



## Old juniper shrubs from the area of Norse Greenlandic Settlements: toward a long growth-ring chronology and its climatic implications

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During the past decades, the Arctic has experienced a more rapid and pronounced temperature increase than most other parts of the world. However, to fully understand the mechanisms and consequences of contemporary and future climate change, it is necessary to study past natural changes in climate and the environment. There is a lack of comprehensive and complementary studies about past changes on a scale of hundreds of years, in which climatic conditions can be reconstructed with high-resolution and replication. Greenland, covered by approximately 90 % of the Greenland ice sheet, is particularly vulnerable to climate change. The Greenland temperature proxy reconstructions are mostly based on ice cores or varve sediments. Available early-instrumental observations reach the second half of the 18th century. The aim of our study was to explore the potential of juniper shrubs growing in multiple sites from hitherto unexplored locations in Greenland, to create and extend growth-ring chronologies back in time, and thus further our knowledge of regional climate variations in the past. Around 90 wood samples were collected from three sites in southern Greenland: Narsarsuaq, Kiattuut Sermiat and Qassiarsuk. From each site, both living and dry wood were available. In addition, we analysed 35 historical juniper discs collected during the Danish expeditions to Greenland at the turn of the 19th and 20th centuries. Data processing was extremely difficult due to very narrow growth rings as well as the occurrence of missing and false rings. Thus, we performed double-stained microscopic sections for each specimen. In addition, anomalies in the anatomy of wood were found, such as frost rings and density fluctuations, related to extreme climatic conditions. Most of the analysed juniper specimens were of similar biological age, i.e. 200-280 for living shrubs, up to 310 years for dead wood, and even 350 for historical discs. However, they have been dated to different time periods, enabling the construction of a 487-year-long growth-ring chronology (1536-2023). The combination of this unique dendrochronological material made it possible to develop a chronology of *Juniperus communis* dating back to the beginning of the Little Ice Age. Up to now, these juniper shrubs are the oldest ones found in Greenland. The possibilities of extending this record in time using archaeological wooden artefacts are being discussed. The newly developed dendrochronological data, as an important element within the Arctic dendrochronological network, will allow a better understanding of environmental changes and human interaction in Greenland.

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