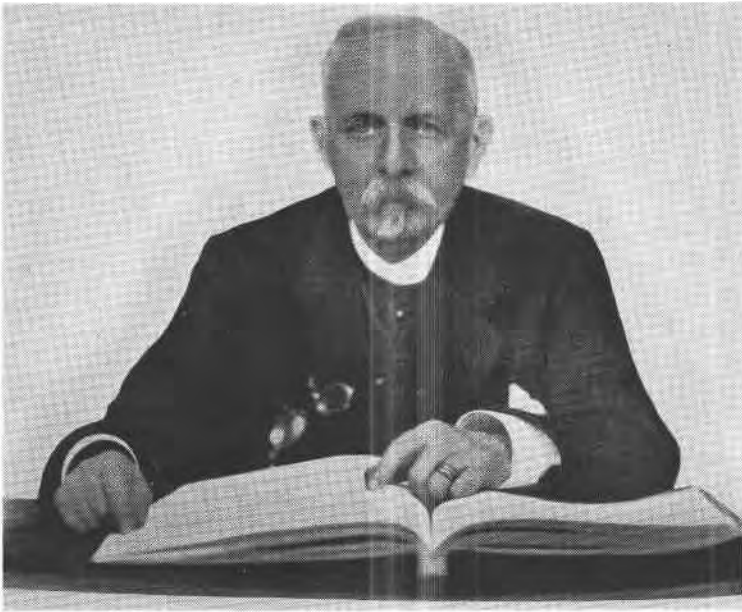


MEMORIAL OF WALDEMAR CHRISTOPHER BRÖGGER

OLAF ANDERSEN,
Stevens Institute of Technology, Hoboken, New Jersey.

With the death of Dr. W. C. Brögger, Professor Emeritus of the University of Oslo, on February 17th, 1940, the science of geology lost one of its most outstanding workers, and Norway lost an ardent patriot and faithful public servant, a truly great son.

Waldemar Christopher Brögger was born in Oslo on November 10th 1851, his parents being Anton Wilhelm and Oline Maria (Bjerring) Brögger. He received his preparatory education in Oslo where he graduated from the "Gymnasium" and was matriculated at the university in



WALDEMAR CHRISTOPHER BRÖGGER
1851-1940

1869. He devoted his entire time at the university to an independent study of science on a broad basis and laid the foundation for the remarkable mastery of the several branches of geology, including mineralogy, that was such a striking feature of his scientific work.

Brögger's professional career may be characterized as easy from the

start, his great gifts, thorough knowledge and inspiring personality opening the way for him to the positions he desired for his life's work. He became an assistant at the Norwegian Geological Survey in 1875 and retained his connection with the survey as a collaborator for the greater part of his life. From 1876 to 1881 he was associated with the University of Oslo as a curator and research fellow. In 1881 he was called to the University of Stockholm as professor of mineralogy and geology and thus attained the position of a full rank professor at the early age of thirty. He was called back to Norway as professor of mineralogy and geology in the University of Oslo, in 1890, and remained active in this professorship till his retirement in 1916.

Through his activity as a university teacher in Stockholm and Oslo, Brögger exerted a great influence on the development of geology in the countries of northern Europe. In Stockholm pupils from all these countries flocked to his classes and among them were many who later became prominent in various fields of geology. In Oslo he became the teacher of practically all Norwegian geologists, mining engineers and natural history instructors now of late middle age or older. During the last ten years or so of his service as professor, heavy public duties forced him to leave most of the teaching to others. In the course of his 24 years of retirement he devoted a major portion of his time to research work in geology.

Brögger's scientific activity extended over nearly all branches of geology; indeed it included zoology and archaeology; but his most important work was in the fields of mineralogy and petrography. As the years passed by, his work was more and more concentrated on petrography and he became one of the leading petrographers of his time.

After publishing a paper on the molluscs of the Oslo fjord in 1872, Brögger concentrated entirely on geology and published his first geological paper, on giant pot holes, jointly with Reusch, in 1874, and his first mineralogical paper, on large crystals of enstatite, in 1876. Thereafter for many years he devoted a considerable part of his time to mineralogical studies, his main interest being the minerals of the syenite pegmatites of the Oslo region. A number of papers containing descriptions of new minerals and new data on previously known minerals from these pegmatites were published and the complete results were gathered in the unique monograph: "Die Mineralien der Syenitpegmatitgänge der Südnorwegischen Augit- und Nephelinsyenite," appearing in 1890 as volume 16 of *Zeitschrift für Krystallographie und Mineralogie*. This remarkable volume of two separately paged parts contains in the first part of 235 pages, an outline of the general geology of the Oslo region and the special geology of the syenite pegmatites, and in the second part of 663 pages, detailed descriptions of the 70 odd minerals occurring in the pegmatites.

An opinion on the scientific value of this monograph was expressed at the time of its publication in the following words of Professor P. Groth: "The present publication will, no doubt, become of epoch-making importance for the knowledge of the natural history of Scandinavia." Another important contribution to mineralogy was Brögger's work on the minerals of the granite pegmatites of southern Norway, but this work was only partly finished. Its results were published in a number of separate papers and in the monograph: "Die Mineralien der Südnorwegischen Granitpegmatitgänge. I. Niobate, Tantalate, Titanate und Titanoniobate" (the *Academy of Sciences of Oslo*, 1906). This monograph would have contributed everlasting value if it added nothing more to mineralogy than all its chemical data. It contains sixteen new analyses of these extremely complicated rare earth minerals, and gives detailed discussions of their chemical and crystallographic relationships. Also the listing of numerous localities and a summary of the geology of the granite pegmatites are features of considerable importance in this publication. Brögger's only later publication in the field of mineralogy was a brief paper giving supplementary crystallographic data on hellandite, published in 1922. As a conclusion of the remarks on Brögger's work in mineralogy it may be stated that the following minerals were named and first described by him: nordenskiöldine, hambergite, johnstrupite, calciothorite, låvenite, hiordahlite, rosenbuschite, barkevikite, cappelinite, melanocerite, mossite, blomstrandine, priorite, and hellandite; and that the mineral bröggerite, a helium-bearing octahedral variety of uraninite, was named after him.

Brögger's work in petrography was largely concerned with the igneous rocks of the Oslo region, but he also made important contributions to the study of pre-Cambrian rocks. The results of his work on the igneous rocks of the Oslo region were published from time to time between 1890 and 1933, and are contained in a number of papers and particularly in the following monographs having the main title: "Eruptivgesteine des Kristianiagebietes" (Oslogebietes) and the following sub-titles: "I. Die Gesteine der Grorudittinguait serie (1894), II. Die Eruptionsfolge der triadischen Eruptivgesteine bei Predazzo in Südtirol (1895), III. Das Gangefolge des Laurdalits (1898), IV. Das Fengebiet in Telemark, Norwegen (1921), V. Der grosse Hurumvulkan (1930), VI. Über verschiedene Ganggesteine des Oslogebietes (1932), VII. Die chemische Zusammensetzung der Eruptivgesteine des Oslogebietes (1933)." All these were written in German and occur in the regular series of publications issued by the *Academy of Sciences of Oslo*. The following two were written in Norwegian and published in 1933 in the series of the Norwegian Geological Survey: No. 138—The eruptions of the essexite series. The oldest

volcanic activity in the Oslo region; and No. 139—On the rhombporphyry dikes and their accompanying faults in the Oslo region.

Rocks from the pre-Cambrian areas adjoining the Oslo region were described by Brögger in the last two publications written by him: "On several Archæan rocks from the south coast of Norway, I—Nodular granites from the environs of Kragerö" (1934), and "II—The South-Norwegian hyperites and their metamorphism" (1935), published by the Academy of Sciences of Oslo. These two volumes on which he worked intermittently for many years, were written in English by Brögger, as a compliment to American friends, although he labored arduously with the language, having learned it late in life. "I am using the dictionary and the grammar all the time," he once told me. In the preface of the first volume he sends "... a cordial and grateful greeting to noble friends among American petrographers and geologists, a greeting full of remembrances from forgotten and ever memorable days during a visit to the United States 32 years ago..." In volume II, on hyperites, Brögger gives very thorough descriptions of all the structural details of these and other rocks and publishes a number of new analyses. The detailed discussion of corona structures is of particular interest.

Brögger's great monograph on the late glacial and post glacial changes of level in the Oslo region with descriptions of the faunas of the Quaternary clay deposits, and his treatise on the levels of the strand-line during the stone age in south-eastern Norway, should also be mentioned as among his important publications. They were written in Norwegian and published in the series of the Norwegian Geological Survey as Nos. 38 (1900) and 41 (1905), respectively.

In the Trondheim district and the Hardanger "Vidda" (plateau) Brögger pursued studies involving stratigraphic and structural problems. At the latter place he worked as a member of a government commission investigating the problems of the mountain passage of the Oslo-Bergen railroad. His work on this commission is said to have played no small part in the successful completion of this difficult engineering project which was finished in 1910, after many years of construction.

Brögger's work on the geology of the Oslo region mentioned above, deserves a few additional remarks. This region extends in a general north-south direction between the Oslofjord and Lake Mjösa. It is about 140 miles long and 22-35 miles wide and covers an area of about 4000 square miles. The region is characterized by the occurrence of a great variety of intrusive and extrusive igneous rocks of the alkaline type associated with older paleozoic sedimentary rocks, the whole complex being surrounded by pre-Cambrian rocks and being preserved from denudation by subsidence along fissure faults. The main features of the geology of the region

were known from earlier investigations, indeed, the "Christianiagebiet" was famous among geologists of the nineteenth century, but a large amount of detailed observations and thorough revisions of the old interpretations were highly desirable. This immense task Brögger undertook at the outset of his career as a geologist and continued it for over sixty years. Aided by a number of younger assistants, he and his collaborator, the late professor J. Schetelig, mapped the region in great detail and published ten sheets on a medium scale (1:100,000) of the greater part of it, and an outline map on a scale 1:250,000 of the entire region. He brought together enormous collections of minerals, rocks and fossils from all parts of the region and examined this material by all available laboratory methods. The results of this work were published in over sixty papers (including the monographs mentioned above) covering subjects in mineralogy, petrography, paleontology, stratigraphy, structural geology, and Quaternary geology. Impressive as this work is, it does not cover nearly all the items of the Oslo region or what Brögger had planned to do. It is particularly to be regretted that the complete summary of all petrographic-geologic data, and the petrogenetic conclusions based on them, alluded to by Brögger in one of his monographs, was never published. It is fortunate, however, that in his last publication on the Oslo region (No. VII in the series mentioned above) he gave a complete, classified list of all the 331 analyses made on the igneous rocks of the region with brief remarks on the igneous history of the rocks. In other monographs (particularly Nos. I and III of the series) he dealt at length with problems of magmatic differentiation, the clarification of which is to a considerable extent due to Brögger's studies in the Oslo region. He established as an empirical rule, the analogy between sequences of crystallization, differentiation, and eruption—the rule of increasing acidity—which also has been found to hold true, in a general way, for a number of other comagmatic regions.

Besides the publications containing the results of his personal research work, Brögger wrote an excellent outline of the geology of Norway and numerous popular articles on a variety of subjects, usually contributed to newspapers.

During the last fifty years of his life, while active and as a retired professor in Oslo, Brögger became engaged in numerous activities in addition to his university work. Thus he served as a member of the Storting (Parliament) for the term 1906–1909 and used much of his influence as a legislator to improve the economic conditions of scientific and educational institutions in Norway, nearly all of which are owned and operated by the state. After having been instrumental in reorganizing the administrative system of the University of Oslo, he was elected its first rector in 1906.

and re-elected for several years, serving in 1911 when he had the strenuous task of organizing and leading the centennial celebration of the university. He did a magnificent work for the general welfare of the university, obtaining among other things, appropriations for highly needed new buildings. For many years he was president of the Academy of Sciences of Oslo and contributed greatly to the advancement of this organization. He was one of the three honorary members of the venerable patriotic organization, "The Society for the Welfare of Norway," and held positions of trust and honor in several other organizations. As early as 1896 he began his illustrious activity as "the biggest beggar in Norway" (self styled), collecting funds from private sources for scientific work and he kept it up for many years thereafter. This was no easy task in a country where large fortunes are few and far between and where tradition, when Brøgger began his "begging," did not favor donations to science as much as to religious organizations and charity. However, Brøgger's tremendous energy and great power of persuasion overcame all difficulties, and the results of his personal efforts and of his leadership and inspiration were funds amounting to several million dollars, the proceeds of which have been at the disposal of Norwegian scientists for their projects of research and the printing of their reports. Brøgger was also largely responsible for shaping the extremely liberal rules under which grants from the funds were distributed, and for many years he took a leading part in the administration of the funds.

Brøgger's cultural interests were many-sided; he appreciated literature and art and was always on the alert against attempts of restricting the perfect liberty of expression in any fields of intellectual activity. His musical talents were so prominent that in his early youth he hesitated for a while before he chose the career of a scientist instead of that of a musician. In politics Brøgger was a conservative liberal, always lined up with those who represented progress and democratic ideals. He had traveled widely visiting most European countries and also the United States where he spent some time in 1902, making a round trip traveling as far as the west coast and becoming a friend for life of most American geologists of prominence then living. He often spoke about these friends in words of love and admiration.

Brøgger's work as a scientist and public servant was widely recognized not only in Norway, but in many foreign countries whose sovereigns and institutions honored him in various ways. He received several prizes and medals, among them the highly cherished Wollaston medal of the Geological Society of London (1911), and held honorary degrees from a number of universities. The Grand Cross (the highest degree) of the Order of St. Olav was awarded to him by the King of Norway in 1911, and he

also held orders of knighthood from Denmark, Sweden, Germany, France, Italy, and Russia. He was a Foreign Member of the Royal Society and an Associé de l'Institut de France, and was elected to membership in about thirty other learned societies.

With all his accomplishments and honors Brögger remained to his death a delightfully human person. He did not suffer from false modesty, for he honestly knew his own worth, but he was easily approached and those who made his acquaintance would find him an interesting and charming man, at the same time they would be impressed by the vigor of his personality. His dynamic energy was an inspiration to most of those who came in contact with him, although some might be taken aback by the strides of the giant. As one of his colleagues said when he compared Brögger, the organizer, with a rotary snow plow forcing its way through densely packed drifts: "It is a magnificent sight, but those who happen to come close to the plow may not always be comfortable." Brögger was fearlessly honest and outspoken and never afraid of a fight if the occasion called for it; but he was far from meddlesome and never posed as a sage; indeed, the restraint of this man of unusual insight and knowledge was quite remarkable. His helpfulness towards those he considered worthy of help was unstinted, expressed as it was in efficient action, not merely in considerate words.

In spite of much illness during his long life, Brögger was physically fit almost to his death, but his memory became slightly deficient during the last five or six years of his life. He died from kidney trouble after an illness of two weeks. His funeral services were held in the large festival hall of the University of Oslo, which was filled to capacity by a gathering representing a good cross-section of the people of Norway. The King, the Crown Prince, the Prime Minister, and numerous other representatives of government, politics, science, art, industry, and business were present together with Brögger's family, friends and colleagues, and hundreds of students from all departments of the university. Memorial meetings were held for him by the Norwegian Geological Society and the Academy of Sciences of Oslo. On all these occasions as well as in the obituaries of the newspapers, tribute was paid to Brögger as a great scientist, an inspiring organizer, and a warm hearted patriot. It was said that Norway is not likely to have another son his equal for a long time.