

CHAPTER 11

CONCLUSIONS

11.1 Historical Resume

A generalised section through the sediments deposited around Tanafjord during the late Precambrian glaciation is presented in figure 91.

An extended period of erosion, subglacial at least during the last stages, preceded the deposition of the Smalfjord Tillite. The tillite is a composite horizon including evidence for five regional advances and retreats of a continental ice sheet.

The glaciation ended suddenly with a major transgression. Supratidal dolomite was deposited directly on the tillite. The thick sequence of turbidites above represents a major regressive basin fill which culminated with the shallow marine environments preserved in the upper part of the Nyborg Formation. The great influx of sediment was due to isostatic uplift in the source area and the rapid release of sediment from wasting ice.

A second period of erosion, also subglacial at least in the final part, was followed by the deposition of the Mortensnes Tillite. This too is a composite unit formed by two advances and retreats of an ice sheet. Ice shelf conditions existed during the first glacial retreat.

Deglaciation was again associated with a major transgression. In the north possibly emergent conditions preceded the covering by water of moderate depth, while in the south glacial marine sedimentation gave way to prodelta quiet water conditions in relatively deep water. Fluvial environments followed the progradation of the delta under strongly regressive conditions. Channel and floodplain deposits were preserved by the ensuing transgression, and covered by distributary bay and nearshore marine sediments.

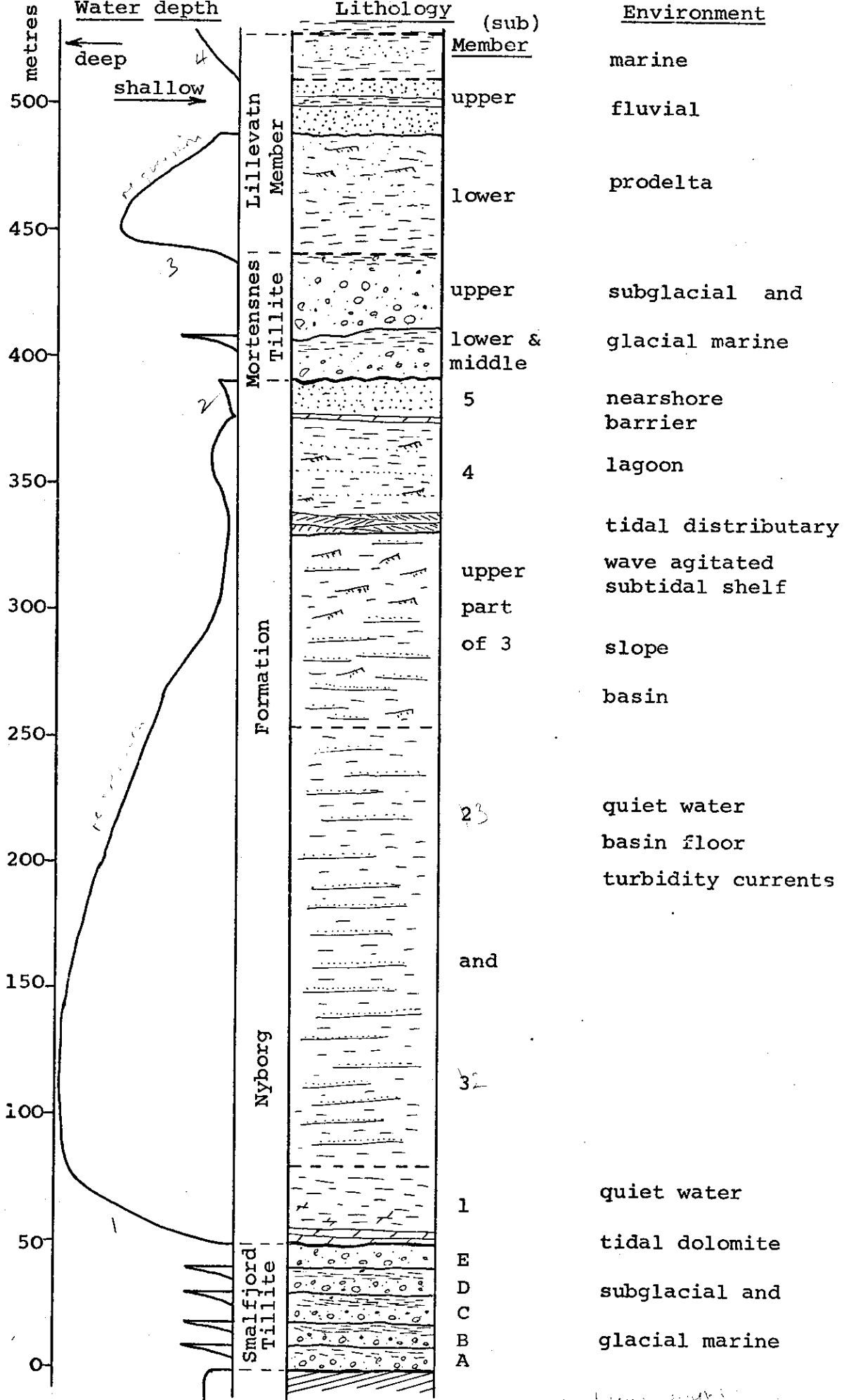


Figure 91. Generalised sedimentological section, late Precambrian glaciation, Tanafjord area, East Finnmark.

11.2 Palaeogeography

Palaeocurrents, and thickness and facies variation suggest that source areas were situated north and south of the study area. Evidence for a northern land mass is provided by the Baikalian orogenic belt which formed during the late Precambrian and now underlies the Timan Mountains and Kanin Peninsula in the U.S.S.R. The continuation of the belt onto the adjacent Barents Sea shelf is suggested by recent geophysical data.

11.3 Recognition of Ancient Glaciations

Many criteria offered for the recognition of tillite in ancient sequences have tended to hinder rather than facilitate their supposed aim. Listed below are several aspects of the Finnmark tillites which are partly intended as a revision of criteria accepted or proposed by previous workers.

1- The erosive base of a ground moraine may appear gradational if exceptional quantities of the substrate have been incorporated into the moraine.

2- Striated pavements are not a necessary product of continental glaciation. This is especially the case when erosion was by block freezing onto the base of the ice sheet, and not by the abrasion of the substrate by entrained debris.

3- Shear banding produced by the mixing of contrasting materials in a glacier by plastic flow should be distinguished from sedimentary lamination.

4- Not only subaqueous mudflows, but also grounded ice sheets are capable of eroding and incorporating the underlying material.

5- Rounded pebbles and boulders are abundant in the

Finnmark tillites. It is being increasingly recognised that rounding is a subglacial process (e.g. Drake, 1972).

6- Beds of tillite may form in a variety of glacial subenvironments. The occurrence of bedding in conglomeratic mudstone argues neither for nor against a glacial origin.

7- Subaqueously deposited fine grained tillites are almost invariably laminated, and can thus be distinguished from ground moraine.

8- The absence of clasts in some of the glacial siltstones suggests that proglacial subaqueous deposits need not contain dispersed clasts.

9- Great continuity of tillite horizons is an attribute of terrestrial ground moraines. Whether or not it is an attribute of glacial marine sediments is uncertain.

10- The occurrence of non-glacial marine sediments adjacent to tillite does not necessarily indicate a marine origin for the tillite as continental shelves are likely to be exposed during a glaciation.

APPENDIX

Electron microprobe analysis* was used to determine the composition of four grains in a thin section cut from a graded sandstone bed (facies E) in facies association 2, member 4, Nyborg Formation at Stappogiedde North. The bed occurs approximately 1.4 m from the base of the association in unit 0 (fig. 54).

The table below presents the results of the analysis. Grains 1 and 3 are dark green, while grains 2 and 4 are light grey. (See p. 150 for fuller description). On each grain, three readings were made at two different points.

	1	2	3	4
SiO ₂	32.4	38.8	28.4	39.2
Al ₂ O ₃	14.5	18.2	15.3	18.4
Fe ₂ O ₃	7.95	3.85	9.35	4.08
CaO	Tr	Tr	Tr	Tr
MgO	5.95	4.4	7.3	4.5
Na ₂ O	0.48	0.53	0.53	0.53
K ₂ O	5.7	10.4	5.7	10.5
Total	67.0	80.1	66.6	72.2

Tr=trace

Figures refer to weight percent.

*The analysis was made by Mr. Colin Fagg.