

Memorial to Olaf Holtedahl

1885-1975

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Professor Olaf Holtedahl (Ph.D.) died August 28, 1975, at the age of 90 years. He was the last representative of the classical old days of geology in Norway—the days when a young man with a bent for the science of geology started to publish his first investigations as a student, when good geologic field work in a new area could produce principal new discoveries, when a sharp-eyed and eager geologist could publish on any subject from paleontology to Quaternary geology because he had a solid and all-around education. The life and work of Holtedahl exemplified, perhaps more than that of any other geologist, this period in the science of geology in Norway.

Olaf Holtedahl was born in Oslo on June 24, 1885. He went to school in Oslo, and he studied at the University of Oslo where he received his degree in 1909 in paleontology with stratigraphy as his main subject. The academic professional career of Holtedahl was connected only with the University of Oslo. Here he became a research associate in 1910 and took his doctor's degree in 1913. In 1914 he became dosent (reader) in paleontology and historical geology and became full professor in historical geology in 1920. He maintained this position until he retired in 1955 at the age of 70 years.

During his school years and student days, Olaf Holtedahl experienced the heroic period in Norwegian science with the expeditions of Fridtjof Nansen. No doubt these deeds inspired the young Holtedahl, and one may indeed say that Holtedahl followed Nansen's trails, a bit more modest in daring expeditions, but on the other side more directly scientific, aimed principally at new geologic discoveries. The expeditionary life of Holtedahl started with his taking part as a geologist in Spitsbergen expeditions in 1909 and 1910. His doctoral thesis was on material from these expeditions, the Carboniferous of West-Spitsbergen. In the period 1914-1917, Holtedahl had summer expeditions around the Arctic coast of Norway, and these led to a survey volume that is a pioneer work on the geology of Finnmark. Still, Holtedahl was not satisfied. He obtained a special grant from the government and permission from the Soviet Union to undertake a special investigation of Novaya Zemlya, an island group that was almost geologically unknown. The report from this expedition was said to be a classic in Arctic geology. In the 1920s the Norwegian whalers had conquered the Antarctic seas and brought back samples from exotic landings. This inspired Holtedahl to an expedition also to Antarctic waters, financed by the owner of a leading Norwegian whaling company (Norvegia expedition of 1927-28). In the reports from short visits in many Antarctic localities, Holtedahl proved his ability to grasp and understand much geology correctly in a short time.

As a necessary supplement to his study, Holtedahl visited several well known foreign universities during this period. He studied one year at Yale University (1912-13) and paid

shorter visits to universities both in Germany and in Russia in connection with his Arctic studies.

As a professor Holtedahl also taught Quaternary geology, and he had a keen eye to this branch of geology all his life. The introduction into this field came naturally from his acquaintance with glacial features in the Arctic, and he used this knowledge in his study of the glacial sand terraces of Romerike just north of Oslo. The description of these sand deltas deposited at the front of the retreating ice is a classic of Norwegian Quaternary geology (1924).

Around 1920 Holtedahl broadened his interest and took up both more local and specific geologic problems relating to the Norwegian Caledonian zone as well as its big problems. In 1921 he published papers in the *Quarterly Journal of the Geological Society of London* on sparagmite geology in Southern Norway as well as on the Scandinavian mountain problem. The discovery that one conglomerate formation must be a tillite by origin was important in linking the sparagmites with the Finnmark sandstones and other tillite-bearing sandstones in Spitsbergen and east Greenland. After more years of study of the general geology of the Caledonian orogenic zone of southern Norway, Holtedahl presented a revolutionary new view at a meeting of Nordic scientists in Helsinki in 1936. Large-scale overthrusting had been postulated by the Swedish professor A. E. Törnebohm in 1896, then inspired by results from Scotland. But Törnebohm studied only the marginal parts of the Caledonian folded and metamorphosed rocks, and he relied especially on field work in marginal parts in Sweden where the thrusting of metamorphic rocks over unmetamorphic Cambrian and Silurian rocks was most clearly observable. In southern Norway the central area of Jotunheimen with the highest peaks of Norway presents a dominating problem: Gabbroic to intermediate igneous rocks of the mountains form an upper layer above rocks that must be Cambrian and Ordovician, but is the situation stratigraphic or tectonic? W. M. Goldschmidt, who described these igneous rocks in a classic paper in 1916, discussed the age problem and preferred an Ordovician age for the igneous activity, with some thrusting a little later. But Holtedahl discussed the possibility that the Jotun rocks represent thrust nappes from the Atlantic. He theorized that the downfolding of these rocks and their Cambrian-Ordovician base as well as the Precambrian were only a later phase of folding. Most geologists still adhere to Holtedahl's theory. It is now certain (from preliminary and unpublished age dating) that the igneous rocks are old Precambrian in age; the only problem that can be discussed is whether the emplacement was by large-scale overthrusting from an area now under the continental shelf, or if the emplacement occurred by mushroom-type doming, due to a nearby subduction zone.

The sketchy views of 1936 were enlarged upon in a general treatise of the Caledonides, in which Holtedahl wrote the Scandinavian part and E. B. Bailey wrote the British part (1938). In those years Holtedahl was so modern that he gave a sketch map of Caledonian geography with Greenland in the pre-drift position, according to the theory of Wegener—a sketch that is inescapable in any present-day regional discussion of Caledonian geology. In the late 1930s this was quite daring, and I remember that it nearly automatically called for a smile among Norwegian geologists.

Another Caledonian breakthrough was published in 1938. After field work with his younger colleague Tom. F. W. Barth at the western contact of the Cambrian-Silurian Trondheim region against Precambrian rocks, Holtedahl discovered that the folding of the Cambrian and Silurian rocks also involved the basement rocks to a considerable depth. Thus, it seems possible that the whole stretch of Precambrian gneisses running from Bergen north on the coast for 700 km were folded during the Caledonian orogeny.

This is also a big question discussed these days: Is most of the folding of the same age as the gneisses (1,800 m.y.), or how deep did the Caledonian folding go? These cover-basement relations make one of the focal points both in the Norwegian and the Swedish International Geological Correlation Program running these years.

The war years with German occupation (1940–1945) hindered but certainly did not stop the geologic work of Høltedahl, who had started on his biggest project, a regional geologic description of Norway. Much of this work was finished in the first years after the war, but the final work came in 1953 in a two-volume description (*Norges geologi*) with 1100 pages. The first volume treats the solid rocks, a skillful compilation of his own work with results from the literature and from unpublished results by his several collaborators and pupils. A completely new geologic map in scale 1:1,000,000 was produced with his assistant Johannes A. Dons, now first curator at Geologisk Museum, Oslo. A testimony of Høltedahl's ability as a compiler, as well as his solid knowledge of general geology, may be learned from the frequently expressed views of his students: The Precambrian, which Høltedahl knew the least about, received skillful treatment, without any tendency to over-emphasize local features or to overdo detailed discussion. The second volume, which is the Quaternary geology, proved equally valuable, because it gave a completely new and very detailed treatment of all sides of Quaternary geology in Norway. This two-volume work may be truly termed Høltedahl's greatest contribution, finished at the age of 68 years. His retirement in 1955 did little to reduce the working power of this general geologist. It was therefore inevitable that Høltedahl would edit an English and condensed version of his great work for the foreign geologic audience. This was published in 1960 on the occasion of the International Geological Congress in Copenhagen (which included excursions in all the Nordic countries). In this volume (*Geology of Norway*), specialists wrote many chapters, but many were from Høltedahl's hand. A slightly revised edition of the geologic map accompanied the book, as well as the Quaternary map of Norway.

In addition to this main line of development in Høltedahl's geologic career, a few other fields of his work must be mentioned: the Oslo region, the continental shelf, and his popular geology.

With the University of Oslo located in the middle of the world-known province of Permian igneous rocks, it was natural that Høltedahl should take an interest in the geologic surroundings of Oslo. These igneous rocks had become world famous through the works of Professor W. C. Brøgger who retired in 1917. In the following decades, however, the Oslo region remained Brøgger's domain. But, owing to the discovery by a German student of the angular unconformity between the Silurian and overlying lava, Høltedahl guided a student excursion to the base of the lavas west of Oslo, for the particular purpose of looking for the contact. Then, Permian fossils were discovered, thus dating the igneous activity of the Oslo region as early Permian. After Brøgger's death in 1940, Høltedahl took up field work in Oslo surroundings and started the new era of Oslo studies with the first volume in the series *Studies on the Igneous Rock Complex of the Oslo Region*. Tom. Barth wrote the second volume, and their pupils continued the series which now comprises 25 numbers.

The submarine relief of the Norwegian continental shelf had caught Høltedahl's interest during his Arctic period, and in 1929 he published his first paper on the remarkable features of the submarine relief outside Norway. After smaller contributions, in 1940 he published the complete submarine relief off the Norwegian coast in seven large map sheets with a discussion of the geologic features, especially the deep trenches parallel to the coast and close to it. In several small contributions, Høltedahl discussed the tectonic

features connected with the elevation of the land mass of the Scandinavian peninsula in early Tertiary time, the latest contribution being in 1970. However, Høltedahl never discussed seriously the possibility of finding thick Mesozoic-Tertiary sequences (with oil) on the shelf. One may, on afterthought, say that this great possibility was the only one not discussed in detail in some paper by Olaf Høltedahl. So thorough were the published discussions of Høltedahl that the younger geologists, when inventing a new hypothesis, often found that the old professor had already said it.

With his deep interest in geology and his great ability in writing up his results, Høltedahl also addressed the public with a rain of articles on popular geology in newspapers and periodicals, as well as in books. Most widespread was his popular narrative of the geology of Norway, *Hvordan landet vårt ble til* (*How Our Country Was Formed*), published first in 1931, with a third edition in 1968. Thus, Høltedahl followed the complete scene of geologic development in Norway at least until he was 83 years of age!

In conclusion, it may be said about Høltedahl's publishing activity in scientific geology that his greatest influence came from the publication of a number of small articles presenting revolutionary new thought and the publication of large-scale reviews discussing all pertinent features and problems. His unusual energy in pursuing geologic problems is shown by the fact that his last work was published at the age of 89—an 85-page treatise of glacial geology in an area just east of the area covered in his 1924 work.

To his students Høltedahl was a serene and inspiring teacher who took his geology and teaching duties seriously. But he also had a fine humor and was a friendly adviser to his younger collaborators and friends.

Olaf Høltedahl was also active outside his field of geology. He served as dean of the faculty of science at the University of Oslo and as president of Det Norske Videnskapsakademi i Oslo. For his manifold and important activities in geology, he was honored by many countries and societies. He was, for instance, elected a member of the Royal Society in London, and he received, to mention just two famous ones, the Wollstone Medal of the Geological Society of London and the Leopold von Buch Medal from Deutsche Geologische Gesellschaft.

The complete bibliography of Olaf Høltedahl is published in "Norsk Geologisk Tidsskrift," v. 54, 1975, p. 231-246.

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