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**Gerard De Geer – a pioneer in Quaternary geology in Scandinavia**

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**Abstract** The paper presents a pioneer in Quaternary geology, both internationally and in Scandinavia – the Swedish geologist and professor Gerard De Geer (1858–1943). This is done, first by highlighting one of his most important contributions to science – the varve chronology – a method he used to describe the Weichselian land–ice recession over Scandinavia, and secondly by the re–publication of a summary article on Gerard De Geer’s early scientific achievement in 1881–1906 related to the Baltic Sea geology, written by his wife, Ebba Hult De Geer.

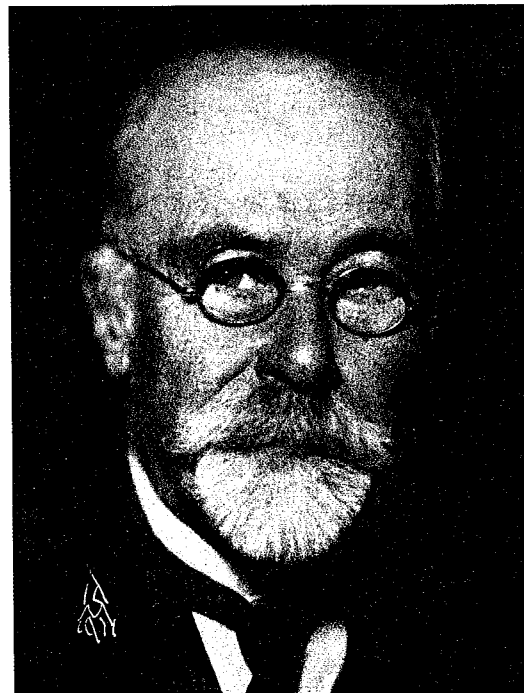
**Keywords** Gerard De Geer • Clay varves • Varve chronology • Glacial and Postglacial • Quaternary geology • Baltic Sea

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**INTRODUCTION**

It is unfortunately becoming more common in scientific papers that authors do not cite original sources of the methodology, observations and interpretations that their studies are based on. In many cases, the references are to very recent articles dealing with similar issues, which at best have correct references to the original sources. But the lack of proper citations and circular references prevents the reader from verifying the facts involved, and may lead to serious, uncontrolled permutations in ideas. This practice is scientifically inaccurate and indicative of shortcomings in both procedure and understanding of the need to always be referred to the original sources of methodology and interpretations. These deficiencies in the referencing technique occurring in many, perhaps all, scientific disciplines – geology is no exception.

Geological research is, arguably, dependent on a very close contact with original sources since most historical “experiments” in nature are not possible to repeat and often require extensive effort to document. The archive function of literature diminishes if referencing is superficial. The good news is that it has never



**Fig. 1** Gerard De Geer (2 October, 1858–23 July, 1943). Photo courtesy of the Geological Survey of Sweden.

been so easy as today to find and access original sources, thanks to the Internet connectivity of our world and increasingly innovative IT programs for literature search and data mining.

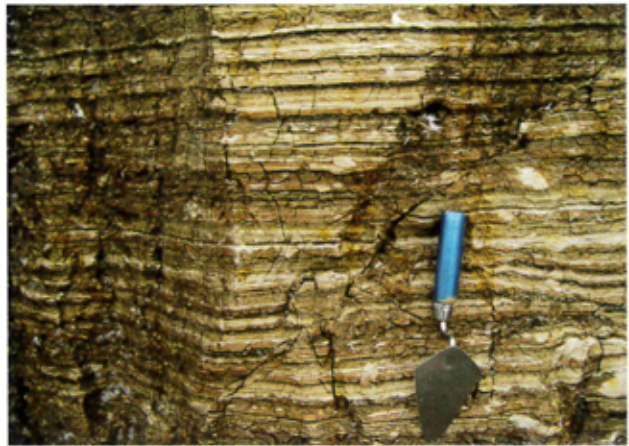
In order to help limit the shortcomings of current bibliographic trends, Baltica has chosen to start publishing classic articles of important scientists in various Earth science disciplines. These are articles that have had a significant impact on scientific knowledge and methodology, as well as a major impact on our understanding of developments within the Baltic field of interest – the geology of the Baltic Sea and surrounding coastal states.

The following paper presents a pioneer in Quaternary geology, both internationally and in Scandinavia – the geologist and professor Gerard De Geer (1858–1943). This is done by re-publication of a summary article on Gerard De Geer's early scientific achievement in 1881–1906 related to the Baltic Sea geology, written by his wife, Ebba Hult De Geer, also a prominent geologist.

### GERARD DE GEER – A BRIEF BIOGRAPHY

Baron G. De Geer is called as “the father of the clay varve chronology”. After his university studies De Geer was employed by the Geological Survey of Sweden (SGU) in 1878. The Survey he left for a professorship (1897–1924) in General and Historical Geology at the Stockholm University. At the same university he served as a Rector from 1902 to 1910 and as vice chancellor from 1911 to 1924. Before that he was a member of the Swedish Parliament Lower House from 1900 to 1905. From 1924 until his death in 1943 he founded and built up and was the head of the Geochronological Institute at the Stockholm University. De Geer also had time during the period 1882–1910 to carry out six expeditions to Svalbard for the study of glaciers and their movements.

Gerard De Geer reached international fame not least through his studies of varved clay, its connection to the glacier annual variation in sedimentation supply that gave rise to two distinct layers—a summer layer and a thin dark winter layer—together forming an annual varve. By measuring the thickness variation of the varves he managed over time to build up a chronology of the Weichselian land-ice recession over Scandinavia. The importance of this chronology to geology and other sciences was shown very clearly in the introduction to Carl Grimberg's book *Swedish history: Swedish people's wonderful stories*, part 1 (Grimberg 1921). Where Grimberg states that De Geer's discovery (published 1912) is “one of the Swedish natural science's most magnificent results”, which for the first time demonstrated “how far back Sweden's land was habitable” (more than 12 000 years BP). This knowledge was based on De Geer's glacial chronology, coupled with one of his pupils established postglacial varve chronology in



**Fig. 2** Varved glacial clay exposed in an intersection during construction of the motorway (E4), approx. 3 km east of Gamla Uppsala, Sweden. Photo by J.O. Svedlund, 2005.

Ångermanälven river valley in central Sweden (Lidén 1911, 1913, 1938).

The latter chronology was based on the sediments formed after the Scandinavian ice sheet had retreated from the interior portions of the Ångermanälven river valley, which at that time was a fjord with a delta forming at the river mouth. Through land uplift by isostatic movement after the recession of the inland ice, the outlets of the rivers and delta formation moved successively from the highest coastline, HK (in Swedish: *Högsta Kustlinjen*) (see definition, *inter alia*, Cato 1982) down to the present level of the Bothnian Sea. This regression created the postglacial varved sediments along the modern river valley with a surface that more-or-less forms a continuous sloping delta plane from the highest coastline, down to the present outlet of the river in the Bothnian Sea. Lidén's postglacial chronology in its entirety was published much later, after his death (Cato 1998), and was also successfully connected with the present (Cato 1985, 1987, 1992).

### SCIENTIFIC IMPACT OF DE GEER'S IDEAS

De Geer began in the decades 1920's and 1930's to spread the knowledge and application of the clay varve chronology outside of Sweden, through his and his pupils' studies in other parts of the world that had been glaciated, such as the Alps, the Americas, the Central Africa, the Himalayas, and New Zealand. In his great summed work *Geochronologia Suecica, Principes* (De Geer 1940), published some years before his death, he tried through tele-connection to clarify the global melting process of the last ice age. The ability for tele-connections, however, was questioned and never received scientific acceptance, due to the varying climatic conditions of the continents. The clay varve chronology based on each individual glaciated area was, however, a great success, along with De Geer's description, among other things, of the genesis of annually formed end moraines (commonly termed “De Geer moraines”) and glaciofluvial eskers, as

well as pioneering studies of the highest coastline in Sweden that showed the land areas of today that once were covered by the sea and later emerged, by isostatic rebound of the Earth crust. All this is only part of the epoch-making research he carried out.

By respecting the original source of ideas, such as with varve chronology, we are also able to reinstate the potential and uncertainties that all methods include. Documented varve sequences by De Geer and others may well provide input for new modeling efforts. Understanding of complex climatic systems is one of the great modern challenges, and new perspectives, statistical tools and data resolution may provide valid comparisons and insights, reminiscent of De Geer's notorious tele-connections. Since science is build mainly upon borrowed ideas both the original intent of these ideas and the new synthesis of new interpretations can complement each other if properly referenced. In this light it is motivated, once more, to highlight the importance of G. Dee Geer's contribution to modern Quaternary geology, well done by Ebba Hult De Geer's 1963 review of her husband's early contributions to the Baltic research.

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