budapest – Lutheran Grammar School on Fásor – final examination

Faculty of Science Eötvös Lóránd University – degree in chemistry



Place of employment, positions:

1952 – Gödöllő - University of Agriculture, Department of Soil Science
- assistant lecturer

1958 – Keszthely – Agricultural College
- assistant professor

1967 – College for Horticulture – associate professor

1977 – University of Horticulture – full professor, head of department

1995 – Professor Emeritus

Scientific degree: 1960. CSc | 1984. DSc

Teaching:

- ◆ Excellent, popular lecturer.
- ◆ Magister Optimus award on 4 occasions by the students
- ◆ Introduction of new subjects:
- ◆ Environmental protection, Soil biochemistry, Soil types of the World
- ◆ Head of PhD programme



Memberships in scientific societies:

- 1968. Hungarian Association of Agricultural Sciences (HAAS) Society of Soil Sciences - Soil Chemistry Section, chairman
- 1972. Society of Soil Sciences, vice-president
- 1972. Hungarian Peat Society, Peatchemistry Section, chairman
- 1978. Hungarian Peat Society, vice-president
- 1963. International Soil Science Society
- 1963. International Humic Substances Society
- 1973. CIEC
- 1982. International Peat Society
- 1984. Peatchemistry Section, chairman

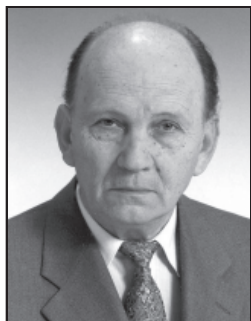
Honours:

- ♦ University of Virginia (1975)
- ♦ FAO, UNDP – Genf (1975)
- ♦ Hungarian Association of Agricultural Sciences (1968)
- ♦ Academy Award, Hungarian Academy of Sciences (1981)
- ♦ Award for Agricultural development (1986)
- ♦ Award for Achievements in Environmental Protection (1988)



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György FILEP (1932–2003)



György Filep left behind a monumental life-work, unforgettable memories, close collegial and friendly relationships. His pretentiousness, accuracy, precision, professional substantiality and diligence; his conscientiousness, morality and ethical purity are exemplary. These have made him a reputation as an internationally well-known and recognized soil chemist.

Prof. György Filep was born on 29 May, 1932 in Császló (Hungary). He graduated from the Faculty of Natural Sciences of the Kossuth Lajos University (Debrecen) with a diploma in chemistry and physics in 1954. Later he obtained an diploma in analytical chemistry at the Faculty of Chemical Engineering of the Budapest Technical University.

From 1954 to 1962 he worked in Debrecen in the Soil Science Department of the National Institute for Agricultural Quality Testing (between 1970 and 1973 he was Head of the Department), and between 1963 and 1969 in Nyíregyháza in the Central Laboratory of the Nyírség Agricultural Research Institute. He was lecturer (from 1974), professor (1981), Head of Department (up to 1997) and later emeritus research professor of the Soil Science and Micobiology Department of the Debrecen Agricultural University.

His main research topics are as follows: description of soil chemical equilibriums and transport processes in soils; development of the scientific basis of soil degradation–soil amelioration; study of the interrelationships between soil and environmental factors. His internationally esteemed new research results were obtained in the following fields: thermodynamic evaluation and quantitative characterization of the dynamism of ion exchange processes in soils and the related energy changes; development of the „colloid model” of surface reactions between the solid and liquid phase of soil; further development of chemical characteristics of salt-affected soils (salt content, ESP, SAR, sodicity index); elaboration of a comprehensive irrigation water evaluation system; contemporary evaluation of the mechanism of soil acidification processes and the buffer capacity of soil, and the elaboration of a calculation procedure for determining lime dose requirement; formulation of a simple model for the estimation of the fixation of pollutants and the leaching risk.

He initiated theoretical researches for the study of soil–micropollutant relationships. He developed a number of new procedures and evaluation methods, among these: precision of the Sephadex-gel chromatographic fractionation of humus extracts and the characterization and measurement of the different humus fractions; rapid determination of the potentially mineralizable N reserve of soil; development of the methodology of soil column experiments for the study of leaching processes and ion exchange; new evaluation method for the characterization of the buffer capacity of soil.

He received the Doctor of Sciences (DSc) degree in 1980 on the basis of his thesis

entitled „Study of the cation exchange and salt leaching in soils”. In 1999 he was nominated for the Correspondent Membership of the Hungarian Academy of Sciences.

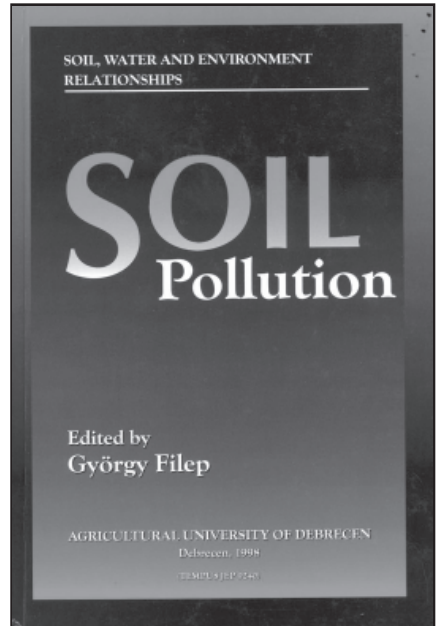
His books („Talajkémia”, „Soil Chemistry. Processes and Constituents”) are the basic works in the field of soil chemistry. He was co-author of the book „Talajtan” (Soil Science) with Pál Stefanovits and György Füleky. In addition to these he published his research results in 5 university lecture notes, 9 book chapters and 150 scientific papers. He was the Editor of the Seminar proceedings: „Land Use and Soil Management”, 1997; and „Soil Pollution”, 1998.

His character was that of a typical professor. He enthusiastically engaged himself in various specialized university educations on different levels. He held lectures for hundreds of students on modern soil science, agrochemistry, land use, soil amelioration and soil conservation. He was the supervisor of numerous diploma dissertations, university doctor, CSc and PhD theses. He was an outstanding creator and coordinator of the modern Hungarian scientific school of soil chemistry.

He played an important role for decades in the scientific life of Hungary. He was member (from 1975), vice president (from 1994) of the Soil Science and Agrochemistry Committee of the Hungarian Academy of Sciences, and acted as Doctor representative in the Section of Agricultural Sciences of the Hungarian Academy of Sciences from 1994 to 2000. He undertook many tasks and positions in the Regional Committee of the Hungarian Academy of Sciences in Debrecen. He took active part in the activities of the Doctor Council, Scientific Council and Habilitation Council of the Debrecen University of Agricultural Sciences, and later in the Centre for Agricultural Sciences of the Debrecen University. He was member of the Presidium of the Hungarian Soil Science Society, member of the International Union of Soil Sciences (IUSS), the International Soil Tillage Organization (ISTRO), the European Society of Agronomy (ESA) and the Hungarian National Committee of the International Humic Substances Society (IHSS).

He was member of the Editorial Board of the journal „Agrokémia és Talajtan” (Agrochemistry and Soil Science) as a high-standard author, reviewer and conceptual colleague.

For his education and research achievements he received many awards, among others, the „Arany Sándor Prize” in 1995, the Széchenyi Professor Grant in 1998, Darányi Ignác Prize in 2001, Treitz Medal in 2002.



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KREYBIG–soil survey 1933–1944 (1951)

Before

A great amount of geographical and soil information is available in Hungary due to agrogeological surveys conducted in the past 150 years. The aim and method of the consecutive surveys differed, and the different aims laid the emphasis on different soil characteristics. The first national soil mapping program was initiated and led by Lajos KREYBIG, based on field and laboratory soil analysis serving practical purposes. The preparation of the maps and the connecting explanatory notes started in 1933 and ended in 1944, the replacement of the sheets destroyed during the war ended in 1951. The main experts of the survey and the laboratory works were: Lajos KREYBIG (leader of the survey), Endre ENDRÉDY (co-leader of the survey), József BABARCZY, Róbert BALLANEGGER, György BUDAY, János DI GLÉRIA, Gyula ÉBÉNYI, Ferenc HAN, László MADOS (KOTZMANN), Károly SÍK, László TEÖREK, Endre WITKOVSZKY and Jenő ZAKARIÁS.



The survey

The so-called “Kreybig-survey” was carried out under the leadership of the Soil Department of the Royal Hungarian Geological Institute based on topographical map sheets. A surveyor with routine, with the help of two assistants could conduct the survey of a sheet in six weeks time in a period from May to November. The survey was carried out with soil pits and boreholes, some of which were deepened to 10 m or to the groundwater level. Three basic types of the observation sites can be distinguished based on the survey methodology. The most detailed point data are the “representative sites”, localized on manuscript map sheets, examined *in situ*, and sampled for laboratory analysis (approx. 30–110 points per sheet). The “observed sites” were examined *in situ*, with description in the explanatory notes, but without laboratory analysis (approx. 40–300 points per sheet). The “delineator sites”

were examined *in situ*, they have not got description, and used for soil patch delineation purpose only (approx. 100-1500 points per sheet).

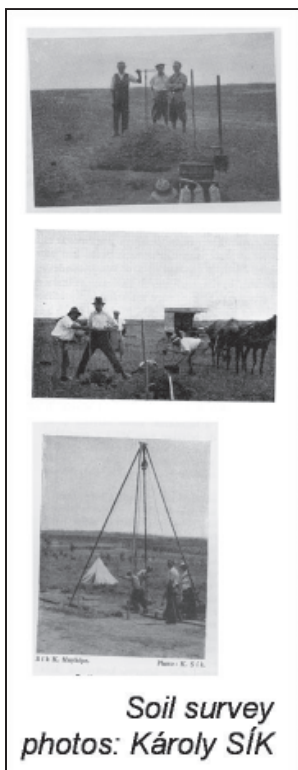
On the mounted topographic map sheets prepared for field survey, the surveyors indicated the location of boreholes, their identification code number and characteristics, making a distinction between the boreholes characteristic of the area and other boreholes occurring in the mapping unit. It was also distinguished which sites were examined *in situ*, described or were sampled for laboratory analysis.

The survey sheets are 1:25 000 scale mounted topographic maps (area: 25 000 ha), which indicate field observations and marks, the boreholes are shown, indicating their original location and category. Thematic resolution of the sheets can be different, depends on the period of the survey (financial opportunities were limited in the latest period of the survey), the geographical conditions and the surveyor's habit.

After

The Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences is the preserver of the Kreybig archive, and at the same time its user, as these maps were utilized in the course of the preparation of regional scale maps (1:200 000 scale „Soil Map of Hungary” (Stefanovits & Szücs, 1961), the 1:100 000 scale „Map on soil factors determining the agro-ecological potential of Hungary” (Várallyay et al., 1979), agrotopographical map series (Várallyay, 1985).

The GIS processing of the Kreybig detailed soil maps and the construction of Kreybig Digital Soil Information System started in 1998 at the GIS Laboratory of RISSAC. This process includes the archivation of the maps, transformation into the Uniform National Map System, the determination of the logical data model of the Information System, the planning of I/O processes, the development of the database and spatial elements, data compilation of a sample area and the thematic reambulance of the database in the future.



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Outstanding personalities of soil science in forestry

Soil science in forestry was developing in the last centuries partly independently. First steps to create forest education and science in Hungary were made in the 18th century, nearly at the same time in different places (Liptóújvár, Kismarton, Keszthely, Selmechánya, etc.). Independent higher forest education was started in 1808 in Selmechánya (Banská Štiavnica), when Heinrich David Wilckens (1763-1832) was appointed as professor and Royal Mining Councillor. In his lecture notes „Forstkunde” (Forest sciences) including five volumes, he had already given a detailed description of the forest site properties, among them about soils. Rudolf Feistmantel (1805-1871) dealt with soil science in his lectures with similar great emphasis. From this time on soil science in forestry started its own development, worth to present here its most important representatives.

Lajos FEKETE (1837–1916)

An outrageous man of Hungarian higher forestry education and research, who gave great respect to forest soil science. After his studies in Selmechánya he got his degree in forestry in 1862, in Kolozsvár (Cluj-Napoca). He gave lectures at the Mining and Forestry Academy in Selmechánya from the year 1867, among others in soil science and climatology.

His duty was the leading of the botanical garden and the silvicultural and research activities of the academical parkland. His book „Forest soil science” was published in Selmechánya in 1882, in Hungarian language, explaining „soil development”, „description and classification of the most important soil types”. This was the first scientific work presenting a summary of forest site description in Hungarian.

He has been acting for decades at first as deputy-director, later as director of the Hungarian Royal Mining and Forestry Academy in Selmechánya. In 1910 he became a corresponding member of the Hungarian Academy of Sciences. Lajos Fekete was the last famous polymath of forestry.

István VÁGI (1888-1960)

He started his professional career in Selmechánya after the 1st World War, as an assistant of professor Gergely Bencze. In 1923 he was appointed as director of the Department of Chemistry at the Forestry Academy in Sopron. In his research work the cooperation with his famous colleague professor Dániel Fehér, a soil microbiologist and plant physiologist, had a significant role.

He examined the effects of various compounds (e.g. nitrite, sodium carbonate) on plant growth, the salt-affected soils in Hortobágy, as well as biochemical problems of afforestation on alkaline soils.

His most important academical lecture notes were the „Forest Site Evaluation” from 1926 and the „Components of Agricultural Chemistry and Fertilization” from 1927. After 1945 he had been giving lectures in Chile and Santiago for some years.

Dr. hc. Imre BABOS (1901-1979)

He got the doctor title in forestry, and worked as an honorary professor at the Forestry Faculty of the University of Sopron. One of his most important achievements was the elaboration and delineation of forestry regions in Hungary with special emphasis to silvicultural activities including the tree species choice based on forest site evaluation.

He founded the basic principles for the system of forest site types and their mapping, which knowledge he summarized in a practical guide for forest site evaluation. He made proposals for the complex evaluation of forest plant communities and abiotic factors like climate and soil.

His further research covered fields like the investigations on the fluctuation of ground water level in the Great Hungarian Plain, as well as the elaboration of the basic principle of poplar production in Hungary.

Due to his scientific and organizational activities the percentage forest cover of Hungary increased from 12 to 18 % within 40 years after the 2nd World War.

Gergely BENCZE (1854-1925)

He graduated in forestry in 1879, in Selmecbánya, then he started his professional career in the forest directorates of Gödöllő and of Beszterce. In 1882 he was appointed as the director of the Péteri Forest Directorate.

In the same year he successfully applied for employment at the Institute of Forest Chemistry at the Hungarian Royal Mining and Forestry Academy in Selmecbánya. In Munich he attended lectures of Bayler, Jolly and Ebermayer between 1883 and 1885. He was the founder of a complex ecological view in the higher education of soil science, climatology and agricultural chemistry. With the aim of a proper evaluation of black locust, in 1883 he analysed its wood ash in detail, and gave recommendations for its use in the agriculture. He examined the heating-value of various timbers, and made first extended interception measurements in Hungary.

Károly BOTVAY (1897-1958)

He started working on the side of István Vági at the Forestry Academy in Sopron. During a visit to the Forest Research Institute in Munich he did research on soil physics. He recognized, that due to the arid climate of Hungary, hydrology is here the crucial limiting forest site property, controlling growth and primary production of forests.

He developed a new sedimentation balance and examined in detail the capillary fundamentals of sandy soils. His extended research on the demands of black locust for the quality of soil supported the afforestation program in the Hungarian Great Plain significantly.

In his synthetic writing about the variation of soil properties across Hungary in 1943, emphasis was placed on his learnings about soil colloidal properties and soil chemistry, but he described the connections between soil hydrology and plant water uptake too.

György PÁNTOS (1924 – 1986)

He was the descendant of Dániel Fehér, leading the Soil-biological Research Laboratory of the Hungarian Academy of Sciences from 1956, then as the director of the Department of Soil Science at the University of Forestry and Wood Sciences in Sopron between 1960 and 1975.

His research focused on rhizosphere bacteria in agricultural soils, but he also examined the soils along artificial watercourses for their afforestation. Under his leadership, his department was active in planning of forest green belts in agricultural areas, in soil mapping, in research on the efficiency of organic and artificial fertilizers in hybrid poplar plantations, as well as in examining the possibilities of agricultural and industrial wastewater. Under his leadership, his department was active in planning of forest green belts in agricultural areas, in soil mapping, in research on the efficiency of organic and artificial fertilizers in hybrid poplar plantations, as well as in examining the possibilities of agricultural and industrial wastewater treatments and the effects of liquid manure on soil microbes.

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Hungarian research on peat and organic matter

The Carpathian Basin is the most closed basin of the World – from the geomorphological point of view – where the proportion of the surface waters was above 1/3 of the whole area, before water regulations of the 18th century. On these water effected areas a considerable amount of organic matter accumulated due to peat and meadow soil formation processes at East-Central European scale. In the last 150 years, technological based management and climatic changes reduced the organic matter content to 30%.

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Chronological scheme of geological and soil research and mapping

Date	Researcher	Institute	Research theme
1862	Pokorny, A.	Hungarian Academy of Sciences	Peat forms of Hungary.
1894	Staub, M.	Hungarian Geographical Society	Distribution of peat in Hungary.
1910–1915	László, G., Emszt, K.	Geological Institute of Hungary	Peaty meadows and their distribution in Hungary.
1948–1949	Dzsida, J.	Peat Research Inst., Peat Mining	Investigation of 12 peaty basins, drilling in 250 m grids, mapping at 1:25,000 scale.
1949–1951	Stefanovits, P., Eörsi, L.	Geological Institute of Hungary	Investigation of 12 peaty basins, drilling in 250 m grids, mapping at 1:25,000 scale.
1951–1954	Schenkengel, L., Kabár, Z.	Mining Research Institute	Investigation of 12 peaty basins, drilling in 100 m grids, mapping at 1:10,000 scale, physical and chemical analyses of the peat.
1965–1998	Dömsödi, J.	Soil Remediation, Stock Research and Planning Agency	Drilling of all peaty areas in 50 m grids, mapping at the scales of 1:2880, 1:2000, 1:4000. Physical and chemical analyses of the peat, making cadastre, landscape and water management.

Agricultural land use, peat use related researches,
nature conservation on water effected areas

Date	Researcher	Institute	Research theme
1921–1946	Ballenegger, Ö.	Geological Institute of Hungary	Soil genetics
1941–	Prettenhofer, I.	Soil Research Institute University of Szeged	Peat use, plant production, 5-years research
1945–1970	Kabar, Z.	Mining Research Institute	Peat loss, peat protection, soil science
1950–	Páter, K., Máté, F., Stefanovits, P.	RISSAC, University of Gödöllő	Soil genetics, soil classification
1950–	Belák, S., Tóth, A., Szabó, I.	University of Keszthely	Plant production, forestation experiments, nature conservation researches
1960–	Tompa, K., Tihanyi, Z., Kovács, G., Dömsödi, J.	University of Sopron	Mapping for establishing the basics for forestation, melioration planning
1970–1995	Hargitai, L.	Horticultural University, Budapest	Production of peaty soil mixes for horticultural uses

The distribution of Hungarian peaty lands decreased from 100,000 ha (Ballenegger 1921) to 26,000 ha until 1975. In these areas 1200 million m³ peat decreased to 306 million m³ according to the geological surveys (Dömsödi 1988).

Larger peaty areas	1921 Area (km ²)	1921 Amount (million m ³)	1975 Area (km ²)	1975 Amount (million m ³)
Sárrét of Fehér County	16.5	40	0	0
Hanság of Moson-Sopron County	230.5	258.8	35	32
Nagyberek at Lake Balaton	92	140	32.3	22.21
Peaty group of Zala and Somogy Counties	60	250	28	86
Between Danube and Tisza Rivers	46	50	3.2	4.6
Szabolcs County peaty areas	20.9	22.4	5	1.1
Peat of Ecsed	169.7	120	0	0

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Short chronology of the study of salt-affected soils in Hungary

In Hungary the relative area of salt-affected soils (SAS) is highest in Europe, therefore the study of these soils is one of the most important topics among Hungarian soil scientists. The origin, formation, properties and reclamation of SAS has been investigated thoroughly during the last two centuries. A list of the monographs on salt-affected soils, important milestones and achievements are presented here in head-words. The mapping of these soils has started in 1897, mapping at the scale of 1:25,000 was carried out by the 1950-ies, and their last assessment, now of the areas covered with native halotolerant vegetation, was carried out in the years 2003-6 at the scale of 1:75,000 by Bölöni et al.

- 1767** Beginning of systematic soil reclamation of SAS Tessedik, S
1839 The lake of Konyár” Irinyi, J
1840 Natural history of the sodic regions of Hungary” Balogh, J
1857 Our sodic lands” Szabó, J
1890 Agrogeological department of Hungarian Geological Institute Treitz, P; Inkey, B
1893 Gypsuming of sodic soil Treitz, P
1898 “Salt-affected soils in Hungary” Treitz, P
1903 ...the flora on the sodic soils shows the quantity, and quality of the salt in the soil...’ Treitz, P
1909 Conference on Agrogeology, Budapest
1910–1990 ~Improvement, reclamation and agricultural utilization of salt affected soils prediction and prevention of secondary salinization-alkalization
Arany, S; Ábrahám, L; Bocskai, J; Darab, K; Filep, Gy; Harmati, I; Herke, S; Jassó, F; Molnár, E; Nyíri, L; Prettenhoffer, I; de Sigmond, A; Szabolcs, I; Szentannay, S; Tóth, T; Várallyay, Gy
1923 Hungarian salt-affected soils and the methods of their reclamation” de Sigmond, A
1926 Mapping, of the SAS, T=soil scientist, B=botanist Arany, S (T); Galambos, J (T); Herke, S (T); Jávorka, S (B); Lengyel, G (B); Magyar, P (B); Moesz, G (B); Pinkert, Zs (B); Rapaics, R (B); Strömpl, G (geographer); Timkó, I (T); Timkó, Gy (B); Treitz, P (T); Zsák, Z (B);
1927 Experimental Station for the Afforestation of Salt-Affected Soils at Püspökladány Magyar, P
1927 “Nature of sodic, and saline soils” Treitz, P
1927 “Hungarian alkali soils and methods of their reclamation” de Sigmond, A
1928–1933 State soil liming campaign Treitz, P
1929 Conference on Salinity Problems, Budapest
1934 Hungarian salt-affected soils” Sajó, E; Trummer, Á
1938 “The geologic and morphological relations of the layers of Pleistocene and Holocene and the context of these with the soil development, especially with the saline soil development in the Hungarian plain” Scherf, E
1947 Research Institute of Karcag
1949 Research Institute for Soil Science and Agricultural Chemistry

- 1954** Soils of Hortobágy” Szabolcs, I
- 1956** “The salt-affected soil and its reclamation” Arany, S
- 1956–1986** ~Role of environmental conditions in the genesis and formation of salt affected soils and saline lakes Arany, S; Darab, K.; Jassó, F; Kuti, L; Máté, F; Molnár, B; Molnár, E; Rajkai, K; Szabolcs, I; Szekrényi, B; Várallyay, Gy
- 1956–1998** ~Studies on the processes of soil salinization-alkalization, effect of salts on soils and soil properties Blaskó, L; Csillag, J; Darab, K; Filep, Gy; Gerei, L; Jassó, F; Karuczka, A; Rajkai, K; Rédly, M; Reményi, M; Szabolcs, I; Szendrei, G; Várallyay, Gy; Zsembeli, J
- 1959** “Farming on our salt-affected soils” Herke, S; Mihályfalvy, I; Prettenhoffer, I; Tury, E; Vezekényi, E
- 1960–1992** ~Study and evaluation of salt affected soils, preparation of maps with different scales Csillag, J; Darab, K; Fórizs, I; Kabos, L; Kertész, M; Kuti, L; Molnár, E; Rajkai, K; Szabolcs, I; Tóth, T; Várallyay, Gy; Rédly, M
M Rédly was the Chairman of the Subcommittee on Salt Affected Soils, 1994–1998
- 1961–2009** ~Soil-plant studies Bagi, I; Bodrogekőzy, Gy., Molnár, E; Molnár, Zs; Oertli, JJ; Précsényi I; Rajkai, K; Tóth, T;
- 1961** “The effect of drainage and irrigation on soil formation in Tiszántúl region” Szabolcs, I
- 1964** Symposium on Sodic Soils, Budapest
- 1967** Subcommittee on Salt Affected Soils 1st Board Meeting, Budapest
- 1968** Subcommittee on Salt Affected Soils 1st Board Meeting, Budapest Workshop of Subcommittee A, Budapest
- 1969** The reclamation and use of Hungarian salt-affected soils in Tiszántúl region” Prettenhoffer, I
- 1969** Soil mapping of irrigated territories” Darab, K; Ferencz, K
- 1971** “European solonetz soils and their reclamation” Szabolcs, I
- 1971** Improvement of salt-affected soils” Ábrahám, L; Bocskai, J
- 1972** “Afforestation of salt-affected soils” Tóth, B; Jassó, F; Leszták, J-né; Szabolcs, I
- 1973–1975** Hortobágy (1973) and Kiskunság (1975) National Parks Hortobágy (1973) and Kiskunság (1975) National Parks
- 1974** “Salt-affected soils in Europe” Szabolcs, I
- 1979** “Review of Research on Salt Affected Soils” Szabolcs, I; Várallyay, Gy
- 1983** “Improvement and utilization of salt-affected soils in the Danube-valley” Herke, S
- 1991–1992** ~Remote sensing of soil salinization Baumgardner, M; Biehl, L; Büttner, Gy; Csillag, F; Juhász, I; Michéli, E; Pásztor, L; Szilágyi, A; Tóth, T
- 1993–2007** ~Spatial statistical analysis of soil salinization Douaik, A; Kabos, L; Kertész, M; Marchand, D; van Meirvenne, M; Kuti, L; Oertli, JJ; Pásztor, L; Rajkai, K; Tóth, T; Várallyay, Gy
- 2003–2008** ~Mycorrhiza studies on SAS Bíró, B; Bothe, H; Füzy, A; Tóth, T
- 1962–2009** ~Study of the dynamism of salinization Bakacsi, Zs; Filep, Gy; Harmati, I; Jassó,; Kovács, D; Szekrényi, B; Tóth, T, Várallyay, Gy
- 2003–2009** Dismissal of earlier rice field’s traces in National Parks
- 2006** Surface salt-minerals of the Hungarian salt-affected soils” Szendrei, G; Tóth, T
- 2009** Compilation of the map of salt-affected soils in the European Union Tóth, G; Tóth, T; Várallyay, Gy
- 2009** IUSS Conference on Salinization, Budapest

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Soil physical and water management research in Hungary

The development of soil physical measuring methods formed a rather divers but integral part of soil scientific research in Hungary. The method's developing activity has been always combined with the interpretation and evaluation of the measured values.

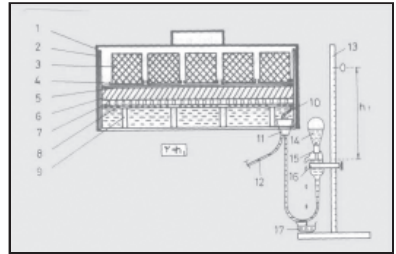
The developments of water management properties' measuring methods of soils always were in the focus of the soil scientific research in Hungary. In a brief review from 1950 the following main developments can be listed:

- Károly SÍK modified measurement of hygroscopic value of soil (Ballanegger and Di Gleria, 1962).
- Lajos KREYBIG, László MADOS, and György VÁRALLYAY used the hygroscopic value by SÍK to estimate the wilting point moisture content of soils. They used the plasticity index of ARANY for estimating the field capacity moisture content of soils as well. (Mados, 1943; Kreybig, 1951; Várallyay, 1942).
- Béla KAZÓ used tensiometer constructed by him to determine the water potential and moisture content of soil. His experiment was mixing the material and firing of the ceramic cups as well (Kazó, 1956).
- Béla KAZÓ carried out field measurements of soil water permeability with different gravitation methods (Kazó, 1970; Kazó, 1972; Kazó, 1973). His development and application was a rainfall simulator for determining water management properties of soil (Kazó, 1966).
- György VÁRALLYAY Jr. adopted and introduced the “evaporation column” laboratory method for measuring the unsaturated conductivity of soils (Várallyay, 1974; Várallyay, 1987). Other field method for measuring the near saturated water conductivity of soil were also introduced and applied (Kézdi, 1961; Thyll, 1983). Sándor DARÓCZI, István KOCSIS, and Ferenc LIGETVÁRI developed an electrical sensing system to the adopted „auger whole” method (Daróczi, Kocsis, and Ligetvári, 1992).
- Miklós DVORACSEK and Andor KLIMES-SZMIK applied small-size core monoliths for measuring soil water management properties such as water percolation, and bulk density (Dvoracsek and Klimes-Szmik, 1951); Várallyay adopted, further developed and set up a complete sand, kaolin box and pressure membrane apparatus for measuring water retentions of soil core samples (Várallyay, 1973).
- Soil moisture content measuring methods form a rather continuous history from the oven drying method through radioactive methods (neutron probe) by János DI GLÉRIA (1966); the alcoholic combustion method by DI GLÉRIA and KAZÓ (1952), by KAZÓ (1956); the continuous measurement of soil moisture potential by Gy. GAJÁRSZKI (1980); with measuring soil dielectric properties by Kálmán RAJKAI (1983; 1991); the penetration resistance of soil in the handbook by DI GLÉRIA, KLIMES-SZMIK and

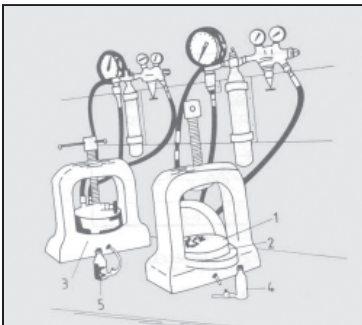
DVORACSEK (1957). General reviews of soil moisture content measuring methods can be found in PAPP (1967), SZABÓ (1972), SZALAY and VARGA (1972), RAJKAI in BUZÁS (ed), (1993).

- Soil compaction and penetration resistance measured with penetrometer designed by DVORACSEK in DI GLÉRIA, KLIMES-SZMIK and DVORACSEK (1957); in BUZÁS (1993); Penetrometer and a soil moisture meter combination by DARÓCZI, KOCSIS, and LIGETVÁRI (1992), and by SINÓROS-SZABÓ (1992).
- Andor KLIMES-SZMIK categorized soil porosity on the water conductivity (Klimes-Szmik, 1962; Klimes-Szmik and Kullmann, 1962).
- HAJAS, KERTÉSZ, and VÉR studied structural features, air conductance and air capacity of soils (Hajas and Kertész, 1951); Vér (1961).
- L. KREYBIG, F. KOZMA and Z. VARGA-HASZONITS determined heat management properties of soils (Kreybig, 1951; Kozma and Varga-Haszonits, 1957).
- I. DEZSÓ, Á. KÉZDI, Z. RÁTZ, I. PATAY, and S. VIRÁG measured and discussed different soil physical and mechanical characteristics such as breaking index, plasticity, shear resistance, etc. mostly in soil mechanics and engineering practice (Dezsó, 1958; Kézdi, 1974; Rátz, 1986; Patay and Virág, 1992).
- Gy. SITKEI discussed material flow in soil from soil mechanical point of view (Sitkei, 1997).

From the above assembly it is obvious that the development of soil physical measuring methods formed a rather divers but integral part of soil scientific research in Hungary. The method's developing activity has been always combined with the interpretation and evaluation of the measured values.



However these measuring methods cannot be used in every soil conditions and varieties because of their limitations. In such cases measurements can be substituted by estimations. Estimation of certain soil physical characteristics or properties came into fashion even quite early as shown above. L. KÉGL published a paper about the mathematical relations of most frequently measured soil physical constants (Kégl, 1949). The introduction of soil water retention measuring apparatus by Gy. VÁRALLYAY (1973) made possible to build up a soil physical database on which the pedotransfer functions for estimating water retention data and/or parameters of water retention function could be derived (Rajkai et al., 1981; Buzás, 1993; Nemes, 2003).



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The “Sopron School of Soil Biology”

The „*Sopron School of Soil Biology*” was founded and headed in 1951 by professor *Dániel Fehér*, soil(micro)biologist and by *Lajos Varga*, soil zoologist as the main classics of the Hungarian soil scientists, working in the University of Forest and Wood Sciences in Sopron, Hungary. This Soil Biological Laboratory moved to Budapest lately in 1959 to the Research Institute of Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences (RISSAC HAS); headed by professor *József Szegi* for about 40 years. Members of this „*first generation of Hungarian soil biologists*” become also well-known scientists in their subjects.

„*School of Soilbiology*” in Sopron

Professors *Dániel Fehér* and *Lajos Varga* were founding the „*School of Soil biology*” in Sopron in 1951. As a result of this activity the Department of Plantphysiology of the University of Forest and Wood Sciences (West-Hungarian University) in Sopron become the most well-equipped institute in Hungary of studying the Anatomy, Ecophysiology and Soilmicrobiology. The team achieving a national and an international reputation become the „*Soilbiological Research Laboratory of the Hungarian Academy of Sciences*”. First members of this „*Sopron School of Soilbiology*” are also well-known scientists: *Rezső Bokor, Ilona Buti, Mária Marton, Ernő Manninger, Pál Gyurkó, Mibály Kecskés and István Mibály Szabó*.

Most of them remained together in one team, after the laboratory moving to Budapest in 1959, as a leading Institute of the Hungarian Academy of Sciences in the soil biology. „*In Sopron there was an enthusiastic and outstanding research team of studying the*



soil(micro)biology” (citation from the Annual Book of Section Soilbiology, the Hungarian Society of Soil Sciences, 1981). At that time the significance of the soil-life in the soil-quality-formation become more and more recognised and appreciated in the World. „*The impact of soilbiology towards the soil fertility needs to be utilised more efficiently in the agriculture*” said *Lajos Kreybig* in 1952 at the statutory meeting of the Soilbiological Section. Since that time, soilbiological knowledge has got a key importance not only in the agriculture, but also in the

environmental-protection-, the risk assessment-, the remediation- and the restoration- of the soils and in the soil formation of spoil-banks in general. The new scientific subject, the soilbiology has proved that the soil is a living entity with the enormous abundance of soil-microorganisms and are acting as an independent organisms, which can be affected by the three main environmental abiotic stress-factors, as *the temperature, the light and the water-content* (Fehér D, 1954: Soilbiology, Academic Publ House, Budapest).

„Sopron School of Soilbiology” in Budapest

The „Laboratory of Soilbiology” had to move to Budapest in 1959 to the Research Institute for SoilScience and Agricultural Chemistry of the Hungarian Academy of Sciences (RISSAC HAS). There are three main departments of the Institute, beside the Soilphysics and Agrochemistry, the Department of „Soilbiology and Soilbiochemistry” was founded and headed by professor *József Szegi* from 1949-1994, who was born in Aba at 14th of January 1928. He is the Doctor of Academy (D.Sc.), and He was a member of the editorial board of „*Agrokémia és Talajtan*” (Agrochemistry and Soilsience) in the RISSAC HAS up till his retirement. As a result of his scientific activity, a large variability of the research topics have been started in the Department at that time in connection with the soilbiology.

A potential recultivation process of the technogenous areas of the coal-mining activities in Gyöngyösvisonta (Hungary) have been developed by the Department of Soilbiology. There were several scientific meetings organised on the subject and several books in Hungarian and in English was edited by *J. Szegi*. Such research results, the way of improving and testing of the soil-fertility at a consequence of the human industrial activity was awarded by the Hung. Government prize in 1960. Studies about the men-made soil-changes has started at that time. Following the book of *Lajos Kreybig* about the „*Life of soil, its quality improvement and the fertilizer use from biological point of view*” in Budapest (1928), there was a great progress towards the practical application of soilbiological results.

Scientific activities and some of the achievements

The scientific activity of the „Sopron School of Soilbiology” team was followed by fundamental and practical books, among them the 5-volumed book of „*Microbiology of the biosphere*” by *István Mihály Szabó*, and the „*Microbiological Investigating methods*” by *József Szegi*, which are still intensively used and studied by the „third generation of Hungarian soilscientists”. Further books were concentrating on the diversity of soil-organisms, such as the „*Taxonomy of bacteria, fungi and mossae*” edited by *Tibor Simon* and *Mihály Kecskés* in 1991 among several other representatives. New, „*up to date*” methods are currently being under construction nowadays, which are applicable not only for the quantification but also for the qualification of the microbiological partners in the soils and growing substances.

The regular National and International meetings, Symposiums, Conferences, such as the classical and well-known ones, as the „*Soilbiology and Conservation of the Biosphere*” and the „*Biodegradation and Humification*”, as the most important subjects of the soilbiology was giving a further chance for the next generation of soil sciences to learn and to improve our common scientific knowledge about the living soils, which is the essential fundament of the human life.



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