Abstract

To obtain a perspective of changes occurring in the marine environment it is essential to study an area over a long time span. Doing so might also facilitate the understanding of the mechanisms and processes that govern a certain marine setting. In this thesis, changes in the pelagic and benthic environment during the last c. 200 years have been investigated in two fjords on the Swedish west coast, Koljö Fjord and Gullmar Fjord; this was done using the sediment record and its content of biological and sedimentological markers, so-called proxies. Further, with the use of hydrographic and meteorological data, this thesis establishes relationships between climatic variations and these changes in the benthic environment. In particular, climate and variations in climate are important factors behind low oxygen conditions in the deep water in Koljö Fjord. Furthermore, with the use of benthic foraminifera as indicators, this thesis demonstrates that the deep water in Koljö Fjord has been a varying but harsh environment for benthic life for at least 170 years. In contrast, the surface water environment in Koljö Fjord has experienced one substantial change over the same time. The composition and abundances of dinoflagellate cysts and diatoms changed markedly in the late 1930s to early 1940s. This change occurred at the same time as engineering works were undertaken at one of the shallow entrances of the fjord. The differences in surface-water exchange due to the engineering work are estimated, and these results suggest that relatively small changes in topography can cause changes in the surface water environment large enough to affect the phytoplankton community. To examine how phytoplankton blooms affect the carbon isotopic composition in foraminifera, analyses from a seasonal study were performed on living *Stainforthia fusiformis* from Havstens and Gullmar Fjord. A marked decrease in the $\delta^{13}C$ was noted after phytodetritus input.

The benthic environment in the deep Gullmar Fjord has experienced rather stable conditions over the last 90 years. From stratigraphical studies, using benthic foraminifera, a major faunal change is noted. The change occurred in the late 1970s to early 1980s when the fauna changed from a common Skagerrak–Kattegat fauna to a fauna dominated by the low-oxygen-tolerant species, *S. fusiformis*. By using stable isotopes, it is shown that *S. fusiformis* did not inhabit the deepest part of the fjord before the late 1970s. This shift occurred in connection with the first (1979/1980) of several, recent low-oxygen events in the fjord. These low-oxygen events have occurred, in general, when the winter climate has been more maritime, with more frequent westerly and south-westerly winds, a wind situation that suppress deep-water exchanges. This demonstrates the large effect climate may have on hydrography and thereby on the benthic environment.

Keywords: Environmental change, fjords, hydrography, climate, NAO, human impact, dysoxia, anoxia, Skagerrak, multiproxy, laminated sediments, benthic foraminifera, stable isotopes, dinoflagellate cysts, diatoms, Sweden