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Hjalmar Sjögren
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HJALMAR SJÖGREN
LIFE AND WORK

HJALMAR SJÖGREN

in memoriam.

At the same time as the 18th Volume of the Bulletin of the Geological Institution of Upsala is completed, the sad news arrives that its Editor, Professor Hjalmar Sjögren, was seized with apoplexy on March 23, causing death in a few hours.

With the decease of Hjalmar Sjögren Swedish science has lost one of its most eminent and representative men. He was a distinguished mineralogist, a generous patron of science, and a personality of high qualities. His memory will be lasting, not least at this university, where, it is true, he acted as Professor in Mineralogy and Geology only for a few years, but where nevertheless his work left deep and permanent traces.

STEN ANDERS HJALMAR SJÖGREN was born on June 13, 1856 at Persberg, at whose mines his father, Anton Sjögren, was then a mining engineer. His mother was Sophie née Petersson, the daughter of a rural dean in Öland. His father, afterwards superintendent of mines in the district of Värmland with its mines Nordmarken, Långban, Paisberg, etc., known all over the world as localities for minerals, was a distinguished mineralogist, and by him and from his native district his son Hjalmar soon had his interests directed towards mineralogy. His acuteness as a mineralogist which was so striking a characteristic of Hjalmar Sjögren was partly an inheritance from his father and is partly to be ascribed to good practice even when he was growing up.

After matriculating in 1875 Sjögren passed through the Polytechnical High School in Stockholm 1875—1878, afterwards spending two years at the University of Lund, where in 1880 he passed his examination in sciences of mining. Already during his student years he took part in geological field work, assisting A. E. Törnebohm in his comprehensive investigations of the ore-bearing Archean of Middle Sweden. In addition he acted as assistant in the Geological Institute at Lund University.

During these years Sjögren published a number of works on new or incompletely known minerals, especially from the Värmland mines of Nordmarken and Långban. These include, inter alia, a crystallographical study of the pyroxene from Nordmarken, which is represented in all large collections of minerals and is peculiar on account of its habitus, and also a number of bismuth minerals from the same locality, including the new mineral galenobismutite.

At that time there was no instruction in crystallography and mineral optics at the Swedish universities; the Swedish mineralogical researches of that time were directed, as had been the tradition even from the period of Torbern Bergman and Berzelius, chiefly to mineral chemistry, in which, among others, the chemists Blomstrand at Lund and Cleve at Upsala were active. There was an almost complete lack of modern instrumental resources for crystallographical and optical investigations. When Sjögren entered this field of research the external conditions for his work were thus very unsatisfactory, and he was almost entirely forced to obtain the necessary training and experience by his own unaided efforts. It is an undeniable tribute both to his gifts and his energy that under these circumstances he was able, even at an early age, to make valuable contributions to our knowledge of a large number of minerals that were previously inadequately investigated or had been newly discovered. When we consider these external conditions it is easily understood and quite excusable that there should be some oversights and mistakes in these earlier works.

When in the beginning of the 'eighties the former holder of the chair of Mineralogy and Geology at the University of Upsala could no longer continue his instruction on account of illness and a deputy was to be appointed, the choice fell on the young Lund mineralogist, who at this time (1882) had sent in his papers for a fellowship at Upsala with a treatise on the minerals of the Chondrodite group. Before this Sjögren had been appointed for short periods both as a mining engineer and superintendent of mines (1881 and 1882). During the four terms (autumn term 1882 — autumn term 1884) that Sjögren carried on the instruction at Upsala university as deputy, he gave, inter alia, a series of lectures on the genesis of the Swedish iron-ores (first published in 1891), a subject that was treated by him several times later in lectures and papers, always in contact with the development of science.

During a journey to Germany and Austria-Hungary in the summer of 1883 for the purpose of study S. also visited the well-known iron-ore

fields of Moravicza and Dognácska in the Banat. He showed the correspondence between these ores and the Swedish archean ores of the Persberg type both with regard to mineral association and geological appearance, and, in accordance with the views then prevalent among Swedish geologists, he explained the ores as sedimentary deposits.

The southern Norwegian apatite dikes, which at that time were the object of considerable mining operations, were also studied by Sjögren. Against the explanation previously put forward by Norwegian geologists that they were magmatic S., following the American Sterry-Hunt, gave the interpretation that, like the Canadian dikes, they were formed as crevice-fillings through reactions between sea-water and the gabbro rocks, rich in apatite, which were supposed to be submarine effusive beds and to whose boundaries these dikes were attached. On this a discussion took place between S. and the Norwegian geologist J. H. L. Vogt, but it was soon obvious that the dikes were not formed in either way but through pneumatolytic processes, issuing from the gabbro massive. S.'s contribution to the question of the genesis of these dikes affords, however, several interesting points of view and observations.

In addition during this first period at Upsala S. eagerly continued his mineralogical investigations, chiefly on Värmland localities, from which he described, inter alia, a number of new mangan arseniates (allaktite, diadelphite, synadelphite, haemafibrite) from Nordmarken.

His geological treatise on Scandinavian Boulders from Heligoland is more aside from his other production.

In 1885 Sjögren left the university to take up a post as geologist at the Nobel works at Baku. He remained in this service for several years. His researches were now directed chiefly towards the geology of the oil-fields. In connection with the extensive journeys in Transcaspia, Armenia and Persia that during this time he had occasion to make, other geological problems, however, also became the objects of his interest and investigations. His most important publications of that time deal with the geological structure of the Apscheron peninsula and its mud volcanoes. His studies on the connection between air-pressure and the activity of naphtha fountains are also of interest. He discovered that these flowed and played more copiously at high than at low air-pressures, which is almost the exact opposite of what might have been expected; and in this phenomenon he saw a proof of the sensitivity of the earth's crust even to very slight differences of pressure. The tectonics and post-tertiary geological history of the Caspian basin were also treated in some papers,

and the very well worked-out comparisons that he made later (1890) in his inaugural lecture as Professor of Geology between continental regions with and without drainage to the sea, may also be said to be a product of his activity at the Nobel works at Baku, as during his journeys he had good opportunities to see and study the contrasts between these natural types. Moreover these years at Baku, with the multitude of grand natural phenomena and formations that occur there, were exceedingly profitable for S.'s geological training. Stratigraphical, tectonic and morphological problems of the most varied kinds presented themselves to him there and gave him views and experiences that he turned to account during his subsequent activity as a university teacher.

In 1889 S. was restored to Upsala, now as ordinary Professor of Mineralogy and Geology at the university, and at the beginning of the following year he entered upon his new duties.

At this time S. had married Ludwig Nobel's daughter Anna and had thus been placed in a financial position that certainly took up a good deal of his time and work but that also made it possible for him to a great extent to afford material assistance and to promote the sciences that interested him. This was not least to benefit for the university institution with which for some years to come his activity was now to be connected. The mineralogical-geological institute, like the instruction and the scientific work, during his predecessor's long illness and the several years interregnum after his death, had been unable to keep on a level with the development of science. The instrumental apparatus was exceedingly poor and had by no means kept pace with the rapid progress that especially mineral optics and microscopic petrography had made during this period. S.'s immediate task was now to make the Institution up-to-date. A good set of instruments was procured, laboratories and work-rooms were fitted up, a skilful preparator was appointed, collections for instruction purposes were bought and arranged, and so on. In addition to the state grant S. had at his disposal for these purposes he also contributed considerable sums of his own money. Among the measures adopted by S. to raise the scientific level in the sphere entrusted to him was the establishment of a special Journal, intended chiefly to print work carried out at the Institution. The 1st volume of this »Bulletin of the Geological Institution of the University of Upsala», comprising the years 1892—93, appeared in 1894. The present volume is the 18th.¹ These

¹ The 17th, whose completion was somewhat delayed by intervening hindrances, will, however, be ready during the present year.

volumes contain 182 papers with a total of 5800 pages of text and 264 plates. The contributions are published in one of the three great cultural languages (English, French and German), and a very large number of them deal with subjects from foreign countries and continents; several important contributions to the geology of Spitsbergen and other Arctic regions, the Antarctic, and South America especially, have been made by members of the many scientific expeditions that have been sent out from Upsala during the last few decades. Because of all this the Bulletin has obtained an estimated place among the international periodical publications. With great generosity Professor S. has borne the entire cost of the publication of the Bulletin and has placed the whole edition at the disposal of the University library; thence it is sent out free or in exchange to a large number of libraries, scientific societies and institutions in all countries.¹

Hjalmar Sjögren retained his post as university professor only till 1894, but during these few years he introduced into the Institution newly arranged by him modern instruction and practical work in crystallography, mineral optics and petrography, and inspired a lively scientific activity, whose results were put forward, inter alia, in the first volumes of his Bulletin. S. himself published during his years in Upsala, besides a number of results of his investigations in the Caspian region, a whole series of mineralogical investigations, connected with the researches on the Värmland mineral localities which he carried on before his stay in Baku. Thus he described the new arseniate adelite (Långban and Nordmarken), swabite (Harstigen), the new antimoniate mauzeliite (Jakobsberg), also astochite, a natronrichterite and celsian, a barium felspar (Långban); further on a number of new finds of previously more or less known minerals were subjected to more detailed investigation, e. g. långbanite, hedyphane, axinite, periclase, vesuvianite, and the interesting find of the minerals of the chondrodite group at Nordmarken. The problems of ore-genesis were also dealt with again during these years. The previously mentioned series of lectures on the genesis of the iron-ores, which S. gave at the university in 1883, were now published, chiefly on account of a work published at that time by Vogt on the iron-ores in Salten and Ranen in northern Norway. This caused a polemic between Sjögren and Vogt, which may be said to form the origin of a treatment, starting out from more modern points of view, of the problems with regard to the genesis of the Scandinavian iron-ores.

The same year (1891) S. made a journey to the United States, where

¹ A list of these will be found in Vol. IX and in the general Index to Vol. I—X.

he got to know more closely the great deposits of iron ore in the Lake Superior district and the American geologists' detailed studies of these ores. S. put forward his experiences from this field in 1893 in his work »Några jämförelser mellan Sveriges och utlandets järnmalmslager med hänsyn till deras genesis». As has already been pointed out, S. had previously taken the Middle Swedish Archean iron-ores as purely sedimentary formations; his experiences of the rôle of the metasomatic processes in the formation of ores in the Lake superior region now led him to a view of the importance of similar processes for the ore concentrations in our Middle Swedish iron-bearing terrains, and he showed the great analogies that exist between these and the above-mentioned North American ones, and that the differences were chiefly due to the stronger metamorphosis that had affected the former. Specially interesting is the comparison that S. makes between our quartz banded hæmatites and the »banded jasper» of the named American ore district.

The change in S.'s explanation of the genesis of the Swedish ores caused by his journey to America may be said to consist chiefly in the fact that S. now ascribes great importance to secondary metasomatic processes and supposed the original sediment to be in general relatively poor in iron.

Besides the Lake Superior region S. also visited other iron-ore districts in North America. In 1891 he published an interesting communication about the Tilly Foster mine in New York State, showing the striking resemblance between this and the Nordmark mine in Värmland, both with regard to mineral paragenesis and the appearance of the ores. The only noteworthy difference was the abundant occurrence of minerals of the chondrodite group at Tilly Foster, while these were not found at Nordmarken. But the very same year these minerals were also found in great quantities at the Swedish locality during mining operations. And this find was also described in detail by S. the following year.

An iron-ore from Routivare in Lapland, of magmatic origin, namely ilmenite-spinellite, was investigated by S. in 1893. He showed that ilmenite, which had previously been overlooked, was an essential component of this ore.

When after only a few years S. felt called upon to resign the professorship he had held in so brilliant a manner, this step was due to the many and extensive economic undertakings in which he was interested. He had become the owner of the famous old silver mine at Sala, he was partner in the great Sulitelma mines which were developing strongly, he

still had interests in the Caspian naphtha fields and had also become a great landowner, as he had bought the extensive estate of Nynäs in Södertörn (1892). He had plans of creating there an outpost for Stockholm and for this purpose to bring about railway communication between these two places. This is not the place to go into detail about how these plans were realized; it need only be mentioned that the railway was completed in 1899, and that at the port the settlement of Nynäshamn grew up since 1911 and now has a population of 4000 inhabitants. During the seven years which S. spent as a private man after his resignation from the professorship at Upsala his time was claimed by the practical tasks connected with his estate and the economic undertakings in which he was also engaged. He also had a better opportunity to exercise his interest for sport, especially yachting and riding, and in this sphere he also helped financially on several occasions. But he also still retained contact with his science and his scientific interests. A number of communications about minerals from Sala were published during this time; among other things he showed that the galenite broken as silver ore contained argentite mechanically enclosed and that, besides, silver also occurred as a substitute for the lead in the galenite. On the great pyrite deposits of Sulitelma and their geology S. began, in collaboration with O. Nordenskjöld, C. O. Kjellström, and P. J. Holmquist, a detailed investigation which resulted in some papers and an excellent geological map, published by S. in 1900. Some contributions to the mineralogy of Värmland also appeared during this period (retzian, manganosite, periclase).

When the post of superintendent of the mineralogical department in the State Museum at Stockholm became vacant on the resignation of A. E. Nordenskiöld, the Royal Academy of Science appointed S. as his successor in Nov., 1901. Once more attached in this way to a scientific state institution S. remained in this post until his death, thus over twenty years. As S. now gradually gave up a number of practical tasks in which he had formerly been engaged, he got more time to devote to his scientific interests, which henceforth were chiefly concentrated round the institution he had to take charge of, and round mineralogical and geological researches linked up with his earlier works.

When S. took up his position as Intendent of the Mineralogical Division of the Royal Museum the collections of the Museum were housed in the old building in Drottninggatan, the space at the disposal of the mineral collection was scanty, and the local conditions were not up-to-date in other respects. But all sorts of measures were taken to remedy the

worst inconveniences, provisionally until a new building could be got ready. The Intendent's story was fitted up as a laboratory and the old laboratory was used for the collections. When G. Lindström, the former assistant, a highly meritorious mineral analyst, resigned in 1905, the distinguished mineralogist Dr. G. Flink was appointed as assistant, a preparator's post was set up, and Lic. N. Zensén (afterwards Flink's successor), Dr. G. Aminoff, Dr. G. Nauckhoff and Mr Morton acted as extra assistants for longer or shorter periods. S. devoted special interest to getting paragenetic collections that would illustrate the geological conditions and genesis of the more important mineral localities and ore-fields, and also to getting together a representative collection of Fenno-Scandian rocks.

The most important and valuable acquisition during this time was the great mineral collection that S. presented to the Museum when he took up his post there. This exquisite and costly collection brought together by him contains at least 7000 items, including the original material of S.'s and his father's mineralogical investigations and in addition a large number of older Swedish finds. The collection is so arranged that it gives a survey of the genetically more remarkable mineral associations. Thus the minerals occurring in vesicular lavas are represented by Icelandic, Australian and Indian finds; contact minerals by, inter alia, a series from Vesuvius; granite pegmatites by Mursinka and other Ural localities, Elba, Colorado, etc.; syenite pegmatites by southern Norway, Ural, Arkansas, and Greenland; furthermore the Alpine quartz-titane association, also gold-tellurian associations from Siebenbürgen, Altai, and California, and several other theoretically interesting ore-formations are included in the collection. It was S.'s intention to publish a well got-up descriptive catalogue of this collection, which, according to the conditions of its donation, is to be kept as an unit apart from the other collections of the Museum, but at the time of S.'s death this plan had not yet got beyond a preparatory stage.

At the beginning of 1915 the new Museum buildings were ready and the removal into the Mineralogical department took place during the summer. In the fine, extensive rooms, well adapted for their purpose, the collections could be arranged and exhibited so that they had a far better effect than in the old museum. During the years immediately after the removal S.'s time was much occupied in organisation work in the museum and he was especially interested in a revision of the older parts of the collection, which threw light on the history of mineralogy, but because of lack of space and care had in the course of time got into a very unsatisfactory condition.

During this stage of his life S. continued to make fresh contributions to the mineralogy of Värmland (barysil and pyrochroite from Långban, chondroarsenite or sarkinite from Pajsberg, thalenite and other pegmatite minerals from Åskagen, etc.) and also published other mineralogical papers, e. g. on the edingtonite from Bölet, on a dikequartz from Norway, with enclosures of mercaptanes. In his mineralogical researches S. had the advantage of collaboration with the able chemist Dr. Naima Sahlbom and the renowned analyst Dr. R. Mauzelius, who died a few months before S. and whose biography was the last work completed by Sjögren.

A considerable part of S.'s production at this time was concerned, however, with the genesis of the Swedish ore deposits. His lecture on this subject (1896) was the introduction to a lively discussion which continued during the following years and resulted in a whole series of valuable monographs on the Swedish ore deposits and in new and profitable theoretical investigations. In this lecture S. modified the views he had previously put forward as to the metasomic formation of the Swedish iron ores, which he now wished to show had been mainly formed by superficial processes younger than the folding of the Archean. These views were objected to, however, from several authors, and views were put forward which ascribed to these ores quite a different formation. Among these the point of view that was developed in a series of papers by Dr. Harald Johansson was the most divergent, as he wished to show a magmatic formation for these types of ores, as well as for the surrounding rock-complexes. These papers, so rich in interesting physical and chemical points of view, raised the problem of ores »on to a new and higher level», to use S.'s expression, and caused S. to depart entirely from his earlier view on the metasomatic processes and their origin. It is true that in his interesting paper in 1908 on the formation of the iron-ores of the primitive rocks he does not accept Johansson's explanation, but all the same he was so much impressed by his exposition that he now explained these ores as formed at high temperatures and as »diamagmatic» derivatives from the granite bodies which are intruded in the ore-bearing rock-complexes. The same interpretation was also given by Sjögren later on (1910) in his paper on the Persberg mines. Consequently at this time S. regarded the ores as contact-metamorphic products, connected with intrusive granite massives. As a matter of fact this view became fairly general about this time even with regard to the sulphidic ores and was corroborated by important investigations by Goldschmidt (the contact metamorphosis in the Christiania region), Trüstedt (Pitkäranta), Eskola (Orijärvi), and Geijer

(Falun, etc.). Continued studies on the geology and petrography of the Middle Swedish iron-ores showed, however, that these ores in many cases were in close genetical connection with the enclosing granulitic or leptitic rocks and must be interpreted as syngenetic with them. S. himself, among others, has by his paper »Chemical and petrographical studies on the ore-bearing rocks of Central Sweden» (1914), published in collaboration with Sahlbom and Johansson, given arguments for this interpretation. The writers conclude their paper by stating »that no geologist, who had the opportunity of studying the conditions more closely at the place, will leave this district with the slightest doubt that the granites have intruded long after the formation of the ore bodies and have no genetical connection at all with the iron ores». During the thirty years that had elapsed between this statement and S.'s first attempts to solve the genetic problems of the ores the views with regard to the Archean ores of Sweden, as is seen from the above, have undergone many alterations which reflect the development of science in this field; and S. had actively taken part in them all, not keeping to a view once arrived at but with a remarkable power of availing himself of new points of view and experiences. Among S.'s geological works on ores there are also a number of surveys of the Swedish ores and ore problems intended for foreign readers (see Bibliography), as his guides to Dannemora, Sala, Falun, Persberg, and Långban, published in 1910 for the International Geological Congress, in which several new observations and views are put forward, and finally the summary he gave to the same congress of the results of the great international *enquête* »The Iron ore Resources of the World».

Sjögren was already before that occasion interested in an inventory of the iron ores of our country and, before the above-mentioned great ore inquiry was started, also attempted to estimate our resources of ore. Another expression of his interest in practical geology was the lecture with which in 1907 at the Geological Society of Stockholm he opened a discussion as to what ought to be done for the development of practical geology in our country. Among other things he suggested the setting-up of chairs in economic geology at our universities and university colleges. The idea that he then put forward of changing the professorships of practical philosophy into chairs of practical geology was scarcely meant very seriously.

S. was very much at home in the history of his science. One can see this from the historical exposés with which he often introduces his writings, and this interest was expressed no less in the description he

has given of the lives and work of individual scientists, as in his papers on Swedenborg and Linnæus and the memoir on his famous predecessor at the Royal Museum, A. E. Nordenskiöld. And to the same sphere of his work are to be referred the sympathetic memoirs written by S. on H. V. Tiberg, manager of the Långban mines, and the eminent chemist Dr. R. Manzelius.

S.'s sphere of investigation is less suited than most other sciences for popular expositions. The works of S. which are intended for a somewhat more extensive circle of readers are, however, exceedingly well written, even if their popular character does not go so far that they are quite enjoyable by a great public; this is the case, for instance, with his papers on the canon Diablo meteorite, on the Ovifak Iron, on artificial gems, on regions without communication with the sea, and his survey of the geology and geography of Värmland that he gave in the recently published collective work »En bok om Värmland». S.'s works are as a matter of fact always characterized by clarity and logical exposition. His stylistic ability is perhaps best shown in his polemical writings, in which he defends his ideas with eminent ingeniousness and always without meticulousness. His oral exposition too was always clear and founded on facts, but his lectures were not specially fluent, but given at a rather slow pace, as if he weighed every word. They were faithful expressions of the undisturbable calmness of temperament which he retained in all life's vicissitudes and situations.

When S. died he had under way two large works which seem to have proceeded so far that their publication in his name will be possible. One was a translation into Swedish of Swedenborg's famous work on iron in his great work »Opera philosophica et mineralia». The part dealing with iron, which was valued so highly by Swedenborg's contemporaries that it was translated both into German and French, was now to be reproduced in Swedish as a tribute to the memory of the great investigator. When Sjögren died about two-thirds of the works was in print (304 pages) and the rest was in proof. The other work, which had interested S. for decades, was a larger Handbook of Swedish Mineralogy. Of this at least the Special Part seems in the main to be ready for publishing, while on the other hand the General Part is only partly present in manuscript.

Sjögren was one of the most widely travelled scientists in our country. Besides the previously mentioned journeys in the Caspian countries and North America we may also mention a journey to Transcaspian and Central Asia in 1911, also his participation in the meeting of the British

Association in South Africa 1905, from which he has given a valuable and richly illustrated description of the Permo-Carbonian glacial formations; his participation in the Geological Congress in Mexico in 1906, where, as the representative of Sweden, he invited the Congress to hold its next session at Stockholm, and where he took part in the excursion arranged to the northern mining district; in addition a journey in Canada in 1913, when he took part in the Geological Congress at Toronto and, in connection with this, the excursions in the Sudbury, Cobalt, and Porcupine ore districts. S. also took part in the Geological Congress in Paris in 1900 and in the Swedenborg Congress in London 1910, where as the representative of the »Kommerskollegium» (Board of Trade) and »Järnkontoret» (an Association of Ironmasters) he gave a lecture on Swedenborg as a metallurgist.

S. was very familiar with the mines and mining districts of his own country and he made repeated journeys to the more important mineral localities. He also travelled in Norway and Finland for purposes of study and even in his old age he took part in the geological excursions to which Professor Sederholm (1911) and Brögger (1913) invited Scandinavian colleagues and students. The Royal Museum contains many valuable collections that were got together or bought by S. during his journeys in foreign countries and continents, and also during his visits to localities in his own country that were interesting from a mineralogical and geological point of view.

Sjögren was well qualified for scientific travels and expeditions. His temperament, his humor, and humanity made him popular among the peoples he visited while at the same time his distinguished appearance inspired respect. He was indefatigable and always interested not only in his geological work but also in ethnology, sociology, and in the economic conditions of the countries and peoples he visited. One of his fellows in the great Asiatic journey, Prof. B. who has afforded me his impressions of Professor Sjögren as an investigator and traveller, has also expressed his admiration for the methodic and skilful working that characterised Sjögren as a field geologist and for the acuteness in his interpretation of tectonics.

Among distinctions that fell to the lot of Prof. Sjögren we may mention the following: Honorary Doctorate in Philosophy at Upsala (1893), Membership of the Royal Scientific Society at Upsala (1892), Royal Academy of Science (1903), Commander of the Orders of the North Star and the Vasa Order. He was also a member of several foreign scientific soci-

eties and a knight of some foreign orders. On several occasions he was official representative of Sweden and Swedish learned bodies at international Congresses. At the Geological Congress in Stockholm too he held a representative position. The brilliant banquet that Prof. S. and his wife gave on this occasion at their country house at Nynäs for a large number of the members of the congress was unique of its kind. And on many other occasions Mr and Mrs Sjögren practised great hospitality, and there are many who have pleasant memories of their visits to Nynäs, where, under the kind ciceronage of the host and hostess, they were also able to enjoy the beautiful natural surroundings and where Prof. S. was always ready to guide his colleagues and friends in his large and exquisite private library.

Although Professor Sjögren was active as a university teacher only for a short time, he was always afterwards in close contact with the votaries of geology at Upsala and felt very much at home and was always a welcome guest at their scientific meetings and discussions. There are numerous students and now working geologists who are indebted to him for the generosity with which he placed his Bulletin at their disposal for the publication of the results of their research.

To this simple and brief memoir the writer, who has been entrusted with the redaction of the »Bulletin» during the greater part of its existence, wishes finally to add his personal thanks for the friendship and goodwill that during this time as well as at other times he has always met with from Hjalmar Sjögren.

Upsala May 8th, 1922.

A. G. Högbom.

Bibliographia Sjögreniana.

A list of Prof. HJ. SJÖGREN's works.

Articles published in news-papers and in the Swedish encyclopedia, Nordisk Familjebok, as well as all reviews are excluded.

G. F. F. = Geologiska föreningens i Stockholm förhandlingar.

1877.

1. Teorierna för den inre jordvärmen. Föredrag på Föreningen T. I. af Hjalmar Sjögren. — *Berättelse vid Föreningens T. I:s sextonde årshögtid den 2 mars 1877*, Stockholm 1877, pp. 151—161.

1878.

2. Sjögren, Hj. Om några vismutmineralier från Nordmarks grufvor i Wermland. — *G. F. F.*, Bd 4 (1878—1879), pp. 106—111.

3. Sjögren, Hj. En barythaltig mangankalk från Långbans grufvor. — *G. F. F.*, Bd 4 (1878—1879), pp. 111—112.

1879.

4. Sjögren, Hj. Kristallografiska studier. 1. Pyroxén från Nordmarken. — *G. F. F.*, Bd 4 (1878—1879), pp. 364—381, pl. 20. [Continuation see No. 7, 9, 12, 21 & 25.]

1880.

5. Lärobok i mineralogi för elementar-läroverk och tekniska skolor af Anton Sjögren. Tredje upplagan. Bearbetad och tillökad af Hjalmar Sjögren. E. o. amanuens vid Lunds universitets mineralsamling. Stockholm [pr. in Norrköping] 1880. 8°. VIII, 218 pp., 213 textfigs.

6. Sjögren, Hj. Fredricit, ett fahlerzartadt mineral från Falu grufva. — *G. F. F.*, Bd 5 (1880—1881), pp. 82—86.

7. Sjögren, Hj. Kristallografiska studier. 2. Bidrag till kännedomen om Pajsbergitens kristallform. — *G. F. F.*, Bd 5 (1880—1881), pp. 259—266, 2 textfigs.

1881.

8. Undersökningar af chondroitartade mineral från Ladugrufvan i Werm-land och Kafveltorp i Westmanland. Förberedande meddelande till A. E. Nordenskiöld. Af Hj. Sjögren. (Meddeladt den 11 maj 1881.) — *Stockholm, Vet.-Ak. Öfvers.*, Årg. 38 (1881) No. 5, pp. 29—33.

9. Sjögren, Hj. Kristallografiska studier. 3. Chondroit från Kafveltorp. *G. F. F.*, Bd 5 (1880—1881), pp. 655—714, pl. 29—31. [Cfr No. 10 & 17.]

1882.

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7. En blyglans med oktaedriska genomgångar från Nordmarks gruffält i Vermland. — Pp. 124—130.

8. Allaktit från Nordmarken. — Pp. 220—236, pl. 7.

9. Diadelphit från Nordmarken. — Pp. 369—381, pl. 10.

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1. Några ord om Långbanit. — Pp. 256—265, 608, 1 textfig. Cover-title: Medd. fr. Ups. univ. mineralog.-geol. inst. 2.

2. Astochit, en ny led af amfibolgruppen. Pp. 604—607. Cover-title: Medd. fr. Ups. univ. mineralog.-geol. inst. 4.

54. Om de svenska jernmalmslagrens genesis. Af Hj. Sjögren. — *G. F. F.*, Bd 13 (1891), pp. 373—435. Cover-title: Medd. fr. Ups. univ. mineralog.-geol. inst. 3.

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1893.

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 62. Ytterligare om Routivare jernmalm. Af Hj. Sjögren. — *G. F. F.*, Bd 15 (1893), pp. 140—143. [Cfr No. 60.]
 63. Om Sulitelma grufvor i Norge. Yttrande med anledning af A. E. Törnebohms föredrag om Falu grufva.) — *G. F. F.*, Bd 15 (1893), pp. 409—412.
 64. Några jemförelser mellan Sveriges och utlandets jernmalmslager med hänsyn till deras genesis. Af Hj. Sjögren. — *G. F. F.*, Bd 15 (1893), pp. 473—510, 5 textfigs.
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 2. Crystallized Hedyphane from the Harstigmüne.
 3. Humite, 4. Chondrodite and 5. Clinohumite from Nordmarken.
 6. Longbanite from the Långban mine.
 7. Svabite, a new member of the Apatite group.
 8. Adelite, a new basic Arseniate from Nordmarken, Jakobsberg and Långban, Vermland.

1894.

66. The iron ore deposits of Dunderland (Norway). Upsala 1894. 8°. 34 pp., pl. 1—6 [maps].
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 68. Minerals de fer de Dunderland, Province de Nordland (Norvège). Upsala 1894. 8°. 33 pp., pl. 1—6 [maps].
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1895.

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10. Retzian, a new arseniate from the Mossgrufva, Nordmark.
11. Pyroaurite from the Mossgrufva, Nordmark.
12. Magnetite of cubic form from the Mossgrufva, Nordmark.
13. Safflorite from Nordmark.
14. On the Richterite of Breithaupt and on Soda Richterite.
15. Urbanite, a new member of the Pyroxene group.
16. On the composition and crystalline form of Caryinite from Långban.
17. On Soda Berzeliite from Långban.
18. Långbanite from the Sjögrufva.
19. Prolectite, a new mineral of the Humite group.

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2. Analyser på axinit från Nordmarken och Dannemora och om axinitens kemiska konstitution.
3. Periklas från Långbans grufvor.
4. Tilasit eller fluor-adelit från Långban.
5. Om pseudomorfoser af chondroit, tremolit och dolomit till serpentin från Kogruvnan i Nordmarken.
6. Om copiapit, ett för Sverige nytt mineral från Falu grufva och om botryogenens formel.
7. Mauzeliit, ett nytt antimonat från Jakobsberg.

74. Återblick på literaturen om de skandinaviska jernmalmerne och kisernas bildning med anledning af professor J. H. L. Vogts senare arbeten på detta område. Af Hj. Sjögren. — *G. F. F.*, Bd 17 (1895), pp. 363—388.

75. Celsian, en anorthiten motsvarande bariumfältspat från Jakobsberg. Preliminärt meddelande. Af Hj. Sjögren. — *G. F. F.*, Bd 17 (1895), pp. 578—582.

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1897.

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79. Om några slamvulkanutbrott i Kaspiska regionen under åren 1892—96. Af Hj. Sjögren. — *G. F. F.*, Bd 19 (1897), pp. 91—105.

80. Om retzian och dess sammansättning. Af Hj. Sjögren. — *G. F. F.*, Bd 19 (1897), pp. 106—112, 3 textfigs.

81. Om boulangeritens kristallform och kemiska sammansättning. Af Hj. Sjögren. — *G. F. F.*, Bd 19 (1897), pp. 153—167.

1898.

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83. Om manganositens och periklasens bildningssätt vid Långban och Nordmarken. Af Hj. Sjögren. — *G. F. F.*, Bd 20 (1898), pp. 25—32.

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87. Den kemiska sammansättningen af amalgam från Sala. Af Hj. Sjögren. — *G. F. F.*, Bd 22 (1900), pp. 187—190.

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1902.

89. A. E. Nordenskiöld som mineralog. Af Hj. Sjögren. — *Ymer*, Årg. 22 (1902), pp. 225—248, 2 textfigs.

1903.

90. Om ett »jordkast» vid Glumstorp i Värmland och om dylika företeelser beskrifna af Urban Hiärne. Af Hj. Sjögren. — *Arkiv för matematik, astronomi och fysik*, Bd 1, 1903, pp. 75—99, 5 textfigs.

1904.

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1905.

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94. Om kristalliserad pyrochroit från Långbans grufvor. Af Hj. Sjögren. — *G. F. F.*, Bd 27 (1905), pp. 37—41.

95. Inneslutningar i en gångkvarts från Salangen i Norge. Af Hj. Sjögren. — *G. F. F.*, Bd 27 (1905), pp. 113—116, 1 pl.

96. Barysil från Långban. Af Hj. Sjögren. — *G. F. F.*, Bd 27 (1905). pp. 458—462, 3 textfigs.

97. Om Sveriges jernmalmstillgångar jemförda med verdens jernmalmsbehof. Einringar med anledn. af Professor A. E. Törnebohm's till riksdagens bevillningsutskott ingifna upplysningar af 14 mars och 15 april 1905 af Hj. Sjögren. Stockholm 1905. 8°. 37 pp. The first paper also in *Bihang till Riksdagens protokoll vid lagtima riksdagen i Stockholm 1905*, Saml. 5: Afd. 1: No. 24, pp. 31—50.

Caused by Törnebohm's pronouncement, *Ibid.*, pp. 8—17. T. replied, *Ibid.*, pp. 51—53. Sjögren's opinion was criticized also by Hj. Lundbohm, *Ibid.*, pp. 54—56. All articles are reprinted in *Teknisk tidskr.*, Årg. 35 (1905): Afd. för Kemi, pp. 73—85, and in *Karlstad, Werml. Bergsmannafören. Annaler*, 1905, pp. 129—182.

Malmgeologiska anteckningar, 2. See No. 91.

1906.

98. Thalenit från Åskagens kvartsbrott i Värmland. Af Hj. Sjögren. — *G. F. F.*, Bd 28 (1906), pp. 93—101.

99. Om den permo-karboniska istiden i Sydafrika. Af Hj. Sjögren. — *G. F. F.*, Bd 28 (1906), pp. 113—132, pl. 4—9, 1 textfig.

100. Edingtonit från Böhlet och från Kilpatrik i Skottland. Af Hj. Sjögren. — *G. F. F.*, Bd 28 (1906), pp. 169—177, 11 textfigs.

101. (Inledningsföredrag till diskussionen om våra järnmalmers bildningssätt.) — *G. F. F.*, Bd 28 (1906), pp. 314—333, 351—356, 6 textfigs. (Diskussionsinlägg.) Pp. 335—337, 346—348.

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1901—1921 he edited the annual reports of the Mineralogical Section of the Royal Museum of natural history, published in *K. Vetenskapsakademiens Årsbok*.

Upsala, May 8th, 1922.

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