CONNECTING IRELAND TO NORWAY

Stratigraphic Development of the Glaciated European Margin

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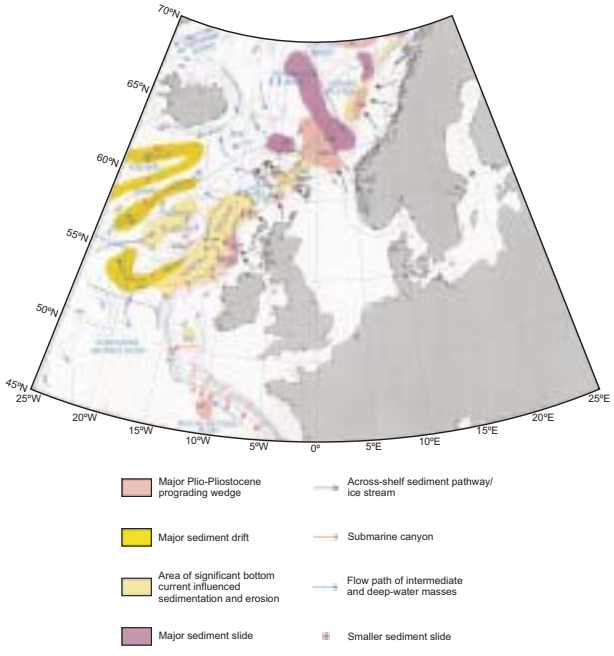
From 2000 to 2003 the Royal NIOZ department of Marine Chemistry and Geology has participated in the European Commission funded Fifth Framework STRATAGEM project. `STRATAGEM' is the acronym of `Stratigraphic Development of the Glaciated European Margin'. A scientific interest as well as the ongoing economical development of the NW European margin (oil and gas exploration and exploitation) and a growing awareness of the need for a sustainable development of this area has increased the need to understand the nature and frequency of geological processes that have shaped and are still shaping this ocean margin. The safety of people and structures working in this offshore setting for instance requires knowledge of the nature of the risk inherent to ocean margins. Special interest should go to continental slope instability which is (partly) related to the rapid deposition of sediments during glacial periods. Unstable slope sediments provide a potential threat to offshore construction. One way of learning to understand the shaping of a margin like this is to develop a time scale, or stratigraphy, for geological events that have affected the margin.

Until recently however there was a lack of a regional approach to the stratigraphical development of the European glaciated margin. In order to solve this problem STRATAGEM was set up with partners from 7 European universities and research institutes and one partner from the oil industry. The STRATAGEM project has received further support from the oil industry through four joint industry projects that represent 31 oil companies working in the area covered by the project. The oil companies' support existed of financial support and mainly the supply of seismic and core data. In addition to the oil industry data, existing data at the individual partner institutes, publicly available data and new seismic and core data acquired during the project were used. The sedimentary packages from Lofoten in the north to the Porcupine margin in the south were defined and a unified stratigraphic framework and common terminology for the mid-Cenozoic (Mid- to Late Eocene, ±40 million years ago) to Recent sediments of the region was produced. Additionally a geological model for the evolution of the margin was produced.

The glaciated European margin can be divided into three main areas: the Porcupine-Rockall Trough area, the area around the Faeroe Islands and the Norwegian margin. Although each of these areas shows its own geological history and resulting deposits, all of them are influenced by some major large scale tectonic events that influenced the basin morphology and thus oceanography. This in turn resulted in the formation of major unconformities in the sedimentary record that could be used to make a margin wide stratigraphical correlation possible. From the Eocene until the Early Pliocene (±4.5 million years ago,) sedimentation along the entire margin was characterised by contourite and basin-floor drift deposition, so the formation of several tens to hundreds of kilometres long sediment bodies deposited by ocean currents following the



Simplified map showing the main controls on sedimentation at the NW European margin during the Neogene (24 million years ago to recent). [After STRATAGEM Partners, 2002. The Neogene stratigraphy of the glaciated European margin from Lofoten to Porcupine.]

depth contours or deep-water bottom currents. Around 4.5 million years ag,o a large scale plate-tectonic event is thought to have occurred, resulting in changes in margin morphology and thus ocean currents. This event is marked by the presence of an unconformity (break in the sedimentary record) along the entire investigated margin. After this event sediment drift formation continued, although locally the depocentres of the drifts and the focus of erosion changed. The most important change in sedimentary regime since 4.5 million years ago is the start of shelf margin progradation, so the oceanward growth of the shelf edge as a result of increased sediment supply, probably resulting from uplift of the continent, and thus increased erosion. The intensification of northern latitude glaciation during the Pleistocene (the period of the ice ages) resulted in an increased erosion of the continental rocks by the glaciers and thus increase in sediment supply to the shelf edge. Especially after the Mid-Pleistocene (0.9 million years ago) the glaciers themselves reached the shelf edge and large amounts of sediment were deposited, resulting in an increased shelf margin progradation. During interglacial periods (including the present day, the Holocene) not much sediment is transported to the shelf edge and bottom currents widely erode the sea bed. The thick sediment packages deposited during the ice ages sometimes became unstable (and might do so in the future) resulting in massive sliding events.